FANAR®

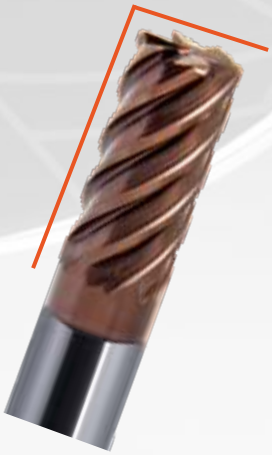
HRC

For **hardened steels**

***HRC** end mills have been designed for machining materials in hardened condition. Hardnesses above 60 HRC generate extremely high temperatures, which imposes specific requirements on the tool.*

VARIANTS

R645



For flat surflaces

B415N

For curves and complicated shapes

HFM 200

For maching with high feed rates

FEATURES

- *Machining of ISO H materials.*
- *Nano-grain cemented carbide grade designed especially for hardened materials.*
- *Newly developed TS coating guarantees effective protection against high temperatures.*
- *Negative rake angles, corner radii and optimized chip flutes shapes increases strength of cutting edges.*
- *Large core diameter increases stiffness and prevent from breakage.*

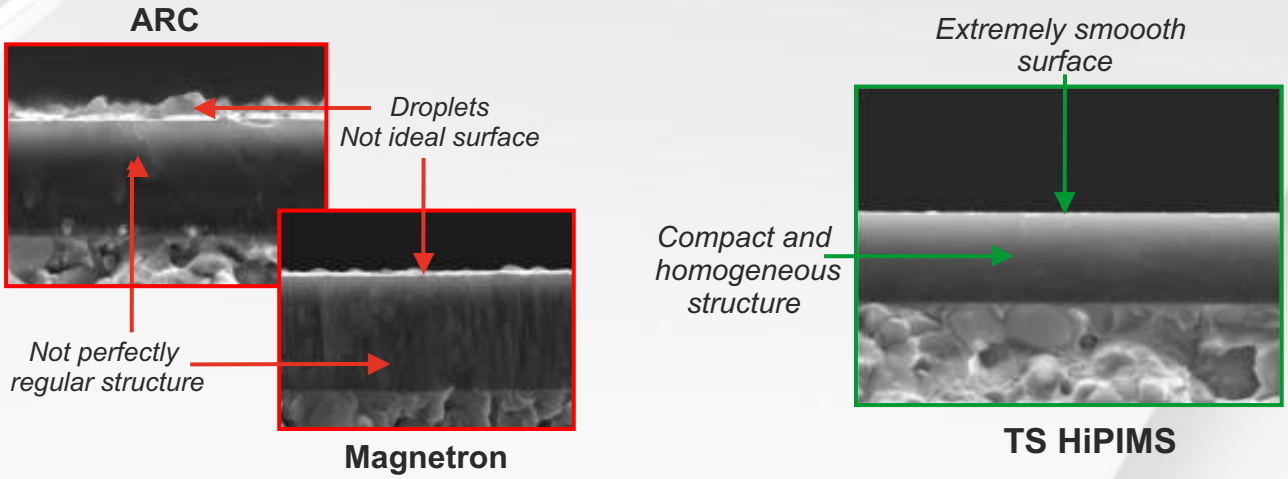
HRC

TS COATING

The ideal temperature barrier is the newly developed TS coating produced in HiPIMS technology. This technology provides much better adhesion and a more compact coating structure as compared to the coating techniques used to date. In-house PVD department ensures full control over the coatings.

Older coating technologies

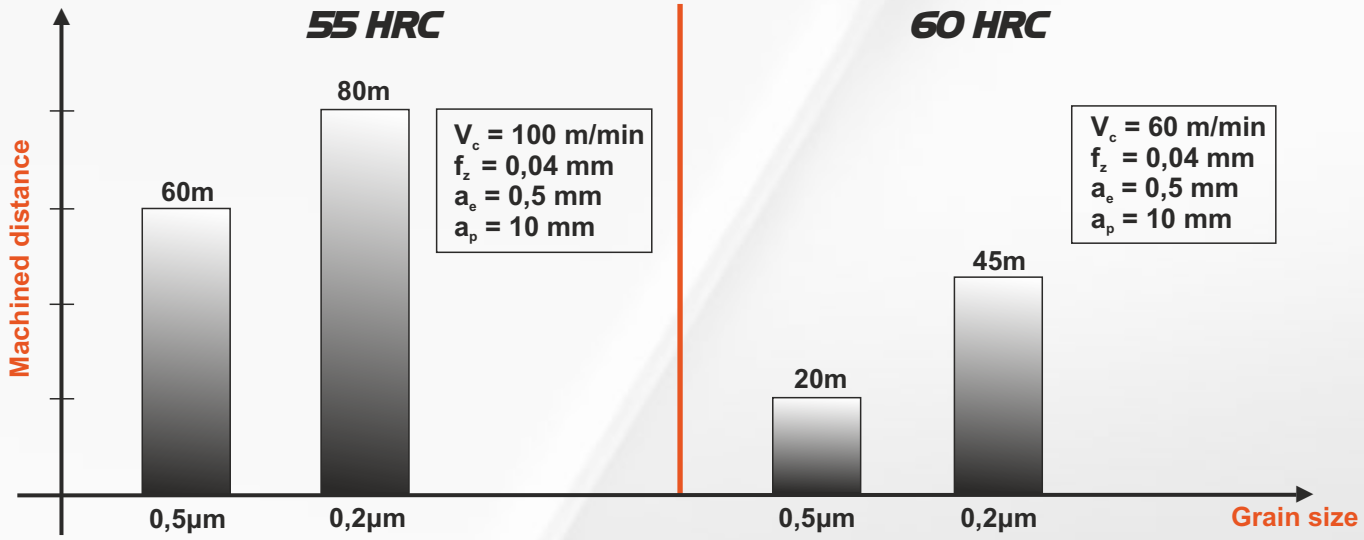
The newst HiPIMS technology



SPECIAL CARBIDE GRADE

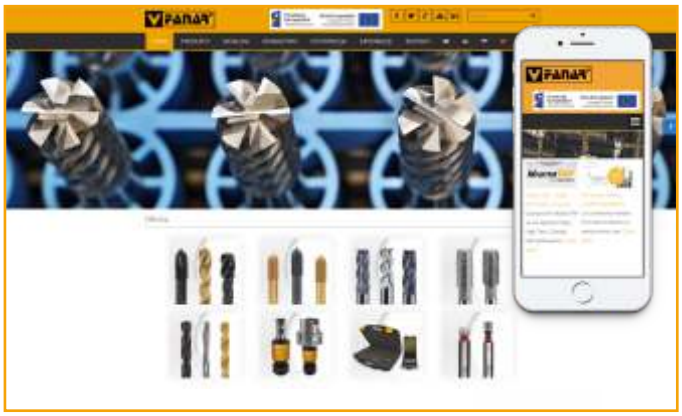
Comented carbide grades with nano-rain size (<0,2 µm), used for the production of HRC milling cutters guarantees the highest resistance to mechanical wear.

Comparison of comented carbide grades for hardened steel.
Tested: 6 flutes milling cutters.



Technical information

Detailed information on the website **www.fanar.eu**



Cutting geometry

- Z=4 — Number of flutes
- Possible feed directions
- Square corner
- Corner radius
- Ball nose
- For High Feed Machining
- 40° — Helix angle
- 35°-39° — Variable helix angle
- Equal pitch
- Unequal pitch

Groups of Tools by Applications

HRC End mills produced of comented carbide grade with nano-grain size (0,2µm), dedicated for machining materials in hardened condition. Optimized geometry and TS coating allow machining materials with higher hardness than 65 HRC.

				Annealed	A		
				Tempered	QT		
				Hardened and tempered	HT		
				Precipitation hardened	PH		

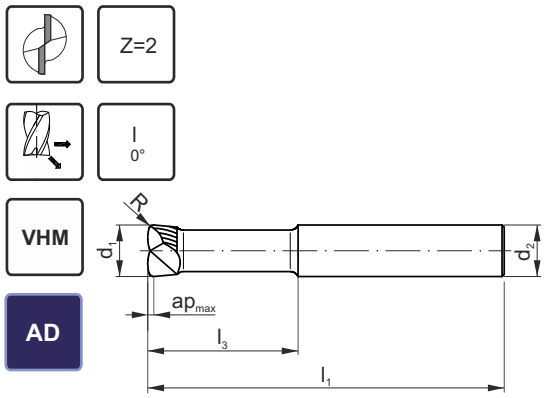
Material group

					Rm	HB	HRC
Steel							
P	P1	Non-alloyed steel	Free cutting steel	A	750	220	
	P2		C ≤ 0,55 %	A	650	190	-
	P3		C > 0,55 %	A	650	190	-
	P4		C ≤ 0,55 %	QT	700	210	-
	P5		C > 0,55 %	QT	1000	300	32
	P6	Low-alloyed steel		A	600	175	-
	P7			QT	1000	300	32
	P8			QT	1200	380	41
	P9			QT	1400	420	45
	P10	High-alloyed steel and high-alloyed tool steel		A	700	210	-
	P11			A	1000	300	32
	P12			HT	1400	420	45
	P13	Stainless steel	Ferritic/martensitic	A	700	210	-
	P14		Martensitic	QT	1100	330	34
Stainless steel							
M	M1	Stainless steel	Austenitic		700	210	-
	M2		Austenitic (PH)	PH	1000	300	32
	M3		Duplex		800	240	23
Cast iron							
K	K1	Grey cast iron(GJL)			400	120	-
	K2	Cast iron with vermicular graphite (GJV) CGI			550	160	-
	K3	Malleable cast iron (GJMW / GJMB)			500	150	-
	K4	Malleable cast iron (GJMB)			800	240	-
	K5	Cast iron with spheroidal graphite (GJS)			700	210	-
	K6	Cast iron with spheroidal graphite (GJS) ADI			1400	420	45
Non-ferrous metals							
N	N1	Aluminium wrought alloys			200	-	-
	N2			PH	500	152	-
	N3	Cast aluminium alloys	Si ≤ 12%		250	75	-
	N4		Si ≤ 12%	PH	300	90	-
	N5		Si> 12 %		450	130	-
	N6	Magnesium alloys			250	70	-
	N7	Copper and copper alloys	Pure, Non-alloyed		350	100	-
	N8		Cu-alloys, long-chipping		600	180	-
	N9		Cu-alloys, short-chipping		400	120	-
	N10		High-strength,		1000	300	32
Superalloys and titanium							
S	S1	Heat-resistant alloys	Fe-based	A	675	200	-
	S2			PH	950	280	29
	S3		Ni / Co base	A	850	250	25
	S4			PH	1200	350	38
	S5			C	1100	320	34
	S6	Titanium alloys	Pure titanium		675	200	-
	S7		α and β alloys		1250	375	40
	S8		β alloys		1400	410	44
Hard materials							
H	H1	Hardened steel		HT			50
	H2			HT			55
	H3			HT			60
	H4	Hardened cast iron		HT			55

For high feed machining

HRC

HFM 200



Workpiece material	P M K N S H
Shank	
Tool material	VHM
Coating	AD
Corner type	

d_1	d_2h6	l_1	ap_{max}	l_3	Z	R	INDEX
6	6	57	0,30	20	2	0,6	M9-20E9A0-0060
8	8	63	0,35	20	2	0,8	M9-20E9A0-0080
10	10	72	0,40	30	2	1,0	M9-20E9A0-0100
12	12	83	0,70	35	2	1,2	M9-20E9A0-0120
16	16	92	0,80	50	2	1,6	M9-20E9A0-0160

ISO		Vc [m/min]	a_e[mm]	d_1 [mm]				
				6	8	10	12	16
				fz [mm]	fz [mm]	fz [mm]	fz [mm]	fz [mm]
P	P1-P5	300-350	0,4 - 0,6xD	0,4	0,5	0,6	0,8	1,2
	P6-P14	200-250	0,4 - 0,6xD	0,3	0,4	0,5	0,6	1,0
K	K1-K3	400-450	0,4 - 0,6xD	0,4	0,5	0,6	0,8	1,2
	K4-K6	300-350	0,4 - 0,6xD	0,3	0,4	0,5	0,6	1,0
H	H1-H4	70-120	0,2 - 0,4xD	0,3	0,4	0,5	0,6	1,0

H - group materials may only be machined dry.

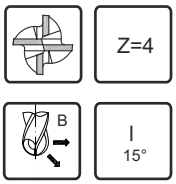
Example of order

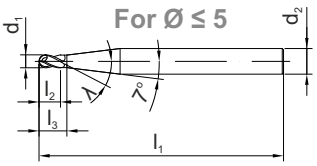
M9-20E9A0-0060
HRC HFM 200 6x6x20x57 R0,6 VHM AD

For hardened materials

HRC

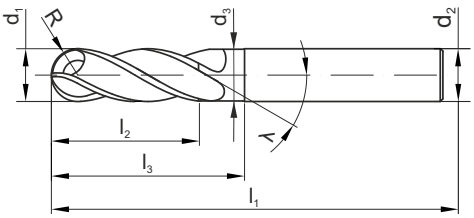
B415N





VHM

TS



Workpiece material	P M K N S H
Shank	
Tool material	VHM
Coating	TS
Corner type	

d_1	d_2h6	d_3	l_1	l_2	l_3	Z	R	INDEX
3	6	2,9	7	57	21	4	1,5	M9-41G9AX-0030
4	6	3,9	8	57	21	4	2,0	M9-41G9AX-0040
5	6	4,9	10	57	21	4	2,5	M9-41G9AX-0050
6	6	5,9	10	57	21	4	3,0	M9-41G9AX-0060
8	8	7,8	12	63	23	4	4,0	M9-41G9AX-0080
10	10	9,8	14	72	27	4	5,0	M9-41G9AX-0100
12	12	11,8	16	75	30	4	6,0	M9-41G9AX-0120
16	16	15,8	22	92	44	4	8,0	M9-41G9AX-0160

ISO		Vc [m/min]	d_1 [mm]							
			3	4	5	6	8	10	12	16
			fz [mm]	fz [mm]	fz [mm]	fz [mm]	fz [mm]	fz [mm]	fz [mm]	fz [mm]
H	H1	180-220	0,040	0,055	0,070	0,085	0,100	0,120	0,160	0,220
	H2, H4	140-180	0,030	0,035	0,055	0,065	0,080	0,100	0,150	0,175
	H3	115-160	0,025	0,035	0,045	0,055	0,065	0,085	0,100	0,150

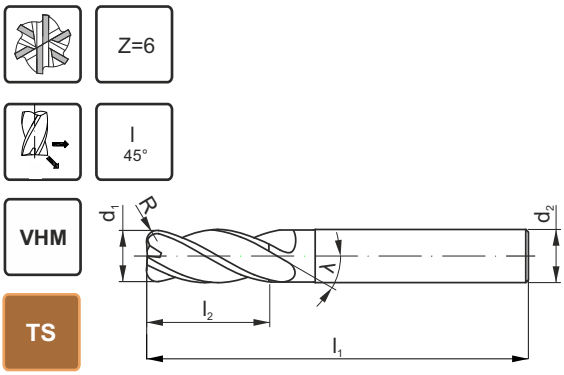
H - group materials may only be machined dry.

Example of order

M9-41G9AX-0030
HRC B415N 3x2,9x6x7x21x57 VHM TS

Another tool dimensions available on request

For hardened materials	HRC R645



Workpiece material	P M K N S H
Shank	
Tool material	VHM
Coating	TS
Corner type	

d_1	d_2h6	l_1	l_2	Z	R	INDEX
6	6	57	13	6	0,5	M9-64G901-0060
8	8	63	19	6	0,5	M9-64G901-0080
10	10	72	22	6	1,0	M9-64G903-0100
12	12	75	26	6	1,0	M9-64G903-0120
16	16	92	32	6	1,5	M9-64G904-0160

ISO		Vc [m/min]	d_1 [mm]				
			6	8	10	12	16
			fz [mm]	fz [mm]	fz [mm]	fz [mm]	fz [mm]
H	H1	80-140	0,035	0,050	0,060	0,070	0,085
	H2-H4	50-80	0,025	0,035	0,045	0,050	0,065

H - group materials may only be machined dry.

Example of order

M9-464G901-0060
HRC R645 6x6x13x57 R0,5 VHM TS

Another tool dimensions available on request

Tool Factory Fanar Joint Stock Company
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For **hardened steels**