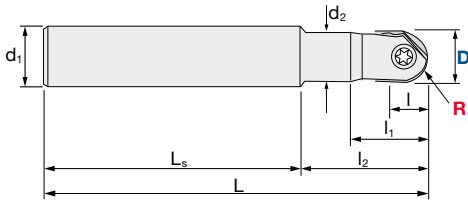
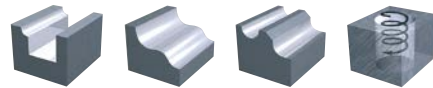


ABPF | Ball High Precision Finish - Carbide Shank

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	l	l ₁	l 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	l	l ₁	l 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	l	l ₁	l 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...

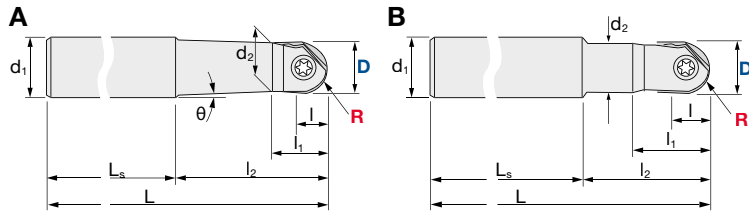
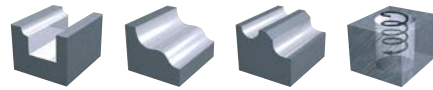


Inserts p. 7

Parts	Clamp Screw				Wrench	
	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
 ARPF-... / ARPFM-...	16	ET156	581-144	4.9 Nm	ET9	101-T25S
	20	ET157	581-145	6.9 Nm		
	25	ET168	581-146	9.8 Nm		
	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
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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	l	l ₁	l 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	110	6.6	15	30	80	-	11.5	B	Z...FG-120...	
FH447	ABPF-16S20		16	8	130	8.8	19	50		2.5°	20		15.5	Z...FG-160...
FH448	ABPF-20S25		20	10	140	11	22	60	3°	25	19.5	A	Z...FG-200...	
FH449	ABPF-25S32		25	12.5	150	13.7	25	70		24.5	Z...FG-250...			
FH450	ABPF-32S32		32	16	160	17.6	30	80	-	32	31.5	B	Z...FG-320...	


ABPF-L Ball High Precision Finish - Long Neck

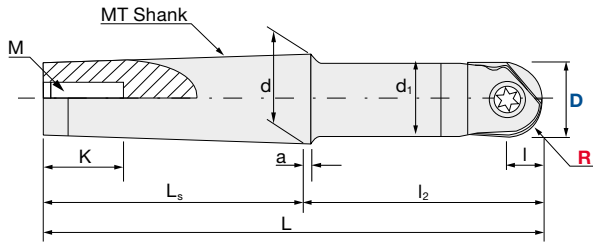
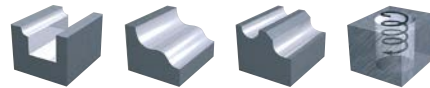
ID Code	Item Code	Flutes	D	R	L	l	l ₁	l ₂	L _s	θ	d ₁	d ₂	Type	Inserts
FH390	ABPF-08S12L	2	8	4	130	4.4	10	50	80	3°	12	7.5	A	Z...FG-080...
FH391	ABPF-10S16L		10	5		150	5.5			13		100		5°
FH392	ABPF-12S16L		12	6	160	6.6	20	60	3°	10.8	15.5	B	Z...FG-120...	
FH451	ABPF-16S20L		16	8	160	8.8	19	65	95	2°			25	Z...FG-160...
FH452	ABPF-20S25L		20	10	180	11	22	80	100	-	20	19.5	A	Z...FG-200...
FH453	ABPF-20S20L120				120									
FH454	ABPF-20S20L150		150											
FH455	ABPF-25S32L		25	12.5	200	13.7	25	90	110	3°	32	24.5	A	Z...FG-250...
FH456	ABPF-25S32L150	150	100	-	32	32	31.5	B	Z...FG-320...					
FH457	ABPF-32S32L	32	16	220	17.6					30	100	120	-	



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

ABPF | Ball High Precision Finish

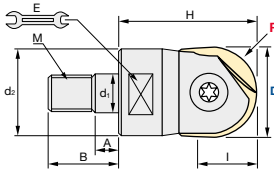
V max High Speed	 Semi Finishing	 Finishing	HRC 65	No. of Teeth 2
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Diameter Holder only [mm]	Insert R Accuracy [mm]
+/-0.01 mm	+/-0.005 mm

ABPF-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


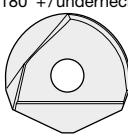

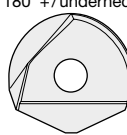


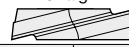
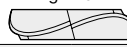
ID Code	Item Code	Flutes	D	R	I	H	d ₁	M	d ₂	A	B	E	Inserts
FH510	ABPFM-10	2	10	5	5.5	26	6.5	M6	9.8	5	14.5	7	Z...FG-100...
FH511	ABPFM-12		12	6	6.6	26	6.5	M6	9.8	5	14.5	7	Z...FG-120...
FH512	ABPFM-16		16	8	8.8	32	8.5	M8	12.8	6	17	10	Z...FG-160...
FH513	ABPFM-20		20	10	11	38	10.5	M10	17.8	6	19	15	Z...FG-200...
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

Tough
Sharp
Toughness / Sharpness of Cutting Edge

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

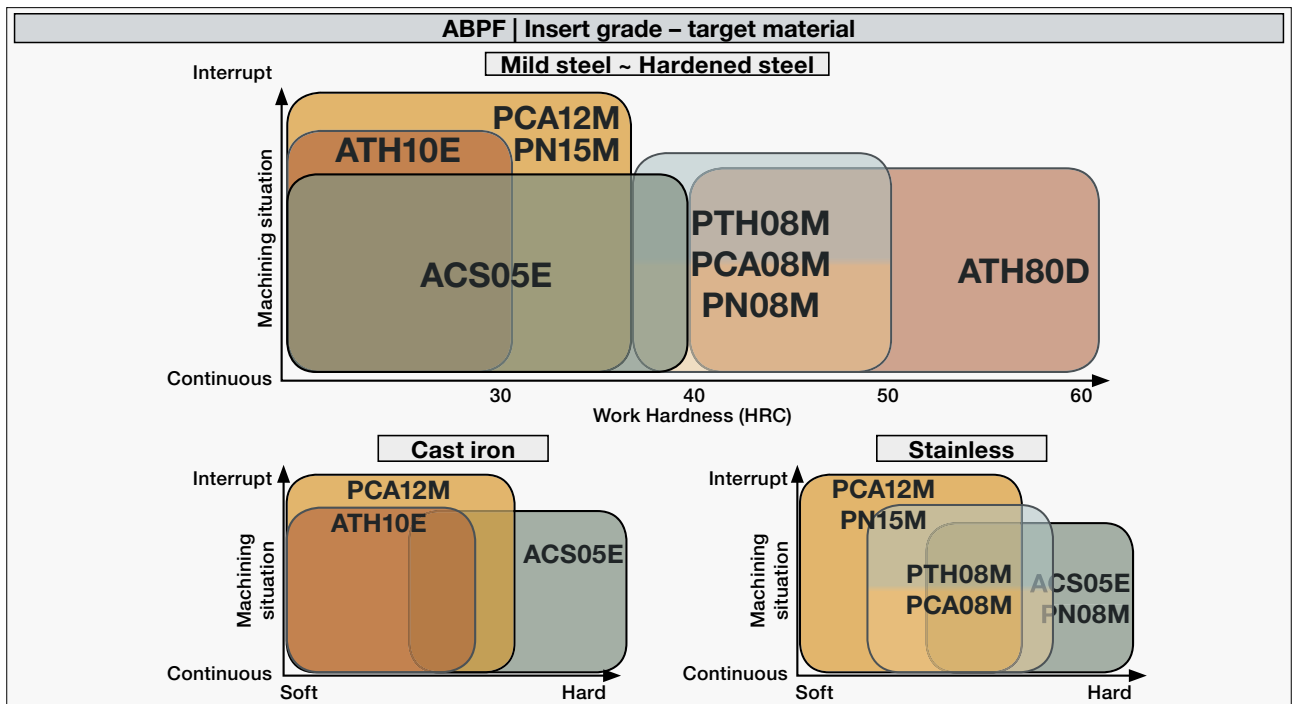
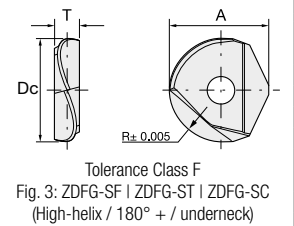
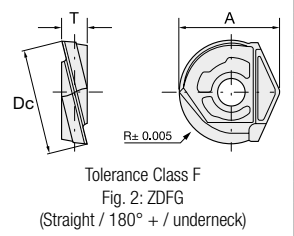
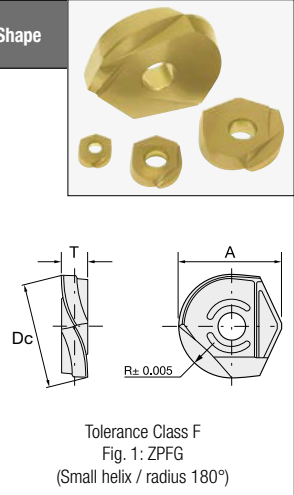
Soft
Hard
Target Hardness of Workpiece

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	Ultra Micro
Hardness	93.0 HRA	93.4 HRA	93.0 HRA	93.0 HRA	93.3 HRA	93.3 HRA	93.3 HRA	94.0 HRA
Coating								
Code	ATH	ACS	PCA	PN	PCA	PN	TH	ATH
Hardness	3800Hv	3200Hv	2600Hv	3200Hv	2600Hv	3200Hv	3600Hv	3800Hv
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



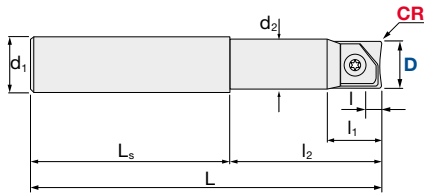
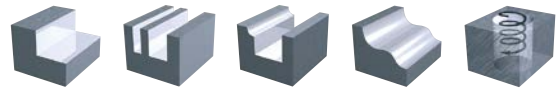
INSERTS | Ball High Precision Finish | Grades Overview

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		
ZPFG-080-GH													
ZPFG-080-GF						WF266							
ZPFG-100	10	5	12.1	2.7			WF548		WF595		WF646		
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							
ZPFG-160	16	8	16.6	4.2			WF598		WF597		WF648		
ZPFG-160-GH													
ZPFG-160-GF						WF272							
ZPFG-200	20	10	20.3	5.2			WF600		WF599		WF649		
ZPFG-200-GH													
ZPFG-200-GF						WF274							
ZPFG-250	25	12.5	24.1	6.2			WF602		WF601		WF650		
ZPFG-250-GH													
ZPFG-250-GF						WF276							
ZPFG-320	32	16	30	7.2			WF604				WF651		
ZPFG-320-GH													
ZPFG-320-GF						WF278							
ZDFG-080-WH	8	4	9.7	2.1								WF281	
ZDFG-080-WF										WF280			
ZDFG-100-WH	10	5	12.1	2.7								WF283	
ZDFG-100-WF										WF282			
ZDFG-120-WH	12	6	14.6	3.2								WF285	
ZDFG-120-WF										WF284			
ZDFG-160-WH	16	8	16.6	4.2								WF164	
ZDFG-160-WF										WF168			
ZDFG-200-WH	20	10	20.3	5.2								WF165	
ZDFG-200-WF										WF169			
ZDFG-250-WH	25	12.5	24.1	6.2								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								
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	
ZDFG-100-ST	10	5	12.1	2.7				WF392				WF386	
ZDFG-100-SC												WF398	
ZDFG-120-ST	12	6	14.6	3.2				WF393				WF387	
ZDFG-120-SC												WF399	
ZDFG-160-ST	16	8	16.6	4.2				WF394				WF388	
ZDFG-160-SC												WF400	
ZDFG-200-ST	20	10	20.3	5.2				WF395				WF389	
ZDFG-200-SC												WF401	
ZDFG-250-ST	25	12.5	24.1	6.2				WF396				WF390	
ZDFG-250-SC												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	l	l ₁	l ₂	L _s	d ₁	d ₂	Inserts
FH473	ARPF-08S08W	2	8	100	2.5	30	70	8	7.8	ZCFW-080-R...	
FH474	ARPF-10S10W		10	100	3	35	65	10	9.8	ZCFW-100-R...	
FH475	ARPF-12S12W		12	110	4	35	75	12	11.8	ZCFW-120-R...	
FH483	ARPF-16S16W		16	140	5	35	105	16	15.5	ZCFW-160-R...	
FH484	ARPF-20S20W		20	160	6	40	120	20	19.5	ZCFW-200-R...	
FH485	ARPF-25S25W		25	180	8	45	135	25	24.5	ZCFW-250-R...	


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

ID Code	Item Code	Flutes	D	L	l	l ₁	l 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

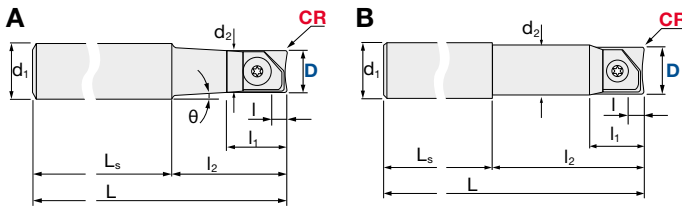
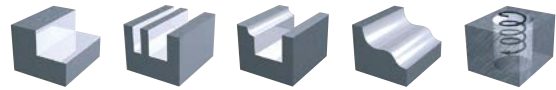
ID Code	Item Code	Flutes	D	L	l	l ₁	l ₂	L _s	d ₁	d ₂	Inserts
FH429	ARPF-16S16WE	2	16	200	5	29	120	80	16	15.8	ZCFW-160-R...
FH430	ARPF-20S20WE		20	250	6	36	150	100	20	19.8	ZCFW-200-R...
FH476	ARPF-25S25WE		25	300	8	41	190	110	25	24.8	ZCFW-250-R...



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	B	ZCFW-120-R...
FH402	ARPF-16S16		16	130	5	17	50			16	15.5		ZCFW-160-R...
FH403	ARPF-20S20		20	140	6	21	60			20	19.5	ZCFW-200-R...	
FH464	ARPF-25S25		25	150	8	24	70			25	24.5	ZCFW-250-R...	
FH465	ARPF-32S32		32	160	10	30	80	32	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°		9.5		ZCFW-100-R...
FH406	ARPF-12S16L		12	160	4	15	60	100	2°		11.5	B	ZCFW-120-R...
FH407	ARPF-16S16L		16	165	5	17	65	100	-	15.5	ZCFW-160-R...		
FH408	ARPF-20S20L		20	180	6	21	80	100		19.5	ZCFW-200-R...		
FH466	ARPF-20S20L120		20	220	6	21	120	100		19.5	ZCFW-200-R...		
FH467	ARPF-20S20L150		20	250	6	21	150	100		19.5	ZCFW-200-R...		
FH468	ARPF-25S25L	25	200	8	24	90	110	24.5	ZCFW-250-R...				
FH469	ARPF-25S32L150	25	250	8	24	150	100	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			ZCFW-200-R...
FH471	ARPF-25S25E		25	300	8	24	90	210			ZCFW-250-R...

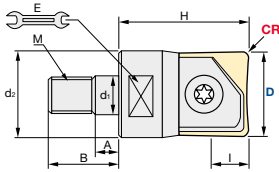
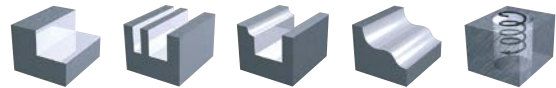


Inserts p. 11

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	L	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								
FH518	ARPFM-16		16	5	32	8.5	M8	12.8	6	17	10	ZCFW-160-R...
FH519	ARPFM-20		20	6	38	10.5	M10	17.8		19	15	ZCFW-200-R...
FH520	ARPFM-25		25	8		12.5	M12	20.8	7	22	17	ZCFW-250-R...
FH521	ARPFM-32		32	10	43	17	M16	28.8		23	22	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		

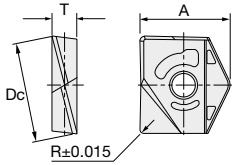
INSERTS | Radius High Precision Finish | Grades Overview


Fig. 1: ZCFW

Item Code	Tolerance Class	Size				Grade		Geometry		
		Dc	R	A	T	PCA12M	PTH08M			
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	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			12		0.3	14.6
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	16	0.3	16.6	4.2	WF561		WF300	Fig-1
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	20	0.3	19.9	5.2	WF565		WF306	Fig-1
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	25	0.3	22.6	6.2	WF610		WF312	Fig-1
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			32			0.3	27.2	7.2	
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					

