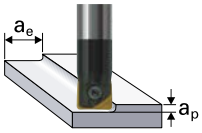
Indexable Milling Tools

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	PCA08M			•	•	•	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

Advanced Engineering

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

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

Option I: Higher feed (V_f) in combination with lower depth (a_p)

OH	V_c	V_f	a_p
till 3x Dia	100%	100%	100%
~ 5x Dia	100%	100%	80%
~ 8x Dia	90%	90%	50%
~ 10x Dia	80%	80%	25%

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

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

Option II: Depth (a_p) kept in combination with reduced speed (V_c) and feed (V_f)

OH	V_c	V_f	a_p
till 3x Dia	100%	100%	100%
~ 5x Dia	70%	70%	100%
~ 8x Dia	60%	60%	100%
~ 10x Dia	50%	50%	100%

The most important is to reduced the force in case of bigger depth (a_p)
In case of bigger Dia (20~32) the flections and cutting-force is less

Info: double tool Dia = 16 times reduced flections!

General-Info

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

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

Insert & screw

- Insert should be replaced if wear or chipping occurs in order not to damage the body
- Before fixing new insert, body-seat - screw and new insert has to be cleaned
- Screw for insert should be tightened not to strong - paste should be used
- Screw should be replaced when damaged or difficult for tightening - to keep tolerance

Surface-quality

- Surface roughness should be decide from cusp-height formula or by f_z concept
- Air-blow will help to evacuate chip's from the cutting zone in order not to have re-cuttings
- Air or high-pressure emulsion can help to reach better optical surface
- Down-cutting (climb milling) and may 45° machining is recommended

ARPF/M | ARPF - 3D Chart

$f_z - a_p - z_e$ list for 3D milling

Job field	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	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 following $f_z/a_p/a_e$.

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