Advanced Engineering

MMC Hitachi Tool

No. 315.4

Indexable Milling +Modular Series

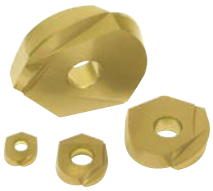
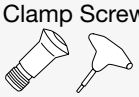
ABPF/M Ball High Precision Finish + Modular
ARPF/M Radius High Precision Finish + Modular

D 8 ~ D 32 · ~ HRC 65

MMC Hitachi Tool Engineering Europe GmbH
www.high-speed-cutting.com

Indexable Milling Tools

Short	Name	Type: CARBIDE	D	Page
ABPF-W	Ball High Precision Finish - Carbide Shank Regular 		8–25	4
ABPF-WL	Ball High Precision Finish - Carbide Shank Long Neck 		8–12	4
ABPF-WE	Ball High Precision Finish - Carbide Shank Extra Long 		16–25	4

Short	Name	Type: STEEL	D	Page
ABPF-S	Ball High Precision Finish - Regular 		8–32	5
ABPF-L	Ball High Precision Finish - Long Neck 		8–32	6
ABPF-MT	Ball High Precision Finish - MT Shank 		20–32	6
ABPF-M	Ball High Precision Finish - Modular 		10–32	6
Inserts	Ball High Precision Finish 		8–32	7
Parts	Clamp Screws, Wrenches 		8–32	10

Cutting Conditions		Page		Page
ABPF D8 – 32	Semi Finishing	12–13	Finishing	12–13

Indexable Milling Tools

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
ARPF-WE	Radius High Precision Finish - Carbide Shank Extra Long 		16–25	8

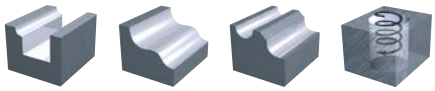
Short	Name	Type: STEEL	D	Page
ARPF-S	Ball High Precision Finish - Regular 		8–32	9
ARPF-L	Radius High Precision Finish - Long Neck 		8–25	9
ARPF-E	Radius High Precision Finish - Extra Long 		16–25	9
ARPF-M	Radius High Precision Finish - Modular 		10–32	10
Inserts	Radius High Precision Finish 		8–32	11
Parts	Clamp Screws, Wrenches 		8–32	10

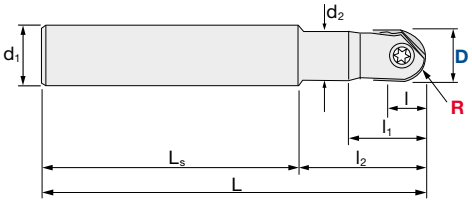
Cutting Conditions		Page		Page
ARPF D8 – 32	Semi Finishing	14–15	Finishing	14–15

Indexable Milling Tools

ABPF | Ball High Precision Finish - Carbide Shank

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





Tolerance R:	Tolerance Dia.:
± 0.005 mm	± 0.01 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...

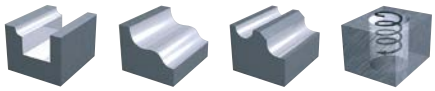
ABPF-WE Ball High Precision Finish - Carbide Shank Extra Long

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...

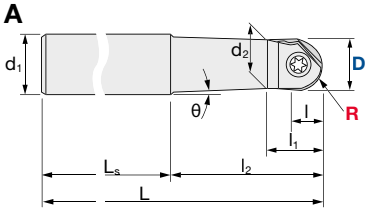
Inserts p. 7

ABPF | Ball High Precision Finish

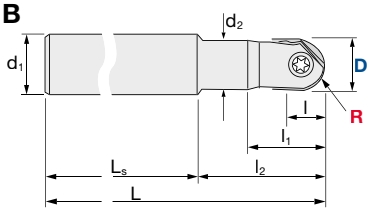
V max	Semi Finishing	Finishing	HRC	No. of Teeth
High Speed	▽▽	▽▽▽	65	2



A



B



Tolerance R:	Tolerance Dia.:
± 0.005 mm	± 0.01 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	A	Z…FG-160…
FH448	**ABPF-20S25**		20	10	140	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	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°	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		25	19.5	B	Z…FG-200…
FH453	**ABPF-20S20L120**				220			120		–	20			
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		B	
FH457	**ABPF-32S32L**		32	16	220	17.6	30	100	120	–	32	31.5	B	Z…FG-320…

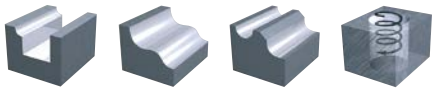
Inserts p. 7

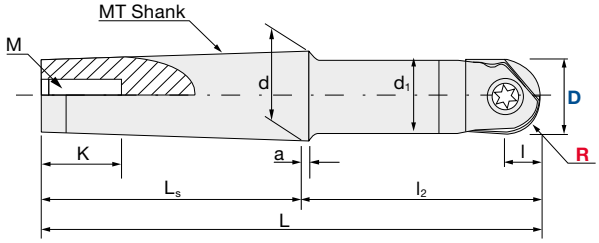
Cutting Conditions		Page		Page	Clamp Screws & Wrenches	Page
ABPF D 8 – 32	Semi Finishing ▽▽	12–13	Finishing ▽▽▽	12–13		10

Indexable Milling Tools

ABPF | Ball High Precision Finish

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

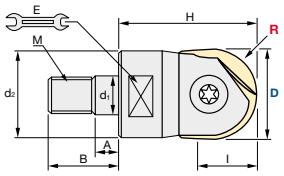




Tolerance R:	Tolerance Dia.:
± 0.005 mm	± 0.01 mm

ABPF-MT Ball High Precision Finish - MT Shank

ID Code	Item Code	Flutes	D	R	l	MT	L	l_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	l	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 — Toughness / Sharpness of Cutting Edge — Sharp

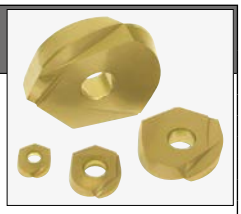
Insert Grade	ZPFG-xxx	ZPFG-xxx-GH	ZPFG-xxx-GF	ZDFG-xxx-ST	ZDFG-xxx-WH	ZDFG-xxx-WF	ZDFG-xxx-SC	ZDFG-xxx-SF
Ball geometry	180°			180° +/underneck	180° +/underneck		180° +/underneck	
Rake angle	Negative +			Negative	Neutral		Positive	
Edge shape	Small helix			High-helix	Straight		High-helix	
Chisel shape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

Soft — Target Hardness of Workpiece — 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	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												WF267	
ZPFG-080-GF						WF266							
ZPFG-100	10	5	12.1	2.7			WF548		WF595		WF646		
ZPFG-100-GH												WF269	
ZPFG-100-GF						WF268							
ZPFG-120	12	6	14.6	3.2			WF549		WF596		WF647		
ZPFG-120-GH												WF271	
ZPFG-120-GF						WF270							
ZPFG-160	16	8	16.6	4.2			WF598		WF597		WF648		
ZPFG-160-GH												WF273	
ZPFG-160-GF						WF272							
ZPFG-200	20	10	20.3	5.2			WF600		WF599		WF649		
ZPFG-200-GH												WF275	
ZPFG-200-GF						WF274							
ZPFG-250	25	12.5	24.1	6.2			WF602		WF601		WF650		
ZPFG-250-GH												WF277	
ZPFG-250-GF						WF276							
ZPFG-320	32	16	30	7.2			WF604		WF603		WF651		
ZPFG-320-GH												WF279	
ZPFG-320-GF						WF278							



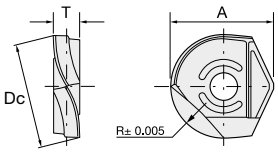


Fig. 1: ZPFG
(Small helix / radius 180°)

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							

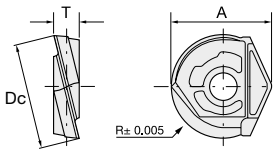


Fig. 2: ZDFG
(Straight / 180° + / underneck)

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			

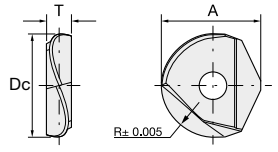
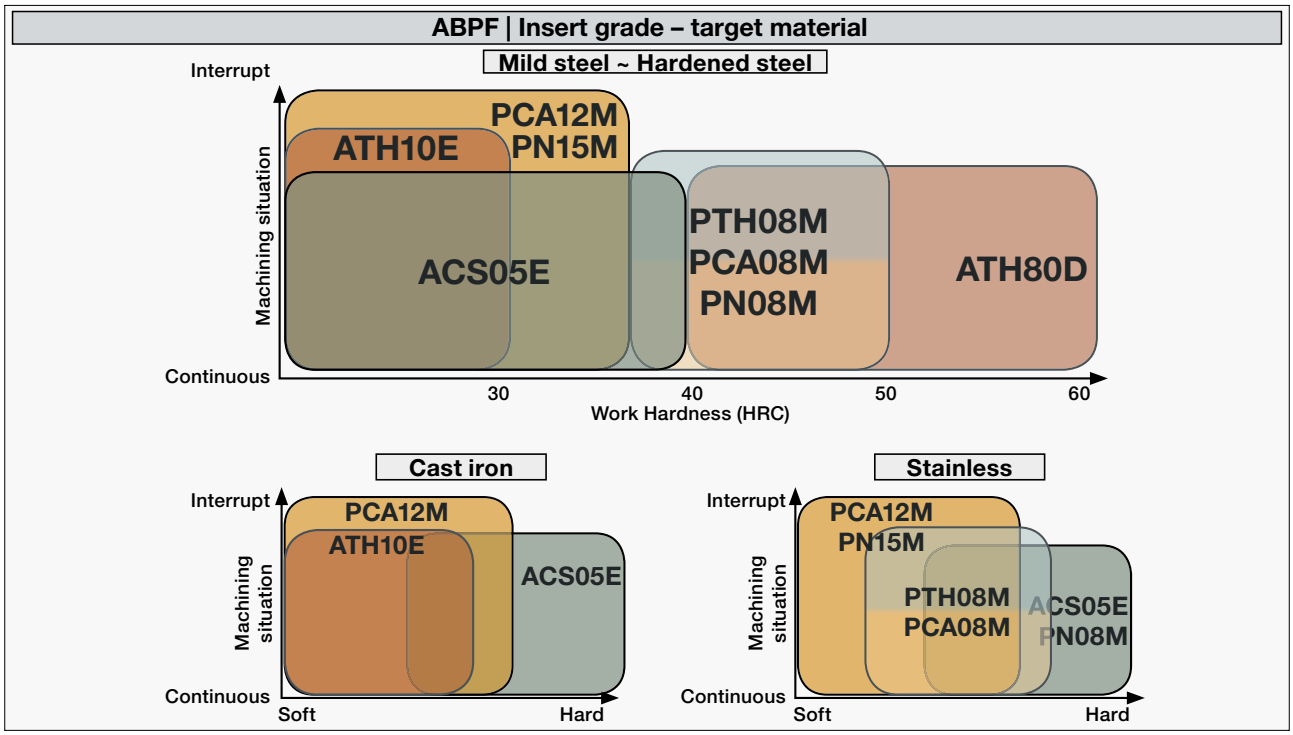


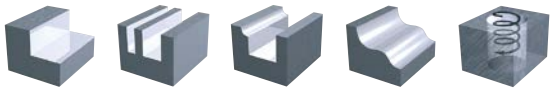
Fig. 3: ZDFG-SF | ZDFG-ST | ZDFG-SC
(High-helix / 180° + / underneck)

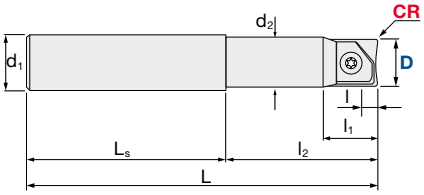


Indexable Milling Tools

ARPF | Radius High Precision Finish - Carbide Shank

V max	▽▽	▽▽▽	HRC	No. of Teeth
High Speed	Semi Finishing	Finishing	62	2





Tolerance CR:	Set-up:
± 0.015 mm	± 0.010 mm

ARPF-W Radius High Precision Finish - Carbide Shank Regular

ID Code	Item Code	Flutes	D	L	l	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…

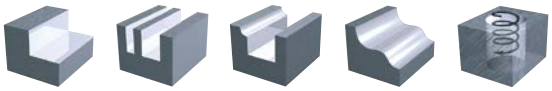
ARPF-WE Radius High Precision Finish - Carbide Shank Extra Long

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…

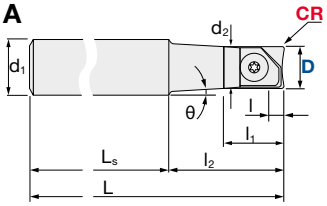
Inserts p. 11

ARPF | Radius High Precision Finish

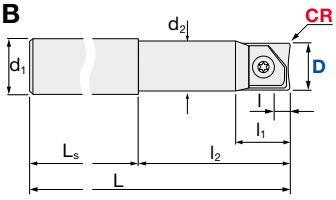
V max	Semi Finishing	Finishing	HRC	No. of Teeth
High Speed	▽▽	▽▽▽	62	2



A



B



Tolerance CR:	Set-up:
± 0.015 mm	± 0.010 mm

ARPF-S Radius High Precision Finish - Regular

ID Code	Item Code	Flutes	D	L	l	l_1	l_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...

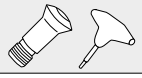
ARPF-L Radius High Precision Finish - Long Neck

ID Code	Item Code	Flutes	D	L	l	l_1	l_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	l	l_1	l_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...

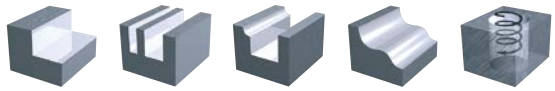
Inserts p. 11

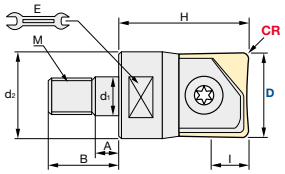
Cutting Conditions		Page		Page	Clamp Screws & Wrenches	Page
ARPF D 8 – 32	Semi Finishing ▽▽	14–15	Finishing ▽▽▽	14–15		10

Indexable Milling Tools

ARPF | Radius High Precision Finish

V max	Semi Finishing	Finishing	HRC	No. of Teeth
High Speed	▽▽	▽▽▽	62	2





Tolerance CR:	Set-up:
± 0.015 mm	± 0.010 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								ZCFW-120-R…
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…


Inserts p. 11

Cutting Conditions		Page		Page
ARPF D 8 – 32	Semi Finishing	14–15	Finishing	14–15

Parts		Clamp Screw			Wrench	
						
Body	**Diameter**	**ID-Code**	**Item-Code**	**Tightening torque**	**ID-Code**	**Item-Code**
ABPF-… / ABPFM-… 	**8**	ET153	581-141	1.5 Nm	ET13	104-T8
	10	ET154	581-142	2.0 Nm	ET11	104-T10
	12	ET155	581-143	5.0 Nm	ET14	105-T20
ARPF-… / ARPFM-… 	**16**	ET156	581-144	5.0 Nm		
	20	ET157	581-145	7.0 Nm	ET9	101-T25S
	25	ET168	581-146	7.0 Nm	ET167	105-T30A
	32	ET169	581-147	7.0 Nm		

INSERTS | Radius High Precision Finish

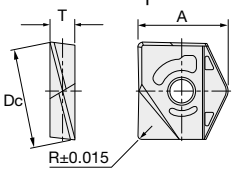
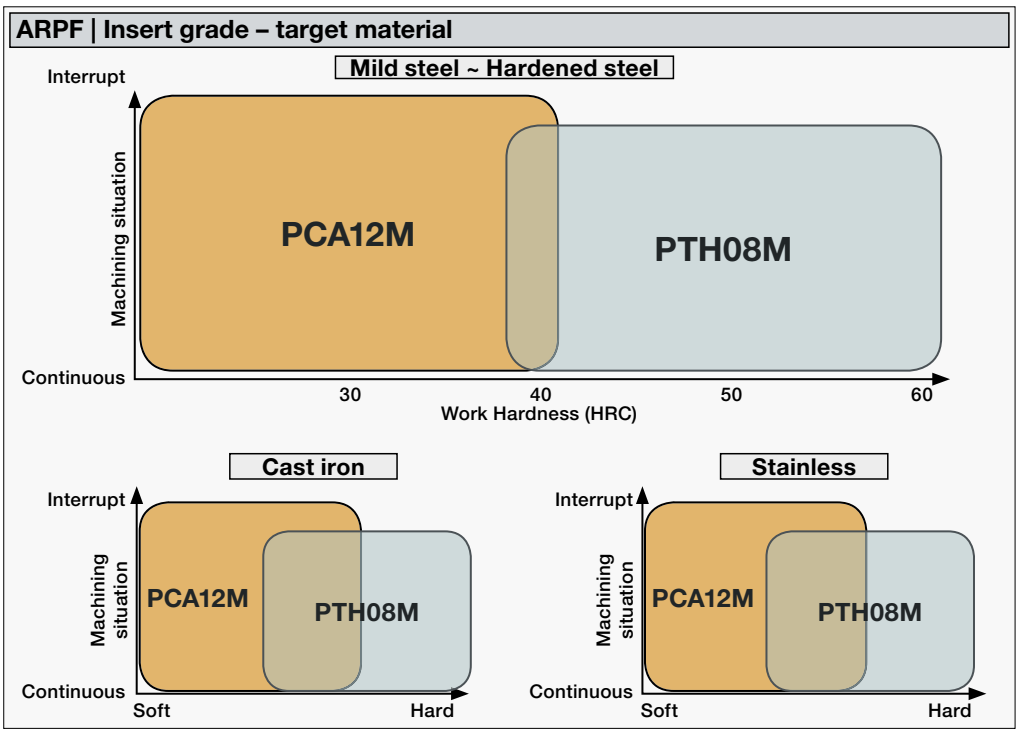


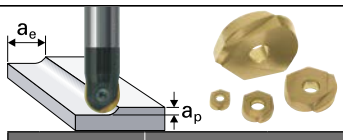
Fig. 1: ZCFW

Item Code	Size				Grade		Geometry
					PCA12M	PTH08M	
	Dc	R	A	T	ID Code		
ZCFW-080-03	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	

ARPF | Insert grade – target material



ABPF/M | Recommended Cutting Conditions



Work piece materialv		Insert Grade		Recommend grade & Target hardness (HRC)	Emulsion	Mist	Air	Parameter		D 8				D 10			
										Semi Finishing ▽▽		Finishing ▽▽▽		Semi Finishing ▽▽		Finishing ▽▽▽	
		Semi Finishing	Finishing	30 40 50						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
				ATH10E	•	•	•	Q	mm^3	815	963	100	148	1498	1966	124	182
III	Alloy-Steel Tool-Steel 30~40HRC	PCA08M PCA12M PN15M	ACS05E PTH08M PN08M	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
				PN08M	•	•	•	a_e	mm	0.80	0.80	0.20	0.20	0.70	0.70	0.22	0.22
								Q	mm^3	697	823	86	127	1281	1681	106	156
IV	Pre-Hardened Steel Tool-Steel 40~50HRC	PCA08M PCA12M PN15M	ACS05E PTH08M PN08M ATH80E	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
				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
V	Hardened Steel Tool-Steel 50~55HRC	PCA08M PCA12M	ACS05E PCA08M PTH08M PN08M ATH80D	ACS05E	•	•	•	V_c	m/min	240	315	315	465	240	315	315	465
								n	min^{-1}	9554	12540	12540	18511	7643	10032	10032	14809
				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	3248	3837	3198	4720	3898	5116	3581	5287
								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
V	Hardened Steel > 55HRC	PCA08M (PCA12M)	PCA08M PTH08M ATH80D					V_c	m/min	208	273	273	403	208	273	273	403
								n	min^{-1}	8280	10868	10868	16043	6624	8694	8694	12834
				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
								a_p	mm	0.16	0.16	0.08	0.08	0.28	0.28	0.08	0.08
								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
VIII	Cast-Iron GG EN-JL10** EN-GJL-***	PCA08M PCA12M PN08M PN15M	PTH08M PN08M ATH10E ATH80D	PCA12M	•	•	•	V_c	m/min	304	399	399	589	304	399	399	589
				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
VIII	Cast-Iron GGG EN-JS10** EN-GJS-***	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
				ATH80D	•	•	•	Q	mm^3	734	867	90	133	1348	1770	111	164
VI	Stainless Steels High alloy Steels	PCA08M PCA12M PN08M PN15M	PTH08M PN08M ATH80D	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
								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
Maximum f_z (mm/t)										<0.5							
Maximum a_p (mm)										<10.0							

Overhang	Vc (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 broche et moindre dynamique
Conditions UGV: Machine dynamique importante et rotation 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_e 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_e 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_e 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_e paso lateral basado en una calidad superficial con Rz 0.0013 mm!

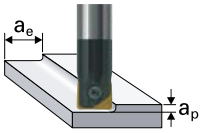
Ces conditions de coupe sont recommandées pour un usinage avec un angle de 15–20 degrés par rapport à l'arête de coupe. Vous obtiendrez ainsi les meilleurs résultats en termes de longévité de vos outils et de qualité surfacique.
a_e le pas latéral est basé sur une qualité surfacique équivalent à un Rz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

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

Indexable Milling Tools

ARPF/M | Recommended Cutting Conditions



Work piece material		Recommend grade & Target hardness (HRC) 30	40	50	Emulsion	Mist	Air	Parameter		D 8 Semi Finishing General	D 8 Semi Finishing High Feed	D 8 Finishing	D 10 Semi Finishing General	D 10 Semi Finishing High Feed	D 10 Finishing	D 12 Semi Finishing General	D 12 Semi Finishing High Feed	D 12 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

Indexable Milling Tools

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

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

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

Insert & screw

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

Surface quality

I. Surface roughness should be decided from cusp-height formula or by a_e / f_z concept
II. Air-blow will help to evacuate chips from the cutting zone in order to avoid re-cutting of chips
III. Air or high-pressure emulsion can help to reach better optical surface
IV. 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	Super Finishing	0.05	0.4	f_z – a_p – a_e	0.01	0.01	0.02	0.02	0.03	0.03
		0.1	0.8		0.02	0.02	0.03	0.03	0.04	0.05
Plastic mold | Die-casting mold | Forging mold	Finishing	0.4	1.6		0.02	0.03	0.04	0.05	0.06	0.07
		1.6	6.3		0.04	0.06	0.08	0.10	0.11	0.14
Forging mold Press mold	Semi Finishing	3.2	12.56		0.06	0.08	0.11	0.14	0.16	0.19
		6.3	25		0.09	0.11	0.16	0.19	0.22	0.27
Press mold	Roughing	12.5	50		0.12	0.16	0.22	0.27	0.32	0.39
		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

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

Wendeschneidplatten und Schrauben

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

Oberflächengüte

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

ARPF/M | ARPF – 3D Chart

$f_z – a_p – a_e$ Überblick für die 3D Zerpanung

Anwendung:	Oberflächengüte				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	▽▽▽▽ Super Finishing	0.05	0.4	$f_z – a_p – a_e$	0.01	0.01	0.02	0.02	0.03	0.03
		0.1	0.8		0.02	0.02	0.03	0.03	0.04	0.05
Spritzguss Form | Druckguss Form | Schmiedegesenk	▽▽▽ Finishing	0.4	1.6		0.02	0.03	0.04	0.05	0.06	0.07
		1.6	6.3		0.04	0.06	0.08	0.10	0.11	0.14
Schmiedegesenk Pressform	▽▽ Semi Finishing	3.2	12.56		0.06	0.08	0.11	0.14	0.16	0.19
		6.3	25		0.09	0.11	0.16	0.19	0.22	0.27
Pressform	▽ Roughing	12.5	50		0.12	0.16	0.22	0.27	0.32	0.39
		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 ap 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:

I. 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
II. Se si verificano problemi di usura, Vc dovrebbe essere ridotta oppure l'avanzamento al dente (fz) dovrebbe essere aumentato.
III. Se si presentano problemi di scheggiatura, OH oppure la profondità di passata (ap) dovrebbero essere ridotte

Inserto & vite

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

Qualità superficiale

I. La rugosità superficiale dovrebbe essere stabilita dalla formula altezza di cresta o dal concetto ae / fz
II. Il soffiaggio aiuterà l'allontanamento dei trucioli dalla zona di taglio per evitare che i trucioli vengano ritagliati
III. L'aria o l'emulsione possono aiutare nel raggiungimento di una migliore qualità superficiale
IV. 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	Super Finishing	0.05	0.4	$f_z – a_p – a_e$	0.01	0.01	0.02	0.02	0.03	0.03
		0.1	0.8		0.02	0.02	0.03	0.03	0.04	0.05
Plastica | Pressofusione | Forgiatura	Finishing	0.4	1.6		0.02	0.03	0.04	0.05	0.06	0.07
		1.6	6.3		0.04	0.06	0.08	0.10	0.11	0.14
Forgiatura Stampi	Semi Finishing	3.2	12.56		0.06	0.08	0.11	0.14	0.16	0.19
		6.3	25		0.09	0.11	0.16	0.19	0.22	0.27
Stampi	Roughing	12.5	50		0.12	0.16	0.22	0.27	0.32	0.39
		25	100		0.15	0.22	0.32	0.39	0.45	0.55

Per taglio 3D, consigliamo ti 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 10 x 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 ap 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

I. 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
II. Si se produce desgaste, la Vc debería reducirse o el avance por diente (fz) debería aumentarse
III. Si se produce micro-roturas, el OH o la profundidad (ap) debería reducirse

Placa y tornillo

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

Calidad superficial

I. La rugosidad superficial deber ser decidida con la fórmula para crestas o por el concepto de a_e / f_z
II. El aire soplado ayudará a evacuar la viruta de la zona de mecanizado con el fin de evitar el remecanizado de viruta
III. El aire o la emulsión a alta presión puede ayudar a conseguir una mejor superficie óptica.
IV. 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	▽▽▽▽ Super Finishing	0.05	0.4	$f_z - a_p - a_e$	0.01	0.01	0.02	0.02	0.03	0.03
		0.1	0.8		0.02	0.02	0.03	0.03	0.04	0.05
Plastic mold | Die-casting mold | Forging mold	▽▽▽ Finishing	0.4	1.6		0.02	0.03	0.04	0.05	0.06	0.07
		1.6	6.3		0.04	0.06	0.08	0.10	0.11	0.14
Forging mold Press mold	▽▽ Semi Finishing	3.2	12.56		0.06	0.08	0.11	0.14	0.16	0.19
		6.3	25		0.09	0.11	0.16	0.19	0.22	0.27
Press mold	▽ Roughing	12.5	50		0.12	0.16	0.22	0.27	0.32	0.39
		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

I. 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
II. Si un problème d'usure apparaît, la vitesse Vc doit être réduite ou l'avance par dent (fz) doit être augmentée
III. Si un problème d'usure apparaît, Le porte-à-faux OH ou la profondeur (ap) doivent être réduits

Plaquette & vis

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

Qualité surfacique

I. La qualité de surface doit être décidée grâce au calcul de crêtes ou par le concept a_e / f_z
II. Le soufflage d'air permettra d'évacuer les copeaux de la zone de travail et évitera de recycler les copeaux
III. L'air ou l'utilisation de soluble peut aider à l'obtention de meilleures surfaces optiques
IV. 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)		0.3	0.5	1.0	1.5	2.0	3.0
Outil de découpe | Moule de fonderie | Moule d'injection	▽▽▽▽ Super Finishing	0.05	0.4	$f_z - a_p - a_e$	0.01	0.01	0.02	0.02	0.03	0.03
		0.1	0.8		0.02	0.02	0.03	0.03	0.04	0.05
Moule d'injection | Moule de fonderie | Matrice de forge	▽▽▽ Finishing	0.4	1.6		0.02	0.03	0.04	0.05	0.06	0.07
		1.6	6.3		0.04	0.06	0.08	0.10	0.11	0.14
Matrice de forge Outillage d'emboutissage	▽▽ Semi Finishing	3.2	12.56		0.06	0.08	0.11	0.14	0.16	0.19
		6.3	25		0.09	0.11	0.16	0.19	0.22	0.27
Outillage d'emboutissage	▽ Roughing	12.5	50		0.12	0.16	0.22	0.27	0.32	0.39
		25	100		0.15	0.22	0.32	0.39	0.45	0.55

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 ap e não do V_c ou V_f.
O maior fator de deflação é o contato e não o movimento

Informação: dobro da altura da ferramenta = deflação 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 deflação e a força de corte são menores.

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

Informação Geral

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

I. 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.
II. Se ocorrer desgaste, o Vc deverá ser reduzido, ou o avanço por dente (fz) deverá ser aumentado
III. Se ocorrer problema na remoção da limalha, a altura da ferramenta (OH) ou profundidade (ap) devem ser reduzidos

Plaquete e parafuso

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

Qualidade de superfície

I. A rugosidade da superfície deve ser decidida a partir da fórmula de altura da crista ou pelo conceito a_e / f_z
II. 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
III. Emulsão de ar ou de alta-pressão pode ajudar na melhoria da superfície ótica
IV. 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	▽▽▽▽ Super Finishing	0.05	0.4	$f_z - a_p - a_e$	0.01	0.01	0.02	0.02	0.03	0.03
		0.1	0.8		0.02	0.02	0.03	0.03	0.04	0.05
Molde para plástico | Matriz | Molde de fundição	▽▽▽ Finishing	0.4	1.6		0.02	0.03	0.04	0.05	0.06	0.07
		1.6	6.3		0.04	0.06	0.08	0.10	0.11	0.14
Molde de fundição Molde de prensa	▽▽ Semi Finishing	3.2	12.56		0.06	0.08	0.11	0.14	0.16	0.19
		6.3	25		0.09	0.11	0.16	0.19	0.22	0.27
Molde de prensa	▽ Roughing	12.5	50		0.12	0.16	0.22	0.27	0.32	0.39
		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.

Indexable Milling Tools

Indexable Milling Tools

Advanced Engineering

MMC Hitachi Tool

Always up to date: Please check our P50 QuickFinder

PRODUCTION50® QuickFinder www.mmc-hitachitool-eu.com/quickfinder

Product Range

Solid Carbide End Mills

microEndMill · HD COATING · Epoch21 · CBN Cubic Boron Nitride · MINIATURE · 3D-Cut

Indexable Milling Tools

Indexable Milling

WHNSB Drills

WHNSB NON STEP BOREA

Milling Chucks

Milling Chucks

Distributed by:

MMC Hitachi Tool Engineering Europe GmbH
Itterpark 12 · 40724 Hilden · Germany · Phone +49 (0) 21 03–24 82-0 · Fax +49 (0) 21 03–24 82-30
E-Mail info@mmc-hitachitool-eu.com · Internet www.mmc-hitachitool-eu.com

HTT659 1512 AxPF-M-6.5 BW-DS

Advanced Engineering
Hitachi Tool

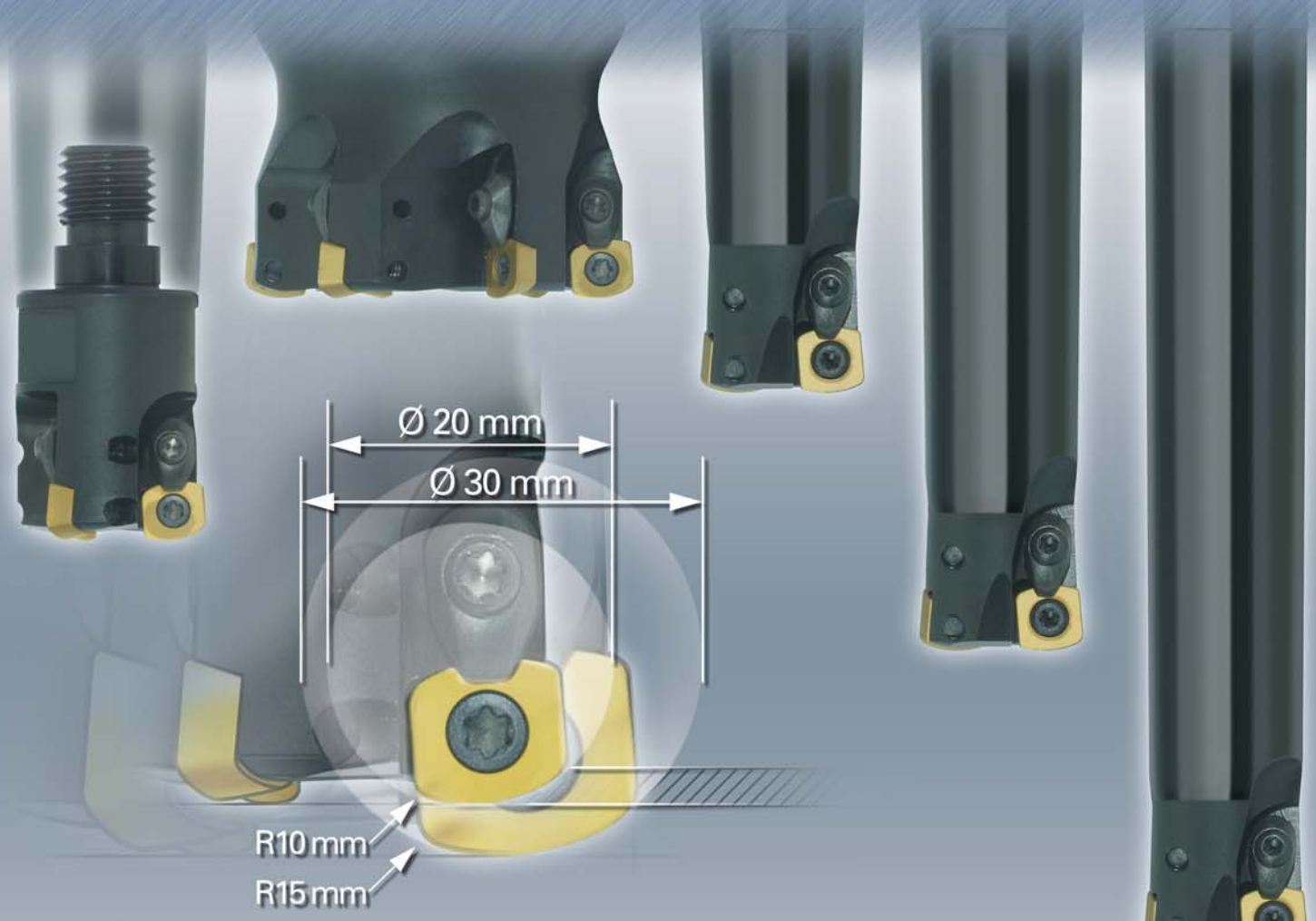
HITACHI
Inspire the Next

No. 317

Indexable Milling

ASR Turbo Metric Series –

Maximum Volume & High Feed Cutting (HFC)



Milling

Hitachi Tool Engineering Europe GmbH
www.high-speed-cutting.com

Indexable Milling Tools

INTRODUCTION

HITACHI TOOL presents a new millenium cutter, the **ASR Turbo**. This is the latest addition to the Hitachi mould tool range, it is able to achieve extraordinary feeds and metal removal rates in roughing applications, on new and old machines.

As shown you can see the comparison between standard round insert style cutters and the new **ASR Turbo**. In most cases we are able to increase the feed (f_z) up to 5 times, without the need to increase the cutting speed (V_c) thus stabilising or increasing tool life.

EINLEITUNG

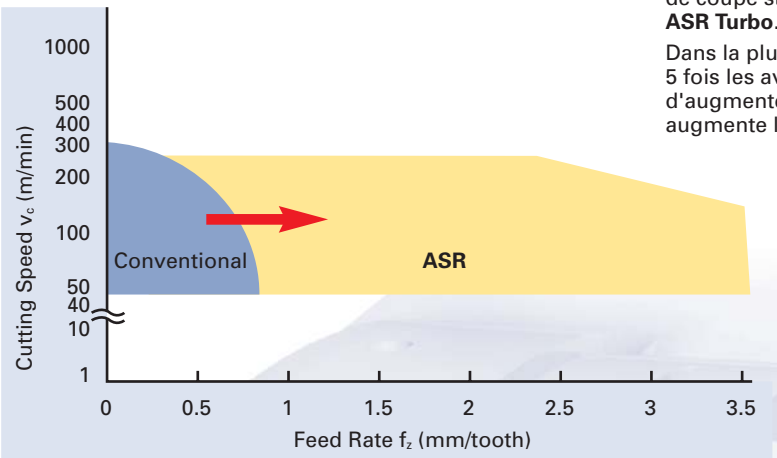
HITACHI TOOL stellt den neuen Millennium Fräser **ASR Turbo**, die neueste Ergänzung des Hitachi Tool Programms für den Werkzeug- und Formenbau. Dieser Fräser ermöglicht höchste Vorschübe und Zerspanvolumen in Schrupp-Operationen, sowohl auf neuen, als auch auf alten Maschinen.

Das u.a. Diagramm zeigt einen Vergleich zwischen den marktüblichen runden (TORIC) Platten und den neuen ASR Platten. In vielen Fällen ist es möglich, den Vorschub pro Zahn (f_z) um bis zu 5 mal anzuheben, ohne dass die Schnittgeschwindigkeit (V_c) erhöht werden muss. Dies stabilisiert, bzw. erhöht die Standzeit der WSP.

INTRODUZIONE

Hitachi Tool presenta il nuovo utensile del millenio, la **ASR Turbo**. Questa fresa, l'ultima nata della gamma HITACHI di utensili per stampi, è in grado di raggiungere, nelle applicazioni di sgrossatura, avanzamenti e volumi di truciolo straordinari, con macchine nuove e tradizionali.

Nella figura qui sotto riportata, è mostrata la comparazione del range di utilizzo delle frese con inserti tondi e della fresa **ASR Turbo**. La nuova fresa HITACHI, è in grado di incrementare l'avanzamento (f_z) fino a 5 volte, mantenendo le stesse velocità di taglio, con la conseguente maggior stabilità e una più lunga vita utensile.



INTRODUCCIÓN

HITACHI TOOL presenta el **ASR Turbo**, la herramienta del nuevo milenio. Esta es la última incorporación de Hitachi a su gama de herramientas para el mecanizado de moldes y matrices, capaz de trabajar con avances extraordinarios y volúmenes de evacuación de viruta realmente increíbles, tanto en maquinas nuevas como viejas.

Como se puede apreciar comparando las herramientas tóricas de placa redonda y el nuevo **ASR Turbo**, podemos aumentar el avance por diente (f_z) hasta 5 veces, sin necesidad de aumentar la velocidad de corte, es decir multiplicamos la producción sin mermar la vida de placa.

INTRODUCTION

HITACHI TOOL présente un nouvel outil de coupe du millénaire, l'**ASR Turbo**. C'est le dernier né de la gamme Hitachi pour moulistes, il est possible d'obtenir d'énormes avances et volumes de copeaux en ébauche, sur des nouvelles et plus anciennes machines. Comme nous vous le montrons vous pouvez voire la comparaison entre les outils de coupe standards à plaquettes rondes et le nouvel outil **ASR Turbo**.

Dans la plupart des cas nous pouvons augmenter jusqu'à 5 fois les avances par dents (f_z), sans avoir besoin d'augmenter la vitesse de coupe (V_c) ceci stabilise ou augmente la durée de vie de l'outil.

1

FEATURES

Specialized R-cutting edge for highest-efficiency machining

In combination of shortening the cutting edge length and setting at a special angle, cut deflection and force during the cutting process is dramatically reduced compared to round insert style cutters. This stabilises the load and makes high feed cutting possible.

EIGENSCHAFTEN

Spezielle Radius-Schnitt Schneidkante für höchste Effizienz beim Fräsen

In Kombination mit einer verkürzten Schneidkantenlänge und einem speziell abgestimmten Plattensitz-Winkel, wird die Werkzeugverbiegung (Deflektion) im Vergleich zu den Rund-Platten, drastisch reduziert. Dies stabilisiert die Kraftaufnahme und ermöglicht höchste Vorschübe.

CARATTERISTICHE

Speciale raggio del tagliente per lavorazioni a massima efficienza

La combinazione di un tagliente corto e di uno speciale angolo d'attacco, riduce drasticamente le forze e le flessioni che nascono durante l'azione di taglio, comparate a una lavorazione effettuata, a parità di condizioni, con inserti tondi.Questo rende il carico sull' inserto stabile, ed è possibile raggiungere alte velocità di avanzamento.

CARACTERISTICAS

Perfil radial optimizado para un mecanizado altamente eficaz.

Una menor longitud de arista combinada con un posicionamiento de placa inclinado reduce drásticamente, en comparación a la placa redonda convencional, el esfuerzo de corte y la flexión de la herramienta.

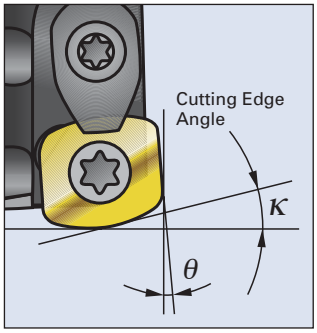
Además el esfuerzo de corte es estable y constante, incluso en las paredes, lo que permite unos altísimos avances.

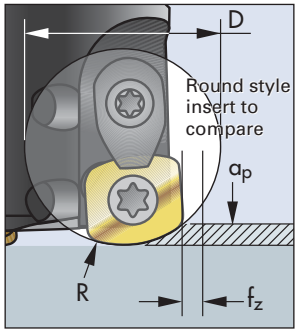
1

CARACTERISTIQUES

Rayon spécial de l'arête de coupe pour une plus grande efficacité d'usinage

En combinant une arête de coupe réduite et un positionnement à un angle spécial, la déflection et la force sont considérablement réduites durant l'usinage en comparaison des outils à plaquettes rondes. Ceci stabilise le processus de coupe et rend possible de grandes avances.





2

2 to 5 times increased efficiency compared to conventional radius cutters

4 to 5 times increased efficiency in deep milling with an overhang of 3D or more, and 2 to 3 times for shallow milling at 3D or less. This enables faster production resulting in quicker turnaround of components.

As shown the chart compares metal removal rates and overhang lengths for ASR and standard radius cutters.

2 bis 5fache Effektivität im Vergleich zu torischen Werkzeugen

4 bis 5fache Steigerung beim Fräsen mit langen Auskrag-Längen (OH) von 3xD oder größer, 2 bis 3fache Steigerung beim Bearbeiten mit Längen bis 3xD. Dieser Erfolg ermöglicht erheblich kürzere Produktionszeiten und als Folge eine höhere Auslastung der Maschine.

Unten abgebildet sehen Sie die Volumen (cm^3) in Verbindung mit Auskraglängen (OH) für den ASR Fräser und für torische Fräshalter.

Incremento dell'efficienza da 2 a 5 volte, comparata a una fresa con inserti tondi

Incremento dell'efficienza da 4 a 5 volte in fresature profonde, con sporgenza utensile di 3xD o più, e da 2 a 3 volte per fresature fino a 3xD. Questo permette di produrre più velocemente e di fornire alle macchine più componenti da lavorare.

Il senso è che i tempi di lavorazione possono essere ridotti di parecchie volte, come mostra il grafico, che compara il volume di truciolo e la sporgenza utensile tra la ASR Turbo e una fresa ad inserti tondi.

De 2 a 5 veces más productividad que una herramienta tórica convencional.

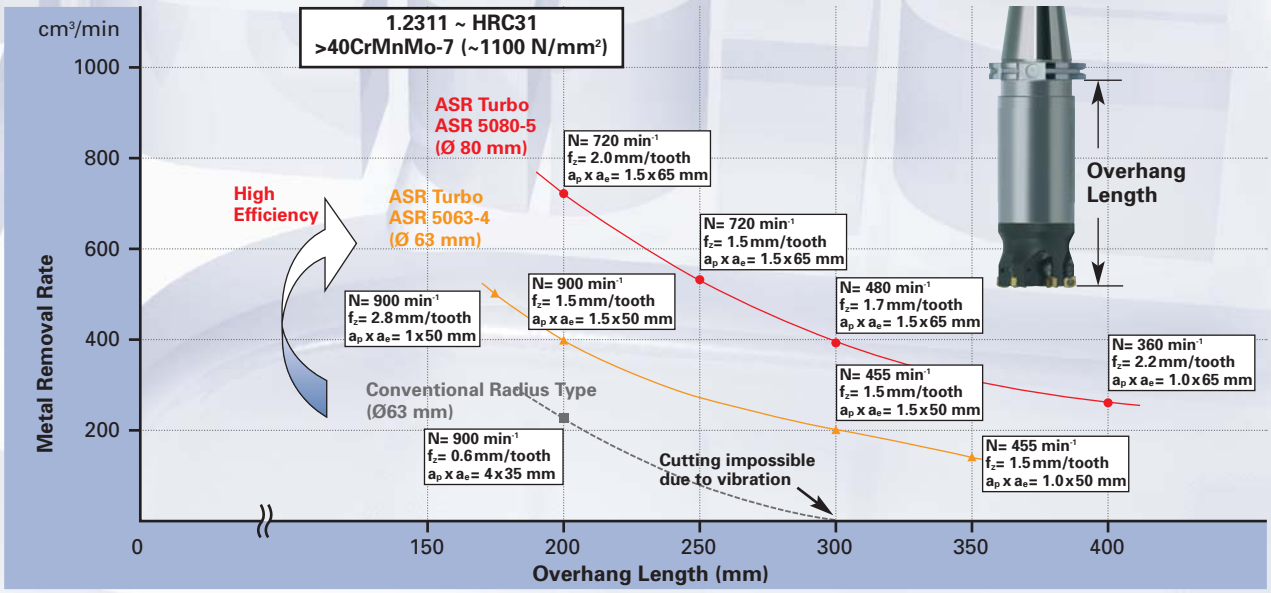
Rendimiento de 4 a 5 superior en mecanizados profundos con voladizos de herramienta de mas de 3D, y de 2 a 3 veces en mecanizados poco profundos con voladizos hasta 3D. Esto permite aumentar la capacidad productiva mediante la drástica reducción de los tiempos de desbate.

En el grafico podemos apreciar la relación entre el volumen de viruta desalojado y el voladizo de herramienta del ASR y de una herramienta tórica convencional.

2 à 5 fois plus efficace que les outils à rayons conventionnels

4 à 5 fois plus efficace dans les usinages profonds avec un porte à faux de 3D ou plus, et 2 à 3 fois dans les usinages peu profonds avec porte à faux de 3D ou moins. Ceci permet une production plus rapide résultant d'une exploitation plus grande des équipements.

Le tableau comparatif montre les ratios d'enlèvement de matière et les longueurs de porte à faux pour ASR et les outils à rayon standards.



Indexable Milling Tools

3

Extraordinary Feed Rates

The cutters low cut structure enables increases in feed per tooth of up to 5 times. In cutting of steel a feed per tooth of 0.6 to 3.5 mm is achievable and already being successfully used. Feed per tooth in cast iron is 0.8 to 4.0 mm.

You can compare the shape and weight of the steel chips at different feeds per tooth.

Incredible Metal Removal Rates

This application gave a metal removal rate of 633 cm^3. ASR Ø63 with an overhang of 480 mm (7.6xD), 1.2 mm axial doc, 44 mm radial doc with a feed rate of 12 m/min. Only 834 min^{-1} was needed, material spec was P20 (1.2311) Toolsteel HRC 32. In other applications 1000 cm^3 removal rates were achieved with a larger diameter cutter.

Please note: The ASR Turbo is capable of cutting 60 to 80 kg of steel, which is equivalent weight of an adult, within 10 minutes.

Höchste Vorschübe

Die geringe Schnittdruck-Struktur der WSP ermöglicht eine bis zu 5fache Anhebung des Zahnvorschubes.

Bei der Zerspanung von Stahl wurden bereits durchgängige f_z ´s von 0,6 bis 3,5 mm erzielt. Für Guss wurden bereits f_z ´s von 0,8 bis 4 mm realisiert.

Höchste und marktunübliche Zerspanungsvolumen

Folgende Beispiel-Bearbeitung ergab eine Zerspanungs-Leistung von 633 cm^3. Ein ASR mit einem Ø63 und einer Auskraglänge (OH) von 480 mm (7,6xD) hat bei einer axialen Eingriffstiefe(a_p) von 1,2 mm und einer radialen Eingriffsbreite (a_e) von 44 mm einen konstanten Vorschub von 12.000 mm/min in Werkzeugstahl 1.2311 (HRC31) erzielt. In weiteren Einsätzen wurden bei ähnlichen Bedingungen, mit größeren Durchmessern oder reduzierten Auskraglängen, ein Volumen von 1000 cm^3 und mehr erreicht.

Merke: Der ASR Turbo ist in der Lage ein Volumen von 60~80 kg, welches dem durchschnittlichen Gewicht eines erwachsenen Menschen entspricht, in nur 10 min zu zerspanen!

Straordinarie velocità di avanzamento

L'asportazione per deformazione, permette di incrementare l'avanzamento per dente fino a 5 volte. Da f_z 0,6 a 3,5 mm/dente per acciaio e da f_z 0,8 a 4 mm/dente per ghisa. Sotto, è possibile confrontare forma e peso di alcuni trucioli in acciaio, ottenuti con differenti avanzamenti per dente.

Incredibili volumi di truciolo asportati mai raggiunti

Esempio di applicazione: Volume di truciolo: 633 cm^3 al minuto.

Fresa ASR Turbo Ø63, con una sporgenza utensile di 480 mm (7,6xD), con una profondità di passata assiale di 1,2 mm, e uno passo radiale di 44 mm (77%D) in combinazione con una velocità di avanzamento di 12 metri al minuto (f_z= 3,6 mm/dente) e con solo 834 giri al minuto (Vt=165 m/min). Il materiale è un acciaio bonificato 1.2311 HRC32. In altre applicazioni, con l'utilizzo di corpi fresa con diametri maggiori, e possibile asportare volumi di truciolo di 1000 cm^3 al minuto.

NB: La fresa ASR Turbo è in grado di asportare da 60 a 80 kg di acciaio, cioè il peso equivalente di una persona adulta, in 10 minuti.

Avances x diente (f_z) extraordinarios.

El bajo esfuerzo de corte permite aumentar el avance por diente hasta 5 veces. Mecanizando acero es posible trabajar con un fz de entre 0,6 y 3,5 mm. En fundición este f_z puede ser de entre 0,8 y 4,0 mm. Aqui podemos apreciar con diferentes fz el tipo de viruta que se genera y el peso de la misma.

Capacidad de vaciado increible

Ejemplo: 633 cm^3/min. con: ASR Ø63, voladizo de 480 mm. (7,6 x D); 1,2 mm de pasada axial; 44 mm de pasada radial; avance 12.000 mm/min; Material 1.2311 (HRC 32). Solo son necesarias 834 rpm. (En otras aplicaciones se superan ampliamente los 1000 cm^3/min.)

Resaltar que el ASR Turbo es capaz de mecanizar de 60 a 80 kg de acero, el peso de un adulto, en tan solo 10 minutos.

Extraordinaires avances

Les plaquettes à structures pour basses vitesses de coupe permettent d'augmenter jusqu'à 5 fois les

avances par dent. Dans l'usinage des aciers une avance par dent de 0.6 à 3.5 mm est envisageable et déjà utilisée avec succès. L'avance par dent dans les fontes est 0.8 à 4.0 mm. Vous pouvez comparer l'aspect et le poids des copeaux à différentes vitesses de coupe.

Incroyable taux d'enlèvement de matière

Cette application donne un enlèvement de matière de 633 cm^3. ASR Ø63 avec un porte à faux de 480 mm (7.6 x D), axial 1.2 mm, radial 44 mm avec une avance de 12 000 mm par minute. Seulement 834 min^{-1} sont nécessaires, la matière est de type P20 (1.2311), acier d'outillage de dureté HRC 32. Dans d'autres applications 1000 cm^3 d'enlèvement de matière peuvent être réalisés avec un plus grand diamètre d'outil.

L'ASR Turbo est capable de couper 60 à 80 kg d'acier, ce qui est l'équivalent en poids d'un adulte, en environ 10 minutes.

f_z= 0.4 – 0.29 g | f_z= 0.8 – 0.59 g | f_z= 1.5 – 1.10 g | f_z= 2.0 – 1.47 g | f_z= 3.0 – 2.21 g | f_z= 3.5 – 2.58 g

4

Reduced radial deflection even with long overhangs

When horizontal (x, y axis) machining with the ASR, radial forces are kept to an equal level to slant or helical milling, where the main force is in the z axis. This allows the ASR Turbo to achieve higher feeds with less deflection and vibration. This table shows the directional forces:

Reduzierte radiale Schnittkraft auch bei längeren Auskragungen

Beim horizontalen Einsatz des ASR Fräsers (X & Y Achse) geht die radiale Schnittkraft, ähnlich wie beim Rampen- oder Helikal-Fräsen, im wesentlichen in die Z-Achse. Daraus resultiert die Möglichkeit, den ASR Turbo Fräser mit wesentlich gesteigerten Vorschüben einzusetzen, ohne größere Probleme mit Deflektionen oder Vibrationen zu haben. In der Tabelle wird die Aufteilung der Kräfte erläutert.

Riduzione delle flessioni radiali anche con lunghe sporgenze utensile

Nei processi di fresatura 2D con la fresa ASR Turbo, le forze vengono distribuite sui tre assi, come nel caso di fresature in interpolazione elicoidale o in rampa.
Questa caratteristica permette di ridurre le forze radiali, che sono la causa delle vibrazioni, a vantaggio di un incremento della spinta in direzione dell'asse zeta. Questo consente alla fresa ASR Turbo di raggiungere alti avanzamenti con basse flessioni e vibrazioni. La seguente tabella mostra la scomposizione delle forze:

Flexión mínima incluso con voladizos grandes.

Durante el proceso de mecanizado plano (en x/y) el ASR mantiene un esfuerzo radial parecido al de un fresado en rampa o helicoidal, en los que la componente de fuerza en el eje z es muy importante. Esto permite trabajar con avances muy elevados sin generar flexión y por lo tanto sin vibraciones. La tabla muestra la composición de estas fuerzas.

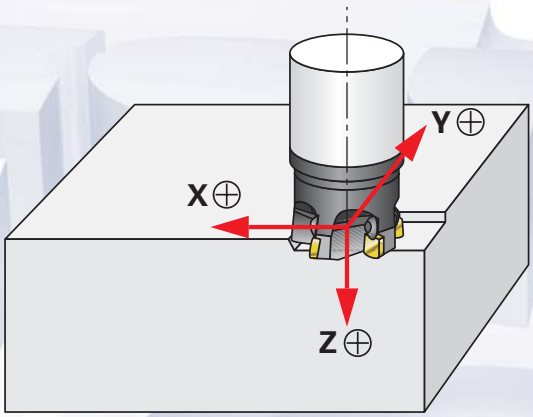
Réduction de la déflection radiale même avec de grands porte à faux

Lors de l'usinage horizontal (axe x et y) avec l' ASR, les forces radiales sont de niveau égal à un fraisage en rampe ou hélicoïdal, où la principale force est dans l'axe z. Ceci permet à l'ASR Turbo d'utiliser de plus grandes avances avec moins de déflection et de vibration. Ce tableau montre les forces directionnelles :

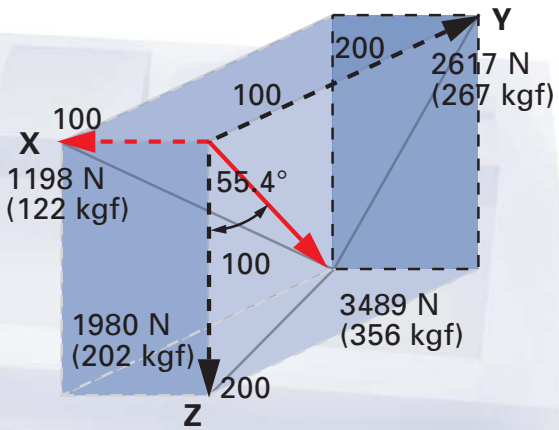
(ASR5080-5)

V_c = 180 m/min (S=720g/min^{-1})
V_f = 1500 mm/min
f_z = 0.42 mm/tooth
a_p x a_e = 1.5 x 60 mm

down cut, dry cutting



Radial force



Indexable Milling Tools

5

Direct milling without any start-hole

Even though the tilt angle is limited due to the cutting edge design, ramping and helical milling methods are possible. Please use the following recommendations:

Direktes Taschenfräsen ohne Startbohrung

Obwohl der Fräser-Freiwinkel limitiert ist, lässt es die Platten-Geometrie zu, Rampen- oder auch Helikal-Fräsen zu praktizieren. Herstellerangaben und Empfehlungen:

Fresatura da pieno senza alcun preforo

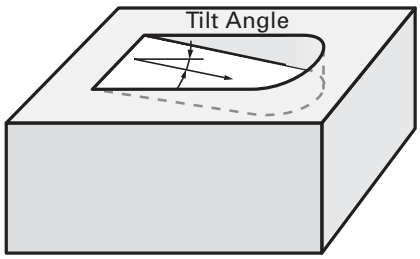
Anche se l'inclinazione dell'angolo è limitata a causa del disegno del tagliente, lavorazioni in rampa e interpolazioni elicoidali sono possibile.
Sono raccomandate le seguenti indicazioni:

Fresado directo sin necesidad de agujero inicial.

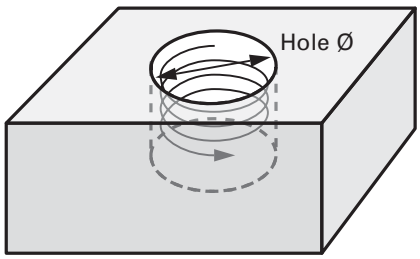
Aunque el ángulo de entrada esta limitado por la geometría de la placa, es posible fresar en rampa y helicoidalmente. Por favor use las recomendaciones siguientes:

Fraisage direct sans avant trou

Même si l'angle d'attaque est limité à cause de la géométrie de l'arête de coupe, l'usinage en rampe et hélicoïdal sont possible. SVP utilisez les recommandations suivantes :



Slant Milling



Helical Milling

Cutting Ø (mm)	20	25	30	32	40	50	60	63	80	100
Tilt Angle	2°	2°	3°	2.5°	2°	1.5°	1°	1°	0.5°	0.5°
Hole Ø (mm)	27~38	37~48	38~58	42~62	58~78	78~98	98~118	101~124	136~158	176~198

6

Programming Information

By programming R3 (theoretic) as the tool radius, the maximum difference between programming and the final shape is shown. These small remains will be left in some corners, and will be corrected later by semi-finishing or finishing operations.

CAM und Programmier Information

Beim Programmieren des theoretischen Werkzeugradius von R3, ergibt sich eine maximale Abweichung zur Endkontur wie aufgezeigt. Der minimale Unterschied (nur in den Ecken) wird problemlos von den Nachfolgewerkzeugen, zur Restbearbeitung oder zum Schlichten, korrigiert.

Informazioni sulla programmazione

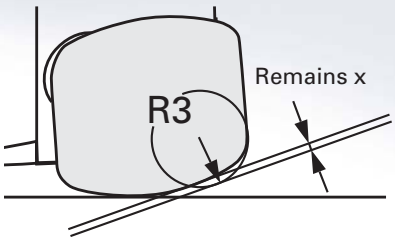
Per tutti i diametri delle frese ASR Turbo, il raggio teorico utensile da inserire nella programmazione è R3.
La massima differenza tra la programmazione e la figura finale, come illustrata qui sotto, è minima e tollerabile per i processi di sgrossatura. Il grosso vantaggio di avere un raggio teorico di 3 mm anche su grossi diametri, è di avvicinarsi il più possibile alla figura del pezzo finito, già in fase di sgrossatura.

Información para la programación.

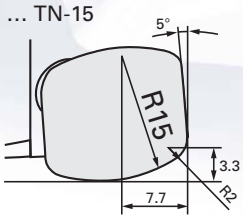
Hay que programar R3 como radio (teórico) de la herramienta. La diferencia máxima que encontraremos en la figura final será la que se muestra en los gráficos. Estos pequeños excedentes quedan solo en las esquinas y son fácilmente eliminados en los procesos de semi-acabado o acabado.

Informations de programmation

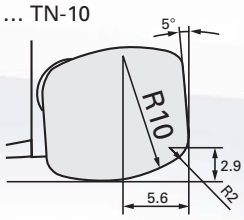
En programmant R3 (théorique) comme rayon de l'outil, la différence entre la programmation et la forme finale est montrée. Ces petits écarts peuvent rester dans certains coins, et être corrigés plus tard par semi finition ou finition.



Approximate Input Corner R : R3
(for all Inserts)



Remains x = approx. 0.6 mm



Remains x = approx. 0.5 mm

6

Cutting depth

The maximum axial doc (a_p) is limited due to insert design, as shown in the table. Ap max for R15 is 3.3mm and for R10 is 2.9mm. We recommend for safety to use R15 2.4mm max and R10 1.8 mm max. The radial stepover should be no less than 50% of the cutter diameter where possible, otherwise vibration may occur causing problems whilst cutting. When machining softer materials up to 25HRC or cast iron, a step over of 100% is achievable.

Schnitt-Tiefen

Die maximale Eingriffstiefe ist durch die Platten-Geometrie limitiert. Die axiale Zustellung (a_p) für den Plattenradius R15 ist 3,3 mm und für R10 ist sie 2,9 mm. Aus technischen Gesichtspunkten und unter dem Aspekt der Sicherheit, sollte bei der R15 WSP die Schnitt-Tiefe nicht größer 2,4 sein und bei R10 maximal 1,8. Die radiale Schnittbreite (a_e) sollte größer 50% betragen, ansonsten könnten Vibrationen auftreten, welche die Standzeit verkürzen würden. Bei der Zerspanung von Materialien bis HRC25 oder auch in Guss, ist eine radiale Zustellung von 100% möglich.

Profondità di taglio

La massima profondità assiale (a_p) è imposta dalla forma dell'inserto, ed è mostrata qui sopra. Ap max per R15 è 3,3 mm e per R10 è 2,9mm. Noi raccomandiamo, per sicurezza, usare a_p max 2,4 mm per R15 e a_p max 1,8 per R10. Il passo radiale, dove possibile, non dovrebbe essere minore del 50% del diametro della fresa. In caso di materiali teneri, con durezze fino a HRC25, o ghise, è possibile raggiungere un passo di 100% del diametro.

Profundidad de corte (axial y radial).

Como puede verse en los gráficos anteriores la profundidad de corte máxima es para la placa R15 de 3,3 mm. y para la R10 2,9 mm. Por razones de seguridad se recomienda utilizar un máximo de 2,4 mm. en la R15 y un máximo de 1,8 mm. para la R10. La pasada radial no debe ser inferior al 50% del diámetro de la herramienta, de lo contrario la herramienta puede vibrar causando problemas durante el mecanizado. En material blando hasta 25HRC o en fundición, puede utilizarse un paso del 100%.

Profondeur de coupe

La profondeur maximale (a_p) est limitée en raison du dessin de la plaquette, comme nous le montrons sur le tableau ci-dessus. AP max pour R15 est 3.3 mm et pour R10 est 2.9 mm. Nous recommandons, par sécurité, d'utiliser pour R15 2.4 mm max et pour R10 1.8 mm max. Le recouvrement radial ne devrait pas être inférieur à 50% du diamètre de l'outil si possible, sinon des vibrations pourraient causer des problèmes de coupe. Dans l'usinage de matériaux doux jusqu'à 25HRC ou la fonte un pas supérieur à 100% est réalisable.

Programming Radius (mm):	3	3
R (mm)	10	15
a_p max (mm)	2.9	3.3
recommended a_p (mm)	1.8	2.4

7

Performance Data

The V-Line graph informs on the relationship between Cutting-Speed (V_c) and Cutting-Length (meter). As shown when V_c is lowered there is an increase in tool-life.
All tests for tool-life are performed using just one single insert, which gives a more representative result.

Vergleichs-Daten

Die V-Linien Grafik zeigt das Zusammenspiel zwischen der Schnittgeschwindigkeit (V_c) und der Standweglänge (Meter). Wenn eine geringere V_c gewählt wird verlängert sich der Standweg. Solche Standwegtests werden nur mit einer WSP durchgeführt, damit man ein repräsentatives Ergebnis ermitteln kann.

Rendimento

Il grafico seguente illustra il legame tra velocità di taglio (V_t) e la lunghezza di taglio (L). Come dimostrato, una diminuzione della velocità di taglio, aumenta i metri percorsi, e quindi la vita utensile. Tutti i test per la vita utensile sono stati eseguiti con un singolo inserto per ottenere un risultato più significativo.

Rendimiento

La tabla V-L relaciona la velocidad de corte (V_c) con la vida de herramienta (metros).

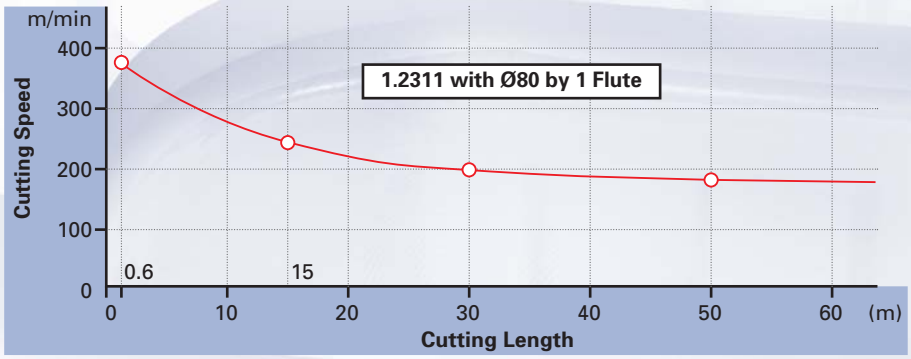
Como se aprecia, una menor velocidad de corte aumenta la vida de herramienta.

Todas las pruebas se han efectuado montando una sola placa a fin de obtener un resultado fácilmente comparable.

Performances

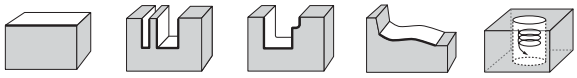
La ligne V du graphique donne la correspondance entre Vitesse de coupe (V_c) et la longueur de coupe (mètre). Ceci montre que quand vc est réduite il y a une augmentation de la durée de vie de l'outil.

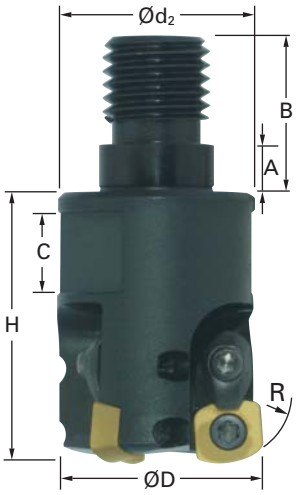
Tous les essais pour la durée de vie de l'outil sont réalisé en utilisant une seule plaquette. Ce qui donne un résultat plus représentatif.

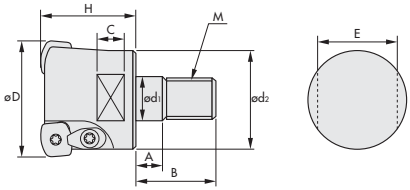


ASRM | Turbo Modular

Q max	▽	HRC	No. of Teeth	No. of Teeth	No. of Teeth
High Efficient	Roughing	50	2	3	4



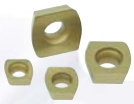




D	0/-0.2

ID Code	Item Code	Stock	Flutes	ØD	H	Ød1	M	Ød2	A	B	C	E	Inserts
FH 494	**ASRM0020-2**	■	2	**20**	30	10.5	**M10**	18	6	19	10	15	EPNW-0803TN-10
FH 495	**ASRM0025-2**	■	2	**25**	35	12.5	**M12**	21	7	22	10	17	EDNW-10T3TN-10
FH 496	**ASRM0032-3**	■	3	**32**	40	17	**M16**	29	7	23	12	22	EDNW-10T3TN-10
FH 497	**ASRM0040-4**	■	4	**40**	40	17	**M16**	29	7	23	12	22	EDNW-10T3TN-10

■ = Stock | Germany

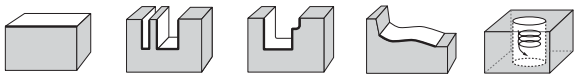


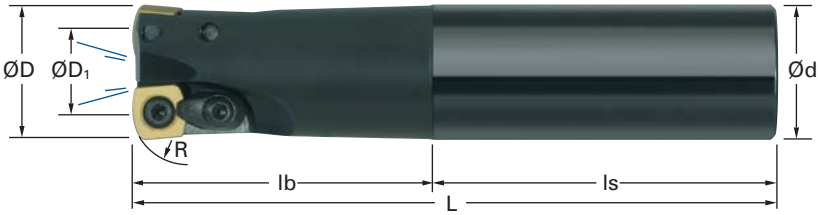
Inserts p. 13

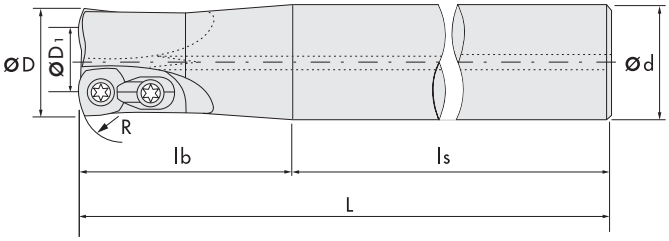
PARTS	Clamp Screw		Clamp Piece Set		Wrench	
						
Body	**ID-Code**	**Item-Code**	**ID-Code**	**Item-Code**	**ID-Code**	**Item-Code**
ASRM-0020-2	ET 32	242-141	–	–	ET 12	104-T15
ASRM-0025-2	ET 38	412-141	ET 163	CM3,5-141	ET 12	104-T15
ASRM-0032-3	ET 38	412-141	ET 163	CM3,5-141	ET 12	104-T15
ASRM-0040-4	ET 38	412-141	ET 163	CM3,5-141	ET 12	104-T15

ASR-S | Turbo - Maximum Volume End Mill - Shank Type - Regular

Q max	Jet	∇	HRC	No. of Teeth	No. of Teeth	No. of Teeth
High Efficient	Air Hole	Roughing	50	2	3	4







D	0/-0.2

ID Code	Item Code	Stock	Flutes	ØD	ØD1	L	Ød	R	lb	ls	Inserts
FH 414	**ASRS-0020**	■	2	**20**	8.8	130	20	10	50	80	EPNW0803TN-10
FH 415	**ASRS-0025**	■	2	**25**	13.8	140	25	10	60	80	EDNW10T3TN-10
FH 416	**ASRS-4032**	■	2	**32**	16.6	150	32	15	70	80	EDNW13T4TN-( )
FH 417	**ASRS-5050**	■	3	**50**	34.6	110	25	15	50	60	EDNW15T4TN-( )
FH 418	**ASRS-5063**	■	4	**63**	47.6	120	32	15	50	70	EDNW15T4TN-( )

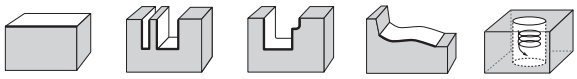
■ = Stock | Germany

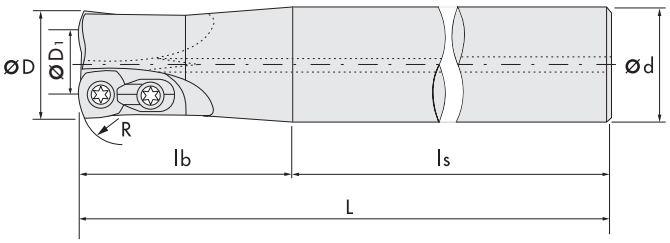
Inserts p. 13

PARTS	Clamp Screw		Clamp Piece Set		Wrench	
						
Body	**ID-Code**	**Item-Code**	**ID-Code**	**Item-Code**	**ID-Code**	**Item-Code**
ASRS-0020	ET 32	242-141	–	–	ET 12	104-T15
ASRS-0025	ET 38	412-141	ET 163	CM3,5-141	ET 12	104-T15
ASRS-4032	ET 162	555-141	ET 164	CM5-147	ET 14	105-T20
ASRS-5050	ET 162	555-141	ET 164	CM5-147	ET 14	105-T20
ASRS-5063	ET 162	555-141	ET 164	CM5-147	ET 14	105-T20

ASR-L | Turbo - Maximum Volume End Mill - Shank Type - Long

Q max	Jet	∇	HRC	No. of Teeth
High Efficient	Air Hole	Roughing	50	2

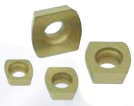




D	0/-0.2

ID Code	Item Code	Stock	Flutes	ØD	ØD1	L	Ød	R	lb	ls	Inserts
FH 419	**ASRL-0020**	■	2	**20**	8.8	180	20	10	100	80	EPNW0803TN-10
FH 420	**ASRL-0025**	■	2	**25**	13.8	200	25	10	120	80	EDNW10T3TN-10
FH 421	**ASRL-4032**	■	2	**32**	16.6	200	32	15	120	80	EDNW13T4TN-( )

■ = Stock | Germany

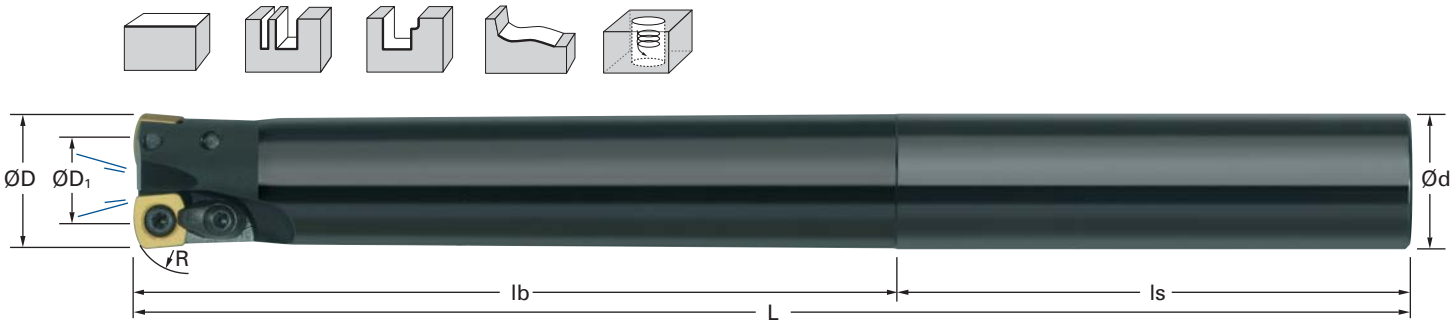


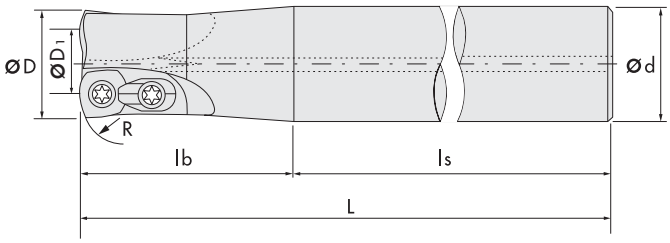
Inserts p. 13

PARTS	Clamp Screw		Clamp Piece Set		Wrench	
						
Body	**ID-Code**	**Item-Code**	**ID-Code**	**Item-Code**	**ID-Code**	**Item-Code**
ASRL-0020	ET 32	242-141	–	–	ET 12	104-T15
ASRL-0025	ET 38	412-141	ET 163	CM3,5-141	ET 12	104-T15
ASRL-4032	ET 162	555-141	ET 164	CM5-147	ET 14	105-T20

ASR-E | Turbo - Maximum Volume End Mill - Shank Type - Extra Long

Q max	Jet	∇	HRC	No. of Teeth
High Efficient	Air Hole	Roughing	50	2





D	0/-0.2

ID Code	Item Code	Stock	Flutes	ØD	ØD1	L	Ød	R	lb	ls	Inserts
FH 422	**ASRE-0020**	■	2	**20**	8.8	250	20	10	130	120	EPNW0803TN-10
FH 423	**ASRE-0025**	■	2	**25**	13.8	300	25	10	180	120	EDNW10T3TN-10
FH 424	**ASRE-4032**	■	2	**32**	16.6	300	32	15	180	120	EDNW13T4TN-( )

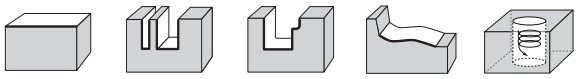
■ = Stock | Germany

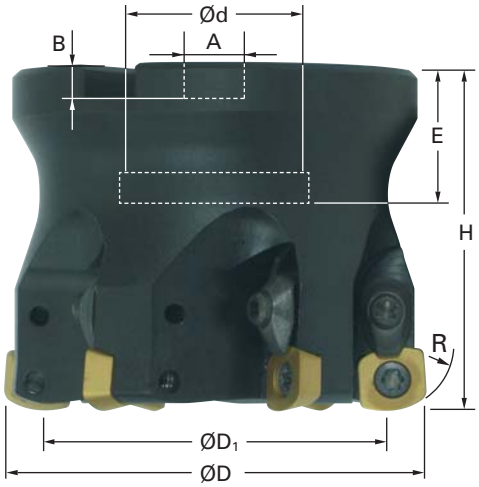
Inserts p. 13

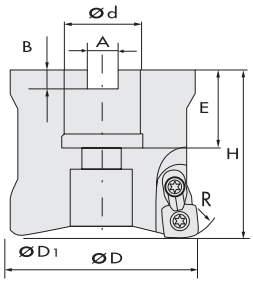
PARTS	Clamp Screw		Clamp Piece Set		Wrench	
						
Body	**ID-Code**	**Item-Code**	**ID-Code**	**Item-Code**	**ID-Code**	**Item-Code**
ASRE-0020	ET 32	242-141	–	–	ET 12	104-T15
ASRE-0025	ET 38	412-141	ET 163	CM3,5-141	ET 12	104-T15
ASRE-4032	ET 162	555-141	ET 164	CM5-147	ET 14	105-T20

ASR-0000-0 | Turbo - Maximum Volume End Mill - Bore Type

Q max	▽	HRC	No. of Teeth	No. of Teeth	No. of Teeth
High Efficient	Roughing	50	4	5	6



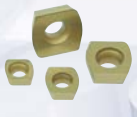




D	0/-0.2

ID Code	Item Code	Stock	Flutes	ØD	$ØD_1$	H	E	R	A	B	Ød	Inserts
FH 433	**ASR-4050M-4**	■	4	**50**	34.6	50	20	15	10.4	6.3	22	EDNW13T4TN-( )
FH 437	**ASR-0050M-5**	■	5	**50**	38.8	50	20	10	10.4	6.3	22	EDNW10T3TN-10
FH 434	**ASR-5063M-4**	■	4	**63**	47.6	50	20	15	10.4	6.3	22	EDNW15T4TN-( )
FH 438	**ASR-0063M-6**	■	6	**63**	51.8	50	20	10	10.4	6.3	22	EDNW10T3TN-10
FH 435	**ASR-5080M-5**	■	5	**80**	64.6	70	22	15	12.4	7	27	EDNW15T4TN-( )
FH 436	**ASR-5100M-6**	■	6	**100**	84.6	70	25	15	14.4	8	32	EDNW15T4TN-( )

■ = Stock | Germany

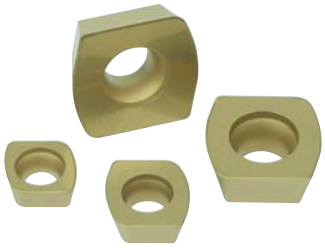


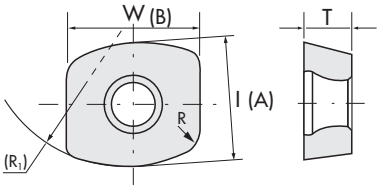
Inserts p. 13

PARTS	Clamp Screw	Clamp Piece Set	Wrench

Body	ID-Code	Item-Code	ID-Code	Item-Code	ID-Code	Item-Code
ASR-4050M-4	ET 162	555-141	ET 164	CM5-147	ET 14	105-T20
ASR-0050M-5	ET 38	412-141	ET 163	CM3,5-141	ET 12	104-T15
ASR-5063M-4	ET 162	555-141	ET 164	CM5-147	ET 14	105-T20
ASR-0063M-6	ET 38	412-141	ET 163	CM3,5-141	ET 12	104-T15
ASR-5080M-5	ET 162	555-141	ET 164	CM5-147	ET 14	105-T20
ASR-5100M-6	ET 162	555-141	ET 164	CM5-147	ET 14	105-T20

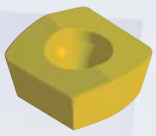
INSERTS | Turbo - Maximum Volume End Mill





ID Code	Item No.	Grade	C-Coated CY100H	CY150	CY250	CY250V	CY9020	PCA08M	PCA12M	PCA15 M	New Coating TB6045 TiBON	G-Coated GF30	HC844	R	R_1	l(A)	T	W(B)
WF 570	**EPNW-0803TN-10**	CY150		■										**3**	10	8.1	3.18	7.94
WF 569	**EPNW-0803TN-10**	CY250			■									**3**	10	8.1	3.18	7.94
WF 571	**EPNW-0803TN-10**	GF30										■		**3**	10	8.1	3.18	7.94
WF 573	**EDNW-10T3TN-10**	CY150		■										**3**	10	10	3.97	10
WF 572	**EDNW-10T3TN-10**	CY250			■									**3**	10	10	3.97	10
WF 574	**EDNW-10T3TN-10**	GF30										■		**3**	10	10	3.97	10
WF 627	**EDNW-13T4TN-10**	TB6045									■			**3**	10	13.5	5.56	12.7
WF 577	**EDNW-13T4TN-15**	CY150		■										**3**	15	13.5	5.56	12.7
WF 576	**EDNW-13T4TN-15**	CY250			■									**3**	15	13.5	5.56	12.7
WF 575	**EDNW-13T4TN-15**	GF30										■		**3**	15	13.5	5.56	12.7
WF 629	**EDNW-15T4TN-10**	TB6045									■			**3**	10	15	5.56	14
WF 579	**EDNW-15T4TN-15**	CY150		■										**3**	15	15	5.56	14
WF 578	**EDNW-15T4TN-15**	CY250			■									**3**	15	15	5.56	14
WF 580	**EDNW-15T4TN-15**	GF30										■		**3**	15	15	5.56	14

Programming Radius



NEW SHAPE AND NEW COATED INSERTS FOR INTERRUPT CUTTING

ID Code	Item No.	Grade												R	R_1	l(A)	T	W(B)
WF 628	**EDNW-13T4TN-15Z**	TB6045									■			**3**	15	13.5	5.56	12.7
WF 630	**EDNW-15T4TN-15Z**	TB6045									■			**3**	15	15	5.56	14

Programming Radius

■ = Stock | Germany

Advanced Engineering
Hitachi Tool

HITACHI
Inspire the Next

Product Range

Solid Carbide End Mills

microEndMill
Epoch21
MINIATURE
3D-Cut
CARBIDE

Indexable Milling Tools

Indexable Milling

ESM Speed End Mills
EMC Power Drills

ESM SPEED

Milling Chucks

Milling Chucks

Distributed by:

Hitachi Tool Engineering Europe GmbH
Itterpark 12 · 40724 Hilden · Germany · Phone +49 (0) 21 03 – 24 82-0 · Fax +49 (0) 21 03 – 24 82-30
e-Mail info@hitachitool-eu.com · Internet www.hitachitool-eu.com

HTT255 0705 ASR-5.0 BW-M