

Small Diameter CBN Endmills for Hardened Steel

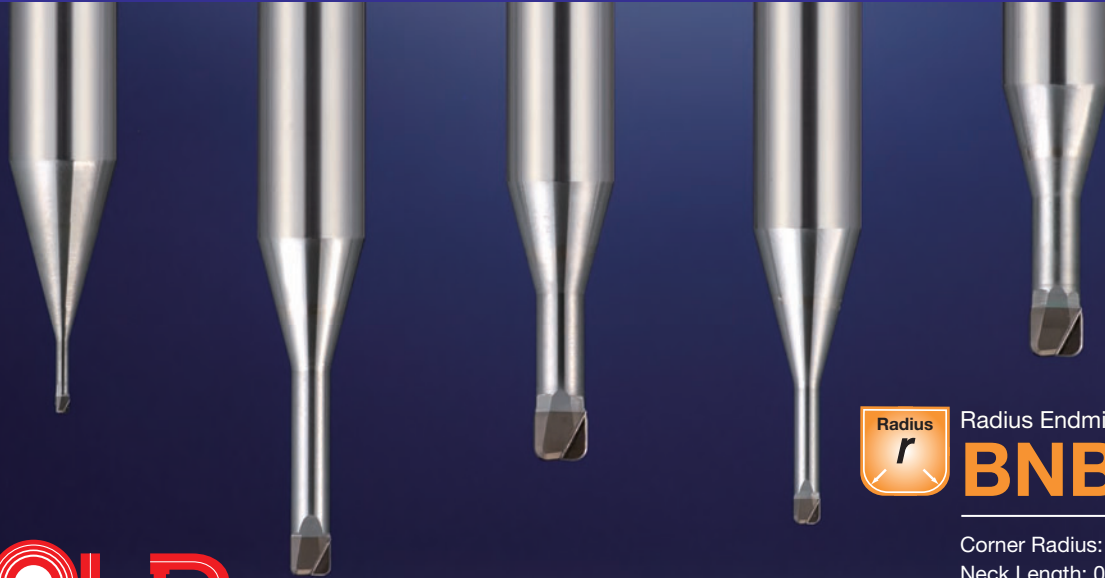
Radius Endmills

Ballnose Endmills

Mold Finish Master
SUMIBORON

BNBR Type / **BNBP** Type

Rev. 6



Radius Endmills
BNBR Type

Corner Radius: RE0.05 to 0.5mm
Neck Length: 0.5 to 7.5mm
Cutting Edge Diameter: ϕ 0.2 to 2.0mm

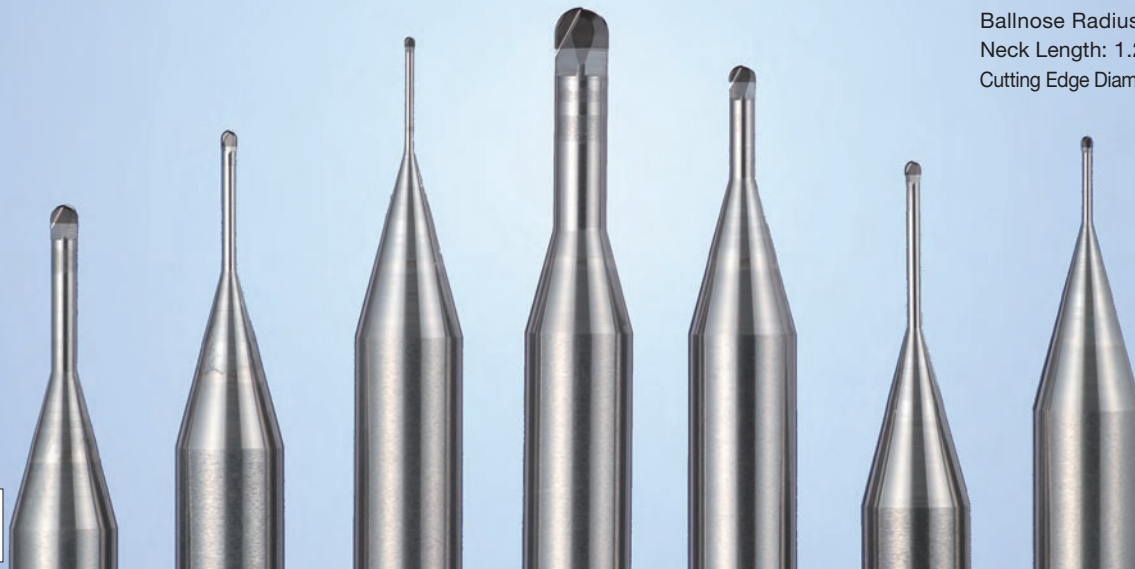
For hardened steels even with hardness exceeding 60HRC!!

- Achieving longer tool life in high-speed, high-precision machining of pre-hardened and hardened steel.
- Leaves an excellent machined surface quality.
- Substantially reduces grinding process time.
- Cutting edge designs for profile and face milling combined with specific grades cover a wide range of applications.



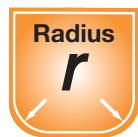
Ballnose Endmills
BNBP Type

Ballnose Radius: RE0.2 to 1.0mm
Neck Length: 1.2 to 8.0mm
Cutting Edge Diameter: ϕ 0.4 to 2.0mm



Revised
standard price
(July 2022)

BNBR Type

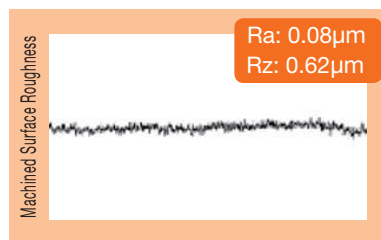
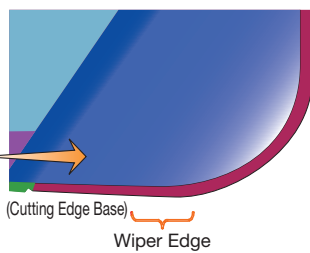
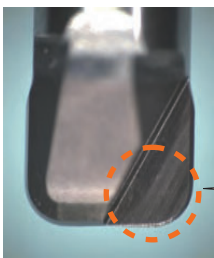


Radius Endmills

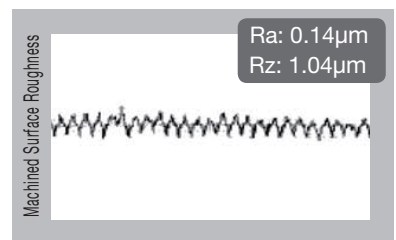
BNBR Type



- Improved machined surface quality through use of a wiper edge (available on $\phi 1.0\text{mm}$ or larger endmills).

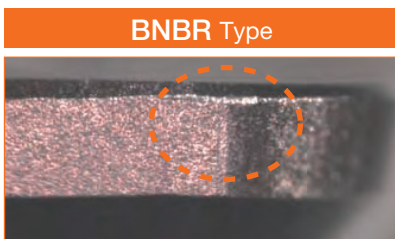


With Wiper Edge

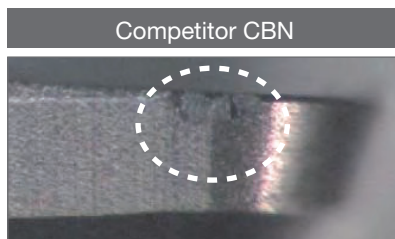


Without Wiper Edge

- Achieving longer tool life with the combination of SUMIBORON BNX20, which has excellent wear resistance, and an optimised cutting edge design.



Small amount of wear

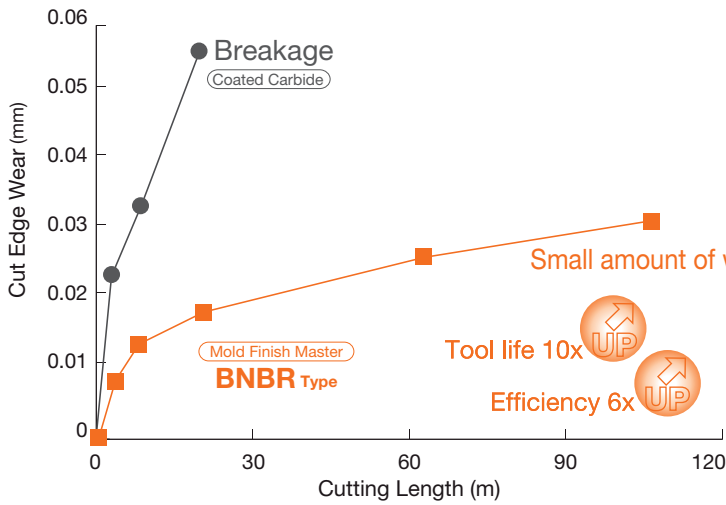


Breakage

Work Material: STAVAX (52HRC)
 Tool: BNBR 2D200R050-0604 ($\phi 2 \times \text{RE}0.5$)
 Cutting Conditions: $n=20,000\text{min}^{-1}$, $v_f=400\text{mm/min}$
 $a_p=0.03\text{mm}$, $p_f=0.70\text{mm}$ Oil Mist

BNBR Type

- Excellent wear resistance delivers almost 10 times longer tool life than carbide endmills.

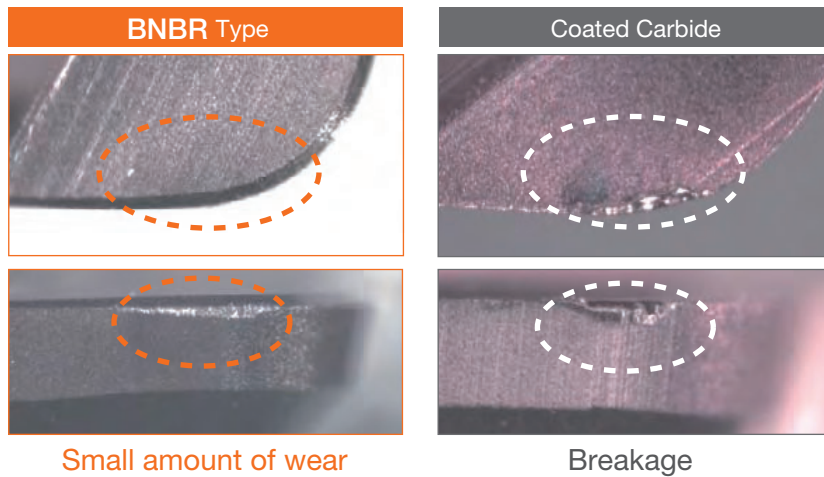


Work Material: STAVAX (52HRC)
 Tool: BNBR 2D200R050-0604 (ø2 x RE0.5)

BNBR Type
 Cutting Conditions: $n=20,000\text{min}^{-1}$, $v_f=800\text{mm/min}$
 $a_p=0.03\text{mm}$, $p_f=0.70\text{mm}$ Oil Mist

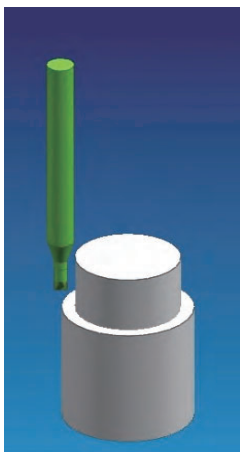
Coated Carbide
 Cutting Conditions: $n=4,800\text{min}^{-1}$, $v_f=120\text{mm/min}$
 $a_p=0.03\text{mm}$, $p_f=0.70\text{mm}$ Oil Mist

Tool Wear Comparison

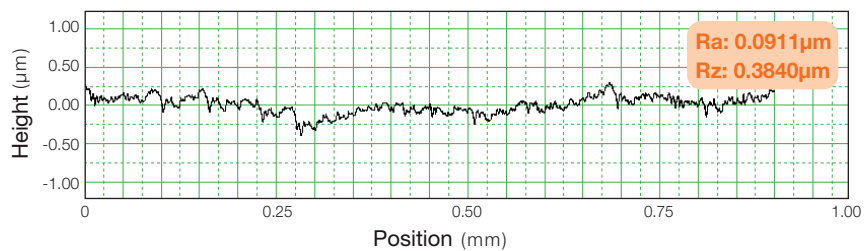


■ Cutting Performance

- Cutting edge flank wear width during contouring: 0.015mm



■ Cross Section Profile



Work Material: STAVAX (52HRC)
 Tool: BNBR 2D200R010-0604 (ø2 x RE0.1)
 Cutting Conditions: $n=35,000\text{min}^{-1}$, $v_f=1,000\text{mm/min}$, $a_p=0.005\text{mm}$, $p_f=0.005\text{mm}$ Oil Mist
 Cutting Length = 20m

BNBP Type



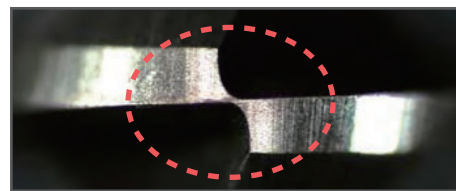
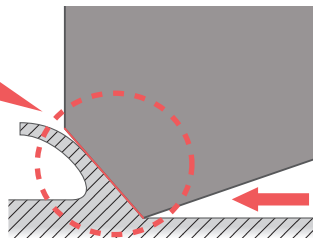
Ballnose Endmills

BNBP Type



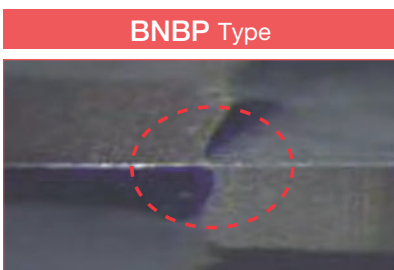
- Achieves high precision machining with precise ball radius of $\pm 0.005\text{mm}$.
- Achieving stable interrupted milling with the combination of SUMIBORON BN350, which has excellent fracture resistance, and a cutting edge with a negative rake angle design.

Large Negative Rake Angle Provides Strong Cutting Edge!

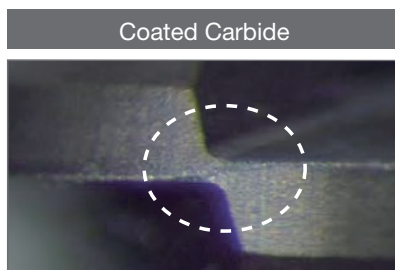


Joined central edge stabilizes machined surface quality

- Strong cutting edge enables use in roughing applications.



No fracture

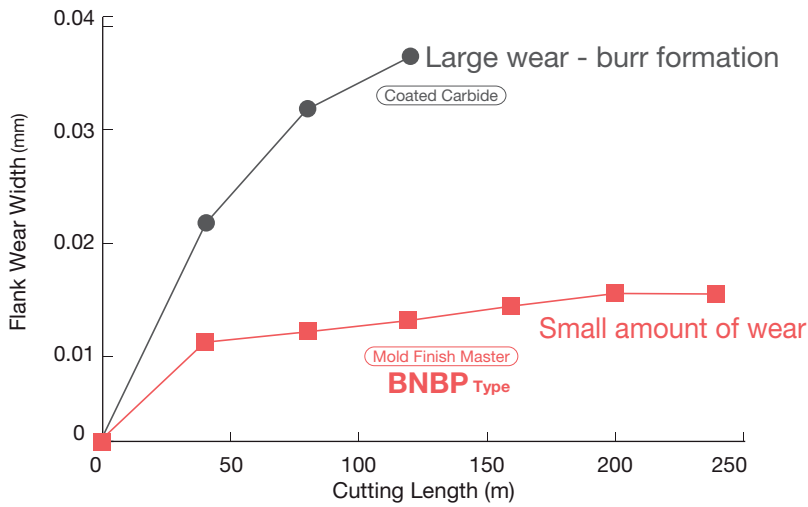


Fracture at joined central edge

Work Material: STAVAX (52HRC)
Tool: BNPB 2R100-0554 (RE1.0)
Cutting Conditions: $n=25,000\text{min}^{-1}$, $v_f=1,500\text{mm/min}$
 $a_p=0.10\text{mm}$, $p_t=0.20\text{mm}$ Oil Mist

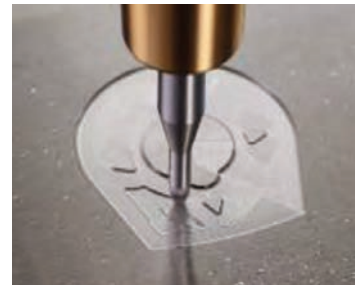
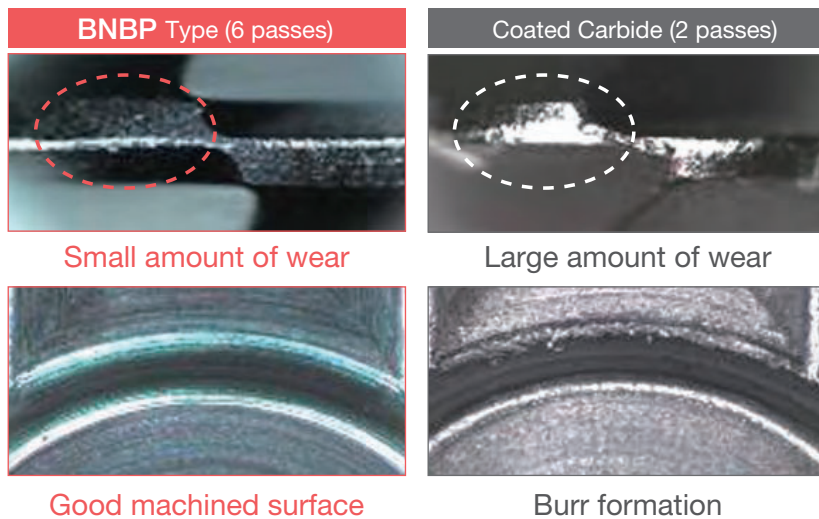
BNBP Type

- Excellent wear resistance and machined surface quality.



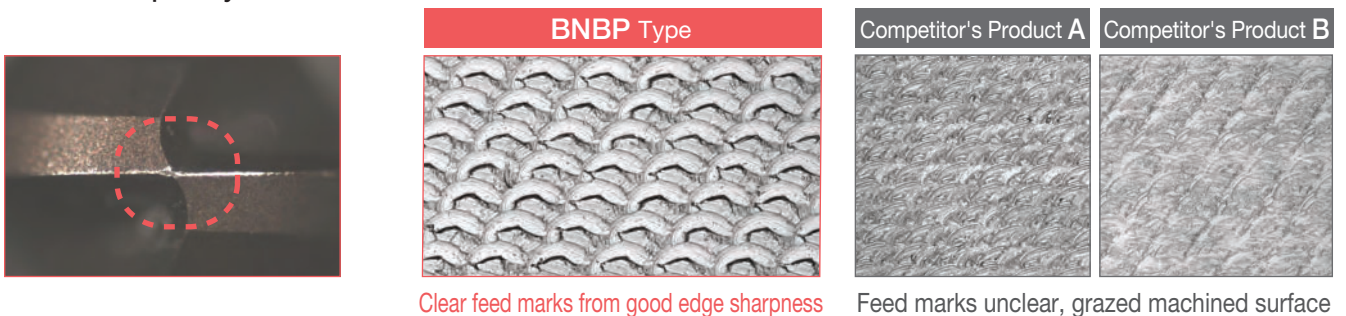
Work Material: STAVAX (52HRC)
 Tool: BNPB 2R030-0154 (RE0.3)
 Cutting Conditions: $n=25,000\text{min}^{-1}$, $v_f=1,500\text{mm/min}$
 $a_p=0.05\text{mm}$, $p_f=0.10\text{mm}$ Oil Mist

Tool Wear Comparison



■ Cutting Performance

- Small center cutting edge maintains sharpness over many hours. Stable machined surface quality!

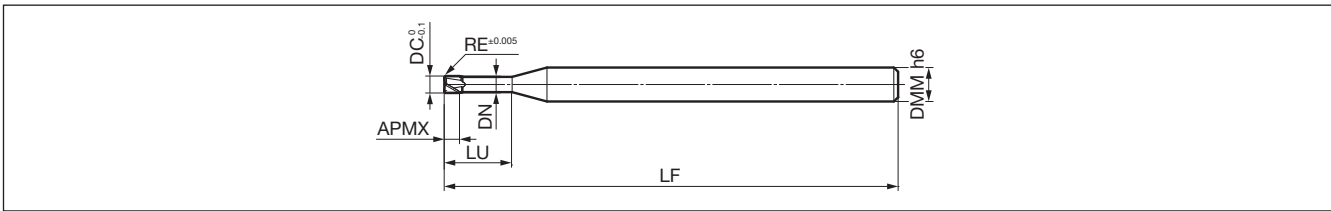


Work Material: DC53-SKD11 Modified (60HRC)
 Tool: RE1.0 Ballnose
 Cutting Conditions: $n=40,000\text{min}^{-1}$, $v_f=4,000\text{mm/min}$, $a_p=0.005\text{mm}$, $p_f=0.005\text{mm}$ Oil Mist
 Cutting Length = 200m

BNBR Type



General Steel	Carbon Steel	Alloy Steel	Pre-hardened Steel	Tempered Steel	Hardened Steel			Stainless Steel	Ti Alloy Heat Resistant Alloy	Cast Iron	Aluminum Alloy	Copper Alloy	Graphite	CFRP
			○		45 ~ 55 HRC	55 ~ 60 HRC	60 ~ 65 HRC				×	×		



Body

Dimensions (mm)

Cat. No.	Stock	Dia. DC	Corner Radius RE	Cutting Edge Length APMX	Neck Length LU	Overall Length LF	Neck Dia. DN	Shank Dia. DMM	Wiper Edge	Standard Price (JPY)
BNBR 2D020R005-0054	●	0.2	0.05	0.1	0.5	50	0.17	4	No	39,100
2D030R005-0054	●	0.3	0.05	0.15	0.5	50	0.27	4	No	38,500
2D040R005-0054	●	0.4	0.05	0.2	0.5	50	0.37	4	No	36,200
2D050R005-0054	●	0.5	0.05	0.3	0.5	50	0.47	4	No	30,100
2D050R005-0154	●	0.5	0.05	0.3	1.5	50	0.47	4	No	30,600
BNBR 2D050R005-0254	●	0.5	0.05	0.3	2.5	50	0.47	4	No	32,200
2D050R010-0154	●	0.5	0.10	0.3	1.5	50	0.47	4	No	30,600
2D050R010-0254	●	0.5	0.10	0.3	2.5	50	0.47	4	No	32,200
2D100R005-0304	●	1.0	0.05	0.7	3.0	50	0.97	4	Yes	29,600
2D100R005-0504	●	1.0	0.05	0.7	5.0	50	0.97	4	Yes	31,100
BNBR 2D100R010-0304	●	1.0	0.10	0.7	3.0	50	0.97	4	Yes	29,600
2D100R010-0504	●	1.0	0.10	0.7	5.0	50	0.97	4	Yes	31,100
2D100R020-0304	●	1.0	0.20	0.7	3.0	50	0.97	4	Yes	29,600
2D100R020-0504	●	1.0	0.20	0.7	5.0	50	0.97	4	Yes	31,100
2D100R030-0304	●	1.0	0.30	0.7	3.0	50	0.97	4	Yes	29,600
BNBR 2D100R030-0504	●	1.0	0.30	0.7	5.0	50	0.97	4	Yes	31,100
2D150R010-0454	●	1.5	0.10	1.2	4.5	50	1.47	4	Yes	31,600
2D150R010-0754	●	1.5	0.10	1.2	7.5	50	1.47	4	Yes	34,500
2D150R020-0454	●	1.5	0.20	1.2	4.5	50	1.47	4	Yes	31,600
2D150R020-0754	●	1.5	0.20	1.2	7.5	50	1.47	4	Yes	34,500
BNBR 2D150R030-0454	●	1.5	0.30	1.2	4.5	50	1.47	4	Yes	31,600
2D150R030-0754	●	1.5	0.30	1.2	7.5	50	1.47	4	Yes	34,500
2D200R010-0604	●	2.0	0.10	1.5	6.0	50	1.97	4	Yes	33,900
2D200R020-0604	●	2.0	0.20	1.5	6.0	50	1.97	4	Yes	33,900
2D200R030-0604	●	2.0	0.30	1.5	6.0	50	1.97	4	Yes	33,900
BNBR 2D200R050-0604	●	2.0	0.50	1.5	6.0	50	1.97	4	Yes	33,900

The List price is a price only for Japan. Grade: BNX20

Identification Code

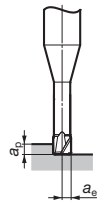
BNBR 2 D050 R010 - 015 4

Series Code: 2
Number of Teeth: 050
Dia.: R010
Corner Radius: -
Neck Length: 015
Shank Dia.: 4

BNBR Type

Recommended Cutting Conditions

1. Use a machine with high rigidity for stable cutting.
2. Non-water soluble cutting oil is recommended. Supply as a mist or external coolant.
Take fire prevention precautions to avoid fire hazards caused by sparks igniting during machining or tool breakage.
3. Shorten overhang as much as possible.
4. Adjust cutting conditions as necessary as machine rigidity and other conditions may vary.
5. Depths of cut shown in the table of conditions are maximum depths. Adjust the actual depth of cut to the desired machined surface roughness.

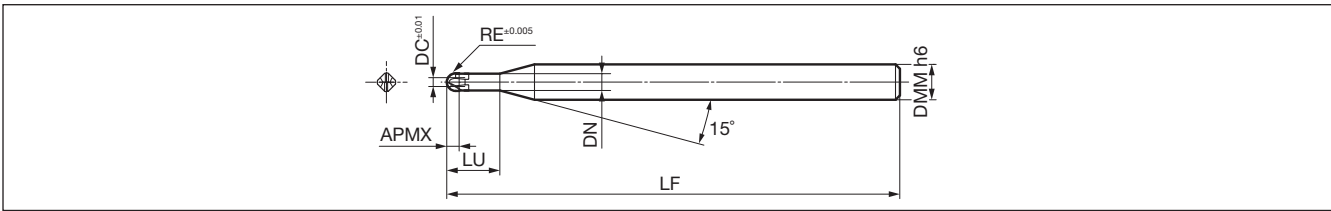


Work Material			STAVAX, NAK80, SKD61 (Up to 52HRC)				ELMAX, DC53, SKD11Modified (up to 62HRC)				YXR3, SKH (up to 70HRC)			
DC (mm)	RE (mm)	LU (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p (mm)	a _e (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p (mm)	a _e (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p (mm)	a _e (mm)
0.2	0.05	0.5	40,000	400	0.005	0.03	40,000	400	0.005	0.03	40,000	250	0.005	0.02
0.3	0.05	0.5	40,000	500	0.010	0.05	40,000	500	0.010	0.05	40,000	300	0.005	0.03
0.4	0.05	0.5	40,000	600	0.015	0.1	40,000	600	0.015	0.1	40,000	400	0.01	0.05
	0.05	0.5	40,000		0.02	0.15	40,000		0.02	0.15	40,000		0.01	0.1
0.5	0.05	1.5	40,000	600	0.02	0.1	40,000	600	0.02	0.1	35,000	400	0.01	0.05
	0.05		40,000				40,000				35,000			
	0.05	40,000	40,000		35,000									
	0.1	40,000	40,000		35,000									
1.0	0.05	3.0	35,000	800	0.03	0.3	35,000	800	0.03	0.2	30,000	600	0.01	0.1
	0.1		35,000				35,000				30,000			
	0.2		35,000				35,000				30,000			
	0.3		35,000				35,000				30,000			
	0.05	5.0	35,000		35,000	30,000								
	0.1		35,000		35,000	30,000								
1.5	0.2	4.5	26,000	800	0.03	0.5	26,000	800	0.03	0.3	20,000	600	0.02	0.3
	0.3		26,000				26,000				20,000			
	0.1		26,000				26,000				20,000			
	0.2	7.5	26,000		26,000	20,000								
	0.3		26,000		26,000	20,000								
2.0	0.1	6.0	20,000	800	0.03	0.7	20,000	800	0.03	0.7	15,000	600	0.03	0.7
	0.2		20,000				20,000				15,000			
	0.3		20,000				20,000				15,000			
	0.5		20,000				20,000				15,000			

BNBP Type



General Steel	Carbon Steel	Alloy Steel	Pre-hardened Steel	Tempered Die Steel	Hardened Steel			Stainless Steel	Ti Alloy (Ti-6Al-4V)	Cast Iron	Aluminum Alloy	Copper Alloy	Graphite	CFRP
			○	○	45 ~ 55 HRC	55 ~ 60 HRC	60 ~ 65 HRC				×	×		



Body

Dimensions (mm)

Cat. No.	Stock	Ballnose Radius RE	Dia. DC	Cutting Edge Length APMX	Neck Length LU	Overall Length LF	Neck Dia. DN	Shank Dia. DMM	Standard Price (JPY)
BNBP 2R020-0124	●	0.20	0.4	0.3	1.2	50	0.37	4	27,900
2R020-0126	●	0.20	0.4	0.3	1.2	50	0.37	6	28,200
2R020-0204	●	0.20	0.4	0.3	2.0	50	0.37	4	29,100
2R020-0304	●	0.20	0.4	0.3	3.0	50	0.37	4	29,300
2R020-0404	●	0.20	0.4	0.3	4.0	50	0.37	4	29,600
BNBP 2R030-0154	●	0.30	0.6	0.4	1.5	50	0.57	4	29,100
2R030-0156	●	0.30	0.6	0.4	1.5	50	0.57	6	29,300
2R030-0204	●	0.30	0.6	0.4	1.5	50	0.57	4	29,400
2R030-0304	●	0.30	0.6	0.4	3.0	50	0.57	4	29,400
2R030-0404	●	0.30	0.6	0.4	4.0	50	0.57	4	29,400
BNBP 2R030-0504	●	0.30	0.6	0.4	5.0	50	0.57	4	29,800
2R030-0604	●	0.30	0.6	0.4	6.0	50	0.57	4	30,200
2R050-0254	●	0.50	1.0	0.6	2.5	50	0.97	4	29,100
2R050-0256	●	0.50	1.0	0.6	2.5	50	0.97	6	29,300
2R050-0304	●	0.50	1.0	0.6	3.0	50	0.97	4	29,300
BNBP 2R050-0404	●	0.50	1.0	0.6	4.0	50	0.97	4	29,400
2R050-0604	●	0.50	1.0	0.6	6.0	50	0.97	4	29,700
2R050-0804	●	0.50	1.0	0.6	8.0	50	0.97	4	29,900
2R075-0404	●	0.75	1.5	0.9	4.0	50	1.47	4	29,100
2R075-0406	●	0.75	1.5	0.9	4.0	50	1.47	6	29,300
BNBP 2R100-0554	●	1.00	2.0	1.4	5.5	50	1.97	4	29,100
2R100-0556	●	1.00	2.0	1.4	5.5	50	1.97	6	29,300
2R100-0804	●	1.00	2.0	1.4	8.0	50	1.97	4	31,700

The List price is a price only for Japan. Grade: BN350

Identification Code

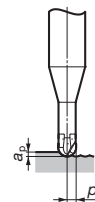
BNBP 2 R030 - 015 4

Series Code	Number of Teeth	Ballnose Radius	Neck Length	Shank Dia.
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BNBP Type

Recommended Cutting Conditions

1. Use a machine with high rigidity for stable cutting.
2. Non-water soluble cutting oil is recommended. Supply as a mist or external coolant.
Take fire prevention precautions to avoid fire hazards caused by sparks igniting during machining or tool breakage.
3. Shorten overhang as much as possible.
4. Adjust cutting conditions as necessary as machine rigidity and other conditions may vary.
5. Depths of cut shown in the table of conditions are maximum depths. Adjust the actual depth of cut to the desired machined surface roughness.



Work Material		STAVAX, NAK80, SKD61 (Up to 52HRC)				ELMAX, DC53, SKD11Modified (up to 62HRC)				YXR3, SKH (up to 70HRC)			
RE (mm)	LU (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p (mm)	ρ _f (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p (mm)	ρ _f (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p (mm)	ρ _f (mm)
0.2	1.2	40,000	1,000	0.005	0.010	40,000	800	0.005	0.010	40,000	600	0.005	0.005
	2.0	40,000	800	0.005	0.010	40,000	600	0.005	0.010	40,000	400	0.005	0.005
	3.0	40,000	600	0.005	0.010	40,000	500	0.005	0.010	40,000	300	0.005	0.005
	4.0	40,000	500	0.005	0.010	40,000	400	0.005	0.005	40,000	200	0.005	0.005
0.3	1.5	40,000	1,600	0.020	0.020	40,000	1,400	0.010	0.020	40,000	1,200	0.010	0.020
	2.0	40,000	1,500	0.010	0.020	40,000	1,300	0.010	0.020	40,000	1,100	0.010	0.010
	3.0	40,000	1,400	0.010	0.020	40,000	1,200	0.010	0.020	40,000	1,000	0.010	0.010
	4.0	30,000	1,200	0.010	0.010	30,000	1,000	0.010	0.010	30,000	700	0.005	0.010
	5.0	30,000	800	0.010	0.010	30,000	700	0.005	0.010	30,000	600	0.005	0.005
	6.0	30,000	600	0.005	0.010	30,000	500	0.005	0.005	30,000	400	0.005	0.005
0.5	2.5	40,000	2,800	0.040	0.050	40,000	2,800	0.030	0.040	40,000	2,200	0.020	0.030
	3.0	40,000	2,600	0.040	0.050	40,000	2,600	0.030	0.040	40,000	2,100	0.020	0.030
	4.0	40,000	2,400	0.030	0.050	40,000	2,400	0.020	0.030	40,000	2,000	0.020	0.020
	6.0	25,000	1,500	0.020	0.030	25,000	1,500	0.010	0.020	25,000	1,300	0.010	0.010
	8.0	16,000	1,200	0.020	0.020	16,000	1,100	0.010	0.020	16,000	850	0.010	0.010
0.75	4.0	32,000	2,400	0.030	0.030	32,000	2,200	0.020	0.030	32,000	2,000	0.020	0.020
1.0	5.5	40,000	4,000	0.050	0.050	40,000	4,000	0.030	0.030	40,000	3,000	0.020	0.030
	8.0	32,000	3,000	0.030	0.050	32,000	2,600	0.020	0.030	32,000	2,200	0.010	0.020

Radius accuracy inspection reports

Radius accuracy inspection reports are attached as below with the ballnose type.

Measurement Data Sheet of Radius accuracy.

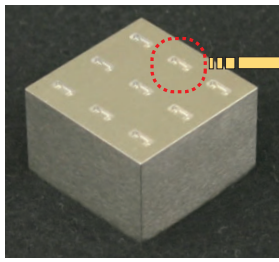
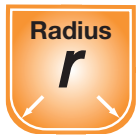
Lot No. SHM***
No. **

R tolerance 1.00 0.005
 -0.005

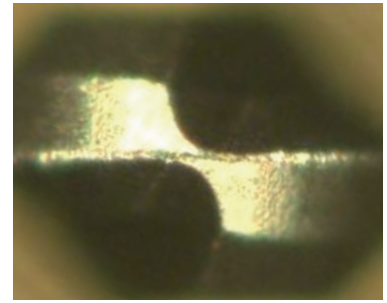
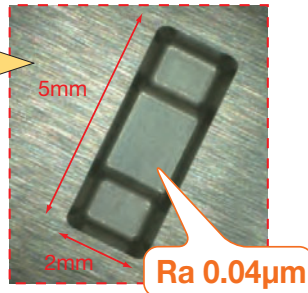
Angle	measurement	Error
0°	1.000	0.000
10°	1.001	0.001
		0.001



■ Application Example

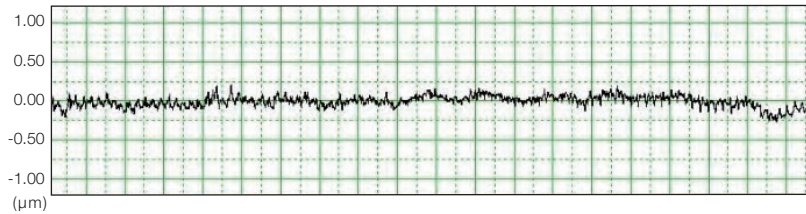


Work Material: ELMAX (60HRC)



BNBP Type (R0.2 Ball)
 (After machining 8 positions)

■ Cross Section Curve



Machining Details	Tool	Spindle Speed $n(\text{min}^{-1})$	Feed Rate $v_f(\text{mm}/\text{min})$	XY (mm)	Z (mm)	Depth of Cut	Cutting Time
Contour roughing	BNBR 2D050R010-0154 ø0.5 RE0.1 Radius Endmill	40,000	400	0.10	0.01	0.05	15min
Contour roughing	BNBP 2R020-0124 RE0.2 Ballnose Endmill	40,000	400	0.05	0.02	0.01	20min
Contour finishing	BNBP 2R020-0124 RE0.2 Ballnose Endmill	40,000	400	0.00	0.02	0	12min
Profile finishing	BNBP 2R020-0124 RE0.2 Ballnose Endmill	40,000	400	0.03	0	0	8min

MEMO

A large grid of dotted lines for writing a memo. The grid consists of 20 columns and 30 rows of small squares, each formed by two dotted lines. The grid is intended for handwritten notes.

Sumitomo Electric Cutting Tools Official Apps for iOS/Android



Cutting calculation App

SumiTool Calculator



Grade & chipbreaker comparison App

SumiTool Converter



< SAFETY NOTES >



- Very hot or lengthy chips may be discharged while the machine is in operation. Therefore, machine guards, safety goggles or other protective covers must be used. Fire safety precautions must also be considered.

- Please handle with care as this product has sharp edges.
- Improper cutting conditions or mis-handling of the tool may result in breakages or projectiles. Therefore, please use the tool within its recommended conditions.

- When using non-water soluble cutting oil, precautions against fire must be taken and please ensure that a fire extinguisher is placed near the machine.

 Sumitomo Electric Industries, Ltd.

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