MITSUBISHI MATERIALS

DF
End Mill Series

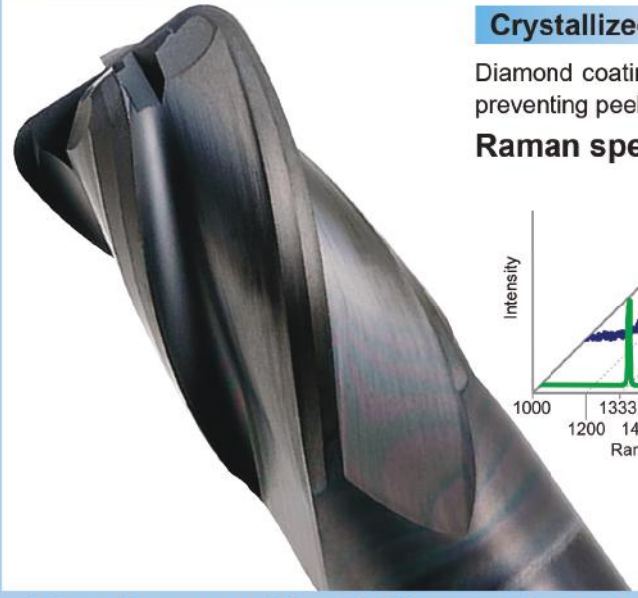
DIAMOND COATED END MILLS FOR GRAPHITE



TOOL NEWS **B179A-F**

Diamond coated end mills for graphite

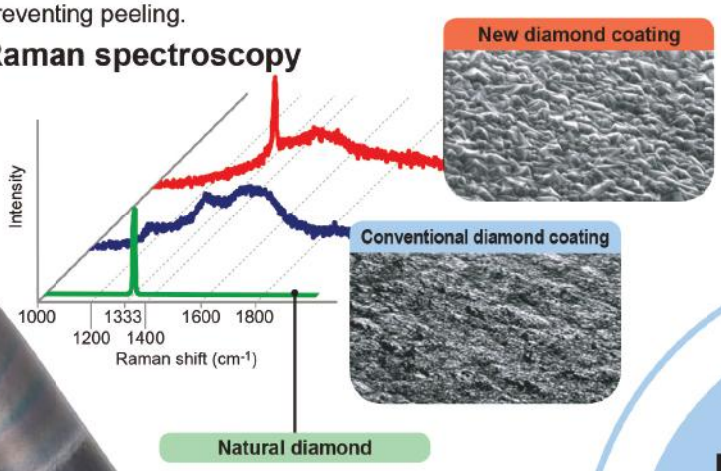
DF (Diamond Four : Fixed / Fast / Fine / First) end mill series



Crystallized diamond coating

Diamond coating is affixed to substrate ensuring long tool life and preventing peeling.

Raman spectroscopy



Fixed crystallized diamond structure

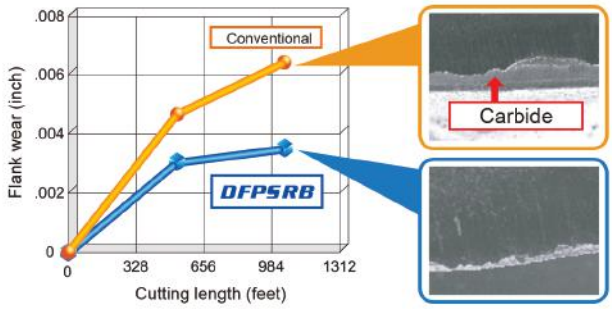
Fixed

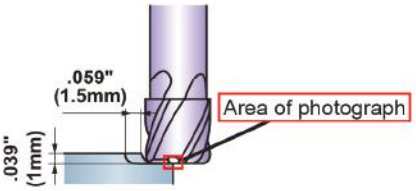
Fast, long life diamond coating

Fast

Excellent wear resistance compared to competitors end mills!

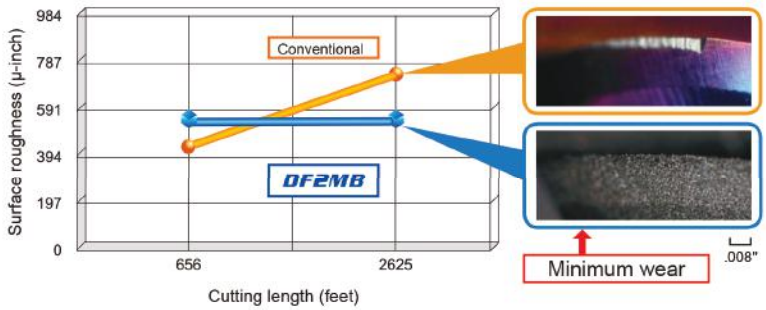
Cutting performance (DFPSRB)

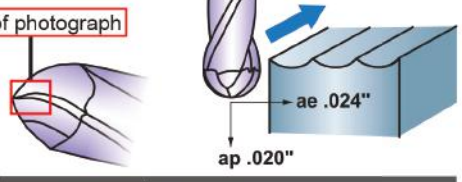




End mill	DFPSRBD0600R100N30 (ø6)
Work material	Graphite (ISO-63)
Revolution	20000min-1 (1235 SFM)
Feed rate	2500mm/min (98 IPM)
Cutting fluid	Dry

Cutting performance (DF2MB)



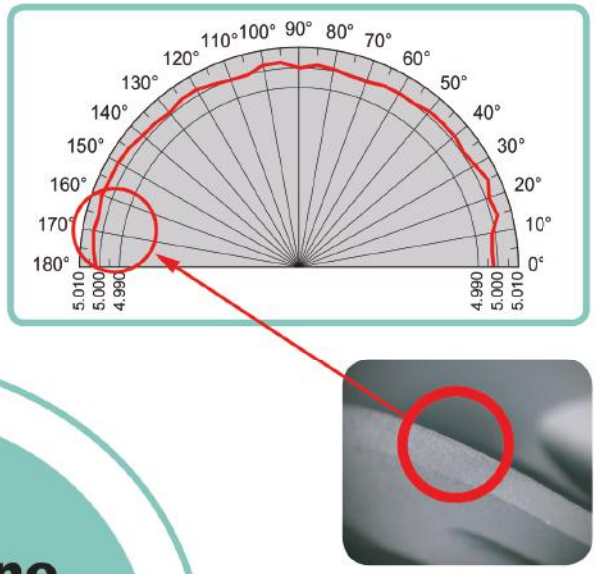


End mill	DF2MBR0300A100
Work material	Copper
Revolution	13000min-1 (440 SFM)
Feed rate	1300mm/min (51 IPM)
Cutting fluid	Wet

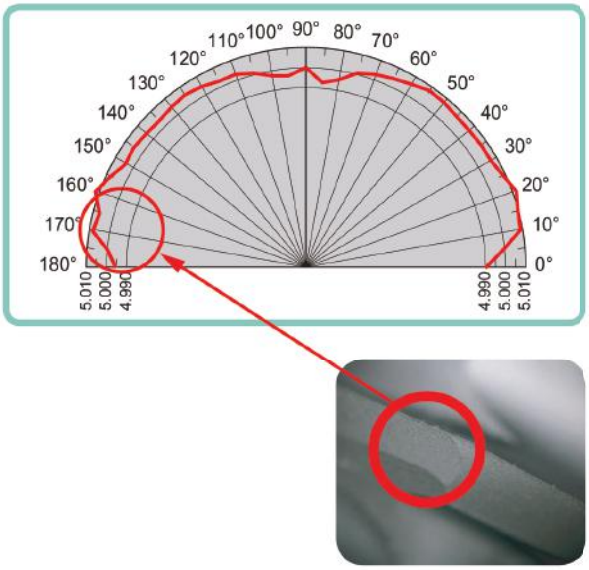
Water-soluble cutting fluid is recommended for milling copper alloys.

The seamless blend between corner radius and peripheral cutting edge ensures a good surface finish.

DF2MB (Seamless)



Conventional



Fine

Fine seamless geometry

First

First choice for graphite machining

DF2MB Expansion

Ball nose, Medium cut length, 2 flute,
For graphite

R3×100–R6×200mm

12 different sizes available

DFPSRB

Corner radius end mill, Short cut length,
2-4 flute, High precision, For graphite

ø0.5×R0.1×4–ø12×R0.5×40mm

41 different sizes available

DF4JC

End mill, Semi long cut length, 4 flute,
For graphite

ø3–ø12mm

6 different sizes available

DF2XLB Expansion

Ball nose, 2 flute, Long neck,
For graphite

R0.1×0.5–R3×12mm

52 different sizes available

DF3XB

Ball nose, 3 flute, Taper neck,
For graphite

R1×0.5°×30–R2×0.5°×100mm

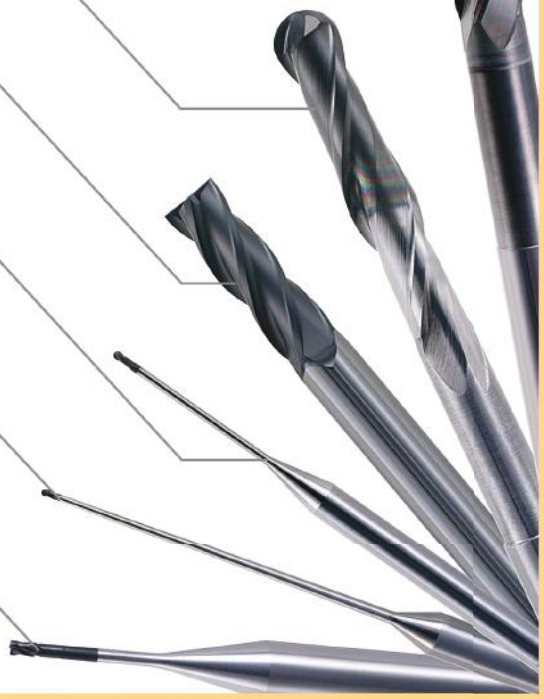
9 different sizes available

DF4XL

End mill, Long neck, 4 flute, For graphite

ø1×6–ø12×30mm

17 different sizes available



DF2XLBF

Diamond Coated End Mills for Graphites (For Finishing)

The combination of optimized cutting edges and a diamond coating greatly enhances cutting performance.

Note that excellent finished surfaces can be achieved with graphites!

End Cutting Edge Geometry



Crystallized Diamond Coating

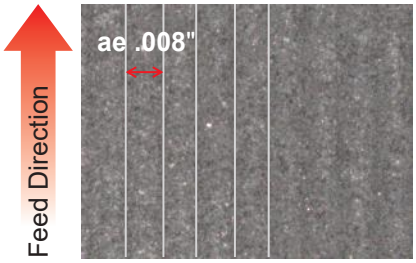
Optimization of the coating film provides even higher sharpness.



Seamless Cutting Edge

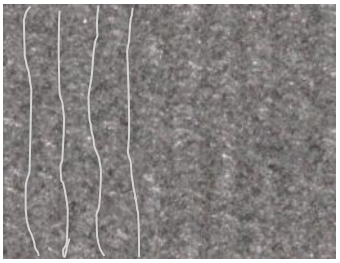
Outstanding finishes are possible even for wall surface machining using minor cutting edges.

Plane Surface Comparison (Graphite ISO-63)



DF2XLBF

The regular cutter path guarantees excellent sharpness.



Conventional

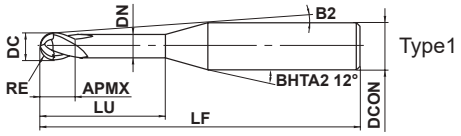
Poor sharpness can cause the cutter path to be crushed.

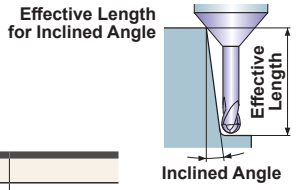
DF2XLBF (For Finishing) NEW

Ball nose, Medium cut length, 2 flute, Long neck, For graphites

Aluminum Alloy	Copper Alloy	Graphite	Zirconia (Before Sintering)	Rigid Composite Resin (Composite Resin)	Machineable Ceramics
○	◎	◎	◎	◎	○







R	0.3≤RE≤1	1.5≤RE			
	±0.005	±0.01			
h5	DCON=4				
	0 - 0.008				

Diamond coated long-neck ball end mills are ideal for finished surfaces of non-ferrous metals.

(mm)

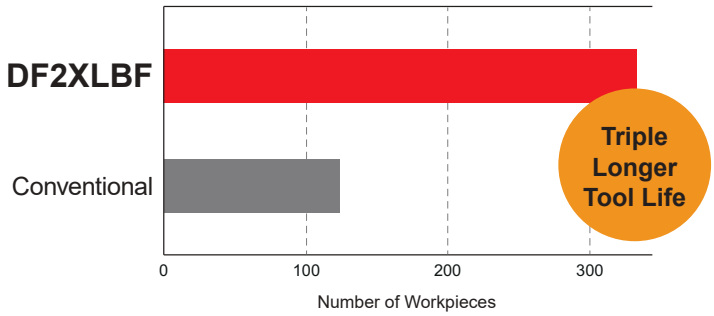
Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No.F *	Stock	Type	Effective Length for Inclined Angle			
												30'	1°	2°	3°
DF2XLBFR0030N100	0.3	0.6	0.45	10	0.57	5.5°	50	4	2	●	1	10.4	10.9	11.9	13.2
DF2XLBFR0050N120	0.5	1	1.5	12	0.86	4.6°	50	4	2	●	1	12.6	13.2	14.4	15.9
DF2XLBFR0050N160	0.5	1	1.5	16	0.86	3.8°	50	4	2	●	1	16.8	17.5	19.2	21.3
DF2XLBFR0050N200	0.5	1	1.5	20	0.86	3.2°	50	4	2	●	1	21	21.9	24	26.6
DF2XLBFR0100N160	1	2	3	16	1.86	2.9°	50	4	2	●	1	16.7	17.4	19	*
DF2XLBFR0100N200	1	2	3	20	1.86	2.4°	50	4	2	●	1	20.9	21.8	23.9	*
DF2XLBFR0150N160	1.5	3	4.5	16	2.86	1.7°	50	4	2	●	1	16.7	17.3	18.9	20.8
DF2XLBFR0150N200	1.5	3	4.5	20	2.86	1.4°	50	4	2	●	1	20.8	21.7	23.7	26.1

* Number of Flutes

* No Interference

Application Example

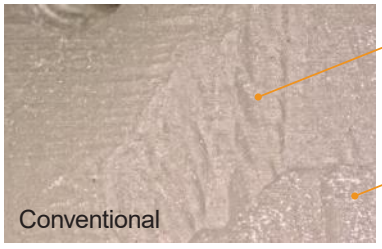
Tool Life Comparison (Reference Surface Roughness)



Comparison of Surface Roughness



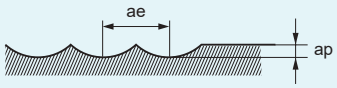


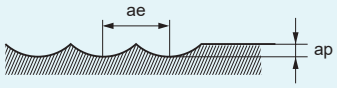


● : USA Stock

Recommended Cutting Conditions

(mm)

Work Material			Graphite				Zirconia (Before Sintering)			
DC	RE	LU	n (min^{-1})	vf (mm/min)	ap	ae	n (min^{-1})	vf (mm/min)	ap	ae
0.6	R0.3	10	35000	1000	0.05	0.015	26000	600	0.06	0.03
1	R0.5	10	40000	2000	0.10	0.200	26000	600	0.10	0.05
		16	35000	1500	0.09	0.200	26000	600	0.08	0.04
		20	30000	1100	0.08	0.200	26000	600	0.08	0.04
2	R1	16	30000	2000	0.20	0.500	18000	1400	0.06	0.80
		20	30000	2000	0.20	0.500	18000	1200	0.50	0.60
3	R1.5	16	28000	3000	0.30	0.900	15000	1600	0.90	0.90
		20	25000	2500	0.20	0.900	15000	1400	0.60	0.80
Depth of Cut										

Work Material			Copper, Copper Alloys				Rigid Composite Resin (Composite Resin)			
DC	RE	LU	n (min^{-1})	vf (mm/min)	ap	ae	n (min^{-1})	vf (mm/min)	ap	ae
0.6	R0.3	10	30000	600	0.005	0.040	28000	450	0.050	0.050
1	R0.5	10	33000	1400	0.010	0.100	25000	900	0.100	0.100
		16	25000	800	0.007	0.080	25000	700	0.080	0.080
		20	20000	500	0.005	0.050	25000	600	0.080	0.080
2	R1	16	30000	1800	0.050	0.200	25000	2100	0.800	0.800
		20	20000	1200	0.040	0.200	25000	1800	0.500	0.500
3	R1.5	16	28000	3000	0.300	0.300	25000	2400	1.000	1.000
		20	25000	2500	0.200	0.300	25000	2100	0.800	0.800
Depth of Cut										

(Note 1) When high machining accuracy is needed, or the work materials becomes chipped, we recommend lowering the revolution and the feed rate.

(Note 2) If the rigidity of the machine or the work materials installation is very low, or chattering and noise are generated, reduce the revolution and the feed rate proportionately.

(Note 3) When drying and machining work materials that contain resin, be careful of tool breakage and mechanical problems (as there is a possibility of blockage caused by cutting chips).

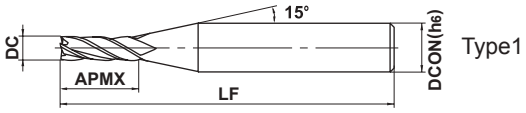
(Note 4) Use a milling machine dedicated for graphites.

DF4JC

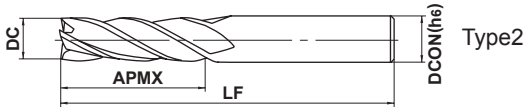
End mill, Semi long cut length, 4 flute, For graphite

Aluminum Alloy	Copper	Graphite	GFRP CFRP	Machineable Ceramics
○	◎	◎	○	○





Type1



Type2

3≤DC≤12				
0 - 0.02				
DCON=6	8≤DCON≤10	DCON=12		
0 - 0.008	0 - 0.009	0 - 0.011		

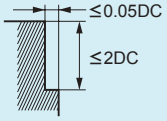
h6

● 4 flute end mill with original diamond coating for graphite machining.

Unit : mm

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
DF4JCD0300	3	12	60	6	4	★	1
DF4JCD0400	4	16	60	6	4	★	1
DF4JCD0600	6	24	60	6	4	★	2
DF4JCD0800	8	28	70	8	4	★	2
DF4JCD1000	10	35	90	10	4	★	2
DF4JCD1200	12	36	110	12	4	★	2

RECOMMENDED CUTTING CONDITIONS

Work material	Graphite					Copper, Copper alloys				
DC (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Width of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Width of cut (mm)
3	22000	2500	98.4	6	0.15	10600	280	11.0	6	0.15
4	18000	2900	114.2	8	0.2	8000	330	13.0	8	0.2
6	14000	3200	126.0	12	0.3	6400	380	15.0	12	0.3
8	10500	2900	114.2	16	0.4	4000	420	16.5	16	0.4
10	8700	2600	102.4	20	0.5	3200	460	18.1	20	0.5
12	7200	2200	86.6	24	0.6	2700	460	18.1	24	0.6
Depth of cut										

1) When high machining accuracy is needed, or work piece becomes chipped, we recommend lowering feed rate.
2) Use a milling machine dedicated for graphite.
3) If rigidity of machine or work materials installation is very low, or chattering and noise are generated, reduce revolution and feed rate proportionately.

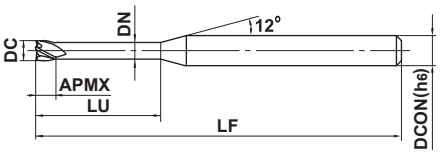
DF4XL

End mill, Long neck, 4 flute, For graphite

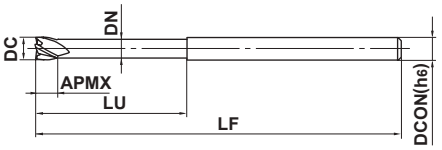


Aluminum Alloy	Copper	Graphite	GFRP CFRP	Machineable Ceramics
○	◎	◎	○	○





Type1



Type2

h6	1≤DC≤12				
	0 - 0.02				
	4≤DCON≤6	8≤DCON≤10	DCON=12		
	0 - 0.008	0 - 0.009	0 - 0.011		

● 4 flute long neck end mill with original diamond coating for graphite machining.

Unit : mm

Order Number	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
DF4XLD0100N060	1	1.5	6	0.94	50	4	4	★	1
DF4XL**D0100N080**	1	1.5	8	0.94	50	4	4	★	1
DF4XL**D0100N100**	1	1.5	10	0.94	50	4	4	★	1
DF4XL**D0150N100**	1.5	2.3	10	1.44	60	4	4	★	1
DF4XL**D0150N160**	1.5	2.3	16	1.44	60	4	4	★	1
DF4XL**D0200N100**	2	3	10	1.9	60	4	4	★	1
DF4XL**D0200N160**	2	3	16	1.9	60	4	4	★	1
DF4XL**D0200N200**	2	3	20	1.9	60	4	4	★	1
DF4XL**D0300N160**	3	4.5	16	2.9	70	4	4	★	1
DF4XL**D0300N200**	3	4.5	20	2.9	70	4	4	★	1
DF4XL**D0300N300**	3	4.5	30	2.9	70	4	4	★	1
DF4XL**D0400N200**	4	6	20	3.9	80	4	4	★	2
DF4XL**D0400N400**	4	6	40	3.9	80	4	4	★	2
DF4XL**D0600N300**	6	9	30	5.85	70	6	4	★	2
DF4XL**D0800N300**	8	12	30	7.85	90	8	4	★	2
DF4XL**D1000N300**	10	15	30	9.7	90	10	4	★	2
DF4XL**D1200N300**	12	18	30	11.7	110	12	4	★	2

DF4XL

End mill, Long neck, 4 flute, For graphite

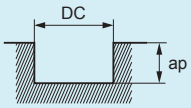
RECOMMENDED CUTTING CONDITIONS

Shoulder milling

Work material		Graphite					Copper, Copper alloys				
DC (mm)	LU (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Width of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Width of cut (mm)
1	6	30000	1300	51.2	1	0.05	30000	1300	51.2	1	0.05
	8	25000	1000	39.4	1	0.05	25000	1000	39.4	1	0.05
	10	22000	700	27.6	1	0.05	22000	700	27.6	1	0.05
1.5	10	25000	1200	47.2	2	0.075	21000	1000	39.4	1.5	0.075
	16	18000	800	31.5	1.5	0.075	18000	800	31.5	1.5	0.075
2	10	22000	1500	59.1	2	0.1	16000	1100	43.3	2	0.1
	16	19000	1100	43.3	2	0.1	16000	930	36.6	2	0.1
	20	16000	800	31.5	2	0.1	16000	800	31.5	2	0.1
3	16	21000	1900	74.8	3	0.15	10600	960	37.8	3	0.15
	20	18000	1500	59.1	3	0.15	10600	890	35.0	3	0.15
	30	14000	1000	39.4	3	0.15	10600	760	29.9	3	0.15
4	20	18000	2400	94.5	4	0.4	8000	1100	43.3	4	0.4
	40	13000	1500	59.1	4	0.4	8000	920	36.2	4	0.4
6	30	14000	3200	126.0	6	0.6	5300	1200	47.2	6	0.6
8	30	10500	2900	114.2	8	0.8	4000	1100	43.3	8	0.8
10	30	8700	2600	102.4	10	1.0	3200	960	37.8	10	1.0
12	30	7200	2200	86.6	12	1.2	2650	800	31.5	12	1.2
Depth of cut		≤0.05DC (DC＜φ4) ≤0.1DC (φ4≤DC) ≤DC									

1) When high machining accuracy is needed, or work piece becomes chipped, we recommend lowering feed rate.
2) Use a milling machine dedicated for graphite.
3) If rigidity of machine or work materials installation is very low, or chattering and noise are generated, reduce revolution and feed rate proportionately.

Slotting

Work material		Graphite				Copper, Copper alloys			
DC (mm)	LU (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)
1	6	30000	1000	39.4	0.1	30000	980	38.6	0.1
	8	25000	700	27.6	0.08	25000	700	27.6	0.08
	10	22000	500	19.7	0.06	22000	500	19.7	0.06
1.5	10	25000	1100	43.3	0.14	21000	750	29.5	0.14
	16	18000	600	23.6	0.1	18000	600	23.6	0.1
2	10	22000	1200	47.2	0.2	16000	820	32.3	0.2
	16	19000	800	31.5	0.16	16000	700	27.6	0.16
	20	16000	600	23.6	0.12	16000	600	23.6	0.12
3	16	21000	1400	55.1	0.3	10600	720	28.3	0.3
	20	18000	1100	43.3	0.25	10600	670	26.4	0.25
	30	14000	700	27.6	0.2	10600	570	22.4	0.2
4	20	18000	1800	70.9	0.5	8000	820	32.3	0.5
	40	13000	900	35.4	0.4	8000	690	27.2	0.4
6	30	14000	2300	90.6	1.2	5300	900	35.4	1.2
8	30	10500	2000	78.7	2.0	4000	820	32.3	2.0
10	30	8700	1900	74.8	3.0	3200	720	28.3	3.0
12	30	7200	1700	66.9	4.0	2650	600	23.6	4.0
Depth of cut									

1) When high machining accuracy is needed, or work piece becomes chipped, we recommend lowering feed rate.
2) Use a milling machine dedicated for graphite.
3) If rigidity of machine or work materials installation is very low, or chattering and noise are generated, reduce revolution and feed rate proportionately.

DIAMOND COATED END MILLS

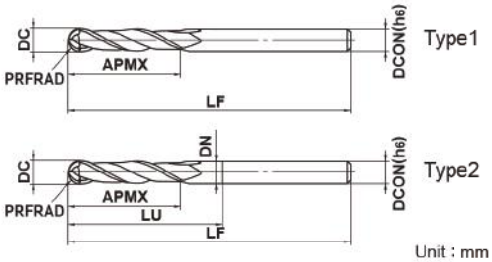
DF2MB

Ball nose, Medium cut length, 2 flute, For graphite

Aluminum Alloy	Copper	Graphite	GFRP CFRP	Machineable Ceramics
○	◎	◎	○	○



R	3≤PRFRAD≤6				
	±0.01				
h6	DCON=6	8≤DCON≤10	DCON=12		
	0 - 0.008	0 - 0.009	0 - 0.011		

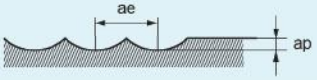


2 flute ball nose end mill with original diamond coating for graphite machining.

Unit : mm

	Order Number	PRFRAD	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
NEW	DF2MBR0300	3	6	30	—	—	100	6	2	★	1
	DF2MBR0300A100	3	6	30	50	5.85	100	6	2	★	2
	DF2MBR0300A150	3	6	30	50	5.85	150	6	2	★	2
NEW	DF2MBR0300N100A150	3	6	30	100	5.85	150	6	2	★	2
	DF2MBR0400A110	4	8	40	60	7.85	110	8	2	★	2
	DF2MBR0400A150	4	8	40	60	7.85	150	8	2	★	2
	DF2MBR0500A120	5	10	50	70	9.7	120	10	2	★	2
	DF2MBR0500A180	5	10	50	70	9.7	180	10	2	★	2
NEW	DF2MBR0500N140A180	5	10	50	140	9.7	180	10	2	★	2
	DF2MBR0600A130	6	12	55	75	11.7	130	12	2	★	2
	DF2MBR0600A200	6	12	55	75	11.7	200	12	2	★	2
NEW	DF2MBR0600N150A200	6	12	55	150	11.7	200	12	2	★	2

RECOMMENDED CUTTING CONDITIONS

Work material		Graphite					Copper, Copper alloys				
PRFRAD (mm)	LF (mm)	Revolution (min⁻¹)	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Width of cut (mm)	Revolution (min⁻¹)	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Width of cut (mm)
R3	100	16000	1900	74.8	0.6	1.5	16000	1500	59.1	0.6	1.5
	150	12000	1200	47.2	0.4	1.2	12000	960	37.8	0.4	1.2
R4	110	12000	2000	78.7	0.8	2.0	12000	1600	63	0.8	2.0
	150	9200	1400	55.1	0.6	1.6	9200	1100	43.3	0.6	1.6
R5	120	9500	2200	86.6	1.0	2.5	9500	1800	70.9	1.0	2.5
	180	7300	1500	59.1	0.8	2.0	7300	1200	47.2	0.8	2.0
R6	130	8000	1800	70.9	1.2	3.0	8000	1400	55.1	1.2	3.0
	200	6100	1200	47.2	1.0	2.5	6100	960	37.8	1.0	2.5
Depth of cut											

1) When high machining accuracy is needed, or work piece becomes chipped, we recommend lowering feed rate.
2) Use a milling machine dedicated for graphite.
3) If rigidity of machine or work materials installation is very low, or chattering and noise are generated, reduce revolution and feed rate proportionately.

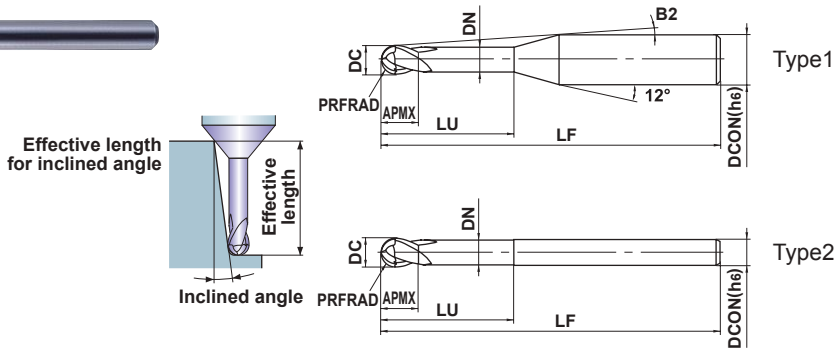
★ : Inventory maintained in Japan.

DF2XLB

Ball nose, Medium cut length, 2 flute, Long neck, For graphite

Aluminum Alloy	Copper	Graphite	GFRP CFRP	Machineable Ceramics
○	◎	◎	○	○





R	0.1≤PRFRAD≤3		
	±0.01		
h6	DCON=4,6		
	0 - 0.008		

● 2 flute long neck ball nose end mill with original diamond coating for graphite machining.

Unit : mm

Order Number	PRFRAD	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle 30'	1°	2°	3°
DF2XLBR0010N005	0.1	0.2	0.2	0.5	0.18	11.5°	50	4	2	★	1	0.5	0.5	0.6	0.7
DF2XLBR0015N020	0.15	0.3	0.3	2	0.27	9.9°	50	4	2	★	1	2.1	2.2	2.4	2.6
DF2XLBR0015N030	0.15	0.3	0.3	3	0.27	9.1°	50	4	2	★	1	3.1	3.2	3.6	3.9
DF2XLBR0020N010	0.2	0.4	0.6	1	0.36	11.0°	50	4	2	★	1	1.0	1.0	1.1	1.2
DF2XLBR0020N020	0.2	0.4	0.6	2	0.36	10.0°	50	4	2	★	1	2.0	2.1	2.3	2.6
DF2XLBR0020N030	0.2	0.4	0.6	3	0.36	9.1°	50	4	2	★	1	3.1	3.2	3.5	3.9
DF2XLBR0020N040	0.2	0.4	0.6	4	0.36	8.4°	60	4	2	★	1	4.1	4.3	4.7	5.2
DF2XLBR0020N080	0.2	0.4	0.6	8	0.36	6.4°	60	4	2	★	1	8.3	8.7	9.5	10.5
DF2XLBR0020N120	0.2	0.4	0.6	12	0.36	5.1°	60	4	2	★	1	12.5	13.0	14.3	15.8
DF2XLBR0025N040	0.25	0.5	0.6	4	0.46	8.3°	60	4	2	★	1	4.1	4.3	4.7	5.2
DF2XLBR0025N050	0.25	0.5	0.6	5	0.46	7.7°	60	4	2	★	1	5.2	5.4	5.9	6.5
DF2XLBR0025N080	0.25	0.5	0.6	8	0.46	6.3°	60	4	2	★	1	8.3	8.7	9.5	10.5
DF2XLBR0030N020	0.3	0.6	0.9	2	0.56	9.9°	60	4	2	★	1	2.1	2.2	2.4	2.6
DF2XLBR0030N040	0.3	0.6	0.9	4	0.56	8.3°	60	4	2	★	1	4.2	4.4	4.8	5.2
DF2XLBR0030N050	0.3	0.6	0.9	5	0.56	7.6°	60	4	2	★	1	5.2	5.4	6.0	6.6
DF2XLBR0030N060	0.3	0.6	0.9	6	0.56	7.1°	60	4	2	★	1	6.3	6.5	7.1	7.9
DF2XLBR0030N080	0.3	0.6	0.9	8	0.56	6.2°	60	4	2	★	1	8.3	8.7	9.5	10.6
DF2XLBR0030N100	0.3	0.6	0.9	10	0.56	5.5°	60	4	2	★	1	10.4	10.9	11.9	13.2
DF2XLBR0030N160	0.3	0.6	0.9	16	0.56	4.1°	60	4	2	★	1	16.7	17.4	19.1	21.2
DF2XLBR0040N060	0.4	0.8	1.2	6	0.76	7.0°	60	4	2	★	1	6.3	6.5	7.1	7.9
DF2XLBR0040N080	0.4	0.8	1.2	8	0.76	6.1°	60	4	2	★	1	8.3	8.7	9.5	10.5
DF2XLBR0050N040	0.5	1	1.5	4	0.94	8.0°	60	4	2	★	1	4.2	4.4	4.8	5.3
DF2XLBR0050N060	0.5	1	1.5	6	0.94	6.8°	60	4	2	★	1	6.3	6.6	7.2	8.0
DF2XLBR0050N080	0.5	1	1.5	8	0.94	5.9°	60	4	2	★	1	8.4	8.8	9.6	10.6
DF2XLBR0050N100	0.5	1	1.5	10	0.94	5.2°	60	4	2	★	1	10.5	11.0	12.0	13.3
DF2XLBR0050N120	0.5	1	1.5	12	0.94	4.6°	60	4	2	★	1	12.6	13.2	14.4	15.9
DF2XLBR0050N200	0.5	1	1.5	20	0.94	3.3°	80	4	2	★	1	21.0	21.9	24.0	26.6
DF2XLBR0050N300	0.5	1	1.5	30	0.94	2.4°	80	4	2	★	1	31.4	32.8	36.0	*
DF2XLBR0050N400	0.5	1	1.5	40	0.94	1.9°	80	4	2	★	1	41.8	43.7	*	*
DF2XLBR0075N080	0.75	1.5	2.3	8	1.44	5.4°	60	4	2	★	1	8.4	8.8	9.6	10.6
DF2XLBR0075N100	0.75	1.5	2.3	10	1.44	4.7°	60	4	2	★	1	10.5	11.0	12.0	13.2

★ : Inventory maintained in Japan.

* No interference

Unit : mm

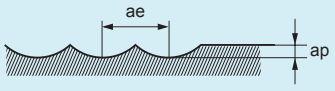
Order Number	PRFRAD	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												30'	1°	2°	3°
DF2XLBR0075N160	0.75	1.5	2.3	16	1.44	3.4°	80	4	2	★	1	16.8	17.5	19.2	21.2
DF2XLBR0075N300	0.75	1.5	2.3	30	1.44	2.1°	80	4	2	★	1	31.4	32.8	35.9	*
NEW **DF2XLBR0075N400**	0.75	1.5	2.3	40	1.44	1.6°	80	4	2	★	1	41.8	43.7	*	*
DF2XLBR0100N080	1	2	3	8	1.9	4.9°	60	4	2	★	1	8.3	8.7	9.4	10.4
DF2XLBR0100N100	1	2	3	10	1.9	4.2°	60	4	2	★	1	10.4	10.9	11.8	13.0
DF2XLBR0100N120	1	2	3	12	1.9	3.7°	60	4	2	★	1	12.5	13.0	14.2	15.7
DF2XLBR0100N160	1	2	3	16	1.9	2.9°	80	4	2	★	1	16.7	17.4	19.0	*
DF2XLBR0100N200	1	2	3	20	1.9	2.5°	80	4	2	★	1	20.9	21.8	23.8	*
DF2XLBR0100N250	1	2	3	25	1.9	2.0°	80	4	2	★	1	26.1	27.2	*	*
DF2XLBR0100N400	1	2	3	40	1.9	1.4°	100	4	2	★	1	41.7	43.5	*	*
DF2XLBR0100N600	1	2	3	60	1.9	0.9°	100	4	2	★	1	62.6	*	*	*
DF2XLBR0150N160	1.5	3	4.5	16	2.9	1.7°	80	4	2	★	1	16.7	17.3	*	*
DF2XLBR0150N250	1.5	3	4.5	25	2.9	1.2°	80	4	2	★	1	26.1	27.2	*	*
DF2XLBR0150N400	1.5	3	4.5	40	2.9	0.7°	100	4	2	★	1	41.7	*	*	*
DF2XLBR0150N600	1.5	3	4.5	60	2.9	0.5°	100	4	2	★	1	*	*	*	*
DF2XLBR0200N080	2	4	6	8	3.9	—	80	4	2	★	2	*	*	*	*
DF2XLBR0200N200	2	4	6	20	3.9	—	80	4	2	★	2	*	*	*	*
DF2XLBR0200N300	2	4	6	30	3.9	—	80	4	2	★	2	*	*	*	*
DF2XLBR0200N400	2	4	6	40	3.9	—	100	4	2	★	2	*	*	*	*
DF2XLBR0200N600	2	4	6	60	3.9	—	100	4	2	★	2	*	*	*	*
DF2XLBR0300N120	3	6	9	12	5.85	—	100	6	2	★	2	*	*	*	*

* No interference

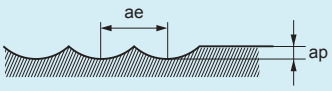
DF2XLB

Ball nose, Medium cut length, 2 flute, Long neck, For graphite

RECOMMENDED CUTTING CONDITIONS

Work material		Graphite					Copper, Copper alloys				
PRFRAD (mm)	LU (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Width of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Width of cut (mm)
R0.1	0.5	40000	800	31.5	0.01	0.03	40000	800	31.5	0.003	0.02
R0.15	2	40000	1200	47.2	0.03	0.08	40000	800	31.5	0.003	0.03
	3	40000	1200	47.2	0.03	0.08	40000	600	23.6	0.002	0.03
R0.2	1	40000	1500	59.1	0.05	0.15	40000	2000	78.7	0.015	0.04
	2	40000	1500	59.1	0.05	0.12	40000	1300	51.2	0.01	0.04
	3	40000	1300	51.2	0.04	0.12	40000	800	31.5	0.005	0.04
	4	40000	1300	51.2	0.04	0.1	32000	600	23.6	0.004	0.04
	8	30000	800	31.5	0.03	0.1	—	—	—	—	—
	12	20000	450	17.7	0.03	0.08	—	—	—	—	—
R0.25	4	40000	1500	59.1	0.05	0.15	40000	800	31.5	0.01	0.05
	5	38000	1300	51.2	0.05	0.15	36000	700	27.6	0.008	0.05
	8	30000	1000	39.4	0.04	0.12	28000	500	19.7	0.002	0.05
R0.3	2	40000	1800	70.9	0.07	0.2	40000	1500	59.1	0.03	0.06
	4	40000	1500	59.1	0.06	0.18	40000	1200	47.2	0.02	0.06
	5	40000	1500	59.1	0.06	0.17	40000	1100	43.3	0.015	0.06
	6	40000	1500	59.1	0.06	0.15	40000	1000	39.4	0.008	0.06
	8	37000	1200	47.2	0.05	0.15	35000	800	31.5	0.005	0.06
	10	35000	1000	39.4	0.05	0.15	—	—	—	—	—
	16	22000	530	20.9	0.04	0.12	—	—	—	—	—
R0.4	6	40000	1700	66.9	0.08	0.2	40000	1500	59.1	0.02	0.08
	8	40000	1700	66.9	0.08	0.15	30000	1200	47.2	0.008	0.08
R0.5	4	40000	2500	98.4	0.12	0.3	40000	2000	78.7	0.05	0.1
	6	40000	2500	98.4	0.1	0.3	40000	2000	78.7	0.03	0.1
	8	40000	2000	78.7	0.1	0.25	40000	1800	70.9	0.02	0.1
	10	40000	2000	78.7	0.1	0.2	33000	1400	55.1	0.01	0.1
	12	40000	2000	78.7	0.1	0.2	30000	1000	39.4	0.007	0.1
	20	30000	1100	43.3	0.08	0.2	—	—	—	—	—
	30	20000	600	23.6	0.06	0.15	—	—	—	—	—
	40	15000	400	15.7	0.04	0.12	—	—	—	—	—
Depth of cut											

1) When high machining accuracy is needed, or work piece becomes chipped, we recommend lowering feed rate.
2) Use a milling machine dedicated for graphite.
3) If rigidity of machine or work materials installation is very low, or chattering and noise are generated, reduce revolution and feed rate proportionately.

Work material		Graphite					Copper, Copper alloys				
PRFRAD (mm)	LU (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Width of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Width of cut (mm)
R0.75	8	40000	2800	110.2	0.15	0.45	40000	2400	94.5	0.07	0.15
	10	40000	2800	110.2	0.15	0.45	32000	1800	70.9	0.05	0.15
	16	35000	2000	78.7	0.15	0.3	20000	900	35.4	0.03	0.15
	30	27000	1000	39.4	0.1	0.3	—	—	—	—	—
	40	21000	700	27.6	0.08	0.25	—	—	—	—	—
R1	8	40000	3000	118.1	0.23	0.7	40000	3000	118.1	0.1	0.2
	10	40000	3000	118.1	0.2	0.6	40000	2800	110.2	0.08	0.2
	12	35000	2500	98.4	0.2	0.6	35000	2300	90.6	0.08	0.2
	16	30000	2000	78.7	0.2	0.5	30000	1800	70.9	0.05	0.2
	20	30000	2000	78.7	0.2	0.5	20000	1200	47.2	0.04	0.2
	25	25000	1500	59.1	0.18	0.45	20000	1000	39.4	0.03	0.2
	40	20000	1000	39.4	0.15	0.4	—	—	—	—	—
	60	15000	500	19.7	0.1	0.3	—	—	—	—	—
R1.5	16	28000	3000	118.1	0.3	0.9	28000	3000	118.1	0.3	0.3
	25	20000	2000	78.7	0.25	0.75	20000	2000	78.7	0.25	0.3
	40	16000	1500	59.1	0.2	0.6	16000	1500	59.1	0.2	0.3
	60	14000	1000	39.4	0.17	0.45	—	—	—	—	—
R2	8	24000	3800	149.6	0.5	1.5	24000	3800	149.6	0.5	0.4
	20	21000	3300	129.9	0.5	1.5	21000	3300	129.9	0.4	0.4
	30	15000	2000	78.7	0.4	1.2	15000	2000	78.7	0.3	0.4
	40	13000	1600	63.0	0.35	1.0	13000	1600	63.0	0.25	0.4
	60	12000	1400	55.1	0.3	0.9	12000	1400	55.1	0.2	0.4
R3	12	17000	2800	110.2	0.6	2.0	17000	2800	110.2	0.6	0.6
Depth of cut											

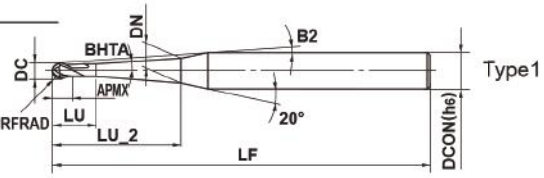
1) When high machining accuracy is needed, or work piece becomes chipped, we recommend lowering feed rate.
2) Use a milling machine dedicated for graphite.
3) If rigidity of machine or work materials installation is very low, or chattering and noise are generated, reduce revolution and feed rate proportionately.

DF3XB

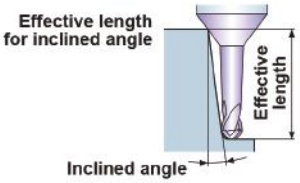
Ball nose, Medium cut length, 3 flute, Taper neck, For graphite

Aluminum Alloy	Copper	Graphite	GFRP CFRP	Machineable Ceramics
○	◎	◎	○	○





R	0.5≤PRFRAD≤2				
	±0.01				
h6	DCON=6				
	0 / - 0.008				



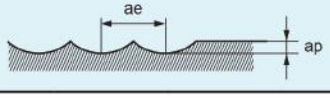
● 3 flute taper neck ball nose end mill with original diamond coating for graphite machining.

Unit : mm

Order Number	PRFRAD	DC	BHTA	APMX	LU_2	LU	B2	DN	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle 30'	1°	2°	3°
DF3XBR0050L030	0.5	1	0.5°	1.5	30	3	4°	1.42	100	6	3	★	1	30.4	32.1	32.8	34.6
DF3XB**R0050L040**	0.5	1	0.5°	1.5	40	3	3.2°	1.60	100	6	3	★	1	40.4	41.4	43.6	46.0
DF3XB**R0050L050**	0.5	1	0.5°	1.5	50	3	2.6°	1.77	100	6	3	★	1	50.4	51.7	54.4	*
DF3XB**R0100L040**	1	2	0.5°	3	40	5	2.6°	2.52	100	6	3	★	1	40.7	41.7	43.9	*
DF3XB**R0100L060**	1	2	0.5°	3	60	5	1.8°	2.86	130	6	3	★	1	60.7	62.2	*	*
DF3XB**R0100L080**	1	2	0.5°	3	80	5	1.4°	3.21	130	6	3	★	1	80.7	82.7	*	*
DF3XB**R0150L060**	1.5	3	0.5°	4.5	60	7.5	1.4°	3.82	130	6	3	★	1	60.8	62.2	*	*
DF3XB**R0150L080**	1.5	3	0.5°	4.5	80	7.5	1.1°	4.17	130	6	3	★	1	80.8	82.8	*	*
DF3XB**R0200L100**	2	4	0.5°	6	100	9	0.6°	5.49	160	6	3	★	1	100.8	*	*	*

* No interference

RECOMMENDED CUTTING CONDITIONS

Work material		Graphite					Copper, Copper alloys				
PRFRAD (mm)	LU_2 (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Width of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Width of cut (mm)
R0.5	**30**	20000	1100	43.3	0.05	0.13	16000	700	27.6	0.04	0.13
	40	15000	750	29.5	0.04	0.11	12000	480	18.9	0.03	0.11
	50	12000	500	19.7	0.03	0.10	9600	320	12.6	0.02	0.10
R1	**40**	20000	1800	70.9	0.13	0.40	16000	1100	43.3	0.10	0.40
	60	15000	900	35.4	0.09	0.27	12000	580	22.8	0.07	0.27
	80	12000	600	23.6	0.07	0.20	9600	380	15	0.06	0.20
R1.5	**60**	14000	1700	66.9	0.15	0.45	11000	1100	43.3	0.12	0.45
	80	12000	1200	47.2	0.12	0.35	9600	770	30.3	0.10	0.35
R2	**100**	10000	1100	43.3	0.20	0.50	8000	700	27.6	0.16	0.50
Depth of cut											

1) When high machining accuracy is needed, or work piece becomes chipped, we recommend lowering feed rate.
2) Use a milling machine dedicated for graphite.
3) If rigidity of machine or work materials installation is very low, or chattering and noise are generated, reduce revolution and feed rate proportionately.

★ : Inventory maintained in Japan.

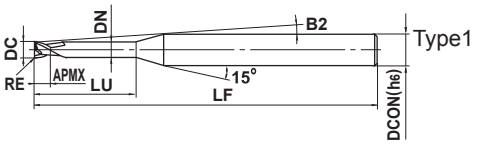
DFPSRB

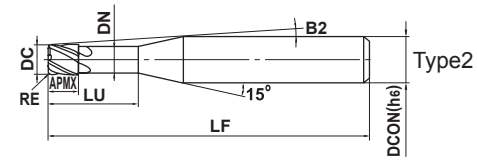
Corner radius end mill, Short cut length, 2-4 flute, High precision, For graphite

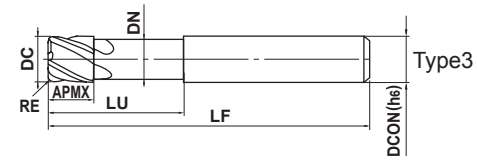
UWC DF 30° DC≤1.5 DC≥2

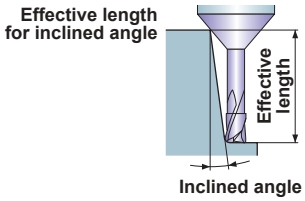
Aluminum Alloy	Copper	Graphite	GFRP CFRP	Machineable Ceramics
○	◎	◎	○	○











R	0.1≤RE≤1			
	±0.01			
	0.5≤DC≤12			
	0 -0.02			
h6	4≤DCON≤6	8≤DCON≤10	DCON=12	
	0 -0.008	0 -0.009	0 -0.011	

● ±0.01mm corner radius tolerance, 0—-0.02mm outer diameter tolerance. Corner radius end mill with original diamond coating for precise and efficient graphite machining.

Unit : mm

Order Number	DC	RE	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle 30'	1°	2°	3°
DFPSRBD0050R010N04	0.5	0.1	0.75	4	0.46	9.5°	60	4	2	★	1	4.1	4.3	4.6	5.0
DFPSRBD0050R010N05	0.5	0.1	0.75	5	0.46	8.7°	60	4	2	★	1	5.2	5.4	5.7	6.2
DFPSRBD0050R010N06	0.5	0.1	0.75	6	0.46	8.0°	60	4	2	★	1	6.2	6.4	6.9	7.5
DFPSRBD0050R010N10	0.5	0.1	0.75	10	0.46	6.1°	60	4	2	★	1	10.3	10.7	11.5	12.4
DFPSRBD0050R010N15	0.5	0.1	0.75	15	0.46	4.7°	60	4	2	★	1	15.5	16.0	17.2	18.6
DFPSRBD0080R010N06	0.8	0.1	1	6	0.76	7.7°	60	4	2	★	1	6.2	6.4	6.9	7.5
DFPSRBD0080R010N08	0.8	0.1	1	8	0.76	6.6°	60	4	2	★	1	8.3	8.6	9.2	9.9
DFPSRBD0100R010N08	1	0.1	1.5	8	0.94	6.3°	60	4	2	★	1	8.5	8.8	9.5	10.2
DFPSRBD0100R010N12	1	0.1	1.5	12	0.94	4.9°	60	4	2	★	1	12.6	13.1	14.1	15.2
DFPSRBD0100R020N08	1	0.2	1.5	8	0.94	6.3°	60	4	2	★	1	8.5	8.8	9.5	10.2
DFPSRBD0100R020N12	1	0.2	1.5	12	0.94	4.9°	60	4	2	★	1	12.6	13.1	14.1	15.2
DFPSRBD0100R020N16	1	0.2	1.5	16	0.94	4.0°	70	4	2	★	1	16.8	17.4	18.7	20.2
DFPSRBD0100R020N20	1	0.2	1.5	20	0.94	3.4°	70	4	2	★	1	20.9	21.7	23.3	25.1
DFPSRBD0100R020N30	1	0.2	1.5	30	0.94	2.5°	70	4	2	★	1	31.3	32.4	34.8	*
DFPSRBD0150R020N10	1.5	0.2	2.3	10	1.44	4.9°	70	4	2	★	1	10.5	11.0	11.8	12.7
DFPSRBD0150R020N20	1.5	0.2	2.3	20	1.44	2.9°	70	4	2	★	1	20.9	21.7	23.3	*
DFPSRBD0200R010N08	2	0.1	3	8	1.9	4.9°	70	4	4	★	2	8.4	8.7	9.4	10.1
DFPSRBD0200R020N12	2	0.2	3	12	1.9	3.7°	70	4	4	★	2	12.5	13.0	14.0	15.1
DFPSRBD0200R020N16	2	0.2	3	16	1.9	2.9°	70	4	4	★	2	16.7	17.3	18.6	*
DFPSRBD0200R020N20	2	0.2	3	20	1.9	2.5°	80	4	4	★	2	20.8	21.5	23.2	*
DFPSRBD0200R020N30	2	0.2	3	30	1.9	1.7°	80	4	4	★	2	31.2	32.2	*	*
DFPSRBD0200R020N40	2	0.2	3	40	1.9	1.4°	80	4	4	★	2	41.5	42.9	*	*
DFPSRBD0200R030N08	2	0.3	3	8	1.9	5.0°	70	4	4	★	2	8.4	8.7	9.3	10.1
DFPSRBD0300R020N20	3	0.2	4.5	20	2.9	1.4°	80	4	4	★	2	20.8	21.5	*	*
DFPSRBD0300R020N40	3	0.2	4.5	40	2.9	0.7°	80	4	4	★	2	41.5	*	*	*
DFPSRBD0300R030N12	3	0.3	4.5	12	2.9	2.1°	80	4	4	★	2	12.5	13.0	13.9	*
DFPSRBD0300R050N20	3	0.5	4.5	20	2.9	1.4°	80	4	4	★	2	20.8	21.5	*	*
DFPSRBD0400R020N20	4	0.2	6	20	3.9	—	80	4	4	★	3	*	*	*	*
DFPSRBD0400R020N40	4	0.2	6	40	3.9	—	80	4	4	★	3	*	*	*	*
DFPSRBD0400R050N20	4	0.5	6	20	3.9	—	80	4	4	★	3	*	*	*	*
DFPSRBD0400R050N40	4	0.5	6	40	3.9	—	80	4	4	★	3	*	*	*	*

★ : Inventory maintained in Japan.

* No interference

Unit : mm

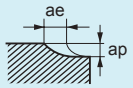
Order Number	DC	RE	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												30'	1°	2°	3°
DFPSRBD0600R010N24	6	0.1	9	24	5.85	—	90	6	4	★	3	*	*	*	*
DFPSRBD0600R030N24	6	0.3	9	24	5.85	—	90	6	4	★	3	*	*	*	*
DFPSRBD0600R050N24	6	0.5	9	24	5.85	—	90	6	4	★	3	*	*	*	*
DFPSRBD0600R050N30	6	0.5	9	30	5.85	—	90	6	4	★	3	*	*	*	*
DFPSRBD0600R100N30	6	1	9	30	5.85	—	90	6	4	★	3	*	*	*	*
DFPSRBD0800R050N30	8	0.5	12	30	7.85	—	90	8	4	★	3	*	*	*	*
DFPSRBD0800R100N30	8	1	12	30	7.85	—	90	8	4	★	3	*	*	*	*
DFPSRBD1000R050N40	10	0.5	15	40	9.7	—	130	10	4	★	3	*	*	*	*
DFPSRBD1000R100N40	10	1	15	40	9.7	—	130	10	4	★	3	*	*	*	*
DFPSRBD1200R050N40	12	0.5	18	40	11.7	—	130	12	4	★	3	*	*	*	*

* No interference

DFPSRB

Corner radius end mill, Short cut length, 2-4 flute, High precision, For graphite

RECOMMENDED CUTTING CONDITIONS

Work material			Graphite					Copper, Copper alloys				
DC (mm)	RE (mm)	LU (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Width of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Width of cut (mm)
0.5	0.1	4	30000	1100	43.3	0.05	0.23	24000	700	27.6	0.04	0.23
	0.1	5	28000	960	37.8	0.05	0.23	22000	600	23.6	0.04	0.23
	0.1	6	25000	850	33.5	0.05	0.23	20000	540	21.3	0.04	0.23
	0.1	10	22000	600	23.6	0.04	0.21	—	—	—	—	—
	0.1	15	20000	500	19.7	0.03	0.18	—	—	—	—	—
0.8	0.1	6	28000	1300	51.2	0.08	0.45	22000	830	32.7	0.06	0.45
	0.1	8	22000	900	35.4	0.08	0.45	18000	580	22.8	0.06	0.45
1	0.1	8	25000	1500	59.1	0.1	0.6	20000	960	37.8	0.08	0.6
	0.1	12	22000	1300	51.2	0.1	0.6	18000	830	32.7	0.08	0.6
	0.2	8	25000	1500	59.1	0.1	0.45	20000	960	37.8	0.08	0.45
	0.2	12	22000	1300	51.2	0.1	0.45	18000	830	32.7	0.08	0.45
	0.2	16	18000	1000	39.4	0.08	0.4	14000	640	25.2	0.06	0.4
	0.2	20	15000	800	31.5	0.08	0.4	—	—	—	—	—
	0.2	30	12000	600	23.6	0.07	0.35	—	—	—	—	—
1.5	0.2	10	18000	1400	55.1	0.15	0.8	14000	900	35.4	0.12	0.8
	0.2	20	12000	900	35.4	0.12	0.65	9600	580	22.8	0.1	0.65
2	0.1	8	24000	3300	129.9	0.2	1.2	19000	2100	82.7	0.16	1.2
	0.2	12	22000	3000	118.1	0.2	1.2	18000	1900	74.8	0.16	1.2
	0.2	16	19000	2500	98.4	0.2	1.2	15000	1600	63.0	0.16	1.2
	0.2	20	16000	2000	78.7	0.2	1.2	13000	1300	51.2	0.16	1.2
	0.2	30	13000	1600	63.0	0.16	1.0	—	—	—	—	—
	0.2	40	11000	1200	47.2	0.14	0.8	—	—	—	—	—
	0.3	8	24000	3300	129.9	0.3	1.2	19000	2100	82.7	0.24	1.2
3	0.2	20	18000	3000	118.1	0.3	2.0	14000	1900	74.8	0.24	2.0
	0.2	40	12000	1800	70.9	0.25	1.7	9600	1100	43.3	0.2	1.7
	0.5	20	18000	3000	118.1	0.3	1.5	14000	1900	74.8	0.24	1.5
	0.3	12	20000	4500	177.2	0.3	1.5	16000	2900	114.2	0.24	1.5
4	0.2	20	18000	4200	165.4	0.4	2.7	14000	2700	106.3	0.3	2.7
	0.2	40	13000	2800	110.2	0.4	2.7	10000	1800	70.9	0.3	2.7
	0.5	20	18000	4200	165.4	0.4	2.3	14000	2700	106.3	0.3	2.3
	0.5	40	13000	2800	110.2	0.4	2.3	10000	1800	70.9	0.3	2.3
6	0.1	24	14000	4600	181.1	0.6	3.8	11000	2900	114.2	0.5	3.8
	0.3	24	14000	4600	181.1	0.6	3.8	11000	2900	114.2	0.5	3.8
	0.5	24	14000	4600	181.1	0.6	3.8	11000	2900	114.2	0.5	3.8
	0.5	30	14000	4600	181.1	0.6	3.8	11000	2900	114.2	0.5	3.8
	1	30	14000	4600	181.1	0.6	3.0	11000	2900	114.2	0.5	3.0
8	0.5	30	10500	4000	157.5	0.8	5.3	8400	2600	102.4	0.6	5.3
	1	30	10500	4000	157.5	0.8	4.5	8400	2600	102.4	0.6	4.5
10	0.5	40	8700	3500	137.8	1.0	6.8	7000	2200	86.6	0.8	6.8
	1	40	8700	3500	137.8	1.0	6.0	7000	2200	86.6	0.8	6.0
12	0.5	40	7200	3000	118.1	1.2	8.0	5800	1900	74.8	1.0	8.0
Depth of cut												

1) When high machining accuracy is needed, or work piece becomes chipped, we recommend lowering feed rate.
2) Use a milling machine dedicated for graphite.
3) If rigidity of machine or work materials installation is very low, or chattering and noise are generated, reduce revolution and feed rate proportionately.

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FOR YOUR SAFETY

- Don't handle inserts and chips without gloves.
- Please machine within the recommended application range and exchange expired tools with new ones in advance of breakage.
- Please use safety covers and wear safety glasses.
- When using compounded cutting oils, please take fire precautions.
- When attaching inserts or spare parts, please use only the correct wrench or driver.
- When using rotating tools, please make a trial run to check run-out, vibration and abnormal sounds etc.

www.mmc-carbide.com/us

Tools specifications subject to change without notice.

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