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 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.

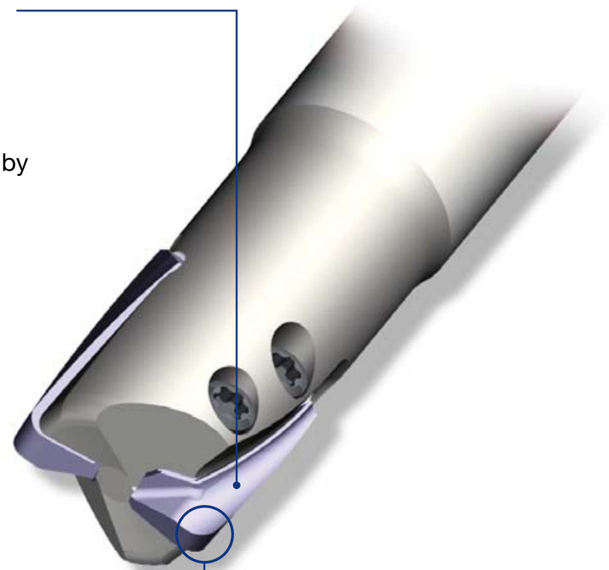
Long cutting edge length and high rake geometry

- Covers wider machining area compared to solid endmills

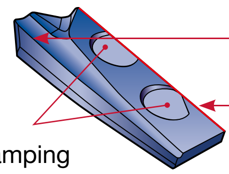
- The problems of small inserts with short edge length plus insufficient sharpness found in conventional indexable insert endmills, is eliminated by the Hybrid TAC Mill.

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

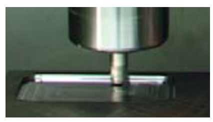
Precision ground edge geometry gives accuracy and cutting edge sharpness comparable to a solid carbide endmill.

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

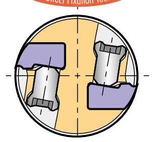


Allows highly productive pocketing

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.

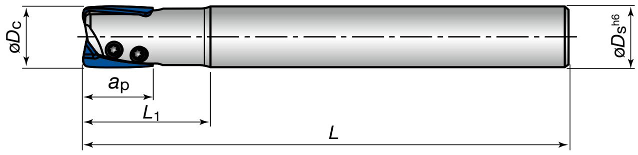
DD-FiT® Double Direct Fixation Technology — Tungaloy’s new logo for the clamping mechanism for small indexable insert cutting tools.



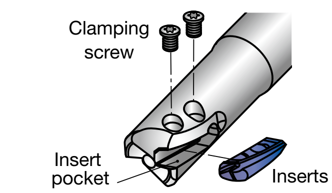
Clamping mechanism
(Two-insert EPH type)

EPH (body) Specification

●Straight type



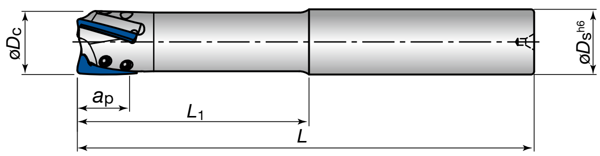
Tool assembly and replacement parts



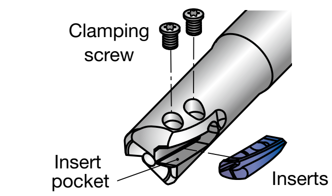
Cat. No.	Stock	No.of inserts	Dimensions (mm) øDc	øDs	Max. ap	L	L1	Clamping screw (Std. fastening torque)	Wrench	Applicable inserts
EPH11R010M10.0-2	●	2	10	10	10	80	21	CSPB-2H (0.7N·m)	IP-6F	XHGR1102□□□R-□□
EPH13R012M12.0-2	●	2	12	12	12	80	25	CSPB-2.2SH (1.1N·m)	IP-7D	XHGR1302□□□R-□□
EPH18R016M16.0-2	●	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



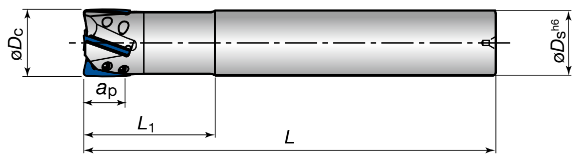
Tool assembly and replacement parts



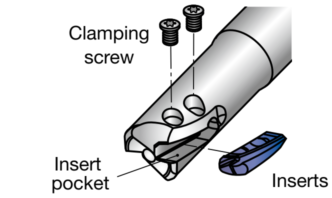
Cat. No.	Stock	No.of inserts	Dimensions (mm) øDc	øDs	Max. ap	L	L1	Clamping screw (Std. fastening torque)	Wrench	Applicable inserts
EPH11R010M10.0-2L	●	2	10	10	10	100	36	CSPB-2H (0.7N·m)	IP-6F	XHGR1102□□□R-□□
EPH13R012M12.0-2L	●	2	12	12	12	110	43	CSPB-2.2SH (1.1N·m)	IP-7D	XHGR1302□□□R-□□
EPH18R016M16.0-2L	●	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



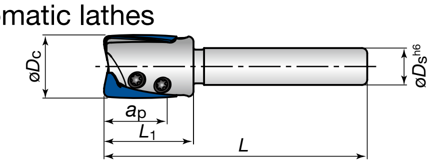
Tool assembly and replacement parts



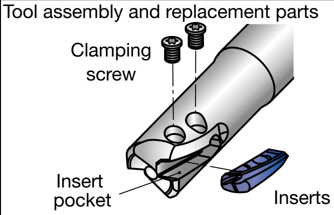
Cat. No.	Stock	No.of inserts	Dimensions (mm) øDc	øDs	Max. ap	L	L1	Clamping screw (Std. fastening torque)	Wrench	Applicable inserts
EPH13R013M12.0-2	●	2	13	12	12	110	25	CSPB-2.2SH (1.1N·m)	IP-7D	XHGR1302□□□R-□□
EPH13R014M12.0-2	●	2	14	12	12	110	25			
EPH18R017M16.0-3	●	3	17	16	16	130	33	CSPB-2.5SH (1.1N·m)	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

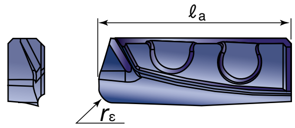


Cat. No.	Stock	No.of inserts	Dimensions (mm) øDc	øDs	Max. ap	L	L1	Clamping screw (Std. fastening torque)	Wrench	Applicable inserts
EPH11R010M06.0-2	●	2	10	6	10	50	15	CSPB-2H (0.7N·m)	IP-6F	XHGR1102□□□R-□□
EPH13R012M07.0-2	●	2	12	7	12	50	17	CSPB-2.2SH (1.1N·m)	IP-7D	XHGR1302□□□R-□□
EPH18R016M10.0-3	●	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



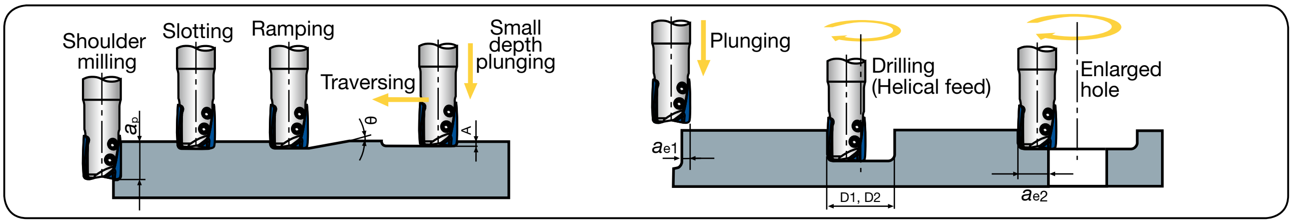
Insert Cat. No.	Grade AH730	Dimensions (mm) ℓa	Corner R rε	Applications	Applicable cutter
XHGR110202ER-MJ	●	11	0.2	P Steels, M Stainless, K Cast irons	EPH11R□□
New XHGR110204ER-MJ	●		0.4		
XHGR110205ER-MJ	●		0.5		
New XHGR110208ER-MJ	●		0.8		
XHGR110210ER-MJ	●		1.0		
New XHGR110212ER-MJ	●		1.2		
XHGR110215ER-MJ	●		1.5		
New XHGR110216ER-MJ	●		1.6		
XHGR110220ER-MJ	●		2.0		
XHGR130202ER-MJ	●	13	0.2		EPH13R□□
New XHGR130204ER-MJ	●		0.4		
XHGR130205ER-MJ	●		0.5		
New XHGR130208ER-MJ	●		0.8		
XHGR130210ER-MJ	●		1.0		
New XHGR130212ER-MJ	●		1.2		
XHGR130215ER-MJ	●		1.5		
New XHGR130216ER-MJ	●		1.6		
XHGR130220ER-MJ	●		2.0		
XHGR18T202ER-MJ	●	18	0.2		EPH18R□□
New XHGR18T204ER-MJ	●		0.4		
XHGR18T205ER-MJ	●		0.5		
New XHGR18T208ER-MJ	●		0.8		
XHGR18T210ER-MJ	●		1.0		
New XHGR18T212ER-MJ	●		1.2		
XHGR18T215ER-MJ	●		1.5		
New XHGR18T216ER-MJ	●		1.6		
XHGR18T220ER-MJ	●		2.0		

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

●: Stocked in Japan

Insert Cat. No.	Grade DS1200	Dimensions (mm) ℓa	Corner R rε	Applications	Applicable cutter
XHGR110200FR-AJ	●	11	0	N Non-ferrous Metals	EPH11R□□
New XHGR110202FR-AJ	●		0.2		
New XHGR110204FR-AJ	●		0.4		
XHGR110205FR-AJ	●		0.5		
New XHGR110208FR-AJ	●		0.8		
XHGR110210FR-AJ	●		1.0		
New XHGR110212FR-AJ	●		1.2		
XHGR110215FR-AJ	●		1.5		
New XHGR110216FR-AJ	●		1.6		
XHGR110220FR-AJ	●		2.0		
XHGR130200FR-AJ	●	13	0		EPH13R□□
New XHGR130202FR-AJ	●		0.2		
New XHGR130204FR-AJ	●		0.4		
XHGR130205FR-AJ	●		0.5		
New XHGR130208FR-AJ	●		0.8		
XHGR130210FR-AJ	●		1.0		
New XHGR130212FR-AJ	●		1.2		
XHGR130215FR-AJ	●		1.5		
New XHGR130216FR-AJ	●		1.6		
XHGR130220FR-AJ	●		2.0		
XHGR18T200FR-AJ	●	18	0		EPH18R□□
New XHGR18T202FR-AJ	●		0.2		
New XHGR18T204FR-AJ	●		0.4		
XHGR18T205FR-AJ	●		0.5		
New XHGR18T208FR-AJ	●		0.8		
XHGR18T210FR-AJ	●		1.0		
New XHGR18T212FR-AJ	●		1.2		
XHGR18T215FR-AJ	●		1.5		
New XHGR18T216FR-AJ	●		1.6		
XHGR18T220FR-AJ	●		2.0		

EPH Machining modes

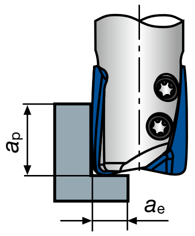


type	Cat. No.	Tool ø øDc (mm)	Max. depth of cut ap (mm)	Max. ramping angle θ	Max. plunging depth A (mm)	Max. cutting width in plunging ae1 (mm)	Min. machinable hole ø D1 (mm)	Max. machinable hole ø D2* (mm)	Max. cutting width in enlarged hole ae2* (mm)
Straight	EPH11R010M10.0-2	ø10	10	3°	0.3	3	13	19.5	9.7
	EPH13R012M12.0-2	ø12	12	3.5°	0.3	3	16	23.5	11.7
	EPH18R016M16.0-2	ø16	16	3.5°	0.3	4	22	31.5	15.7
	EPH18R016M16.0-3	ø16	16	3.5°	0.3	4	22	31.5	15.7
	EPH18R020M20.0-3	ø20	16	2°	0.3	4	29	39.5	19.7
	EPH18R025M25.0-4	ø25	16	1.5°	0.3	4	39	49.5	24.7
Long	EPH11R010M10.0-2L	ø10	10	3°	0.3	3	13	19.5	9.7
	EPH13R012M12.0-2L	ø12	12	3.5°	0.3	3	16	23.5	11.7
	EPH18R016M16.0-2L	ø16	16	3.5°	0.3	4	22	31.5	15.7
	EPH18R016M16.0-3L	ø16	16	3.5°	0.3	4	22	31.5	15.7
	EPH18R020M20.0-3L	ø20	16	2°	0.3	4	29	39.5	19.7
	EPH18R025M25.0-4L	ø25	16	1.5°	0.3	4	39	49.5	24.7
Undercut	EPH13R013M12.0-2	ø13	12	2°	0.3	3	17	25.5	12.7
	EPH13R014M12.0-2	ø14	12	1.5°	0.3	3	19	27.5	13.7
	EPH18R017M16.0-3	ø17	16	3°	0.3	4	23	33.5	16.7
	EPH18R018M16.0-3	ø18	16	2.5°	0.3	4	25	35.5	17.7
	EPH18R021M20.0-3	ø21	16	2°	0.3	4	31	41.5	20.7
	EPH18R026M25.0-4	ø26	16	1.5°	0.3	4	41	51.5	25.7
For automatic lathes	EPH11R010M06.0-2	ø10	10	3°	0.3	3	13	19.5	9.7
	EPH13R012M07.0-2	ø12	12	3.5°	0.3	3	16	23.5	11.7
	EPH18R016M10.0-3	ø16	16	3.5°	0.3	4	22	31.5	15.7
	EPH18R020M10.0-3	ø20	16	2°	0.3	4	29	39.5	19.7

*Where the insert corner radius ≤ 0.2 mm

EPH Standard cutting conditions

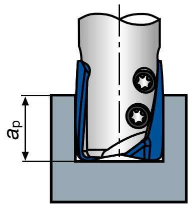
● **Shoulder milling**



ap: Axial depth of cut
ae: Radial depth of cut

Work material	Cutting speed V_c (m/min)	Feed rate f_z (mm/t)	Cutting conditions ø10≤ øD_c < ø12	ø12 ≤ øD_c < ø16	ø16≤ øD_c ≤ø26
Carbon steels Alloy steels (< 30HRC)	60 ~ 180	0.03 ~ 0.1	V_c = 120 m/mim, f_z = 0.08 mm/t		
			ap ≤ 7.5 mm ae ≤ 1.5 mm	ap ≤ 9.0 mm ae ≤ 1.5 mm	ap ≤ 12.0 mm ae ≤ 2.0 mm
Alloy steels prehardened steels (30 ~ 40HRC)	50 ~ 150	0.03 ~ 0.08	V_c = 100 m/min, f_z = 0.05 mm/t		
			ap ≤ 5.5 mm ae ≤ 1.5 mm	ap ≤ 6.5 mm ae ≤ 1.5 mm	ap ≤ 9.0 mm ae ≤ 2.0 mm
Stainless steels (< 250HB)	50 ~ 150	0.03 ~ 0.06	V_c = 100 m/min, f_z = 0.04 mm/t		
			ap ≤ 4.5 mm ae ≤ 1.5 mm	ap ≤ 5.5 mm ae ≤ 1.5 mm	ap ≤ 7.5 mm ae ≤ 2.0 mm
Cast irons	80 ~ 200	0.03 ~ 0.1	V_c = 140 m/min, f_z = 0.08 mm/t		
			ap ≤ 9.5 mm ae ≤ 2.0 mm	ap ≤ 11.5 mm ae ≤ 2.0 mm	ap ≤ 15.5 mm ae ≤ 3.0 mm
Aluminium alloys (Si < 12%)	100 ~ 300	0.03 ~ 0.1	V_c = 200 m/min, f_z = 0.07 mm/t		
			ap ≤ 9.5 mm ae ≤ 2.0 mm	ap ≤ 11.5 mm ae ≤ 2.0 mm	ap ≤ 15.5 mm ae ≤ 3.0 mm
Aluminium alloys (Si > 13%)	80 ~ 180	0.03 ~ 0.08	V_c = 130 m/min, f_z = 0.06 mm/t		
			ap ≤ 9.5 mm ae ≤ 2.0 mm	ap ≤ 11.5 mm ae ≤ 2.0 mm	ap ≤ 15.5 mm ae ≤ 3.0 mm

● **Slotting**



Work material	Cutting speed V_c (m/min)	Feed rate f_z (mm/t)	Cutting conditions ø10 ≤ øD_c < ø12	ø12 ≤ øD_c < ø16	ø16 ≤ øD_c ≤ø18	ø18 < øD_c ≤ ø21	ø21 < øD_c ≤ ø26
Carbon steels Alloy steels (< 30HRC)	60 ~ 180	0.03 ~ 0.1	V_c = 100 m/mim, f_z = 0.06 mm/t				
			ap ≤ 1.5 mm	ap ≤ 2.0 mm	ap ≤ 3.0 mm	ap ≤ 2.5 mm	ap ≤ 2.5 mm
Alloy steels prehardened steels (30 ~ 40HRC)	50 ~ 150	0.03 ~ 0.08	V_c = 70 m/min, f_z = 0.05 mm/t				
			ap ≤ 1.0 mm	ap ≤ 1.5 mm	ap ≤ 2.0 mm	ap ≤ 1.5 mm	ap ≤ 1.5 mm
Stainless steels (< 250HB)	50 ~ 150	0.03 ~ 0.06	V_c = 70 m/min, f_z = 0.04 mm/t				
			ap ≤ 1.0 mm	ap ≤ 1.0 mm	ap ≤ 1.5 mm	ap ≤ 1.5 mm	ap ≤ 1.5 mm
Cast irons	80 ~ 200	0.03 ~ 0.1	V_c = 120 m/min, f_z = 0.07 mm/t				
			ap ≤ 3.5 mm	ap ≤ 4.0 mm	ap ≤ 4.5 mm	ap ≤ 3.5 mm	ap ≤ 3.0 mm
Aluminium alloys (Si < 12%)	100 ~ 300	0.03 ~ 0.1	V_c = 150 m/min, f_z = 0.07 mm/t				
			ap ≤ 3.5 mm	ap ≤ 4.0 mm	ap ≤ 4.5 mm	ap ≤ 3.5 mm	ap ≤ 3.0 mm
Aluminium alloys (Si > 13%)	80 ~ 180	0.03 ~ 0.08	V_c = 110 m/min, f_z = 0.06 mm/t				
			ap ≤ 3.5 mm	ap ≤ 4.0 mm	ap ≤ 4.5 mm	ap ≤ 3.5 mm	ap ≤ 3.0 mm

Notes:

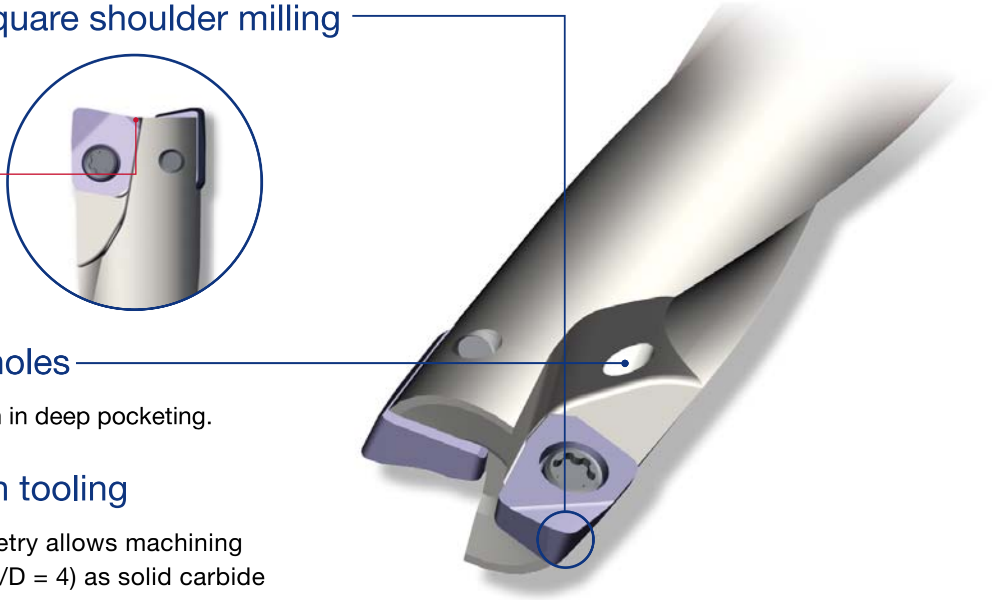
- When slotting, use a rigid machine.
- When chips stay in the cutting zone during slotting or pocketing, use air to remove chips from the work area.
- If chips tend to stick to the cutting edge (such as aluminium alloy machining), use a water soluble cutting fluid.
- If cutting a casting skin or heavily 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.

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



Long helical pockets & air holes

- Allows trouble free chip evacuation even in deep pocketing.

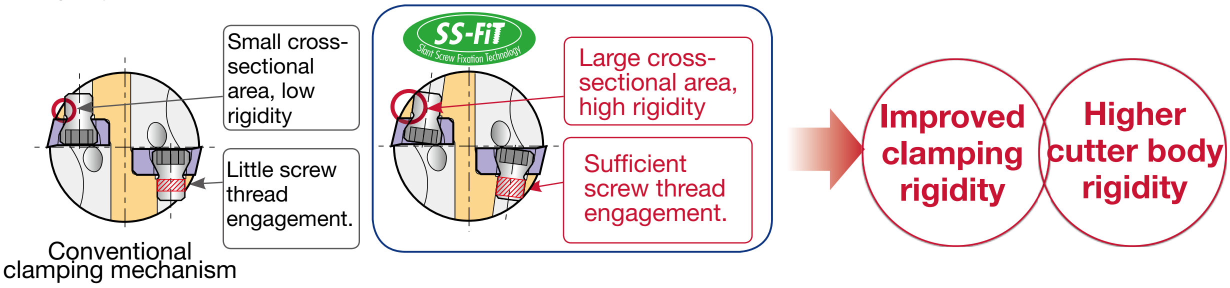
Most suitable for long reach tooling

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

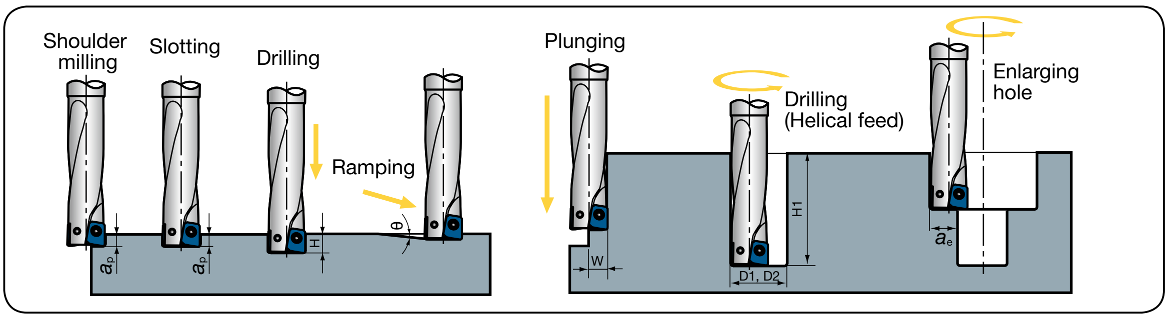
The new clamping mechanism

- 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.

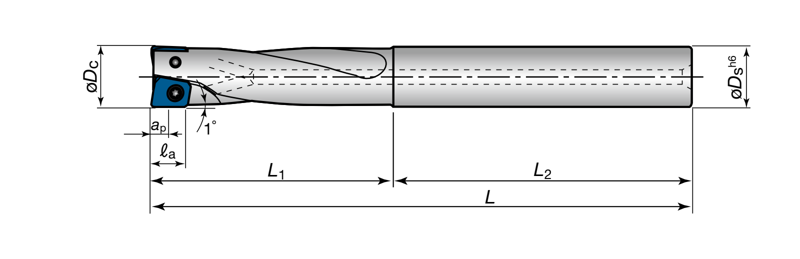


EVH Machining modes

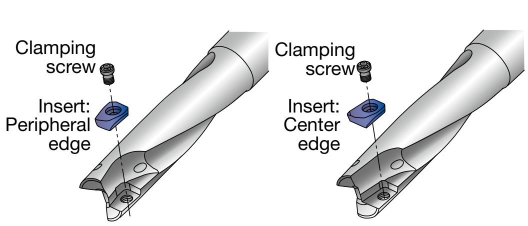


Cat. No.	Tool ø øDc (mm)	Max. depth of cut ap (mm)	Max. depth of drilling H (mm)	Max. cutting width in plunging W (mm)	Max. ramping angle θ	Min. machinable hole ø D1 (mm)	Max. machinable hole ø D2 (mm)	Max. depth of drilling (Helical feed) H1 (mm)	Max. cutting width in enlarging ae (mm)
EVH06R010M10.0-02	ø10	3	5	5	5°	12	19	30	9
EVH07R012M12.0-02	ø12	3.5	6	6	5°	14	23	36	11
EVH09R016M16.0-02	ø16	4.5	8	8	5°	18	31	48	15

EVH (body) Specification

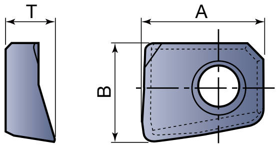


Tool assembly and replacement parts

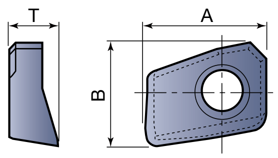


Cat. No.	Stock	No.of inserts	Dimensions (mm) øDc	øDs	max. ap	ℓa	L	L1	L2	Clamping screw (Std. fastening torque)	Wrench	Applicable inserts
EVH06R010M10.0-02	●	2	10	10	3	5	90	40	50	CSPD-1.8S (0.7N·m)	IP-6F	XVGT06H205□□-□□
EVH07R012M12.0-02	●	2	12	12	3.5	6	98	48	50	CSPB-2H (0.7N·m)	IP-6F	XVGT07H305□□-□□
EVH09R016M16.0-02	●	2	16	16	4.5	8	124	64	60	CSPB-2.5S (1.3N·m)	IP-8D	XVGT09H405□□-□□

EVH Inserts Specification



Center edge insert



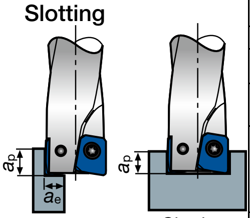
Peripheral edge insert

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

● : Stocked in Japan

EVH Standard cutting conditions

● Shoulder milling, Slotting

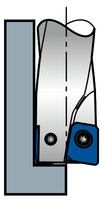


Shoulder milling　Slotting

ap: Axial depth of cut
ae: Radial depth of cut

Work material		Carbon steels Alloy steels		Alloy steels Prehardened steels		Stainless steels		Cast irons		Aluminium alloys (Si < 12%)		Aluminium alloys (Si > 13%)	
Hardness		< 30 HRC		30 ~ 40 HRC		< 250 HB		-		-		-	
Cutting speed Vc = m/min		50 ~ 120		30 ~ 100		50 ~ 120		60 ~ 140		100 ~ 300		100 ~ 200	
Cutting conditions		No. of revs n (min^{-1})	Feed Vf (mm/min)	No. of revs n (min^{-1})	Feed Vf (mm/min)	No. of revs n (min^{-1})	Feed Vf (mm/min)	No. of revs n (min^{-1})	Feed Vf (mm/min)	No. of revs n (min^{-1})	Feed Vf (mm/min)	No. of revs n (min^{-1})	Feed Vf (mm/min)
Tool ø (mm)	ø10	2550	380	1910	190	2550	380	3180	510	6370	1020	4770	670
	ø12	2120	320	1590	160	2120	320	2650	420	5300	850	3980	560
	ø16	1590	240	1190	120	1590	240	1990	320	3980	640	2980	420
depth of cut	Shoulder milling	ap < 0.25D ae < 0.2D		ap < 0.25D ae < 0.2D		ap < 0.25D ae < 0.2D		ap < 0.25D ae < 0.3D		ap < 0.25D ae < 0.3D		ap < 0.25D ae < 0.3D	
	Slotting	ap < 0.1D		ap < 0.1D		ap < 0.1D		ap < 0.15D		ap < 0.2D		ap < 0.2D	

● Plunging



Work material		Carbon steels Alloy steels		Alloy steels Prehardened steels		Stainless steels		Cast irons		Aluminium alloys (Si < 12%)		Aluminium alloys (Si > 13%)	
Hardness		< 30 HRC		30 ~ 40 HRC		< 250 HB		-		-		-	
Cutting speed Vc = m/min		50 ~ 120		30 ~ 100		50 ~ 120		60 ~ 140		100 ~ 300		100 ~ 200	
Cutting conditions		No. of revs n (min^{-1})	Feed Vf (mm/min)	No. of revs n (min^{-1})	Feed Vf (mm/min)	No. of revs n (min^{-1})	Feed Vf (mm/min)	No. of revs n (min^{-1})	Feed Vf (mm/min)	No. of revs n (min^{-1})	Feed Vf (mm/min)	No. of revs n (min^{-1})	Feed Vf (mm/min)
Tool ø (mm)	ø10	2550	130	1910	80	2550	130	3180	190	6370	450	4770	290
	ø12	2120	110	1590	65	2120	110	2650	160	5300	370	3980	240
	ø16	1590	80	1190	50	1590	80	1990	120	3980	280	2980	180

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.

EXH type

High feed

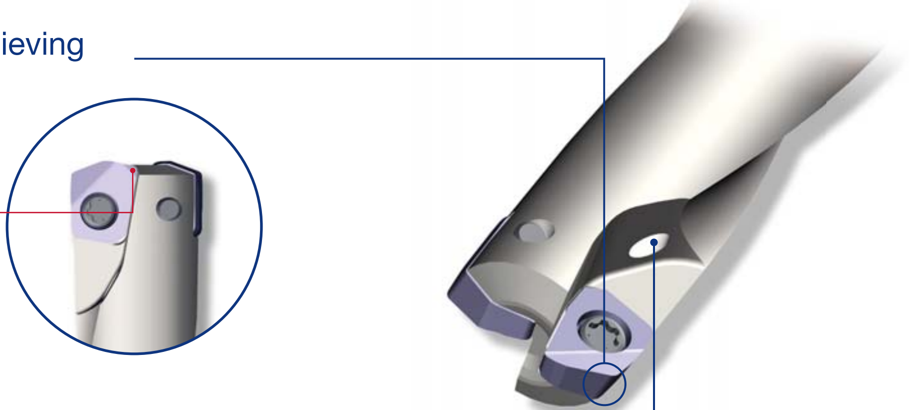
Super high feed cutter for improving productivity in roughing applications. Center cutting design permits multiple application machining.

Cutting edge geometry for achieving higher productivity

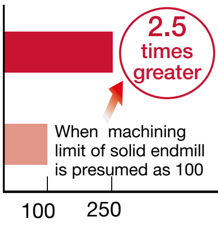
● EXH improves productivity in roughing

Center cutting edge

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

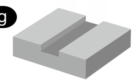


Efficiency of machining



EXH (High-feed):
Cutting speed : Vc = 100 m/min
Axial depth of cut : ap = 0.5 mm
Feed per tooth : fz = 0.3 mm/t

Solid endmill:
Cutting speed : Vc = 60 m/min
Axial depth of cut : ap = 1.0 mm
Feed per tooth : fz = 0.1 mm/t



Machine : Small M/C (BT30)
Work material: Carbon steels JIS S55C, 200HB
Neck length : 40 mm
Tool ø : ø10
Length from a gauge side : 110 mm

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.

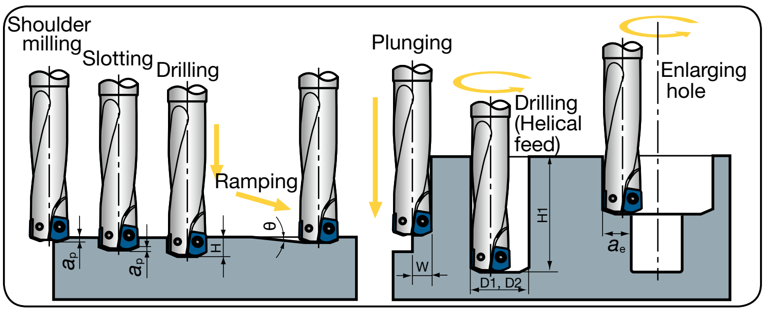
The new clamping mechanism

● The new clamping mechanism, “SS-FiT” (PAT.P), improves rigidity and downsized tool diameter.

SS-FiT Slant Screw Fixation Technology

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

EXH Machining modes

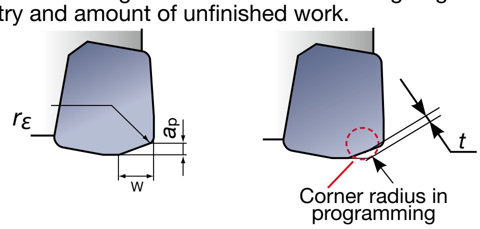


unit : mm

Cat. No.	Tool ø øDc	Max. depth of cut ap	Max. depth of drilling H	Max. cutting width in plunging W	Max. ramp-ing angle θ	Min. machi-nable hole ø D1	Max. machi-nable hole ø D2	Max. depth of drilling (Helical feed) H1	Max. cutting width in enlarging ae
EXH06R010M10.0-02	ø10	0.6	5	5	5°	12	19	30	7
EXH07R012M12.0-02	ø12	0.6	6	6	5°	14	23	36	9
EXH09R016M16.0-02	ø16	0.8	8	8	5°	18	31	48	12.5

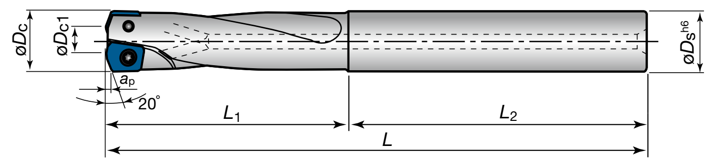
Notes for programming

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

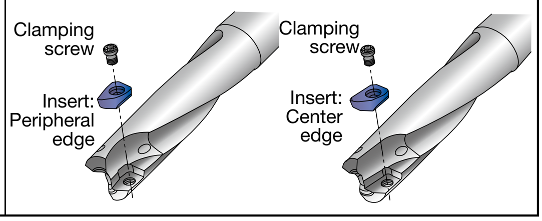


Cat. No.	Tool ø	Max. depth of cut ap	Corner R rε	wide of tooth W	Amount of uncut t	Corner radius in progra-mming
EXH06R010M10.0-02	ø10	0.6	0.5	2.5	0.7	R0.5
					0.6	R1.0
EXH07R012M12.0-02	ø12	0.6	0.5	2.5	0.7	R0.5
					0.6	R1.0
EXH09R016M16.0-02	ø16	0.8	0.8	3.0	0.8	R0.5
					0.7	R1.0
					0.6	R1.5

EXH (body) Specification

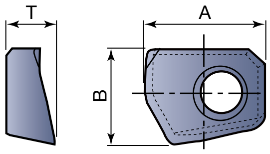


Tool assembly and replacement parts

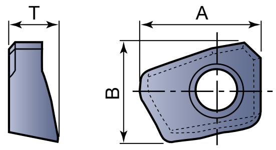


Cat. No.	Stock	No.of inserts	øDc	øDs	øDc1	ap	L	L1	L2	Clamping screw (Std. fastening torque)	Wrench	Applicable inserts
			Dimensions (mm)									
EXH06R010M10.0-02	●	2	10	10	5	0.6	90	40	50	CSPD-1.8S (0.7N·m)	IP-6F	XXGT06H205□□-□□
EXH07R012M12.0-02	●	2	12	12	7	0.6	98	48	50	CSPB-2H (0.7N·m)	IP-6F	XXGT07H305□□-□□
EXH09R016M16.0-02	●	2	16	16	10	0.8	124	64	60	CSPB-2.5S (1.3N·m)	IP-8D	XXGT09H408□□-□□

EXH Inserts Specification



Center edge insert



Peripheral edge insert

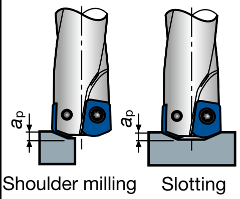
	Insert Cat. No.	Grade AH730	Grade DS1200	A	B	T	Appli-cations	Applicable cutter
Center	**XXGT06H205EC-MJ**	●		6.2	4.9	2.5	P Steels, M Stainless, K Cast irons	EXH06R010M10.0-02
Center	**XXGT07X305EC-MJ**	●		7.0	5.9	3.0		EXH07R012M12.0-02
Center	**XXGT09X408EC-MJ**	●		8.9	7.9	4.0		EXH09R016M16.0-02
Peripheral	**XXGT06H205EP-MJ**	●		6.2	5.1	2.5		EXH06R010M10.0-02
Peripheral	**XXGT07X305EP-MJ**	●		7.0	6.3	3.0		EXH07R012M12.0-02
Peripheral	**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
Center	**XXGT07X305FC-AJ**		●	7.0	5.9	3.0		EXH07R012M12.0-02
Center	**XXGT09X408FC-AJ**		●	8.9	7.9	4.0		EXH09R016M16.0-02
Peripheral	**XXGT06H205FP-AJ**		●	6.2	5.1	2.5		EXH06R010M10.0-02
Peripheral	**XXGT07X305FP-AJ**		●	7.0	6.3	3.0		EXH07R012M12.0-02
Peripheral	**XXGT09X408FP-AJ**		●	8.9	8.0	4.0		EXH09R016M16.0-02

Dimensions (mm): A, B, T

● : Stocked in Japan

EXH Standard cutting conditions

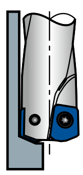
● Shoulder milling, Slotting



ap :Axial depth of cut

Work material		Carbon steels Alloy steels		Alloy steels Prehardened steels		Stainless steels		Cast irons		Aluminium alloys (Si < 12%)		Aluminium alloys (Si > 13%)	
Hardness		< 30 HRC		30 ~ 40 HRC		< 250 HB		-		-		-	
Cutting speed Vc = m/min		100 ~ 300		100 ~ 250		100 ~ 300		100 ~ 300		100 ~ 500		100 ~ 300	
Cutting conditions		No. of revs n (min⁻¹)	Feed Vf (mm/min)	No. of revs n (min⁻¹)	Feed Vf (mm/min)	No. of revs n (min⁻¹)	Feed Vf (mm/min)	No. of revs n (min⁻¹)	Feed Vf (mm/min)	No. of revs n (min⁻¹)	Feed Vf (mm/min)	No. of revs n (min⁻¹)	Feed Vf (mm/min)
Tool ø (mm)	ø10	4770	1430	3820	760	4770	1430	6360	2540	9550	5730	6360	3180
	ø12	3980	1190	3180	630	3980	1190	5300	2120	7950	4770	5300	2650
	ø16	2980	890	2380	470	2980	890	3970	1580	5960	3570	3970	1980
depth of cut (mm)	ø10	ap < 0.6		ap < 0.5		ap < 0.6		ap < 0.6		ap < 0.6		ap < 0.6	
	ø12	ap < 0.6		ap < 0.5		ap < 0.6		ap < 0.6		ap < 0.6		ap < 0.6	
	ø16	ap < 0.8		ap < 0.6		ap < 0.8		ap < 0.8		ap < 0.8		ap < 0.8	

● Plunging



Work material		Carbon steels Alloy steels		Alloy steels Prehardened steels		Stainless steels		Cast irons		Aluminium alloys (Si < 12%)		Aluminium alloys (Si > 13%)	
Hardness		< 30 HRC		30 ~ 40 HRC		< 250 HB		-		-		-	
Cutting speed Vc = m/min		100 ~ 300		100 ~ 250		100 ~ 300		100 ~ 300		100 ~ 500		100 ~ 300	
Cutting conditions		No. of revs n (min⁻¹)	Feed Vf (mm/min)	No. of revs n (min⁻¹)	Feed Vf (mm/min)	No. of revs n (min⁻¹)	Feed Vf (mm/min)	No. of revs n (min⁻¹)	Feed Vf (mm/min)	No. of revs n (min⁻¹)	Feed Vf (mm/min)	No. of revs n (min⁻¹)	Feed Vf (mm/min)
Tool ø (mm)	ø10	4770	240	3820	150	4770	240	6360	440	9550	760	6360	440
	ø12	3980	200	3180	130	3980	200	5300	370	7950	640	5300	370
	ø16	2980	150	2380	95	2980	150	3970	280	5960	480	3970	280

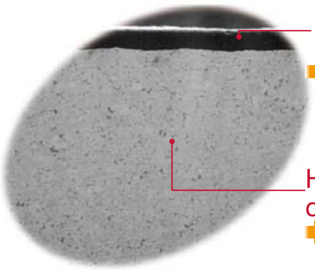
Notes:

- ●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.

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.

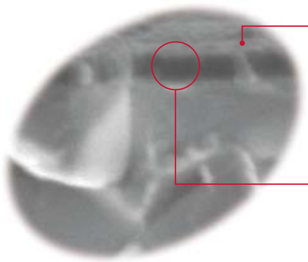
High toughness fine-grained carbide

- 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

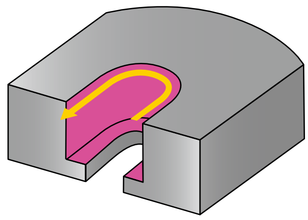
Improvement from solid radius endmill

Tool : **EPH18R016M16.0-2** (ø16, 2 teeth)

Inserts : **XHGR18T210ER-MJ AH730** (Corner R: 1.0)

Work material	: S45C	
Applications	: Roughing	Finishing
Cutting speed	: *Vc* = 100 m/min	*Vc* = 100 m/min
Axial depth of cut	: *ap* = 2.0 mm	*ap* =13 mm
Radial depth of cut	: *ae* = 16 mm	*ae* = 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	

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



Machine component

Results Feed marks were not noticable. 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)

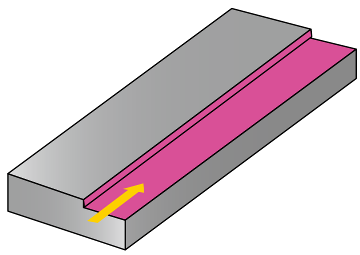
Inserts : **XHGR110205ER-MJ AH730** (Corner R:0.5)

Work material	: S45C	
Applications	: Roughing	Finishing
Cutting speed	: *Vc* = 100 m/min	*Vc* = 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	

Existing tool

Tool (For roughing) : competitor indexable cutter (ø10, 1 tooth)
(For finishing) : Coated solid endmill (ø10, 2 teeth)

Inserts : PVD coated



Fixture component

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

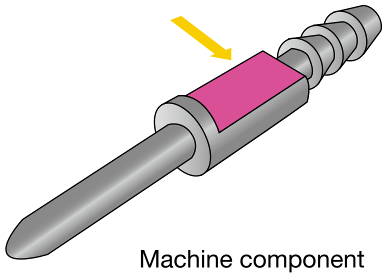
Increased machining productivity on automatic lathe

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

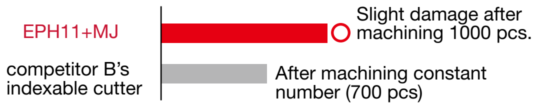
Existing tool

Tool	: competitor indexable cutter (ø10, 2 teeth)
Inserts	: PVD coated



Machine component

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.



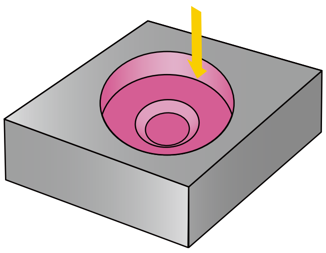
Improvement from 2 teeth, round-insert cutter

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



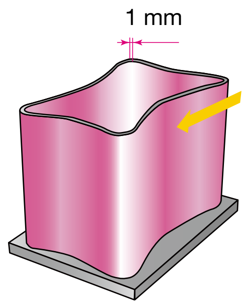
Mould part

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

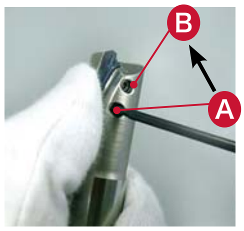


sample part

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/ttj/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.

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