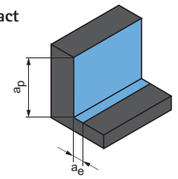
Cutting data recommendations for shoulder milling cutters

Feed and cutting speed

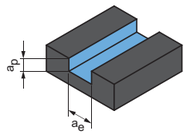
OptiMill-Alu-HPC-Pocket | SCM854

Part-contact cutting

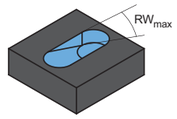


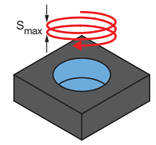
a_p = 3xD
a_e = 0.1xD

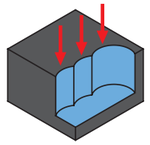
Full cutting



a_p = 1xD
a_e = 1xD



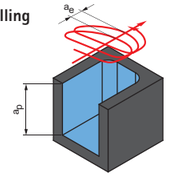




MMG*		Workpiece material	Strength/hardness [N/mm²] [HRC]	Cooling			v_c [m/min]	f_z [mm]								v_c [m/min]	f_z [mm]								Ramps	Helix milling			Grooving
								Diameter of milling cutter [mm]									Diameter of milling cutter [mm]								RW_{max}	S_{max}	EW_{max}		f_z factor
				MQL/Air	Dry	Coolant		5.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00		5.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00			G = 1.5	G = 1.8	
N	N1	N1.1	Aluminium, non-alloy and alloy < 3 % Si		✓	✓	✓	**915**	0.061	0.091	0.110	0.126	0.141	0.154	0.166	0.176	**495**	0.045	0.068	0.081	0.093	0.104	0.114	0.123	0.130	45°	0.75xD	25°	16°	0.8
		N1.2	Aluminium, alloy ≤ 7 % Si		✓	✓	✓	**610**	0.064	0.096	0.115	0.132	0.148	0.162	0.174	0.185	**330**	0.047	0.071	0.085	0.098	0.109	0.120	0.129	0.137	45°	0.75xD	25°	16°	0.8
		N1.3	Aluminium, alloy > 7-12 % Si		✓	✓	✓	**485**	0.067	0.101	0.121	0.139	0.155	0.169	0.182	0.193	**265**	0.050	0.075	0.089	0.103	0.115	0.125	0.135	0.143	45°	0.75xD	25°	16°	0.8
		N1.4	Aluminium, alloy > 12 % Si		✓	✓	✓	**350**	0.073	0.110	0.131	0.151	0.169	0.185	0.199	0.211	**190**	0.054	0.081	0.097	0.112	0.125	0.137	0.147	0.156	45°	0.75xD	25°	16°	0.8
	N2	N2.1	Copper, non-alloy and low-alloy	< 300	✓	✓	✓	**350**	0.049	0.073	0.088	0.101	0.113	0.123	0.132	0.141	**190**	0.036	0.054	0.065	0.075	0.083	0.091	0.098	0.104	45°	0.75xD	25°	16°	0.8
		N2.2	Copper, alloy	> 300	✓	✓	✓	**265**	0.049	0.073	0.088	0.101	0.113	0.123	0.132	0.141	**145**	0.036	0.054	0.065	0.075	0.083	0.091	0.098	0.104	45°	0.75xD	25°	16°	0.8
		N2.3	Brass, bronze, gunmetal	< 1200	✓	✓	✓	**440**	0.030	0.046	0.055	0.063	0.070	0.077	0.083	0.088	**240**	0.023	0.034	0.041	0.047	0.052	0.057	0.061	0.065	45°	0.75xD	25°	16°	0.8
	N4	N4.1	Plastic, thermoplastics		✓	✓	✓	**120**	0.030	0.046	0.055	0.063	0.070	0.077	0.083	0.088	**65**	0.023	0.034	0.041	0.047	0.052	0.057	0.061	0.065	45°	0.75xD	25°	16°	0.8
		N4.2	Plastic, thermosets		✓	✓	✓	**180**	0.030	0.046	0.055	0.063	0.070	0.077	0.083	0.088	**100**	0.023	0.034	0.041	0.047	0.052	0.057	0.061	0.065	45°	0.75xD	25°	16°	0.8
		N4.3	Plastic, foams		✓	✓		**315**	0.018	0.027	0.033	0.038	0.042	0.046	0.050	0.053	**170**	0.014	0.020	0.024	0.028	0.031	0.034	0.037	0.039	45°	0.75xD	25°	16°	0.8

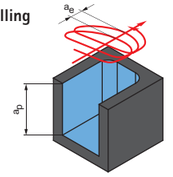
OptiMill-Alu-HPC-Pocket | SCM854

Trochoidal milling



a_p = 3xD
a_e = 0.1xD

Trochoidal milling



a_p = 3xD
a_e = 0.2xD

MMG*		Workpiece material	Strength/hardness [N/mm²] [HRC]	Cooling			v_c [m/min]	f_z [mm] in % of D	h_{max} [mm] in % of D	v_c [m/min]	f_z [mm] in % of D	h_{max} [mm] in % of D
				MQL/Air	Dry	Coolant						
N	N1	N1.1	Aluminium, non-alloy and alloy < 3 % Si	✓	✓	✓	**915**	0.1 - 1.4	0.84	**810**	0.7 - 0.9	1.12
		N1.2	Aluminium, alloy ≤ 7 % Si	✓	✓	✓	**610**	0.1 - 1.5	0.90	**540**	0.7 - 1.0	1.20
		N1.3	Aluminium, alloy > 7-12 % Si	✓	✓	✓	**485**	1.0 - 1.3	0.78	**430**	0.8 - 1.0	1.04
		N1.4	Aluminium, alloy > 12 % Si	✓	✓	✓	**350**	1.1 - 1.5	0.90	**310**	0.8 - 1.1	1.20
	N2	N2.1	Copper, non-alloy and low-alloy	< 300	✓	✓	✓	**350**	0.7 - 1.0	0.60	**310**	0.5 - 0.8	0.80
		N2.2	Copper, alloy	> 300	✓	✓	✓	**265**	0.7 - 1.0	0.60	**235**	0.5 - 0.8	0.80
		N2.3	Brass, bronze, gunmetal	< 1200	✓	✓	✓	**440**	0.4 - 0.6	0.36	**390**	0.3 - 0.5	0.48
	N4	N4.1	Plastic, thermoplastics		✓	✓	✓	**120**	0.4 - 0.6	0.36	**105**	0.3 - 0.5	0.48
		N4.2	Plastic, thermosets		✓	✓	✓	**180**	0.4 - 0.6	0.36	**160**	0.3 - 0.5	0.48
		N4.3	Plastic, foams		✓			**315**	0.3 - 0.4	0.24	**280**	0.2 - 0.3	0.32

Calculation example for 42CrMo4 ø 12 mm:

f_z | a_e | h_m max. = $\frac{D}{100}$ · See table for value

									①		②				
N1.1	Aluminium, non-alloy and alloy < 3 % Si		✓	✓	✓	**915**	0.061	0.091	0.110	0.126	0.141	0.154	0.166	0.176

① $f_z = \frac{12\ mm}{100} \cdot 1{,}2 = 0{,}144\ mm$

② h_m max. = $\frac{12\ mm}{100} \cdot 0{,}84 = 0{,}101\ mm$

* MAPAL machining groups
** If the alloy parts Cr, Mo, Ni, V, W in total > 8%, then select the next highest MAPAL machining group.

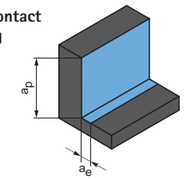
Explanation of terms:
RW_{max} = Maximum angle of the ramp
S_{max} = Maximum slope of the helix
G = Ratio of circular pocket Ø when plunging to the tool Ø
E.g.: Tool Ø 12 mm at G=1.5 results in a pocket Ø of 18 mm
EW_{max} = Slope angle of the helix (results from G and S_{max})

Cutting data recommendations for shoulder milling cutters

Feed and cutting speed

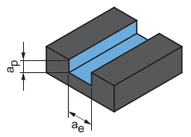
Tool length/correction factor:	
Length	f_z & v_c
short	1
Long	1
Overlong	0.8
Extra long	-

Part-contact cutting

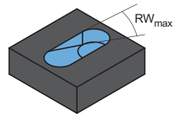


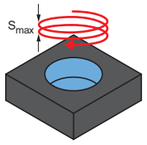
a_p = 1.5xD
a_e = 0.25xD

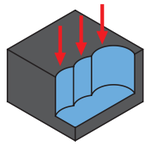
Full cutting



a_p = 1xD
a_e = 1xD







OptiMill-Alu-HPC-Pocket | SCM850

MMG*		Workpiece material	Strength/hardness [N/mm²] [HRC]	Cooling			v_c [m/min]	f_z [mm]						v_c [m/min]	f_z [mm]						Ramps	Helix milling			Drilling
								Diameter of milling cutter [mm]							Diameter of milling cutter [mm]										
				MQL/Air	Dry	Coolant		5.00	8.00	10.00	12.00	16.00	20.00		5.00	8.00	10.00	12.00	16.00	20.00	RW_{max}	S_{max}	EW_{max} G = 1.5	EW_{max} G = 1.8	f_z factor
N	N1.1	Aluminium, non-alloy and alloy < 3 % Si		✓	✓	✓	**945**	0.080	0.120	0.145	0.169	0.210	0.243	**610**	0.047	0.071	0.086	0.099	0.124	0.144	45°	0.75xD	25°	16°	0.8
	N1 N1.2	Aluminium, alloy ≤ 7 % Si		✓	✓	✓	**625**	0.084	0.126	0.152	0.177	0.221	0.256	**405**	0.049	0.074	0.090	0.104	0.130	0.151	45°	0.75xD	25°	16°	0.8
	N1.3	Aluminium, alloy > 7-12 % Si		✓	✓	✓	**500**	0.088	0.132	0.160	0.186	0.231	0.268	**325**	0.052	0.078	0.094	0.109	0.136	0.158	45°	0.75xD	25°	16°	0.8
	N1.4	Aluminium, alloy > 12 % Si		✓	✓	✓	**360**	0.096	0.144	0.174	0.202	0.252	0.292	**235**	0.057	0.085	0.103	0.119	0.149	0.172	45°	0.75xD	25°	16°	0.8
	N2.1	Copper, non-alloy and low-alloy	< 300	✓	✓	✓	**360**	0.064	0.096	0.116	0.135	0.168	0.195	**235**	0.038	0.057	0.068	0.080	0.099	0.115	45°	0.75xD	25°	16°	0.8
	N2 N2.2	Copper, alloy	> 300	✓	✓	✓	**270**	0.064	0.096	0.116	0.135	0.168	0.195	**175**	0.038	0.057	0.068	0.080	0.099	0.115	45°	0.75xD	25°	16°	0.8
	N2.3	Brass, bronze, gunmetal	< 1200	✓	✓	✓	**450**	0.040	0.060	0.073	0.084	0.105	0.122	**295**	0.024	0.035	0.043	0.050	0.062	0.072	45°	0.75xD	25°	16°	0.8
	N4.1	Plastic, thermoplastics		✓	✓	✓	**125**	0.040	0.060	0.073	0.084	0.105	0.122	**80**	0.024	0.035	0.043	0.050	0.062	0.072	45°	0.75xD	25°	16°	0.8
	N4 N4.2	Plastic, thermosets		✓	✓	✓	**185**	0.040	0.060	0.073	0.084	0.105	0.122	**120**	0.024	0.035	0.043	0.050	0.062	0.072	45°	0.75xD	25°	16°	0.8
	N4.3	Plastic, foams		✓	✓		**565**	0.024	0.036	0.044	0.051	0.063	0.073	**365**	0.014	0.021	0.026	0.030	0.037	0.043	45°	0.75xD	25°	16°	0.8

* MAPAL machining groups
** If the alloy parts Cr, Mo, Ni, V, W in total > 8%, then select the next highest MAPAL machining group.

Explanation of terms:
RW_{max} = Maximum angle of the ramp
S_{max} = Maximum slope of the helix
G = Ratio of circular pocket Ø when plunging to the tool Ø
E.g.: Tool Ø 12 mm at G=1.5 results in a pocket Ø of 18 mm
EW_{max} = Slope angle of the helix (results from G and S_{max})

The specified machining values are guide values.
The optimum data for the respective machining task should be determined during the test or machining.