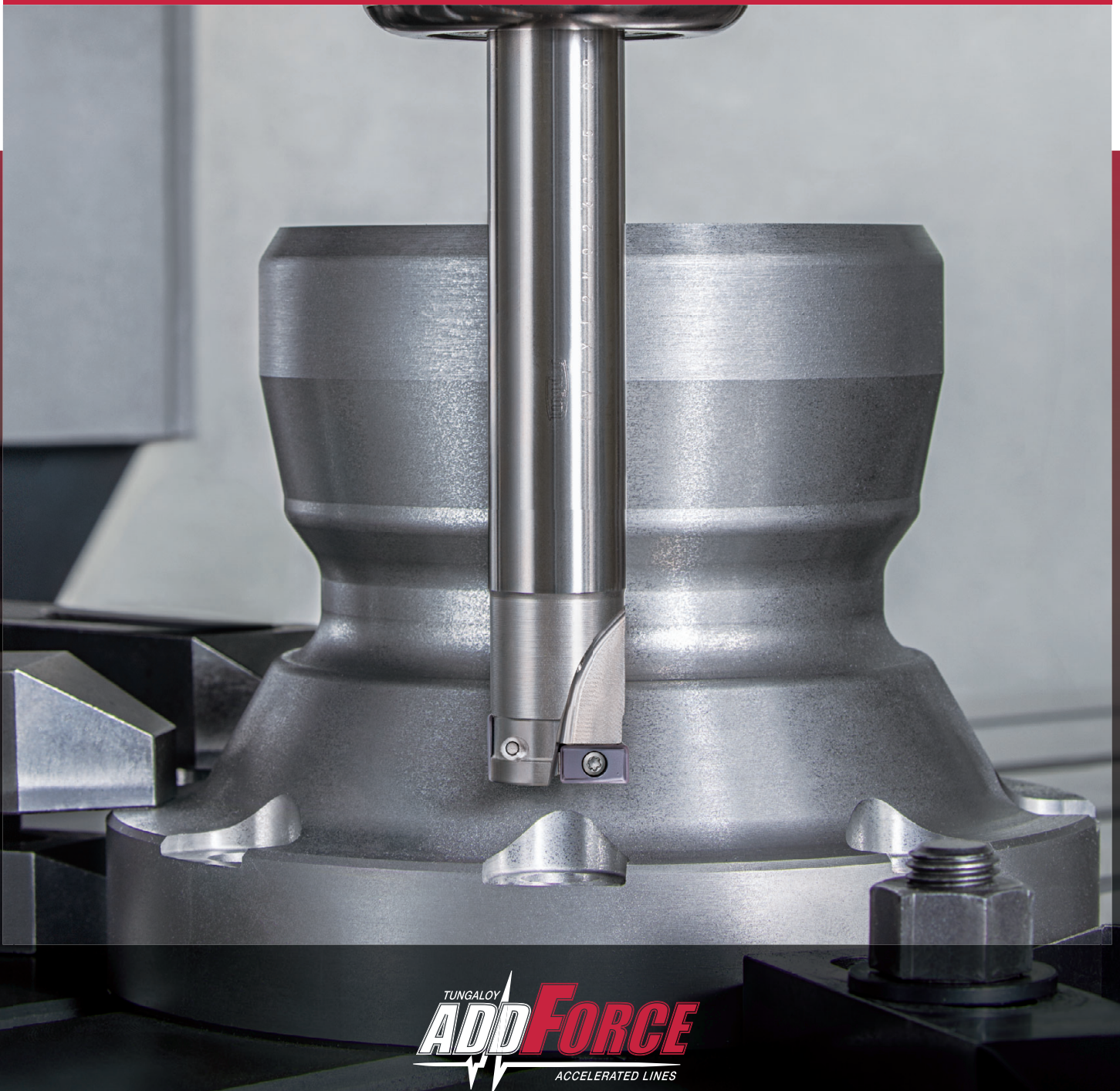


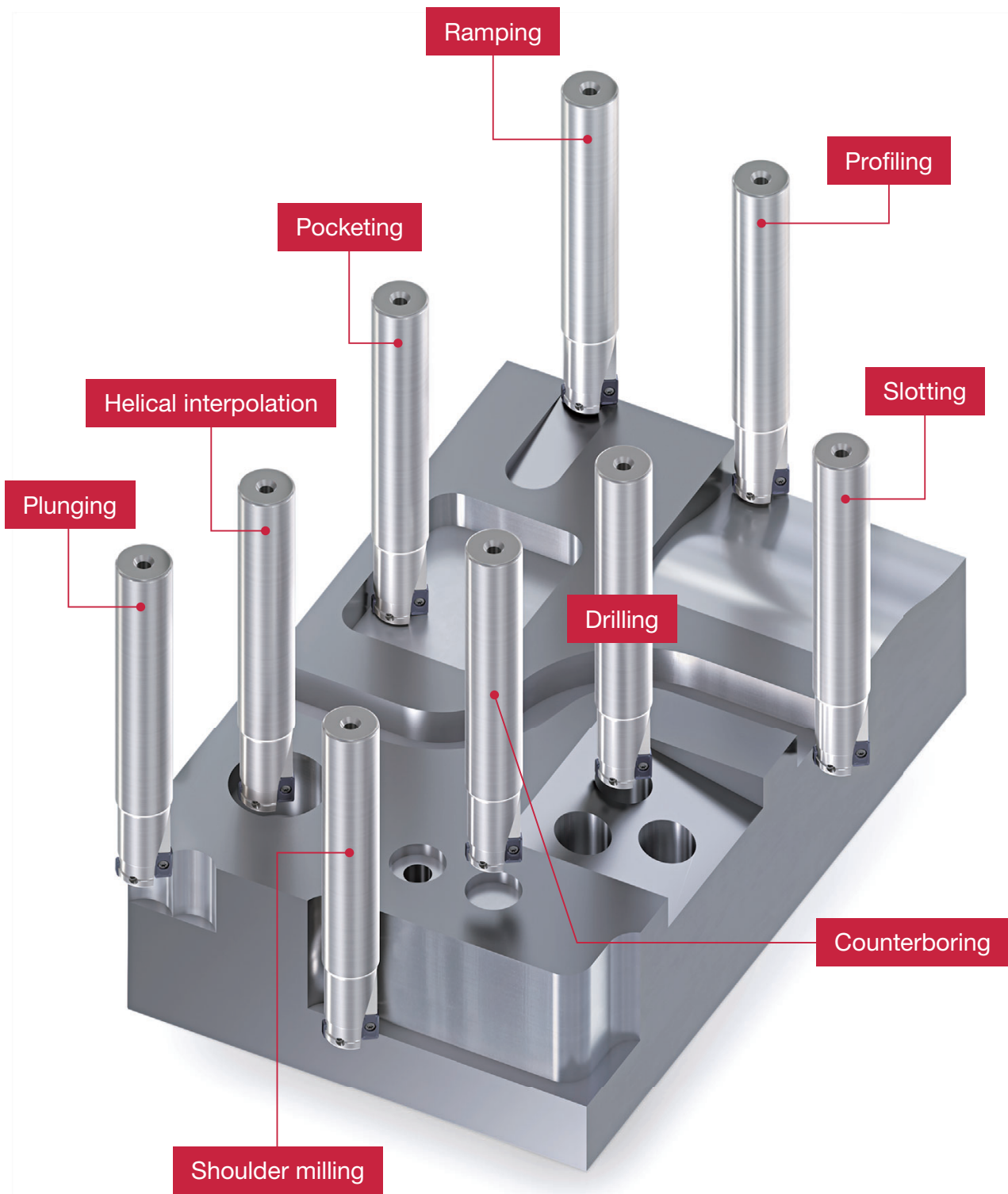
Multifunctional milling cutter with center cutting edge

DOM^{ULTI}**REC**

Tungaloy Report No. 548-G

From shoulder milling to hole making —
All-round cutter with center cutting capability
provides ultimate machining versatility







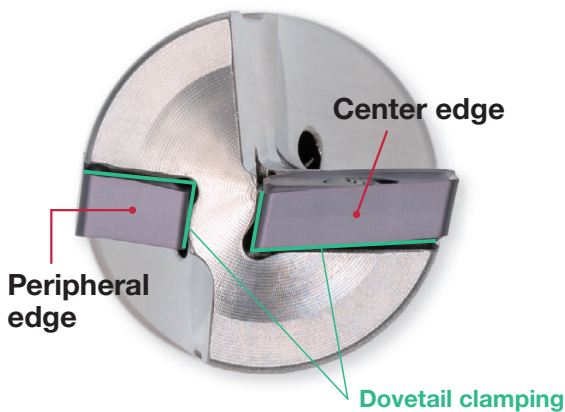
Great tool versatility reduces the number of tool changes
for improved machine utilization

Innovative four-edged inserts provide ultimate machining flexibility and economy – from flat bottom drilling to profiling

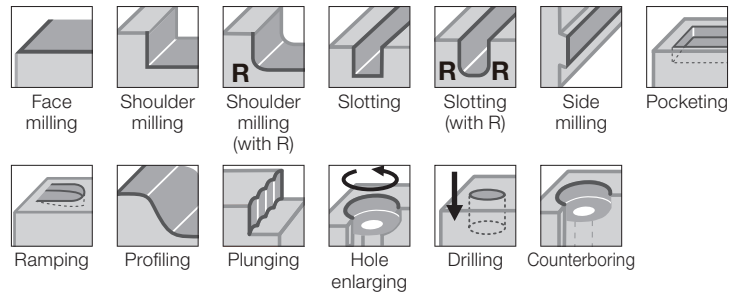


Ultimate versatility

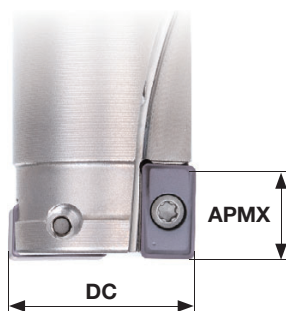
With center cutting capability, a single cutter can perform a wide array of applications, enabling process and tool integrations for maximum productivity. Dovetail insert clamping ensures for high process security.



Applications capabilities with DoMultiRec



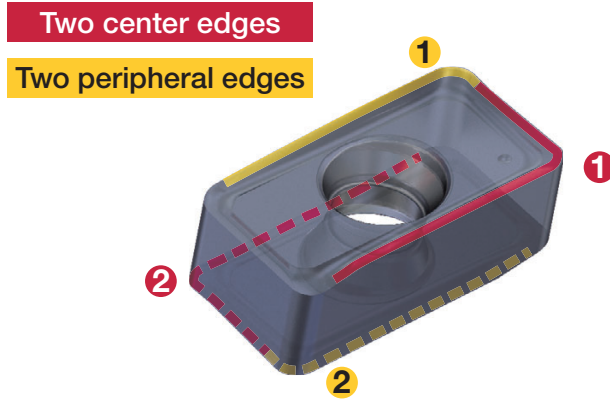
Lineup



Insert size	APMX (mm)	Tool dia. DC (mm)
08	7	ø16
		ø17
10	9	ø20
		ø21
12	11	ø25
		ø26

Maximum cost per edge for shoulder cutters with a center cutting edge

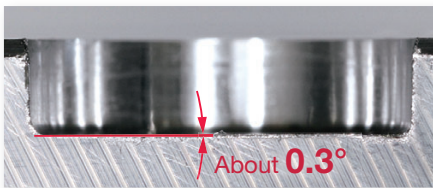
A single insert can be used either for center edge or peripheral edge and can be used twice in each position – four total cutting edges for highest insert economy.



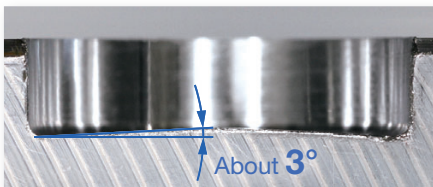
Flat hole bottom

Easy to make hole bottoms as flat as possible. Also makes it suitable for counter boring.

DOM ULTI **REC**



Competitor



Flat hole bottom
(Slant angle $\approx 0.3^\circ$)



Conical bottom
(Slant angle $\approx 3^\circ$)

Size 12

Cutter : EVLX12M025C25.0R02 ($\phi 25$ mm, $z = 2$)
 Insert : LXMU120408PER-MM AH3225
 Cutting speed : $V_c = 150$ m/min
 Feed per tooth : $f_z = 0.07$ mm/t
 Hole depth : 5 mm
 Overhang length : 45 mm
 Coolant : Dry

Optimized bottom edge design provides hole bottom with flatness.

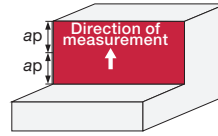
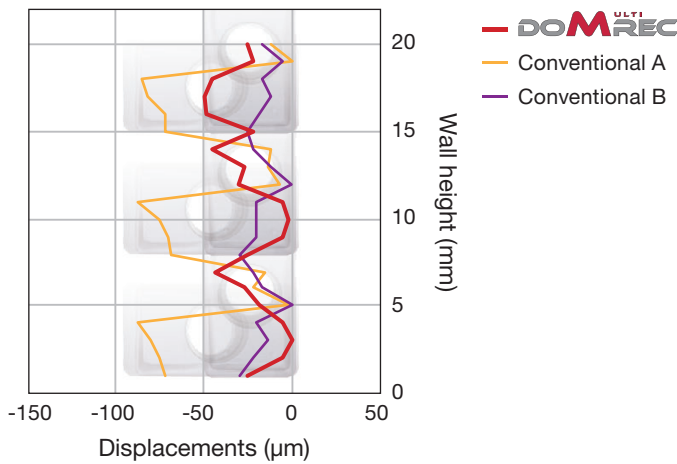
See page 12 for more information on the bottom edge design

High machining precision

Excellent wall accuracy and surface finish quality

Wall accuracy

Size 08

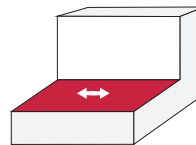
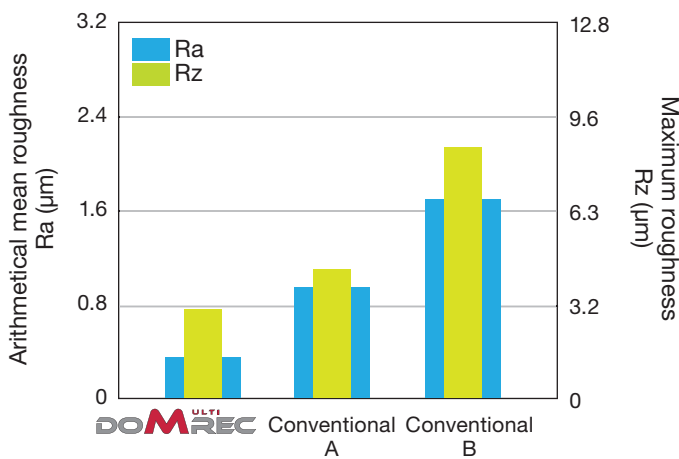


Cutter : EVLX08M016C16.0R02 (ø16 mm, z = 2)
 Insert : LXMU080304PER-MM AH3225
 Workpiece material: S55C / C55 (210HB)
 Cutting speed : $V_c = 140$ m/min
 Feed per tooth : $f_z = 0.07$ mm/t
 Depth of cut : $a_p = 7$ mm x 3 pass
 Width of cut : $a_e = 4$ mm
 Overhang length : 40 mm
 Coolant : Dry

Better wall straightness with less step-overs than conventional cutters.

Surface roughness

Size 10



Cutter : EVLX10M020C20.0R02 (ø20 mm, z = 2)
 Insert : LXMU10T308PER-MM AH3225
 Workpiece material: S55C / C55 (210HB)
 Cutting speed : $V_c = 140$ m/min
 Feed per tooth : $f_z = 0.07$ mm/t
 Depth of cut : $a_p = 1$ mm
 Width of cut : $a_e = 12.5$ mm
 Overhang length : 40 mm
 Coolant : Dry

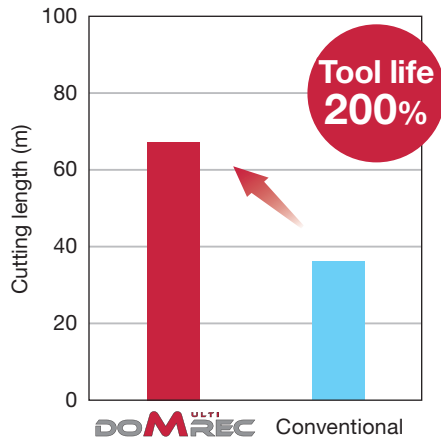
Better surface quality than conventional cutters.

Cutting performance

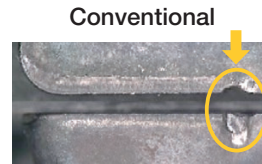
Tool life

P S55C / C55 (195HB)

Size 10



No edge fracture



Edge fracture occurred due to low cutting edge strength

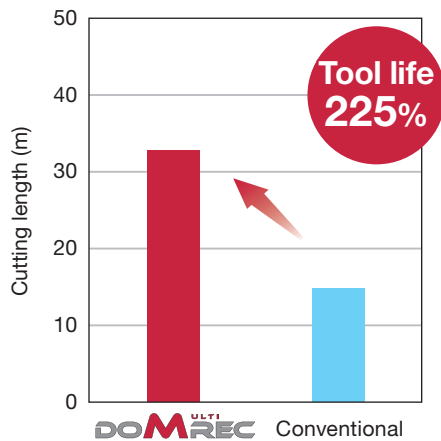


Cutter : EVLX10M020C20.0R02 ($\phi 20$ mm, $z = 2$)
 Insert : LXMU10T308PER-MM AH3225
 Cutting speed : $V_c = 150$ m/min
 Feed per tooth : $f_z = 0.1$ mm/t
 Depth of cut : $a_p = 4$ mm
 Width of cut : $a_e = 12.5$ mm
 Overhang length : 30 mm
 Coolant : Dry

Strong cutting edge design eliminated edge fracture, providing longer tool life.

P NAK80 (40HRC)

Size 08

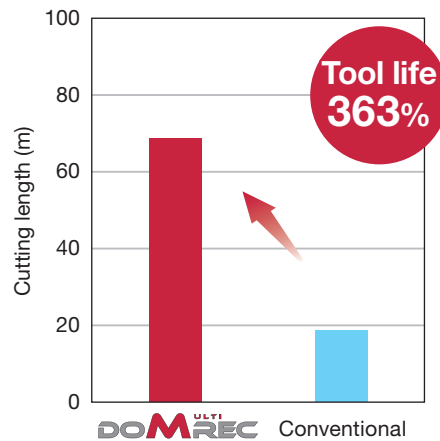


Cutter : EVLX08M016C16.0R02 ($\phi 16$ mm, $z = 2$)
 Insert : LXMU080404PER-MM AH8015
 Cutting speed : $V_c = 70$ m/min
 Feed per tooth : $f_z = 0.06$ mm/t
 Depth of cut : $a_p = 4$ mm
 Width of cut : $a_e = 11.2$ mm
 Overhang length : 32 mm
 Coolant : Dry

Eliminated edge chipping during machining of extremely hard pre-hardened steel, providing longer tool life.

K FC250 / 250 (162HB)

Size 10



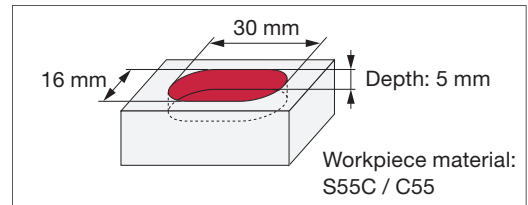
Cutter : EVLX10M020C20.0R02 ($\phi 20$ mm, $z = 2$)
 Insert : LXMU10T308PER-MM AH8015
 Cutting speed : $V_c = 200$ m/min
 Feed per tooth : $f_z = 0.12$ mm/t
 Depth of cut : $a_p = 7$ mm
 Width of cut : $a_e = 12$ mm
 Overhang length : 60 mm
 Coolant : Dry

Wear-resistant AH8015 provided long tool life in cast iron.

Machining improvement using DoMultiRec

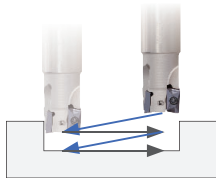
1 Making short closed slots

With the ramping method, the pass depth will be minimal due to the short cutting length of the slot and shallow ramp down angle, resulting in increased number of passes. Use the **drilling + endmilling** method (peck milling method) for increased d.o.c. and reduced number of passes, dramatically improving machining efficiency.



Conventional method (linear ramping)

The pass depth is restricted by short cutting length, increasing the number of passes.



Shoulder milling cutter
ø16 mm, z = 2

Ramping

Cutting speed : $V_c = 150$ m/min
Feed per tooth : $f_z = 0.1$ mm/t
Feed speed : $V_f = 600$ mm/min
Ramping angle : 3°
Depth of cut : $a_p = 2.5$ mm
Number of passes : 4 passes

Machining time: 6 sec.

High feed milling cutter
ø16 mm, z = 2

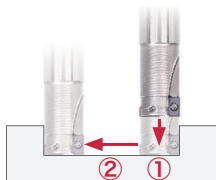
Ramping

Cutting speed : $V_c = 150$ m/min
Feed per tooth : $f_z = 0.8$ mm/t
Feed speed : $V_f = 4800$ mm/min
Ramping angle : 2°
Depth of cut : $a_p = 0.5$ mm
Number of passes : 20 passes

Machining time: 3.5 sec.

Accelerated solution (drilling + endmilling)

A combination of ① drilling followed by ② endmilling will greatly reduce the number of passes.



DOM^{ULTI}REC ø16 mm, z = 2

①Drilling

Cutting speed : $V_c = 150$ m/min
Feed : $f = 0.1$ mm/rev
Feed speed : $V_f = 300$ mm/min
Machining depth: 5 mm
Machining time : 1 sec.

②Endmilling

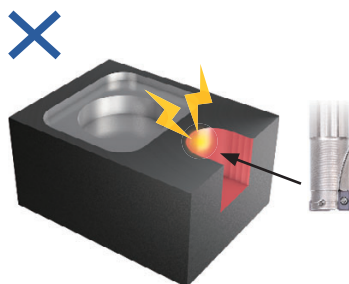
Cutting speed : $V_c = 150$ m/min
Feed per tooth : $f_z = 0.1$ mm/t
Feed speed : $V_f = 600$ mm/min
Depth of cut : $a_p = 5$ mm
Number of passes : 1 pass
Machining time : 1.4 sec.

Machining time: 2.4 sec.

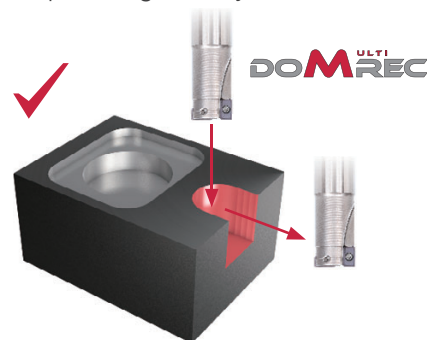
(① + ②)

2 Opening a slot with a closed end

Instead of simply endmilling into the side of the material, which often results in chattering at the end, use **drilling + endmilling** method. This eliminates chatter, while providing stability.



Endmilling into the side of the material often results in chatter at the end of closed slot.

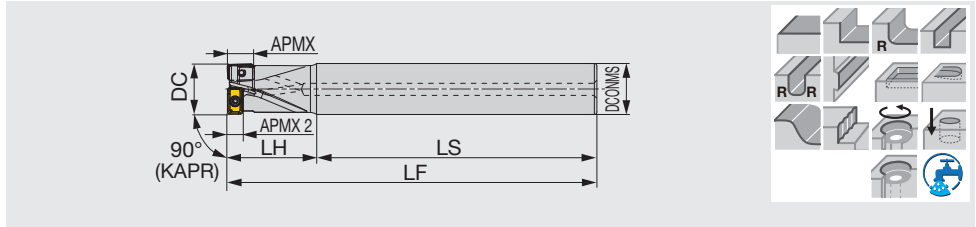


Instead, drill into the material, thus eliminating chatter, then endmill out of the material.

EVLX08/10/12

Multi-function endmill, shank type, with center cutting edge

GAMP: Center insert $-2.6^\circ \sim -4.4^\circ$, Peripheral insert $+6.1^\circ \sim +7.1^\circ$
 GAMF: Center insert $+0.2^\circ \sim +1.3^\circ$, Peripheral insert $-15.7^\circ \sim -15^\circ$



Designation	APMX	APMX 2	DC	CICT	DCONMS	LS	LH	LF	WT(kg)	Air hole	Insert
EVLX08M016C16.0R02	7	4	16	2	16	100	30	130	0.18	With	LXMU08...
EVLX08M016C16.0R02L	7	4	16	2	16	130	50	180	0.25	With	LXMU08...
EVLX08M017C16.0R02L	7	4	17	2	16	155	25	180	0.26	With	LXMU08...
EVLX10M020C20.0R02	9	4	20	2	20	110	35	145	0.31	With	LXMU10...
EVLX10M020C20.0R02L	9	4	20	2	20	130	60	190	0.41	With	LXMU10...
EVLX10M021C20.0R02L	9	4	21	2	20	160	30	190	0.42	With	LXMU10...
EVLX12M025C25.0R02	11	6	25	2	25	105	45	150	0.51	With	LXMU12...
EVLX12M025C25.0R02L	11	6	25	2	25	150	75	225	0.77	With	LXMU12...
EVLX12M026C25.0R02L	11	6	26	2	25	190	35	225	0.8	With	LXMU12...

SPARE PARTS



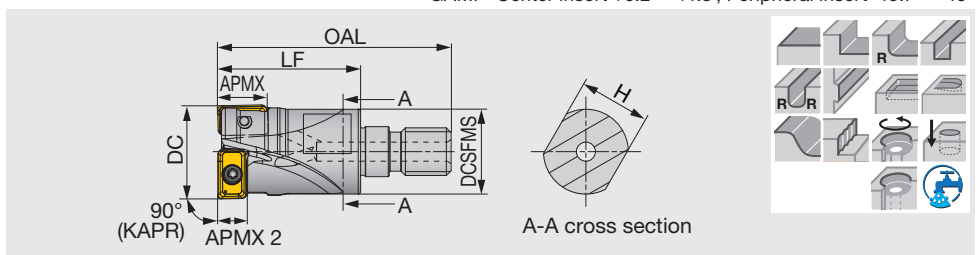
Designation	Clamping screw	Wrench
E/HVLX08...	CSPB-2.2	IP-7D
E/HVLX10...	SR-M2.5x0.45-L6IP7	IP-7D
E/HVLX12...	TS30100/HG-P	IP-9D

*Recommended clamping torque (N·m): CSPB-2.2, SR-M2.5x0.45-L6IP7 = 1, TS30100/HG-P = 2

HVLX08/10/12-M

Multi-function endmill, modular type (TungFlex), with center cutting edge

GAMP: Center insert $-2.6^\circ \sim -4.4^\circ$, Peripheral insert $+6.1^\circ \sim +7.1^\circ$
 GAMF: Center insert $+0.2^\circ \sim +1.3^\circ$, Peripheral insert $-15.7^\circ \sim -15^\circ$



Designation	APMX	APMX 2	DC	CICT	OAL	LF	H	DCSFMS	CRKS	WT(kg)	Air hole	Insert
HVLX08M016M08R02	7	4	16	2	42	25	10	14.5	M8	0.03	With	LXMU08...
HVLX10M020M10R02	9	4	20	2	49	30	15	17.8	M10	0.05	With	LXMU10...
HVLX12M025M12R02	11	6	25	2	57	35	17	23	M12	0.1	With	LXMU12...

SPARE PARTS

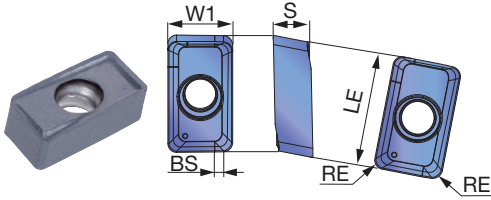


Designation	Clamping screw	Wrench
HVLX08M016M08R02	CSPB-2.2	IP-7D
HVLX10M020M10R02	SR-M2.5x0.45-L6IP7	IP-7D
HVLX12M025M12R02	TS30100/HG-P	IP-9D

*Recommended clamping torque (N·m): CSPB-2.2, SR-M2.5x0.45-L6IP7 = 1, TS30100/HG-P = 2

INSERT

LXMU-MM



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

★ : First choice
☆ : Second choice

Designation	RE	APMX	Coated			LE	W1	S	BS
			AH3225	AH120	AH8015				
LXMU080304PER-MM	0.4	7	●	●	●	7.7	5	2.8	0.8
LXMU10T308PER-MM	0.8	9	●	●	●	10	6	3.214	0.8
LXMU120408PER-MM	0.8	11	●	●	●	12.2	7.08	4.176	0.8

● : Line up

GRADES

AH3225 **P M S**

- Nano multi-layer coating technology with three major properties for optimal cutting edge integrity
- Increased resistance to wear, fracture, oxidation, built-up edge, and delamination

AH120 **P K**

- PVD grade with a well-balanced wear and fracture resistance
- Ideal for general machining of steel and stainless steel

AH8015 **H S**

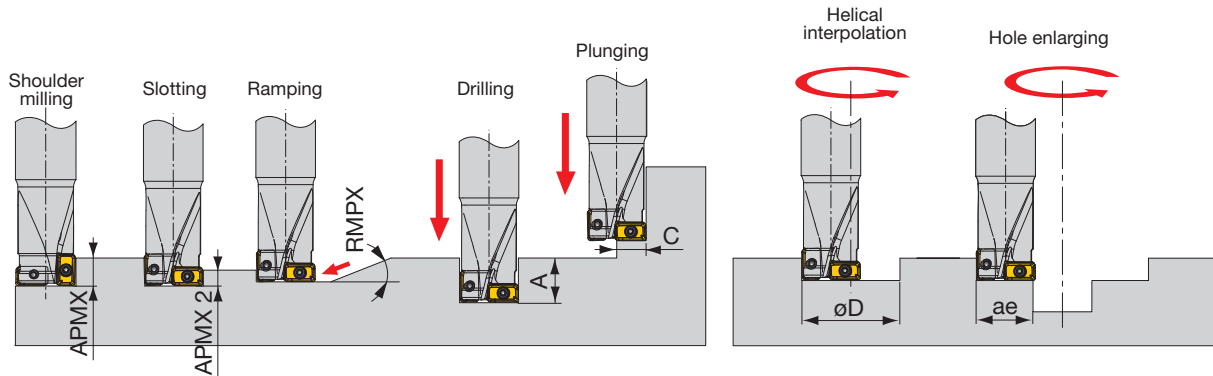
- Incorporates a hard coating layer and carbide substrate
- Strong resistance to wear, heat, and built-up edge, ideal for machining hard or difficult materials

STANDARD CUTTING CONDITIONS

ISO	Workpiece materials	Hardness	Priority	Grades	Cutting speed Vc (m/min)	Feed per tooth: fz (mm/t)			
						Drilling	Shouldering / Helical interpolation		
						08	10 / 12		
P	Low carbon steel S15C, SS400, etc. C15E4, E275A, etc.	- 200 HB	First choice	AH3225	100 - 300	0.03 - 0.08	0.05 - 0.25	0.05 - 0.3	
	Carbon steel and alloy steel S55C, SCM440, etc. C55, 42CrMo4, etc.	- 300 HB	First choice	AH3225	100 - 250	0.03 - 0.08	0.05 - 0.25	0.05 - 0.3	
	Prehardened steel NAK80, PX5, etc.	30 - 40 HRC	First choice	AH3225	100 - 200	0.03 - 0.06	0.05 - 0.2	0.05 - 0.25	
M	Stainless steel SUS304, SUS316, etc. X5CrNi18-9, X5CrNiMo17-12-3, etc.	-	First choice	AH3225	80 - 180	0.03 - 0.08	0.05 - 0.2	0.05 - 0.22	
K	Grey cast iron FC250, FC300, etc. 250, 300, etc.	150 - 250 HB	First choice	AH120	100 - 300	0.03 - 0.1	0.05 - 0.25	0.05 - 0.3	
	Ductile cast iron FCD400, FCD600, etc. 400-15S, 600-3, etc.	150 - 250 HB	First choice	AH120	100 - 250	0.03 - 0.08	0.05 - 0.2	0.05 - 0.25	
S	Titanium alloys Ti-6Al-4V, etc.	-	First choice	AH3225	20 - 60	0.03 - 0.06	0.04 - 0.15	0.04 - 0.15	
	Superalloys Inconel 718, etc.	-	First choice	AH8015	20 - 40	0.03 - 0.06	0.04 - 0.15	0.04 - 0.15	
H	Hardened steel	SKD61, etc. X40CrMoV5-1, etc.	40 - 50 HRC	First choice	AH8015	50 - 150	0.03 - 0.05	0.04 - 0.15	0.04 - 0.15
		SKD11, etc. X153CrMoV12, etc.	50 - 60 HRC	First choice	AH8015	40 - 70	0.03 - 0.05	0.04 - 0.15	0.04 - 0.15

*When using depth of cut \geq "APMX 2", feed rate has to set by 1 tooth.

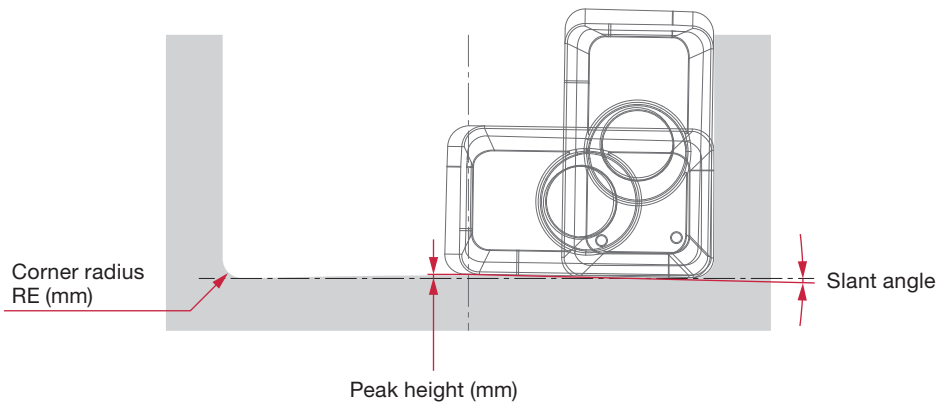
APPLICATION RANGE



Designation	DC	Max. depth of cut		Max. drilling depth A	Max. cutting width in plunging C	Max. ramping angle RMPX	Hole diameters (w/ flat bottom) machinable		Hole diameters machinable		Max. cutting width engagement ae
		APMX	APMX 2				øDmin	øDmax	øDmin	øDmax	
E/HVLX08M016...	16	7	4	12	8	90°	17	30.75	16	31.75	14
EVLX08M017...	17	7	4	12	8.5	90°	19	32.75	17	33.75	15
E/HVLX10M020...	20	9	4	15	10	90°	22	37.95	20	39.15	18
EVLX10M021...	21	9	4	15	10.5	90°	23.35	39.95	21	40.95	19
E/HVLX12M025...	25	11	6	18.5	12.5	90°	26.65	47.85	25	48.95	23
EVLX12M026...	26	11	6	18.5	13	90°	28.65	49.85	26	50.95	24

*Use pecking or dwelling method when drilling holes deeper than 5 mm.

■ HOLE BOTTOM PROFILE AFTER DRILLING

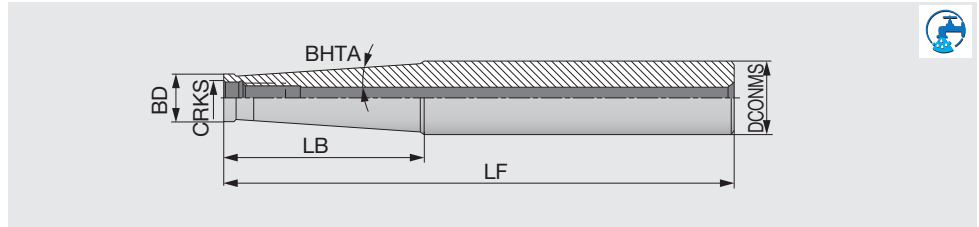


DC	D16	D17	D20	D21	D25	D26
Insert	LXMU08...		LXMU10...		LXMU12...	
Peak height (mm)	0.03	0.031	0.047	0.055	0.06	0.06
Slant angle	Conical shape with $\approx 0.3^\circ$ slant angle					
RE (mm)	0.4		0.8			

TUNGFLEX

SM

TungFlex - Modular shank

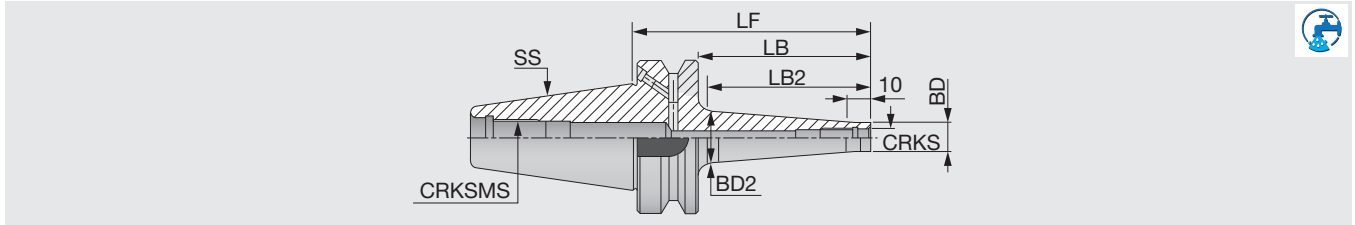


Designation	DCONMS	BD	LF	LB	BHTA	CRKS
SM08-L73C16	16	13	73	25	0°	M8
SM08-L128-C16	16	13	128	80	0.9°	M8
SM08-L170-C20	20	13	170	66.8	3.3°	M8
SM10-L80-C20	20	18	80	30	0°	M10
SM10-L130-C20	20	18	130	80	0.6°	M10
SM10-L200-C25	25	19	200	57.2	3.3°	M10
SM12-L86-C25	25	21	86	30	5.1°	M12
SM12-L200-C32	32	21	200	78	4.4°	M12

TUNGFLEX

BT-ODP (Screw clamping head holder)

TungFlex modular tooling system with BT shank



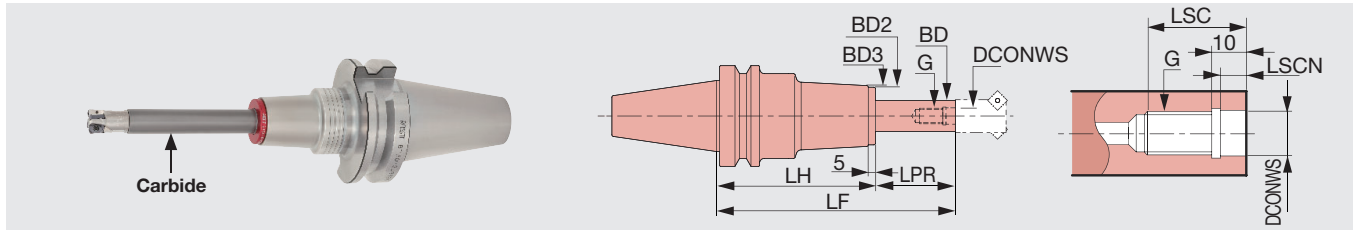
Designation	SS	CRKS	BD	BD2	LF	LB	LB2	CRKSMS
BT40ODP6X66	40	M6	9.8	13	66	39	30	M16
BT40ODP6X106	40	M6	9.8	23	106	79	70	M16
BT40ODP8X66	40	M8	13	15	66	39	30	M16
BT40ODP8X106	40	M8	13	23	106	79	70	M16
BT40ODP10X66	40	M10	18	20	66	39	30	M16
BT40ODP10X106	40	M10	18	28	106	79	70	M16
BT40ODP12X66	40	M12	21	24	66	39	30	M16
BT40ODP12X106	40	M12	21	31	106	79	70	M16
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

Applicable for 10 MPa pressure coolant

(1) Balanced to G6.3 at 12,000 min⁻¹

BT-RSG (Screw clamping head holder)


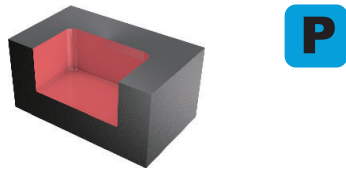
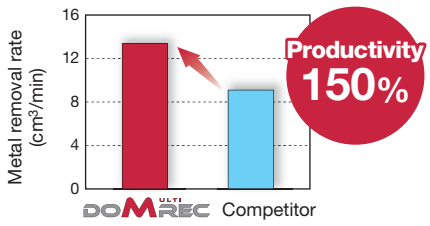
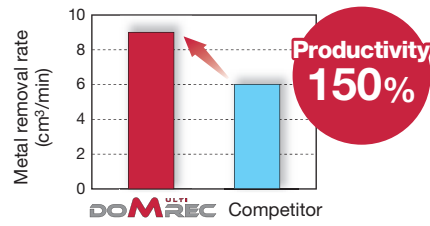
TungFlex modular tooling system with BT shank



Designation	DCONWS	LSC	LSCN	BD	LF	LPR	LH	BD2	BD3	WT (kg)	G
BT40-RSG 8-105-M 25	8.5	18	6.5	15	105	25	80	30	32	1.4	M8
BT40-RSG 8-135-M 25	8.5	18	6.5	15	135	25	110	30	32	1.8	M8
BT40-RSG 8-130-M 50	8.5	18	6.5	15	130	50	80	30	32	1.4	M8
BT40-RSG 8-160-M 50	8.5	18	6.5	15	160	50	110	30	32	1.8	M8
BT40-RSG 8-155-M 75	8.5	18	6.5	15	155	75	80	30	32	1.5	M8
BT40-RSG 8-185-M 75	8.5	18	6.5	15	185	75	110	30	32	1.9	M8
BT40-RSG 10-125-M 25	10.5	22	6.5	19	125	25	100	36	38	1.8	M10
BT40-RSG 10-155-M 25	10.5	22	6.5	19	155	25	130	36	38	2.2	M10
BT40-RSG 10-150-M 50	10.5	22	6.5	19	150	50	100	36	38	1.9	M10
BT40-RSG 10-180-M 50	10.5	22	6.5	19	180	50	130	36	38	2.3	M10
BT40-RSG 10-175-M 75	10.5	22	6.5	19	175	75	100	36	38	2	M10
BT40-RSG 10-205-M 75	10.5	22	6.5	19	205	75	130	36	38	2.4	M10
BT40-RSG 10-200-M100	10.5	22	6.5	19	200	100	100	36	38	2	M10
BT40-RSG 10-230-M100	10.5	22	6.5	19	230	100	130	36	38	2.4	M10
BT40-RSG 12-125-M 25	12.5	22	6	24	125	25	100	43	45	2	M12
BT40-RSG 12-155-M 25	12.5	22	6	24	155	25	130	43	45	2.4	M12
BT40-RSG 12-150-M 50	12.5	22	6	24	150	50	100	43	45	2.1	M12
BT40-RSG 12-180-M 50	12.5	22	6	24	180	50	130	43	45	2.5	M12
BT40-RSG 12-175-M 75	12.5	22	6	24	175	75	100	43	45	2.3	M12
BT40-RSG 12-205-M 75	12.5	22	6	24	205	75	130	43	45	2.7	M12
BT40-RSG 12-200-M100	12.5	22	6	24	200	100	100	43	45	2.4	M12
BT40-RSG 12-230-M100	12.5	22	6	24	230	100	130	43	45	2.8	M12
BT50-RSG 8-120-M 25	8.5	18	6.5	15	120	25	95	30	32	4	M8
BT50-RSG 8-150-M 25	8.5	18	6.5	15	150	25	125	30	32	4.3	M8
BT50-RSG 8-145-M 50	8.5	18	6.5	15	145	50	95	30	32	4	M8
BT50-RSG 8-175-M 50	8.5	18	6.5	15	175	50	125	30	32	4.3	M8
BT50-RSG 8-170-M 75	8.5	18	6.5	15	170	75	95	30	32	4.1	M8
BT50-RSG 8-200-M 75	8.5	18	6.5	15	200	75	125	30	32	4.4	M8
BT50-RSG 10-140-M 25	10.5	22	6.5	19	140	25	115	36	38	4.3	M10
BT50-RSG 10-170-M 25	10.5	22	6.5	19	170	25	145	36	38	4.6	M10
BT50-RSG 10-165-M 50	10.5	22	6.5	19	165	50	115	36	38	4.4	M10
BT50-RSG 10-195-M 50	10.5	22	6.5	19	195	50	145	36	38	4.7	M10
BT50-RSG 10-190-M 75	10.5	22	6.5	19	190	75	115	36	38	4.5	M10
BT50-RSG 10-220-M 75	10.5	22	6.5	19	220	75	145	36	38	4.8	M10
BT50-RSG 10-215-M100	10.5	22	6.5	19	215	100	115	36	38	4.5	M10
BT50-RSG 10-245-M100	10.5	22	6.5	19	245	100	145	36	38	4.8	M10
BT50-RSG 12-140-M 25	12.5	22	6	24	140	25	115	43	45	4.6	M12
BT50-RSG 12-170-M 25	12.5	22	6	24	170	25	145	43	45	5	M12
BT50-RSG 12-165-M 50	12.5	22	6	24	165	50	115	43	45	4.7	M12
BT50-RSG 12-195-M 50	12.5	22	6	24	195	50	145	43	45	5.1	M12
BT50-RSG 12-190-M 75	12.5	22	6	24	190	75	115	43	45	4.9	M12
BT50-RSG 12-220-M 75	12.5	22	6	24	220	75	145	43	45	5.3	M12
BT50-RSG 12-215-M100	12.5	22	6	24	215	100	115	43	45	5	M12
BT50-RSG 12-245-M100	12.5	22	6	24	245	100	145	43	45	5.4	M12
BT50-RSG 12-240-M125	12.5	22	6	24	240	125	115	43	45	5.2	M12

Manufactured by: **MST** corporation

PRACTICAL EXAMPLES

Workpiece type	Machine part	Machine part	
Cutter	EVLX12M026C25.0R02 (ø26 mm, z = 2)	EVLX12M026C25.0R02 (ø26 mm, z = 2)	
Insert	LXMU120408PER-MM	LXMU120408PER-MM	
Grade	AH3225	AH3225	
Workpiece material	Cast stainless steel	SCM420/18CrMo4	
	Size 12 	Size 12 	
Cutting conditions	Cutting speed: V_c (m/min)	60	118
	Feed per tooth: f_z (mm/t)	0.07	0.31
	Feed speed: V_f (mm/min)	102.8	900
	Depth of cut : a_p (mm)	5	2
	Width of cut : a_e (mm)	26	5
	Machining	Counterboring, Slotting	Shoulder milling
	Coolant	External	Air blast
	Overhang length (mm)	40	100
Machine	Vertical M/C, BT40	Vertical M/C, BT50	
Results	 <p>DoMultiRec generated soft cutting, while eliminating chatter and cutting edge fracture. 1.5 times productivity was achieved.</p>	 <p>Thanks to strong cutting edges, DoMultiRec enabled higher feed rate than the competitor without causing chipping on the cutting edge. 1.5 times productivity was achieved.</p>	

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