

Tungaloy

Member IMC Group

Keeping the Customer First

Tungaloy Report No. 366-E1

EPH / EVH / EXH

Hybrid TAC Mill Series

Extended
Range

Next generation TAC Endmills - One tool for multiple machining processes

EPH

New!

Straight, Long,
Undercut and
reduced shank
types.

EVH
EXH



Hybrid TAC Mills

EPH type

High precision

Generates low cutting forces, high productivity levels and highly accurate machining that is comparable to solid carbide endmills! Inserts are available with various corner radii.



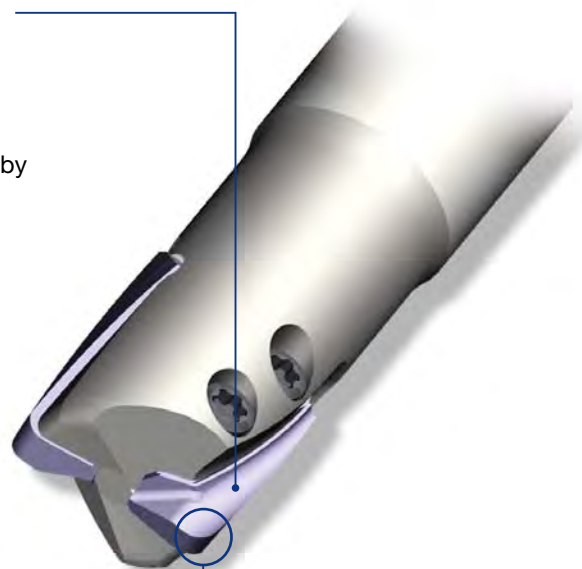
In addition to the current range, dedicated shank types for automatic lathes are available.

Long cutting edge length and high rake geometry

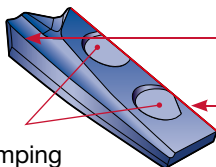
- Covers wider machining area compared to solid endmills
- The problems of small inserts with short edge length plus insufficient sharpness found in conventional indexable insert endmills, is eliminated by the Hybrid TAC Mill.

Edge length equal to cutter diameter. 15 ° helix angle

Tool diameters:
Ø10 / Ø12 (2 teeth)
Ø16 (2 or 3 teeth)
Ø20 / Ø21 (3 teeth)
Ø25 / Ø26 (4 teeth)



Highly accurate insert geometry



Cavities for clamping

Precision ground edge geometry gives accuracy and cutting edge sharpness comparable to a solid carbide endmill.

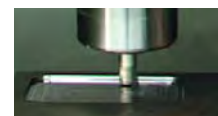
Axial base delivers excellent positional accuracy

Available in a variety of corner radius

- Caters for square to radius endmills

For steels Corner radii are available in: 0.2/0.4/0.5/0.8/1.0/1.2/1.5/1.6/2.0 mm

For aluminium alloys Corner radii are available in: 0.0/0.2/0.4/0.5/0.8/1.0/1.2/1.5/1.6/2.0 mm



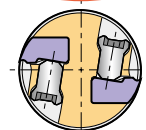
Allows highly productive pocketing

Highly functional body design

- Special surface treatment reduces friction and corrosion.
- The new clamping mechanism, "DD-FiT", directly fixes the insert to the upper surface with two clamping screws. It improves rigidity between insert and body. The insert can also be changed without removing the screws from the body, preventing the loss of small screws.



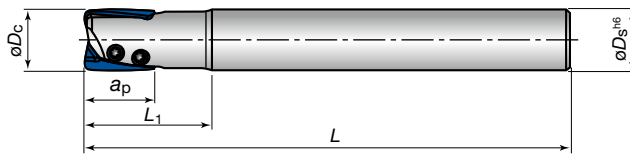
Tungaloy's new logo for the clamping mechanism for small indexable insert cutting tools.



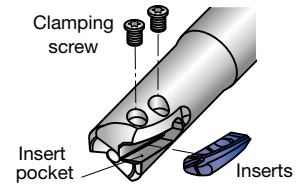
Clamping mechanism (Two-insert EPH type)

EPH (body) Specification

● Straight type



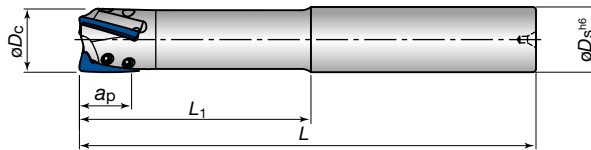
Tool assembly and replacement parts



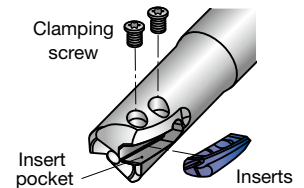
Cat. No.	Stock	No. of inserts	Dimensions (mm)					Clamping screw (Std. fastening torque)	Wrench	Applicable inserts
			ϕD_c	ϕD_s	Max. a_p	L	L_1			
EPH11R010M10.0-2	●	2	10	10	10	80	21	CSPB-2H (0.7N·m)	IP-6F	XHGR1102□□□R-□□
EPH13R012M12.0-2	●	2	12	12	12	80	25	CSPB-2.2SH (1.1N·m)	IP-7D	XHGR1302□□□R-□□
EPH18R016M16.0-2	●	2	16	16	16	100	33	CSPB-2.5SH (1.1N·m)	IP-7D	XHGR18T2□□□R-□□
EPH18R016M16.0-3	●	3	16	16	16	100	33			
New EPH18R020M20.0-3	●	3	20	20	16	110	41			
New EPH18R025M25.0-4	●	4	25	25	16	120	51			

● Long type

New



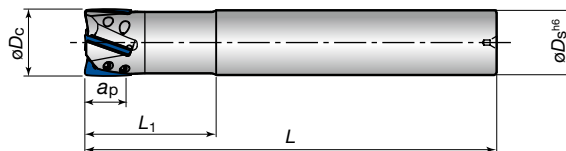
Tool assembly and replacement parts



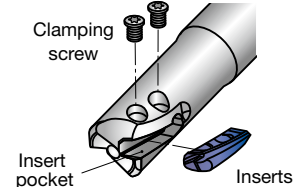
Cat. No.	Stock	No. of inserts	Dimensions (mm)					Clamping screw (Std. fastening torque)	Wrench	Applicable inserts
			ϕD_c	ϕD_s	Max. a_p	L	L_1			
EPH11R010M10.0-2L	●	2	10	10	10	100	36	CSPB-2H (0.7N·m)	IP-6F	XHGR1102□□□R-□□
EPH13R012M12.0-2L	●	2	12	12	12	110	43	CSPB-2.2SH (1.1N·m)	IP-7D	XHGR1302□□□R-□□
EPH18R016M16.0-2L	●	2	16	16	16	130	56	CSPB-2.5SH (1.1N·m)	IP-7D	XHGR18T2□□□R-□□
EPH18R016M16.0-3L	●	3	16	16	16	130	56			
EPH18R020M20.0-3L	●	3	20	20	16	140	71			
EPH18R025M25.0-4L	●	4	25	25	16	160	88.5			

● Undercut type

New



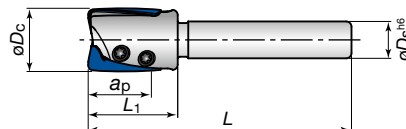
Tool assembly and replacement parts



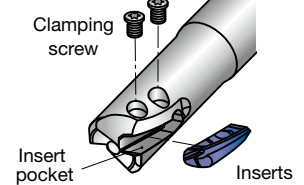
Cat. No.	Stock	No. of inserts	Dimensions (mm)					Clamping screw (Std. fastening torque)	Wrench	Applicable inserts
			ϕD_c	ϕD_s	Max. a_p	L	L_1			
EPH13R013M12.0-2	●	2	13	12	12	110	25	CSPB-2.2SH (1.1N·m)	IP-7D	XHGR1302□□□R-□□
EPH13R014M12.0-2	●	2	14	12	12	110	25			
EPH18R017M16.0-3	●	3	17	16	16	130	33	CSPB-2.5SH (1.1N·m)	IP-7D	XHGR18T2□□□R-□□
EPH18R018M16.0-3	●	3	18	16	16	130	33			
EPH18R021M20.0-3	●	3	21	20	16	140	41			
EPH18R026M25.0-4	●	4	26	25	16	160	51			

● Reduced shank for automatic lathes

New



Tool assembly and replacement parts

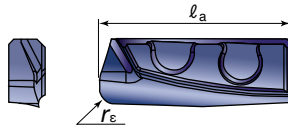


Cat. No.	Stock	No. of inserts	Dimensions (mm)					Clamping screw (Std. fastening torque)	Wrench	Applicable inserts
			ϕD_c	ϕD_s	Max. a_p	L	L_1			
EPH11R010M06.0-2	●	2	10	6	10	50	15	CSPB-2H (0.7N·m)	IP-6F	XHGR1102□□□R-□□
EPH13R012M07.0-2	●	2	12	7	12	50	17	CSPB-2.2SH (1.1N·m)	IP-7D	XHGR1302□□□R-□□
EPH18R016M10.0-3	●	3	16	10	16	60	22	CSPB-2.5SH (1.1N·m)	IP-7D	XHGR18T2□□□R-□□
EPH18R020M10.0-3	●	3	20	10	16	60	22			

●: Stocked in Japan

Hybrid TAC Mills

EPH Inserts Specification

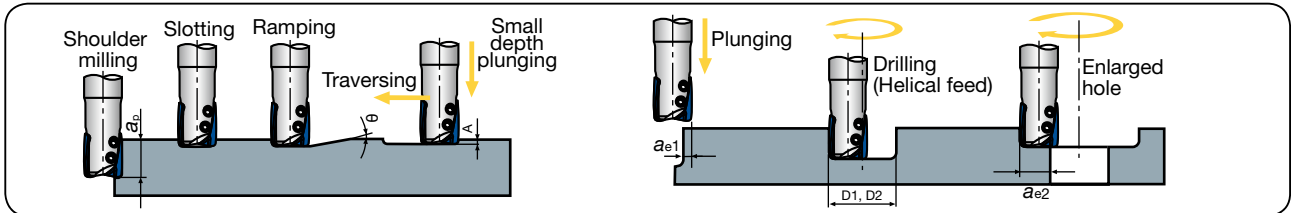


Insert Cat. No.	Grade	Dimensions (mm)		Applica-tions	Applicable cutter	Insert Cat. No.	Grade	Dimensions (mm)		Applica-tions	Applicable cutter
	AH730	l_a	Corner R r_e				DS1200	l_a	Corner R r_e		
XHGR110202ER-MJ	●	11	0.2	P Steels	EPH11R□□	XHGR110200FR-AJ	●	11	0	N Non-ferrous Metals	EPH11R□□
XHGR110204ER-MJ	●		0.4			XHGR110202FR-AJ	●		0.2		
XHGR110205ER-MJ	●		0.5			XHGR110204FR-AJ	●		0.4		
XHGR110208ER-MJ	●		0.8			XHGR110205FR-AJ	●		0.5		
XHGR110210ER-MJ	●		1.0			XHGR110208FR-AJ	●		0.8		
XHGR110212ER-MJ	●		1.2			XHGR110210FR-AJ	●		1.0		
XHGR110215ER-MJ	●		1.5			XHGR110212FR-AJ	●		1.2		
XHGR110216ER-MJ	●		1.6			XHGR110215FR-AJ	●		1.5		
XHGR110220ER-MJ	●		2.0			XHGR110216FR-AJ	●		1.6		
XHGR130202ER-MJ	●		13			0.2	M Stainless K Cast irons		EPH13R□□		
XHGR130204ER-MJ	●	0.4		XHGR130202FR-AJ	●	0.2					
XHGR130205ER-MJ	●	0.5		XHGR130204FR-AJ	●	0.4					
XHGR130208ER-MJ	●	0.8		XHGR130205FR-AJ	●	0.5					
XHGR130210ER-MJ	●	1.0		XHGR130208FR-AJ	●	0.8					
XHGR130212ER-MJ	●	1.2		XHGR130210FR-AJ	●	1.0					
XHGR130215ER-MJ	●	1.5		XHGR130212FR-AJ	●	1.2					
XHGR130216ER-MJ	●	1.6		XHGR130215FR-AJ	●	1.5					
XHGR130220ER-MJ	●	2.0		XHGR130216FR-AJ	●	1.6					
XHGR18T202ER-MJ	●	18		0.2	K Cast irons	EPH18R□□		XHGR18T200FR-AJ		●	18
XHGR18T204ER-MJ	●		0.4	XHGR18T202FR-AJ			●	0.2			
XHGR18T205ER-MJ	●		0.5	XHGR18T204FR-AJ			●	0.4			
XHGR18T208ER-MJ	●		0.8	XHGR18T205FR-AJ			●	0.5			
XHGR18T210ER-MJ	●		1.0	XHGR18T208FR-AJ			●	0.8			
XHGR18T212ER-MJ	●		1.2	XHGR18T210FR-AJ			●	1.0			
XHGR18T215ER-MJ	●		1.5	XHGR18T212FR-AJ			●	1.2			
XHGR18T216ER-MJ	●		1.6	XHGR18T215FR-AJ			●	1.5			
XHGR18T220ER-MJ	●		2.0	XHGR18T216FR-AJ			●	1.6			
									XHGR18T220FR-AJ	●	

Note: When using inserts with a corner radius in excess of 1mm, additional work to the cutter body is needed.

●: Stocked in Japan

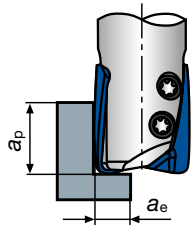
EPH Machining modes

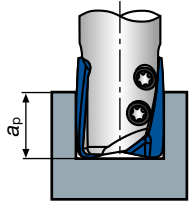


type	Cat. No.	Tool ϕ ϕD_c (mm)	Max. depth of cut a_p (mm)	Max. ramping angle θ	Max. plunging depth A (mm)	Max. cutting width in plunging a_{e1} (mm)	Min. machinable hole ϕ $D1$ (mm)	Max. machinable hole ϕ $D2^*$ (mm)	Max. cutting width in enlarged hole a_{e2}^* (mm)
Straight	EPH11R010M10.0-2	$\phi 10$	10	3°	0.3	3	13	19.5	9.7
	EPH13R012M12.0-2	$\phi 12$	12	3.5°	0.3	3	16	23.5	11.7
	EPH18R016M16.0-2	$\phi 16$	16	3.5°	0.3	4	22	31.5	15.7
	EPH18R016M16.0-3	$\phi 16$	16	3.5°	0.3	4	22	31.5	15.7
	EPH18R020M20.0-3	$\phi 20$	16	2°	0.3	4	29	39.5	19.7
Long	EPH18R025M25.0-4	$\phi 25$	16	1.5°	0.3	4	39	49.5	24.7
	EPH11R010M10.0-2L	$\phi 10$	10	3°	0.3	3	13	19.5	9.7
	EPH13R012M12.0-2L	$\phi 12$	12	3.5°	0.3	3	16	23.5	11.7
	EPH18R016M16.0-2L	$\phi 16$	16	3.5°	0.3	4	22	31.5	15.7
	EPH18R016M16.0-3L	$\phi 16$	16	3.5°	0.3	4	22	31.5	15.7
Undercut	EPH18R020M20.0-3L	$\phi 20$	16	2°	0.3	4	29	39.5	19.7
	EPH18R025M25.0-4L	$\phi 25$	16	1.5°	0.3	4	39	49.5	24.7
	EPH13R013M12.0-2	$\phi 13$	12	2°	0.3	3	17	25.5	12.7
	EPH13R014M12.0-2	$\phi 14$	12	1.5°	0.3	3	19	27.5	13.7
	EPH18R017M16.0-3	$\phi 17$	16	3°	0.3	4	23	33.5	16.7
	EPH18R018M16.0-3	$\phi 18$	16	2.5°	0.3	4	25	35.5	17.7
For automatic lathes	EPH18R021M20.0-3	$\phi 21$	16	2°	0.3	4	31	41.5	20.7
	EPH18R026M25.0-4	$\phi 26$	16	1.5°	0.3	4	41	51.5	25.7
	EPH11R010M06.0-2	$\phi 10$	10	3°	0.3	3	13	19.5	9.7
	EPH13R012M07.0-2	$\phi 12$	12	3.5°	0.3	3	16	23.5	11.7
	EPH18R016M10.0-3	$\phi 16$	16	3.5°	0.3	4	22	31.5	15.7
	EPH18R020M10.0-3	$\phi 20$	16	2°	0.3	4	29	39.5	19.7

*Where the insert corner radius ≤ 0.2 mm

EPH Standard cutting conditions

● Shoulder milling	Work material	Cutting speed V_c (m/min)	Feed rate f_z (mm/t)	Cutting conditions		
				$\phi 10 \leq \phi D_C < \phi 12$	$\phi 12 \leq \phi D_C < \phi 16$	$\phi 16 \leq \phi D_C \leq \phi 26$
 <p>a_p: Axial depth of cut a_e: Radial depth of cut</p>	Carbon steels Alloy steels ($< 30\text{HRC}$)	60 ~ 180	0.03 ~ 0.1	$V_c = 120 \text{ m/min}, f_z = 0.08 \text{ mm/t}$		
				$a_p \leq 7.5 \text{ mm}$ $a_e \leq 1.5 \text{ mm}$	$a_p \leq 9.0 \text{ mm}$ $a_e \leq 1.5 \text{ mm}$	$a_p \leq 12.0 \text{ mm}$ $a_e \leq 2.0 \text{ mm}$
	Alloy steels prehardened steels (30 ~ 40HRC)	50 ~ 150	0.03 ~ 0.08	$V_c = 100 \text{ m/min}, f_z = 0.05 \text{ mm/t}$		
				$a_p \leq 5.5 \text{ mm}$ $a_e \leq 1.5 \text{ mm}$	$a_p \leq 6.5 \text{ mm}$ $a_e \leq 1.5 \text{ mm}$	$a_p \leq 9.0 \text{ mm}$ $a_e \leq 2.0 \text{ mm}$
	Stainless steels ($< 250\text{HB}$)	50 ~ 150	0.03 ~ 0.06	$V_c = 100 \text{ m/min}, f_z = 0.04 \text{ mm/t}$		
				$a_p \leq 4.5 \text{ mm}$ $a_e \leq 1.5 \text{ mm}$	$a_p \leq 5.5 \text{ mm}$ $a_e \leq 1.5 \text{ mm}$	$a_p \leq 7.5 \text{ mm}$ $a_e \leq 2.0 \text{ mm}$
	Cast irons	80 ~ 200	0.03 ~ 0.1	$V_c = 140 \text{ m/min}, f_z = 0.08 \text{ mm/t}$		
				$a_p \leq 9.5 \text{ mm}$ $a_e \leq 2.0 \text{ mm}$	$a_p \leq 11.5 \text{ mm}$ $a_e \leq 2.0 \text{ mm}$	$a_p \leq 15.5 \text{ mm}$ $a_e \leq 3.0 \text{ mm}$
Aluminium alloys (Si $< 12\%$)	100 ~ 300	0.03 ~ 0.1	$V_c = 200 \text{ m/min}, f_z = 0.07 \text{ mm/t}$			
			$a_p \leq 9.5 \text{ mm}$ $a_e \leq 2.0 \text{ mm}$	$a_p \leq 11.5 \text{ mm}$ $a_e \leq 2.0 \text{ mm}$	$a_p \leq 15.5 \text{ mm}$ $a_e \leq 3.0 \text{ mm}$	
Aluminium alloys (Si $> 13\%$)	80 ~ 180	0.03 ~ 0.08	$V_c = 130 \text{ m/min}, f_z = 0.06 \text{ mm/t}$			
			$a_p \leq 9.5 \text{ mm}$ $a_e \leq 2.0 \text{ mm}$	$a_p \leq 11.5 \text{ mm}$ $a_e \leq 2.0 \text{ mm}$	$a_p \leq 15.5 \text{ mm}$ $a_e \leq 3.0 \text{ mm}$	

● Slotting	Work material	Cutting speed V_c (m/min)	Feed rate f_z (mm/t)	Cutting conditions				
				$\phi 10 \leq \phi D_C < \phi 12$	$\phi 12 \leq \phi D_C < \phi 16$	$\phi 16 \leq \phi D_C \leq \phi 18$	$\phi 18 < \phi D_C \leq \phi 21$	$\phi 21 < \phi D_C \leq \phi 26$
	Carbon steels Alloy steels ($< 30\text{HRC}$)	60 ~ 180	0.03 ~ 0.1	$V_c = 100 \text{ m/min}, f_z = 0.06 \text{ mm/t}$				
				$a_p \leq 1.5 \text{ mm}$	$a_p \leq 2.0 \text{ mm}$	$a_p \leq 3.0 \text{ mm}$	$a_p \leq 2.5 \text{ mm}$	$a_p \leq 2.5 \text{ mm}$
	Alloy steels prehardened steels (30 ~ 40HRC)	50 ~ 150	0.03 ~ 0.08	$V_c = 70 \text{ m/min}, f_z = 0.05 \text{ mm/t}$				
				$a_p \leq 1.0 \text{ mm}$	$a_p \leq 1.5 \text{ mm}$	$a_p \leq 2.0 \text{ mm}$	$a_p \leq 1.5 \text{ mm}$	$a_p \leq 1.5 \text{ mm}$
	Stainless steels ($< 250\text{HB}$)	50 ~ 150	0.03 ~ 0.06	$V_c = 70 \text{ m/min}, f_z = 0.04 \text{ mm/t}$				
				$a_p \leq 1.0 \text{ mm}$	$a_p \leq 1.0 \text{ mm}$	$a_p \leq 1.5 \text{ mm}$	$a_p \leq 1.5 \text{ mm}$	$a_p \leq 1.5 \text{ mm}$
	Cast irons	80 ~ 200	0.03 ~ 0.1	$V_c = 120 \text{ m/min}, f_z = 0.07 \text{ mm/t}$				
				$a_p \leq 3.5 \text{ mm}$	$a_p \leq 4.0 \text{ mm}$	$a_p \leq 4.5 \text{ mm}$	$a_p \leq 3.5 \text{ mm}$	$a_p \leq 3.0 \text{ mm}$
Aluminium alloys (Si $< 12\%$)	100 ~ 300	0.03 ~ 0.1	$V_c = 150 \text{ m/min}, f_z = 0.07 \text{ mm/t}$					
			$a_p \leq 3.5 \text{ mm}$	$a_p \leq 4.0 \text{ mm}$	$a_p \leq 4.5 \text{ mm}$	$a_p \leq 3.5 \text{ mm}$	$a_p \leq 3.0 \text{ mm}$	
Aluminium alloys (Si $> 13\%$)	80 ~ 180	0.03 ~ 0.08	$V_c = 110 \text{ m/min}, f_z = 0.06 \text{ mm/t}$					
			$a_p \leq 3.5 \text{ mm}$	$a_p \leq 4.0 \text{ mm}$	$a_p \leq 4.5 \text{ mm}$	$a_p \leq 3.5 \text{ mm}$	$a_p \leq 3.0 \text{ mm}$	

Notes:

- When slotting, use a rigid machine.
- When chips stay in the cutting zone during slotting or pocketing, use air to remove chips from the work area.
- If chips tend to stick to the cutting edge (such as aluminium alloy machining), use a water soluble cutting fluid.
- If cutting a casting skin or heavily interrupted work surface, decrease the feed per tooth and maximum depth of cut to 1/2 to 2/3 times the values shown in the table.
- Tool overhang length must be as short as possible to avoid chatter. When the tool overhang length is long, decrease the number of revolutions and feed.
- Cutting conditions are generally limited by the rigidity and power of the machine and the rigidity of the workpiece. When setting the conditions, start from half of the values of the standard cutting conditions and then increase the value gradually while making sure the machine is running normally.

Hybrid TAC Mills

EVH type

Multi-functional

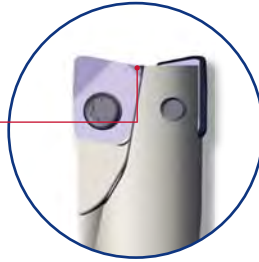
The EVH is a center cutting endmill that allows shoulder milling, slotting and drilling with only one tool.



Center cutting design for square shoulder milling

Center cutting edge

Tool diameter:
 $\phi 10 / \phi 12 / \phi 16$ (2 teeth)



Long helical pockets & air holes

- Allows trouble free chip evacuation even in deep pocketing.

Most suitable for long reach tooling

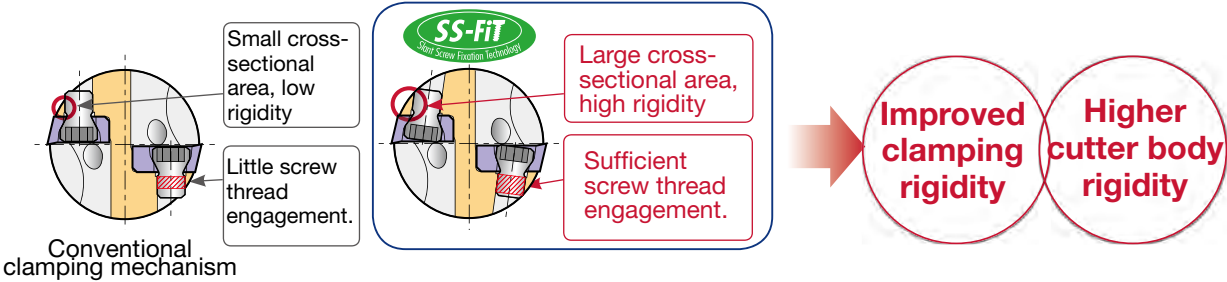
- The low resistance cutting edge geometry allows machining with the same tool overhang length ($L/D = 4$) as solid carbide endmills.

The new clamping mechanism

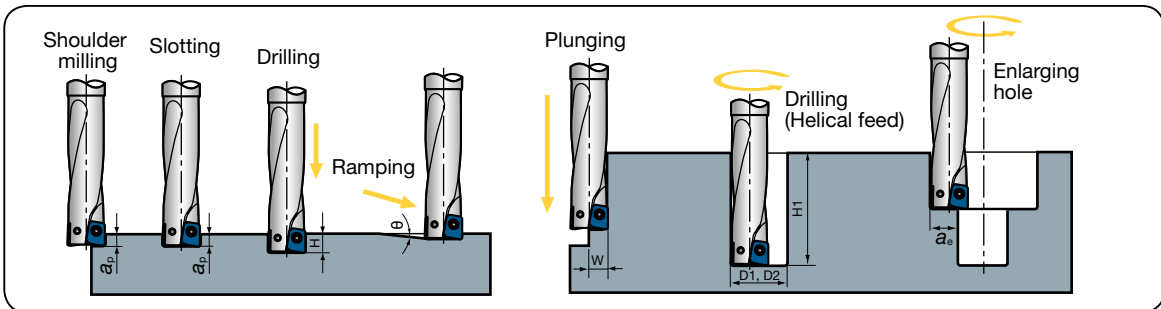
- The new clamping mechanism, "SS-FIT" (PAT.P), improves rigidity and allows for downsized tool diameters.



This logo stands for Tungaloy's original new clamping mechanism for small diameter cutting indexable insert cutting tools.

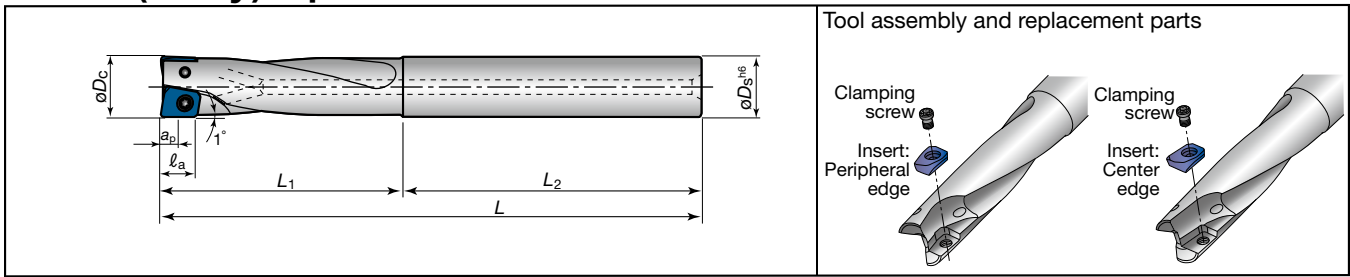


EVH Machining modes



Cat. No.	Tool ϕ ϕD_C (mm)	Max. depth of cut a_p (mm)	Max. depth of drilling H (mm)	Max. cutting width in plunging W (mm)	Max. ramping angle θ	Min. machinable hole ϕ D1 (mm)	Max. machinable hole ϕ D2 (mm)	Max. depth of drilling (Helical feed) H1 (mm)	Max. cutting width in enlarging a_e (mm)
EVH06R010M10.0-02	$\phi 10$	3	5	5	5°	12	19	30	9
EVH07R012M12.0-02	$\phi 12$	3.5	6	6	5°	14	23	36	11
EVH09R016M16.0-02	$\phi 16$	4.5	8	8	5°	18	31	48	15

EVH (body) Specification



Cat. No.	Stock	No. of inserts	Dimensions (mm)						Clamping screw (Std. fastening torque)	Wrench	Applicable inserts	
			ϕD_c	ϕD_s	max. a_p	λ_a	L	L_1				L_2
EVH06R010M10.0-02	●	2	10	10	3	5	90	40	50	CSPD-1.8S (0.7N·m)	IP-6F	XVGT06H205□□-□□
EVH07R012M12.0-02	●	2	12	12	3.5	6	98	48	50	CSPB-2H (0.7N·m)	IP-6F	XVGT07H305□□-□□
EVH09R016M16.0-02	●	2	16	16	4.5	8	124	64	60	CSPB-2.5S (1.3N·m)	IP-8D	XVGT09H405□□-□□

EVH Inserts Specification

	Insert Cat. No.	Grade		Dimensions (mm)				Applications r_ϵ	Applicable cutter
		AH730	DS1200	A	B	T	Corner R		
Center edge insert	XVGT06H205EC-MJ	●		6.2	5.0	2.5	0.5	P Steels	EVH06R010M10.0-02
	XVGT07X305EC-MJ	●		7.1	6.1	3.0			EVH07R012M12.0-02
	XVGT09X405EC-MJ	●		9.0	8.2	4.0			EVH09R016M16.0-02
Peripheral edge insert	XVGT06H205EP-MJ	●		6.2	5.3	2.5	0.5	M Stainless K Cast irons	EVH06R010M10.0-02
	XVGT07X305EP-MJ	●		7.1	6.4	3.0			EVH07R012M12.0-02
	XVGT09X405EP-MJ	●		9.0	8.2	4.0			EVH09R016M16.0-02
Center edge insert	XVGT06H205FC-AJ		●	6.2	5.0	2.5	0.5	N Non-ferrous Metals	EVH06R010M10.0-02
	XVGT07X305FC-AJ		●	7.1	6.1	3.0			EVH07R012M12.0-02
	XVGT09X405FC-AJ		●	9.0	8.2	4.0			EVH09R016M16.0-02
Peripheral edge insert	XVGT06H205FP-AJ		●	6.2	5.3	2.5	0.5	N Non-ferrous Metals	EVH06R010M10.0-02
	XVGT07X305FP-AJ		●	7.1	6.4	3.0			EVH07R012M12.0-02
	XVGT09X405FP-AJ		●	9.0	8.2	4.0			EVH09R016M16.0-02

● : Stocked in Japan

EVH Standard cutting conditions

	Work material	Carbon steels Alloy steels		Alloy steels Prehardened steels		Stainless steels		Cast irons		Aluminium alloys (Si < 12%)		Aluminium alloys (Si > 13%)			
		Hardness		30 ~ 40 HRC		< 250 HB		-		-		-			
		Cutting speed $V_c = \text{m/min}$		50 ~ 120		30 ~ 100		50 ~ 120		60 ~ 140		100 ~ 300		100 ~ 200	
		Cutting conditions		No. of revs $n (\text{min}^{-1})$	Feed $V_f (\text{mm/min})$	No. of revs $n (\text{min}^{-1})$	Feed $V_f (\text{mm/min})$	No. of revs $n (\text{min}^{-1})$	Feed $V_f (\text{mm/min})$	No. of revs $n (\text{min}^{-1})$	Feed $V_f (\text{mm/min})$	No. of revs $n (\text{min}^{-1})$	Feed $V_f (\text{mm/min})$	No. of revs $n (\text{min}^{-1})$	Feed $V_f (\text{mm/min})$
Shoulder milling	Tool ϕ (mm)	$\phi 10$	2550	380	1910	190	2550	380	3180	510	6370	1020	4770	670	
		$\phi 12$	2120	320	1590	160	2120	320	2650	420	5300	850	3980	560	
		$\phi 16$	1590	240	1190	120	1590	240	1990	320	3980	640	2980	420	
Slotting	depth of cut	Shoulder milling	$a_p < 0.25D$ $a_e < 0.2D$		$a_p < 0.25D$ $a_e < 0.2D$		$a_p < 0.25D$ $a_e < 0.2D$		$a_p < 0.25D$ $a_e < 0.3D$		$a_p < 0.25D$ $a_e < 0.3D$		$a_p < 0.25D$ $a_e < 0.3D$		
		Slotting	$a_p < 0.1D$		$a_p < 0.1D$		$a_p < 0.1D$		$a_p < 0.15D$		$a_p < 0.2D$		$a_p < 0.2D$		

Notes:

- When chips stay in the cutting zone during slotting or pocketing, use air to remove chips from the work area.
- If chips tend to stick to the cutting edge (such as aluminium alloy machining), use a water soluble cutting fluid.
- If cutting a casting skin or heavily interrupted work surface, decrease the feed and feed speed to 1/2 to 2/3 times the values shown in the table.
- Tool overhang length must be as short as possible to avoid chatter. When the tool overhang length is long, decrease the number of revolutions and feed.
- Cutting conditions are generally limited by the rigidity and power of the machine and the rigidity of the workpiece. When setting the conditions, start from half of the values of the standard cutting conditions and then increase the value gradually while making sure the machine is running normally.

Hybrid TAC Mills

EXH type

High feed

Super high feed cutter for improving productivity in roughing applications. Center cutting design permits multiple application machining.

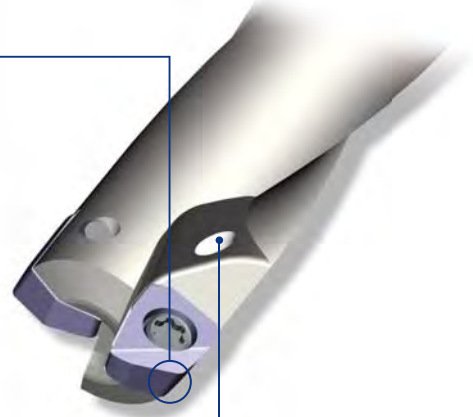


Cutting edge geometry for achieving higher productivity

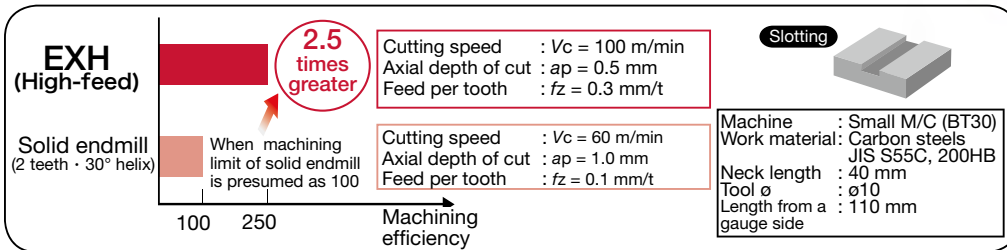
- EXH improves productivity in roughing

Center cutting edge

Tool diameter:
ø10 / ø12 / ø16 (2-teeth)



Efficiency of machining



Most suitable for long reach tooling

- Low resistance cutting edge allows machining with the same tool overhang length (L/D = 4) as solid endmills.

Long helical pockets & air holes

- Allows smooth chip evacuation even in deep pocketing.

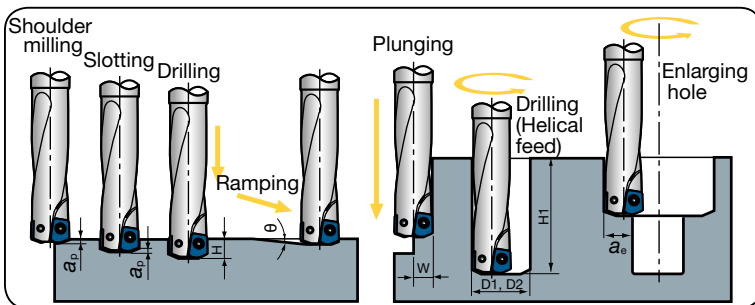
The new clamping mechanism

- The new clamping mechanism, "SS-FIT" (PAT.P), improves rigidity and downsized tool diameter.



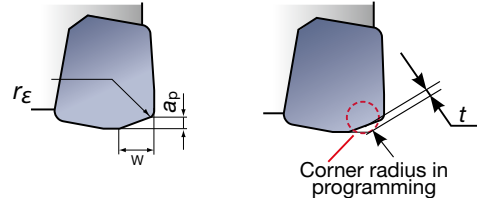
This logo stands for Tungaloy's original new clamping mechanism for small diameter cutting indexable insert cutting tools.

EXH Machining modes



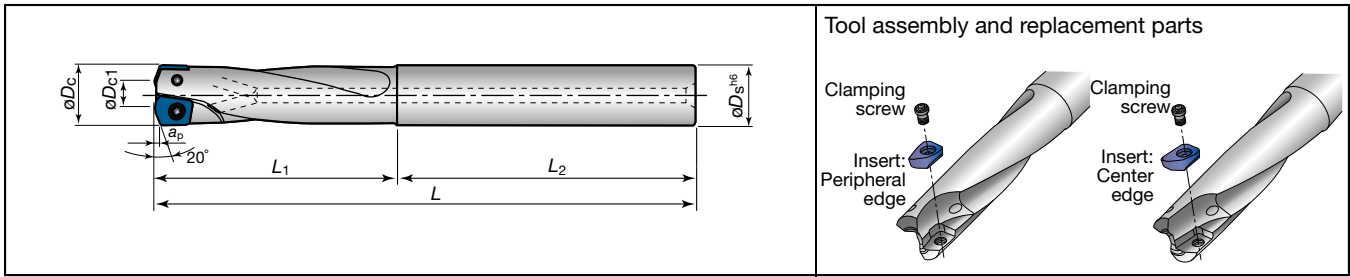
Notes for programming

When using CAD/CAM, please program as a radius cutter. The following table shows actual cutting edge geometry and amount of unfinished work.



Cat. No.	Tool ø	Max. depth of cut ap	Corner R rε	wide of tooth W	Amount of uncut t	Corner radius in programming
EXH06R010M10.0-02	ø10	0.6	0.5	2.5	0.7	R0.5
					0.6	R1.0
EXH07R012M12.0-02	ø12	0.6	0.5	2.5	0.7	R0.5
					0.6	R1.0
EXH09R016M16.0-02	ø16	0.8	0.8	3.0	0.8	R0.5
					0.7	R1.0
					0.6	R1.5

EXH (body) Specification



Cat. No.	Stock	No. of inserts	Dimensions (mm)							Clamping screw (Std. fastening torque)	Wrench	Applicable inserts
			ϕD_c	ϕD_s	ϕD_{c1}	a_p	L	L_1	L_2			
EXH06R010M10.0-02	●	2	10	10	5	0.6	90	40	50	CSPD-1.8S (0.7N·m)	IP-6F	XXGT06H205□□-□□
EXH07R012M12.0-02	●	2	12	12	7	0.6	98	48	50	CSPB-2H (0.7N·m)	IP-6F	XXGT07H305□□-□□
EXH09R016M16.0-02	●	2	16	16	10	0.8	124	64	60	CSPB-2.5S (1.3N·m)	IP-8D	XXGT09H408□□-□□

EXH Inserts Specification

Insert Cat. No.	Grade		Dimensions (mm)			Applications	Applicable cutter	
	AH730	DS1200	A	B	T			
Center	XXGT06H205EC-MJ	●		6.2	4.9	2.5	P Steels	EXH06R010M10.0-02
	XXGT07X305EC-MJ	●		7.0	5.9	3.0		EXH07R012M12.0-02
	XXGT09X408EC-MJ	●		8.9	7.9	4.0		EXH09R016M16.0-02
Peripheral	XXGT06H205EP-MJ	●		6.2	5.1	2.5	M Stainless	EXH06R010M10.0-02
	XXGT07X305EP-MJ	●		7.0	6.3	3.0		EXH07R012M12.0-02
	XXGT09X408EP-MJ	●		8.9	8.0	4.0		EXH09R016M16.0-02
Center	XXGT06H205FC-AJ		●	6.2	4.9	2.5	N Non-ferrous Metals	EXH06R010M10.0-02
	XXGT07X305FC-AJ		●	7.0	5.9	3.0		EXH07R012M12.0-02
	XXGT09X408FC-AJ		●	8.9	7.9	4.0		EXH09R016M16.0-02
Peripheral	XXGT06H205FP-AJ		●	6.2	5.1	2.5	N Non-ferrous Metals	EXH06R010M10.0-02
	XXGT07X305FP-AJ		●	7.0	6.3	3.0		EXH07R012M12.0-02
	XXGT09X408FP-AJ		●	8.9	8.0	4.0		EXH09R016M16.0-02

● : Stocked in Japan

EXH Standard cutting conditions

Work material	Carbon steels		Alloy steels		Stainless steels		Cast irons		Aluminium alloys (Si < 12%)		Aluminium alloys (Si > 13%)		
	Alloy steels		Prehardened steels										
Hardness	< 30 HRC		30 ~ 40 HRC		< 250 HB		-		-		-		
Cutting speed $V_c = m/min$	100 ~ 300		100 ~ 250		100 ~ 300		100 ~ 300		100 ~ 500		100 ~ 300		
Cutting conditions	No. of revs $n (min^{-1})$	Feed $V_f (mm/min)$	No. of revs $n (min^{-1})$	Feed $V_f (mm/min)$	No. of revs $n (min^{-1})$	Feed $V_f (mm/min)$	No. of revs $n (min^{-1})$	Feed $V_f (mm/min)$	No. of revs $n (min^{-1})$	Feed $V_f (mm/min)$	No. of revs $n (min^{-1})$	Feed $V_f (mm/min)$	
	Tool ϕ (mm)												
depth of cut (mm)	$\phi 10$	4770	1430	3820	760	4770	1430	6360	2540	9550	5730	6360	3180
	$\phi 12$	3980	1190	3180	630	3980	1190	5300	2120	7950	4770	5300	2650
	$\phi 16$	2980	890	2380	470	2980	890	3970	1580	5960	3570	3970	1980
Shoulder milling, Slotting	$\phi 10$	$a_p < 0.6$		$a_p < 0.5$		$a_p < 0.6$		$a_p < 0.6$		$a_p < 0.6$		$a_p < 0.6$	
	$\phi 12$	$a_p < 0.6$		$a_p < 0.5$		$a_p < 0.6$		$a_p < 0.6$		$a_p < 0.6$		$a_p < 0.6$	
	$\phi 16$	$a_p < 0.8$		$a_p < 0.6$		$a_p < 0.8$		$a_p < 0.8$		$a_p < 0.8$		$a_p < 0.8$	

Work material	Carbon steels		Alloy steels		Stainless steels		Cast irons		Aluminium alloys (Si < 12%)		Aluminium alloys (Si > 13%)		
	Alloy steels		Prehardened steels										
Hardness	< 30 HRC		30 ~ 40 HRC		< 250 HB		-		-		-		
Cutting speed $V_c = m/min$	100 ~ 300		100 ~ 250		100 ~ 300		100 ~ 300		100 ~ 500		100 ~ 300		
Cutting conditions	No. of revs $n (min^{-1})$	Feed $V_f (mm/min)$	No. of revs $n (min^{-1})$	Feed $V_f (mm/min)$	No. of revs $n (min^{-1})$	Feed $V_f (mm/min)$	No. of revs $n (min^{-1})$	Feed $V_f (mm/min)$	No. of revs $n (min^{-1})$	Feed $V_f (mm/min)$	No. of revs $n (min^{-1})$	Feed $V_f (mm/min)$	
	Tool ϕ (mm)												
Plunging	$\phi 10$	4770	240	3820	150	4770	240	6360	440	9550	760	6360	440
	$\phi 12$	3980	200	3180	130	3980	200	5300	370	7950	640	5300	370
	$\phi 16$	2980	150	2380	95	2980	150	3970	280	5960	480	3970	280

Notes:

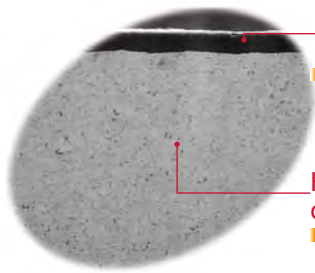
- In slotting or pocketing where chips tend to stay in the cutting zone, use an air blast to remove chips to prevent chip recutting.
- When chips tend to weld excessively on the cutting edge such as in machining aluminium alloys, use a water soluble cutting fluid.
- In the case of cutting a casting skin or a heavily interrupted work surface, decrease the feed and feed speed to 1/2 to 2/3 times the values shown in the table.
- Tool overhang length must be as short as possible to avoid chatter. When the tool overhang length is long, decrease the number of revolutions and feed.
- Cutting conditions are generally limited by the rigidity and power of the machine and the rigidity of the workpiece. When setting the conditions, start from half of the values of the standard cutting conditions and then increase the value gradually while making sure that the machine is running normally.

Hybrid TAC Mills

Grades

PVD coated grade for steel, stainless steel, and cast irons

AH730



- Improved wear resistance
 - ▶ “Flash-coat” improves wear resistance and coating adhesion to allow longer tool life and reliability.
- High toughness fine-grained carbide
 - ▶ Improved chipping resistance and impact resistance.
 - ▶ Maintains sharp cutting edge.

DLC coated grade for aluminium alloy

DS1200

DLC = Diamond Like Carbon

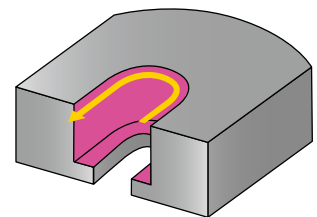


- Improved welding resistance
 - ▶ Provides good lubricity between insert surface and work surface, reducing built up edge during machining.
- Improved adhesion strength of DLC coat and substrate
 - ▶ High welding resistance.
 - ▶ Maintains high quality machining surface.

Practical Examples

Improvement from solid radius endmill

Tool	: EPH18R016M16.0-2 (ø16, 2 teeth)	
Inserts	: XHGR18T210ER-MJ AH730 (Corner R: 1.0)	
Work material	: S45C	
Applications	: Roughing	Finishing
Cutting speed	: $V_c = 100$ m/min	$V_c = 100$ m/min
Axial depth of cut	: $a_p = 2.0$ mm	$a_p = 13$ mm
Radial depth of cut	: $a_e = 16$ mm	$a_e = 0.5$ mm
Feed per tooth	: $f_z = 0.07$ mm/t	$f_z = 0.05$ mm/t
Table Feed	: $v_f = 280$ mm/min	$v_f = 200$ mm/min
Machine	: Vertical machining center (BT50)	
Cutting fluid	: Dry cutting	



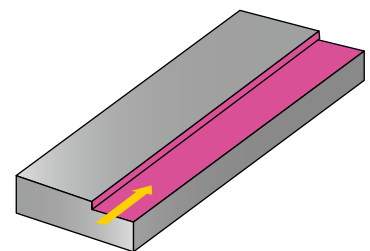
Machine component

Existing tool : Coated solid radius endmill (ø16, 2 teeth)

Results Feed marks were not noticeable. The surface quality and accuracy were good. Compared with existing solid radius endmills, Hybrid TAC Mill reduced tool costs and simplified tool management.

Reduced machining processes from 2 to 1

Tool	: EPH11R010M10.0-2 (ø10, 2 teeth)	
Inserts	: XHGR110205ER-MJ AH730 (Corner R:0.5)	
Work material	: S45C	
Applications	: Roughing	Finishing
Cutting speed	: $V_c = 100$ m/min	$V_c = 100$ m/min
Axial depth of cut	: $a_p = 2.0$ mm	$a_p = 0.1$ mm
Radial depth of cut	: $a_e = 8$ mm	$a_e = 8$ mm
Feed per tooth	: $f_z = 0.1$ mm/t	$f_z = 0.1$ mm/t
Table Feed	: $v_f = 640$ mm/min	$v_f = 640$ mm/min
Machine	: Vertical machining center (BT40)	
Cutting fluid	: Dry cutting	



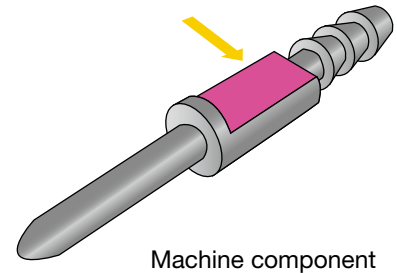
Fixture component

Existing tool : Coated solid radius endmill (ø16, 2 teeth)
 Tool (For roughing) : competitor indexable cutter (ø10, 1 tooth)
 (For finishing) : Coated solid endmill (ø10, 2 teeth)
 Inserts : PVD coated

Results The EPH type improves machining accuracy for both roughing and finishing applications. With reduced processes, machining time is dramatically reduced.

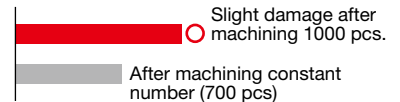
Increased machining productivity on automatic lathe

Tool	: EPH11R010M10.0-2 (ø10, 2 teeth)
Inserts	: XHGR110202ER-MJ AH730 (Corner R: 0.2)
Work material	: S15C
Cutting speed	: $V_c = 40$ m/min
Axial depth of cut	: $a_p = 1.2$ mm
Radial depth of cut	: $a_e = 7$ mm
Feed per tooth	: $f_z = 0.06$ mm/t
Machine	: NC automatic lathe
Cutting fluid	: Water insoluble type
Existing tool	
Tool	: competitor indexable cutter (ø10, 2 teeth)
Inserts	: PVD coated



Results Compared to competitor tools, the Hybrid TAC Mill lowers cutting forces to reduce machining noise. The surface quality and machining accuracy are also improved with tool life improved 1.4 times more than competitor tools.

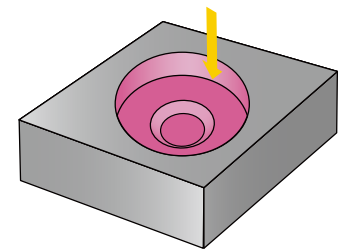
EPH11+MJ
competitor B's
indexable cutter



Improvement from 2 teeth, round-insert cutter

Tool	: EXH07R012M12.0-02 (ø12, 2 teeth)
Inserts	: XXGT07X305EC/P-MJ AH730

Work material	: S50C (200 HB)
Cutting speed	: $V_c = 160$ m/min
Axial depth of cut	: $a_p = 0.5$ mm
Radial depth of cut	: $a_e = 6$ mm
Feed per tooth	: $f_z = 0.3$ mm/t
Table Feed	: $v_f = 2550$ mm/min
Machine	: Vertical machining center (BT40)
Cutting fluid	: Dry cutting (Air blast)



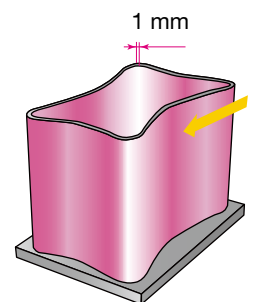
Existing tool	
Tool	: competitor indexable round-insert cutter (ø12, 2 teeth)
Inserts	: PVD coated

Results In contour cutting, EXH was able to reduce cutting force and machining noise. With existing tooling, it was necessary to change tool after only 60 min of cutting time. The EXH was able to double the tool life (120 min).

Deep pocket milling of thin-walled workpiece

Tool	: EVH09R016M16.0-02 (ø16, 2 teeth)
Inserts	: XVGT09X405FC/P-AJ DS1200 (Corner R: 0.5)

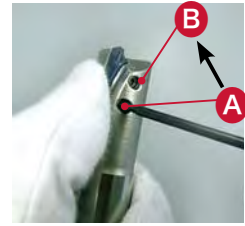
Work material	: Aluminium alloy (JIS A7075)
Cutting speed	: $V_c = 360$ m/min
Axial depth of cut	: $a_p = 1.5$ mm
Radial depth of cut	: $a_e = 16$ mm
Feed per tooth	: $f_z = 0.1$ mm/t
Table Feed	: $v_f = 1430$ mm/min
Machine	: Vertical machining center (BT30)
Cutting fluid	: Dry cutting (Air blast)
Net machining time	: 23 min



Results Pocketing a 1mm thin-walled job, the EVH was able to machine with no chatter. Chip evacuation was satisfactory due to the effect of the through spindle air blast.

EPH Insert mounting procedure

1. After loosening the clamping screws, place the insert in the pocket of the body while pushing it with your finger.
2. Lightly fasten the clamping screws in order of A then B.
3. Securely tighten the clamping screws in order of A then B.
(Refer to the standard tightening torque values.)
4. Check the condition of insert seating clearance between the insert and insert pocket, the tool diameter, and the peripheral edge runout.



● Allowable revolutions

- The clamping screw should be torqued to the value specified for each cutter size.
- The face mill arbor and collet chuck should be well balanced. Ensure safe operation at the allowable revolutions is certified.
- The inserts should be of the same type and grade.
- The inserts and parts should be used in the specified number.
- Any modification should not be applied to the inserts, parts, and cutter body.

The maximum allowable number of revolutions shown above is determined only to keep the balance of the rotating body in line with the centrifugal force. Please refer to the general cutting conditions for the work material and insert grade.

The tables show the maximum allowable number of revolutions of cutters. Avoid using the cutter at revolutions in excess of the allowable number because it can cause breakage of the machine and tool. Broken tool parts can be propelled at the operator.

Please refer to manual on website. (http://www.tungaloy.co.jp/tj/english/products/cutting/cutting_12.html)

● Notes

- Be sure to use the specified inserts listed in Tungaloy's catalogs or the instruction manual. Use of other inserts may result in undesirable machining or cutter body breakage.
- Before changing or indexing the insert, remove chips and other foreign matter from the inserts and insert pockets using an air blast or a wiping cloth.
- Clamping screws should be fastened with the specified wrench contained in the package.
- Make sure to replace clamping screws and wrench before they are excessively worn or deformed due to long term use.



Tungaloy Corporation

Tungaloy Corporation (Head office)

Solid Square, 580 Horikawa-cho, Saiwai-ku, Kawasaki City, 212-8503 Japan
Phone: +81-44-548-9514 Fax: +81-44-548-9551
<http://www.tungaloy.co.jp/>

Tungaloy America, Inc.

1226A Michael Drive, Wood Dale, IL 60191, U.S.A.
Phone: +1-630-227-3700 Fax: +1-630-227-0690
<http://www.tungaloyamerica.com/>

Tungaloy de Mexico S.A.

C Los Arellano 113, Vista Alegre, Aguascalientes, AGS, Mexico 20290
Phone: +52-449-929-5410 Fax: +52-449-929-5411
<http://www.tungaloyamerica.com/>

Tungaloy Germany GmbH

Elisabeth-Selbert-Strasse 3, 40764 Langenfeld, Germany
Phone: +49-2173-90420-0 Fax: +49-2173-90420-18
<http://www.tungaloy-eu.com/>

Tungaloy France S.a.r.l.

6 Avenue des Andes, 91952 Courtaboeuf Cedex, France
Phone: +33-1-6486-4300 Fax: +33-1-6907-7817
<http://www.tungaloy-eu.com/>

Tungaloy Italia S.p.A.

Via E. Andolfato 10, 20126 Milano, Italy
Phone: +39-02-252012-1 Fax: +39-02-252012-65
<http://www.tungaloy-eu.com/>

Tungaloy Czech s.r.o

4D Center Building B10F Kodanska 46 10100 Prauge 10 Czech Republic
Phone: +420-272652218 Fax: +420-234064270
<http://www.tungaloy-eu.com/>

Tungaloy Cutting Tool (Shanghai) Co.,Ltd.

United Plaza 1202, 1468 Nan Jing Road West, Shanghai 200040, China
Phone: +86-21-6247-0512 Fax: +86-21-6289-1302
<http://www.tungaloy.co.jp/tcts>

Tungaloy Cutting Tool (Thailand) Co.,Ltd.

11th Floor, Sorachai Bldg. 23/7, Soi Sukhumvit 63, Klongtonnue, Wattana, Bangkok 10110, Thailand
Phone: +66-2-714-3130 Fax: +66-2-714-3134
<http://www.tungaloy.co.th/>

Tungaloy Singapore(Pte.),Ltd.

50 Kallang Avenue #06-03 Noel Corporate Building, Singapore 339505
Phone: +65-6391-1833 Fax: +65-6299-4557
<http://www.tungaloy.co.jp/tspl>



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