

ABPF/M *Ball High Precision Finish+Modular*
ARPF/M *Radius High Precision Finish+Modular*












D8mm ~ D32mm
• **Modular Types**
• **Carbide Shank & Steel Shank Types**
• **For Materials $\leq 65\text{HRC}$**



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ABPF/M | Ball High Precision Finish + Modular







Short	Name	Type: CARBIDE	D	Page
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ABPF-WE	Ball High Precision Finish - Carbide Shank Extra Long 		16-25	4



Short	Name	Type: STEEL	D	Page
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Inserts	Ball High Precision Finish 		8-32	7
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Cutting Conditions		Page		Page
ABPF D8 - 32	Semi Finishing 	12-13	Finishing 	12-13

ARPF/M | Radius High Precision Finish + Modular

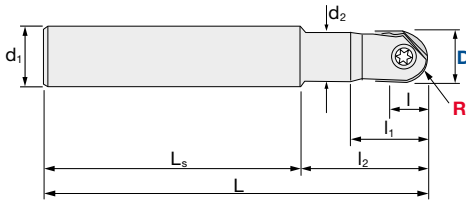
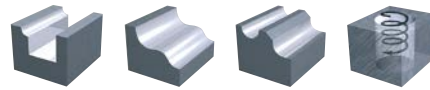
Short	Name	Type: CARBIDE	D	Page
ARPF-W	Radius High Precision Finish - Carbide Shank Regular 		8-25	8
ARPF-WL	Radius High Precision Finish - Carbide Shank Long Neck 		8-12	8
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Parts	Clamp Screws, Wrenches 		8-32	10

Cutting Conditions		Page		Page
ARPF D8 - 32	Semi Finishing 	14-15	Finishing 	14-15

ABPF | Ball High Precision Finish - Carbide Shank

V max High Speed	▽▽ Semi Finishing	▽▽▽ Finishing	HRC 65	No. of Teeth 2
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Diameter Holder only [mm]	Insert R Accuracy [mm]
+/-0.01 mm	+/-0.005 mm

ABPF-W Ball High Precision Finish - Carbide Shank Regular

ID Code	Item Code	Flutes	D	R	L	I	I ₁	I ₂	L _s	d ₁	d ₂	Inserts
FH393	ABPF-08S08W	2	8	4	100	4.4	18	30	70	8	7.8	Z...FG-080...
FH394	ABPF-10S10W		10	5		5.5	23	35	65	10	9.8	Z...FG-100...
FH395	ABPF-12S12W		12	6	110	6.6	26	45	65	12	11.8	Z...FG-120...
FH478	ABPF-16S16W		16	8	140	8.8	19	35	105	16	15.5	Z...FG-160...
FH479	ABPF-20S20W		20	10	160	11	22	40	120	20	19.5	Z...FG-200...
FH480	ABPF-25S25W		25	12.5	180	13.7	25	45	135	25	24.5	Z...FG-250...



ABPF-WL Ball High Precision Finish - Carbide Shank Long Neck

ID Code	Item Code	Flutes	D	R	L	I	I ₁	I ₂	L _s	d ₁	d ₂	Inserts
FH396	ABPF-08S08WL	2	8	4	130	4.4	18	65	65	8	7.8	Z...FG-080...
FH397	ABPF-10S10WL		10	5	140	5.5	23	75		10	9.8	Z...FG-100...
FH398	ABPF-12S12WL		12	6	150	6.6	26	85		12	11.8	Z...FG-120...







ABPF-WE Ball High Precision Finish - Carbide Shank Extra Long

ID Code	Item Code	Flutes	D	R	L	I	I ₁	I ₂	L _s	d ₁	d ₂	Inserts
FH458	ABPF-16S16WE	2	16	8	200	8.8	19	120	80	16	15.8	Z...FG-160...
FH459	ABPF-20S20WE		20	10	250	11	22	150	100	20	19.8	Z...FG-200...
FH460	ABPF-25S25WE		25	12.5	300	13.7	25	190	110	25	24.8	Z...FG-250...



Inserts p. 7

Parts		Clamp Screw			Wrench	
						
Body	Diameter	ID-Code	Item-Code	Fastening Torque [Nm]	ID-Code	Item-Code
	8	ET153	581-141	1.1 Nm	ET13	104-T8
	10	ET154	581-142	2.2 Nm	ET11	104-T10
	12	ET155	581-143	4.9 Nm	ET14	105-T20
	16	ET156	581-144	4.9 Nm		
	20	ET157	581-145	6.9 Nm	ET9	101-T25S
	25	ET168	581-146	9.8 Nm	ET167	105-T30A
	32	ET169	581-147	9.8 Nm		

ABPF | Ball High Precision Finish

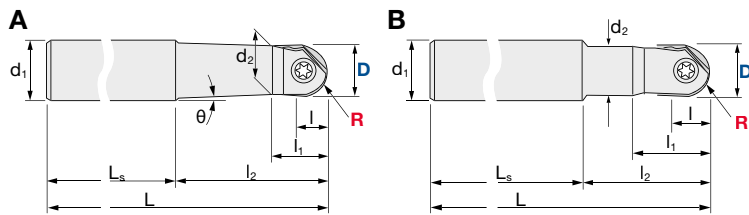
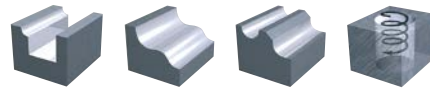
V max
High Speed

Semi Finishing

Finishing

HRC
65

No. of Teeth
2



Diameter Holder only [mm]	Insert R Accuracy [mm]
+/-0.01 mm	+/-0.005 mm

ABPF-S Ball High Precision Finish - Regular

ID Code	Item Code	Flutes	D	R	L	I	I ₁	I ₂	L _s	θ	d ₁	d ₂	Type	Inserts
FH387	ABPF-08S12	2	8	4	100	4.4	10	22	78	9.5°	12	7.5	A	Z...FG-080...
FH388	ABPF-10S12		10	5		5.5	13	25	75	5°		9.5		Z...FG-100...
FH389	ABPF-12S12		12	6		6.6	15	30		–		11.5		Z...FG-120...
FH447	ABPF-16S20		16	8	110	8.8	19	50	80	2.5°	20	15.5	A	Z...FG-160...
FH448	ABPF-20S25		20	10	130	11	22	60		–	25	19.5		Z...FG-200...
FH449	ABPF-25S32		25	12.5	150	13.7	25	70		3°	32	24.5		Z...FG-250...
FH450	ABPF-32S32		32	16	160	17.6	30	80		–		31.5		Z...FG-320...






ABPF-L Ball High Precision Finish - Long Neck

ID Code	Item Code	Flutes	D	R	L	I	I ₁	I ₂	L _s	θ	d ₁	d ₂	Type	Inserts
FH390	ABPF-08S12L	2	8	4	130	4.4	10	50	80	3°	12	7.5	A	Z...FG-080...
FH391	ABPF-10S16L		10	5	150	5.5	13		100	5°	16	9.5		Z...FG-100...
FH392	ABPF-12S16L		12	6	160	6.6	20	60		3°		10.8		Z...FG-120...
FH451	ABPF-16S20L		16	8	160	8.8	19	65	95	2°	20	15.5		Z...FG-160...
FH452	ABPF-20S25L		20	10	180	11	22	80	100	–	20	19.5	B	Z...FG-200...
FH453	ABPF-20S20L120				220			120						
FH454	ABPF-20S20L150				250			150						
FH455	ABPF-25S32L		25	12.5	200	13.7	25	90	110	3°	32	24.5	A	Z...FG-250...
FH456	ABPF-25S32L150				250			150	100	–	32			
FH457	ABPF-32S32L				220			100	120	–	32	31.5		

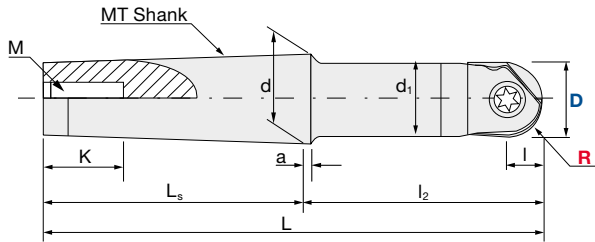
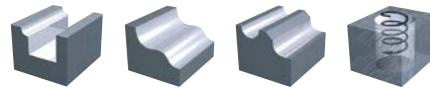


Inserts p. 7

Cutting Conditions		Page		Page	Clamp Screws & Wrenches	Page
ABPF D8 – 32	Semi Finishing 	12–13	Finishing 	12–13		10

ABPF | Ball High Precision Finish

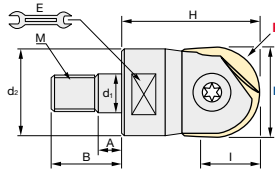
V max	▽▽	▽▽▽	HRC	No. of Teeth
High Speed	Semi Finishing	Finishing	65	2



Diameter Holder only [mm]	Insert R Accuracy [mm]
+/-0.01 mm	+/-0.005 mm

ABPF-MT Ball High Precision Finish - MT Shank

ID Code	Item Code	Flutes	D	R	I	MT	L	I ₂	L _s	d	d ₁	a	K	M	Inserts
FH461	ABPF-20MT2	2	20	10	11	MT2	129	65	64	17.78	19.5	5	24	M10	Z...FG-200...
FH462	ABPF-25MT3		25	12.5	13.7	MT3	166	85	81	23.825	24.5	5	28	M12	Z...FG-250...
FH463	ABPF-32MT4		32	16	17.6	MT4	217.5	115	102.5	31.267	30.8	6.5	32	M16	Z...FG-320...



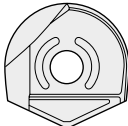
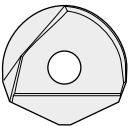

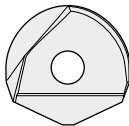




ABPF-M Ball High Precision Finish Modular

ID Code	Item Code	Flutes	D	R	I	H	d ₁	M	d ₂	A	B	E	Inserts
FH510	ABPFM-10	2	10	5	5.5	26	6.5	M6	9.8	5	14.5	7	Z...FG-100...
FH511	ABPFM-12		12	6	6.6	26	6.5	M6	9.8	5	14.5	7	Z...FG-120...
FH512	ABPFM-16		16	8	8.8	32	8.5	M8	12.8	6	17	10	Z...FG-160...
FH513	ABPFM-20		20	10	11	38	10.5	M10	17.8	6	19	15	Z...FG-200...
FH514	ABPFM-25		25	12.5	13.7	38	12.5	M12	20.8	7	22	17	Z...FG-250...
FH515	ABPFM-32		32	16	17.6	43	17	M16	28.8	7	23	22	Z...FG-320...



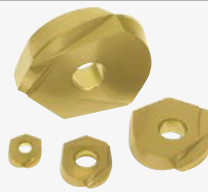
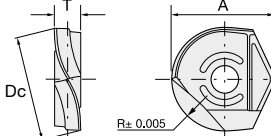
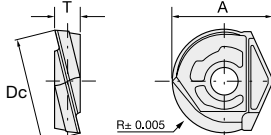
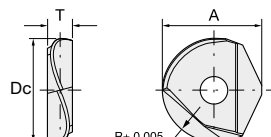
Inserts p. 7

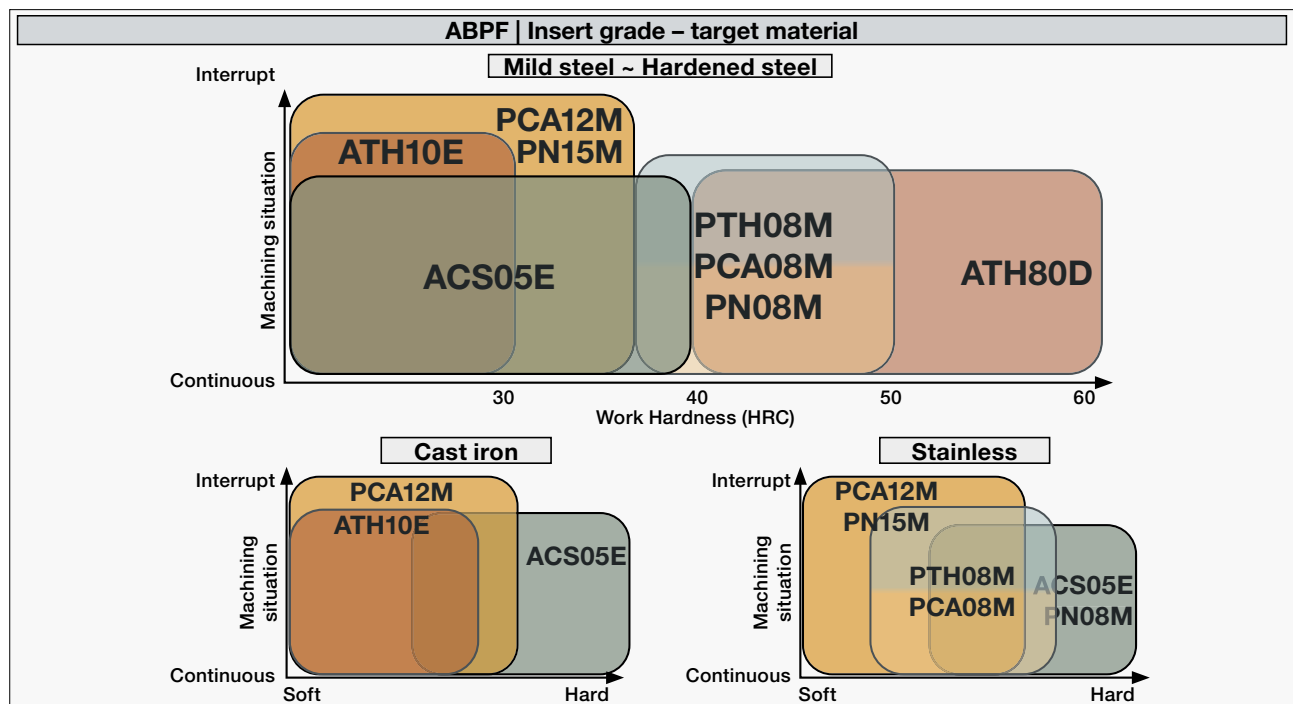
ABPF | Insert selection – Geometry + Grade

Toughness / Sharpness of Cutting Edge									
Tough				Sharp					
Insert Grade	ZPFG-xxx	ZPFG-xxx-GH	ZPFG-xxx-GF	ZDFG-xxx-ST	ZDFG-xxx-WH	ZDFG-xxx-WF	ZDFG-xxx-SC	ZDFG-xxx-SF	
Ball geometry	180° 			180° + / underneck 	180° + / underneck 		180° + / underneck 		
Rake angle	Negative + Small helix			Negative High-helix	Neutral Straight		Positive High-helix		
Edge shape									
Chisel shape	Wide & Tough		Small & Sharp	Wide & Tough			Small & Sharp		
Available grades	PTH08M PCA08M PCA12M	ATH80D	ACS05E	ATH80D PN15M	ATH80D	ACS05E	PN08M	ATH10E	

	Target Hardness of Workpiece							
	Soft				Hard			
Insert Grade	ATH10E	ACS05E	PCA12M	PN15M	PCA08M	PN08M	PTH08M	ATH80D
Substrate	Grain size	Ultra Micro	Ultra Micro	Ultra Micro	Ultra Micro	Ultra Micro	Ultra Micro	Ultra Micro
	Hardness	93.0 HRA	93.4 HRA	93.0 HRA	93.0 HRA	93.3 HRA	93.3 HRA	94.0 HRA
Coating	Code	ATH	ACS	PCA	PN	PCA	PN	TH
	Hardness	3800Hv	3200Hv	2600Hv	3200Hv	2600Hv	3200Hv	3600Hv
Target hardness of workpiece	Cast iron Carbon steel (< 30 HRC)	Cast iron Carbon steel (< 30 HRC)	Tool steels < 45 HRC	Tool steels < 45 HRC	Tool steels, Pre hardened steels	Tool steels, Pre hardened steels	Pre hardened steel Hardened steel > 45 HRC	Hardened steel > 50 HRC

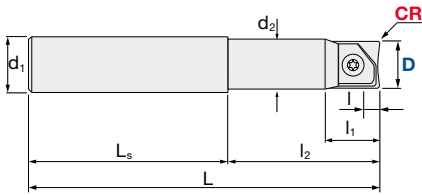
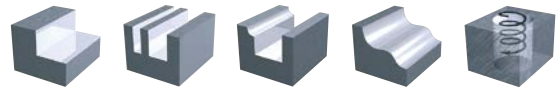
INSERTS | Ball High Precision Finish | Grades Overview

Item Code	Size				Grade								Shape
	Dc	R	A	T	ATH10E	ACS05E	PCA12M	PN15M	PCA08M	PN08M	PTH08M	ATH80D	
					ID-Code								
ZPFG-080	8	4	9.7	2.1			WF547		WF594		WF645	WF267	  Tolerance Class F Fig. 1: ZPFG (Small helix / radius 180°)
ZPFG-080-GH													
ZPFG-080-GF						WF266							
ZPFG-100	10	5	12.1	2.7			WF548		WF595		WF646	WF269	
ZPFG-100-GH													
ZPFG-100-GF						WF268							
ZPFG-120	12	6	14.6	3.2			WF549		WF596		WF647		
ZPFG-120-GH													
ZPFG-120-GF						WF270						WF271	
ZPFG-160	16	8	16.6	4.2			WF598		WF597		WF648		
ZPFG-160-GH													
ZPFG-160-GF						WF272						WF273	
ZPFG-200	20	10	20.3	5.2			WF600		WF599		WF649		
ZPFG-200-GH													
ZPFG-200-GF						WF274						WF275	
ZPFG-250	25	12.5	24.1	6.2			WF602		WF601		WF650		
ZPFG-250-GH													
ZPFG-250-GF						WF276						WF277	
ZPFG-320	32	16	30	7.2			WF604				WF651		
ZPFG-320-GH													
ZPFG-320-GF						WF278						WF279	
ZDFG-080-WH	8	4	9.7	2.1								WF281	 Tolerance Class F Fig. 2: ZDFG (Straight / 180° + / underneck)
ZDFG-080-WF						WF280							
ZDFG-100-WH												WF283	
ZDFG-100-WF	10	5	12.1	2.7		WF282							
ZDFG-120-WH												WF285	
ZDFG-120-WF						WF284							
ZDFG-160-WH	16	8	16.6	4.2								WF164	
ZDFG-160-WF						WF168							
ZDFG-200-WH												WF165	
ZDFG-200-WF	20	10	20.3	5.2		WF169							
ZDFG-250-WH												WF166	
ZDFG-250-WF						WF170							
ZDFG-320-WH	32	16	30	7.2								WF167	
ZDFG-320-WF						WF171							
ZDFG-160-SF	16	8	16.6	4.2	WF263								 Tolerance Class F Fig. 3: ZDFG-SF ZDFG-ST ZDFG-SC (High-helix / 180° + / underneck)
ZDFG-200-SF	20	10	20.3	5.2	WF264								
ZDFG-250-SF	25	12.5	24.1	6.2	WF265								
ZDFG-080-ST	8	4	9.7	2.1				WF391				WF385	
ZDFG-080-SC										WF397		WF386	
ZDFG-100-ST								WF392					
ZDFG-100-SC	10	5	12.1	2.7						WF398		WF387	
ZDFG-120-ST								WF393					
ZDFG-120-SC										WF399			
ZDFG-160-ST	16	8	16.6	4.2				WF394				WF388	
ZDFG-160-SC										WF400			
ZDFG-200-ST								WF395				WF389	
ZDFG-200-SC	20	10	20.3	5.2						WF401			
ZDFG-250-ST								WF396				WF390	
ZDFG-250-SC	25	12.5	24.1	6.2						WF402			



ARPF | Radius High Precision Finish - Carbide Shank

V max High Speed	▽▽ Semi Finishing	▽▽▽ Finishing	HRC 62	No. of Teeth 2
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Diameter Holder only [mm]	Insert R Accuracy [mm]
0/-0.02 mm	+/-0.015 mm

ARPF-W Radius High Precision Finish - Carbide Shank Regular

ID Code	Item Code	Flutes	D	L	I	I ₁	I ₂	L _s	d ₁	d ₂	Inserts
FH473	ARPF-08S08W	2	8	100	2.5	30	70	8	7.8	7.8	ZCFW-080-R...
FH474	ARPF-10S10W		10	100	3	35	65	10	9.8	9.8	ZCFW-100-R...
FH475	ARPF-12S12W		12	110	4	35	75	12	11.8	11.8	ZCFW-120-R...
FH483	ARPF-16S16W		16	140	5	35	105	16	15.5	15.5	ZCFW-160-R...
FH484	ARPF-20S20W		20	160	6	40	120	20	19.5	19.5	ZCFW-200-R...
FH485	ARPF-25S25W		25	180	8	45	135	25	24.5	24.5	ZCFW-250-R...



ARPF-WL Radius High Precision Finish - Carbide Shank Long Neck

ID Code	Item Code	Flutes	D	L	I	I ₁	I ₂	L _s	d ₁	d ₂	Inserts
FH411	ARPF-08S08WL	2	8	130	2.5	18	65	65	8	7.8	ZCFW-080-R...
FH412	ARPF-10S10WL		10	140	3	23	75	65	10	9.8	ZCFW-100-R...
FH413	ARPF-12S12WL		12	150	4	26	85	65	12	11.8	ZCFW-120-R...



ARPF-WE Radius High Precision Finish - Carbide Shank Extra Long

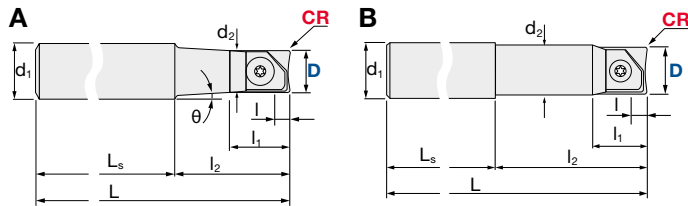
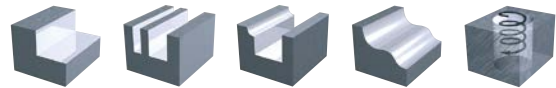
ID Code	Item Code	Flutes	D	L	I	I ₁	I ₂	L _s	d ₁	d ₂	Inserts
FH429	ARPF-16S16WE	2	16	200	5	29	120	80	16	15.8	ZCFW-160-R...
FH430	ARPF-20S20WE		20	250	6	36	150	100	20	19.8	ZCFW-200-R...
FH476	ARPF-25S25WE		25	300	8	41	190	110	25	24.8	ZCFW-250-R...



Inserts p. 11

ARPF | Radius High Precision Finish

V max High Speed	 Semi Finishing	 Finishing	HRC 62	No. of Teeth 2
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Diameter Holder only [mm]	Insert R Accuracy [mm]
0/-0.02 mm	+/-0.015 mm

ARPF-S Radius High Precision Finish - Regular

ID Code	Item Code	Flutes	D	L	I	I ₁	I ₂	L _s	θ	d ₁	d ₂	Type	Inserts
FH399	ARPF-08S12	2	8	100	2.5	10	22	78	9.5°	12	7.5	A	ZCFW-080-R...
FH400	ARPF-10S12		10	100	3	13	25	75	3°		9.5		ZCFW-100-R...
FH401	ARPF-12S12		12	110	4	15	30	80	-	11.5	ZCFW-120-R...		
FH402	ARPF-16S16		16	130	5	17	50			15.5	ZCFW-160-R...		
FH403	ARPF-20S20		20	140	6	21	60			19.5	ZCFW-200-R...		
FH464	ARPF-25S25		25	150	8	24	70			24.5	ZCFW-250-R...		
FH465	ARPF-32S32		32	160	10	30	80			31.5	ZCFW-320-R...		



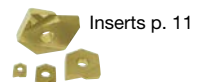
ARPF-L Radius High Precision Finish - Long Neck




ID Code	Item Code	Flutes	D	L	I	I ₁	I ₂	L _s	θ	d ₁	d ₂	Type	Inserts
FH404	ARPF-08S12L	2	8	130	2.5	10	50	80	3°	12	7.5	A	ZCFW-080-R...
FH405	ARPF-10S16L		10	150	3	13	50	100	4.5°	16	9.5		ZCFW-100-R...
FH406	ARPF-12S16L		12	160	4	15	60	100	2°	16	11.5		ZCFW-120-R...
FH407	ARPF-16S16L		16	165	5	17	65	100	-	16	15.5	B	ZCFW-160-R...
FH408	ARPF-20S20L		20	180	6	21	80	100		20	19.5		ZCFW-200-R...
FH466	ARPF-20S20L120		20	220	6	21	120	100		20	19.5		ZCFW-200-R...
FH467	ARPF-20S20L150		20	250	6	21	150	100		20	19.5		ZCFW-200-R...
FH468	ARPF-25S25L		25	200	8	24	90	110		25	24.5		ZCFW-250-R...
FH469	ARPF-25S32L150		25	250	8	24	150	100		32	24.5		ZCFW-250-R...



ARPF-E Radius High Precision Finish - Extra Long

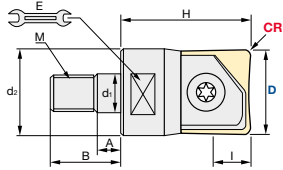
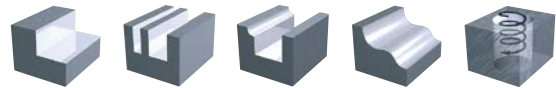
ID Code	Item Code	Flutes	D	L	I	I ₁	I ₂	L _s	d ₁	d ₂	Inserts
FH409	ARPF-16S16E	2	16	200	5	17	65	135	16	15.5	ZCFW-160-R...
FH410	ARPF-20S20E		20	250	6	21	80	170	20	19.5	ZCFW-200-R...
FH471	ARPF-25S25E		25	300	8	24	90	210	25	24.5	ZCFW-250-R...



Cutting Conditions		Page		Page	Clamp Screws & Wrenches	Page
ARPF D8 - 32	Semi Finishing 	14-15	Finishing 	14-15		10

ARPF | Radius High Precision Finish

V max High Speed	 Semi Finishing	 Finishing	HRC 62	No. of Teeth 2
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Diameter Holder only [mm]	Insert R Accuracy [mm]
0/-0.02 mm	+/-0.015 mm

ARPF-M Radius High Precision Finish Modular

ID Code	Item Code	Flutes	D	I	H	d ₁	M	d ₂	A	B	E	Inserts
FH516	ARPFM-10	2	10	3	26	6.5	M6	9.8	5	14.5	7	ZCFW-100-R...
FH517	ARPFM-12		12	4								ZCFW-120-R...
FH518	ARPFM-16		16	5	38	8.5	M8	12.8	6	17	10	ZCFW-160-R...
FH519	ARPFM-20		20	6								ZCFW-200-R...
FH520	ARPFM-25		25	8								ZCFW-250-R...
FH521	ARPFM-32		32	10								ZCFW-320-R...



Cutting Conditions		Page		Page
ARPF D8 – 32	Semi Finishing 	14–15	Finishing 	14–15

Parts		Clamp Screw			Wrench	
						
Body	Diameter	ID-Code	Item-Code	Fastening Torque [Nm]	ID-Code	Item-Code
 ABPF-... / ABPFM-...	8	ET153	581-141	1.1 Nm	ET13	104-T8
	10	ET154	581-142	2.2 Nm	ET11	104-T10
	12	ET155	581-143	4.9 Nm	ET14	105-T20
	16	ET156	581-144	4.9 Nm		
 ARPF-... / ARPFM-...	20	ET157	581-145	6.9 Nm	ET9	101-T25S
	25	ET168	581-146	9.8 Nm	ET167	105-T30A
	32	ET169	581-147	9.8 Nm		

INSERTS | Radius High Precision Finish | Grades Overview

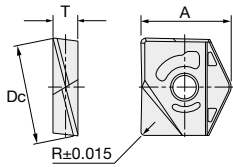
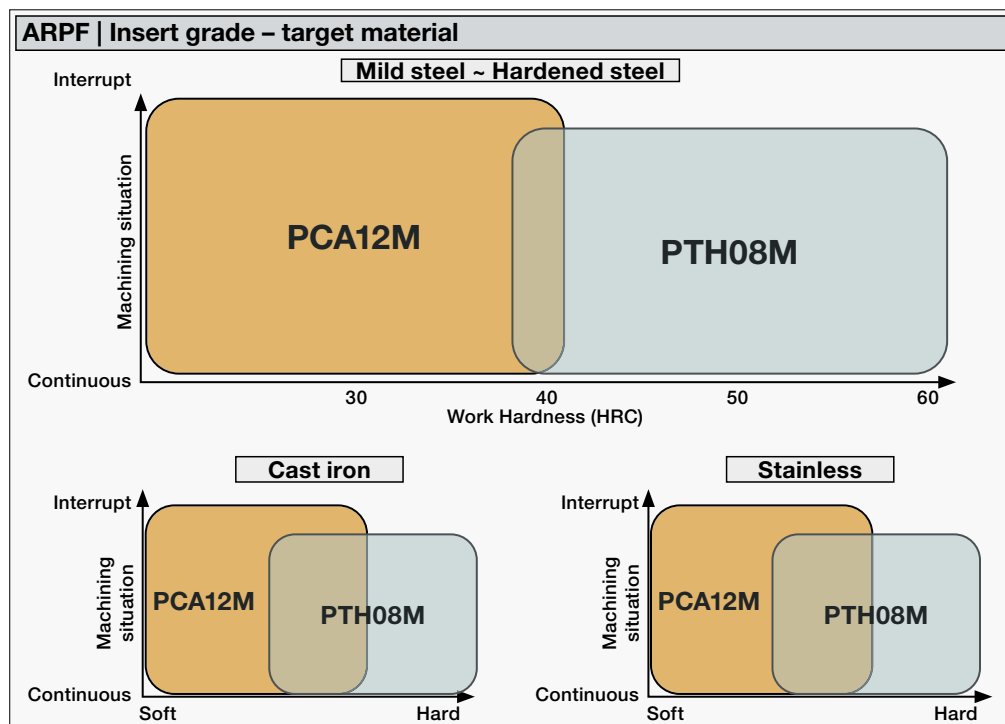


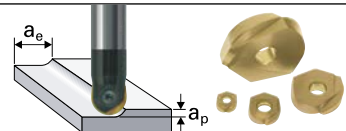
Fig. 1: ZCFW



						Grade		Geometry
Item Code	Size					PCA12M	PTH08M	
	Tolerance Class	Dc	R	A	T	ID Code		
ZCFW-080-03	F	8	0.3	9.7	2.1	WF551	WF286	Fig-1
ZCFW-080-05			0.5			WF605	WF287	
ZCFW-080-10			1.0			WF552	WF288	
ZCFW-100-03		10	0.3	12	2.7	WF553	WF289	
ZCFW-100-05			0.5			WF606	WF290	
ZCFW-100-10			1.0			WF554	WF291	
ZCFW-100-15			1.5			WF555	WF292	
ZCFW-100-20		2.0	WF556	WF293				
ZCFW-120-03		12	0.3	14.6	3.2	WF557	WF294	
ZCFW-120-05			0.5			WF607	WF295	
ZCFW-120-10			1.0			WF558	WF296	
ZCFW-120-15			1.5			WF559	WF297	
ZCFW-120-20			2.0			WF560	WF298	
ZCFW-120-30		3.0	WF652	WF299				
ZCFW-160-03		16	0.3	16.6	4.2	WF561	WF300	
ZCFW-160-05			0.5			WF608	WF301	
ZCFW-160-10			1.0			WF562	WF302	
ZCFW-160-15			1.5			WF563	WF303	
ZCFW-160-20			2.0			WF564	WF304	
ZCFW-160-30		3.0	WF653	WF305				
ZCFW-200-03		20	0.3	19.9	5.2	WF565	WF306	
ZCFW-200-05			0.5			WF609	WF307	
ZCFW-200-10			1.0			WF566	WF308	
ZCFW-200-15			1.5			WF567	WF309	
ZCFW-200-20			2.0			WF568	WF310	
ZCFW-200-30		3.0	WF654	WF311				
ZCFW-250-03		25	0.3	22.6	6.2	WF610	WF312	
ZCFW-250-05			0.5			WF611	WF313	
ZCFW-250-10			1.0			WF612	WF314	
ZCFW-250-20			2.0			WF613	WF315	
ZCFW-250-30			3.0			WF655	WF316	
ZCFW-320-03		32	0.3	27.2	7.2	WF614	WF317	
ZCFW-320-05			0.5			WF615	WF318	
ZCFW-320-10			1.0			WF616	WF319	
ZCFW-320-20			2.0			WF617	WF320	
ZCFW-320-30			3.0			WF656	WF321	





ABPF/M | Recommended Cutting Conditions





Work piece material		Insert Grade		Recommend grade & Target hardness (HRC)			Emulsion	Mist	Air	Parameter	D 8				D 10						
											Semi Finishing		Finishing		Semi Finishing		Finishing				
		General		High Speed		General					High Speed		General		High Speed		General		High Speed		
		General		High Speed		General					High Speed		General		High Speed		General		High Speed		
I II	Carbon-Steel Alloy-Steel <30HRC	PCA08M PCA12M PN15M	ACS05E PTH08M PN08M ATH10E	ACS05E			•	•	•	V _c	m/min	320	420	420	620	320	420	420	620		
				PCA12M			•	•	•	n	min ⁻¹	12739	16720	16720	24682	10191	13376	13376	19745		
				PCA08M			•	•	•	f _z	mm/t	0.20	0.18	0.15	0.15	0.30	0.30	0.21	0.21		
				PTH08M			•	•	•	V _f	mm/min	5096	6019	5016	7404	6115	8025	5618	8293		
				PN15M			•	•	•	a _p	mm	0.20	0.20	0.10	0.10	0.35	0.35	0.10	0.10		
				PN08M			•	•	•	a _e	mm	0.80	0.80	0.20	0.20	0.70	0.70	0.22	0.22		
III	Alloy-Steel Tool-Steel 30~40HRC	PCA08M PCA12M PN15M	ACS05E PTH08M PN08M	ATH10E			•	•	•	Q	mm ³	815	963	100	148	1498	1966	124	182		
				ACS05E			•	•	•	V _c	m/min	288	378	378	558	288	378	378	558		
				PCA12M			•	•	•	n	min ⁻¹	11465	15048	15048	22213	9172	12038	12038	17771		
				PCA08M			•	•	•	f _z	mm/t	0.19	0.17	0.14	0.14	0.29	0.29	0.20	0.20		
				PTH08M			•	•	•	V _f	mm/min	4357	5146	4289	6331	5228	6862	4803	7091		
				PN15M			•	•	•	a _p	mm	0.20	0.20	0.10	0.10	0.35	0.35	0.10	0.10		
IV	Pre-Hardened Steel Tool-Steel 40~50HRC	PCA08M PCA12M PN15M	ACS05E PTH08M PN08M ATH80D	PN08M			•	•	•	a _e	mm	0.80	0.80	0.20	0.20	0.70	0.70	0.22	0.22		
				ATH80D			•	•	•	Q	mm ³	697	823	86	127	1281	1681	106	156		
				ACS05E			•	•	•	V _c	m/min	256	336	336	496	256	336	336	496		
				PCA12M			•	•	•	n	min ⁻¹	10191	13376	13376	19745	8153	10701	10701	15796		
				PCA08M			•	•	•	f _z	mm/t	0.17	0.15	0.13	0.13	0.26	0.26	0.18	0.18		
				PTH08M			•	•	•	V _f	mm/min	3465	4093	3411	5035	4158	5457	3820	5639		
V	Hardened Steel Tool-Steel 50~55HRC	PCA08M PCA12M	ACS05E PCA08M PTH08M PN08M ATH80D	PN15M			•	•	•	a _p	mm	0.18	0.18	0.09	0.09	0.32	0.32	0.09	0.09		
				PN08M			•	•	•	a _e	mm	0.72	0.72	0.18	0.18	0.63	0.63	0.20	0.20		
				ATH80D			•	•	•	Q	mm ³	449	530	55	82	825	1083	68	100		
				ACS05E			•	•	•	V _c	m/min	240	315	315	465	240	315	315	465		
				PCA08M			•	•	•	n	min ⁻¹	9554	12540	12540	18511	7643	10032	10032	14809		
				PTH08M			•	•	•	f _z	mm/t	0.17	0.15	0.13	0.13	0.26	0.26	0.18	0.18		
VI	Hardened Steel > 55HRC	PCA08M (PCA12M)	PCA08M PTH08M ATH80D	PTH08M			•	•	•	V _f	mm/min	3248	3837	3198	4720	3898	5116	3581	5287		
				PN08M			•	•	•	a _p	mm	0.17	0.17	0.09	0.09	0.30	0.30	0.09	0.09		
				PN08M			•	•	•	a _e	mm	0.68	0.68	0.17	0.17	0.60	0.60	0.19	0.19		
				ATH80D			•	•	•	Q	mm ³	376	444	46	68	690	906	57	84		
				ACS05E			•	•	•	V _c	m/min	208	273	273	403	208	273	273	403		
				PCA08M			•	•	•	n	min ⁻¹	8280	10868	10868	16043	6624	8694	8694	12834		
VII	Cast-Iron GG EN-JL10** EN-GJL-***	PCA08M PCA12M PN08M PN15M	PTH08M PN08M ATH10E ATH80D	PCA08M			•	•	•	f _z	mm/t	0.16	0.14	0.12	0.12	0.24	0.24	0.17	0.17		
				PTH08M			•	•	•	V _f	mm/min	2650	3130	2608	3850	3180	4173	2921	4312		
				PN15M			•	•	•	a _p	mm	0.16	0.16	0.08	0.08	0.28	0.28	0.08	0.08		
				PN08M			•	•	•	a _e	mm	0.64	0.64	0.16	0.16	0.56	0.56	0.18	0.18		
				ATH80D			•	•	•	Q	mm ³	271	321	33	49	499	654	41	61		
				PCA12M			•	•	•	V _c	m/min	304	399	399	589	304	399	399	589		
VIII	Cast-Iron GGG EN-JS10** EN-GJS-***	PCA08M PCA12M PN08M PN15M	PTH08M PN08M ATH10E ATH80D	PCA08M			•	•	•	n	min ⁻¹	12102	15884	15884	23447	9682	12707	12707	18758		
				PTH08M			•	•	•	f _z	mm/t	0.20	0.18	0.15	0.15	0.30	0.30	0.21	0.21		
				PN15M			•	•	•	V _f	mm/min	4841	5718	4765	7034	5809	7624	5337	7878		
				PN08M			•	•	•	a _p	mm	0.20	0.20	0.10	0.10	0.35	0.35	0.10	0.10		
				ATH10E			•	•	•	a _e	mm	0.80	0.80	0.20	0.20	0.70	0.70	0.22	0.22		
				ATH80D			•	•	•	Q	mm ³	775	915	95	141	1423	1868	117	173		
IX	Stainless Steels High alloy Steels	PCA08M PCA12M PN08M PN15M	PTH08M PN08M ATH10E ATH80D	PCA12M			•	•	•	V _c	m/min	288	378	378	558	288	378	378	558		
				PCA08M			•	•	•	n	min ⁻¹	11465	15048	15048	22213	9172	12038	12038	17771		
				PTH08M			•	•	•	f _z	mm/t	0.20	0.18	0.15	0.15	0.30	0.30	0.21	0.21		
				PN15M			•	•	•	V _f	mm/min	4586	5417	4514	6664	5503	7223	5056	7464		
				PN08M			•	•	•	a _p	mm	0.20	0.20	0.10	0.10	0.35	0.35	0.10	0.10		
				ATH10E			•	•	•	a _e	mm	0.80	0.80	0.20	0.20	0.70	0.70	0.22	0.22		
X	Stainless Steels High alloy Steels	PCA08M PCA12M PN08M PN15M	PTH08M PN08M ATH10E ATH80D	ATH80D			•	•	•	Q	mm ³	734	867	90	133	1348	1770	111	164		
				PCA12M			•	•	•	V _c	m/min	256	336	336	496	256	336	336	496		
				PCA08M			•	•	•	n	min ⁻¹	10191	13376	13376	19745	8153	10701	10701	15796		
				PTH08M			•	•	•	f _z	mm/t	0.17	0.15	0.13	0.13	0.26	0.26	0.18	0.18		
				PN15M			•	•	•	V _f	mm/min	3465	4093	3411	5035	4158	5457	3820	5639		
				PN08M			•	•	•	a _p	mm	0.18	0.18	0.09	0.09	0.32	0.32	0.09	0.09		
Maximum f _z (mm/t)												< 0.5									
Maximum a _p (mm)												< 10.0									


Overhang	V _c (m/min)	f _z (mm)
< 4xD	100%	100%
4xD ~ 10xD	85%	85%


 **General conditions:** Machine with lower rpm and less dynamic
HSC conditions: Machine with high r.p.m. and dynamic Set-Up

 **Normale Werte:** Maschine mit geringer Drehzahl und geringer Dynamik.
HSC Werte: Maschine mit hoher Drehzahl mit hoher Dynamik.

 **Condizioni generali:** Macchine con minor rpm e minor dinamica
Condizioni HSC: Macchine con maggior rpm e maggior dinamica

 **Condiciones generales:** Máquinas con rpm bajas y poca dinámica
Condiciones HSC: Máquinas con rpm altas y buena dinámica

 **Conditions générales:** Machine avec faible rotation de broche et moindre dynamique
Conditions UGV: Machine avec dynamique importante et rotation de broche élevée

 **Condições Gerais:** Máquina com baixa rpm e menor dinâmica
Condições de Corte em Alta Velocidade: Máquina com alta rpm e set-up dinâmico



ABPF/M | Recommended Cutting Conditions



D 12				D 16				D 20				D 25				D 32			
Semi Finishing		Finishing		Semi Finishing		Finishing		Semi Finishing		Finishing		Semi Finishing		Finishing		Semi Finishing		Finishing	
General	High Speed	General	High Speed	General	High Speed	General	High Speed	General	High Speed	General	High Speed	General	High Speed	General	High Speed	General	High Speed	General	High Speed
320	420	420	620	320	420	420	620	320	420	420	620	320	420	420	620	320	420	420	620
8493	11146	11146	16454	6369	8360	8360	12341	5096	6688	6688	9873	4076	5350	5350	7898	3185	4180	4180	6170
0.36	0.36	0.24	0.24	0.43	0.43	0.30	0.30	0.45	0.45	0.32	0.32	0.50	0.50	0.36	0.36	0.50	0.50	0.36	0.36
6115	8025	5350	7898	5478	7189	5016	7404	4586	6019	4280	6318	4076	5350	3852	5687	3185	4180	3010	4443
0.35	0.35	0.15	0.15	0.50	0.50	0.15	0.15	0.50	0.50	0.20	0.20	0.50	0.50	0.20	0.20	0.50	0.50	0.20	0.20
0.85	0.85	0.25	0.25	1.00	1.00	0.30	0.30	1.20	1.20	0.32	0.32	1.35	1.35	0.36	0.36	1.50	1.50	0.41	0.41
1819	2388	201	296	2739	3595	226	333	2752	3611	274	404	2752	3611	277	409	2389	3135	247	364
288	378	378	558	288	378	378	558	288	378	378	558	288	378	378	558	288	378	378	558
7643	10032	10032	14809	5732	7524	7524	11107	4586	6019	6019	8885	3669	4815	4815	7108	2866	3762	3762	5553
0.34	0.34	0.23	0.23	0.41	0.41	0.29	0.29	0.43	0.43	0.30	0.30	0.48	0.48	0.34	0.34	0.48	0.48	0.34	0.34
5228	6862	4575	6753	4683	6147	4289	6331	3921	5146	3660	5402	3485	4575	3294	4862	2723	3574	2573	3798
0.35	0.35	0.15	0.15	0.50	0.50	0.15	0.15	0.50	0.50	0.20	0.20	0.50	0.50	0.20	0.20	0.50	0.50	0.20	0.20
0.85	0.85	0.25	0.25	1.00	1.00	0.30	0.30	1.20	1.20	0.32	0.32	1.35	1.35	0.36	0.36	1.50	1.50	0.41	0.41
1555	2041	172	253	2342	3074	193	285	2353	3088	234	346	2353	3088	237	350	2042	2680	211	311
256	336	336	496	256	336	336	496	256	336	336	496	256	336	336	496	256	336	336	496
6794	8917	8917	13163	5096	6688	6688	9873	4076	5350	5350	7898	3261	4280	4280	6318	2548	3344	3344	4936
0.31	0.31	0.20	0.20	0.37	0.37	0.26	0.26	0.38	0.38	0.27	0.27	0.43	0.43	0.31	0.31	0.43	0.43	0.31	0.31
4158	5457	3638	5371	3725	4889	3411	5035	3118	4093	2911	4297	2772	3638	2620	3867	2166	2842	2046	3021
0.32	0.32	0.14	0.14	0.45	0.45	0.14	0.14	0.45	0.45	0.18	0.18	0.45	0.45	0.18	0.18	0.45	0.45	0.18	0.18
0.77	0.77	0.23	0.23	0.90	0.90	0.27	0.27	1.08	1.08	0.29	0.29	1.22	1.22	0.32	0.32	1.35	1.35	0.37	0.37
1002	1315	111	163	1509	1980	124	184	1516	1989	151	223	1516	1989	153	226	1316	1727	136	201
240	315	315	465	240	315	315	465	240	315	315	465	240	315	315	465	240	315	315	465
6369	8360	8360	12341	4777	6270	6270	9256	3822	5016	5016	7404	3057	4013	4013	5924	2389	3135	3135	4628
0.31	0.31	0.20	0.20	0.37	0.37	0.26	0.26	0.38	0.38	0.27	0.27	0.43	0.43	0.31	0.31	0.43	0.43	0.31	0.31
3898	5116	3411	5035	3492	4583	3198	4720	2924	3837	2729	4028	2599	3411	2456	3625	2030	2665	1919	2832
0.30	0.30	0.13	0.13	0.43	0.43	0.13	0.13	0.43	0.43	0.17	0.17	0.43	0.43	0.17	0.17	0.43	0.43	0.17	0.17
0.72	0.72	0.21	0.21	0.85	0.85	0.26	0.26	1.02	1.02	0.27	0.27	1.15	1.15	0.31	0.31	1.28	1.28	0.35	0.35
838	1100	92	136	1261	1656	104	153	1267	1663	126	186	1267	1663	128	189	1100	1444	114	168
208	273	273	403	208	273	273	403	208	273	273	403	208	273	273	403	208	273	273	403
5520	7245	7245	10695	4140	5434	5434	8021	3312	4347	4347	6417	2650	3478	3478	5134	2070	2717	2717	4011
0.29	0.29	0.19	0.19	0.34	0.34	0.24	0.24	0.36	0.36	0.26	0.26	0.40	0.40	0.29	0.29	0.40	0.40	0.29	0.29
3180	4173	2782	4107	2848	3739	2608	3850	2385	3130	2226	3286	2120	2782	2003	2957	1656	2174	1565	2310
0.28	0.28	0.12	0.12	0.40	0.40	0.12	0.12	0.40	0.40	0.16	0.16	0.40	0.40	0.16	0.16	0.40	0.40	0.16	0.16
0.68	0.68	0.20	0.20	0.80	0.80	0.24	0.24	0.96	0.96	0.26	0.26	1.08	1.08	0.29	0.29	1.20	1.20	0.33	0.33
605	795	67	99	911	1196	75	111	916	1202	91	135	916	1202	92	136	795	1043	82	121
304	399	399	589	304	399	399	589	304	399	399	589	304	399	399	589	304	399	399	589
8068	10589	10589	15632	6051	7942	7942	11724	4841	6354	6354	9379	3873	5083	5083	7503	3025	3971	3971	5862
0.36	0.36	0.24	0.24	0.43	0.43	0.30	0.30	0.45	0.45	0.32	0.32	0.50	0.50	0.36	0.36	0.50	0.50	0.36	0.36
5809	7624	5083	7503	5204	6830	4765	7034	4357	5718	4066	6003	3873	5083	3660	5402	3025	3971	2859	4221
0.35	0.35	0.15	0.15	0.50	0.50	0.15	0.15	0.50	0.50	0.20	0.20	0.50	0.50	0.20	0.20	0.50	0.50	0.20	0.20
0.85	0.85	0.25	0.25	1.00	1.00	0.30	0.30	1.20	1.20	0.32	0.32	1.35	1.35	0.36	0.36	1.50	1.50	0.41	0.41
1728	2268	191	281	2602	3415	214	317	2614	3431	260	384	2614	3431	263	389	2269	2978	234	346
288	378	378	558	288	378	378	558	288	378	378	558	288	378	378	558	288	378	378	558
7643	10032	10032	14809	5732	7524	7524	11107	4586	6019	6019	8885	3669	4815	4815	7108	2866	3762	3762	5553
0.36	0.36	0.24	0.24	0.43	0.43	0.30	0.30	0.45	0.45	0.32	0.32	0.50	0.50	0.36	0.36	0.50	0.50	0.36	0.36
5503	7223	4815	7108	4930	6471	4514	6664	4127	5417	3852	5687	3669	4815	3467	5118	2866	3762	2709	3998
0.35	0.35	0.15	0.15	0.50	0.50	0.15	0.15	0.50	0.50	0.20	0.20	0.50	0.50	0.20	0.20	0.50	0.50	0.20	0.20
0.85	0.85	0.25	0.25	1.00	1.00	0.30	0.30	1.20	1.20	0.32	0.32	1.35	1.35	0.36	0.36	1.50	1.50	0.41	0.41
1637	2149	181	267	2465	3235	203	300	2476	3250	247	364	2476	3250	250	368	2150	2821	222	328
256	336	336	496	256	336	336	496	256	336	336	496	256	336	336	496	256	336	336	496
6794	8917	8917	13163	5096	6688	6688	9873	4076	5350	5350	7898	3261	4280	4280	6318	2548	3344	3344	4936
0.31	0.31	0.20	0.20	0.37	0.37	0.26	0.26	0.38	0.38	0.27	0.27	0.43	0.43	0.31	0.31	0.43	0.43	0.31	0.31
4158	5457	3638	5371	3725	4889	3411	5035	3118	4093	2911	4297	2772	3638	2620	3867	2166	2842	2046	3021
0.32	0.32	0.14	0.14	0.45	0.45	0.14	0.14	0.45	0.45	0.18	0.18	0.45	0.45	0.18	0.18	0.45	0.45	0.18	0.18
0.77	0.77	0.23	0.23	0.90	0.90	0.27	0.27	1.08	1.08	0.29	0.29	1.22	1.22	0.32	0.32	1.35	1.35	0.37	0.37
1002	1315	111	163	1509	1980	124	184	1516	1989	151	223	1516	1989	153	226	1316	1727	136	201
<0.5																			
<10.0																			

This cutting condition is recommended for using 15–20 degree contact point from the chisel. Therefore you get the best result of tool life and surface quality.
a_s sidestep is based on a surface quality of Rz 0.0013 mm!

Die Schnittwerte beziehen sich auf einen Kontaktpunkt an der Kugel von 15–20 Grad außerhalb des Werkzeug-Zentrums. Somit erhalten Sie die beste Standzeit in Verbindung mit der bestmöglichen Oberflächengüte. Die seitliche Zustellung **a_s** basiert auf einer Oberflächengüte von Rz 0,0013 mm!

Condizione di taglio consigliata con un'inclinazione di 15–20 gradi rispetto al punto di contatto. In questo modo è possibile ottenere il miglior risultato in termini di vita utensile e qualità superficiale.
a_s L'incremento laterale è calcolato su una qualità superficiale di Rz 0.0013 mm!

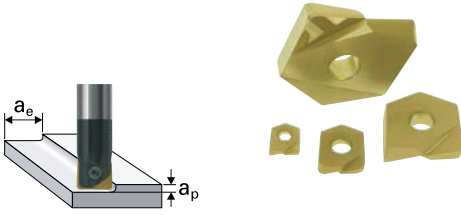
Estas condiciones de corte están recomendadas para trabajar con un punto de contacto a 15-20 grados del centro de la herramienta (chisel). Por lo que se obtiene mejor resultado en cuanto a vida de herramienta y calidad superficial.
a_s paso lateral basado en una calidad superficial con Rz 0.0013 mm!

Ces conditions de coupe sont recommandées pour un usinage avec un angle de 15–20 degrés par rapport à l'arête de coupe. Vous obtiendrez ainsi les meilleurs résultats en termes de longévité de vos outils et de qualité surfacique.
a_s le pas latéral est basé sur une qualité surfacique équivalent à un Rz = 0.0013 mm!

Estas condições de corte são recomendadas para uso do chanfro em contato a 15–20 graus de inclinação. Consegue, assim, os melhores resultados em termos de tempo de vida e de qualidade de superfície.
a_s passo lateral baseado numa qualidade de superfície de Rz 0.0013 mm!

Cutting Conditions			Page
ARPF D8–32	Semi Finishing	Finishing	14–15

ARPF/M | Recommended Cutting Conditions



Work piece material		Recommend grade & Target hardness (HRC)			Emulsion	Mist	Air	Parameter	D 8			D 10			D 12					
									Semi Finishing			Semi Finishing			Semi Finishing					
		General	High Feed	Finishing					General	High Feed	Finishing	General	High Feed	Finishing						
I II	Carbon-Steel Alloy-Steel <30HRC	PCA12M				•	•	•	V _c	m/min	250	350	350	250	350	350	250	350	350	
									n	min ⁻¹	9950	13930	13930	7960	11140	11140	6630	9280	9280	
									f _z	mm/t	0.2	0.15	0.1	0.2	0.15	0.15	0.2	0.15	0.15	
									V _f	mm/min	3980	4180	2790	3180	3340	3340	2650	2790	2790	
									a _p	mm	0.2	0.15	0.1	0.5	0.3	0.1	0.6	0.4	0.1	
									a _e	mm	0.8	0.4	0.2	1	0.5	0.2	1.2	0.6	0.2	
III	Alloy-Steel Tool-Steel 30~40HRC	PCA12M				•	•	•	V _c	m/min	200	300	300	200	300	300	200	300	300	
									n	min ⁻¹	7960	11940	11940	6370	9550	9550	5310	7960	7960	
									f _z	mm/t	0.2	0.15	0.1	0.2	0.15	0.15	0.2	0.15	0.15	
			PTH08M				•	•	•	V _f	mm/min	3180	3580	2390	2550	2860	2860	2120	2390	2390
									a _p	mm	0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.1	
									a _e	mm	0.8	0.4	0.2	1	0.5	0.2	1.2	0.6	0.2	
IV	Pre-Hardened Steel Tool-Steel 40~50HRC	PCA12M				•	•	•	V _c	m/min	180	280	280	180	280	280	180	280	280	
									n	min ⁻¹	7160	11140	11140	5730	8910	8910	4770	7430	7430	
									f _z	mm/t	0.15	0.1	0.05	0.15	0.1	0.05	0.15	0.1	0.05	
			PTH08M				•	•	•	V _f	mm/min	2150	2230	1110	1720	1780	890	1430	1490	740
									a _p	mm	0.15	0.15	0.1	0.15	0.15	0.1	0.15	0.15	0.1	
									a _e	mm	0.8	0.4	0.2	1	0.5	0.2	1.2	0.6	0.2	
V	Hardened Steel Tool-Steel 50~55HRC								V _c	m/min	150	250	250	150	250	250	150	250	250	
									n	min ⁻¹	5970	9950	9950	4770	7960	7960	3980	6630	6630	
									f _z	mm/t	0.1	0.07	0.05	0.1	0.07	0.05	0.1	0.07	0.05	
			PTH08M				•	•	•	V _f	mm/min	1190	1390	990	950	1110	800	800	930	660
									a _p	mm	0.15	0.15	0.1	0.15	0.15	0.1	0.15	0.15	0.1	
									a _e	mm	0.8	0.4	0.2	1	0.5	0.2	1.2	0.6	0.2	
V	Hardened Steel > 55HRC								V _c	m/min	120	200	200	120	200	200	120	200	200	
									n	min ⁻¹	4770	7960	7960	3820	6370	6370	3180	5310	5310	
									f _z	mm/t	0.1	0.07	0.05	0.1	0.07	0.05	0.1	0.07	0.05	
			PTH08M				•	•	•	V _f	mm/min	950	1110	800	760	890	640	640	740	530
									a _p	mm	0.15	0.15	0.1	0.15	0.15	0.1	0.15	0.15	0.1	
									a _e	mm	0.8	0.4	0.2	1	0.5	0.2	1.2	0.6	0.2	
VIII	Cast-Iron GG EN-JL10** EN-GJL-***	PCA12M				•	•	•	V _c	m/min	250	350	350	250	350	350	250	350	350	
									n	min ⁻¹	9950	13930	13930	7960	11140	11140	6630	9280	9280	
									f _z	mm/t	0.2	0.15	0.1	0.2	0.15	0.1	0.2	0.15	0.1	
			PTH08M				•	•	•	V _f	mm/min	3980	4180	2790	3180	3340	2230	2650	2790	1860
									a _p	mm	0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.1	
									a _e	mm	0.8	0.4	0.2	1	0.5	0.2	1.2	0.6	0.2	
VIII	Cast-Iron GGG EN-JS10** EN-GJS-***	PCA12M				•	•	•	V _c	m/min	200	300	300	200	300	300	200	300	300	
									n	min ⁻¹	7960	11940	11940	6370	9550	9550	5310	7960	7960	
									f _z	mm/t	0.2	0.15	0.1	0.2	0.15	0.1	0.2	0.15	0.1	
			PTH08M				•	•	•	V _f	mm/min	3180	3580	2390	2550	2860	1910	2120	2390	1590
									a _p	mm	0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.1	
									a _e	mm	0.8	0.4	0.2	1	0.5	0.2	1.2	0.6	0.2	
VI	Stainless Steels High alloy Steels	PCA12M				•	•	•	V _c	m/min	200	300	300	200	300	300	200	300	300	
									n	min ⁻¹	7960	11940	11940	6370	9550	9550	5310	7960	7960	
									f _z	mm/t	0.2	0.15	0.1	0.2	0.15	0.1	0.2	0.15	0.1	
			PTH08M				•	•	•	V _f	mm/min	3180	3580	2390	2550	2860	1910	2120	2390	1590
									a _p	mm	0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.1	
									a _e	mm	0.8	0.4	0.2	1	0.5	0.2	1.2	0.6	0.2	

ARPF/M | Recommended Cutting Conditions



D 16			D 20			D 25			D 32		
Semi Finishing			Semi Finishing			Semi Finishing			Semi Finishing		
General	High Feed	Finishing	General	High Feed	Finishing	General	High Feed	Finishing	General	High Feed	Finishing
250	350	350	250	350	350	250	350	350	250	350	350
4970	6960	6960	3980	5570	5570	3180	4460	4460	2490	3480	3480
0.2	0.15	0.15	0.2	0.15	0.15	0.2	0.15	0.15	0.2	0.15	0.15
1990	2090	2090	1590	1670	1670	1270	1340	1340	990	1040	1040
0.8	0.6	0.1	1	0.8	0.1	1.2	1	0.1	1.5	1.2	0.1
1.6	1	0.2	2	1.5	0.2	2.5	2	0.2	3	2.5	0.2
200	300	300	200	300	300	200	300	300	200	300	300
3980	5970	5970	3180	4770	4770	2550	3820	3820	1990	2980	2980
0.2	0.15	0.15	0.2	0.15	0.15	0.2	0.15	0.15	0.2	0.15	0.15
1590	1790	1790	1270	1430	1430	1020	1150	1150	800	900	900
0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.1
1.6	1	0.2	2	1.5	0.2	2.5	2	0.2	3	2.5	0.2
180	280	280	180	280	280	180	280	280	180	280	280
3580	5570	5570	2860	4460	4460	2290	3570	3570	1790	2790	2790
0.15	0.1	0.05	0.15	0.1	0.05	0.15	0.1	0.05	0.15	0.1	0.05
1070	1110	560	860	890	450	690	710	360	540	560	280
0.15	0.15	0.1	0.15	0.15	0.1	0.15	0.15	0.1	0.15	0.15	0.1
1.6	1	0.2	2	1.5	0.2	2.5	2	0.2	3	2.5	0.2
150	250	250	150	250	250	150	250	250	150	250	250
2980	4970	4970	2390	3980	3980	1910	3180	3180	1490	2490	2490
0.1	0.07	0.05	0.1	0.07	0.05	0.1	0.07	0.05	0.1	0.07	0.05
600	700	500	480	560	400	380	450	320	300	350	250
0.15	0.15	0.1	0.15	0.15	0.1	0.15	0.15	0.1	0.15	0.15	0.1
1.6	1	0.2	2	1.5	0.2	2.5	2	0.2	3	2.5	0.2
120	200	200	120	200	200	120	200	200	120	200	200
2390	3980	3980	1910	3180	3180	1530	2550	2550	1190	1990	1990
0.1	0.07	0.05	0.1	0.07	0.05	0.1	0.07	0.05	0.1	0.07	0.05
480	560	400	380	450	320	310	360	250	240	280	200
0.15	0.15	0.1	0.15	0.15	0.1	0.15	0.15	0.1	0.15	0.15	0.1
1.6	1	0.2	2	1.5	0.2	2.5	2	0.2	3	2.5	0.2
250	350	350	250	350	350	250	350	350	250	350	350
4970	6960	6960	3980	5570	5570	3180	4460	4460	2490	3480	3480
0.2	0.15	0.1	0.2	0.15	0.1	0.2	0.15	0.1	0.2	0.15	0.1
1990	2090	1390	1590	1670	1110	1270	1340	890	990	1040	700
0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.1
1.6	1	0.2	2	1.5	0.2	2.5	2	0.2	3	2.5	0.2
200	300	300	200	300	300	200	300	300	200	300	300
3980	5970	5970	3180	4770	4770	2550	3820	3820	1990	2980	2980
0.2	0.15	0.1	0.2	0.15	0.1	0.2	0.15	0.1	0.2	0.15	0.1
1590	1790	1190	1270	1430	950	1020	1150	760	800	900	600
0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.1
1.6	1	0.2	2	1.5	0.2	2.5	2	0.2	3	2.5	0.2
200	300	300	200	300	300	200	300	300	200	300	300
3980	5970	5970	3180	4770	4770	2550	3820	3820	1990	2980	2980
0.2	0.15	0.1	0.2	0.15	0.1	0.2	0.15	0.1	0.2	0.15	0.1
1590	1790	1190	1270	1430	950	1020	1150	760	800	900	600
0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.1
1.6	1	0.2	2	1.5	0.2	2.5	2	0.2	3	2.5	0.2
200	300	300	200	300	300	200	300	300	200	300	300
3980	5970	5970	3180	4770	4770	2550	3820	3820	1990	2980	2980
0.2	0.15	0.1	0.2	0.15	0.1	0.2	0.15	0.1	0.2	0.15	0.1
1590	1790	1190	1270	1430	950	1020	1150	760	800	900	600
0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.1
1.6	1	0.2	2	1.5	0.2	2.5	2	0.2	3	2.5	0.2

ABPF/M / ARPF/M | Cutting Conditions | Long – up to 10x D

 Long conditions are based on short condition data-sheet, please adopt like follow:

Option I: Higher feed (based on f_z) in combination with lower depth (a_p)			
OH	V_c	f_z	a_p
till 3x D	100%	100%	100%
~ 5x D	100%	100%	80%
~ 8x D	90%	90%	50%
~ 10x D	80%	80%	25%

The most important factor is to reduce drastically a_p and not V_c or V_f
The main factor for deflection is the contact and not the movement

Info: double over-hang length = 8 times increased deflection!

Option II: Depth (a_p) kept in combination with reduced speed (V_c) and feed/tooth (f_z)			
OH	V_c	f_z	a_p
till 3x D	100%	100%	100%
~ 5x D	70%	70%	100%
~ 8x D	60%	60%	100%
~ 10x D	50%	50%	100%

The most important is to reduce the force in case of bigger depth (a_p)
In case of bigger Diameter, the deflection is less

Info: double tool D = 16 times reduced deflection!

General Info

These are recommended conditions which have to be adopted to material-machine-strategy Conditions

- If no problems occur in using long tools, speeds, feeds and depth can be improved like in short conditions
- If wear problems occur, V_c should be reduced or feed per tooth (f_z) should be increased
- If chipping problems occur, OH or depth (a_p) should be reduced





Insert & screw

- Inserts should be replaced if wear or chipping occurs in order not to damage the body
- Before fixing new insert, body-seat, screw and new insert have to be cleaned
- Screws for inserts should be tightened with the correct torque (see p. 10) – paste should be used
- Screws should be replaced when damaged or difficult to tighten to keep tolerance

Surface quality

- Surface roughness should be decided from cusp-height formula or by a_e / f_z concept
- Air-blow will help to evacuate chips from the cutting zone in order to avoid re-cutting of chips
- Air or high-pressure emulsion can help to reach better optical surface
- Down-cutting (climb milling) is recommended

ARPF/M | ARPF – 3D Chart

f _z –a _p –a _e overview for 3D milling										
Job field / Application	Surface roughness				Corner-R size (mm)					
	Drawing	Ra (μm)	Rz (μm)		0.3	0.5	1.0	1.5	2.0	3.0
Punching mold Die-casting mold Plastic mold		0.05	0.4	f _z – a _p – a _e	0.01	0.01	0.02	0.02	0.03	0.03
	Super Finishing	0.1	0.8		0.02	0.02	0.03	0.03	0.04	0.05
Plastic mold Die-casting mold Forging mold		0.4	1.6		0.02	0.03	0.04	0.05	0.06	0.07
	Finishing	1.6	6.3		0.04	0.06	0.08	0.10	0.11	0.14
Forging mold Press mold		3.2	12.56		0.06	0.08	0.11	0.14	0.16	0.19
	Semi Finishing	6.3	25		0.09	0.11	0.16	0.19	0.22	0.27
Press mold		12.5	50		0.12	0.16	0.22	0.27	0.32	0.39
	Roughing	25	100		0.15	0.22	0.32	0.39	0.45	0.55

For 3D cutting, we recommend to increase V_c 20% more, and use f_z/a_p/a_e from table.

ABPF/M / ARPF/M | Schnittbedingungen | Lange Werkzeuge – über 10x D

 **Die Schnittwerte basieren auf den kurzen Werkzeuglängen, bitte reduzieren Sie diese wie folgt dargestellt:**

Option I: Höhere Vorschubgeschwindigkeit (basierend auf f_z) in Kombination mit geringerer Schnitttiefe (a_p)			
OH	V_c	f_z	a_p
bis zu 3x D	100%	100%	100%
~ 5x D	100%	100%	80%
~ 8x D	90%	90%	50%
~ 10x D	80%	80%	25%

Die Hauptursache für zu hohe Schnittkräfte und die damit verbundene Deflektion (seitliche Ablenkung/Verbiegung) ist ein zu großer Kontaktpunkt an der Schneide, nicht die Vorschubgeschwindigkeit.

Info: Doppelte Werkzeuglänge = 8fach höhere Deflektion!

Option II: Beibehalten der Zustellung (a_p) in Kombination mit einer Reduzierung von V_c und f_z			
OH	V_c	f_z	a_p
bis zu 3x D	100%	100%	100%
~ 5x D	70%	70%	100%
~ 8x D	60%	60%	100%
~ 10x D	50%	50%	100%

Wichtig ist hierbei, dass Sie bedingt durch die Schnitttiefe (a_p) den Druck auf die Schneide (f_z) reduzieren. Verwenden Sie einen größeren Durchmesser, somit wird die Deflektion geringer.

Info: Doppelter Werkzeugdurchmesser = 16fach reduzierte Deflektion!

Allgemeine Information

Die empfohlenen Schnittwerte müssen je nach Bedarf an Werkstoff, Maschine und Bearbeitungs-Strategie angepasst werden

- Treten beim Verwenden von langen Werkzeugen keine Probleme auf, können die Werte V_c , f_z und a_p wieder erhöht werden
- Sollte die Standzeit unzureichend sein, reduzieren Sie V_c oder erhöhen Sie f_z
- Sollten Schneidenausbrüche auftreten, reduzieren Sie bitte die Werkzeuglänge oder die Schnitttiefe a_p





Wendeschneidplatten und Schrauben

- Bitte wechseln Sie die Wendeschneidplatte bei auftretendem Verschleiß, bevor der Werkzeughalter beschädigt wird
- Bevor Sie die neue Wendeschneidplatte einsetzen, überzeugen Sie sich bitte von einem intakten Plattensitz und reinigen Sie diesen sowie die Schraube zuvor
- Bitte ziehen Sie die Schraube mit dem vorgesehenen Drehmoment an (siehe Seite 10), Graphitpaste erleichtert das Lösen!
- Verwenden Sie eine neue Schraube, sobald Probleme beim Lösen bzw. Anziehen auftreten

Oberflächengüte

- Die Oberflächengüte sollte unter Berücksichtigung der seitlichen Zustellung zuvor berechnet werden, ggf. kann auch das „ a_e / f_z Konzept“ berücksichtigt werden
- Innen-/ oder Außenluft sorgt für die Späneabfuhr und vermeidet ein erneutes Zerspanen der Späne
- Luft oder Kühlschmierstoff verbessert die optische Oberflächengüte
- Gleichlaufräsen wird empfohlen

ARPF/M | ARPF – 3D Chart

f _z -a _p -a _e Überblick für die 3D Zerpanung										
Anwendung:	Oberflächengüte			f _z - a _p - a _e	Eckenradius Größe (mm)					
	Zeichen	Ra (µm)	Rz (µm)		0.3	0.5	1.0	1.5	2.0	3.0
Stanzform Druckguss Form Spritzguss Form		0.05	0.4	f _z - a _p - a _e	0.01	0.01	0.02	0.02	0.03	0.03
	Super Finishing	0.1	0.8		0.02	0.02	0.03	0.03	0.04	0.05
Spritzguss Form Druckguss Form Schmiedegesenk		0.4	1.6		0.02	0.03	0.04	0.05	0.06	0.07
	Finishing	1.6	6.3		0.04	0.06	0.08	0.10	0.11	0.14
Schmiedegesenk Pressform		3.2	12.56		0.06	0.08	0.11	0.14	0.16	0.19
	Semi Finishing	6.3	25		0.09	0.11	0.16	0.19	0.22	0.27
Pressform		12.5	50		0.12	0.16	0.22	0.27	0.32	0.39
	Roughing	25	100		0.15	0.22	0.32	0.39	0.45	0.55

Zur 3D Bearbeitung empfehlen wir V_c um 20% zu erhöhen und f_z/a_p/a_e gemäß Tabelle zu benutzen.

ABPF/M / ARPF/M | Condizioni di taglio | Sporgenza – fino a 10 x D

■ ■ Si prega di calcolare le condizioni di taglio con alta sporgenza in funzione della tabella sottostante e prendendo come riferimento i parametri indicati nelle condizioni a bassa sporgenza.

Opzione I: maggiore avanzamento (basato su f_z) in combinazione con minor profondità di passata (a_p)			
OH	V_c	f_z	a_p
Fino a 3x D	100%	100%	100%
~ 5x D	100%	100%	80%
~ 8x D	90%	90%	50%
~ 10x D	80%	80%	25%

Il fattore più importante è ridurre drasticamente a_p e non V_c o V_f
Il maggior fattore di deflessione è il contatto e non il movimento

Info: doppia sporgenza = aumento della flessione pari a 8 volte

Opzione II: Profondità di passata (a_p) mantenuta in combinazione con ridotta velocità (V_c) e ridotto avanzamento al dente (f_z)			
OH	V_c	f_z	a_p
Fino a 3x D	100%	100%	100%
~ 5x D	70%	70%	100%
~ 8x D	60%	60%	100%
~ 10x D	50%	50%	100%

Il fattore più importante è ridurre la forza in caso di maggior profondità di passata (a_p)
In caso di diametro più grande, la flessione e la forza di taglio sono minori.

Info: doppio diametro = flessione ridotta di 16 volte!

Informazioni generali

Di seguito le condizioni consigliate da adottare in funzione delle seguenti situazioni:

- Se non si verificano problemi nell'utilizzo di utensili di lunga sporgenza; velocità, avanzamento e profondità di passata possono essere migliorate utilizzando le condizioni a bassa sporgenza
- Se si verificano problemi di usura, V_c dovrebbe essere ridotta oppure l'avanzamento al dente (f_z) dovrebbe essere aumentato.
- Se si presentano problemi di scheggiatura, OH oppure la profondità di passata (a_p) dovrebbero essere ridotte





Inserto & vite

- Se si presentano segni di usura o scheggiatura, l'inserto dovrebbe essere sostituito per evitare di danneggiare il corpo
- Prima di fissare nuovi inserti, la sede, la vite e il nuovo inserto devono essere puliti
- La vite per gli inserti deve essere serrata con l'apposita chiave dinamometrica (vedi pag. 10) – deve inoltre essere usata apposita pasta.
- La vite deve essere sostituita in caso sia danneggiata o in caso di problemi di serraggio in modo da mantenere la tolleranza

Qualità superficiale

- La rugosità superficiale dovrebbe essere stabilita dalla formula altezza di cresta o dal concetto a_e / f_z
- Il soffiaggio aiuterà l'allontanamento dei trucioli dalla zona di taglio per evitare che i trucioli vengano ritagliati
- L'aria o l'emulsione possono aiutare nel raggiungimento di una migliore qualità superficiale
- Taglio sotto squadra (a salire) è consigliato.

ARPF/M | ARPF – Grafico 3D

f _z -a _p -a _e panoramica lavorazione 3D										
settore/ applicazione di lavorazione	rugosità superficiale				dimensione raggio torico (mm)					
	Drawing	Ra (µm)	Rz (µm)		0.3	0.5	1.0	1.5	2.0	3.0
Stampi trancia Pressofusione Plastica		0.05	0.4	f _z - a _p - a _e	0.01	0.01	0.02	0.02	0.03	0.03
	Super Finishing	0.1	0.8		0.02	0.02	0.03	0.03	0.04	0.05
Plastica Pressofusione Forgiatura		0.4	1.6		0.02	0.03	0.04	0.05	0.06	0.07
	Finishing	1.6	6.3		0.04	0.06	0.08	0.10	0.11	0.14
Forgiatura Stampi		3.2	12.56		0.06	0.08	0.11	0.14	0.16	0.19
	Semi Finishing	6.3	25		0.09	0.11	0.16	0.19	0.22	0.27
Stampi		12.5	50		0.12	0.16	0.22	0.27	0.32	0.39
	Roughing	25	100		0.15	0.22	0.32	0.39	0.45	0.55

Per taglio 3D, consigliamo di aumentare V_c del 20%, e usare f_z/a_p/a_e come da tabella.

ABPF/M / ARPF/M | Condiciones de corte | Longitud hasta 10x D

Las condiciones con gran voladizo están basadas en la hoja de datos con poco voladizo, por favor adaptar de la siguiente manera:

Opción I: Aumentar el avance (aumentando la f_z) en combinación con una profundidad menor (a_p)

OH	V_c	f_z	a_p
hasta 3x D	100%	100%	100%
~ 5x D	100%	100%	80%
~ 8x D	90%	90%	50%
~ 10x D	80%	80%	25%

El factor más importante es reducir drásticamente a_p y no V_c o V_f
El principal factor para la flexión de la herramienta es el contacto y no el movimiento

Información: el doble de longitud de voladizo = incremento de 8 veces la flexión de la herramienta!

Opción II: Mantener la profundidad (a_p) reduciendo la velocidad de corte (V_c) y el avance por diente (f_z)

OH	V_c	f_z	a_p
hasta 3x D	100%	100%	100%
~ 5x D	70%	70%	100%
~ 8x D	60%	60%	100%
~ 10x D	50%	50%	100%

Lo más importante es reducir el esfuerzo en el caso de grandes profundidades de pasada (a_p)
En el caso de grandes diámetros, la flexión de la herramienta y el esfuerzo de corte es menor.

Información: el doble de D de la herramienta = reducción de 16 veces la flexión de la herramienta

Información general

Estas son las condiciones recomendadas las cuales tienen que ser adaptadas dependiendo de las condiciones de material-máquina-estrategia

- Si no se producen problemas en el uso de herramientas largas, la velocidad, el avance y la profundidad de pasada se pueden mejorar al igual que en voladizos cortos
- Si se produce desgaste, la V_c debería reducirse o el avance por diente (f_z) debería aumentarse
- Si se produce micro-roturas, el OH o la profundidad (a_p) debería reducirse

Placa y tornillo





- La placa debe cambiarse si se produce desgaste o rotura, con el fin de no dañar el plato.
- Antes de poner la nueva placa, el asiento de la placa, el tornillo y la placa tienen que ser limpiados.
- Los tornillos de las placas deben apretarse con el par correcto (ver p. 10). Además debe usarse pasta.
- Los tornillos deben ser reemplazados cuando esté dañado para mantener la tolerancia.

Calidad superficial

- La rugosidad superficial deber ser decidida con la fórmula para crestas o por el concepto de a_e / f_z
- El aire soplado ayudará a evacuar la viruta de la zona de mecanizado con el fin de evitar el remecanizado de viruta
- El aire o la emulsión a alta presión puede ayudar a conseguir una mejor superficie óptica.
- Se recomienda el mecanizado en concordancia (a derechas)

ARPF/M | ARPF – Tabla 3D

$f_z - a_p - a_e$ Visión general para mecanizado 3D

Campo de trabajo / Aplicación	Rugosidad superficial				Corner-R size (mm)					
	Drawing	Ra (µm)	Rz (µm)		0.3	0.5	1.0	1.5	2.0	3.0
Punching mold Die-casting mold Plastic mold		0.05	0.4	$f_z - a_p - a_e$	0.01	0.01	0.02	0.02	0.03	0.03
	Super Finishing	0.1	0.8		0.02	0.02	0.03	0.03	0.04	0.05
Plastic mold Die-casting mold Forging mold		0.4	1.6		0.02	0.03	0.04	0.05	0.06	0.07
	Finishing	1.6	6.3		0.04	0.06	0.08	0.10	0.11	0.14
Forging mold Press mold		3.2	12.56		0.06	0.08	0.11	0.14	0.16	0.19
	Semi Finishing	6.3	25		0.09	0.11	0.16	0.19	0.22	0.27
Press mold		12.5	50		0.12	0.16	0.22	0.27	0.32	0.39
	Roughing	25	100		0.15	0.22	0.32	0.39	0.45	0.55

Para el mecanizado 3D, recomendamos incrementar la V_c un 20% más, y usar la $f_z/a_p/a_e$ de la tabla.

ABPF/M / ARPF/M | Conditions de coupe | Longueur – jusqu'à 10x D

■ ■ Les conditions pour longs porte-à-faux sont basées sur les paramètres exprimés dans le tableau des conditions, veuillez adapter comme suit :

Option I : vitesse supérieure (basé sur f_z) combinée avec une faible profondeur (a_p)			
OH	V_c	f_z	a_p
Jusqu'à 3x D	100%	100%	100%
~ 5x D	100%	100%	80%
~ 8x D	90%	90%	50%
~ 10x D	80%	80%	25%

Le facteur le plus important est de réduire drastiquement la profondeur a_p sans réduire les vitesses de coupe V_c ou d'avance V_f .
La source la plus importante de la flexion est l'effort de coupe, non pas le mouvement

Info: Porte-à-faux double = Flexion multipliée par 8!

Option II : profondeur (a_p) combinée avec une vitesse réduite (V_c) et avance à la dent (f_z)			
OH	V_c	f_z	a_p
Jusqu'à 3x D	100%	100%	100%
~ 5x D	70%	70%	100%
~ 8x D	60%	60%	100%
~ 10x D	50%	50%	100%

Il est essentiel de réduire les efforts de coupe dans le cas de l'utilisation d'une grande profondeur de coupe (a_p).
Dans le cas de diamètres d'outils plus importants, les efforts de coupe et la flexion sont moindres.

Info: Diamètre outil multiplié par 2 = 16 fois moins de flexion!

Informations générales

Ces conditions recommandées doivent être adaptées à votre situation particulière en termes de matière, machine et stratégie d'usinage

- Si, lors de l'utilisation d'outils longs, aucun problème particulier ne survient, les vitesses, avances et profondeurs de passes peuvent être augmentées comme pour l'utilisation d'un outil court
- Si un problème d'usure apparaît, la vitesse V_c doit être réduite ou l'avance par dent (f_z) doit être augmentée
- Si un problème d'usure apparaît, Le porte-à-faux OH ou la profondeur (a_p) doivent être réduits





Plaquette & vis

- Si de l'usure ou de l'écaillage apparaissent, la plaquette doit être remplacée pour ne pas abîmer le corps d'outil
- Avant de monter la nouvelle plaquette, l'assise, la vis et la nouvelle plaquette doivent être soigneusement nettoyées
- La vis doit être serrée au couple de serrage prescrit (voir p. 10) – Utiliser de la pâte fournie
- La vis doit être remplacée quand elle est endommagée ou quand le serrage s'avère difficile pour conserver la tolérance

Qualité surfacique

- La qualité de surface doit être décidée grâce au calcul de crêtes ou par le concept a_e / f_z
- Le soufflage d'air permettra d'évacuer les copeaux de la zone de travail et évitera de recycler les copeaux
- L'air ou l'utilisation de soluble peut aider à l'obtention de meilleures surfaces optiques
- L'usinage en avalant est recommandé

ARPF/M | ARPF – Tableau 3D

$f_z - a_p - a_e$ vue d'ensemble pour usinage 3D									
Domaine d'activité / Application	Rugosité			Dimension du rayon R (mm)					
	Visuel	Ra (μm)	Rz (μm)	$f_z - a_p - a_e$	0.3	0.5	1.0	1.5	2.0
Outil de découpe Moule de fonderie Moule d'injection		0.05	0.4	$f_z - a_p - a_e$	0.01	0.01	0.02	0.02	0.03
	Super Finishing	0.1	0.8		0.02	0.02	0.03	0.03	0.04
Moule d'injection Moule de fonderie Matrice de forge		0.4	1.6		0.02	0.03	0.04	0.05	0.06
	Finishing	1.6	6.3		0.04	0.06	0.08	0.10	0.11
Matrice de forge		3.2	12.56		0.06	0.08	0.11	0.14	0.16
	Semi Finishing	6.3	25		0.09	0.11	0.16	0.19	0.22
Outillage d'emboutissage		12.5	50		0.12	0.16	0.22	0.27	0.32
	Roughing	25	100		0.15	0.22	0.32	0.39	0.45

Pour de l'usinage 3D, nous recommandons d'augmenter la vitesse de coupe V_c de 20% et d'utiliser les $f_z/a_p/a_e$ du tableau.

ABPF/M / ARPF/M | Valores de Corte | comprimento – até 10x D

As condições de corte longo são baseadas em condições de corte curto da tabela, queira pf adotar as seguintes alterações:

Opção 1: Maior avanço (baseado em f_z) em combinação com menor profundidade (a_p)			
Altura da Ferramenta (OH)	V_c	f_z	a_p
até 3x D	100%	100%	100%
~ 5x D	100%	100%	80%
~ 8x D	90%	90%	50%
~ 10x D	80%	80%	25%

O fator mais importante é a redução drástica do a_p e não do V_c ou V_f .
O maior fator de deflexão é o contato e não o movimento

Informação: dobro da altura da ferramenta = deflexão aumentada 8 vezes!

Opção 2: Profundidade (a_p) mantida em combinação com velocidade (V_c) e avanço por dente (f_z) reduzidos			
Altura da Ferramenta (OH)	V_c	f_z	a_p
até 3x D	100%	100%	100%
~ 5x D	70%	70%	100%
~ 8x D	60%	60%	100%
~ 10x D	50%	50%	100%

O mais importante é reduzir a força de corte, em casos de maior profundidade (a_p)
Em situações de maior diâmetro, a deflexão e a força de corte são menores.

Informação: dobro do Diâmetro da ferramenta = deflexão reduzida 16 vezes!

Informação Geral

Apresentam-se condições que devem ser adaptadas conforme as condições de material – máquina – estratégia

- Se não ocorrerem problemas na utilização de ferramentas longas, as condições de velocidade, avanço e profundidade podem ser melhoradas conforme as condições de corte curto.
- Se ocorrer desgaste, o V_c deverá ser reduzido, ou o avanço por dente (f_z) deverá ser aumentado
- Se ocorrer problema na remoção da limalha, a altura da ferramenta (OH) ou profundidade (a_p) devem ser reduzidos





Plaquete e parafuso

- As plaquetas devem ser substituídas em caso de desgaste ou de problema na remoção da limalha, de modo a não danificar a roca
- Antes de aplicar uma nova plaquete, deve limpar o seu assentamento, o parafuso e a nova plaquete
- Os parafusos para plaquetas devem ser apertados com a chave de torque correta (ver p.10) – deve aplicar a massa

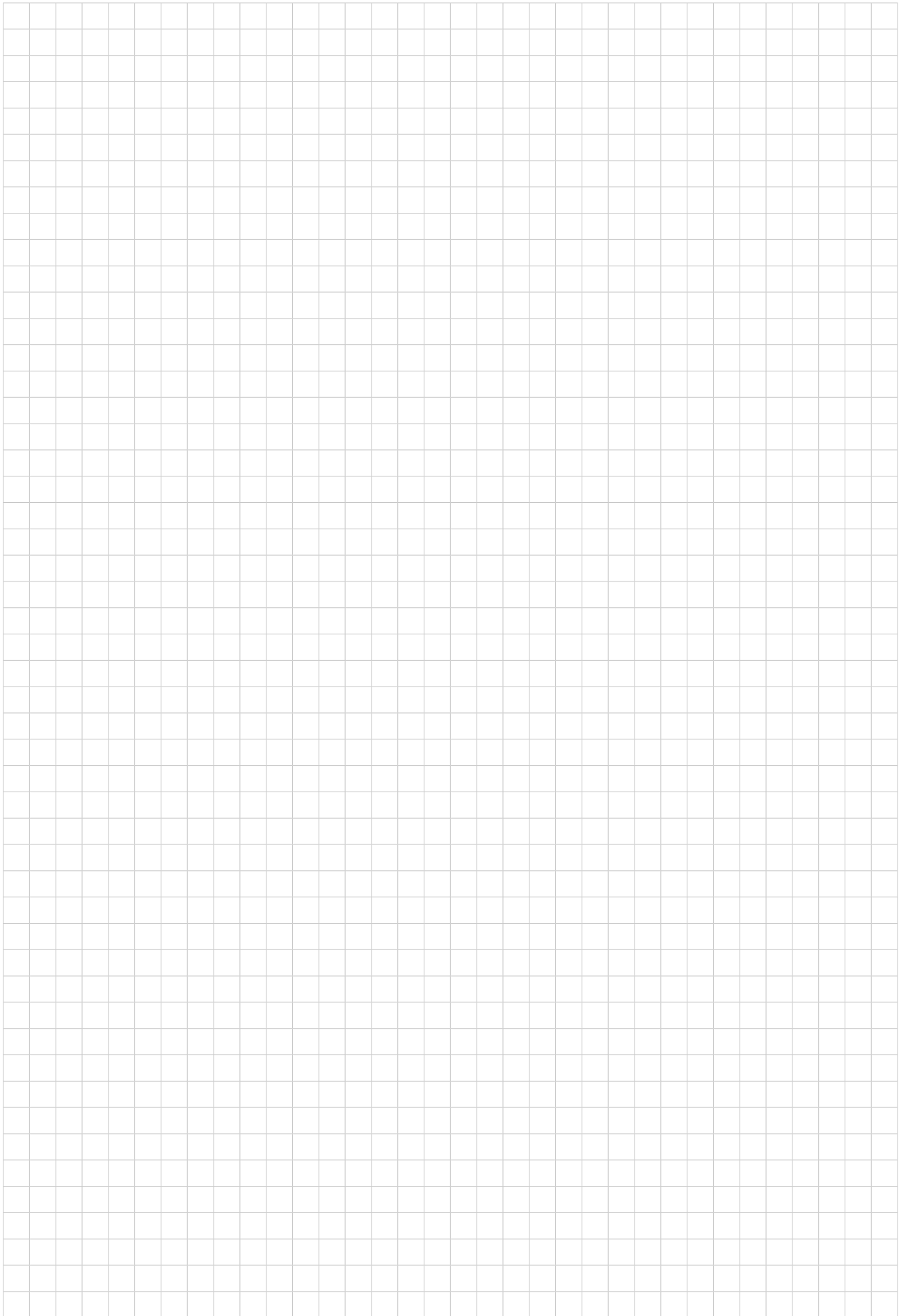
Qualidade de superfície

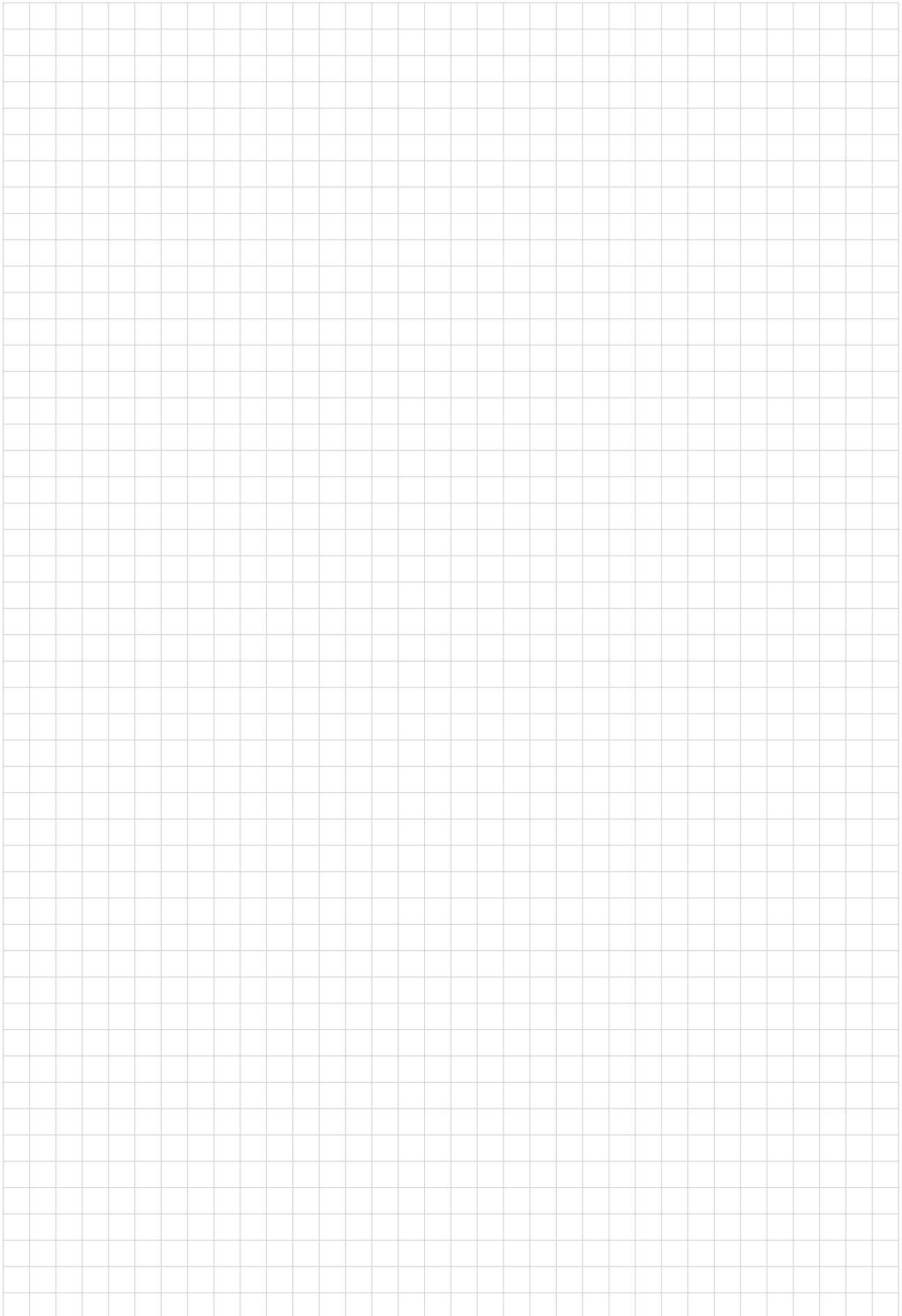
- A rugosidade da superfície deve ser decidida a partir da fórmula de altura da crista ou pelo conceito a_e / f_z
- Uso de sopro de ar facilitará a evacuação das limalhas da zona de corte, de modo a evitar que a ferramenta corte em cima da limalha
- Emulsão de ar ou de alta-pressão pode ajudar na melhoria da superfície ótica
- Recomenda-se corte vertical (corte a favor)

ARPF/M | ARPF – Gráfico 3D

f _z -a _p -a _e resumo para fresagem em 3D										
Tipo de trabalho / Aplicação	Rugosidade de Superfície				Raio de canto (mm)					
	Desenho	Ra (µm)	Rz (µm)		0.3	0.5	1.0	1.5	2.0	3.0
Molde de Estampagem Matriz Molde para plástico		0.05	0.4	f _z - a _p - a _e	0.01	0.01	0.02	0.02	0.03	0.03
	Super Finishing	0.1	0.8		0.02	0.02	0.03	0.03	0.04	0.05
Molde para plástico Matriz Molde de fundição		0.4	1.6		0.02	0.03	0.04	0.05	0.06	0.07
	Finishing	1.6	6.3		0.04	0.06	0.08	0.10	0.11	0.14
Molde de fundição		3.2	12.56		0.06	0.08	0.11	0.14	0.16	0.19
Molde de prensa	Semi Finishing	6.3	25		0.09	0.11	0.16	0.19	0.22	0.27
Molde de prensa		12.5	50		0.12	0.16	0.22	0.27	0.32	0.39
	Roughing	25	100		0.15	0.22	0.32	0.39	0.45	0.55

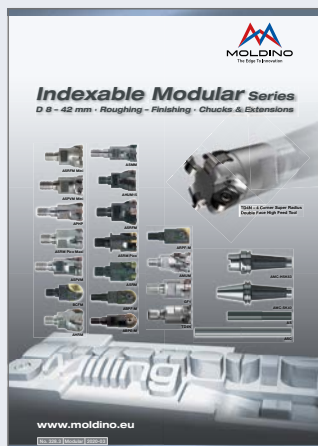
Para corte em 3D, recomendamos que se aumente o V_c em 20%, utilizando valores de f_z/a_p/a_e da tabela.





➔ For more information about Modular Tools and available Shanks please check our brochures:

Indexable Modular No. 328.x



AS/ASC Shanks No. 708



⚠ Attention on Safety

1. Cautions regarding handling

- (1) When removing the tool from its case (packaging), be careful that the tool does not pop out or is dropped. Be particularly careful regarding contact with the tool flutes.
- (2) When handling tools with sharp cutting flutes, be careful not to touch the cutting flutes directly with your bare hands.

2. Cautions regarding mounting

- (1) Before use, check the outside appearance of the tool for scratches, cracks, etc. and that it is firmly mounted in the collet chuck, etc.
- (2) When preparing for use, be sure that the inserts are firmly mounted in place and that they are firmly mounted on the arbor, etc.
- (3) If abnormal chattering, etc. occurs during use, stop the machine immediately and remove the cause of the chattering.

3. Cautions during use

- (1) Before use, confirm the dimensions and direction of rotation of the tool and milling work material.
- (2) The numerical values in the standard cutting conditions table should be used as criteria when starting new work. The cutting conditions should be adjusted as appropriate when the cutting depth is large, the rigidity of the machine being used is low, or according to the conditions of the work material.
- (3) Cutting tools are made of a hard material. During use, they may break and fly off. In addition, cutting chips may also fly off. Since there is a danger of injury to workers, fire, or eye damage from such flying pieces, a safety cover should be attached when work is performed and safety equipment such as safety goggles should be worn to create a safe environment for work.
- (4) There is a risk of fire or inflammation due to sparks, heat due to breakage, and cutting chips. Do not use where there is a risk of fire or explosion. Please caution of fire while using oil base coolant, fire prevention is necessary.
- (5) Do not use the tool for any purpose other than that for which it is intended.

4. Cautions regarding regrinding

- (1) If regrinding is not performed at the proper time, there is a risk of the tool breaking. Replace the tool with one in good condition, or perform regrinding.
- (2) Grinding dust will be created when regrinding a tool. When regrinding, be sure to attach a safety cover over the work area and wear safety clothes such as safety goggles, etc.
- (3) This product contains the specified chemical substance cobalt and its inorganic compounds. When performing regrinding or similar processing, be sure to handle the processing in accordance with the local laws and regulations regarding prevention of hazards due to specified chemical substances.

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