



Contents:

Page:

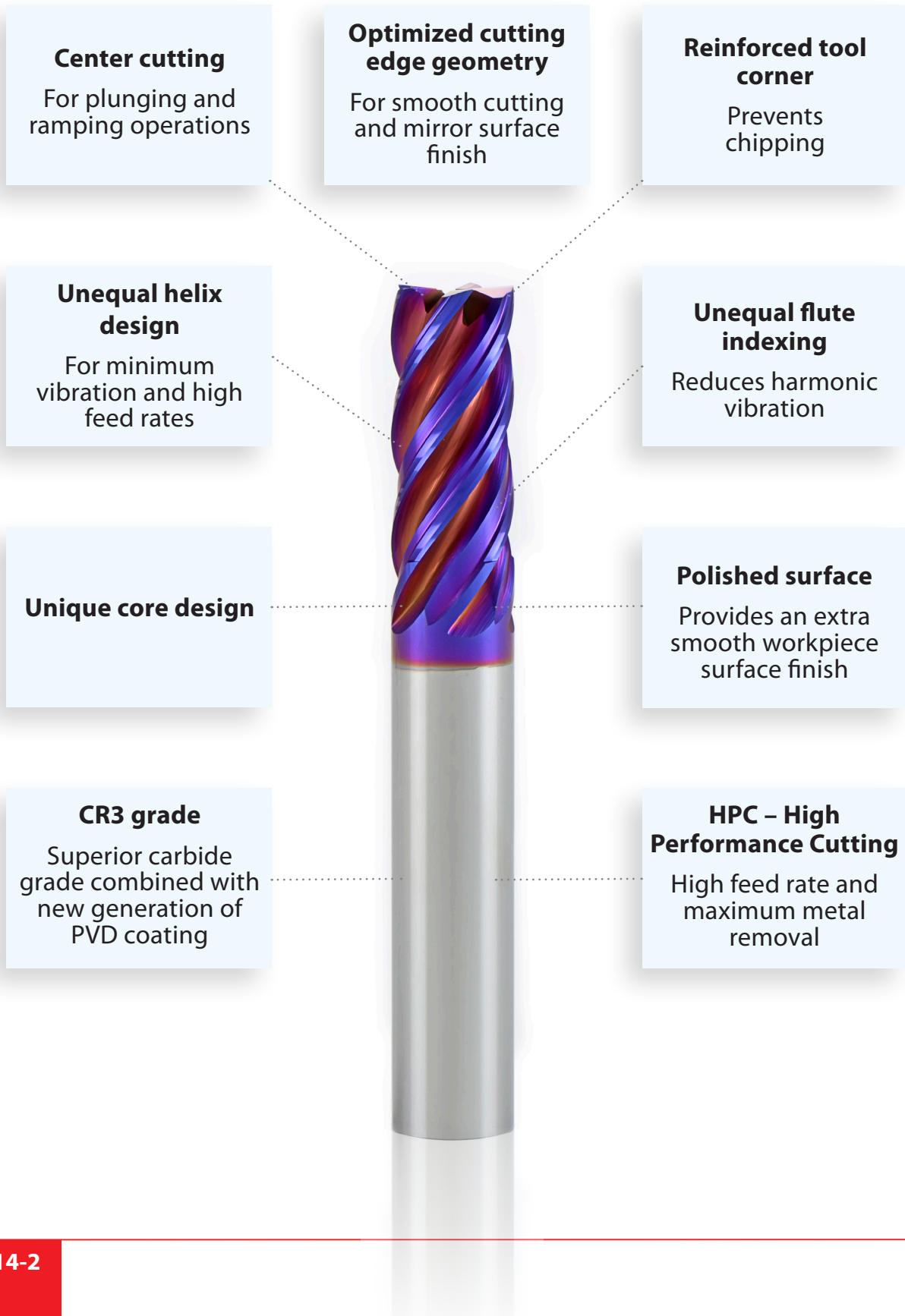
End-Mills Features	2
Product Identification	3
High Performance Solid Carbide End-Mills	4-19
4 flutes - Short or Long	5
4 flutes with corner radius - Short or Long	6
4 flutes with corner radius and neck	7
5 flutes - Long	8
5 flutes with corner radius - Long	8
5 flutes with corner radius and neck	9
6 flutes - Extra Long	10
6 flutes with corner radius and neck	10
7 flutes with corner radius	11
Ballnose End-Mills 4 flutes with neck	11
Technical Section	12-15
High Performance Solid Carbide End-Mills for Aluminum machining	16-19
Solid Carbide End-Mills 3 flutes	17
Solid Carbide End-Mills 3 flutes with corner radius	17
Technical Section	18
Application Example	19
Multi-Function Milling Tools (MF)	20-23
Product Identification	21

Contents:

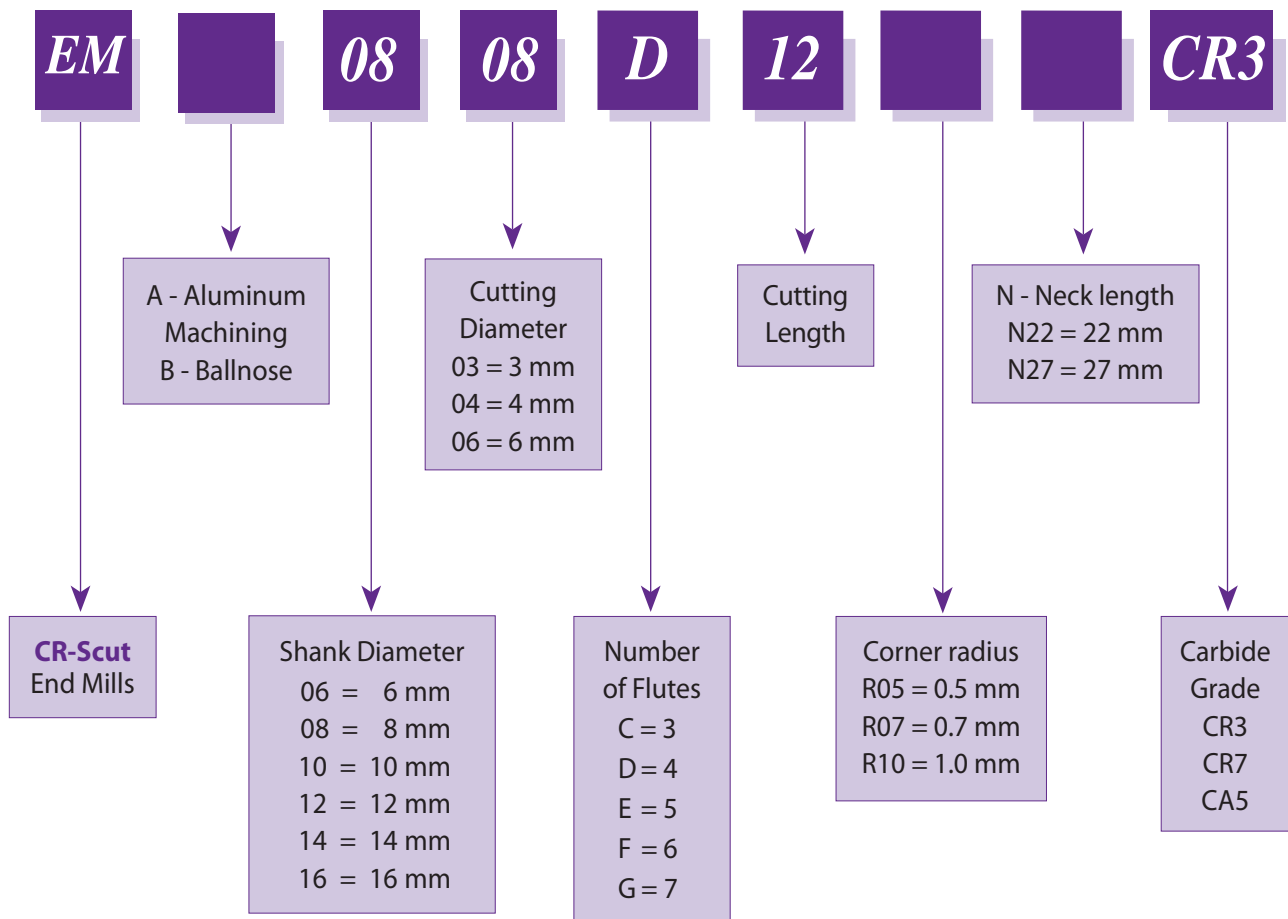
Page:

Working Methods	22
Technical Section	23
CR-Supercut Roughers	24-30
Product Identification	25
Short	26
Long	26
With Neck	27
Solid Carbide Roughers for Aluminum Machining	28-30
Without internal coolant	28
With internal coolant through the flutes	29
Technical Section	30
Indexable CMT Roughers and Finishers	31-33
Product Identification	31
Roughers	32
Finishers	32
Toolholders	33
CR-Supercut High Feed End-Mills	34-39
CR-Supercut High Feed End-Mills Features	35
Product Identification	36
Solid Carbide High Feed End-Mills	37
Technical Section	38
Case Study	39

End-Mills Features

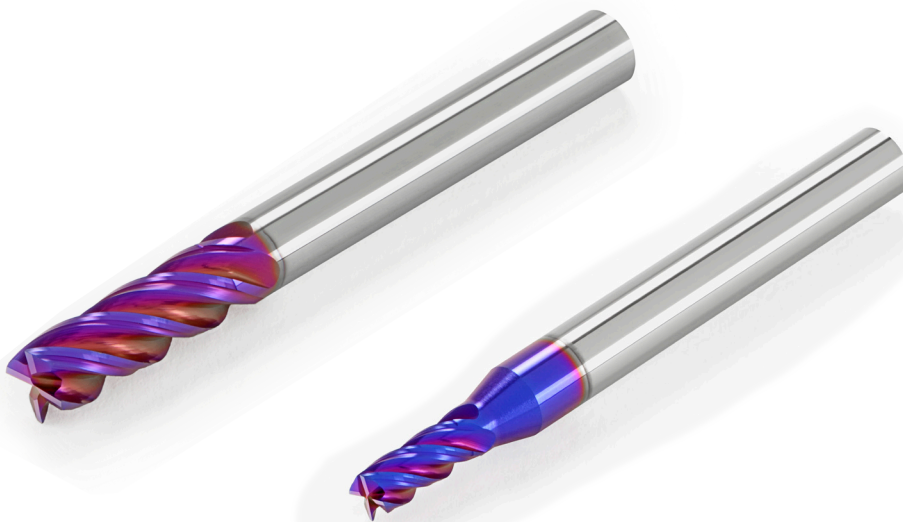


Product Identification Ordering Codes



CR-Supercut End-Mills

High Performance Solid Carbide End-Mills



High Performance CR-Supercut End-Mills, designed for high feed machining and high metal removal rate for a wide range of materials. Innovative tool geometry delivers high performance with low vibration machining in one pass. One tool for semi-finishing and fine-finishing operation with sharp corner or radii.

- High Performance Cutting (HPC)
- Center cutting
- Low vibration machining
- High metal removal rates in Slotting, Shouldering and Helical Plunging operations.
- 3-7 flutes

Carbide grade: CR3

Ultra-Fine carbide grade with high hardness and toughness provides high cutting edge stability and wear resistance.

A New Generation of PVD Coating for High-Performance Cutting Applications.

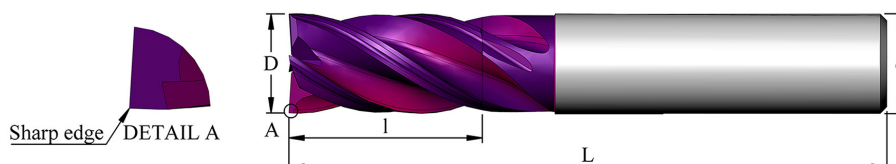
Carbide grade: CR7

Optimal combination of high hardness and excellent wear resistance grade, both in dry or wet machining. Suitable for finishing and semi-finishing of steels, stainless steels and super alloys.

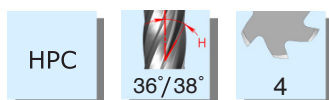
A New Generation of PVD Coating for High-Performance Cutting Applications.

High Performance Solid Carbide End-Mills

Solid Carbide End-Mills 4 flutes



Short Design

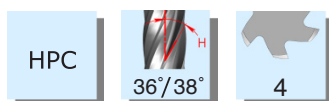


Grade	P	M	K	N	S	H
CR3	●	○	●		○	≤48 HRc
CR7	●	●			●	≤58 HRc

Ordering Code	d	D	No. of Flutes	I	L
EM 0604 D08	6	4	4	8	57
EM 0605 D10	6	5	4	10	57
EM 0606 D10	6	6	4	10	57
EM 0808 D12	8	8	4	12	63
EM 1010 D14	10	10	4	14	72
EM 1212 D16	12	12	4	16	73
EM 1414 D18	14	14	4	18	75
EM 1616 D24	16	16	4	24	82
EM 2020 D30	20	20	4	30	92

Order example: EM 1212 D16 CR7

Long Design



Grade	P	M	K	N	S	H
CR3	●	○	●		○	≤48 HRc
CR7	●	●			●	≤58 HRc

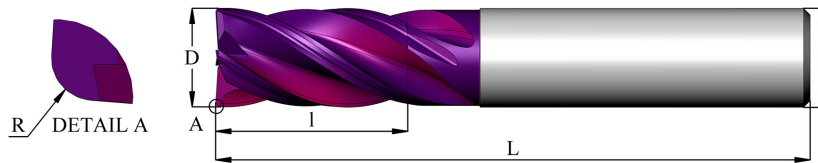
Ordering Code	d	D	No. of Flutes	I	L
EM 0603 D08	6	3	4	8	57
EM 0604 D11	6	4	4	11	57
EM 0605 D13	6	5	4	13	57
EM 0606 D16	6	6	4	16	57
EM 0807 D16	8	7	4	16	63
EM 0808 D19	8	8	4	19	63
EM 1009 D20	10	9	4	20	72
EM 1010 D22	10	10	4	22	72
EM 1212 D26	12	12	4	26	83
EM 1414 D26	14	14	4	26	85
EM 1616 D32	16	16	4	32	92
EM 2020 D38	20	20	4	38	104

Order example: EM 0808 D19 CR3

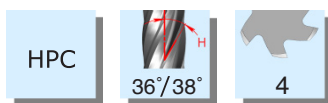
● First choice

○ Alternative

Solid Carbide End-Mills 4 flutes with corner radius



Short Design

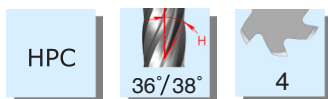


Grade	P	M	K	N	S	H
CR3	●	○	●		○	≤48 HRc
CR7	●	●			●	≤58 HRc

Ordering Code	d	D	No. of Flutes	R	I	L
EM 0606 D12 R02	6	6	4	0.2	12	57
EM 0808 D12 R05	8	8	4	0.5	12	63
EM 1010 D14 R05	10	10	4	0.5	14	72
EM 1212 D16 R07	12	12	4	0.7	16	73
EM 1414 D18 R07	14	14	4	0.7	18	75
EM 1616 D24 R10	16	16	4	1.0	24	82
EM 2020 D30 R10	20	20	4	1.0	30	92

Order example: EM 1616 D24 R10 CR3

Long Design



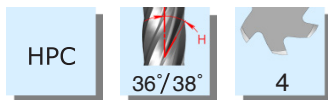
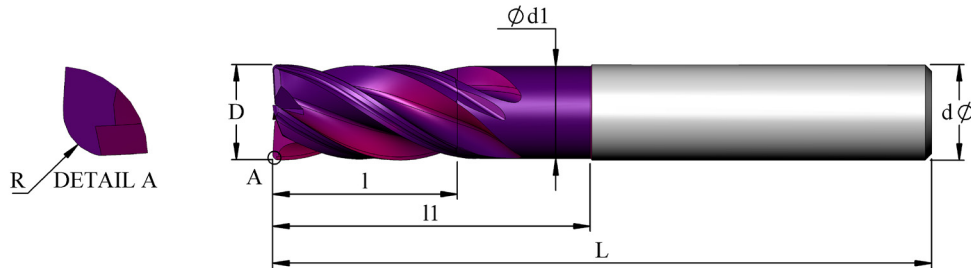
Grade	P	M	K	N	S	H
CR3	●	○	●		○	≤48 HRc
CR7	●	●			●	≤58 HRc

Ordering Code	d	D	No. of Flutes	R	I	L
EM 0603 D08 R03	6	3	4	0.3	8	57
EM 0604 D11 R03	6	4	4	0.3	11	57
EM 0605 D13 R03	6	5	4	0.3	13	57
EM 0606 D16 R05	6	6	4	0.5	16	57
EM 0807 D16 R03	8	7	4	0.3	16	63
EM 0808 D19 R05	8	8	4	0.5	19	63
EM 1010 D22 R03	10	10	4	0.3	22	72
EM 1010 D22 R05	10	10	4	0.5	22	72
EM 1212 D26 R03	12	12	4	0.3	26	83
EM 1212 D26 R07	12	12	4	0.7	26	83
EM 1414 D26 R07	14	14	4	0.7	26	85
EM 1616 D32 R03	16	16	4	0.3	32	92
EM 1616 D32 R10	16	16	4	1.0	32	92
EM 2020 D38 R10	20	20	4	1.0	38	104

Order example: EM 1212 D26 R03 CR7

● First choice ○ Alternative

Solid Carbide End-Mills 4 flutes with corner radius and neck



Grade	P	M	K	N	S	H
CR7	●	●			●	≤58 HRc

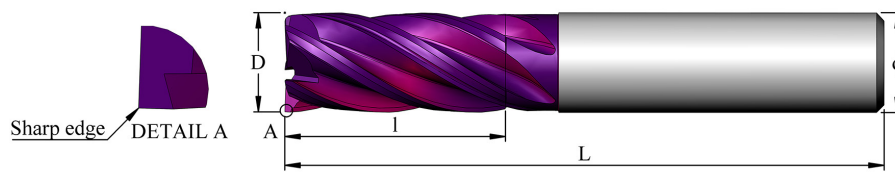
Ordering Code	d	D	l	l1	d1	R	No. of Flutes	L
EM 0605 D13 R04 N20	6	5	13	20	4.8	0.4	4	57
EM 0605 D13 R10 N20	6	5	13	20	4.8	1.0	4	57
EM 0606 D13 R05 N22	6	6	13	22	5.8	0.5	4	57
EM 0606 D13 R10 N22	6	6	13	22	5.8	1.0	4	57
EM 0808 D17 R05 N29	8	8	17	29	7.7	0.5	4	80
EM 0808 D17 R10 N29	8	8	17	29	7.7	1.0	4	80
EM 1010 D22 R05 N33	10	10	22	33	9.7	0.5	4	80
EM 1010 D22 R10 N33	10	10	22	33	9.7	1.0	4	80
EM 1212 D26 R05 N40	12	12	26	40	11.6	0.5	4	102
EM 1212 D26 R10 N40	12	12	26	40	11.6	1.0	4	102
EM 1616 D32 R05 N46	16	16	32	46	15.5	0.5	4	105
EM 1616 D32 R10 N46	16	16	32	46	15.5	1.0	4	105

Order example: EM 0808 D17 R10 N29 CR7

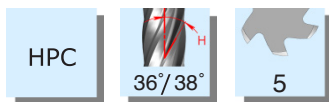
● First choice

○ Alternative

Solid Carbide End-Mills 5 flutes



Long Design

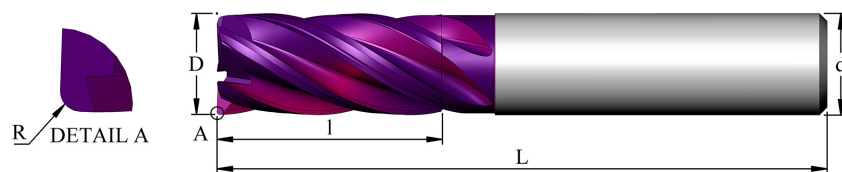


Grade	P	M	K	N	S	H
CR3	●	○	●		○	≤48 HRc
CR7	●	●			●	≤58 HRc

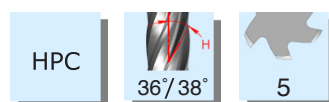
Ordering Code	d	D	No. of Flutes	I	L
EM 0606 E13	6	6	5	13	57
EM 0808 E19	8	8	5	19	63
EM 1010 E22	10	10	5	22	72
EM 1212 E26	12	12	5	26	83
EM 1414 E26	14	14	5	26	85
EM 1616 E32	16	16	5	32	92
EM 2020 E38	20	20	5	38	104

Order example: EM 0606 E13 CR7

Solid Carbide End-Mills 5 flutes with corner radius



Long Design



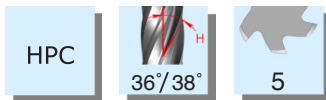
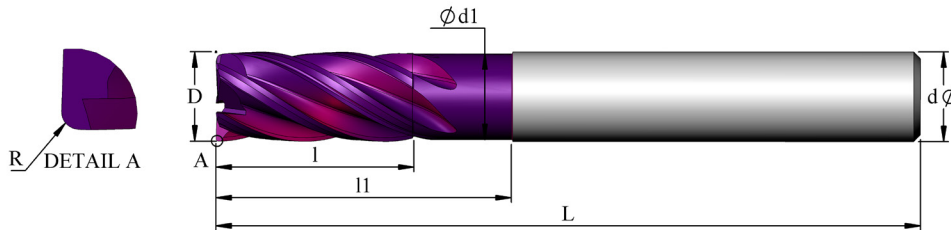
Grade	P	M	K	N	S	H
CR3	●	○	●		○	≤48 HRc
CR7	●	●			●	≤58 HRc

Ordering Code	d	D	No. of Flutes	R	I	L
EM 0606 E13 R05	6	6	5	0.5	13	57
EM 0808 E19 R05	8	8	5	0.5	19	63
EM 1010 E22 R05	10	10	5	0.5	22	72
EM 1212 E26 R07	12	12	5	0.7	26	83
EM 1414 E26 R07	14	14	5	0.7	26	85
EM 1616 E32 R10	16	16	5	1.0	32	92
EM 2020 E38 R10	20	20	5	1.0	38	104

Order example: EM 0808 E19 R05 CR7

● First choice ○ Alternative

Solid Carbide End-Mills 5 flutes with corner radius and neck



Grade	P	M	K	N	S	H
CR7	●	●			●	≤58 HRc

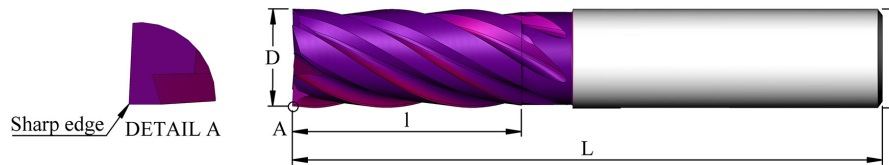
Ordering Code	d	D	l	l1	d1	R	No. of Flutes	L
EM 0606 E13 R05 N22	6	6	13	22	5.8	0.5	5	57
EM 0606 E13 R10 N22	6	6	13	22	5.8	1.0	5	57
EM 0808 E19 R05 N27	8	8	19	27	7.7	0.5	5	80
EM 0808 E19 R10 N27	8	8	19	27	7.7	1.0	5	80
EM 1010 E22 R05 N33	10	10	22	33	9.7	0.5	5	80
EM 1010 E22 R10 N33	10	10	22	33	9.7	1.0	5	80
EM 1212 E26 R05 N38	12	12	26	38	11.6	0.5	5	102
EM 1212 E26 R10 N38	12	12	26	38	11.6	1.0	5	102
EM 1616 E32 R05 N48	16	16	32	48	15.5	0.5	5	105
EM 1616 E32 R10 N48	16	16	32	48	15.5	1.0	5	105

Order example: EM 1212 E26 R05 N38 CR7

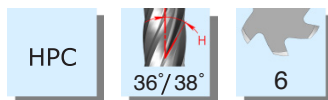
● First choice

○ Alternative

Solid Carbide End-Mills 6 flutes



Extra-long Design

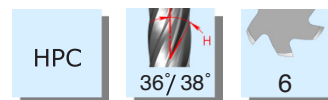
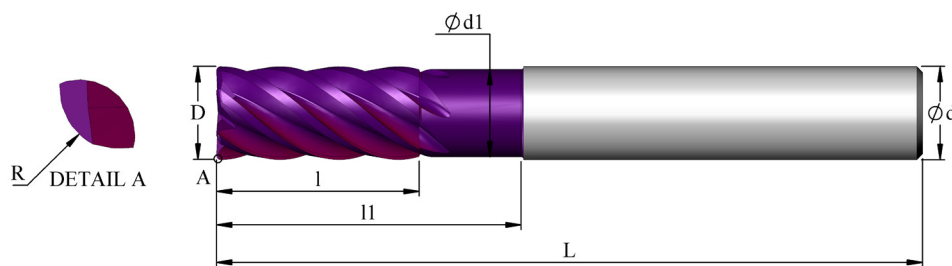


Grade	P	M	K	N	S	H
CR3	●	○	●		○	≤48 HRc
CR7	●	●			●	≤58 HRc

Ordering Code	d	D	No. of Flutes	I	L
EM 0606 F18	6	6	6	18	57
EM 0808 F24	8	8	6	24	63
EM 1010 F30	10	10	6	30	80
EM 1212 F36	12	12	6	36	83
EM 1414 F42	14	14	6	42	100
EM 1616 F48	16	16	6	48	105
EM 2020 F60	20	20	6	60	150

Order example: EM 1414 F42 CR7

Solid Carbide End-Mills 6 flutes with corner radius and neck



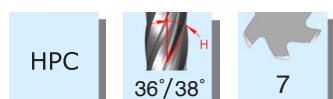
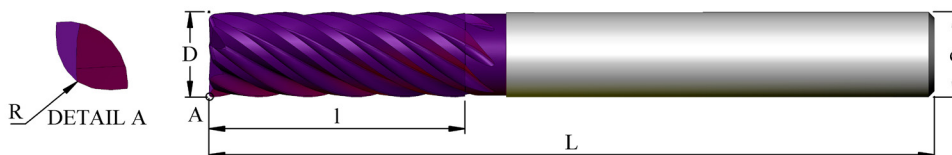
Grade	P	M	K	N	S	H
CR7	●	●			●	≤58 HRc

Ordering Code	d	D	I	I1	d1	R	No. of Flutes	L
EM 1010 F22 R05 N33	10	10	22	33	9.7	0.5	6	80
EM 1010 F22 R10 N33	10	10	22	33	9.7	1.0	6	80
EM 1212 F26 R05 N38	12	12	26	38	11.6	0.5	6	102
EM 1212 F26 R10 N38	12	12	26	38	11.6	1.0	6	102
EM 1616 F34 R05 N48	16	16	34	48	15.5	0.5	6	105
EM 1616 F34 R10 N48	16	16	34	48	15.5	1.0	6	105
EM 2020 F38 R05 N60	20	20	38	60	19.0	0.5	6	150
EM 2020 F38 R10 N60	20	20	38	60	19.0	1.0	6	150

Order example: EM 1010 F22 R10 N33 CR7

● First choice ○ Alternative

Solid Carbide End-Mills 7 flutes with corner radius

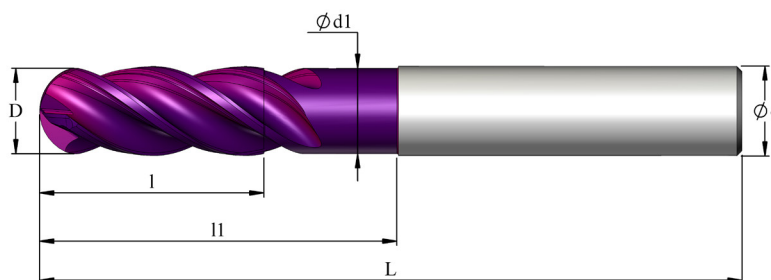


Grade	P	M	K	N	S	H
CR7	●	●			●	≤58 HRc

Ordering Code	d	D	No. of Flutes	R	I	L
EM 1010 G30 R05	10	10	7	0.5	30	80
EM 1010 G30 R10	10	10	7	1.0	30	80
EM 1212 G36 R05	12	12	7	0.5	36	102
EM 1212 G36 R10	12	12	7	1.0	36	102
EM 1616 G48 R05	16	16	7	0.5	48	110
EM 1616 G48 R10	16	16	7	1.0	48	110

Order example: EM 1010 G30 R05 CR7

Solid Carbide Ballnose End-Mills 4 flutes with neck



Grade	P	M	K	N	S	H
CR7	●	●			●	≤58 HRc

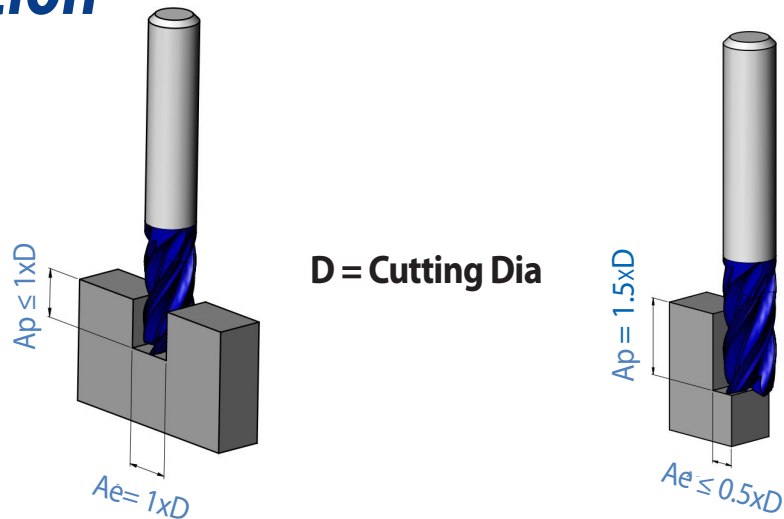
Ordering Code	d	D	I	I1	d1	No. of Flutes	L
EMB 0605 D09 N14	6	5	9	14	4.8	4	57
EMB 0606 D10 N15	6	6	10	15	5.8	4	57
EMB 0808 D15 N20	8	8	15	20	7.7	4	63
EMB 1010 D18 N25	10	10	18	25	9.7	4	80
EMB 1212 D24 N30	12	12	24	30	11.6	4	83
EMB 1616 D32 N38	16	16	32	38	15.5	4	105

Order example: EMB 1010 D18 N25 CR7

● First choice

○ Alternative

Technical Section



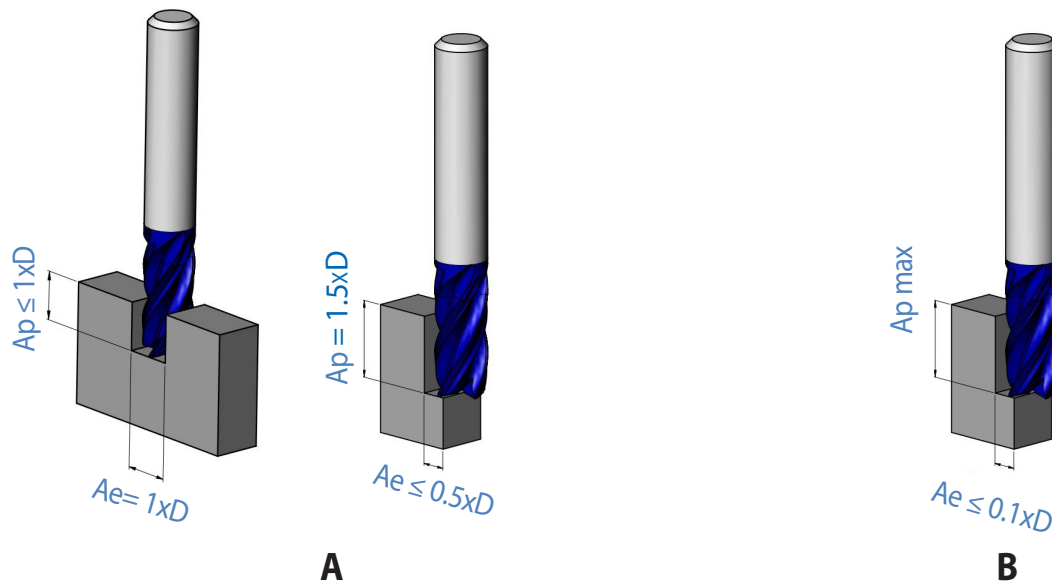
Cutting Data

4 fluted End-Mills and Ballnose

ISO	Materials Class	Vc [m/min]	Fz [mm/tooth]								
			Cutting Diameter								
			Ø3	Ø4 - Ø5	Ø6 - Ø7	Ø8 - Ø9	Ø10	Ø12	Ø14	Ø16	Ø20
P	Low & Medium Carbon Steels <0.55%C	120-160	0.006	0.020	0.030	0.040	0.047	0.056	0.059	0.064	0.078
	High Carbon Steels ≥0.55%C	120-160	0.006	0.020	0.030	0.040	0.047	0.056	0.059	0.064	0.078
	Alloy Steels, Treated Steels	100-140	0.005	0.012	0.020	0.030	0.039	0.047	0.049	0.053	0.065
M	Stainless Steel-Free Cutting	80-140	0.005	0.017	0.020	0.030	0.040	0.047	0.049	0.053	0.065
	Stainless Steel-Austenitic	70-130	0.004	0.012	0.020	0.022	0.034	0.04	0.043	0.045	0.055
	Cast Steels	70-130	0.004	0.012	0.020	0.022	0.034	0.04	0.043	0.045	0.055
K	Cast Iron	80-140	0.005	0.017	0.023	0.027	0.039	0.047	0.049	0.053	0.065
S	Heat-resistant alloys	20-40	0.005	0.010	0.018	0.031	0.048	0.056	0.060	0.064	0.077
	Titanium alloys	80-100	0.005	0.010	0.018	0.031	0.048	0.056	0.060	0.064	0.077
H	Hardened Steel <48 HRc	40-70	0.007	0.010	0.017	0.020	0.023	0.025	0.026	0.027	0.028
	Hardened Steel 48-58 HRc	35-60	0.005	0.007	0.012	0.015	0.017	0.018	0.019	0.020	0.020

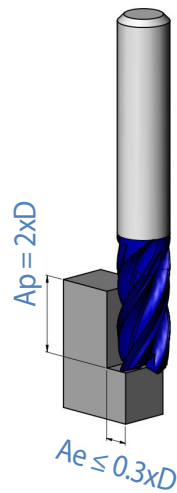
5 fluted End-Mills

ISO	Materials Class	Vc [m/min]	Fz [mm/tooth] Cutting Diameter						
			Ø6	Ø8	Ø10	Ø12	Ø14	Ø16	Ø20
P	Low & Medium Carbon Steels <0.55%C	120-160	0.034	0.040	0.050	0.063	0.069	0.076	0.089
	High Carbon Steels ≥0.55%C	120-160	0.034	0.040	0.050	0.063	0.069	0.076	0.089
	Alloy Steels, Treated Steels	100-140	0.034	0.038	0.050	0.063	0.069	0.076	0.089
M	Stainless Steel-Free Cutting	80-140	0.030	0.032	0.045	0.063	0.065	0.069	0.076
	Stainless Steel-Austenitic	70-130	0.030	0.032	0.045	0.063	0.065	0.069	0.076
	Cast Steels	70-130	0.030	0.032	0.045	0.063	0.065	0.069	0.076
K	Cast Iron	80-140	0.035	0.037	0.048	0.068	0.068	0.073	0.080
S	Heat-resistant alloys	20-40	0.018	0.031	0.048	0.056	0.060	0.064	0.077
	Titanium alloys	80-100	0.018	0.031	0.048	0.056	0.060	0.064	0.077
H	Hardened Steel <48 HRc	40-70	0.020	0.020	0.025	0.027	0.030	0.035	0.040
	Hardened Steel 48-58 HRc	35-60	0.015	0.015	0.018	0.020	0.022	0.026	0.030

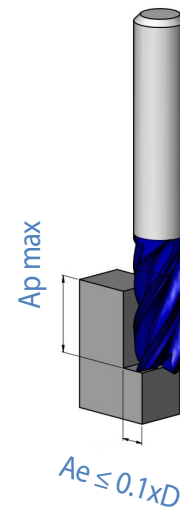


6 fluted End-Mills

ISO	Materials Class	Vc [m/min]	Fz [mm/tooth]						
			Cutting Diameter						
			Ø6	Ø8	Ø10	Ø12	Ø14	Ø16	Ø20
P	Low & Medium Carbon Steels <0.55%C	A:120-160 B:240-320	A:0.040 B:0.048	A:0.045 B:0.054	A:0.055 B:0.066	A:0.068 B:0.082	A:0.075 B:0.090	A:0.081 B:0.097	A:0.089 B:0.107
	High Carbon Steels ≥0.55%C	A:120-160 B:240-320	A:0.040 B:0.048	A:0.045 B:0.054	A:0.055 B:0.066	A:0.068 B:0.082	A:0.075 B:0.090	A:0.081 B:0.097	A:0.089 B:0.107
	Alloy Steels, Treated Steels	A:100-140 B:200-280	A:0.040 B:0.048	A:0.045 B:0.054	A:0.055 B:0.066	A:0.068 B:0.082	A:0.075 B:0.090	A:0.081 B:0.097	A:0.089 B:0.107
M	Stainless Steel-Free Cutting	A:80-140 B:160-280	A:0.035 B:0.042	A:0.037 B:0.044	A:0.050 B:0.060	A:0.068 B:0.078	A:0.070 B:0.084	A:0.074 B:0.089	A:0.081 B:0.097
	Stainless Steel-Austenitic	A:70-130 B:140-260	A:0.035 B:0.042	A:0.037 B:0.044	A:0.050 B:0.060	A:0.068 B:0.078	A:0.070 B:0.084	A:0.074 B:0.089	A:0.081 B:0.097
	Cast Steels	A:70-130 B:140-260	A:0.035 B:0.042	A:0.037 B:0.044	A:0.050 B:0.060	A:0.068 B:0.078	A:0.070 B:0.084	A:0.074 B:0.089	A:0.081 B:0.097
K	Cast Iron	A:80-140 B:150-270	A:0.038 B:0.045	A:0.040 B:0.047	A:0.053 B:0.063	A:0.071 B:0.081	A:0.073 B:0.087	A:0.077 B:0.092	A:0.084 B:0.100
S	Heat-resistant alloys	A:20-40 B:40-80	A:0.018 B:0.022	A:0.031 B:0.037	A:0.048 B:0.058	A:0.056 B:0.067	A:0.060 B:0.072	A:0.064 B:0.077	A:0.077 B:0.098
	Titanium alloys	A:80-100 B:160-200	A:0.018 B:0.022	A:0.031 B:0.037	A:0.048 B:0.058	A:0.056 B:0.067	A:0.060 B:0.072	A:0.064 B:0.077	A:0.077 B:0.098
H	Hardened Steel <48 HRc	A:40-70 B:80-140	A:0.023 B:0.028	A:0.025 B:0.030	A:0.030 B:0.036	A:0.033 B:0.040	A:0.036 B:0.043	A:0.040 B:0.048	A:0.045 B:0.054
	Hardened Steel 48-58 HRc	A:35-60 B:70-120	A:0.017 B:0.020	A:0.019 B:0.022	A:0.022 B:0.026	A:0.024 B:0.030	A:0.026 B:0.032	A:0.030 B:0.035	A:0.033 B:0.040



A



B

7 fluted End-Mills

ISO	Materials Class	Vc [m/min]	Fz [mm/tooth] Cutting Diameter		
			Ø10	Ø12	Ø16
P	Low & Medium Carbon Steels <0.55%C	A:120-160 B:240-330	A:0.055 B:0.066	A:0.068 B:0.082	A:0.081 B:0.097
	High Carbon Steels ≥0.55%C	A:120-160 B:240-330	A:0.055 B:0.066	A:0.068 B:0.082	A:0.081 B:0.097
	Alloy Steels, Treated Steels	A:100-140 B:200-280	A:0.055 B:0.066	A:0.068 B:0.082	A:0.081 B:0.097
M	Stainless Steel-Free Cutting	A:80-140 B:160-280	A:0.050 B:0.060	A:0.068 B:0.078	A:0.074 B:0.089
	Stainless Steel-Austenitic	A:70-130 B:140-260	A:0.050 B:0.060	A:0.068 B:0.078	A:0.074 B:0.089
	Cast Steels	A:70-130 B:140-260	A:0.050 B:0.060	A:0.068 B:0.078	A:0.074 B:0.089
S	Heat-resistant alloys	A:20-40 B:40-80	A:0.048 B:0.058	A:0.056 B:0.067	A:0.064 B:0.077
	Titanium alloys	A:80-100 B:160-200	A:0.048 B:0.058	A:0.056 B:0.067	A:0.064 B:0.077
H	Hardened Steel <48 HRc	A:40-70 B:80-140	A:0.030 B:0.036	A:0.033 B:0.040	A:0.040 B:0.048
	Hardened Steel 48-58 HRc	A:35-60 B:70-120	A:0.022 B:0.026	A:0.024 B:0.030	A:0.030 B:0.035

CR-Supercut End-Mills

High Performance Solid Carbide End-Mills for Aluminum machining

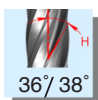
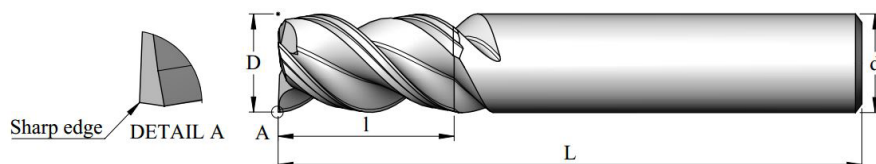


- High Performance Cutting (HPC)
- Center cutting
- Low vibration machining
- High metal removal rates in Slotting, Shouldering and Helical Plunging operations.
- Smooth polished flutes, more flute space and open flute design for better chip flow away from cutting area.
- 3 flutes

Carbide Grade: CA5

Ultra-Fine carbide grade with high hardness and toughness provides high cutting edge stability and wear resistance.

Solid Carbide End-Mills 3 flutes

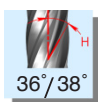
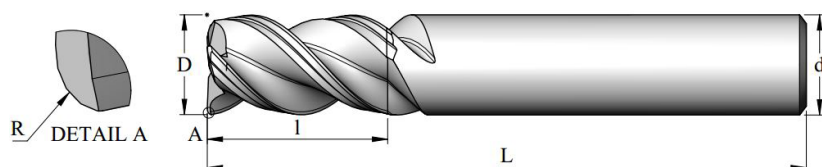


Grade	P	M	K	N	S	H
CA5				●		

Ordering Code	d	D	No. of Flutes	I	L
EMA 0303 C12	3	3	3	12	38
EMA 0404 C12	4	4	3	12	50
EMA 0505 C14	5	5	3	14	50
EMA 0606 C16	6	6	3	16	50
EMA 0808 C20	8	8	3	20	63
EMA 1010 C22	10	10	3	22	72
EMA 1212 C25	12	12	3	25	83
EMA 1414 C32	14	14	3	32	85
EMA 1616 C32	16	16	3	32	92
EMA 2020 C38	20	20	3	38	104

Order example: EMA 1010 C22 CA5

Solid Carbide End-Mills 3 flutes with corner radius



Grade	P	M	K	N	S	H
CA5				●		

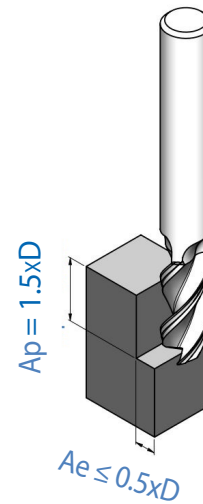
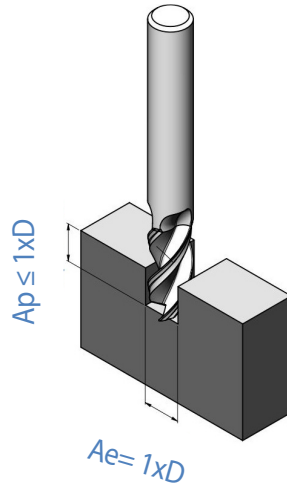
Ordering Code	d	D	No. of Flutes	R	I	L
EMA 0303 C12 R03	3	3	3	0.3	12	38
EMA 0404 C12 R03	4	4	3	0.3	12	50
EMA 0505 C14 R03	5	5	3	0.3	14	50
EMA 0606 C16 R05	6	6	3	0.5	16	50
EMA 0808 C20 R05	8	8	3	0.5	20	63
EMA 1010 C22 R05	10	10	3	0.5	22	72
EMA 1212 C25 R07	12	12	3	0.7	25	83
EMA 1414 C32 R07	14	14	3	0.7	32	85
EMA 1616 C32 R10	16	16	3	1.0	32	92
EMA 2020 C38 R10	20	20	3	1.0	38	104

Order example: EMA 1010 C22 R05 CA5

● First choice

○ Alternative

Technical Section



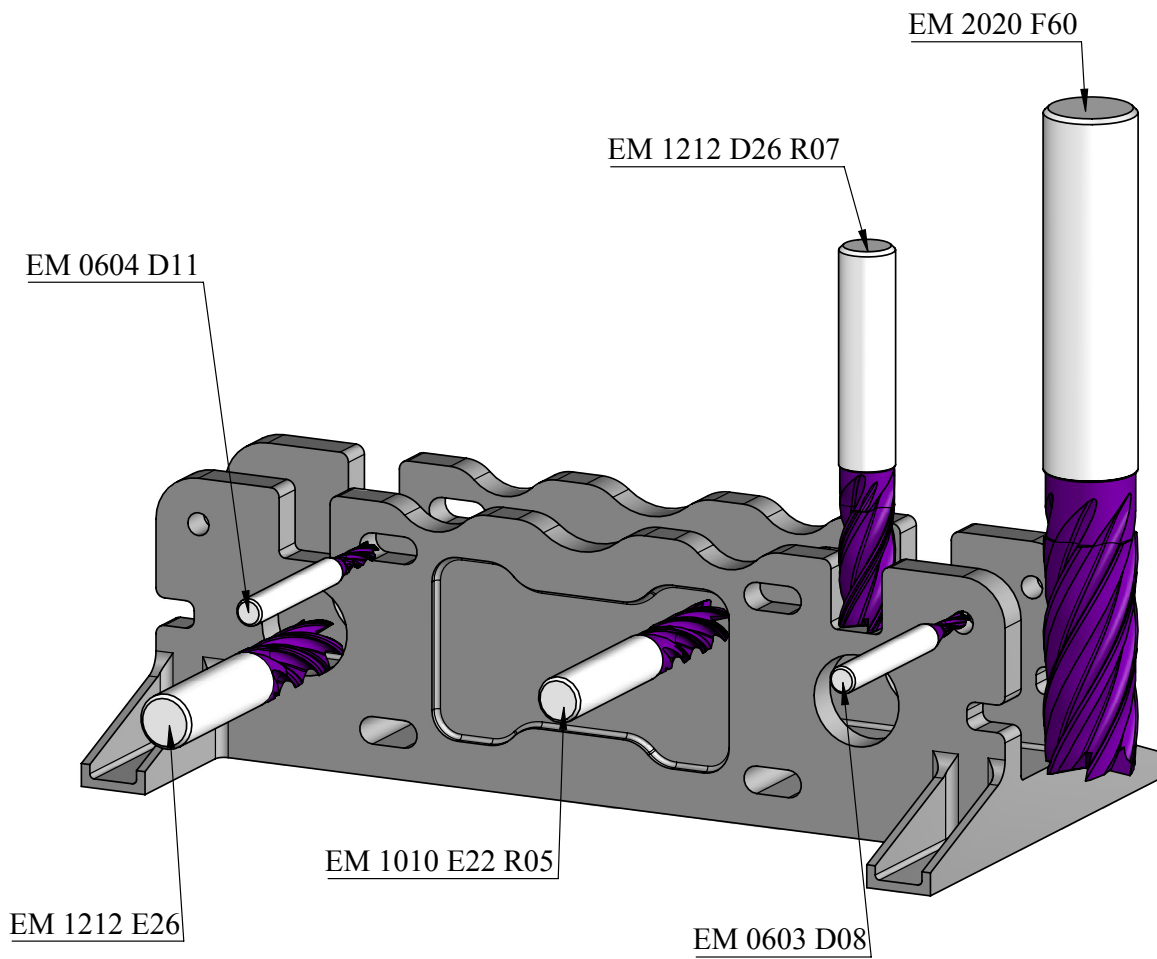
Cutting Data

Cutting conditions for side milling

ISO	Materials Class	Vc [m/min]	Fz [mm/tooth] Cutting Diameter									
			Ø3	Ø4	Ø5	Ø6	Ø8	Ø10	Ø12	Ø14	Ø16	Ø20
N	Aluminum ≤12%Si, Copper	500-1000	0.025	0.035	0.045	0.055	0.070	0.090	0.105	0.125	0.145	0.180
	Aluminum >12%Si	500-1000	0.020	0.030	0.038	0.049	0.063	0.081	0.096	0.115	0.130	0.160
	Synthetics, duroplastics, thermoplastics	500-1000	0.025	0.035	0.045	0.055	0.070	0.090	0.105	0.125	0.145	0.180

For slotting, reduce the Fz by 15%-25% depending on the application

Application Example



Multi-Function Milling Tools (MF)

Advantages

- Performs multiple operations with one tool
- Eliminates tool changes
- Reduces programming and setup times
- Reduces tool inventories
- Ideal for machines with a limited number of tool stations

Applications

- Spotting and Drilling
- Side milling
- Chamfering
- Slotting
- Grooving
- Engraving



Demonstration



Carbide grades

CR3

Ultra-Fine carbide grade with high hardness and toughness provides high cutting edge stability and wear resistance.

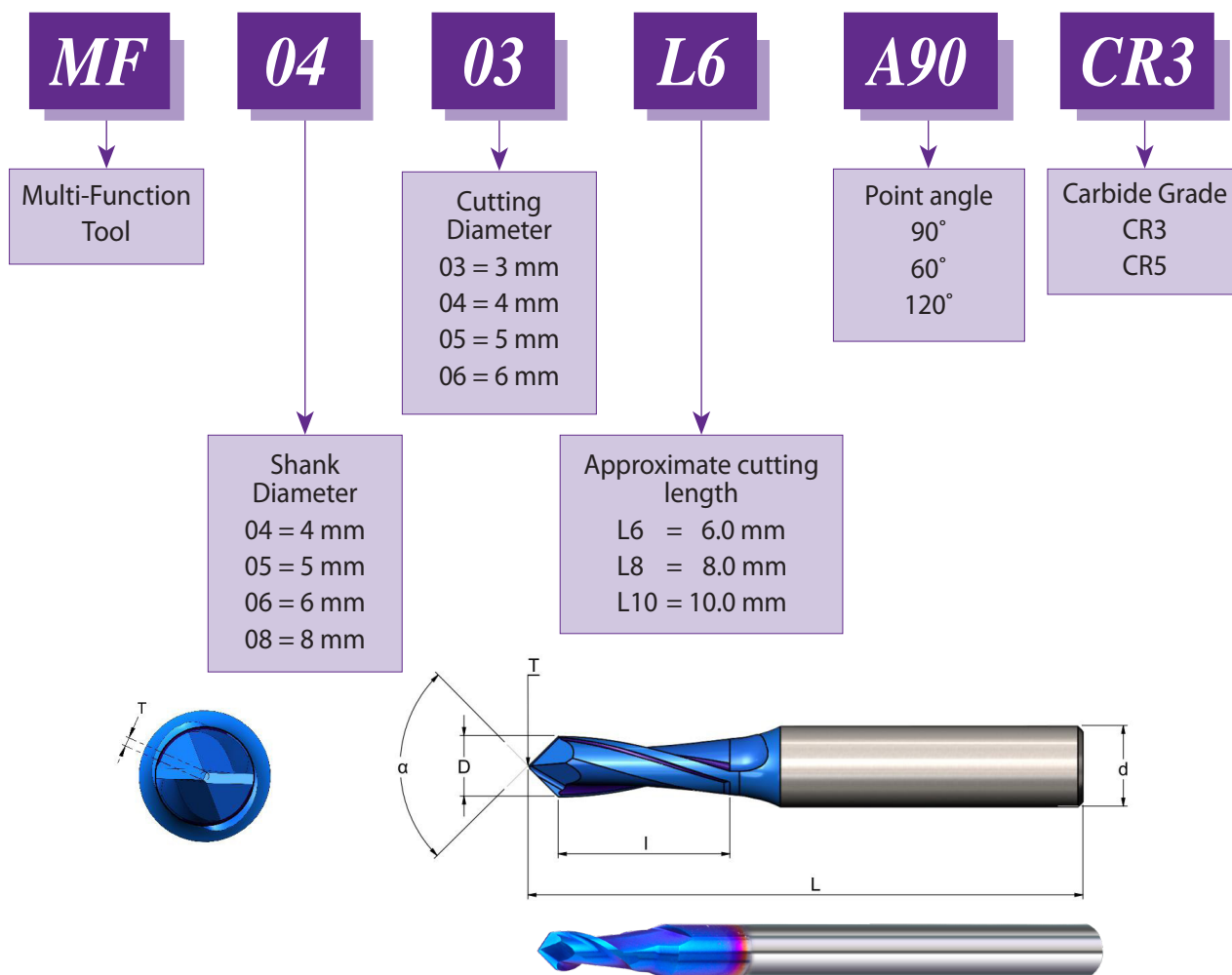
A **New Generation** of PVD Coating for High-Performance Cutting Applications.

CR5

PVD coated **New** grade for machining hardened materials up to 56 HRC and Super alloys.

Product Identification

Ordering Codes



Grade	P	M	K	N	S	H
CR3	●	●	●	●	●	○
CR5	○		○		●	≤ 56 HRc

Ordering Code	d	D	α	*T	I	L
MF 0403 L6 A90	4	3.0	90°	0.3	6.0	51
MF 0504 L8 A90	5	4.0	90°	0.4	8.0	51
MF 0605 L10 A90	6	5.0	90°	0.5	10.0	58
MF 0806 L12 A90	8	6.0	90°	0.6	12.0	64
MF 1008 L16 A90	10	8.0	90°	0.8	16.0	73
MF 1210 L18 A90	12	10.0	90°	1.0	18.0	84
MF 1212 L20 A90	12	12.0	90°	1.2	20.0	84

* T = Web thickness No. of Flutes: 2

For 60°, specify MF...A60

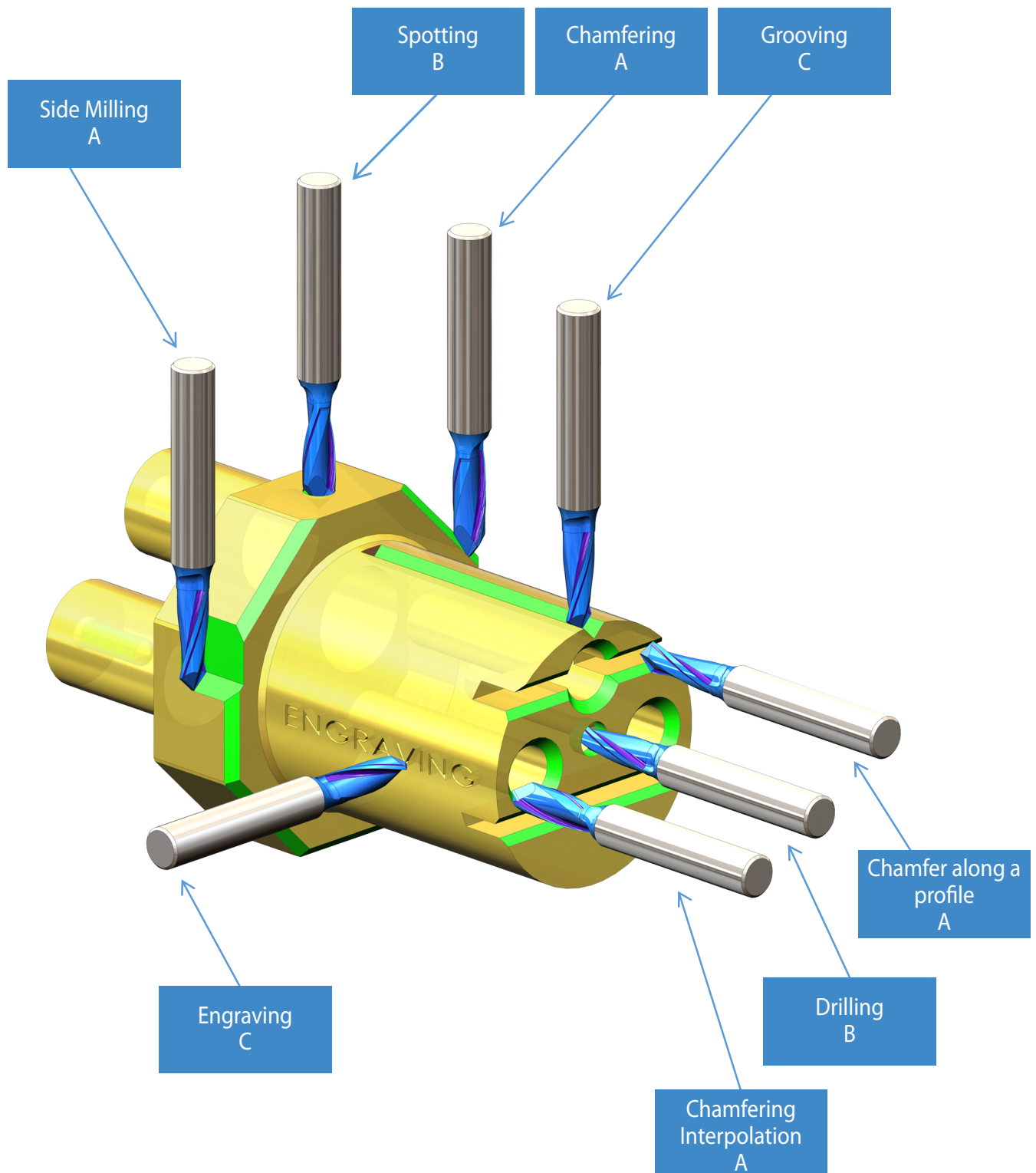
For 120°, specify MF...A120

Order example: MF 1210 L18 A90 CR3

● First choice

○ Alternative

Working Methods



* A, B, C refers to cutting data on next page.

Technical Section

Cutting Data

A: Side milling, Chamfering

B: Spotting, Drilling

C: Grooving, Engraving

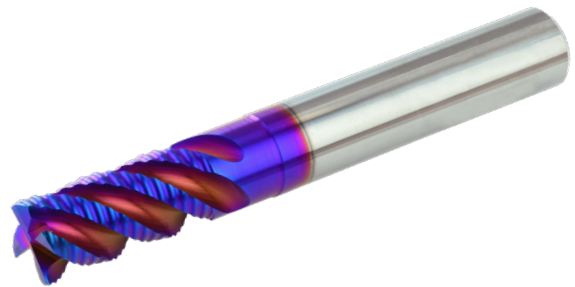
ISO Standard	Materials Class	Vc m/min	Fz mm/tooth Cutting Diameter		
			Ø3 - Ø4	Ø5 - Ø6	Ø8 - Ø12
P	Low & Medium Carbon Steels <0.55%C	50-115	A: 0.003-0.01 B: 0.003-0.007 C: 0.005-0.015	A: 0.005-0.02 B: 0.004-0.009 C: 0.006-0.025	A: 0.013-0.038 B: 0.007-0.015 C: 0.015-0.038
	High Carbon Steels ≥0.55%C	40-100	A: 0.002-0.012 B: 0.003-0.007 C: 0.005-0.018	A: 0.005-0.018 B: 0.006-0.01 C: 0.01-0.028	A: 0.009-0.03 B: 0.009-0.018 C: 0.016-0.047
	Alloy Steels, Treated Steels	40-100	A: 0.002-0.008 B: 0.003-0.006 C: 0.005-0.015	A: 0.005-0.015 B: 0.004-0.009 C: 0.005-0.018	A: 0.013-0.031 B: 0.006-0.015 C: 0.015-0.031
M	Stainless Steel-Free Cutting	30-85	A: 0.004-0.012 B: 0.003-0.007 C: 0.004-0.018	A: 0.007-0.018 B: 0.004-0.016 C: 0.006-0.018	A: 0.018-0.047 B: 0.008-0.024 C: 0.012-0.047
	Stainless Steel-Austenitic	25-70	A: 0.005-0.010 B: 0.003-0.006 C: 0.004-0.015	A: 0.006-0.015 B: 0.004-0.015 C: 0.005-0.017	A: 0.017-0.04 B: 0.007-0.02 C: 0.01-0.035
	Cast Steels	40-90	A: 0.004-0.012 B: 0.003-0.007 C: 0.004-0.018	A: 0.007-0.018 B: 0.004-0.016 C: 0.006-0.018	A: 0.018-0.047 B: 0.008-0.024 C: 0.012-0.047
K	Cast Iron	30-120	A: 0.003-0.01 B: 0.003-0.007 C: 0.005-0.015	A: 0.005-0.02 B: 0.004-0.009 C: 0.006-0.025	A: 0.013-0.038 B: 0.007-0.015 C: 0.015-0.038
N	Aluminum ≤12%Si, Copper	90-120	A: 0.005-0.008 B: 0.004-0.007 C: 0.005-0.008	A: 0.01-0.02 B: 0.008-0.015 C: 0.01-0.02	A: 0.025-0.045 B: 0.02-0.04 C: 0.025-0.045
	Aluminum >12%Si	75-100	A: 0.003-0.006 B: 0.003-0.005 C: 0.003-0.008	A: 0.005-0.015 B: 0.006-0.01 C: 0.005-0.015	A: 0.02-0.032 B: 0.015-0.035 C: 0.02-0.032
	Synthetics, Duroplastics, Thermoplastics	90-120	A: 0.005-0.008 B: 0.004-0.007 C: 0.005-0.008	A: 0.01-0.02 B: 0.008-0.015 C: 0.01-0.02	0.025-0.045 B: 0.02-0.04 C: 0.025-0.045
S	Nickel alloys, Titanium alloys	20-60	A: 0.004-0.008 B: 0.003-0.007 C: 0.002-0.005	A: 0.007-0.01 B: 0.006-0.008 C: 0.005-0.007	A: 0.01-0.025 B: 0.008-0.02 C: 0.007-0.015
H	Hardened Steel 40-45 HRc	20-60	A: 0.005-0.009 B: 0.004-0.008 C: 0.003-0.006	A: 0.008-0.015 B: 0.007-0.009 C: 0.006-0.008	A: 0.015-0.03 B: 0.009-0.025 C: 0.008-0.02
	Hardened Steel 45-56 HRc	10-50	A: 0.004-0.009 B: 0.003-0.008 C: 0.002-0.006	A: 0.007-0.015 B: 0.006-0.009 C: 0.005-0.008	A: 0.014-0.03 B: 0.008-0.025 C: 0.007-0.02

CR-Supercut Roughers

CPT solid carbide **Roughers** are innovative high performance mills, specifically designed for high volume machining applications.

Multi-flute, semi-finish profile and center cutting.

Provides high metal removal rates in Slotting, Shouldering and Helical Plunging operations.



Features

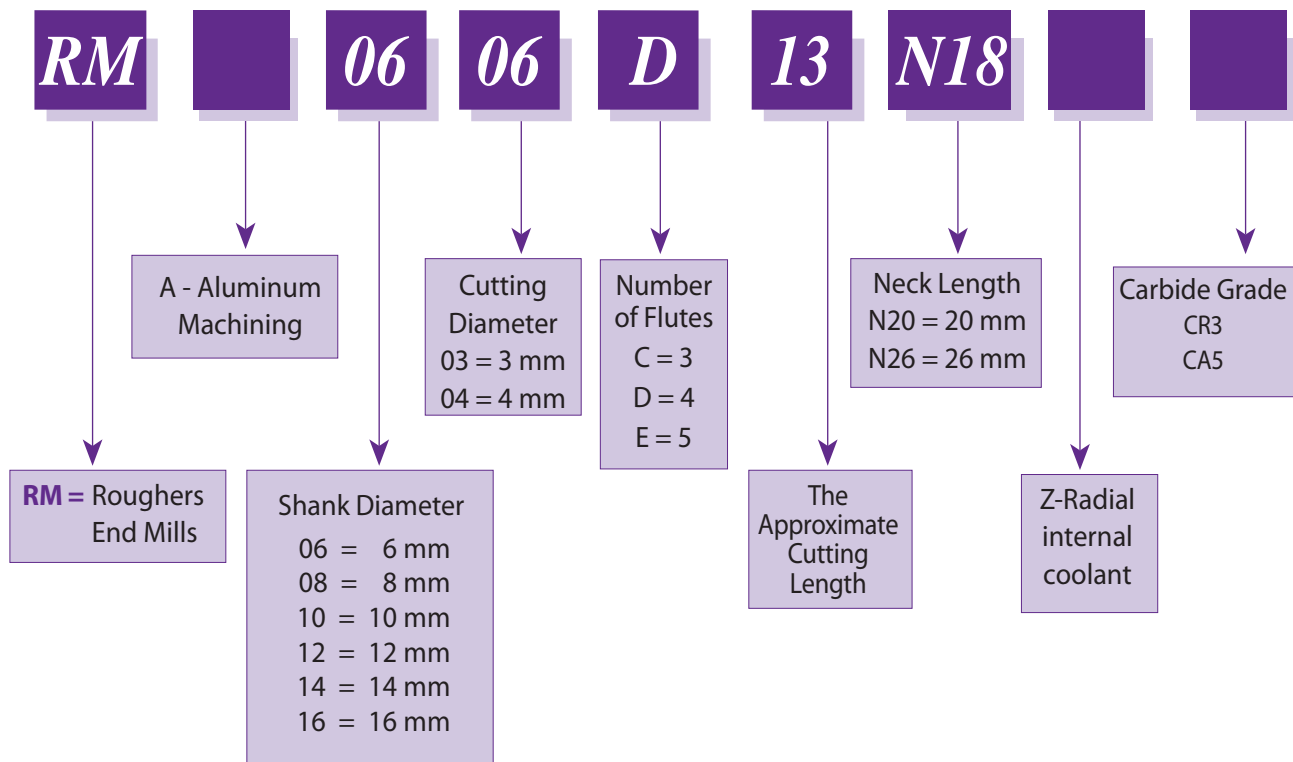
- High Performance Cutting (HPC)
- Innovative roughing geometry produces smaller chips
- Low cutting forces
- Extremely high material removal rate
- Reinforced corner chamfer, promotes additional strength for longer tool life
- Designed to machine difficult and abrasive materials

Carbide Grade: CR3

Ultra-Fine carbide grade with high hardness and toughness provides high cutting edge stability and wear resistance.

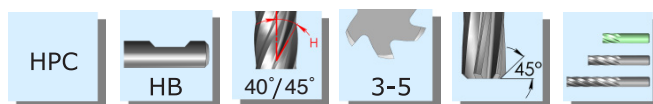
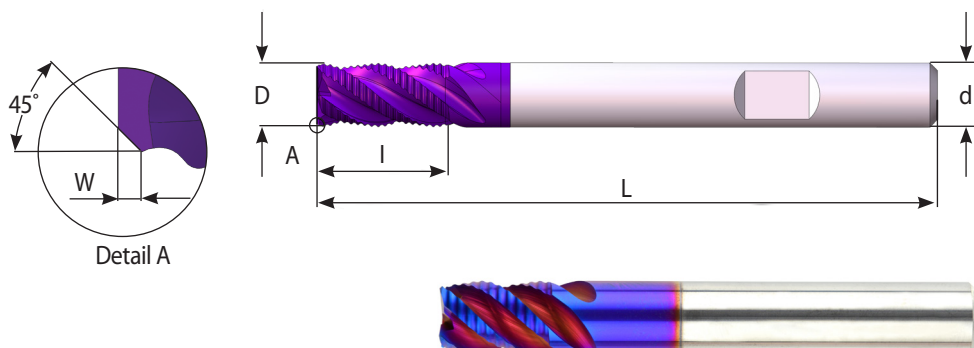
A **New Generation** of PVD Coating for High-Performance Cutting Applications.

Product Identification Ordering Codes



Solid Carbide Roughers

Short Design

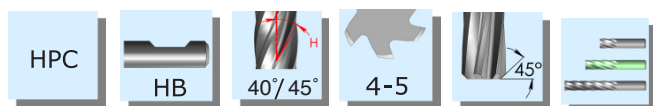


Grade	P	M	K	N	S	H
CR3	●	●	●	○	●	≤56 HRc

Ordering Code	d	D	W	No. of Flutes	I	L
RM 0603 C05	6	3	0.2	3	5	58
RM 0604 C09	6	4	0.3	3	9	58
RM 0605 D10	6	5	0.3	4	10	58
RM 0606 D10	6	6	0.3	4	10	58
RM 0808 D12	8	8	0.3	4	12	64
RM 1010 D14	10	10	0.3	4	14	73
RM 1212 D16	12	12	0.4	4	16	84
RM 1414 D20	14	14	0.5	4	20	84
RM 1616 E27	16	16	0.5	5	27	105

Order example: RM 0606 D10 CR3

Long Design



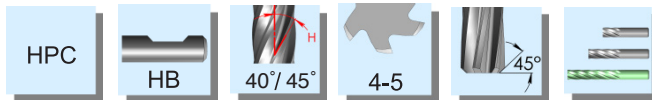
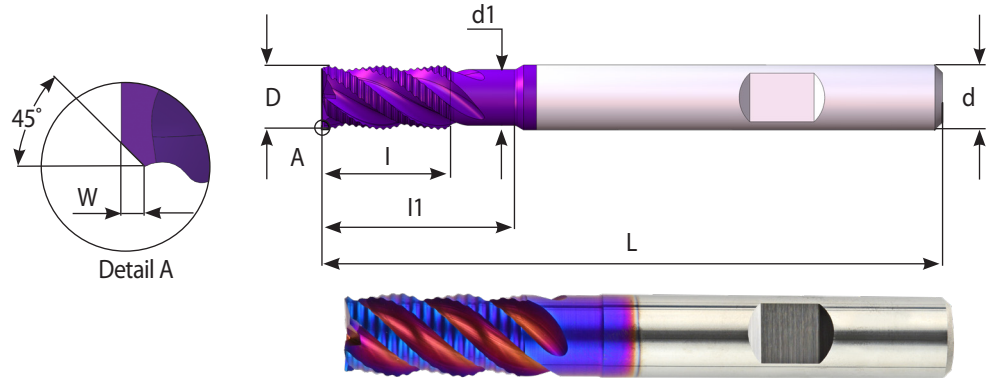
Grade	P	M	K	N	S	H
CR3	●	●	●	○	●	≤56 HRc

Ordering Code	d	D	W	No. of Flutes	I	L
RM 0606 D16	6	6	0.3	4	16	58
RM 0807 D16	8	7	0.3	4	16	64
RM 0808 D18	8	8	0.3	4	18	64
RM 1010 D22	10	10	0.3	4	22	73
RM 1212 D26	12	12	0.4	4	26	84
RM 1414 D30	14	14	0.5	4	30	92
RM 1616 E32	16	16	0.5	5	32	92
RM 2020 E40	20	20	0.5	5	40	104

Order example: RM 1212 D26 CR3

● First choice ○ Alternative

Solid Carbide Roughers with Neck



Grade	P	M	K	N	S	H
CR3	●	●	●	○	●	≤56 HRc

Ordering Code	d	D	l	l1	d1	W	No. of Flutes	L
RM 0606 D13 N18	6	6	13	18	5.8	0.3	4	58
RM 0808 D17 N24	8	8	17	24	7.7	0.3	4	64
RM 1010 D21 N30	10	10	21	30	9.7	0.3	4	73
RM 1212 D25 N36	12	12	25	36	11.6	0.4	4	84
RM 1616 E33 N48	16	16	33	48	15.5	0.5	5	105

Order example: RM 1010 D21 N30 CR3

● First choice

○ Alternative

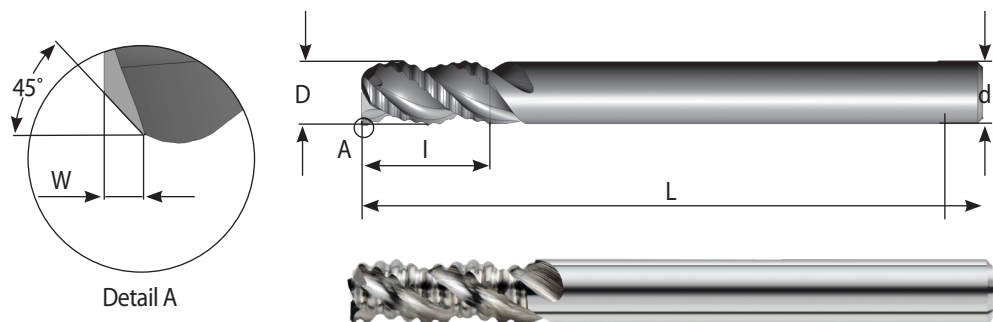
Solid Carbide Roughers - Aluminum Machining

Features

- High Performance Cutting (HPC)
- Optimal flute geometry delivers maximum metal removal rates and better chip evacuation
- Low cutting forces
- Reinforced corner chamfer, promotes additional strength for longer tool life
- Uncoated smooth polished surface finish

Carbide Grade: CA5

Ultra-Fine carbide grade with high hardness and toughness provides high cutting edge stability and wear resistance.



Grade	P	M	K	N	S	H
CA5		○	○	●	○	

Ordering Code	d	D	W	No. of Flutes	I	L
RMA 0604 C08	6	4	0.3	3	8	57
RMA 0606 C16	6	6	0.3	3	16	57
RMA 0808 C19	8	8	0.3	3	19	63
RMA 1010 C22	10	10	0.3	3	22	72
RMA 1212 C26	12	12	0.4	3	26	83

Order example: RMA 0604 C08 CA5

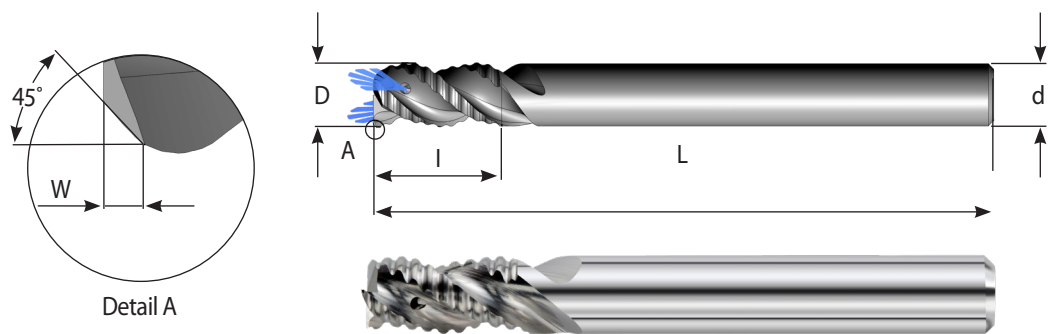
● First choice

○ Alternative

Solid Carbide Roughers - Aluminum Machining with internal coolant through the flutes

The coolant bores provides high coolant pressure through the tool into the application pre-hole, and wash the chips away.

Carbide Grade: CA5



Grade	P	M	K	N	S	H
CA5		○	○	●	○	

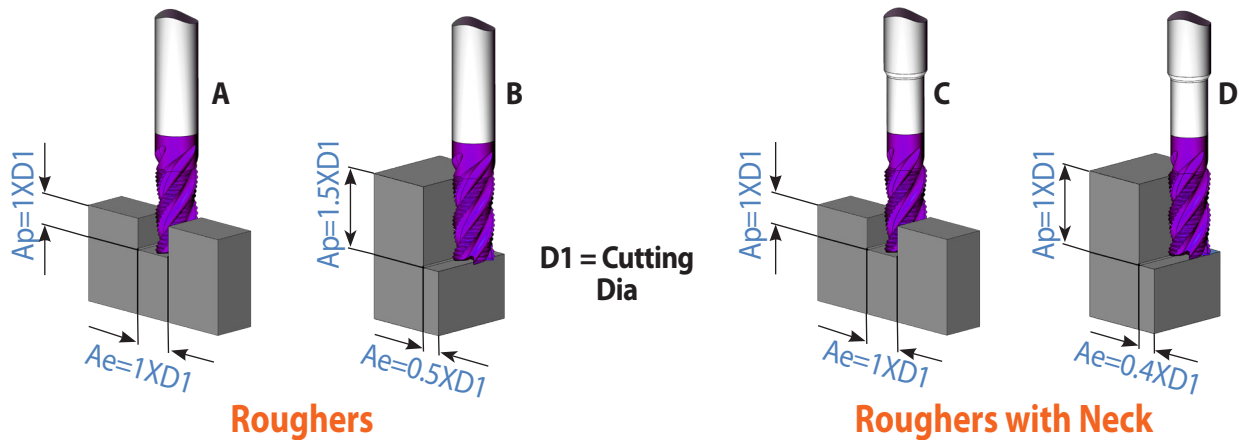
Ordering Code	d	D	W	No. of Flutes	I	L
RMA 0606 C16 Z	6	6	0.3	3	16	58
RMA 0808 C19 Z	8	8	0.3	3	19	64
RMA 1010 C22 Z	10	10	0.3	3	22	73
RMA 1212 C26 Z	12	12	0.4	3	26	84

Order example: RMA 0808 C19 Z CA5

● First choice

○ Alternative

Technical Section



Cutting Data

Roughers with neck (C, D) can be used with same feed and speed as below.

ISO Standard	Materials Class	Vc [m/min]	Fz [mm/tooth] Cutting Diameter			
			Ø3- Ø4	Ø5- Ø6	Ø7- Ø10	Ø12- Ø20
P	Low & Medium Carbon Steels <0.55%C	A: 120-180 B: 140-200	A: 0.012-0.02 B: 0.018-0.024	A: 0.025-0.03 B: 0.03-0.036	A: 0.035-0.05 B: 0.048-0.06	A: 0.055-0.08 B: 0.072-0.096
	High Carbon Steels ≥0.55%C	A: 110-160 B: 140-180	A: 0.01-0.015 B: 0.015-0.02	A: 0.015-0.02 B: 0.025-0.03	A: 0.03-0.04 B: 0.035-0.045	A: 0.04-0.055 B: 0.06-0.08
	Alloy Steels, Treated Steels	A: 100-140 B: 130-160	A: 0.009-0.012 B: 0.009-0.012	A: 0.015-0.018 B: 0.015-0.018	A: 0.024-0.03 B: 0.024-0.03	A: 0.036-0.048 B: 0.036-0.048
M	Stainless Steel-Free Cutting	A: 100-140 B: 130-150	A: 0.009-0.012 B: 0.012-0.016	A: 0.015-0.018 B: 0.02- 0.024	A: 0.024-0.03 B: 0.032-0.04	A: 0.036-0.048 B: 0.048-0.064
	Stainless Steel-Austenitic	A: 70-100 B: 90-130	A: 0.008-0.011 B: 0.01-0.016	A: 0.01-0.015 B: 0.015- 0.024	A: 0.02-0.025 B: 0.03-0.04	A: 0.03-0.04 B: 0.045-0.06
	Cast Steels	A: 120-160 B: 140-180	A: 0.009-0.012 B: 0.012-0.016	A: 0.015-0.018 B: 0.02- 0.024	A: 0.024-0.03 B: 0.032-0.04	A: 0.036-0.048 B: 0.048-0.064
K	Cast Iron	A: 100-160 B: 140-180	A: 0.012-0.02 B: 0.018-0.024	A: 0.025-0.03 B: 0.03-0.036	A: 0.035-0.05 B: 0.048-0.06	A: 0.055-0.08 B: 0.072-0.096
N	Aluminum ≤12%Si, Copper	A: 180-250 B: 200-300	A: 0.015-0.025 B: 0.018-0.03	A: 0.03-0.04 B: 0.035-0.045	A: 0.04-0.06 B: 0.045-0.065	A: 0.06-0.09 B: 0.065-0.095
	Aluminum >12%Si	A: 100-200 B: 130-250	A: 0.01-0.02 B: 0.01-0.02	A: 0.025-0.035 B: 0.03-0.04	A: 0.035-0.055 B: 0.04-0.05	A: 0.055-0.08 B: 0.05-0.09
	Synthetics, Duroplastics, Thermoplastics	A: 180-250 B: 200-300	A: 0.015-0.025 B: 0.018-0.03	A: 0.03-0.04 B: 0.035-0.045	A: 0.04-0.06 B: 0.045-0.065	A: 0.06-0.09 B: 0.065-0.095
S	Nickel alloys, Titanium alloys	A: 50-70 B: 60-80	A: 0.012-0.016 B: 0.012-0.016	A: 0.02-0.024 B: 0.02-0.024	A: 0.032-0.04 B: 0.032-0.04	A: 0.048-0.064 B: 0.048-0.064
H	Hardened Steel 45-50 HRc	A: 50-70 B: 60-80	A: 0.01-0.02 B: 0.018-0.024	A: 0.02-0.025 B: 0.025-0.03	A: 0.03-0.04 B: 0.04-0.05	A: 0.04-0.06 B: 0.06-0.08
	Hardened Steel 51-56 HRc	A: 40-60 B: 50-70	A: 0.01-0.015 B: 0.015-0.02	A: 0.015-0.025 B: 0.02-0.025	A: 0.02-0.035 B: 0.025-0.04	A: 0.03-0.055 B: 0.035-0.065

Indexable CMT Roughers and Finishers

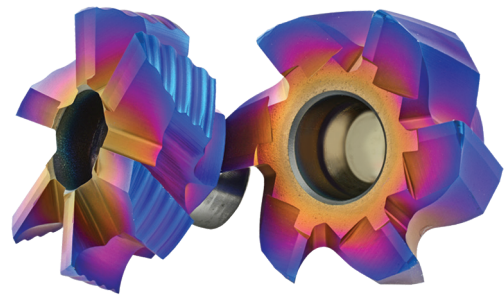
For excellent performance

- Solid and accurate clamping method enables full repeatability
- Working at high machining parameters
- Modular system using the standard CMT tool holders with various shank options
- Enables machining with large overhang

Carbide grade: CR3

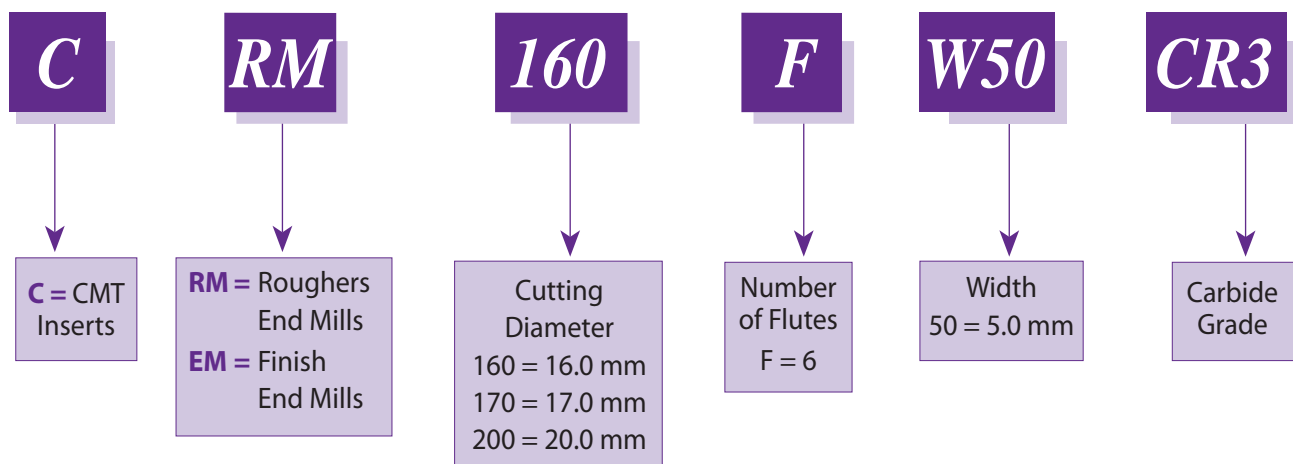
Ultra-Fine carbide grade with high hardness and toughness provides high cutting edge stability and wear resistance.

A New Generation of PVD Coating for High-Performance Cutting Applications.

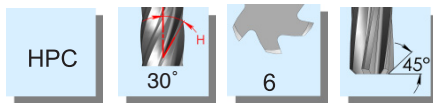
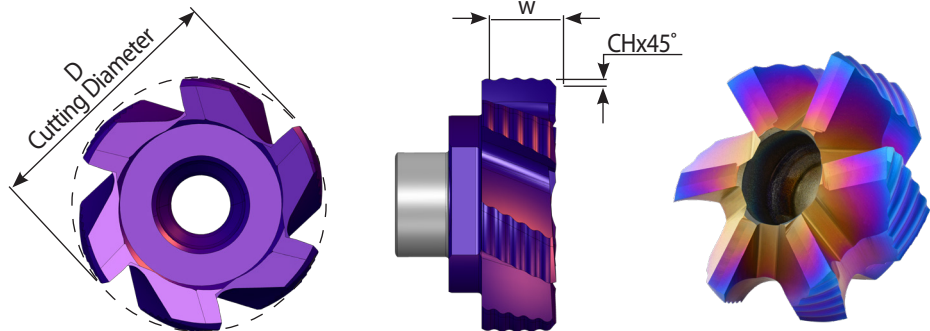


Product Identification

Ordering Codes



Roughers

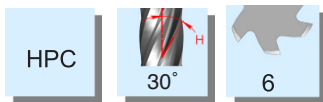
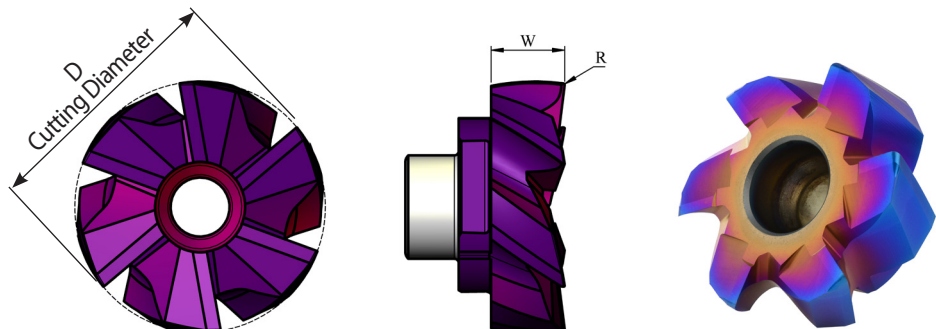


Grade	P	M	K	N	S	H
CR3	●	●	●	○	●	≤56 HRc

Insert Type	Ordering Code	D	No. of Flutes	W	CH
S20	CRM160 F W50	16.0	6	5.0	0.4
S20	CRM170 F W50	17.0	6	5.0	0.4
S20	CRM200 F W50	20.0	6	5.0	0.4

Order example: CRM170 F W50 CR3

Finishers



Grade	P	M	K	N	S	H
CR3	●	●	●	○	●	≤56 HRc

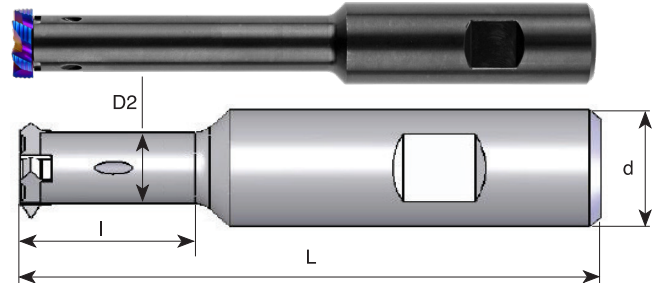
Insert Type	Ordering Code	D	No. of Flutes	W	R
S20	CEM160 F W50	16.0	6	5.0	0.1
S20	CEM170 F W50	17.0	6	5.0	0.1
S20	CEM200 F W50	20.0	6	5.0	0.1

Order example: CEM200 F W50 CR3

The CMT Roughers should be used with the toolholders shown on page B14-33

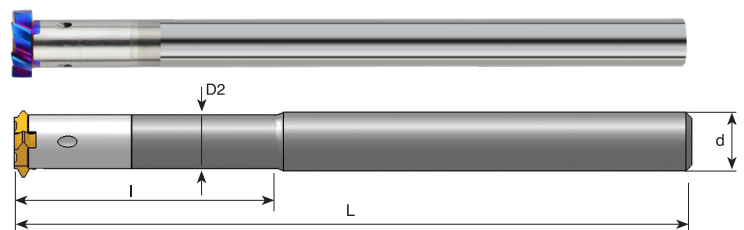
● First choice ○ Alternative

Steel Toolholders With internal coolant



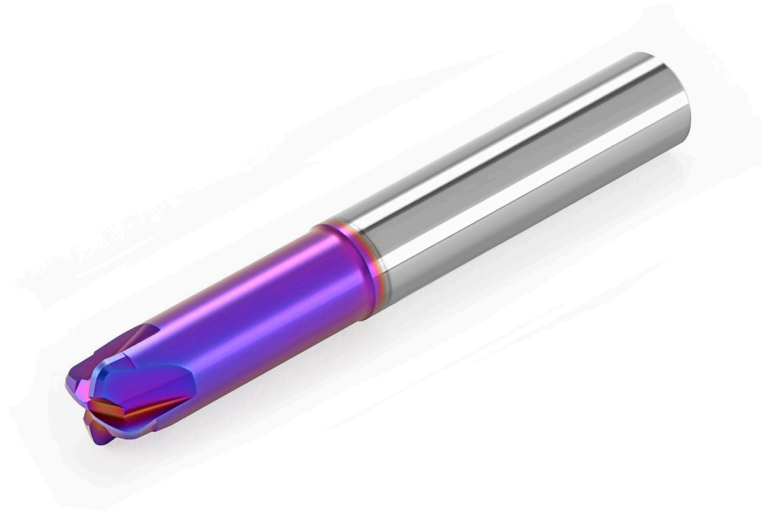
Ordering Code	Insert Type	d	D2	I	L	Insert Screw	Torx Key
SRC 1618 F	S20	16	12.0	25	80	S16	K16
SRC 1618 G	S20	16	12.0	40	90	S16	K16
SRC 1618 H	S20	16	13.8	48	100	S16	K16
SRC 2018 H	S20	20	13.8	32	100	S16	K16
SRC 2018 J	S20	20	13.8	48	110	S16	K16
SRC 2018 L	S20	20	13.8	74	140	S16	K16

Carbide Shank Toolholders With internal coolant



Ordering Code	Insert Type	d	D2	I	L	Insert Screw	Torx Key
CRC 1218 P	S20	12	12.0	-	170	S16	K16
CRC 1618 L48 R	S20	16	13.8	48	195	S16	K16
CRC 1618 L74 R	S20	16	13.8	74	195	S16	K16

CR-Supercut High Feed End-Mills



High Performance milling tools, designed for high feed rates with shallow cutting depths.

Innovative tool geometry enables extremely high **Material Removal Rate (MRR)** and high machine productivity.

High feed machining is the first choice for applications with deep and shallow workpiece features, 3D profiling, mold & die applications and machining in unstable conditions.

- High Performance Cutting (HPC)
- Up to 3xD neck length allowing ramping or helical interpolation working techniques
- High rates of material removal, provides a reduced cycle time
- Same tool for roughing or semi-finishing operations
- For a wide range of materials up to 62 HRc

Carbide grade: CR3

Ultra-Fine carbide grade with high hardness and toughness provides high cutting edge stability and wear resistance.

A New Generation of PVD Coating for High-Performance Cutting Applications.

CR-Supercut High Feed End-Mills

Features

Optimized cutting-edge geometry

For maximum material removal rate

Multi-function operation

Ramping,
Helical interpolation
Face milling

Long neck

Allows extended reach to deep applications

Short flutes and large core

For high rigidity

HPC – High Performance Cutting

High feed rate for maximum material removal rate

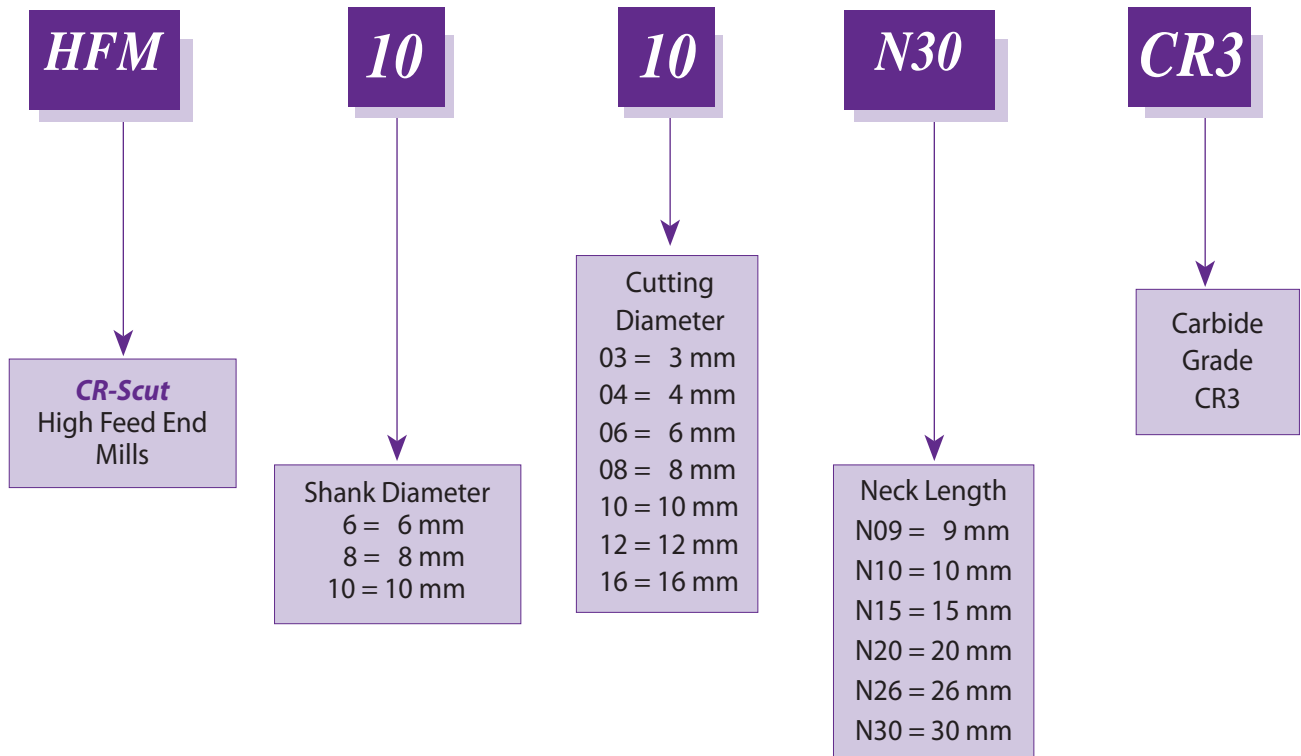
CR3 grade

Superior carbide grade combined with new generation of PVD coating

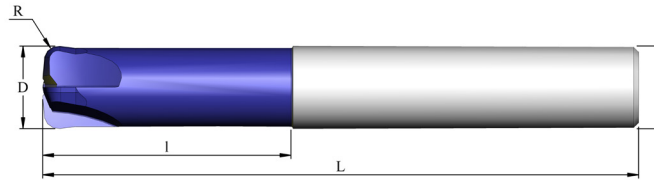


Product Identification

Ordering Codes



Solid Carbide High Feed End-Mills



Grade	P	M	K	N	S	H
CR3	●	●	●		●	≤62 HRc

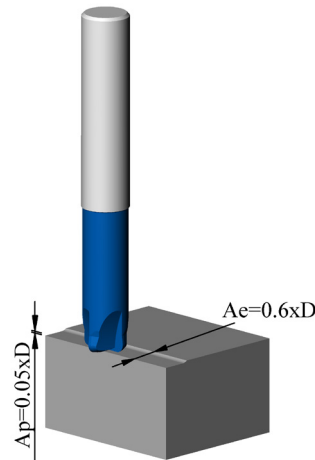
Ordering Code	d	D	No. of Flutes	R	l	L
HFM 0603 N09	6	3	4	0.4	9	57
HFM 0604 N10	6	4	4	0.5	10	57
HFM 0605 N15	6	5	4	0.8	15	57
HFM 0606 N20	6	6	4	0.9	20	57
HFM 0808 N26	8	8	4	1.3	26	63
HFM 1010 N30	10	10	4	1.7	30	72
HFM 1212 N34	12	12	4	2.1	34	83
HFM 1616 N42	16	16	4	2.7	42	110

Order example: HFM 0603 N09 CR3

● First choice

○ Alternative

Technical Section

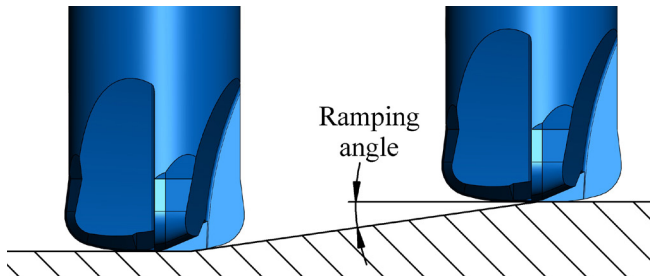


D = Cutting Dia

Cutting Data

ISO	Materials	Cutting Speed Vc [m/min]	Feed Fz [mm/tooth]							
			Tool Cutting Diameter							
			Ø3	Ø4	Ø5	Ø6	Ø8	Ø10	Ø12	Ø16
P	Low & Medium Carbon Steels <0.55%C	140 - 200	0.25	0.25	0.30	0.35	0.35	0.45	0.55	0.60
	High Carbon Steels ≥0.55%C	140 - 200	0.25	0.25	0.30	0.35	0.35	0.45	0.55	0.60
	Alloy Steels, Treated Steels	120 - 200	0.20	0.20	0.25	0.30	0.30	0.40	0.50	0.55
M	Stainless Steel-Free Cutting	100 - 140	0.10	0.15	0.20	0.20	0.30	0.30	0.40	0.50
	Stainless Steel-Austenitic	90 - 130	0.10	0.10	0.15	0.15	0.20	0.20	0.30	0.40
	Cast Steels	90 - 130	0.10	0.10	0.15	0.15	0.20	0.20	0.30	0.40
K	Cast Iron	100 - 140	0.10	0.15	0.20	0.20	0.30	0.30	0.40	0.50
S	Heat-resistant alloys	70 - 90	0.10	0.10	0.10	0.15	0.15	0.20	0.20	0.25
	Titanium alloys	80 - 100	0.10	0.10	0.10	0.15	0.15	0.20	0.20	0.25
H	Hardened Steel 45-50 HRc	80 - 190	0.15	0.15	0.20	0.25	0.25	0.35	0.45	0.50
	Hardened Steel 51-56 HRc	80 - 180	0.10	0.10	0.10	0.20	0.20	0.30	0.40	0.40
	Hardened Steel 56-62 HRc	40 - 80	0.10	0.10	0.10	0.15	0.15	0.20	0.25	0.30

Ramping



Ramping angle	Feed
1°	100%
2°	80%
3°	70%
4°	60%
5°	50%



Case Study

Application

Pocket machining by helical interpolation

Workpiece material

Tempered steel SAE 4340

Hardness: 45 HRC

End-Mill description

HFM 0604 N10 CR3

Shank diameter: Ø6 mm

Cutting diameter: Ø4 mm

Number of flutes: 4

Neck length: 10 mm

Cutting conditions

Cutting speed: 170 m/min

Feed: 0.15 mm/tooth

Ap=0.2 mm

Machine

Mazak Integrex

Coolant: emulsion 6%

Results

Tool life: The tool worked 94 minutes and is still in good condition to continue.