High precision mold manufacture solution

The Mirror Endmill

PCD Endmill / cBN Endmill / H-star Endmill

KORLOY

The Mirror Endmill

PCD Endmill / cBN Endmill / H-star Endmill

PCD Endmill

Polishing PCD ball Endmill

For polishing of high precision workpiece and high hardness mold

- Optimal surface finish by PCD ball Endmill with no edge
- Nano-level surface finish due to its ultra-fine Endmill
- Enhanced wear resistance from applying the optimal grade for PCD

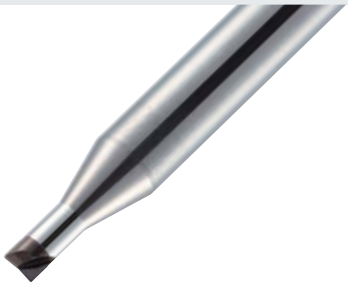
cBN Endmill

cBN ball Endmill for high hardness cutting

For ultra-fine and mirror-like workpiece and mold with over HRC60 machining

- Higher productivity and surface finish in high speed cutting
- Enhanced wear resistance due to the optimal cBN grade
- Longer tool life by shape with strong cutting edge
- Stable tool life and surface from high precision Endmill

cBN Endmill



Launching of cBN radius Endmill for high hardness cutting

For medium cutting of high precision workpiece and mold machining above HRC60

- Higher productivity in high speed machining
- Better wear resistance of tool due to applying the optimal grade for cBN
- Good surface finish through connecting smooth cutting edge and body
- Long tool life from strong cutting edge

H-Star Endmill

Suitable for high speed cutting of workpiece with HRC50~63

Proper for the various cutting processes with long neck, rib and taper neck etc.

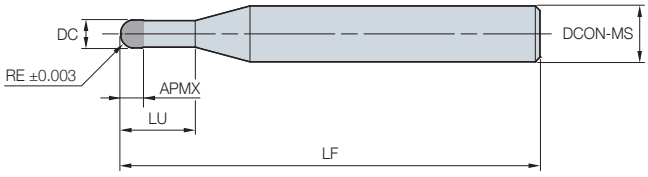
- Stronger cutting edge strength of the tool applied ultra-fine substrate
- Enhanced high temperature heat resistance by applying new coating layer on the edge in high speed cutting
- Stable cutting performance due to the optimal cutting edge for high speed machining

The Mirror PCD Endmill

PCD-MBE0000 (Ball)

h3 shank

Type	Tolerance	R tolerance
DC	0.3 ~ 2.0	0.000 ~ -0.008
RE	0.3 ~ 2.0	±0.003



(mm)

Designation		Drill dia. [DC]	R [RE]	Flute length [APMX]	Neck length [LU]	Overall length [LF]	Shank dia. [DCON-MS]
PCD-MBE	0003-048-N007S04	0.3	0.15	0.15	0.75	48	4
	0004-048-N010S04	0.4	0.2	0.2	1	48	4
	0006-048-N015S04	0.6	0.3	0.3	1.5	48	4
	0010-048-N025S04	1	0.5	0.5	2.5	48	4
	0015-048-N040S04	1.5	0.75	0.75	4	48	4
	0020-048-N050S04	2	1	1	5	48	4

Recommended cutting conditions

(mm)

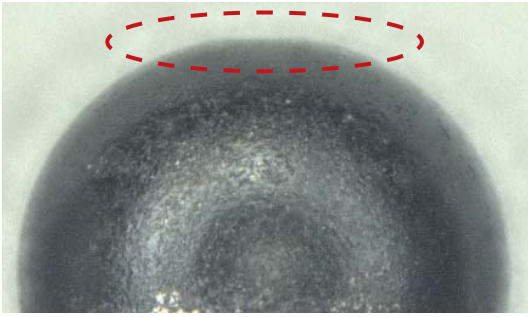
공구직경 (DC, Ø)	R	High speed steel, pre-hardened steel and heat treatment steel(~HRC65)			
		n (min⁻¹)	vf (mm/min)	ap (mm)	ae (mm)
0.3 ~ 0.4	0.15 ~ 0.2	40,000	200	0.002	0.002
0.6	0.3	40,000	400	0.003	0.003
1	0.5	40,000	500	0.005	0.005
1.5 ~ 2	0.75 ~ 1	40,000	600	0.005	0.005

Application Examples

Surface finish, wear resistance

- **Workpiece**_____ STD11(HRC60)
- **Cutting conditions**__ **n** (min-1) = 40,000, **vf** (mm/min) = 400, **ap** (mm) = 0.003, **ae** (mm) = 0.003, Mist
- **Tools**_____ PCD-MBE2004-048-N010S04
- **Wear resistance**____ 3㎛ (Continuous cutting for 10h)

Good wear resistance



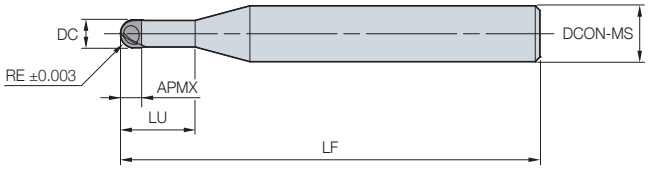
▶ After continuous cutting for 10h

The Mirror cBN Endmill

cBN-MBE2000 (Ball)

2 | H·A 0° | h4 shank

Type	Tolerance	R tolerance
DC	0.4 ~ 2.0	0.000 ~ -0.008
RE	0.4 ~ 2.0	±0.003



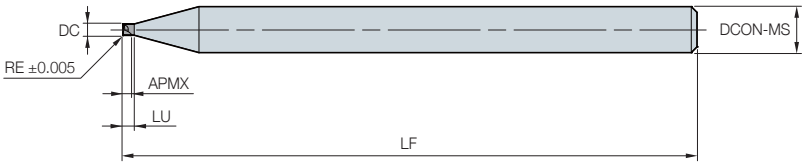
(mm)

	Designation	Drill dia. [DC]	R [RE]	Flute length [APMX]	Neck length [LU]	Overall length [LF]	Shank dia. [DCON-MS]
cBN-MBE 2	2004-050-N005S04	0.4	0.2	0.33	0.5	50	4
	2004-050-N010S04	0.4	0.2	0.33	1	50	4
	2005-050-N010S04	0.5	0.25	0.38	1	50	4
	2006-050-N015S04	0.6	0.3	0.5	1.5	50	4
	2008-050-N020S04	0.8	0.4	0.6	2	50	4
	2010-050-N025S04	1	0.5	0.7	2.5	50	4
	2012-050-N030S04	1.2	0.6	0.8	3	50	4
	2015-050-N040S04	1.5	0.75	1	4	50	4
	2020-050-N050S04	2	1	1.2	5	50	4

cBN-MRE2000 (Radius)

2 | H·A 0° | h4 shank

Type	Tolerance	R tolerance
DC	0.4 ~ 2.0	0.000 ~ -0.008
RE	0.4 ~ 2.0	±0.003



(mm)

	Designation	Drill dia. [DC]	R [RE]	Flute length [APMX]	Neck length [LU]	Overall length [LF]	Shank dia. [DCON-MS]
cBN-MRE 2	2004-050-R005-N005S04	0.4	0.05	0.24	0.5	50	4
	2004-050-R005-N010S04	0.4	0.05	0.24	1	50	4
	2004-050-R010-N005S04	0.4	0.1	0.24	0.5	50	4
	2004-050-R010-N010S04	0.4	0.1	0.24	1	50	4
	2005-050-R005-N005S04	0.5	0.05	0.3	0.5	50	4
	2005-050-R005-N010S04	0.5	0.05	0.3	1	50	4
	2005-050-R010-N005S04	0.5	0.1	0.3	0.5	50	4
	2005-050-R010-N010S04	0.5	0.1	0.3	1	50	4
	2010-050-R010-N010S04	1	0.1	0.7	1	50	4
	2010-050-R010-N020S04	1	0.1	0.7	2	50	4
	2010-050-R010-N030S04	1	0.1	0.7	3	50	4
	2010-050-R010-N040S04	1	0.1	0.7	5	50	4
	2010-050-R020-N010S04	1	0.2	0.7	1	50	4
	2010-050-R020-N020S04	1	0.2	0.7	2	50	4
	2015-050-R010-N030S04	1.5	0.1	0.85	3	50	4
	2015-050-R010-N045S04	1.5	0.1	0.85	4.5	50	4
	2015-050-R010-N075S04	1.5	0.1	0.85	7.5	50	4
	2015-050-R020-N045S04	1.5	0.2	0.85	4.5	50	4
	2020-050-R010-N040S04	2	0.1	0.85	4	50	4
	2020-050-R010-N060S04	2	0.1	0.85	6	50	4
	2020-050-R010-N100S04	2	0.1	0.85	10	50	4
	2020-050-R020-N040S04	2	0.2	0.85	4	50	4
	2020-050-R020-N060S04	2	0.2	0.85	6	50	4
	2020-050-R020-N100S04	2	0.2	0.85	10	50	4

※ In case longer flute length than 0.85mm with Ø1.5~ 2.0 is necessary, it could be order made by 1.2mm.

The Mirror Endmill

Recommended cutting conditions (Ball)

(mm)

Drill dia. (DC, Ø)	Neck length (LU)	~HRC55				HRC55~65				HRC65~68			
		n (min^{-1})	vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	vf (mm/min)	ap (mm)	ae (mm)
0.4	0.5	40,000	1,500	0.005	0.010	40,000	1,200	0.005	0.010	40,000	750	0.005	0.005
0.4	1	40,000	1,200	0.005	0.010	40,000	900	0.005	0.010	40,000	600	0.005	0.005
0.5	1	40,000	1,500	0.010	0.010	40,000	1,400	0.010	0.010	40,000	900	0.010	0.010
0.6	1.5	35,000	2,000	0.020	0.030	35,000	2,000	0.020	0.030	35,000	1,000	0.010	0.020
0.8	2	35,000	2,000	0.030	0.040	35,000	2,000	0.020	0.030	35,000	1,500	0.010	0.020
1	2.5	35,000	3,000	0.040	0.050	35,000	3,000	0.030	0.040	35,000	2,000	0.020	0.030
1.2	3	35,000	3,000	0.050	0.050	35,000	2,500	0.035	0.035	35,000	2,000	0.020	0.025
1.5	4	30,000	3,000	0.060	0.060	30,000	2,500	0.040	0.040	30,000	2,000	0.020	0.025
2	5	30,000	3,000	0.080	0.080	30,000	2,500	0.050	0.050	30,000	2,000	0.020	0.050

※ The cutting conditions above are for drilling with external coolant and cutting depth, under 5D.

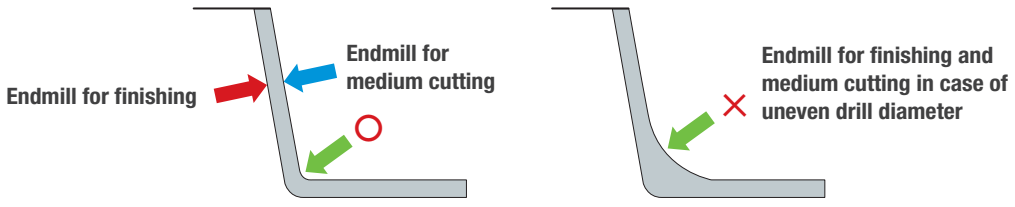
Recommended cutting conditions (Radius)

(mm)

Shape			~HRC52				HRC52~62				HRC62~68			
Drill dia. (DC, Ø)	Radius (RE)	Neck length [LU]	n (min^{-1})	vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	vf (mm/min)	ap (mm)	ae (mm)
0.4	0.05 , 0.1	0.5 , 1	50,000	700	0.005	0.1	50,000	600	0.005	0.1	50,000	400	0.003	0.03
0.5	0.05 , 0.1	0.5 , 1	50,000	600	0.01	0.2	50,000	600	0.01	0.2	50,000	500	0.005	0.2
1	0.1 , 0.2	1 , 2	48,000	1,500	0.03	0.4	48,000	1,200	0.03	0.3	32,000	1,000	0.01	0.2
		3 , 5	48,000	1,500	0.02	0.3	48,000	1,200	0.02	0.2	32,000	1,000	0.01	0.1
1.5	0.1 , 0.2	3 , 4.5 , 7.5	32,000	2,000	0.04	0.7	32,000	1,500	0.04	0.6	20,000	1,200	0.01	0.3
2	0.1 , 0.2	4 , 6	24,000	2,000	0.05	0.8	24,000	1,500	0.05	0.7	16,000	1,200	0.01	0.5
		10	24,000	2,000	0.03	0.6	24,000	1,500	0.03	0.5	16,000	1,200	0.01	0.3

※ The recommended cutting condition in the chart above is for cutting with external coolant and depth of cut, under 50.

Notice for cBN Endmill



- Please select the same drill diameter as the Endmill for finishing (cBN Endmill) considering minimizing the amount of rest cutting in selecting Endmill for medium cutting

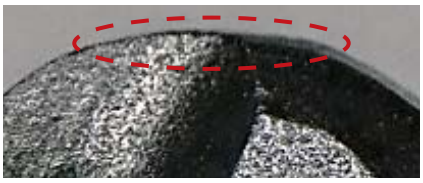
Application Examples

Surface finish, wear resistance

- **Workpiece**_____ STD11(HRC60)
- **Cutting condition**___ **n** (min-1) = 40,000, **vf** (mm/min) = 700, **ap** (mm) = 0.005, **ae** (mm) = 0.01, Mist
- **Tool**_____ cBN-MBE2004-050-N010S04
- **Wear resistance**___ 5㎛ (Continuous cutting for 2h)

» After continuous cutting for 2h

Good wear resistance

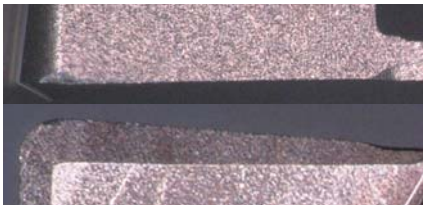


» Maintain the shape of cutting edge even after continuous cutting for 2h

- **Workpiece**_____ STD11(HRC60)
- **Cutting condition**___ **n** (min^{-1}) = 25,000, **vf** (mm/min) = 1,000, **ap** (mm) = 0.015, **ae** (mm) = 0.15, Mist
- **Tool**_____ cBN-MRE2020-050-R010-N04S04
- **Wear resistance**___ 27㎛ (Cutting for 100 min)

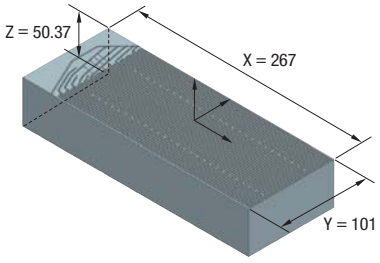
» After cutting for 100 min, Ra(㎛) = 0.03

Good wear resistance

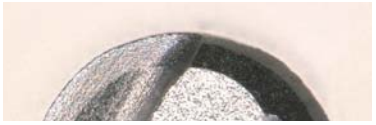


» After cutting for 100 min, the cutting edge was kept sharp.

Machining example



- **Workpiece** STD11(HRC60)
- **Size** 267 × 101 × 50mm
- **Coolant** Oil mist
- **Tool** cBN-MBE2004-050-N010S04



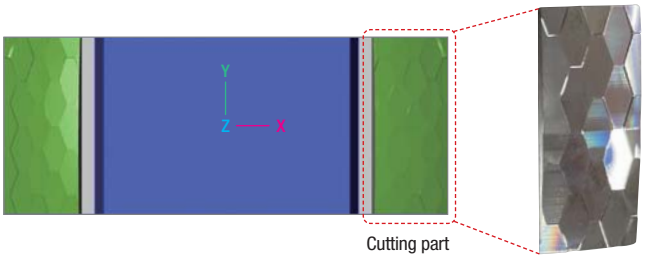
» After cutting for 3h and 25min, the cutting edge was kept sharp.

No.	cutting	Tool	n(min-1)	vf(mm/min)	ap(mm)	ae(mm)	Stock	Cutting hour	Cutting pass
1	Roughing	ESB734060	8,500	1,500	1	2	0.05	51m	1
2	Roughing	ESB702010S4	24,000	2,000	0.07	0.07	0.05	3h 35m	1
3	Medium to roughing	ESR7040100204S4	27,000	1,200	0.2	0.03	0.03	6h 9m	1
4	Medium cutting	ESR7040100204S4	27,000	1,200	0.2	0.03	0.01	6h 8m	1
5	Medium to finishing	ESB702004	40,000	700	0.02	0.03	0.005	4h 50m	7
6	Finishing	cBN-MBE2004-050-N010S04	40,000	1,000	0.005	0.01	0	3h 25m	14

※ Total cutting hours 98h 23m

The Mirror Endmill

Machining example



- **Workpiece** STAVAX(HRC50)
- **Size** 100 × 40 × 50mm
- **Coolant** Oil mist
- **Tool** cBN-MBE2004-050-N010S04

No.	cutting	Tool	n(min^{-1})	vf(mm/min)	ap(mm)	ae(mm)	Stock	cutting hour
1	Whole roughing	ESB703040	22,000	2,200	0.1	0.1	0.1	54m
2	Rib roughing	ESB702010S4	39,000	2,000	0.04	0.05	0.02	33m
3	Shape medium cutting	ESB702010S4	39,000	2,000	0.01	0.05	0.01	18m
4	Shape medium to finishing	ESB702004	40,000	800	0.008	0.015	0.005	20m
5	cBN cutting	cBN-MBE2004-050-N010S04	40,000	1,000	0.005	0.01	0.005	2h 46m
6	PCD finishing	PCD-MBE0004-048-N010S04	40,000	400	0.005	0.003	0	11h 8m

※ Total cutting hours 15h 59m

Order-made tool

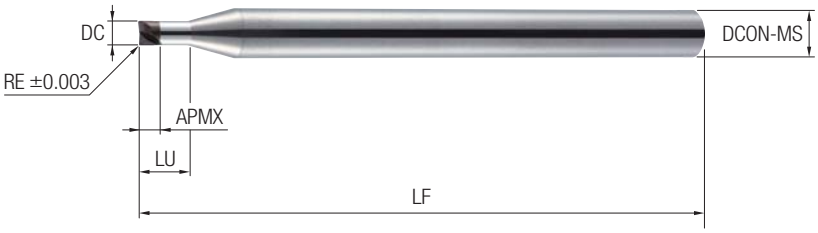
- Please fill the data sheet and send Korloy office then, we can customize tool you want.

Workpiece	**Workpiece material**	
	HRC	
Drill Dia. (mm)	**DC** (Ø0.4 ~ Ø2)	
Corner R (mm)	**RE** (0.05 ~ 0.2)	
Flute length (mm)	**APMX** (0.24 ~ 1.2)	
Neck length (mm)	**LU** (0.5 ~ 10)	
Overall length (mm)	**LF**	
Shank Dia. (mm)	**DCON-MS**	

[ ] is the range of order-made

[Ball]

[Radius]



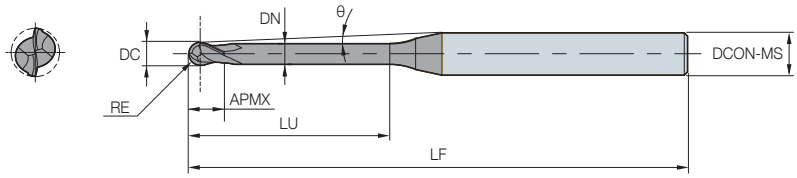
The Mirror H-star Endmill

ESLNB

Long neck Ball

ULTRA FINE | 2 | H·A 30° | R ±0.005 (Above Ø6) | AlTiN | h5 shank | 재종 PC305H

Type	Tolerance	R tolerance
DC	All	0.000 ~ -0.015
RE	-	±0.005



(mm)

Designation	R [RE]	Drill dia. [DC]	Shank dia. [DCON-MS]	Flute length [APMX]	Neck length [LU]	Neck Diameter [DN]	θ	Overall length [LF]	Effective length by inclination angle 0.5°	1°	1.5°	2°	3°
ESLNB2001-0.2	0.05	0.1	4	0.08	0.2	0.08	11.8	45	0.3	0.3	0.3	0.4	0.4
ESLNB2001-0.3	0.05	0.1	4	0.08	0.3	0.08	11.7	45	0.4	0.4	0.5	0.5	0.5
ESLNB2001-0.5	0.05	0.1	4	0.08	0.5	0.08	11.4	45	0.6	0.7	0.7	0.7	0.8
ESLNB2002-0.5	0.1	0.2	4	0.15	0.5	0.17	11.5	50	1.2	1.3	1.5	1.6	2
ESLNB2002-1	0.1	0.2	4	0.15	1	0.17	10.9	50	1.7	1.9	2.1	2.3	2.7
ESLNB2002-1.5	0.1	0.2	4	0.15	1.5	0.17	10.4	50	2.3	2.5	2.8	3	3.4
ESLNB2002-2	0.1	0.2	4	0.15	2	0.17	9.9	50	2.8	3.1	3.4	3.6	4.1
ESLNB2002-2.5	0.1	0.2	4	0.15	2.5	0.17	9.5	50	3.4	3.7	4	4.2	4.7
ESLNB2002-3.0	0.1	0.2	4	0.15	3	0.17	9.1	50	3.9	4.3	4.6	4.9	5.4
ESLNB2003-1	0.15	0.3	4	0.25	1	0.27	10.9	50	1.7	1.9	2.1	2.3	2.7
ESLNB2003-1.5	0.15	0.3	4	0.25	1.5	0.27	10.4	50	2.3	2.5	2.7	3	3.4
ESLNB2003-2	0.15	0.3	4	0.25	2	0.27	9.9	50	2.8	3.1	3.4	3.6	4
ESLNB2003-2.5	0.15	0.3	4	0.25	2.5	0.27	9.5	50	3.4	3.7	4	4.2	4.7
ESLNB2003-3	0.15	0.3	4	0.25	3	0.27	9.1	50	3.9	4.3	4.6	4.8	5.3
ESLNB2004-1	0.2	0.4	4	0.3	1	0.37	11	50	1.7	1.9	2.1	2.3	2.7
ESLNB2004-1.5	0.2	0.4	4	0.3	1.5	0.37	10.4	50	2.3	2.5	2.7	2.9	3.4
ESLNB2004-2	0.2	0.4	4	0.3	2	0.37	9.9	50	2.8	3.1	3.4	3.6	4
ESLNB2004-2.5	0.2	0.4	4	0.3	2.5	0.37	9.5	50	3.4	3.7	4	4.2	4.7
ESLNB2004-3	0.2	0.4	4	0.3	3	0.37	9.1	50	3.9	4.3	4.6	4.8	5.3
ESLNB2004-3.5	0.2	0.4	4	0.3	3.5	0.37	8.7	50	4.5	4.8	5.2	5.4	6
ESLNB2004-4	0.2	0.4	4	0.3	4	0.37	8.3	50	5	5.4	5.7	6	6.6
ESLNB2004-4.5	0.2	0.4	4	0.3	4.5	0.37	8	50	5.6	6	6.3	6.6	7.2
ESLNB2005-1	0.25	0.5	4	0.35	1	0.47	11	50	1.7	1.9	2.1	2.3	2.6
ESLNB2005-2	0.25	0.5	4	0.35	2	0.47	9.9	50	2.8	3.1	3.3	3.6	4
ESLNB2005-3	0.25	0.5	4	0.35	3	0.47	9	50	3.9	4.3	4.6	4.8	5.3
ESLNB2005-4	0.25	0.5	4	0.35	4	0.47	8.3	50	5	5.4	5.7	6	6.6
ESLNB2005-5	0.25	0.5	4	0.35	5	0.47	7.7	50	6.1	6.5	6.9	7.2	7.8
ESLNB2005-6	0.25	0.5	4	0.35	6	0.47	7.1	50	7.2	7.6	8	8.4	9
ESLNB2005-8	0.25	0.5	4	0.35	8	0.47	6.3	50	9.3	9.9	10.3	10.7	11.4

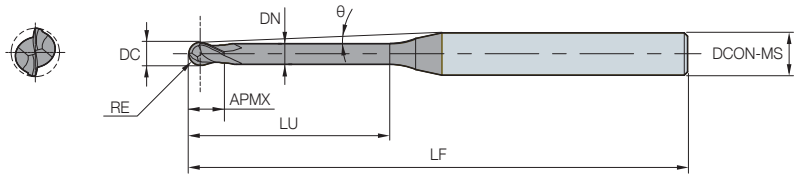
H-star Endmill

ESLNB

Long neck Ball

ULTRA FINE | 2 | H·A 30° | R ±0.005 Above Ø6 | AlTiN | h5 shank | 재종 PC305H

Type	Tolerance	R tolerance
DC	All	0.000 ~ -0.015
RE	-	±0.005



(mm)

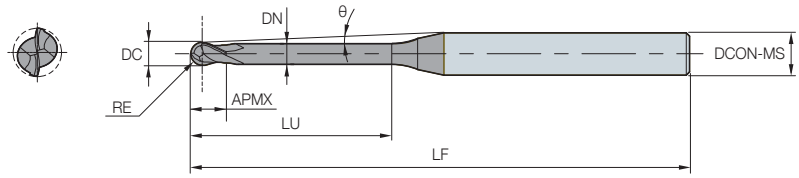
Designation	R [RE]	Drill dia. [DC]	Shank dia. [DCON-MS]	Flute length [APMX]	Neck length [LU]	Neck Diameter [DN]	θ	Overall length [LF]	Effective length by inclination angle 0.5°	1°	1.5°	2°	3°
ESLNB2006-1	0.3	0.6	4	0.4	1	0.57	11	50	1.7	1.9	2.1	2.3	2.6
ESLNB2006-2	0.3	0.6	4	0.4	2	0.57	9.9	50	2.8	3.1	3.3	3.6	4
ESLNB2006-3	0.3	0.6	4	0.4	3	0.57	9	50	3.9	4.3	4.5	4.8	5.3
ESLNB2006-4	0.3	0.6	4	0.4	4	0.57	8.3	50	5	5.4	5.7	6	6.6
ESLNB2006-5	0.3	0.6	4	0.4	5	0.57	7.6	50	6.1	6.5	6.9	7.2	7.8
ESLNB2006-6	0.3	0.6	4	0.4	6	0.57	7.1	50	7.2	7.6	8	8.4	9
ESLNB2006-7	0.3	0.6	4	0.4	7	0.57	6.6	50	8.3	8.8	9.2	9.5	10.2
ESLNB2006-8	0.3	0.6	4	0.4	8	0.57	6.2	50	9.3	9.9	10.3	10.7	11.4
ESLNB2006-9	0.3	0.6	4	0.4	9	0.57	5.8	50	10.4	10.9	11.4	11.8	12.5
ESLNB2006-10	0.3	0.6	4	0.4	10	0.57	5.5	50	11.4	12	12.5	12.9	13.7
ESLNB2006-12	0.3	0.6	4	0.4	12	0.57	5	50	13.6	14.2	14.7	15.2	16
ESLNB2008-2	0.4	0.8	4	0.5	2	0.77	9.9	50	2.8	3.1	3.3	3.5	4
ESLNB2008-4	0.4	0.8	4	0.5	4	0.77	8.2	50	5	5.4	5.7	6	6.5
ESLNB2008-5	0.4	0.8	4	0.5	5	0.77	7.5	50	6.1	6.5	6.9	7.2	7.8
ESLNB2008-6	0.4	0.8	4	0.5	6	0.77	7	50	7.2	7.6	8	8.4	9
ESLNB2008-8	0.4	0.8	4	0.5	8	0.77	6.1	50	9.3	9.8	10.3	10.7	11.3
ESLNB2008-10	0.4	0.8	4	0.5	10	0.77	5.4	50	11.4	12	12.5	12.9	13.7
ESLNB2010-2	0.5	1	4	0.8	2	0.96	9.9	50	2.9	3.1	3.3	3.5	4
ESLNB2010-3	0.5	1	4	0.8	3	0.96	8.9	50	4	4.3	4.5	4.8	5.3
ESLNB2010-4	0.5	1	4	0.8	4	0.96	8.1	50	5	5.4	5.7	6	6.5
ESLNB2010-5	0.5	1	4	0.8	5	0.96	7.4	50	6.1	6.5	6.9	7.2	7.8
ESLNB2010-6	0.5	1	4	0.8	6	0.96	6.8	50	7.2	7.7	8	8.4	9
ESLNB2010-7	0.5	1	4	0.8	7	0.96	6.3	50	8.3	8.8	9.2	9.5	10.2
ESLNB2010-8	0.5	1	4	0.8	8	0.96	5.9	50	9.3	9.9	10.3	10.7	11.3
ESLNB2010-9	0.5	1	4	0.8	9	0.96	5.5	50	10.4	11	11.4	11.8	12.5
ESLNB2010-10	0.5	1	4	0.8	10	0.96	5.2	50	11.5	12	12.5	12.9	13.7
ESLNB2010-12	0.5	1	4	0.8	12	0.96	4.6	55	13.6	14.2	14.7	15.2	15.9
ESLNB2010-14	0.5	1	4	0.8	14	0.96	4.2	55	15.7	16.4	16.9	17.4	18.5
ESLNB2010-16	0.5	1	4	0.8	16	0.96	3.8	55	17.8	18.5	19.1	19.6	21.2

ESLNB

Long neck Ball

ULTRA FINE | 2 | H·A 30° | R ±0.005 Above Ø6 | AlTiN | h5 shank | 재종 PC305H

Type	Tolerance	R tolerance
DC	All	0.000 ~ -0.015
RE	-	±0.005



Designation	R [RE]	Drill dia. [DC]	Shank dia. [DCON-MS]	Flute length [APMX]	Neck length [LU]	Neck Diameter [DN]	θ	Overall length [LF]	Effective length by inclination angle 0.5°	1°	1.5°	2°	3°
ESLNB2010-18	0.5	1	4	0.8	18	0.96	3.5	60	19.9	20.7	21.3	21.8	23.8
ESLNB2010-20	0.5	1	4	0.8	20	0.96	3.3	60	22	22.8	23.4	24	26.5
ESLNB2012-4	0.6	1.2	4	1.1	4	1.15	7.9	50	5.1	5.4	5.7	6	6.5
ESLNB2012-6	0.6	1.2	4	1.1	6	1.15	6.6	50	7.2	7.7	8	8.4	9
ESLNB2012-8	0.6	1.2	4	1.1	8	1.15	5.7	50	9.4	9.9	10.3	10.7	11.3
ESLNB2012-10	0.6	1.2	4	1.1	10	1.15	5	50	11.5	12.1	12.5	12.9	13.7
ESLNB2012-12	0.6	1.2	4	1.1	12	1.15	4.5	55	13.6	14.2	14.7	15.2	15.9
ESLNB2014-8	0.7	1.4	4	1.3	8	1.34	5.5	50	9.4	9.9	10.3	10.7	11.3
ESLNB2014-12	0.7	1.4	4	1.3	12	1.34	4.3	55	13.6	14.2	14.7	15.2	15.9
ESLNB2014-16	0.7	1.4	4	1.3	16	1.34	3.5	55	17.8	18.5	19.1	19.6	21.2
ESLNB2015-4	0.75	1.5	4	1.35	4	1.44	7.7	50	5.1	5.4	5.7	6	6.5
ESLNB2015-6	0.75	1.5	4	1.35	6	1.44	6.4	50	7.3	7.7	8	8.4	9
ESLNB2015-8	0.75	1.5	4	1.35	8	1.44	5.4	50	9.4	9.9	10.3	10.7	11.3
ESLNB2015-10	0.75	1.5	4	1.35	10	1.44	4.7	50	11.5	12.1	12.5	12.9	13.7
ESLNB2015-12	0.75	1.5	4	1.35	12	1.44	4.2	55	13.6	14.2	14.7	15.2	15.9
ESLNB2015-14	0.75	1.5	4	1.35	14	1.44	3.8	55	15.7	16.4	16.9	17.4	18.5
ESLNB2015-16	0.75	1.5	4	1.35	16	1.44	3.4	55	17.8	18.5	19.1	19.6	21.1
ESLNB2015-20	0.75	1.5	4	1.35	20	1.44	2.9	60	22	22.8	23.4	24	-
ESLNB2016-8	0.8	1.6	4	1.4	8	1.54	5.3	50	9.4	9.9	10.3	10.7	11.3
ESLNB2016-10	0.8	1.6	4	1.4	10	1.54	4.6	55	11.5	12.1	12.5	12.9	13.7
ESLNB2016-12	0.8	1.6	4	1.4	12	1.54	4.1	55	13.6	14.2	14.7	15.2	15.9
ESLNB2016-16	0.8	1.6	4	1.4	16	1.54	3.3	55	17.8	18.5	19.1	19.6	21.1
ESLNB2016-20	0.8	1.6	4	1.4	20	1.54	2.8	60	22	22.8	23.4	24	-
ESLNB2018-8	0.9	1.8	4	1.6	8	1.73	5.1	50	9.4	9.9	10.3	10.7	11.3
ESLNB2018-12	0.9	1.8	4	1.6	12	1.73	3.9	55	13.7	14.3	14.7	15.2	15.9
ESLNB2018-16	0.9	1.8	4	1.6	16	1.73	3.1	55	17.9	18.6	19.1	19.6	21.1
ESLNB2018-20	0.9	1.8	4	1.6	20	1.73	2.6	60	22	22.8	23.4	24	-
ESLNB2020-3	1	2	4	1.7	3	1.92	8.3	50	4.1	4.4	4.6	4.8	5.2
ESLNB2020-4	1	2	4	3	4	1.92	7.3	50	5.2	5.5	5.8	6	6.5

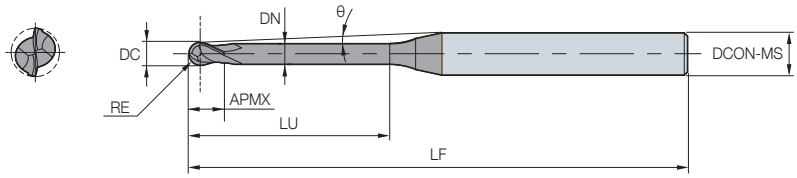
H-star Endmill

ESLNB

Long neck Ball

ULTRA FINE | 2 | H·A 30° | R ±0.005 Above Ø6 | AlTiN | h5 shank | 재종 PC305H

Type	Tolerance	R tolerance
DC	All	0.000 ~ -0.015
RE	-	±0.005



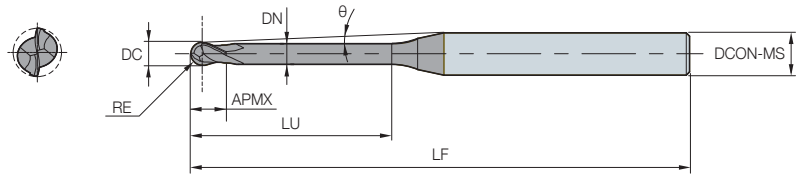
Designation	R [RE]	Drill dia. [DC]	Shank dia. [DCON-MS]	Flute length [APMX]	Neck length [LU]	Neck Diameter [DN]	θ	Overall length [LF]	Effective length by inclination angle				
									0.5°	1°	1.5°	2°	3°
ESLNB2020-6	1	2	4	3	6	1.92	5.8	50	7.3	7.7	8.1	8.4	9
ESLNB2020-8	1	2	4	3	8	1.92	4.9	50	9.5	9.9	10.3	10.7	11.3
ESLNB2020-10	1	2	4	3	10	1.92	4.2	50	11.6	12.1	12.6	12.9	13.6
ESLNB2020-12	1	2	4	3	12	1.92	3.7	55	13.7	14.3	14.8	15.2	15.9
ESLNB2020-14	1	2	4	3	14	1.92	3.2	55	15.8	16.4	16.9	17.4	18.5
ESLNB2020-16	1	2	4	3	16	1.92	2.9	55	17.9	18.6	19.1	19.6	-
ESLNB2020-18	1	2	4	3	18	1.92	2.7	60	20	20.7	21.3	21.8	-
ESLNB2020-20	1	2	4	3	20	1.92	2.4	60	22.1	22.8	23.4	24	-
ESLNB2020-22	1	2	4	3	22	1.92	2.3	60	24.1	24.9	25.6	26.3	-
ESLNB2020-25	1	2	4	3	25	1.92	2	65	27.3	28.1	28.8	-	-
ESLNB2020-30	1	2	4	3	30	1.92	1.7	70	32.4	33.4	34.2	-	-
ESLNB2020-35	1	2	4	3	35	1.92	1.5	75	37.6	38.6	-	-	-
ESLNB2020-40	1	2	4	3	40	1.92	1.4	80	42.8	43.8	-	-	-
ESLNB2025-10	1.25	2.5	4	4	10	2.4	3.4	50	11.6	12.1	12.6	13	13.6
ESLNB2025-16	1.25	2.5	4	4	16	2.4	2.3	55	17.9	18.6	19.1	19.6	-
ESLNB2025-20	1.25	2.5	4	4	20	2.4	1.9	60	22.1	22.8	23.5	-	-
ESLNB2030-8	1.5	3	6	4	8	2.88	6.2	55	9.6	10	10.4	10.7	11.3
ESLNB2030-10	1.5	3	6	4	10	2.88	5.5	55	11.7	12.2	12.6	13	13.6
ESLNB2030-13	1.5	3	6	4	13	2.88	4.6	60	14.8	15.4	15.9	16.3	17.1
ESLNB2030-16	1.5	3	6	4	16	2.88	4	60	18	18.6	19.1	19.6	21.1
ESLNB2030-18	1.5	3	6	4	18	2.88	3.6	60	20	20.7	21.3	21.8	23.7
ESLNB2030-20	1.5	3	6	4	20	2.88	3.4	65	22.1	22.9	23.5	24	26.4
ESLNB2030-25	1.5	3	6	4	25	2.88	2.8	70	27.3	28.2	28.8	29.9	-
ESLNB2030-30	1.5	3	6	4	30	2.88	2.2	75	32.5	33.4	34.3	35.9	-
ESLNB2030-35	1.5	3	6	4	35	2.88	4.5	80	37.7	38.7	40	41.9	-
ESLNB2040-10	2	4	6	5	10	3.9	3.6	55	11.6	12.1	12.5	12.9	13.5
ESLNB2040-13	2	4	6	5	13	3.9	3.1	60	14.7	15.3	15.8	16.2	17
ESLNB2040-16	2	4	6	5	16	3.9	2.5	60	17.9	18.5	19.1	19.5	20.9
ESLNB2040-20	2	4	6	5	20	3.9	2.1	65	22.1	22.8	23.4	23.9	-

ESLNB

Long neck Ball

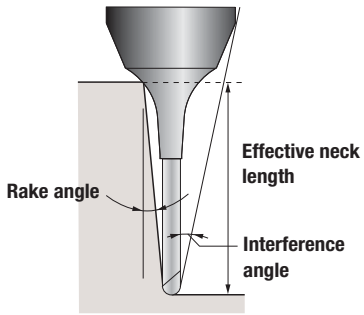
ULTRA FINE | 2 | H·A 30° | R ±0.005 (Above Ø6) | AlTiN | h5 shank | 재종 PC305H

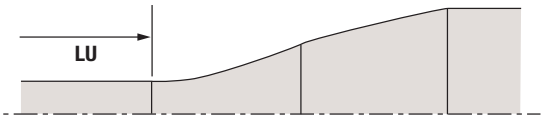
Type	Tolerance	R tolerance
DC	All	0.000 ~ -0.015
RE	-	±0.005



Designation	R [RE]	Drill dia. [DC]	Shank dia. [DCON-MS]	Flute length [APMX]	Neck length [LU]	Neck Diameter [DN]	θ	Overall length [LF]	Effective length by inclination angle				
									0.5°	1°	1.5°	2°	3°
ESLNB2040-25	2	4	6	5	25	3.9	1.8	70	27.3	28.1	28.8	29.8	-
ESLNB2040-30	2	4	6	5	30	3.9	1.6	75	32.4	33.4	34.2	-	-
ESLNB2040-35	2	4	6	5	35	3.9	1.4	80	37.6	38.6	39.9	-	-
ESLNB2040-40	2	4	6	5	40	3.9	1.2	80	42.8	43.8	-	-	-
ESLNB2040-45	2	4	6	5	45	3.9	1.1	90	47.9	49.1	-	-	-
ESLNB2040-50	2	4	6	5	50	3.9	1.4	100	53.1	54.5	-	-	-
ESLNB2050-20	2.5	5	6	6	20	4.9	1.2	65	22	22.8	-	-	-
ESLNB2050-25	2.5	5	6	6	25	4.9	1	70	27.2	28.1	-	-	-
ESLNB2050-30	2.5	5	6	6	30	4.9	0.8	75	32.4	-	-	-	-
ESLNB2050-35	2.5	5	6	6	35	4.9	0.7	80	42.8	-	-	-	-
ESLNB2050-40	2.5	5	6	6	40	4.9		90	42.8	-	-	-	-

※ The above specifications are subject to change without prior notice for product quality improvement.





※ The marked effective neck length is the default value to prevent interference with the workpiece.
Proper control of the processing environment is required.

• Applicable Workpiece

Carbon steel ~ HB225	Alloy steel HB225~325	Pre-hardened steel HRC30~50	Hardened steel		Copper	Graphite	Cast iron ~FCD500	Aluminum	Stainless steel
			SKD61~HRC55	SKD11 HRC55~63					
		○	◎	◎	○				

◎: Excellent ○: Good

The Mirror Endmill

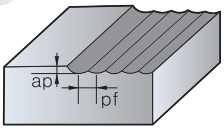
H-star Endmill

Recommended cutting conditions

Long neck ball

Workpiece	Alloy steel, HRSA			Heat treated steel			High hardness steel			Copper, copper alloy		
Hardness	HRC30~45			HRC45~55			HRC55~65			(Copper Alloys)		
condition / Flute Dia.(mm)	n (min^{-1})	vf (mm/min)	ae (mm)	n (min^{-1})	vf (mm/min)	ae (mm)	n (min^{-1})	vf (mm/min)	ae (mm)	n (min^{-1})	vf (mm/min)	ae (mm)
0.1	50,000	250	0.003~0.006	50000	225	0.002~0.005	50,000	188	0.002~0.004	50000	300	0.005~0.009
0.2	40,800~50,000	212~325	0.003~0.016	36,000~45,500	173~273	0.002~0.013	33,600~42,000	134~210	0.002~0.012	48,000~50,000	232~420	0.005~0.024
0.3	45,900~50,000	372~450	0.006~0.021	40,500~45,000	310~383	0.005~0.017	37,800~42,000	272~336	0.004~0.016	47,000~50,000	540~600	0.009~0.032
0.4	32,640~50,000	305~770	0.006~0.034	28,800~46,800	245~655	0.005~0.027	26,880~43,680	228~612	0.004~0.025	46,080~50,000	470~967	0.010~0.051
0.5	27,200~44,200	416~1,193	0.006~0.036	24,000~39,000	367~1,053	0.005~0.029	22,400~36,400	324~743	0.004~0.027	38,400~50,000	653~1,500	0.009~0.054
0.6	20,400~50,000	424~1,950	0.005~0.060	18,000~48,000	346~1,728	0.004~0.048	16,800~44,800	269~1,344	0.004~0.045	28,800~50,000	691~2,250	0.008~0.090
0.8	27,200~50,000	740~2,400	0.033~0.096	24,000~48,000	612~2,592	0.027~0.078	22,400~44,800	533~1,882	0.025~0.072	38,400~50,000	1,175~2,700	0.050~0.144
1	18,360~45,900	661~3,098	0.008~0.160	16,200~43,200	544~2,722	0.006~0.130	15,120~37,800	484~2,268	0.006~0.120	25,920~50,000	1,037~3,750	0.012~0.240
1.2	29,376~39,230	1,322~2,717	0.030~0.160	25,920~36,923	1,026~2,555	0.024~0.130	24,192~32,307	871~1,860	0.022~0.120	41,472~50,000	1,940~3,924	0.045~0.240
1.5	19,040~35,700	971~3,213	0.030~0.160	16,800~31,500	771~2,552	0.024~0.130	15,680~29,400	666~2,205	0.022~0.120	26,880~50,000	1,508~4,951	0.045~0.240
2	10,710~26,775	617~3,616	0.017~0.320	9,450~23,625	514~3,049	0.014~0.260	8,820~22,050	452~2,646	0.013~0.240	15,120~37,800	968~5,670	0.026~0.480
3	10,880~20,400	1,239~4,100	0.064~0.480	9,600~18,000	1,028~3,402	0.052~0.0390	10,752~16,800	1,097~3,024	0.048~0.360	15,360~28,800	1,958~6,480	0.096~0.720
4	7,820~14,663	1,196~3,960	0.080~0.480	6,900~12,938	997~3,299	0.065~0.390	6,440~12,075	876~2,898	0.060~0.360	11,040~20,700	1,877~6,210	0.120~0.720
5	8,262~10,710	1,487~3,213	0.160~0.420	7,290~9,450	1,313~2,835	0.130~0.341	6,804~8,820	1,103~2,381	0.12~0.315	11,664~15,120	2,520~5,443	0.240~0.630

Depth of cut



- ap = 0.02D
- pf = 0.05D

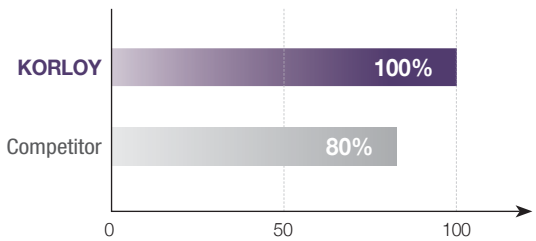
※ Please reduce the RPM and feed rate in the chart above with equal proportions in clamping workpiece with chattering and low rigidity.

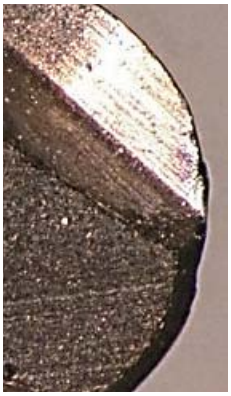
Application Examples

Wear resistance, chipping resistance

- **Workpiece**_____ STD11Heat treatment (HRC55~60)
- **Cutting conditions**__ **n** (min-1) = 40,000, **vf** (mm/min) = 400, **ap** (mm) = 0.03, **ae** (mm) = 0.03, Mist
- **Tools**_____ ESLNB2006-2
- **Machining**_____ Pocket

» Better wear resistance than competitor's





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Competitor

H-star Endmill Line up

Type	Designation	Shape	Coated	No. of flute	Drill dia.(ø)		Workpiece					
							P	M	K	N	S	H
					Min	Max	Steel	Stainless steel	Cast iron	Non-ferrous metal	Heat resistant alloy, Titanium alloy	Hardened steel
ball	ESB702		AℓTiN	2	0.1	12.0	◎		◎		○	◎
	ESB712			2	1.0	12.0	◎		◎		○	◎
	ESB703			3	2.0	12.0	◎		◎		○	◎
	ESB734			4	2.0	10.0	◎		◎		○	◎
Flat	ESE702		AℓTiN	2	0.1	20.0	◎		◎		○	◎
	ESE712			2	1.0	6.0	◎		◎		○	◎
	ESE704			4	1.0	20.0	◎		◎		○	◎
	ESE714			4	1.0	12.0	◎		◎		○	◎
	ESE724(6)			4/6	1.0	12.0	◎		◎		○	◎
	ESE744			4	1.0	12.0	◎		◎		○	◎
	ESE716			6	6.0	20.0	◎		◎		○	◎
Radius	ESR702		AℓTiN	2	1.0	12.0	◎		◎		○	◎
	ESR732			2	1.0	12.0	◎		◎		○	◎
	ESR704			4	1.0	12.0	◎		◎		○	◎
	ESR714			4	3.0	12.0	◎		◎		○	◎
	ESR724			4	6.0	12.0	◎		◎		○	◎
	ESR734			4	1.0	12.0	◎		◎		○	◎
	ESR706			6	6.0	12.0	◎		◎		○	◎
	ESR736			6	6.0	12.0	◎		◎		○	◎

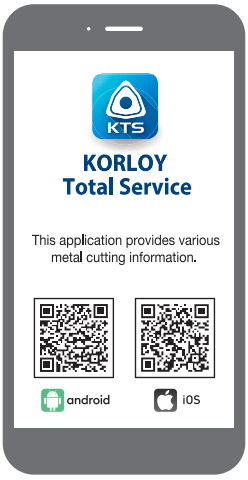
The Mirror Endmill

H-star Endmill Line up

Type	Designation	Shape	Coated	No. of flute	Drill dia.(ø)		Workpiece					
							P	M	K	N	S	H
					Min	Max	Steel	Stainless steel	Cast iron	Non-ferrous metal	Heat resistant alloy Titanium alloy	Hardened steel
Rib ball	ESRB712		AℓTiN	2	0.1	12.0	◎		◎		○	◎
Rib flat	ESRE712		AℓTiN	2	0.1	12.0	◎		◎		○	◎
	ESRE714			4	0.5	12.0	◎		◎		○	◎
Rib radius	ESRR712		AℓTiN	2	0.2	16.0	◎		◎		○	◎
	ESRR714			4	0.5	20.0	◎		◎		○	◎
Flat	ESXE704		AℓTiN	4	1.0	12.0	◎		◎		○	◎
	ESXE714			4	2.0	12.0	◎		◎		○	◎
Radius	ESXR704		AℓTiN	4	2.0	12.0	◎		◎		○	◎
Rib ball	ESLNB		AℓTiN	2	0.1	5.0	◎		◎		○	◎
	ESTNB20			2	0.2	10.0	◎		◎		○	◎
	ESTNB30			3	2.0	5.0	◎		◎		○	◎
Rib flat	ESLNS20		AℓTiN	2	0.1	5.0	◎		◎		○	◎
	ESLNS40			4	1.0	5.0	◎		◎		○	◎
Rib radius	ESLNR		AℓTiN	2	0.2	3.0	◎		◎		○	◎
	ESTNR			2	0.2	3.0	◎		◎		○	◎
High feed	ESPM4		AℓTiN	4	3.0	12.0	◎		◎		○	◎

⚠ For the safe metalcutting

- Use safety supplies such as protective gloves to prevent possible injury while touching the edge of tools.
- Use safety glasess or safety cover to hedge possible dangers. Inappropriate usage or excessive cutting condition may lead tool's breakage or even the fragment's scattering.
- Clamp the workpiece tightly enough to prevent its movement while its machining.
- Properly manage the tool change phase because the inordinately used tool can be easily broken under the excessive cutting load or severe wear, and it may threat the operator's safety.
- Use safety cover because chips evacuated during cutting are hot and sharp and may cause burns and cuts. To remove chips safely, stop machining, put on protective gloves, and use a hook or other tools.
- Prepare for fire prevention measures as the use of the non-water soluble cutting oil may cause fire.
- Use safety cover and other safety supplies because the spare parts or the inserts can be pulled out due to centrifugal force while high speed machining.



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