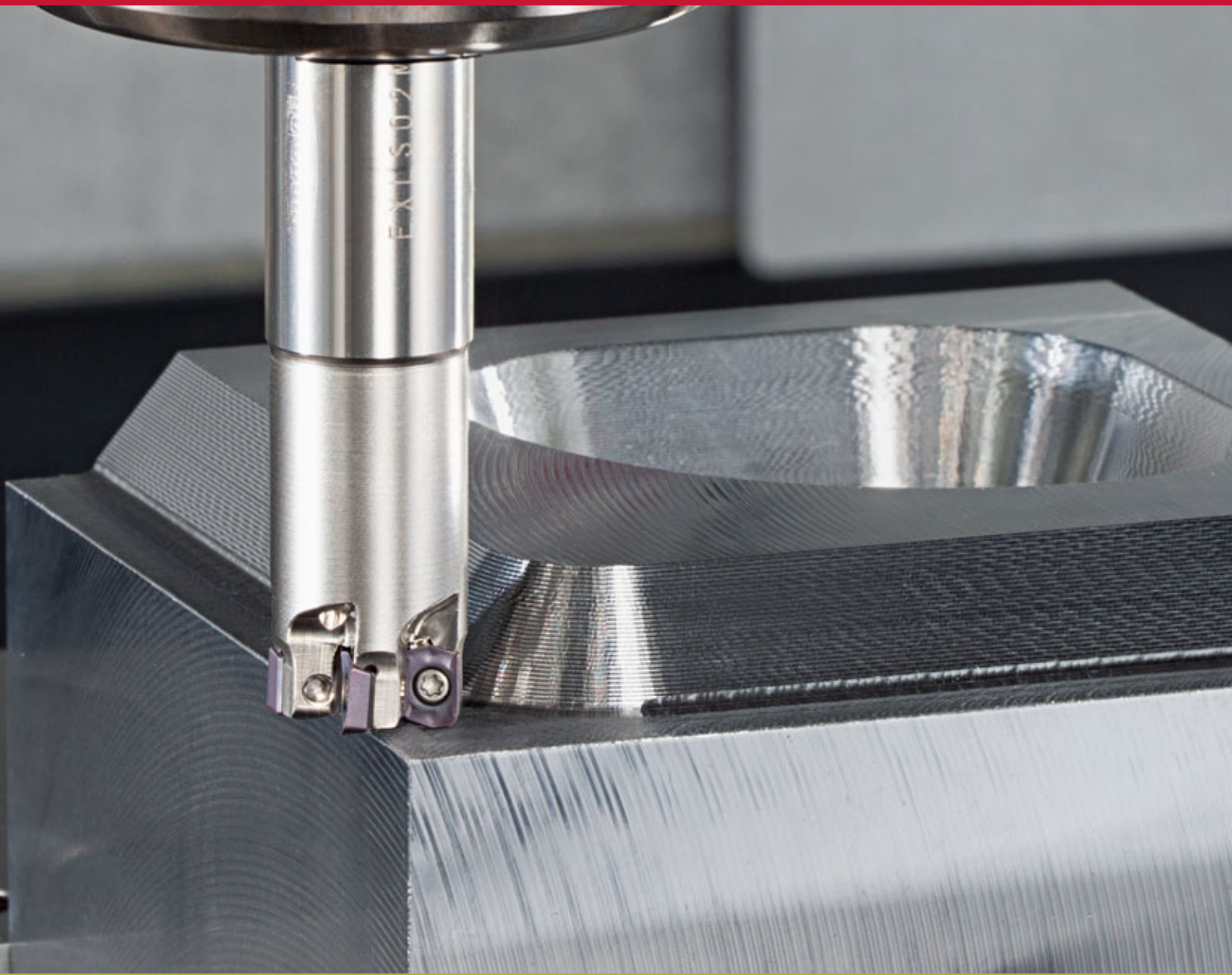


TUNG**F**ORCE**FEED**

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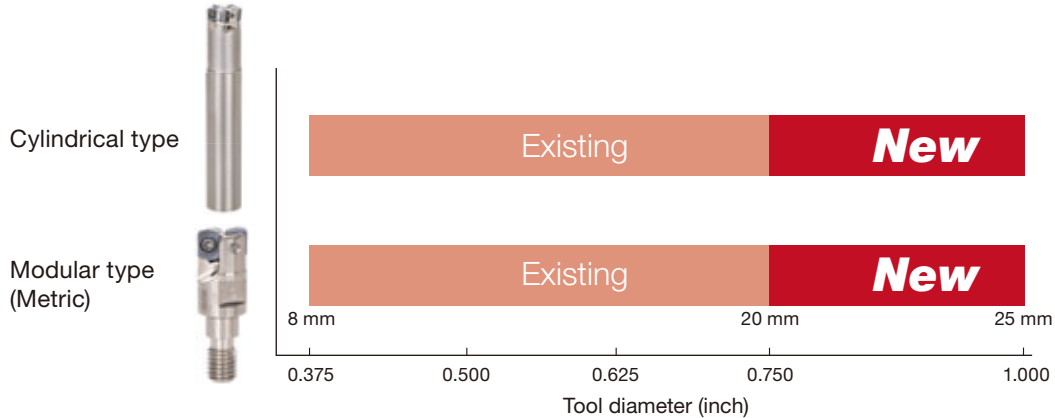
Tungaloy Report No. 521S1-US

TungForceFeed expansion! Now available in diameter ranges from **0.375 to 1.000**



Expansion of $\varnothing 0.750''$, $\varnothing 1.000''$

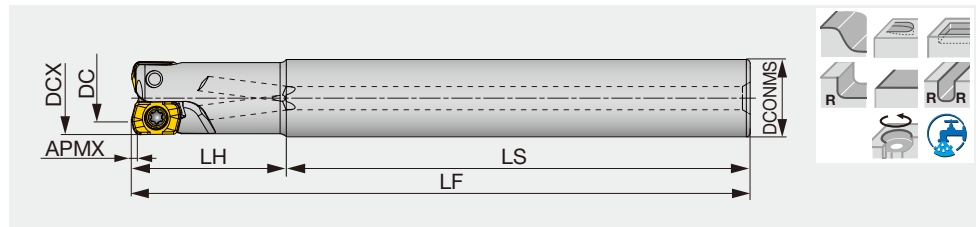
Improve table feeds thanks to a higher insert density



EXLS

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

GAMP = +4°, GAMF = -21° ~ -17°



Inch	APMX	DCX	CICT	DC	DCONMS	LS	LH	LF	WT (lbs)	Air hole	Insert
EXLS02U0.37C0.37LH0.75R01	0.019	0.375	1	0.228	0.375	2.250	0.750	3.000	0.088	With	LSMT02...
EXLS02U0.37C0.37LH1.25R01	0.019	0.375	1	0.228	0.375	2.250	1.250	3.500	0.110	With	LSMT02...
EXLS02U0.37C0.31LH0.75R01	0.019	0.375	1	0.228	0.3125	2.250	0.750	3.000	0.066	With	LSMT02...
EXLS02U0.50C0.50LH0.75R03	0.019	0.500	3	0.354	0.500	2.250	0.750	3.000	0.132	With	LSMT02...
EXLS02U0.50C0.50LH2.00R02	0.019	0.500	2	0.354	0.500	2.250	2.000	4.250	0.176	With	LSMT02...
EXLS02U0.50C0.37LH0.75R03	0.019	0.500	3	0.354	0.375	2.250	0.750	3.000	0.088	With	LSMT02...
EXLS02U0.62C0.62LH1.50R05	0.019	0.625	5	0.479	0.625	2.500	1.500	4.000	0.308	With	LSMT02...
EXLS02U0.62C0.62LH2.00R03	0.019	0.625	3	0.479	0.625	2.500	2.000	4.500	0.375	With	LSMT02...
New EXLS02U0.75C0.75LH2.00R05	0.019	0.750	5	0.602	0.750	3.000	2.000	5.000	0.529	With	LSMT02...
New EXLS02U0.75C0.75LH2.00R06	0.019	0.750	6	0.602	0.750	3.000	2.000	5.000	0.529	With	LSMT02...
New EXLS02U0.75C0.75LH3.50R05	0.019	0.750	5	0.602	0.750	3.000	3.500	6.500	0.683	With	LSMT02...
New EXLS02U1.00C1.00LH2.50R06	0.019	1.000	6	0.850	1.000	3.000	2.500	5.500	1.036	With	LSMT02...
New EXLS02U1.00C1.00LH2.50R08	0.019	1.000	8	0.850	1.000	3.000	2.500	5.500	1.036	With	LSMT02...
New EXLS02U1.00C1.00LH4.00R06	0.019	1.000	6	0.850	1.000	3.000	4.000	7.000	1.279	With	LSMT02...

Metric	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

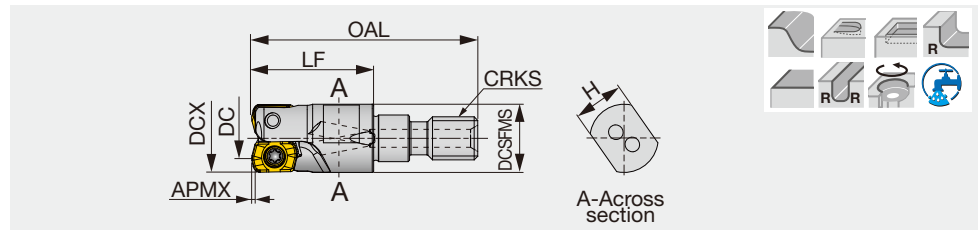
Designation	Clamping screw	Lubricant	Wrench
EXLS02U...	CSPB-2H	M-1000	IP-6DB

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

TUNGFLX

HXLS

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



Metric	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	57	30	17	20.8	M12	0.08	With	LSMT02...
New HXLS02M025M12R08	0.5	25	8	21.31	57	30	17	20.8	M12	0.08	With	LSMT02...

SPARE PARTS

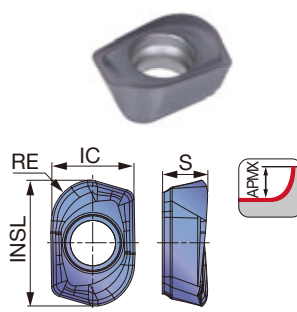
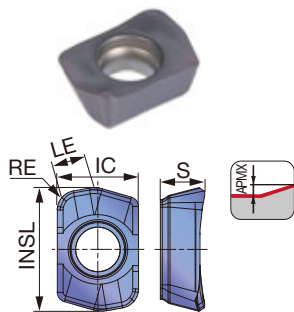
Designation	Clamping screw	Lubricant
HXLS02M...	CSPB-2H	M-1000

*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	0.039	0.019	●	●	0.067	0.252	0.165	0.091
LSMT0202R2-MM	0.079	0.079	●	●	-	0.252	0.169	0.091

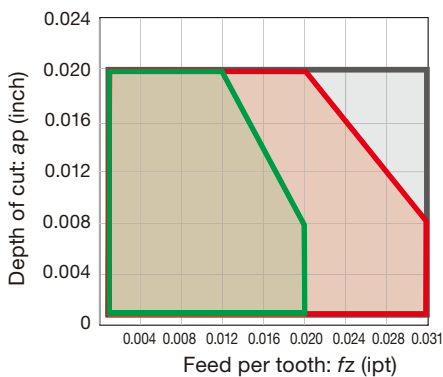
● : Line up

STANDARD CUTTING CONDITIONS

ISO	Workpiece materials	Hardness	Priority	Grades	Cutting speed Vc (sfm)	Feed per tooth fz (ipt)
P	Carbon steels (1045, 1055, etc.)	- 300HB	First choice	AH3225	330 - 990	0.008 - 0.031
		- 300HB	For wear resistance	AH8015	330 - 990	0.008 - 0.031
	Alloy steels (4140, etc.)	- 300HB	First choice	AH3225	330 - 990	0.008 - 0.031
		- 300HB	For wear resistance	AH8015	330 - 990	0.008 - 0.031
	Prehardened steels (NAK80, PX5, etc.)	30 - 40HRC	First choice	AH8015	330 - 660	0.008 - 0.020
		30 - 40HRC	For impact resistance	AH3225	330 - 660	0.008 - 0.020
M	Stainless steels (304, 316, etc.)	- 200HB	First choice	AH3225	330 - 660	0.008 - 0.020
K	Gray cast irons (No.250B, etc.)	150 - 250HB	First choice	AH8015	330 - 990	0.008 - 0.031
		150 - 250HB	For impact resistance	AH3225	330 - 990	0.008 - 0.031
	Ductile cast irons (65-45-12, etc.)	150 - 250HB	First choice	AH8015	260 - 660	0.008 - 0.031
		150 - 250HB	For impact resistance	AH3225	260 - 660	0.008 - 0.031
S	Titanium alloy (Ti-6Al-4V, etc.)	- 40HRC	First choice	AH3225	100 - 200	0.004 - 0.012
		- 40HRC	For wear resistance	AH8015	100 - 200	0.004 - 0.012
	Heat resistant alloy (Inconel, Hastelloy, etc.)	- 40HRC	First choice	AH8015	70 - 170	0.004 - 0.012
		- 40HRC	For impact resistance	AH3225	70 - 170	0.004 - 0.012
H	Hardened steel	H13, etc	First choice	AH8015	260 - 490	0.004 - 0.020
		D2, D3, etc	First choice	AH8015	160 - 230	0.004 - 0.012

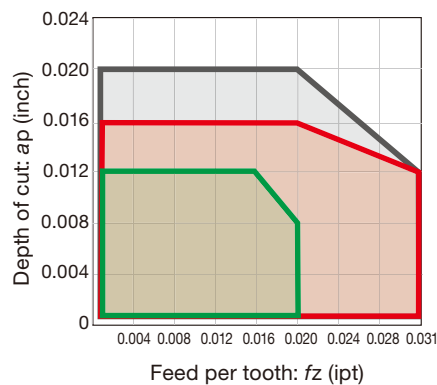
APPLICATION

LSMT02-HM



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

LSMT02-MM



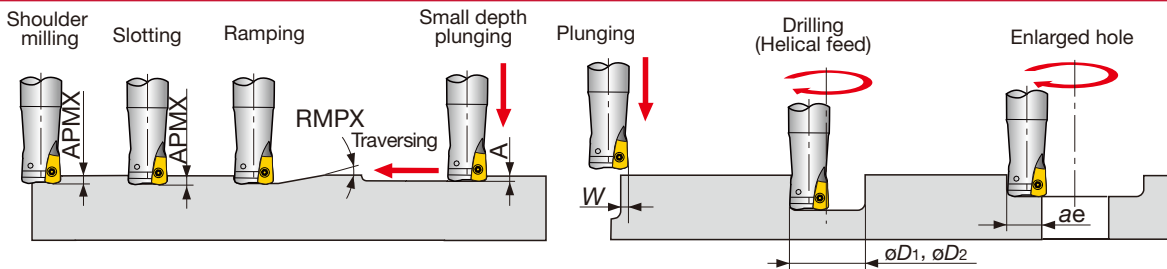
- For standard shanks in $\leq 3xD$
- For long-neck shanks in $\geq 4xD$
- For modular head shanks in $\geq 7xD$

* When the DOC is 0.020" or more, the feed less than 0.006 ipt is recommended.

Tool dia.: (inch), Number of revolutions: n (rpm), Feed speed: V_f (ipm), Max. depth of cut: $ap = 0.020"$, Number of teeth: CICT

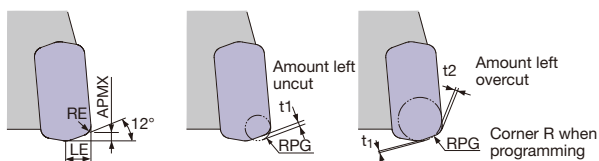
$\phi 0.375"$, CICT = 1		$\phi 0.5"$		$\phi 0.625"$		$\phi 0.750"$		$\phi 1.000"$					
n	V_f	n	V_f	n	V_f	n	V_f	n	V_f				
		CICT = 2	CICT = 3	CICT = 3	CICT = 5	CICT = 5	CICT = 6	CICT = 5	CICT = 8				
6682	134	5011	200	301	4009	241	401	3341	334	401	2506	301	401
$V_c = 656$ sfm, $f_z = 0.020$ ipt													
6682	134	5011	200	301	4009	241	401	3341	334	401	2506	301	401
$V_c = 656$ sfm, $f_z = 0.020$ ipt													
5011	80	3759	120	180	3007	144	241	2506	200	241	1879	180	241
$V_c = 492$ sfm, $f_z = 0.016$ ipt													
4013	64	3010	96	144	2408	116	193	2007	161	193	1505	144	193
$V_c = 394$ sfm, $f_z = 0.016$ ipt													
6682	134	5011	200	301	4009	241	401	3341	334	401	2506	301	401
$V_c = 656$ sfm, $f_z = 0.020$ ipt													
5011	100	3759	150	226	3007	180	301	2506	251	301	1879	225	301
$V_c = 492$ sfm, $f_z = 0.020$ ipt													
1334	11	1001	16	24	801	19	32	667	27	32	500	24	32
$V_c = 131$ sfm, $f_z = 0.008$ ipt													
998	8	749	12	18	599	14	24	499	20	24	374	18	24
$V_c = 98$ sfm, $f_z = 0.008$ ipt													
4013	48	3010	72	108	2408	87	144	2007	120	145	1505	108	144
$V_c = 394$ sfm, $f_z = 0.012$ ipt													
2007	16	1505	24	36	1204	29	48	1003	40	48	752	36	48
$V_c = 197$ sfm, $f_z = 0.008$ ipt													

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
EXLS02U0.37...	0.375	0.019	3.6°	0.007	0.078	0.513	0.730	0.292
EXLS02U0.50...	0.500	0.019	1.8°	0.007	0.078	0.763	0.980	0.417
EXLS02U0.62...	0.625	0.019	1.3°	0.007	0.078	1.013	1.230	0.542
EXLS02U0.75...	0.750	0.019	1.2°	0.007	0.078	1.260	1.460	0.660
EXLS02U1.00...	1.000	0.019	1.0°	0.007	0.078	1.760	1.960	0.910


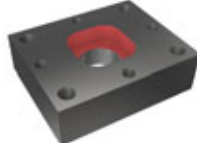
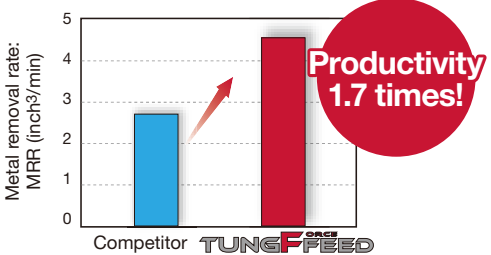
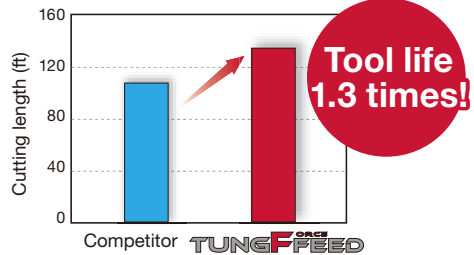


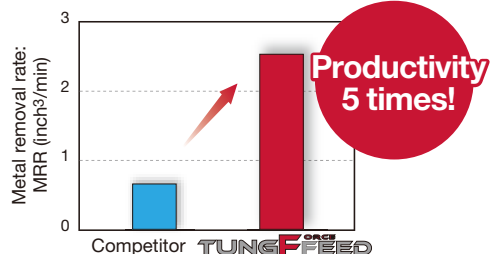
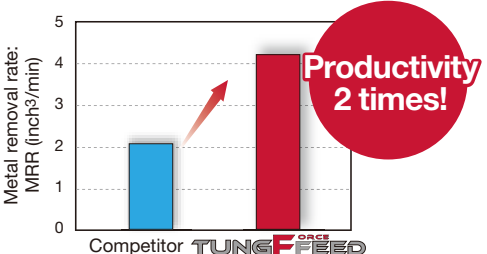
Tool geometry on programming



LSMT02...-HM

Corner R when programming: RPG	Amount left uncut t_1 (inch)	Amount left overcut t_2 (inch)
0.039 _{Recommend}	0.006	0
0.059	0.003	0.006
0.079	0	0.013

PRACTICAL EXAMPLES

Workpiece type		Stator shaft	Stamping die part	
Cutter		EXLS02U0.37C0.31LH0.75R01 ($\phi 0.375"$, CICT = 1)	HXLS02M010M06R02 ($\phi 10\text{mm}$, CICT = 2)	
Insert		LSMT0202ZER-HM	LSMT0202ZER-HM	
Grade		AH3225	AH3225	
		1045	H13(before hardening)	
Workpiece material		 P	 P	
Cutting conditions	Cutting speed : Vc (sfm)	492	394	
	Feed per tooth: fz (ipt)	0.020 (Competitor: fz = 0.012)	0.024	
	Depth of cut : ap (inch)	0.012	0.012	
	Width of cut : ae (inch)	0.315	0.197	
	Machining	Grooving	Pocketing	
	Coolant	Wet	Dry	
	Machine	Vertical M/C, CAT30	Vertical M/C, CAT40	
Results	 <p>TungForceFeed insert's light cutting action ensured reliable high feed milling improving MRR by 1.7x</p>		 <p>AH3225 prevented wear and chipping, while improving tool life by 1.3 times.</p>	
Workpiece type		Stamping die part	Turbine blade	
Cutter		EXLS02U0.50C0.50LH2.00R02 ($\phi 0.5"$, CICT = 2)	EXLS02U0.37C0.31LH0.75R01 ($\phi 0.375"$, CICT = 1)	
Insert		LSMT0202ZER-HM	LSMT0202ZER-HM	
Grade		AH3225	AH8015	
		H13 (45HRC)	Inconel 939	
Workpiece material		 H	 S	
Cutting conditions	Cutting speed : Vc (sfm)	371	98	
	Feed per tooth: fz (ipt)	0.020 (Competitor: fz = 0.004)	0.008 (Competitor: fz = 0.002)	
	Depth of cut : ap (inch)	0.012	0.012	
	Width of cut : ae (inch)	0.472	0.315	
	Machining	Face milling	Grooving	
	Coolant	Air	Dry	
	Machine	Vertical M/C, CAT50	Vertical M/C, CAT50	
Results	 <p>Strong TungForceFeed inserts ensured reliable machining of hard material, improving MRR by 5 times.</p>		 <p>Higher feed per tooth improved MRR by double, while reducing tool cost thanks to indexability.</p>	

MEMO

A large grid of graph paper, consisting of 20 columns and 30 rows of small squares, intended for writing a memo.

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