MITSUBISHI
MITSUBISHI MATERIALS

TOOLS NEWS

B063G

DIAMOND COATED END MILLS

DC-2XLB DC-XB
DC-2MB DC-2LB
DC-2MS-3 DC-2SB-NF DC-2MB-NF

Great for deep slotting of Graphite electorode

DIAMOND COATED END MILLS

DC-2XLB NEW
Ball Nose, Long Neck, 2 flute, For Graphite

DC-XB NEW
Ball Nose, Taper Neck, 2 flute, For Graphite

DC-2MB
Ball Nose, Medium, 2 flute, For Graphite

DC-2LB
Ball Nose, Long, 2 flute, For Graphite

DC-2MS-3
Medium, 2 flute, For Non-ferrous Material (3mm shank series)

DC-2SB-NF
Ball Nose, Short, 2 flute, For Non-ferrous Material

DC-2MB-NF
Ball Nose, Medium, 2 flute, For Non-ferrous Material

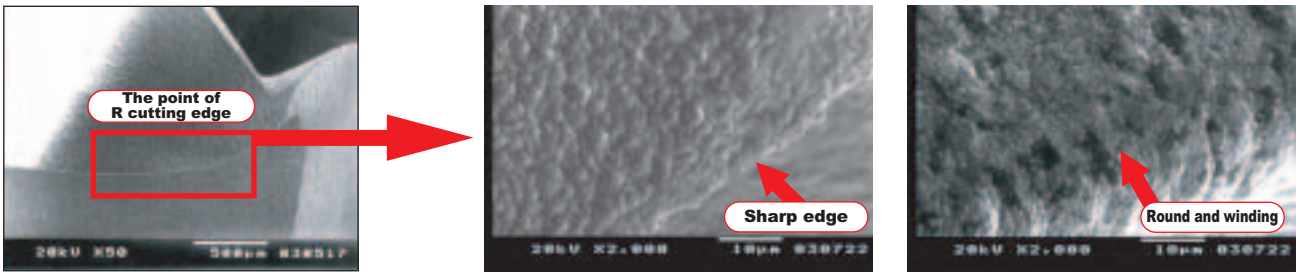
■Features

- **New additions to the long neck and taper neck series of diamond coated end mills for Graphite machining.**
- **Diamond coated end mill series that is most effective in deep slotting graphite electrodes that are essential to mould machining. Ten to 20 times longer tool life than carbide end mills (including (Ti,Al)N coated end mills).**
- **Use of Mitsubishi's original developed diamond coating that provides more stable tool life than competitor's diamond coatings.**

Diamond Coating

Diamond Coating for non-ferrous and new non-metal materials.

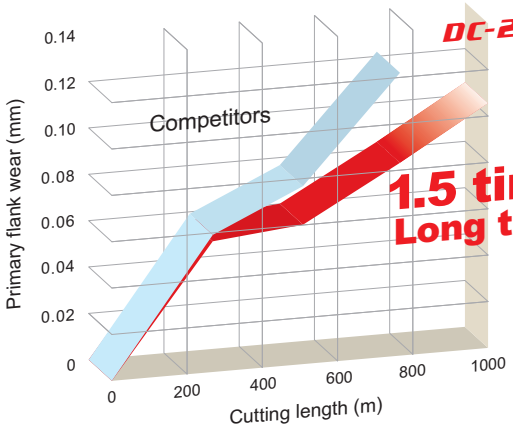
- **We developed an original coating technology with the plasma chemical vapor deposition method (CVD process), and succeeded in commercialization of coated tools with excellent adhesion of diamond film.**
- **Besides ten to 20 times longer tool life than carbide end mills, we will be able to earn excellent finishing processed surface from the sharp edge,and cut the polish time.**

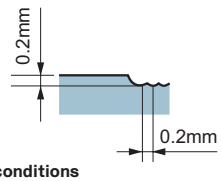


Mitsubishi Competitor

■Machining example

Graphite





■Cutting conditions

End mill	DC-2XLB R1×20
Work material	Graphite (EX70)
Revolution	15,000min^{-1}
Feed rate	1,500mm/min(0.05mm/tooth)
Cutting method	Air blow

Competitor

Wide range

For Graphite

DC-2XLB NEW
Ball Nose, Long Neck,
2 flute, For Graphite

DC-XB NEW
Ball Nose, Taper Neck,
2 flute, For Graphite

DC-2MB
Ball Nose, Medium, 2 flute, For Graphite

DC-2LB
Ball Nose, Long, 2 flute, For Graphite

For Non-ferrous material (High Si-Al-Alloy, Ceramics, Graphite)

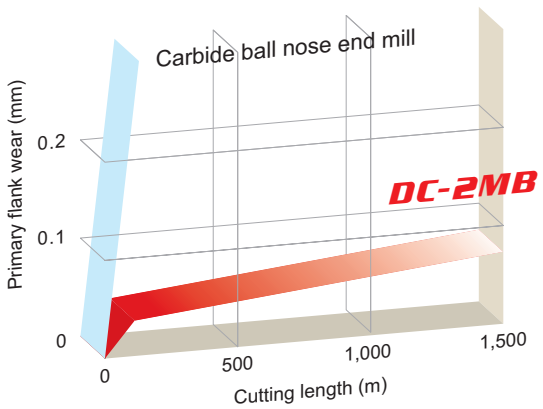
DC-2MS-3
Medium, 2 flute,
For Non-ferrous material
(3mm shank series)

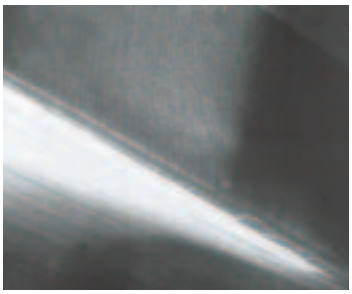
DC-2SB-NF
Ball Nose, Short, 2 flute,
For Non-ferrous material

DC-2MB-NF
Ball Nose, Medium, 2 flute,
For Non-ferrous material

■Machining example

Graphite

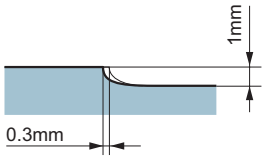




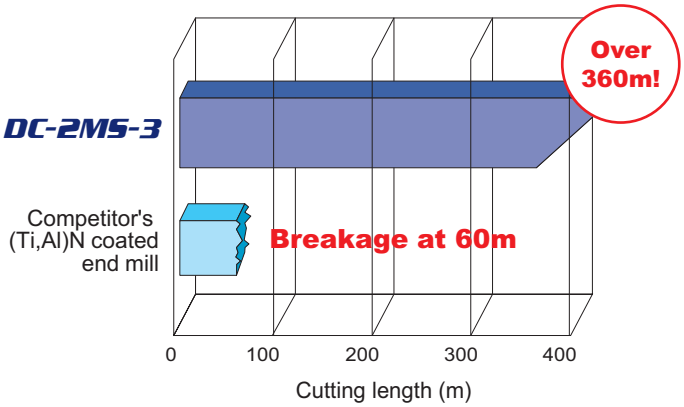
Wear of cutting edge
(After cutting 1,800m)

■Cutting conditions

End mill	DC-2MB R3
Revolution	12,000min^{-1}
Feed rate	2,000mm/min(0.083mm/tooth)
Cutting method	Air blow

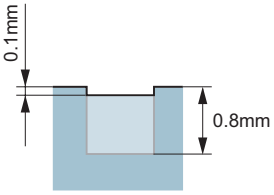


High Si-Al-Alloy



■Cutting conditions

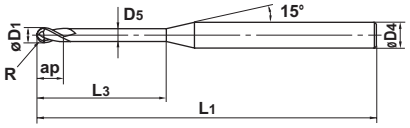
End mill	DC-2MS-3 ϕ0.5
Work material	High Si-Al-Alloy
Revolution	40,000min^{-1}(628m/min)
Feed rate	240mm/min(0.003mm/tooth)
Cutting method	Air blow



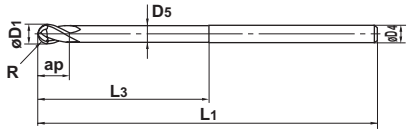
DC-2XLB

Ball Nose, Long Neck, 2 flute, For Graphite

D1<6 0 — -0.028
6=D1 0 — -0.038



Type 1



Type 2

UWC DC 30°

- Taper neck ball nose end mill for graphite that use of Mitsubishi's uniquely developed diamond coating.

Unit : mm

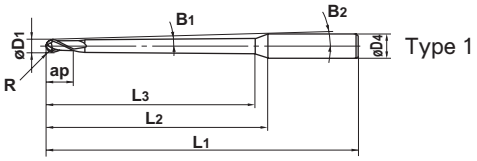
Order Number	Radius of Ball Nose R	Dia. D1	Length of Cut ap	Neck Length L3	Neck Dia. D5	Overall Length L1	Shank Dia. D4	No. of Flute N	Stock	Type
DC2XLBR0020N040	0.2	0.4	0.6	4	0.36	50	6	2	■	1
DC2XLBR0020N060	0.2	0.4	0.6	6	0.36	50	6	2	■	1
DC2XLBR0025N050	0.25	0.5	0.8	5	0.46	50	6	2	■	1
DC2XLBR0025N075	0.25	0.5	0.8	7.5	0.46	50	6	2	■	1
DC2XLBR0030N060	0.3	0.6	1	6	0.56	50	6	2	■	1
DC2XLBR0030N090	0.3	0.6	1	9	0.56	50	6	2	■	1
DC2XLBR0040N080	0.4	0.8	1.2	8	0.76	50	6	2	■	1
DC2XLBR0040N120	0.4	0.8	1.2	12	0.76	50	6	2	■	1
DC2XLBR0050N120	0.5	1	1.5	12	0.94	60	6	2	■	1
DC2XLBR0050N160	0.5	1	1.5	16	0.94	60	6	2	■	1
DC2XLBR0060N120	0.6	1.2	1.8	12	1.14	60	6	2	■	1
DC2XLBR0060N180	0.6	1.2	1.8	18	1.14	60	6	2	■	1
DC2XLBR0075N150	0.75	1.5	2.3	15	1.44	60	6	2	■	1
DC2XLBR0075N230	0.75	1.5	2.3	23	1.44	60	6	2	■	1
DC2XLBR0100N160	1	2	3	16	1.90	70	6	2	■	1
DC2XLBR0100N200	1	2	3	20	1.90	70	6	2	■	1
DC2XLBR0100N250	1	2	3	25	1.90	70	6	2	■	1
DC2XLBR0100N300	1	2	3	30	1.90	70	6	2	■	1
DC2XLBR0150N300	1.5	3	4.5	30	2.90	80	6	2	■	1
DC2XLBR0150N400	1.5	3	4.5	40	2.90	80	6	2	■	1
DC2XLBR0200N300	2	4	6	30	3.90	100	6	2	■	1
DC2XLBR0200N500	2	4	6	50	3.90	100	6	2	■	1
DC2XLBR0250N400	2.5	5	7.5	40	4.90	100	6	2	■	1
DC2XLBR0250N600	2.5	5	7.5	60	4.90	100	6	2	■	1
DC2XLBR0300N600	3	6	9	60	5.85	120	6	2	■	2
DC2XLBR0300N900	3	6	9	90	5.85	120	6	2	■	2

■ : Inventory maintained in Japan.

DC-XB

Ball Nose, Taper Neck, 2 flute, For Graphite

D1 < 6 0 – -0.028
6 = D1 0 – -0.038



Type 1

- Long neck ball nose end mill for graphite that use of Mitsubishi's uniquely developed diamond coating.

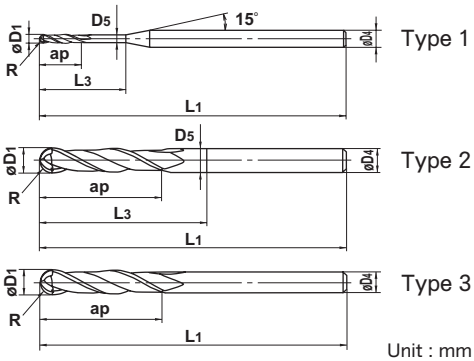
Unit : mm

Order Number	Radius of Ball Nose R	Dia. D1	Taper Angle on Side B1	Length of Cut ap	Neck Length L3	Under Shank Length L2	Cutting edge to Shank Angle B2	Overall Length L1	Shank Dia. D4	No. of Flute N	Stock	Type
DCXBR0020T0100L008	0.2	0.4	1°	0.8	8	18.1	8.9°	50	6	2	■	1
DCXBR0025T0100L010	0.25	0.5	1°	1	10	19.8	8.0°	50	6	2	■	1
DCXBR0030T0100L012	0.3	0.6	1°	1.2	12	21.5	7.2°	50	6	2	■	1
DCXBR0040T0100L016	0.4	0.8	1°	1.6	16	24.9	6.1°	50	6	2	■	1
DCXBR0050T0100L020	0.5	1	1°	2	20	26.2	5.6°	60	6	2	■	1
DCXBR0060T0100L024	0.6	1.2	1°	2.4	24	29.7	4.7°	60	6	2	■	1
DCXBR0075T0100L030	0.75	1.5	1°	3	30	35.0	3.8°	60	6	2	■	1
DCXBR0100T0100L040	1	2	1°	4	40	44.0	2.7°	80	6	2	■	1
DCXBR0150T0100L060	1.5	3	1°	6	60	62.1	1.4°	100	6	2	■	1
DCXBR0200T0100L080	2	4	1°	8	80	82.7	1.4°	130	8	2	■	1
DCXBR0250T0100L100	2.5	5	1°	10	100	103.2	1.4°	150	10	2	■	1
DCXBR0300T0100L120	3	6	1°	12	120	121.0	1.0°	180	10	2	■	1

DC-2MB

Ball Nose, Medium, 2 flute, For Graphite

D1＜6　0 － -0.028
6≦D1　0 － -0.038



- Due to the Diamond Coating original technology of our company, it excels in the adhesion of the film. There are neither flaking off nor cutting edge chipping. A steady cutting is possible.

Unit : mm

Order Number	Radius of ball nose R	Dia. D1	Length of Cut ap	Neck Length L3	Neck Dia. D5	Overall Length L1	Shank Dia. D4	No. of Flute N	Stock	Type
DC2MBR0050	0.5	1.0	3	10	0.96	60	4	2	■	1
DC2MBR0100	1	2.0	10	20	1.96	80	4	2	■	1
DC2MBR0150	1.5	3.0	15	25	2.96	80	4	2	■	1
DC2MBR0200	2	4.0	20	30	3.96	80	4	2	■	2
DC2MBR0250	2.5	5.0	30	50	4.96	100	6	2	■	1
DC2MBR0300	3	6.0	30	50	5.85	100	6	2	■	2
DC2MBR0350	3.5	7.0	30	—	—	100	6	2	■	3
DC2MBR0400	4	8.0	40	60	7.85	110	8	2	■	2
DC2MBR0450	4.5	9.0	40	—	—	110	8	2	■	3
DC2MBR0500	5	10.0	50	70	9.85	120	10	2	■	2
DC2MBR0600	6	12.0	55	75	11.85	130	12	2	■	2

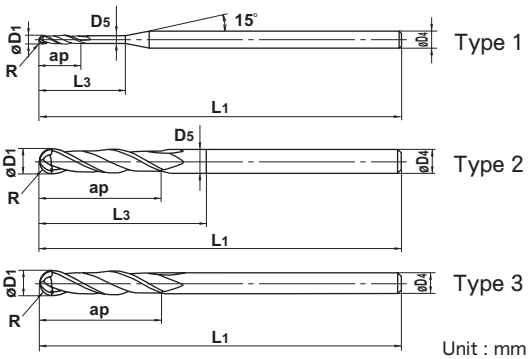
(Effective Coating Length : 1－1.5D1)

■ : Inventory maintained in Japan.

DC-2LB

Ball Nose, Long, 2 flute, For Graphite

$D_1 < 6$ $0\ -\ -0.028$
$6 \leq D_1$ $0\ -\ -0.038$



- Due to the Diamond Coating original technology of our company, it excels in the adhesion of the film. There are neither flaking off nor cutting edge chipping. A steady cutting is possible.

Unit : mm

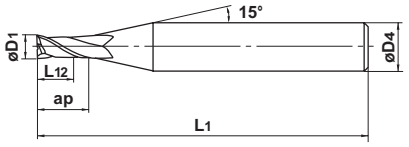
Order Number	Radius of ball nose R	Dia. D_1	Length of Cut ap	Neck Length L_3	Neck Dia. D_5	Overall Length L_1	Shank Dia. D_4	No. of Flute N	Stock	Type
DC2LBR0100	1	2.0	10	20	1.96	100	4	2	■	1
DC2LBR0150	1.5	3.0	15	25	2.96	100	4	2	■	1
DC2LBR0200	2	4.0	20	30	3.96	100	4	2	■	2
DC2LBR0250	2.5	5.0	30	50	4.96	120	6	2	■	1
DC2LBR0300	3	6.0	30	50	5.85	150	6	2	■	2
DC2LBR0350	3.5	7.0	30	—	—	150	6	2	■	3
DC2LBR0400	4	8.0	40	60	7.85	150	8	2	■	2
DC2LBR0450	4.5	9.0	40	—	—	150	8	2	■	3
DC2LBR0500	5	10.0	50	70	9.85	180	10	2	■	2
DC2LBR0600	6	12.0	55	75	11.85	200	12	2	■	2

(Effective Coating Length : $1 - 1.5D_1$)

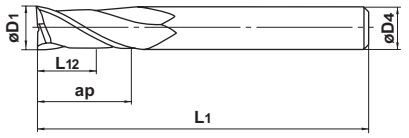
DC-2MS-3

Medium, 2 flute, For Non-ferrous material (3mm Shank Series)

-0.005 – -0.028



Type 1



Type 2

- It displays its great power in machining high silicone aluminum alloy, graphite, and other non-ferrous materials.

Unit : mm

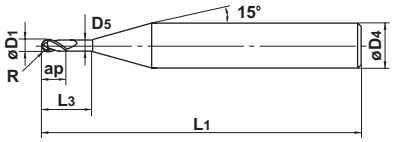
Order Number	Dia. D1	Length of Cut ap	Effective Coating Length L12	Overall Length L1	Shank Dia. D4	No. of Flute N	Stock	Type
DC2MS3D0050	0.5	1	1	38	3	2	■	1
DC2MS3D0100	1	2.5	1.5	38	3	2	■	1
DC2MS3D0150	1.5	4	2.5	38	3	2	■	1
DC2MS3D0200	2	6	3	45	3	2	■	1
DC2MS3D0250	2.5	8	4	45	3	2	■	1
DC2MS3D0300	3	8	4.5	45	3	2	■	2

■ : Inventory maintained in Japan.

DC-2SB-NF

Ball Nose, Short, 2 flute, For Non-ferrous material

0 — -0.028



Type 1

UWC DC 30°

- Achieving long lifetime high-precision processing in machining non-ferrous materials including electrode materials such as copper and graphite.

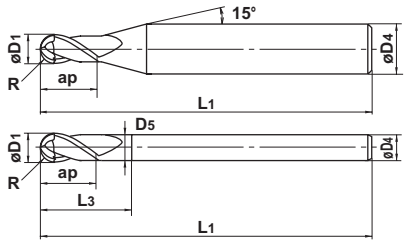
Unit : mm

Order Number	Radius of ball nose R	Dia. D1	Length of Cut ap	Neck Length L3	Neck Dia. D5	Overall Length L1	Shank Dia. D4	No. of Flute N	Stock	Type
DC2SBNFR0030	0.3	0.6	0.6	1.2	0.56	50	6	2	■	1
DC2SBNFR0050	0.5	1	1	2.5	0.96	50	6	2	■	1

DC-2MB-NF

Ball Nose, Medium, 2 flute, For Non-ferrous material

D1<6 0 — -0.028
6≤D1 0 — -0.038



Type 1

Type 2

UWC DC 30°

- Achieving long lifetime high-precision processing in machining non-ferrous materials including electrode materials such as copper and graphite.

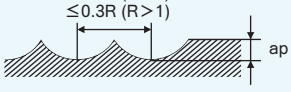
Unit : mm

Order Number	Radius of ball nose R	Dia. D1	Length of Cut ap	Neck Length L3	Neck Dia. D5	Overall Length L1	Shank Dia. D4	No. of Flute N	Stock	Type
DC2MBNFR0030	0.3	0.6	1.2	—	—	38	3	2	■	1
DC2MBNFR0050	0.5	1	2.5	—	—	40	4	2	■	1
DC2MBNFR0100	1	2	6	—	—	60	6	2	■	1
DC2MBNFR0150	1.5	3	8	—	—	70	6	2	■	1
DC2MBNFR0200	2	4	8	—	—	70	6	2	■	1
DC2MBNFR0250	2.5	5	12	—	—	80	6	2	■	1
DC2MBNFR0300	3	6	12	22	5.80	80	6	2	■	2
DC2MBNFR0400	4	8	14	27	7.80	90	8	2	■	2
DC2MBNFR0500	5	10	18	31	9.80	100	10	2	■	2
DC2MBNFR0600	6	12	22	35	11.80	110	12	2	■	2

(Effective Coating Length : 1—1.5D1)

DC-2XLB
Ball Nose, Medium, 2 flute, For Graphite

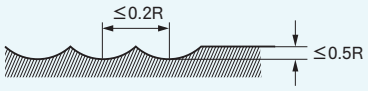
DC-XB
Ball Nose, Medium, 2 flute, For Graphite

Work material				Graphite	
R (mm)	Neck taper half angle	Neck length (mm)	Depth of cut ap (mm)	Revolution (min^{-1})	Feed rate (mm/min)
R0.2	DC-2XLB	4	0.1	40,000	1,300
		6	0.06		
	DC-XB	8	0.06		
R0.3	DC-2XLB	6	0.15	40,000	1,500
		9	0.1		
	DC-XB	12	0.1		
R0.4	DC-2XLB	8	0.15	40,000	1,100
		12	0.1		
	DC-XB	16	0.1		
R0.5	DC-2XLB	12	0.2	40,000	2,000
		16	0.12		
	DC-XB	20	0.12		
R0.75	DC-2XLB	15	0.2	35,000	2,000
		23	0.12		
	DC-XB	30	0.12		
R1	DC-2XLB	16	0.3	30,000	2,000
		30	0.15		
	DC-XB	40	0.15		
R1.5	DC-2XLB	30	0.35	20,000	2,000
		40	0.25		
	DC-XB	60	0.25		
R2	DC-2XLB	30	0.5	15,000	2,000
		50	0.3		
	DC-XB	80	0.3		
R2.5	DC-2XLB	40	0.6	12,000	1,800
		60	0.4		
	DC-XB	100	0.4		
R3	DC-2XLB	60	0.6	10,000	1,600
		90	0.4		
	DC-XB	120	0.4		
Depth of cut				≤0.2R (R≤1) ≤0.3R (R>1) 	

1) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.
   When high machining accuracy is especially needed, we recommend lowering feed rate.
2) When high machining accuracy is especially needed, we recommend reduce feed rate.

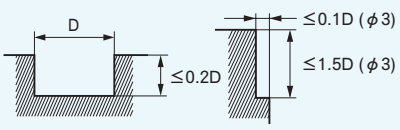
DC-2MB
Ball Nose, Medium, 2 flute, For Graphite

DC-2LB
Ball Nose, Long, 2 flute, For Graphite

Work material	Graphite (−65HS) ISEM-2, 3, 8, HED-100 ED-2, 3, E+18A, E+20A etc.		Graphite (65HS−) ISO-61, 63, 88, 95, HED-130, 150 EX-70, ED-4, E+25A, E+30A etc.	
R (mm)	Revolution (min^{-1})	Feed rate (mm/min)	Revolution (min^{-1})	Feed rate (mm/min)
R0.5	40,000	2,000	40,000	1,600
R1	40,000	2,200	40,000	1,800
R1.5	30,000	2,400	30,000	1,900
R2	24,000	2,600	24,000	2,100
R2.5	19,000	2,600	19,000	2,100
R3	16,000	2,600	16,000	2,100
R3.5	14,000	2,600	14,000	2,100
R4	12,000	2,800	12,000	2,200
R4.5	11,000	2,900	11,000	2,300
R5	10,000	3,000	10,000	2,400
R6	8,000	2,400	8,000	1,900
Depth of cut	 R:Radius			

1) Cutting conditions need to be changed, depending on the overhang, allowance for machining and machine. Use the above as a general guide.
2) High-speed, high-feed machining is desirable. But reduce feed rate if flaking of workpieces occurs.

DC-2MS-3
Medium, 2 flute, For Non-ferrous material (3mm shank series)

Work material	Aluminum Alloy		Copper, Copper Alloys, Graphite, Machineable Ceramics	
Dia. (mm)	Revolution (min^{-1})	Feed rate (mm/min)	Revolution (min^{-1})	Feed rate (mm/min)
0.5	20,000	60	20,000	60
1	20,000	120	20,000	120
2	20,000	320	11,000	180
3	17,000	380	8,500	200
Depth of cut	 D:Dia.			

1) When cutting a very hard work material, reduce the feed rate.
2) The revolution can be increased by using a high speed spindle.
3) When operating in vertical feed, use one third the standard feed rate given in the table above.

DC-2SB-NF

Ball Nose, Short, 2 flute, For Non-ferrous material

DC-2MB-NF

Ball Nose, Medium, 2 flute, For Non-ferrous material

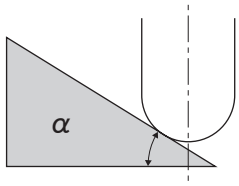
Work material	Graphite							
R (mm)	Roughing				Finishing			
	α≤15°		α>15°		α≤15°		α>15°	
	Revolution (min⁻¹)	Feed rate (mm/min)	Revolution (min⁻¹)	Feed rate (mm/min)	Revolution (min⁻¹)	Feed rate (mm/min)	Revolution (min⁻¹)	Feed rate (mm/min)
R0.5	20,000	400	20,000	380	20,000	600	20,000	520
R1	20,000	480	20,000	440	20,000	700	20,000	600
R2	18,500	930	14,500	640	20,000	1,400	20,000	1,200
R3	13,000	1,010	10,000	700	20,000	2,200	15,000	1,500
R4	10,000	1,260	8,000	800	15,000	2,700	11,000	1,500
R5	8,000	1,260	6,500	820	13,000	2,900	9,000	1,500
R6	6,600	1,160	5,300	740	10,000	2,500	7,200	1,500
Depth of cut	≤0.5R ≤0.2R				≤0.1R ≤0.06R			

R:Radius

Work material	Copper, Pure copper							
R (mm)	Roughing				Finishing			
	α≤15°		α>15°		α≤15°		α>15°	
	Revolution (min⁻¹)	Feed rate (mm/min)	Revolution (min⁻¹)	Feed rate (mm/min)	Revolution (min⁻¹)	Feed rate (mm/min)	Revolution (min⁻¹)	Feed rate (mm/min)
R0.5	20,000	360	20,000	320	20,000	480	20,000	400
R1	18,000	360	16,000	290	20,000	600	20,000	450
R2	11,100	440	9,200	330	17,000	900	13,000	550
R3	7,700	480	6,400	360	13,000	1,000	10,000	600
R4	6,000	600	4,800	380	10,000	1,300	7,500	700
R5	4,800	600	3,800	450	8,000	1,400	6,000	800
R6	4,000	560	3,200	410	6,600	1,400	5,000	800
Depth of cut	≤0.5R ≤0.2R				≤0.1R ≤0.06R			

R:Radius

1) α is the inclination of machining surface.
2) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately. Cutting condition may be considerably different due to the overhang (milling depth), cutting stock, and machine tools.
3) Please see the above table as a standard.
4) If the depth of cut is shallow, the revolution and feed rate can be increased.



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