

MillLine

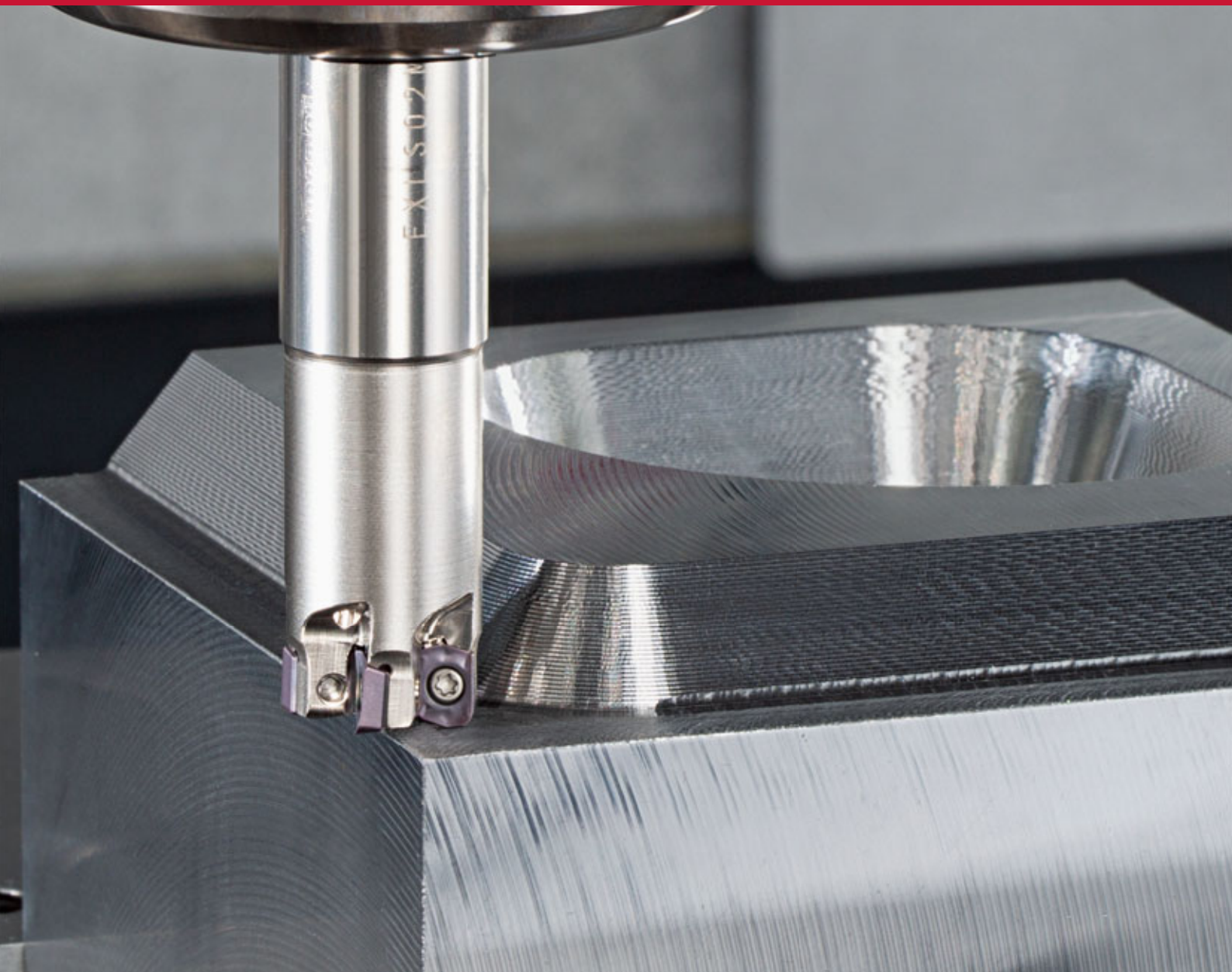


TUNG^{ORCE}**FEED**

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Tungaloy Report No. 521S1-G

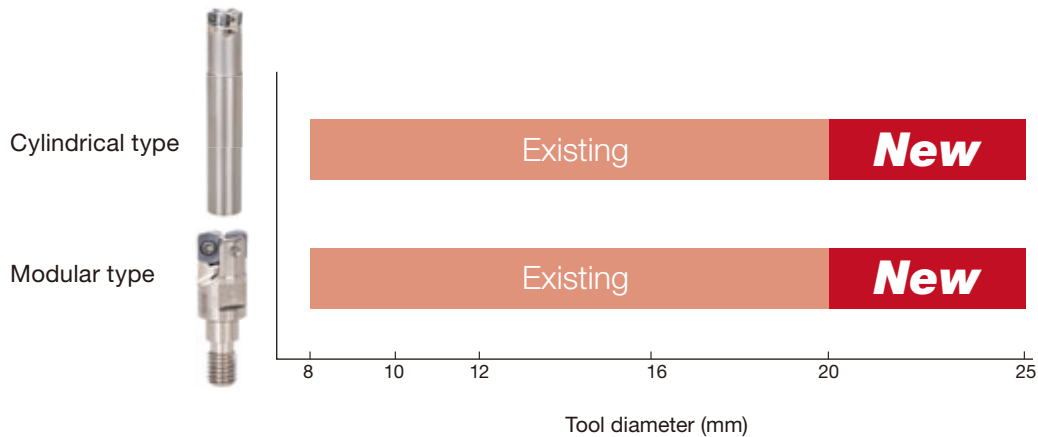
TungForceFeed is now available
in the new range of **ø8 - ø25 mm**



INDUSTRY 4.0
FEED the SPEED!

Expansion of $\varnothing 20 - \varnothing 25$ mm

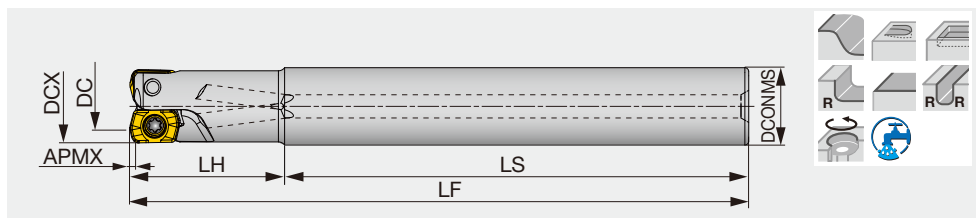
Improve table feeds thanks to a higher insert density



EXLS

Cylindrical type holder for high-feed milling, screw-on

GAMP = +4°, GAMF = -21° ~ -17°



Designation	APMX	DCX	CICT	DC	DCONMS	LS	LH	LF	WT (kg)	Air hole	Insert
EXLS02M008C08.0LH16R01	0.5	8	1	4.29	8	59	16	75	0.02	With	LSMT02...
EXLS02M008C08.0LH30R01	0.5	8	1	4.29	8	59	31	90	0.03	With	LSMT02...
EXLS02M010C10.0LH20R02	0.5	10	2	6.28	10	60	20	80	0.04	With	LSMT02...
EXLS02M010C10.0LH40R02	0.5	10	2	6.28	10	60	40	100	0.05	With	LSMT02...
EXLS02M010C08.0LH20R02	0.5	10	2	6.28	8	60	20	80	0.03	With	LSMT02...
EXLS02M012C12.0LH20R03	0.5	12	3	8.31	12	60	20	80	0.06	With	LSMT02...
EXLS02M012C12.0LH50R02	0.5	12	2	8.31	12	60	50	110	0.08	With	LSMT02...
EXLS02M012C10.0LH20R03	0.5	12	3	8.31	10	60	20	80	0.04	With	LSMT02...
EXLS02M016C16.0LH30R05	0.5	16	5	12.31	16	70	30	100	0.14	With	LSMT02...
EXLS02M016C16.0LH50R03	0.5	16	3	12.31	16	70	50	120	0.17	With	LSMT02...
New EXLS02M020C20.0LH50R05	0.5	20	5	16.31	20	80	50	130	0.27	With	LSMT02...
New EXLS02M020C20.0LH50R06	0.5	20	6	16.31	20	80	50	130	0.27	With	LSMT02...
New EXLS02M020C20.0LH80R05	0.5	20	5	16.31	20	80	80	160	0.33	With	LSMT02...
New EXLS02M025C25.0LH60R06	0.5	25	6	21.31	25	80	60	140	0.45	With	LSMT02...
New EXLS02M025C25.0LH60R08	0.5	25	8	21.31	25	80	60	140	0.47	With	LSMT02...
New EXLS02M025C25.0LH100R06	0.5	25	6	21.31	25	80	100	180	0.57	With	LSMT02...

SPARE PARTS

Designation	Clamping screw	Lubricant	Wrench
EXLS02M...	CSPB-2H	M-1000	IP-6DB

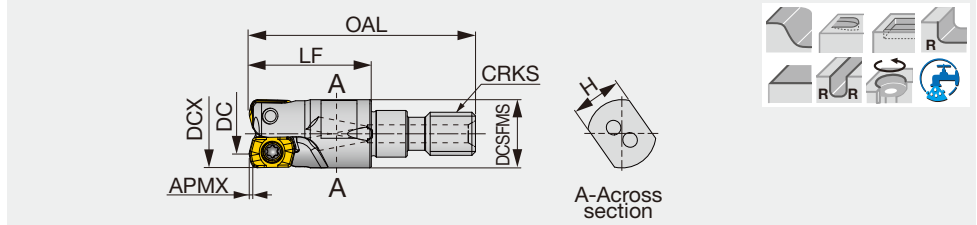
*Recommended clamping torque (N·m): CSPB-2H=0.7

TUNGFLEX

HXLS

Modular head for high-feed milling, screw-on (TungFlex)

GAMP = +4°, GAMF = -21° ~ -17°



Designation	APMX	DCX	CICT	DC	OAL	LF	H	DCSFMS	CRKS	WT (kg)	Air hole	Insert
HXLS02M008M06R01	0.5	8	1	4.29	33.5	19	7	9.5	M6	0.01	With	LSMT02...
HXLS02M010M06R02	0.5	10	2	6.28	31.5	17	7	9.5	M6	0.01	With	LSMT02...
HXLS02M012M06R03	0.5	12	3	8.31	31.5	17	7	10	M6	0.01	With	LSMT02...
HXLS02M012M06R02	0.5	12	2	8.31	31.5	17	7	10	M6	0.01	With	LSMT02...
HXLS02M016M08R05	0.5	16	5	12.31	40	23	10	13	M8	0.03	With	LSMT02...
HXLS02M016M08R03	0.5	16	3	12.31	40	23	10	13	M8	0.03	With	LSMT02...
New HXLS02M020M10R05	0.5	20	5	16.31	49	30	15	17.8	M10	0.05	With	LSMT02...
New HXLS02M020M10R06	0.5	20	6	16.31	49	30	15	17.8	M10	0.05	With	LSMT02...
New HXLS02M025M12R06	0.5	25	6	21.31	52	30	17	20.8	M12	0.08	With	LSMT02...
New HXLS02M025M12R08	0.5	25	8	21.31	52	30	17	20.8	M12	0.08	With	LSMT02...

SPARE PARTS



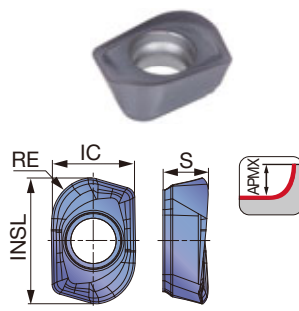
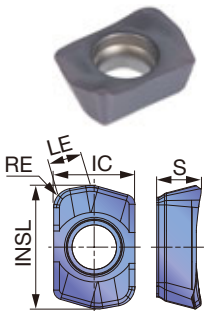
Designation	Clamping screw	Lubricant
HXLS02M...	CSPB-2H	M-1000

*Recommended clamping torque (N·m): CSPB-2H=0.7

INSERTS

LSMT-HM (High feed)

LSMT-MM (Radius)



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

★ : First choice
☆ : Second choice

Designation	RE	APMX	Coated								LE	INSL	IC	S	
			AH3225	AH8015											
LSMT0202ZER-HM	1	0.5	●	●								1.7	6.4	4.2	2.3
LSMT0202R2-MM	2	2	●	●								-	6.4	4.3	2.3

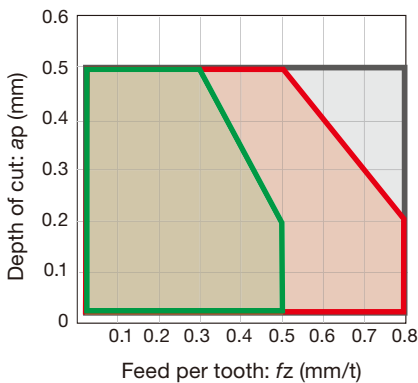
● : Line up

STANDARD CUTTING CONDITIONS

ISO	Workpiece materials	Hardness	Priority	Grades	Cutting speed Vc (m/min)	Feed per tooth fz (mm/t)	
P	Carbon steels (S45C / C45, S55C / C55, etc)	- 300HB	First choice	AH3225	100 - 300	0.2 - 0.8	
		- 300HB	For wear resistance	AH8015	100 - 300	0.2 - 0.8	
	Alloy steels (SCM440 / 42CrMo4, etc)	- 300HB	First choice	AH3225	100 - 300	0.2 - 0.8	
		- 300HB	For wear resistance	AH8015	100 - 300	0.2 - 0.8	
	Prehardened steels (NAK80, PX5, etc)	30 - 40HRC	First choice	AH8015	100 - 200	0.2 - 0.5	
		30 - 40HRC	For impact resistance	AH3225	100 - 200	0.2 - 0.5	
M	Stainless steels (SUS304 / X5CrNi18-9, SUS316 / X5CrNiMo17-12-3, etc)	- 200HB	First choice	AH3225	100 - 150	0.2 - 0.5	
K	Gray cast irons (FC250 / 250 / GG25, FC300 / 300 / GG30, etc)	150 - 250HB	First choice	AH8015	100 - 300	0.2 - 0.8	
		150 - 250HB	For impact resistance	AH3225	100 - 300	0.2 - 0.8	
	Ductile cast irons (FCD600 / 600-3 / GGG60, etc)	150 - 250HB	First choice	AH8015	80 - 200	0.2 - 0.8	
		150 - 250HB	For impact resistance	AH3225	80 - 200	0.2 - 0.8	
S	Titanium alloy (Ti-6Al-4V, etc)	- 40HRC	First choice	AH3225	30 - 60	0.1 - 0.3	
		- 40HRC	For wear resistance	AH8015	30 - 60	0.1 - 0.3	
	Heat resistance alloy (Inconel, Hastelloy, etc)	- 40HRC	First choice	AH8015	20 - 50	0.1 - 0.3	
		- 40HRC	For impact resistance	AH3225	20 - 50	0.1 - 0.3	
H	Hardened steel	SKD61 / X40CrMoV5-1, etc	40 - 50HRC	First choice	AH8015	80 - 150	0.1 - 0.5
		SKD11 / X153CrMoV12, etc	50-60HRC	First choice	AH8015	50 - 70	0.1 - 0.3

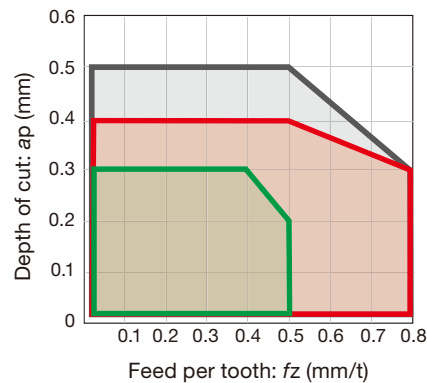
APPLICATION

LSMT02-HM



- For standard shanks in $\leq 3xD$
- For long-neck shanks in $\geq 4xD$
- For modular head shanks in $\geq 7xD$

LSMT02-MM



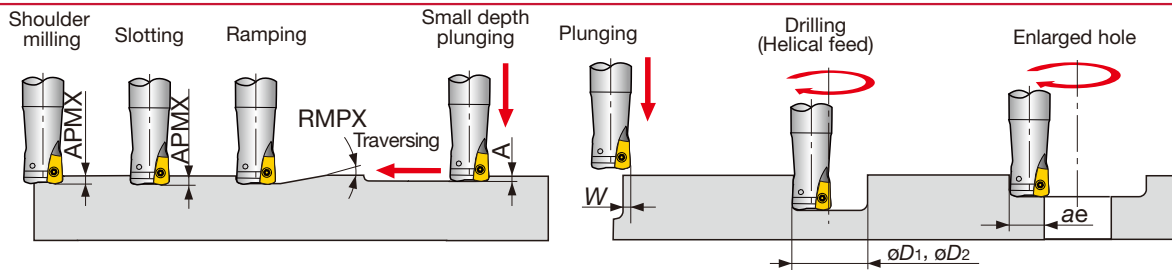
- For standard shanks in $\leq 3xD$
- For long-neck shanks in $\geq 4xD$
- For modular head shanks in $\geq 7xD$

* When the DOC is 0.5 mm or more, the feed less than 0.15 mm/t is recommended.

Tool dia.: ϕD_c (mm), Number of revolutions: n (min-1), Feed speed: V_f (mm/min), Max. depth of cut: $a_p = 0.5$ mm, Number of teeth: CICT

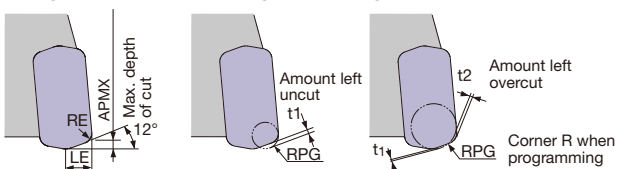
$\phi 8$, CICT = 1		$\phi 10$, CICT = 2		$\phi 12$		$\phi 16$			$\phi 20$		$\phi 25$				
n	V_f	n	V_f	n	V_f		n	V_f		n	V_f				
					CICT = 2	CICT = 3		CICT = 3	CICT = 5		CICT = 5	CICT = 6	n	V_f	
														CICT = 6	CICT = 8
7,960	3,980	6,370	6,370	5,310	5,310	7,970	3,980	5,970	9,950	3,180	7,950	9,540	2,550	7,650	10,200
$V_c = 200$ m/min, $f_z = 0.5$ mm/t															
7,960	3,980	6,370	6,370	5,310	5,310	7,970	3,980	5,970	9,950	3,180	7,950	9,540	2,550	7,650	10,200
$V_c = 200$ m/min, $f_z = 0.5$ mm/t															
5,970	2,390	4,780	3,820	3,980	3,180	4,780	2,990	3,590	5,980	2,390	4,780	5,740	1,910	4,590	6,120
$V_c = 150$ m/min, $f_z = 0.4$ mm/t															
4,780	1,910	3,820	3,060	3,190	2,550	3,830	2,390	2,870	4,780	1,910	3,820	4,590	1,530	3,680	4,900
$V_c = 120$ m/min, $f_z = 0.4$ mm/t															
7,960	3,980	6,370	6,370	5,310	5,310	7,970	3,980	5,970	9,950	3,180	7,950	9,540	2,550	7,650	10,200
$V_c = 200$ m/min, $f_z = 0.5$ mm/t															
5,970	2,990	4,780	4,780	3,980	3,980	5,970	2,990	4,490	7,480	2,390	5,980	7,170	1,530	4,590	6,120
$V_c = 150$ m/min, $f_z = 0.5$ mm/t															
1,590	320	1,270	510	1,060	420	640	800	480	800	640	640	770	510	620	820
$V_c = 40$ m/min, $f_z = 0.2$ mm/t															
1,190	240	1,000	400	800	320	480	600	360	600	480	480	580	380	460	460
$V_c = 30$ m/min, $f_z = 0.2$ mm/t															
4,780	1,430	3,820	2,290	3,190	1,910	2,870	2,390	2,150	3,590	1,910	2,870	3,440	1,530	2,760	3,680
$V_c = 120$ m/min, $f_z = 0.3$ mm/t															
2,390	480	1,910	760	1,590	640	950	1,190	710	1,190	950	950	1,140	760	920	1,220
$V_c = 60$ m/min, $f_z = 0.2$ mm/t															

MACHINING APPLICATIONS



Designation	DC	Max. depth of cut APMX	Max. ramping angle RMPX	Max. plunging depth A	Max. cutting width in plunging W	Min. machining ϕD_1	Max. machining ϕD_2	Max. cutting width in enlarged hole ae
E/HXLS02M008...	8	0.5	4°	0.2	2	10	15	5.9
E/HXLS02M010...	10	0.5	3.3°	0.2	2	14	19	7.9
E/HXLS02M012...	12	0.5	2°	0.2	2	18	23	9.9
E/HXLS02M016...	16	0.5	1.3°	0.2	2	26	31	13.9
E/HXLS02M020...	20	0.5	1.2°	0.2	2	34	39	17.9
E/HXLS02M025...	25	0.5	1°	0.2	2	44	49	22.9

Tool geometry on programming



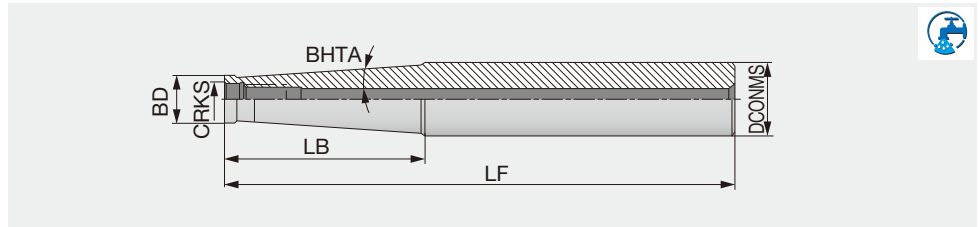
LSMT02...-HM

Corner R when programming: RPG	Amount left uncut t1 (mm)	Amount left overcut t2 (mm)
1 *Recommend	0.162	0
1.5	0.07	0.14
2	0	0.34

TUNGFLEX

SM

TungFlex - Modular shank

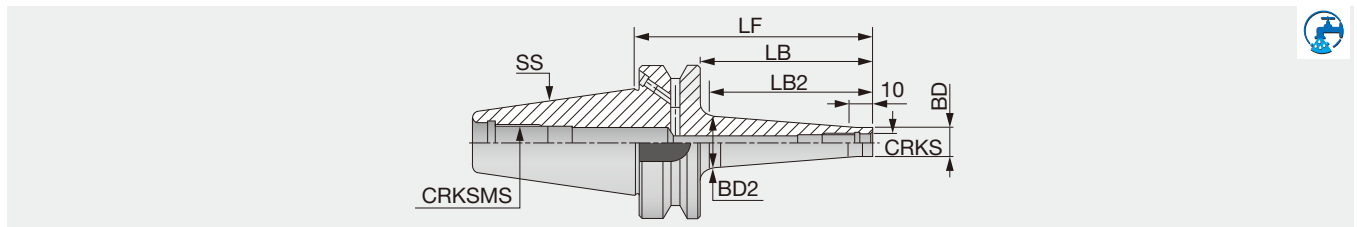


Designation	DCONMS	BD	LF	LB	BHTA	CRKS
SM06-L60C10	10	9.7	60	20	0°	M6
SM06-L105-C12	12	9.7	105	60	1.2°	M6
SM06-L125-C16	16	9.7	125	60	3.3°	M6
SM08-L73C16	16	13	73	25	0°	M8
SM08-L128-C16	16	13	128	80	0.9°	M8
SM08-L170-C20	20	13	170	66.8	3.3°	M8
SM10-L80-C20	20	18	80	30	0°	M10
SM10-L130-C20	20	18	130	80	0.6°	M10
SM10-L200-C25	25	19	200	57.2	3.3°	M10
SM12-L86-C25	25	21	86	30	5.1°	M12
SM12-L200-C32	32	21	200	78	4.4°	M12
SM16-L95-C32	32	29	95	35	1.7°	M16
SM16-L230-C32	32	29	230	50	1.8°	M16

TUNGFLEX

BT-ODP(Screw clamping head holder)

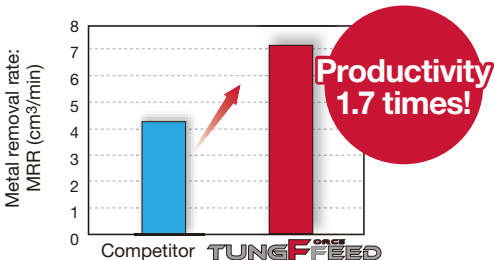
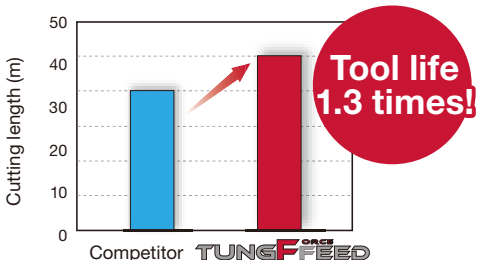
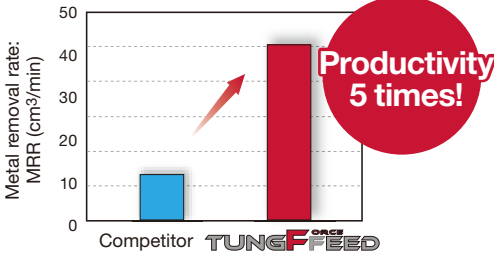
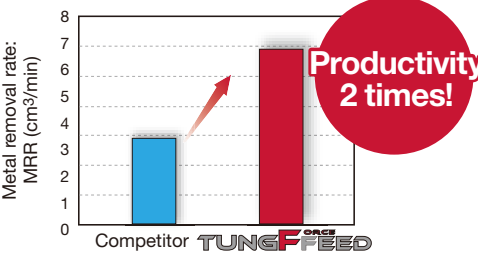
TungFlex modular tooling system with BT shank



Designation	SS	CRKS	BD	BD2	LF	LB	LB2	CRKSMS
BT40ODP6X66	40	M6	9.8	13	66	39	30	M16
BT40ODP6X106	40	M6	9.8	23	106	79	70	M16
BT40ODP8X66	40	M8	13	15	66	39	30	M16
BT40ODP8X106	40	M8	13	23	106	79	70	M16
BT40ODP10X66	40	M10	18	20	66	39	30	M16
BT40ODP10X106	40	M10	18	28	106	79	70	M16
BT40ODP12X66	40	M12	21	24	66	39	30	M16
BT40ODP12X106	40	M12	21	31	106	79	70	M16
BT40ODP16X66	40	M16	29	28.6	66	39	-	M16
BT40ODP16X106	40	M16	29	34	106	79	70	M16
BT50ODP12X94	50	M12	23	30	94	56	50	M24
BT50ODP12X144 (1)	50	M12	23	40	144	106	100	M24
BT50ODP12X194 (1)	50	M12	23	40	194	156	150	M24
BT50ODP12X244 (1)	50	M12	23	46	244	206	200	M24
BT50ODP16X94 (1)	50	M16	29	34	94	56	50	M24
BT50ODP16X144 (1)	50	M16	29	40	144	106	100	M24
BT50ODP16X194 (1)	50	M16	29	55	194	156	150	M24
BT50ODP16X244 (1)	50	M16	29	60	244	206	200	M24

• Applicable for 10 MPa pressure coolant (1) Balanced to G6.3 at 12,000 min⁻¹

PRACTICAL EXAMPLES

Workpiece type		Stator shaft	Stamping die part
Cutter		EXLS02M008C8.0LH16R01 (ø8, CICT = 1)	HXLS02M010M06R02 (ø10, CICT = 2)
Insert		LSMT0202ZER-HM	LSMT0202ZER-HM
Grade		AH3225	AH3225
Workpiece material		S45C / C45	SKD11 / X153CrMoV12 (before hardening)
Cutting speed : V_c (m/min)		150	120
Feed per tooth: f_z (mm/t)		0.5 (Competitor : $f_z = 0.3$)	0.6
Depth of cut : ap (mm)		0.3	0.3
Width of cut : ae (mm)		8	5
Machining		Grooving	Pocketing
Coolant		Wet	Dry
Machine		Vertical MC, BT30	Vertical MC, BT40
Results		 <p>Productivity 1.7 times!</p> <p>TungForceFeed insert's light cutting action ensured reliable high feed milling improving MRR by 1.7x</p>	 <p>Tool life 1.3 times!</p> <p>AH3225 prevented wear and chipping, while improving tool life by 1.3 times.</p>
Workpiece type		Stamping die part	Turbine blade
Cutter		EXLS02M012C12.0LH50R02 (ø12, CICT = 2)	EXLS02M008C8.0LH16R01 (ø8, CICT = 1)
Insert		LSMT0202ZER-HM	LSMT0202ZER-HM
Grade		AH3225	AH8015
Workpiece material		SKD61 / X40CrMoV5-1 (45HRC)	Inconel 939
Cutting speed : V_c (m/min)		113	30
Feed per tooth: f_z (mm/t)		0.5 (Competitor : $f_z = 0.1$)	0.2 (Competitor : $f_z = 0.05$)
Depth of cut : ap (mm)		0.3	0.3
Width of cut : ae (mm)		12	8
Machining		Face milling	Grooving
Coolant		Air	Dry
Machine		Vertical MC, BT50	Vertical MC, BT50
Results		 <p>Productivity 5 times!</p> <p>Strong TungForceFeed inserts ensured reliable machining of hard material, improving MRR by 5 times.</p>	 <p>Productivity 2 times!</p> <p>Higher feed per tooth improved MRR by double, while reducing tool cost thanks to indexability.</p>

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 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 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 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 Germany GmbH

An der Alten Ziegelei 1
D-40789 Monheim, Germany
Phone: +49-2173-90420-0
Fax: +49-2173-90420-19
www.tungaloy.com/de

Tungaloy France S.A.S.

ZA Courtaboeuf - Le Rio
1 rue de la Terre de feu
F-91952 Courtaboeuf Cedex, France
Phone: +33-1-6486-4300
Fax: +33-1-6907-7817
www.tungaloy.com/fr

Tungaloy Italia S.r.l.

Via E. Andolfato 10
I-20126 Milano, Italy
Phone: +39-02-252012-1
Fax: +39-02-252012-65
www.tungaloy.com/it

Tungaloy Czech s.r.o.

Turanka 115
CZ-627 00 Brno, Czech Republic
Phone: +420-532 123 391
Fax: +420-532 123 392
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
Fax: +34 93 876 2798
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 U.K. Ltd

Gallan Park, Watling Street,
Cannock, WS110XG, 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.

Rm No 401 No.88 Zhabei
Jiangchang No.3 Rd
Shanghai 200436, 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 Cutting Tools (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, #06-11 Oxley BizHub 2
Singapore 408734
Phone: +65-6391-1833
Fax: +65-6299-4557
www.tungaloy.com/sg

Tungaloy Vietnam

LE04.38, Lexington Residence
67 Mai Chi Tho St., Dist. 2,
Ho Chi Minh City, Vietnam
Phone: +84-2837406660
www.tungaloy.com/sg

Tungaloy India Pvt. Ltd.

Indiabulls Finance Centre,
Unit # 902-A, 9th Floor,
Tower 1, Senapati Bapat Marg,
Elphinstone Road (West),
Mumbai-400013, India
Phone: +91-22-6124-8804
Fax: +91-22-6124-8899
www.tungaloy.com/in

Tungaloy Korea Co., Ltd

#1312, Byucksan Digital Valley 5-cha
Beotkkot-ro 244, Geumcheon-gu
153-788 Seoul, Korea
Phone: +82-2-2621-6161
Fax: +82-2-6393-8952
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

Kompleks Grand Wisata Block AA-10 No.3-5
Cibitung
Bekasi 17510, Indonesia
Phone: +62-21-8261-5808
Fax: +62-21-8261-5809
www.tungaloy.com/id



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