

NS TOOL

CORE LINE

For Crafting Tomorrow

CBN

CBN END MILL SERIES Vol.4

SQUARE END MILL

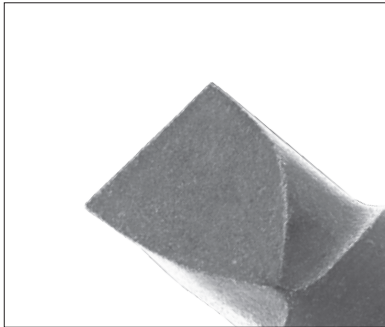


Various lineup optimize a long time machining on hardened steel

CBN "MICRO EDGE Z"

SMEZ120

ϕ 0.03 ~ ϕ 0.1



CBN 4-Flute
Square End Mill

SSE400

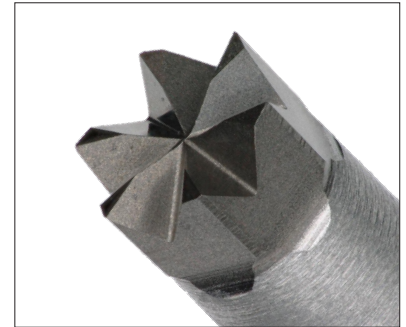
ϕ 0.1



CBN 6-Flute
Square End Mill

SSE600

ϕ 0.2 ~ ϕ 1

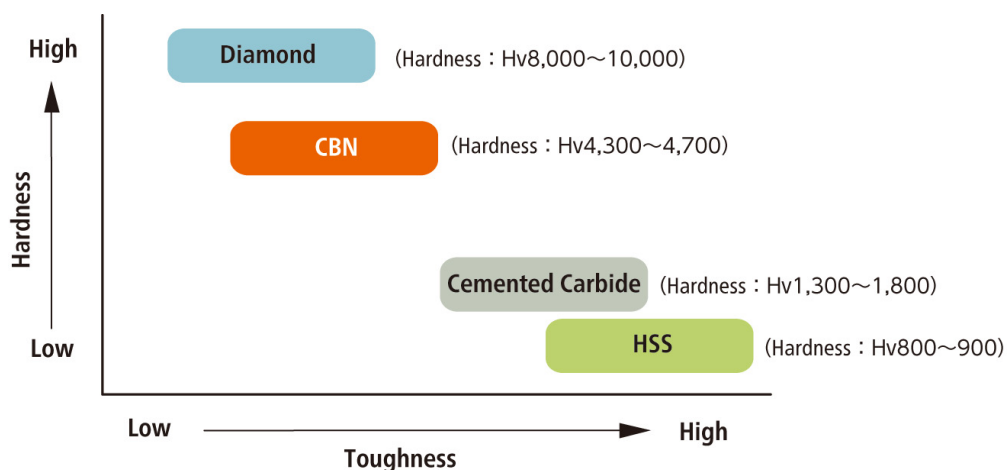


Features

Long tool life

CBN(Cubic Boron Nitride) sintered alloy

CBN(Cubic Boron Nitride) sintered alloy is 3 times harder than Tungsten carbide, second hardest material next to diamond, Moreover strong heat-resistant and high thermal conductivity. However less tough characteristic of CBN often causes chipping of tool edge easily. Accordingly, CBN is recommended for finishing of hard materials with less cutting load on the tool edge, which guarantees extra long tool life.



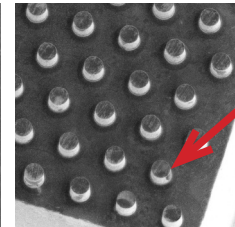
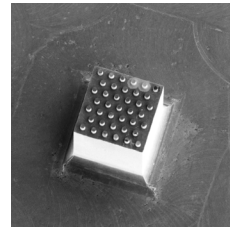
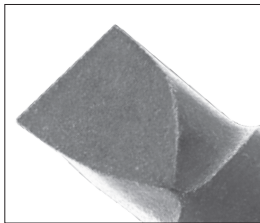
Machining case

CBN "MICRO EDGE Z"

Realize stable pin diameter in machining micro pins of ϕ 0.03mm

SMEZ120

Size ϕ 0.03 ~ ϕ 0.1



Pin dia.
Target
0.030mm
Actual
0.027mm

Work material : STAVAX (52HRC)
Work size : 0.4x0.4 mm
(Machining depth 0.03 mm)
Coolant : Oil mist
Total machining time : 1hr 3min

Process	Roughing	Finishing
Tool	SMEZ120 ϕ 0.05 x 0.05	SMEZ120 ϕ 0.03 x 0.03
Spindle speed [min ⁻¹]	60,000	60,000
Feed [mm/min]	10	10
Depth of cut ap x ae [mm]	0.001 x 0.005	ap 0.001
Machining time	25 min	38 min

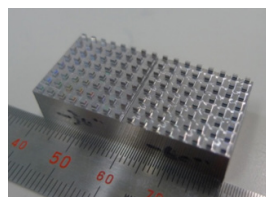
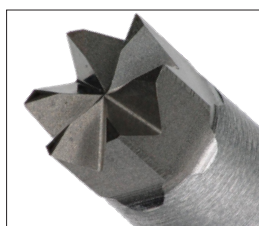
CBN Square End Mill

Stable corner edge even in long-term machining on hardened steels

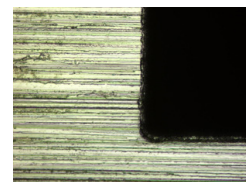
SSE400 SSE600

Size ϕ 0.1

Size ϕ 0.2 ~ ϕ 1



57th corner



64th side surface



Ra 0.08 μ m

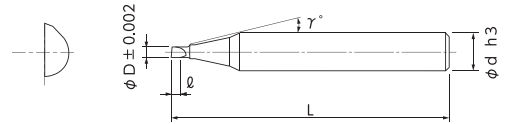
Work material : HAP40 (64HRC)
Machined size : 1 x 1 mm
(Machining depth 1 mm)
Coolant : Oil mist
Total machining time : 3 hr 40 min

Process	Contour line finishing	Scanning line finishing
Tool	SSE600 ϕ 1 x 2	
Spindle speed [min ⁻¹]	30,000	
Feed [mm/min]	600	
Depth of cut ap x ae [mm]	0.005 x 0.006	0.003 x 0.1
Machining time	3hr 40min	

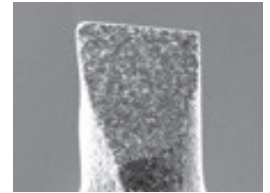
CBN "MICRO EDGE Z"

Total 8 sizes

CBN micro end mill with standardized of Dia.0.1mm or smaller



- NS TOOL engineering technology and selected CBN material realize sharp edge.
- Tolerance of flute diameter is $\pm 2\mu\text{m}$.
- Tolerance of shank diameter is h3 (0 ~ -0.0025).



Cutting edge shape

Work Material

Prehardened Steel P	Hardened Steel H		
	~55HRC	~65HRC	~70HRC
○	◎	◎	○

Unit [Size : mm]

Code No.	Dia. (D)	Length of Cut (ℓ)	Neck Taper Angle (γ)	Shank Dia. (d)	Overall Length (L)
01-00480-00030	0.03	0.03	15°	4	50
01-00480-00040	0.04	0.04	15°	4	50
01-00480-00050	0.05	0.05	15°	4	50
01-00480-00060	0.06	0.06	15°	4	50
01-00480-00070	0.07	0.07	15°	4	50
01-00480-00080	0.08	0.08	15°	4	50
01-00480-00090	0.09	0.09	15°	4	50
01-00480-00100	0.1	0.1	15°	4	50

How to Order

When you order, indicate SMEZ120 (D).

※(γ) is reference value.

Recommended Milling Conditions

Work Material	Prehardened Steels・Hardened Steels NAK・STAVAX・SKD11・PD613 (~62HRC)			
	Depth of Cut		Feed	Spindle Speed
Dia.	ap mm	ae mm	mm/min	min ⁻¹
0.03	0.0005	0.003	10	60,000
0.04	0.001	0.003	20	60,000
0.05	0.001	0.005	30	60,000
0.06	0.002	0.005	40	60,000
0.07	0.002	0.01	50	60,000
0.08	0.003	0.015	65	60,000
0.09	0.003	0.02	80	60,000
0.1	0.003	0.025	100	60,000

Notes

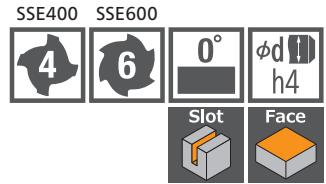
- ※1 Depth of Cut : ap=Axial Depth of Cut / ae=Radial Depth of Cut.
- ※2 Handle with care when exchanging and presetting tool.
- ※3 We recommend using oil mist coolant.
- ※4 Minimize chucking runout.
(Recommend to measure actual runout at activated spindle speed.)
- ※5 Increase of Depth of Cut may cause a tool breakage, especially careful for Axial Depth of Cut.

CBN Square End Mill

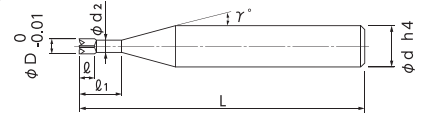
SSE400
Size ϕ 0.1 Total 2 sizes

SSE600
Size ϕ 0.2 ~ ϕ 1 Total 14 sizes

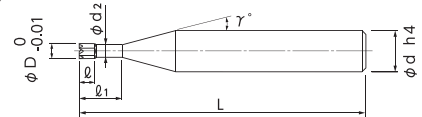
Best applicable for precise machining on minute corners of the narrow pitch connectors and etc



SSE400



SSE600



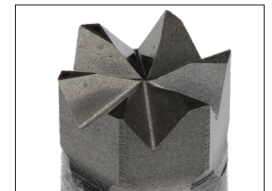
- Possible to machine the corner edge of hardened steels.
- Intensified wear resistance by NS TOOL original design of cutting edge.

Work Material

Hardened Steel (~ 70HRC)	H
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SSE400
Cutting edge shape



SSE600
Cutting edge shape

SSE400

Unit [Size : mm]

Code No.	Dia. (D)	Under Neck Length (l ₁)	Length of Cut (l)	Neck Dia. (d ₂)	Neck Taper Angle (γ)	Shank Dia. (d)	Overall Length (L)
01-00440-01002	0.1	0.2	0.04	0.075	15°	4	53
01-00440-01005		0.5	0.04	0.08	15°	4	53

How to Order When you order, indicate SSE400 (D)×(l₁). ※(γ) is reference value.

SSE600

Unit [Size : mm]

Code No.	Dia. (D)	Under Neck Length (l ₁)	Length of Cut (l)	Neck Dia. (d ₂)	Neck Taper Angle (γ)	Shank Dia. (d)	Overall Length (L)
01-00450-02004	0.2	0.4	0.08	0.175	15°	4	53
01-00450-02010		1	0.08	0.175	15°	4	53
01-00450-03005	0.3	0.5	0.12	0.275	15°	4	49
01-00450-03015		1.5	0.12	0.275	15°	4	50
01-00450-04008	0.4	0.8	0.16	0.37	15°	4	49
01-00450-04020		2	0.16	0.37	15°	4	50
01-00450-05010	0.5	1	0.2	0.46	15°	4	49
01-00450-05025		2.5	0.2	0.46	15°	4	50
01-00450-06012	0.6	1.2	0.24	0.56	15°	4	49
01-00450-06030		3	0.24	0.56	15°	4	50
01-00450-08015	0.8	1.5	0.32	0.76	15°	4	49
01-00450-08040		4	0.32	0.76	15°	4	52
01-00450-10020	1	2	0.4	0.95	15°	4	49
01-00450-10050		5	0.4	0.95	15°	4	52

How to Order When you order, indicate SSE600 (D)×(l₁). ※(γ) is reference value.

Recommended Milling Conditions

Work Material			Hardened Steels HPM-38·STAVAX·SKD61 (~55HRC)				Hardened Steels SKD11 (~62HRC)				High Speed Steels SKH (~65HRC)			
Model	Dia.	Under Neck Length	Depth of Cut		Feed	Spindle Speed	Depth of Cut		Feed	Spindle Speed	Depth of Cut		Feed	Spindle Speed
			ap mm	ae mm	mm/min	min ⁻¹	ap mm	ae mm	mm/min	min ⁻¹	ap mm	ae mm	mm/min	min ⁻¹
SSE400	0.1	0.2	0.001	0.002	250	40,000	0.001	0.002	200	40,000	0.001	0.002	150	40,000
		0.5	0.001	0.002	200	40,000	0.001	0.002	150	40,000	0.001	0.001	100	40,000
SSE600	0.2	0.4	0.003	0.002	400	40,000	0.002	0.002	300	40,000	0.002	0.002	200	40,000
		1	0.003	0.002	300	40,000	0.002	0.002	200	40,000	0.002	0.002	100	40,000
	0.3	0.5	0.005	0.003	600	40,000	0.004	0.003	400	40,000	0.003	0.003	400	40,000
		1.5	0.005	0.002	500	40,000	0.004	0.002	300	40,000	0.003	0.002	200	40,000
	0.4	0.8	0.007	0.004	700	40,000	0.005	0.003	600	40,000	0.003	0.003	600	40,000
		2	0.007	0.003	600	40,000	0.005	0.002	400	40,000	0.003	0.002	400	40,000
	0.5	1	0.01	0.005	800	40,000	0.007	0.003	700	40,000	0.005	0.003	600	40,000
		2.5	0.01	0.004	800	40,000	0.007	0.002	500	40,000	0.005	0.002	400	40,000
	0.6	1.2	0.01	0.005	800	40,000	0.007	0.003	700	40,000	0.005	0.003	600	40,000
		3	0.01	0.004	800	40,000	0.007	0.002	500	40,000	0.005	0.002	400	40,000
	0.8	1.5	0.01	0.005	800	40,000	0.007	0.004	800	40,000	0.005	0.004	700	40,000
		4	0.01	0.004	800	40,000	0.007	0.003	600	40,000	0.005	0.003	500	40,000
	1	2	0.01	0.006	800	40,000	0.007	0.006	800	40,000	0.005	0.006	800	40,000
		5	0.01	0.005	800	40,000	0.007	0.005	600	40,000	0.005	0.005	600	40,000
	Notes			<p>※1 Depth of Cut is the maximum effective value for the contour line tool path. ※2 ap: Axial Depth of Cut, ae: Radial Depth of Cut. ※3 Recommended oil mist coolant. ※4 Minimize a possible tool overhang length. ※5 Minimize chucking runout. (Recommend to measure actual runout of activated spindle speed.) ※6 For the reference value, when finishing process of bottom surface, reduce the feed approx. 50% of the recommended milling conditions and Depth of Cut (ap): 0.002mm for Dia. 0.2mm and 0.3mm, for Dia. 0.4 to 1mm, up to 0.003mm, (ae): Dia. x 0.05mm.</p>										

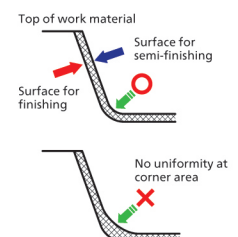
Points in Use

Advice on Cutting Environment

- Minimize the deflection of cutting edge.
- To understand the nature of the expansion of the main spindle and machine posture transformation, and take measures against them.

Advice on Finishing Allowance (stock amount)

- When using small CBN End Mill, **uniform finishing allowance (stock amount) is important.**
- When tool is used on roughing and semi-finishing and it has a big abrasion, finishing allowance (stock amount) on semi-finishing and finishing is increasing and it affects tool life and cutting accuracy. **Therefore, it is important to get uniform stock amount in the pre-stage cutting.**



Machining case 1

Microfluidic device STAVAX (52HRC)

Realized stable dimension accuracy on machining hardened steels

Work material : STAVAX (52HRC)
 Work size : 15 x 15 mm
 (Machining depth 0.05 mm)
 Coolant : Oil mist
 Total machining time : 5hr 57min

Process	Semi-Finishing	Finishing 1	Finishing 2
Tool	SSBL200 R0.2 x 1.2	SSBL200 R0.1 x 0.6	SMEZ120 φ0.1
Spindle speed [min ⁻¹]	60,000		60,000
Feed [mm/min]	1,200	200	50
Depth of cut ap x ae [mm]	0.005x0.01	0.005x0.005	0.003x0.005 ~0.1
Machining time	3hr 9min	44 min	2hr 4min

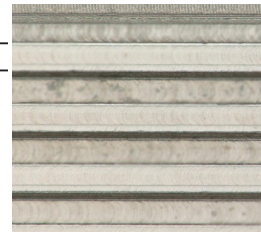


Flow width (凸)

Target 0.1000 mm
 Actual **0.0964 mm**

Surface roughness (凸)

Ra 0.04 μm
 Rz 0.58 μm



Surface roughness (凹)

Ra 0.06 μm
 Rz 0.96 μm

Flow width (凹)

Target 0.1000 mm
 Actual **0.1036 mm**

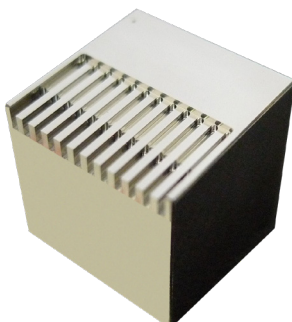
Machining case 2

Narrow pitch connector HAP40 (64HRC)

Realize high precision machining even when requires edge shapes

Work material : HAP40 (64HRC)
 Work size : 15 x 15 mm
 (Machining depth 2 mm)
 Coolant : Oil mist
 Total machining time : 13hr 32min

Process	Contour line finishing	Scanning line finishing
Tool	SSE600 φ0.5x2.5	
Spindle speed [min ⁻¹]	30,000	
Feed [mm/min]	400	300
Depth of cut ap x ae [mm]	0.005x0.002	0.002x0.01
Machining time	3hr 20min	



	Before machining	After machining	Scanning line finishing (μm)
Bottom cutting edge 1			
Bottom cutting edge 2			

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Attention on Safety

- 1) When removing tools from cases, be careful of getting-out of tools and don't touch directly the cutting edges.
- 2) Never touch the cutting edges directly with bare hand.
- 3) Use safety covers and eye protection, as tools may be broken.
- 4) Use holders, etc. that match the tools and nature of the machining operations.
The tool should be firmly attached to the holder to prevent shaking.
- 5) The work materials clamp firmly.
- 6) Make sure of dimensions of tools and work pieces before starting operation.
- 7) It is necessary to adjust conditions according to the dimensions of work materials and the machine.
- 8) Select a cutting fluid appropriate to the particular usage. Using water-insoluble fluid could lead to fires due to sparks generated during machining or heat caused by breakage.
Ensure that you take proper fire-prevention measures.
- 9) If abnormal sound, etc. occurs during machining, stop the machine immediately.
- 10) Don't modify tools.