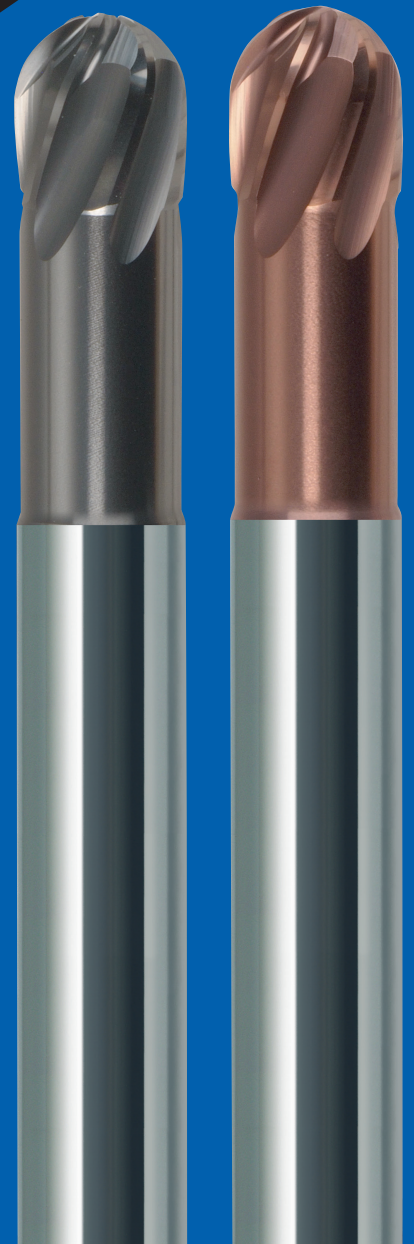


6 Flutes Ball End Mill for High-Efficiency Finishing

# ***EPHB***



**MOLDINO Tool Engineering Europe GmbH**

## 6-flute ball end mill for high efficiency semi- and finishing operations

### Features of EPHB

**01** High accuracy 6-flute design

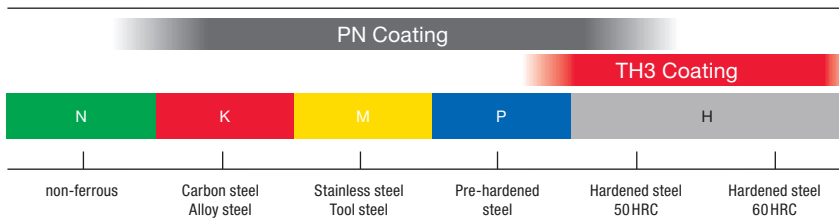
**02** PN and TH3 coating

**Line-up:** 8 items

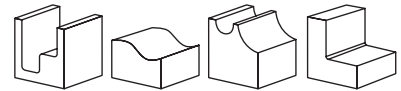
**DC:** 6 – 12 mm



### Recommended usage

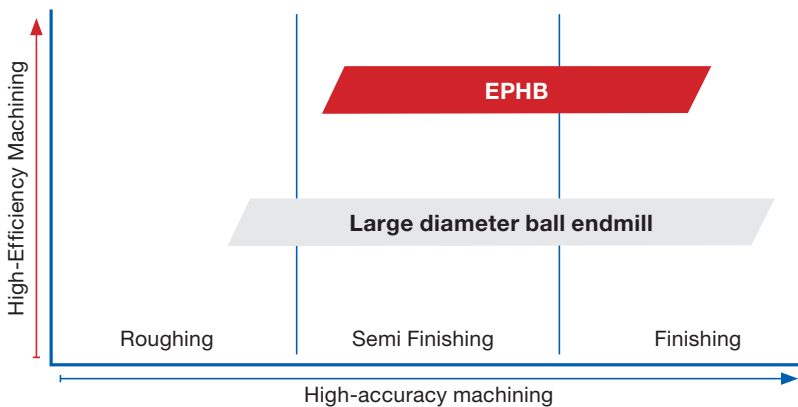


### Applications



### Customer need and benefit

High-efficiency (semi-) finishing of mid- to large-sized molds and dies.



### Challenge

Size, tolerance and restmaterial operations of alternative indexable tools.

### Solution

High-feed machining with EPHB in soft and hard materials and less follow-up-operations.

Feature

**01**

High-accuracy 6-flute design



The employed geometry of EPHB provides 6 finely tuned and coordinated cutting edges.

High accuracy machining with long tool life is possible since each edge works uniformly with micro cutting depth.

Feature

**02**

PN and TH3 coating

	PN	TH3
Hardness	3,000HV	3,800HV
Oxidation start temperature	1,200 °C	1,200 °C
Coefficient of friction	0.5	0.9
Structure	Mono-columnar micro-composite	Multi-Layer super-nano-composite

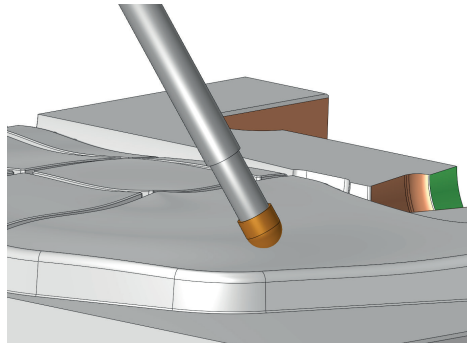
The availability of both PN and TH3 coatings enables the processing of a wide variety of materials, covering from soft to hard.

The proper selection will provide much longer tool life!

Example

**01**

Comparison with large diameter indexable tool

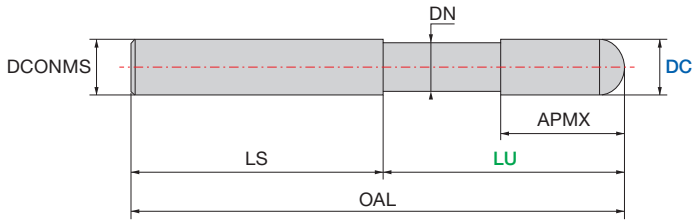


2.5 times higher machining efficiency with EPHB. Additionally, corners can be finished with a single tool change, more precise finished surface can be obtained.

Item	DC	RPM	Vc	Vf	fz	ae	Cusp height	Ra	Rz
	mm	min <sup>-1</sup>	m/min	mm/min	mm/t	mm	µm	µm	µm
EPHB-6080-24-PN	8	14900	375	21460	0.24	0.3	2.8	1.084	7.096
Index. Ball endmill	30	6000	565	4000	0.30	0.6	3.0	1.435	10.400

## EPHB-PN 6 Flutes Ball End Mill for High-Efficiency Finishing

6 Flutes Rake angle positive Helix 20° h5 Carbide PN coated 50 HRC

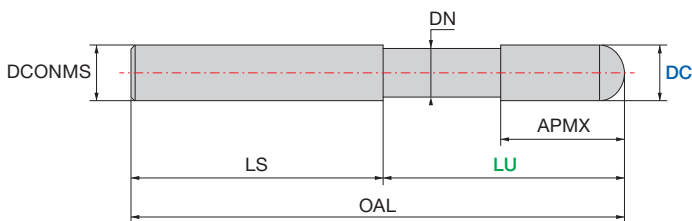


Radius tolerance  
± 0.01

ID Code	Item Code	Stock	Z	Size (mm)						
				DC	APMX	LU	DN	LS	OAL	DCONMS
EP2096	EPHB-6060-18-PN	●	6	6	6	18	5.7	38	56	6
EP2097	EPHB-6080-24-PN	●	6	8	8	24	7.6	39	63	8
EP2098	EPHB-6100-30-PN	●	6	10	10	30	9.5	44	74	10
EP2099	EPHB-6120-36-PN	●	6	12	12	36	11.5	50	86	12

## EPHB-TH3 6 Flutes Ball End Mill for High-Efficiency Finishing

6 Flutes Rake angle positive Helix 20° h5 Carbide TH3 coated 65 HRC



Radius tolerance  
± 0.01

ID Code	Item Code	Stock	Z	Size (mm)						
				DC	APMX	LU	DN	LS	OAL	DCONMS
EP2100	EPHB-6060-18-TH3	●	6	6	6	18	5.7	38	56	6
EP2101	EPHB-6080-24-TH3	●	6	8	8	24	7.6	39	63	8
EP2102	EPHB-6100-30-TH3	●	6	10	10	30	9.5	44	74	10
EP2103	EPHB-6120-36-TH3	●	6	12	12	36	11.5	50	86	12

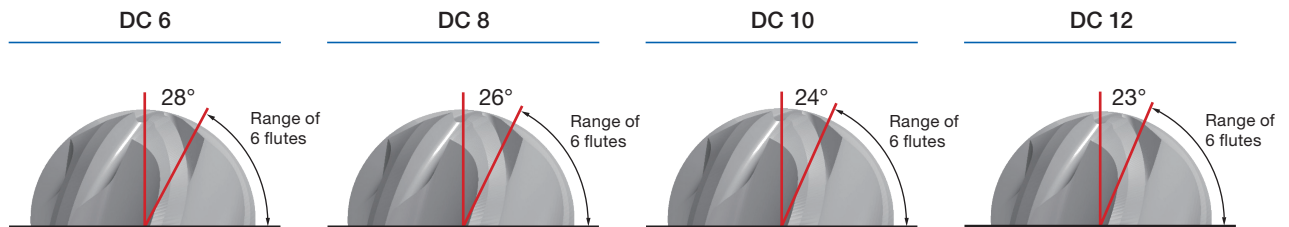
● Stock Item

## EPHB Usage instructions

### 6 flutes usable range by ball radius

- Angles represent non 6-flutes parts around tool tip center.
- EPHB is usable with 3-axis since tool has 2 cutting edges at tip center, but EPHB performs at its true potential when using the below shown 6-flutes range with 3+2 or 5-axis.
- When machining with spindle tilted, please set the angle of spindle considering  $a_p$  etc.

#### Minimum tilt angle



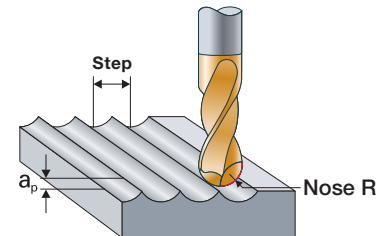
### Ball end mill pitch and theoretical cusp height table (μm)

Ball radius (mm)	Pitch: step (mm)						
	0.05	0.10	0.20	0.30	0.40	0.50	0.60
3	0.104	0.417	1.667	3.752	6.674	10.435	15.038
4	0.078	0.313	1.250	2.813	5.003	7.820	11.266
5	0.063	0.250	1.000	2.251	4.002	6.254	9.008
6	0.052	0.208	0.833	1.875	3.334	5.211	7.505

#### Pitch and cusp height

$$h = R - \sqrt{\frac{(2 \cdot R)^2 - \text{Step}^2}{4}}$$

$$h = \frac{\text{Step}^2}{8 \cdot R}$$

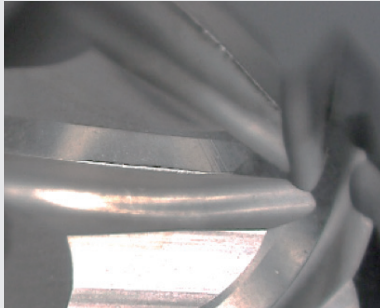


## EPHB Application example

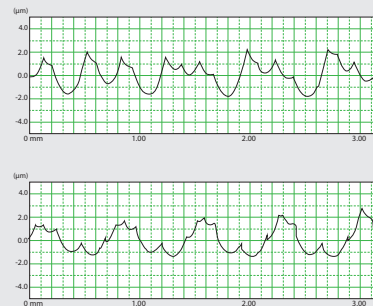
### Tool life tests in soft and hard on 45° inclined surfaces (dry machining)

**i** Total wear is uniform and small after 2.7 hours and 1400 m of constant cutting. Comparing the work surface roughness after cutting 1400 m, there is no major change from the initial machining.

EPHB-PN after 1400 m in HPM7



Surface roughness



**Initial stage**  
Ra: 0.96 μm Rz: 3.92 μm

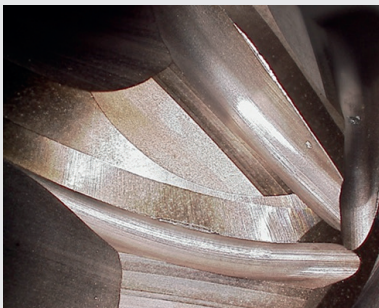


**After 1400 m**  
Ra: 1.00 μm Rz: 3.96 μm

Item	DC	RPM	V <sub>c</sub>	V <sub>f</sub>	f <sub>z</sub>	a <sub>e</sub>	Cutting Time	Cutting Length
	mm	min <sup>-1</sup>	m/min	mm/min	mm/t	mm	min	m
EPHB-6080-24-PN	8	12000	301	8640	0.12	0.3	162	1400

**i** EPHB-TH3 shows its potential especially in hard materials > 40 HRC. Tool wear is uniform and relatively small after 6.5 hours and 3000 m of constant cutting in 60 HRC!

EPHB-TH3 after 3000m in 1.2379



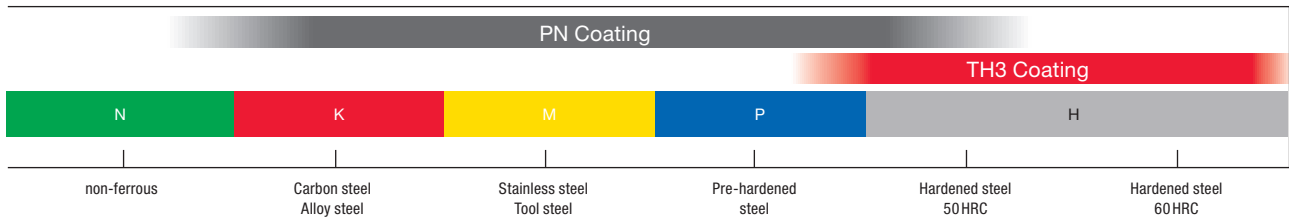
Width of wear

VB=0.03mm

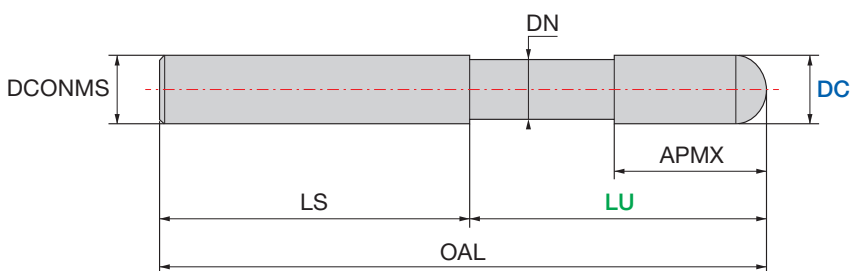


Item	DC	RPM	V <sub>c</sub>	V <sub>f</sub>	f <sub>z</sub>	a <sub>p</sub>	a <sub>e</sub>	Cutting Time	Cutting Length
	mm	min <sup>-1</sup>	m/min	mm/min	mm/t	mm	mm	min	m
EPHB-6120-36-PN	12	6600	250	5760	0.145	0.15	0.15	390	3000

## EPHB General technical information



ISO 513 Symbol	Description	Examples
<b>P</b>	Non-alloy steel, low alloy steel, high alloy steel, ferritic/martensitic stainless steel, tool steel	1.2343 / X38CrMoV5-1; 1.2738 / 40CrMnNiMo8; 1.0503 / C45; 1.0570 / ST52-3; 1.1730 / C45W; 1.7131 / 16MnCr5; 1.7225 / 42CrMo4; 1.3343 / HS6-5-2; 1.0511 / C40; 1.2312 / 40CrMnMoS8-6; 1.2311 / 40CrMnMo7; 1.2344 / X40CrMoV5-1; 1.2767 / X45NiCrMo4; 1.2083 / X42Cr13; 1.2085 / X33CrS16; 1.2714 / 55NiCrMoV7; 1.2842 / 90MnCrV8;
<b>M</b>	Austenitic stainless steel	1.4301 / X5CrNi18-9; 1.4401 / X5CrNiMo17-12-2; 1.4404 / X2CrNiMo17-13-2; 1.4828 / X15CrNiSi20 12
<b>K</b>	Grey cast iron (GG), nodular cast iron (GGG), malleable cast iron	0.6025 / GG-25; GGG-40.3; 0.8155 / GTS-55-04
<b>N</b>	Aluminum wrought all, copper alloy, aluminum-cast, alloyed, non-ferrous	2.0060 / E-Cu57; 2.0321 / CuZn37; 3.0255 / Al99.5; 3.5103 / MgSE3Zn27r1
<b>S</b>	High temperature alloys, titanium and Ti alloys	1.4864 / X12NiCrSi36 16; 2.4856 / NiCr22Mo9Nb; 1.4977 / X40CoCrNi20 20; 2.4669 / NiCr15Fe7TiAl
<b>H</b>	Hardened steel, chilled cast iron, cast iron	



Drawing nomenclature (mm)	
APMX	Cutting edge length
DC	Diameter cutting
DCONMS	Connection diameter
DN	Neck diameter
LS	Shaft length
LU	Underneck length
OAL	Overall length

## **Attentions on Safety**

### **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) When preparing for use, be sure that the inserts are firmly mounted in place and that they are firmly mounted on the arbor, etc.
- (3) 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 the local laws and regulations regarding prevention of hazards due to specified chemical substances.

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