MOLDINO
The Edge To Innovation

4 Flute High Efficiency Ball End Mill

EHHBE-TH3

Epoch High Hard Ball-TH3

MOLDINO Tool Engineering, Ltd.

New Product News | No. H2005A-1 | 2020-10

EHHBE has evolved by adopting the new TH3 coating for high hardened steel machining. Longer tool life capability when cutting high hardened steels.

Features of EHHBE-TH3

01 Highly efficient cutting with 4 flutes

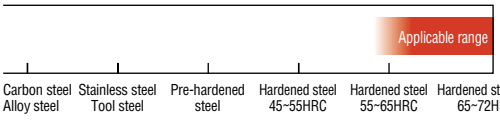
02 Special cutting edge shape on the tool tip that improves cutting performance.

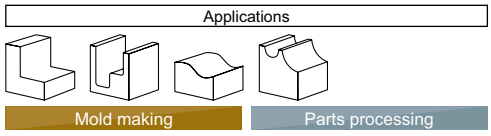
03 TH3 Coating provides long tool life even on hardened steels.

04 Variable Pitch tool geometry reduces cutting vibration.

05 Wide chip pocket improves chip removal.

06 Available for high-efficiency side milling.



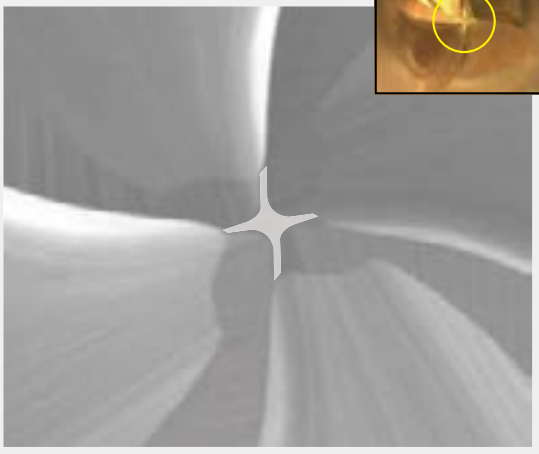


EHHBE-TH3

R0.5～R6 [17 Items]

Features Special tip shape

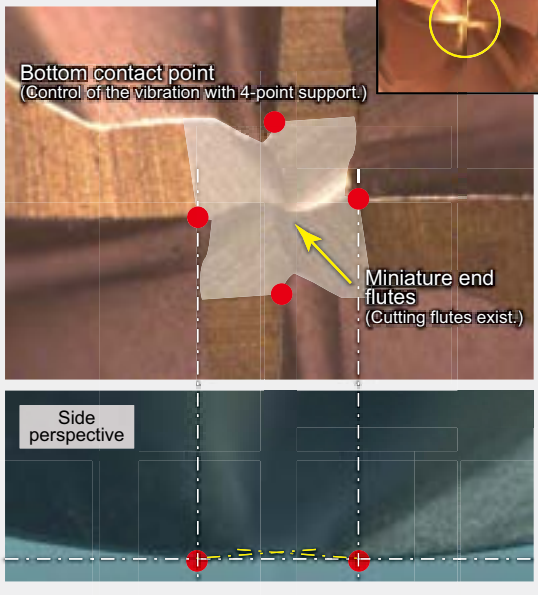
ϕ1 ～ϕ3



<Features and effects>

By creating a special flank face with a tiny relief angle at the very tip section, R accuracy is improved even with 4 flutes.

ϕ4 ～ϕ12

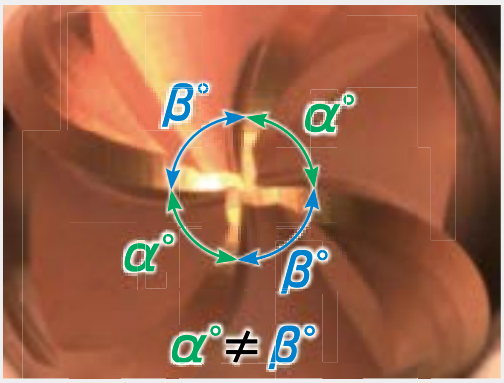


<Features and effects>

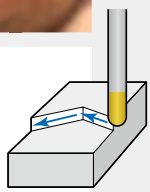
Features: There is no cutting point at the center of the tool tip.

Effects: Flute chipping, due to chip jamming at the center of the tip, is reduced.

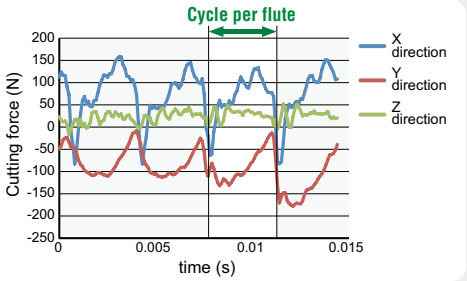
Features Suppressed vibration with Variable Pitch geometry



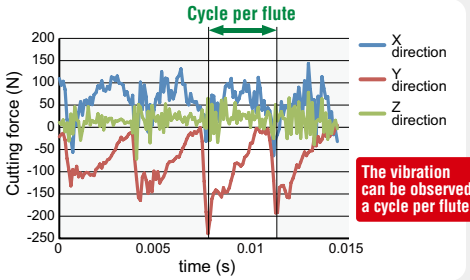
Work material：Matrix HSS(58HRC)
Tool：φ8（R4）×4 flutes
n=4,000min^{-1} (v_c=100m/min)
v_f=1,920mm/min (f_z=0.12mm/t)
a_p=0.3mm a_e=0.1mm Dry Air-blow
Machine：HSK-A63 Over hang：32mm



EHHBE-TH3
4 flutes
Variable Pitch

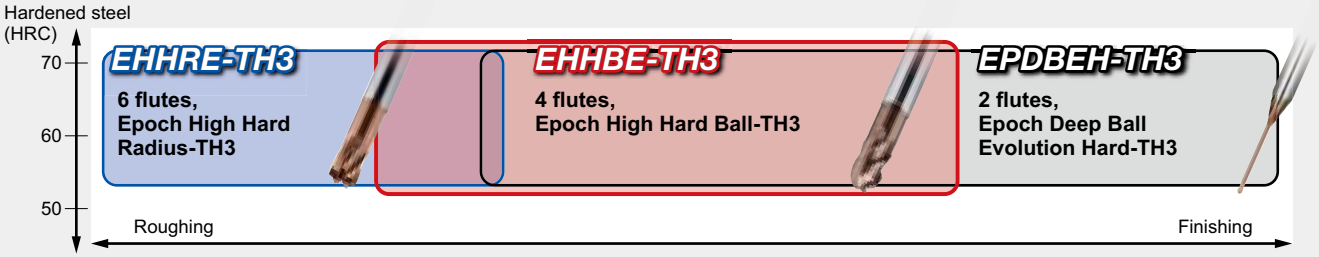


Conventional
4 flutes
Equal pitch



Features Performance and positioning

EHHBE-TH3 exhibits the performance during roughing to semi-finishing of high hardened steel (55HRC～).



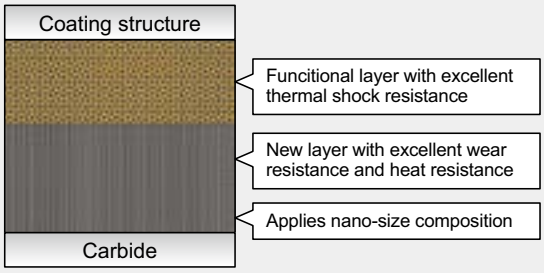
Features Newly developed "TH3" coating for hardened steel machining.

Features and performance

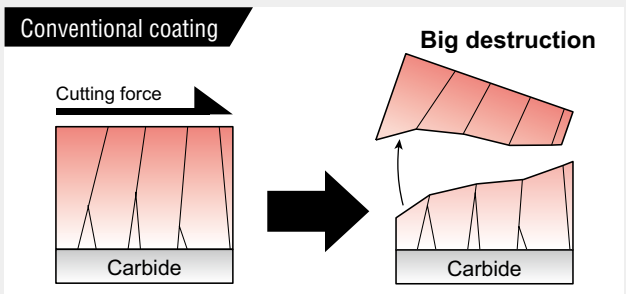
- High hardness coating with excellent wear resistance and heat resistance
- Has excellent thermal shock resistance which reduces the risk of rapid tool chipping.
- Long tool life when cutting high-hardness materials (50HRC or higher) such as hardened steel

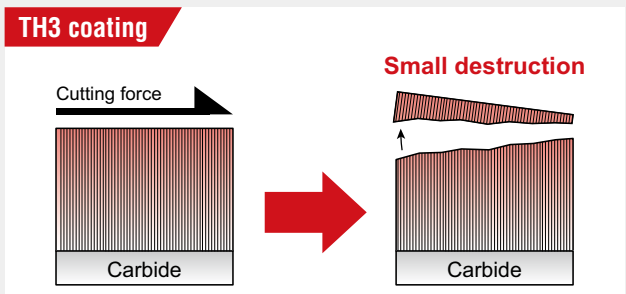
Target steel grade

- Hardened steel (especially 50HRC or higher), high-speed steel



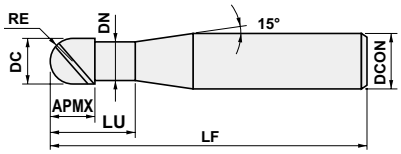
! Point TH3 coating utilizes nano-size composition to reduce large chipping of the coating.



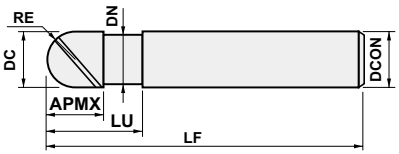


Line Up, Recommended Cutting Conditions

A type



B type



(mm)

Ball Radius RE	Tolerance on RE	Tolerance on dia.
0.5~1.5	±0.005	0~−0.010
2~3	±0.007	0~−0.014
4~6	±0.010	0~−0.020

EHHBE4○○○(-S○)-TH3

Carbide | TH3 Coated | 72 HRC | Helix 40° | Variable Pitch | h5

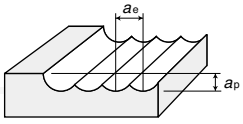
Order Number	Stock	Size (mm) Ball radius RE	Tool dia. DC	Flute length APMX	Under neck length LU	Neck dia. DN	Overall length LF	Shank dia. DCON	No. of flutes	Type
EHHBE4010-S4-TH3	●	0.5	1	1.5	3	0.95	50	4	4	A
EHHBE4010-S6-TH3	●			1.5	3	0.95	50	6	4	A
EHHBE4015-S4-TH3	●	0.75	1.5	2.5	4.5	1.43	50	4	4	A
EHHBE4015-S6-TH3	●			2.5	4.5	1.43	50	6	4	A
EHHBE4020-S4-TH3	●	1	2	3	6	1.9	50	4	4	A
EHHBE4020-S6-TH3	●			3	6	1.9	50	6	4	A
EHHBE4025-S4-TH3	●	1.25	2.5	4	7.5	2.38	50	4	4	A
EHHBE4025-S6-TH3	●			4	7.5	2.38	50	6	4	A
EHHBE4030-S4-TH3	●	1.5	3	4.5	9	2.9	70	4	4	A
EHHBE4030-S6-TH3	●			4.5	9	2.9	70	6	4	A
EHHBE4040-S4-TH3	●	2	4	6	12	3.9	70	4	4	B
EHHBE4040-S6-TH3	●			6	12	3.9	70	6	4	A
EHHBE4050-TH3	●	2.5	5	7.5	15	4.7	80	6	4	A
EHHBE4060-TH3	●	3	6	9	18	5.7	90	6	4	B
EHHBE4080-TH3	●	4	8	12	24	7.6	100	8	4	B
EHHBE4100-TH3	●	5	10	15	30	9.5	100	10	4	B
EHHBE4120-TH3	●	6	12	18	36	11.5	110	12	4	B

● : Stoked Items.

Recommended Cutting Conditions

Roughing

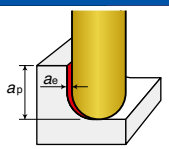
For work materials with hardnesses up to 55HRC, we recommend our company's 2-flute or 3-flute tool series.



Work material		Hardened Steels (55~62HRC) D2, Matrix HSS					Hardened Steels (62~66HRC) Powdered HSS, Matrix HSS, HSS					Hardened Steels (66~72HRC) Powdered HSS				
Ball radius RE (mm)	Tool dia. DC (mm)	Cutting speed v_c=110m/min Revolution n min^{-1}	Feed rate V_f mm/min	IPM	a_p mm	a_e mm	Cutting speed v_c=90m/min Revolution n min^{-1}	Feed rate V_f mm/min	IPM	a_p mm	a_e mm	Cutting speed v_c=70m/min Revolution n min^{-1}	Feed rate V_f mm/min	IPM	a_p mm	a_e mm
0.5	1	35,000	1,930	76	0.08	0.23	28,700	1,340	53	0.06	0.18	22,300	860	34	0.05	0.14
0.75	1.5	23,400	1,760	69	0.11	0.34	19,100	1,220	48	0.09	0.27	14,900	780	31	0.07	0.20
1	2	17,500	1,750	69	0.15	0.45	14,300	1,220	48	0.12	0.36	11,100	780	31	0.09	0.27
1.25	2.5	14,000	1,650	65	0.19	0.56	11,500	1,150	45	0.15	0.45	8,900	730	29	0.11	0.34
1.5	3	11,700	1,650	65	0.23	0.68	9,600	1,150	45	0.18	0.54	7,400	730	29	0.14	0.41
2	4	8,800	1,670	66	0.30	0.90	7,200	1,160	46	0.24	0.72	5,600	740	29	0.18	0.54
2.5	5	7,000	1,700	67	0.38	1.13	5,700	1,170	46	0.30	0.90	4,500	760	30	0.23	0.68
3	6	5,800	1,690	67	0.45	1.35	4,800	1,190	47	0.36	1.08	3,700	750	30	0.27	0.81
4	8	4,400	1,760	69	0.60	1.80	3,600	1,220	48	0.48	1.44	2,800	780	31	0.36	1.08
5	10	3,500	1,750	69	0.75	2.25	2,900	1,230	48	0.60	1.80	2,200	770	30	0.45	1.35
6	12	2,900	1,650	65	0.90	2.70	2,400	1,160	46	0.72	2.16	1,900	760	30	0.54	1.62

Side Cutting

For work materials with hardnesses up to 55HRC, we recommend our company's 2-flute or 3-flute tool series.

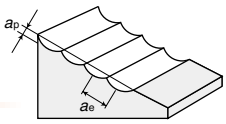


Work material		Hardened Steels (55～62HRC) D2, Matrix HSS					Hardened Steels (62～66HRC) Powdered HSS, Matrix HSS, HSS					Hardened Steels (66～72HRC) Powdered HSS				
Ball radius RE (mm)	Tool dia. DC (mm)	Cutting speed v_c=150m/min					Cutting speed v_c=125m/min					Cutting speed v_c=100m/min				
		Revolution n min^{-1}	Feed rate V_f mm/min	IPM	a_p mm	a_e mm	Revolution n min^{-1}	Feed rate V_f mm/min	IPM	a_p mm	a_e mm	Revolution n min^{-1}	Feed rate V_f mm/min	IPM	a_p mm	a_e mm
0.5	1	47,800	2,630	104	1.00	0.02	39,800	1,750	69	1.00	0.02	31,800	1,050	41	1.00	0.01
0.75	1.5	31,800	2,390	94	1.50	0.03	26,500	1,590	63	1.50	0.02	21,200	950	37	1.50	0.02
1	2	23,900	2,390	94	2.00	0.04	19,900	1,590	63	2.00	0.03	15,900	950	37	2.00	0.02
1.25	2.5	19,100	2,240	88	2.50	0.05	15,900	1,490	59	2.50	0.04	12,700	900	35	2.50	0.03
1.5	3	15,900	2,240	88	3.00	0.06	13,300	1,500	59	3.00	0.05	10,600	900	35	3.00	0.03
2	4	11,900	2,260	89	4.00	0.08	10,000	1,520	60	4.00	0.06	8,000	910	36	4.00	0.04
2.5	5	9,600	2,330	92	5.00	0.10	8,000	1,550	61	5.00	0.08	6,400	930	37	5.00	0.05
3	6	8,000	2,330	92	6.00	0.12	6,600	1,540	61	6.00	0.09	5,300	930	37	6.00	0.06
4	8	6,000	2,400	94	8.00	0.16	5,000	1,600	63	8.00	0.12	4,000	960	38	8.00	0.08
5	10	4,800	2,400	94	10.00	0.20	4,000	1,600	63	10.00	0.15	3,200	960	38	10.00	0.10
6	12	4,000	2,280	90	12.00	0.24	3,300	1,500	59	12.00	0.18	2,700	920	36	12.00	0.12

	55～62HRC	62～66HRC	66～72HRC
Slant angle for helical boring	1°	0.5°	0.2°
Feed rate for helical boring	70% of side cutting conditions		

※Set the hole diameter for helical boring to between 1.6 and 2.0 times the tool diameter.

※Set the maximum depth for helical boring to the tool diameter or smaller (≤ 1D).



Finishing

Work material		Tool Steels (25～35HRC) P20, 4140					Pre-hardened Steels (35～45HRC) P21					Hardened Steels (45～55HRC) H13, H13 Modified, 420 Stainless Steel				
Ball radius RE (mm)	Tool dia. DC (mm)	Cutting speed v_c=280m/min					Cutting speed v_c=250m/min					Cutting speed v_c=210m/min				
		Revolution n min^{-1}	Feed rate V_f mm/min	IPM	a_p mm	a_e mm	Revolution n min^{-1}	Feed rate V_f mm/min	IPM	a_p mm	a_e mm	Revolution n min^{-1}	Feed rate V_f mm/min	IPM	a_p mm	a_e mm
0.5	1	60,000	3,240	128	0.02～0.05	0.02	60,000	2,970	117	0.02～0.05	0.02	60,000	2,700	106	0.02～0.05	0.02
0.75	1.5	60,000	4,860	191	0.02～0.07	0.03	53,100	3,940	155	0.02～0.07	0.03	44,600	3,010	119	0.02～0.07	0.03
1	2	44,600	4,820	190	0.02～0.10	0.04	39,800	3,940	155	0.02～0.10	0.04	33,400	3,010	119	0.02～0.10	0.04
1.25	2.5	35,700	5,030	198	0.05～0.12	0.05	31,800	4,110	162	0.05～0.12	0.05	26,800	3,150	124	0.05～0.12	0.05
1.5	3	29,700	5,030	198	0.05～0.15	0.06	26,500	4,110	162	0.05～0.15	0.06	22,300	3,140	124	0.05～0.15	0.06
2	4	22,300	5,080	200	0.05～0.20	0.08	19,900	4,160	164	0.05～0.20	0.08	16,700	3,170	125	0.05～0.20	0.08
2.5	5	17,800	5,180	204	0.05～0.25	0.1	15,900	4,240	167	0.05～0.25	0.1	13,400	3,250	128	0.05～0.25	0.10
3	6	14,900	5,200	205	0.05～0.3	0.12	13,300	4,260	168	0.05～0.3	0.12	11,100	3,230	127	0.05～0.3	0.12
4	8	11,100	5,330	210	0.05～0.4	0.16	10,000	4,400	173	0.05～0.4	0.16	8,400	3,360	132	0.05～0.4	0.16
5	10	8,900	5,340	210	0.05～0.5	0.2	8,000	4,400	173	0.05～0.5	0.2	6,700	3,350	132	0.05～0.5	0.20
6	12	7,400	5,060	199	0.05～0.6	0.24	6,600	4,140	163	0.05～0.6	0.24	5,600	3,190	126	0.05～0.6	0.24

Work material		Hardened Steels (55～62HRC) D2, Matrix HSS					Hardened Steels (62～66HRC) Powdered HSS, Matrix HSS, HSS					Hardened Steels (66～72HRC) Powdered HSS				
Ball radius RE (mm)	Tool dia. DC (mm)	Cutting speed v_c=160m/min					Cutting speed v_c=140m/min					Cutting speed v_c=120m/min				
		Revolution n min^{-1}	Feed rate V_f mm/min	IPM	a_p mm	a_e mm	Revolution n min^{-1}	Feed rate V_f mm/min	IPM	a_p mm	a_e mm	Revolution n min^{-1}	Feed rate V_f mm/min	IPM	a_p mm	a_e mm
0.5	1	51,000	1,840	72	0.02～0.05	0.02	44,600	1,300	51	0.02～0.05	0.02	38,200	950	37	0.02～0.05	0.02
0.75	1.5	34,000	1,840	72	0.02～0.07	0.03	29,700	1,300	51	0.02～0.07	0.03	25,500	950	37	0.02～0.07	0.03
1	2	25,500	1,840	72	0.02～0.10	0.04	22,300	1,300	51	0.02～0.10	0.04	19,100	950	37	0.02～0.10	0.04
1.25	2.5	20,400	1,920	76	0.05～0.12	0.05	17,800	1,360	54	0.05～0.12	0.05	15,300	990	39	0.05～0.12	0.05
1.5	3	17,000	1,920	76	0.05～0.15	0.06	14,900	1,370	54	0.05～0.15	0.06	12,700	980	39	0.05～0.15	0.06
2	4	12,700	1,930	76	0.05～0.20	0.08	11,100	1,370	54	0.05～0.20	0.08	9,600	1,000	39	0.05～0.20	0.08
2.5	5	10,200	1,980	78	0.05～0.25	0.10	8,900	1,400	55	0.05～0.25	0.10	7,600	1,010	40	0.05～0.25	0.10
3	6	8,500	1,980	78	0.05～0.3	0.12	7,400	1,400	55	0.05～0.3	0.12	6,400	1,020	40	0.05～0.3	0.12
4	8	6,400	2,050	81	0.05～0.4	0.16	5,600	1,460	57	0.05～0.4	0.16	4,800	1,060	42	0.05～0.4	0.16
5	10	5,100	2,040	80	0.05～0.5	0.20	4,500	1,460	57	0.05～0.5	0.20	3,800	1,050	41	0.05～0.5	0.20
6	12	4,200	1,920	76	0.05～0.6	0.24	3,700	1,370	54	0.05～0.6	0.24	3,200	1,000	39	0.05～0.6	0.24

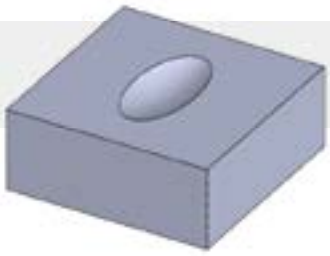
【Note】

① Use the appropriate coolant for the work material and machining shape.
② Use as highly rigid and accurate machine as possible.
③ These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
④ If the rpm available is lower than that recommended please reduce the feed rate to the same ratio.

Field Data

01 Cold tool steel cutting example [D2, 60HRC]

Tool：ϕ6 (R3)　Machine：Vertical MC(BT50)
n=8,000min^{-1}(v_c=150m/min)　v_f=2,100mm/min (f_z=0.066mm/t)　a_e=0.1mm
Scanning　Dry, Air-blow　　Over hang：18mm

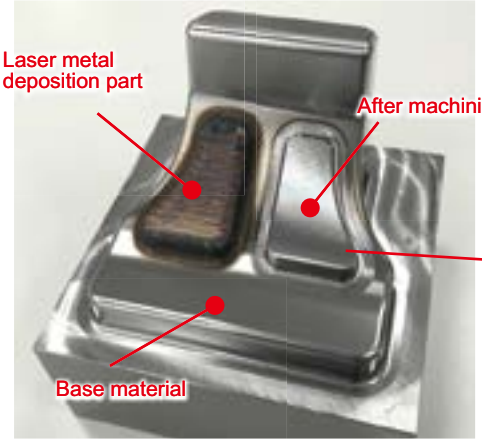


Size :30×60×5mm
Machining time：10min

Conventional

EHHBE4060-TH3

02 Cutting application for Laser metal deposition [H13Ⓗ 56HRC]



After machining

■ Condition for tool wear (after machining)

EHHBE4120-TH3

EHHBE4040-S4-TH3

Work size：150×150×150mm

Work material
Base material：H13 43HRC
Laser metal deposition part：H13 56HRC

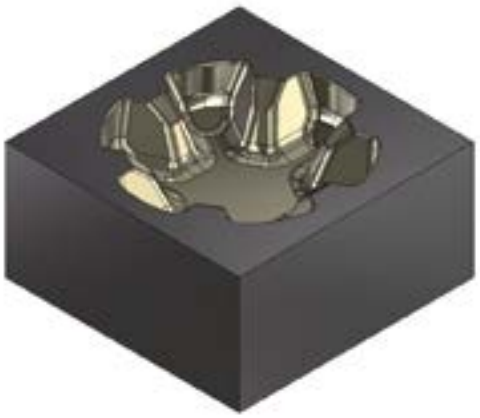
Microwear and possible to use continuously

Machine tool : Okuma Corporation MU-8000V LASER EX
CAM : C&G SYSTEMS INC. CAM-TOOL

Process		Tool	Tool dia. (mm)	Revolution n (min^{-1})	Cutting speed v_c (m/min)	Feed rate v_f (mm/min)	Feed per tooth f_z (mm/t)	a_p (mm)	a_e (mm)	Coolant
Laser metal deposition part	Rouging	EHHBE4120-TH3	12	2,400	90	1,160	0.12	0.5	0.7	Air
		EHHBE4040-S4-TH3	4	7,200	90	1,160	0.04	0.2	0.6	Air
	Finishing	EHHBE4120-TH3	12	3,700	139	1,370	0.09	–	0.2	Air
		EHHBE4040-S4-TH3	4	10,000	126	1,240	0.03	–	0.1	Air

03 Compare with contouring machining and high efficiency side milling.

■ Cutting application for cold forging die (Bevel Gear) [Matrix HSS 60HRC]

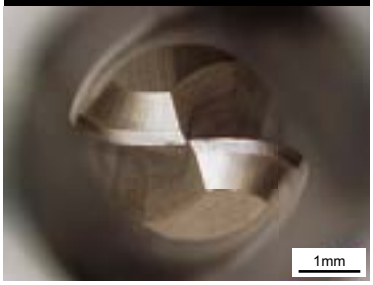


(ϕ25.6×Depth 6mm)

EHHBE4040-S4-TH3
(High-efficiency side milling)

Flank wear：0.015mm

Conventional 2 flutes ball end mill
(Contouring)



Flank wear：0.062mm

High efficiency side milling with EHHBE-TH3 increases tool life when compared to conventional ball end mill (2 flutes).

Cutting conditions

Machine : Vertical MC(HSK-F63) Coolant : Air-blow

Cutting method	Tool	Revolution n (min^{-1})	Cutting speed v_c (m/min)	Feed rate v_f (mm/min)	Feed per tooth f_z (mm/t)	a_p (mm)	a_e (mm)	Max. chip removal volume (cm^3/min)	Actual cutting time
Contouring	Conventional 2 flutes Ball End Mill	14,000	176	750	0.027	0.2	0.6	0.09	28 min.
High efficiency side milling (Helical cutting ⇒ Trochoidal cutting)	EHHBE4040-S4-TH3	11,900	150	1,200	0.025	4	0.25 (Max.)	1.2	10 min.

⚠ Safety notes

1. Cautions regarding handling
(1) When removing the tool from its case (packaging), be careful that the tool does not pop out or is dropped. Be particularly careful regarding contact with the tool flutes.
(2) When handling tools with sharp cutting flutes, be careful not to touch the cutting flutes directly with your bare hands.

2. Cautions regarding mounting
(1) Before use, check the outside appearance of the tool for scratches, cracks, etc. and that it is firmly mounted in the collet chuck, etc.
(2) If abnormal chattering, etc. occurs during use, stop the machine immediately and remove the cause of the chattering.

3. Cautions during use
(1) Before use, confirm the dimensions and direction of rotation of the tool and milling work material.
(2) The numerical values in the standard cutting conditions table should be used as criteria when starting new work. The cutting conditions should be adjusted as appropriate when the cutting depth is large, the rigidity of the machine being used is low, or according to the conditions of the work material.
(3) Cutting tools are made of a hard material. During use, they may break and fly off. In addition, cutting chips may also fly off. Since there is a danger of injury to workers, fire, or eye damage from such flying pieces, a safety cover should be attached when work is performed and safety equipment such as safety goggles should be worn to create a safe environment for work.
(4) There is a risk of fire or inflammation due to sparks, heat due to breakage, and cutting chips. Do not use where there is a risk of fire or explosion. **Please caution of fire while using oil base coolant, fire prevention is necessary.**
(5) Do not use the tool for any purpose other than that for which it is intended.

4. Cautions regarding regrinding
(1) If regrinding is not performed at the proper time, there is a risk of the tool breaking. Replace the tool with one in good condition, or perform regrinding.
(2) Grinding dust will be created when regrinding a tool. When regrinding, be sure to attach a safety cover over the work area and wear safety clothes such as safety goggles, etc.
(3) This product contains the specified chemical substance cobalt and its inorganic compounds. When performing regrinding or similar processing, be sure to handle the processing in accordance with thelocal laws and regulations regarding prevention of hazards due to specified chemical substances.

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