

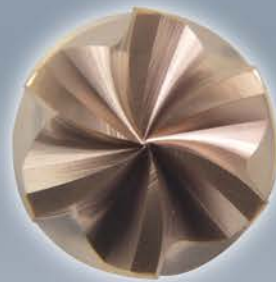
Epoch21

ADVANCED
TH60+
NANO-PVD COATING

No. 441.2

EHHB/EHHR Epoch High Hard Ball/Radius

Multi-purpose Ball Type/Corner Radius End Mill
for High Hardened Materials up to 72HRC

**EHHB:**

- Diameter 1-12 mm
- 4 flutes
- Unequal pitch (vibration-free)

EHHR:

- Diameter 1-12 mm
- 4 or 6 flutes
- Peripheral clearance geometry (vibration-free)

Ultra Micro Grain Solid Carbide End Mill

EHHB-ATH/EHHR-ATH | Epoch High Hard Ball/Radius ATH

End mill Overview for Z constant cutting in hard material (55–72 HRC)

Performance (High efficiency Roughing)

Performance (High efficiency Finishing)

EHHx Series

0.1 mm ← 1 mm → 6 mm → 12 mm → 32 mm Diameter

EPSBE (Ball Nose)

EPBTS (Ball Nose)

APHP (Radius) (PJP08M)

ABPF (Ball Nose) (PTH08M, ATH80D)

CBN (Ball & Radius)

A comprehensive range of tools are available for milling material up to 72HRC, for roughing to super finishing applications.

For further detailed information, please refer to www.hitachitool-eu.com or download our P50 QuickFinder:

P50 PRODUCTIONS[®] QuickFinder www.hitachitool-eu.com/quickfinder

ATH (Advanced TH) Coating – Characteristics

- Excellent adhesion strength
- Oxidation temperature: 1200°C
- Coating Hardness: 3800Hv
- Higher temperature resistance and wear resistance

TH Coating (Conventional)

New ATH Coating

High hardness coating

High heat resistant coating

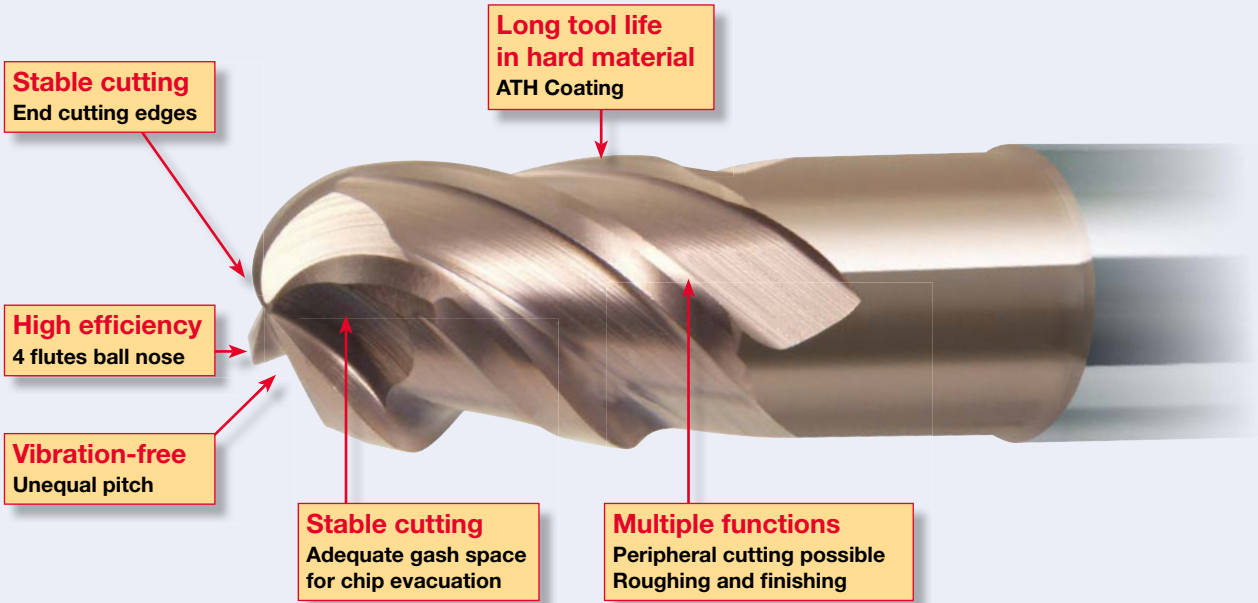
Nano multi-layer coating

Coating	Coating Hardness (Hv)	Oxidation temp. (°C)
TiAlN	~2800	~800
PN	~3000	~1200
TH	~3500	~1100
ATH	~3800	~1200

Ultra Micro Grain Solid Carbide End Mill

EHHB-ATH | Epoch High Hard Ball ATH

Features of Epoch High Hard Ball EHHB-ATH



Available for Z-constant and side milling application

Optimize your productivity & reduce your cost by PRODUCTION50[®]

Application example – Material: high speed steel 60 HRC, Tool diameter: 8mm
Removed Volume 100 cm²

Tool info		Conventional Tool	Low Cost Tool	HITACHI
		Competitor	Competitor	EHHB-ATH
Item name		for hard milling	some	EHHB-4080-ATH
Tool cost ratio (only example)	%	100	80	120
Machine cost	€/min	1,2	1,2	1,2
Cutting Parameters				
Cutting Speed (Vc)	m / min	125	100	150
Spindle revolution (n)	min ⁻¹	6630	5310	7960
feed per tooth (fz)	mm/tooth	0,11	0,09	0,12
Feed rate (Vf)	mm/min	2920	1910	5730
Step down (ap)	mm	0,7	0,6	9
Step over (ae)	mm	2,1	1,5	0,35
Tool life	min	130	100	180
Efficiency (one work removal volume is 51 cm³)				
Metal Removable Rate (MRR)	cm ³ /min	4,3	1,7	18,0
Efficiency ratio	%	100%	40%	420%
Total Chip volume / tool	cm ³	558	172	3249
Total Job ratio	%	100%	31%	582%
Cost Calculation				
Total milling time	min	151	377	36
Total Machining Cost	€	181 €	452 €	43 €
Total Tool Cost (all used tools)	€	116,1 €	301,6 €	23,9 €
Total Production Cost / work	€	297 €	754 €	67 €
Total Production Cost Ratio	%	100%	254%	23%

Strategy: Z constant + side milling
Machine cost & price is only example.

Production cost is dramatically reduced by using advanced tool EHHB & new strategy

Ultra Micro Grain Solid Carbide End Mill

EHHB-ATH | Epoch High Hard Ball ATH

Comparison of conventional Ball End Mill / Epoch High Hard Ball EHHB-ATH

Conventional 4-flute ball nose		EHHB-ATH	
<p>Top view</p> <p>Bottom point ($V_c=0$ point)</p>	<p>Bottom point ($V_c = \text{NOT } 0$)</p> <p>Small cutting edge (stable area)</p> <p>※ Patent. P</p>		
<p>Side view</p> <p>Problem:</p> <ol style="list-style-type: none"> 1. Unstable point on top ($V_c=0$) 2. Vibration caused by one point contact <p>Bottom point ($V_c = 0$)</p>	<p>Side view</p> <p>Improved point:</p> <ol style="list-style-type: none"> 1. Bottom point V_c is NOT 0, stable cutting. 2. Avoid chipping & vibration thanks to multi contact point <p>Bottom point ($V_c = \text{NOT } 0$)</p>		

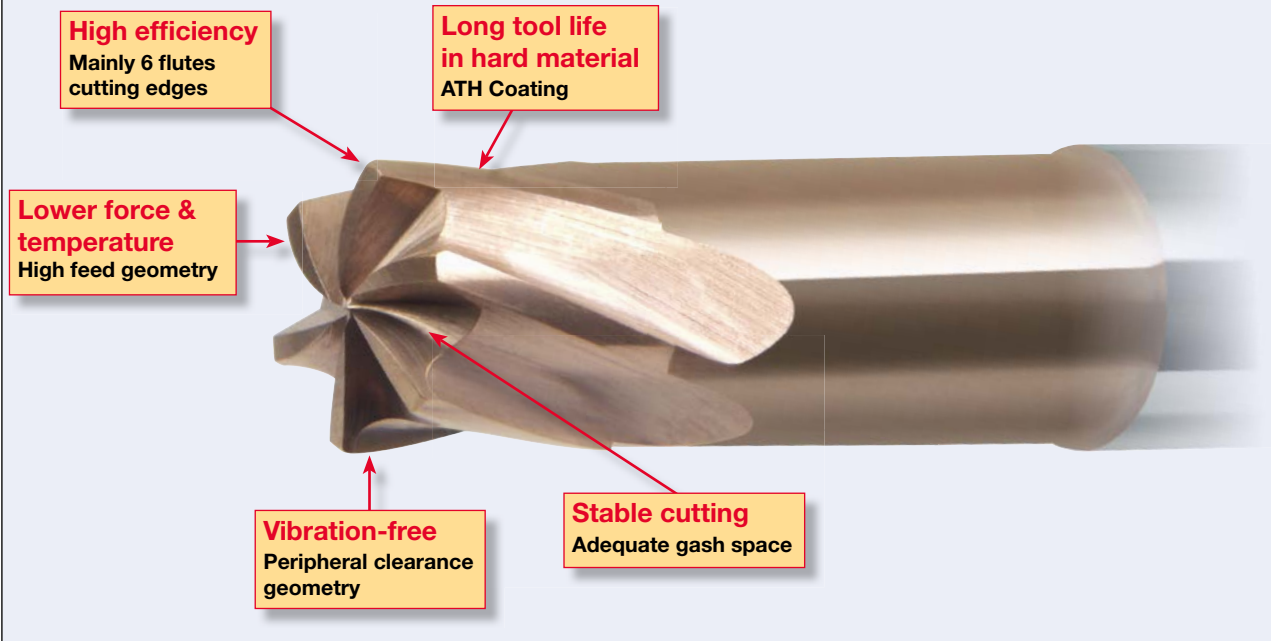
Unequal pitch (reducing vibration) EHHB-ATH

Conventional 4-flute ball nose	EHHB-ATH
<p>Zoom on</p> <p>Material : HSS (58HRC) $n=4,000$ ($V_c=100$ m/min) $V_f=1,920$ mm/min ($f_z=0.12$ mm/tooth) $a_p=0.3$ mm, $a_e=0.1$ mm, Dry Air blow, (HSK-A63), OH=32 mm</p>	<p>Zoom on</p> <p>Corner cutting</p>

Ultra Micro Grain Solid Carbide End Mill

EHHR-ATH | Epoch High Hard Radius ATH

Features of new Epoch High Hard Radius **EHHR-ATH**



Optimize your productivity & reduce your cost by **PRODUCTION50[®]**

Application example – Material: high speed steel 64 HRC, Tool diameter: 6 mm
Removed Volume 650 cm²

Tool info		Conventional Tool	Low Cost Tool	HITACHI
		Competitor	Competitor	EHHR-ATH
Item name		for hard milling		EHHR-6060-ATH
Tool cost ratio (only example)	%	100	70	125
Machine cost	€/min	1,2	1,2	1,2
Cutting Parameters				
Cutting Speed (Vc)	m / min	75	50	60
Spindle revolution (n)	min ⁻¹	3980	2650	3180
feed per tooth (fz)	mm/tooth	0,113	0,113	0,135
Feed rate (Vf)	mm/min	1800	1200	2580
Step down (ap)	mm	0,15	0,15	0,13
Step over (ae)	mm	3,6	3,6	5
Tool life	min	80	60	160
Efficiency (one work removal volume is 60 cm³)				
Metal Removable Rate (MRR)	cm ³ /min	1,0	0,6	1,7
Efficiency ratio	%	100%	67%	173%
Total Chip volume / tool	cm ³	78	39	268
Total Job ratio	%	100%	50%	345%
Cost Calculation				
Total milling time	min	103	154	60
Total Machining Cost	€	123 €	185 €	72 €
Total Tool Cost (all used tools)	€	128,6 €	180,0 €	46,6 €
Total Production Cost / work	€	252 €	365 €	118 €
Total Production Cost Ratio	%	100%	145%	47%

Strategy: Z constant milling
Machine cost & price is only example.

Production costs are dramatically reduced by using the advanced tool EHHR, to reach higher efficiency and longer tool life.

Ultra Micro Grain Solid Carbide End Mill

EHHR-ATH | Epoch High Hard Radius ATH

New Cutting Edge Geometry EHHR-ATH Approximate radius makes much thinner chip than real radius

Conventional Radius

Removed chip Maximum chip thickness: T_{max}

EHHR Radius

Removed chip Maximum chip thickness: T_{max}

Reduced

- cutting force
- cutting temperature
- radial cutting force

Peripheral clearance geometry EHHR-ATH reduced vibration even when the tool enters into a corner

Peripheral clearance geometry – reducing vibration

Conventional

Time [s] Cycle No.: 1

EHHR-ATH

Time [s]

Corner milling

Material: 1.2344 (49HRC) | Machine: MAKINO V33 (HSK-A63)
 Condition: $n = 6,000 \text{ min}^{-1}$ ($V_c=188\text{m/min}$) | $V_f = 1,800 \text{ mm/min}$ ($f_z = 0.05 \text{ mm/tooth}$)
 $a_p=0.3\text{mm}$, dry with air blow

Ultra Micro Grain Solid Carbide End Mill



Ultra Micro Grain Solid Carbide End Mill

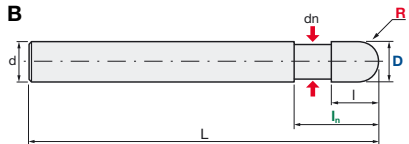
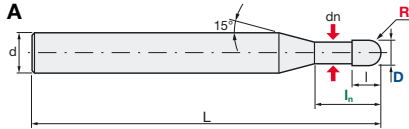
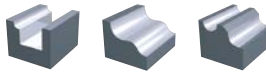
EHHB-ATH | Epoch High Hard Ball ATH

V max
High Speed

▽
Semi-Finishing

HRC
72

No. of
Teeth
4



Carbide
Micro Grain

TH60+
Nano-PVD Coating

Rake Angle
Negative



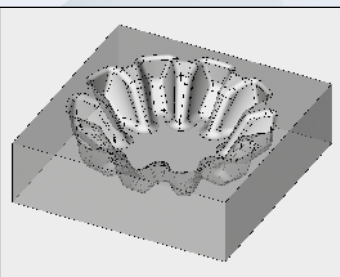
Helix angle	40°		Tolerance on R	Tolerance on D
d	h5	R 0.5-1.5	± 0.005 mm	0/-0.010 mm
		R 2-3	± 0.007 mm	0/-0.014 mm
		R 4-6	± 0.010 mm	0/-0.020 mm

ID Code	Item Code	Z	D	R	l _n	l	dn	L	d	Type
EP1340	EHHB-4010-S4-ATH	4	1	0.5	3	1.5	0.95	50	4	A
EP1341	EHHB-4010-S6-ATH								6	
EP1342	EHHB-4015-S4-ATH		1.5	0.75	4.5	2.5	1.43		4	
EP1343	EHHB-4015-S6-ATH								6	
EP1344	EHHB-4020-S4-ATH		2	1	6	3	1.9		4	
EP1345	EHHB-4020-S6-ATH								6	
EP1346	EHHB-4025-S4-ATH		2.5	1.25	7.5	4	2.38	4		
EP1347	EHHB-4025-S6-ATH							6		
EP1348	EHHB-4030-S4-ATH		3	1.5	9	4.5	2.9	70	4	A
EP1349	EHHB-4030-S6-ATH								6	
EP1350	EHHB-4040-S4-ATH		4	2	12	6	3.9	80	4	B
EP1351	EHHB-4040-S6-ATH								6	
EP1352	EHHB-4050-ATH		5	2.5	15	7.5	4.7	90	6	B
EP1353	EHHB-4060-ATH		6	3	18	9	5.7	100	6	
EP1354	EHHB-4080-ATH		8	4	24	12	7.6	110	8	
EP1355	EHHB-4100-ATH		10	5	30	15	9.5	12	10	
EP1356	EHHB-4120-ATH	12	6	36	18	11.5	12	12		

NOTE: For precise tool definition for the CAM system please download DXF data (QuickFinder) or contact your local Hitachi Tool staff for more details.

Roughing Application EHHB-ATH

Helical Milling + Trochoid milling + Z-constant milling -> Total cutting time: 22 min.



Work geometry
Size: 80x80x20mm
Material: 1.2379 (60HRC)



Used end mill -
less and stable wear situation



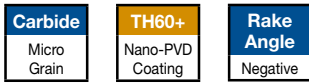
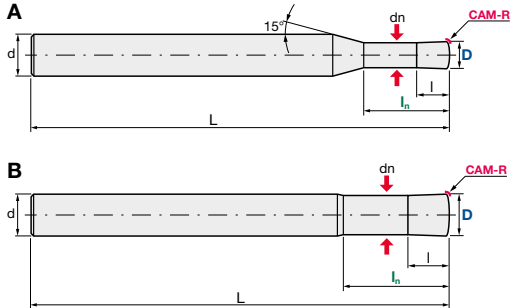
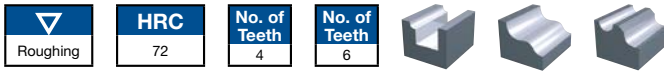
Work after roughing application

Tool: D8 x 4Z (EHHB-4080-ATH)

n = 5,970 min⁻¹ (V_c=150m/min)
V_f = 2,860 mm/min (f_z=0.12mm/tooth)
a_p = 9 mm, a_e = 0.5 mm (max)
Q = 12.9 cm³/min
Dry Air blow, (HSK-A63), OH=32mm

Ultra Micro Grain Solid Carbide End Mill

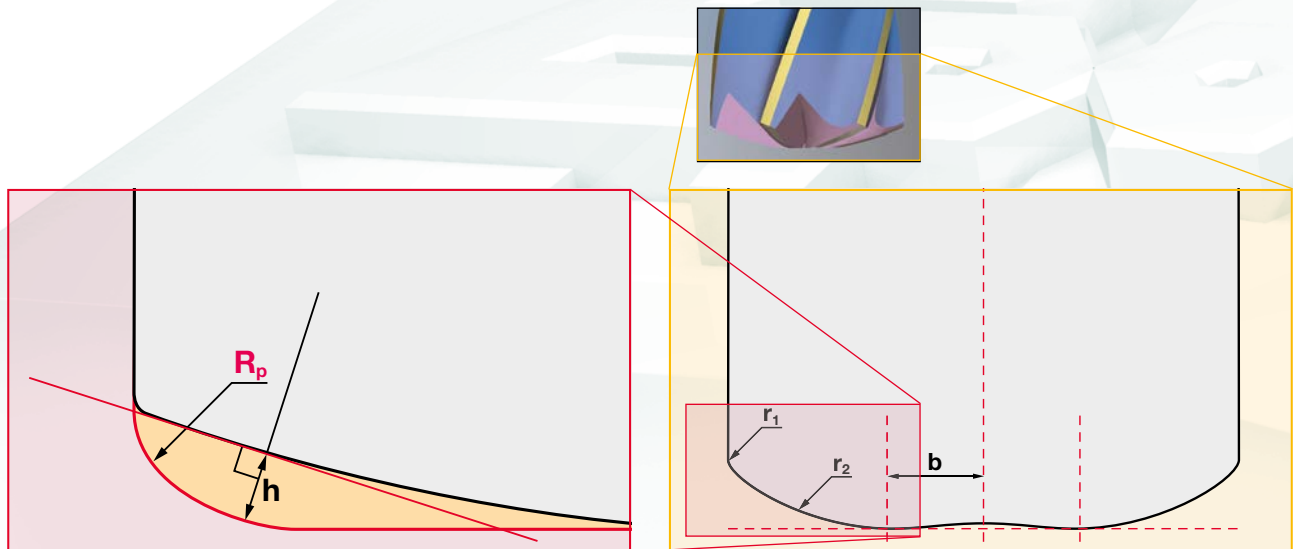
EHHR-ATH | Epoch High Hard Radius ATH



Helix angle	20°
D	(0/-0.02 mm)
d	h5

ID Code	Item Code	Z	D	CAM-R (R _p)	l _n	l	dn	L	d	Type	Lowest point to centre (b)	Max. remaining stock (h)				
EP1327	EHHR-4010-S4-ATH	4	1	0.134	3	1	0.95	50	4	A	0.14	0.026				
EP1328	EHHR-4010-S6-ATH		6													
EP1329	EHHR-4020-S4-ATH		2	0.194	6	2	1.9		4							
EP1330	EHHR-4020-S6-ATH		6													
EP1331	EHHR-4030-S4-ATH		3	0.328	9	3	2.9		4							
EP1332	EHHR-4030-S6-ATH		6													
EP1333	EHHR-6040-S4-ATH	6	4	0.387	12	4	3.9	60	4	B	0.56	0.136				
EP1334	EHHR-6040-S6-ATH		6													
EP1335	EHHR-6050-ATH		5	0.521	15	5	4.7		6				A	0.7	0.162	
EP1336	EHHR-6060-ATH		6	0.581	18	6	5.7		6							
EP1337	EHHR-6080-ATH		8	0.849	24	8	7.6		75				8	B	1.12	0.255
EP1338	EHHR-6100-ATH		10	0.968	30	10	9.5		80				10			
EP1339	EHHR-6120-ATH	12	1.088	36	12	11.5	100	12								

NOTE: Please use CAM-R for your programming corner radius. For precise tool definition for the CAM system please download DXF data (QuickFinder) or contact your local Hitachi Tool staff for more details.



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Solid Carbide End Mills



Indexable Milling Tools



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Milling Chucks



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