7leaders™

The Art of Cutting

7leaders™

The Art of Cutting

Universal End Mills

	E172	MG Carbide	Uncoated Blank	30°	P ● H M K ○ N ● S	P3、5	
	E182 E185	MG Carbide	Uncoated Blank	30°	P ● H M K ○ N ● S	P4、5	
	E187	MG Carbide	Uncoated Blank	30°	P ● H M K ○ N ● S	P4	
	E113F	MG Carbide	TiAlN F-NaNo	35°	P ● H ● M ○ K ● N ○ S	P6	
	E102F	MG Carbide	TiAlN F-NaNo	35°	P ● H ● M ○ K ● N ○ S	P7	
	E112F	MG Carbide	TiAlN F-NaNo	35°	P ● H ● M ○ K ● N ○ S	P8	
	E122F	MG Carbide	TiAlN F-NaNo	35°	P ● H ● M ○ K ● N ○ S	P9	
	E125F E127F	MG Carbide	TiAlN F-NaNo	35°	P ● H ● M ○ K ● N ○ S	P10	
	E162X	UMG Carbide	AlTiCrN X	35°	P ● H ● M K ○ N S	P11	
	E163X	UMG Carbide	AlTiCrN X	35°	P ● H ● M K ○ N S	P11	
	E107X	MG Carbide	AlTiCrN X	30°	P ● H ● M ○ K ● N ● S	P12	

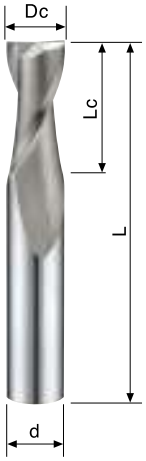
Universal End Mills

N P < 30HRC

E172-Dc

Dc h10	Lc mm	L mm	d h6	Blank E172	TiAlN E172F
0.2	0.5	38	3	●	○
0.3	0.8	38	3	●	○
0.4	1.0	38	3	●	○
0.5	1.2	38	3	●	○
0.6	1.5	38	3	●	○
0.7	1.8	38	3	●	○
0.8	2.0	38	3	●	○
0.9	2.5	38	3	●	○
1.0	3.0	38	3	●	○
1.5	5.0	38	3	●	○
2.0	6.0	38	3	●	○
2.5	7.0	38	3	●	○
3.0	9.0	38	3	●	○
3.5	12.0	50	4	●	○
4.0	14.0	50	4	●	○
4.5	14.0	50	5	●	○
5.0	16.0	50	5	●	○
5.5	16.0	50	6	●	○
6.0	20.0	63	6	●	○
6.5	20.0	63	8	●	○
7.0	20.0	63	8	●	○
7.5	20.0	63	8	●	○
8.0	20.0	63	8	●	○
8.5	22.0	72	10	●	○
9.0	22.0	72	10	●	○
9.5	22.0	72	10	●	○
10.0	22.0	72	10	●	○
11.0	26.0	75	12	●	○
12.0	26.0	75	12	●	○
13.0	32.0	89	14	●	○
14.0	32.0	89	14	●	○
15.0	32.0	89	16	●	○
16.0	32.0	89	16	●	○
17.0	38.0	100	18	●	○
18.0	38.0	100	18	●	○
20.0	38.0	100	20	●	○

○ The light color: On request, no stock



MG Carbide

Uncoated Blank

30°

2

H

90°

P	H	M	K	N	S
●			○	●	

GR.1
Vc.80-100 fz.161

GR.2 <24HRC
Vc.80-100 fz.161

GR.3 <30HRC
Vc.60-80 fz.161

GR.9
Vc.80-120 fz.161

GR.10
Vc.150-200 fz.161

GR.11
Vc.100-150 fz.161

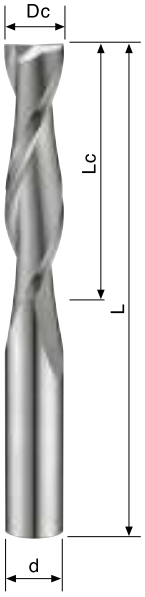
GR.12
Vc.60-80 fz.161

Universal End Mills

N P < 30HRC

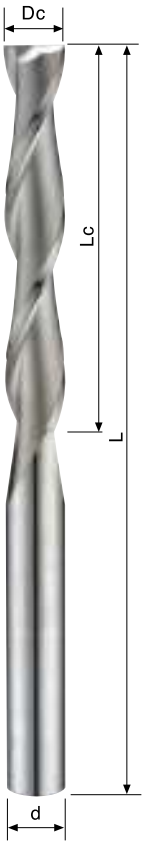
E182-Dc

Dc h10	Lc mm	L mm	d h6	Blank E182	TiAlN E182F
3	20	57	3	●	○
4	20	57	4	●	○
5	25	63	5	●	○
6	28	75	6	●	○
7	30	75	8	●	○
8	30	75	8	●	○
9	32	75	10	●	○
10	32	75	10	●	○
12	50	100	12	●	○
14	57	127	14	●	○
16	57	127	16	●	○
20	57	127	20	●	○



E185-Dc

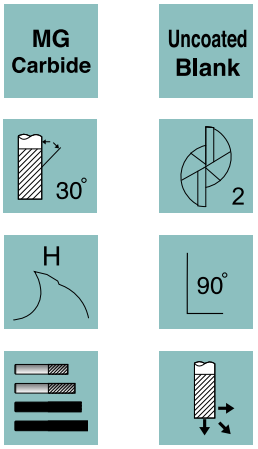
Dc h10	Lc mm	L mm	d h6	Blank E185	TiAlN E185F
3	25	75	3	●	○
4	28	75	4	●	○
5	32	75	5	●	○
6	38	100	6	●	○
8	42	100	8	●	○
10	45	100	10	●	○
12	75	150	12	●	○
14	80	150	14	●	○
16	80	150	16	●	○
20	80	150	20	●	○

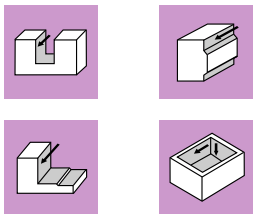


E187-Dc

Dc h10	Lc mm	L mm	d h6	Blank E187	TiAlN E187F
5	45	100	6	●	○
6	50	100	6	●	○
8	75	150	8	●	○
10	75	150	10	●	○
12	75	200	12	●	○
16	80	200	16	●	○
20	80	200	20	●	○

○ The light color: On request, no stock





P	H	M	K	N	S
●			○	●	

GR.1 Vc.60-80 fz.161

GR.2 <24HRC Vc.60-80 fz.161

GR.3 <30HRC Vc.30-60 fz.161

GR.9 Vc.60-100 fz.161

GR.10 Vc.120-150 fz.161

GR.11 Vc.80-120 fz.161

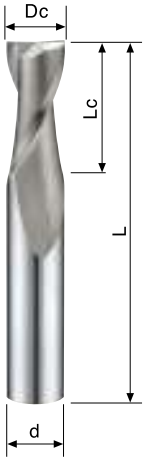
GR.12 Vc.40-60 fz.161

Universal End Mills

N P < 30HRC

E172-Dc

Dc h10	Lc Inch	L Inch	d h6	Blank E172	TiAlN E172F
1/32	3/32	1-1/2	1/8	●	○
3/64	9/64	1-1/2	1/8	●	○
1/16	3/16	1-1/2	1/8	●	○
5/64	1/4	1-1/2	1/8	●	○
3/32	5/16	1-1/2	1/8	●	○
7/64	3/8	1-1/2	1/8	●	○
1/8	1/2	1-1/2	1/8	●	○
5/32	9/16	2	3/16	●	○
3/16	5/8	2	3/16	●	○
7/32	5/8	2-1/2	1/4	●	○
1/4	3/4	2-1/2	1/4	●	○
9/32	3/4	2-1/2	5/16	●	○
5/16	13/16	2-1/2	5/16	●	○
3/8	7/8	2-1/2	3/8	●	○
7/16	1	3	7/16	●	○
1/2	1	3	1/2	●	○
9/16	1-1/4	3-1/2	9/16	●	○
5/8	1-1/4	3-1/2	5/8	●	○
3/4	1-1/2	4	3/4	●	○
1	1-1/2	4	1	●	○



MG Carbide

Uncoated Blank

30°

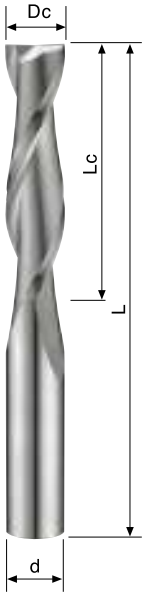
2

H

90°

E182-Dc

Dc h10	Lc Inch	L Inch	d h6	Blank E182	TiAlN E182F
1/8	3/4	2-1/4	1/8	●	○
3/16	3/4	2-1/2	3/16	●	○
1/4	1-1/8	3	1/4	●	○
5/16	1-1/8	3	5/16	●	○
3/8	1-1/8	3	3/8	●	○
7/16	2	4	7/16	●	○
1/2	2	4	1/2	●	○
5/8	2-1/4	5	5/8	●	○
3/4	2-1/4	5	3/4	●	○
1	2-1/4	5	1	●	○



P	H	M	K	N	S
●			○	●	

GR.1 Vc.60-100 fz.161

GR.2 <24HRC Vc.60-100 fz.161

GR.3 <30HRC Vc.30-80 fz.161

GR.9 Vc.60-120 fz.161

GR.10 Vc.120-200 fz.161

GR.11 Vc.80-150 fz.161

GR.12 Vc.40-80 fz.161

E185-Dc

Dc h10	Lc Inch	L Inch	d h6	Blank E185	TiAlN E185F
1/8	1	3	1/8	●	○
3/16	1-1/8	3	3/16	●	○
1/4	1-1/2	4	1/4	●	○
5/16	1-5/8	4	5/16	●	○
3/8	1-3/4	4	3/8	●	○
7/16	3	6	7/16	●	○
1/2	3	6	1/2	●	○
5/8	3	6	5/8	●	○
3/4	3	6	3/4	●	○
1	3	6	1	●	○

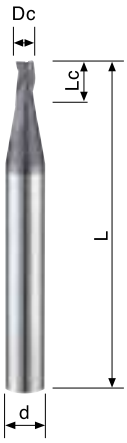
○ The light color: On request, no stock

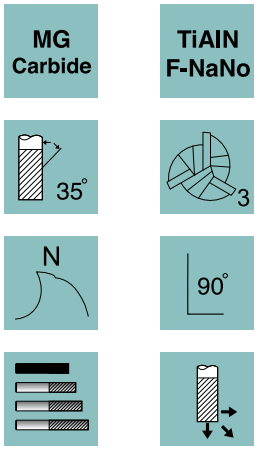
Universal End Mills

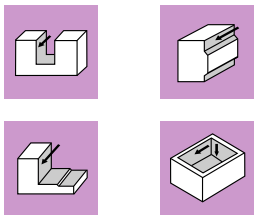
K P H < 48HRC

E113F-Dc

Dc h10	Lc mm	L mm	d h6	TiAlN E113F
2.0	3	50	6	●
2.5	4	50	6	●
3.0	5	50	6	●
3.5	6	50	6	●
4.0	6	50	6	●
5.0	8	50	6	●
6.0	10	50	6	●
8.0	12	50	8	●
10.0	15	50	10	●







P	H	M	K	N	S
●	●	○	●	○	

GR.1
Vc.60-100 fz.P161

GR.2 <24HRC
Vc.60-100 fz.P161

GR.3 <30HRC
Vc.50-80 fz.P161

GR.4 30~38HRC
Vc.30-60 fz.P161

GR.5 38~48HRC
Vc.20-40 fz.P161

GR.8
Vc.30-60 fz.P161

GR.9
Vc.80-120 fz.P161

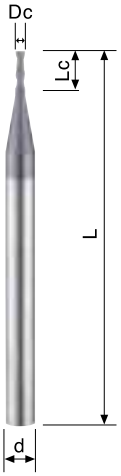
GR.11
Vc.100-160 fz.P161

Universal End Mills

K P H < 48HRC

E102F-Dc

Dc h10	Lc mm	L mm	d h6	TiAlN E102F
0.2	0.5	38	3	●
0.3	0.8	38	3	●
0.4	1.0	38	3	●
0.5	1.2	38	3	●
0.6	1.5	38	3	●
0.7	1.8	38	3	●
0.8	2.0	38	3	●
0.9	2.5	38	3	●
1.0	3.0	38	3	●
1.1	3.0	38	3	●
1.2	4.0	38	3	●
1.3	4.0	38	3	●
1.4	4.0	38	3	●
1.5	5.0	38	3	●
1.6	5.0	38	3	●
1.7	5.0	38	3	●
1.8	5.0	38	3	●
1.9	5.0	38	3	●
2.0	6.0	38	3	●
2.1	6.0	38	3	●
2.2	6.0	38	3	●
2.3	6.0	38	3	●
2.4	8.0	38	3	●
2.5	8.0	38	3	●
2.6	8.0	38	3	●
2.7	8.0	38	3	●
2.8	8.0	38	3	●
2.9	8.0	38	3	●
3.0	8.0	38	3	●
3.0A	8.0	50	3	●



MG Carbide

TiAlN F-NaNo

35°

2

N

90°

P	H	M	K	N	S
●	●	○	●	○	

GR.1
Vc.80-120 fz.P161

GR.2 <24HRC
Vc.80-120 fz.P161

GR.3 <30HRC
Vc.60-100 fz.P161

GR.4 30~38HRC
Vc.40-80 fz.P161

GR.5 38~48HRC
Vc.30-60 fz.P161

GR.8
Vc.40-60 fz.P161

GR.9
Vc.100-140 fz.P161

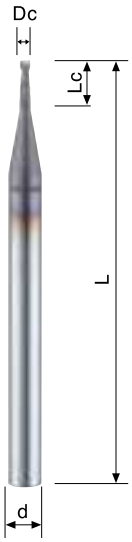
GR.11
Vc.120-180 fz.P161

Universal End Mills

K P H < 48HRC

E112F-Dc

Dc h10	Lc mm	L mm	d h6	TiAlN E112F
0.2	0.5	50	4	●
0.3	0.8	50	4	●
0.4	1.0	50	4	●
0.5	1.2	50	4	●
0.6	1.5	50	4	●
0.7	1.8	50	4	●
0.8	2.0	50	4	●
0.9	2.5	50	4	●
1.0	3.0	50	4	●
1.1	3.0	50	4	●
1.2	4.0	50	4	●
1.3	4.0	50	4	●
1.4	4.0	50	4	●
1.5	5.0	50	4	●
1.6	5.0	50	4	●
1.7	5.0	50	4	●
1.8	5.0	50	4	●
1.9	5.0	50	4	●
2.0	6.0	50	4	●
2.1	6.0	50	4	●
2.2	6.0	50	4	●
2.3	6.0	50	4	●
2.4	8.0	50	4	●
2.5	8.0	50	4	●
2.6	8.0	50	4	●
2.7	8.0	50	4	●
2.8	8.0	50	4	●
2.9	8.0	50	4	●
3.0	8.0	50	4	●
3.1	10.0	50	4	●
3.2	10.0	50	4	●
3.3	10.0	50	4	●
3.4	10.0	50	4	●
3.5	10.0	50	4	●
3.6	10.0	50	4	●
3.7	10.0	50	4	●
3.8	11.0	50	4	●
3.9	11.0	50	4	●
4.0	11.0	50	4	●
4.1	11.0	50	5	●
4.2	11.0	50	5	●
4.3	11.0	50	5	●
4.4	11.0	50	5	●
4.5	11.0	50	5	●
4.6	11.0	50	5	●
4.7	11.0	50	5	●
4.8	13.0	50	5	●
4.9	13.0	50	5	●
5.0	13.0	50	5	●
5.1	13.0	50	6	●
5.2	13.0	50	6	●
5.3	13.0	50	6	●
5.4	13.0	50	6	●
5.5	13.0	50	6	●
5.6	16.0	50	6	●
5.7	16.0	50	6	●
5.8	16.0	50	6	●
5.9	16.0	50	6	●
6.0	16.0	50	6	●
6.0A	20.0	60	6	●



MG Carbide

TiAlN F-NaNo

35°

2

N

90°

P	H	M	K	N	S
●	●	○	●	○	

GR.1
Vc.80-120 fz.P161

GR.2 <24HRC
Vc.80-120 fz.P161

GR.3 <30HRC
Vc.60-100 fz.P161

GR.4 30~38HRC
Vc.40-80 fz.P161

GR.5 38~48HRC
Vc.30-60 fz.P161

GR.8
Vc.40-60 fz.P161

GR.9
Vc.100-140 fz.P161

GR.11
Vc.120-180 fz.P161

Universal End Mills

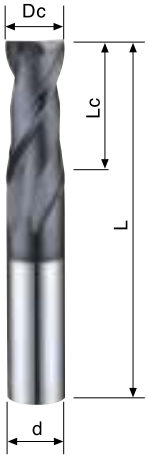
K P H < 48HRC

E122F-Dc

Dc h10	Lc mm	L mm	d h6	TiAlN E122F
1.0	3	50	4	●
1.5	5	50	4	●
2.0	6	50	4	●
2.5	8	50	4	●
3.0 A	8	50	4	●
4.0 A	11	50	4	●
3.0	8	50	6	●
3.5	10	50	6	●
4.0	11	50	6	●
4.5	11	50	6	●
5.0	13	50	6	●
5.5	13	50	6	●
6.0	16	50	6	●
6.5	16	60	8	●
7.0	20	60	8	●
7.5	20	60	8	●
8.0	20	60	8	●
8.5	20	72	10	●
9.0	22	72	10	●
9.5	22	72	10	●
10.0	22	72	10	●
10.5	26	75	12	●
11.0	26	75	12	●
12.0	26	75	12	●
13.0	32	90	16	●
14.0	32	90	16	●
15.0	32	90	16	●
16.0	38	100	16	●
17.0	38	100	20	●
18.0	38	100	20	●
19.0	38	100	20	●
20.0	38	100	20	●

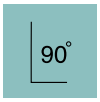
E122F-Dc

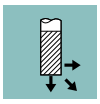
Dc h10		Lc mm	L mm	d h6	TiAlN E122F
1/8	3.175	8	50	6	●
3/16	4.760	12	50	6	●
1/4	6.350	18	60	8	●
5/16	7.940	20	60	8	●
3/8	9.525	22	72	10	●
1/2	12.700	26	75	12	●
5/8	15.880	38	100	16	●
3/4	19.050	38	100	20	●

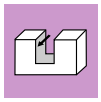


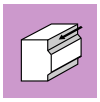
MG Carbide

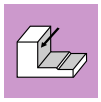
TiAlN F-NaNo

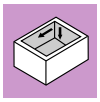












P	H	M	K	N	S
●	●	○	●	○	

GR.1
Vc.80-120 fz.P161

GR.2 <24HRC
Vc.80-120 fz.P161

GR.3 <30HRC
Vc.60-100 fz.P161

GR.4 30~38HRC
Vc.40-80 fz.P161

GR.5 38~48HRC
Vc.30-60 fz.P161

GR.8
Vc.40-60 fz.P161

GR.9
Vc.100-140 fz.P161

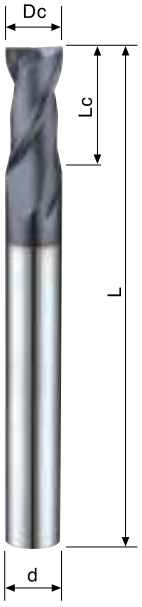
GR.11
Vc.120-180 fz.P161

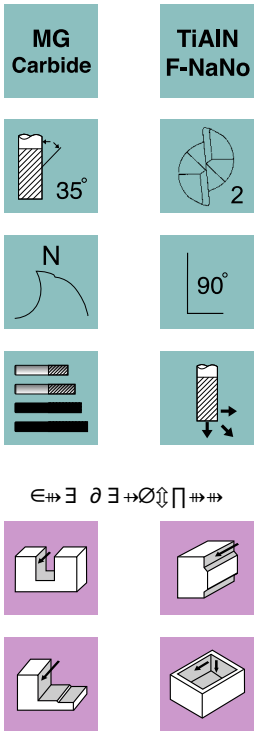
Universal End Mills

K P H < 48HRC

E125F-Dc

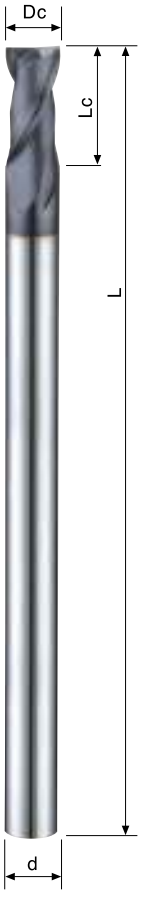
Dc h10	Lc mm	L mm	d h6	TiAlN E125F
3	12	70	6	●
4	15	70	6	●
5	20	80	6	●
6	20	80	6	●
7	25	100	8	●
8	25	100	8	●
9	30	100	10	●
10	30	100	10	●
11	35	110	12	●
12	35	110	12	●
14	40	120	16	●
16	50	140	16	●
20	55	160	20	●





E127F-Dc

Dc h10	Lc mm	L mm	d h6	TiAlN E127F
3	12	80	4	●
4	15	80	4	●
5	20	100	6	●
6	20	100	6	●
8	25	130	8	●
10	30	160	10	●
12	35	180	12	●
16	50	210	16	●
20	55	210	20	●



P	H	M	K	N	S
●	●	○	●	○	

GR.1 Vc.60-100 fz.P161

GR.2 <24HRC Vc.60-100 fz.P161

GR.3 <30HRC Vc.50-80 fz.P161

GR.4 30~38HRC Vc.30-60 fz.P161

GR.5 38~48HRC Vc.20-40 fz.P161

GR.8 Vc.30-60 fz.P161

GR.9 Vc.80-120 fz.P161

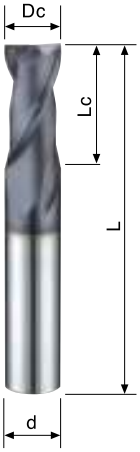
GR.11 Vc.100-160 fz.P161

Universal End Mills

P H < 56HRC

E162X-Dc

Dc h10	Lc mm	L mm	d h6	AlTiCrN E162X
0.3	0.8	50	4	●
0.4	1.0	50	4	●
0.5	1.2	50	4	●
0.6	1.5	50	4	●
0.8	2.0	50	4	●
1.0	3.0	50	4	●
1.5	5.0	50	4	●
2.0	6.0	50	4	●
2.5	8.0	50	4	●
3.0 A	8.0	50	4	●
4.0 A	11.0	50	4	●
3.0	8.0	50	6	●
3.5	10.0	50	6	●
4.0	11.0	50	6	●
4.5	11.0	50	6	●
5.0	13.0	50	6	●
5.5	13.0	50	6	●
6.0	16.0	50	6	●
7.0	20.0	60	8	●
8.0	20.0	60	8	●
9.0	22.0	72	10	●
10.0	22.0	72	10	●
11.0	26.0	75	12	●
12.0	26.0	75	12	●
14.0	32.0	90	16	●
16.0	38.0	100	16	●
18.0	38.0	100	20	●
20.0	38.0	100	20	●



UMG Carbide

AlTiCrN X

35°

2

N

90°

P	H	M	K	N	S
●	●		○		

GR.1
Vc.100-120 fz.P161

GR.2 <24HRC
Vc.100-120 fz.P161

GR.3 <30HRC
Vc.80-100 fz.P161

GR.4 30~38HRC
Vc.60-80 fz.P161

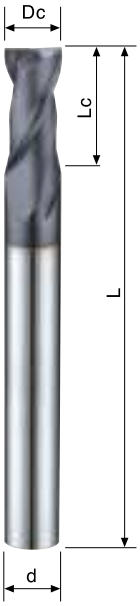
GR.5 38~48HRC
Vc.40-60 fz.P161

GR.6 48~56HRC
Vc.25-40 fz.P161

GR.9
Vc.120-140 fz.P161

E163X-Dc

Dc h10	Lc mm	L mm	d h6	AlTiCrN E163X
3	12	70	6	●
4	15	70	6	●
5	20	80	6	●
6	20	80	6	●
7	25	100	8	●
8	25	100	8	●
9	30	100	10	●
10	30	100	10	●
11	35	110	12	●
12	35	110	12	●
14	40	120	16	●
16	50	140	16	●
20	55	160	20	●

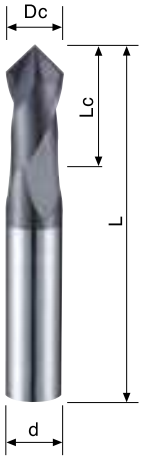


Chamfering Mills

N K P H < 48HRC

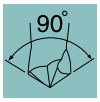
E107X-Dc

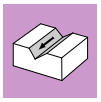
Dc h10	Lc mm	L mm	d h6	AlTiCrN E107X
3	6	50	3	●
4	8	50	4	●
6	12	50	6	●
8	16	60	8	●
10	20	72	10	●
12	24	75	12	●

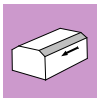


MG Carbide

AlTiCrN X







P	H	M	K	N	S
●	●	○	●	●	

GR.1
Vc.80-100 fz.P161

GR.2 <24HRC
Vc.80-100 fz.P161

GR.3 <30HRC
Vc.70-90 fz.P161

GR.4 30~38HRC
Vc.70-90 fz.P161

GR.5 38~48HRC
Vc.50-70 fz.P161

GR.8
Vc.60-80 fz.P161

GR.9
Vc.80-100 fz.P161

GR.10
Vc.120-150 fz.P161

GR.11
Vc.100-120 fz.P161

7leaders™

The Art of Cutting

Finishing End Mills

①4.15.4	⑨5.(t)	⑬6.8.4.				
	E174	MG Carbide	Uncoated Blank	30°	P ● H M K ○ N ● S	P15、17
	E184 E186	MG Carbide	Uncoated Blank	30°	P ● H M K ○ N ● S	P16、17
	E188	MG Carbide	Uncoated Blank	30°	P ● H M K ○ N ● S	P16
	E104F	MG Carbide	TiAlN F-NaNo	35°	P ● H ● M ○ K ● N ○ S	P18
	E114F	MG Carbide	TiAlN F-NaNo	35°	P ● H ● M ○ K ● N ○ S	P19
	E124F	MG Carbide	TiAlN F-NaNo	35°	P ● H ● M ○ K ● N ○ S	P20
	E126F E128F	MG Carbide	TiAlN F-NaNo	35°	P ● H ● M ○ K ● N ○ S	P21
	E144X	MG Carbide	AlTiCrN X	45°	P ● H ● M ● K ○ N S	P22
	E146X	MG Carbide	AlTiCrN X	45°	P ● H ● M ● K ○ N S	P22
	E164X	UMG Carbide	AlTiCrN X	35°	P ● H ● M K ○ N S	P23
	E165X	UMG Carbide	AlTiCrN X	35°	P ● H ● M K ○ N S	P23
	E166EX	UMG Carbide	AlTiSiN EX	45°	P H ● M K ○ N S	P24
	E167EX	UMG Carbide	AlTiSiN EX	45°	P H ● M K ○ N S	P24

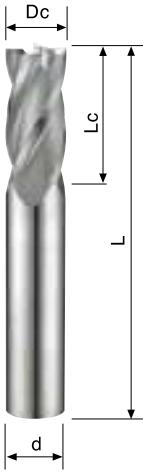
Finishing End Mills

N P < 30HRC

E174-Dc

Dc h10	Lc mm	L mm	d h6	Blank E174	TiAlN E174F
1.0	3	38	3	●	○
1.5	5	38	3	●	○
2.0	6	38	3	●	○
2.5	7	38	3	●	○
3.0	9	38	3	●	○
3.5	12	50	4	●	○
4.0	14	50	4	●	○
4.5	14	50	5	●	○
5.0	16	50	5	●	○
5.5	16	50	6	●	○
6.0	20	63	6	●	○
6.5	20	63	8	●	○
7.0	20	63	8	●	○
7.5	20	63	8	●	○
8.0	20	63	8	●	○
8.5	22	72	10	●	○
9.0	22	72	10	●	○
9.5	22	72	10	●	○
10.0	22	72	10	●	○
11.0	26	75	12	●	○
12.0	26	75	12	●	○
13.0	32	89	14	●	○
14.0	32	89	14	●	○
15.0	32	89	16	●	○
16.0	32	89	16	●	○
17.0	38	100	18	●	○
18.0	38	100	18	●	○
20.0	38	100	20	●	○

○ The light color: On request, no stock



MG Carbide

Uncoated Blank

30°

4

H

90°

P	H	M	K	N	S
●			○	●	

GR.1

Vc.80-100 fz.P162

GR.2 <24HRC

Vc.80-100 fz.P162

GR.3 <30HRC

Vc.60-80 fz.P162

GR.9

Vc.80-120 fz.P162

GR.10

Vc.150-200 fz.P162

GR.11

Vc.100-150 fz.P162

GR.12

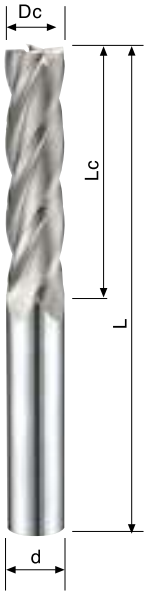
Vc.60-80 fz.P162

Finishing End Mills

N P < 30HRC

E184-Dc

Dc h10	Lc mm	L mm	d h6	Blank E184	TiAlN E184F
3	20	57	3	●	○
4	20	57	4	●	○
5	25	63	5	●	○
6	28	75	6	●	○
7	30	75	8	●	○
8	30	75	8	●	○
9	32	75	10	●	○
10	32	75	10	●	○
12	50	100	12	●	○
14	57	127	14	●	○
16	57	127	16	●	○
20	57	127	20	●	○



MG Carbide

Uncoated Blank

30°

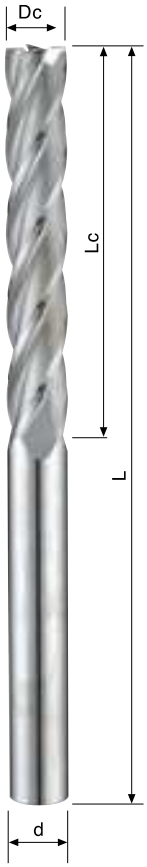
4

H

90°

E186-Dc

Dc h10	Lc mm	L mm	d h6	Blank E186	TiAlN E186F
3	25	75	3	●	○
4	28	75	4	●	○
5	32	75	5	●	○
6	38	100	6	●	○
8	42	100	8	●	○
10	45	100	10	●	○
12	75	150	12	●	○
14	80	150	14	●	○
16	80	150	16	●	○
20	80	150	20	●	○



P	H	M	K	N	S
●			○	●	

GR.1
Vc.60-80 fz.P162

GR.2 <24HRC
Vc.60-80 fz.P162

GR.3 <30HRC
Vc.30-60 fz.P162

GR.9
Vc.60-100 fz.P162

GR.10
Vc.120-150 fz.P162

GR.11
Vc.80-120 fz.P162

GR.12
Vc.40-60 fz.P162

E188-Dc

Dc h10	Lc mm	L mm	d h6	Blank E188	TiAlN E188F
5	45	100	6	●	○
6	50	100	6	●	○
8	75	150	8	●	○
10	75	150	10	●	○
12	75	200	12	●	○
16	80	200	16	●	○
20	80	200	20	●	○

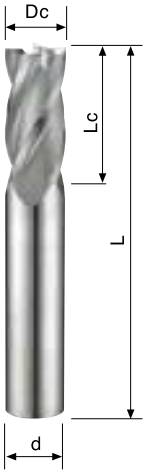
○ The light color: On request, no stock

Finishing End Mills

N P < 30HRC

E174-Dc

Dc h10	Lc Inch	L Inch	d h6	Blank E174	TiAlN E174F
1/16	3/16	1-1/2	1/8	●	○
5/64	1/4	1-1/2	1/8	●	○
3/32	5/16	1-1/2	1/8	●	○
7/64	3/8	1-1/2	1/8	●	○
1/8	1/2	1-1/2	1/8	●	○
5/32	9/16	2	3/16	●	○
3/16	5/8	2	3/16	●	○
7/32	5/8	2-1/2	1/4	●	○
1/4	3/4	2-1/2	1/4	●	○
9/32	3/4	2-1/2	5/16	●	○
5/16	13/16	2-1/2	5/16	●	○
3/8	7/8	2-1/2	3/8	●	○
7/16	1	3	7/16	●	○
1/2	1	3	1/2	●	○
9/16	1-1/4	3-1/2	9/16	●	○
5/8	1-1/4	3-1/2	5/8	●	○
3/4	1-1/2	4	3/4	●	○
1	1-1/2	4	1	●	○



MG Carbide

Uncoated Blank

30°

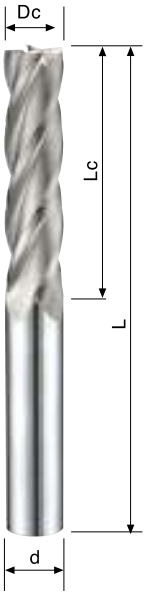
4

H

90°

E184-Dc

Dc h10	Lc Inch	L Inch	d h6	Blank E184	TiAlN E184F
1/8	3/4	2-1/4	1/8	●	○
3/16	3/4	2-1/2	3/16	●	○
1/4	1-1/8	3	1/4	●	○
5/16	1-1/8	3	5/16	●	○
3/8	1-1/8	3	3/8	●	○
7/16	2	4	7/16	●	○
1/2	2	4	1/2	●	○
5/8	2-1/4	5	5/8	●	○
3/4	2-1/4	5	3/4	●	○
1	2-1/4	5	1	●	○



P	H	M	K	N	S
●			○	●	

GR.1
Vc.60-100 fz.P162

GR.2 <24HRC
Vc.60-100 fz.P162

GR.3 <30HRC
Vc.30-80 fz.P162

GR.9
Vc.60-120 fz.P162

GR.10
Vc.120-200 fz.P162

GR.11
Vc.80-150 fz.P162

GR.12
Vc.40-80 fz.P162

E186-Dc

Dc h10	Lc Inch	L Inch	d h6	Blank E186	TiAlN E186F
1/8	1	3	1/8	●	○
3/16	1-1/8	3	3/16	●	○
1/4	1-1/2	4	1/4	●	○
5/16	1-5/8	4	5/16	●	○
3/8	1-3/4	4	3/8	●	○
7/16	3	6	7/16	●	○
1/2	3	6	1/2	●	○
5/8	3	6	5/8	●	○
3/4	3	6	3/4	●	○
1	3	6	1	●	○

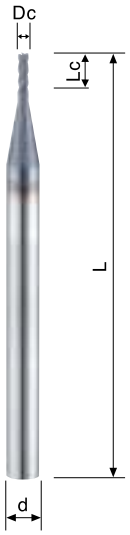
○ The light color: On request, no stock

Finishing End Mills

K P H < 48HRC

E104F-Dc

Dc h10	Lc mm	L mm	d h6	TiAlN E104F
1.0	3.0	38	3	●
1.1	3.0	38	3	●
1.2	4.0	38	3	●
1.3	4.0	38	3	●
1.4	4.0	38	3	●
1.5	5.0	38	3	●
1.6	5.0	38	3	●
1.7	5.0	38	3	●
1.8	5.0	38	3	●
1.9	5.0	38	3	●
2.0	6.0	38	3	●
2.1	6.0	38	3	●
2.2	6.0	38	3	●
2.3	6.0	38	3	●
2.4	8.0	38	3	●
2.5	8.0	38	3	●
2.6	8.0	38	3	●
2.7	8.0	38	3	●
2.8	8.0	38	3	●
2.9	8.0	38	3	●
3.0	8.0	38	3	●
3.0A	8.0	50	3	●



MG Carbide

TiAlN F-NaNo

35°

4

N

90°

P	H	M	K	N	S
●	●	○	●	○	

GR.1
Vc.80-120 fz.P162

GR.2 <24HRC
Vc.80-120 fz.P162

GR.3 <30HRC
Vc.60-100 fz.P162

GR.4 30~38HRC
Vc.40-80 fz.P162

GR.5 38~48HRC
Vc.30-60 fz.P162

GR.8
Vc.40-60 fz.P162

GR.9
Vc.100-140 fz.P162

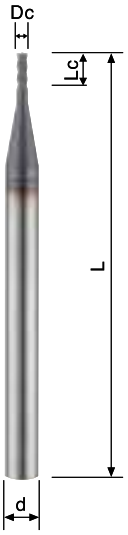
GR.11
Vc.120-180 fz.P162

Finishing End Mills

K P H < 48HRC

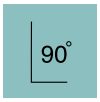
E114F-Dc

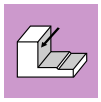
Dc h10	Lc mm	L mm	d h6	TiAlN E114F
1.0	3	50	4	●
1.1	3	50	4	●
1.2	4	50	4	●
1.3	4	50	4	●
1.4	4	50	4	●
1.5	5	50	4	●
1.6	5	50	4	●
1.7	5	50	4	●
1.8	5	50	4	●
1.9	5	50	4	●
2.0	6	50	4	●
2.1	6	50	4	●
2.2	6	50	4	●
2.3	6	50	4	●
2.4	8	50	4	●
2.5	8	50	4	●
2.6	8	50	4	●
2.7	8	50	4	●
2.8	8	50	4	●
2.9	8	50	4	●
3.0	8	50	4	●
3.1	10	50	4	●
3.2	10	50	4	●
3.3	10	50	4	●
3.4	10	50	4	●
3.5	10	50	4	●
3.6	10	50	4	●
3.7	10	50	4	●
3.8	11	50	4	●
3.9	11	50	4	●
4.0	11	50	4	●
4.1	11	50	5	●
4.2	11	50	5	●
4.3	11	50	5	●
4.4	11	50	5	●
4.5	11	50	5	●
4.6	11	50	5	●
4.7	11	50	5	●
4.8	13	50	5	●
4.9	13	50	5	●
5.0	13	50	5	●
5.1	13	50	6	●
5.2	13	50	6	●
5.3	13	50	6	●
5.4	13	50	6	●
5.5	13	50	6	●
5.6	16	50	6	●
5.7	16	50	6	●
5.8	16	50	6	●
5.9	16	50	6	●
6.0	16	50	6	●
6.0A	20	60	6	●

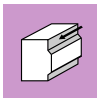


MG Carbide

TiAlN F-NaNo







P	H	M	K	N	S
●	●	○	●	○	

GR.1
Vc.80-120 fz.P162

GR.2 <24HRC
Vc.80-120 fz.P162

GR.3 <30HRC
Vc.60-100 fz.P162

GR.4 30~38HRC
Vc.40-80 fz.P162

GR.5 38~48HRC
Vc.30-60 fz.P162

GR.8
Vc.40-60 fz.P162

GR.9
Vc.100-140 fz.P162

GR.11
Vc.120-180 fz.P162

Finishing End Mills

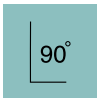
K P H < 48HRC

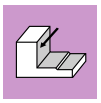
E124F-Dc

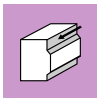
Dc h10	Lc mm	L mm	d h6	TiAlN E124F
1.0	3	50	4	●
1.5	5	50	4	●
2.0	6	50	4	●
2.5	8	50	4	●
3.0A	8	50	4	●
4.0A	11	50	4	●
3.0	8	50	6	●
3.5	10	50	6	●
4.0	11	50	6	●
4.5	11	50	6	●
5.0	13	50	6	●
5.5	13	50	6	●
6.0	16	50	6	●
6.5	16	60	8	●
7.0	20	60	8	●
7.5	20	60	8	●
8.0	20	60	8	●
8.5	20	72	10	●
9.0	22	72	10	●
9.5	22	72	10	●
10.0	22	72	10	●
10.5	26	75	12	●
11.0	26	75	12	●
12.0	26	75	12	●
13.0	32	90	16	●
14.0	32	90	16	●
15.0	32	90	16	●
16.0	38	100	16	●
17.0	38	100	20	●
18.0	38	100	20	●
19.0	38	100	20	●
20.0	38	100	20	●

MG Carbide

TiAlN F-NaNo







P	H	M	K	N	S
●	●	○	●	○	

GR.1 Vc.80-120 fz.P162

GR.2 <24HRC Vc.80-120 fz.P162

GR.3 <30HRC Vc.60-100 fz.P162

GR.4 30~38HRC Vc.40-80 fz.P162

GR.5 38~48HRC Vc.30-60 fz.P162

GR.8 Vc.40-60 fz.P162

GR.9 Vc.100-140 fz.P162

GR.11 Vc.120-180 fz.P162

E124F-Dc

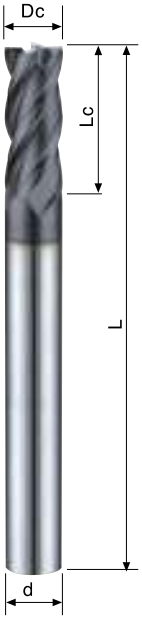
Dc h10		Lc mm	L mm	d h6	TiAlN E124F
1/8	3.175	8	50	6	●
3/16	4.760	12	50	6	●
1/4	6.350	18	60	8	●
5/16	7.940	20	60	8	●
3/8	9.525	22	72	10	●
1/2	12.700	26	75	12	●
5/8	15.880	38	100	16	●
3/4	19.050	38	100	20	●

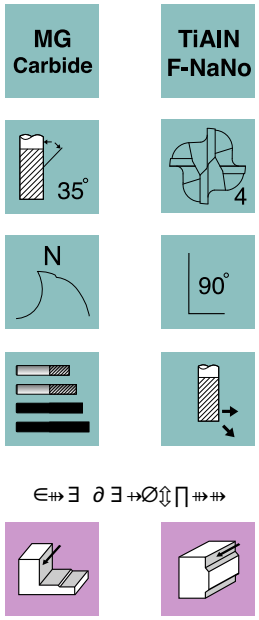
Finishing End Mills

K P H < 48HRC

E126F-Dc

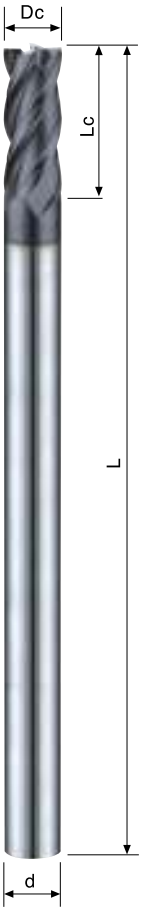
Dc h10	Lc mm	L mm	d h6	TiAlN E126F
3	12	70	6	●
4	15	70	6	●
5	20	80	6	●
6	20	80	6	●
7	25	100	8	●
8	25	100	8	●
9	30	100	10	●
10	30	100	10	●
11	35	110	12	●
12	35	110	12	●
14	40	120	16	●
16	50	140	16	●
20	55	160	20	●





E128F-Dc

Dc h10	Lc mm	L mm	d h6	TiAlN E128F
3	12	80	4	●
4	15	80	4	●
5	20	100	6	●
6	20	100	6	●
8	25	130	8	●
10	30	160	10	●
12	35	180	12	●
16	50	210	16	●
20	55	210	20	●



P	H	M	K	N	S
●	●	○	●	○	

GR.1 Vc.60-100 fz.P162

GR.2 <24HRC Vc.60-100 fz.P162

GR.3 <30HRC Vc.50-80 fz.P162

GR.4 30~38HRC Vc.30-60 fz.P162

GR.5 38~48HRC Vc.20-40 fz.P162

GR.8 Vc.30-60 fz.P162

GR.9 Vc.80-120 fz.P162

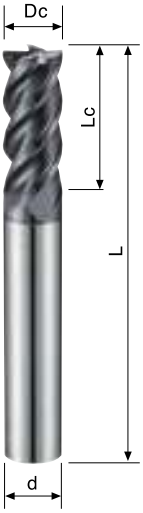
GR.11 Vc.100-160 fz.P162

Finishing End Mills

M P H < 48HRC

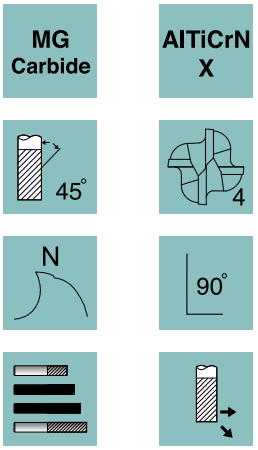
E144X-Dc

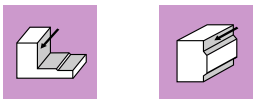
Dc h10	Lc mm	L mm	d h6	AlTiCrN E144X
1.0	3	50	4	●
1.5	5	50	4	●
2.0	6	50	4	●
2.5	8	50	4	●
3.0 A	8	50	4	●
4.0 A	11	50	4	●
3.0	8	50	6	●
4.0	11	50	6	●
5.0	13	50	6	●
6.0	16	50	6	●
7.0	20	60	8	●
8.0	20	60	8	●
9.0	25	72	10	●
10.0	25	72	10	●
12.0	30	75	12	●
14.0	40	100	16	●
16.0	45	100	16	●
20.0	50	110	20	●



MG Carbide

AlTiCrN X





P	H	M	K	N	S
●	●	●	○		

GR.1 Vc.80-120 fz.P162

GR.2 <24HRC Vc.80-120 fz.P162

GR.3 <30HRC Vc.60-100 fz.P162

GR.4 30~38HRC Vc.40-80 fz.P162

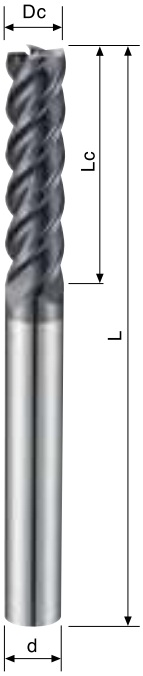
GR.5 38~48HRC Vc.30-60 fz.P162

GR.8 Vc.40-80 fz.P162

GR.9 Vc.100-140 fz.P162

E146X-Dc

Dc h10	Lc mm	L mm	d h6	AlTiCrN E146X
3	15	80	4	●
4	20	80	4	●
5	25	100	6	●
6	30	100	6	●
8	35	100	8	●
10	40	100	10	●
12	45	110	12	●
14	55	150	16	●
16	60	150	16	●
20	65	150	20	●

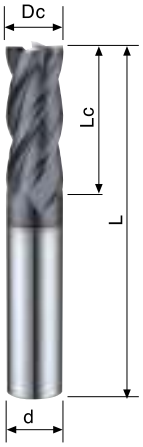


Finishing End Mills

P H < 56HRC

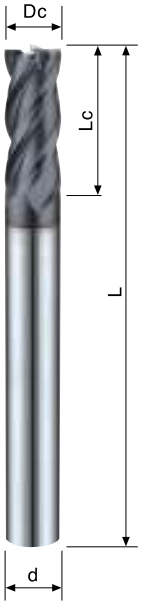
E164X-Dc

Dc h10	Lc mm	L mm	d h6	AlTiCrN E164X
1.0	3	50	4	●
1.5	5	50	4	●
2.0	6	50	4	●
2.5	8	50	4	●
3.0 A	8	50	4	●
4.0 A	11	50	4	●
3.0	8	50	6	●
3.5	10	50	6	●
4.0	11	50	6	●
4.5	11	50	6	●
5.0	13	50	6	●
5.5	13	50	6	●
6.0	16	50	6	●
7.0	20	60	8	●
8.0	20	60	8	●
9.0	22	72	10	●
10.0	22	72	10	●
11.0	26	75	12	●
12.0	26	75	12	●
14.0	32	90	16	●
16.0	38	100	16	●
18.0	38	100	20	●
20.0	38	100	20	●



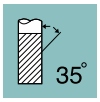
E165X-Dc

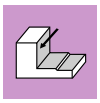
Dc h10	Lc mm	L mm	d h6	AlTiCrN E165X
3	12	70	6	●
4	15	70	6	●
5	20	80	6	●
6	20	80	6	●
7	25	100	8	●
8	25	100	8	●
9	30	100	10	●
10	30	100	10	●
11	35	110	12	●
12	35	110	12	●
14	40	120	16	●
16	50	140	16	●
20	55	160	20	●

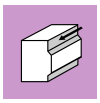


UMG Carbide

AlTiCrN X







P	H	M	K	N	S
●	●		○		

GR.1
Vc.100-120 fz.P162

GR.2 <24HRC
Vc.100-120 fz.P162

GR.3 <30HRC
Vc.80-100 fz.P162

GR.4 30~38HRC
Vc.60-80 fz.P162

GR.5 38~48HRC
Vc.40-60 fz.P162

GR.6 48~56HRC
Vc.25-40 fz.P162

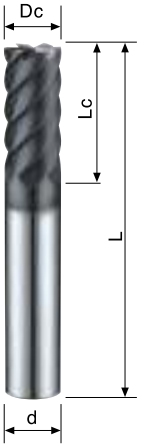
GR.9
Vc.120-140 fz.P162

Finishing End Mills

H 30-68HRC

E166EX-Dc

Dc h10	Lc mm	L mm	d h6	NO.of Flute	AlTiSiN E166EX
3	8	50	6	4	●
4	11	50	6	4	●
5	13	50	6	6	●
6	16	50	6	6	●
8	20	60	8	6	●
10	22	72	10	6	●
12	26	75	12	6	●
16	38	100	16	6	●
20	38	100	20	6	●



UMG Carbide

AlTiSiN EX

45°

6

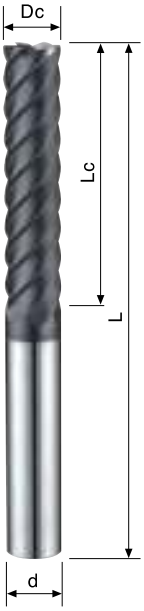
N

0.05-0.15

45°

E167EX-Dc

Dc h10	Lc mm	L mm	d h6	NO.of Flute	AlTiSiN E167EX
6	26	80	6	6	●
8	36	100	8	6	●
10	46	100	10	6	●
12	56	110	12	6	●
16	66	140	16	6	●
20	76	160	20	6	●



P	H	M	K	N	S
	●		○		

GR.4 30~38HRC
Vc.120-140 fz.P162

GR.5 38~48HRC
Vc.100-120 fz.P162

GR.6 48~56HRC
Vc.80-100 fz.P162

GR.7 56~68HRC
Vc.50-80 fz.P162

GR.9
Vc.120-160 fz.P162

7leaders™

The Art of Cutting

Ball Nose End Mills

	B212	MG Carbide	Uncoated Blank	30°	P	H	M	K	N	S	P27
					●			○	●		
	B280 B282	MG Carbide	Uncoated Blank	30°	P	H	M	K	N	S	P28
					●			○	●		
	B214	MG Carbide	Uncoated Blank	30°	P	H	M	K	N	S	P29
					●			○	●		
	B281 B284	MG Carbide	Uncoated Blank	30°	P	H	M	K	N	S	P30
					●			○	●		
	B202F	MG Carbide	TiAlN F-NaNo	30°	P	H	M	K	N	S	P31
					●	●	○	●	○		
	B221F	MG Carbide	TiAlN F-NaNo	30°	P	H	M	K	N	S	P32
					●	●	○	●	○		
	B222F	MG Carbide	TiAlN F-NaNo	30°	P	H	M	K	N	S	P33
					●	●	○	●	○		
	B232F B242F	MG Carbide	TiAlN F-NaNo	30°	P	H	M	K	N	S	P34
					●	●	○	●	○		
	B262X	UMG Carbide	AlTiCrN X	30°	P	H	M	K	N	S	P35
					●	●		○			
	B263X B264X	UMG Carbide	AlTiCrN X	30°	P	H	M	K	N	S	P36
					●	●		○			
	B251EX	UMG Carbide	AlTiSiN EX	25°	P	H	M	K	N	S	P37
						●					
	B261EX	UMG Carbide	AlTiSiN EX	15°	P	H	M	K	N	S	P38
						●		○			
	B254GX	UMG Carbide	AlTiSiN GX	30°	P	H	M	K	N	S	P39
						●		○			
	B250EX	UMG Carbide	AlTiSiN EX	30°	P	H	M	K	N	S	P40
					●	●		○			

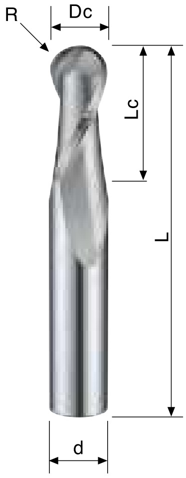
Ball Nose End Mills ⑯11.⒃7⒆14.⒃8.1⒆6)15.413.⒃18.⒃11.7⒃18.

N P < 30HRC

⑨5⒂(t) B212-Dc

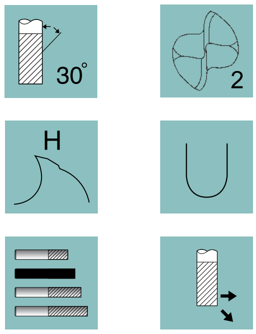
Dc h10	R ±0.01	Lc mm	L mm	d h6	Blank B212	TiAlN B212F
0.2	0.10R	0.4	38	3	●	○
0.3	0.15R	0.6	38	3	●	○
0.4	0.20R	0.8	38	3	●	○
0.5	0.25R	1.0	38	3	●	○
0.6	0.30R	1.2	38	3	●	○
0.7	0.35R	1.4	38	3	●	○
0.8	0.40R	1.6	38	3	●	○
0.9	0.45R	2.0	38	3	●	○
1.0	0.50R	3.0	38	3	●	○
1.5	0.75R	5.0	38	3	●	○
2.0	1.00R	6.0	38	3	●	○
2.5	1.25R	7.0	38	3	●	○
3.0	1.50R	9.0	38	3	●	○
3.5	1.75R	12.0	50	4	●	○
4.0	2.00R	14.0	50	4	●	○
4.5	2.25R	16.0	50	5	●	○
5.0	2.50R	16.0	50	5	●	○
5.5	2.75R	16.0	50	6	●	○
6.0	3.00R	20.0	63	6	●	○
6.5	3.25R	20.0	63	8	●	○
7.0	3.50R	20.0	63	8	●	○
7.5	3.75R	20.0	63	8	●	○
8.0	4.00R	20.0	63	8	●	○
8.5	4.25R	22.0	72	10	●	○
9.0	4.50R	22.0	72	10	●	○
9.5	4.75R	22.0	72	10	●	○
10.0	5.00R	22.0	72	10	●	○
11.0	5.50R	26.0	75	12	●	○
12.0	6.00R	26.0	75	12	●	○
13.0	6.50R	32.0	89	14	●	○
14.0	7.00R	32.0	89	14	●	○
15.0	7.50R	32.0	89	16	●	○
16.0	8.00R	32.0	89	16	●	○
17.0	8.50R	38.0	100	18	●	○
18.0	9.00R	38.0	100	18	●	○
20.0	10.00R	38.0	100	20	●	○

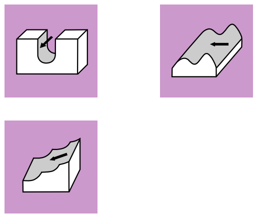
○ The light color: On request, no stock



MG Carbide

Uncoated Blank





P	H	M	K	N	S
●			○	●	

GR.1 Vc.80-120 fz.P163-4

GR.2 <24HRC Vc.80-120 fz.P163-4

GR.3 <30HRC Vc.60-100 fz.P163-4

GR.9 Vc.100-140 fz.P163-4

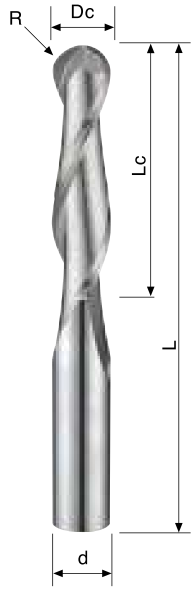
GR.10 Vc.180-300 fz.P163-4

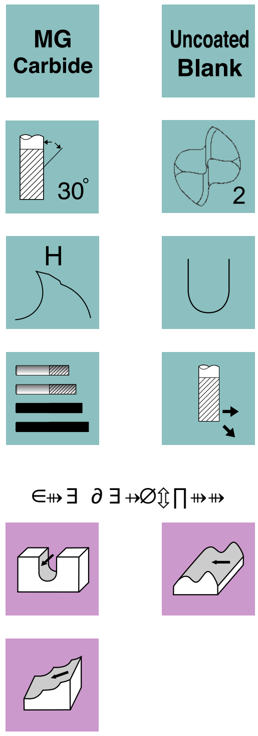
GR.11 Vc.120-160 fz.P163-4

GR.12 Vc.80-120 fz.P163-4

B280-Dc

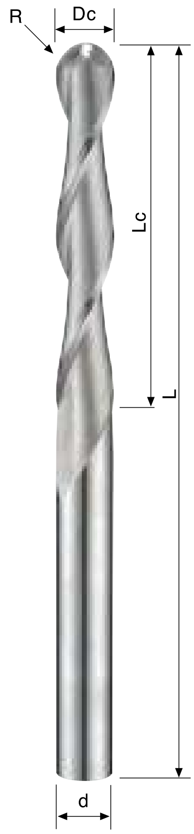
Dc h10	R ±0.01	Lc mm	L mm	d h6	Blank B280	TiAlN B280F
3	1.5R	20	57	3	●	○
4	2.0R	20	57	4	●	○
5	2.5R	25	63	5	●	○
6	3.0R	28	75	6	●	○
7	3.5R	30	75	8	●	○
8	4.0R	30	75	8	●	○
9	4.5R	32	75	10	●	○
10	5.0R	32	75	10	●	○
12	6.0R	50	100	12	●	○
14	7.0R	57	127	14	●	○
16	8.0R	57	127	16	●	○
20	10.0R	57	127	20	●	○





B282-Dc

Dc h10	R ±0.01	Lc mm	L mm	d h6	Blank B282	TiAlN B282F
3	1.5R	25	75	3	●	○
4	2.0R	28	75	4	●	○
5	2.5R	32	75	5	●	○
6	3.0R	38	100	6	●	○
8	4.0R	42	100	8	●	○
10	5.0R	45	100	10	●	○
12	6.0R	75	150	12	●	○
14	7.0R	80	150	14	●	○
16	8.0R	80	150	16	●	○
20	10.0R	80	150	20	●	○



○ The light color: On request, no stock

P	H	M	K	N	S
●			○	●	

GR.1 Vc.60-100 fz.P163-4

GR.2 <24HRC Vc.60-100 fz.P163-4

GR.3 <30HRC Vc.40-80 fz.P163-4

GR.9 Vc.80-120 fz.P163-4

GR.10 Vc.150-200 fz.P163-4

GR.11 Vc.100-120 fz.P163-4

GR.12 Vc.60-100 fz.P163-4

Ball Nose End Mills ⑯11.⑯7⑰14.⑯8.1⑲⑯15.413.⑯18⑯11.7⑯18.

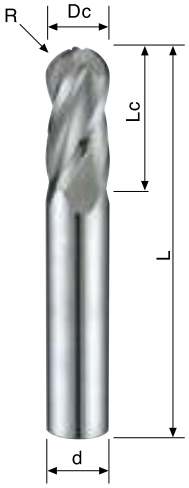
N P < 30HRC

⑨5⑮⑮(t) B214-Dc

Dc h10	R ±0.01	Lc mm	L mm	d h6	Blank B214	TiAlN B214F
1.0	0.50R	3	38	3	●	○
1.5	0.75R	5	38	3	●	○
2.0	1.00R	6	38	3	●	○
2.5	1.25R	7	38	3	●	○
3.0	1.50R	9	38	3	●	○
3.5	1.75R	12	50	4	●	○
4.0	2.00R	14	50	4	●	○
4.5	2.25R	16	50	5	●	○
5.0	2.50R	16	50	5	●	○
5.5	2.75R	16	50	6	●	○
6.0	3.00R	20	63	6	●	○
6.5	3.25R	20	63	8	●	○
7.0	3.50R	20	63	8	●	○
7.5	3.75R	20	63	8	●	○
8.0	4.00R	20	63	8	●	○
8.5	4.25R	22	72	10	●	○
9.0	4.50R	22	72	10	●	○
9.5	4.75R	22	72	10	●	○
10.0	5.00R	22	72	10	●	○
11.0	5.50R	26	75	12	●	○
12.0	6.00R	26	75	12	●	○
13.0	6.50R	32	89	14	●	○
14.0	7.00R	32	89	14	●	○
15.0	7.50R	32	89	16	●	○
16.0	8.00R	32	89	16	●	○
17.0	8.50R	38	100	18	●	○
18.0	9.00R	38	100	18	●	○
20.0	10.00R	38	100	20	●	○

○ The light color: On request, no stock

⑭589.⑪⑬2(ⓑⓐ)98.ⓑ)952191⑮.65.67⑯⑮⑪⑬⑰⑲⑯219453.10⑯⑪.⑪⑭C



MG Carbide

Uncoated Blank

30°

4

H

∈⇻∃ ∂∃↛∅⇳∏⇻⇻

⑬–⑮⁓⁓⑰⑥①⁓④⑪⑥④⑪⁓⑰⑭⑮⑦⁓⑩⑥

P	H	M	K	N	S
●			○	●	

GR.1 ∇≠‖ ::⊂
∀∫ ::∫ ∩:.≌ ∨‖ ∽∽‖ ∄
Vc.80-120 fz.P163-4

GR.2 ∇≠‖ ::⊂ **<24HRC**
∽.:∮ :≅ ::∫ ∩:.≌ ∨‖ ∽∽‖ ∄
Vc.80-120 fz.P163-4

GR.3 ∇≠‖ ::⊂ **<30HRC**
⇾∫ ∩:.≌ ∨‖ ∽∽‖ ∄
Vc.60-100 fz.P163-4

GR.9 ∑ ≡∩≅∽
Vc.100-140 fz.P163-4

GR.10 ⇳::∉ ~ ∴.∽.:.∵
Vc.180-300 fz.P163-4

GR.11 ↮∫ ∪⊂
Vc.120-160 fz.P163-4

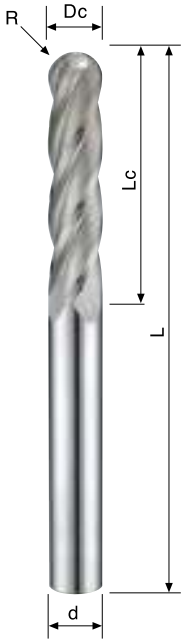
GR.12 ∃:‖ ≒∴:∴
Vc.80-120 fz.P163-4

Ball Nose End Mills

N P < 30HRC

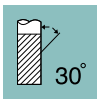
B281-Dc

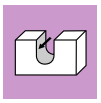
Dc h10	R ±0.01	Lc mm	L mm	d h6	Blank B281	TiAlN B281F
3	1.5R	20	57	3	●	○
4	2.0R	20	57	4	●	○
5	2.5R	25	63	5	●	○
6	3.0R	28	75	6	●	○
7	3.5R	30	75	8	●	○
8	4.0R	30	75	8	●	○
9	4.5R	32	75	10	●	○
10	5.0R	32	75	10	●	○
12	6.0R	50	100	12	●	○
14	7.0R	57	127	14	●	○
16	8.0R	57	127	16	●	○
20	10.0R	57	127	20	●	○



MG Carbide

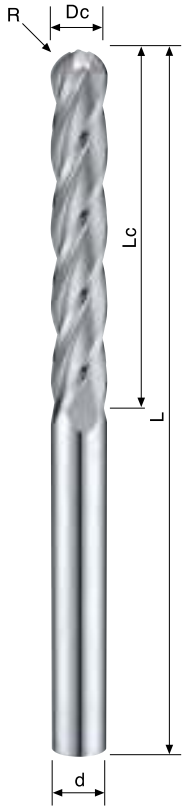
Uncoated Blank





B284-Dc

Dc h10	R ±0.01	Lc mm	L mm	d h6	Blank B284	TiAlN B284F
3	1.5R	25	75	3	●	○
4	2.0R	28	75	4	●	○
5	2.5R	32	75	5	●	○
6	3.0R	38	100	6	●	○
8	4.0R	42	100	8	●	○
10	5.0R	45	100	10	●	○
12	6.0R	75	150	12	●	○
14	7.0R	80	150	14	●	○
16	8.0R	80	150	16	●	○
20	10.0R	80	150	20	●	○



P	H	M	K	N	S
●			○	●	

GR.1
Vc.60-100 fz.P163-4

GR.2 <24HRC
Vc.60-100 fz.P163-4

GR.3 <30HRC
Vc.40-80 fz.P163-4

GR.9
Vc.80-120 fz.P163-4

GR.10
Vc.150-200 fz.P163-4

GR.11
Vc.100-120 fz.P163-4

GR.12
Vc.60-100 fz.P163-4

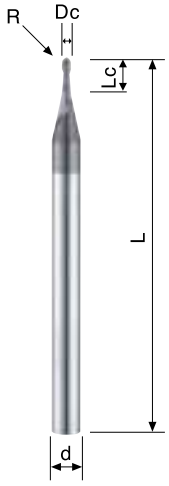
○ The light color: On request, no stock

Ball Nose End Mills ⑯11.⑯7.⑲14.⑯8.1.⑲⑯15.413.⑯⑬18.⑯11.7.⑯18.

K P H < 48HRC

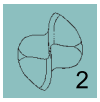
⑨5.⑮(t) B202F-DC

Dc h10	R ±0.01	Lc mm	L mm	d h6	TiAlN B202F
0.2	0.10R	0.4	38	3	●
0.3	0.15R	0.6	38	3	●
0.4	0.20R	0.8	38	3	●
0.5	0.25R	1.0	38	3	●
0.6	0.30R	1.2	38	3	●
0.7	0.35R	1.4	38	3	●
0.8	0.40R	1.6	38	3	●
0.9	0.45R	1.8	38	3	●
1.0	0.50R	2.0	38	3	●
1.1	0.55R	2.2	38	3	●
1.2	0.60R	2.4	38	3	●
1.4	0.70R	2.8	38	3	●
1.5	0.75R	3.0	38	3	●
1.6	0.80R	3.2	38	3	●
1.8	0.90R	3.6	38	3	●
2.0	1.00R	4.0	38	3	●
2.5	1.25R	5.0	38	3	●
3.0	1.50R	6.0	38	3	●
3.0A	1.50R	6.0	50	3	●



MG Carbide

TiAlN F-NaNo



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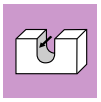


⑬–⑮⌒⌒⑰⑯①⑭⑪⑥④⑪⌒⑰⑭⑮⑦⌒⑩⑥

P	H	M	K	N	S
●	●	○	●	○	

GR.1 ∇≠‖ ::⊂
∀∫ ::∫ ∩∴≌ ∨‖ ∽∽‖ ∅
Vc.100-140 fz.P163-4

GR.2 ∇≠‖ ::⊂ <24HRC
∽∴∮ :≡ ::∫ ∩∴≌ ∨‖ ∽∽‖ ∅
Vc.100-140 fz.P163-4

GR.3 ∇≠‖ ::⊂ <30HRC
⇾∫ ∩∴≌ ∨‖ ∽∽‖ ∅
Vc.80-120 fz.P163-4

GR.4 ∇≠‖ ::⊂ 30~38HRC
⇻‖ :‖ ::∫ ∽∽‖ ∅
Vc.70-100 fz.P163-4

GR.5 ∇≠‖ ::⊂ 38~48HRC
⇻‖ :‖ ::∫ ∽∽‖ ∅
Vc.50-80 fz.P163-4

GR.8 ∇≠‖ ::⊂
∀∫ ≒∬‖ ∨∫ ∉≫‖ ∅
Vc.60-90 fz.P163-4

GR.9 ∑≡∩≅∽
Vc.120-160 fz.P163-4

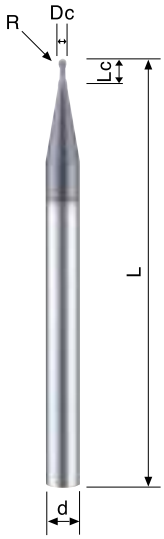
GR.11 ⇿∫ ∪⊂
Vc.140-200 fz.P163-4

Ball Nose End Mills

K P H < 48HRC

B221F-Dc

Dc h10	R ±0.01	Lc mm	L mm	d h6	TiAlN B221F
0.2	0.10R	0.4	50	4	●
0.3	0.15R	0.6	50	4	●
0.4	0.20R	0.8	50	4	●
0.5	0.25R	1.0	50	4	●
0.6	0.30R	1.2	50	4	●
0.7	0.35R	1.4	50	4	●
0.8	0.40R	1.6	50	4	●
0.9	0.45R	1.8	50	4	●
1.0	0.50R	2.0	50	4	●
1.1	0.55R	2.2	50	4	●
1.2	0.60R	2.4	50	4	●
1.4	0.70R	2.8	50	4	●
1.5	0.75R	3.0	50	4	●
1.6	0.80R	3.2	50	4	●
1.8	0.90R	3.6	50	4	●
2.0	1.00R	4.0	50	4	●
2.5	1.25R	5.0	50	4	●
3.0	1.50R	6.0	50	4	●
3.5	1.75R	8.0	50	4	●
4.0	2.00R	8.0	50	4	●
4.5	2.25R	10.0	50	5	●
5.0	2.50R	10.0	50	5	●
5.5	2.75R	12.0	50	6	●
6.0	3.00R	12.0	50	6	●
6.0A	3.00R	12.0	60	6	●



MG Carbide

TiAlN F-NaNo

30°

2

H

P	H	M	K	N	S
●	●	○	●	○	

GR.1
Vc.100-140 fz.P163-4

GR.2 <24HRC
Vc.100-140 fz.P163-4

GR.3 <30HRC
Vc.80-120 fz.P163-4

GR.4 30~38HRC
Vc.70-100 fz.P163-4

GR.5 38~48HRC
Vc.50-80 fz.P163-4

GR.8
Vc.60-90 fz.P163-4

GR.9
Vc.120-160 fz.P163-4

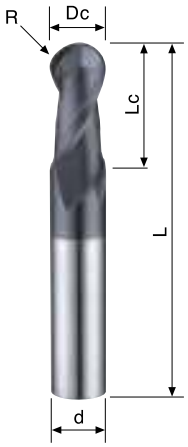
GR.11
Vc.140-200 fz.P163-4

Ball Nose End Mills ⑯11.⑯7⑲14.⑯8.1⑲⑥154.13.⑯3⑯18.⑯11.7⑯18.

K P H < 48HRC

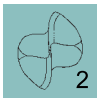
⑨5⑮⑮⑴ B222F-Dc

Dc h10	R ±0.01	Lc mm	L mm	d h6	TiAlN B222F
1.0	0.50R	2	50	4	●
1.5	0.75R	3	50	4	●
2.0	1.00R	4	50	4	●
2.5	1.25R	5	50	4	●
3.0A	1.50R	6	50	4	●
4.0A	2.00R	8	50	4	●
3.0	1.50R	6	50	6	●
3.5	1.75R	8	50	6	●
4.0	2.00R	8	50	6	●
4.5	2.25R	10	50	6	●
5.0	2.50R	10	50	6	●
5.5	2.75R	12	50	6	●
6.0	3.00R	12	50	6	●
6.5	3.25R	14	60	8	●
7.0	3.50R	14	60	8	●
7.5	3.75R	14	60	8	●
8.0	4.00R	14	60	8	●
8.5	4.25R	18	72	10	●
9.0	4.50R	18	72	10	●
9.5	4.75R	18	72	10	●
10.0	5.00R	18	72	10	●
11.0	5.50R	22	75	12	●
12.0	6.00R	22	75	12	●
13.0	6.50R	26	90	16	●
14.0	7.00R	26	90	16	●
15.0	7.50R	30	90	16	●
16.0	8.00R	30	100	16	●
17.0	8.50R	34	100	20	●
18.0	9.00R	34	100	20	●
19.0	9.50R	38	100	20	●
20.0	10.00R	38	100	20	●



MG Carbide

TiAlN F-NaNo



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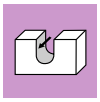


⑬–⑮⁓⑰⑥①⁓④⑪⑥④⑪⁓⑰④⑮⑦⁓⑩⑥

P	H	M	K	N	S
●	●	○	●	○	

GR.1 ∇≠‖ ::⊂
∀∫ ::∫ ∩:.≌ ∨‖ ∽≃‖ ⊅
Vc.100-140 fz.P163-4

GR.2 ∇≠‖ ::⊂ **<24HRC**
∽.:∮ :≅ ::∫ ∩:.≌ ∨‖ ∽≃‖ ⊅
Vc.100-140 fz.P163-4

GR.3 ∇≠‖ ::⊂ **<30HRC**
⇾∫ ∩:.≌ ∨‖ ∽≃‖ ⊅
Vc.80-120 fz.P163-4

GR.4 ∇≠‖ ::⊂ **30~38HRC**
⇷‖ :‖ ::∫ ∽≃‖ ⊅
Vc.70-100 fz.P163-4

GR.5 ∇≠‖ ::⊂ **38~48HRC**
⇷‖ :‖ ::∫ ∽≃‖ ⊅
Vc.50-80 fz.P163-4

GR.8 ∇≠‖ ::⊂
∀∫ ≌∬‖ ∨∫ ∉≫‖ ⊅
Vc.60-90 fz.P163-4

GR.9 ∑≡∩≡∽
Vc.120-160 fz.P163-4

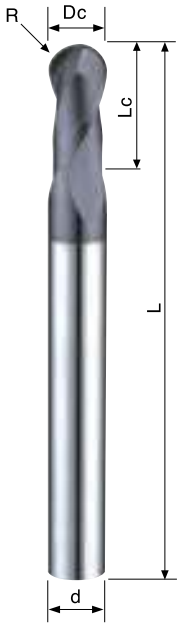
GR.11 ⇿∫ ∪⊂
Vc.140-200 fz.P163-4

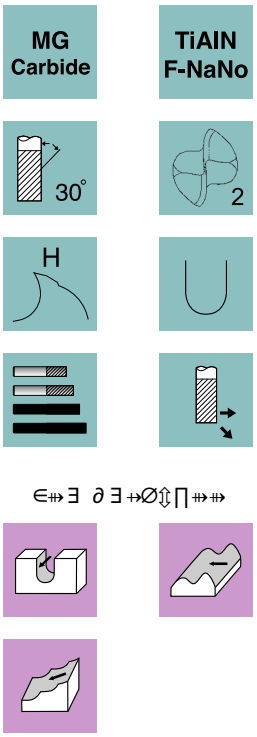
Ball Nose End Mills

K P H < 48HRC

B232F-Dc

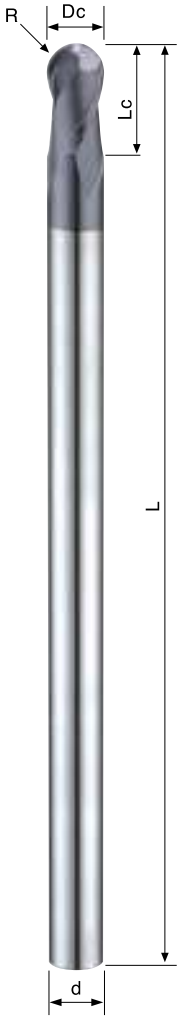
Dc h10	R ±0.01	Lc mm	L mm	d h6	TiAlN B232F
1.0	0.50R	2	50	6	●
1.5	0.75R	3	50	6	●
2.0	1.00R	4	60	6	●
2.5	1.25R	5	60	6	●
3.0	1.50R	6	70	6	●
4.0	2.00R	8	70	6	●
5.0	2.50R	10	80	6	●
6.0	3.00R	12	80	6	●
7.0	3.50R	14	100	8	●
8.0	4.00R	14	100	8	●
9.0	4.50R	18	100	10	●
10.0	5.00R	18	100	10	●
12.0	6.00R	22	110	12	●
14.0	7.00R	26	120	16	●
16.0	8.00R	30	140	16	●
20.0	10.00R	38	160	20	●





B242F-Dc

Dc h10	R ±0.01	Lc mm	L mm	d h6	TiAlN B242F
1	0.5R	2	70	3	●
2	1.0R	4	70	3	●
3	1.5R	6	80	4	●
4	2.0R	8	80	4	●
5	2.5R	10	100	6	●
6	3.0R	12	100	6	●
8	4.0R	14	130	8	●
10	5.0R	18	160	10	●
12	6.0R	22	180	12	●
16	8.0R	30	210	16	●
20	10.0R	38	210	20	●



P	H	M	K	N	S
●	●	○	●	○	

GR.1
Vc.80-120 fz.P163-4

GR.2 <24HRC
Vc.80-120 fz.P163-4

GR.3 <30HRC
Vc.60-100 fz.P163-4

GR.4 30~38HRC
Vc.50-90 fz.P163-4

GR.5 38~48HRC
Vc.40-70 fz.P163-4

GR.8
Vc.50-80 fz.P163-4

GR.9
Vc.100-140 fz.P163-4

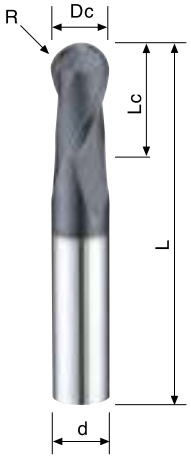
GR.11
Vc.120-180 fz.P163-4

Ball Nose End Mills

P H < 56HRC

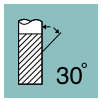
B262X-Dc

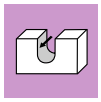
Dc h10	R ±0.01	Lc mm	L mm	d h6	AlTiCrN B262X
0.3	0.15R	0.6	50	4	●
0.4	0.20R	0.8	50	4	●
0.5	0.25R	1.0	50	4	●
0.6	0.30R	1.2	50	4	●
0.8	0.40R	1.6	50	4	●
1.0	0.50R	2.0	50	4	●
1.5	0.75R	3.0	50	4	●
2.0	1.00R	4.0	50	4	●
2.5	1.25R	5.0	50	4	●
3.0 A	1.50R	6.0	50	4	●
4.0 A	2.00R	8.0	50	4	●
3.0	1.50R	6.0	50	6	●
4.0	2.00R	8.0	50	6	●
5.0	2.50R	10.0	50	6	●
6.0	3.00R	12.0	50	6	●
7.0	3.50R	14.0	60	8	●
8.0	4.00R	14.0	60	8	●
9.0	4.50R	18.0	72	10	●
10.0	5.00R	18.0	72	10	●
12.0	6.00R	22.0	75	12	●
14.0	7.00R	26.0	90	16	●
16.0	8.00R	30.0	100	16	●
20.0	10.00R	38.0	100	20	●



UMG Carbide

AlTiCrN X





P	H	M	K	N	S
●	●		○		

GR.2 <24HRC
Vc.120-160 fz.P163-4

GR.3 <30HRC
Vc.100-140 fz.P163-4

GR.4 30~38HRC
Vc.80-120 fz.P163-4

GR.5 38~48HRC
Vc.60-90 fz.P163-4

GR.6 48~56HRC
Vc.40-70 fz.P163-4

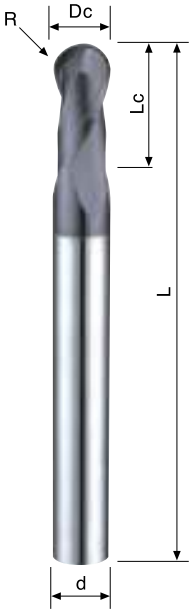
GR.9
Vc.140-180 fz.P163-4

Ball Nose End Mills

P H < 56HRC

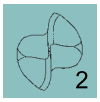
B263X-Dc

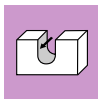
Dc h10	R ±0.01	Lc mm	L mm	d h6	AlTiCrN B263X
1.0	0.50R	2	50	6	●
1.5	0.75R	3	50	6	●
2.0	1.00R	4	60	6	●
2.5	1.25R	5	60	6	●
3.0	1.50R	6	70	6	●
4.0	2.00R	8	70	6	●
5.0	2.50R	10	80	6	●
6.0	3.00R	12	80	6	●
7.0	3.50R	14	100	8	●
8.0	4.00R	14	100	8	●
9.0	4.50R	18	100	10	●
10.0	5.00R	18	100	10	●
12.0	6.00R	22	110	12	●
14.0	7.00R	26	120	16	●
16.0	8.00R	30	140	16	●
20.0	10.00R	38	160	20	●



UMG Carbide

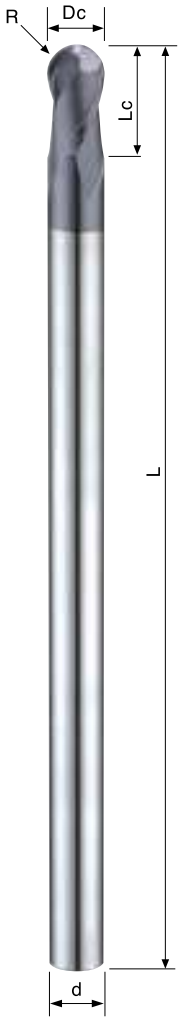
AlTiCrN X





B264X-Dc

Dc h10	R ±0.01	Lc mm	L mm	d h6	AlTiCrN B264X
1	0.5R	2	70	3	●
2	1.0R	4	70	3	●
3	1.5R	6	80	4	●
4	2.0R	8	80	4	●
5	2.5R	10	100	6	●
6	3.0R	12	100	6	●
8	4.0R	14	130	8	●
10	5.0R	18	160	10	●
12	6.0R	22	180	12	●
16	8.0R	30	210	16	●
20	10.0R	38	210	20	●



P	H	M	K	N	S
●	●		○		

GR.2 <24HRC
Vc.100-140 fz.P163-4

GR.3 <30HRC
Vc.80-120 fz.P163-4

GR.4 30~38HRC
Vc.60-100 fz.P163-4

GR.5 38~48HRC
Vc.50-80 fz.P163-4

GR.6 48~56HRC
Vc.30-60 fz.P163-4

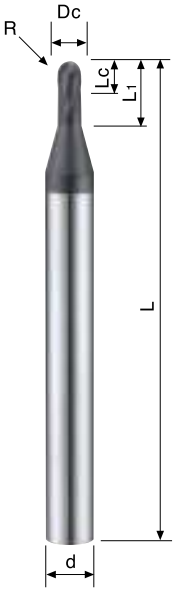
GR.9
Vc.120-160 fz.P163-4

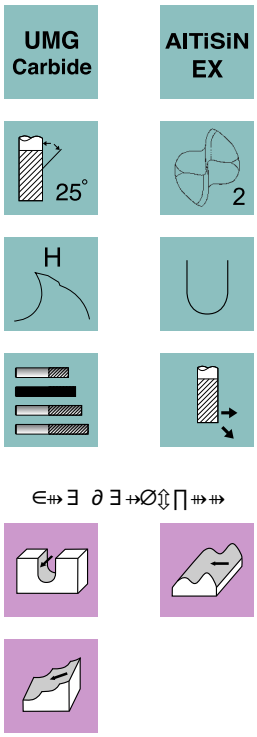
Ball Nose End Mills

H 48-68HRC

B251EX-Dc

Dc h10	R ±0.01	Lc mm	L mm	d h6	L1 mm	AlTiSiN B251EX
0.3	0.15R	0.3	50	4	0.8	●
0.4	0.20R	0.4	50	4	1.0	●
0.5	0.25R	0.5	50	4	1.3	●
0.6	0.30R	0.6	50	4	1.5	●
0.8	0.40R	0.8	50	4	2.0	●
1.0	0.50R	1.0	50	4	2.5	●
1.5	0.75R	1.5	50	4	3.8	●
2.0	1.00R	2.0	50	6	5.0	●
3.0	1.50R	3.0	60	6	8.0	●
4.0	2.00R	4.0	60	6	10.0	●
5.0	2.50R	5.0	60	6	12.0	●
6.0	3.00R	6.0	60	6	15.0	●





P	H	M	K	N	S
	●				

GR.6 48~56HRC
Vc.60-150 fz.P163-4

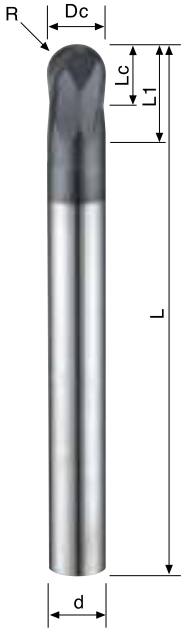
GR.7 56~68HRC
Vc.40-120 fz.P163-4

Ball Nose End Mills

H 48-68HRC

B261EX-Dc

Dc h10	R ±0.01	Lc mm	L mm	d h6	L1 mm	AlTiSiN B261EX
1.0	0.50R	1.0	50	4	2	●
1.5	0.75R	1.5	50	4	3	●
2.0	1.00R	2.0	60	6	4	●
3.0	1.50R	3.0	70	6	6	●
4.0	2.00R	4.0	70	6	8	●
5.0	2.50R	5.0	80	6	10	●
6.0	3.00R	6.0	80	6	12	●
8.0	4.00R	8.0	100	8	16	●
10.0	5.00R	10.0	100	10	20	●
12.0	6.00R	12.0	110	12	24	●



UMG Carbide

AlTiSiN EX

15°

2

H

GR.6 48~56HRC
Vc.160-220 fz.P163-4

GR.7 56~68HRC
Vc.100-160 fz.P163-4

GR.9
Vc.160-180 fz.P163-4

P	H	M	K	N	S
	●		○		

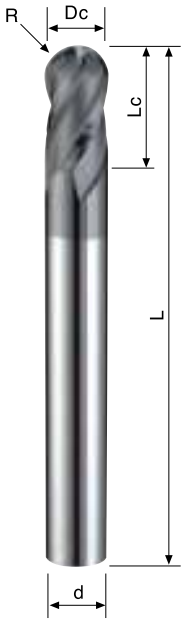
Ball Nose End Mills - 4 Flutes

H 30-68HRC

⑯11.⑯7⑲14.⑯8.1⑲⑯14.⑯9⑱8.7⑯12.⑱10.⑫18⑯15.413.⑯318⑯11.7⑯⑱18.

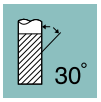
⑨5.⑮(t)　B254GX-Dc

Dc h10	R ±0.01	Lc mm	L mm	d h6	AlTiSiN B254GX
3	1.5R	6	70	6	●
4	2.0R	8	70	6	●
5	2.5R	10	80	6	●
6	3.0R	12	80	6	●
8	4.0R	14	100	8	●
10	5.0R	18	100	10	●
12	6.0R	22	110	12	●
16	8.0R	30	140	16	●
20	10.0R	38	160	20	●



UMG Carbide

AlTiSiN GX



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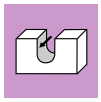


⑬⑮⑰⑥①④⑪⑥④⑪⑰④⑮⑦⑩⑥

P	H	M	K	N	S
	●		○		

GR.4 ∇≠‖ ::⊂ **30~38HRC**
⇻‖ :‖ ::∫ ∽∽‖ ⊅
Vc.160-180　fz.P163-4

GR.5 ∇≠‖ ::⊂ **38~48HRC**
⇻‖ :‖ ::∫ ∽∽‖ ⊅
Vc.130-150　fz.P163-4

GR.6 ∇≠‖ ::⊂ **48~56HRC**
⇻‖ :‖ ::∫ ∽∽‖ ⊅
Vc.100-120　fz.P163-4

GR.7 ∇≠‖ ::⊂ **56~68HRC**
⇻‖ :‖ ::∫ ∽∽‖ ⊅
Vc.80-100　fz.P163-4

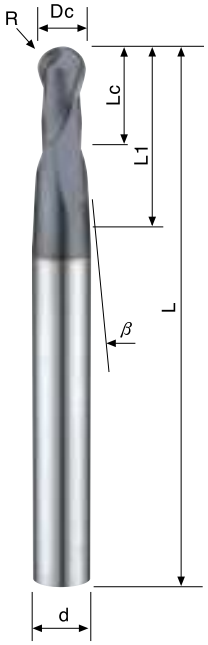
GR.9 ∑≡∩≅∽
Vc.210-230　fz.P163-4

Ball Nose End Mills ⑯11.⑯7⑲14.8.1.⑲⑯15.413.⑯318⑯11.7⑯18.

P H < 56HRC

⑨5⑮(t) B250EX-R×β

R ±0.01	β on Side	Lc mm	L mm	d h6	L1 mm	AlTiSiN B250EX
0.5R	1˚ 30'	2	60	6	23	●
0.5R	5˚	2	60	6	23	●
0.5R	3˚	2	80	6	42	●
1.0R	1˚ 30'	4	60	6	23	●
1.0R	5˚	4	60	6	23	●
1.0R	3˚	4	80	6	41	●
1.5R	3˚	6	70	6	32	●
1.5R	1˚ 30'	6	90	6	52	●
2.0R	3˚	8	70	6	28	●
2.0R	1˚ 30'	8	90	6	49	●
2.5R	3˚	10	90	8	41	●
2.5R	1˚ 30'	10	110	8	61	●
3.0R	3˚	12	90	8	34	●
3.0R	1˚ 30'	12	110	8	53	●
4.0R	3˚	14	100	10	36	●
4.0R	1˚ 30'	14	120	10	55	●
5.0R	3˚	18	110	12	40	●
5.0R	1˚ 30'	18	130	12	59	●
6.0R	3˚	22	140	16	63	●
6.0R	1˚ 30'	22	160	16	83	●



UMG Carbide

AlTiSiN EX

30˚

2

H

∈↠∃ ∂∃↠Ø⇳∏↠↠

⑬⑮⑰⑥①④⑪⑥④⑪⑰④⑮⑦⑩⑥

P	H	M	K	N	S
●	●		○		

GR.2 ∇≠‖ ::⊂ **<24HRC**
∽:ϕ :≡ ::∫ ∩:≌ ∨‖ ∽∾‖ ∅
Vc.100-140 fz.P163-4

GR.3 ∇≠‖ ::⊂ **<30HRC**
→∫ ∩:≌ ∨‖ ∽∾‖ ∅
Vc.80-120 fz.P163-4

GR.4 ∇≠‖ ::⊂ **30~38HRC**
↞‖ :‖ ::∫ ∽∾‖ ∅
Vc.60-100 fz.P163-4

GR.5 ∇≠‖ ::⊂ **38~48HRC**
↞‖ :‖ ::∫ ∽∾‖ ∅
Vc.50-80 fz.P163-4

GR.6 ∇≠‖ ::⊂ **48~56HRC**
↞‖ :‖ ::∫ ∽∾‖ ∅
Vc.30-60 fz.P163-4

GR.9 ∑≡∩≡∽
Vc.120-160 fz.P163-4


7leaders™
The Art of Cutting

End Mills For Rib Processing

	F692GX	UMG Carbide	AlTiSiN GX	30°	P ● H ● M K ○ N ○ S	P43、44
	F690GX	UMG Carbide	AlTiSiN GX	30°	P ● H ● M K ○ N ○ S	P45、46
	F695GX	UMG Carbide	AlTiSiN GX	30°	P ● H ● M K ○ N ○ S	P47、48
	F694GX	UMG Carbide	AlTiSiN GX	30°	P ● H ● M K ○ N ○ S	P49
	F691GX	UMG Carbide	AlTiSiN GX	30°	P ● H ● M K ○ N ○ S	P50

End Mills For Rib Processing

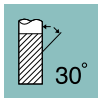
P H < 68HRC

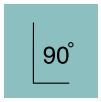
F692GX-Dc×L1

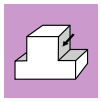
Dc +0 -0.02	L1 mm	Lc mm	L mm	d h5	D1 mm	AlTiSiN F692GX
0.3	1	0.45	50	4	0.27	●
0.3	1.5	0.45	50	4	0.27	●
0.3	2	0.45	50	4	0.27	●
0.3	3	0.45	50	4	0.27	●
0.3	4	0.45	50	4	0.27	●
0.4	1.5	0.6	50	4	0.37	●
0.4	2	0.6	50	4	0.37	●
0.4	3	0.6	50	4	0.37	●
0.4	4	0.6	50	4	0.37	●
0.4	5	0.6	50	4	0.37	●
0.5	2	0.7	50	4	0.45	●
0.5	3	0.7	50	4	0.45	●
0.5	4	0.7	50	4	0.45	●
0.5	6	0.7	50	4	0.45	●
0.5	8	0.7	50	4	0.45	●
0.5	10	0.7	50	4	0.45	●
0.6	2	0.9	50	4	0.55	●
0.6	3	0.9	50	4	0.55	●
0.6	4	0.9	50	4	0.55	●
0.6	6	0.9	50	4	0.55	●
0.6	8	0.9	50	4	0.55	●
0.6	10	0.9	50	4	0.55	●
0.7	2	1.0	50	4	0.65	●
0.7	4	1.0	50	4	0.65	●
0.7	6	1.0	50	4	0.65	●
0.8	4	1.2	50	4	0.75	●
0.8	6	1.2	50	4	0.75	●
0.8	8	1.2	50	4	0.75	●
0.8	10	1.2	50	4	0.75	●
0.8	12	1.2	50	4	0.75	●
0.9	4	1.4	50	4	0.85	●
0.9	6	1.4	50	4	0.85	●
0.9	8	1.4	50	4	0.85	●
0.9	10	1.4	50	4	0.85	●
1.0	4	1.5	50	4	0.95	●
1.0	6	1.5	50	4	0.95	●
1.0	8	1.5	50	4	0.95	●
1.0	10	1.5	50	4	0.95	●
1.0	12	1.5	50	4	0.95	●
1.0	14	1.5	50	4	0.95	●
1.0	16	1.5	50	4	0.95	●
1.0	18	1.5	60	4	0.95	●
1.0	20	1.5	60	4	0.95	●
1.2	6	1.8	50	4	1.15	●
1.2	8	1.8	50	4	1.15	●
1.2	10	1.8	50	4	1.15	●
1.2	12	1.8	50	4	1.15	●
1.2	14	1.8	50	4	1.15	●
1.2	16	1.8	50	4	1.15	●
1.4	6	2.1	50	4	1.35	●
1.4	8	2.1	50	4	1.35	●
1.4	10	2.1	50	4	1.35	●
1.4	12	2.1	50	4	1.35	●
1.4	14	2.1	50	4	1.35	●
1.4	16	2.1	50	4	1.35	●
1.5	6	2.3	50	4	1.45	●
1.5	8	2.3	50	4	1.45	●
1.5	10	2.3	50	4	1.45	●
1.5	12	2.3	50	4	1.45	●
1.5	14	2.3	50	4	1.45	●

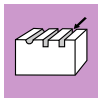
UMG Carbide

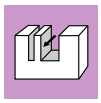
AlTiSiN GX











P	H	M	K	N	S
●	●		○	○	

GR.1
Vc.60-80 fz.P161

GR.2 <24HRC
Vc.60-80 fz.P161

GR.3 <30HRC
Vc.50-60 fz.P161

GR.4 30~38HRC
Vc.40-60 fz.P161

GR.5 38~48HRC
Vc.40-50 fz.P161

GR.6 48~56HRC
Vc.30-50 fz.P161

GR.7 56~68HRC
Vc.30-40 fz.P161

GR.9
Vc.80-100 fz.P161

GR.11
Vc.100-120 fz.P161

End Mills For Rib Processing

P H < 68HRC

F692GX-Dc×L1

Dc +0 -0.02	L1 mm	Lc mm	L mm	d h5	D1 mm	AlTiSiN F692GX
1.5	16	2.3	50	4	1.45	●
1.5	18	2.3	60	4	1.45	●
1.5	20	2.3	60	4	1.45	●
1.6	6	2.4	50	4	1.55	●
1.6	8	2.4	50	4	1.55	●
1.6	10	2.4	50	4	1.55	●
1.6	12	2.4	50	4	1.55	●
1.6	14	2.4	50	4	1.55	●
1.6	16	2.4	50	4	1.55	●
1.6	18	2.4	60	4	1.55	●
1.6	20	2.4	60	4	1.55	●
1.8	6	2.7	50	4	1.75	●
1.8	8	2.7	50	4	1.75	●
1.8	10	2.7	50	4	1.75	●
1.8	12	2.7	50	4	1.75	●
1.8	14	2.7	50	4	1.75	●
1.8	16	2.7	50	4	1.75	●
1.8	18	2.7	60	4	1.75	●
1.8	20	2.7	60	4	1.75	●
2.0	6	3.0	50	4	1.95	●
2.0	8	3.0	50	4	1.95	●
2.0	10	3.0	50	4	1.95	●
2.0	12	3.0	50	4	1.95	●
2.0	14	3.0	50	4	1.95	●
2.0	16	3.0	50	4	1.95	●
2.0	18	3.0	60	4	1.95	●
2.0	20	3.0	60	4	1.95	●
2.0	25	3.0	60	4	1.95	●
2.0	30	3.0	70	4	1.95	●
2.5	8	3.7	50	4	2.40	●
2.5	10	3.7	50	4	2.40	●
2.5	12	3.7	50	4	2.40	●
2.5	14	3.7	50	4	2.40	●
2.5	16	3.7	60	4	2.40	●
2.5	18	3.7	60	4	2.40	●
2.5	20	3.7	60	4	2.40	●
2.5	25	3.7	70	4	2.40	●
2.5	30	3.7	70	4	2.40	●
3.0	8	4.5	50	6	2.85	●
3.0	10	4.5	50	6	2.85	●
3.0	12	4.5	50	6	2.85	●
3.0	14	4.5	60	6	2.85	●
3.0	16	4.5	60	6	2.85	●
3.0	18	4.5	60	6	2.85	●
3.0	20	4.5	60	6	2.85	●
3.0	25	4.5	70	6	2.85	●
3.0	30	4.5	70	6	2.85	●
3.0	35	4.5	80	6	2.85	●
4.0	12	6.0	60	6	3.85	●
4.0	16	6.0	60	6	3.85	●
4.0	20	6.0	70	6	3.85	●
4.0	25	6.0	70	6	3.85	●
4.0	30	6.0	80	6	3.85	●
4.0	35	6.0	80	6	3.85	●
4.0	40	6.0	90	6	3.85	●
4.0	45	6.0	100	6	3.85	●
4.0	50	6.0	100	6	3.85	●

UMG Carbide

AlTiSiN GX

30°

2

N

90°

P	H	M	K	N	S
●	●		○	○	

GR.1
Vc.60-80 fz.P161

GR.2 <24HRC
Vc.60-80 fz.P161

GR.3 <30HRC
Vc.50-60 fz.P161

GR.4 30~38HRC
Vc.40-60 fz.P161

GR.5 38~48HRC
Vc.40-50 fz.P161

GR.6 48~56HRC
Vc.30-50 fz.P161

GR.7 56~68HRC
Vc.30-40 fz.P161

GR.9
Vc.80-100 fz.P161

GR.11
Vc.100-120 fz.P161

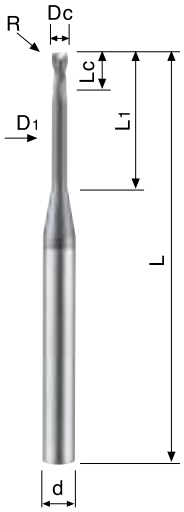
Toric End Mills For Rib Processing

P H < 68HRC

⑰5.7⑲14.⑯8.1.⑲⑯95.713.⑯⑬18⑯15.413.⑯⑬18⑯11.7⑯⑱18.

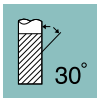
⑨5.⑮(t) F690GX-Dc×R×L1

Dc +0 -0.02	R ±0.005	L1 mm	Lc mm	L mm	d h5	D1 mm	AlTiSiN F690GX
0.5	R0.05	2	0.4	50	4	0.45	●
0.5	R0.05	3	0.4	50	4	0.45	●
0.5	R0.05	4	0.4	50	4	0.45	●
0.5	R0.05	5	0.4	50	4	0.45	●
0.5	R0.05	6	0.4	50	4	0.45	●
0.5	R0.1	2	0.4	50	4	0.45	●
0.5	R0.1	3	0.4	50	4	0.45	●
0.5	R0.1	4	0.4	50	4	0.45	●
0.5	R0.1	5	0.4	50	4	0.45	●
0.5	R0.1	6	0.4	50	4	0.45	●
0.6	R0.1	2	0.5	50	4	0.55	●
0.6	R0.1	4	0.5	50	4	0.55	●
0.6	R0.1	6	0.5	50	4	0.55	●
0.8	R0.1	4	0.65	50	4	0.75	●
0.8	R0.1	6	0.65	50	4	0.75	●
0.8	R0.1	8	0.65	50	4	0.75	●
0.8	R0.2	4	0.65	50	4	0.75	●
0.8	R0.2	6	0.65	50	4	0.75	●
0.8	R0.2	8	0.65	50	4	0.75	●
1.0	R0.1	4	0.8	50	4	0.95	●
1.0	R0.1	6	0.8	50	4	0.95	●
1.0	R0.1	8	0.8	50	4	0.95	●
1.0	R0.1	10	0.8	50	4	0.95	●
1.0	R0.1	12	0.8	50	4	0.95	●
1.0	R0.2	4	0.8	50	4	0.95	●
1.0	R0.2	6	0.8	50	4	0.95	●
1.0	R0.2	8	0.8	50	4	0.95	●
1.0	R0.2	10	0.8	50	4	0.95	●
1.0	R0.2	12	0.8	50	4	0.95	●
1.0	R0.3	4	0.8	50	4	0.95	●
1.0	R0.3	6	0.8	50	4	0.95	●
1.0	R0.3	8	0.8	50	4	0.95	●
1.0	R0.3	10	0.8	50	4	0.95	●
1.0	R0.3	12	0.8	50	4	0.95	●
1.2	R0.2	6	1.0	50	4	1.15	●
1.2	R0.2	8	1.0	50	4	1.15	●
1.2	R0.2	10	1.0	50	4	1.15	●
1.5	R0.2	4	1.2	50	4	1.45	●
1.5	R0.2	6	1.2	50	4	1.45	●
1.5	R0.2	8	1.2	50	4	1.45	●
1.5	R0.2	10	1.2	50	4	1.45	●
1.5	R0.2	12	1.2	50	4	1.45	●
1.5	R0.2	16	1.2	50	4	1.45	●
1.5	R0.3	4	1.2	50	4	1.45	●
1.5	R0.3	6	1.2	50	4	1.45	●
1.5	R0.3	8	1.2	50	4	1.45	●
1.5	R0.3	10	1.2	50	4	1.45	●
1.5	R0.3	12	1.2	50	4	1.45	●
1.5	R0.3	16	1.2	50	4	1.45	●
2.0	R0.2	6	1.6	50	4	1.95	●
2.0	R0.2	8	1.6	50	4	1.95	●
2.0	R0.2	10	1.6	50	4	1.95	●
2.0	R0.2	12	1.6	50	4	1.95	●
2.0	R0.2	16	1.6	50	4	1.95	●
2.0	R0.2	20	1.6	60	4	1.95	●



UMG Carbide

AlTiSiN GX



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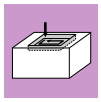
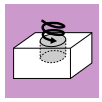
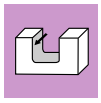
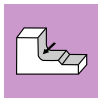
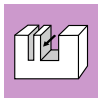
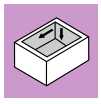












⑬⑮⑰⑥①④⑪⑥④⑪⑰④⑮⑦⑩⑥

P	H	M	K	N	S
●	●		○	○	

GR.1 ∇≠‖ ::⊂ ∀∫ ::∫ ∩:≌ ∨‖ ∽∾‖ ∅
Vc.60-80 fz.P161

GR.2 ∇≠‖ ::⊂ <24HRC ∽:∮ :≡ ::∫ ∩:≌ ∨‖ ∽∾‖ ∅
Vc.60-80 fz.P161

GR.3 ∇≠‖ ::⊂ <30HRC ⇾∫ ∩:≌ ∨‖ ∽∾‖ ∅
Vc.50-60 fz.P161

GR.4 ∇≠‖ ::⊂ 30~38HRC ⇹‖ :‖ ::∫ ∽∾‖ ∅
Vc.40-60 fz.P161

GR.5 ∇≠‖ ::⊂ 38~48HRC ⇹‖ :‖ ::∫ ∽∾‖ ∅
Vc.40-50 fz.P161

GR.6 ∇≠‖ ::⊂ 48~56HRC ⇹‖ :‖ ::∫ ∽∾‖ ∅
Vc.30-50 fz.P161

GR.7 ∇≠‖ ::⊂ 56~68HRC ⇹‖ :‖ ::∫ ∽∾‖ ∅
Vc.30-40 fz.P161

GR.9 ∑≡∩≅∽
Vc.80-100 fz.P161

GR.11 ⇹⇾∫ ∪⊂
Vc.100-120 fz.P161

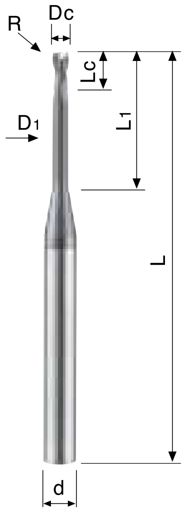
Toric End Mills For Rib Processing

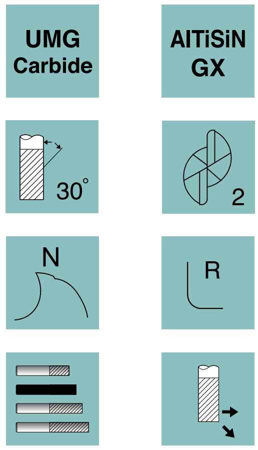
P **H** < 68HRC

⑰5.7.⒆14.⒃8.1.⒆⒃)95.7.13.⒃⒀18.⒃)15.4.13.⒃⒀18.⒃)11.7.⒃⒅8.

⑨5.⒂-(t) F690GX-Dc×R×L1

Dc +0 -0.02	R ±0.005	L1 mm	Lc mm	L mm	d h5	D1 mm	AlTiSiN F690GX
2.0	R0.3	6	1.6	50	4	1.95	●
2.0	R0.3	8	1.6	50	4	1.95	●
2.0	R0.3	10	1.6	50	4	1.95	●
2.0	R0.3	12	1.6	50	4	1.95	●
2.0	R0.3	16	1.6	50	4	1.95	●
2.0	R0.3	20	1.6	60	4	1.95	●
2.0	R0.5	6	1.6	50	4	1.95	●
2.0	R0.5	8	1.6	50	4	1.95	●
2.0	R0.5	10	1.6	50	4	1.95	●
2.0	R0.5	12	1.6	50	4	1.95	●
2.0	R0.5	16	1.6	50	4	1.95	●
2.0	R0.5	20	1.6	60	4	2.85	●
3.0	R0.2	8	2.5	50	6	2.85	●
3.0	R0.2	12	2.5	50	6	2.85	●
3.0	R0.2	16	2.5	60	6	2.85	●
3.0	R0.2	20	2.5	60	6	2.85	●
3.0	R0.2	25	2.5	70	6	2.85	●
3.0	R0.2	30	2.5	70	6	2.85	●
3.0	R0.3	8	2.5	50	6	2.85	●
3.0	R0.3	12	2.5	50	6	2.85	●
3.0	R0.3	16	2.5	60	6	2.85	●
3.0	R0.3	20	2.5	60	6	2.85	●
3.0	R0.3	25	2.5	70	6	2.85	●
3.0	R0.3	30	2.5	70	6	2.85	●
3.0	R0.5	8	2.5	50	6	2.85	●
3.0	R0.5	12	2.5	50	6	2.85	●
3.0	R0.5	16	2.5	60	6	2.85	●
3.0	R0.5	20	2.5	60	6	2.85	●
3.0	R0.5	25	2.5	70	6	2.85	●
3.0	R0.5	30	2.5	70	6	2.85	●
4.0	R0.2	12	4.0	60	6	3.85	●
4.0	R0.2	16	4.0	60	6	3.85	●
4.0	R0.2	20	4.0	70	6	3.85	●
4.0	R0.2	25	4.0	70	6	3.85	●
4.0	R0.2	30	4.0	80	6	3.85	●
4.0	R0.2	40	4.0	90	6	3.85	●
4.0	R0.3	12	4.0	60	6	3.85	●
4.0	R0.3	16	4.0	60	6	3.85	●
4.0	R0.3	20	4.0	70	6	3.85	●
4.0	R0.3	25	4.0	70	6	3.85	●
4.0	R0.3	30	4.0	80	6	3.85	●
4.0	R0.3	40	4.0	90	6	3.85	●
4.0	R0.5	12	4.0	60	6	3.85	●
4.0	R0.5	16	4.0	60	6	3.85	●
4.0	R0.5	20	4.0	70	6	3.85	●
4.0	R0.5	25	4.0	70	6	3.85	●
4.0	R0.5	30	4.0	80	6	3.85	●
4.0	R0.5	40	4.0	90	6	3.85	●
4.0	R1.0	12	4.0	60	6	3.85	●
4.0	R1.0	16	4.0	60	6	3.85	●
4.0	R1.0	20	4.0	70	6	3.85	●
4.0	R1.0	25	4.0	70	6	3.85	●
4.0	R1.0	30	4.0	80	6	3.85	●
4.0	R1.0	40	4.0	90	6	3.85	●





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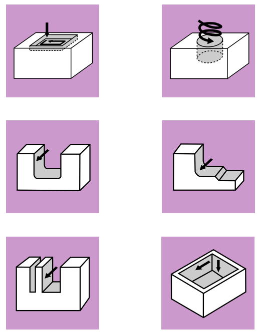


⑬–⑮⌒–⌒⑰⑹①⌒④⑪⑹④⑪⌒⑰④⑮⑦⌒⑩⑹

P	H	M	K	N	S
●	●		○	○	

GR.1 ∇≠‖ ::⊂ ∀∫ ::∫ ∩:.≌ ⩛ ∽∽‖ ⊅
Vc.60-80 fz.P161

GR.2 ∇≠‖ ::⊂ **<24HRC** ∽.:∮ :≅ ::∫ ∩:.≌ ⩛ ∽∽‖ ⊅
Vc.60-80 fz.P161

GR.3 ∇≠‖ ::⊂ **<30HRC** ⤑∫ ∩:.≌ ⩛ ∽∽‖ ⊅
Vc.50-60 fz.P161

GR.4 ∇≠‖ ::⊂ **30~38HRC** ⤆‖ :‖ ::∫ ∽∽‖ ⊅
Vc.40-60 fz.P161

GR.5 ∇≠‖ ::⊂ **38~48HRC** ⤆‖ :‖ ::∫ ∽∽‖ ⊅
Vc.40-50 fz.P161

GR.6 ∇≠‖ ::⊂ **48~56HRC** ⤆‖ :‖ ::∫ ∽∽‖ ⊅
Vc.30-50 fz.P161

GR.7 ∇≠‖ ::⊂ **56~68HRC** ⤆‖ :‖ ::∫ ∽∽‖ ⊅
Vc.30-40 fz.P161

GR.9 ∑≡∩≡∽
Vc.80-100 fz.P161

GR.11 ⇹∫ ∪⊂
Vc.100-120 fz.P161

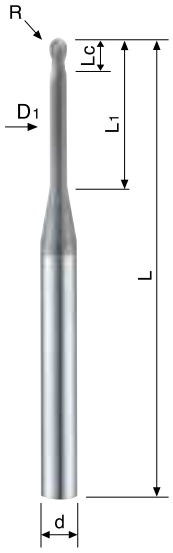
Ball Nose End Mills For Rib Processing

P H < 68HRC

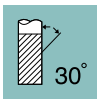
⑯11.⑯7⑲14.⑯8.1⑲⑯95.713.⑯318⑯1543.⑯318⑯11.7⑯818.

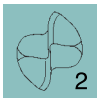
⑨5⑮(t)　F695GX-R×L1

R ±0.01	L1 mm	Lc mm	L mm	d h5	D1 mm	AlTiSiN F695GX
0.15R	1	0.24	50	4	0.27	●
0.15R	2	0.24	50	4	0.27	●
0.15R	3	0.24	50	4	0.27	●
0.2 R	1	0.3	50	4	0.37	●
0.2 R	2	0.3	50	4	0.37	●
0.2 R	3	0.3	50	4	0.37	●
0.2 R	4	0.3	50	4	0.37	●
0.2 R	5	0.3	50	4	0.37	●
0.25R	2	0.4	50	4	0.45	●
0.25R	3	0.4	50	4	0.45	●
0.25R	4	0.4	50	4	0.45	●
0.25R	5	0.4	50	4	0.45	●
0.25R	6	0.4	50	4	0.45	●
0.25R	8	0.4	50	4	0.45	●
0.3 R	2	0.5	50	4	0.55	●
0.3 R	3	0.5	50	4	0.55	●
0.3 R	4	0.5	50	4	0.55	●
0.3 R	5	0.5	50	4	0.55	●
0.3 R	6	0.5	50	4	0.55	●
0.3 R	8	0.5	50	4	0.55	●
0.4 R	2	0.6	50	4	0.75	●
0.4 R	3	0.6	50	4	0.75	●
0.4 R	4	0.6	50	4	0.75	●
0.4 R	5	0.6	50	4	0.75	●
0.4 R	6	0.6	50	4	0.75	●
0.4 R	8	0.6	50	4	0.75	●
0.4 R	10	0.6	50	4	0.75	●
0.5 R	3	0.8	50	4	0.95	●
0.5 R	4	0.8	50	4	0.95	●
0.5 R	5	0.8	50	4	0.95	●
0.5 R	6	0.8	50	4	0.95	●
0.5 R	8	0.8	50	4	0.95	●
0.5 R	10	0.8	50	4	0.95	●
0.5 R	12	0.8	50	4	0.95	●
0.5 R	16	0.8	50	4	0.95	●
0.5 R	20	0.8	60	4	0.95	●
0.6 R	4	1.0	50	4	1.15	●
0.6 R	6	1.0	50	4	1.15	●
0.6 R	8	1.0	50	4	1.15	●
0.6 R	10	1.0	50	4	1.15	●
0.6 R	12	1.0	50	4	1.15	●
0.75R	4	1.2	50	4	1.45	●
0.75R	6	1.2	50	4	1.45	●
0.75R	8	1.2	50	4	1.45	●
0.75R	10	1.2	50	4	1.45	●
0.75R	12	1.2	50	4	1.45	●
0.75R	16	1.2	50	4	1.45	●
0.75R	20	1.2	60	4	1.45	●



UMG Carbide　AlTiSiN GX







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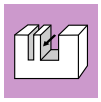
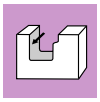
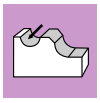





⑬⑮⑰⑥①④⑪⑥④⑪⑰④⑮⑦⑩⑥

P	H	M	K	N	S
●	●		○	○	

GR.1 ∇≠‖ ::⊂ ∀∫ ::∫ ∩:≌ ∨‖ ∽∽‖ ∅
Vc.50-65　fz.P163-4

GR.2 ∇≠‖ ::⊂ <24HRC ∽.∮ :≡ ::∫ ∩:≌ ∨‖ ∽∽‖ ∅
Vc.50-56　fz.P163-4

GR.3 ∇≠‖ ::⊂ <30HRC →∫ ∩:≌ ∨‖ ∽∽‖ ∅
Vc.40-55　fz.P163-4

GR.4 ∇≠‖ ::⊂ 30~38HRC ↞‖ :‖ ::∫ ∽∽‖ ∅
Vc.40-50　fz.P163-4

GR.5 ∇≠‖ ::⊂ 38~48HRC ↞‖ :‖ ::∫ ∽∽‖ ∅
Vc.30-40　fz.P163-4

GR.6 ∇≠‖ ::⊂ 48~56HRC ↞‖ :‖ ::∫ ∽∽‖ ∅
Vc.25-30　fz.P163-4

GR.7 ∇≠‖ ::⊂ 56~68HRC ↞‖ :‖ ::∫ ∽∽‖ ∅
Vc.25-30　fz.P163-4

GR.9 ∑≡∩≅∽
Vc.40-60　fz.P163-4

GR.11 ↔∫ ∪⊂
Vc.60-65　fz.P163-4

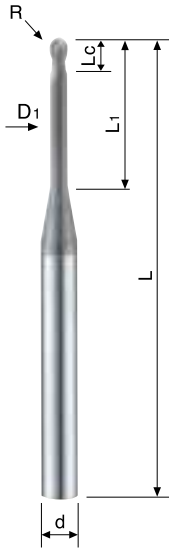
Ball Nose End Mills For Rib Processing

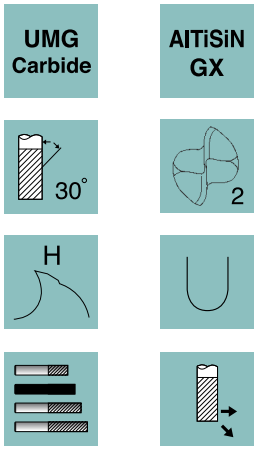
P H < 68HRC

⑯11.⑯7⑲14.⑯8.1.⑲⑯95.713.⑯318.⑯15.413.⑯318.⑯11.7⑯18.

⑨5.⑮(t)　F695GX-R×L1

R ±0.01	L1 mm	Lc mm	L mm	d h5	D1 mm	AlTiSiN F695GX
1.0 R	4	1.6	50	4	1.95	●
1.0 R	6	1.6	50	4	1.95	●
1.0 R	8	1.6	50	4	1.95	●
1.0 R	10	1.6	50	4	1.95	●
1.0 R	12	1.6	50	4	1.95	●
1.0 R	16	1.6	50	4	1.95	●
1.0 R	20	1.6	60	4	1.95	●
1.0 R	25	1.6	60	4	1.95	●
1.0 R	30	1.6	70	4	1.95	●
1.5 R	6	2.4	50	6	2.85	●
1.5 R	8	2.4	50	6	2.85	●
1.5 R	10	2.4	50	6	2.85	●
1.5 R	12	2.4	50	6	2.85	●
1.5 R	16	2.4	60	6	2.85	●
1.5 R	20	2.4	60	6	2.85	●
1.5 R	25	2.4	70	6	2.85	●
1.5 R	30	2.4	70	6	2.85	●
1.5 R	35	2.4	80	6	2.85	●
2.0 R	8	3.2	60	6	3.85	●
2.0 R	10	3.2	60	6	3.85	●
2.0 R	12	3.2	60	6	3.85	●
2.0 R	16	3.2	60	6	3.85	●
2.0 R	20	3.2	70	6	3.85	●
2.0 R	25	3.2	70	6	3.85	●
2.0 R	30	3.2	80	6	3.85	●
2.0 R	35	3.2	80	6	3.85	●
2.0 R	40	3.2	90	6	3.85	●
2.0 R	45	3.2	100	6	3.85	●
2.0 R	50	3.2	100	6	3.85	●





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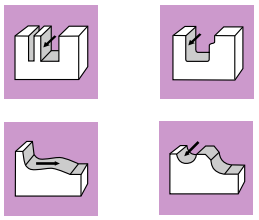


⑬⑮⑰⑥①④⑪⑥④⑪⑰④⑮⑦⑩⑥

P	H	M	K	N	S
●	●		○	○	

GR.1 ∇≠‖ ::⊂ ∀∫ ::∫ ∩∴≦ ∨‖ ∽∾‖ ⊅
Vc.50-65　fz.P163-4

GR.2 ∇≠‖ ::⊂ <24HRC ∽∴∮ ∴≡ ::∫ ∩∴≦ ∨‖ ∽∾‖ ⊅
Vc.50-56　fz.P163-4

GR.3 ∇≠‖ ::⊂ <30HRC →∫ ∩∴≦ ∨‖ ∽∾‖ ⊅
Vc.40-55　fz.P163-4

GR.4 ∇≠‖ ::⊂ 30~38HRC ↤‖ :‖ ::∫ ∽∾‖ ⊅
Vc.40-50　fz.P163-4

GR.5 ∇≠‖ ::⊂ 38~48HRC ↤‖ :‖ ::∫ ∽∾‖ ⊅
Vc.30-40　fz.P163-4

GR.6 ∇≠‖ ::⊂ 48~56HRC ↤‖ :‖ ::∫ ∽∾‖ ⊅
Vc.25-30　fz.P163-4

GR.7 ∇≠‖ ::⊂ 56~68HRC ↤‖ :‖ ::∫ ∽∾‖ ⊅
Vc.25-30　fz.P163-4

GR.9 ∑≡∩≅∽
Vc.40-60　fz.P163-4

GR.11 ↤∫ ∪⊂
Vc.60-65　fz.P163-4

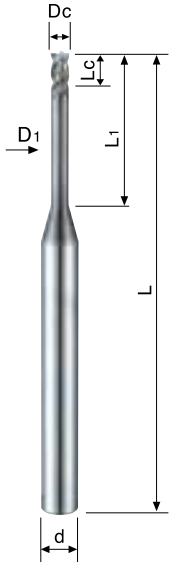
End Mills For Rib Processing

P H < 68HRC

⑰5.7⑬⑯⑬⑱⑯15.4⑬.⑯⑬⑱⑯11.7⑯⑬⑱.

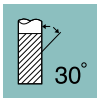
⑨5⑮(t) F694GX-Dc×L1

Dc +0 -0.02	L1 mm	Lc mm	L mm	d h5	D1 mm	AlTiSiN F694GX
1.0	4	1.5	50	4	0.95	●
1.0	6	1.5	50	4	0.95	●
1.0	8	1.5	50	4	0.95	●
1.0	10	1.5	50	4	0.95	●
1.0	12	1.5	50	4	0.95	●
1.5	6	2.3	50	4	1.45	●
1.5	8	2.3	50	4	1.45	●
1.5	10	2.3	50	4	1.45	●
1.5	12	2.3	50	4	1.45	●
1.5	16	2.3	50	4	1.45	●
2.0	6	3.0	50	4	1.95	●
2.0	8	3.0	50	4	1.95	●
2.0	10	3.0	50	4	1.95	●
2.0	12	3.0	50	4	1.95	●
2.0	16	3.0	50	4	1.95	●
2.0	20	3.0	60	4	1.95	●
2.0	25	3.0	60	4	1.95	●
2.0	30	3.0	70	4	1.95	●
3.0	10	4.5	50	6	2.85	●
3.0	12	4.5	50	6	2.85	●
3.0	16	4.5	60	6	2.85	●
3.0	20	4.5	60	6	2.85	●
3.0	25	4.5	70	6	2.85	●
3.0	30	4.5	70	6	2.85	●
4.0	12	6.0	60	6	3.85	●
4.0	16	6.0	60	6	3.85	●
4.0	20	6.0	70	6	3.85	●
4.0	25	6.0	70	6	3.85	●
4.0	30	6.0	80	6	3.85	●



UMG Carbide

AlTiSiN GX



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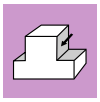
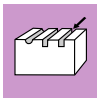
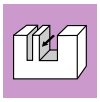






⑬–⑮⌒⌒⑰⑥①⌒④⑪⑥④⑪⌒⑰④⑮⑦⌒⑩⑥

P	H	M	K	N	S
●	●		○	○	

GR.1 ∇≠‖ ::⊂ ∀∫ ::∫ ∩:.≌ ∨‖ ∽∽‖ ∅
Vc.60-80 fz.P162

GR.2 ∇≠‖ ::⊂ <24HRC ∽.:∮ :≡ ::∫ ∩:.≌ ∨‖ ∽∽‖ ∅
Vc.60-80 fz.P162

GR.3 ∇≠‖ ::⊂ <30HRC ⇾∫ ∩:.≌ ∨‖ ∽∽‖ ∅
Vc.50-60 fz.P162

GR.4 ∇≠‖ ::⊂ 30~38HRC ⇹‖ ::∫ ∽∽‖ ∅
Vc.40-60 fz.P162

GR.5 ∇≠‖ ::⊂ 38~48HRC ⇹‖ ::∫ ∽∽‖ ∅
Vc.40-50 fz.P162

GR.6 ∇≠‖ ::⊂ 48~56HRC ⇹‖ ::∫ ∽∽‖ ∅
Vc.30-50 fz.P162

GR.7 ∇≠‖ ::⊂ 56~68HRC ⇹‖ ::∫ ∽∽‖ ∅
Vc.30-40 fz.P162

GR.9 ∑≡∩≅∽
Vc.80-100 fz.P162

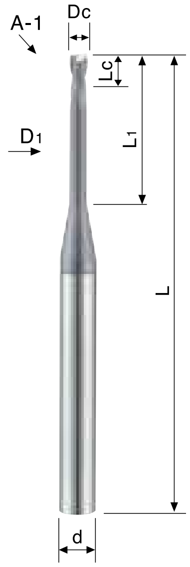
GR.11 ⇿∫ ∪⊂
Vc.100-120 fz.P162

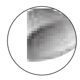
End Mills For Rib Processing

⑰5.7⑬.⑯⑬⑱⑯15.4⑬.⑯⑬⑱⑯11.7⑯⑱.

⑨5⑮(t) F691GX-Dc×L1

Dc +0 -0.02	L1 mm	Lc mm	L mm	d h5	D1 mm	AlTiSiN F691GX
0.5	2	0.7	50	4	0.45	●
0.5	4	0.7	50	4	0.45	●
0.5	6	0.7	50	4	0.45	●
0.6	2	0.9	50	4	0.55	●
0.6	4	0.9	50	4	0.55	●
0.6	6	0.9	50	4	0.55	●
0.7	2	1.0	50	4	0.65	●
0.7	4	1.0	50	4	0.65	●
0.7	6	1.0	50	4	0.65	●
0.8	4	1.2	50	4	0.75	●
0.8	6	1.2	50	4	0.75	●
0.8	8	1.2	50	4	0.75	●
1.0	6	1.5	50	4	0.95	●
1.0	8	1.5	50	4	0.95	●
1.0	10	1.5	50	4	0.95	●
1.0	12	1.5	50	4	0.95	●
1.2	6	1.8	50	4	1.15	●
1.2	10	1.8	50	4	1.15	●
1.5	6	2.3	50	4	1.45	●
1.5	8	2.3	50	4	1.45	●
1.5	10	2.3	50	4	1.45	●
1.5	12	2.3	50	4	1.45	●
1.5	14	2.3	50	4	1.45	●
1.5	16	2.3	50	4	1.45	●
1.5	20	2.3	60	4	1.45	●
2.0	6	3.0	50	4	1.95	●
2.0	8	3.0	50	4	1.95	●
2.0	10	3.0	50	4	1.95	●
2.0	12	3.0	50	4	1.95	●
2.0	14	3.0	50	4	1.95	●
2.0	16	3.0	50	4	1.95	●
2.0	20	3.0	60	4	1.95	●
2.5	8	3.7	50	4	2.40	●
2.5	10	3.7	50	4	2.40	●
2.5	12	3.7	50	4	2.40	●
2.5	16	3.7	60	4	2.40	●
3.0	12	4.5	50	6	2.85	●
3.0	14	4.5	60	6	2.85	●
3.0	16	4.5	60	6	2.85	●
3.0	18	4.5	60	6	2.85	●
3.0	20	4.5	60	6	2.85	●
3.0	25	4.5	70	6	2.85	●





Sharp Corner edge
A-1

UMG Carbide

AlTiSiN GX

30°

2

N

90°

P	H	M	K	N	S
●	●		○	○	

GR.1 Vc.60-80 fz.P161

GR.2 <24HRC Vc.60-80 fz.P161

GR.3 <30HRC Vc.50-60 fz.P161

GR.4 30~38HRC Vc.40-60 fz.P161

GR.5 38~48HRC Vc.40-50 fz.P161

GR.6 48~56HRC Vc.30-50 fz.P161

GR.7 56~68HRC Vc.30-40 fz.P161

GR.9 Vc.80-100 fz.P161

GR.11 Vc.100-120 fz.P161


7leaders™
The Art of Cutting

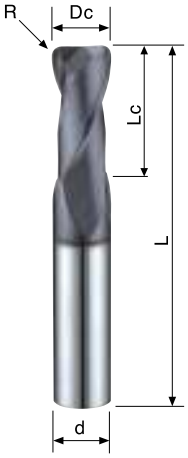
①4⒃5.4⒆⒇⒀⑼5)	⑨5⒂(t)	⑬6.⒆8.⑾4⒆6)			⑬⑿7⑽⑷⑼8⒀⒃3⒅⒇3⑾⑼7⑽2.						⑯97⒁4⒆13⑾
					P	H	M	K	N	S	
	B255X	UMG Carbide	AlTiN X	30°	●	●	○	●	○		P53
	B257X	UMG Carbide	AlTiN X	30°	●	●	○	●	○		P53
	B256X	UMG Carbide	AlTiN X	30°	●	●	○	●	○		P54
	B258X	UMG Carbide	AlTiN X	30°	●	●	○	●	○		P54
	B265X	UMG Carbide	AlTiCrN X	30°	●	●	○	●	○		P55
	B267X	UMG Carbide	AlTiCrN X	30°	●	●	○	●	○		P55
	B266X	UMG Carbide	AlTiCrN X	30°	●	●	○	●	○		P56
	B268X	UMG Carbide	AlTiCrN X	30°	●	●	○	●	○		P56
	B252GX	UMG Carbide	AlTiSiN GX	35° 38°	●	●	○	●	○		P57
	B269EX	UMG Carbide	AlTiSiN EX	45°		●		○			P58
	B270EX	UMG Carbide	AlTiSiN EX	45°	●	●		○			P59
	B271GX	UMG Carbide	AlTiSiN GX	0°		●		●			P60
	E105X	UMG Carbide	AlTiCrN X	30°	●	●		○	○		P61、62

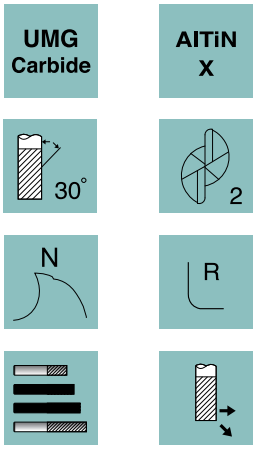
End Mills With Corner Radius

K P H < 52HRC

B255X-Dc×R

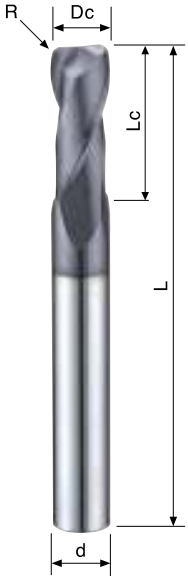
Dc h10	R ±0.01	Lc mm	L mm	d h6	AlTiN B255X
4	R0.2	11	50	6	●
4	R0.5	11	50	6	●
6	R0.3	16	50	6	●
6	R0.5	16	50	6	●
6	R1.0	16	50	6	●
8	R0.3	20	60	8	●
8	R0.5	20	60	8	●
8	R1.0	20	60	8	●
10	R0.5	22	72	10	●
10	R1.0	22	72	10	●
10	R2.0	22	72	10	●
12	R0.5	26	75	12	●
12	R1.0	26	75	12	●
12	R2.0	26	75	12	●





B257X-Dc×R

Dc h10	R ±0.01	Lc mm	L mm	d h6	AlTiN B257X
4	R0.2	15	60	4	●
4	R0.5	15	60	4	●
6	R0.3	20	80	6	●
6	R0.5	20	80	6	●
6	R1.0	20	80	6	●
8	R0.3	25	100	8	●
8	R0.5	25	100	8	●
8	R1.0	25	100	8	●
10	R0.5	30	100	10	●
10	R1.0	30	100	10	●
10	R2.0	30	100	10	●
12	R0.5	35	110	12	●
12	R1.0	35	110	12	●
12	R2.0	35	110	12	●



P	H	M	K	N	S
●	●	○	●	○	

GR.1
Vc.80-100 fz.P161

GR.2 <24HRC
Vc.80-100 fz.P161

GR.3 <30HRC
Vc.60-80 fz.P161

GR.4 30~38HRC
Vc.50-70 fz.P161

GR.5 38~48HRC
Vc.40-60 fz.P161

GR.6 48~56HRC
Vc.25-40 fz.P161

GR.8
Vc.40-60 fz.P161

GR.9
Vc.80-100 fz.P161

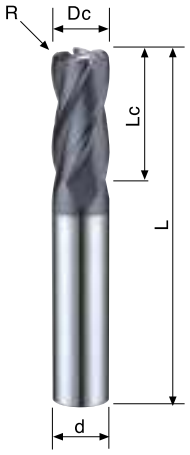
GR.11
Vc.150-200 fz.P161

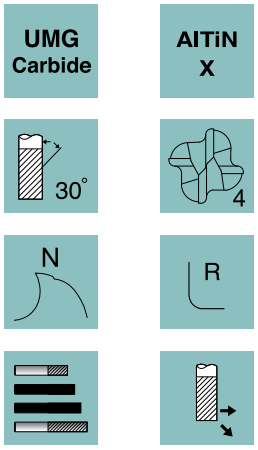
End Mills With Corner Radius

K P H < 52HRC

B256X-Dc×R

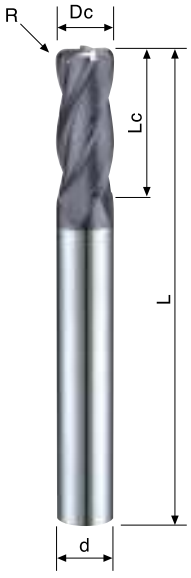
Dc h10	R ±0.01	Lc mm	L mm	d h6	AlTiN B256X
4	R0.2	11	50	6	●
4	R0.5	11	50	6	●
6	R0.3	16	50	6	●
6	R0.5	16	50	6	●
6	R1.0	16	50	6	●
8	R0.3	20	60	8	●
8	R0.5	20	60	8	●
8	R1.0	20	60	8	●
10	R0.5	22	72	10	●
10	R1.0	22	72	10	●
10	R2.0	22	72	10	●
12	R0.5	26	75	12	●
12	R1.0	26	75	12	●
12	R2.0	26	75	12	●





B258X-Dc×R

Dc h10	R ±0.01	Lc mm	L mm	d h6	AlTiN B258X
4	R0.2	15	60	4	●
4	R0.5	15	60	4	●
6	R0.3	20	80	6	●
6	R0.5	20	80	6	●
6	R1.0	20	80	6	●
8	R0.3	25	100	8	●
8	R0.5	25	100	8	●
8	R1.0	25	100	8	●
10	R0.5	30	100	10	●
10	R1.0	30	100	10	●
10	R2.0	30	100	10	●
12	R0.5	35	110	12	●
12	R1.0	35	110	12	●
12	R2.0	35	110	12	●



P	H	M	K	N	S
●	●	○	●	○	

GR.1
Vc.80-100 fz.P162

GR.2 <24HRC
Vc.80-100 fz.P162

GR.3 <30HRC
Vc.60-80 fz.P162

GR.4 30~38HRC
Vc.50-70 fz.P162

GR.5 38~48HRC
Vc.40-60 fz.P162

GR.6 48~56HRC
Vc.25-40 fz.P162

GR.8
Vc.40-60 fz.P162

GR.9
Vc.80-100 fz.P162

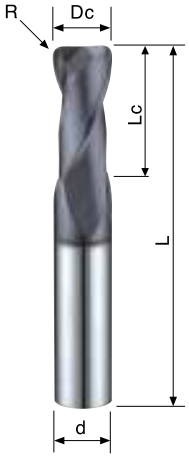
GR.11
Vc.150-200 fz.P162

End Mills With Corner Radius

K P H < 56HRC

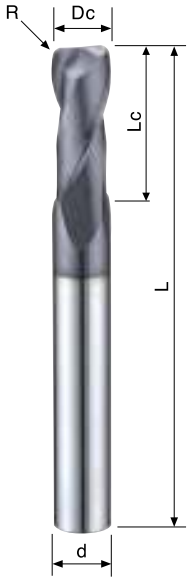
B265X-Dc×R

Dc h10	R ±0.01	Lc mm	L mm	d h6	AlTiCrN B265X
3	R0.2	8	50	6	●
3	R0.3	8	50	6	●
3	R0.5	8	50	6	●
4	R0.2	11	50	6	●
4	R0.3	11	50	6	●
4	R0.5	11	50	6	●
5	R0.3	13	50	6	●
5	R0.5	13	50	6	●
6	R0.3	16	50	6	●
6	R0.5	16	50	6	●
6	R1.0	16	50	6	●
6	R1.5	16	50	6	●
8	R0.3	20	60	8	●
8	R0.5	20	60	8	●
8	R1.0	20	60	8	●
8	R1.5	20	60	8	●
8	R2.0	20	60	8	●
10	R0.3	22	72	10	●
10	R0.5	22	72	10	●
10	R1.0	22	72	10	●
10	R1.5	22	72	10	●
10	R2.0	22	72	10	●
10	R3.0	22	72	10	●
12	R0.5	26	75	12	●
12	R1.0	26	75	12	●
12	R1.5	26	75	12	●
12	R2.0	26	75	12	●
12	R3.0	26	75	12	●



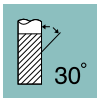
B267X-Dc×R

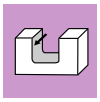
Dc h10	R ±0.01	Lc mm	L mm	d h6	AlTiCrN B267X
3	R0.2	10	50	3	●
3	R0.5	10	50	3	●
4	R0.2	15	60	4	●
4	R0.5	15	60	4	●
6	R0.3	20	80	6	●
6	R0.5	20	80	6	●
6	R1.0	20	80	6	●
6	R1.5	20	80	6	●
8	R0.3	25	100	8	●
8	R0.5	25	100	8	●
8	R1.0	25	100	8	●
8	R1.5	25	100	8	●
8	R2.0	25	100	8	●
10	R0.3	30	100	10	●
10	R0.5	30	100	10	●
10	R1.0	30	100	10	●
10	R1.5	30	100	10	●
10	R2.0	30	100	10	●
12	R0.5	35	110	12	●
12	R1.0	35	110	12	●
12	R1.5	35	110	12	●
12	R2.0	35	110	12	●

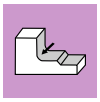


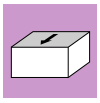
UMG Carbide

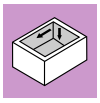
AlTiCrN X











P	H	M	K	N	S
●	●	○	●	○	

GR.1
Vc.80-100 fz.P161

GR.2 <24HRC
Vc.80-100 fz.P161

GR.3 <30HRC
Vc.60-80 fz.P161

GR.4 30~38HRC
Vc.50-70 fz.P161

GR.5 38~48HRC
Vc.40-60 fz.P161

GR.6 48~56HRC
Vc.25-40 fz.P161

GR.8
Vc.40-60 fz.P161

GR.9
Vc.80-100 fz.P161

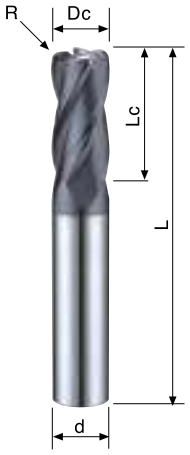
GR.11
Vc.150-200 fz.P161

End Mills With Corner Radius

K P H < 56HRC

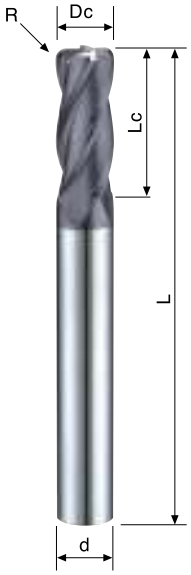
B266X-Dc×R

Dc h10	R ±0.01	Lc mm	L mm	d h6	AlTiCrN B266X
3	R0.2	8	50	6	●
3	R0.3	8	50	6	●
3	R0.5	8	50	6	●
4	R0.2	11	50	6	●
4	R0.3	11	50	6	●
4	R0.5	11	50	6	●
5	R0.3	13	50	6	●
5	R0.5	13	50	6	●
6	R0.3	16	50	6	●
6	R0.5	16	50	6	●
6	R1.0	16	50	6	●
6	R1.5	16	50	6	●
8	R0.3	20	60	8	●
8	R0.5	20	60	8	●
8	R1.0	20	60	8	●
8	R1.5	20	60	8	●
8	R2.0	20	60	8	●
10	R0.3	22	72	10	●
10	R0.5	22	72	10	●
10	R1.0	22	72	10	●
10	R1.5	22	72	10	●
10	R2.0	22	72	10	●
10	R3.0	22	72	10	●
12	R0.5	26	75	12	●
12	R1.0	26	75	12	●
12	R1.5	26	75	12	●
12	R2.0	26	75	12	●
12	R3.0	26	75	12	●



B268X-Dc×R

Dc h10	R ±0.01	Lc mm	L mm	d h6	AlTiCrN B268X
3	R0.2	10	50	3	●
3	R0.5	10	50	3	●
4	R0.2	15	60	4	●
4	R0.5	15	60	4	●
6	R0.3	20	80	6	●
6	R0.5	20	80	6	●
6	R1.0	20	80	6	●
6	R1.5	20	80	6	●
8	R0.3	25	100	8	●
8	R0.5	25	100	8	●
8	R1.0	25	100	8	●
8	R1.5	25	100	8	●
8	R2.0	25	100	8	●
10	R0.3	30	100	10	●
10	R0.5	30	100	10	●
10	R1.0	30	100	10	●
10	R1.5	30	100	10	●
10	R2.0	30	100	10	●
12	R0.5	35	110	12	●
12	R1.0	35	110	12	●
12	R1.5	35	110	12	●
12	R2.0	35	110	12	●



UMG Carbide

AlTiCrN X

30°

4

N

R

P	H	M	K	N	S
●	●	○	●	○	

GR.1
Vc.80-100 fz.P162

GR.2 <24HRC
Vc.80-100 fz.P162

GR.3 <30HRC
Vc.60-80 fz.P162

GR.4 30~38HRC
Vc.50-70 fz.P162

GR.5 38~48HRC
Vc.40-60 fz.P162

GR.6 48~56HRC
Vc.25-40 fz.P162

GR.8
Vc.40-60 fz.P162

GR.9
Vc.80-100 fz.P162

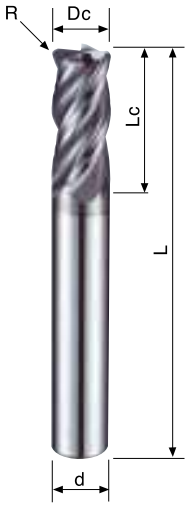
GR.11
Vc.150-200 fz.P162

End Mills With Corner Radius

K P H < 68HRC

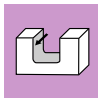
B252GX-Dc×R

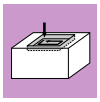
Dc h10	R ±0.01	Lc mm	L mm	d h6	AlTiSiN B252GX
4	R0.2	11	50	6	●
4	R0.5	11	50	6	●
6	R0.3	16	50	6	●
6	R0.5	16	50	6	●
6	R1.0	16	50	6	●
8	R0.3	20	60	8	●
8	R0.5	20	60	8	●
8	R1.0	20	60	8	●
10	R0.5	22	72	10	●
10	R1.0	22	72	10	●
10	R2.0	22	72	10	●
12	R0.5	26	75	12	●
12	R1.0	26	75	12	●
12	R2.0	26	75	12	●

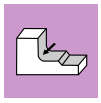


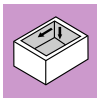
UMG Carbide

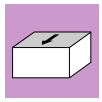
AlTiSiN GX

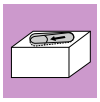












P	H	M	K	N	S
●	●	○	●	○	

GR.1 Vc.100-120 fz.P162

GR.2 <24HRC Vc.100-120 fz.P162

GR.3 <30HRC Vc.80-100 fz.P162

GR.4 30~38HRC Vc.60-80 fz.P162

GR.5 38~48HRC Vc.40-60 fz.P162

GR.6 48~56HRC Vc.30-40 fz.P162

GR.7 56~68HRC Vc.20-30 fz.P162

GR.8 Vc.40-60 fz.P162

GR.9 Vc.100-120 fz.P162

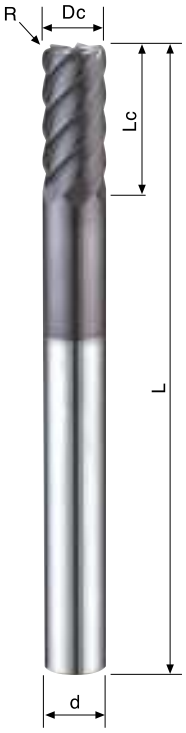
GR.11 Vc.150-200 fz.P162

End Mills With Corner Radius

H 30-68HRC

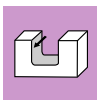
B269EX-Dc×R

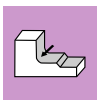
Dc h10	R ±0.01	Lc mm	L mm	d h6	AlTiSiN B269EX
6	R0.5	16	80	6	●
6	R1.0	16	80	6	●
8	R0.5	20	100	8	●
8	R1.0	20	100	8	●
10	R0.5	22	100	10	●
10	R1.0	22	100	10	●
12	R0.5	26	110	12	●
12	R1.0	26	110	12	●
16	R1.0	38	140	16	●
16	R2.0	38	140	16	●
20	R1.0	38	160	20	●
20	R2.0	38	160	20	●



UMG Carbide

AlTiSiN EX





P	H	M	K	N	S
	●		○		

GR.4 30~38HRC
Vc.120-140 fz.P162

GR.5 38~48HRC
Vc.100-120 fz.P162

GR.6 48~56HRC
Vc.80-100 fz.P162

GR.7 56~68HRC
Vc.50-80 fz.P162

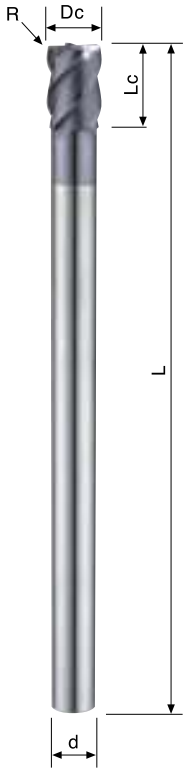
GR.9
Vc.120-160 fz.P162

End Mills With Corner Radius

P H < 68HRC

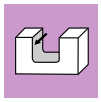
B270EX-Dc×R

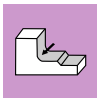
Dc h10	R ±0.01	Lc mm	L mm	d h6	AlTiSiN B270EX
10	R0.5	15	130	8	●
10	R1.0	15	130	8	●
12	R0.5	18	150	10	●
12	R1.0	18	150	10	●
14	R0.5	21	160	12	●
14	R1.0	21	160	12	●
18	R0.5	27	180	16	●
18	R1.0	27	180	16	●



UMG Carbide

AlTiSiN EX





P	H	M	K	N	S
●	●		○		

GR.1
Vc.80-100 fz.P162

GR.2 <24HRC
Vc.70-80 fz.P162

GR.3 <30HRC
Vc.60-70 fz.P162

GR.4 30~38HRC
Vc.50-60 fz.P162

GR.5 38~48HRC
Vc.40-50 fz.P162

GR.6 48~56HRC
Vc.30-40 fz.P162

GR.7 56~68HRC
Vc.20-30 fz.P162

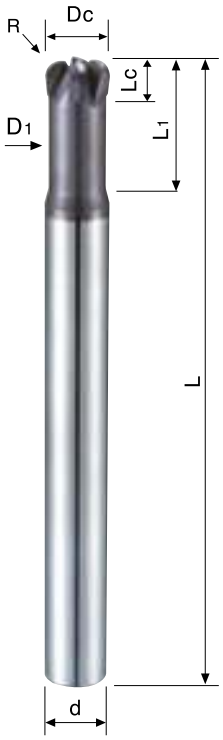
GR.9
Vc.120-160 fz.P162

End Mills With Corner Radius

K H 30-68HRC

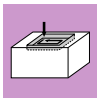
B271GX-Dc

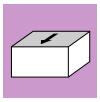
Dc h10	R ±0.01	Lc mm	L mm	d h6	L1 mm	D1 mm	AlTiSiN B271GX
3	R0.75	1.5	70	6	6	2.7	●
4	R1.0	2.0	70	6	8	3.6	●
5	R1.2	2.5	80	6	10	4.5	●
6	R1.5	3.0	80	6	12	5.4	●
8	R2.0	4.0	100	8	16	7.2	●
10	R2.0	5.0	100	10	20	9.0	●
12	R3.0	6.0	110	12	24	11.0	●

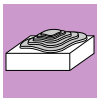


UMG Carbide

AlTiSiN GX







P	H	M	K	N	S
	●		●		

GR.4 30~38HRC
Vc.70-80 fz.P162

GR.5 38~48HRC
Vc.60-70 fz.P162

GR.6 48~56HRC
Vc.40-50 fz.P162

GR.7 56~68HRC
Vc.25-30 fz.P162

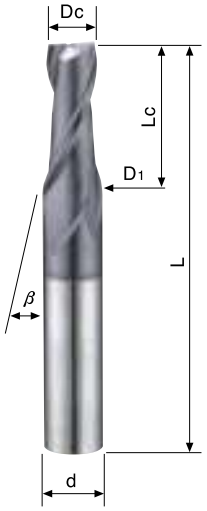
GR.9
Vc.100-120 fz.P162

Taper End Mills

P H < 56HRC

E105X-Dc×β

Dc h10	β on Side	D1 mm	Lc mm	L mm	d h6	AlTiCrN E105X
1.0	30'	1.07	4	50	4	●
1.0	1°	1.14	4	50	4	●
1.0	1°30'	1.21	4	50	4	●
1.0	2°	1.28	4	50	4	●
1.0	2°30'	1.35	4	50	4	●
1.0	3°	1.42	4	50	4	●
1.0	4°	1.56	4	50	4	●
1.0	5°	1.70	4	50	4	●
1.0	6°	1.84	4	50	4	●
1.0	7°	1.98	4	50	4	●
1.0	10°	2.41	4	50	4	●
1.5	30'	1.59	5	50	4	●
1.5	1°	1.67	5	50	4	●
1.5	1°30'	1.76	5	50	4	●
1.5	2°	1.85	5	50	4	●
1.5	2°30'	1.93	5	50	4	●
1.5	3°	2.02	5	50	4	●
1.5	4°	2.20	5	50	4	●
1.5	5°	2.37	5	50	4	●
1.5	6°	2.55	5	50	4	●
1.5	7°	2.73	5	50	4	●
1.5	10°	3.26	5	50	4	●
2.0	30'	2.10	6	50	4	●
2.0	1°	2.21	6	50	4	●
2.0	1°30'	2.31	6	50	4	●
2.0	2°	2.41	6	50	4	●
2.0	2°30'	2.52	6	50	4	●
2.0	3°	2.62	6	50	4	●
2.0	4°	2.84	6	50	4	●
2.0	5°	3.05	6	50	4	●
2.0	6°	3.26	6	50	4	●
2.0	7°	3.47	6	50	4	●
2.0	10°	4.11	6	50	6	●
2.5	30'	2.64	8	50	4	●
2.5	1°	2.78	8	50	4	●
2.5	1°30'	2.91	8	50	4	●
2.5	2°	3.05	8	50	4	●
2.5	2°30'	3.20	8	50	4	●
2.5	3°	3.33	8	50	4	●
2.5	4°	3.62	8	50	4	●
2.5	5°	3.90	8	50	4	●
2.5	6°	4.18	8	50	6	●
2.5	7°	4.46	8	50	6	●
2.5	10°	5.32	8	50	6	●
3.0	30'	3.17	10	50	6	●
3.0	1°	3.35	10	50	6	●
3.0	1°30'	3.52	10	50	6	●
3.0	2°	3.69	10	50	6	●
3.0	2°30'	3.87	10	50	6	●
3.0	3°	4.05	10	50	6	●
3.0	4°	4.40	10	50	6	●
3.0	5°	4.75	10	50	6	●
3.0	6°	5.10	10	50	6	●
3.0	7°	5.46	10	50	6	●
3.0	10°	6.53	10	60	8	●



UMG Carbide

AlTiCrN X

30°

2

N

90°

P	H	M	K	N	S
●	●		○	○	

GR.1 Vc.50-70 fz.P161

GR.2 <24HRC Vc.50-70 fz.P161

GR.3 <30HRC Vc.40-60 fz.P161

GR.4 30~38HRC Vc.40-60 fz.P161

GR.5 38~48HRC Vc.30-40 fz.P161

GR.6 48~56HRC Vc.25-30 fz.P161

GR.9 Vc.60-80 fz.P161

GR.10 Vc.100-120 fz.P161

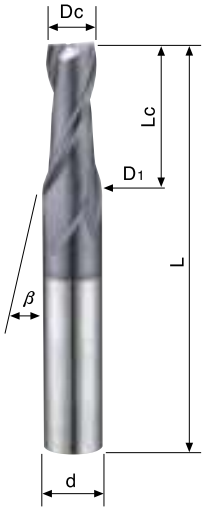
GR.11 Vc.70-90 fz.P161

Taper End Mills

P H < 56HRC

E105X-Dc×β

Dc h10	β on Side	D1 mm	Lc mm	L mm	d h6	AlTiCrN E105X
4.0	30'	4.26	15	50	6	●
4.0	1°	4.52	15	50	6	●
4.0	1°30'	4.79	15	50	6	●
4.0	2°	5.04	15	50	6	●
4.0	2°30'	5.31	15	50	6	●
4.0	3°	5.57	15	50	6	●
4.0	4°	6.10	15	60	8	●
4.0	5°	6.62	15	60	8	●
4.0	6°	7.15	15	60	8	●
4.0	7°	7.68	15	60	8	●
4.0	10°	9.30	15	70	10	●
5.0	30'	5.34	20	60	6	●
5.0	1°	5.70	20	60	6	●
5.0	1°30'	6.00	20	60	6	●
5.0	2°	6.39	20	60	8	●
5.0	2°30'	6.75	20	60	8	●
5.0	3°	7.10	20	60	8	●
5.0	4°	7.80	20	60	8	●
5.0	5°	8.50	20	70	10	●
5.0	6°	9.20	20	70	10	●
5.0	7°	9.91	20	70	10	●
5.0	10°	12.00	20	75	12	●
6.0	30'	6.35	20	60	8	●
6.0	1°	6.70	20	60	8	●
6.0	1°30'	7.05	20	60	8	●
6.0	2°	7.40	20	60	8	●
6.0	2°30'	7.75	20	60	8	●
6.0	3°	8.00	20	60	8	●
6.0	4°	8.80	20	70	10	●
6.0	5°	9.50	20	70	10	●
6.0	6°	10.20	20	75	12	●
6.0	7°	10.91	20	75	12	●
6.0	10°	13.05	20	75	12	●
8.0	30'	8.44	25	70	10	●
8.0	1°	8.87	25	70	10	●
8.0	1°30'	9.31	25	70	10	●
8.0	2°	9.74	25	70	10	●
8.0	2°30'	10.00	25	70	10	●
8.0	3°	10.62	25	75	12	●
8.0	5°	12.37	25	90	12	●
10.0	30'	10.61	35	90	10	●
10.0	1°	11.22	35	90	10	●
10.0	1°30'	11.83	35	90	10	●
10.0	2°	12.44	35	90	12	●
10.0	2°30'	13.06	35	90	12	●
10.0	3°	13.67	35	90	12	●
10.0	5°	16.00	35	100	16	●



UMG Carbide

AlTiCrN X

30°

2

N

90°

P	H	M	K	N	S
●	●		○	○	

GR.1
Vc.50-70 fz.P161

GR.2 <24HRC
Vc.50-70 fz.P161

GR.3 <30HRC
Vc.40-60 fz.P161

GR.4 30~38HRC
Vc.40-60 fz.P161

GR.5 38~48HRC
Vc.30-40 fz.P161

GR.6 48~56HRC
Vc.25-30 fz.P161

GR.9
Vc.60-80 fz.P161

GR.10
Vc.100-120 fz.P161

GR.11
Vc.70-90 fz.P161

7leaders™
The Art of Cutting

End Mills For AL/CU/FRP/PVC

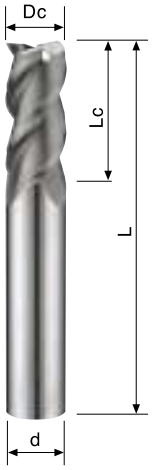
	E133	MG Carbide	Uncoated Blank	45°	P	H	M	K	N	S	P65
	E135 E136	MG Carbide	Uncoated Blank	45°	P	H	M	K	N	S	P66
	E137	MG Carbide	Uncoated Blank	45°	P	H	M	K	N	S	P66
	E132	UMG Carbide	Uncoated Blank	30°	P	H	M	K	N	S	P67
	E134	UMG Carbide	Uncoated Blank	30°	P	H	M	K	N	S	P67
	E143	MG Carbide	Uncoated Blank	40°	P	H	M	K	N	S	P68
	E145	MG Carbide	Uncoated Blank	40°	P	H	M	K	N	S	P69
	E192	MG Carbide	Uncoated Blank	55°	P	H	M	K	N	S	P70
	E193	MG Carbide	Uncoated Blank	50°	P	H	M	K	N	S	P71
	F622	UMG Carbide	Uncoated Blank	25°	P	H	M	K	N	S	P72
	E105	UMG Carbide	Uncoated Blank	30°	P	H	M	K	N	S	P73、74
	E195R	MG Carbide	Uncoated Blank	30°	P	H	M	K	N	S	P75
	E195L	MG Carbide	Uncoated Blank	30°	P	H	M	K	N	S	P75
	E189R	MG Carbide	Uncoated Blank	21°	P	H	M	K	N	S	P76
	E189L	MG Carbide	Uncoated Blank	21°	P	H	M	K	N	S	P76
	E190 E191	MG Carbide			P	H	M	K	N	S	P77
	E196 E197	MG Carbide			P	H	M	K	N	S	P78
	E198 E199	MG Carbide			P	H	M	K	N	S	P79

AL CU PVC FRP

End Mills For Aluminum

E133-Dc

Dc h10	Lc mm	L mm	d h6	Blank E133
1.0	3	38	3	●
1.5	5	38	3	●
2.0	6	38	3	●
2.5	7	38	3	●
3.0	9	38	3	●
4.0	14	50	4	●
5.0	16	50	5	●
6.0	20	63	6	●
7.0	20	63	8	●
8.0	20	63	8	●
9.0	22	72	10	●
10.0	22	72	10	●
12.0	26	75	12	●
14.0	32	89	14	●
16.0	32	89	16	●
18.0	38	100	18	●
20.0	38	100	20	●



MG Carbide

Uncoated Blank

45°

3

H

90°

P	H	M	K	N	S
				●	

GR.10
Vc.150-200 fz.P161

GR.11
Vc.100-150 fz.P161

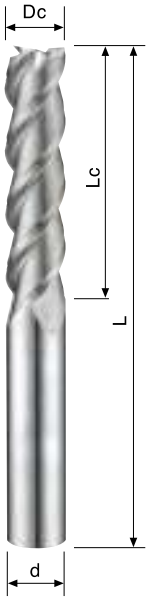
GR.12
Vc.60-80 fz.P161

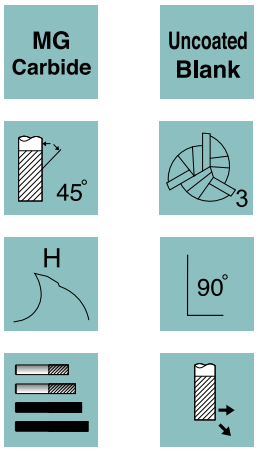
End Mills For Aluminum

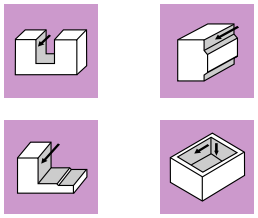
N

E135-Dc

Dc h10	Lc mm	L mm	d h6	Blank E135
3	20	57	3	●
4	20	57	4	●
5	25	63	5	●
6	28	75	6	●
7	30	75	8	●
8	30	75	8	●
9	32	75	10	●
10	32	75	10	●
12	50	100	12	●
14	57	127	14	●
16	57	127	16	●
20	57	127	20	●

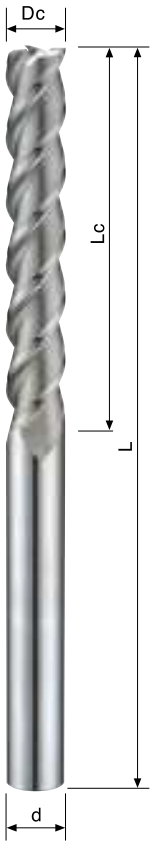






E136-Dc

Dc h10	Lc mm	L mm	d h6	Blank E136
3	25	75	3	●
4	28	75	4	●
5	32	75	5	●
6	38	100	6	●
8	42	100	8	●
10	45	100	10	●
12	75	150	12	●
14	80	150	14	●
16	80	150	16	●
20	80	150	20	●



P	H	M	K	N	S
				●	

GR.10
Vc.120-150 fz.P161

GR.11
Vc.80-120 fz.P161

GR.12
Vc.40-60 fz.P161

E137-Dc

Dc h10	Lc mm	L mm	d h6	Blank E137
5	45	100	6	●
6	50	100	6	●
8	75	150	8	●
10	75	150	10	●
12	75	200	12	●
16	80	200	16	●
20	80	200	20	●

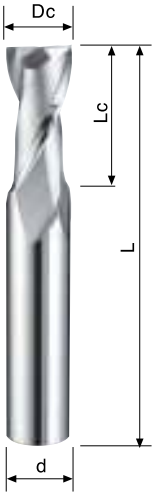
AL Cu PVC FRP

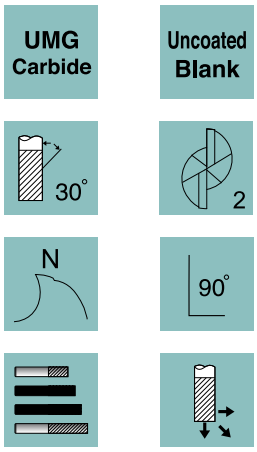
End Mills For Aluminium

N

E132-Dc

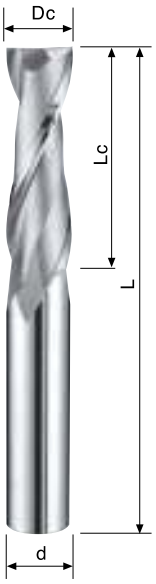
Dc h10	Lc mm	L mm	d h6	Blank E132
1.0	3	50	4	●
1.5	5	50	4	●
2.0	6	50	4	●
2.5	8	50	4	●
3.0	8	50	6	●
4.0	11	50	6	●
5.0	13	50	6	●
6.0	16	50	6	●
8.0	20	60	8	●
10.0	22	72	10	●
12.0	26	75	12	●

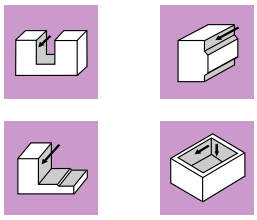




E134-Dc

Dc h10	Lc mm	L mm	d h6	Blank E134
3	12	50	6	●
4	17	50	6	●
5	20	60	6	●
6	20	60	6	●
8	28	70	8	●
10	34	80	10	●
12	40	90	12	●





P	H	M	K	N	S
				●	

GR.10
Vc.120-160 fz.P161

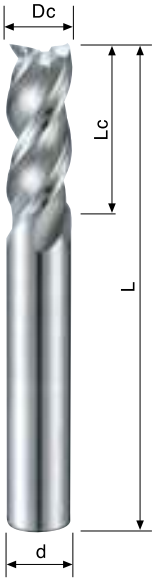
GR.11
Vc.80-120 fz.P161

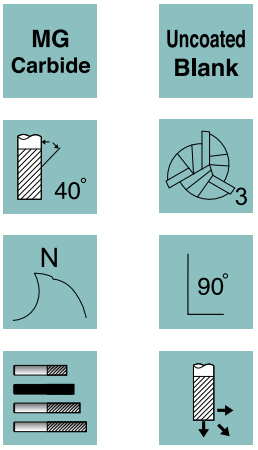
End Mills For Aluminium

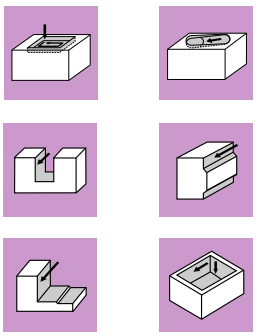
N

E143-Dc

Dc h10	Lc mm	L mm	d h6	Blank E143
3	8	50	6	●
4	11	50	6	●
5	13	50	6	●
6	16	50	6	●
8	20	60	8	●
10	22	72	10	●
12	26	75	12	●







P	H	M	K	N	S
				●	

GR.10

Vc.180-220 fz.P161

GR.11

Vc.80-120 fz.P161

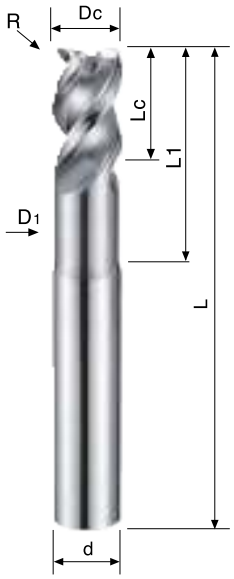
AL Cu PVC FRP

End Mills For Aluminium

N

E145-Dc×R

Dc h10	R 0/+0.02	Lc mm	L mm	d h6	L1 mm	D1 mm	Blank E145
3	R0.5	4.5	50	6	9	2.8	●
4	R0.5	6.0	50	6	12	3.7	●
5	R0.5	7.5	60	6	15	4.6	●
6	R0.5	9.0	60	6	18	5.5	●
6	R1.0	9.0	60	6	18	5.5	●
8	R0.5	12.0	70	8	24	7.4	●
8	R1.0	12.0	70	8	24	7.4	●
10	R0.5	15.0	80	10	30	9.2	●
10	R1.0	15.0	80	10	30	9.2	●
12	R0.5	18.0	90	12	36	11.0	●
12	R1.0	18.0	90	12	36	11.0	●



MG Carbide

Uncoated Blank

40°

3

N

R

P	H	M	K	N	S
				●	

GR.10

Vc.180-220 fz.P161

GR.11

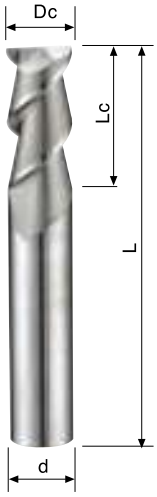
Vc.80-120 fz.P161

End Mills For Aluminium

N

E192-Dc

Dc h10	Lc mm	L mm	d h6	Blank E192
3	9	38	3	●
4	14	50	4	●
5	16	50	5	●
6	20	63	6	●
8	22	63	8	●
10	30	72	10	●
12	30	75	12	●
16	40	100	16	●
20	45	100	20	●



MG Carbide

Uncoated Blank

55°

2

W

90°

AL
Cu
PVC
FRP

P	H	M	K	N	S
				●	

GR.10

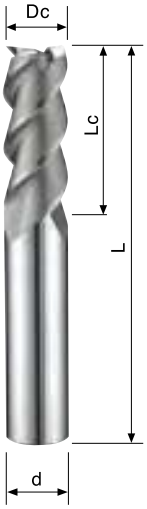
Vc.150-200 fz.P161

End Mills For Aluminium

N

E193-Dc

Dc h10	Lc mm	L mm	d h6	Blank E193
3	9	50	6	●
4	14	50	6	●
5	16	50	6	●
6	20	63	6	●
8	22	63	8	●
10	30	72	10	●
12	30	75	12	●
16	40	100	16	●
20	45	100	20	●



MG Carbide

Uncoated Blank

50°

3

W

90°

P	H	M	K	N	S
				●	

GR.10

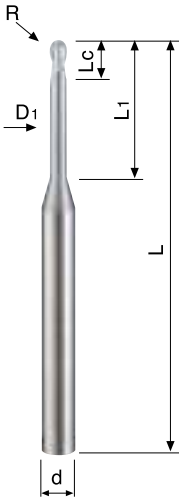
Vc.150-200 fz.P161

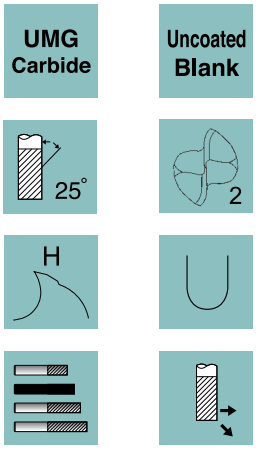
Ball Nose End Mills For Copper

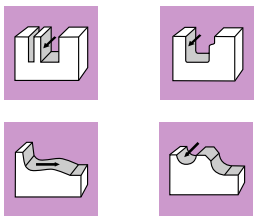
N

F622-R×L1

R ±0.01	L1 mm	Lc mm	L mm	d h6	D1 mm	Blank F622
0.25R	2	0.7	50	4	0.45	●
0.25R	4	0.7	50	4	0.45	●
0.25R	6	0.7	50	4	0.45	●
0.3 R	2	0.9	50	4	0.55	●
0.3 R	4	0.9	50	4	0.55	●
0.3 R	6	0.9	50	4	0.55	●
0.4 R	6	1.2	50	4	0.75	●
0.4 R	8	1.2	50	4	0.75	●
0.5 R	6	1.5	50	4	0.95	●
0.5 R	8	1.5	50	4	0.95	●
0.5 R	10	1.5	50	4	0.95	●
0.5 R	12	1.5	50	4	0.95	●
0.5 R	16	1.5	50	4	0.95	●
0.6 R	8	1.8	50	4	1.15	●
0.6 R	12	1.8	50	4	1.15	●
0.75R	6	2.3	50	4	1.45	●
0.75R	8	2.3	50	4	1.45	●
0.75R	12	2.3	50	4	1.45	●
0.75R	16	2.3	50	4	1.45	●
0.75R	20	2.3	60	4	1.45	●
1.0 R	8	3.0	50	4	1.95	●
1.0 R	12	3.0	50	4	1.95	●
1.0 R	16	3.0	50	4	1.95	●
1.0 R	20	3.0	60	4	1.95	●
1.0 R	25	3.0	60	4	1.95	●
1.5 R	10	4.5	50	6	2.85	●
1.5 R	16	4.5	60	6	2.85	●
1.5 R	20	4.5	60	6	2.85	●
1.5 R	25	4.5	70	6	2.85	●
1.5 R	30	4.5	70	6	2.85	●







P	H	M	K	N	S
				●	

GR.10

Vc.100-150 fz.P163-4

GR.11

Vc.60-65 fz.P163-4

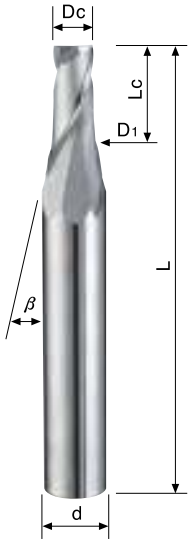
AL PVC Cu FRP

Taper End Mills For Copper

N

E105-Dc×β

Dc h10	β on Side	D1 mm	Lc mm	L mm	d h6	Blank E105
1.0	30'	1.07	4	50	4	●
1.0	1°	1.14	4	50	4	●
1.0	1°30'	1.21	4	50	4	●
1.0	2°	1.28	4	50	4	●
1.0	2°30'	1.35	4	50	4	●
1.0	3°	1.42	4	50	4	●
1.0	4°	1.56	4	50	4	●
1.0	5°	1.70	4	50	4	●
1.0	6°	1.84	4	50	4	●
1.0	7°	1.98	4	50	4	●
1.0	10°	2.41	4	50	4	●
1.5	30'	1.59	5	50	4	●
1.5	1°	1.67	5	50	4	●
1.5	1°30'	1.76	5	50	4	●
1.5	2°	1.85	5	50	4	●
1.5	2°30'	1.93	5	50	4	●
1.5	3°	2.02	5	50	4	●
1.5	4°	2.20	5	50	4	●
1.5	5°	2.37	5	50	4	●
1.5	6°	2.55	5	50	4	●
1.5	7°	2.73	5	50	4	●
1.5	10°	3.26	5	50	4	●
2.0	30'	2.10	6	50	4	●
2.0	1°	2.21	6	50	4	●
2.0	1°30'	2.31	6	50	4	●
2.0	2°	2.41	6	50	4	●
2.0	2°30'	2.52	6	50	4	●
2.0	3°	2.62	6	50	4	●
2.0	4°	2.84	6	50	4	●
2.0	5°	3.05	6	50	4	●
2.0	6°	3.26	6	50	4	●
2.0	7°	3.47	6	50	4	●
2.0	10°	4.11	6	50	6	●
2.5	30'	2.64	8	50	4	●
2.5	1°	2.78	8	50	4	●
2.5	1°30'	2.91	8	50	4	●
2.5	2°	3.05	8	50	4	●
2.5	2°30'	3.20	8	50	4	●
2.5	3°	3.33	8	50	4	●
2.5	4°	3.62	8	50	4	●
2.5	5°	3.90	8	50	4	●
2.5	6°	4.18	8	50	6	●
2.5	7°	4.46	8	50	6	●
2.5	10°	5.32	8	50	6	●
3.0	30'	3.17	10	50	6	●
3.0	1°	3.35	10	50	6	●
3.0	1°30'	3.52	10	50	6	●
3.0	2°	3.69	10	50	6	●
3.0	2°30'	3.87	10	50	6	●
3.0	3°	4.05	10	50	6	●
3.0	4°	4.40	10	50	6	●
3.0	5°	4.75	10	50	6	●
3.0	6°	5.10	10	50	6	●
3.0	7°	5.46	10	50	6	●
3.0	10°	6.53	10	60	8	●



UMG Carbide

Uncoated Blank

30°

2

N

90°

P	H	M	K	N	S
				●	

GR.10

Vc.100-120 fz.P161

GR.11

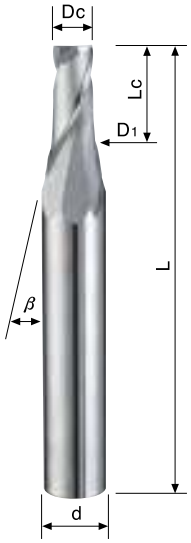
Vc.70-90 fz.P161

Taper End Mills For Copper

N

E105-Dc×β

Dc h10	β on Side	D1 mm	Lc mm	L mm	d h6	Blank E105
4.0	30'	4.26	15	50	6	●
4.0	1°	4.52	15	50	6	●
4.0	1°30'	4.79	15	50	6	●
4.0	2°	5.04	15	50	6	●
4.0	2°30'	5.31	15	50	6	●
4.0	3°	5.57	15	50	6	●
4.0	4°	6.10	15	60	8	●
4.0	5°	6.62	15	60	8	●
4.0	6°	7.15	15	60	8	●
4.0	7°	7.68	15	60	8	●
4.0	10°	9.30	15	70	10	●
5.0	30'	5.34	20	60	6	●
5.0	1°	5.70	20	60	6	●
5.0	1°30'	6.00	20	60	6	●
5.0	2°	6.39	20	60	8	●
5.0	2°30'	6.75	20	60	8	●
5.0	3°	7.10	20	60	8	●
5.0	4°	7.80	20	60	8	●
5.0	5°	8.50	20	70	10	●
5.0	6°	9.20	20	70	10	●
5.0	7°	9.91	20	70	10	●
5.0	10°	12.00	20	75	12	●
6.0	30'	6.35	20	60	8	●
6.0	1°	6.70	20	60	8	●
6.0	1°30'	7.05	20	60	8	●
6.0	2°	7.40	20	60	8	●
6.0	2°30'	7.75	20	60	8	●
6.0	3°	8.00	20	60	8	●
6.0	4°	8.80	20	70	10	●
6.0	5°	9.50	20	70	10	●
6.0	6°	10.20	20	75	12	●
6.0	7°	10.91	20	75	12	●
6.0	10°	13.05	20	75	12	●
8.0	30'	8.44	25	70	10	●
8.0	1°	8.87	25	70	10	●
8.0	1°30'	9.31	25	70	10	●
8.0	2°	9.74	25	70	10	●
8.0	2°30'	10.00	25	70	10	●
8.0	3°	10.62	25	75	12	●
8.0	5°	12.37	25	90	12	●
10.0	30'	10.61	35	90	10	●
10.0	1°	11.22	35	90	10	●
10.0	1°30'	11.83	35	90	10	●
10.0	2°	12.44	35	90	12	●
10.0	2°30'	13.06	35	90	12	●
10.0	3°	13.67	35	90	12	●
10.0	5°	16.00	35	100	16	●



UMG Carbide

Uncoated Blank

30°

2

N

90°

P	H	M	K	N	S
				●	

GR.10

Vc.100-120 fz.P161

GR.11

Vc.70-90 fz.P161

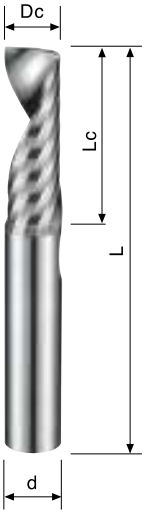
AL Cu PVC FRP

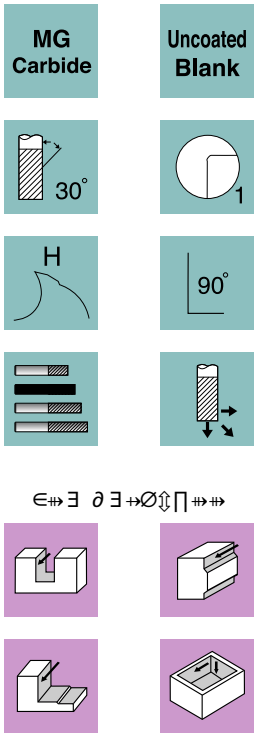
End Mills For Aluminium

N

E195R-Dc

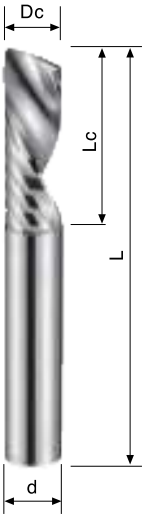
Dc h10	Lc mm	L mm	d h6	Blank E195R
3	12	38	3	●
4	15	50	4	●
6	18	50	6	●
8	22	60	8	●
10	30	72	10	●
12	30	75	12	●





E195L-Dc

Dc h10	Lc mm	L mm	d h6	Blank E195L
3	12	38	3	●
4	15	50	4	●
6	18	50	6	●
8	22	60	8	●
10	30	72	10	●
12	30	75	12	●



P	H	M	K	N	S
				●	

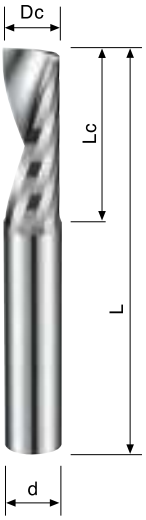
GR.10

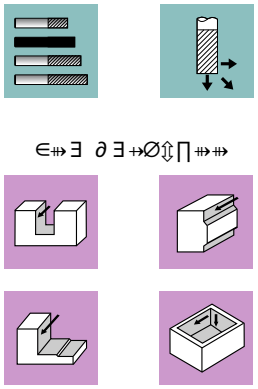
Vc.200-250 fz.P161

N

E189R-Dc

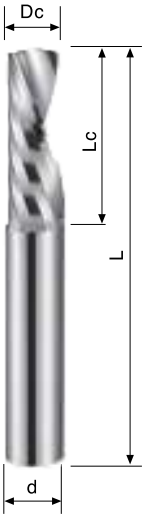
Dc h10	Lc mm	L mm	d h6	Blank E189R
3	12	50	3	●
4	15	50	4	●
6	20	63	6	●
8	25	63	8	●
10	30	72	10	●
12	38	75	12	●





E189L-Dc

Dc h10	Lc mm	L mm	d h6	Blank E189L
3	12	50	3	●
4	15	50	4	●
6	20	63	6	●
8	25	63	8	●
10	30	72	10	●
12	38	75	12	●



P	H	M	K	N	S
				●	

GR.12

Vc.150-200 fz.P161

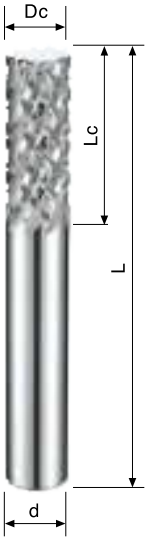
AL Cu PVC FRP

N FRP

E190-Dc

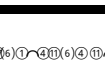
Dc h10	Lc mm	L mm	d h6	Blank E190
6	20	63	6	○
8	25	63	8	○
10	30	72	10	○
12	38	75	12	○

○ The light color: On request, no stock



No
End cut

MG
Carbide

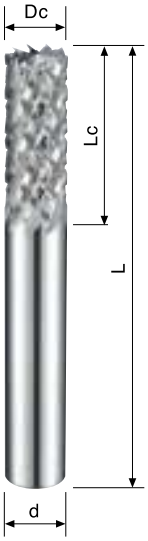


P	H	M	K	N	S
				●	

GR.13
Vc.250-300 fz.P161

E191-Dc

Dc h10	Lc mm	L mm	d h6	Blank E191
6	20	63	6	●
8	25	63	8	●
10	30	72	10	●
12	38	75	12	●

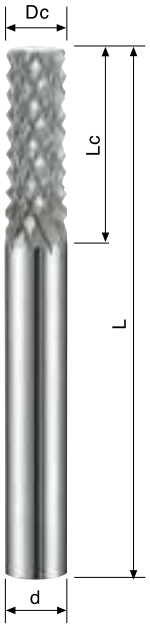


Burr
End cut

E196-Dc

Dc h10	Lc mm	L mm	d h6	Blank E196
3	12	38	3	○
4	15	50	4	○
6	18	50	6	○
8	22	60	8	○
10	30	72	10	○
12	30	75	12	○

○ The light color: On request, no stock



No
End cut

MG
Carbide

⑬⑮⑰⑥①④⑪⑥④⑪⑰④⑮⑦⑩⑥

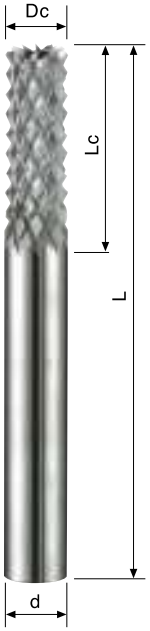
P	H	M	K	N	S
				●	

GR.13 ⇦≅ ~ ≈≦∮ ∴≠∽≯∫ ~‖ ≠∫ ≌∴‖ ::≯

Vc.250-300 fz.P161

E197-Dc

Dc h10	Lc mm	L mm	d h6	Blank E197
3	12	38	3	●
4	15	50	4	●
6	18	50	6	●
8	22	60	8	●
10	30	72	10	●
12	30	75	12	●



Burr
End cut

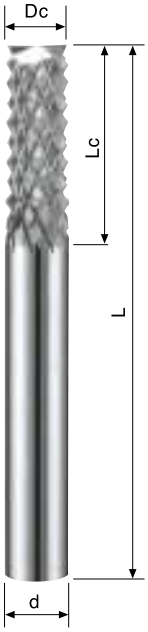
AL PVC Cu FRP

Routers For Fiberglass

N FRP

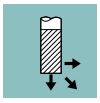
E198-Dc

Dc h10	Lc mm	L mm	d h6	Blank E198
3	12	38	3	●
4	15	50	4	●
6	18	50	6	●
8	22	60	8	●
10	30	72	10	●
12	30	75	12	●



End Mill
End cut

MG
Carbide

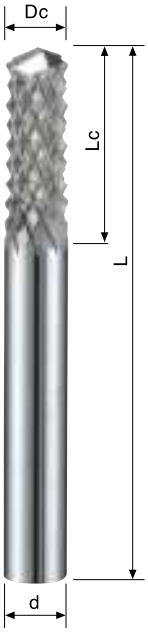


P	H	M	K	N	S
				●	

GR.13
Vc.250-300 fz.P161

E199-Dc

Dc h10	Lc mm	L mm	d h6	Blank E199
3	12	38	3	●
4	15	50	4	●
6	18	50	6	●
8	22	60	8	●
10	30	72	10	●
12	30	75	12	●



135°
Drill Point

7leaders™

The Art of Cutting

High Performance End Mills

①18.85.156.75.(19)(18)35.(15)(19)9.(16)219.418.(16)15.413.(16)(13)18.(16)11.7(16)18.

①4.(16)5.4.(19)(20)(13)(19)(15)	⑨5.(15)(t)	⑬6.(19)8.(11)4.(19)(16)			⑬(12)7.(10)(14)(19)8.(14)(16)3.18.(20)3.(11)(19)(16)7.(19)(12).	⑯9.7.(11)(14)(19)(13)(11)
	F636GX	UMG Carbide	AlTiSiN GX	38° 41°	P H M K N S ● ● ○ ○ ○	P83
	F634GX	UMG Carbide	AlTiSiN GX	38° 41°	P H M K N S ● ● ○ ○ ○	P84
	F670GX	UMG Carbide	AlTiSiN GX	38° 41°	P H M K N S ● ● ○ ○ ○	P85
	F602GX	UMG Carbide	AlTiSiN GX	35° 38°	P H M K N S ● ● ○	P86
	F603GX	UMG Carbide	AlTiSiN GX	35° 38°	P H M K N S ● ● ○	P87
	F604GX F606GX	UMG Carbide	AlTiSiN GX	35° 38°	P H M K N S ● ● ○ ○ ○	P88
	F674GX	UMG Carbide	AlTiSiN GX	42° 45°	P H M K N S ● ● ○ ○ ○	P89
	F640GX	UMG Carbide	AlTiSiN GX	55°	P H M K N S ○ ●	P90
	F660GX F661GX	UMG Carbide	AlTiSiN GX	55°	P H M K N S ● ○	P91
	F608HX F609HX	UMG Carbide	AlTiCrN HX	20°	P H M K N S ● ● ● ○	P92
	F630GX	UMG Carbide	AlTiSiN GX	30°	P H M K N S ● ● ○ ○	P93
	F676GX	UMG Carbide	AlTiSiN GX	0°	P H M K N S ● ●	P94
	F621HX	UMG Carbide	AlTiCrN HX	30°	P H M K N S ● ● ○	P95
	F601HX	UMG Carbide	AlTiCrN HX	30°	P H M K N S ● ● ○	P96
	F610HX	UMG Carbide	AlTiCrN HX	40°	P H M K N S ● ● ○ ○ ○	P97
	F612GX F617GX	UMG Carbide	AlTiSiN GX	38° 41°	P H M K N S ● ● ○ ○ ○	P98
	F632GX F633GX	UMG Carbide	AlTiSiN GX	55°	P H M K N S ● ●	P99
	F635GX F637GX F639GX	UMG Carbide	AlTiSiN GX	55°	P H M K N S ● ●	P100
	F615GX F619GX	UMG Carbide	AlTiSiN GX	30° 33°	P H M K N S ● ○	P101

∅**181-190** ∇.:.:≅ ∨≠∫ ≈‖≠≌ ∽≠ ≒≈∫ ≦.:‖ ::⊂≃ ≝‖∮ ≝‖ ≃≠‖ ∽∽≠∫ ∪::∅**HPC/HSC** ≡ ∧∫ ≒≈∫ ≧.:∨‖ ⊄≫.:∫ ⊃≤∫ :≠∴∨≃∫ ∮‖ ∬‖≠.:∫ ∴ ∨≠ ≒≅ : ≡⊄ ≒ :≡ ≌ ≒⊂≃≡ ≧≃∫ ∮‖ ∬‖≠.:∫ ∧∫∮ ∧∫∮ ∧.:∫ ∽.:∅ ∴ ≡ ≒:.‖ ∧:.∫ ∽.:∅

P181~190 Power chucks specially designed for HPC/HSC provide effective cutting and high-speed precise cutting without deflection or loosening.

High Performance End Mills

①18.85.156.75(19)(18)35.(15)19.9.(16)219.418(16)15.413.(14)318.(16)11.7(16)(18).

①4.(16)15.4.(19)(20)(13)(9)(15)	⑨5.(15)(t)	⑬6.(19)8.(11)4.(19)(16)			⑬(12)7.(11)(14)19.8.(14)(16)3.18.(20)3.(11)9.(16)7.(14)(11)2.	⑯97.(11)4.(19)13.(11)
	F613GX F614GX	UMG Carbide	AlTiSiN GX	45°	P H M K N S ● ○	P102
	F623HX F624HX	UMG Carbide	AlTiCrN HX	30°	P H M K N S ● ● ○	P103
	F625GX F626GX	UMG Carbide	AlTiSiN GX	30°	P H M K N S ● ○	P104
	F651SX	UMG Carbide	one AlTiCrN SX	36° 39°	P H M K N S ● ○	P105
	F652SX	UMG Carbide	one AlTiCrN SX	36° 39°	P H M K N S ● ○	P106
	F653SX	UMG Carbide	one AlTiCrN SX	36° 39°	P H M K N S ● ○	P107
	F605	UMG Carbide	Uncoated Blank	30° 33°	P H M K N S ●	P108
	F600	UMG Carbide	Uncoated Blank	40°	P H M K N S ●	P109
	F631	UMG Carbide	Uncoated Blank	42° 45°	P H M K N S ●	P110
	F607	UMG Carbide	Uncoated Blank	42° 45°	P H M K N S ●	P111
	F642	UMG Carbide	Uncoated Blank	40°	P H M K N S ●	P112
	F647	UMG Carbide	Uncoated Blank	40°	P H M K N S ●	P113
	F618 F620	UMG Carbide	Uncoated Blank	40°	P H M K N S ●	P114
	F680DC	MG Carbide	Diamond DC	30°	P H M K N S ●	P115
	F685DC	MG Carbide	Diamond DC	30°	P H M K N S ●	P116
	F645TX	UMG Carbide	AlCrSiN TX	45°	P H M K N S ○ ●	P117
	F665TX	UMG Carbide	AlCrSiN TX	45°	P H M K N S ○ ●	P118
	F667TX	UMG Carbide	AlCrSiN TX	55°	P H M K N S ○ ●	P119
	F668T X	UMG Carbide	AlCrSiN TX	45°	P H M K N S ○ ●	P120

∅181-190 ∇.:.:≅ ∨≠∫ ≈‖≠≌∽≠ ≒≈∫ ≦∴‖ ::⊂∨≅ ≦‖∮≦‖ ∧≅≠‖ ∽∽≠∫ ∪:.:∌**HPC/HSC** ≡ ∧∫ ≒≈∫ ≧∴∨‖ ∉≪∴∫ ⊃≤∫ :≠:.∴∨∽≅∫∮‖∬‖≠.:∫ ∴ ∨≠ ≒≡ : ≡∉ ≒ :≡ ≦ ≒≠⊂≠≡≧∽≅∫∮‖∬‖≠∴:∫ ∧∫∮ ∧∫∮ ∧.:∫ ∽∴:∌ ∴ ≡ ≒::‖ ∧::∫ ∽∴:∌

P181~190 Power chucks specially designed for HPC/HSC provide effective cutting and high-speed precise cutting without deflection or loosening.

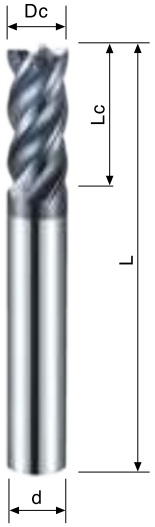
High Performance End Mills

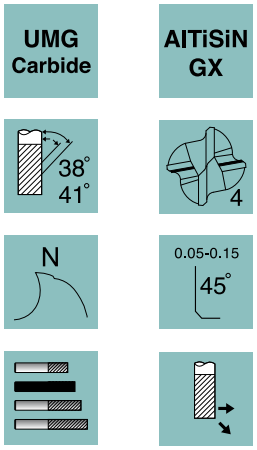
P H < 56HRC

①18.85.15.6.7.5.(19)(18)(13)5.(15)(19)9.(16)21.9.4.18.(16)15.4.13.(14)(13)18.(16)11.7.(16)(18).

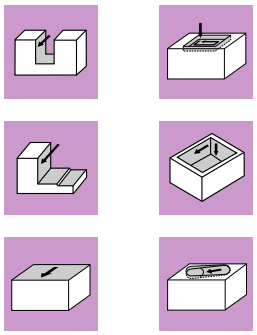
⑨5.(15)(t) F636GX-Dc

Dc h10	Lc mm	L mm	d h5	AlTiSiN F636GX
3	8	57	6	●
4	11	57	6	●
5	13	57	6	●
6	13	57	6	●
8	19	63	8	●
10	22	72	10	●
12	26	83	12	●
16	32	92	16	●
20	38	104	20	●





∈↠∃ ∂∃↛Ø⇳∏↠↠



⑬–⑮~⑰(6)①~④⑪(6)④⑪~⑰④⑮⑦~⑩(6)

P	H	M	K	N	S
●	●	○	○		○

GR.1 ∇≠‖ ::⊂
∀∫ ::∫ ∩:≧ ∨‖ ∽∽‖ ∅

Vc.160-200 fz.P165

GR.2 ∇≠‖ ::⊂ <24HRC
∽.:∮ :≡ ::∫ ∩:≧ ∨‖ ∽∽‖ ∅

Vc.160-200 fz.P165

GR.3 ∇≠‖ ::⊂ <30HRC
→∫ ∩:≧ ∨‖ ∽∽‖ ∅

Vc.100-150 fz.P165

GR.4 ∇≠‖ ::⊂ 30~38HRC
↞‖ :‖ ::∫ ∽∽‖ ∅

Vc.80-120 fz.P165

GR.5 ∇≠‖ ::⊂ 38~48HRC
↞‖ :‖ ::∫ ∽∽‖ ∅

Vc.60-100 fz.P165

GR.6 ∇≠‖ ::⊂ 48~56HRC
↞‖ :‖ ::∫ ∽∽‖ ∅

Vc.40-70 fz.P165

GR.8 ∇≠‖ ::⊂
∀∫ ≌∬‖ ∨∫ ⊄≫‖ ∅

Vc.40-80 fz.P165

GR.9 ∑≡∩≅∽

Vc.140-180 fz.P165

GR.15 ∈.:≠‖ ∽

Vc.60-90 fz.P165

GR.17 ∇≠‖ ::⊂
↔‖ ≌ ≈≌ ≧∽‖ ∅

Vc.30-50 fz.P165

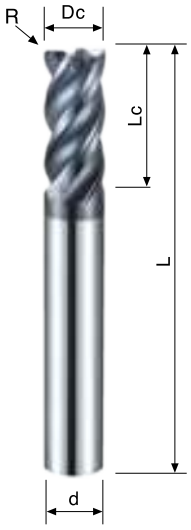
High Performance End Mills

P H < 56HRC

①18.85.156.75(19)(8)35(15)19(16)219418(16)15413(16)318(16)11.7(16)48.

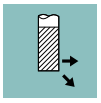
⑨5(15)(t) F634GX-Dc×R

Dc h10	R 0/+0.02	Lc mm	L mm	d h5	AlTiSiN F634GX
3	0.2	8	57	6	●
4	0.2	11	57	6	●
5	0.2	13	57	6	●
6	0.2	13	57	6	●
8	0.2	19	63	8	●
10	0.2	22	72	10	●
12	0.2	26	83	12	●
16	0.2	32	92	16	●
20	0.2	38	104	20	●
3	0.5	8	57	6	●
4	0.5	11	57	6	●
5	0.5	13	57	6	●
6	0.5	13	57	6	●
8	0.5	19	63	8	●
10	0.5	22	72	10	●
12	0.5	26	83	12	●
16	0.5	32	92	16	●
20	0.5	38	104	20	●

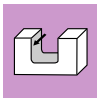


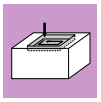
UMG Carbide

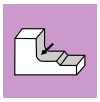
AlTiSiN GX

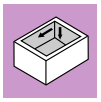


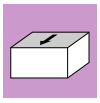
∈↠∃ ∂∃↠Ø⇳∏↠↠

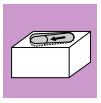












⑬–⑮~⑰(6)①~④⑪(6)④⑪~⑰④⑧⑦~⑩(6)

P	H	M	K	N	S
●	●	○	○		○

GR.1 ∇≠‖ ::⊂ ∀∫ ::∫ ∩:≧ ∨‖ ∽∾‖ ⊅
Vc.160-200 fz.P165

GR.2 ∇≠‖ ::⊂ <24HRC ∽:∮ ⇒:: ∫ ∩:≧ ∨‖ ∽∾‖ ⊅
Vc.160-200 fz.P165

GR.3 ∇≠‖ ::⊂ <30HRC ↠∫ ∩:≧ ∨‖ ∽∾‖ ⊅
Vc.100-150 fz.P165

GR.4 ∇≠‖ ::⊂ 30~38HRC ↞‖ :‖ ::∫ ∽∾‖ ⊅
Vc.80-120 fz.P165

GR.5 ∇≠‖ ::⊂ 38~48HRC ↞‖ :‖ ::∫ ∽∾‖ ⊅
Vc.60-100 fz.P165

GR.6 ∇≠‖ ::⊂ 48~56HRC ↞‖ :‖ ::∫ ∽∾‖ ⊅
Vc.40-70 fz.P165

GR.8 ∇≠‖ ::⊂ ∀∫ ⊆∬‖ ∨∫ ⊄≫‖ ⊅
Vc.40-80 fz.P165

GR.9 ∑≡∩≡∽
Vc.140-180 fz.P165

GR.15 ∈:≠‖ ∽
Vc.60-90 fz.P165

GR.17 ∇≠‖ ::⊂ ↔‖ ≦ ≈≦ ≥∾‖ ⊅
Vc.30-50 fz.P165

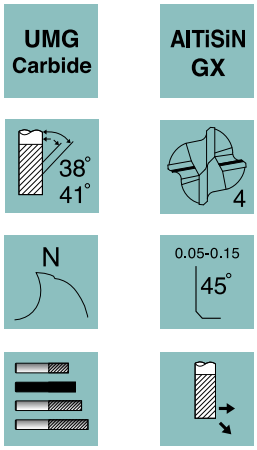
High Performance End Mills

P H < 56HRC

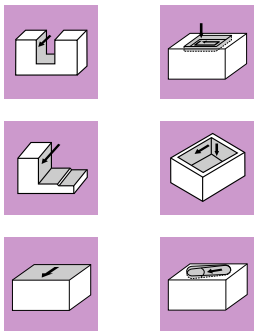
①18.85.15 6.75 (19) (18) 35. (15) (19) 9. (16) 219 418 (16) 15 413. (14) (13) 18 (16) 11. 7 (16) 18.

⑨5. (15) (t) F670GX-Dc

Dc h10	Lc mm	L mm	d h5	AlTiSiN F670GX
3	8	57	6	●
4	11	57	6	●
5	13	57	6	●
6	13	57	6	●
8	19	63	8	●
10	22	72	10	●
12	26	83	12	●
16	32	92	16	●
20	38	104	20	●



∈↠∃ ∂ ∃ ↛∅⇳∏ ↠↠



⑬–⑮~⑰⑯①~④⑪(⑥)④⑪~⑰④⑮⑦~⑩(⑥)

P	H	M	K	N	S
●	●	○	○		○

GR.1 ∇≠‖ ::⊂ ∀∫ ::∫ ∩:.≌ ∨‖ ∽≃‖ ⊅
Vc.180-200 fz.P165

GR.2 ∇≠‖ ::⊂ <24HRC ∽.:∮ :≡ ::∫ ∩:.≌ ∨‖ ∽≃‖ ⊅
Vc.180-200 fz.P165

GR.3 ∇≠‖ ::⊂ <30HRC →∫ ∩:.≌ ∨‖ ∽≃‖ ⊅
Vc.120-150 fz.P165

GR.4 ∇≠‖ ::⊂ 30~38HRC ↞‖ :‖ ::∫ ∽≃‖ ⊅
Vc.100-120 fz.P165

GR.5 ∇≠‖ ::⊂ 38~48HRC ↞‖ :‖ ::∫ ∽≃‖ ⊅
Vc.80-100 fz.P165

GR.6 ∇≠‖ ::⊂ 48~56HRC ↞‖ :‖ ::∫ ∽≃‖ ⊅
Vc.50-70 fz.P165

GR.8 ∇≠‖ ::⊂ ∀∫ ∽∬‖ ∨∫ ⊄ ≫‖ ⊅
Vc.60-80 fz.P165

GR.9 ∑ ≡∩≅∽
Vc.160-180 fz.P165

GR.15 ∈:≠‖ ∽
Vc.70-90 fz.P165

GR.17 ∇≠‖ ::⊂ ↔‖ ≌ ≈≌ ≥∽‖ ⊅
Vc.40-50 fz.P165

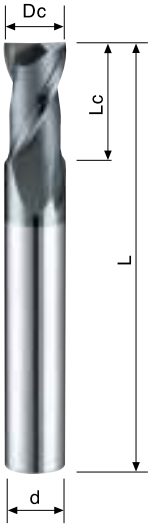
High Performance End Mills

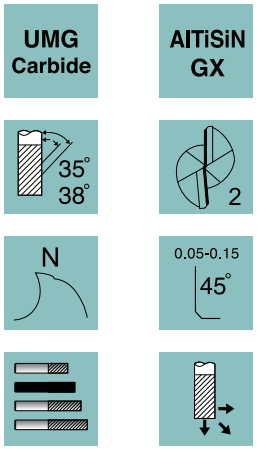
P H < 68HRC

①18.85.156.75.(19)(18)35.(15)(19)9.(16)219.418.(16)15.413.(16)318.(16)11.7(16)18.

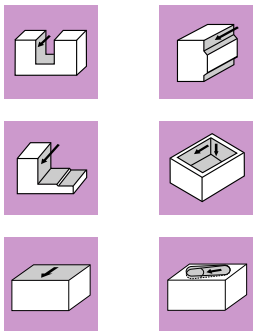
⑨5.(15)(t)　F602GX-Dc

Dc h10	Lc mm	L mm	d h5	AlTiSiN F602GX
1	2	50	4	●
1.5	4	50	4	●
2	6	50	4	●
2.5	7	50	4	●
3	7	57	6	●
4	8	57	6	●
5	10	57	6	●
6	10	57	6	●
8	16	63	8	●
10	19	72	10	●
12	22	83	12	●





∈↠∃ ∂∃↛Ø⇳∏↠↠



⑬–⑮~⑰⑥①④⑪⑥④⑪~⑰④⑤⑦~⑩⑥

P	H	M	K	N	S
●	●		○		

GR.1 ≒‖ ::⊂
∀∫ ::∫ ∩∴≦ ∨‖ ∽∾‖ ⊅
Vc.100-120　fz.P165

GR.2 ∇≠‖ ::⊂ **<24HRC**
∽∴∮ :≡ ::∫ ∩∴≦ ∨‖ ∽∾‖ ⊅
Vc.100-120　fz.P165

GR.3 ∇≠‖ ::⊂ **<30HRC**
→∫ ∩∴≦ ∨‖ ∽∾‖ ⊅
Vc.80-100　fz.P165

GR.4 ∇≠‖ ::⊂ **30~38HRC**
↞‖ :‖ ::∫ ∽∾‖ ⊅
Vc.60-80　fz.P165

GR.5 ∇≠‖ ::⊂ **38~48HRC**
↞‖ :‖ ::∫ ∽∾‖ ⊅
Vc.40-60　fz.P165

GR.6 ∇≠‖ ::⊂ **48~56HRC**
↞‖ :‖ ::∫ ∽∾‖ ⊅
Vc.25-40　fz.P165

GR.7 ∇≠‖ ::⊂ **56~68HRC**
↞‖ :‖ ::∫ ∽∾‖ ⊅
Vc.20-30　fz.P165

GR.9 ∑≡∩≅∽
Vc.120-160　fz.P165

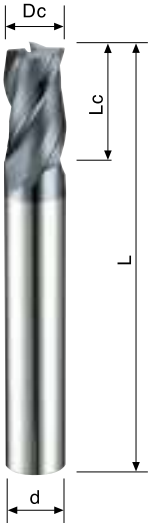
High Performance End Mills

P H < 68HRC

①18.85.156.75(19)(8)35(15)9(16)219418(16)15413(16)318(16)11.7(16)18.

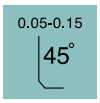
F603GX-Dc

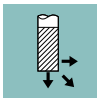
Dc h10	Lc mm	L mm	d h5	AlTiSiN F603GX
1	2	50	4	●
1.5	4	50	4	●
2	6	50	4	●
2.5	7	50	4	●
3	7	57	6	●
4	8	57	6	●
5	10	57	6	●
6	10	57	6	●
8	16	63	8	●
10	19	72	10	●
12	22	83	12	●



UMG Carbide

AlTiSiN GX





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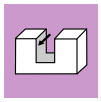
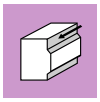
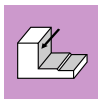
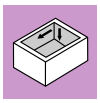
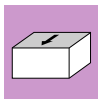










⑬–⑮~⌒⑰⑥①~④⑪⑥④⑪~⑰④⑤⑦~⑩⑥

P	H	M	K	N	S
●	●		○		

GR.1 ∇≠‖ ::⊂
∀∫ ::∫ ∩:.≌ ∨‖ ∽∾‖ ∅
Vc.100-120 fz.P165

GR.2 ∇≠‖ ::⊂ <24HRC
∽.:∮ :≡ ::∫ ∩:.≌ ∨‖ ∽∾‖ ∅
Vc.100-120 fz.P165

GR.3 ∇≠‖ ::⊂ <30HRC
⇢∫ ∩:.≌ ∨‖ ∽∾‖ ∅
Vc.80-100 fz.P165

GR.4 ∇≠‖ ::⊂ 30~38HRC
⇸‖ :‖ ::∫ ∽∾‖ ∅
Vc.60-80 fz.P165

GR.5 ∇≠‖ ::⊂ 38~48HRC
⇸‖ :‖ ::∫ ∽∾‖ ∅
Vc.40-60 fz.P165

GR.6 ∇≠‖ ::⊂ 48~56HRC
⇸‖ :‖ ::∫ ∽∾‖ ∅
Vc.25-40 fz.P165

GR.7 ∇≠‖ ::⊂ 56~68HRC
⇸‖ :‖ ::∫ ∽∾‖ ∅
Vc.20-30 fz.P165

GR.9 ∑≡∩≅∽
Vc.120-160 fz.P165

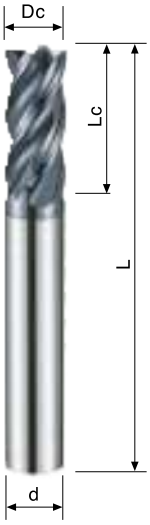
High Performance End Mills

P H < 68HRC

①18.85.156.75.(19)(8)35.(15)(19)9.(16)219418.(16)154.13.(16)318.(16)11.7(16)18.

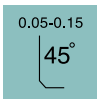
F604GX-Dc

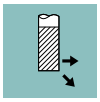
Dc h10	Lc mm	L mm	d h5	AlTiSiN F604GX
1	3	50	4	●
1.5	5	50	4	●
2	7	50	4	●
2.5	8	50	4	●
3	8	57	6	●
4	11	57	6	●
5	13	57	6	●
6	13	57	6	●
8	19	63	8	●
10	22	72	10	●
12	26	83	12	●
16	32	92	16	●
20	38	104	20	●



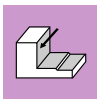
UMG Carbide

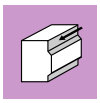
AlTiSiN GX

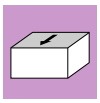




∈↠∃ ∂∃↠Ø⇳∏↠↠

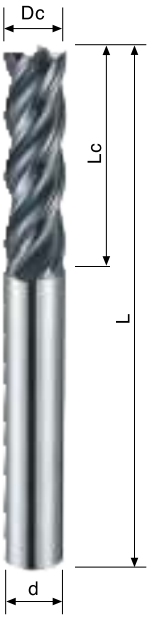






F606GX-Dc

Dc h10	Lc mm	L mm	d h5	AlTiSiN F606GX
3	12	63	6	●
4	17	63	6	●
5	19	63	6	●
6	19	63	6	●
8	28	72	8	●
10	34	84	10	●
12	40	97	12	●
16	48	108	16	●
20	56	122	20	●



⑬–⑮⌒⌒⑰⑥①⌒④⑪⑥④⑪⌒⑰④⑮⑦⌒⑩⑥

P	H	M	K	N	S
●	●	○	○		○

GR.1 ∇≠‖ ::⊂ ∀∫ ::∫ ∩∴≌ ∨‖ ∽≃‖ ∄
Vc.120-160 fz.P165

GR.2 ∇≠‖ ::⊂ **<24HRC** ∽∴∮ ∶≡ ::∫ ∩∴≌ ∨‖ ∽≃‖ ∄
Vc.120-160 fz.P165

GR.3 ∇≠‖ ::⊂ **<30HRC** →∫ ∩∴≌ ∨‖ ∽≃‖ ∄
Vc.100-120 fz.P165

GR.4 ∇≠‖ ::⊂ **30~38HRC** ↞‖ ∶‖ ::∫ ∽≃‖ ∄
Vc.80-100 fz.P165

GR.5 ∇≠‖ ::⊂ **38~48HRC** ↞‖ ∶‖ ::∫ ∽≃‖ ∄
Vc.60-80 fz.P165

GR.6 ∇≠‖ ::⊂ **48~56HRC** ↞‖ ∶‖ ::∫ ∽≃‖ ∄
Vc.40-60 fz.P165

GR.7 ∇≠‖ ::⊂ **56~68HRC** ↞‖ ∶‖ ::∫ ∽≃‖ ∄
Vc.20-40 fz.P165

GR.8 ∇≠‖ ::⊂ ∀∫ ≦∬‖ ∨∫ ⊄≫‖ ∄
Vc.50-70 fz.P165

GR.9 ∑ ≡∩≅∽
Vc.120-140 fz.P165

GR.15 ∈∴≠‖ ∽
Vc.60-80 fz.P165

GR.17 ∇≠‖ ::⊂ ↔‖ ≌ ≈≌ ≧≃‖ ∄
Vc.30-40 fz.P165

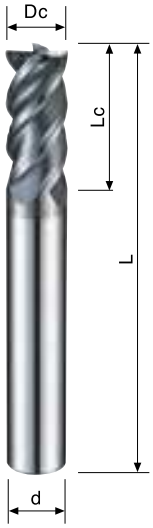
High Performance End Mills

P H < 68HRC

①18.85.156.75.(19)(18)35.(15)19.(16)219418.(16)15.413.(14)(13)18.(16)11.7(16)(18.

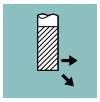
F674GX-Dc

Dc h10	Lc mm	L mm	d h5	AlTiSiN F674GX
6	13	57	6	●
8	19	63	8	●
10	22	72	10	●
12	26	83	12	●
16	32	92	16	●
20	38	104	20	●

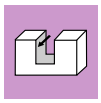


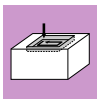
UMG Carbide

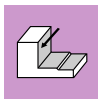
AlTiSiN GX

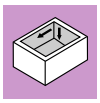


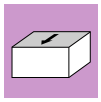
∈↠∃ ∂∃↠Ø⇳∏↠↠











⑬⑮⑰⑥①④⑩⑥④⑪⑰⑭⑮⑦⑩⑥

P	H	M	K	N	S
●	●	○	○		○

GR.1 ∇≠‖ ::⊂
∀∫ ::∫ ∩:≌ ∨‖ ∽≃‖ ∅
Vc.200-220 fz.P165

GR.2 ∇≠‖ ::⊂ <24HRC
∽:∮ :≡ ::∫ ∩:≌ ∨‖ ∽≃‖ ∅
Vc.200-220 fz.P165

GR.3 ∇≠‖ ::⊂ <30HRC
→∫ ∩:≌ ∨‖ ∽≃‖ ∅
Vc.140-160 fz.P165

GR.4 ∇≠‖ ::⊂ 30~38HRC
↞‖ :‖ ::∫ ∽≃‖ ∅
Vc.120-160 fz.P165

GR.5 ∇≠‖ ::⊂ 38~48HRC
↞‖ :‖ ::∫ ∽≃‖ ∅
Vc.100-120 fz.P165

GR.6 ∇≠‖ ::⊂ 48~56HRC
↞‖ :‖ ::∫ ∽≃‖ ∅
Vc.50-80 fz.P165

GR.7 ∇≠‖ ::⊂ 56~68HRC
↞‖ :‖ ::∫ ∽≃‖ ∅
Vc.30-50 fz.P165

GR.8 ∇≠‖ ::⊂
∀∫ ≌∬‖ ∨∫ ∝≫‖ ∅
Vc.60-90 fz.P165

GR.9 ∑≡∩≅∽
Vc.180-200 fz.P165

GR.15 ∈:≠‖ ∽
Vc.80-100 fz.P165

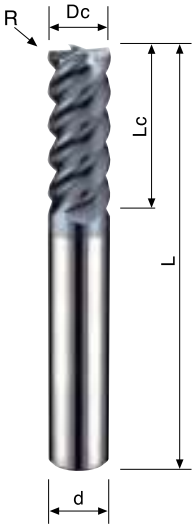
GR.17 ∇≠‖ ::⊂
↔‖ ≌ ≈≌ ≥∽≃‖ ∅
Vc.40-60 fz.P165

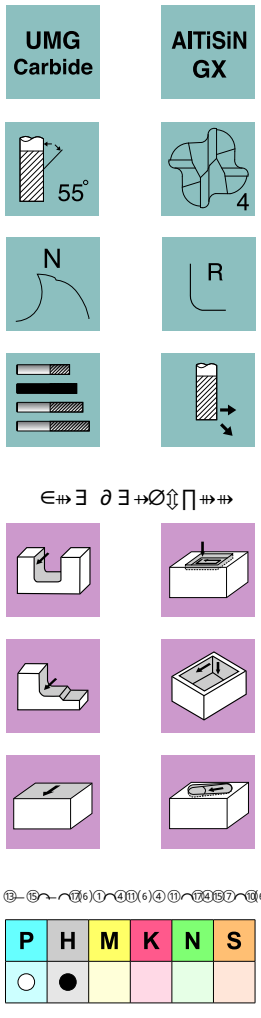
High Performance End Mills

H < 68HRC

F640GX-Dc×R

Dc h10	R 0/+0.02	Lc mm	L mm	d h5	AlTiSiN F640GX
3	0.2	8	57	6	●
4	0.2	11	57	6	●
5	0.2	13	57	6	●
6	0.2	13	57	6	●
8	0.2	19	63	8	●
10	0.2	22	72	10	●
12	0.2	26	83	12	●
16	0.2	32	92	16	●
20	0.2	38	104	20	●
3	0.5	8	57	6	●
4	0.5	11	57	6	●
5	0.5	13	57	6	●
6	0.5	13	57	6	●
8	0.5	19	63	8	●
10	0.5	22	72	10	●
12	0.5	26	83	12	●
16	0.5	32	92	16	●
20	0.5	38	104	20	●





P	H	M	K	N	S
○	●				

GR.2 <24HRC
Vc.180-200 fz.P165

GR.3 <30HRC
Vc.150-180 fz.P165

GR.4 30~38HRC
Vc.120-150 fz.P165

GR.5 38~48HRC
Vc.100-120 fz.P165

GR.6 48~56HRC
Vc.50-60 fz.P165

GR.7 56~68HRC
Vc.30-40 fz.P165

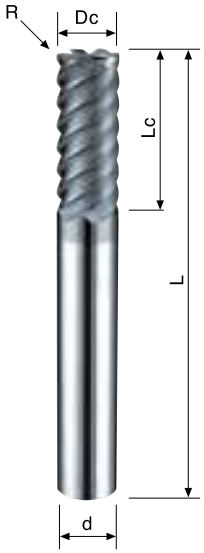
High Performance End Mills

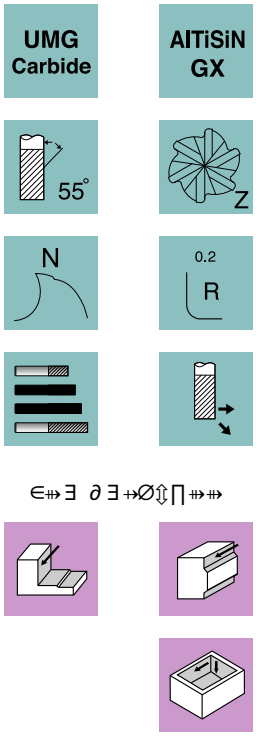
H 48~68HRC

①18.85.15 6.75 (19) (18) 35 (15) 19 (16) 2 19 4.18 (16) 15 4 13. (14) 3 18 (16) 11. 7 (16) 18.

F660GX-Dc

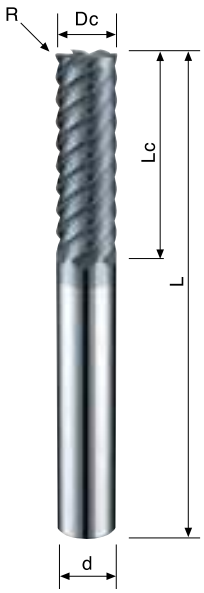
Dc h10	Lc mm	L mm	d h5	Z	AlTiSiN F660GX
6	13	57	6	6	●
8	19	63	8	6	●
10	22	72	10	6	●
12	26	83	12	6	●
16	32	92	16	8	●
20	38	104	20	10	●





F661GX-Dc

Dc h10	Lc mm	L mm	d h5	Z	AlTiSiN F661GX
6	19	63	6	6	●
8	28	72	8	6	●
10	34	84	10	6	●
12	40	97	12	6	●
16	48	108	16	8	●
20	56	122	20	10	●



P	H	M	K	N	S
	●		○		

GR.6 48~56HRC
Vc.60-100 fz.P165

GR.7 56~68HRC
Vc.30-60 fz.P165

GR.9
Vc.120-180 fz.P165

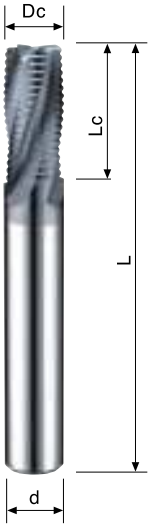
High Performance Roughing End Mills

K P H < 56HRC

①18.85.156.75(19)(8)35(15)(19)9(16)219418(16)14(16)7.45(13)18(16)15.413(16)18(16)11. 7(16)48.

F608HX-Dc

Dc h10	Lc mm	L mm	d h5	Z	AlTiCrN F608HX
6	13	57	6	3	●
8	19	63	8	3	●
10	22	72	10	4	●
12	26	83	12	4	●
14	26	83	14	4	●
16	32	92	16	4	●
18	32	92	18	4	●
20	38	104	20	4	●



UMG Carbide

AlTiCrN HX

20°

4

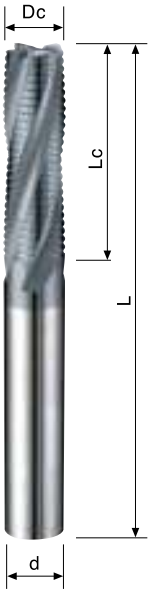
HR

0.05-0.15

45°

F609HX-Dc

Dc h10	Lc mm	L mm	d h5	Z	AlTiCrN F609HX
6	19	63	6	3	●
8	28	72	8	3	●
10	34	84	10	4	●
12	40	97	12	4	●
16	48	108	16	4	●
20	56	122	20	4	●



P	H	M	K	N	S
●	●		●		○

GR.1 Vc.100-120 fz.P165

GR.2 <24HRC Vc.100-120 fz.P165

GR.3 <30HRC Vc.60-80 fz.P165

GR.4 30~38HRC Vc.40-60 fz.P165

GR.5 38~48HRC Vc.30-40 fz.P165

GR.6 48~56HRC Vc.20-30 fz.P165

GR.9 Vc.120-160 fz.P165

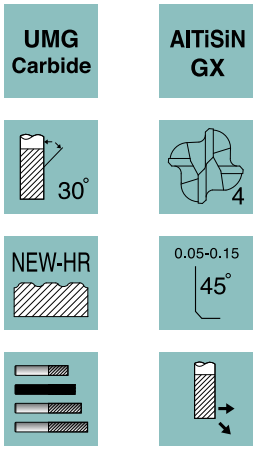
GR.15 Vc.30-40 fz.P165

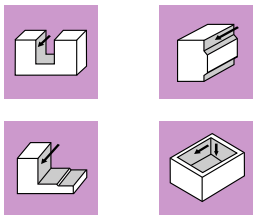
High Performance Roughing End Mills

P H < 68HRC

F630GX-Dc

Dc h10	Lc mm	L mm	d h5	Z	AlTiSiN F630GX
6	13	57	6	3	●
8	19	63	8	3	●
10	22	72	10	4	●
12	26	83	12	4	●
16	32	92	16	4	●
20	38	104	20	4	●





P	H	M	K	N	S
●	●		○		○

GR.1
Vc.120-160 fz.P165

GR.2 <24HRC
Vc.120-160 fz.P165

GR.3 <30HRC
Vc.80-100 fz.P165

GR.4 30~38HRC
Vc.60-80 fz.P165

GR.5 38~48HRC
Vc.40-60 fz.P165

GR.6 48~56HRC
Vc.25-40 fz.P165

GR.7 56~68HRC
Vc.20-30 fz.P165

GR.9
Vc.120-160 fz.P165

GR.15
Vc.30-40 fz.P165

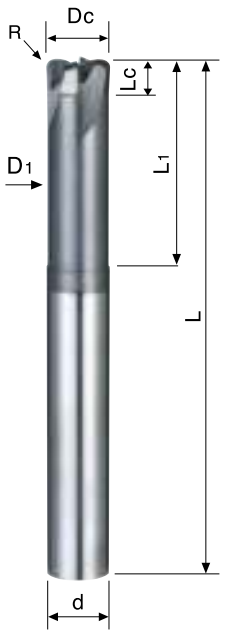
High Feed End Mills

P H < 68HRC

⑨5.413.⑯318⑯11.7⑯818. 8.⑬1885.15.⑳65.⑮1114.⑯⑳fz

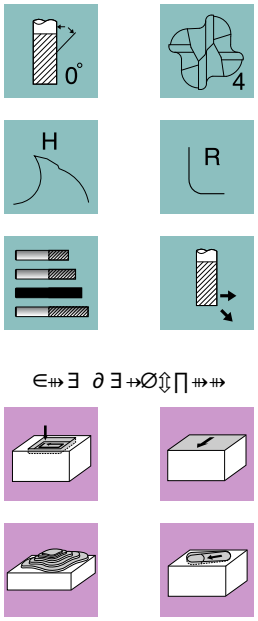
⑨5⑮(t) F676GX-Dc

Dc h10	Progrmmable Radius	Lc mm	L mm	d h5	L1 mm	D1 mm	AlTiSiN F676GX
3	0.37	2	70	6	12	2.7	●
4	0.47	2	70	6	16	3.7	●
5	0.60	2.5	70	6	20	4.6	●
6	0.73	3	70	6	25	5.6	●
8	0.98	4	80	8	30	7.6	●
10	1.23	5	90	10	35	9.6	●
12	1.65	6	100	12	40	11.6	●



UMG Carbide

AlTiSiN GX



∈↠∃ ∂∃↦Ø⇳∏↠↠

⑬⑮⑰⑥①④⑪⑥④⑪⑰④⑬⑦⑩⑥

P	H	M	K	N	S
●	●				

GR.2 ∇≠‖ ::⊂ **<24HRC**
∽:ϕ :≡ ::∫ ∩:≌ ∨‖ ∽∾‖ ∅
Vc.250-300 fz.P166

GR.3 ∇≠‖ ::⊂ **<30HRC**
→∫ ∩:≌ ∨‖ ∽∾‖ ∅
Vc.250-300 fz.P166

GR.4 ∇≠‖ ::⊂ **30~38HRC**
↞‖ :‖ ::∫ ∽∾‖ ∅
Vc.180-200 fz.P166

GR.5 ∇≠‖ ::⊂ **38~48HRC**
↞‖ :‖ ::∫ ∽∾‖ ∅
Vc.160-180 fz.P166

GR.6 ∇≠‖ ::⊂ **48~56HRC**
↞‖ :‖ ::∫ ∽∾‖ ∅
Vc.100-120 fz.P166

GR.7 ∇≠‖ ::⊂ **56~68HRC**
↞‖ :‖ ::∫ ∽∾‖ ∅
Vc.80-100 fz.P166

High Performance End Mills

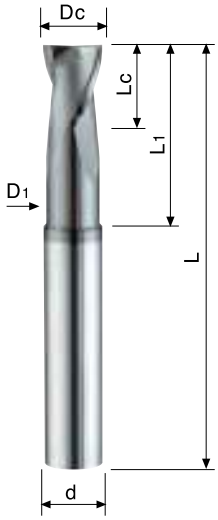
P H < 56HRC

①18.85.156.75(19)(8)35(15)(19)9(16)219418(16)15.413.(16)318(16)11.7(16)18.

F621HX-Dc

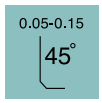
Dc h10	Lc mm	L mm	d h5	L1 mm	D1 mm	AlTiCrN F621HX
3.0	4.0	57	6	9	2.8	●
4.0	5.0	57	6	12	3.7	●
5.0	6.0	57	6	15	4.6	●
6.0	7.0	57	6	20	5.5	●
8.0	9.0	63	8	26	7.4	●
10.0	11.0	72	10	31	9.2	●
12.0	13.0	83	12	37	11.0	●
16.0	15.0	92	16	43	15.0	●

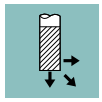
※Limited quantity, production discounted.



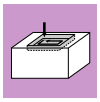
UMG Carbide

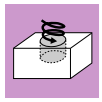
AlTiCrN HX

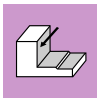


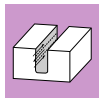


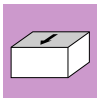
∈↠∃ ∂∃↠∅⇳∏↠↠

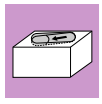












⑬–⑮~⌒⑰⑥①~④⑪⑥④⑪~⑰④⑮⑦⌒⑩⑥

P	H	M	K	N	S
●	●		○		

GR.1 ∇≠‖ ::⊂
∀∫ ::∫ ∩:.≌ ∨‖ ∽≃‖ ∄
Vc.160-180 fz.P165

GR.2 ∇≠‖ ::⊂ <24HRC
∽.:∮ :≡ ::∫ ∩:.≌ ∨‖ ∽≃‖ ∄
Vc.160-180 fz.P165

GR.3 ∇≠‖ ::⊂ <30HRC
→∫ ∩:.≌ ∨‖ ∽≃‖ ∄
Vc.100-120 fz.P165

GR.4 ∇≠‖ ::⊂ 30~38HRC
⇔‖ :‖ ::∫ ∽≃‖ ∄
Vc.80-100 fz.P165

GR.5 ∇≠‖ ::⊂ 38~48HRC
⇔‖ :‖ ::∫ ∽≃‖ ∄
Vc.60-80 fz.P165

GR.6 ∇≠‖ ::⊂ 48~56HRC
⇔‖ :‖ ::∫ ∽≃‖ ∄
Vc.40-60 fz.P165

GR.9 ∑ ≡∩≅∽
Vc.140-160 fz.P165

High Performance End Mills

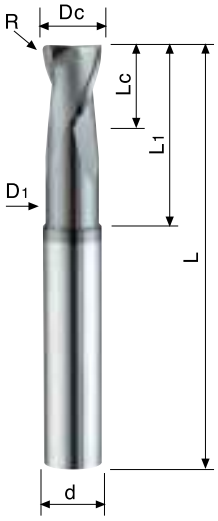
P H < 56HRC

①18.85.156.75.(19)(8)35.(15)(19)9.(16)219418.(16)15.413.(16)318.(16)11.7.(16)(14)8.

F601HX-Dc

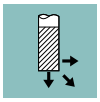
Dc h10	R 0/+0.02	Lc mm	L mm	d h5	L1 mm	D1 mm	AlTiCrN F601HX
3.0	R0.1	4.0	57	6	9	2.8	●
4.0	R0.1	5.0	57	6	12	3.7	●
5.0	R0.2	6.0	57	6	15	4.6	●
6.0	R0.2	7.0	57	6	20	5.5	●
8.0	R0.2	9.0	63	8	26	7.4	●
10.0	R0.2	11.0	72	10	31	9.2	●
12.0	R0.3	13.0	83	12	37	11.0	●
16.0	R0.3	17.0	92	16	43	15.0	●

※Limited quantity, production discounted.



UMG Carbide

AlTiCrN HX



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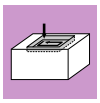
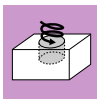
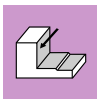
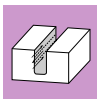
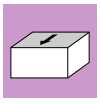
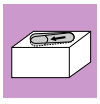












⑬–⑮–⑰⑥①④⑪⑥④⑪–⑰④⑮⑦–⑩⑥

P	H	M	K	N	S
●	●		○		

GR.1 ∇≠‖ ::⊂ ∀∫ ::∫ ∩:≧ ∨‖ ∽≪‖ ⊅
Vc.160-180 fz.P165

GR.2 ∇≠‖ ::⊂ <24HRC ∽:∮ :≡ ::∫ ∩:≧ ∨‖ ∽≪‖ ⊅
Vc.160-180 fz.P165

GR.3 ∇≠‖ ::⊂ <30HRC →∫ ∩:≧ ∨‖ ∽≪‖ ⊅
Vc.100-120 fz.P165

GR.4 ∇≠‖ ::⊂ 30~38HRC ↞‖ :‖ ::∫ ∽≪‖ ⊅
Vc.80-100 fz.P165

GR.5 ∇≠‖ ::⊂ 38~48HRC ↞‖ :‖ ::∫ ∽≪‖ ⊅
Vc.60-80 fz.P165

GR.6 ∇≠‖ ::⊂ 48~56HRC ↞‖ :‖ ::∫ ∽≪‖ ⊅
Vc.40-60 fz.P165

GR.9 ∑≡∩≅∽
Vc.140-160 fz.P165

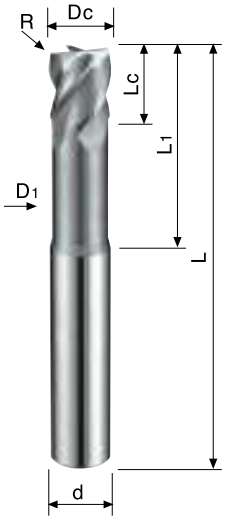
High Performance End Mills

P H < 56HRC

F610HX-Dc

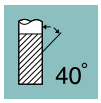
Dc h10	R 0/+0.02	Lc mm	L mm	d h5	L1 mm	D1 mm	AlTiCrN F610HX
3	R0.1	4	57	6	9	2.8	●
4	R0.1	5	57	6	12	3.7	●
5	R0.2	6	57	6	15	4.6	●
6	R0.2	7	57	6	20	5.5	●
8	R0.2	9	63	8	26	7.4	●
10	R0.2	11	72	10	31	9.2	●
12	R0.3	13	83	12	37	11.0	●
16	R0.3	17	92	16	43	15.0	●
20	R0.3	21	104	20	53	19.0	●

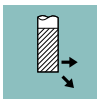
※Limited quantity, production discounted.

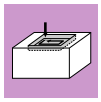


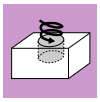
UMG Carbide

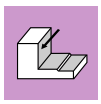
AlTiCrN HX

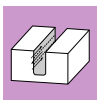


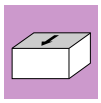












P	H	M	K	N	S
●	●	○	○		○

GR.1
Vc.180-200 fz.P165

GR.2 <24HRC
Vc.180-200 fz.P165

GR.3 <30HRC
Vc.120-150 fz.P165

GR.4 30~38HRC
Vc.100-120 fz.P165

GR.5 38~48HRC
Vc.80-100 fz.P165

GR.6 48~56HRC
Vc.50-70 fz.P165

GR.8
Vc.60-80 fz.P165

GR.9
Vc.160-180 fz.P165

GR.15
Vc.70-90 fz.P165

GR.17
Vc.40-50 fz.P165

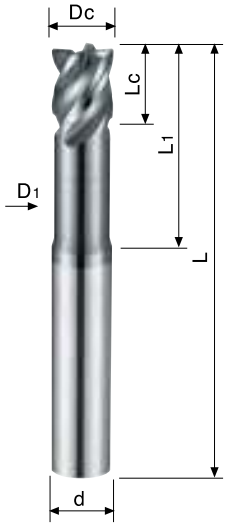
High Performance End Mills

P H < 56HRC

①18.85.156.75(19)(18)35(15)(19)9(16)219418(16)15413(16)318(16)11.7(16)18.

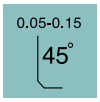
F612GX-Dc

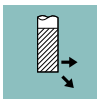
Dc h10	Lc mm	L mm	d h5	L1 mm	D1 mm	AlTiSiN F612GX
3	4	57	6	9	2.8	●
4	5	57	6	12	3.7	●
5	6	57	6	15	4.6	●
6	7	57	6	20	5.5	●
8	9	63	8	26	7.4	●
10	11	72	10	31	9.2	●
12	13	83	12	37	11.0	●
16	17	92	16	43	15.0	●
20	21	104	20	53	19.0	●



UMG Carbide

AlTiSiN GX





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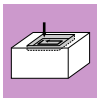
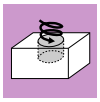
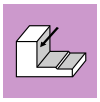
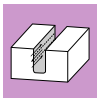
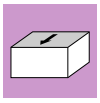




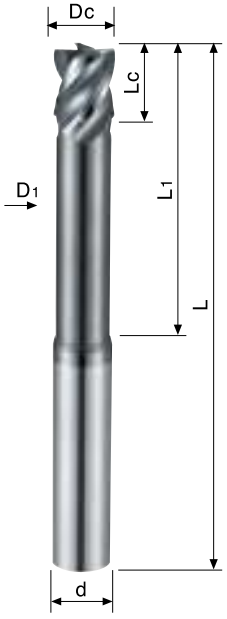






F617GX-Dc

Dc h10	Lc mm	L mm	d h5	L1 mm	D1 mm	AlTiSiN F617GX
6	7	70	6	33	5.5	●
8	9	80	8	43	7.4	●
10	11	90	10	49	9.2	●
12	13	100	12	54	11.0	●
16	17	115	16	66	15.0	●
20	21	130	20	79	19.0	●



P	H	M	K	N	S
●	●	○	○		○

GR.1 ∇≠‖ ::⊂ ∀∫ ::∫ ∩:≌ ∨‖ ∽∾‖ ∅
Vc.180-200 fz.P165

GR.2 ∇≠‖ ::⊂ <24HRC ∽:∮ :≡ ::∫ ∩:≌ ∨‖ ∽∾‖ ∅
Vc.180-200 fz.P165

GR.3 ∇≠‖ ::⊂ <30HRC ⇾∫ ∩:≌ ∨‖ ∽∾‖ ∅
Vc.120-150 fz.P165

GR.4 ∇≠‖ ::⊂ 30~38HRC ⇹‖ :‖ ::∫ ∽∾‖ ∅
Vc.100-120 fz.P165

GR.5 ∇≠‖ ::⊂ 38~48HRC ⇹‖ :‖ ::∫ ∽∾‖ ∅
Vc.80-100 fz.P165

GR.6 ∇≠‖ ::⊂ 48~56HRC ⇹‖ :‖ ::∫ ∽∾‖ ∅
Vc.50-70 fz.P165

GR.8 ∇≠‖ ::⊂ ∀∫ ≦∬‖ ∨∫ ⊄≫‖ ∅
Vc.60-80 fz.P165

GR.9 ∑≡∩≡∽
Vc.160-180 fz.P165

GR.15 ∈:≠‖ ∽
Vc.70-90 fz.P165

GR.17 ∇≠‖ ::⊂ ↭‖ ≌ ≈≌ ≥∾‖ ∅
Vc.40-50 fz.P165

High Performance End Mills

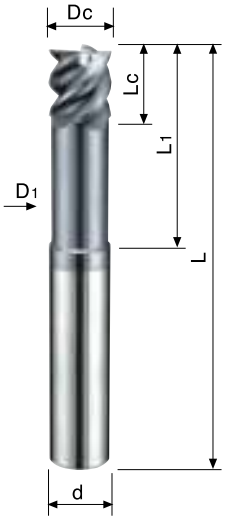
P H < 68HRC

①18.85.156.75.⑲⑱⑬5.⑮⑲9.⑯219418.⑯15413.⑯⑬18.⑯11.7⑯⑱18.




⑨5.⑮(t) F632GX-Dc

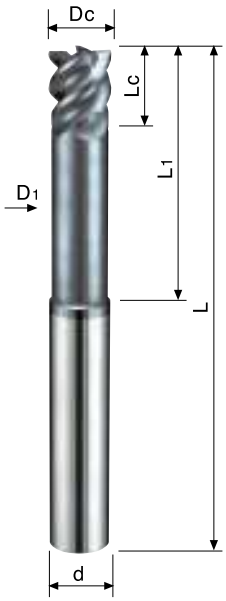
Dc h10	Lc mm	L mm	d h5	L1 mm	D1 mm	AlTiSiN F632GX
3	4	57	6	9	2.8	●
4	5	57	6	12	3.7	●
5	6	57	6	15	4.6	●
6	7	57	6	20	5.5	●
8	9	63	8	26	7.4	●
10	11	72	10	31	9.2	●
12	13	83	12	37	11.0	●
16	17	92	16	43	15.0	●
20	21	104	20	53	19.0	●

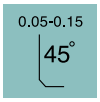


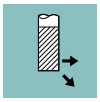



⑨5.⑮(t) F633GX-Dc

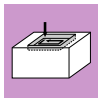
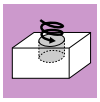
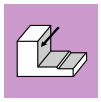
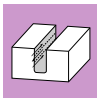
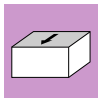
Dc h10	Lc mm	L mm	d h5	L1 mm	D1 mm	AlTiSiN F633GX
6	7	70	6	33	5.5	●
8	9	80	8	43	7.4	●
10	11	90	10	49	9.2	●
12	13	100	12	54	11.0	●
16	17	115	16	66	15.0	●
20	21	130	20	79	19.0	●





∈↠∃ ∂∃↛∅⇳∏↠↠


⑬–⑮⌒⑰⑥①⌒④⑪⑥④⑪⌒⑰⑭⑮⑦⌒⑩⑥

P	H	M	K	N	S
●	●				

GR.2 ∇≠‖ ::⊂ **<24HRC**
∽.∮ :≡ ::∫ ∩.≌ ∨‖ ∽∾‖ ⊅
Vc.140-160 fz.P165

GR.3 ∇≠‖ ::⊂ **<30HRC**
⇢∫ ∩.≌ ∨‖ ∽∾‖ ⊅
Vc.120-150 fz.P165

GR.4 ∇≠‖ ::⊂ **30~38HRC**
⇽‖ :‖ ::∫ ∽∾‖ ⊅
Vc.100-120 fz.P165

GR.5 ∇≠‖ ::⊂ **38~48HRC**
⇽‖ :‖ ::∫ ∽∾‖ ⊅
Vc.80-100 fz.P165

GR.6 ∇≠‖ ::⊂ **48~56HRC**
⇽‖ :‖ ::∫ ∽∾‖ ⊅
Vc.40-60 fz.P165

GR.7 ∇≠‖ ::⊂ **56~68HRC**
⇽‖ :‖ ::∫ ∽∾‖ ⊅
Vc.20-30 fz.P165

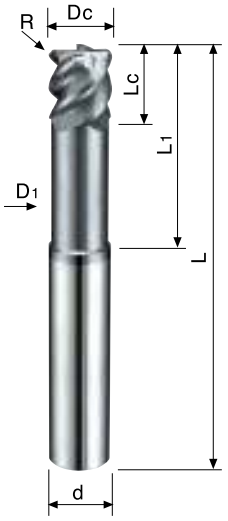
High Performance End Mills

P H < 68HRC

①18.85.156.75(19)(8)35(15)(19)9(16)219418(16)15413(16)318(16)11.7(16)18.

⑨5(15)(t) F635GX-Dc

Dc h10	R 0/+0.02	Lc mm	L mm	d h5	L1 mm	D1 mm	AlTiSiN F635GX
6	R1.0	7	57	6	20	5.5	●
8	R1.0	9	63	8	26	7.4	●
10	R1.5	11	72	10	31	9.2	●
12	R1.5	13	83	12	37	11.0	●
16	R1.5	17	92	16	43	15.0	●



UMG Carbide

AlTiSiN GX

55°

4

N

R

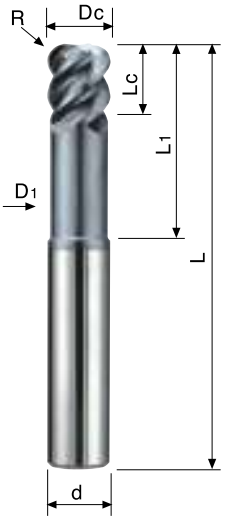
∈↠∃ ∂∃↠Ø⇳∏↠↠

⑬–⑮–⑰(6)①–④⑪(6)④⑪–⑰④⑮⑦–⑩(6)

P	H	M	K	N	S
●	●				

⑨5(15)(t) F637GX-Dc

Dc h10	R 0/+0.02	Lc mm	L mm	d h5	L1 mm	D1 mm	AlTiSiN F637GX
6	R1.5	7	57	6	20	5.5	●
8	R2.0	9	63	8	26	7.4	●
10	R2.5	11	72	10	31	9.2	●
12	R3.0	13	83	12	37	11.0	●
16	R3.5	17	92	16	43	15.0	●
20	R4.0	21	104	20	53	19.0	●



GR.2 ∇≠‖ ::⊂ <24HRC
∽:ϟ :≡ ::∫ ∩:≌ ∀‖ ∽∾‖ ∅
Vc.140-160 fz.P165

GR.3 ∇≠‖ ::⊂ <30HRC
→∫ ∩:≌ ∀‖ ∽∾‖ ∅
Vc.120-150 fz.P165

GR.4 ∇≠‖ ::⊂ 30~38HRC
↞‖ :‖ ::∫ ∽∾‖ ∅
Vc.100-120 fz.P165

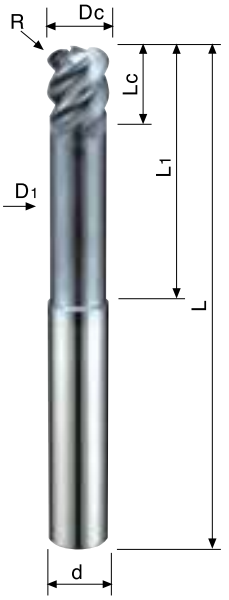
GR.5 ∇≠‖ ::⊂ 38~48HRC
↞‖ :‖ ::∫ ∽∾‖ ∅
Vc.80-100 fz.P165

GR.6 ∇≠‖ ::⊂ 48~56HRC
↞‖ :‖ ::∫ ∽∾‖ ∅
Vc.40-60 fz.P165

GR.7 ∇≠‖ ::⊂ 56~68HRC
↞‖ :‖ ::∫ ∽∾‖ ∅
Vc.20-30 fz.P165

⑨5(15)(t) F639GX-Dc

Dc h10	R 0/+0.02	Lc mm	L mm	d h5	L1 mm	D1 mm	AlTiSiN F639GX
6	R1.5	7	70	6	33	5.5	●
8	R2.0	9	80	8	43	7.4	●
10	R2.5	11	90	10	49	9.2	●
12	R3.0	13	100	12	54	11.0	●
16	R3.5	17	115	16	66	15.0	●
20	R4.0	17	130	20	79	19.0	●

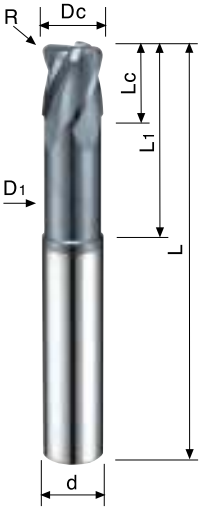


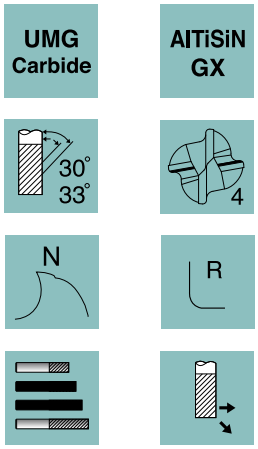
High Performance Toric End Mills

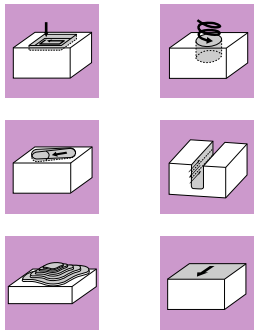
H < 56HRC

F615GX-Dc×R

Dc h10	R 0/+0.02	Lc mm	L mm	d h5	L1 mm	D1 mm	AlTiSiN F615GX
3	R0.3	4	57	6	14	2.8	●
3	R0.5	4	57	6	14	2.8	●
4	R0.3	5	57	6	16	3.7	●
4	R0.5	5	57	6	16	3.7	●
4	R1.0	5	57	6	16	3.7	●
6	R0.5	7	57	6	20	5.5	●
6	R1.0	7	57	6	20	5.5	●
6	R1.5	7	57	6	20	5.5	●
8	R0.5	9	63	8	26	7.4	●
8	R1.0	9	63	8	26	7.4	●
8	R1.5	9	63	8	26	7.4	●
8	R2.0	9	63	8	26	7.4	●
10	R0.5	11	72	10	31	9.2	●
10	R1.0	11	72	10	31	9.2	●
10	R1.5	11	72	10	31	9.2	●
10	R2.0	11	72	10	31	9.2	●
10	R2.5	11	72	10	31	9.2	●
12	R0.5	13	83	12	37	11.0	●
12	R1.0	13	83	12	37	11.0	●
12	R1.5	13	83	12	37	11.0	●
12	R2.0	13	83	12	37	11.0	●
12	R3.0	13	83	12	37	11.0	●
16	R2.0	17	92	16	43	15.0	●
16	R4.0	17	92	16	43	15.0	●







P	H	M	K	N	S
	●		○		

GR.4 30~38HRC
Vc.180-200 fz.P167

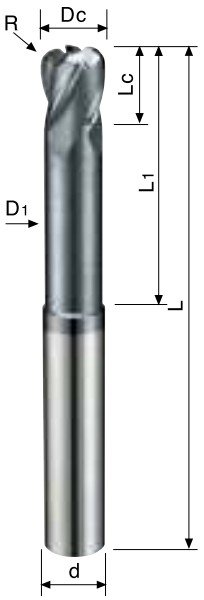
GR.5 38~48HRC
Vc.150-180 fz.P167

GR.6 48~56HRC
Vc.120-150 fz.P167

GR.9
Vc.220-250 fz.P167

F619GX-Dc×R

Dc h10	R 0/+0.02	Lc mm	L mm	d h5	L1 mm	D1 mm	AlTiSiN F619GX
6	R1.5	7	70	6	33	5.5	●
8	R2.0	9	80	8	43	7.4	●
10	R2.5	11	90	10	49	9.2	●
12	R3.0	13	100	12	54	11.0	●
16	R4.0	17	115	16	66	15.0	●

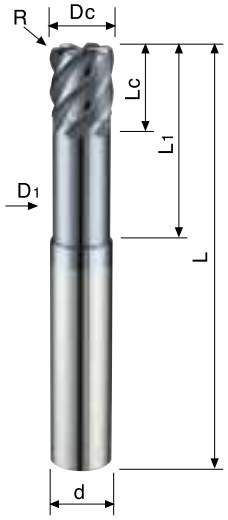


High Performance Toric End Mills

H < 68HRC

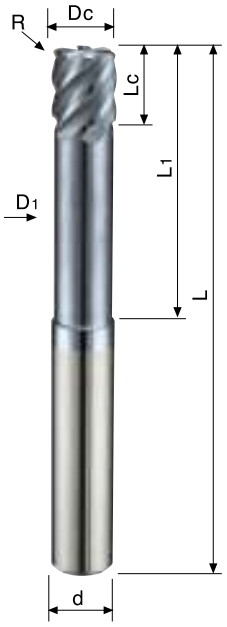
F613GX-Dc×R

Dc h10	R 0/+0.02	Lc mm	L mm	d h5	L1 mm	D1 mm	Z	AlTiSiN F613GX
3	R0.5	4	57	6	14	2.8	4	●
4	R0.5	5	57	6	16	3.7	4	●
5	R0.5	6	57	6	18	4.6	4	●
6	R0.5	7	57	6	20	5.5	6	●
8	R0.5	9	63	8	26	7.4	6	●
10	R0.5	11	72	10	31	9.2	6	●
12	R0.5	13	83	12	37	11.0	6	●
6	R1.0	7	57	6	20	5.5	6	●
8	R1.0	9	63	8	26	7.4	6	●
10	R1.0	11	72	10	31	9.2	6	●
12	R1.0	13	83	12	37	11.0	6	●



F614GX-Dc×R

Dc h10	R 0/+0.02	Lc mm	L mm	d h5	L1 mm	D1 mm	Z	AlTiSiN F614GX
3	R0.5	4	70	6	27	2.8	4	●
4	R0.5	5	70	6	29	3.7	4	●
5	R0.5	6	70	6	31	4.6	4	●
6	R0.5	7	70	6	33	5.5	6	●
8	R0.5	9	80	8	43	7.4	6	●
10	R0.5	11	90	10	49	9.2	6	●
12	R0.5	13	100	12	54	11.0	6	●
6	R1.0	7	70	6	33	5.5	6	●
8	R1.0	9	80	8	43	7.4	6	●
10	R1.0	11	90	10	49	9.2	6	●
12	R1.0	13	100	12	54	11.0	6	●



UMG Carbide

AlTiSiN GX

45°

6

N

R

P	H	M	K	N	S
	●		○		

GR.4 30~38HRC
Vc.180-200 fz.P167

GR.5 38~48HRC
Vc.150-180 fz.P167

GR.6 48~56HRC
Vc.120-150 fz.P167

GR.7 56~68HRC
Vc.60-80 fz.P167

GR.9
Vc.220-250 fz.P167

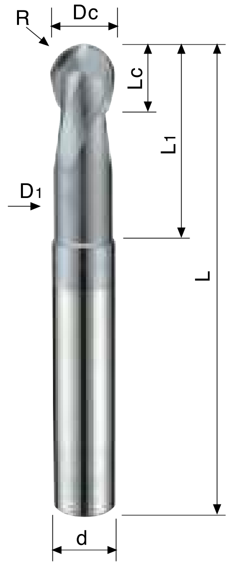
High Performance Ball Nose End Mills

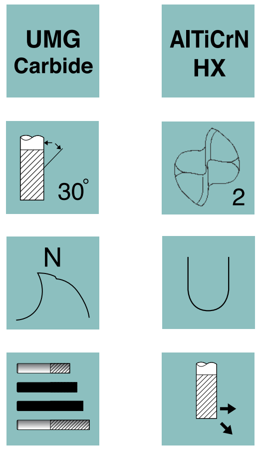
P H < 56HRC

①18.85.156.75⑲⑱⑬5.⑮⑲9.⑯219.418⑯⑯11.⑯7⑲14.⑯8.1⑲⑯15.413.⑯⑬18⑯11.7⑯18.

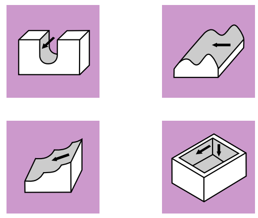
⑨5⑮(t) F623HX-Dc

Dc h9	R ±0.01	Lc mm	L mm	d h5	L1 mm	D1 mm	AlTiCrN F623HX
1	0.5R	1	50	6	3	0.95	●
1.5	0.75R	2	50	6	4	1.4	●
2	1.0R	3	57	6	6	1.9	●
3	1.5R	4	57	6	9	2.8	●
4	2.0R	5	57	6	12	3.7	●
5	2.5R	6	57	6	15	4.6	●
6	3.0R	7	57	6	20	5.5	●
8	4.0R	9	63	8	26	7.4	●
10	5.0R	11	72	10	31	9.2	●
12	6.0R	13	83	12	37	11.0	●



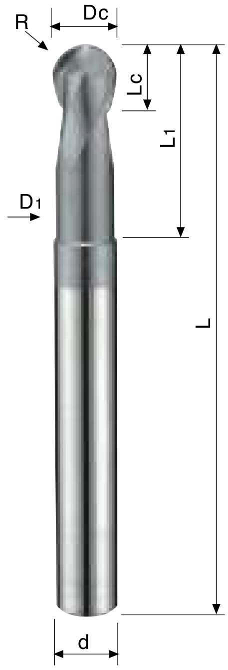


∈⇻∃ ∂∃⇸∅⇳∏⇻⇻



⑨5⑮(t) F624HX-Dc

Dc h9	R ±0.01	Lc mm	L mm	d h5	L1 mm	D1 mm	AlTiCrN F624HX
3	1.5R	4	70	6	9	2.8	●
4	2.0R	5	70	6	12	3.7	●
5	2.5R	6	80	6	15	4.6	●
6	3.0R	7	80	6	20	5.5	●
8	4.0R	9	100	8	26	7.4	●
10	5.0R	11	100	10	31	9.2	●
12	6.0R	13	110	12	37	11.0	●



⑬–⑮⌒⌒⑰⑥①⌒④⑪⑥④⑪⌒⑰④⑮⑦⌒⑩⑥

P	H	M	K	N	S
●	●		○		

GR.2 ∇≠‖ ::⊂ <24HRC
Vc.250-300 fz.P164

GR.3 ∇≠‖ ::⊂ <30HRC
Vc.220-250 fz.P164

GR.4 ∇≠‖ ::⊂ 30~38HRC
Vc.200-220 fz.P164

GR.5 ∇≠‖ ::⊂ 38~48HRC
Vc.180-200 fz.P164

GR.6 ∇≠‖ ::⊂ 48~56HRC
Vc.160-180 fz.P164

GR.9 ∑≡∩≡∽
Vc.250-280 fz.P164

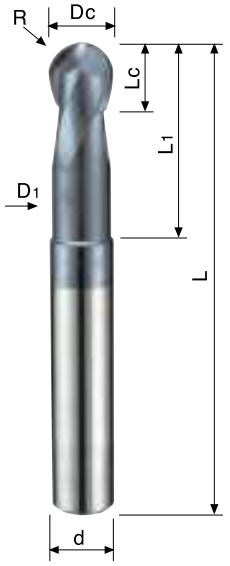
High Performance Ball Nose End Mills

H 48-68HRC

①18.85.156.75.(19)(18)35.(15)(19)9.(16)219.418.(16)(16)11.(16)7.(19)14.(16)8.1.(19)(16)15.413.(16)318.(16)11.7.(16)(19)8.

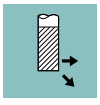
F625GX-Dc

Dc h9	R ±0.01	Lc mm	L mm	d h5	L1 mm	D1 mm	AlTiSiN F625GX
1	0.5R	1	50	6	3	0.95	●
1.5	0.75R	2	50	6	4	1.4	●
2	1.0R	3	57	6	6	1.9	●
3	1.5R	4	57	6	9	2.8	●
4	2.0R	5	57	6	12	3.7	●
5	2.5R	6	57	6	15	4.6	●
6	3.0R	7	57	6	20	5.5	●
8	4.0R	9	63	8	26	7.4	●
10	5.0R	11	72	10	31	9.2	●
12	6.0R	13	83	12	37	11.0	●

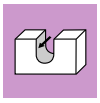


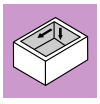
UMG Carbide

AlTiSiN GX



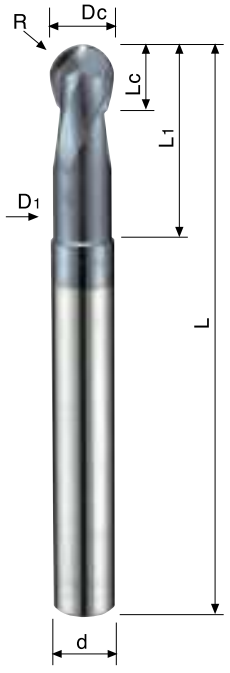
∈⇸∃ ∂∃⇸∅⇳∏⇸⇸





F626GX-Dc

Dc h9	R ±0.01	Lc mm	L mm	d h5	L1 mm	D1 mm	AlTiSiN F626GX
3	1.5R	4	70	6	9	2.8	●
4	2.0R	5	70	6	12	3.7	●
5	2.5R	6	80	6	15	4.6	●
6	3.0R	7	80	6	20	5.5	●
8	4.0R	9	100	8	26	7.4	●
10	5.0R	11	100	10	31	9.2	●
12	6.0R	13	110	12	37	11.0	●



⑬–⑮~⑰⑥①~④⑪⑥④⑪~⑰④⑤⑦~⑩⑥

P	H	M	K	N	S
	●		○		

GR.6 ∇≠‖ ::⊂ 48~56HRC
⇸‖ :‖ ::∫ ∽∽‖ ∅
Vc.160-180 fz.P164

GR.7 ∇≠‖ ::⊂ 56~68HRC
⇸‖ :‖ ::∫ ∽∽‖ ∅
Vc.60-80 fz.P164

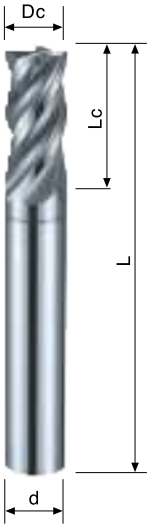
GR.9 ∑≡∩≡∽
Vc.280-320 fz.P164

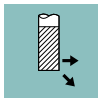
High Performance End Mills

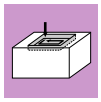
M

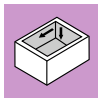
F651SX-Dc

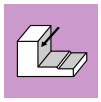
Dc h10	Lc mm	L mm	d h5	AlTiCrN F651SX
3	8	57	6	●
4	11	57	6	●
5	13	57	6	●
6	13	57	6	●
8	19	63	8	●
10	22	72	10	●
12	26	83	12	●
16	32	92	16	●
20	38	104	20	●

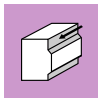


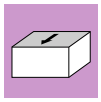












P	H	M	K	N	S
		●			○

GR.8
Vc.80-100 fz.P165

GR.15
Vc.60-80 fz.P165

GR.16
Vc.40-60 fz.P165

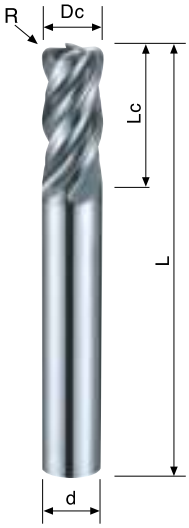
GR.17
Vc.50-70 fz.P165

High Performance End Mills

M

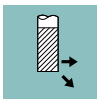
F652SX-Dc×R

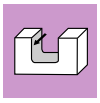
Dc h10	R 0/+0.02	Lc mm	L mm	d h5	AlTiCrN F652SX
3	0.2	8	57	6	●
4	0.2	11	57	6	●
5	0.2	13	57	6	●
6	0.2	13	57	6	●
8	0.2	19	63	8	●
10	0.2	22	72	10	●
12	0.2	26	83	12	●
16	0.2	32	92	16	●
20	0.2	38	104	20	●
3	0.5	8	57	6	●
4	0.5	11	57	6	●
5	0.5	13	57	6	●
6	0.5	13	57	6	●
8	0.5	19	63	8	●
10	0.5	22	72	10	●
12	0.5	26	83	12	●
16	0.5	32	92	16	●
20	0.5	38	104	20	●
6	1.0	13	57	6	●
8	1.0	19	63	8	●
10	1.0	22	72	10	●
12	1.0	26	83	12	●
16	1.0	32	92	16	●
20	1.0	38	104	20	●
6	2.0	13	57	6	●
8	2.0	19	63	8	●
10	2.0	22	72	10	●
12	2.0	26	83	12	●
16	2.0	32	92	16	●
20	2.0	38	104	20	●

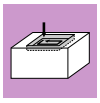


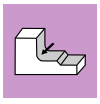
UMG Carbide

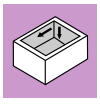
one AlTiCrN SX

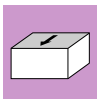












P	H	M	K	N	S
		●			○

GR.8

Vc.80-100 fz.P165

GR.15

Vc.60-80 fz.P165

GR.16

Vc.40-60 fz.P165

GR.17

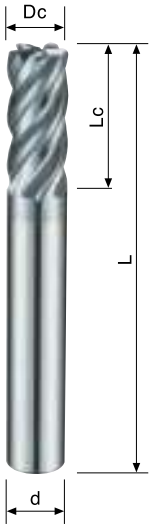
Vc.50-70 fz.P165

High Performance End Mills

M

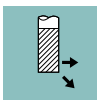
F653SX-Dc×R

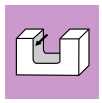
Dc h10	R 0/+0.02	Lc mm	L mm	d h5	AlTiCrN F653SX
3	0.5	8	57	6	●
4	0.5	11	57	6	●
5	0.5	13	57	6	●
6	0.5	13	57	6	●
8	0.5	19	63	8	●
10	0.5	22	72	10	●
12	0.5	26	83	12	●
16	0.5	32	92	92	●
20	0.5	38	104	104	●

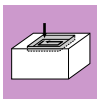


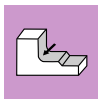
UMG Carbide

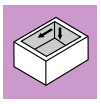
one AlTiCrN SX

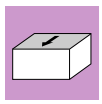












P	H	M	K	N	S
		●			○

GR.8
Vc.80-100 fz.P165

GR.15
Vc.60-80 fz.P165

GR.16
Vc.40-60 fz.P165

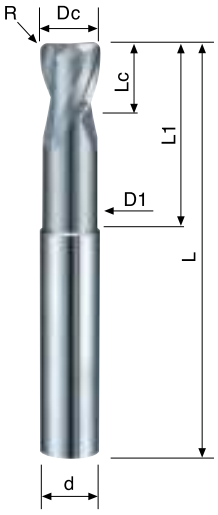
GR.17
Vc.50-70 fz.P165

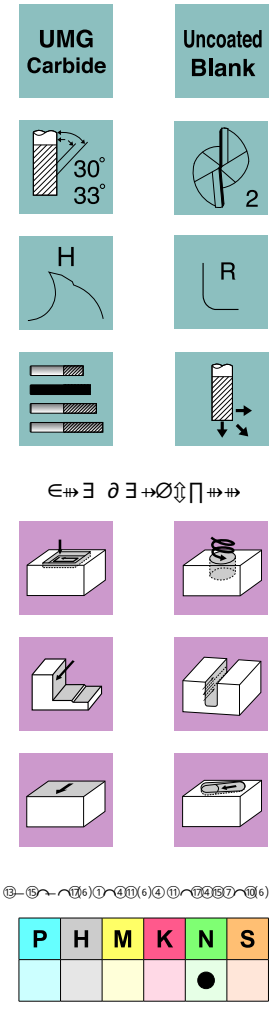
High Performance End Mills

N

F605-Dc×R

Dc h10	R 0/+0.02	Lc mm	L mm	d h5	L1 mm	D1 mm	Blank F605
3	R0.5	4	57	6	9	2.8	●
4	R0.5	5	57	6	12	3.7	●
5	R0.5	6	57	6	15	4.6	●
6	R0.5	7	57	6	20	5.5	●
6	R1.0	7	57	6	20	5.5	●
8	R0.5	9	63	8	26	7.4	●
8	R1.0	9	63	8	26	7.4	●
10	R1.0	11	72	10	31	9.2	●
10	R1.5	11	72	10	31	9.2	●
12	R1.0	13	83	12	37	11.0	●
12	R1.5	13	83	12	37	11.0	●
16	R2.0	17	92	16	43	15.0	●
20	R2.0	21	104	20	53	19.0	●





P	H	M	K	N	S
				●	

GR.10

Vc.300-800 fz.P165

GR.11

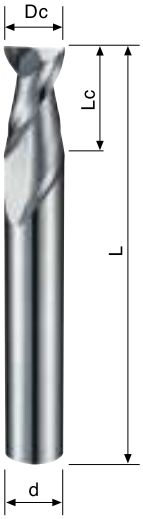
Vc.200-600 fz.P165

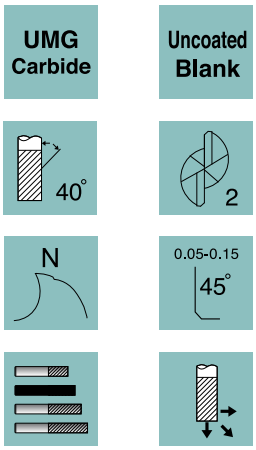
High Performance End Mills

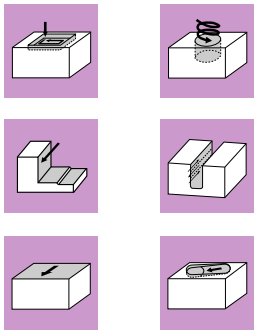
N

F600-Dc

Dc h10	Lc mm	L mm	d h5	Blank F600
3	7	57	6	●
4	8	57	6	●
5	10	57	6	●
6	10	57	6	●
8	16	63	8	●
10	19	72	10	●
12	22	83	12	●







P	H	M	K	N	S
				●	

GR.10

Vc.300-800 fz.P165

GR.11

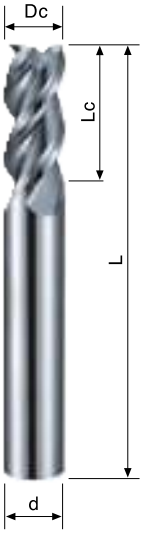
Vc.200-600 fz.P165

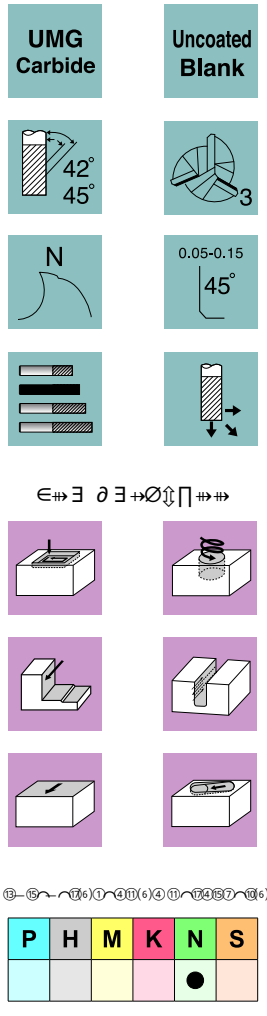
High Performance End Mills

N

F631-Dc

Dc h10	Lc mm	L mm	d h5	Blank F631
3	8	57	6	●
4	11	57	6	●
5	13	57	6	●
6	13	57	6	●
8	19	63	8	●
10	22	72	10	●
12	26	83	12	●





P	H	M	K	N	S
				●	

GR.10

Vc.300-800 fz.P165

GR.11

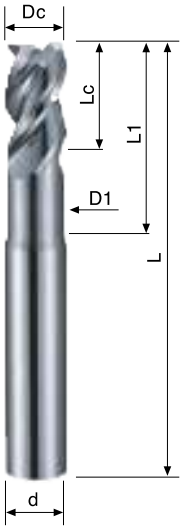
Vc.300-600 fz.P165

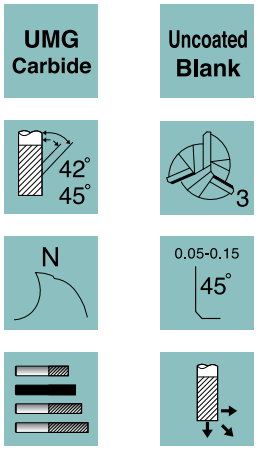
High Performance End Mills

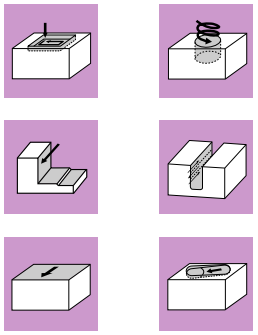
N

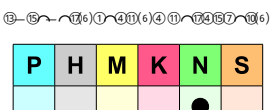
F607-Dc

Dc h10	Lc mm	L mm	d h5	L1 mm	D1 mm	Blank F607
3	4.5	57	6	9	2.8	●
4	6	57	6	12	3.7	●
5	7.5	57	6	15	4.6	●
6	9	57	6	20	5.5	●
8	12	63	8	26	7.4	●
10	15	72	10	31	9.2	●
12	18	83	12	37	11.0	●









P	H	M	K	N	S
				●	

GR.10

Vc.300-800 fz.P165

GR.11

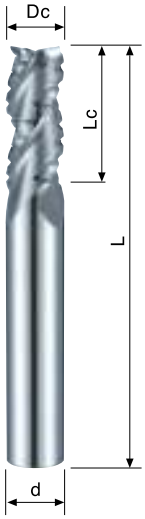
Vc.300-600 fz.P165

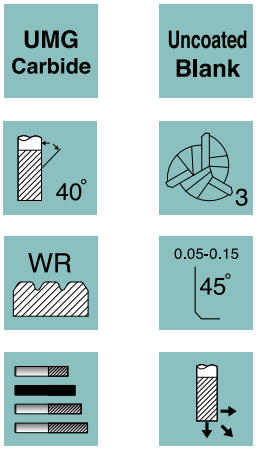
High Performance Roughing End Mills

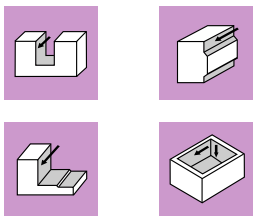
N

F642-Dc

Dc h10	Lc mm	L mm	d h5	Blank F642
6	13	57	6	●
8	19	63	8	●
10	22	72	10	●
12	26	83	12	●
16	32	92	16	●
20	38	104	20	●







P	H	M	K	N	S
				●	

GR.10

Vc.200-450 fz.P165

GR.11

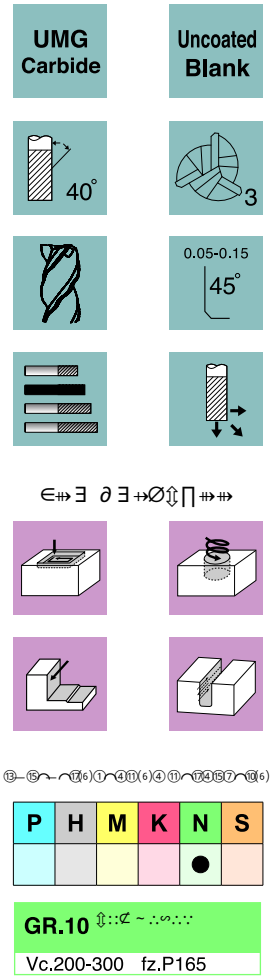
Vc.100-300 fz.P165

High Performance End Mills

N

F647-Dc

Dc h10	Lc mm	L mm	d h5	Blank F647
6	13	57	6	●
8	19	63	8	●
10	22	72	10	●
12	26	83	12	●



P	H	M	K	N	S
				●	

GR.10

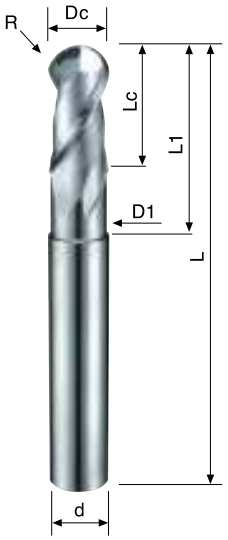
Vc.200-300 fz.P165

High Performance Ball Nose End Mills

N

F618-Dc

Dc h9	R ±0.01	Lc mm	L mm	d h5	L1 mm	D1 mm	Blank F618
3	1.5R	6	57	6	9	2.8	●
4	2.0R	8	57	6	12	3.7	●
5	2.5R	10	57	6	15	4.6	●
6	3.0R	12	57	6	20	5.5	●
8	4.0R	16	63	8	26	7.4	●
10	5.0R	20	72	10	31	9.2	●
12	6.0R	24	83	12	37	11.0	●



UMG Carbide

Uncoated Blank

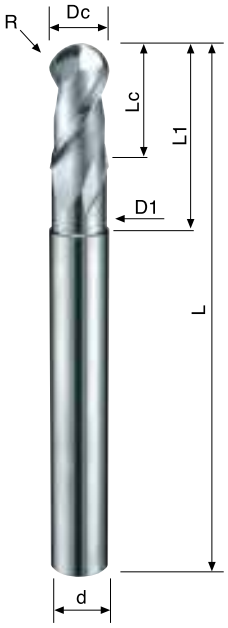
40°

2

H

F620-Dc

Dc h9	R ±0.01	Lc mm	L mm	d h5	L1 mm	D1 mm	Blank F620
3	1.5R	6	70	6	9	2.8	●
4	2.0R	8	70	6	12	3.7	●
5	2.5R	10	80	6	15	4.6	●
6	3.0R	12	80	6	20	5.5	●
8	4.0R	16	100	8	26	7.4	●
10	5.0R	20	100	10	31	9.2	●
12	6.0R	24	110	12	37	11.0	●



P	H	M	K	N	S
				●	

GR.10

Vc.400-800 fz.P164

GR.11

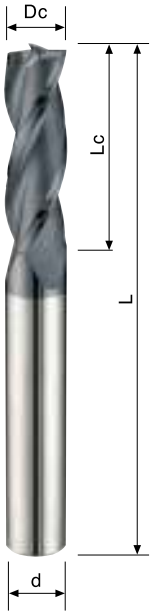
Vc.300-600 fz.P164

High Performance End Mills

N

F680DC-Dc

Dc h10	Lc mm	L mm	d h5	Diamond F680DC
1	4	38	3	●
1.5	6	38	3	●
2	8	38	3	●
3	12	38	3	●
4	14	50	4	●
5	16	50	5	●
6	22	65	6	●
8	28	80	8	●
10	32	100	10	●
12	38	100	12	●



MG Carbide

Diamond DC

30°

3

H

0.05-0.15

45°

P	H	M	K	N	S
				●	

GR.14

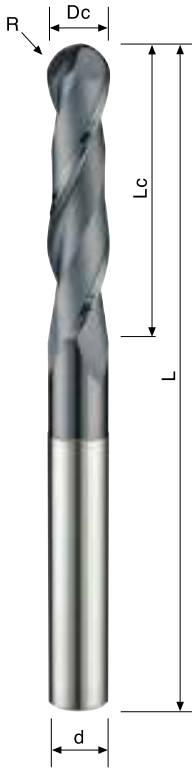
Vc.700-1000 fz.P165

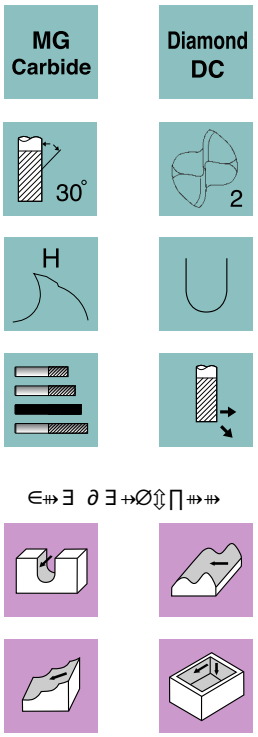
High Performance Ball Nose End Mills

N

F685DC-Dc

Dc h10	R 0/+0.02	Lc mm	L mm	d h5	L1 mm	D1 mm	Diamond F685DC
2	1R	10	80	4	20	1.9	●
3	1.5R	15	80	4	25	2.9	●
4	2R	20	80	4	30	3.9	●
5	2.5R	30	100	6	50	4.8	●
6	3R	30	100	6	50	5.8	●
8	4R	40	110	8	60	7.8	●
10	5R	50	120	10	70	9.7	●
12	6R	55	130	12	75	11.7	●





P	H	M	K	N	S
				●	

GR.14

Vc.800-1000 fz.P164

High Performance End Mills

S

F645TX-Dc

Dc h10	Lc mm	L mm	d h5	Z	AlCrSiN F645TX
6	13	57	6	4	●
8	19	63	8	4	●
10	22	72	10	4	●
12	26	83	12	4	●
16	32	92	16	4	●
20	38	104	20	4	●

UMG Carbide

AlCrSiN TX

45°

4

NEW-HR

0.05-0.15

45°

P	H	M	K	N	S
		○			●

GR.8

Vc.50-70 fz.P165

GR.15

Vc.40-60 fz.P165

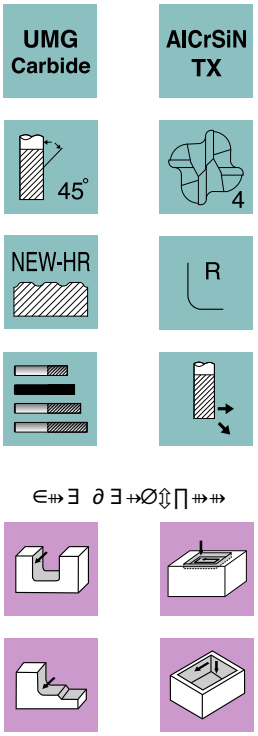
High Performance End Mills

S

①18.85.156.75(19)(8)35(15)(19)9(16)219.418(16)15.413.(16)(13)18(16)11.7(16)(14)8.

F665TX-Dc×R

Dc h10	R 0/+0.02	Lc mm	L mm	d h5	Z	AlCrSiN F665TX
6	R2.0	13	57	6	4	●
8	R2.0	19	63	8	4	●
10	R2.0	22	72	10	4	●
12	R2.0	26	83	12	4	●
16	R2.0	32	92	16	4	●
20	R2.0	38	104	20	4	●



∈↠∃ ∂∃↦∅⇳∏↠↠

⑬–⑮~⑰⑥①~④⑩⑥④⑪~⑰④⑤⑦~⑩⑥

P	H	M	K	N	S
		○			●

GR.8 ∇≠‖ ::⊂
∀∫ ≅∬‖ ∨∫ ⊄≫‖ ⧄
Vc.50-70 fz.165

GR.15 ∈∴≠‖ ∽
Vc.40-70 fz.165

High Performance End Mills

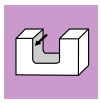
S

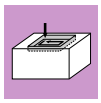
F667TX-Dc×R

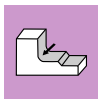
Dc h10	R 0/+0.02	Lc mm	L mm	d h5	AlCrSiN F667TX
6	R2.0	13	57	6	●
8	R2.0	19	63	8	●
10	R2.0	22	72	10	●
12	R2.0	26	83	12	●
16	R2.0	32	92	16	●
20	R2.0	38	104	20	●

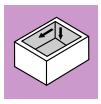
UMG Carbide

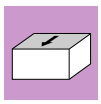
AlCrSiN TX











P	H	M	K	N	S
		○			●

GR.8

Vc.40-80 fz.P165

GR.15

Vc.70-90 fz.P165

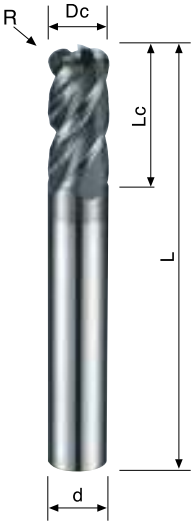
High Performance Roughing End Mills

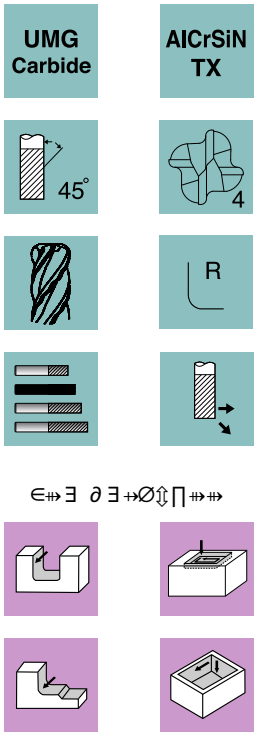
S

①18.85.156.75(19)(8)35(15)(19)9(16)219.418(16)15.413(16)18(16)11.7(16)18.

⑨5(15)(t)　F668TX-Dc×R

Dc h10	R 0/+0.02	Lc mm	L mm	d h5	Z	AlCrSiN F668TX
10	R3.0	22	72	10	4	●
12	R3.0	26	83	12	4	●
16	R3.0	32	92	16	4	●
20	R3.0	38	104	20	4	●





∈↠∃ ∂∃↠∅⇳∏↠↠

⑬⑮⑰⑥①④⑪⑥④⑪⑰⑭⑮⑦⑩⑥

P	H	M	K	N	S
		○			●

GR.8 ∇≠‖ ::⊂ ∀∫ ≅∬‖ ∨∫ ⊄≫‖ ∄

Vc.50-70　fz.P165

GR.15 ∈∴≠‖ ∽

Vc.40-60　fz.P165


7leaders™
The Art of Cutting

①4.⑯5.4.⑲⑳⑬⑨⑤	⑨5.⑮⑦	⑬6.⑲8.⑪4.⑲⑯	⑬⑫7.⑩⑫⑲9.⑭⑩3.18⑳3.⑪⑨0.⑥7.⑲⑫2.	⑯97⑪4.⑲⑪
	D903 D904	MG Carbide / Uncoated Blank / D	P H M K N S ● ● ○ ● ○ ○	P123
	D913 D914	MG Carbide / Uncoated Blank / D	P H M K N S ● ● ○ ● ○ ○	P124
	D908	MG Carbide / Uncoated Blank / 60°	P H M K N S ● ● ○ ● ○	P125
	D400	MG Carbide / Uncoated Blank / 5XD	P H M K N S ○ ○ ●	P126
	D412	MG Carbide / Uncoated Blank / 3XD	P H M K N S ○ ○ ●	P127
	D413	MG Carbide / Uncoated Blank / 5XD	P H M K N S ○ ○ ●	P128
	D430FN	MG Carbide / TiAlN F-NaNo / 3XD	P H M K N S ● ● ○ ●	P129
	D433FN	MG Carbide / TiAlN F-NaNo / 5XD	P H M K N S ● ● ○ ●	P130
	D421FN	MG Carbide / TiAlN F-NaNo / 5XD	P H M K N S ● ● ○ ● ○	P131
	D422	MG Carbide / Uncoated Blank / 5XD	P H M K N S ●	P132
	D431FT	UMG Carbide / TiAlN F-TOP / 3XD	P H M K N S ● ● ○ ○	P133 P134
	D432FT	UMG Carbide / TiAlN F-TOP / 5XD	P H M K N S ● ● ○ ○	P135 P136
	D435FT	UMG Carbide / TiAlN F-TOP / 3XD	P H M K N S ● ● ○ ○	P137 P138
	D436FT	UMG Carbide / TiAlN F-TOP / 5XD	P H M K N S ● ● ○ ○	P139 P140
	D437FT	UMG Carbide / TiAlN F-TOP / 8XD	P H M K N S ● ● ○ ○	P141 P142
	D441FT D442FT D443FT	UMG Carbide / TiAlN F-TOP / 12XD 16XD 20XD	P H M K N S ● ○ ○ ●	P143
	D419FT	UMG Carbide / TiAlN F-TOP / 90°	P H M K N S ● ● ○ ● ○	P144
	D402	MG Carbide / Uncoated Blank / 5XD	P H M K N S ● ● ●	P145
	D405	MG Carbide / Uncoated Blank / 5XD	P H M K N S ● ● ●	P146

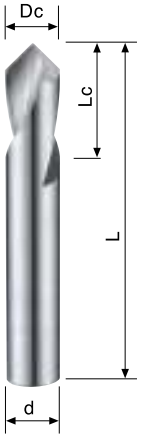
NC Spot Drills / 90°

K P H < 48HRC

(2)(14)(18)(1)(16)4975(13)5144(16)8(13)(6)72(11)/ 90

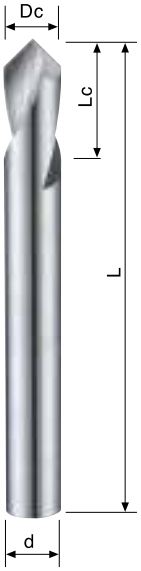
D903-Dc

Dc h6	Lc mm	L mm	d h6	Blank D903
3	10	38	3	●
4	12	50	4	●
5	15	50	5	●
6	20	60	6	●
8	25	60	8	●
10	25	72	10	●
12	30	75	12	●
16	35	100	16	●
20	40	100	20	●



D904-Dc

Dc h6	Lc mm	L mm	d h6	Blank D904
6	20	100	6	●
8	25	125	8	●
10	25	150	10	●
12	30	150	12	●
16	35	150	16	●
20	40	150	20	●



MG Carbide

Uncoated Blank

D

2

7Leaders Standard

90°

P	H	M	K	N	S
●	●	○	●	○	○

GR.1 Vc.50-60 f.P168

GR.2 <24HRC Vc.50-60 f.P168

GR.3 <30HRC Vc.40-50 f.P168

GR.4 30~38HRC Vc.40-50 f.P168

GR.5 38~48HRC Vc.30-40 f.P168

GR.8 Vc.20-30 f.P168

GR.9 Vc.60-70 f.P168

GR.11 Vc.80-100 f.P168

GR.15 Vc.20-40 f.P168

GR.16 Vc.15-20 f.P168

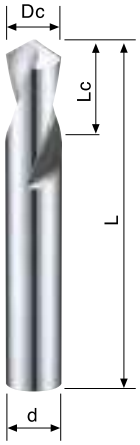
NC Spot Drills / 120°

K P H < 48HRC

(2)(14)(18)(1)(16)4.97.5(13)5144.18(16)8(13)(6)7.2(11) / 120

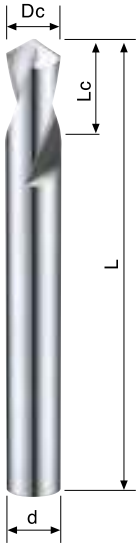
95(15)(t) D913-Dc

Dc h6	Lc mm	L mm	d h6	Blank D913
3	10	38	3	●
4	12	50	4	●
5	15	50	5	●
6	20	60	6	●
8	25	60	8	●
10	25	72	10	●
12	30	75	12	●
16	35	100	16	●
20	40	100	20	●



95(15)(t) D914-Dc

Dc h6	Lc mm	L mm	d h6	Blank D914
6	20	100	6	●
8	25	125	8	●
10	25	150	10	●
12	30	150	12	●
16	35	150	16	●
20	40	150	20	●



MG Carbide

Uncoated Blank

D

2

7Leaders Standard

120°

P	H	M	K	N	S
●	●	○	●	○	○

GR.1 Vc.50-60 f.P168

GR.2 <24HRC Vc.50-60 f.P168

GR.3 <30HRC Vc.40-50 f.P168

GR.4 30~38HRC Vc.40-50 f.P168

GR.5 38~48HRC Vc.30-40 f.P168

GR.8 Vc.20-30 f.P168

GR.9 Vc.60-70 f.P168

GR.11 Vc.80-100 f.P168

GR.15 Vc.20-40 f.P168

GR.16 Vc.15-20 f.P168

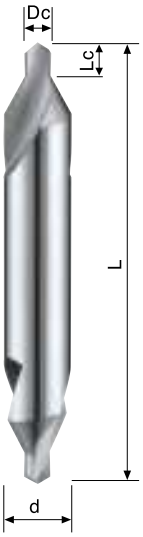
Combined Drill and Countersink

K P H < 48HRC

⑨53.(12)(19)4(19)75(13)(1)44418(16)8(13)(6)72(11)(19)(18)(6)41.(16)7.

⑨5(15)(t) D908-Dc

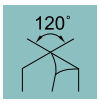
Dc h7	Lc mm	L mm	d h6	Blank D908
0.50	0.8	38	3	●
0.80	1.1	38	3	●
1.00	1.3	38	3	●
1.25	1.6	38	3	●
1.60	2.0	38	4	●
2.00	2.5	50	5	●
2.50	3.1	50	6	●
3.15	3.9	63	8	●
4.00	5.0	66	10	●
5.00	6.3	73	12	●



MG Carbide

Uncoated Blank

DIN 333



⑬–⑮~⑰(6)①~④⑪(6)④⑪~⑰④⑮⑦~⑩(6)

P	H	M	K	N	S
●	●	○	●	○	

GR.1 ∇≠‖ ::⊂ ∀∫ ::∫ ∩∴≦ ∨‖ ∽∽‖ ⊅
Vc.30-40 f.P168

GR.2 ∇≠‖ ::⊂ **<24HRC** ∽∴∮ :≡ ::∫ ∩∴≦ ∨‖ ∽∽‖ ⊅
Vc.30-40 f.P168

GR.3 ∇≠‖ ::⊂ **<30HRC** →∫ ∩∴≦ ∨‖ ∽∽‖ ⊅
Vc.20-30 f.P168

GR.4 ∇≠‖ ::⊂ **30~38HRC** ⇔‖ :‖ ::∫ ∽∽‖ ⊅
Vc.10-20 f.P168

GR.5 ∇≠‖ ::⊂ **38~48HRC** ⇔‖ :‖ ::∫ ∽∽‖ ⊅
Vc.10-20 f.P168

GR.8 ∇≠‖ ::⊂ ∀∫ ≦∬‖ ∨∫ ⊄≫‖ ⊅
Vc.15-25 f.P168

GR.9 ∑ ≡∩≡∽
Vc.40-50 f.P168

GR.10 ⇳::⊄ ~ ∴∽∴∵
Vc.80-100 f.P168

GR.11 ⇔∫ ∪⊂
Vc.60-80 f.P168

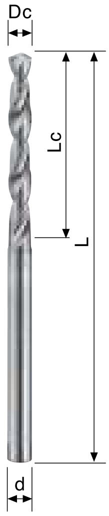
Micro Precision Drills

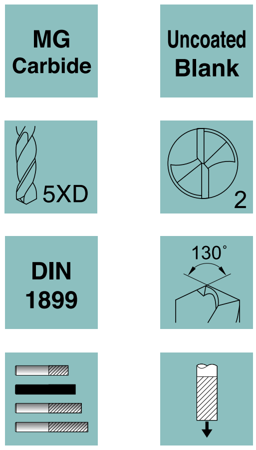
N AL, Cu, PVC, CFRP

⑪⑲175.9514418⑯8⑬⑥72⑪

⑨5⑮(t) D400-Dc

Dc h7	Lc mm	L mm	d h6	Blank D400
0.30	1.9	25	1.00	●
0.35	2.4	25	1.00	●
0.40	3.0	25	1.00	●
0.45	3.0	25	1.00	●
0.50	3.4	25	1.00	●
0.55	3.9	25	1.00	●
0.60	3.9	25	1.00	●
0.65	4.2	25	1.00	●
0.70	4.8	25	1.00	●
0.75	4.8	25	1.00	●
0.80	5.3	25	1.50	●
0.85	5.3	25	1.50	●
0.90	6.0	25	1.50	●
0.95	6.0	25	1.50	●
1.00	6.8	25	1.50	●
1.05	6.8	25	1.50	●
1.10	7.6	25	1.50	●
1.15	7.6	25	1.50	●
1.20	8.5	25	1.50	●
1.25	8.5	25	1.50	●
1.30	8.5	25	1.50	●
1.35	9.5	25	1.50	●
1.40	9.5	25	1.50	●





P	H	M	K	N	S
○			○	●	

GR.1 Vc.60-80 f.P168

GR.2 <24HRC Vc.60-80 f.P168

GR.3 <30HRC Vc.50-70 f.P168

GR.9 Vc.30-50 f.P168

GR.10 Vc.100-120 f.P168

GR.11 Vc.80-100 f.P168

GR.12 Vc.25-50 f.P168

GR.13 Vc.30-60 f.P168

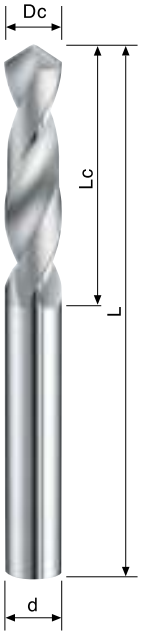
Twist Drills

N AL, Cu, PVC, CFRP

⑯6⑲7⑪21941816⑧⑬6⑰7.2⑪

⑨5⑮(t) D412-Dc

Dc h7	Lc mm	L mm	Blank D412	Dc h7	Lc mm	L mm	Blank D412
1.00	6	26	●	5.00	26	62	●
1.05	6	26	●	5.10	26	62	●
1.10	7	28	●	5.20	26	62	●
1.15	7	28	●	5.30	26	62	●
1.20	8	30	●	5.40	28	66	●
1.25	8	30	●	5.50	28	66	●
1.30	8	30	●	5.60	28	66	●
1.35	9	32	●	5.70	28	66	●
1.40	9	32	●	5.80	28	66	●
1.45	9	32	●	5.90	28	66	●
1.50	9	32	●	6.00	28	66	●
1.55	10	34	●	6.10	31	70	●
1.60	10	34	●	6.20	31	70	●
1.65	10	34	●	6.30	31	70	●
1.70	10	34	●	6.40	31	70	●
1.75	11	36	●	6.50	31	70	●
1.80	11	36	●	6.60	31	70	●
1.85	11	36	●	6.70	31	70	●
1.90	11	36	●	6.80	34	74	●
1.95	12	38	●	6.90	34	74	●
2.00	12	38	●	7.00	34	74	●
2.05	12	38	●	7.10	34	74	●
2.10	12	38	●	7.20	34	74	●
2.15	13	40	●	7.30	34	74	●
2.20	13	40	●	7.40	34	74	●
2.25	13	40	●	7.50	34	74	●
2.30	13	40	●	7.60	37	79	●
2.35	13	40	●	7.70	37	79	●
2.40	14	43	●	7.80	37	79	●
2.45	14	43	●	7.90	37	79	●
2.50	14	43	●	8.00	37	79	●
2.55	14	43	●	8.10	37	79	●
2.60	14	43	●	8.20	37	79	●
2.65	14	43	●	8.30	37	79	●
2.70	16	46	●	8.40	37	79	●
2.75	16	46	●	8.50	37	79	●
2.80	16	46	●	8.60	40	84	●
2.85	16	46	●	8.70	40	84	●
2.90	16	46	●	8.80	40	84	●
2.95	16	46	●	8.90	40	84	●
3.00	16	46	●	9.00	40	84	●
3.10	18	49	●	9.10	40	84	●
3.20	18	49	●	9.20	40	84	●
3.30	18	49	●	9.30	40	84	●
3.40	20	52	●	9.40	40	84	●
3.50	20	52	●	9.50	40	84	●
3.60	20	52	●	9.60	43	89	●
3.70	20	52	●	9.70	43	89	●
3.80	22	55	●	9.80	43	89	●
3.90	22	55	●	9.90	43	89	●
4.00	22	55	●	10.00	43	89	●
4.10	22	55	●	10.20	43	89	●
4.20	22	55	●	10.50	43	89	●
4.30	24	58	●	10.80	47	95	●
4.40	24	58	●	11.00	47	95	●
4.50	24	58	●	11.50	47	95	●
4.60	24	58	●	12.00	51	102	●
4.70	24	58	●	12.50	51	102	●
4.80	26	62	●	13.00	51	102	●
4.90	26	62	●				



MG Carbide

Uncoated Blank

3XD

2

DIN 6539

118°

⑬⑮⑰⑥①④⑪⑥④⑪⑰④⑮⑦⑩⑥

P	H	M	K	N	S
○			○	●	

GR.1 ∇≠‖ ::⊂ ∀∫ ::∫ ∩:.≌ ∨‖ ∽∽‖ ∅
Vc.60-80 f.P168

GR.2 ∇≠‖ ::⊂ <24HRC ∽:.∮ := ::∫ ∩:.≌ ∨‖ ∽∽‖ ∅
Vc.60-80 f.P168

GR.3 ∇≠‖ ::⊂ <30HRC →∫ ∩:.≌ ∨‖ ∽∽‖ ∅
Vc.50-70 f.P168

GR.9 ∑ ≡∩≡∽
Vc.30-50 f.P168

GR.10 ⇳::∉ ~ ∴∽.∴∵
Vc.100-120 f.P168

GR.11 ⇔∫ ∪⊂
Vc.80-100 f.P168

GR.12 ∃:‖ ≒∴:∴
Vc.25-50 f.P168

GR.13 ⇐≒ ~ ≈≌∮ .:≠∽≯∫ ~‖≠∫ ≌:‖ ::≯
Vc.30-60 f.P168

Twist Drills

N AL, Cu, PVC, CFRP

⑯6.(19)7.(11)219418.(16)8.(13)67.2.(11)

⑨5.(15)(t) D413-Dc

Dc h7	Lc mm	L mm	Blank D413	Dc h7	Lc mm	L mm	Blank D413
1.0	12	34	●	6.6	63	101	●
1.1	14	36	●	6.7	63	101	●
1.2	16	38	●	6.8	69	109	●
1.3	16	38	●	6.9	69	109	●
1.4	18	40	●	7.0	69	109	●
1.5	18	40	●	7.1	69	109	●
1.6	20	43	●	7.2	69	109	●
1.7	20	43	●	7.3	69	109	●
1.8	22	46	●	7.4	69	109	●
1.9	22	46	●	7.5	69	109	●
2.0	24	49	●	7.6	75	117	●
2.1	24	49	●	7.7	75	117	●
2.2	27	53	●	7.8	75	117	●
2.3	27	53	●	7.9	75	117	●
2.4	30	57	●	8.0	75	117	●
2.5	30	57	●	8.1	75	117	●
2.6	30	57	●	8.2	75	117	●
2.7	33	61	●	8.3	75	117	●
2.8	33	61	●	8.4	75	117	●
2.9	33	61	●	8.5	75	117	●
3.0	33	61	●	8.6	81	125	●
3.1	36	65	●	8.7	81	125	●
3.2	36	65	●	8.8	81	125	●
3.3	36	65	●	8.9	81	125	●
3.4	39	70	●	9.0	81	125	●
3.5	39	70	●	9.1	81	125	●
3.6	39	70	●	9.2	81	125	●
3.7	39	70	●	9.3	81	125	●
3.8	43	75	●	9.4	81	125	●
3.9	43	75	●	9.5	81	125	●
4.0	43	75	●	9.6	87	133	●
4.1	43	75	●	9.7	87	133	●
4.2	43	75	●	9.8	87	133	●
4.3	47	80	●	9.9	87	133	●
4.4	47	80	●	10.0	87	133	●
4.5	47	80	●	10.2	87	133	●
4.6	47	80	●	10.5	87	133	●
4.7	47	80	●	10.8	94	142	●
4.8	52	86	●	11.0	94	142	●
4.9	52	86	●	11.5	94	142	●
5.0	52	86	●	12.0	101	151	●
5.1	52	86	●	12.5	101	151	●
5.2	52	86	●	13.0	101	151	●
5.3	52	86	●				
5.4	57	93	●				
5.5	57	93	●				
5.6	57	93	●				
5.7	57	93	●				
5.8	57	93	●				
5.9	57	93	●				
6.0	57	93	●				
6.1	63	101	●				
6.2	63	101	●				
6.3	63	101	●				
6.4	63	101	●				
6.5	63	101	●				

MG Carbide

Uncoated Blank

5XD

2

DIN 338

118°

⑬–⑮~⑰⑥①~④⑪⑥④⑪~⑰④⑮⑦~⑩⑥

P	H	M	K	N	S
○			○	●	

GR.1 ∇≠‖ ::⊂ ∀∫ ::∫ ∩:.≌ ∨‖ ∽∾‖ ∅
Vc.60-80 f.P168

GR.2 ∇≠‖ ::⊂ <24HRC ∽:.∮ :≡ ::∫ ∩:.≌ ∨‖ ∽∾‖ ∅
Vc.60-80 f.P168

GR.3 ∇≠‖ ::⊂ <30HRC ⇒∫ ∩:.≌ ∨‖ ∽∾‖ ∅
Vc.50-70 f.P168

GR.9 ∑≡∩⋿∽
Vc.30-50 f.P168

GR.10 ⇳::∉ ~ ∴.∽.:.∵
Vc.100-120 f.P168

GR.11 ⇔∫ ∪⊂
Vc.80-100 f.P168

GR.12 ∃:‖ ≒≠.:.:.
Vc.25-50 f.P168

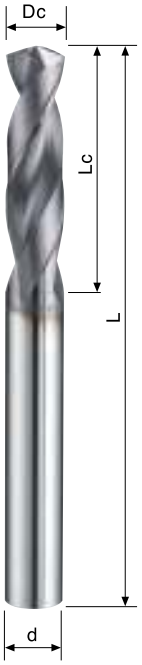
GR.13 ⇦≡ ~ ≃∮ .:≠∽≯∫ ~‖ ≠∫ ⊋.:‖ ::≯
Vc.30-60 f.P168

High Performance Drills

K P H < 48HRC

⑤5(15)(t) D430FN-Dc

Dc h7	Lc mm	L mm	TiAlN D430FN	Dc h7	Lc mm	L mm	TiAlN D430FN
2.0	12	38	●	7.6	37	79	●
2.1	12	38	●	7.7	37	79	●
2.2	13	40	●	7.8	37	79	●
2.3	13	40	●	7.9	37	79	●
2.4	14	43	●	8.0	37	79	●
2.5	14	43	●	8.1	37	79	●
2.6	14	43	●	8.2	37	79	●
2.7	16	46	●	8.3	37	79	●
2.8	16	46	●	8.4	37	79	●
2.9	16	46	●	8.5	37	79	●
3.0	16	46	●	8.6	40	84	●
3.1	18	49	●	8.7	40	84	●
3.2	18	49	●	8.8	40	84	●
3.3	18	49	●	8.9	40	84	●
3.4	20	52	●	9.0	40	84	●
3.5	20	52	●	9.1	40	84	●
3.6	20	52	●	9.2	40	84	●
3.7	20	52	●	9.3	40	84	●
3.8	22	55	●	9.4	40	84	●
3.9	22	55	●	9.5	40	84	●
4.0	22	55	●	9.6	43	89	●
4.1	22	55	●	9.7	43	89	●
4.2	22	55	●	9.8	43	89	●
4.3	24	58	●	9.9	43	89	●
4.4	24	58	●	10.0	43	89	●
4.5	24	58	●	10.2	43	89	●
4.6	24	58	●	10.5	43	89	●
4.7	24	58	●	10.8	47	95	●
4.8	26	62	●	11.0	47	95	●
4.9	26	62	●	11.5	47	95	●
5.0	26	62	●	12.0	51	102	●
5.1	26	62	●	12.5	51	102	●
5.2	26	62	●	13.0	51	102	●
5.3	26	62	●				
5.4	28	66	●				
5.5	28	66	●				
5.6	28	66	●				
5.7	28	66	●				
5.8	28	66	●				
5.9	28	66	●				
6.0	28	66	●				
6.1	31	70	●				
6.2	31	70	●				
6.3	31	70	●				
6.4	31	70	●				
6.5	31	70	●				
6.6	31	70	●				
6.7	31	70	●				
6.8	34	74	●				
6.9	34	74	●				
7.0	34	74	●				
7.1	34	74	●				
7.2	34	74	●				
7.3	34	74	●				
7.4	34	74	●				
7.5	34	74	●				



MG Carbide

TiAlN F-NaNo

3XD

2

DIN 6539

140°

P	H	M	K	N	S
●	●	○	●		

GR.1 Vc.80-100 f.P169

GR.2 <24HRC Vc.80-100 f.P169

GR.3 <30HRC Vc.60-80 f.P169

GR.4 30~38HRC Vc.50-60 f.P169

GR.5 38~48HRC Vc.40-50 f.P169

GR.8 Vc.40-60 f.P169

GR.9 Vc.80-100 f.P169

High Performance Drills

K P H < 48HRC

①18.85.156.75.⑲⑱⑬5.⑮⑲2.⑯219418.⑯8.⑬⑯7.2.⑪

⑨5.⑮(t)

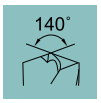
D433FN-Dc

Dc h7	Lc mm	L mm	TiAlN D433FN
2.0	24	49	●
2.1	24	49	●
2.2	27	53	●
2.3	27	53	●
2.4	30	57	●
2.5	30	57	●
2.6	30	57	●
2.7	33	61	●
2.8	33	61	●
2.9	33	61	●
3.0	33	61	●
3.1	36	65	●
3.2	36	65	●
3.3	36	65	●
3.4	39	70	●
3.5	39	70	●
3.6	39	70	●
3.7	39	70	●
3.8	43	75	●
3.9	43	75	●
4.0	43	75	●
4.1	43	75	●
4.2	43	75	●
4.3	47	80	●
4.4	47	80	●
4.5	47	80	●
4.6	47	80	●
4.7	47	80	●
4.8	52	86	●
4.9	52	86	●
5.0	52	86	●
5.1	52	86	●
5.2	52	86	●
5.3	52	86	●
5.4	57	93	●
5.5	57	93	●
5.6	57	93	●
5.7	57	93	●
5.8	57	93	●
5.9	57	93	●
6.0	57	93	●
6.1	63	101	●
6.2	63	101	●
6.3	63	101	●
6.4	63	101	●
6.5	63	101	●
6.6	63	101	●
6.7	63	101	●
6.8	69	109	●
6.9	69	109	●
7.0	69	109	●
7.1	69	109	●
7.2	69	109	●
7.3	69	109	●
7.4	69	109	●
7.5	69	109	●
7.6	75	117	●
7.7	75	117	●
7.8	75	117	●
7.9	75	117	●
8.0	75	117	●
8.1	75	117	●
8.2	75	117	●
8.3	75	117	●
8.4	75	117	●
8.5	75	117	●
8.6	81	125	●
8.7	81	125	●
8.8	81	125	●
8.9	81	125	●
9.0	81	125	●
9.1	81	125	●
9.2	81	125	●
9.3	81	125	●
9.4	81	125	●
9.5	81	125	●
9.6	87	133	●
9.7	87	133	●
9.8	87	133	●
9.9	87	133	●
10.0	87	133	●
10.2	87	133	●
10.5	87	133	●
10.8	94	142	●
11.0	94	142	●
11.5	94	142	●
12.0	101	151	●
12.5	101	151	●
13.0	101	151	●

MG Carbide

TiAlN F-NaNo

DIN 338



⑬⑮⑰⑥①④⑪⑥④⑪⑰④⑮⑦⑩⑥

P	H	M	K	N	S
●	●	○	●		

GR.1 ∇≠‖ ::⊂ ∀∫ ::∫ ∩∴≌ ∨‖ ∽≪‖ ⊅
Vc.80-100 f.P169

GR.2 ∇≠‖ ::⊂ <24HRC ∽∴∮ :≡ ::∫ ∩∴≌ ∨‖ ∽≪‖ ⊅
Vc.80-100 f.P169

GR.3 ∇≠‖ ::⊂ <30HRC →∫ ∩∴≌ ∨‖ ∽≪‖ ⊅
Vc.60-80 f.P169

GR.4 ∇≠‖ ::⊂ 30~38HRC ⇔‖ :‖ ::∫ ∽≪‖ ⊅
Vc.50-60 f.P169

GR.5 ∇≠‖ ::⊂ 38~48HRC ⇔‖ :‖ ::∫ ∽≪‖ ⊅
Vc.40-50 f.P169

GR.8 ∇≠‖ ::⊂ ∀∫ ⌀∬‖ ∨∫ ⊄≫‖ ⊅
Vc.40-60 f.P169

GR.9 ∑≡∩≅∽
Vc.80-100 f.P169

3-Flute Drills

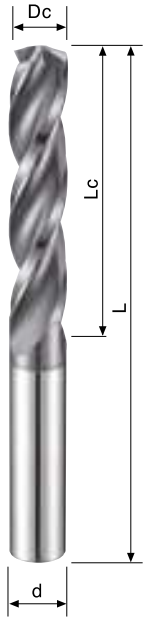
K P H < 48HRC

3-12.6(16)7.18(16)8.(13)(16)7.2(11)

95(15)(t) D421FN-Dc

Dc h7	Lc mm	L mm	Blank D421FN
3.0	22	46	●
3.1	24	49	●
3.2	24	49	●
3.3	24	49	●
3.4	27	52	●
3.5	27	52	●
3.6	27	52	●
3.7	27	52	●
3.8	30	55	●
3.9	30	55	●
4.0	30	55	●
4.1	30	55	●
4.2	30	55	●
4.3	32	58	●
4.4	32	58	●
4.5	32	58	●
4.6	32	58	●
4.7	32	58	●
4.8	35	62	●
4.9	35	62	●
5.0	35	62	●
5.1	35	62	●
5.2	35	62	●
5.3	35	62	●
5.4	39	66	●
5.5	39	66	●
5.6	39	66	●
5.7	39	66	●
5.8	39	66	●
5.9	39	66	●
6.0	39	66	●
6.1	42	70	●
6.2	42	70	●
6.3	42	70	●
6.4	42	70	●
6.5	42	70	●
6.6	42	70	●
6.7	42	70	●
6.8	45	74	●
6.9	45	74	●
7.0	45	74	●
7.1	45	74	●
7.2	45	74	●
7.3	45	74	●
7.4	45	74	●
7.5	45	74	●
7.6	48	79	●
7.7	48	79	●
7.8	48	79	●
7.9	48	79	●
8.0	48	79	●
8.1	48	79	●
8.2	48	79	●
8.3	48	79	●
8.4	48	79	●
8.5	48	79	●

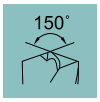
Dc h7	Lc mm	L mm	TiAlN D421FN
8.6	52	84	●
8.7	52	84	●
8.8	52	84	●
8.9	52	84	●
9.0	52	84	●
9.1	52	84	●
9.2	52	84	●
9.3	52	84	●
9.4	52	84	●
9.5	52	84	●
9.6	55	89	●
9.7	55	89	●
9.8	55	89	●
9.9	55	89	●
10.0	55	89	●
10.2	55	89	●
10.5	55	89	●
10.8	60	95	●
11.0	60	95	●
11.5	60	95	●
12.0	65	102	●
12.5	65	102	●
13.0	65	102	●



MG Carbide

TiAlN F-NaNo

DIN 6539



P	H	M	K	N	S
●	●	○	●		○

GR.1 Vc.80-100 f.P169

GR.2 <24HRC Vc.80-100 f.P169

GR.3 <30HRC Vc.60-80 f.P169

GR.4 30~38HRC Vc.50-60 f.P169

GR.5 38~48HRC Vc.40-50 f.P169

GR.8 Vc.40-60 f.P169

GR.9 Vc.80-100 f.P169

GR.15 Vc.30-40 f.P169

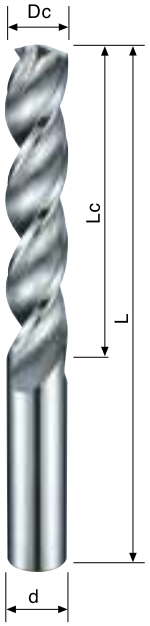
GR.16 Vc.20-30 f.P169

3-Flute Drills

N Aluminium

D422-Dc

Dc h7	Lc mm	L mm	Blank D422	Dc h7	Lc mm	L mm	Blank D422
3.0	22	46	●	8.6	52	84	●
3.1	24	49	●	8.7	52	84	●
3.2	24	49	●	8.8	52	84	●
3.3	24	49	●	8.9	52	84	●
3.4	27	52	●	9.0	52	84	●
3.5	27	52	●	9.1	52	84	●
3.6	27	52	●	9.2	52	84	●
3.7	27	52	●	9.3	52	84	●
3.8	30	55	●	9.4	52	84	●
3.9	30	55	●	9.5	52	84	●
4.0	30	55	●	9.6	55	89	●
4.1	30	55	●	9.7	55	89	●
4.2	30	55	●	9.8	55	89	●
4.3	32	58	●	9.9	55	89	●
4.4	32	58	●	10.0	55	89	●
4.5	32	58	●	10.2	55	89	●
4.6	32	58	●	10.5	55	89	●
4.7	32	58	●	10.8	60	95	●
4.8	35	62	●	11.0	60	95	●
4.9	35	62	●	11.5	60	95	●
5.0	35	62	●	12.0	65	102	●
5.1	35	62	●	12.5	65	102	●
5.2	35	62	●	13.0	65	102	●
5.3	35	62	●				
5.4	39	66	●				
5.5	39	66	●				
5.6	39	66	●				
5.7	39	66	●				
5.8	39	66	●				
5.9	39	66	●				
6.0	39	66	●				
6.1	42	70	●				
6.2	42	70	●				
6.3	42	70	●				
6.4	42	70	●				
6.5	42	70	●				
6.6	42	70	●				
6.7	42	70	●				
6.8	45	74	●				
6.9	45	74	●				
7.0	45	74	●				
7.1	45	74	●				
7.2	45	74	●				
7.3	45	74	●				
7.4	45	74	●				
7.5	45	74	●				
7.6	48	79	●				
7.7	48	79	●				
7.8	48	79	●				
7.9	48	79	●				
8.0	48	79	●				
8.1	48	79	●				
8.2	48	79	●				
8.3	48	79	●				
8.4	48	79	●				
8.5	48	79	●				



MG Carbide

Uncoated Blank

5XD

3

DIN 6539

135°

P	H	M	K	N	S
				●	

GR.10

Vc.120-150 f.P169

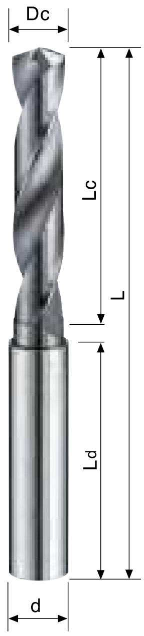
GR.11

Vc.80-100 f.P169

①18.85.156.75.⒆⒅⒀5.⒂⒆9.⒃219.418.⒃8.⒀⒃7.2.⑾

⑨5.⒂-(t) D431FT-Dc

Dc m7	Lc mm	L mm	d h6	Ld mm	TiAlN D431FT
3.0	20	62	6	36	●
3.1	20	62	6	36	●
3.2	20	62	6	36	●
3.3	20	62	6	36	●
3.4	20	62	6	36	●
3.5	20	62	6	36	●
3.6	20	62	6	36	●
3.7	20	62	6	36	●
3.8	24	66	6	36	●
3.9	24	66	6	36	●
4.0	24	66	6	36	●
4.1	24	66	6	36	●
4.2	24	66	6	36	●
4.3	24	66	6	36	●
4.4	24	66	6	36	●
4.5	24	66	6	36	●
4.6	24	66	6	36	●
4.7	24	66	6	36	●
4.8	28	66	6	36	●
4.9	28	66	6	36	●
5.0	28	66	6	36	●
5.1	28	66	6	36	●
5.2	28	66	6	36	●
5.3	28	66	6	36	●
5.4	28	66	6	36	●
5.5	28	66	6	36	●
5.6	28	66	6	36	●
5.7	28	66	6	36	●
5.8	28	66	6	36	●
5.9	28	66	6	36	●
6.0	28	66	6	36	●
6.1	34	79	8	36	●
6.2	34	79	8	36	●
6.3	34	79	8	36	●
6.4	34	79	8	36	●
6.5	34	79	8	36	●
6.6	34	79	8	36	●
6.7	34	79	8	36	●
6.8	34	79	8	36	●
6.9	34	79	8	36	●
7.0	34	79	8	36	●
7.1	41	79	8	36	●
7.2	41	79	8	36	●
7.3	41	79	8	36	●
7.4	41	79	8	36	●
7.5	41	79	8	36	●
7.6	41	79	8	36	●
7.7	41	79	8	36	●
7.8	41	79	8	36	●
7.9	41	79	8	36	●
8.0	41	79	8	36	●
8.1	47	89	10	40	●
8.2	47	89	10	40	●
8.3	47	89	10	40	●
8.4	47	89	10	40	●
8.5	47	89	10	40	●



UMG Carbide

TiAlN F-TOP

3XD

2

DIN 6537K

140°

⑬–⑮⌒–⌒⒄⑹⑴⌒④⑾⑹④ ⑪⌒⒄④⑮⑦⌒⑩⑹

P	H	M	K	N	S
●	●	○			○

GR.1 ∇≠‖ ::⊂ ∀∫ ::∫ ∩:≌ ⋁‖ ∽∽‖ ⊅
Vc.80-100 f.P169

GR.2 ∇≠‖ ::⊂ <24HRC ∽:∲ :≅ ::∫ ∩:≌ ⋁‖ ∽∽‖ ⊅
Vc.80-100 f.P169

GR.3 ∇≠‖ ::⊂ <30HRC ⇸∫ ∩:≌ ⋁‖ ∽∽‖ ⊅
Vc.60-80 f.P169

GR.4 ∇≠‖ ::⊂ 30~38HRC ⇷‖ :‖ ::∫ ∽∽‖ ⊅
Vc.50-60 f.P169

GR.5 ∇≠‖ ::⊂ 38~48HRC ⇷‖ :‖ ::∫ ∽∽‖ ⊅
Vc.40-50 f.P169

GR.6 ∇≠‖ ::⊂ 48~56HRC ⇷‖ :‖ ::∫ ∽∽‖ ⊅
Vc.20-30 f.P169

GR.8 ∇≠‖ ::⊂ ∀∫ ≌∬‖ ⋁∫ ⊄≫‖ ⊅
Vc.40-60 f.P169

GR.15 ∈:≠‖ ∽
Vc.40-50 f.P169

GR.16 ∀∴:∫ ::⊂
Vc.20-40 f.P169

GR.17 ∇≠‖ ::⊂ ↮‖ ≌ ≈≌ ≧∽‖ ⊅
Vc.30-50 f.P169

High Performance Drills

P H < 56HRC

①18.85.156.75.(19)(8)35.(15)(19)9.(16)219418.(16)8.(13)(16)7.2.(11)

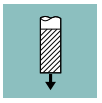
⑨5.(15)(t) D431FT-Dc

Dc m7	Lc mm	L mm	d h6	Ld mm	TiAlN D431FT
8.6	47	89	10	40	●
8.7	47	89	10	40	●
8.8	47	89	10	40	●
8.9	47	89	10	40	●
9.0	47	89	10	40	●
9.1	47	89	10	40	●
9.2	47	89	10	40	●
9.3	47	89	10	40	●
9.4	47	89	10	40	●
9.5	47	89	10	40	●
9.6	47	89	10	40	●
9.7	47	89	10	40	●
9.8	47	89	10	40	●
9.9	47	89	10	40	●
10.0	47	89	10	40	●
10.2	55	102	12	45	●
10.5	55	102	12	45	●
10.8	55	102	12	45	●
11.0	55	102	12	45	●
11.5	55	102	12	45	●
12.0	55	102	12	45	●
12.5	60	107	14	45	●
13.0	60	107	14	45	●
13.5	60	107	14	45	●
14.0	60	107	14	45	●
14.5	65	115	16	48	●
15.0	65	115	16	48	●
15.5	65	115	16	48	●
16.0	65	115	16	48	●
16.5	73	123	18	48	●
17.0	73	123	18	48	●
17.5	73	123	18	48	●
18.0	73	123	18	48	●
18.5	79	131	20	50	●
19.0	79	131	20	50	●
19.5	79	131	20	50	●
20.0	79	131	20	50	●

UMG Carbide

TiAlN F-TOP

DIN 6537K



⑬–⑮∼⑰⑥①∼④⑪⑥④⑪∼⑰④⑮⑦∼⑩⑥

P	H	M	K	N	S
●	●	○			○

GR.1 ∇≠‖ ::⊂
∀∫ ::∫ ∩∴≌ ∨‖ ∽∝‖ ∌
Vc.80-100 f.P169

GR.2 ∇≠‖ ::⊂ <24HRC
∽∴∮ ∶≡ ::∫ ∩∴≌ ∨‖ ∽∝‖ ∌
Vc.80-100 f.P169

GR.3 ∇≠‖ ::⊂ <30HRC
→∫ ∩∴≌ ∨‖ ∽∝‖ ∌
Vc.60-80 f.P169

GR.4 ∇≠‖ ::⊂ 30~38HRC
↞‖ ∶‖ ::∫ ∽∝‖ ∌
Vc.50-60 f.P169

GR.5 ∇≠‖ ::⊂ 38~48HRC
↞‖ ∶‖ ::∫ ∽∝‖ ∌
Vc.40-50 f.P169

GR.6 ∇≠‖ ::⊂ 48~56HRC
↞‖ ∶‖ ::∫ ∽∝‖ ∌
Vc.20-30 f.P169

GR.8 ∇≠‖ ::⊂
∀∫ ≦∬‖ ∨∫ ∉≫‖ ∌
Vc.40-60 f.P169

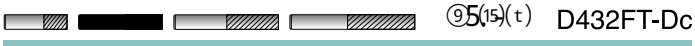
GR.15 ∈∴≠‖ ∽
Vc.40-50 f.P169

GR.16 ∀∴∶∫ ::⊂
Vc.20-40 f.P169

GR.17 ∇≠‖ ::⊂
↔‖ ≦ ≈≌ ≥∝‖ ∌
Vc.30-50 f.P169

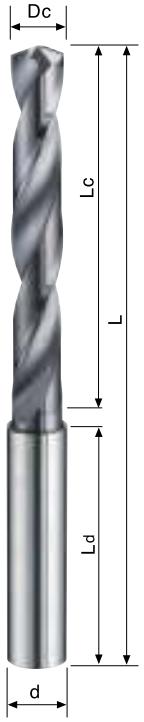
High Performance Drills

P H < 56HRC



D432FT-Dc

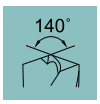
Dc m7	Lc mm	L mm	d h6	Ld mm	TiAlN D432FT
3.0	28	66	6	36	●
3.1	28	66	6	36	●
3.2	28	66	6	36	●
3.3	28	66	6	36	●
3.4	28	66	6	36	●
3.5	28	66	6	36	●
3.6	28	66	6	36	●
3.7	28	66	6	36	●
3.8	36	74	6	36	●
3.9	36	74	6	36	●
4.0	36	74	6	36	●
4.1	36	74	6	36	●
4.2	36	74	6	36	●
4.3	36	74	6	36	●
4.4	36	74	6	36	●
4.5	36	74	6	36	●
4.6	36	74	6	36	●
4.7	36	74	6	36	●
4.8	44	82	6	36	●
4.9	44	82	6	36	●
5.0	44	82	6	36	●
5.1	44	82	6	36	●
5.2	44	82	6	36	●
5.3	44	82	6	36	●
5.4	44	82	6	36	●
5.5	44	82	6	36	●
5.6	44	82	6	36	●
5.7	44	82	6	36	●
5.8	44	82	6	36	●
5.9	44	82	6	36	●
6.0	44	82	6	36	●
6.1	53	91	8	36	●
6.2	53	91	8	36	●
6.3	53	91	8	36	●
6.4	53	91	8	36	●
6.5	53	91	8	36	●
6.6	53	91	8	36	●
6.7	53	91	8	36	●
6.8	53	91	8	36	●
6.9	53	91	8	36	●
7.0	53	91	8	36	●
7.1	53	91	8	36	●
7.2	53	91	8	36	●
7.3	53	91	8	36	●
7.4	53	91	8	36	●
7.5	53	91	8	36	●
7.6	53	91	8	36	●
7.7	53	91	8	36	●
7.8	53	91	8	36	●
7.9	53	91	8	36	●
8.0	53	91	8	36	●
8.1	61	103	10	40	●
8.2	61	103	10	40	●
8.3	61	103	10	40	●
8.4	61	103	10	40	●
8.5	61	103	10	40	●



UMG Carbide

TiAlN F-TOP

DIN 6537L



P	H	M	K	N	S
●	●	○			○

GR.1 Vc.80-100 f.P169

GR.2 <24HRC Vc.80-100 f.P169

GR.3 <30HRC Vc.60-80 f.P169

GR.4 30~38HRC Vc.50-60 f.P169

GR.5 38~48HRC Vc.40-50 f.P169

GR.6 48~56HRC Vc.20-30 f.P169

GR.8 Vc.40-60 f.P169

GR.15 Vc.40-50 f.P169

GR.16 Vc.20-40 f.P169

GR.17 Vc.30-50 f.P169

High Performance Drills

P H < 56HRC

D432FT-Dc

Dc m7	Lc mm	L mm	d h6	Ld mm	TiAlN D432FT
8.6	61	103	10	40	●
8.7	61	103	10	40	●
8.8	61	103	10	40	●
8.9	61	103	10	40	●
9.0	61	103	10	40	●
9.1	61	103	10	40	●
9.2	61	103	10	40	●
9.3	61	103	10	40	●
9.4	61	103	10	40	●
9.5	61	103	10	40	●
9.6	61	103	10	40	●
9.7	61	103	10	40	●
9.8	61	103	10	40	●
9.9	61	103	10	40	●
10.0	61	103	10	40	●
10.2	71	118	12	45	●
10.5	71	118	12	45	●
10.8	71	118	12	45	●
11.0	71	118	12	45	●
11.5	71	118	12	45	●
12.0	71	118	12	45	●
12.5	77	124	14	45	●
13.0	77	124	14	45	●
13.5	77	124	14	45	●
14.0	77	124	14	45	●
14.5	83	133	16	48	●
15.0	83	133	16	48	●
15.5	83	133	16	48	●
16.0	83	133	16	48	●
16.5	93	143	18	48	●
17.0	93	143	18	48	●
17.5	93	143	18	48	●
18.0	93	143	18	48	●
18.5	101	153	20	50	●
19.0	101	153	20	50	●
19.5	101	153	20	50	●
20.0	101	153	20	50	●

UMG Carbide

TiAlN F-TOP

5XD

2

DIN 6537L

140°

P	H	M	K	N	S
●	●	○			○

GR.1 Vc.80-100 f.P169

GR.2 <24HRC Vc.80-100 f.P169

GR.3 <30HRC Vc.60-80 f.P169

GR.4 30~38HRC Vc.50-60 f.P169

GR.5 38~48HRC Vc.40-50 f.P169

GR.6 48~56HRC Vc.20-30 f.P169

GR.8 Vc.40-60 f.P169

GR.15 Vc.40-50 f.P169

GR.16 Vc.20-40 f.P169

GR.17 Vc.30-50 f.P169

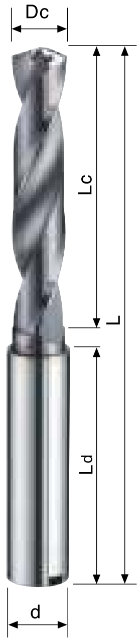
Oil-Feed High Performance Drills

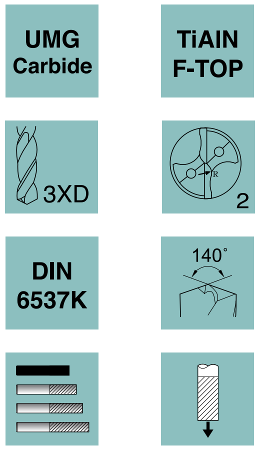
P **H** < 56HRC

①18.85.156.75.⒆⒅⒀5.⒂⒆9.⒃219.418.⒃8.⒀⒃7.2.⑾8.65.⒂⒀5.⒂53. ⑯⑬⑤

⑨5.⒂(t) D435FT-Dc

Dc m7	Lc mm	L mm	d h6	Ld mm	TiAIN D435FT
3.0	20	62	6	36	●
3.1	20	62	6	36	●
3.2	20	62	6	36	●
3.3	20	62	6	36	●
3.4	20	62	6	36	●
3.5	20	62	6	36	●
3.6	20	62	6	36	●
3.7	20	62	6	36	●
3.8	24	66	6	36	●
3.9	24	66	6	36	●
4.0	24	66	6	36	●
4.1	24	66	6	36	●
4.2	24	66	6	36	●
4.3	24	66	6	36	●
4.4	24	66	6	36	●
4.5	24	66	6	36	●
4.6	24	66	6	36	●
4.7	24	66	6	36	●
4.8	28	66	6	36	●
4.9	28	66	6	36	●
5.0	28	66	6	36	●
5.1	28	66	6	36	●
5.2	28	66	6	36	●
5.3	28	66	6	36	●
5.4	28	66	6	36	●
5.5	28	66	6	36	●
5.6	28	66	6	36	●
5.7	28	66	6	36	●
5.8	28	66	6	36	●
5.9	28	66	6	36	●
6.0	28	66	6	36	●
6.1	34	79	8	36	●
6.2	34	79	8	36	●
6.3	34	79	8	36	●
6.4	34	79	8	36	●
6.5	34	79	8	36	●
6.6	34	79	8	36	●
6.7	34	79	8	36	●
6.8	34	79	8	36	●
6.9	34	79	8	36	●
7.0	34	79	8	36	●
7.1	41	79	8	36	●
7.2	41	79	8	36	●
7.3	41	79	8	36	●
7.4	41	79	8	36	●
7.5	41	79	8	36	●
7.6	41	79	8	36	●
7.7	41	79	8	36	●
7.8	41	79	8	36	●
7.9	41	79	8	36	●
8.0	41	79	8	36	●
8.1	47	89	10	40	●
8.2	47	89	10	40	●
8.3	47	89	10	40	●
8.4	47	89	10	40	●
8.5	47	89	10	40	●





⑬—⑮⌒—⌒⒄⑹①⌒④⑾⑹④ ⑪⌒⒄④⑮⑦⌒⑩⑹

P	H	M	K	N	S
●	●	○			○

GR.1 ∇≠‖ ::⊂
∀∫ ::∫ ∩:≌ ⩗ ∽∽‖ ⊅
Vc.100-120 f.P169

GR.2 ∇≠‖ ::⊂ **<24HRC**
∽:∲ :≅ ::∫ ∩:≌ ⩗ ∽∽‖ ⊅
Vc.100-120 f.P169

GR.3 ∇≠‖ ::⊂ **<30HRC**
⤳∫ ∩:≌ ⩗ ∽∽‖ ⊅
Vc.80-100 f.P169

GR.4 ∇≠‖ ::⊂ **30~38HRC**
⤛‖ :‖ ::∫ ∽∽‖ ⊅
Vc.60-80 f.P169

GR.5 ∇≠‖ ::⊂ **38~48HRC**
⤛‖ :‖ ::∫ ∽∽‖ ⊅
Vc.50-60 f.P169

GR.6 ∇≠‖ ::⊂ **48~56HRC**
⤛‖ :‖ ::∫ ∽∽‖ ⊅
Vc.25-35 f.P169

GR.8 ∇≠‖ ::⊂
∀∫ ≌∬‖ ⩗∫ ⊄≫‖ ⊅
Vc.50-60 f.P169

GR.15 ∈:≠‖ ∽
Vc.30-50 f.P169

GR.16 ∀∴:∫ ::⊂
Vc.25-45 f.P169

GR.17 ∇≠‖ ::⊂
↮‖ ≌ ≈≌ ≧∽‖ ⊅
Vc.40-60 f.P169

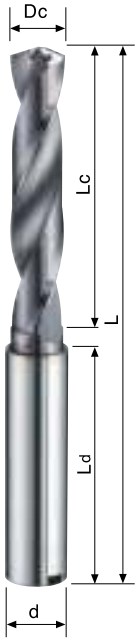
Oil-Feed High Performance Drills

P H < 56HRC

①18.85.156.75.(19)(18)35.(15)(19)9.(16)219418.(16)8.(13)(16)7.2(11)8.65.(15)(13)5.(15)53. ⑯⑬⑤

(9)5.(15)(t) D435FT-Dc

Dc m7	Lc mm	L mm	d h6	Ld mm	TiAlN D435FT
8.6	47	89	10	40	●
8.7	47	89	10	40	●
8.8	47	89	10	40	●
8.9	47	89	10	40	●
9.0	47	89	10	40	●
9.1	47	89	10	40	●
9.2	47	89	10	40	●
9.3	47	89	10	40	●
9.4	47	89	10	40	●
9.5	47	89	10	40	●
9.6	47	89	10	40	●
9.7	47	89	10	40	●
9.8	47	89	10	40	●
9.9	47	89	10	40	●
10.0	47	89	10	40	●
10.2	55	102	12	45	●
10.5	55	102	12	45	●
10.8	55	102	12	45	●
11.0	55	102	12	45	●
11.5	55	102	12	45	●
12.0	55	102	12	45	●
12.5	60	107	14	45	●
13.0	60	107	14	45	●
13.5	60	107	14	45	●
14.0	60	107	14	45	●
14.5	65	115	16	48	●
15.0	65	115	16	48	●
15.5	65	115	16	48	●
16.0	65	115	16	48	●
16.5	73	123	18	48	●
17.0	73	123	18	48	●
17.5	73	123	18	48	●
18.0	73	123	18	48	●
18.5	79	131	20	50	●
19.0	79	131	20	50	●
19.5	79	131	20	50	●
20.0	79	131	20	50	●



UMG Carbide

TiAlN F-TOP

3XD

2

DIN 6537K

140°

⑬⑮⑰⑥①④⑪⑥④⑪⑰④⑤⑦⑩⑥

P	H	M	K	N	S
●	●	○			○

GR.1 ∇≠‖ ::⊂ ∀∫ ::∫ ∩∴≌ ∀‖ ∽≪‖ ∅
Vc.100-120 f.P169

GR.2 ∇≠‖ ::⊂ **<24HRC** ∽∴∮ :≡ ::∫ ∩∴≌ ∀‖ ∽≪‖ ∅
Vc.100-120 f.P169

GR.3 ∇≠‖ ::⊂ **<30HRC** →∫ ∩∴≌ ∀‖ ∽≪‖ ∅
Vc.80-100 f.P169

GR.4 ∇≠‖ ::⊂ **30~38HRC** ↞‖ :‖ ::∫ ∽≪‖ ∅
Vc.60-80 f.P169

GR.5 ∇≠‖ ::⊂ **38~48HRC** ↞‖ :‖ ::∫ ∽≪‖ ∅
Vc.50-60 f.P169

GR.6 ∇≠‖ ::⊂ **48~56HRC** ↞‖ :‖ ::∫ ∽≪‖ ∅
Vc.25-35 f.P169

GR.8 ∇≠‖ ::⊂ ∀∫ ⊆∬‖ ∨∫ ⊄≫‖ ∅
Vc.50-60 f.P169

GR.15 ∈∴≠‖ ∽
Vc.30-50 f.P169

GR.16 ∀∴:∫ ::⊂
Vc.25-45 f.P169

GR.17 ∇≠‖ ::⊂ ↔‖ ≌ ≈≌ ≥∽≪‖ ∅
Vc.40-60 f.P169

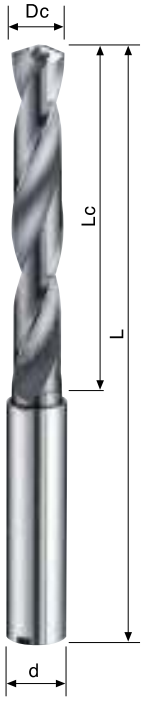
Oil-Feed High Performance Drills

P H < 56HRC

①18.85.15.6.7.5.⑲⑱⑬5.⑮⑲⑯9.⑯2.19.4.18.⑯8.⑬⑥7.2.⑪8.65.⑮⑬5.⑮5.3. ⑯⑬⑤

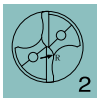
⑨5.⑮(t) D436FT-Dc

Dc m7	Lc mm	L mm	d h6	Ld mm	TiAlN D436FT
3.0	28	66	6	36	●
3.1	28	66	6	36	●
3.2	28	66	6	36	●
3.3	28	66	6	36	●
3.4	28	66	6	36	●
3.5	28	66	6	36	●
3.6	28	66	6	36	●
3.7	28	66	6	36	●
3.8	36	74	6	36	●
3.9	36	74	6	36	●
4.0	36	74	6	36	●
4.1	36	74	6	36	●
4.2	36	74	6	36	●
4.3	36	74	6	36	●
4.4	36	74	6	36	●
4.5	36	74	6	36	●
4.6	36	74	6	36	●
4.7	36	74	6	36	●
4.8	44	82	6	36	●
4.9	44	82	6	36	●
5.0	44	82	6	36	●
5.1	44	82	6	36	●
5.2	44	82	6	36	●
5.3	44	82	6	36	●
5.4	44	82	6	36	●
5.5	44	82	6	36	●
5.6	44	82	6	36	●
5.7	44	82	6	36	●
5.8	44	82	6	36	●
5.9	44	82	6	36	●
6.0	44	82	6	36	●
6.1	53	91	8	36	●
6.2	53	91	8	36	●
6.3	53	91	8	36	●
6.4	53	91	8	36	●
6.5	53	91	8	36	●
6.6	53	91	8	36	●
6.7	53	91	8	36	●
6.8	53	91	8	36	●
6.9	53	91	8	36	●
7.0	53	91	8	36	●
7.1	53	91	8	36	●
7.2	53	91	8	36	●
7.3	53	91	8	36	●
7.4	53	91	8	36	●
7.5	53	91	8	36	●
7.6	53	91	8	36	●
7.7	53	91	8	36	●
7.8	53	91	8	36	●
7.9	53	91	8	36	●
8.0	53	91	8	36	●
8.1	61	103	10	40	●
8.2	61	103	10	40	●
8.3	61	103	10	40	●
8.4	61	103	10	40	●
8.5	61	103	10	40	●

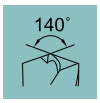


UMG Carbide

TiAlN F-TOP



DIN 6537L



⑬⑮⑰⑥①④⑪⑥④⑪⑰④⑮⑦⑩⑥

P	H	M	K	N	S
●	●	○			○

GR.1 ∇≠‖ ::⊂ ∀∫ ::∫ ∩∴≌ ∨‖ ∽∾‖ ⊅
Vc.100-120 f.P169

GR.2 ∇≠‖ ::⊂ **<24HRC** ∽∴∮ :≡ ::∫ ∩∴≌ ∨‖ ∽∾‖ ⊅
Vc.100-120 f.P169

GR.3 ∇≠‖ ::⊂ **<30HRC** ⇾∫ ∩∴≌ ∨‖ ∽∾‖ ⊅
Vc.80-100 f.P169

GR.4 ∇≠‖ ::⊂ **30~38HRC** ⇔‖ :‖ ::∫ ∽∾‖ ⊅
Vc.60-80 f.P169

GR.5 ∇≠‖ ::⊂ **38~48HRC** ⇔‖ :‖ ::∫ ∽∾‖ ⊅
Vc.50-60 f.P169

GR.6 ∇≠‖ ::⊂ **48~56HRC** ⇔‖ :‖ ::∫ ∽∾‖ ⊅
Vc.25-35 f.P169

GR.8 ∇≠‖ ::⊂ ∀∫ ⊆∬‖ ∨∫ ⊄≫‖ ⊅
Vc.50-60 f.P169

GR.15 ∈∴≠‖ ∽
Vc.30-50 f.P169

GR.16 ∀∴ :∫ ::⊂
Vc.25-45 f.P169

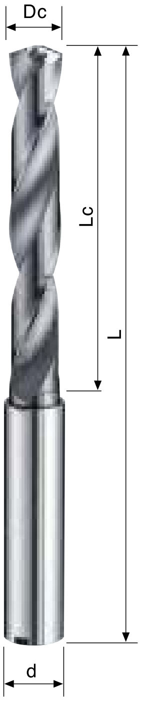
GR.17 ∇≠‖ ::⊂ ↔‖ ≌ ≈≌ ≧∾‖ ⊅
Vc.40-60 f.P169

Oil-Feed High Performance Drills

P H < 56HRC

D436FT-Dc

Dc m7	Lc mm	L mm	d h6	Ld mm	TiAlN D436FT
8.6	61	103	10	40	●
8.7	61	103	10	40	●
8.8	61	103	10	40	●
8.9	61	103	10	40	●
9.0	61	103	10	40	●
9.1	61	103	10	40	●
9.2	61	103	10	40	●
9.3	61	103	10	40	●
9.4	61	103	10	40	●
9.5	61	103	10	40	●
9.6	61	103	10	40	●
9.7	61	103	10	40	●
9.8	61	103	10	40	●
9.9	61	103	10	40	●
10.0	61	103	10	40	●
10.2	71	118	12	45	●
10.5	71	118	12	45	●
10.8	71	118	12	45	●
11.0	71	118	12	45	●
11.5	71	118	12	45	●
12.0	71	118	12	45	●
12.5	77	124	14	45	●
13.0	77	124	14	45	●
13.5	77	124	14	45	●
14.0	77	124	14	45	●
14.5	83	133	16	48	●
15.0	83	133	16	48	●
15.5	83	133	16	48	●
16.0	83	133	16	48	●
16.5	93	143	18	48	●
17.0	93	143	18	48	●
17.5	93	143	18	48	●
18.0	93	143	18	48	●
18.5	101	153	20	50	●
19.0	101	153	20	50	●
19.5	101	153	20	50	●
20.0	101	153	20	50	●



UMG Carbide

TiAlN F-TOP

5XD

2

DIN 6537L

140°

P	H	M	K	N	S
●	●	○			○

GR.1
Vc.100-120 f.P169

GR.2 <24HRC
Vc.100-120 f.P169

GR.3 <30HRC
Vc.80-100 f.P169

GR.4 30~38HRC
Vc.60-80 f.P169

GR.5 38~48HRC
Vc.50-60 f.P169

GR.6 48~56HRC
Vc.25-35 f.P169

GR.8
Vc.50-60 f.P169

GR.15
Vc.30-50 f.P169

GR.16
Vc.25-45 f.P169

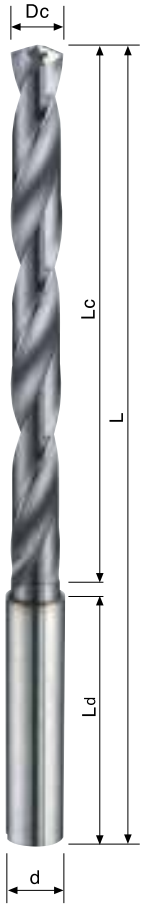
GR.17
Vc.40-60 f.P169

Oil-Feed High Performance Drills

P H < 56HRC

⑨5⑮(t) D437FT-Dc

Dc m7	Lc mm	L mm	d h6	Ld mm	TiAlN D437FT
3.0	34	74	6	36	●
3.1	34	74	6	36	●
3.2	34	74	6	36	●
3.3	34	74	6	36	●
3.4	34	74	6	36	●
3.5	34	74	6	36	●
3.6	34	74	6	36	●
3.7	34	74	6	36	●
3.8	45	85	6	36	●
3.9	45	85	6	36	●
4.0	45	85	6	36	●
4.1	45	85	6	36	●
4.2	45	85	6	36	●
4.3	45	85	6	36	●
4.4	45	85	6	36	●
4.5	45	85	6	36	●
4.6	45	85	6	36	●
4.7	45	85	6	36	●
4.8	57	97	6	36	●
4.9	57	97	6	36	●
5.0	57	97	6	36	●
5.1	57	97	6	36	●
5.2	57	97	6	36	●
5.3	57	97	6	36	●
5.4	57	97	6	36	●
5.5	57	97	6	36	●
5.6	57	97	6	36	●
5.7	57	97	6	36	●
5.8	57	97	6	36	●
5.9	57	97	6	36	●
6.0	57	97	6	36	●
6.1	66	106	8	36	●
6.2	66	106	8	36	●
6.3	66	106	8	36	●
6.4	66	106	8	36	●
6.5	66	106	8	36	●
6.6	66	106	8	36	●
6.7	66	106	8	36	●
6.8	66	106	8	36	●
6.9	66	106	8	36	●
7.0	66	106	8	36	●
7.1	76	116	8	36	●
7.2	76	116	8	36	●
7.3	76	116	8	36	●
7.4	76	116	8	36	●
7.5	76	116	8	36	●
7.6	76	116	8	36	●
7.7	76	116	8	36	●
7.8	76	116	8	36	●
7.9	76	116	8	36	●
8.0	76	116	8	36	●
8.1	95	139	10	40	●
8.2	95	139	10	40	●
8.3	95	139	10	40	●
8.4	95	139	10	40	●
8.5	95	139	10	40	●



UMG Carbide

TiAlN F-TOP

8XD

2

7Leaders Standard

140°

⑬⑮⑰⑥①④⑪⑥④⑪⑰⑭⑮⑦⑩⑥

P	H	M	K	N	S
●	●	○			○

GR.1 ∇≠‖ ::⊂ ∀∫ ::∫ ∩:≌ ∨‖ ∽≃‖ ∅
Vc.100-120 f.P169

GR.2 ∇≠‖ ::⊂ <24HRC ∽:∮ :≡ ::∫ ∩:≌ ∨‖ ∽≃‖ ∅
Vc.100-120 f.P169

GR.3 ∇≠‖ ::⊂ <30HRC →∫ ∩:≌ ∨‖ ∽≃‖ ∅
Vc.80-100 f.P169

GR.4 ∇≠‖ ::⊂ 30~38HRC ⇔‖ :‖ ::∫ ∽≃‖ ∅
Vc.60-80 f.P169

GR.5 ∇≠‖ ::⊂ 38~48HRC ⇔‖ :‖ ::∫ ∽≃‖ ∅
Vc.50-60 f.P169

GR.6 ∇≠‖ ::⊂ 48~56HRC ⇔‖ :‖ ::∫ ∽≃‖ ∅
Vc.25-35 f.P169

GR.8 ∇≠‖ ::⊂ ∀∫ ⊆∬‖ ∨∫ ∉≫‖ ∅
Vc.50-60 f.P169

GR.15 ∈:≠‖ ∽
Vc.30-50 f.P169

GR.16 ∀∴:∫ ::⊂
Vc.25-45 f.P169

GR.17 ∇≠‖ ::⊂ ↔‖ ≌ ≈≌ ≥∽‖ ∅
Vc.40-60 f.P169

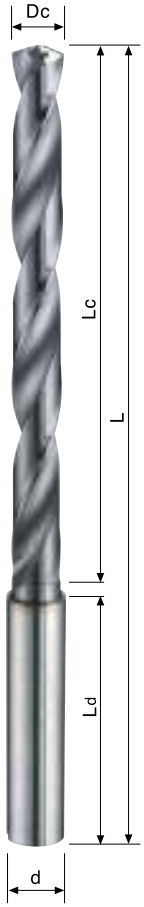
Oil-Feed High Performance Drills

P H < 56HRC

①18.85.156.75.⑲⑱⑬5.⑮⑲9.⑯219418.⑯8.⑬⑯7.2⑪8.65.⑮⑬5.⑮53. ⑯⑬⑤

⑨5.⑮(t) D437FT-Dc

Dc m7	Lc mm	L mm	d h6	Ld mm	TiAlN D437FT
8.6	95	139	10	40	●
8.7	95	139	10	40	●
8.8	95	139	10	40	●
8.9	95	139	10	40	●
9.0	95	139	10	40	●
9.1	95	139	10	40	●
9.2	95	139	10	40	●
9.3	95	139	10	40	●
9.4	95	139	10	40	●
9.5	95	139	10	40	●
9.6	95	139	10	40	●
9.7	95	139	10	40	●
9.8	95	139	10	40	●
9.9	95	139	10	40	●
10.0	95	139	10	40	●
10.2	114	163	12	45	●
10.5	114	163	12	45	●
10.8	114	163	12	45	●
11.0	114	163	12	45	●
11.5	114	163	12	45	●
12.0	114	163	12	45	●
12.5	133	182	14	45	●
13.0	133	182	14	45	●
13.5	133	182	14	45	●
14.0	133	182	14	45	●
14.5	152	204	16	48	●
15.0	152	204	16	48	●
15.5	152	204	16	48	●
16.0	152	204	16	48	●
16.5	171	223	18	48	●
17.0	171	223	18	48	●
17.5	171	223	18	48	●
18.0	171	223	18	48	●
18.5	190	244	20	50	●
19.0	190	244	20	50	●
19.5	190	244	20	50	●
20.0	190	244	20	50	●



UMG Carbide

TiAlN F-TOP

8XD

2

7Leaders Standard

140°

⑬–⑮~⑰⑥①~④⑪⑥④⑪~⑰④⑧⑦~⑩⑥

P	H	M	K	N	S
●	●	○			○

GR.1 ∇≠‖ ::⊂
∀∫ ::∫ ∩∴≌ ∨‖ ∽∾‖ ∠
Vc.100-120 f.P169

GR.2 ∇≠‖ ::⊂ <24HRC
∽∴∮ ∶= ::∫ ∩∴≌ ∨‖ ∽∾‖ ∠
Vc.100-120 f.P169

GR.3 ∇≠‖ ::⊂ <30HRC
→∫ ∩∴≌ ∨‖ ∽∾‖ ∠
Vc.80-100 f.P169

GR.4 ∇≠‖ ::⊂ 30~38HRC
↞‖ ∶‖ ::∫ ∽∾‖ ∠
Vc.60-80 f.P169

GR.5 ∇≠‖ ::⊂ 38~48HRC
↞‖ ∶‖ ::∫ ∽∾‖ ∠
Vc.50-60 f.P169

GR.6 ∇≠‖ ::⊂ 48~56HRC
↞‖ ∶‖ ::∫ ∽∾‖ ∠
Vc.25-35 f.P169

GR.8 ∇≠‖ ::⊂
∀∫ ≦∬‖ ∨∫ ∝≫‖ ∠
Vc.50-60 f.P169

GR.15 ∈∴≠‖ ∽
Vc.30-50 f.P169

GR.16 ∀∴∶∫ ::⊂
Vc.25-45 f.P169

GR.17 ∇≠‖ ::⊂
↔‖ ≦ ≈≌ ≥∾‖ ∠
Vc.40-60 f.P169

Oil-Feed High Performance Drills

K P < 48HRC

①18.85.156.75.⒆⒅⒀5.⒂⒆9.⒃219.418.⒃8.⒀⒃7.2.⒒8.65.⒂⒀5.⒂53. ⑯⑬⑤

⑨5.⒂(t) D441FT-Dc

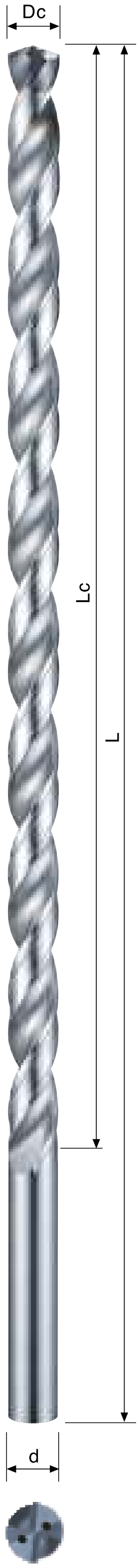
Dc m7	Lc mm	L mm	d h6	Ld mm	12XD D441FT
3.0	54	92	6	36	○
3.5	54	92	6	36	○
4.0	64	102	6	36	○
4.5	64	102	6	36	○
5.0	83	121	6	36	○
5.5	83	121	6	36	○
6.0	83	121	6	36	○
6.5	110	148	8	36	○
7.0	110	148	8	36	○
8.0	110	148	8	36	○
8.5	138	180	10	40	○
9.0	138	180	10	40	○
10.0	138	180	10	40	○
11.0	158	206	12	45	○
12.0	158	206	12	45	○

⑨5.⒂(t) D442FT-Dc

Dc m7	Lc mm	L mm	d h6	Ld mm	16XD D442FT
3.0	57	100	6	36	○
3.5	78	120	6	36	○
4.0	78	120	6	36	○
4.5	100	140	6	36	○
5.0	100	140	6	36	○
5.5	110	150	6	36	○
6.0	120	160	6	36	○
6.5	135	175	8	36	○
7.0	135	175	8	36	○
8.0	152	192	8	36	○
8.5	162	206	10	40	○
9.0	162	206	10	40	○
10.0	180	224	10	40	○
11.0	198	247	12	45	○
12.0	216	265	12	45	○

⑨5.⒂(t) D443FT-Dc

Dc m7	Lc mm	L mm	d h6	Ld mm	20XD D443FT
3.0	65	107	6	36	○
3.5	92	134	6	36	○
4.0	92	134	6	36	○
4.5	118	158	6	36	○
5.0	118	158	6	36	○
5.5	132	170	6	36	○
6.0	144	182	6	36	○
6.5	162	200	8	36	○
7.0	162	200	8	36	○
8.0	184	222	8	36	○
8.5	198	240	10	40	○
9.0	198	240	10	40	○
10.0	220	262	10	40	○
11.0	242	289	12	45	○
12.0	264	311	12	45	○



UMG Carbide

TiAlN F-TOP

12XD 16XD 20XD

2

7Leaders Standard

140°

P	H	M	K	N	S
●	○	○	●		

GR.1 Vc.80-100 f.P169

GR.2 <24HRC Vc.60-80 f.P169

GR.3 <30HRC Vc.40-60 f.P169

GR.4 30~38HRC Vc.30-50 f.P169

GR.5 38~48HRC Vc.25-40 f.P169

GR.8 Vc.30-50 f.P169

GR.9 Vc.60-100 f.P169

○ The light color: On request, no stock

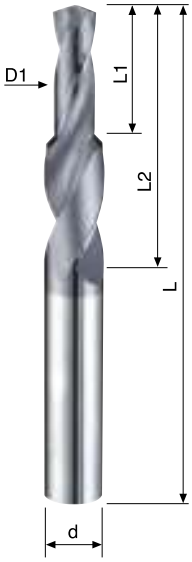
Combined Drill and Chamfer Tool

K P H < 48HRC

⑨53.(12)(19)4.(19)7.5.(13)(14)4.418(16)8.(13)(16)7.2.(11)(19)11.(11)8514418(20)(19)4897103.(16)49.

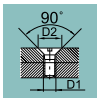
D419FT-thread

For thread size	D1 mm	L1 mm	L2 mm	L mm	d h6	TiAIN D419FT
M 4	3.3	11.4	28	66	6	●
M 5	4.2	13.6	28	66	6	●
M 6	5.0	16.5	41	79	8	●
M 8	6.8	21.0	47	89	10	●
M10	8.5	25.5	55	102	12	●
M12	10.2	30.0	60	107	14	●
M14	12.0	34.5	65	115	16	●
M16	14.0	38.5	73	123	18	●



UMG Carbide

TiAIN F-TOP



7Leaders Standard

⑬⑮⑰⑥①④⑪⑥④⑪⑰④⑮⑦⑩⑥

P	H	M	K	N	S
●	●	○	●	○	

GR.1 ∇≠‖ ::⊂ ∀∫ ::∫ ∩∴≌ ∨‖ ∽≪‖ ∅
Vc.60-80 f.P169

GR.2 ∇≠‖ ::⊂ <24HRC ∽∴≠ :≡ ::∫ ∩∴≌ ∨‖ ∽≪‖ ∅
Vc.60-80 f.P169

GR.3 ∇≠‖ ::⊂ <30HRC →∫ ∩∴≌ ∨‖ ∽≪‖ ∅
Vc.40-60 f.P169

GR.4 ∇≠‖ ::⊂ 30~38HRC ⇔‖ :‖ ::∫ ∽≪‖ ∅
Vc.40-60 f.P169

GR.5 ∇≠‖ ::⊂ 38~48HRC ⇔‖ :‖ ::∫ ∽≪‖ ∅
Vc.30-40 f.P169

GR.8 ∇≠‖ ::⊂ ∀∫ ≒∬‖ ∨∫ ∝≫‖ ∅
Vc.40-50 f.P169

GR.9 ∑≡∩⊑∽
Vc.80-100 f.P169

GR.10 ⇳::∝ ~ ∴∽∴∵
Vc.100-120 f.P169

GR.11 ⇔∫ ∪⊂
Vc.80-100 f.P169

Twist Drills

K H 30-68HRC

D402-Dc

Dc h8	Lc mm	L mm	Blank D402	Dc h8	Lc mm	L mm	Blank D402
2.0	24	49	●	7.6	75	117	●
2.1	24	49	●	7.7	75	117	●
2.2	27	53	●	7.8	75	117	●
2.3	27	53	●	7.9	75	117	●
2.4	30	57	●	8.0	75	117	●
2.5	30	57	●	8.1	75	117	●
2.6	30	57	●	8.2	75	117	●
2.7	33	61	●	8.3	75	117	●
2.8	33	61	●	8.4	75	117	●
2.9	33	61	●	8.5	75	117	●
3.0	33	61	●	8.6	81	125	●
3.1	36	65	●	8.7	81	125	●
3.2	36	65	●	8.8	81	125	●
3.3	36	65	●	8.9	81	125	●
3.4	39	70	●	9.0	81	125	●
3.5	39	70	●	9.1	81	125	●
3.6	39	70	●	9.2	81	125	●
3.7	39	70	●	9.3	81	125	●
3.8	43	75	●	9.4	81	125	●
3.9	43	75	●	9.5	81	125	●
4.0	43	75	●	9.6	87	133	●
4.1	43	75	●	9.7	87	133	●
4.2	43	75	●	9.8	87	133	●
4.3	47	80	●	9.9	87	133	●
4.4	47	80	●	10.0	87	133	●
4.5	47	80	●	10.2	87	133	●
4.6	47	80	●	10.5	87	133	●
4.7	47	80	●	11.0	94	142	●
4.8	52	86	●	11.5	94	142	●
4.9	52	86	●	12.0	101	151	●
5.0	52	86	●	12.5	101	151	●
5.1	52	86	●	13.0	101	151	●
5.2	52	86	●				
5.3	52	86	●				
5.4	57	93	●				
5.5	57	93	●				
5.6	57	93	●				
5.7	57	93	●				
5.8	57	93	●				
5.9	57	93	●				
6.0	57	93	●				
6.1	63	101	●				
6.2	63	101	●				
6.3	63	101	●				
6.4	63	101	●				
6.5	63	101	●				
6.6	63	101	●				
6.7	63	101	●				
6.8	69	109	●				
6.9	69	109	●				
7.0	69	109	●				
7.1	69	109	●				
7.2	69	109	●				
7.3	69	109	●				
7.4	69	109	●				
7.5	69	109	●				

MG Carbide

Uncoated Blank

5XD

2

DIN 338

118°

P	H	M	K	N	S
	●		●		

GR.4 30~38HRC
Vc.15-25 f.P168

GR.5 38~48HRC
Vc.15-25 f.P168

GR.6 48~56HRC
Vc.15-25 f.P168

GR.7 56~68HRC
Vc.10-15 f.P168

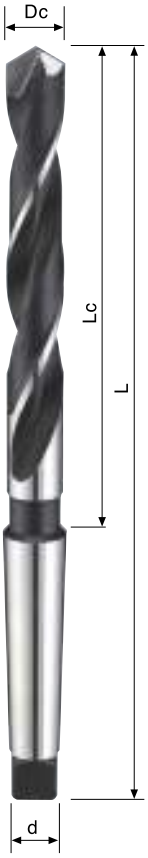
GR.9
Vc.20-30 f.P168

Twist Drills

K H 30-68HRC

D405-Dc

Dc h8	Lc mm	L mm	d M.T.	Blank D405
13.0	101	182	1	●
13.5	108	189	1	●
14.0	108	189	1	●
14.5	114	212	2	●
15.0	114	212	2	●
15.5	120	218	2	●
16.0	120	218	2	●
16.5	125	223	2	●
17.0	125	223	2	●
17.5	130	228	2	●
18.0	130	228	2	●
18.5	135	233	2	●
19.0	135	233	2	●
19.5	140	238	2	●
20.0	140	238	2	●
20.5	145	243	2	●
21.0	145	243	2	●
21.5	150	248	2	●
22.0	150	248	2	●
22.5	155	253	2	●
23.0	155	253	2	●
23.5	155	276	3	●
24.0	160	281	3	●
24.5	160	281	3	●
25.0	160	281	3	●
26.0	165	286	3	●
27.0	170	291	3	●
28.0	170	291	3	●
29.0	175	296	3	●
30.0	175	296	3	●
31.0	180	301	3	●
32.0	185	334	4	●
33.0	185	334	4	●
34.0	190	339	4	●
35.0	190	339	4	●



MG Carbide

Uncoated Blank

5XD

2

DIN 345

118°

P	H	M	K	N	S
	●		●		

GR.4 30~38HRC
Vc.15-25 f.P168

GR.5 38~48HRC
Vc.15-25 f.P168

GR.6 48~56HRC
Vc.15-25 f.P168

GR.7 56~68HRC
Vc.10-15 f.P168

GR.9
Vc.20-30 f.P168


7leaders™
The Art of Cutting

Reamers / Rods

	R300	MG Carbide	0°	Z	P H M K N S ● ● ○	P149
	R301	MG Carbide	7°	Z	P H M K N S ● ● ○	P150
	R302	MG Carbide	7°	Z	P H M K N S ● ● ○	P151
	R303	MG Carbide	7°	Z	P H M K N S ● ● ○	P152
	R305	MG Carbide	45°	Z	P H M K N S ● ○ ●	P153
	R308	MG Carbide	7°	Z	P H M K N S ● ● ○	P154、155
	R309	MG Carbide	7°	Z	P H M K N S ● ● ○	P156
	M210-REB1	MG Carbide	0°		P H M K N S ● ○ ● ●	P157
	M210-REB2	MG Carbide	0°		P H M K N S ● ○ ● ●	P157
	M210-RRG	MG Carbide	0°		P H M K N S ● ○ ● ●	P157
	M612-REB1	UMG Carbide	0°		P H M K N S ● ● ○	P158
	M612-REB2	UMG Carbide	0°		P H M K N S ● ● ○	P158
	M612-RRG	UMG Carbide	0°		P H M K N S ● ● ○	P158

Machine Reamers

K P H < 56HRC

R300-Dc

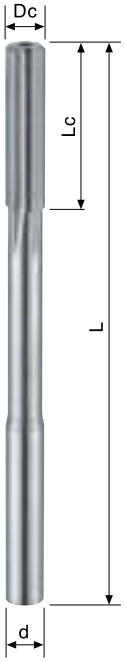
Dc H7	Lc mm	L mm	d mm	Z teeth	Blank R300
2.0	11	49	2.0	4	●
2.5	14	57	2.5	4	●
3.0	15	61	3.0	4	●
3.5	18	70	3.5	4	●
4.0	19	75	4.0	4	●
4.5	21	80	4.5	4	●
5.0	23	86	5.0	6	●
6.0	26	93	6.0	6	●
7.0	31	109	7.0	6	●
8.0	33	117	8.0	6	●
9.0	36	125	9.0	6	●
10.0	38	133	10.0	6	●
11.0	41	142	10.0	6	●
12.0	44	151	10.0	6	●
13.0	44	151	10.0	6	●
14.0	47	160	12.5	6	●
15.0	50	162	12.5	6	●
16.0	52	170	12.5	6	●
18.0	56	182	14.0	6	●
20.0	60	195	16.0	6	●

2.0-9.5 Solid Carbide

2,0-9,5

10.0-20.0 Carbide Tipped

10,0-20,0



MG Carbide

P	H	M	K	N	S
●	●		●	○	

GR.1
Vc.10-18 f.P170

GR.2 <24HRC
Vc.10-18 f.P170

GR.3 <30HRC
Vc.8-15 f.P170

GR.4 30~38HRC
Vc.5-10 f.P170

GR.5 38~48HRC
Vc.5-8 f.P170

GR.6 48~56HRC
Vc.4-6 f.P170

GR.9
Vc.10-18 f.P170

GR.10
Vc.15-20 f.P170

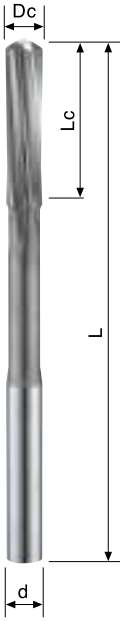
GR.11
Vc.15-25 f.P170

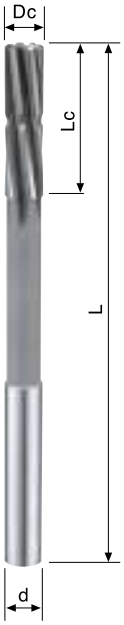
Machine Reamers

K P H < 56HRC

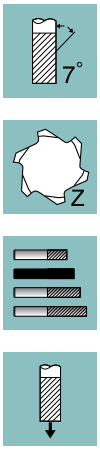
R301-Dc

Dc H7	Lc mm	L mm	d mm	Z teeth	Blank R301
2.0	11	49	2.0	4	●
2.5	14	57	2.5	4	●
3.0	15	61	3.0	4	●
3.5	18	70	3.5	4	●
4.0	19	75	4.0	4	●
4.5	21	80	4.5	4	●
5.0	23	86	5.0	6	●
5.5	26	93	5.5	6	●
6.0	26	93	6.0	6	●
6.5	28	101	6.5	6	●
7.0	31	109	7.0	6	●
7.5	31	109	7.5	6	●
8.0	33	117	8.0	6	●
8.5	33	117	8.5	6	●
9.0	36	125	9.0	6	●
9.5	36	125	9.5	6	●
10.0	38	133	10.0	6	●
10.5	38	133	10.0	6	●
11.0	41	142	10.0	6	●
11.5	41	142	10.0	6	●
12.0	44	151	10.0	6	●
12.5	44	151	10.0	6	●
13.0	44	151	10.0	6	●
13.5	47	160	12.5	6	●
14.0	47	160	12.5	6	●
14.5	50	162	12.5	6	●
15.0	50	162	12.5	6	●
15.5	52	170	12.5	6	●
16.0	52	170	12.5	6	●
17.0	54	175	14.0	6	●
18.0	56	182	14.0	6	●
19.0	58	189	16.0	6	●
20.0	60	195	16.0	6	●





MG Carbide



P	H	M	K	N	S
●	●		●	○	

GR.1 Vc.10-18 f.P170

GR.2 <24HRC Vc.10-18 f.P170

GR.3 <30HRC Vc.8-15 f.P170

GR.4 30~38HRC Vc.5-10 f.P170

GR.5 38~48HRC Vc.5-8 f.P170

GR.6 48~56HRC Vc.4-6 f.P170

GR.9 Vc.10-18 f.P170

GR.10 Vc.15-20 f.P170

GR.11 Vc.15-25 f.P170

2.0-9.5 Solid Carbide

2.0-9.5

10.0-20.0 Carbide Tipped

10.0-20.0

Machine Reamers Long Length

K P H < 56HRC

R302-Dc

Dc H7	Lc mm	L mm	d mm	Z teeth	Blank R302
3.0	15	100	3.0	4	●
3.5	18	112	3.5	4	●
4.0	19	119	4.0	4	●
4.5	21	126	4.5	4	●
5.0	23	132	5.0	6	●
6.0	26	139	6.0	6	●
7.0	31	156	7.0	6	●
8.0	33	165	8.0	6	●
9.0	36	175	9.0	6	●
10.0	38	184	10.0	6	●
11.0	41	195	10.0	6	○
12.0	44	205	10.0	6	●
13.0	44	205	10.0	6	○
14.0	47	214	12.5	6	●
15.0	50	220	12.5	6	○
16.0	52	227	12.5	6	●
17.0	54	235	14.0	6	○
18.0	56	241	14.0	6	●
19.0	58	247	16.0	6	○
20.0	60	254	16.0	6	●

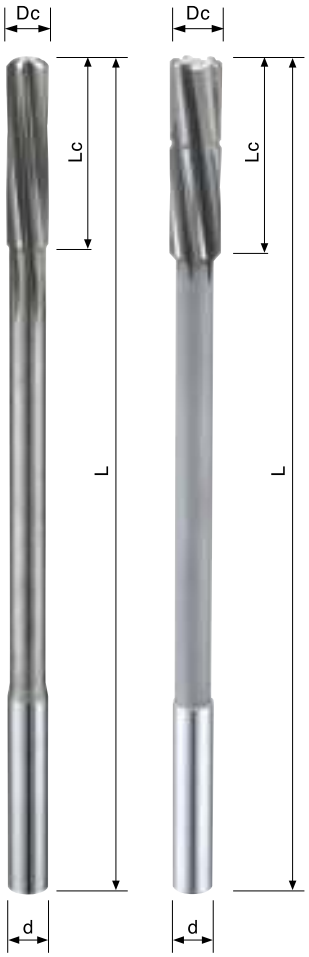
3.0-9.0 Solid Carbide

3.0-9.0

10.0-20.0 Carbide Tipped

10,0-20,0

○ The light color: On request, no stock



MG Carbide

P	H	M	K	N	S
●	●		●	○	

GR.1
Vc.10-18 f.P170

GR.2 <24HRC
Vc.10-18 f.P170

GR.3 <30HRC
Vc.8-15 f.P170

GR.4 30~38HRC
Vc.5-10 f.P170

GR.5 38~48HRC
Vc.5-8 f.P170

GR.6 48~56HRC
Vc.4-6 f.P170

GR.9
Vc.10-18 f.P170

GR.10
Vc.15-20 f.P170

GR.11
Vc.15-25 f.P170

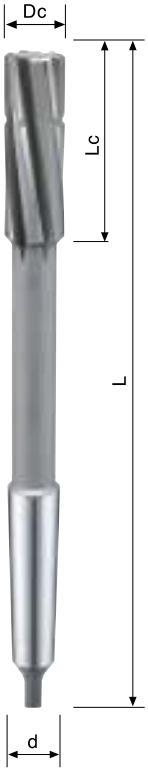
Machine Reamers Carbide Tipped

K P H < 56HRC

⑰⑬⑥7.⑮5862.⑪⑬418.⑯⑪⑪15.⑲4418.⑯⑮⑪⑧⑬⑥791.⑲

⑨5.⑮(t) R303-Dc

Dc H7	Lc mm	L mm	d M.T.	Z teeth	Blank R303
10.0	38	168	1	6	●
11.0	41	175	1	6	●
12.0	44	182	1	6	●
13.0	44	182	1	6	●
14.0	47	189	1	6	●
15.0	50	204	2	6	●
16.0	52	210	2	6	●
17.0	54	214	2	6	●
18.0	56	219	2	6	●
19.0	58	223	2	6	●
20.0	60	228	2	6	●
22.0	64	237	2	6	●
24.0	68	268	3	8	●
25.0	68	268	3	8	●
26.0	70	273	3	8	●
28.0	71	277	3	8	●
30.0	73	281	3	8	●
32.0	77	317	4	8	●
35.0	78	321	4	8	●
36.0	79	325	4	8	●
38.0	81	329	4	8	●
40.0	81	329	4	8	●



MG Carbide

7°

Z

⑬⑮⑰⑥①④⑪⑥④⑪⑰④⑮⑦⑩⑥

P	H	M	K	N	S
●	●		●	○	

GR.1 ∇≠‖ ::⊂ ∀∫ ::∫ ∩·.≌ ∨‖ ∽∾‖ ⊅
Vc.10-18 f.P170

GR.2 ∇≠‖ ::⊂ **<24HRC**
∽.∮ :≡ ::∫ ∩·.≌ ∨‖ ∽∾‖ ⊅
Vc.10-18 f.P170

GR.3 ∇≠‖ ::⊂ **<30HRC**
→∫ ∩·.≌ ∨‖ ∽∾‖ ⊅
Vc.8-15 f.P170

GR.4 ∇≠‖ ::⊂ **30~38HRC**
⇔‖ :‖ ::∫ ∽∾‖ ⊅
Vc.5-10 f.P170

GR.5 ∇≠‖ ::⊂ **38~48HRC**
⇔‖ :‖ ::∫ ∽∾‖ ⊅
Vc.5-8 f.P170

GR.6 ∇≠‖ ::⊂ **48~56HRC**
⇔‖ :‖ ::∫ ∽∾‖ ⊅
Vc.4-6 f.P170

GR.9 ∑ ≡∩≅∽
Vc.10-18 f.P170

GR.10 ⇳::∠ ~ ∴∽.:.:
Vc.15-20 f.P170

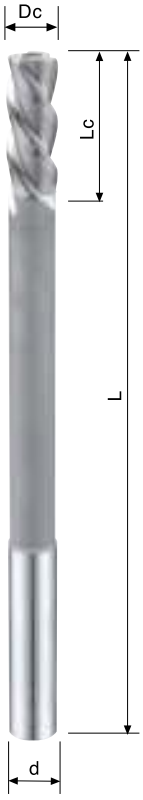
GR.11 ⇔∫ ∪⊂
Vc.15-25 f.P170

Machine Reamers 45º Left-Hand Spiral

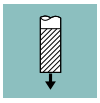
N P < 30HRC

R305-Dc

Dc H7	Lc mm	L mm	d mm	Z teeth	Blank R305
3.0	20	105	3.0	3	●
3.5	20	105	3.5	3	●
4.0	20	105	4.0	3	●
4.5	20	105	4.5	3	●
5.0	25	130	5.0	3	●
5.5	25	130	5.5	3	●
6.0	25	130	6.0	3	●
6.5	25	130	6.5	3	●
7.0	25	130	7.0	3	●
8.0	25	130	8.0	3	●
9.0	30	150	10.0	3	●
10.0	30	150	10.0	3	●
11.0	30	170	12.0	3	●
12.0	30	170	12.0	3	●
13.0	35	170	12.0	3	●
14.0	35	210	16.0	3	●
15.0	35	210	16.0	4	●
16.0	35	210	16.0	4	●
20.0	35	260	20.0	4	●



MG Carbide



P	H	M	K	N	S
●		○		●	

GR.1
Vc.10-18 f.P170

GR.2 <24HRC
Vc.10-18 f.P170

GR.3 <30HRC
Vc.8-15 f.P170

GR.8
Vc.5-10 f.P170

GR.10
Vc.20-25 f.P170

GR.11
Vc.15-20 f.P170

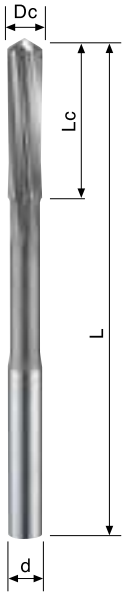
K P H < 56HRC

R308-Dc

Dc H7	Lc mm	L mm	Z teeth	Blank R308
1.0	6	34	4	●
1.2	7	38	4	●
1.4	8	40	4	●
1.5	8	40	4	●
1.6	9	43	4	●
1.8	10	46	4	●
2.0	11	49	4	●
2.2	12	53	4	●
2.5	14	57	4	●
2.8	15	61	4	●
3.0	15	61	4	●
3.2	16	65	4	●
3.5	18	70	4	●
4.0	19	75	4	●
4.5	21	80	4	●
5.0	23	86	6	●
5.5	26	93	6	●
6.0	26	93	6	●
6.5	28	101	6	●
7.0	31	109	6	●
7.5	31	109	6	●
8.0	33	117	6	●
8.5	33	117	6	●
9.0	36	125	6	●
9.5	36	125	6	●
10.0	38	133	6	●
10.5	38	133	6	●
11.0	41	142	6	●
11.5	41	142	6	●
12.0	44	151	6	●

Dc=d

1.0-12.0 Solid Cardibe



MG Carbide

P	H	M	K	N	S
●	●		●	○	

GR.1
Vc.10-18 f.P170

GR.2 <24HRC
Vc.10-18 f.P170

GR.3 <30HRC
Vc.8-15 f.P170

GR.4 30~38HRC
Vc.5-10 f.P170

GR.5 38~48HRC
Vc.5-8 f.P170

GR.6 48~56HRC
Vc.4-6 f.P170

GR.9
Vc.10-18 f.P170

GR.10
Vc.15-20 f.P170

GR.11
Vc.15-25 f.P170

Machine Reamers In Steps of 0.1mm

K P H < 56HRC

⑪⑪15.⑲4.418⑯⑮⑪⑱⑬⑯7.91⑲8.15⑪⑭53.0.1 3.3.

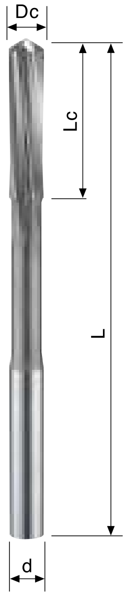
⑨5⑮(t) R308-Dc

Dc H7	Lc mm	L mm	Z teeth	Blank R308
1.0	6	34	4	●
1.1	7	36	4	●
1.2	7	38	4	●
1.3	7	38	4	●
1.4	8	40	4	●
1.5	8	40	4	●
1.6	9	43	4	●
1.7	9	43	4	●
1.8	10	46	4	●
1.9	10	46	4	●
2.0	11	49	4	●
2.1	11	49	4	●
2.2	12	53	4	●
2.3	12	53	4	●
2.4	14	57	4	●
2.5	14	57	4	●
2.6	14	57	4	●
2.7	15	61	4	●
2.8	15	61	4	●
2.9	15	61	4	●
3.0	15	61	4	●
3.1	16	65	4	●
3.2	16	65	4	●
3.3	16	65	4	●
3.4	18	70	4	●
3.5	18	70	4	●
3.6	18	70	4	●
3.7	18	70	4	●
3.8	19	75	4	●
3.9	19	75	4	●
4.0	19	75	4	●
4.1	19	75	4	●
4.2	19	75	4	●
4.3	21	80	4	●
4.4	21	80	4	●
4.5	21	80	4	●
4.6	21	80	6	●
4.7	21	80	6	●
4.8	23	86	6	●
4.9	23	86	6	●
5.0	23	86	6	●
5.1	23	86	6	●
5.2	23	86	6	●
5.3	23	86	6	●
5.4	26	93	6	●
5.5	26	93	6	●
5.6	26	93	6	●
5.7	26	93	6	●
5.8	26	93	6	●
5.9	26	93	6	●
6.0	26	93	6	●
6.1	28	101	6	●
6.2	28	101	6	●
6.3	28	101	6	●
6.4	28	101	6	●
6.5	28	101	6	●
6.6	28	101	6	●
6.7	31	101	6	●
6.8	31	109	6	●
6.9	31	109	6	●
7.0	31	109	6	●
7.1	31	109	6	●
7.2	31	109	6	●
7.3	31	109	6	●
7.4	31	109	6	●
7.5	31	109	6	●
7.6	33	117	6	●
7.7	33	117	6	●
7.8	33	117	6	●
7.9	33	117	6	●
8.0	33	117	6	●
8.1	33	117	6	●
8.2	33	117	6	●
8.3	33	117	6	●
8.4	33	117	6	●
8.5	33	117	6	●
8.6	36	125	6	●
8.7	36	125	6	●
8.8	36	125	6	●
8.9	36	125	6	●
9.0	36	125	6	●
9.1	36	125	6	●
9.2	36	125	6	●
9.3	36	125	6	●
9.4	36	125	6	●
9.5	36	125	6	●
9.6	38	133	6	●
9.7	38	133	6	●
9.8	38	133	6	●
9.9	38	133	6	●
10.0	38	133	6	●
10.1	38	133	6	●
10.2	38	133	6	●
10.3	38	133	6	●
10.4	38	133	6	●
10.5	38	133	6	●
10.6	38	133	6	●
10.7	41	142	6	●
10.8	41	142	6	●
10.9	41	142	6	●
11.0	41	142	6	●
11.1	41	142	6	●
11.2	41	142	6	●
11.3	41	142	6	●
11.4	41	142	6	●
11.5	41	142	6	●
11.6	41	142	6	●
11.7	41	142	6	●
11.8	41	142	6	●
11.9	44	151	6	●
12.0	44	151	6	●

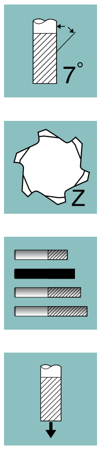
Dc=d

1.0-12.0 Solid Cardibe

1.0-12.0 ∈√∫ ㉧U≡ ≒≈:‖ ∨∽≯∫



MG Carbide



⑬–⑮⌒⑰⑯①⌒④⑪⑯④⑪⌒⑰④⑮⑰⌒⑩⑯

P	H	M	K	N	S
●	●		●	○	

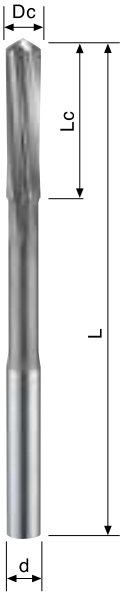
Group	Condition	Vc	f
GR.1		Vc.10-18	f.P170
GR.2	<24HRC	Vc.10-18	f.P170
GR.3	<30HRC	Vc.8-15	f.P170
GR.4	30~38HRC	Vc.5-10	f.P170
GR.5	38~48HRC	Vc.5-8	f.P170
GR.6	48~56HRC	Vc.4-6	f.P170
GR.9		Vc.10-18	f.P170
GR.10		Vc.15-20	f.P170
GR.11		Vc.15-25	f.P170

NC Machine Reamers

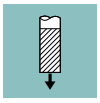
K P H < 56HRC

R309-Dc

Dc +0.003 -0	Lc mm	L mm	d h6	Z teeth	Blank R309
1.98	11	49	2	4	●
1.99	11	49	2	4	●
2.00	11	49	2	4	●
2.01	11	49	2	4	●
2.02	11	49	2	4	●
2.03	11	49	2	4	●
2.97	15	61	3	4	●
2.98	15	61	3	4	●
2.99	15	61	3	4	●
3.00	15	61	3	4	●
3.01	15	61	3	4	●
3.02	15	61	3	4	●
3.03	15	61	3	4	●
3.97	19	75	4	4	●
3.98	19	75	4	4	●
3.99	19	75	4	4	●
4.00	19	75	4	4	●
4.01	19	75	4	4	●
4.02	19	75	4	4	●
4.03	19	75	4	4	●
4.97	23	86	5	6	●
4.98	23	86	5	6	●
4.99	23	86	5	6	●
5.00	23	86	5	6	●
5.01	23	86	5	6	●
5.02	23	86	5	6	●
5.03	23	86	5	6	●
5.97	26	93	6	6	●
5.98	26	93	6	6	●
5.99	26	93	6	6	●
6.00	26	93	6	6	●
6.01	26	93	6	6	●
6.02	26	93	6	6	●
6.03	26	93	6	6	●
7.97	33	117	8	6	●
7.98	33	117	8	6	●
7.99	33	117	8	6	●
8.00	33	117	8	6	●
8.01	33	117	8	6	●
8.02	33	117	8	6	●
8.03	33	117	8	6	●
9.97	38	133	10	6	●
9.98	38	133	10	6	●
9.99	38	133	10	6	●
10.00	38	133	10	6	●
10.01	38	133	10	6	●
10.02	38	133	10	6	●
10.03	38	133	10	6	●
11.97	44	151	12	6	●
11.98	44	151	12	6	●
11.99	44	151	12	6	●
12.00	44	151	12	6	●
12.01	44	151	12	6	●
12.02	44	151	12	6	●
12.03	44	151	12	6	●



MG Carbide



P	H	M	K	N	S
●	●		●	○	

GR.1 Vc.10-18 f.P170

GR.2 <24HRC Vc.10-18 f.P170

GR.3 <30HRC Vc.8-15 f.P170

GR.4 30~38HRC Vc.5-10 f.P170

GR.5 38~48HRC Vc.5-8 f.P170

GR.6 48~56HRC Vc.4-6 f.P170

GR.9 Vc.10-18 f.P170

GR.10 Vc.15-20 f.P170

GR.11 Vc.15-25 f.P170

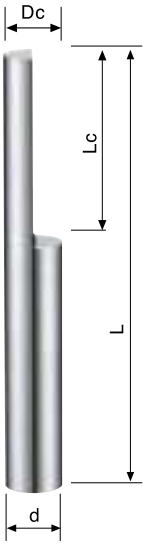
Engraving Blanks Precision Ground

K N P < 30HRC

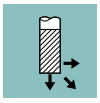
(2)(16)7.4.5(13)(1)(b)(14)7(11)(13)(9)7.5(13)1(11)95144181.2(18)(1)45.95(13)5.1.

M210-REB1-Dc

Dc h6	Lc mm	L mm	d mm	M210 REB1
2.0	6	38	2.0	●
2.5	8	38	2.5	●
3.0	9	38	3.0	●
4.0	12	50	4.0	●
5.0	15	50	5.0	●
6.0	18	50	6.0	●
8.0	24	60	8.0	●
10.0	30	75	10.0	●
12.0	36	75	12.0	●

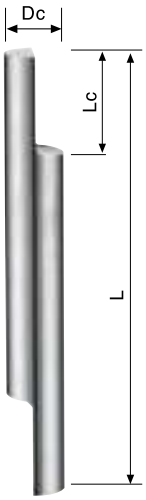


MG Carbide



M210-REB2-Dc

Dc h6	Lc mm	L mm	d mm	M210 REB2
2.0	3	38	2.0	●
2.5	4	38	2.5	●
3.0	5	38	3.0	●
4.0	6	50	4.0	●
5.0	8	50	5.0	●
6.0	9	50	6.0	●
8.0	12	60	8.0	●
10.0	15	75	10.0	●
12.0	18	75	12.0	●



P	H	M	K	N	S
●		○	●	●	

GR.1

GR.2 <24HRC

GR.3 <30HRC

GR.8

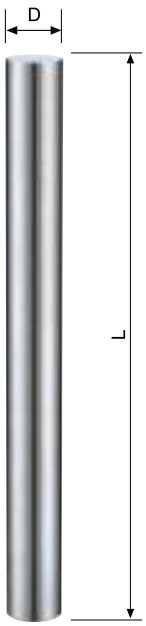
GR.9

GR.10

GR.11

M210-RRG-D×L

D h6	L mm	M210 RRG
1.0	100	●
1.5	100	●
2.0	100	●
2.5	100	●
3.0	100	●
4.0	100	●
5.0	100	●
6.0	100	●
8.0	100	●
10.0	100	●
12.0	100	●



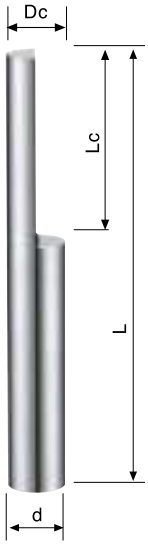
Engraving Blanks Precision Ground

P H < 56HRC

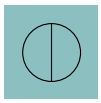
(2)(16)7.45(13)(1)(b)(14)7(11)(13)(9)7.5(13)(11)95144.1812.(18)(14)5.95(13)5.1.

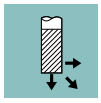
M612-REB1-Dc

Dc h6	Lc mm	L mm	d mm	M612 REB1
3.0	9	38	3.0	●
4.0	12	50	4.0	●
5.0	15	50	5.0	●
6.0	18	50	6.0	●



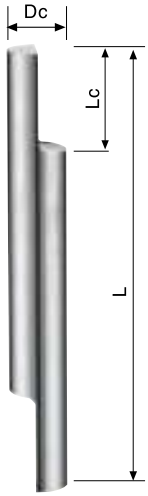
UMG Carbide

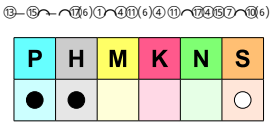




M612-REB2-Dc

Dc h6	Lc mm	L mm	d mm	M612 REB2
3.0	5	38	3.0	●
4.0	6	50	4.0	●
5.0	8	50	5.0	●
6.0	9	50	6.0	●





GR.1 ∇≠‖ ::⊂ ∀∫ ::∫ ∩∴≌ ∨‖ ∽≪‖ ⊄

GR.2 ∇≠‖ ::⊂ <24HRC ∽∴∮ ∶≡ ::∫ ∩∴≌ ∨‖ ∽≪‖ ⊄

GR.3 ∇≠‖ ::⊂ <30HRC →∫ ∩∴≌ ∨‖ ∽≪‖ ⊄

GR.4 ∇≠‖ ::⊂ 30~38HRC ↞‖ :‖ ::∫ ∽≪‖ ⊄

GR.5 ∇≠‖ ::⊂ 38~48HRC ↞‖ :‖ ::∫ ∽≪‖ ⊄

GR.6 ∇≠‖ ::⊂ 48~56HRC ↞‖ :‖ ::∫ ∽≪‖ ⊄

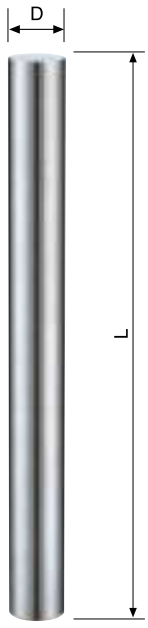
GR.15 ∈∴≠‖ ∽

GR.16 ∀∴:∫ ::⊂

GR.17 ∇≠‖ ::⊂ ↔‖ ≌ ≈≌ ≥≪‖ ⊄

M612-RRG-D×L

D h6	L mm	M612 RRG
3.0	100	●
4.0	100	●
5.0	100	●
6.0	100	●
8.0	100	●
10.0	100	●
12.0	100	●
		●



Technical Data - Materials

			N/mm2	HB	JIS	DIN
P	GR.1	∀≠‖ ::⊂ ∀∫ ::∫ ∩∴≌ ∨‖ ∽∽‖ ⊅	≦700	≦210	SS330 SS400 SS490 S10C S15C S20C S25C S30C S35C S40C S45C S50C S55C S58C SUM22 SUM22L SUM24 SUM25 SK3 SUP4	RST37-1 St37-3 St37-2 9SMn28 9SMnPb28 9SMnPb36 Ck15 Ck25 CK30 Ck45 Cf53C10 C15 C20 C22C35 C45 C55 C60 Ck55 Ck60 C105W1 C105W1
	GR.2	∀≠‖ ::⊂ <24HRC ∀∴∮ :≡ ::∫ ∩∴≌ ∨‖ ∽∽‖ ⊅	700-1000	210-300	SCR415 SCR420 SCR430 SCR440 SCR445 SCM420 SCM415 SCM430 SCM440 SK1 SK2 SK3 SK5 SK6 SK7	St.44-2 St.52-3 100Cr6 21NiCrMo2 40NiCrMo22 17CrNiMo6 15Cr3 42Cr3 55Cr3 15CrMo5 36NiCr6 14NiCr10 34Cr4 41Cr4 16MnCr5 25CrMo4 34CrMo4 41CrMo4 42CrMo4 32CrMo12 50CrV4 41CrAlMo7 100Cr6 105WCr6
	GR.3	∀≠‖ ::⊂ <30HRC ⇾∫ ∩∴≌ ∨‖ ∽∽‖ ⊅	＞1000	＞300	SKD1 SKD2 SKD3 SKD4 SKD11 SKD12 SKD61 P20 P21 P30 SUP3 SUP4 SUP6 SUP3 SUP6 SUP7 SUP9 SUP10 SKH2 SKH3 SKH52 SKH55	X210Cr12 X40CrMoV5 1 X100CrMoV5 1 X210CrW12 45WCrV7 X30WCrV9 3 X30WCrV9 3KU X165CrMoV12 X45GrSi93 S6-5-2 S6/5/2 S6/5/2/5 S2/9/2 X210Cr12 G
H	GR.4	∀≠‖ ::⊂ 30~38HRC ⇷‖ :‖ ::∫ ∽∽‖ ⊅				
	GR.5	∀≠‖ ::⊂ 38~48HRC ⇷‖ :‖ ::∫ ∽∽‖ ⊅				
	GR.6	∀≠‖ ::⊂ 48~56HRC ⇷‖ :‖ ::∫ ∽∽‖ ⊅				
	GR.7	∀≠‖ ::⊂ 56~68HRC ⇷‖ :‖ ::∫ ∽∽‖ ⊅				
M	GR.8	∀≠‖ ::⊂ ∀∫ ⊊∬‖ ∨∫ ∉≫‖ ⊅	500~950	250~320	SUS301 SUS302 SUS303 SUS304 SUS316 SUS321 SUS410 SUS416 SUS420 SUS420J2 SUS430 SUS431 SUS440	X12CrNi17-7 X12CrNi18-8 X10CrNiS18-9 X5CrNi18-10 X5CrMo17-12-2 X6CrNiTi18-10 X10Cr13 X12CrS13 X30Cr13 X12CrMoS17 X20CrNi17-2 X65CrMo14
K	GR.9	∑≡∩⋿∽		180-280	FC100 FC150 FC200 FC250 FC300 FC350 FCD400 FCD500 FCD600 FCD700 FCMB31 0FCMW330 FCMW370 FCMP490 FCMP540 FCMP590 FCMP690	GG10 GG15 GG20 GG25 GG30 GG35 GGG40 GGG50 GGG60 GGG70 GTS-35 GTS-45 GTS-55 GTS-65 GTS-65-02 GTS-70-02
N	GR.10	⇳::∉ ~ ∴∽∴∵		Si<10%	A1050 A1080 A2014 A3003 A5052 A6061 A7075 MP1	A199,5 A199.8 AlMnCu AlCuSiMn AiMgSiCu AlZnMgCu4.5 MgA13Zn G-AlSi5Mg
				Si10%>	A1050 A1080 A2014 A3003 A5052 A6061 A7075 MP1	GD-AlSi12 GD-AlSi10Mg G-AlSi10Mg AlSi17C4 AlSi21CuNiMg AlSi25CuNiMg
	GR.11	⇿∫ ∪⊂		<250	C1220P C3710P C2400P C5210P C3602BE C3601BE C3604BE C3771BE C4622BE C4430P C6711P BC3 BC6	CuZn36Pb3 CuZn39Pb2 CuZn39Pb3 CuZn40Pb2 CuZn28Sn1 CuZn38Si1 CuZn15 CuZn36 CuZn40 ZCuSn10Zn2 CuAl5 CuAl8Fe3 CuAl10Ni5Fe4 CuBe2F40 CuSi3Mn G-CuSn5ZnPb G-CuSn10Zn
				>250	C1700P C1720P C5212P C6782BE	CuBe1.7 F55 CuBe1.7 F110 CuBe2 F70 CuBe2 F125 CuZn40A11 CuAl11Ni6Fe5 AMPCO 20
	GR.12	∃:‖ ≒≠∴:∴			PP PS POM PC PA PMMA TFE CTFE	
	GR.13	⇳≡ ~ ≈≦∮ .:≠∽⋋∫ ~‖ ≠∫ ⊊∴‖ ::⋋			GFK KFK AFK	
	GR.14	⇶‖ ≤ .:≠				
S	GR.15	∈.:≠‖ ∽	700~1250	210~370	TP (TR)270H© TP (TR)340H© TP (TR)550H(C) TP (TR)480H© TP (TR)270Pd© TP (TR)340Pd TP (TR)550Pd© TP (TR)480Pd© TAP6400	Ti 1 Ti 2 Ti 3 Ti 4 Ti 1 Pd Ti 2 Pd Ti 3 Pd Ti99.7 Ti99.8 TiAl6V4 TiAl6V4ELI TiAl5Sn2.5 TiAl4Mo4Sn4Si0.5 TiCu2
	GR.16	∀∴ :∫ ::⊂	900~1200	260~350	Incoloy 800 Incoloy 825 I Inconel 400 nconel 625 Inconel 600 Inconel 700 Inconel 713 Inconel 718 Haynes 600 Hastelloy C Nimocast PD36 Nimonic PE13 Nimonic 901 Nimonic 75 Rene 95 ,Monet400, Mar-M432, Waspaloy ,Jessop G64 AirResist213 Jetalloy209	
	GR.17	⇿‖ ≌ ≈≌ ≧∽‖ ⊅ ∀≠‖ ::⊂	900-1400	210-400	SUH309 SUH310 SUH330 SUH1 SUH31 SUH35 SUH321 SUH430 SUH420J1	X15CrNiSi20-12 X15CrNiSi25-20 X45CrSi9-3 X45CrNiW18-9 X53CrMnNiN21-9 X10CrNiTi18-9 X6Cr17 X20Cr13

AISI/SAE	BS	GB
1010 1015 1020 1025 1030 1035 1040 1045 1050 1055 1060 W1 W210 1213 12L13 12L14	230M07 080M15 060A35 080M46 060A35 080M46 060A52 070M55 080A62 070M55 080 A 62 060A 96 BW 1A BW2	Q215AF Q235A~D 10 15 20 25 30 35 40 45 50 55 60 Y12 Y15pb
9840 4340 5132 5140 5115 4130 4137, 4135 4140, 4142 4140 L3 L6 ASTM A350LF5 8620 8740 5010 5140 5155 9262 52100	708M40 708M40 722M24 735A50 805M20 311-TYPE7 820A16 523M15 527A60 534A99 4360 43C 4360 50B	15Cr 20Cr 30Cr 40Cr 45Cr 20CrMo 15CrMo 30CrMo 42CrMo
D3 H13 A2 S1 H21 HW3 D3 M2 M35 M7 HNV3	BD3 BH13 BA2 BS1 BH21 401S45 4959BA2 BM2 BM35	Cr12 C12MoV Cr12MoV1 CrMo1v 4Cr5MoSiV1 W18Cr4V W18Cr4V5Co5 W6Mo5Cr4V2Co5 W6MoCr4V3 55CrMnA 85 60Si2Mn 50CrVa
AISI301 AISI302 AISI303 AISI304 AISI316 AISI321 AISI410 AISI416 AISI420 AISI430 AISI431 AISI440	430S15 410S21 420S45 431S29 430S17 304S11 303S21 304C12 321S12 316S16 317S12 403S17	1Cr17Ni7 1Cr18Ni9 Y1Cr18Ni9 0Cr18Ni9 0Cr17Ni12Mo2 0Cr18Ni11Ti 1Cr13 Y1Cr13 3Cr13 1Cr17 7Cr17 2Cr13 Y3Cr13
No20B No25B No30B No35B No45B No50B 60-40-18 80-55-06 A43D2 100-70-03 32510 40010 50005 70003 A220-70003 A220-80002	Grade150 Grade220 Grade260 Grade300 Grade350 Grade400 SNG420/12 SNG500/7 SNG600/3 SNG700/2 8290/6 B340/12 P440/7 P510/4 P570/3 P690/2	HT-100 HT-150 HT-200 HT-250 HT-300 HT350 QT400-15 QT450-10 QT500-7 QT600-3 QT700-2 KTH-330-08 KTZ-450-06 KTZ-550-04 KTZ-700-2
2014 3003 5052 6061 7075 AZ31C A296.0 A331.1	LM4 LM12 LM16 LM21 LM22 LM24 LM25 LM27	L1 L3 LD10 LF2 LF21 LD2 LC4 LC9
S12A SC84A SC102A AA336 A332 B26M520.0	LM5 LM6 LM9 LM13 LM28 LM29 LM30	ZL104 Y104 Y102 ZL102 ZL301
C36000 C37700 C44300 C46200 C83600 C90500 CT-00 10-N 75Cu-5Al 77CU-15Pb-7Sn-1Fe 1C Am CDA544 CDA65600	CA104 CZ121 CZ122 CZ108 CZ114 CDA544 CDA65600 CDA656	ZCuSn5Pb5Zn5 G-CuSn10Z HPb 61-1 HPb 59-1 HSn 62-1
C17000 C17200		QBe1.7 QBe2 HA1 60-1-1
AMS R54520 AMS R56400 AMS R56401 Gr.1 Gr.2 Gr.3 Gr.4 Gr.11 Gr.7 Gr.5	TA14/17 TA10-13 TA28 TA11	TA0 TA1 TA2 TA3 TA9 TC4
AISI309 AISA310 HNV3 EV9 AISI321 AISI430 ASIS420	330C11 Hr5.203-4 3146-3 HR8 3072-76 Hr401.601	2Cr23Ni13 2Cr25Ni20 4Cr9Si2 5Cr21Mn9Ni4N 0Cr18Ni11Ti 1Cr17 2Cr13

Universal End Mills

			N/mm2	HB	Ø1	Ø2	Ø3	Ø4	Ø6	Ø8	Ø10	Ø12	Ø16	Ø20
P	GR.1		≦700	≦210	0.005/0.006	0.01-0.011	0.014-0.017	0.022-0.026	0.028-0.033	0.037-0.045	0.048-0.058	0.063-0.075	0.082-0.087	0.1-0.13
	GR.2	<24HRC	700-1000	210-300	0.005/0.006	0.01-0.011	0.014-0.017	0.022-0.026	0.028-0.033	0.037-0.045	0.048-0.058	0.063-0.075	0.082-0.087	0.1-0.13
	GR.3	<30HRC	＞1000	＞300	0.00-0.005	0.007-0.009	0.011-0.014	0.016-0.02	0.021-0.027	0.028-0.035	0.035-0.045	0.048-0.058	0.065-0.075	0.08-0.1
H	GR.4	30~38HRC			0.00-0.005	0.007-0.009	0.011-0.014	0.016-0.02	0.021-0.027	0.028-0.035	0.035-0.045	0.048-0.058	0.065-0.075	0.08-0.1
	GR.5	38~48HRC			0.003	0.005	0.007	0.01	0.014	0.019	0.025	0.032	0.042	0.05
	GR.6	48~56HRC			0.002	0.003	0.005	0.007	0.09	0.012	0.016	0.02	0.03	0.04
	GR.7	56~68HRC			0.001	0.002	0.004	0.005	0.007	0.009	0.012	0.016	0.02	0.03
M	GR.8		500~950	250~320	0.003-0.005	0.007-0.01	0.01-0.014	0.014-0.021	0.019-0.028	0.026-0.037	0.033-0.048	0.043-0.063	0.055-0.082	0.08-0.11
K	GR.9			180-280	0.004-0.006	0.008-0.011	0.012-0.017	0.017-0.025	0.022-0.033	0.03-0.045	0.039-0.058	0.051-0.075	0.067-0.097	0.09-0.13
N	GR.10			Si 0.5~12%	0.004-0.006	0.008-0.011	0.013-0.016	0.018-0.023	0.025-0.032	0.035-0.045	0.042-0.055	0.055-0.071	0.072-0.092	0.09-0.12
	GR.11			180=250	0.003-0.006	0.006-0.011	0.009-0.016	0.014-0.023	0.018-0.031	0.025-0.042	0.032-0.055	0.041-0.071	0.055-0.092	0.07-0.12
	GR.12				0.005	0.01	0.015	0.022	0.029	0.04	0.052	0.068	0.087	0.11
	GR.13				0.005	0.01	0.015	0.022	0.029	0.04	0.052	0.068	0.087	0.11
	GR.14				0.005-0.007	0.006-0.09	0.009-0.013	0.014-0.021	0.032-0.04	0.048-0.07	0.072-0.11	0.087-0.13	0.11-0.16	0.14-0.21
S	GR.15		700~1250	210~370	0.003-0.005	0.006-0.01	0.009-0.015	0.013-0.022	0.017-0.029	0.023-0.04	0.03-0.051	0.039-0.067	0.051-0.087	0.07-0.012
	GR.16		900~1200	260~350	0.003-0.004	0.005-0.008	0.008-0.013	0.012-0.018	0.016-0.024	0.021-0.033	0.027-0.042	0.035-0.055	0.046-0.072	0.06-0.09
	GR.17		900-1400	210-400	0.003-0.004	0.007-0.008	0.01-0.013	0.014-0.018	0.019-0.024	0.026-0.033	0.033-0.042	0.043-0.055	0.056-0.072	0.08-0.1

Finishing End Mills

			N/mm2	HB	Ø1	Ø2	Ø3	Ø4	Ø6	Ø8	Ø10	Ø12	Ø16	Ø20
P	GR.1		≦700	≦210	0.006~0.008	0.011-0.013	0.016-0.019	0.023-0.028	0.03-0.04	0.045-0.055	0.055-0.065	0.075-0.085	0.08-0.09	0.12-0.14
	GR.2	<24HRC	700-1000	210-300	0.006~0.008	0.011-0.013	0.016-0.019	0.023-0.028	0.03-0.04	0.045-0.055	0.055-0.065	0.075-0.085	0.08-0.09	0.12-0.14
	GR.3	<30HRC	＞1000	＞300	0.005-0.007	0.009-0.011	0.014-0.017	0.022-0.026	0.026-0.037	0.037-0.052	0.05-0.06	0.07-0.08	0.07-0.08	0.1-0.12
H	GR.4	30~38HRC			0.005-0.007	0.009-0.011	0.014-0.017	0.022-0.026	0.026-0.037	0.037-0.052	0.05-0.06	0.07-0.08	0.07-0.08	0.1-0.12
	GR.5	38~48HRC			0.006	0.008	0.009	0.012	0.016	0.022	0.03	0.04	0.05	0.06
	GR.6	48~56HRC			0.004	0.005	0.007	0.01	0.013	0.017	0.02	0.03	0.04	0.05
	GR.7	56~68HRC			0.002	0.004	0.005	0.007	0.009	0.011	0.015	0.02	0.03	0.04
M	GR.8		500~950	250~320	0.005-0.01	0.01-0.015	0.013-0.017	0.017-0.024	0.022-0.032	0.03-0.04	0.04-0.05	0.047-0.055	0.05-0.06	0.08-0.13
K	GR.9			180-280	0.006-0.009	0.011-0.016	0.017-0.022	0.022-0.03	0.029-0.036	0.037-0.055	0.052-0.063	0.06-0.08	0.07-0.09	0.12-0.15
N	GR.10			Si 0.5~12%	0.006-0.009	0.012-0.03	0.018-0.025	0.023-0.033	0.03-0.04	0.04-0.06	0.06-0.07	0.062-0.083	0.08-0.11	0.13-0.2
	GR.11			180=250	0.005-0.009	0.001-0.03	0.015-0.024	0.02-0.03	0.025-0.035	0.03-0.05	0.04-0.06	0.055-0.075	0.06-0.08	0.07-0.18
	GR.12				0.007	0.012	0.017	0.025	0.032	0.045	0.06	0.07	0.095	0.13
	GR.13				0.007	0.012	0.017	0.025	0.032	0.045	0.06	0.07	0.095	0.13
	GR.14				0.007-0.01	0.01-0.013	0.012-0.017	0.016-0.02	0.035-0.045	0.055-0.075	0.08-0.12	0.1-0.15	0.12-0.17	0.16-0.23
S	GR.15		700~1250	210~370	0.005-0.007	0.008-0.013	0.012-0.017	0.015-0.025	0.02-0.032	0.03-0.045	0.038-0.05	0.045-0.07	0.065-0.094	0.08-0.13
	GR.16		900~1200	260~350	0.004-0.006	0.007-0.01	0.01-0.015	0.014-0.022	0.018-0.028	0.025-0.04	0.03-0.045	0.04-0.06	0.06-0.08	0.07-0.1
	GR.17		900-1400	210-400	0.005-0.0065	0.008-0.011	0.011-0.016	0.015-0.024	0.02-0.03	0.03-0.044	0.033-0.048	0.04-0.065	0.063-0.09	0.1-0.12

Ball Nose End Mills

Ap=0.03-0.05d Ae=0.2d fz=

			N/mm2	HB	Ø1	Ø2	Ø3	Ø4	Ø6	Ø8	Ø10	Ø12	Ø16	Ø20
P	GR.1		≦700	≦210	0.01~0.012	0.02~0.022	0.026~0.03	0.037~0.041	0.062~0.066	0.1~0.11	0.11~0.126	0.12~0.14	0.16~0.18	0.18~0.2
	GR.2	<24HRC	700-1000	210-300	0.01~0.012	0.02~0.022	0.026~0.03	0.037~0.041	0.062~0.066	0.1~0.11	0.11~0.126	0.12~0.14	0.16~0.18	0.18~0.2
	GR.3	<30HRC	＞1000	＞300	0.008~0.01	0.018~0.02	0.026~0.028	0.035~0.039	0.059~0.063	0.08~0.09	0.09~0.11	0.1~0.12	0.14~0.16	0.16~0.18
H	GR.4	30~38HRC			0.008~0.01	0.018~0.02	0.026~0.028	0.035~0.039	0.059~0.063	0.08~0.09	0.09~0.11	0.1~0.12	0.14~0.16	0.16~0.18
	GR.5	38~48HRC			0.005~0.008	0.009~0.012	0.015~0.019	0.03~0.034	0.048~0.052	0.079~0.083	0.094~0.098	0.09~0.116	0.12~0.14	0.14~0.16
	GR.6	48~56HRC			0.006	0.01	0.016	0.028	0.046	0.07	0.088	0.1	0.12	0.13
	GR.7	56~68HRC			0.005	0.009	0.012	0.02	0.04	0.06	0.07	0.08	0.1	0.11
M	GR.8		500~950	250~320	0.005~0.008	0.009~0.012	0.015~0.019	0.03~0.034	0.048~0.052	0.079~0.083	0.094~0.098	0.09~0.116	0.12~0.14	0.14~0.16
K	GR.9			180-280	0.01~0.012	0.02~0.022	0.026~0.03	0.037~0.041	0.062~0.066	0.1~0.11	0.11~0.126	0.12~0.14	0.16~0.18	0.18~0.2
N	GR.10			Si 0.5~12%	0.012~0.014	0.02~0.024	0.03~0.036	0.044~0.048	0.07~0.075	0.11~0.13	0.12~0.14	0.14~0.16	0.18~0.2	0.2~0.22
	GR.11			180=250	0.01~0.012	0.018~0.022	0.028~0.032	0.04~0.044	0.065~0.07	0.1~0.12	0.11~0.13	0.12~0.14	0.16~0.18	0.18~0.2
	GR.12				0.015~0.023	0.03~0.037	0.05~0.065	0.06~.075	0.09~0.12	0.13~0.17	0.16~0.2	0.2~0.3	0.25~0.4	0.3~0.5
	GR.13				0.015~0.023	0.03~0.037	0.05~0.065	0.06~.075	0.09~0.12	0.13~0.17	0.16~0.2	0.2~0.3	0.25~0.4	0.3~0.5
	GR.14				0.02~0.025	0.03~0.04	0.05~0.06	0.05~0.06	0.08~0.09	0.1~0.12	0.12~0.15	0.14~0.18	0.18~0.22	0.2~0.24
S	GR.15		700~1250	210~370	0.005~0.008	0.009~0.012	0.015~0.019	0.03~0.034	0.048~0.052	0.079~0.083	0.094~0.098	0.09~0.116	0.12~0.14	0.14~0.16
	GR.16		900~1200	260~350	0.006~0.008	0.08~0.01	0.012~0.014	0.025~0.028	0.044~0.048	0.07~0.075	0.08~0.085	0.08~0.1	0.1~0.12	0.11~0.13
	GR.17		900-1400	210-400	0.006~0.008	0.08~0.01	0.012~0.014	0.025~0.028	0.044~0.048	0.07~0.075	0.08~0.085	0.08~0.1	0.1~0.12	0.11~0.13

High Performance Ball Nose End Mills

HSC Ap=0.03d Ae=0.05d fz=

			N/mm2	HB	Ø1	Ø2	Ø3	Ø4	Ø6	Ø8	Ø10	Ø12	Ø16	Ø20
P	GR.1		≦700	≦210	0.02~0.03	0.05~0.055	0.07~0.084	0.09~0.102	0.12~0.13	0.12~0.13	0.13~0.16	0.13~0.16	0.14~0.17	0.14~0.17
	GR.2	<24HRC	700-1000	210-300	0.02~0.03	0.05~0.055	0.07~0.084	0.09~0.102	0.12~0.13	0.12~0.13	0.13~0.16	0.13~0.16	0.14~0.17	0.14~0.17
	GR.3	<30HRC	＞1000	＞300	0.02~0.03	0.05~0.055	0.07~0.084	0.09~0.102	0.12~0.13	0.12~0.13	0.13~0.16	0.13~0.16	0.14~0.17	0.14~0.17
H	GR.4	30~38HRC			0.02~0.025	0.04~0.045	0.06~0.074	0.08~0.09	0.11~0.12	0.11~0.12	0.12~0.15	0.12~0.15	0.13~0.16	0.13~0.16
	GR.5	38~48HRC			0.02~0.025	0.04~0.045	0.06~0.074	0.08~0.09	0.11~0.12	0.11~0.12	0.12~0.15	0.12~0.15	0.13~0.16	0.13~0.16
	GR.6	48~56HRC			0.015~0.02	0.03~0.04	0.04~0.05	0.06~0.08	0.08~0.1	0.08~0.1	0.1~0.12	0.1~0.12	0.11~0.13	0.11~0.13
	GR.7	56~68HRC			0.015~0.02	0.03~0.04	0.04~0.05	0.06~0.08	0.08~0.1	0.08~0.1	0.1~0.12	0.1~0.12	0.11~0.13	0.11~0.13
M	GR.8		500~950	250~320	0.02~0.025	0.04~0.045	0.06~0.074	0.08~0.09	0.11~0.12	0.11~0.12	0.12~0.15	0.12~0.15	0.13~0.16	0.13~0.16
K	GR.9			180-280	0.02~0.03	0.05~0.055	0.07~0.084	0.09~0.102	0.12~0.13	0.12~0.13	0.13~0.16	0.13~0.16	0.14~0.17	0.14~0.17
N	GR.10			Si 0.5~12%	0.03~0.05	0.05~0.07	0.06~0.09	0.12~0.15	0.15~0.2	0.18~0.24	0.22~0.26	0.25~0.3	0.28~0.32	0.3~0.35
	GR.11			180=250	0.03~0.05	0.05~0.07	0.06~0.09	0.12~0.15	0.15~0.2	0.18~0.24	0.22~0.26	0.25~0.3	0.28~0.32	0.3~0.35
	GR.12				0.02~0.04	0.04~0.05	0.06~0.09	0.12~0.15	0.15~0.2	0.18~0.24	0.25~0.35	0.3~0.4	0.4~0.5	0.5~0.6
	GR.13				0.02~0.04	0.04~0.05	0.06~0.09	0.12~0.15	0.15~0.2	0.18~0.24	0.25~0.35	0.3~0.4	0.4~0.5	0.5~0.6
	GR.14				0.04~0.08	0.06~0.08	0.1~0.12	0.1~0.13	0.15~0.18	0.2~0.23	0.24~0.28	0.26~0.3	0.3~0.33	0.32~0.36
S	GR.15		700~1250	210~370	0.015~0.02	0.03~0.04	0.04~0.05	0.06~0.08	0.08~0.1	0.08~0.1	0.1~0.12	0.1~0.12	0.11~0.13	0.11~0.13
	GR.16		900~1200	260~350	0.015~0.02	0.03~0.04	0.04~0.05	0.06~0.08	0.08~0.1	0.08~0.1	0.1~0.12	0.1~0.12	0.11~0.13	0.11~0.13
	GR.17		900-1400	210-400	0.015~0.02	0.03~0.04	0.04~0.05	0.06~0.08	0.08~0.1	0.08~0.1	0.1~0.12	0.1~0.12	0.11~0.13	0.11~0.13

High Performance End Mills

HPC fz=

			N/mm2	HB	Ø1	Ø2	Ø3	Ø4	Ø6	Ø8	Ø10	Ø12	Ø16	Ø20
P	GR.1	∀≠‖ ::⊂ ∀∫ ::∫ ∩∴≌ ∨‖ ∽∾‖ ⊄	≦700	≦210	0.008-0.012	0.01-0.014	0.015-0.02	0.025-0.03	0.03-0.05	0.04-0.05	0.06-0.08	0.07-0.09	0.11-0.14	0.12-0.15
P	GR.2	∀≠‖ ::⊂ <24HRC ∀∴∮ :≡ ::∫ ∩∴≌ ∨‖ ∽∾‖ ⊄	700-1000	210-300	0.008-0.012	0.01-0.014	0.015-0.02	0.025-0.03	0.03-0.05	0.04-0.05	0.06-0.08	0.07-0.09	0.11-0.14	0.12-0.15
P	GR.3	∀≠‖ ::⊂ <30HRC →∫ ∩∴≌ ∨‖ ∽∾‖ ⊄	＞1000	＞300	0.006-0.008	0.008-0.012	0.014-0.016	0.022-0.026	0.025-0.04	0.03-0.04	0.04-0.06	0.06-0.08	0.08-0.1	0.1-0.13
H	GR.4	∀≠‖ ::⊂ 30~38HRC ↞‖ :‖ ::∫ ∽∾‖ ⊄			0.006-0.008	0.008-0.012	0.014-0.016	0.022-0.026	0.025-0.04	0.03-0.04	0.04-0.06	0.06-0.08	0.08-0.1	0.1-0.13
H	GR.5	∀≠‖ ::⊂ 38~48HRC ↞‖ :‖ ::∫ ∽∾‖ ⊄			0.005	0.008	0.012	0.015	0.02	0.025	0.035	0.05	0.06	0.08
H	GR.6	∀≠‖ ::⊂ 48~56HRC ↞‖ :‖ ::∫ ∽∾‖ ⊄			0.004	0.006	0.01	0.012	0.015	0.02	0.03	0.04	0.05	0.07
H	GR.7	∀≠‖ ::⊂ 56~68HRC ↞‖ :‖ ::∫ ∽∾‖ ⊄			0.002	0.004	0.008	0.01	0.012	0.015	0.024	0.03	0.04	0.06
M	GR.8	∀≠‖ ::⊂ ∀∫ ⊴∬‖ ∨∫ ⊄≫‖ ⊄	500~950	250~320	0.004-0.006	0.08-0.012	0.012-0.016	0.018-0.025	0.022-0.03	0.04-0.06	0.05-0.07	0.06-0.09	0.08-0.1	0.09-0.15
K	GR.9	∑≡∩≡∽		180-280	0.08-0.011	0.01-0.016	0.015-0.025	0.025-0.035	0.03-0.065	0.04-0.08	0.06-0.09	0.08-0.11	0.09-0.012	0.11-0.16
N	GR.10	⇳::⊄ ~ ∴∽∴∵		Si 0.5~12%	0.008-0.01	0.0015-0.02	0.018-0.025	0.02-0.04	0.03-0.06	0.04-0.07	0.05-0.08	0.06-0.09	0.08-0.12	0.1-0.15
N	GR.11	⇔∫ ∪⊂		180=250	0.006-0.008	0.008-0.012	0.012-0.02	0.012-0.025	0.015-0.04	0.02-0.05	0.03-0.06	0.04-0.07	0.06-0.01	0.08-0.12
N	GR.12	∃∴‖ ≒∴∴∴			0.005-0.01	0.01-0.02	0.01-0.03	0.02-0.04	0.04-0.06	0.05-0.08	0.06-0.1	0.1-0.14	0.1-0.16	0.15-0.2
N	GR.13	∻≡ ~ ≈≅∮ ∴≠∽∗∫ ⇔‖ ≠∫ ⊴∴‖ ::∗			0.005-0.01	0.01-0.02	0.01-0.03	0.02-0.04	0.04-0.06	0.05-0.08	0.06-0.1	0.1-0.14	0.1-0.16	0.15-0.2
N	GR.14	∃⋡‖ ≤ ∴≠			0.005-0.007	0.006-0.09	0.009-0.013	0.014-0.021	0.032-0.04	0.048-0.07	0.072-0.11	0.087-0.13	0.11-0.16	0.14-0.21
S	GR.15	∈∴≠‖ ∽	700~1250	210~370	0.005-0.007	0.008-0.012	0.011-0.017	0.015-0.024	0.019-0.031	0.025-0.05	0.03-0.05	0.04-0.07	0.06-0.09	0.08-0.013
S	GR.16	∀∴∴∫ ::⊂	900~1200	260~350	0.005-0.006	0.007-0.01	0.01-0.015	0.014-0.02	0.018-0.026	0.024-0.04	0.03-0.05	0.04-0.06	0.05-0.08	0.07-0.1
S	GR.17	↔‖ ⊴≌ ≈⊴≥ ∽⊄ ⊄ ∀≠‖ ::⊂	900-1400	210-400	0.005-0.006	0.009-0.01	0.012-0.015	0.016-0.02	0.021-0.026	0.028-0.035	0.035-0.05	0.05-0.06	0.06-0.085	0.09-0.12

High Feed End Mills

HFC fz=

			N/mm2	HB	Ø1	Ø2	Ø3	Ø4	Ø6	Ø8	Ø10	Ø12	Ø16	Ø20
P	GR.1		≦700	≦210			0.05-0.1	0.09-0.15	0.13-0.22	0.16-0.3	0.22-0.4	0.25-0.45	0.3-0.6	0.4-0.75
	GR.2	<24HRC	700-1000	210-300			0.05-0.1	0.09-0.15	0.13-0.22	0.16-0.3	0.22-0.4	0.25-0.45	0.3-0.6	0.4-0.75
	GR.3	<30HRC	＞1000	＞300			0.05-0.1	0.09-0.15	0.13-0.22	0.16-0.3	0.22-0.4	0.25-0.45	0.3-0.6	0.4-0.75
H	GR.4	30~38HRC					0.05-0.1	0.15-0.2	0.13-0.22	0.16-0.3	0.22-0.4	0.25-0.45	0.3-0.6	0.4-0.75
	GR.5	38~48HRC					0.05-0.1	0.15-0.2	0.13-0.22	0.16-0.3	0.22-0.4	0.25-0.45	0.3-0.6	0.4-0.75
	GR.6	48~56HRC					0.05-0.1	0.15-0.2	0.13-0.22	0.16-0.3	0.22-0.4	0.25-0.45	0.3-0.6	0.4-0.75
	GR.7	56~68HRC					0.05-0.1	0.15-0.2	0.13-0.22	0.16-0.3	0.22-0.4	0.25-0.45	0.3-0.6	0.4-0.75
M	GR.8		500~950	250~320										
K	GR.9			180-280										
N	GR.10			Si 0.5~12%										
	GR.11			180=250										
	GR.12													
	GR.13													
	GR.14													
S	GR.15		700~1250	210~370										
	GR.16		900~1200	260~350										
	GR.17		900-1400	210-400										

High Performance End Mills

HSC

			N/mm2	HB	Ø1	Ø2	Ø3	Ø4	Ø6	Ø8	Ø10	Ø12	Ø16	Ø20
P	GR.1		≦700	≦210	0.008-0.01	0.011-0.013	0.016-0.019	0.023-0.028	0.032-0.039	0.044-0.052	0.057-0.068	0.074-0.088	0.096-0.114	0.125-0.149
	GR.2	<24HRC	700-1000	210-300	0.008-0.01	0.011-0.013	0.016-0.019	0.023-0.028	0.032-0.039	0.044-0.052	0.057-0.068	0.074-0.088	0.096-0.114	0.125-0.149
	GR.3	<30HRC	＞1000	＞300	0.006-0.008	0.008-0.01	0.012-0.015	0.017-0.022	0.024-0.03	0.03-0.041	0.043-0.053	0.056-0.069	0.072-0.09	0.094-0.117
H	GR.4	30~38HRC			0.006-0.008	0.008-0.01	0.012-0.015	0.017-0.022	0.024-0.03	0.03-0.041	0.043-0.053	0.056-0.069	0.072-0.09	0.094-0.117
	GR.5	38~48HRC			0.005	0.007	0.011	0.016	0.022	0.03	0.04	0.05	0.066	0.086
	GR.6	48~56HRC			0.004	0.006	0.01	0.014	0.019	0.025	0.032	0.04	0.052	0.07
	GR.7	56~68HRC			0.002	0.005	0.009	0.012	0.016	0.02	0.025	0.03	0.04	0.055
M	GR.8		500~950	250~320	0.005-0.006	0.07-0.09	0.011-0.013	0.016-0.019	0.022-0.026	0.03-0.036	0.039-0.046	0.051-0.06	0.066-0.078	0.086-0.102
K	GR.9			180-280	0.08-0.011	0.009-0.013	0.013-0.019	0.019-0.028	0.026-0.039	0.036-0.052	0.046-0.068	0.06-0.088	0.078-0.0114	0.104-0.149
N	GR.10			Si 0.5~12%	0.005	0.005	0.007	0.01	0.02	0.027	0.035	0.043	0.057	0.075
	GR.11			180=250	0.006	0.006	0.009	0.012	0.024	0.03	0.037	0.045	0.06	0.08
	GR.12				0.005	0.007	0.01	0.014	0.025	0.035	0.042	0.05	0.065	0.08
	GR.13				0.008	0.011	0.017	0.025	0.035	0.047	0.061	0.079	0.102	0.133
	GR.14				0.015	0.02	0.03	0.04	0.06	0.07	0.09	0.12	0.14	0.016
S	GR.15		700~1250	210~370	0.005-0.008	0.007-0.011	0.01-0.017	0.015-0.025	0.02-0.035	0.027-0.047	0.036-0.061	0.046-0.079	0.06-0.1	0.08-0.013
	GR.16		900~1200	260~350	0.004-0.006	0.006-0.009	0.009-0.014	0.013-0.02	0.018-0.028	0.025-0.038	0.032-0.05	0.042-0.065	0.054-0.084	0.07-0.11
	GR.17		900-1400	210-400	0.005-0.007	0.009-0.011	0.014-0.016	0.016-0.023	0.022-0.032	0.03-0.044	0.039-0.057	0.06-0.074	0.065-0.095	0.085-0.125

Twist Drills

	⇶≡≈≈✗ ⇿∥≠∫ ⍯∴∥ :≅ ∨		N/mm2	HB	Ø1	Ø2	Ø3	Ø4	Ø6	Ø8	Ø10	Ø12	Ø16	Ø20
P	GR.1	∇≠∥ ::⊂ ∀∫ ::∫ ∩∴⍯ ∨∥ ∽∾∥ ⊄	≦700	≦210	0.015~0.02	0.02~0.03	0.03~0.05	0.045~0.07	0.065~0.1	0.085~0.125	0.1~0.155	0.13~0.19	0.13~0.24	0.15~0.25
	GR.2	∇≠∥ ::⊂ <24HRC ∀∴∮ :≡ ::∫ ∩∴⍯ ∨∥ ∽∾∥ ⊄	700-1000	210-300	0.015~0.02	0.02~0.03	0.03~0.05	0.045~0.07	0.065~0.1	0.085~0.125	0.1~0.155	0.13~0.19	0.13~0.24	0.15~0.25
	GR.3	∇≠∥ ::⊂ <30HRC →∫ ∩∴⍯ ∨∥ ∽∾∥ ⊄	＞1000	＞300	0.01~0.016	0.016~0.02	0.025~0.03	0.035~0.045	0.05~0.06	0.065~0.08	0.08~0.1	0.1~0.12	0.12~0.15	0.14~0.2
H	GR.4	∇≠∥ ::⊂ 30~38HRC ⇹∥ :∥ ::∫ ∽∾∥ ⊄			0.01~0.016	0.016~0.02	0.025~0.03	0.035~0.045	0.05~0.06	0.065~0.08	0.08~0.1	0.1~0.12	0.12~0.15	0.14~0.2
	GR.5	∇≠∥ ::⊂ 38~48HRC ⇹∥ :∥ ::∫ ∽∾∥ ⊄			0.005	0.01	0.015	0.022	0.031	0.04	0.05	0.06	0.075	0.09
	GR.6	∇≠∥ ::⊂ 48~56HRC ⇹∥ :∥ ::∫ ∽∾∥ ⊄												
	GR.7	∇≠∥ ::⊂ 56~68HRC ⇹∥ :∥ ::∫ ∽∾∥ ⊄												
M	GR.8	∇≠∥ ::⊂ ∀∫ ⍯∬∥ ∨∫ ⊄≫∥ ⊄	500~950	250~320	0.01~0.015	0.016~0.023	0.025~0.035	0.035~0.05	0.05~0.07	0.065~0.09	0.08~0.12	0,1~0.14	0.12~0.175	0.135~0.2
K	GR.9	∑≡∪⋿∽		180-280	0.013~0.02	0.023~0.037	0.034~0.055	0.05~0.08	0.07~0.11	0.09~0.145	0.11~0.18	0.135~0.22	0.17~0.27	0.19~0.32
N	GR.10	⇳::⊄ ~ ∴∽∴::		Si 0.5~12%	0.015~0.025	0.03~0.051	0.045~0.076	0.066~0.11	0.092~0.154	0.12~0.2	0.15~0.25	0.18~0.3	0.225~0.375	0.25~0.4
	GR.11	⇿∫ ∪⊂		180=250	0.012~0.03	0.022~0.04	0.03~0.06	0.05~0.08	0.06~0.14	0.08~0.17	0.11~0.2	0.12~0.25	0.15~0.27	0.2~0.3
	GR.12	∃:∦ ≒≠∴:∴			0.01~0.02	0.02~0.024	0.03~0.036	0.044~0.052	0.062~0.073	0.08~0.095	0.1~0.12	0.12~0.15	0.15~0.18	0.16~0.2
	GR.13	⇹≡ ~ ≈≋∮ .:≠∽✗∫ ⇿∥ ≠∫ ⍯∴∥ ::✗			0.015~0.02	0.023~0.027	0.034~0.04	0.049~0.058	0.069~0.081	0.09~0.105	0.11~0.13	0.13~0.158	0.17~0.2	0.2~0.25
	GR.14	⇶∦ ≤ .:≠												
S	GR.15	∈.:≠∥ ∽	700~1250	210~370	0.01~0.016	0.02~0.029	0.03~0.044	0.044~0.063	0.062~0.088	0.08~0.115	0.1~0.144	0.12~0.173	0.15~0.216	0.18~0.25
	GR.16	∀∴:∫ ::⊂	900~1200	260~350	0.008~0.014	0.019~0.024	0.03~0.04	0.04~0.05	0.06~0.075	0.075~0.095	0.095~0.12	0.11~0.145	0.14~0.17	0.16~0.2
	GR.17	⇿∥ ⋚ ≈⋚ ≥∽∥ ⊄ ∇≠∥ ::⊂	900-1400	210-400	0.01~0.02	0.02~0.03	0.25~0.045	0.036~0.066	0.05~0.071	0.065~0.12	0.08~0.15	0.098~0.18	0.122~0.225	0.14~0.26

High Performance Drills

			N/mm2	HB	Ø1	Ø2	Ø3	Ø4	Ø6	Ø8	Ø10	Ø12	Ø16	Ø20
P	GR.1		≦700	≦210	0.02~0.04	0.03~0.04	0.04~0.08	0.06~0.1	0.08~0.15	0.1~0.2	0.13~0.25	0.15~0.3	0.16~0.35	0.2~0.45
	GR.2	<24HRC	700-1000	210-300	0.02~0.04	0.03~0.04	0.04~0.08	0.06~0.1	0.08~0.15	0.1~0.2	0.13~0.25	0.15~0.3	0.16~0.35	0.2~0.45
	GR.3	<30HRC	＞1000	＞300	0.015~0.025	0.02~0.035	0.03~0.06	0.04~0.07	0.06~0.09	0.08~0.14	0.01~0.16	0.12~0.2	0.14~0.25	0.16~0.3
H	GR.4	30~38HRC			0.015~0.025	0.02~0.035	0.03~0.06	0.04~0.07	0.06~0.09	0.08~0.14	0.01~0.16	0.12~0.2	0.14~0.25	0.16~0.3
	GR.5	38~48HRC			0.007	0.014	0.022	0.03	0.045	0.06	0.07	0.08	0.09	0.11
	GR.6	48~56HRC			0.005	0.01	0.015	0.025	0.035	0.04	0.05	0.06	0.075	0.09
	GR.7	56~68HRC												
M	GR.8		500~950	250~320	0.014~0.017	0.025~0.03	0.04~0.05	0.05~0.07	0.09~0.11	0.11~0.15	0.13~0.17	0,15~0.19	0.17~0.22	0.2~0.25
K	GR.9			180-280	0.025~0.038	0.04~0.07	0.07~0.11	0.1~0.15	0.14~0.22	0.2~0.3	0.25~0.35	0.3~0.4	0.35~0.45	0.35~0.5
N	GR.10			Si 0.5~12%	0.03~0.04	0.05~0.08	0.08~0.12	0.11~0.16	0.15~0.23	0.22~0.32	0.27~0.38	0.32~0.42	0.37~0.48	0.37~0.55
	GR.11			180=250	0.015~0.035	0.025~0.05	0.04~0.08	0.05~0.1	0.08~0.15	0.1~0.2	0.13~0.25	0.15~0.3	0.19~0.3	0.22~0.35
	GR.12				0.015~0.03	0.03~0.04	0.04~0.06	0.055~0.08	0.07~0.09	0.08~0.11	0.11~0.14	0.14~0.17	0.17~0.2	0.18~0.23
	GR.13				0.015~0.03	0.03~0.04	0.04~0.06	0.055~0.08	0.07~0.09	0.08~0.11	0.11~0.14	0.14~0.17	0.17~0.2	0.18~0.23
	GR.14				0.015~0.03	0.03~0.04	0.04~0.06	0.055~0.08	0.07~0.09	0.08~0.11	0.11~0.14	0.14~0.17	0.17~0.2	0.18~0.23
S	GR.15		700~1250	210~370	0.015~0.023	0.03~0.04	0.04~0.06	0.055~0.08	0.07~0.1	0.1~0.14	0.12~0.16	0.14~0.19	0.17~0.24	0.19~0.26
	GR.16		900~1200	260~350	0.01~0.02	0.02~0.034	0.035~0.05	0.045~0.066	0.07~0.09	0.08~0.1	0.1~0.14	0.12~0.16	0.15~0.19	0.17~0.22
	GR.17		900-1400	210-400	0.013~0.016	0.024~0.028	0.03~0.04	0.04~0.06	0.08~0.1	0.1~0.14	0.12~0.16	0,14~0.18	0.16~0.21	0.18~0.23

Machine Reamers

Reamers

			N/mm2	HB	Ø1	Ø2	Ø3	Ø4	Ø6	Ø8	Ø10	Ø12	Ø16	Ø20	Ø25	Ø30
P	GR.1		≦700	≦210	0.052~0.056	0.083~0.09	0.11~0.125	0.14~0.15	0.17~0.19	0.20~0.23	0.24~0.26	0.27~0.3	0.32~0.35	0.36~0.39	0.42~0.46	0.46~0.5
	GR.2	<24HRC	700-1000	210-300	0.052~0.056	0.083~0.09	0.11~0.125	0.14~0.15	0.17~0.19	0.20~0.23	0.24~0.26	0.27~0.3	0.32~0.35	0.36~0.39	0.42~0.46	0.46~0.5
	GR.3	<30HRC	＞1000	＞300	0.034~0.044	0.055~0.07	0.078~0.1	0.09~0.12	0.12~0.15	0.14~0.18	0.16~0.20	0.18~0.23	0.21~0.27	0.24~0.31	0.28~0.36	0.30~0.39
H	GR.4	30~38HRC			0.034~0.044	0.055~0.07	0.078~0.1	0.09~0.12	0.12~0.15	0.14~0.18	0.16~0.20	0.18~0.23	0.21~0.27	0.24~0.31	0.28~0.36	0.30~0.39
	GR.5	38~48HRC			0.025	0.04	0.056	0.067	0.084	0.101	0.116	0.133	0.153	0.176	0.203	0.223
	GR.6	48~56HRC			0.015	0.024	0.034	0.04	0.05	0.06	0.07	0.08	0.092	0.106	0.122	0.134
	GR.7	56~68HRC														
M	GR.8		500~950	250~320	0.03~0.045	0.05~0.07	0.07~0.1	0.08~0.12	0.10~0.15	0.12~0.18	0.14~0.20	0.16~0.23	0.19~0.27	0.22~0.31	0.25~0.36	0.27~0.39
K	GR.9			180-280	0.053~0.066	0.085~0.105	0.11~0.15	0.14~0.17	0.17~0.22	0.21~0.26	0.24~0.3	0.28~0.35	0.32~0.4	0.37~0.46	0.43~0.53	0.47~0.58
N	GR.10			Si 0.5~12%	0.06~0.085	0.095~0.135	0.13~0.19	0.16~0.23	0.2~0.285	0.24~0.34	0.275~0.39	0.32~0.45	0.36~0.52	0.42~0.6	0.48~0.68	0.53~0.73
	GR.11			180=250	0.047~0.069	0.075~0.11	0.105~0.155	0.125~0.185	0.16~0.23	0.19~0.28	0.22~0.32	0.25~0.37	0.29~0.42	0.33~0.485	0.38~0.56	0.42~0.62
	GR.12				0.047	0.075	0.105	0.125	0.16	0.19	0.22	0.25	0.285	0.33	0.38	0.42
	GR.13				0.047	0.075	0.105	0.125	0.16	0.19	0.22	0.25	0.285	0.33	0.38	0.42
	GR.14															
S	GR.15		700~1250	210~370	0.019~0.028	0.03~0.045	0.042~0.063	0.05~0.076	0.063~0.095	0.076~0.113	0.09~0.13	0.1~0.15	0.115~0.17	0.13~0.2	0.15~0.23	0.167~0.25
	GR.16		900~1200	260~350	0.019~0.028	0.03~0.045	0.042~0.063	0.05~0.076	0.063~0.095	0.075~0.115	0.09~0.13	0.1~0.15	0.115~0.175	0.13~0.2	0.15~0.23	0.17~0.25
	GR.17		900-1400	210-400	0.031~0.044	0.05~0.07	0.07~0.01	0.085~0.12	0.105~0.15	0.125~0.18	0.145~0.2	0.167~0.235	0.19~0.27	0.22~0.31	0.25~0.355	0.28~0.39

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Hardness Conversion Table

HRC	HB	HV10	N/mm²		HRC	HB	HV10	N/mm²
	71	75	240		28	273	287	920
	76	80	255		29	278	293	940
	81	85	270		30	287	302	970
	86	90	285		31	295	310	995
	90	95	305		32	301	317	1020
	95	100	320		33	311	327	1050
	100	105	335		34	319	336	1080
	105	110	350		35	328	345	1110
	109	115	370		36	337	355	1140
	114	120	385		37	346	364	1170
	119	125	400		38	354	373	1200
	124	130	415		39	363	382	1230
	128	135	430		40	372	392	1260
	133	140	450		41	383	403	1300
	138	145	465		42	393	413	1330
	143	150	480		43	402	423	1360
	147	155	495		44	413	434	1400
	152	160	510		45	424	446	1440
	157	165	530		46	435	458	1480
	162	170	545		47	449	473	1530
	166	175	560		48	460	484	1570
	171	180	575		49	472	497	1620
	176	185	595		50	488	514	1680
	181	190	610		51	501	527	1730
	185	195	625		52	517	544	1790
	190	200	640		53	532	560	1845
	195	205	660		54	549	578	1910
	199	210	675		55	567	596	1980
	204	215	690		56	584	615	2050
	209	220	705		57	607	639	2140
	214	225	720		58	622	655	
	219	230	740		59		675	
	223	235	755		60		698	
	228	240	770		61		720	
	233	245	785		62		745	
22	238	250	800		63		773	
23	242	255	820		64		800	
24	247	260	835		65		829	
25	255	268	860		66		864	
26	258	272	870		67		900	
27	266	280	900		68		940	

Table of Cutting Formula

Metric MM

$$Vc = \frac{\pi \times Dc \times N}{1000}$$

$$N = \frac{Vc \times 1000}{\pi \times Dc}$$

$$Vf = N \times Z \times fz$$

$$T = \frac{L}{Vf}$$

Vc=	Cutting Speed	m/min
Dc=	Cutter Diameter	mm
N =	RPM	rev/min
Vf=	Feed Speed	mm/min
fz =	Feed Per Tooth	mm/tooth
fn =	Feed Per Revolution	mm/rev
Z =	Number of Flutes	Z
T =	Time of Cut In Minutes	mm
L =	Cut Length	mm
Ap=	Axial depth of cut	mm
Ae=	Radial depth of cut	mm

English INCH

$$Vc = \frac{\pi \times Dc \times N}{12}$$

$$N = \frac{Vc \times 12}{\pi \times Dc}$$

$$Vf = N \times Z \times fz$$

$$T = \frac{L}{Vf}$$

Vc=	Cutting Speed	inch/min
Dc=	Cutter Diameter	inch
N =	RPM	rev/min
Vf=	Feed Speed	inch/min
fz =	Feed Per Tooth	inch/tooth
fn =	Feed Per Revolution	inch/rev
Z =	Number of Flutes	Z
T =	Time of Cut In Minutes	inch
L =	Cut Length	inch
Ap=	Axial depth of cut	inch
Ae=	Radial depth of cut	inch

RPM Conversion Table

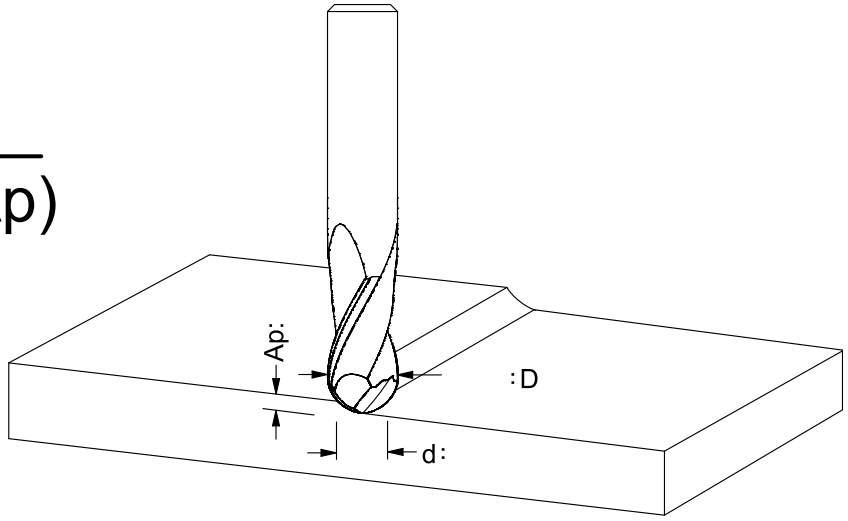
Dia	VC m/min cutting speed															
D	20	30	40	50	60	70	80	90	100	120	140	150	180	200	250	300
0.2	31850	47770	63690	79620	95540	111460	127390	143310	159240	191080	222930	238850	286620	318470	398090	477710
0.3	21230	31850	42460	53080	63690	74310	84930	95540	106160	127390	148620	159240	191080	212310	265390	318470
0.4	15920	23890	31850	39810	47770	55730	63690	71660	79620	95540	111460	119430	143310	159240	199040	238850
0.5	12740	19110	25480	31850	38220	44590	50960	57320	63690	76430	89170	95540	114650	127390	159240	191080
0.6	10620	15920	21230	26540	31850	37150	42460	47770	53080	63690	74310	79620	95540	106160	132700	159240
0.7	9100	13650	18200	22750	27300	31850	36400	40950	45500	54600	63690	68240	81890	90990	113740	136490
0.8	7960	11940	15920	19900	23890	27870	31850	35830	39810	47770	55730	59710	71660	79620	99520	119430
0.9	7080	10620	14150	17690	21230	24770	28310	31850	35390	42460	49540	53080	63690	70770	88460	106160
1.0	6370	9550	12740	15920	19110	22290	25480	28660	31850	38220	44590	47770	57320	63690	79620	95540
1.2	5310	7960	10620	13270	15920	18580	21230	23890	26540	31850	37150	39810	47770	53080	66350	79620
1.5	4250	6370	8490	10620	12740	14860	16990	19110	21230	25480	29720	31850	38220	42460	53080	63690
1.8	3540	5310	7080	8850	10620	12380	14150	15920	17690	21230	24770	26540	31850	35390	44230	53080
2.0	3180	4780	6370	7960	9550	11150	12740	14330	15920	19110	22290	23890	28660	31850	39810	47770
2.2	2900	4340	5790	7240	8690	10130	11580	13030	14480	17370	20270	21710	26060	28950	36190	43430
2.5	2550	3820	5100	6370	7640	8920	10190	11460	12740	15290	17830	19110	22930	25480	31850	38220
2.8	2270	3410	4550	5690	6820	7960	9100	10240	11370	13650	15920	17060	20470	22750	28430	34120
3.0	2120	3180	4250	5310	6370	7430	8490	9550	10620	12740	14860	15920	19110	21230	26540	31850
3.5	1820	2730	3640	4550	5460	6370	7280	8190	9100	10920	12740	13650	16380	18200	22750	27300
4.0	1590	2390	3180	3980	4780	5570	6370	7170	7960	9550	11150	11940	14330	15920	19900	23890
4.5	1420	2120	2830	3540	4250	4950	5660	6370	7080	8490	9910	10620	12740	14150	17690	21230
5.0	1270	1910	2550	3180	3820	4460	5100	5730	6370	7640	8920	9550	11460	12740	15920	19110
5.5	1160	1740	2320	2900	3470	4050	4630	5210	5790	6950	8110	8690	10420	11580	14480	17370
6.0	1060	1590	2120	2650	3180	3720	4250	4780	5310	6370	7430	7960	9550	10620	13270	15920
6.5	980	1470	1960	2450	2940	3430	3920	4410	4900	5880	6860	7350	8820	9800	12250	14700
7.0	910	1360	1820	2270	2730	3180	3640	4090	4550	5460	6370	6820	8190	9100	11370	13650
7.5	850	1270	1700	2120	2550	2970	3400	3820	4250	5100	5940	6370	7640	8490	10620	12740
8.0	800	1190	1590	1990	2390	2790	3180	3580	3980	4780	5570	5970	7170	7960	9950	11940
8.5	750	1120	1500	1870	2250	2620	3000	3370	3750	4500	5250	5620	6740	7490	9370	11240
9.0	710	1060	1420	1770	2120	2480	2830	3180	3540	4250	4950	5310	6370	7080	8850	10620
9.5	670	1010	1340	1680	2010	2350	2680	3020	3350	4020	4690	5030	6030	6700	8380	10060
10	640	960	1270	1590	1910	2230	2550	2870	3180	3820	4460	4780	5730	6370	7960	9550
11	580	870	1160	1450	1740	2030	2320	2610	2900	3470	4050	4340	5210	5790	7240	8690
12	530	800	1060	1330	1590	1860	2120	2390	2650	3180	3720	3980	4780	5310	6630	7960
13	490	730	980	1220	1470	1710	1960	2200	2450	2940	3430	3670	4410	4900	6120	7350
14	450	680	910	1140	1360	1590	1820	2050	2270	2730	3180	3410	4090	4550	5690	6820
15	420	640	850	1060	1270	1490	1700	1910	2120	2550	2970	3180	3820	4250	5310	6370
16	400	600	800	1000	1190	1390	1590	1790	1990	2390	2790	2990	3580	3980	4980	5970
17	370	560	750	940	1120	1310	1500	1690	1870	2250	2620	2810	3370	3750	4680	5620
18	350	530	710	880	1060	1240	1420	1590	1770	2120	2480	2650	3180	3540	4420	5310
19	340	500	670	840	1010	1170	1340	1510	1680	2010	2350	2510	3020	3350	4190	5030
20	320	480	640	800	960	1110	1270	1430	1590	1910	2230	2390	2870	3180	3980	4780
21	300	450	610	760	910	1060	1210	1360	1520	1820	2120	2270	2730	3030	3790	4550
22	290	430	580	720	870	1010	1160	1300	1450	1740	2030	2170	2610	2900	3620	4340
23	280	420	550	690	830	970	1110	1250	1380	1660	1940	2080	2490	2770	3460	4150
24	270	400	530	660	800	930	1060	1190	1330	1590	1860	1990	2390	2650	3320	3980
25	250	380	510	640	760	890	1020	1150	1270	1530	1780	1910	2290	2550	3180	3820
26	240	370	490	610	730	860	980	1100	1220	1470	1710	1840	2200	2450	3060	3670
27	240	350	470	590	710	830	940	1060	1180	1420	1650	1770	2120	2360	2950	3540
28	230	340	450	570	680	800	910	1020	1140	1360	1590	1710	2050	2270	2840	3410
29	220	330	440	550	660	770	880	990	1100	1320	1540	1650	1980	2200	2750	3290
30	210	320	420	530	640	740	850	960	1060	1270	1490	1590	1910	2120	2650	3180
31	210	310	410	510	620	720	820	920	1030	1230	1440	1540	1850	2050	2570	3080
32	200	300	400	500	600	700	800	900	1000	1190	1390	1490	1790	1990	2490	2990

Ball End Milling Actual Diameter

R	D	Axial Depth of Cut (Ap) mm														
Radius	Dia	0.01	0.02	0.03	0.04	0.05	0.08	0.1	0.15	0.2	0.3	0.5	0.8	1	2	3
0.1R	0.2	0.087	0.12	0.143	0.16	0.173	0.196	0.2								
0.2R	0.4	0.125	0.174	0.211	0.24	0.265	0.32	0.35	0.39	0.4						
0.3R	0.6	0.154	0.215	0.262	0.299	0.332	0.41	0.45	0.52	0.57	0.6					
0.4R	0.8	0.178	0.25	0.304	0.349	0.387	0.48	0.53	0.62	0.69	0.77					
0.5R	1	0.199	0.28	0.341	0.392	0.436	0.54	0.6	0.71	0.8	0.92	1				
1R	2	0.282	0.398	0.486	0.56	0.624	0.78	0.87	1.05	1.2	1.43	1.73	1.96	2		
1.5R	3	0.346	0.488	0.597	0.688	0.768	0.97	1.08	1.31	1.5	1.8	2.24	2.65	2.83		
2R	4	0.399	0.564	0.69	0.796	0.889	1.12	1.25	1.52	1.74	2.11	2.65	3.2	3.46	4	
2.5R	5	0.447	0.631	0.722	0.891	0.995	1.25	1.4	1.71	1.96	2.37	3	3.67	4	4.9	
3R	6	0.489	0.692	0.846	0.977	1.091	1.38	1.54	1.87	2.15	2.62	3.32	4.08	4.47	5.66	6
4R	8	0.565	0.799	0.978	1.129	1.261	1.59	1.78	2.17	2.5	3.04	3.87	4.8	5.29	6.93	7.75
5R	10	0.632	0.894	1.094	1.262	1.411	1.78	1.99	2.43	2.8	3.41	4.36	5.43	6	8	9.17
6R	12	0.693	0.979	1.198	1.383	1.546	1.95	2.18	2.67	3.07	3.75	4.8	5.99	6.63	8.94	10.39
7R	14	0.748	1.058	1.295	1.495	1.67	2.11	2.36	2.88	3.32	4.05	5.2	6.5	7.21	9.8	11.49
8R	16	0.8	1.131	1.384	1.598	1.786	2.26	2.52	3.08	3.56	4.34	5.57	6.97	7.75	10.58	12.49
9R	18	0.848	1.199	1.468	1.695	1.895	2.39	2.68	3.27	3.77	4.61	5.92	7.42	8.25	11.31	13.42
10R	20	0.894	1.264	1.548	1.787	1.997	2.52	2.82	3.45	3.98	4.86	6.24	7.84	8.72	12	14.28

Calculation of Actual Diameter

$$d=2\sqrt{Ap(D-Ap)}$$



Guide Lines

Tool Materia

MG Carbide

Micro Grain

UMG Carbide

Ultra Micro Grain

Coating Type

TiAlN F-NaNo

High heat resistance, high oxidation resistance, nanocomposite coating with lubrication property.
Suitable for any materail and steels < 48HRC.

TiAlN F-Top

High wear resistance, high oxidation resistance, thermal insulation, edge passivation.
Suitable for drilling application in any kind of steels.

AlTiN X

Very high heat resistance and oxidation resistance.
Suitable for steels < 52HRC.

AlTiCrN X

Multilayer, higher hardness, high oxidatino resistance, good thermal insulation.
Suitable for steels < 56HRC.

AlTiCrN HX

Multilayer, higher hardness, high oxidatino resistance, good thermal insulation.
Suitable for steels < 56HRC.

AlTiSiN GX

Multilayer, higher nanohardness, extremly high heat resistance, very good thermal insulation
Suitable for high performance machining condition and also for midhardness alloy steels < 68HRC.

one AlTiCrN SX

Multilayer, higher hardness, high oxidation resistance、high wear resistance.
Suitable for machining stainless steels

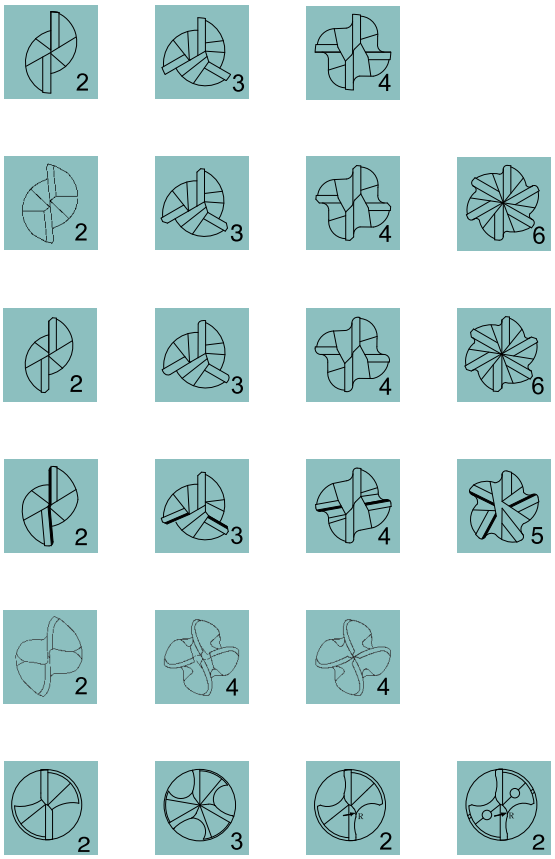
AlCrSiN TX

Multilayer with high coating thickness , extremely high wear resistance、heat resistance.
Suitable for milling in heavily machinable materials

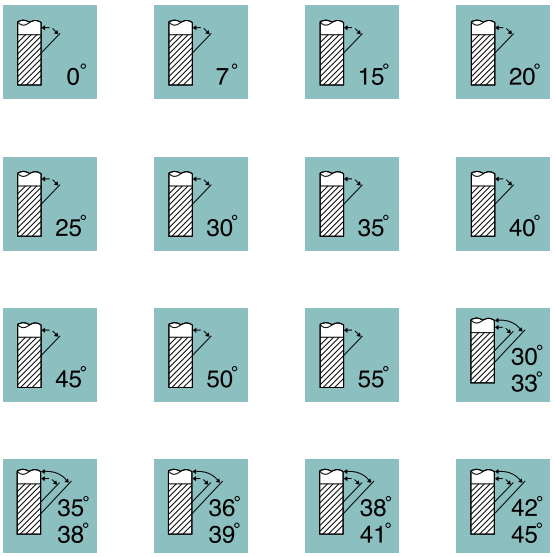
Diamond Dc

Extremely high hardness、good chemical stability.
Suitable for machining graphite.

Number of Flute



Helix Angle



Guide Lines

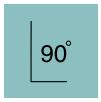
Relief

Slant Relief

Eccentric Relief

Big Eccentric Relief

Corner of Cutting Edges



Sharp

Ball Nose

Corner Edge 45°

Corner Radius

Series Length

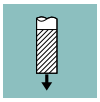
Stub Length

Standard Length

Long Length

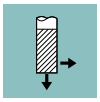
Extra Long Length

Machining Direction

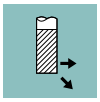


Slotting

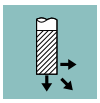
Side Milling



Side Milling / Slotting

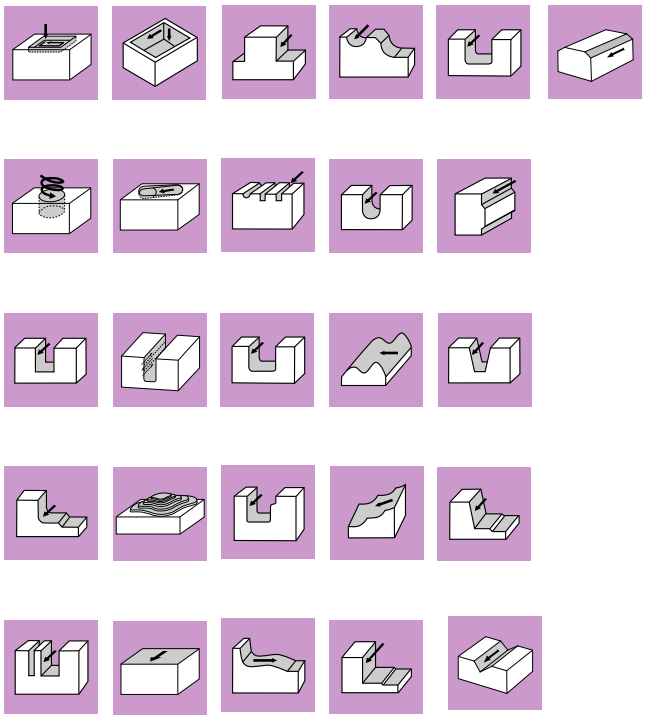


Side Milling / Profile Milling



Side Milling / Profile Milling / Slotting

Type of Operation



Coating type for work material

∈∴≈ ∇≈:‖ ∨‖ ∪::∅≅ ∧≌‖ ∧≅≠ :∴ ~‖≠∫ ≌:‖ :‖

		⇶≌≡≈≈≠ ~‖≠∫ ≌:‖ :≅ ∨	∈∴≈ ≒≈:‖ ∨‖											
			TiAlN F-NaNo	TiAlN F-TOP	AlTiN X	AlTiCrN X	AlTiCrN HX	AlTiSiN GX	AlTiSiN NX	*one* AlTiCrN SX	AlCrSiN TX	CrN W	DLC AX	Diamond DC
P	GR.1	∇≠‖ ::⊂ ∀∫ ::∫ ∪:≌ ∨‖ ∽∾‖ ∅	●	●	●	●	●	●	●					
P	GR.2	∇≠‖ ::⊂ <24HRC ∀∴∮ :≅ ::∫ ∪:≌ ∨‖ ∽∾‖ ∅	●	●	●	●	●	●	●					
P	GR.3	∇≠‖ ::⊂ <30HRC ∀∫ ::∫ ∪:≌ ∨‖ ∽∾‖ ∅	●	●	●	●	●	●	●					
H	GR.4	∇≠‖ ::⊂ 30~38HRC ⇷‖ :‖ ::∫ ∽∾‖ ∅	●	●	●	●	●	●	●					
H	GR.5	∇≠‖ ::⊂ 38~48HRC ⇷‖ :‖ ::∫ ∽∾‖ ∅	●	●	●	●	●	●	●					
H	GR.6	∇≠‖ ::⊂48~56HRC ⇷‖ :‖ ::∫ ∽∾‖ ∅		○	○	●	●	●	●					
H	GR.7	∇≠‖ ::⊂ 56~68HRC ⇷‖ :‖ ::∫ ∽∾‖ ∅						●	●					
M	GR.8	∇≠‖ ::⊂ ∀∫ ≌∬‖ ∨∫ ⊄≫‖ ∅	○	○	○	●	●	●	●	●	○			
K	GR.9	∑≡∩≅∽	●	●	●	●	●	●	●					
N	GR.10	⇳::⊄ ~ ∴:∽∴∵	○	○	○	○	○	○	○				●	
N	GR.11	⇿∫ ∪⊂	○	○	○	○	○	○	○			●		
N	GR.12	∃:‖ ≒≠∴:												
N	GR.13	⇦≅ ~ ≈≅∮ :≠∽↗∫ ⇿‖ ≠∫ ≌:‖ ::↗												
N	GR.14	⇶≒‖ ≤ :≠												●
S	GR.15	∈:≠‖ ∽				○	○	○	○	○	●			
S	GR.16	∀∴:∫ ::⊂				○	○	○	○	○	●			
S	GR.17	∇≠‖ ::⊂ ⇿‖ ≌≈≌ ≧∽‖ ∅				○	○	○	○	○	●			

Special End Mills Inquiry Form

Customers

Tel Fax

contatc Ext

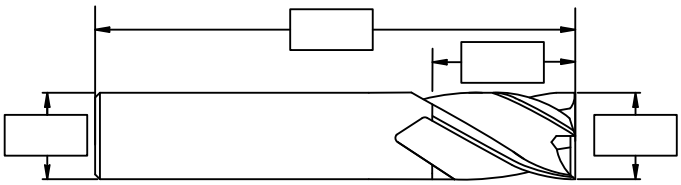
E-maill:

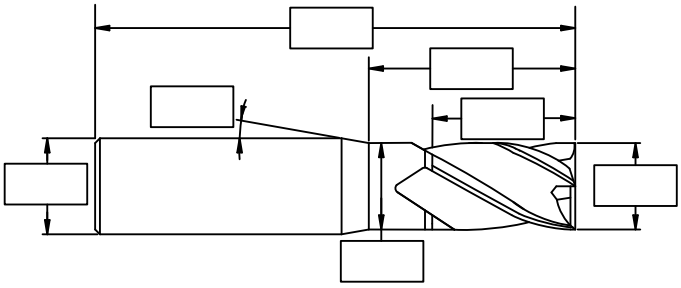
Date:

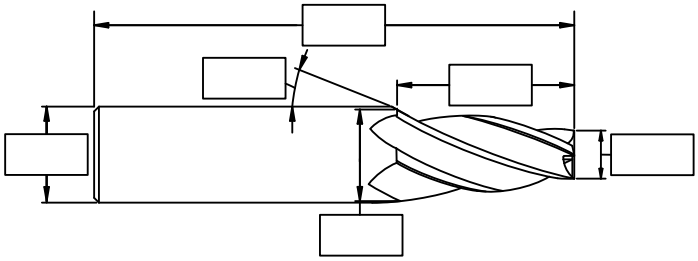
material to be cut _____ Hardened _____

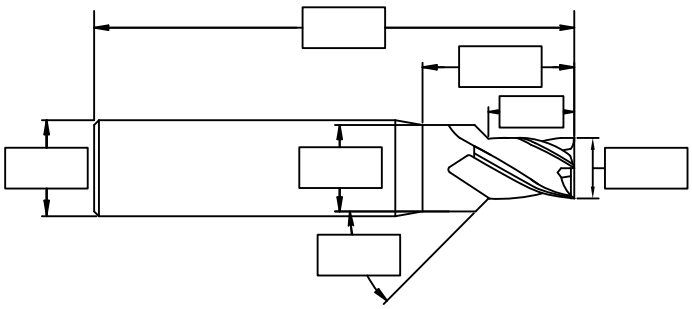
Works Type Ap: ☐ mm Ae: ☐ mm

Quantities,pcs _____ conting ☐ Coating ☐ Uncoating

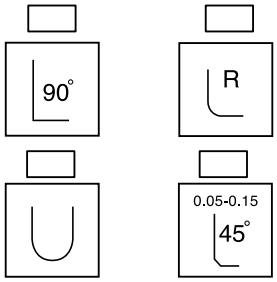




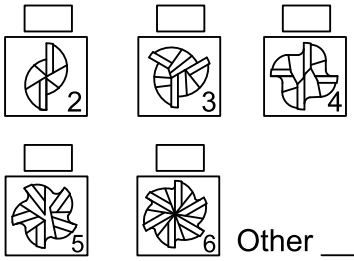




corner of cutting angle

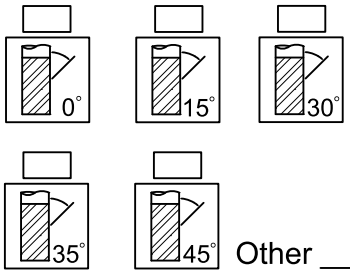


teeth



Other _____

Helix Angle



Other _____

Remarks

Special Drills Inquiry Form

Customers

Tel Fax

contatc Ext

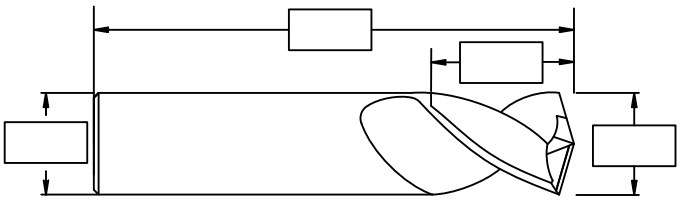
E-maill:

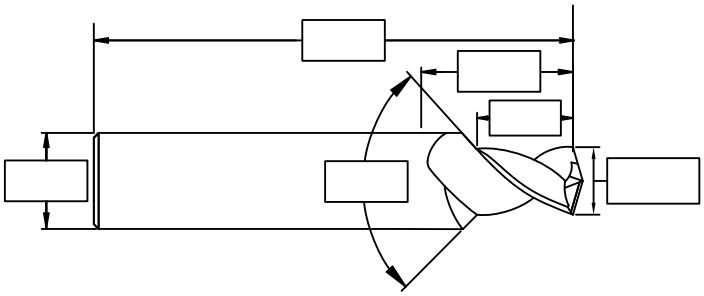
Date: Y M D

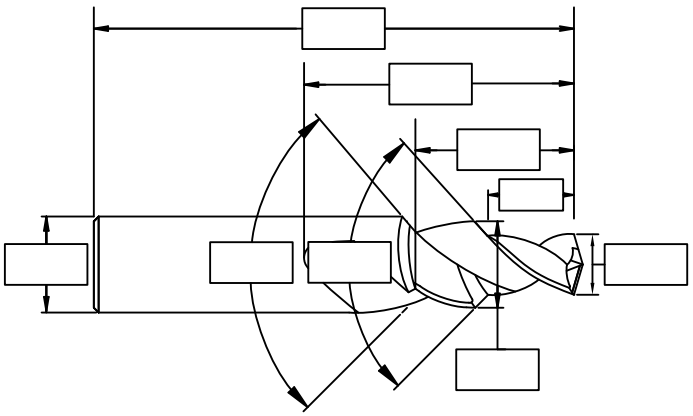
material to be cut _____ Hardened _____

Works Type Dp: ☐ mm coolant holes: ☐ yes ☐ no

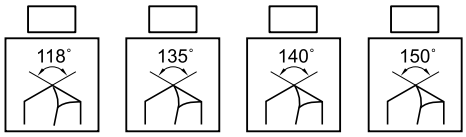
Quantities,pcs _____ conting ☐ Coating ☐ Uncoating



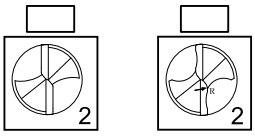




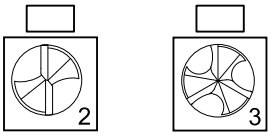
Point Angle



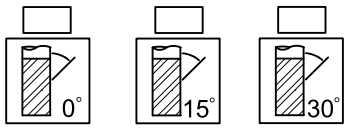
Point Type

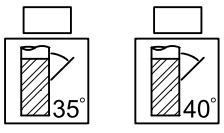


teeth



Helix Angle





Other _____

Remarks

Special Reamers Inquiry Form

Customers

Date: Y M D

Tel Fax

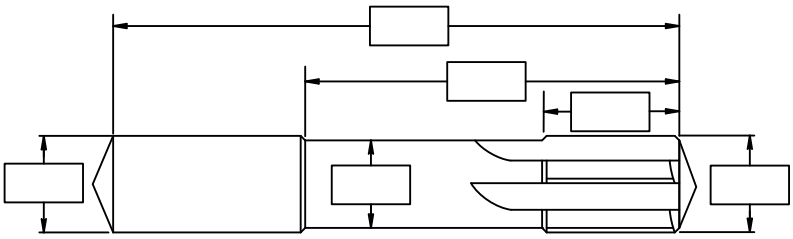
material to be cut _____ Hardened _____

contatc Ext

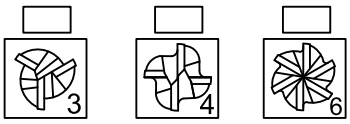
Works Type Dp: ☐ mm

E-maill:

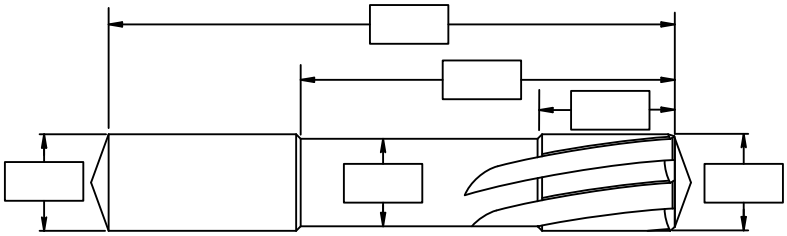
Quantities,pcs _____ conting ☐ Coating ☐ Uncoating



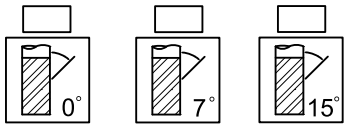
teeth

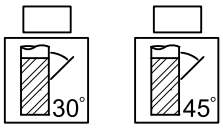


Other _____

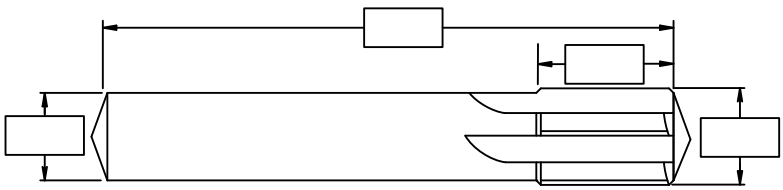


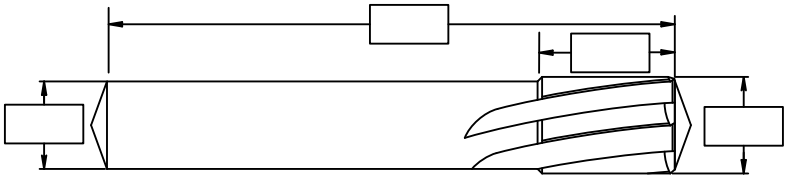
Helix Angle





Other _____





Remarks

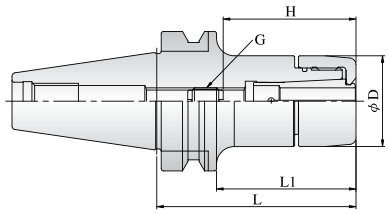

7leaders™
The Art of Cutting

High Speed Collet Chuck

JIS B 6339 / BT40

○ HPC ● HSC

Code No.	L mm	L1 mm	D mm	G mm	H mm	Collet	Nut	Spanner
BT30-HSC8-50AM	50	28	30	L-M10	32-46	HSC8	CN-HSC8AM	SP-SR30
BT30-HSC8-75AM	75	53	30	L-M10	32-64	HSC8	CN-HSC8AM	SP-SR30
BT40-HSC8-60AM	60	33	30	L-M10	32-70	HSC8	CN-HSC8AM	SP-SR30
BT40-HSC8-90AM	90	63	30	L-M10	32-70	HSC8	CN-HSC8AM	SP-SR30
BT40-HSC12-60AM	60	33	42	L-M12	40-70	HSC12	CN-HSC12AM	SP-SR42
BT40-HSC12-90AM	90	63	42	L-M12	40-80	HSC12	CN-HSC12AM	SP-SR42

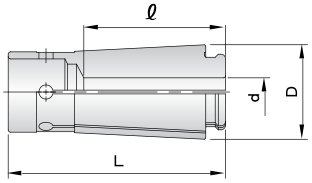


- ☑ Runout accuracy < 5μm. (4 X D)
- ☑ Chuck body fine balanced.
- ☑ Highest Spindle speed: 30,000RPM ; G2.5
- ☑ Collets specially designed for end mills. Collets with small angle enhance the stiffness rigidity and clamping force on end mills.
- ☑ The coolant can spurt out from the collet slot.
- ☑ ⋹ ⩾≃ ≒⊂ ∧∴∫ ∽∴◸
- ☑ ∃‖ ≠⩾ ∽ ≈⨌ :⋐‖ ≒≃ ≒∧‖ :⁞‖ ∽≒∴⩾ ∨‖ ∽.
- ☑ ⇵↗ ≒ :‖ ◸ ∇ :≡ ⩾ ≒⊂ ∨⋐‖ ≫∫ ∽∴◸≪≈∴∽∪∫ ::◸ **30000** ≅ ∧≅ ⩾≠≅ ∨ ∨ ~ ∴∽≠≒ **G2.5**
- ☑ ∏‖ ∽∩∴ ≒≈∫ ≦∴‖ ::⊂≃ ⋐‖ ∮ ⋐‖ ∧≅≠‖ ∽ ∪::◸ :≡ ∽≦∫ ∨↗ ≥ ≤ ⨌∫ ∮. ∏‖ ∽∩∴ ≒ ~‖ ::↗ ~ ≡∩≒ ~ ≈≃ ∨↗≪∫ ∽∴◸ ∬∫ ≒≠ :≡ ≒≠∴ ∬∫ ≒≠ :≡ ≒≠∴ ∴ ≈⩾∴∬ ∴~ ∽≡∉ ≒∴:::≡ ∽‖ :≡ ∽≦∫ ∨↗ ≥ ≤ ⨌∫ ∮.
- ☑ ∂ ≥:⁞‖ ∬ ∪‖ ∉≫∫ ∵ ∬ ∴∪:≡ ≒≠∴ ~≅ ∬∫≠ ≈≃ ∪‖ ∨‖≠⊂≒◸ ∴∮ ≦‖ ∽ⱷ ∨≅ ⱷ ≒:≅≠‖.

Collet

When put end mill into collet must reach length "ℓ" to get best performance

Code No.	d mm	ℓ mm	D mm	L mm
HSC8-03	3	15	15.6	35
04	4	20		
05	5	25		
06	6	25		
08	8	25		
HSC12-03	3	15	20	46
04	4	20		
05	5	25		
06	6	30		
08	8	34		
10	10	34		
12	12	34		



HSC Nut

Code No.	Outside Dia
CN-HSC8AM	30
CN-HSC12AM	42

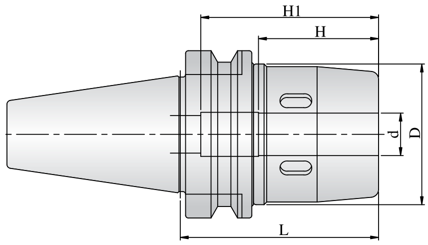
HSC Spanner

Code No.	Interior Dia
SP-SR30	30
SP-SR42	42

● HPC ○ HSC

Code No.	L mm	D mm	d mm	H mm	H1 mm	Collet
BT40-HPC20-90	90	57	20	47	90	HPC20

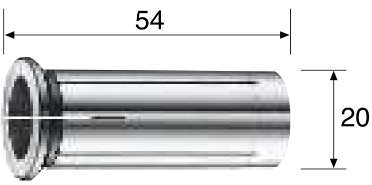
Remark：H = ø20min tool length



- ✓ Runout accuracy < 5μm. (4 X D)
- ✓ Chuck body fine balanced.
- ✓ Highest Spindle speed : 30,000RPM ; G2.5
- ✓ Design by needle roller bearing, it can bring powerful clamping force.
- ✓ The coolant can spurt out from the collet slot.

- ✓ ⋐≧∽≒≠⊂∧∴∫∽∴⊅
- ✓ ∃‖≠≌∽≈≌∫ :≌‖≒∽≒ ≒∧‖ :‖ ∽≒∴≌ ∨‖ ∽.
- ✓ ⇃↾⊁ ≒ :‖ ⊅ ∇ :≡ ≌ ≒⊂ ∨≌‖ ≫∫ ∽∴⊅≪≈∴∽∪∫ ::⊅ **30.000RPM; G2.5**
- ✓ ∅‖∮≌‖ ∧≡≠‖ ∽∽⊁∫ ∴⋒ ::⊂≧‖≠⊁∫ ≈ ∪≪∴≈∽∴:∴ ≈∮ ∨≡ ::⊅⊄≠ ≈≌ ∴∮ ∨∫ ≒∴ ~≡≫∽≡⊄ ⇷‖ ∬ ∴~∽≡⊄ ≒∴::≡
- ✓ ∂≥::‖ ∬∪‖ ⊄≫∫ ∵ ∬ ∴∪:≡ ≒∴ ~≡ ∬∫≠ ≈ ∪‖ ∨‖≠⊂≒⊅ ∴∮ ≦‖ ∽⋒ ∨≡ ⋒ ≒:≡≠‖.

Collet



Code No.	Ø d
HPC20-06	6
HPC20-08	8
HPC20-10	10
HPC20-12	12
HPC20-16	16

Spanner

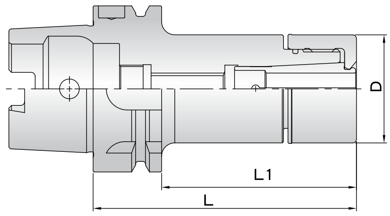
Code No.	No. 30194-704

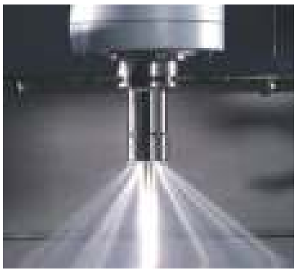
High Speed Collet Chuck

DIN 69839-1 / HSK63A

○ HPC ● HSC

Code No.	L mm	L1 mm	D mm	Collet	Nut	Spanner
HSK63A-HSC8-75AM	75	49	30	HSC8	CN-HSC8AM	SP-SR30
HSK63A-HSC12-75AM	75	49	42	HSC12	CN-HSC12AM	SP-SR42
HSK63A-HSC12-100AM	100	74	42	HSC12	CN-HSC12AM	SP-SR42





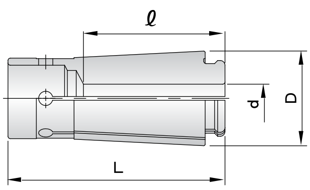
- √ Runout accuracy < 5μm. (4 X D)
- √ Chuck body fine balanced.
- √ Highest Spindle speed: 30,000RPM ; G2.5
- √ Collets specially designed for end mills. Collets with small angle enhance the stiffness rigidity and clamping force on end mills.
- √ The coolant can spurt out from the collet slot.

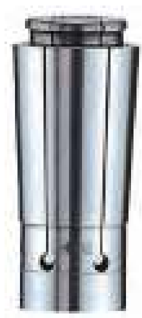
⋐≅ ≩∽≅ ≢⊂ ∧∴∫ ∽∴⊅
∃‖≠≌ ∽ ≈≌∫ :≌‖ ≒∽≅ ≒∧‖ :‖ ∽≒∴≌ ∨‖ ∽.
↓↑≯ ≒ :‖ ⊅ ∇ :≅ ≌ ≢⊂ ∨≌‖ ≫∫ ∽∴⊅≪≈∴∽∪∫ ::⊅ **30000** ≅ ∧≅ ≌≠≅ ∨ ∨ ~ ∴∽≢≒ **G2.5**
∏‖ ∽∩. ≒≈∫ ≦∴‖ ::⊂∽≅ ≌‖∮ ≌‖ ∧≅≠‖ ∽ ∪::⊅ :≅ ∽≦∫ ∨≯ ≥ ≤ ≌∫∮. ∏‖ ∽∩. ≒ ~‖ ::≯ ~ ≡∩≅ ~
≈≅ ∨≯≪∫ ∽∴⊅ ∬∫ ≢ :≅ ≢∴ ∬∫ ≢ :≅ ≢∴ ∴ ≈≌∴∬ ∴~ ∽≡⊄ ≒∴::≡ ∽‖ :≅ ∽≦∫ ∨≯ ≥ ≤ ≌∫∮.
∂ ≥::‖ ∬∪‖ ⊄≫∫ ∵ ∬ ∴∪:≅ ≢∴ ~≅ ∭∫≠ ≈≅∪‖ ∨‖≠⊂≒⊅ ∴∮ ≦‖ ∽∩ ⊻≅ ∩ ≒:≅≠‖.

Collet

When put end mill into collet must reach length "ℓ" to get best performance

Code No.	d mm	ℓ mm	D mm	L mm
HSC8-03	3	15		
04	4	20		
05	5	25	15.6	35
06	6	25		
08	8	25		
HSC12-03	3	15		
04	4	20		
05	5	25		
06	6	30	20	46
08	8	34		
10	10	34		
12	12	34		





HSC Nut

Code No.	Outside Dia
CN-HSC8AM	30
CN-HSC12AM	42

HSC Spanner

Code No.	Interior Dia
SP-SR30	30
SP-SR42	42

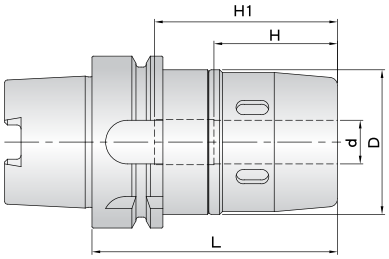
Powergrip Collet Chuck

DIN 69839-1 / HSK63A

● HPC ○ HSC

Code No.	L mm	D mm	d mm	H mm	H1 mm	Collet
HSK63A-HPC20-105	105	57	20	47	75	HPC20

Remark：H = ø20min tool length



- ☑ Runout accuracy < 5μm. (4 X D)
- ☑ Chuck body fine balanced.
- ☑ Highest Spindle speed : 30,000RPM ; G2.5
- ☑ Design by needle roller bearing, it can bring powerful clamping force.
- ☑ The coolant can spurt out from the collet slot.

∈≅ ≥∽≅ ≒∴ ∧∴∫ ∽∴∅
∃‖ ≠≌ ∽ ≈≌∫ :≌‖ ≒∽≅ ≒∧‖ ::‖ ∽≒∴≌ ∨‖ ∽.
⇃↑≯ ≒ :‖ ∅ ∇ :≅ ≌ ≒⊂ ∨≌‖ ≫∫ ∽∴∅≪≈∴∽∪∫ ::∅ **30.000RPM; G2.5**
↞∴∮‖ ∵∽ ∴∩∓ ::⊂≧‖ ≠≯ ≥ ≈≅ ∪≪∴≈∽∴ :≅ ∨, ≅ ∽≅ ~≅ ∬∫≠ ≈≌∴∽∫ ≒≠∴ ~≅≫∽≡∉ ≈≌∴∬ ∴~ ∽≡∉ ≒∴::≒
∂ ≥:‖ ∬ ∪‖ ∉≫∫ ∵ ∬ ∴∪:≅ ≒⊂ ~≅ ∬∫≠ ≈≅ ∪‖ ∨‖≠⊂≒∅ ∴∮ ≦‖ ∽∩∓ ∨≅ ∩∓ ≒:≅≠‖.

Collet

Code No.	Ø d
HPC20-06	6
HPC20-08	8
HPC20-10	10
HPC20-12	12
HPC20-16	16

Spanner

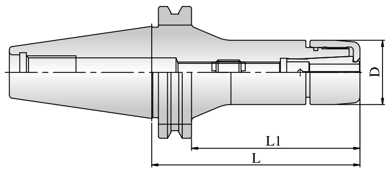
Code No.	No. 30194-704

High Speed Collet Chuck

DIN 69871 / SK40

○ HPC ● HSC

Code No.	L mm	L1 mm	D mm	G mm	H mm	Collet	Nut	Spanner
SK40-HSC8-63AM	63	44	30	L-M10	32-70	HSC8	CN-HSC8AM	SP-SR30
SK40-HSC12-100AM	100	81	42	L-M12	40-80	HSC12	CN-HSC12AM	SP-SR42



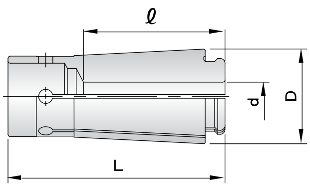
- ✓ Runout accuracy < 5μm. (4 X D)
- ✓ Chuck body fine balanced.
- ✓ Highest Spindle speed: 20,000RPM ; G2.5
- ✓ Collets specially designed for end mills. Collets with small angle enhance the stiffness rigidity and clamping force on end mills.
- ✓ The coolant can spurt out from the collet slot.

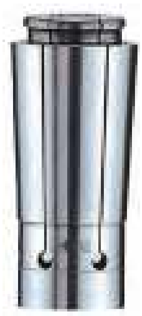
⋐≅ ≧∽≅ ≒≠⊂ ∧∴∫ ∽∴⊅
∃‖≠≌ ∽ ≈≌∫ :≌‖ ≒∽≅ ≒∧‖ ::‖ ∽≒∴≌ ⋎‖ ∽.
↓↑⊁ ≒≅ :‖ ⊅ ∇ :≅ ≌ ≒≠⊂ ∨≌‖ ≫∫ ∽∴⊅≪≈∴∽∪∫ ::⊅ **20000** ≅ ∧≅ ≌≠≅ ∨ ∨ ~ ∴∽≡≠≓ **G2.5**
∏‖ ∽∩∴ ≒≈∫ ≦∴‖ ::⊂∽≅ ≌‖∳ ≌‖ ∧≅≠‖ ∽ ∪::⊅ :≅ ∽≦∫ ∨⊁ ≥ ≤ ≌∫∳. ∏‖ ∽∩∴ ≒ ~‖ ::⊁ ~ ≡∩:≅ ~
≈≅ ∨⊁≪∫ ∽∴⊅∬∫ ≒≠ :≅ ≒≠∴ ∬∫ ≒≠ :≅ ≒≠∴ ∴ ≈≌∴∬ ∴~∽≡⊄ ≒∴::≡ ∽‖ :≅ ∽≦∫ ∨⊁ ≥ ≤ ≌∫∳.
∂≥::‖ ∬⋓‖ ⊄≫∫ ∵ ∬ ∴∪:≅ ≒≠∴ ~≅ ∬∫≠ ≈≅ ⋓‖ ⋎‖≠⊂≒⊅ ∴∳ ≦‖ ∽⋒≢ ⋎≅ ⋒≢ ≒:≌≠‖.

Collet

When put end mill into collet must reach length "ℓ" to get best performance

Code No.	d mm	ℓ mm	D mm	L mm
HSC8-03	3	15	15.6	35
04	4	20		
05	5	25		
06	6	25		
08	8	25		
HSC12-03	3	15	20	46
04	4	20		
05	5	25		
06	6	30		
08	8	34		
10	10	34		
12	12	34		





HSC Nut

Code No.	Outside Dia
CN-HSC8AM	30
CN-HSC12AM	42

HSC Spanner

Code No.	Interior Dia
SP-SR30	30
SP-SR42	42

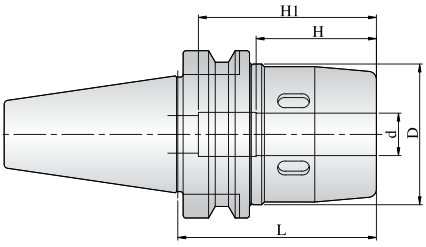
Powergrip Collet Chuck

DIN 698371 / SK40

● HPC ○ HSC

Code No.	L mm	D mm	d mm	H mm	H1 mm	Coolet
SK40-HPC20-95	95	57	20	47	90	HPC20

Remark：H = ø20min tool length



- ☑ Runout accuracy < 5μm. (4 X D)
- ☑ Chuck body fine balanced.
- ☑ Highest Spindle speed : 20,000RPM ; G2.5
- ☑ Design by needle roller bearing, it can bring powerful clamping force.
- ☑ The coolant can spurt out from the collet slot.

∈≅≤≃≒∴ ∧∴∫ ≃∴∅
∃‖≠≌≃ ≈≌∫ :≌‖ ≒≃≅ ≒∧‖ ::‖ ≃≒∴≌≅ ∨‖ ≃.
⇵↗ ≒≅ :‖ ∅ ∇ :≅ ≌≅ ≒⊄ ∨≌‖ ≫∫ ≃∴∅≪≈∴≃∪∫ ::∅ **30.000RPM; G2.5**
↞∴∮‖ ∵≃ ∴∩∄::⊂≧‖≠↗≥ ≃≅∪≪∴≈≃∴ :≅ ∨, ≅≃≅ ~≅∬∫≠ ≈≌∴≃∫ ≒≠∴ ~≅≫≃≡∉ ≈≌∴∬∴~≃≡∉ ≒∴::≒
∂≥:‖ ∬∪‖ ∉≫∫ ∵ ∬∴∪:≅ ≒≠⊂~≅∬∫≠ ≃≅∪‖ ∨‖≠⊂≒∅∴∮ ≦‖ ≃∩∄∨≂∩∄ ≒:≅≠‖.

Collet

Code No.	Ø d
HPC20-06	6
HPC20-08	8
HPC20-10	10
HPC20-12	12
HPC20-16	16

Spanner

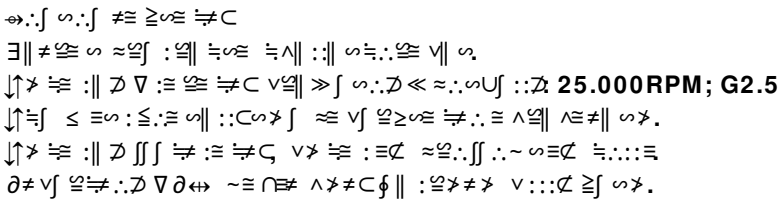
Code No.	No. 30194-704

Powergrip Shrink Chuck

JIS B 6339 / BT40

● HPC ● HSC

- ☑ Runout accuracy < 3μm.
- ☑ Chuck body fine balanced.
- ☑ Highest Spindle speed : 25,000RPM ; G2.5
- ☑ All functional surfaces machined.
- ☑ High rigidity, high clamping force.
- ☑ Cool Jet bores that can be sealed included.



25.000RPM; G2.5

- ☑ Runout accuracy < 3μm.
- ☑ Chuck body fine balanced.
- ☑ Highest Spindle speed : 25,000RPM ; G2.5
- ☑ All functional surfaces machined.
- ☑ High rigidity, high clamping force.
- ☑ 2 type: Standard (3 mm wall thickness) and extra slim (1.5 mm wall thickness)

■ The powergrip shrink chucks are supplied by HAIMER, for size specification please refer to www.haimer.com

Powergrip Shrink Chuck

DIN 69893-1 / HSK63A

● HPC ● HSC

- ✓ Runout accuracy < 3μm.
- ✓ Chuck body fine balanced.
- ✓ Highest Spindle speed : 25,000RPM ; G2.5
- ✓ All functional surfaces machined.
- ✓ High rigidity, high clamping force.
- ✓ Cool Jet bores that can be sealed included.

⇻∴∫ ∽∴∫ ≉≅ ≧∽≅ ≒⊂
∃∥≠≌∽ ≈≌∫ :≌∥ ≒∽≅ ≒∧∥ ::∥ ∽≒∴≌ ∨∥ ∽.
⇅≯ ≒≅ :∥ ⊅ ∇ :≅ ≌ ≒⊂ ∨≌∥ ≫∫ ∽∴⊅ ≪ ≈∴∽∪∫ ::⊅ **25.000RPM; G2.5**
⇅≒∫ ≤ ≡∽ : ≦∴≅ ∽∥ ::⊂∽≯∫ ≈≅ ∨∫ ≌≥∽≅ ≒∴≡ ∧≌∥ ∧≅≠∥ ∽≯.
⇅≯ ≒≅ :∥ ⊅ ∬∫ ≒ :≅ ≒⊊ ∨≯ ≒≅ : ≡⊄ ≈≌∴∬ ∴~∽≡⊄ ≒∴::≡
∂≠∨∫ ≌≒∴⊅ ∇∂⇹ ~≡∩≢ ∧≯≠⊂∮∥ :≌≯≠≯ ∨:::⊄ ≧∫ ∽≯.

Powergrip Shrink Chuck

DIN 69871 / SK40

● HPC ● HSC

- ✓ Runout accuracy < 3μm.
- ✓ Chuck body fine balanced.
- ✓ Highest Spindle speed : 25,000RPM ; G2.5
- ✓ All functional surfaces machined.
- ✓ High rigidity, high clamping force.
- ✓ Cool Jet bores that can be sealed included.

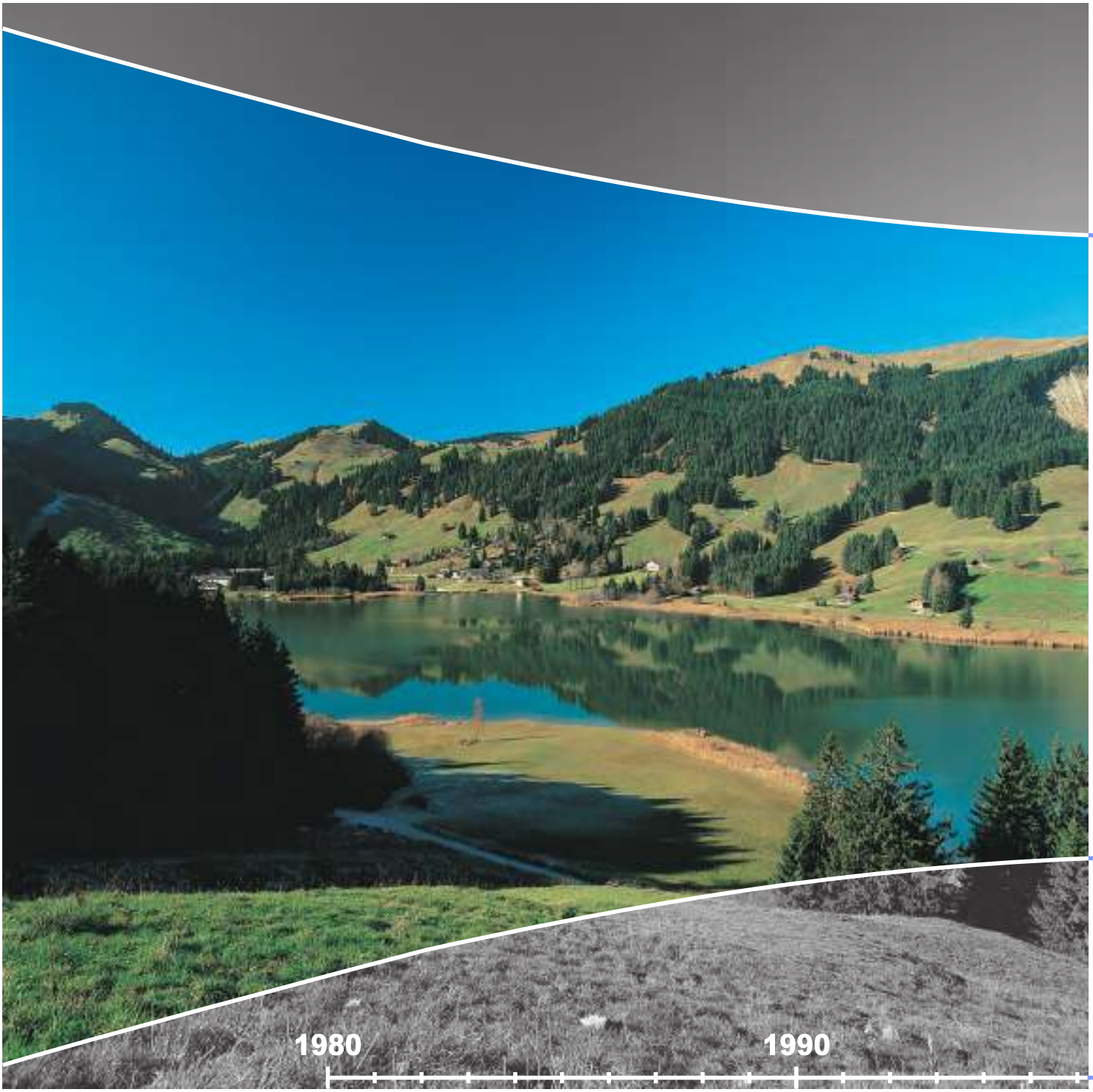
⇻∴∫ ∽∴∫ ≉≅ ≧∽≅ ≒⊂
∃∥≠≌∽ ≈≌∫ :≌∥ ≒∽≅ ≒∧∥ ::∥ ∽≒∴≌ ∨∥ ∽.
⇅≯ ≒≅ :∥ ⊅ ∇ :≅ ≌ ≒⊂ ∨≌∥ ≫∫ ∽∴⊅ ≪ ≈∴∽∪∫ ::⊅ **25.000RPM; G2.5**
⇅≒∫ ≤ ≡∽ : ≦∴≅ ∽∥ ::⊂∽≯∫ ≈≅ ∨∫ ≌≥∽≅ ≒∴≡ ∧≌∥ ∧≅≠∥ ∽≯.
⇅≯ ≒≅ :∥ ⊅ ∬∫ ≒ :≅ ≒⊊ ∨≯ ≒≅ : ≡⊄ ≈≌∴∬ ∴~∽≡⊄ ≒∴::≡
∂≠∨∫ ≌≒∴⊅ ∇∂⇹ ~≡∩≢ ∧≯≠⊂∮∥ :≌≯≠≯ ∨:::⊄ ≧∫ ∽≯.

■ The powergrip shrink chucks are supplied by HAIMER, for size specification please refer to www.haimer.com


7leaders™
The Art of Cutting

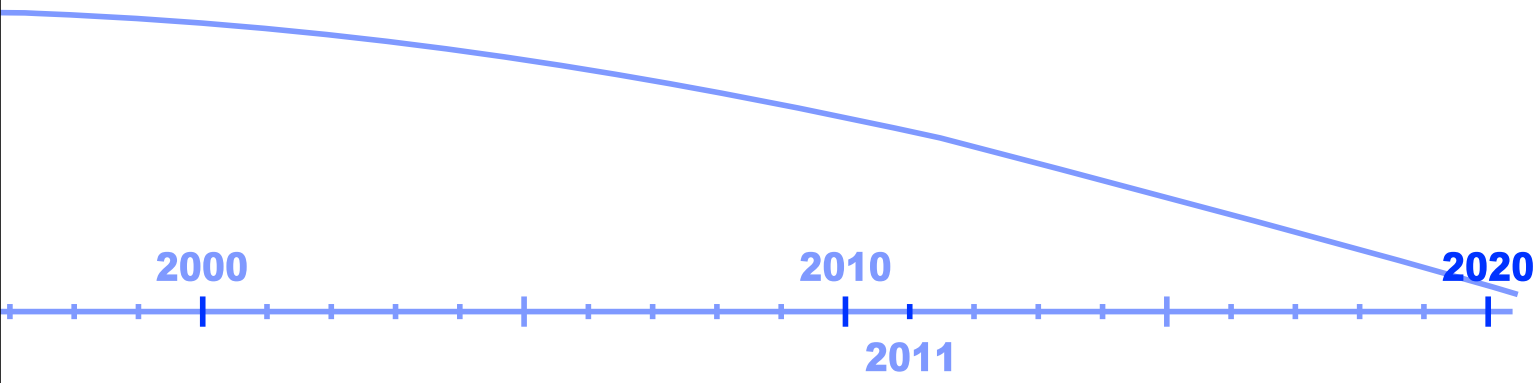
Contents

Factory overview



Our History!

7-Leaders Corp., founded in 1990, and EXTREMET, founded in 1980 in Plaffeien, Switzerland, have been cooperating with each other since 1990. We offer Tungsten Carbide solid rods, Tungsten Carbide tubes, Tungsten Carbide rods with two parallel or twisted coolant holes, Tungsten Carbide squares and rectangular bars. 7-Leaders Corp. has successfully reached a leading position in Tungsten Carbide Rods Industry with its well-known stable quality in Taiwan.

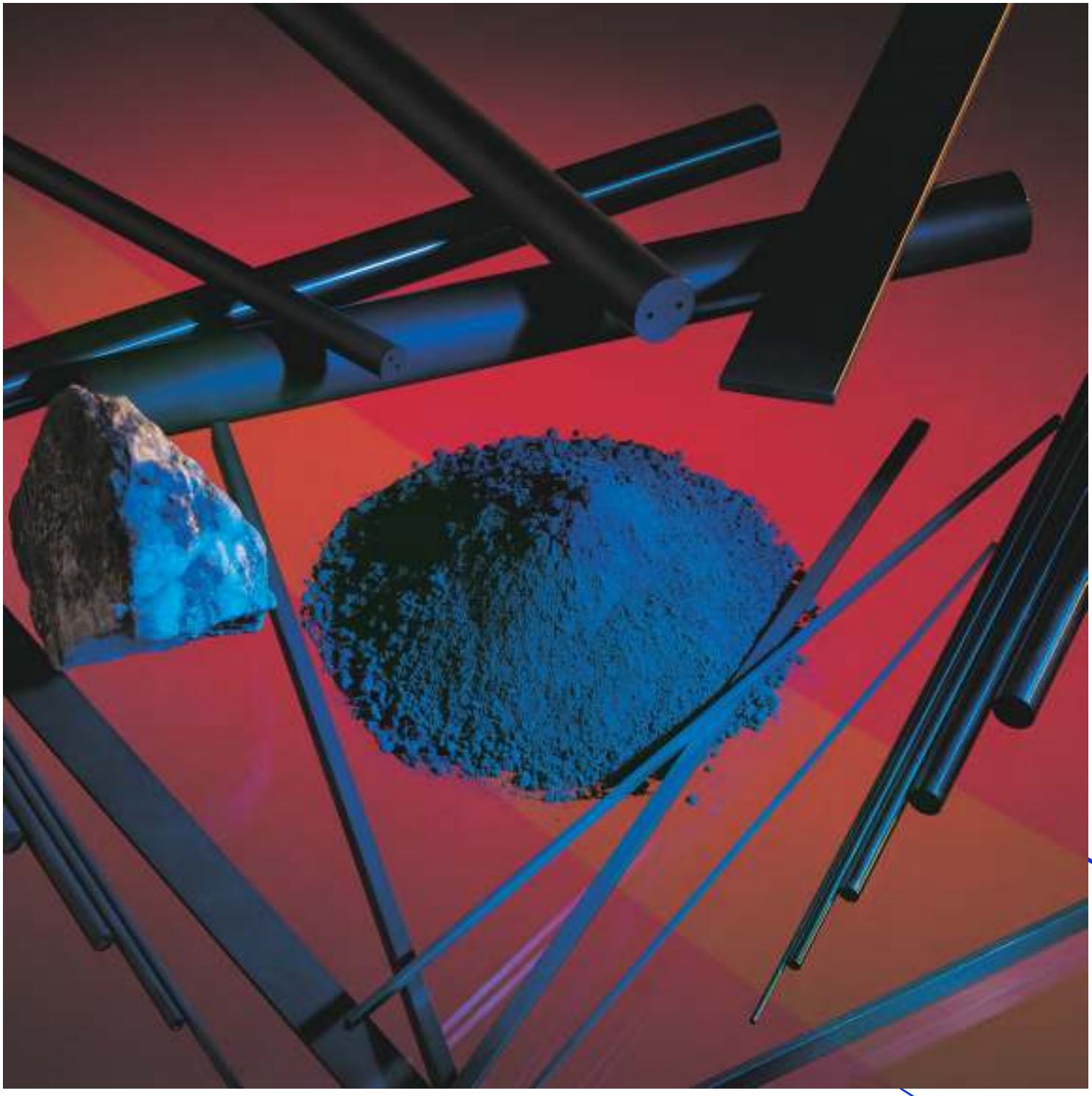


Our Customer Services!

"Quality and Reliability" are two integral parts of our Company's basic policy. We take it as our serious responsibility that we thoroughly understand our customers' market and satisfy their needs. Our professionally well-trained employees are devoted to assisting all our customers, finding solutions for their specific requirements and problems that they encounter.

Continual assessment of our production process, coupled with our experience focusing on R&D, ensures that we are able to offer the highest standard of quality for our full range of Tungsten Carbide products.

R&D **Extramet in Swiss** **7-Leaders Corp. in Taiwan**



Our
Products!

Through the years, our products line has evolved from solid carbide rods to a complete line of extruded tungsten carbide products. Our standard program now includes:

- Tungsten Carbide solid rods.
- Tungsten Carbide tubes.
- Tungsten Carbide rods with two parallel or twisted coolant holes.
- Tungsten Carbide squares and rectangular bars.
- Special Tungsten Carbide parts, manufactured to customer specification.

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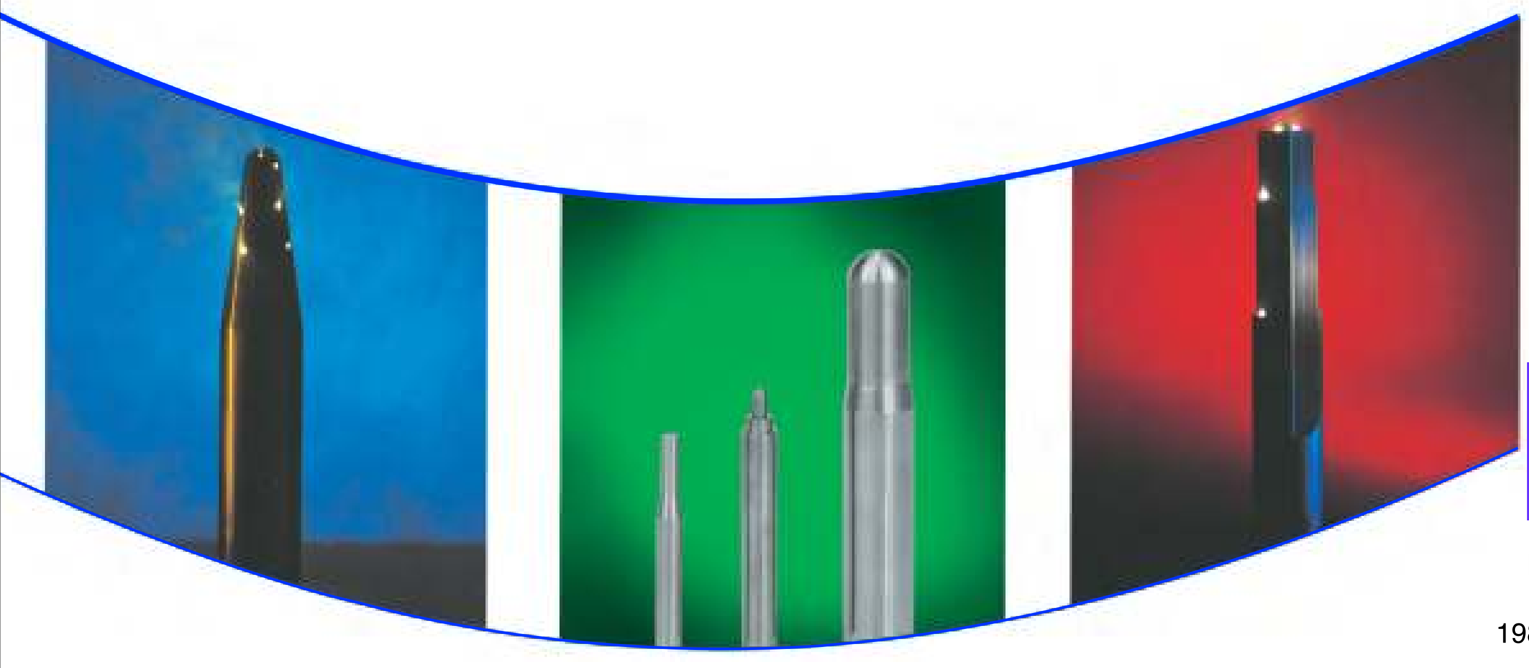


Grade	Wc %	Co %	µm	g/cm³	HV30 N/mm²	TRS N/mm²	Application
M100	94	6	< 0.8	14.80	1790	> 3000	**M100**
M210	90	10	< 0.8	14.45	1570	> 4000	**M210** **TRS** **12:05**
M212	88	12	< 0.6	14.10	1680	> 3600	**M212** **12%,**
M409	91	9	~1.2	14.49	1550	> 3500	**M409**
M412	88	12	~1.2	14.26	1440	> 4000	**M412**
M509	91	9	~1.2	14.50	1560	> 3500	**M509**
M512	88	12	~1.2	14.25	1440	> 4000	**M512**
M609	91	9	< 0.4	14.40	1950	> 4000	**M609** **0.4/ym,**
M610	90	10	< 0.5	14.40	1780	> 4000	**M610** **10%** **48-68 HRC**
M612	88	12	< 0.5	14.10	1720	> 4200	**M612** **12%** **T.R.S.** **64 HRC,**

Grade	Wc %	Co %	Grain size µm	Density g/cm³	Hardness HV30 N/mm²	TRS N/mm²	Application
M100	94	6	< 0.8	14.80	1790	> 3000	M100 Universal grade for the machining of non-ferrous metals, aluminium, copper, porcelain, plastic, cast iron, steel of low hardness and fibre reinforced materials. High wear resistance, excellent suitability for diamond coating.
M210	90	10	< 0.8	14.45	1570	> 4000	M210 Submicron grade with a good impact strength and T.R.S. for the machining of non-ferrous metals, aluminium alloys, nickel alloys and stainless steel. Main submicron grade with broad applications for rotating, solid carbide tools.
M212	88	12	< 0.6	14.10	1680	> 3600	M212 is made of ultrafine tungsten carbide grade. In combination with a Cobalt content of 12%, high hardness and superior toughness are obtained. It is particularly suitable for milling and, due to its high cutting edge stability, well suited for drilling and milling applications in high temperature alloys, stainless steels, cast iron, titanium alloys.
M409	91	9	~1.2	14.49	1550	> 3500	M409 With its cutting edge strength and wear resistance – coupled with its temperature resistance – this grade is primarily aimed at mill roughing, or drilling of heavily machinable materials (example: stainless steel and non corrosive nickel-base alloys).
M412	88	12	~1.2	14.26	1440	> 4000	M412 The exceptional transverse strength paired with a high fracture toughness, predestines this fine grade for the application of heavily machinable materials. High usability in interrupted cutting applications.
M509	91	9	~1.2	14.50	1560	> 3500	M509 This carbide grade, with its specifically developed alloy content, optimises fracture toughness and cutting edge strength. It is ideally suited for applications like dies, punches for fine blanking, powder pressing tools and mandrels.
M512	88	12	~1.2	14.25	1440	> 4000	M512 The exceptional transverse strength paired with a high fracture toughness, predestines this fine grade for dies and punches for steel forming tools. Future applications could include the production of tools from carbide.
M609	91	9	< 0.4	14.40	1950	> 4000	M609 This outstanding ultrafine grade is for high-performance applications. This is made of superfine tungsten carbide with grain sizes smaller than 0.4µm, significantly surpassing the hardness of any other grades. This carbide grade features high cutting- edge stability while maintaining high wear resistance and considerable toughness. This grade is applied in highly wear-resistant materials, such as hardened steels, highstrength aluminium alloys, graphite, as well as new composite materials.
M610	90	10	< 0.5	14.40	1780	> 4000	M610 is our top carbide grade for milling hard materials. High hardness and wear resistance with sufficient toughness are achieved by combination of 10% Cobalt content and a grain size of 0.5µm. This grade was especially developed for end milling applications in materials covering hardness range 48-68 HRC and is recommended for milling in fully hardened and tempered steels, hard cast materials, tempered alloys and tool steels.
M612	88	12	< 0.5	14.10	1720	> 4200	M612 A Cobalt content of 12% is responsible for a high toughness. And a good impact strength and T.R.S. is the essential advantage of this ultrafine grade. For machining of materials hardened up to 64 HRC, mould constructions and machining of hardened steels, titanium alloys, high temperature alloys, stainless steels as well as glass-fiber reinforced plastics.

Tungsten Carbide Rods

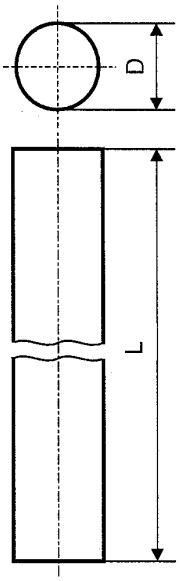
RR-ØD×L Grade

ØDmm Tol	Lmm Tol ±5.0	Grade									
		M100	M210	M212	M609	M610	M612	M409	M412	M509	M512
1.2 -0.05/+0.15	330	●	●								
1.4 -0.05/+0.15	330	●	●								
1.6 -0.05/+0.15	330	●	●								
1.8 -0.05/+0.15	330	●	●								
2.0 -0.05/+0.15	330	●	●								
2.3 -0.05/+0.15	330	●	●								
2.5 -0.05/+0.15	330	●	●								
2.8 -0.05/+0.15	330	●	●								
3.3 -0.05/+0.15	330	●	●	●	●		●		●		●
3.5 -0.05/+0.15	330	●	●								
3.8 -0.05/+0.15	330	●	●								
4.3 -0.05/+0.15	330	●	●	●	●	●	●		●		●
4.8 -0.05/+0.15	330	●	●								
5.0 -0.05/+0.15	330	●	●								
5.3 -0.05/+0.15	330	●	●	●	●		●				
5.5 -0.05/+0.15	330	●	●								
5.8 -0.05/+0.15	330	●	●								
6.3 -0.05/+0.20	330	●	●	●	●	●	●	●	●	●	●
6.7 -0.05/+0.20	330	●	●								
7.3 -0.05/+0.20	330	●	●								
7.8 -0.05/+0.20	330	●	●								
8.3 -0.05/+0.20	330	●	●	●	●	●	●	●	●	●	●
8.8 -0.05/+0.20	330	●	●								
9.3 -0.05/+0.20	330	●	●								
9.8 -0.05/+0.20	330	●	●								
10.3 -0.05/+0.20	330	●	●	●	●	●	●	●	●	●	●
10.8 -0.05/+0.25	330	●	●								
11.3 -0.05/+0.25	330	●	●								
11.8 -0.05/+0.25	330	●	●								
12.3 -0.05/+0.25	330	●	●	●	●	●	●	●	●	●	●
12.8 -0.05/+0.25	330	●	●								
13.3 -0.05/+0.25	330	●	●								
13.8 -0.05/+0.25	330	●	●								
14.3 -0.05/+0.25	330	●	●	●	●		●	●		●	
14.8 -0.05/+0.25	330	●	●								
15.3 -0.05/+0.30	330	●	●								
15.8 -0.05/+0.30	330	●	●								
16.3 -0.05/+0.30	330	●	●	●	●	●	●	●	●	●	●
16.8 -0.05/+0.30	330	●	●								
17.3 -0.05/+0.30	330	●	●								
17.8 -0.05/+0.30	330	●	●								
18.3 -0.05/+0.30	330	●	●	●	●		●	●		●	
18.8 -0.05/+0.30	330	●	●								
19.3 -0.05/+0.30	330	●	●								
19.8 -0.05/+0.30	330	●	●								
20.3 -0.05/+0.30	330	●	●	●	●	●	●	●		●	
20.8 -0.05/+0.40	330	●	●								
21.3 -0.05/+0.40	330	●	●								
21.8 -0.05/+0.40	330	●	●								
22.3 -0.05/+0.40	330	●	●								
22.8 -0.05/+0.40	330	●	●								
23.3 -0.05/+0.40	330	●	●								
24.3 -0.05/+0.40	330	●	●								
25.3 -0.05/+0.40	330	●	●		●		●				
25.8 -0.05/+0.40	330	●	●								
26.3 -0.05/+0.40	330	●	●								
28.3 -0.05/+0.60	330	●	●								
30.3 -0.05/+0.60	330	●	●								
32.6 -0.05/+0.60	330	●	●								

100mm

RRG-ØD×L Grade

ØDmm Tol h6	Lmm Tol ±1.0	Grade		
		M100	M210	M612
1.0	100	●	●	
1.5	100	●	●	
2.0	100	●	●	
2.5	100	●	●	
3.0	100	●	●	●
4.0	100	●	●	●
5.0	100	●	●	●
6.0	100	●	●	●
8.0	100	●	●	●
10.0	100	●	●	●
12.0	100	●	●	●
16.0	100	●	●	●
20.0	100	●	●	●



330mm

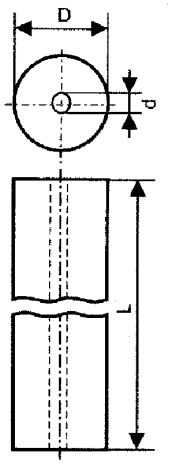
RRG-ØD×L Grade

ØDmm Tol h6	Lmm Tol ±5.0	Grade			
		M100	M210	M609	M612
1.0	330	●	●		
1.5	330	●	●		
2.0	330	●	●		
2.5	330	●	●		
3.0	330	●	●	●	●
4.0	330	●	●	●	●
5.0	330	●	●	●	●
6.0	330	●	●	●	●
7.0	330	●	●		
8.0	330	●	●	●	●
9.0	330	●	●		
10.0	330	●	●	●	●
12.0	330	●	●	●	●
14.0	330	●	●	●	●
16.0	330	●	●	●	●
18.0	330	●	●	●	●
20.0	330	●	●	●	●

Tungsten Carbide Tubes

⑰⑬⑯⑦⑮⑤⑧⑥②⑪⑬④⑱⑯⑨⑦⑩⑫①⑲

⑨⑤⑮(t) RO-ØD×d×L Grade



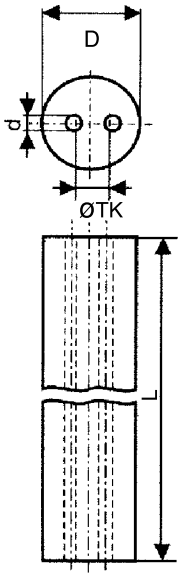
ØDmm Tol	dmm Tol 0/-0.1	Lmm Tol ±5.0	Grade	
			M100	M210
2.3 -0.05/+0.15	0.2	330	●	●
2.3 -0.05/+0.15	0.8	330	●	●
3.3 -0.05/+0.15	0.2	330	●	●
3.3 -0.05/+0.15	0.3	330	●	●
3.3 -0.05/+0.15	0.4	330	●	●
3.3 -0.05/+0.15	0.6	330	●	●
3.3 -0.05/+0.15	0.8	330	●	●
3.3 -0.05/+0.15	1.0	330	●	●
4.3 -0.05/+0.15	0.2	330	●	●
4.3 -0.05/+0.15	0.3	330	●	●
4.3 -0.05/+0.15	0.4	330	●	●
4.3 -0.05/+0.15	0.6	330	●	●
4.3 -0.05/+0.15	0.8	330	●	●
4.3 -0.05/+0.15	1.0	330	●	●
5.3 -0.05/+0.15	1.0	330	●	●
6.3 -0.05/+0.20	0.3	330	●	●
6.3 -0.05/+0.20	0.4	330	●	●
6.3 -0.05/+0.20	0.6	330	●	●
6.3 -0.05/+0.20	0.8	330	●	●
6.3 -0.05/+0.20	1.0	330	●	●
6.3 -0.05/+0.20	1.5	330	●	●
6.3 -0.05/+0.20	2.0	330	●	●
7.3 -0.05/+0.20	1.5	330	●	●
8.3 -0.05/+0.20	1.0	330	●	●
8.3 -0.05/+0.20	1.5	330	●	●
8.3 -0.05/+0.20	2.0	330	●	●
10.3 -0.05/+0.20	1.0	330	●	●
10.3 -0.05/+0.20	1.5	330	●	●
10.3 -0.05/+0.20	2.0	330	●	●
12.3 -0.05/+0.25	1.5	330	●	●
12.3 -0.05/+0.25	2.0	330	●	●
12.3 -0.05/+0.25	2.5	330	●	●
12.3 -0.05/+0.25	3.0	330	●	●
13.3 -0.05/+0.25	2.0	330	●	●
13.3 -0.05/+0.25	2.5	330	●	●
14.3 -0.05/+0.25	2.0	330	●	●
14.3 -0.05/+0.25	2.5	330	●	●
15.3 -0.05/+0.30	2.8	330	●	●
16.3 -0.05/+0.30	2.0	330	●	●
16.3 -0.05/+0.30	3.0	330	●	●
20.3 -0.05/+0.30	2.0	330	●	●
20.3 -0.05/+0.30	3.5	330	●	●
25.3 -0.05/+0.40	5.0	330	●	●
32.6 -0.05/+0.60	5.0	330	●	●

Tungsten Carbide Rods With Two Straight Coolant Holes

Twisted - 30 ° / 40 °

RS-ØD×TK×d×L Grade

ØDmm Tol	TK mm	d mm	Lmm Tol ±5.0	Grade M100
4.3 -0.05/+0.15	1.5	0.9	330	●
5.3 -0.05/+0.15	2.0	0.9	330	●
6.3 -0.05/+0.20	2.0	0.9	330	●
6.3 -0.05/+0.20	3.0	0.9	330	●
7.3 -0.05/+0.20	2.0	0.9	330	●
7.3 -0.05/+0.20	3.5	0.9	330	●
8.3 -0.05/+0.20	2.0	0.9	330	●
8.3 -0.05/+0.20	4.0	0.9	330	●
9.3 -0.05/+0.20	2.6	1.2	330	●
9.3 -0.05/+0.20	4.0	1.2	330	●
10.3 -0.05/+0.20	2.6	1.2	330	●
10.3 -0.05/+0.20	5.0	1.2	330	●
11.3 -0.05/+0.25	3.5	1.5	330	●
11.3 -0.05/+0.25	5.0	2.0	330	●
12.3 -0.05/+0.25	3.5	1.5	330	●
12.3 -0.05/+0.25	6.2	2.0	330	●
13.3 -0.05/+0.25	3.5	1.5	330	●
13.3 -0.05/+0.25	6.2	2.0	330	●
14.3 -0.05/+0.25	3.5	1.5	330	●
14.3 -0.05/+0.25	7.0	2.0	330	●
15.3 -0.05/+0.30	5.0	2.0	330	●
15.3 -0.05/+0.30	7.0	2.0	330	●
16.3 -0.05/+0.30	5.0	2.0	330	●
16.3 -0.05/+0.30	8.0	2.0	330	●
17.3 -0.05/+0.30	6.2	2.0	330	●
17.3 -0.05/+0.30	8.0	2.0	330	●
18.3 -0.05/+0.30	6.2	2.0	330	●
18.3 -0.05/+0.30	9.0	2.0	330	●
19.3 -0.05/+0.30	6.2	2.0	330	●
19.3 -0.05/+0.30	9.0	2.0	330	●
20.3 -0.05/+0.30	6.2	2.0	330	●
20.3 -0.05/+0.30	10.0	2.5	330	●
25.3 -0.05/+0.40	8.0	2.5	330	●
25.3 -0.05/+0.40	12.0	3.0	330	●

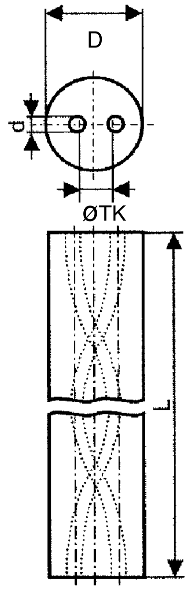


Tungsten Carbide Rods With Two Coolant Ducts Twisted - 30°

⑰⒀⒃7⒂5862⑾⒀418⒃89⒃7⒄4⒃⒇8⒂⒀103⒝817104⒃4418.3⒆1⑾4⑾2⑾3⒆5122⑾⒄⒂⑾⒜16⒃⒇⒄⒆⒂1589⒆30 ° / 40 °

⑨5⒂-⒯ RX-ØD×TK×d×L×Helix angle Grade

ØDmm Tol +0.5	ØTKmm Tol	Ødmm Tol	Pitch Tol ±0.5°	Helix angle of rods	Lmm Tol ±5.0	Cutter Dia of 30° Helix	Grade M210
3.3	1.5	0.4	P16.32	30°	330	3	●
4.3	2.1	0.5	P21.77	30°	330	4	●
5.3	2.6	0.7	P27.21	30°	330	5	●
6.3	2.6	0.7	P32.65	30°	330	6	●
8.3	4.0	1.0	P43.53	30°	330	8	●
10.3	4.8	1.4	P54.41	30°	330	10	●
12.3	5.4	1.5	P65.30	30°	330	12	●
14.3	7.1	1.7	P76.18	30°	330	14	●
16.3	8.3	1.7	P87.06	30°	330	16	●
18.3	9.5	2.0	P97.95	30°	330	18	●
20.3	10.4	2.8	P108.83	30°	330	20	●

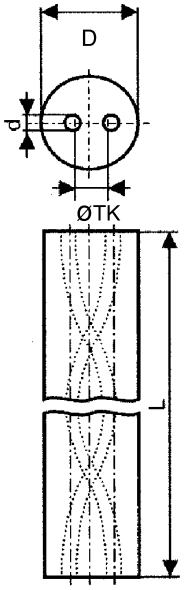


Tungsten Carbide Rods With Two Coolant Ducts Twisted - 30°/40°

⑰⑬⑥7⑮5862⑪⑬4418⑯89⑯7⑰4⑯⑳8⑮⑬103ⓑ8171014⑯4418③⑲1⑪4⑪2⑪3⑲5122⑪⑰⑮⑪ⓐ16⑯⑳⑰⑲⑮1589⑲30 ° / 40 °

⑨5⑮ⓣ RX-ØD×TK×d×L×Helix angle Grade

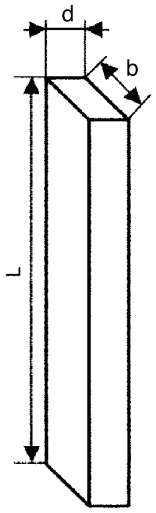
ØDmm Tol +0.5	ØTKmm Tol	Ødmm Tol	Pitch Tol ±0.5°	Helix angle of rods	Lmm Tol ±5.0	Shank h6	Cutter Dia of 30° Helix	Grade M210
6.3	1.6	0.5	P18.00	40°	330	6	3-4	●
6.3	2.0	0.5	P22.46	40°	330	6	4-5	●
6.3	2.6	0.7	P32.65	30°	330	6	5-6	●
8.3	3.5	0.9	P35.00	40°	330	8	6-7	●
8.3	4.0	1.0	P43.53	30°	330	8	7-8	●
10.3	4.5	1.1	P46.00	40°	330	10	8-9	●
10.3	4.8	1.4	P54.41	30°	330	10	9-10	●
12.3	5.4	1.5	P65.30	30°	330	12	10-12	●
14.3	7.1	1.7	P76.18	30°	330	14	12-14	●
16.3	8.3	1.7	P87.06	30°	330	16	14-16	●
18.3	9.5	2.0	P97.95	30°	330	18	16-18	●
20.3	10.4	2.8	P108.83	30°	330	20	18-20	●



Tungsten Carbide Strips ⑰⑬⑯7⑮5862⑪③418⑯652581⑲

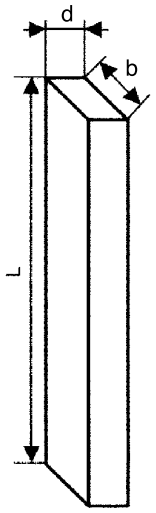
⑨5⑮(t) RTS-d×b×L Grade

d mm Tol +0.2/+0.5	b mm Tol +0.2/+0.5	Lmm Tol ±5.0	Grade	
			M100	M210
1.0	3.0	330	●	●
1.0	4.0	330	●	●
1.5	3.0	330	●	●
1.5	4.0	330	●	●
1.5	5.0	330	●	●
1.5	6.0	330	●	●
1.5	8.0	330	●	●
1.5	10.0	330	●	●
2.0	2.0	330	●	●
2.0	3.0	330	●	●
2.0	4.0	330	●	●
2.0	5.0	330	●	●
2.0	6.0	330	●	●
2.0	8.0	330	●	●
2.0	10.0	330	●	●
2.0	12.0	330	●	●
2.0	15.0	330	●	●
2.0	18.0	330	●	●
2.0	20.0	330	●	●
3.0	3.0	330	●	●
3.0	4.0	330	●	●
3.0	5.0	330	●	●
3.0	6.0	330	●	●
3.0	8.0	330	●	●
3.0	10.0	330	●	●
3.0	12.0	330	●	●
3.0	13.0	330	●	●
3.0	15.0	330	●	●
3.0	18.0	330	●	●
3.0	20.0	330	●	●
3.0	22.0	330	●	●
3.0	25.0	330	●	●
3.0	30.0	330	●	●
4.0	4.0	330	●	●
4.0	6.0	330	●	●
4.0	8.0	330	●	●
4.0	10.0	330	●	●
4.0	12.0	330	●	●
4.0	13.0	330	●	●
4.0	15.0	330	●	●
4.0	18.0	330	●	●
4.0	20.0	330	●	●
4.0	22.0	330	●	●
4.0	25.0	330	●	●
4.0	30.0	330	●	●
4.0	35.0	330	●	●



RTS-d×b×L Grade

d mm Tol +0.2/+0.5	b mm Tol +0.2/+0.5	Lmm Tol ±5.0	Grade	
			M100	M210
5.0	5.0	330	●	●
5.0	8.0	330	●	●
5.0	10.0	330	●	●
5.0	13.0	330	●	●
5.0	16.0	330	●	●
5.0	18.0	330	●	●
5.0	20.0	330	●	●
5.0	22.0	330	●	●
5.0	25.0	330	●	●
5.0	30.0	330	●	●
5.0	35.0	330	●	●
6.0	6.0	330	●	●
6.0	16.0	330	●	●
6.0	20.0	330	●	●
6.0	25.0	330	●	●
6.0	30.0	330	●	●
6.0	35.0	330	●	●
8.0	8.0	330	●	●
10.0	10.0	330	●	●
12.0	12.0	330	●	●



ISO Tolerance measure table (μm)

ϕ mm	< 3	3—6	6—10	10—18	18—30	30—50	50—65	65—80
e 7	- 14 - 24	- 20 - 32	- 25 - 40	- 32 - 50	- 40 - 61	- 50 - 75	- 60 - 90	- 60 - 90
e 8	- 14 - 28	- 20 - 38	- 25 - 47	- 32 - 59	- 40 - 73	- 50 - 89	- 60 - 106	- 60 - 106
e 9	- 14 - 39	- 20 - 50	- 25 - 61	- 32 - 75	- 40 - 92	- 50 - 112	- 60 - 134	- 60 - 134
h 5	0 - 4	0 - 5	0 - 6	0 - 8	0 - 9	0 - 11	0 - 13	0 - 13
h 6	0 - 6	0 - 8	0 - 9	0 - 11	0 - 13	0 - 16	0 - 19	0 - 19
h 7	0 - 10	0 - 12	0 - 15	0 - 18	0 - 21	0 - 25	0 - 30	0 - 30
h 8	0 - 14	0 - 18	0 - 22	0 - 27	0 - 33	0 - 39	0 - 46	0 - 46
h 9	0 - 25	0 - 30	0 - 36	0 - 43	0 - 52	0 - 62	0 - 74	0 - 74
h10	0 - 40	0 - 48	0 - 58	0 - 70	0 - 84	0 - 100	0 - 120	0 - 120
h11	0 - 60	0 - 75	0 - 90	0 - 110	0 - 130	0 - 160	0 - 190	0 - 190
h16	0 - 600	0 - 750	0 - 900	0 - 1100	0 - 1300	0 - 1600	0 - 1900	0 - 1900
js14	+ 125 - 125	+ 150 - 150	+ 180 - 180	+ 215 - 215	+ 260 - 260	+ 310 - 310	+ 370 - 370	+ 370 - 370
js16	+ 300 - 300	+ 375 - 375	+ 450 - 450	+ 550 - 550	+ 650 - 650	+ 800 - 800	+ 950 - 950	+ 950 - 950
k11	+ 60 0	+ 75 0	+ 90 0	+ 110 0	+ 130 0	+ 160 0	+ 190 0	+ 190 0
k12	+ 100 0	+ 120 0	+ 150 0	+ 180 0	+ 210 0	+ 250 0	+ 300 0	+ 300 0
m 6	+ 8 + 2	+ 12 + 4	+ 15 + 6	+ 18 + 7	+ 21 + 8	+ 25 + 9	+ 30 + 11	+ 30 + 11
m 7	+ 12 + 2	+ 16 + 4	+ 21 + 6	+ 25 + 7	+ 29 + 8	+ 34 + 9	+ 41 + 11	+ 41 + 11
z 9	+ 51 + 26	+ 65 + 35	+ 78 + 42	+ 103 + 60	+ 140 + 88	+ 198 + 136	+ 246 + 172	+ 284 + 210
H 5	+ 4 0	+ 5 0	+ 6 0	+ 8 0	+ 9 0	+ 11 0	+ 13 0	+ 13 0
H 6	+ 6 0	+ 8 0	+ 9 0	+ 11 0	+ 13 0	+ 16 0	+ 19 0	+ 19 0
H 7	+ 10 0	+ 12 0	+ 15 0	+ 18 0	+ 21 0	+ 25 0	+ 30 0	+ 30 0
H 8	+ 14 0	+ 18 0	+ 22 0	+ 27 0	+ 33 0	+ 39 0	+ 46 0	+ 46 0
H 9	+ 25 0	+ 30 0	+ 36 0	+ 43 0	+ 52 0	+ 62 0	+ 74 0	+ 74 0
H10	+ 40 0	+ 48 0	+ 58 0	+ 70 0	+ 84 0	+ 100 0	+ 120 0	+ 120 0
H11	+ 60 0	+ 75 0	+ 90 0	+ 110 0	+ 130 0	+ 160 0	+ 190 0	+ 190 0
P 6	- 6 - 12	- 9 - 17	- 12 - 21	- 15 - 26	- 18 - 31	- 21 - 37	- 26 - 45	- 26 - 45
P 7	- 6 - 16	- 8 - 20	- 9 - 24	- 11 - 29	- 14 - 35	- 17 - 42	- 21 - 51	- 21 - 51
P 9	- 6 - 31	- 12 - 42	- 15 - 51	- 18 - 61	- 22 - 74	- 26 - 88	- 32 - 106	- 32 - 106