

Guide for recommended cutting data – solid carbide milling

End mill – GM series

1	Material group	Composition / structure / heat treatment	Brinell hardness HB	Machining group	Starting values for cutting speed v_c [m/min]							
					5501R302GM 5601R302GM 5502R302GM 5602R302GM				GM-2E GM-2EFP GM-2F			
					Slot milling		Shoulder milling		Slot milling		Shoulder milling	
					ϕ [mm]	$a_{p \max}$	ϕ [mm]	$a_{e \max}$	ϕ [mm]	$a_{p \max}$	ϕ [mm]	$a_{e \max}$
2	Unalloyed steel	ca. 0,15 % C	annealed	125	$0 < x < 3$	$0,1 \times D$	$0 < x \leq 20$	$< 0,5 \times D$	$0 < x < 3$	$0,1 \times D$	$0 < x \leq 20$	$< 0,5 \times D$
		ca. 0,45 % C	annealed	190	$3 \leq x \leq 20$	$0,8 \times D$			$3 \leq x \leq 20$	$0,8 \times D$		
		ca. 0,45 % C	tempered	250								
		ca. 0,75 % C	annealed	270								
3	Low-alloyed steel	ca. 0,75 % C	tempered	300								
			annealed	180								
			tempered	275								
			tempered	300								
4	High-alloyed steel and high-alloyed tool steel		annealed	200								
			hardened and tempered	325								
5	Stainless steel	ferritic/martensitic	annealed	200								
		martensitic	tempered	240								
		austenitic	quench hardened	180								
		austenitic-ferritic		230								
6	Grey cast iron	perlite/ferritic		180								
		perlite (martensitic)		260								
		ferritic		160								
		perlite		250								
7	Cast iron with spheroidal graphite	ferritic		130								
		perlite		230								
		ferritic		130								
		perlite		230								
8	Malleable cast iron	cannot be hardened		60								
		hardenable	hardened	100								
		$\leq 12\% \text{ Si}$, cannot be hardened		75								
		$\leq 12\% \text{ Si}$, hardenable	hardened	90								
9	Aluminium wrought alloys	$> 12\% \text{ Si}$, cannot be hardened		130								
10	Cast aluminium alloys	machining steel, PB > 1%		110								
		CuZn, CuSnZn		90								
		CuSn, Pb-free copper, electrolytic copper		100								
11	Copper and copper alloys (bronze/brass)											
12	Heat-resistant alloys	Fe-based alloys	annealed	200								
			hardened	280								
		Ni or Co base	annealed	250								
			hardened	350								
13	Titanium alloys	cast		320								
		pure titanium		R_m 400								
		α and β alloys	hardened	R_m 1050								
14	Hardened steel		hardened and tempered	55 HRC								
			hardened and tempered	60 HRC								
			cast	400								
			hardened and tempered	55 HRC								
15	Hard cast iron											
16	Hardened cast iron											
17	Non-metallic materials	Thermoplasts		41								
		Thermosetting plastics		42								
		Plastic, glass-fibre reinforced GFRP		43								
		Plastic, carbon fibre reinforced CFRP		44								
18	Graphite			45								
19	Wood			46								

Note: The given cutting values are guide values, which were determined under ideal conditions.
The values have to be adapted in individual cases.
Feed rate recommendations on page B460
For examples of material for cutting tool groups view page D22.

Recommend feed rate

Solid carbide milling group 2 – Square shoulder mills GM series

4 a_p / D		Feed rate per cutting edge (f_z) [mm]																	
		Ø0,5	Ø0,8	Ø1	Ø2	Ø3	Ø4	Ø5	Ø6	Ø8	Ø10	Ø12	Ø14	Ø16	Ø18	Ø20			
P	1/1	0,01	0,02	0,02	0,02	0,02	0,02	0,03	0,03	0,04	0,06	0,07	0,07	0,08	0,08	0,09			
	1/2	0,01	0,03	0,03	0,03	0,03	0,03	0,04	0,04	0,05	0,08	0,09	0,09	0,10	0,10	0,12			
	1/10	0,02	0,04	0,04	0,04	0,04	0,04	0,06	0,06	0,08	0,12	0,14	0,14	0,16	0,16	0,18			
M	1/1	0,01	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,03	0,05	0,06	0,06	0,06	0,06	0,07			
	1/2	0,01	0,02	0,02	0,02	0,02	0,02	0,03	0,03	0,04	0,06	0,07	0,07	0,08	0,08	0,09			
	1/10	0,02	0,03	0,03	0,03	0,03	0,03	0,05	0,05	0,06	0,10	0,11	0,11	0,13	0,13	0,15			
K	1/1	0,01	0,02	0,02	0,02	0,02	0,02	0,03	0,03	0,04	0,06	0,07	0,07	0,08	0,08	0,09			
	1/2	0,01	0,03	0,03	0,03	0,03	0,03	0,04	0,04	0,05	0,08	0,09	0,09	0,10	0,10	0,12			
	1/10	0,02	0,04	0,04	0,04	0,04	0,04	0,06	0,06	0,08	0,12	0,14	0,14	0,16	0,16	0,18			

Note: The given cutting values are guide values, which were determined under ideal conditions.
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1. Select the appropriate product series.
2. Determine the immersion.
3. Select the used material and read the cutting speed.
4. Determine the feed rate group and have a look at the appropriate feed rate recommendations.
5. Select the diameter of tool and determine the immersion.

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End mill – GM series

Material group		Composition / structure / heat treatment		Brinell hardness HB	Machining group	Starting values for cutting speed v_c [m/min]								
						5501R302GM 5601R302GM 5502R302GM 5602R302GM				GM-2E GM-2EFP GM-2F				
						Slot milling		Shoulder milling		Slot milling		Shoulder milling		
						$\varnothing$ [mm]	a_p max	$\varnothing$ [mm]	a_e max	$\varnothing$ [mm]	a_p max	$\varnothing$ [mm]	a_e max	
						$0 < x < 3$	$0,1 \times D$	$0 < x \leq 20$	$< 0,5 \times D$	$0 < x < 3$	$0,1 \times D$	$0 < x \leq 20$	$< 0,5 \times D$	
						$3 \leq x \leq 20$	$0,8 \times D$			$3 \leq x \leq 20$	$0,8 \times D$			
KMG303				KMG303										
a_e / D				a_e / D										
1/1	1/2	1/10	f-group	1/1	1/2	1/10	f-group							
P	Unalloyed steel	approx. 0,15 % C	annealed	125	1	150	200	270	2	150	200	270	2	
		approx. 0,45 % C	annealed	190	2	145	190	260	2	145	190	260	2	
		approx. 0,45 % C	tempered	250	3	105	140	190	2	105	140	190	2	
		approx. 0,75 % C	annealed	270	4	90	120	165	2	90	120	165	2	
		approx. 0,75 % C	tempered	300	5	85	110	150	2	85	110	150	2	
	Low-alloyed steel		annealed	180	6	115	150	205	2	115	150	205	2	
			tempered	275	7	90	120	165	2	90	120	165	2	
			tempered	300	8	85	110	150	2	85	110	150	2	
			tempered	350	9	80	105	145	2	80	105	145	2	
High-alloyed steel and high-alloyed tool steel		annealed	200	10	105	140	190	2	105	140	190	2		
		hardened and tempered	325	11	80	110	145	2	80	110	145	2		
M	Stainless steel	ferritic/martensitic	annealed	200	12	50	65	90	2	50	65	90	2	
		martensitic	tempered	240	13	45	60	80	2	45	60	80	2	
		austenitic	quench hardened	180	14	55	70	95	2	55	70	95	2	
		austenitic-ferritic		230	15	45	60	80	2	45	60	80	2	
K	Grey cast iron	perlitic/ferritic		180	16	110	150	200	2	110	150	200	2	
		perlitic (martensitic)		260	17	90	120	165	2	90	120	165	2	
	Cast iron with spheroidal graphite	ferritic		160	18	135	180	245	2	135	180	245	2	
		perlitic		250	19	105	140	190	2	105	140	190	2	
	Malleable cast iron	ferritic		130	20	150	200	270	2	150	200	270	2	
		perlitic		230	21	120	160	220	2	120	160	220	2	
N	Aluminium wrought alloys	cannot be hardened		60	22									
		hardenable	hardened	100	23									
	Cast aluminium alloys	$\leq 12\%$ Si, cannot be hardened		75	24									
		$\leq 12\%$ Si, hardenable	hardened	90	25									
		$> 12\%$ Si, cannot be hardened		130	26									
	Copper and copper alloys (bronze/brass)	machining steel, PB> 1%		110	27									
CuZn, CuSnZn		90	28											
CuSn, Pb-free copper, electrolytic copper		100	29											
S	Heat-resistant alloys	Fe-based alloys	annealed	200	30									
			hardened	280	31									
		Ni or Co bass	annealed	250	32									
			hardened	350	33									
			cast	320	34									
	Titanium alloys	pure titanium		R _m 400	35									
α and β alloys		hardened	R _m 1050	36										
H	Hardened steel		hardened and tempered	55 HRC	37									
			hardened and tempered	60 HRC	38									
	Hard cast iron		cast	400	39									
	Hardened cast iron		hardened and tempered	55 HRC	40									
X	Non-metallic materials	Thermoplasts			41									
		Thermosetting plastics			42									
		Plastic, glass-fibre reinforced GFRP			43									
		Plastic, carbon fibre reinforced CFRP			44									
		Graphite			45									
		Wood			46									

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Feed rate recommendations on page B460.
For examples of material for cutting tool groups view page D22.

	Starting values for cutting speed v _c [m/min]																			
	GM-2EL GM-2EX GM-2FL				GM-2EP GM-2ES				GM-3E GM-4E GM-4E-G				GM-2EL GM-4EL-G				5501R303GM 5601R303GM 5502R303GM 5602R303GM			
	Slot milling		Shoulder milling		Slot milling		Shoulder milling		Slot milling		Shoulder milling		Slot milling		Shoulder milling		Slot milling		Shoulder milling	
	Ø [mm]	ap max	Ø [mm]	ae max	Ø [mm]	ap max	Ø [mm]	ae max	Ø [mm]	ap max	Ø [mm]	ae max	Ø [mm]	ap max	Ø [mm]	ae max	Ø [mm]	ap max	Ø [mm]	ae max
	0 < x < 3	0,1 x D	0 < x ≤ 20	< 0,5 x D	0 < x < 3	0,1 x D	0 < x ≤ 20	< 0,5 x D	0 < x < 3	0,1 x D	0 < x ≤ 20	< 0,5 x D	0 < x < 3	0,1 x D	0 < x ≤ 20	< 0,5 x D	0 < x < 3	0,1 x D	0 < x ≤ 20	< 0,5 x D
	3 ≤ x ≤ 20	0,8 x D			3 ≤ x ≤ 20	0,8 x D			3 ≤ x ≤ 20	0,8 x D			3 ≤ x ≤ 20	0,8 x D			3 ≤ x ≤ 20	0,8 x D		
	KMG303				KMG303				KMG303				KMG303				KMG303			
	ae / D				ae / D				ae / D				ae / D				ae / D			
	1/1	1/2	1/10	f-group	1/1	1/2	1/10	f-group	1/1	1/2	1/10	f-group	1/1	1/2	1/10	f-group	1/1	1/2	1/10	f-group
	130	170	230	2	150	200	270	2	150	200	270	2	130	170	230	2	140	185	245	2
	125	165	220	2	145	190	260	2	145	190	260	2	125	165	220	2	135	180	235	2
	95	120	165	2	105	140	190	2	105	140	190	2	95	120	165	2	100	130	175	2
	80	105	140	2	90	120	165	2	90	120	165	2	80	105	140	2	85	115	150	2
	75	95	130	2	85	110	150	2	85	110	150	2	75	95	130	2	80	105	135	2
	100	130	175	2	115	150	205	2	115	150	205	2	100	130	175	2	105	140	185	2
	80	105	140	2	90	120	165	2	90	120	165	2	80	105	140	2	85	115	150	2
	75	95	130	2	85	110	150	2	85	110	150	2	75	95	130	2	80	105	135	2
	70	90	120	2	80	105	145	2	80	105	145	2	70	90	120	2	75	100	130	2
	95	120	165	2	105	140	190	2	105	140	190	2	95	120	165	2	100	130	175	2
	70	95	125	2	80	110	145	2	80	110	145	2	70	95	125	2	75	100	130	2
	45	55	75	2	50	65	90	2	50	65	90	2	45	55	75	2	45	60	80	2
	40	50	65	2	45	60	80	2	45	60	80	2	40	50	65	2	40	55	70	2
	45	60	80	2	55	70	95	2	55	70	95	2	45	60	80	2	50	65	85	2
	40	50	65	2	45	60	80	2	45	60	80	2	40	50	65	2	40	55	70	2
	95	125	170	2	110	150	200	2	110	150	200	2	95	125	170	2	105	140	180	2
	80	105	140	2	90	120	165	2	90	120	165	2	80	105	140	2	85	115	150	2
	120	155	210	2	135	180	245	2	135	180	245	2	120	155	210	2	130	170	225	2
	95	120	165	2	105	140	190	2	105	140	190	2	95	120	165	2	100	130	175	2
	130	170	230	2	150	200	270	2	150	200	270	2	130	170	230	2	140	185	245	2
	105	140	185	2	120	160	220	2	120	160	220	2	105	140	185	2	115	150	200	2

End mill – GM series

Material group		Composition / structure / heat treatment		Brinell hardness HB	Machining group	Starting values for cutting speed v_c [m/min]								
						5501R304GF 5601R304GF 5502R304GF 5602R304GF				GM-4F-G GM-4EFP				
						Slot milling		Shoulder milling		Slot milling		Shoulder milling		
						$\varnothing$ [mm]	a_p max	$\varnothing$ [mm]	a_e max	$\varnothing$ [mm]	a_p max	$\varnothing$ [mm]	a_e max	
						$0 < x < 3$	$0,1 \times D$	$0 < x \leq 20$	$< 0,5 \times D$	$0 < x < 3$	$0,1 \times D$	$0 < x \leq 20$	$< 0,5 \times D$	
						$3 \leq x \leq 20$	$0,8 \times D$			$3 \leq x \leq 20$	$0,8 \times D$			
KMG303				KMG303										
a_e / D				a_e / D										
1/1	1/2	1/10	f-group	1/1	1/2	1/10	f-group							
P	Unalloyed steel	approx. 0,15 % C	annealed	125	1	155	200	265	2	150	200	270	2	
		approx. 0,45 % C	annealed	190	2	150	190	255	2	145	190	260	2	
		approx. 0,45 % C	tempered	250	3	110	140	190	2	105	140	190	2	
		approx. 0,75 % C	annealed	270	4	95	120	160	2	90	120	165	2	
		approx. 0,75 % C	tempered	300	5	90	110	150	2	85	110	150	2	
	Low-alloyed steel		annealed	180	6	120	150	200	2	115	150	205	2	
			tempered	275	7	95	120	160	2	90	120	165	2	
			tempered	300	8	90	110	150	2	85	110	150	2	
			tempered	350	9	85	105	140	2	80	105	145	2	
High-alloyed steel and high-alloyed tool steel		annealed	200	10	110	140	190	2	105	140	190	2		
		hardened and tempered	325	11	85	110	145	2	80	110	145	2		
M	Stainless steel	ferritic/martensitic	annealed	200	12	50	65	85	2	50	65	90	2	
		martensitic	tempered	240	13	45	60	75	2	45	60	80	2	
		austenitic	quench hardened	180	14	55	70	95	2	55	70	95	2	
		austenitic-ferritic		230	15	45	60	75	2	45	60	80	2	
K	Grey cast iron	perlitic/ferritic		180	16	115	150	195	2	110	150	200	2	
		perlitic (martensitic)		260	17	95	120	160	2	90	120	165	2	
	Cast iron with spheroidal graphite	ferritic		160	18	140	180	240	2	135	180	245	2	
		perlitic		250	19	110	140	190	2	105	140	190	2	
	Malleable cast iron	ferritic		130	20	155	200	265	2	150	200	270	2	
		perlitic		230	21	125	160	215	2	120	160	220	2	
N	Aluminium wrought alloys	cannot be hardened		60	22									
		hardenable	hardened	100	23									
		$\leq 12\%$ Si, cannot be hardened		75	24									
	Cast aluminium alloys	$\leq 12\%$ Si, hardenable	hardened	90	25									
		$> 12\%$ Si, cannot be hardened		130	26									
		Copper and copper alloys (bronze/brass)	machining steel, PB> 1%		110	27								
	CuZn, CuSnZn		90	28										
CuSn, Pb-free copper, electrolytic copper			100	29										
S	Heat-resistant alloys	Fe-based alloys	annealed	200	30									
			hardened	280	31									
		Ni or Co bass	annealed	250	32									
			hardened	350	33									
			cast	320	34									
	Titanium alloys	pure titanium		R_m 400	35									
		α and β alloys	hardened	R_m 1050	36									
H	Hardened steel		hardened and tempered	55 HRC	37									
			hardened and tempered	60 HRC	38									
	Hard cast iron		cast	400	39									
	Hardened cast iron		hardened and tempered	55 HRC	40									
X	Non-metallic materials	Thermoplasts			41									
		Thermosetting plastics			42									
		Plastic, glass-fibre reinforced GFRP			43									
		Plastic, carbon fibre reinforced CFRP			44									
		Graphite			45									
		Wood			46									

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For examples of material for cutting tool groups view page D22.

[illegible]

End mill – GM series

Material group		Composition / structure / heat treatment		Brinell hardness HB	Machining group	Starting values for cutting speed v_c [m/min]								
						GM-2BL GM-4BL GM-2BFP				GM-2R GM-4R				
										Slot milling		Shoulder milling		
										$\varnothing$ [mm]	a_p max	$\varnothing$ [mm]	a_e max	
										$0 < x < 3$	$0,1 \times D$	$0 < x \leq 20$	$< 0,5 \times D$	
										$3 \leq x \leq 20$	$0,8 \times D$			
						KMG303				KMG303				
						a_e / D				a_e / D				
1/1	1/10	1/20	f-group	1/1	1/2	1/10	f-group							
P	Unalloyed steel	approx. 0,15 % C	annealed	125	1		220	250	5	160	215	275	2	
		approx. 0,45 % C	annealed	190	2		210	240	5	155	205	265	2	
		approx. 0,45 % C	tempered	250	3		155	175	5	115	155	195	2	
		approx. 0,75 % C	annealed	270	4		135	150	5	100	130	165	2	
		approx. 0,75 % C	tempered	300	5		125	140	5	90	120	155	2	
	Low-alloyed steel		annealed	180	6		165	190	5	120	165	210	2	
			tempered	275	7		135	150	5	100	130	165	2	
			tempered	300	8		125	140	5	90	120	155	2	
			tempered	350	9		115	130	5	85	115	145	2	
High-alloyed steel and high-alloyed tool steel		annealed	200	10		155	175	5	115	155	195	2		
		hardened and tempered	325	11		120	135	5	85	115	150	2		
M	Stainless steel	ferritic/martensitic	annealed	200	12		75	80	5	55	70	90	2	
		martensitic	tempered	240	13		65	70	5	45	65	80	2	
		austenitic	quench hardened	180	14		75	85	5	55	75	95	2	
		austenitic-ferritic		230	15		65	70	5	45	65	80	2	
K	Grey cast iron	perlitic/ferritic		180	16		165	185	5	120	160	205	2	
		perlitic (martensitic)		260	17		135	150	5	100	130	165	2	
	Cast iron with spheroidal graphite	ferritic		160	18		200	225	5	145	195	250	2	
		perlitic		250	19		155	175	5	115	155	195	2	
	Malleable cast iron	ferritic		130	20		220	250	5	160	215	275	2	
		perlitic		230	21		180	200	5	130	175	220	2	
N	Aluminium wrought alloys	cannot be hardened		60	22									
		hardenable	hardened	100	23									
	Cast aluminium alloys	$\leq 12\%$ Si, cannot be hardened		75	24									
		$\leq 12\%$ Si, hardenable	hardened	90	25									
		$> 12\%$ Si, cannot be hardened		130	26									
	Copper and copper alloys (bronze/brass)	machining steel, PB> 1%		110	27									
CuZn, CuSnZn		90	28											
CuSn, Pb-free copper, electrolytic copper		100	29											
S	Heat-resistant alloys	Fe-based alloys	annealed	200	30									
			hardened	280	31									
		Ni or Co bass	annealed	250	32									
			hardened	350	33									
			cast	320	34									
	Titanium alloys	pure titanium		R_m 400	35									
α and β alloys		hardened	R_m 1050	36										
H	Hardened steel		hardened and tempered	55 HRC	37									
			hardened and tempered	60 HRC	38									
	Hard cast iron		cast	400	39									
	Hardened cast iron		hardened and tempered	55 HRC	40									
X	Non-metallic materials	Thermoplasts			41									
		Thermosetting plastics			42									
		Plastic, glass-fibre reinforced GFRP			43									
		Plastic, carbon fibre reinforced CFRP			44									
		Graphite			45									
		Wood			46									

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Feed rate recommendations on page B460.

For examples of material for cutting tool groups view page D22.

A Turning

B Milling

C Drilling

D Technical Information

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End mill – HM series

Material group		Composition / structure / heat treatment		Brinell hardness HB	Machining group	Starting values for cutting speed v_c [m/min]								
						HM-2E HM-2EP HM-2ES HM-4E				HM-2EFP HM-4EL HM-4EFP				
								Shoulder milling				Shoulder milling		
								$\varnothing$ [mm]	a_e max			$\varnothing$ [mm]	a_e max	
								$0 < x \leq 20$	$0,05 \times D$			$0 < x \leq 20$	$0,05 \times D$	
						KMG555				KMG555				
1/1		1/2	1/10	f-group	1/1	1/2	1/10	f-group						
P	Unalloyed steel	approx. 0,15 % C	annealed	125	1									
		approx. 0,45 % C	annealed	190	2									
		approx. 0,45 % C	tempered	250	3									
		approx. 0,75 % C	annealed	270	4									
		approx. 0,75 % C	tempered	300	5									
	Low-alloyed steel		annealed	180	6									
			tempered	275	7									
			tempered	300	8									
			tempered	350	9									
High-alloyed steel and high-alloyed tool steel		annealed	200	10										
		hardened and tempered	325	11										
M	Stainless steel	ferritic/martensitic	annealed	200	12									
		martensitic	tempered	240	13									
		austenitic	quench hardened	180	14									
		austenitic-ferritic		230	15									
K	Grey cast iron	perlitic/ferritic		180	16									
		perlitic (martensitic)		260	17									
	Cast iron with spheroidal graphite	ferritic		160	18									
		perlitic		250	19									
	Malleable cast iron	ferritic		130	20									
		perlitic		230	21									
N	Aluminium wrought alloys	cannot be hardened		60	22									
		hardenable	hardened	100	23									
	Cast aluminium alloys	$\leq 12\%$ Si, cannot be hardened		75	24									
		$\leq 12\%$ Si, hardenable	hardened	90	25									
		$> 12\%$ Si, cannot be hardened		130	26									
	Copper and copper alloys (bronze/brass)	machining steel, PB> 1%		110	27									
		CuZn, CuSnZn		90	28									
CuSn, Pb-free copper, electrolytic copper		100	29											
S	Heat-resistant alloys	Fe-based alloys	annealed	200	30									
			hardened	280	31									
		Ni or Co bass	annealed	250	32									
			hardened	350	33									
			cast	320	34									
	Titanium alloys	pure titanium		R _m 400	35									
		α and β alloys	hardened	R _m 1050	36									
H	Hardened steel		hardened and tempered	55 HRC	37	55	100	125	3	50	95	115	3	
			hardened and tempered	60 HRC	38	55	95	120	3	50	95	110	3	
	Hard cast iron		cast	400	39	70	125	160	3	65	120	145	3	
	Hardened cast iron		hardened and tempered	55 HRC	40	55	100	125	3	50	95	115	3	
X	Non-metallic materials	Thermoplasts			41									
		Thermosetting plastics			42									
		Plastic, glass-fibre reinforced GFRP			43									
		Plastic, carbon fibre reinforced CFRP			44									
		Graphite			45									
		Wood			46									

Note: The given cutting values are guide values, which were determined under ideal conditions.
The values have to be adapted in individual cases.
Feed rate recommendations on page B460.
For examples of material for cutting tool groups view page D22.

[illegible]

End mill – NM series

Material group		Composition / structure / heat treatment		Brinell hardness HB	Machining group	Starting values for cutting speed v_c [m/min]								
						NM-2E 5502R402NM NM-4E NM-2EP				NM-2B NM-4BP				
						Slot milling		Shoulder milling						
						$\varnothing$ [mm]	a_p max	$\varnothing$ [mm]	a_e max					
						$0 < x < 12$	$0,5 \times D$	$0 < x \leq 20$	$< 0,5 \times D$					
						$12 \leq x \leq 20$	$1,0 \times D$							
				KMG309				KMG309						
				a_e / D				a_e / D						
				1/1	1/2	1/10	f-group	1/1	1/10	1/20	f-group			
P	Unalloyed steel	approx. 0,15 % C	annealed	125	1									
		approx. 0,45 % C	annealed	190	2									
		approx. 0,45 % C	tempered	250	3									
		approx. 0,75 % C	annealed	270	4									
		approx. 0,75 % C	tempered	300	5									
	Low-alloyed steel		annealed	180	6									
			tempered	275	7									
			tempered	300	8									
			tempered	350	9									
	High-alloyed steel and high-alloyed tool steel		annealed	200	10									
		hardened and tempered	325	11										
M	Stainless steel	ferritic/martensitic	annealed	200	12									
		martensitic	tempered	240	13									
		austenitic	quench hardened	180	14									
		austenitic-ferritic		230	15									
K	Grey cast iron	perlitic/ferritic		180	16									
		perlitic (martensitic)		260	17									
	Cast iron with spheroidal graphite	ferritic		160	18									
		perlitic		250	19									
	Malleable cast iron	ferritic		130	20									
		perlitic		230	21									
N	Aluminium wrought alloys	cannot be hardened		60	22	920	1100	1200	4		1400	1550	4	
		hardenable	hardened	100	23	555	660	720	4		840	930	4	
	Cast aluminium alloys	$\leq 12\%$ Si, cannot be hardened		75	24	370	440	480	4		560	620	4	
		$\leq 12\%$ Si, hardenable	hardened	90	25	460	550	600	4		700	775	4	
		$> 12\%$ Si, cannot be hardened		130	26	140	165	180	4		210	235	4	
	Copper and copper alloys (bronze/brass)	machining steel, PB> 1%		110	27	280	330	360	4		420	465	4	
		CuZn, CuSnZn		90	28	325	385	420	4		490	545	4	
CuSn, Pb-free copper, electrolytic copper		100	29	280	330	360	4		420	465	4			
S	Heat-resistant alloys	Fe-based alloys	annealed	200	30									
			hardened	280	31									
		Ni or Co bass	annealed	250	32									
			hardened	350	33									
			cast	320	34									
	Titanium alloys	pure titanium		R _m 400	35									
		α and β alloys	hardened	R _m 1050	36									
H	Hardened steel		hardened and tempered	55 HRC	37									
			hardened and tempered	60 HRC	38									
	Hard cast iron		cast	400	39									
	Hardened cast iron		hardened and tempered	55 HRC	40									
X	Non-metallic materials	Thermoplasts			41									
		Thermosetting plastics			42									
		Plastic, glass-fibre reinforced GFRP			43									
		Plastic, carbon fibre reinforced CFRP			44									
		Graphite			45									
		Wood			46									

Note: The given cutting values are guide values, which were determined under ideal conditions.
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End mill – AL series

Material group		Composition / structure / heat treatment		Brinell hardness HB	Machining group	Starting values for cutting speed v_c [m/min]								
						AL-1E AL-2E AL-3E (W) ALG-2E				AL-2EL AL-3EL				
						Slot milling		Shoulder milling		Slot milling		Shoulder milling		
						$\varnothing$ [mm]	a_p max	$\varnothing$ [mm]	a_e max	$\varnothing$ [mm]	a_p max	$\varnothing$ [mm]	a_e max	
						$0 < x < 12$	$0.5 \times D$	$0 < x \leq 20$	$< 0.5 \times D$	$0 < x < 12$	$0.5 \times D$	$0 < x \leq 20$	$< 0.5 \times D$	
						$12 \leq x \leq 20$	$1.0 \times D$			$12 \leq x \leq 20$	$1.0 \times D$			
YK30F / YK40F				YK30F										
a_e / D				a_e / D										
1/1	1/2	1/10	f-group	1/1	1/2	1/10	f-group							
P	Unalloyed steel	approx. 0,15 % C	annealed	125	1									
		approx. 0,45 % C	annealed	190	2									
		approx. 0,45 % C	tempered	250	3									
		approx. 0,75 % C	annealed	270	4									
		approx. 0,75 % C	tempered	300	5									
	Low-alloyed steel		annealed	180	6									
			tempered	275	7									
			tempered	300	8									
			tempered	350	9									
	High-alloyed steel and high-alloyed tool steel		annealed	200	10									
		hardened and tempered	325	11										
M	Stainless steel	ferritic/martensitic	annealed	200	12									
		martensitic	tempered	240	13									
		austenitic	quench hardened	180	14									
		austenitic-ferritic		230	15									
K	Grey cast iron	perlitic/ferritic		180	16									
		perlitic (martensitic)		260	17									
	Cast iron with spheroidal graphite	ferritic		160	18									
		perlitic		250	19									
	Malleable cast iron	ferritic		130	20									
		perlitic		230	21									
N	Aluminium wrought alloys	cannot be hardened		60	22	920	1100	1200	4	830	990	1080	4	
		hardenable	hardened	100	23	555	660	720	4	500	595	650	4	
	Cast aluminium alloys	$\leq 12\%$ Si, cannot be hardened		75	24	370	440	480	4	335	400	435	4	
		$\leq 12\%$ Si, hardenable	hardened	90	25	460	550	600	4	415	495	540	4	
		$> 12\%$ Si, cannot be hardened		130	26	140	165	180	4	125	150	165	4	
	Copper and copper alloys (bronze/brass)	machining steel, PB> 1%		110	27	280	330	360	4	250	300	325	4	
		CuZn, CuSnZn		90	28	325	385	420	4	295	350	380	4	
CuSn, Pb-free copper, electrolytic copper		100	29	280	330	360	4	250	300	325	4			
S	Heat-resistant alloys	Fe-based alloys	annealed	200	30									
			hardened	280	31									
		Ni or Co bass	annealed	250	32									
			hardened	350	33									
			cast	320	34									
	Titanium alloys	pure titanium		R _m 400	35									
		α and β alloys	hardened	R _m 1050	36									
H	Hardened steel		hardened and tempered	55 HRC	37									
			hardened and tempered	60 HRC	38									
	Hard cast iron		cast	400	39									
	Hardened cast iron		hardened and tempered	55 HRC	40									
X	Non-metallic materials	Thermoplasts			41									
		Thermosetting plastics			42									
		Plastic, glass-fibre reinforced GFRP			43									
		Plastic, carbon fibre reinforced CFRP			44									
		Graphite			45									
		Wood			46									

Note: The given cutting values are guide values, which were determined under ideal conditions.
The values have to be adapted in individual cases.
Feed rate recommendations on page B460.
For examples of material for cutting tool groups view page D22.

[illegible]

End mill – AL series

Material group		Composition / structure / heat treatment		Brinell hardness HB	Machining group	Starting values for cutting speed v_c [m/min]								
						AL-2RL-AIR AL-3RL-AIR								
						Slot milling		Shoulder milling						
						$\varnothing$ [mm]	a_p max	$\varnothing$ [mm]	a_e max					
						$0 < x < 12$	$0,5 \times D$	$0 < x \leq 20$	$< 0,5 \times D$					
						$12 \leq x \leq 20$	$1,0 \times D$							
				YK40F										
				a_e / D										
						f-group								
P	Unalloyed steel	approx. 0,15 % C	annealed	125	1									
		approx. 0,45 % C	annealed	190	2									
		approx. 0,45 % C	tempered	250	3									
		approx. 0,75 % C	annealed	270	4									
		approx. 0,75 % C	tempered	300	5									
	Low-alloyed steel		annealed	180	6									
			tempered	275	7									
			tempered	300	8									
			tempered	350	9									
	High-alloyed steel and high-alloyed tool steel		annealed	200	10									
		hardened and tempered	325	11										
M	Stainless steel	ferritic/martensitic	annealed	200	12									
		martensitic	tempered	240	13									
		austenitic	quench hardened	180	14									
		austenitic-ferritic		230	15									
K	Grey cast iron	perlitic/ferritic		180	16									
		perlitic (martensitic)		260	17									
	Cast iron with spheroidal graphite	ferritic		160	18									
		perlitic		250	19									
	Malleable cast iron	ferritic		130	20									
		perlitic		230	21									
N	Aluminium wrought alloys	cannot be hardened		60	22	1035	1250	1350	8					
		hardenable	hardened	100	23	625	750	810	8					
	Cast aluminium alloys	$\leq 12\%$ Si, cannot be hardened		75	24	415	500	540	8					
		$\leq 12\%$ Si, hardenable	hardened	90	25	520	625	675	8					
		$> 12\%$ Si, cannot be hardened		130	26	160	190	205	8					
	Copper and copper alloys (bronze/brass)	machining steel, PB> 1%		110	27	315	375	405	8					
		CuZn, CuSnZn		90	28	365	440	475	8					
CuSn, Pb-free copper, electrolytic copper		100	29	315	375	405	8							
S	Heat-resistant alloys	Fe-based alloys	annealed	200	30									
			hardened	280	31									
		Ni or Co bass	annealed	250	32									
			hardened	350	33									
			cast	320	34									
	Titanium alloys	pure titanium		R_m 400	35									
		α and β alloys	hardened	R_m 1050	36									
H	Hardened steel		hardened and tempered	55 HRC	37									
			hardened and tempered	60 HRC	38									
	Hard cast iron		cast	400	39									
	Hardened cast iron		hardened and tempered	55 HRC	40									
X	Non-metallic materials	Thermoplasts			41									
		Thermosetting plastics			42									
		Plastic, glass-fibre reinforced GFRP			43									
		Plastic, carbon fibre reinforced CFRP			44									
		Graphite			45									
		Wood			46									

Note: The given cutting values are guide values, which were determined under ideal conditions.
 The values have to be adapted in individual cases.
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End mill – PM series

Material group		Composition / structure / heat treatment		Brinell hardness HB	Machining group	Starting values for cutting speed v _c [m/min]								
						PM-2E PM-4E PM-4E-G				PM-4EL PM-4EL-G PM-4EX-G				
						Slot milling		Shoulder milling		Slot milling		Shoulder milling		
						Ø [mm]	a _p max	Ø [mm]	a _e max	Ø [mm]	a _p max	Ø [mm]	a _e max	
						0 < x < 3	0,15xD	0 < x ≤ 20	0,15xD	0 < x < 3	0,15xD	0 < x ≤ 20	0,15xD	
						3 ≤ x < 6	0,3xD			3 ≤ x < 6	0,3xD			
						6 ≤ x ≤ 20	0,5xD			6 ≤ x ≤ 20	0,5xD			
KMG405				KMG405										
a _e / D				a _e / D										
1/1	1/2	1/10	f-group	1/1	1/2	1/10	f-group							
P	Unalloyed steel	approx. 0,15 % C	annealed	125	1	165	220	300	1	140	190	255	1	
		approx. 0,45 % C	annealed	190	2	160	210	285	1	135	185	245	1	
		approx. 0,45 % C	tempered	250	3	120	155	210	1	100	135	180	1	
		approx. 0,75 % C	annealed	270	4	100	135	180	1	85	115	155	1	
		approx. 0,75 % C	tempered	300	5	95	125	165	1	80	105	145	1	
	Low-alloyed steel		annealed	180	6	125	165	225	1	110	145	195	1	
			tempered	275	7	100	135	180	1	85	115	155	1	
			tempered	300	8	95	125	165	1	80	105	145	1	
			tempered	350	9	90	115	160	1	75	100	135	1	
High-alloyed steel and high-alloyed tool steel		annealed	200	10	120	155	210	1	100	135	180	1		
		hardened and tempered	325	11	90	120	160	1	75	105	140	1		
M	Stainless steel	ferritic/martensitic	annealed	200	12	55	75	100	1	45	65	85	1	
		martensitic	tempered	240	13	50	65	85	1	40	55	75	1	
		austenitic	quench hardened	180	14	60	75	105	1	50	65	90	1	
		austenitic-ferritic		230	15	50	65	85	1	40	55	75	1	
K	Grey cast iron	perlitic/ferritic		180	16	125	165	220	1	105	140	190	1	
		perlitic (martensitic)		260	17	100	135	180	1	85	115	155	1	
	Cast iron with spheroidal graphite	ferritic		160	18	150	200	270	1	130	175	230	1	
		perlitic		250	19	120	155	210	1	100	135	180	1	
	Malleable cast iron	ferritic		130	20	165	220	300	1	145	190	255	1	
		perlitic		230	21	135	180	240	1	115	155	205	1	
N	Aluminium wrought alloys	cannot be hardened		60	22									
		hardenable	hardened	100	23									
	Cast aluminium alloys	≤ 12 % Si, cannot be hardened		75	24									
		≤ 12 % Si, hardenable	hardened	90	25									
		> 12 % Si, cannot be hardened		130	26									
	Copper and copper alloys (bronze/brass)	machining steel, PB> 1%		110	27									
		CuZn, CuSnZn		90	28									
CuSn, Pb-free copper, electrolytic copper		100	29											
S	Heat-resistant alloys	Fe-based alloys	annealed	200	30									
			hardened	280	31									
		Ni or Co bass	annealed	250	32									
			hardened	350	33									
			cast	320	34									
	Titanium alloys	pure titanium		R _m 400	35									
		α and β alloys	hardened	R _m 1050	36									
H	Hardened steel		hardened and tempered	55 HRC	37	80	105	140	1	65	90	120	1	
			hardened and tempered	60 HRC	38									
	Hard cast iron		cast	400	39	105	140	185	1	85	120	160	1	
	Hardened cast iron		hardened and tempered	55 HRC	40									
X	Non-metallic materials	Thermoplasts			41									
		Thermosetting plastics			42									
		Plastic, glass-fibre reinforced GFRP			43									
		Plastic, carbon fibre reinforced CFRP			44									
		Graphite			45									
		Wood			46									

Note: The given cutting values are guide values, which were determined under ideal conditions.
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Feed rate recommendations on page B460.
For examples of material for cutting tool groups view page D22.

	Starting values for cutting speed v _c [m/min]																			
	PM-6E				PM-6EL				PM-2B PM-4B				PM-2BL PM-2BFP PM-4BL				PM-2BC			
			Shoulder milling				Shoulder milling													
			Ø [mm]	a _p max			Ø [mm]	a _p max												
			0 < x ≤ 20	0.15xD			0 < x ≤ 20	0.15xD												
	KMG405				KMG405				KMG405				KMG405				KMG405			
	a _e / D				a _e / D				a _e / D				a _e / D				a _e / D			
	1/1	1/2	1/10	f-group	1/1	1/2	1/10	f-group	1/1	1/10	1/20	f-group	1/1	1/10	1/20	f-group	1/1	1/10	1/20	f-group
		220	300	1		190	255	1		270	300	5		230	255	5		230	255	5
		210	285	1		185	245	1		260	285	5		220	245	5		220	245	5
		155	210	1		135	180	1		190	210	5		165	180	5		165	180	5
		135	180	1		115	155	1		165	180	5		140	155	5		140	155	5
		125	165	1		105	145	1		150	165	5		130	145	5		130	145	5
		165	225	1		145	195	1		205	225	5		175	195	5		175	195	5
		135	180	1		115	155	1		165	180	5		140	155	5		140	155	5
		125	165	1		105	145	1		150	165	5		130	145	5		130	145	5
		115	160	1		100	135	1		145	160	5		120	135	5		120	135	5
		155	210	1		135	180	1		190	210	5		165	180	5		165	180	5
		120	160	1		105	140	1		145	160	5		125	140	5		125	140	5
		75	100	1		65	85	1		90	100	5		75	85	5		75	85	5
		65	85	1		55	75	1		80	85	5		65	75	5		65	75	5
		75	105	1		65	90	1		95	105	5		80	90	5		80	90	5
		65	85	1		55	75	1		80	85	5		65	75	5		65	75	5
		165	220	1		140	190	1		200	220	5		170	190	5		170	190	5
		135	180	1		115	155	1		165	180	5		140	155	5		140	155	5
		200	270	1		175	230	1		245	270	5		210	230	5		210	230	5
		155	210	1		135	180	1		190	210	5		165	180	5		165	180	5
		220	300	1		190	255	1		270	300	5		230	255	5		230	255	5
		180	240	1		155	205	1		220	240	5		185	205	5		185	205	5

End mill – PM series

Material group		Composition / structure / heat treatment		Brinell hardness HB	Machining group	Starting values for cutting speed v_c [m/min]								
						PM-2R PM-4R				PM-4RL				
						Slot milling		Shoulder milling		Slot milling		Shoulder milling		
						$\varnothing$ [mm]	a_p max	$\varnothing$ [mm]	a_e max	$\varnothing$ [mm]	a_p max	$\varnothing$ [mm]	a_e max	
						$0 < x < 3$	0,1 5xD	$0 < x \leq 20$	0,15xD	$0 < x < 3$	0,1 5xD	$0 < x \leq 20$	0,15xD	
						$3 \leq x < 6$	0,3xD			$3 \leq x < 6$	0,3xD			
						$6 \leq x \leq 20$	0,5xD			$6 \leq x \leq 20$	0,5xD			
KMG405				KMG405										
a_e / D				a_e / D										
1/1	1/2	1/10	f-group	1/1	1/2	1/10	f-group							
P	Unalloyed steel	approx. 0,15 % C	annealed	125	1	165	220	300	1	150	200	265	1	
		approx. 0,45 % C	annealed	190	2	160	210	285	1	145	190	255	1	
		approx. 0,45 % C	tempered	250	3	120	155	210	1	105	140	190	1	
		approx. 0,75 % C	annealed	270	4	100	135	180	1	90	120	160	1	
		approx. 0,75 % C	tempered	300	5	95	125	165	1	85	110	150	1	
	Low-alloyed steel		annealed	180	6	125	165	225	1	115	150	200	1	
			tempered	275	7	100	135	180	1	90	120	160	1	
			tempered	300	8	95	125	165	1	85	110	150	1	
			tempered	350	9	90	115	160	1	80	105	140	1	
High-alloyed steel and high-alloyed tool steel		annealed	200	10	120	155	210	1	105	140	190	1		
		hardened and tempered	325	11	90	120	160	1	80	110	145	1		
M	Stainless steel	ferritic/martensitic	annealed	200	12	55	75	100	1	50	65	85	1	
		martensitic	tempered	240	13	50	65	85	1	45	60	75	1	
		austenitic	quench hardened	180	14	60	75	105	1	55	70	95	1	
		austenitic-ferritic		230	15	50	65	85	1	45	60	75	1	
K	Grey cast iron	perlitic/ferritic		180	16	125	165	220	1	110	150	195	1	
		perlitic (martensitic)		260	17	100	135	180	1	90	120	160	1	
	Cast iron with spheroidal graphite	ferritic		160	18	150	200	270	1	135	180	240	1	
		perlitic		250	19	120	155	210	1	105	140	190	1	
	Malleable cast iron	ferritic		130	20	165	220	300	1	150	200	265	1	
		perlitic		230	21	135	180	240	1	120	160	215	1	
N	Aluminium wrought alloys	cannot be hardened		60	22									
		hardenable	hardened	100	23									
				75	24									
	Cast aluminium alloys	$\leq 12\%$ Si, cannot be hardened		75	24									
		$\leq 12\%$ Si, hardenable	hardened	90	25									
		$> 12\%$ Si, cannot be hardened		130	26									
	Copper and copper alloys (bronze/brass)	machining steel, PB> 1%		110	27									
CuZn, CuSnZn		90	28											
CuSn, Pb-free copper, electrolytic copper		100	29											
S	Heat-resistant alloys	Fe-based alloys	annealed	200	30									
			hardened	280	31									
		Ni or Co bass	annealed	250	32									
			hardened	350	33									
			cast	320	34									
	Titanium alloys	pure titanium		R _m 400	35									
		α and β alloys	hardened	R _m 1050	36									
H	Hardened steel		hardened and tempered	55 HRC	37	85	110	145	1	70	95	125	1	
			hardened and tempered	60 HRC	38									
	Hard cast iron		cast	400	39	115	145	190	1	95	125	165	1	
	Hardened cast iron		hardened and tempered	55 HRC	40									
X	Non-metallic materials	Thermoplasts			41									
		Thermosetting plastics			42									
		Plastic, glass-fibre reinforced GFRP			43									
		Plastic, carbon fibre reinforced CFRP			44									
		Graphite			45									
		Wood			46									

[illegible]

End mill – UM/HPC/VSM series

Material group		Composition / structure / heat treatment		Brinell hardness HB	Machining group	Starting values for cutting speed v_c [m/min]								
						5501R38414GM (-R) 5502R38414GM (-R) 5602R38414GM (-R)				5501R38414GM (-R) long series 5502R38414GM (-R) long series 5602R38414GM (-R) long series				
						Slot milling		Shoulder milling		Slot milling		Shoulder milling		
						$\varnothing$ [mm]	a_p max	$\varnothing$ [mm]	a_e max	$\varnothing$ [mm]	a_p max	$\varnothing$ [mm]	a_e max	
						$0 < x < 3$	0,3xD	$0 < x < 3$	0,15xD	$0 < x < 3$	0,3xD	$0 < x < 3$	0,15xD	
						$3 \leq x < 12$	0,7xD	$3 \leq x < 20$	0,3xD	$3 \leq x < 12$	0,7xD	$3 \leq x < 20$	0,3xD	
$12 \leq x \leq 20$	1,5xD			$12 \leq x \leq 20$	1,5xD									
				KMG405		KMG405								
				a_e / D		a_e / D								
				1/1	1/2	1/10	f-group	1/1	1/2	1/10	f-group			
P	Unalloyed steel	approx. 0,15 % C	annealed	125	1	250	300	380	9	190	225	285	9	
		approx. 0,45 % C	annealed	190	2	240	285	365	9	185	215	275	9	
		approx. 0,45 % C	tempered	250	3	175	210	270	9	135	160	200	9	
		approx. 0,75 % C	annealed	270	4	150	180	230	9	115	135	175	9	
		approx. 0,75 % C	tempered	300	5	140	165	210	9	105	125	160	9	
	Low-alloyed steel		annealed	180	6	190	225	285	9	145	170	215	9	
			tempered	275	7	150	180	230	9	115	135	175	9	
			tempered	300	8	140	165	210	9	105	125	160	9	
			tempered	350	9	130	160	200	9	100	120	150	9	
	High-alloyed steel and high-alloyed tool steel		annealed	200	10	175	210	270	9	135	160	200	9	
		hardened and tempered	325	11	135	160	205	9	105	120	155	9		
M	Stainless steel	ferritic/martensitic	annealed	200	12	80	100	125	9	65	75	95	9	
		martensitic	tempered	240	13	70	85	110	9	55	65	80	9	
		austenitic	quench hardened	180	14	85	105	130	9	65	80	100	9	
		austenitic-ferritic		230	15	70	85	110	9	55	65	80	9	
K	Grey cast iron	perlitic/ferritic		180	16	185	220	280	9	140	165	210	9	
		perlitic (martensitic)		260	17	150	180	230	9	115	135	175	9	
	Cast iron with spheroidal graphite	ferritic		160	18	225	270	345	9	175	205	260	9	
		perlitic		250	19	175	210	270	9	135	160	200	9	
	Malleable cast iron	ferritic		130	20	250	300	380	9	190	225	285	9	
		perlitic		230	21	200	240	305	9	155	180	230	9	
N	Aluminium wrought alloys	cannot be hardened		60	22									
		hardenable	hardened	100	23									
	Cast aluminium alloys	$\leq 12\%$ Si, cannot be hardened		75	24									
		$\leq 12\%$ Si, hardenable	hardened	90	25									
		$> 12\%$ Si, cannot be hardened		130	26									
	Copper and copper alloys (bronze/brass)	machining steel, PB> 1%		110	27									
		CuZn, CuSnZn		90	28									
CuSn, Pb-free copper, electrolytic copper		100	29											
S	Heat-resistant alloys	Fe-based alloys	annealed	200	30									
			hardened	280	31									
		Ni or Co bass	annealed	250	32									
			hardened	350	33									
			cast	320	34									
	Titanium alloys	pure titanium		R _m 400	35									
		α and β alloys	hardened	R _m 1050	36									
H	Hardened steel		hardened and tempered	55 HRC	37	115	140	175	9					
			hardened and tempered	60 HRC	38									
	Hard cast iron		cast	400	39	135	165	205	9					
	Hardened cast iron		hardened and tempered	55 HRC	40									
X	Non-metallic materials	Thermoplasts			41									
		Thermosetting plastics			42									
		Plastic, glass-fibre reinforced GFRP			43									
		Plastic, carbon fibre reinforced CFRP			44									
		Graphite			45									
		Wood			46									

Note: The given cutting values are guide values, which were determined under ideal conditions.
The values have to be adapted in individual cases.
Feed rate recommendations on page B460.
For examples of material for cutting tool groups view page D22.

[illegible]

Deburring cutters – FM series

Material group		Composition / structure / heat treatment		Brinell hardness HB	Machining group	Starting values for cutting speed v_c [m/min]					
						5501 / 5601 5501 / 5601 5601					
						KMG303					
						a _e / D					
1/1	1/2	1/10	f-group								
P	Unalloyed steel	approx. 0,15 % C	annealed	125	1			230	11		
		approx. 0,45 % C	annealed	190	2			220	11		
		approx. 0,45 % C	tempered	250	3			165	11		
		approx. 0,75 % C	annealed	270	4			140	11		
		approx. 0,75 % C	tempered	300	5			130	11		
	Low-alloyed steel		annealed	180	6			175	11		
			tempered	275	7			140	11		
			tempered	300	8			130	11		
			tempered	350	9			120	11		
High-alloyed steel and high-alloyed tool steel		annealed	200	10			165	11			
		hardened and tempered	325	11			125	11			
M	Stainless steel	ferritic/martensitic	annealed	200	12			75	11		
		martensitic	tempered	240	13			65	11		
		austenitic	quench hardened	180	14			80	11		
		austenitic-ferritic		230	15			65	11		
K	Grey cast iron	perlitic/ferritic		180	16			170	11		
		perlitic (martensitic)		260	17			140	11		
	Cast iron with spheroidal graphite	ferritic		160	18			210	11		
		perlitic		250	19			165	11		
	Malleable cast iron	ferritic		130	20			230	11		
		perlitic		230	21			185	11		
N	Aluminium wrought alloys	cannot be hardened		60	22			1200	11		
		hardenable	hardened	100	23			720	11		
	Cast aluminium alloys	≤ 12 % Si, cannot be hardened		75	24			480	11		
		≤ 12 % Si, hardenable	hardened	90	25			600	11		
		> 12 % Si, cannot be hardened		130	26			180	11		
	Copper and copper alloys (bronze/brass)	machining steel, PB> 1%		110	27			360	11		
CuZn, CuSnZn		90	28			420	11				
CuSn, Pb-free copper, electrolytic copper		100	29			360	11				
S	Heat-resistant alloys	Fe-based alloys	annealed	200	30						
			hardened	280	31						
		Ni or Co bass	annealed	250	32						
			hardened	350	33						
			cast	320	34						
	Titanium alloys	pure titanium		R _m 400	35						
α and β alloys		hardened	R _m 1050	36							
H	Hardened steel		hardened and tempered	55 HRC	37						
			hardened and tempered	60 HRC	38						
	Hard cast iron		cast	400	39						
	Hardened cast iron		hardened and tempered	55 HRC	40						
X	Non-metallic materials	Thermoplasts			41						
		Thermosetting plastics			42						
		Plastic, glass-fibre reinforced GFRP			43						
		Plastic, carbon fibre reinforced CFRP			44						
		Graphite			45						
		Wood			46						

Note: The given cutting values are guide values, which were determined under ideal conditions.

The values have to be adapted in individual cases.

Feed rate recommendations on page B460.

For examples of material for cutting tool groups view page D22.

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Recommended feed rate

Solid carbide milling group 1 – Square shoulder mills PM series

	a_e / D	Feed rate per cutting edge (f_z) [mm]																	
		Ø0,5	Ø0,8	Ø 1	Ø 2	Ø 3	Ø 4	Ø 5	Ø 6	Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 18	Ø 20			
P	1/1	0,01	0,02	0,02	0,02	0,02	0,02	0,03	0,03	0,05	0,07	0,08	0,08	0,09	0,09	0,10			
	1/2	0,01	0,03	0,03	0,03	0,03	0,03	0,04	0,04	0,06	0,09	0,10	0,10	0,12	0,12	0,13			
	1/10	0,02	0,05	0,05	0,05	0,05	0,05	0,07	0,07	0,09	0,14	0,16	0,16	0,18	0,18	0,20			
M	1/1	0,01	0,02	0,02	0,02	0,02	0,02	0,03	0,03	0,04	0,05	0,06	0,06	0,07	0,07	0,08			
	1/2	0,01	0,02	0,02	0,02	0,02	0,02	0,04	0,04	0,05	0,07	0,08	0,08	0,10	0,10	0,11			
	1/10	0,02	0,04	0,04	0,04	0,04	0,04	0,05	0,05	0,07	0,11	0,13	0,13	0,15	0,15	0,16			
K	1/1	0,01	0,02	0,02	0,02	0,02	0,02	0,03	0,03	0,05	0,07	0,08	0,08	0,09	0,09	0,10			
	1/2	0,01	0,03	0,03	0,03	0,03	0,03	0,04	0,04	0,06	0,09	0,10	0,10	0,12	0,12	0,13			
	1/10	0,02	0,05	0,05	0,05	0,05	0,05	0,07	0,07	0,09	0,14	0,16	0,16	0,18	0,18	0,20			
H	1/1	0,01	0,02	0,02	0,02	0,02	0,02	0,03	0,03	0,04	0,05	0,06	0,06	0,07	0,07	0,08			
	1/2	0,01	0,02	0,02	0,02	0,02	0,02	0,04	0,04	0,05	0,07	0,08	0,08	0,10	0,10	0,11			
	1/10	0,02	0,04	0,04	0,04	0,04	0,04	0,05	0,05	0,07	0,11	0,13	0,13	0,15	0,15	0,16			

Note: The given cutting values are guide values, which were determined under ideal conditions.
The values have to be adapted in individual cases.

Solid carbide milling group 2 – Square shoulder mills GM series

	a_e / D	Feed rate per cutting edge (f_z) [mm]																	
		Ø0,5	Ø0,8	Ø 1	Ø 2	Ø 3	Ø 4	Ø 5	Ø 6	Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 18	Ø 20			
P	1/1	0,01	0,02	0,02	0,02	0,02	0,02	0,03	0,03	0,04	0,06	0,07	0,07	0,08	0,08	0,09			
	1/2	0,01	0,03	0,03	0,03	0,03	0,03	0,04	0,04	0,05	0,08	0,09	0,09	0,10	0,10	0,12			
	1/10	0,02	0,04	0,04	0,04	0,04	0,04	0,06	0,06	0,08	0,12	0,14	0,14	0,16	0,16	0,18			
M	1/1	0,01	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,03	0,05	0,06	0,06	0,06	0,06	0,07			
	1/2	0,01	0,02	0,02	0,02	0,02	0,02	0,03	0,03	0,04	0,06	0,07	0,07	0,08	0,08	0,09			
	1/10	0,02	0,03	0,03	0,03	0,03	0,03	0,05	0,05	0,06	0,10	0,11	0,11	0,13	0,13	0,15			
K	1/1	0,01	0,02	0,02	0,02	0,02	0,02	0,03	0,03	0,04	0,06	0,07	0,07	0,08	0,08	0,09			
	1/2	0,01	0,03	0,03	0,03	0,03	0,03	0,04	0,04	0,05	0,08	0,09	0,09	0,10	0,10	0,12			
	1/10	0,02	0,04	0,04	0,04	0,04	0,04	0,06	0,06	0,08	0,12	0,14	0,14	0,16	0,16	0,18			

Note: The given cutting values are guide values, which were determined under ideal conditions.
The values have to be adapted in individual cases.

Solid carbide milling group 3 – Square shoulder mills HM series

	a_e / D	Feed rate per cutting edge (f_z) [mm]																	
		Ø0,5	Ø0,8	Ø 1	Ø 2	Ø 3	Ø 4	Ø 5	Ø 6	Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 18	Ø 20			
H	1/1	0,01	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,03	0,05	0,06	0,06	0,06	0,06	0,07			
	1/2	0,01	0,02	0,02	0,02	0,02	0,02	0,03	0,03	0,04	0,06	0,07	0,07	0,08	0,08	0,09			
	1/10	0,02	0,03	0,03	0,03	0,03	0,03	0,05	0,05	0,06	0,10	0,11	0,11	0,13	0,13	0,15			

Note: The given cutting values are guide values, which were determined under ideal conditions.
The values have to be adapted in individual cases.

Solid carbide milling group 4 – Square shoulder mills AL/NM series

	a_e / D	Feed rate per cutting edge (f_z) [mm]																	
		Ø0,5	Ø0,8	Ø 1	Ø 2	Ø 3	Ø 4	Ø 5	Ø 6	Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 18	Ø 20			
N	1/1	0,02	0,03	0,03	0,03	0,03	0,03	0,05	0,05	0,06	0,09	0,11	0,11	0,12	0,12	0,14			
	3/4	0,02	0,04	0,04	0,04	0,04	0,04	0,06	0,06	0,08	0,12	0,14	0,14	0,16	0,16	0,18			
	1/10	0,03	0,06	0,06	0,06	0,06	0,06	0,09	0,09	0,12	0,19	0,22	0,22	0,25	0,25	0,28			
	1/20	0,04	0,08	0,08	0,08	0,08	0,08	0,12	0,12	0,16	0,23	0,27	0,27	0,31	0,31	0,35			

Note: The given cutting values are guide values, which were determined under ideal conditions.
The values have to be adapted in individual cases.

Recommended feed rate

Solid carbide milling group 5 – Ball nose cutters GM series

	a_e / D	Feed rate per cutting edge (f_z) [mm]																	
		Ø0,5	Ø0,8	Ø 1	Ø 2	Ø 3	Ø 4	Ø 5	Ø 6	Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 18	Ø 20			
P	1/1																		
	1/10	0,02	0,05	0,05	0,05	0,05	0,05	0,07	0,07	0,09	0,14	0,16	0,16	0,18	0,18	0,20			
	1/20	0,03	0,06	0,06	0,06	0,06	0,06	0,08	0,08	0,11	0,17	0,20	0,20	0,23	0,23	0,25			
M	1/1																		
	1/10	0,02	0,04	0,04	0,04	0,04	0,04	0,05	0,05	0,07	0,11	0,13	0,13	0,15	0,15	0,16			
	1/20	0,02	0,05	0,05	0,05	0,05	0,05	0,07	0,07	0,09	0,14	0,16	0,16	0,18	0,18	0,21			
K	1/1																		
	1/10	0,02	0,05	0,05	0,05	0,05	0,05	0,07	0,07	0,09	0,14	0,16	0,16	0,18	0,18	0,20			
	1/20	0,03	0,06	0,06	0,06	0,06	0,06	0,08	0,08	0,11	0,17	0,20	0,20	0,23	0,23	0,25			
H	1/1																		
	1/10	0,02	0,04	0,04	0,04	0,04	0,04	0,05	0,05	0,07	0,11	0,13	0,13	0,15	0,15	0,16			
	1/20	0,02	0,05	0,05	0,05	0,05	0,05	0,07	0,07	0,09	0,14	0,16	0,16	0,18	0,18	0,21			

Note: The given cutting values are guide values, which were determined under ideal conditions.
The values have to be adapted in individual cases.

Solid carbide milling group 6 – High feed mills PM series

	a_e / D	Feed rate per cutting edge (f_z) [mm]																	
		Ø 3	Ø 4	Ø 5	Ø 6	Ø 8	Ø 10	Ø 12											
P	1/1																		
	1/10																		
	1/20	0,15	0,25	0,28	0,33	0,44	0,55	0,66											
M	1/1																		
	1/10																		
	1/20	0,12	0,22	0,25	0,30	0,41	0,52	0,63											
K	1/1																		
	1/10																		
	1/20	0,15	0,25	0,28	0,33	0,44	0,55	0,66											
H	1/1																		
	1/10																		
	1/20	0,12	0,22	0,25	0,30	0,41	0,52	0,63											

Note: The given cutting values are guide values, which were determined under ideal conditions.
The values have to be adapted in individual cases.

Solid carbide milling group 7 – Ball nose cutters HM series

	a_e / D	Feed rate per cutting edge (f_z) [mm]																	
		Ø0,5	Ø0,8	Ø 1	Ø 2	Ø 3	Ø 4	Ø 5	Ø 6	Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 18	Ø 20			
H	1/1																		
	1/2	0,02	0,04	0,04	0,04	0,04	0,04	0,05	0,05	0,07	0,11	0,13	0,13	0,15	0,15	0,16			
	1/10	0,02	0,05	0,05	0,05	0,05	0,05	0,07	0,07	0,09	0,14	0,16	0,16	0,18	0,18	0,21			

Note: The given cutting values are guide values, which were determined under ideal conditions.
The values have to be adapted in individual cases.

Solid carbide milling group 8 – High feed mills AL series

	a_e / D	Feed rate per cutting edge (f_z) [mm]																	
		Ø 6	Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 18	Ø 20										
N	1/1	0,04	0,05	0,08	0,09	0,11	0,13	0,16	0,18										
	3/4	0,05	0,07	0,10	0,12	0,14	0,16	0,20	0,23										
	1/10	0,08	0,11	0,16	0,19	0,22	0,25	0,31	0,36										

Note: The given cutting values are guide values, which were determined under ideal conditions.
The values have to be adapted in individual cases.

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Solid carbide milling group 9 – Square shoulder mills UM series HSC/HPC

	a_e / D	Feed rate per cutting edge (f_z) [mm]																			
		Ø 4	Ø 5	Ø 6	Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 18	Ø 20										
P	1/1	0,06	0,06	0,06	0,07	0,07	0,07	0,07	0,08	0,08	0,08										
	1/2	0,08	0,08	0,08	0,09	0,09	0,09	0,09	0,10	0,10	0,10										
	1/10	0,14	0,14	0,16	0,18	0,22	0,25	0,27	0,3	0,32	0,36										
M	1/1	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,06	0,06	0,06										
	1/2	0,06	0,06	0,06	0,07	0,07	0,07	0,07	0,08	0,08	0,08										
	1/10	0,10	0,10	0,10	0,12	0,12	0,14	0,16	0,16	0,18	0,18										
K	1/1	0,06	0,06	0,06	0,07	0,07	0,07	0,07	0,08	0,08	0,08										
	1/2	0,08	0,08	0,08	0,09	0,09	0,09	0,09	0,10	0,10	0,10										
	1/10	0,14	0,14	0,16	0,18	0,22	0,25	0,27	0,3	0,32	0,36										
H	1/1	0,045	0,045	0,045	0,053	0,053	0,053	0,053	0,06	0,06	0,06										
	1/2	0,06	0,06	0,06	0,07	0,07	0,07	0,07	0,08	0,08	0,08										
	1/10	0,10	0,10	0,10	0,12	0,12	0,14	0,16	0,16	0,18	0,18										

Note: The given cutting values are guide values, which were determined under ideal conditions.
The values have to be adapted in individual cases.

Solid carbide milling group 10 – Square shoulder mills VSM series

	a_e / D	Feed rate per cutting edge (f_z) [mm]																			
		Ø 4	Ø 5	Ø 6	Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 18	Ø 20										
P	1/1	0,03	0,04	0,05	0,05	0,05	0,05	0,06	0,06	0,07	0,08										
	1/2	0,04	0,06	0,07	0,07	0,07	0,07	0,08	0,09	0,10	0,11										
	1/10	0,05	0,08	0,09	0,09	0,09	0,09	0,11	0,12	0,14	0,15										
M	1/1	0,02	0,03	0,04	0,04	0,04	0,04	0,04	0,05	0,05	0,06										
	1/2	0,03	0,05	0,05	0,05	0,05	0,05	0,06	0,07	0,08	0,08										
	1/10	0,04	0,06	0,07	0,07	0,07	0,07	0,08	0,09	0,10	0,11										
S	1/1	0,02	0,03	0,04	0,04	0,04	0,04	0,04	0,05	0,05	0,06										
	1/2	0,03	0,05	0,05	0,05	0,05	0,05	0,06	0,07	0,08	0,08										
	1/10	0,04	0,06	0,07	0,07	0,07	0,07	0,08	0,09	0,10	0,11										

Note: The given cutting values are guide values, which were determined under ideal conditions.
The values have to be adapted in individual cases.

Solid carbide milling group 11 – Deburring cutters FM series

	a_e / D	Feed rate per cutting edge (f_z) [mm]																			
		Ø 3	Ø 4	Ø 5	Ø 6	Ø 8	Ø 10	Ø 12	Ø 14	Ø 16	Ø 18	Ø 20									
P	1/1																				
	1/2																				
	1/10	0,02	0,02	0,03	0,03	0,04	0,06	0,07	0,07	0,08	0,08	0,09									
M	1/1																				
	1/2																				
	1/10	0,02	0,02	0,02	0,02	0,03	0,05	0,06	0,06	0,06	0,06	0,07									
K	1/1																				
	1/2																				
	1/10	0,02	0,02	0,03	0,03	0,04	0,06	0,07	0,07	0,08	0,08	0,09									
N	1/1																				
	1/2																				
	1/10	0,03	0,03	0,05	0,05	0,06	0,09	0,11	0,11	0,12	0,12	0,14									

Note: The given cutting values are guide values, which were determined under ideal conditions.
The values have to be adapted in individual cases.