ARNO®
WERKZEUGE

MILLING

Product expansion Milling

www.arno.com.sg

TÜV SÜD ISO 9001

Dear customer,

With this brochure we would like to present our new product expansions for milling applications. Detailed information of the general tool range you will find in our main milling catalogue.

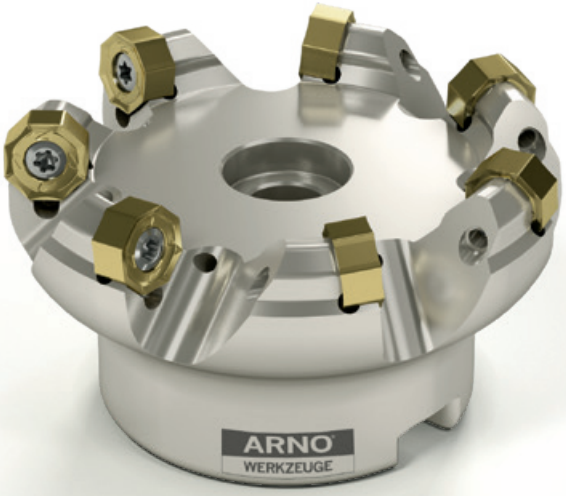
In addition to our excellent products we offer overnight delivery service, competent special solutions where our standards may not suffice and a qualified team of external technical sales engineers.

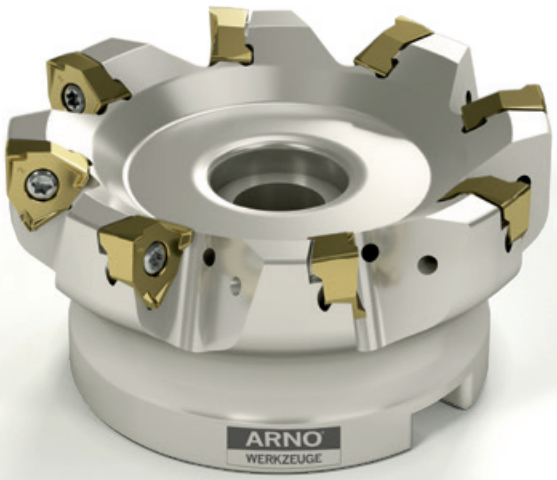
Enjoy your reading and should you have any questions, please do not hesitate to contact us.

Your ARNO® team

Product expansion Milling

Run up to peak shape. ARNO milling systems.





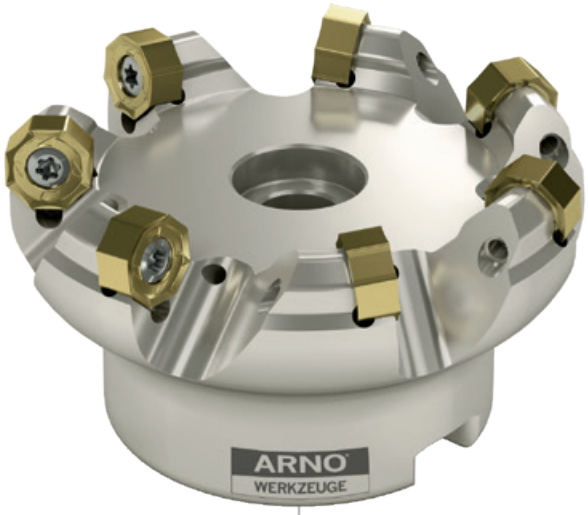
Features FPA

- 16 cutting edges for increase of productivity
- Negativ basic geometry, thus extremly stable
- Effective positive cutting edge geometry, therefore soft cut
- Numbering of cutting edges for exact true running
- WIPER – geometry for qualitativ high-class surface. Best results if increasing cutting speed (approximately double vc, small cutting depth, approximately ap 0.7 mm, tooth feed approximately fz 0.25 mm with milling cutter diameter 63 mm)
- Big metal removal due to close division of the tools
- Uneven spacing leads to reduced vibration and extremely smooth running
- Cutting material diversity for optimal cutting results on a wide material range

Features FZA

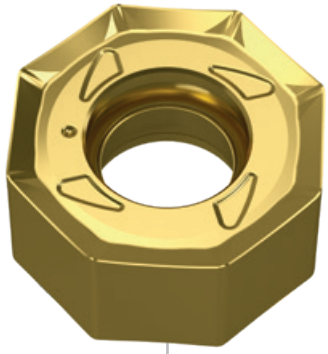
- Stable tool system through negative geometry basic design therefore process security on roughing
- 6 cutting edges for increase of productivity on 90° face milling
- Effective positive chip angle for smooth cut
- Productivity guaranteed through 6 cutting edges

Holders

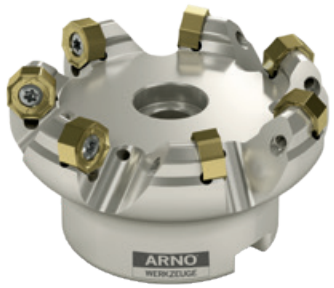


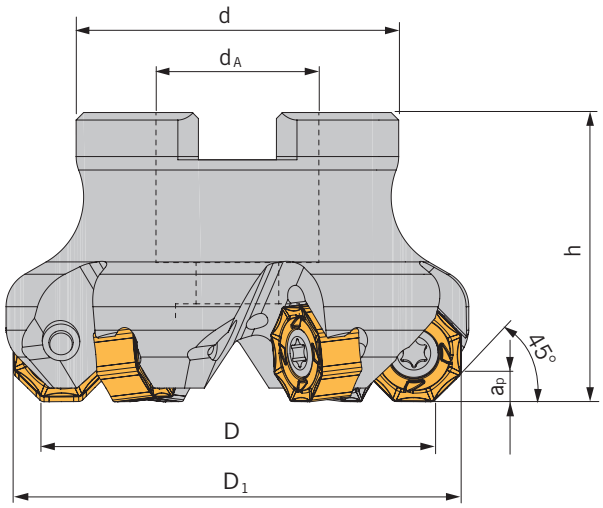
FPA	145	080	R07	05
Milling system	1 = Generation 45 = Approach angle	Diameter (mm)	R = Direction 07 = No. of teeth	Insert Size

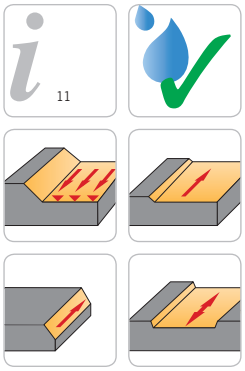
Inserts



ONMU	05	06	08	SN	NMR	AP	3035
ISO-Code	Insert Size	Insert thickness	Corner radius	Edge preparation	Chipbreaker	ARNO®-Application area	ISO- Cutting material code







Face milling cutter with octagonal inserts

Designation	D	D_1	d	h	d_A	a_p	z	Indexable insert
FPA-145.050.R04-05	50	57,5	50	40	22	3	4	**ONMU 05...**
FPA-145.050.R06-05	50	57,5	50	40	22	3	6	**ONMU 05...**
FPA-145.063.R06-05	63	70,5	50	40	22	3	6	**ONMU 05...**
FPA-145.063.R08-05	63	70,5	50	40	22	3	8	**ONMU 05...**
FPA-145.080.R07-05	80	87,5	60	50	27	3	7	**ONMU 05...**
FPA-145.080.R10-05	80	87,5	60	50	27	3	10	**ONMU 05...**
FPA-145.100.R08-05	100	107,5	80	50	32	3	8	**ONMU 05...**
FPA-145.100.R12-05	100	107,5	80	50	32	3	12	**ONMU 05...**
FPA-145.125.R10-05	125	132,5	95	63	40	3	10	**ONMU 05...**
FPA-145.125.R16-05	125	132,5	95	63	40	3	16	**ONMU 05...**

Spare Parts

Designation	Torx-screw	Torque	Torx-wrench
FPA-...-05	AS 0320	5 Nm	T5120-IP

HC – CARBIDE GRADE COATED

AP3025

PVD

- For machining conventional steel grades
- For high cutting speeds
- Suitable for dry and wet machining

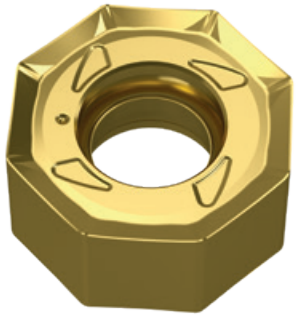
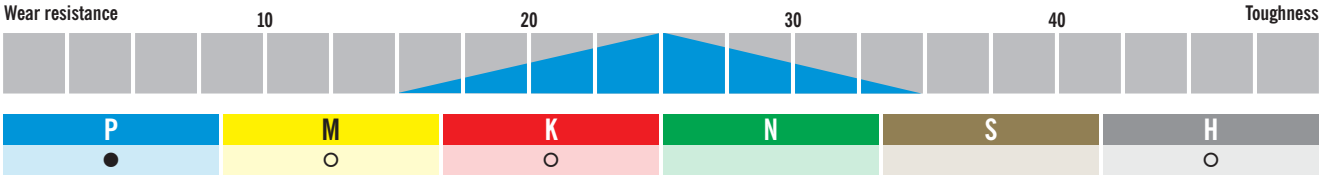


Illustration similar



AP3035

PVD

- For machining conventional steel grades
- Tough carbide grade for difficult conditions
- Especially well suited for dry milling

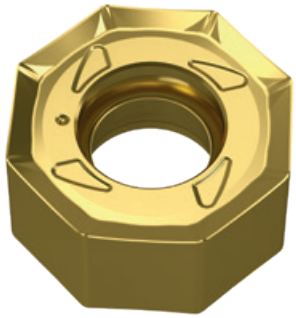


Illustration similar

AM3140

PVD

- Ideal grade for duplex grade stainless steels
- Extremely tough and fine-grain grade
- Also suitable for wet machining

Illustration similar

AK3220

PVD

- Very well suited for machining cast materials
- Thick heat-resistant coating
- Also suitable for finish machining steel and hard materials

Illustration similar

-NMS

- Effective positive rake angle for easy cutting
- Extremely high cutting edge stability
- Universal application

both sided

Finishing	Medium machining	Rough machining

P	M	K	N	S	H
●	○				

-NMR

- Low cutting forces
- Sharp cutting edge
- For medium to good machining conditions

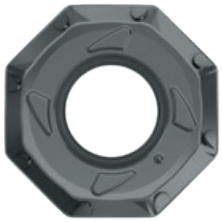
both sided

Finishing	Medium machining	Rough machining

P	M	K	N	S	H
	●			○	

-NMG

- Very high process reliability
- Suitable for sand inclusions or casting skins
- For unfavourable machining conditions

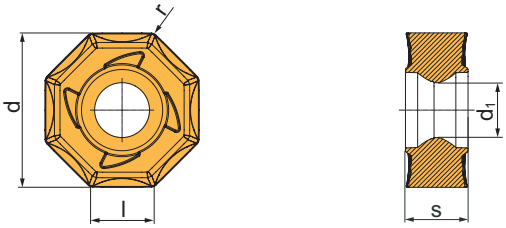


both sided

Finishing	Medium machining	Rough machining

P	M	K	N	S	H
○		●			○

ONMU



Designation	l	s	d	d_1	r	HC AP3025	HC AP3035	HC AM3140	HC AK3220
ONMU 050608SN-NMS	5,24	5,8	12,7	5,45	0,8	◆	◆		
ONMU 050608SN-NMR	5,24	5,8	12,7	5,45	0,8			◆	
ONMU 050608SN-NMG	5,24	5,8	12,7	5,45	0,8				◆

HC = Carbide grade coated

	HC AP3025	HC AP3035	HC AM3140	HC AK3220
P	●	●		○
M	○	○	●	
K	○			●
N				
S			○	
H	○			○

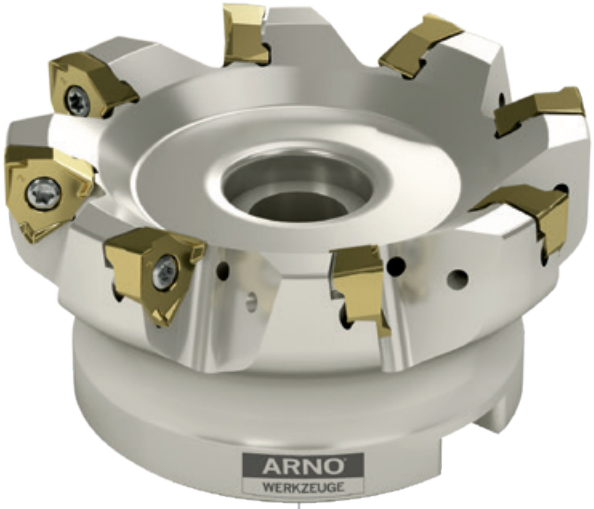
● **Main application**
○ **Secondary application**

Material group	Structure of the material groups and identification letters			Brinell hardness HB	Tensile strength Rm (N/mm²)	Chipping group	Cutting speed Vc (m/min) HC AP3025	AP3035	AM3140	AK3220
P	Unalloyed steel	C ≤ 0.25 %	annealed	125	428	P1	190 - 240 - 290	150 - 190 - 230	-	200 - 250 - 300
		C > = 0.25 ... > = 0.55 %	annealed	190	639	P2	190 - 240 - 290	150 - 190 - 230	-	200 - 250 - 300
		C > = 0.25 ... > = 0.55 %	hardened and tempered	210	708	P3	190 - 240 - 290	150 - 190 - 230	-	200 - 250 - 300
		C ≤ 0.55 %	annealed	190	639	P4	190 - 240 - 290	150 - 190 - 230	-	200 - 250 - 300
		C ≤ 0.55 %	hardened and tempered	300	1013	P5	190 - 240 - 290	150 - 190 - 230	-	200 - 250 - 300
		Machinig steel (short-clipping)	annealed	220	745	P6	190 - 240 - 290	150 - 190 - 230	-	200 - 250 - 300
	Low alloyed steel	annealed		175	591	P7	160 - 195 - 230	130 - 155 - 180	-	180 - 215 - 250
		hardened and tempered		300	1013	P8	160 - 195 - 230	130 - 155 - 180	-	180 - 215 - 250
		hardened and tempered		380	1282	P9	160 - 195 - 230	130 - 155 - 180	-	180 - 215 - 250
		hardened and tempered		430	1477	P10	160 - 195 - 230	130 - 155 - 180	-	180 - 215 - 250
	High alloyed steel and high alloyed tool steel	annealed		200	675	P11	145 - 178 - 210	110 - 135 - 160	-	160 - 190 - 220
		hardened		300	1013	P12	145 - 178 - 210	110 - 135 - 160	-	160 - 190 - 220
		hardened		400	1361	P13	145 - 178 - 210	110 - 135 - 160	-	160 - 190 - 220
	Stainless steel	ferretic / martensitic, annealed		200	675	P14	110 - 140 - 170	-	-	120 - 150 - 180
		martensitic, hardened and tempered		330	1114	P15	110 - 140 - 170	-	-	120 - 150 - 180
M	Stainless steel	austenitic, chilled		200	675	M1	90 - 120 - 150	80 - 110 - 140	100 - 130 - 160	-
		austenitic, precipitation-hardened (PH)		300	1013	M2	60 - 85 - 110	80 - 110 - 140	100 - 130 - 160	-
		austenitic-ferritic, Duplex		230	778	M3	-	-	70 - 95 - 120	-
K	Malleable cast iron	ferritic		200	675	K1	140 - 220 - 300	-	-	150 - 235 - 320
		pearlitic		260	867	K2	140 - 220 - 300	-	-	150 - 235 - 320
	Cast iron	low tensile strength		180	602	K3	140 - 220 - 300	-	-	150 - 235 - 320
		high tensile strength / austenitic		245	825	K4	140 - 220 - 300	-	-	150 - 235 - 320
	Cast iron with nodular graphite	ferritic		155	518	K5	100 - 130 - 160	-	-	110 - 145 - 180
		pearlitic		265	885	K6	100 - 130 - 160	-	-	110 - 145 - 180
	GGV (CGI)			200	675	K7	100 - 130 - 160	-	-	110 - 145 - 180
N	Aluminium alloys long chipping	not heat treatable		30	-	N1	-	-	-	-
		heat treatable, heat treated		100	343	N2	-	-	-	-
	Casted aluminium alloys	≤ 12 % Si, not heat treatable		75	260	N3	-	-	-	-
		≤ 12 % Si, heat treatable, heat treated		90	314	N4	-	-	-	-
		> 12 % Si, not heat treatable		130	447	N5	-	-	-	-
	Magnesium alloys	> 12 % Si, not heat treatable		70	250	N6	-	-	-	-
	Copper and copper alloys (Brass / Bronze)	Unalloyed, elektrolyte copper		100	343	N7	-	-	-	-
		Brass, Bronze		90	314	N8	-	-	-	-
		Cu-alloys, short-chipping		110	382	N9	-	-	-	-
				300	1013	N10	-	-	-	-
	Non-ferrous materials	Lead alloys (without abrasive filling material)		-	-	N11	-	-	-	-
		Duroplastic (without abrasive filling material)		-	-	N12	-	-	-	-
		Plastic glas fibre reinforced GFRP		-	-	N13	-	-	-	-
		Plastic carbon fibre reinforced CFRP		-	-	N14	-	-	-	-
		Plastic aramid fibre reinforced AFRP		-	-	N15	-	-	-	-
		Graphite (tech.)		80 Shore	-	N16	-	-	-	-
S	High temperature resistant alloys	Fe-based	annealed	200	675	S1	-	-	30 - 45 - 60	-
		Fe-based	heat treated	280	943	S2	-	-	30 - 45 - 60	-
		Ni- or Co-alloyed	annealed	250	839	S3	-	-	30 - 45 - 60	-
		Ni- or Co-alloyed	heat treated	350	1177	S4	-	-	30 - 45 - 60	-
		Ni- or Co-alloyed	casting	320	1076	S5	-	-	30 - 45 - 60	-
	Titanium alloys	Pure titan		200	675	S6	-	-	30 - 45 - 60	-
		α- and β-alloys, heat treated		375	1262	S7	-	-	30 - 45 - 60	-
		β-alloys		410	1396	S8	-	-	30 - 45 - 60	-
	Wolfram alloys			300	1013	S9	-	-	-	-
	Molybdän alloys			300	1013	S10	-	-	-	-
H	Hardened steel	hardened		50 HRC	-	H1	100 - 125 - 150	-	-	80 - 100 - 120
		hardened		55 HRC	-	H2	-	-	-	-
		hardened		60 HRC	-	H3	-	-	-	-
	Hardened cast iron	hardened		55 HRC	-	H4	-	-	-	-

The recommended cutting data are only approximate values.
It may be necessary to adjust them to each individual machining application.
HC = Solid carbide coated

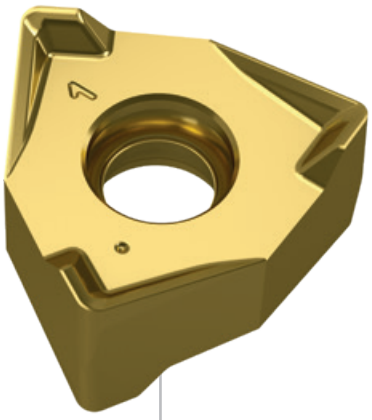
ISO	Material	Medium machining		Rough machining	
		f_z (mm)	a_p (mm)	f_z (mm)	a_p (mm)
P	Steel	0,15 - 0,18 - 0,22	0,4 - 1,2 - 2,0	0,22 - 0,26 - 0,30	2,0 - 2,5 - 3,0
M	Stainless steel	0,12 - 0,15 - 0,18	0,4 - 1,2 - 2,0	0,18 - 0,22 - 0,25	2,0 - 2,5 - 3,0
K	Cast iron	0,20 - 0,22 - 0,25	0,4 - 1,2 - 2,0	0,25 - 0,30 - 0,35	2,0 - 2,5 - 3,0
N	Non ferrous materials	-	-	-	-
S	High temperature resistant alloys	0,12 - 0,15 - 0,18	0,4 - 1,2 - 2,0	0,18 - 0,22 - 0,25	2,0 - 2,5 - 3,0
H	Hardened steel	-	-	-	-

Holders

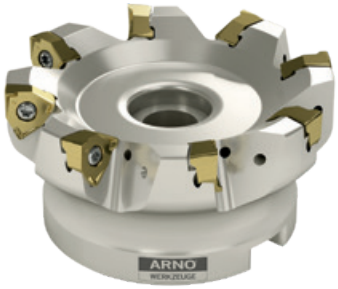


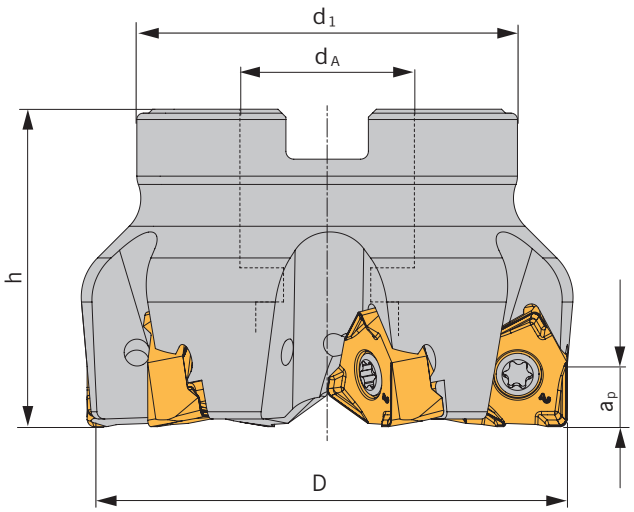
FZA	190	050	R05	08
Milling system	1 = Generation 90 = Approach angle	Diameter (mm)	R = Direction 05 = No. of teeth	Insert Size

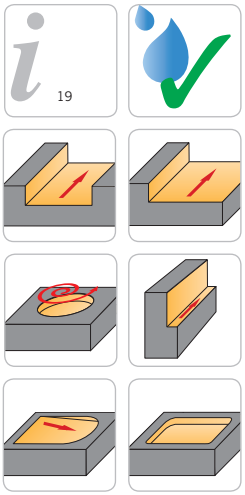
Inserts



WNEX	08	06	08	SR	NMS	AP	3035
ISO-Code	Insert Size	Insert thickness	Corner radius	Edge preparation	Chipbreaker	ARNO®-Application area	ISO- Cutting material code







Square shoulder milling cutter

Designation	D	d_1	h	d_A	a_p	z	Indexable insert
FZA-190.050.R05-08	50	46	40	22	7	5	**WNEX 08...**
FZA-190.063.R06-08	63	47	40	22	7	6	**WNEX 08...**
FZA-190.080.R07-08	80	62	50	27	7	7	**WNEX 08...**
FZA-190.100.R08-08	100	78	50	32	7	8	**WNEX 08...**
FZA-190.125.R10-08	125	90	63	40	7	10	**WNEX 08...**
FZA-190.160.R11-08	160	90	63	40	7	11	**WNEX 08...**

Spare Parts

Designation	Torx-screw	Torque	Torx-wrench
FZA-...-08	AS 0310	3 Nm	T5115-IP

HC – CARBIDE GRADE COATED

AP3025

PVD

- For machining conventional steel grades
- For high cutting speeds
- Suitable for dry and wet machining

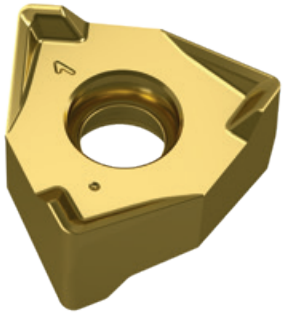
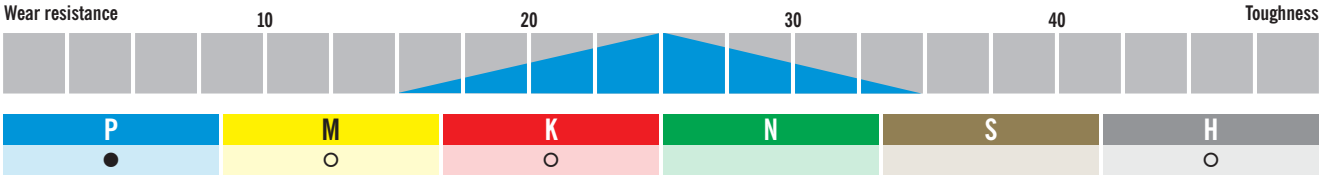


Illustration similar



AP3035

PVD

- For machining conventional steel grades
- Tough carbide grade for difficult conditions
- Especially well suited for dry milling

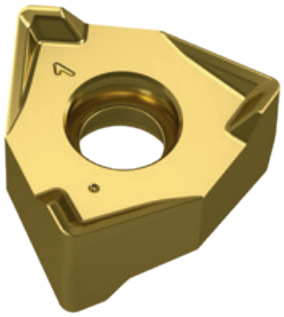


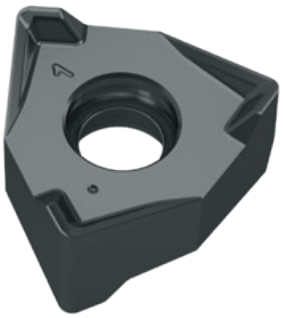
Illustration similar

AM3140

PVD

- Ideal grade for duplex grade stainless steels
- Extremely tough and fine-grain grade
- Also suitable for wet machining

Illustration similar

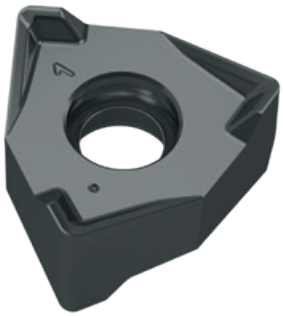


AK3220

PVD

- Very well suited for machining cast materials
- Thick heat-resistant coating
- Also suitable for finish machining steel and hard materials

Illustration similar



-NMS

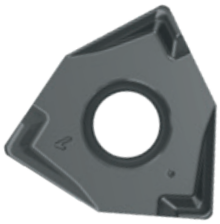
- Effective positive rake angle for easy cutting
- Extremely high cutting edge stability
- Universal application

both sided

Finishing		Medium machining		Rough machining	
P	M	K	N	S	H
●	○				

-NMR

- Low cutting forces
- Sharp cutting edge
- For medium to good machining conditions

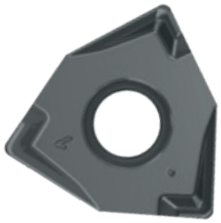


both sided

Finishing		Medium machining		Rough machining	
P	M	K	N	S	H
	●			○	

-NMG

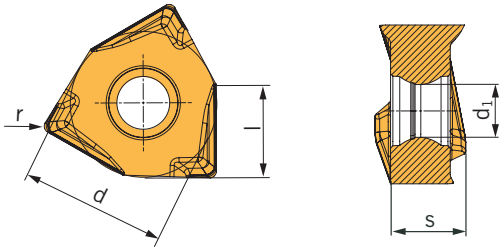
- Very high process reliability
- Suitable for sand inclusions or casting skins
- For unfavourable machining conditions

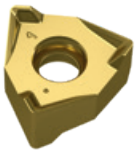


both sided

Finishing		Medium machining		Rough machining	
P	M	K	N	S	H
○		●			○

WNEX





Designation	l	s	d	d_1	r	HC AP3025	HC AP3035	HC AM3140	HC AK3220
WNEX 080608SR-NMS	8	6,55	12,7	4,6	0,8	◆	◆		
WNEX 080608SR-NMR	8	6,55	12,7	4,6	0,8			◆	
WNEX 080608SR-NMG	8	6,55	12,7	4,6	0,8				◆

HC = Carbide grade coated

	AP3025	AP3035	AM3140	AK3220
P	●	●		○
M	○	○	●	
K	○			●
N				
S			○	
H	○			○

● Main application
○ Secondary application

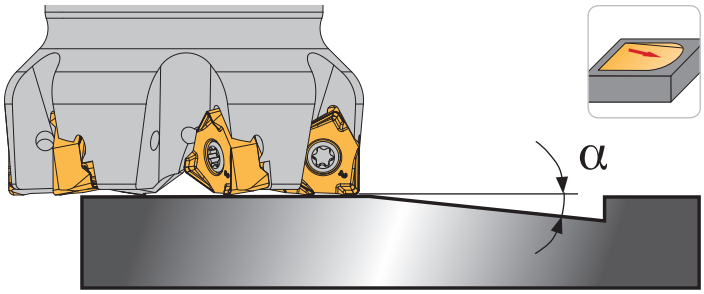
Material group	Structure of the material groups and identification letters			Brinell hardness HB	Tensile strength Rm (N/mm²)	Chipping group	Cutting speed Vc (m/min) HC AP3025	AP3035	AM3140	AK3220
P	Unalloyed steel	C ≤ 0.25 %	annealed	125	428	P1	190 - 240 - 290	150 - 190 - 230	-	200 - 250 - 300
		C > = 0.25 ... > = 0.55 %	annealed	190	639	P2	190 - 240 - 290	150 - 190 - 230	-	200 - 250 - 300
		C > = 0.25 ... > = 0.55 %	hardened and tempered	210	708	P3	190 - 240 - 290	150 - 190 - 230	-	200 - 250 - 300
		C ≤ 0.55 %	annealed	190	639	P4	190 - 240 - 290	150 - 190 - 230	-	200 - 250 - 300
		C ≤ 0.55 %	hardened and tempered	300	1013	P5	190 - 240 - 290	150 - 190 - 230	-	200 - 250 - 300
		Machinig steel (short-clipping)	annealed	220	745	P6	190 - 240 - 290	150 - 190 - 230	-	200 - 250 - 300
	Low alloyed steel	annealed		175	591	P7	160 - 195 - 230	130 - 155 - 180	-	180 - 215 - 250
		hardened and tempered		300	1013	P8	160 - 195 - 230	130 - 155 - 180	-	180 - 215 - 250
		hardened and tempered		380	1282	P9	160 - 195 - 230	130 - 155 - 180	-	180 - 215 - 250
		hardened and tempered		430	1477	P10	160 - 195 - 230	130 - 155 - 180	-	180 - 215 - 250
	High alloyed steel and high alloyed tool steel	annealed		200	675	P11	145 - 178 - 210	110 - 135 - 160	-	160 - 190 - 220
		hardened		300	1013	P12	145 - 178 - 210	110 - 135 - 160	-	160 - 190 - 220
		hardened		400	1361	P13	145 - 178 - 210	110 - 135 - 160	-	160 - 190 - 220
	Stainless steel	ferretic / martensitic, annealed		200	675	P14	110 - 140 - 170	-	-	120 - 150 - 180
		martensitic, hardened and tempered		330	1114	P15	110 - 140 - 170	-	-	120 - 150 - 180
M	Stainless steel	austenitic, chilled		200	675	M1	90 - 120 - 150	80 - 110 - 140	100 - 130 - 160	-
		austenitic, precipitation-hardened (PH)		300	1013	M2	60 - 85 - 110	80 - 110 - 140	100 - 130 - 160	-
		austenitic-ferritic, Duplex		230	778	M3	-	-	70 - 95 - 120	-
K	Malleable cast iron	ferritic		200	675	K1	140 - 220 - 300	-	-	150 - 235 - 320
		pearlitic		260	867	K2	140 - 220 - 300	-	-	150 - 235 - 320
	Cast iron	low tensile strength		180	602	K3	140 - 220 - 300	-	-	150 - 235 - 320
		high tensile strength / austenitic		245	825	K4	140 - 220 - 300	-	-	150 - 235 - 320
	Cast iron with nodular graphite	ferritic		155	518	K5	100 - 130 - 160	-	-	110 - 145 - 180
		pearlitic		265	885	K6	100 - 130 - 160	-	-	110 - 145 - 180
	GGV (CGI)			200	675	K7	100 - 130 - 160	-	-	110 - 145 - 180
N	Aluminium alloys long chipping	not heat treatable		30	-	N1	-	-	-	-
		heat treatable, heat treated		100	343	N2	-	-	-	-
	Casted aluminium alloys	≤ 12 % Si, not heat treatable		75	260	N3	-	-	-	-
		≤ 12 % Si, heat treatable, heat treated		90	314	N4	-	-	-	-
		> 12 % Si, not heat treatable		130	447	N5	-	-	-	-
	Magnesium alloys	> 12 % Si, not heat treatable		70	250	N6	-	-	-	-
	Copper and copper alloys (Brass / Bronze)	Unalloyed, elektrolyte copper		100	343	N7	-	-	-	-
		Brass, Bronze		90	314	N8	-	-	-	-
		Cu-alloys, short-chipping		110	382	N9	-	-	-	-
				300	1013	N10	-	-	-	-
	Non-ferrous materials	Lead alloys (without abrasive filling material)		-	-	N11	-	-	-	-
		Duroplastic (without abrasive filling material)		-	-	N12	-	-	-	-
		Plastic glas fibre reinforced GFRP		-	-	N13	-	-	-	-
		Plastic carbon fibre reinforced CFRP		-	-	N14	-	-	-	-
		Plastic aramid fibre reinforced AFRP		-	-	N15	-	-	-	-
		Graphite (tech.)		80 Shore	-	N16	-	-	-	-
S	High temperature resistant alloys	Fe-based	annealed	200	675	S1	-	-	30 - 45 - 60	-
		Fe-based	heat treated	280	943	S2	-	-	30 - 45 - 60	-
		Ni- or Co-alloyed	annealed	250	839	S3	-	-	30 - 45 - 60	-
		Ni- or Co-alloyed	heat treated	350	1177	S4	-	-	30 - 45 - 60	-
		Ni- or Co-alloyed	casting	320	1076	S5	-	-	30 - 45 - 60	-
	Titanium alloys	Pure titan		200	675	S6	-	-	30 - 45 - 60	-
		α- and β-alloys, heat treated		375	1262	S7	-	-	30 - 45 - 60	-
		β-alloys		410	1396	S8	-	-	30 - 45 - 60	-
	Wolfram alloys			300	1013	S9	-	-	-	-
	Molybdän alloys			300	1013	S10	-	-	-	-
H	Hardened steel	hardened		50 HRC	-	H1	100 - 125 - 150	-	-	80 - 100 - 120
		hardened		55 HRC	-	H2	-	-	-	-
		hardened		60 HRC	-	H3	-	-	-	-
	Hardened cast iron	hardened		55 HRC	-	H4	-	-	-	-

The recommended cutting data are only approximate values.
It may be necessary to adjust them to each individual machining application.
HC = Solid carbide coated

ISO-Application area

ISO	Material	Medium machining		Rough machining	
		f_z (mm)	a_p (mm)	f_z (mm)	a_p (mm)
P	Steel	0,15 - 0,18 - 0,20	1,0 - 2,0 - 3,0	0,20 - 0,25 - 0,30	3,0 - 5,0 - 7,0
M	Stainless steel	0,15 - 0,18 - 0,20	1,0 - 2,0 - 3,0	0,20 - 0,24 - 0,28	3,0 - 5,0 - 7,0
K	Cast iron	0,18 - 0,22 - 0,25	1,0 - 2,0 - 3,0	0,25 - 0,30 - 0,35	3,0 - 5,0 - 7,0
N	Non ferrous materials	-	-	-	-
S	High temperature resistant alloys	0,15 - 0,18 - 0,20	1,0 - 2,0 - 3,0	0,20 - 0,24 - 0,28	3,0 - 5,0 - 7,0
H	Hardened steel	-	-	-	-

Ramping



D_1	α_{max}
50	0,46°
63	0,36°
80	0,23°
100	0,17°
125	0,12°
160	0,07°

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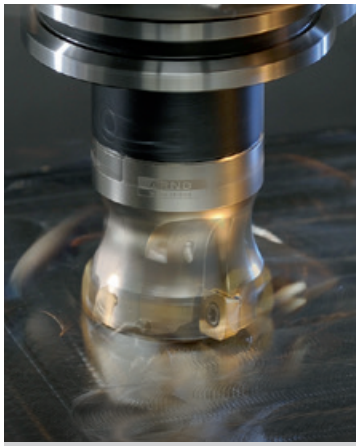
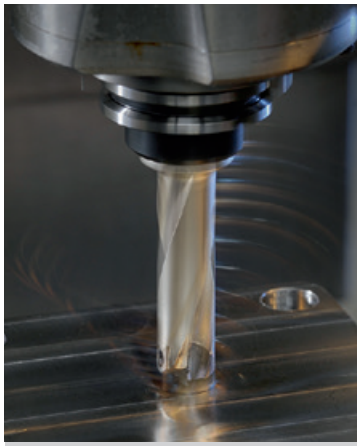
Tools and inserts for parting and grooving

Tooling and indexable inserts for turning and threading



Milling cutters and indexable inserts for milling and thread milling



Drilling tools and indexable inserts for drilling

For further information please ask for our complete catalogue.

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