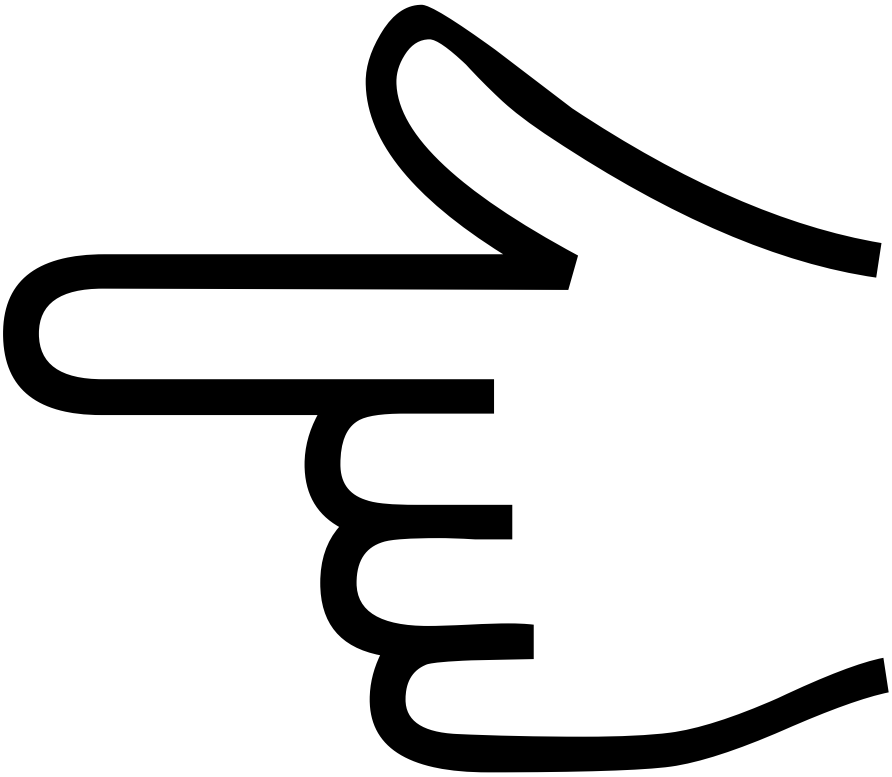
This PDF document is divided into several files

Please click here to continue

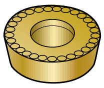


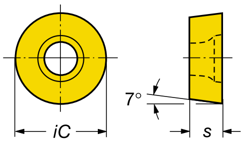
SANDVIK Coromant

Tool code	Spare parts Page	Inserts Page	Replacement article	Page
Facemills and square shoulder facemills				
Modulmill 285.1				
L285.1-125-20 160-20 200-20 250-20	A 210	A 111	L245	A 12
R/L285.1-315-20 400-20 500-20	A 210	A 111	–	
R/L285.1-125-30 160-30 200-30 250-30	A 210	A 111	R285.1-10	A 12
R/L285.1-115-30 400-30 500-30	A 210	A 111	–	
R/L285.1-125-40 160-40 200-40 250-40	A 210	A 111	R285.1-20	A 12
R/L285.1-315-40 400-40 500-40	A 210	A 111	–	
R/L285.1-125-50 160-50 200-50 250-50	A 210	A 111	R285.1-10	A 12
R/L285.1-315-50 400-50 500-50	A 210	A 111	–	
R/L285.1-125-60 160-60 200-60 250-60	A 210	A 111	R285.1-20	A 12
R/L285.1-315-60 400-60 500-60	A 210	A 111	–	
Modulmill 285.2				
L285.2-080-10 100-10 125-10 160-10 200-10 250-10	A 210	A 203	L245	A 12
L285.2-315-10	A 210	A 203	–	
R/L285.2-400-10 500-10	A 210	A 203	–	
L285.2-125-20 160-20 200-20 250-20	A 210	A 203	L245	A 12
L285.2-315-20	A 210	A 203	–	
R/L285.2-400-20 500-20	A 210	A 203	–	
L285.2-080-15 100-15 125-15 160-15 200-15 250-15 315-15	A 210	A 203	–	
R/L285.2-400-15 500-15	A 210	A 203	–	
L285.2-125-25 160-25 200-25 250-25	A 210	A 203	L245	A 12

Tool code	Spare parts Page	Inserts Page	Replacement article	Page
Facemills and square shoulder facemills				
L285.2-315-25	A 210	A 203	–	
R/L285.2-400-25 500-25	A 210	A 203	–	
L285.2-080-30 100-30 125-30 160-30 200-30 250-30	A 210	A 203	L245	A 12
L285.2-315-30	A 210	A 203	–	
R/L285.2-400-30 500-30	A 210	A 203	–	
L285.2-125-40 160-40 200-40 250-40	A 210	A 203	L245	A 12
L285.2-315-40	A 210	A 203	–	
R/L285.2-400-40 500-40	A 210	A 203	–	
L285.2-125-50 160-50 200-50 250-50 315-50	A 210	A 203	–	
R/L285.2-400-50 500-50	A 210	A 203	–	
L285.2-125-60 160-60 200-60 250-60 315-60	A 210	A 203	–	
R/L285.2-400-60 500-60	A 210	A 203	–	
CoroMill 290				
R290.90-	A 209	A 202	R290	A 20
R290- Varilock	A 209	A 25	Tailor Made	A 23
T-MAX AL				
R/L262.2	A 215	A 208	R590	A 46
R/L265.2	A 214	A 207	R590	A 46
R/L265.23	A 214	A 207	–	A 46
Slitting cutters				
T-MAX slitting cutter				
331.31-	A 212	A 205	331	A 82
Long edge milling cutters				
U-MAX R215.44				
R215.44	A 213	A 206	R390	A 26
Routers				
T-MAX aluminium router				
R775.44	A 213	A 209	R790	A 52
RA775.44	A 213	A 209	R790	A 52

Inserts for U-MAX round insert cutter R250.24 and U-MAX round insert endmill R215.24

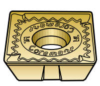


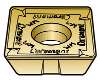


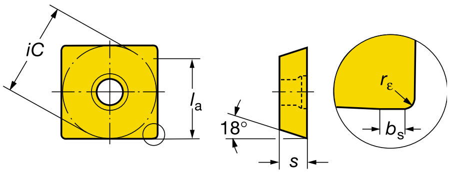
Insert code		P Steel 4015	P 4025	P 4035	P 435	M Stainless steel H10A	K Cast iron H13A	K 3015	K 3025	K 4015	K 4025	Dimensions, mm iC	s
10	RCMT 10 T3 M0	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	10	3,97
12	RCMT 12 04 M0	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	12	4,76
16	RCMT 16 06 M0	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	16	6,35
20	RCMT 20 06 M0	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	20	6,35

Ordering example: 10 pieces RCMT 10 T3 M0 4015

Inserts for CoroMill® R290.90


MM-WL


M-WM

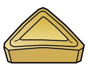


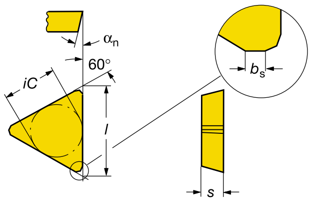
l_a = max recommended cutting depth

Insert code		P Steel 530	P 4030	P 4040	P SM30	M Stainless steel 530	M SM30	K Cast iron 3020	K 3040	K H13A	Dimensions, mm l_a	$l = iC$	s	b_s	$r_ε$
12	R290.90-12 T3 08PPM-WL				☆		☆			☆	10,7	13,29	3,97	-	0,8
	R290.90-12 T3 08PPM-WM				☆		☆			☆	10,7	13,29	3,97	-	0,8
15	R290.90-15 04M-WL	☆	☆	☆	☆	☆	☆	☆	☆	☆	12,7	15,875	4,76	2,12	0,8
	R290.90-15 04 20M-WL	☆	☆			☆					12,7	15,875	4,76	2,12	2,0
	R290.90-15 04M-WM	☆	☆	☆	☆	☆	☆	☆	☆	☆	12,7	15,875	4,76	2,12	0,8
	R290.90-15 04 20M-WM		☆					☆	☆		12,7	15,875	4,76	2,12	2,0

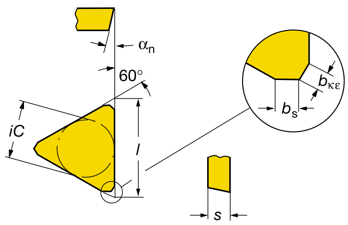
Ordering example: 10 pieces: R290.90-12 T3 08PPM-WL SM30

Inserts for Modulmill R/L282.2


TPKR




TPKN

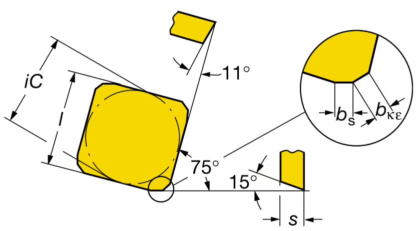


Insert code		P Steel 530	P 4030	P 4040	P S6	P SM30	M Stainless steel 530	M S6	M SM30	M 2030	M 2040	K Cast iron 3020	K 3040	K H1P	K H13A	Dimensions, mm l	iC	s	b_s	$b_{κε}$	$α_n$
16	TPKR 16 03 PP R-WH		☆	☆									☆			16,5	9,525	3,18	1,2	–	13,5°
	TPKN 16 03 PP R	☆	☆	☆	☆	☆	☆	☆	☆			☆	☆		☆	16,5	9,525	3,18	1,2	1,0	11°
22	TPKR 22 04 PD R-WH		☆	☆									☆			22,0	12,7	4,76	1,4	–	15°
	TPKR 22 04 PD L-WH		☆																		
	TPKN 22 04 PD R	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	22,0	12,7	4,76	1,4	0,7	15°
	TPKN 22 04 PD L		☆		☆	☆		☆	☆			☆			☆						

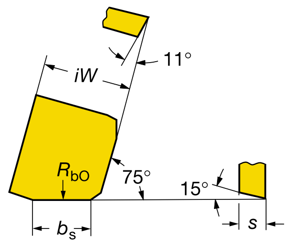
When ordering, please note that letters R and L in the ordering code indicate right hand (R) and left hand (L) styles.

Ordering example: 10 pieces TPKR 16 03 PP R-WH 4030

Inserts for Modulmill R/L285.2



Wiper

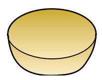


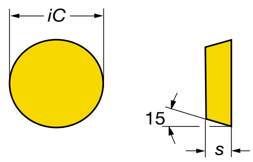
Insert code			Coromant grades P Steel								M Stainless steel						K Cast iron							Dimensions, mm			
iC	s		530	4030	4040	S6	SM30	S1P			530	S6	SM30				6090	3020	3040	H13A	H1P			l = iC	s	b_s	$b_{κε}$
12	03	SPKR 12 03 ED R-WH		☆	☆														☆					12,7	3,18	1,4	–
		SPKR 12 03 ED L-WH		☆																							
	04	SPKR 12 04 ED R-WH		☆	☆														☆					12,7	4,76	1,4	–
		SPKR 12 04 ED L-WH		☆																							
15	04	SPKR 15 04 ED R-WH		☆	☆														☆					15,875	4,76	1,4	–
		SPKR 15 04 ED L-WH		☆																							
19	04	SPKR 19 04 ED R-WH		☆	☆																			19,05	4,76	2,7	–
12	03	SPKN 12 03 ED R	☆	☆	☆	☆	☆	☆			☆	☆	☆				☆	☆	☆	☆	☆			12,7	3,18	1,4	1,0
		SPKN 12 03 ED L	☆	☆		☆	☆				☆	☆	☆					☆		☆	☆						
		SPAN 12 03 ED R				☆	☆	☆				☆	☆							☆	☆			12,7	3,18	1,4	1,0
		SPAN 12 03 ED L				☆	☆					☆	☆							☆	☆						
	04	SPKN 12 04 ED R	☆	☆	☆		☆				☆		☆					☆	☆	☆				12,7	4,76	1,4	1,0
		SPKN 12 04 ED L		☆																							
15	04	SPKN 15 04 ED R	☆	☆	☆	☆	☆				☆	☆	☆					☆	☆	☆				15,875	4,76	1,4	1,0
		SPKN 15 04 ED L		☆			☆						☆					☆									
		SPAN 15 04 ED R																		☆	☆			15,875	4,76	1,4	1,0
19	04	SPKN 19 04 ED R					☆						☆											19,05	4,76	2,7	1,0
		Wiper																						iW	s	b_s	R_{bo}
12	03	SPEX 12 03 ED R-1	☆					☆			☆										☆			12,7	3,18	10	500
		SPEX 12 03 ED L-1	☆					☆													☆						
	04	SPEX 12 04 ED R-1	☆					☆			☆										☆			12,7	4,76	10	500
		SPEX 12 04 ED L-1	☆					☆			☆										☆						
15	04	SPEX 15 04 ED R-1	☆					☆			☆										☆			15,875	4,76	10	500
		SPEX 15 04 ED L-1	☆					☆			☆										☆						
19	04	SPEX 19 04 ED R-1						☆													☆			19,05	4,76	10	500
		19 04 ED L-1						☆																			

When ordering, please note that letters R and L in the ordering code indicate right hand (R) and left hand (L) styles.

Ordering example: 10 pieces SPKR 12 03 ED R-WH 4030

Inserts for Modulmilll R280.6

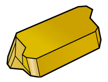


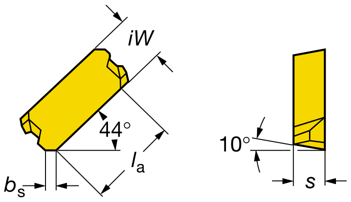


Insert code		Coromant grades P Steel							M Stainless steel						K Cast iron						Dimensions, mm	
iC									H10A						H13A						iC	s
19	RDHN 19 04 00								☆						☆						19,05	4,76

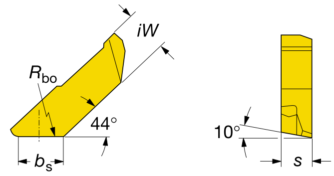
Ordering example: 10 pieces: RDHN 19 04 00 H10A

Inserts for T-MAX 45 R/L260.7





Wiper

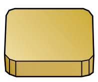


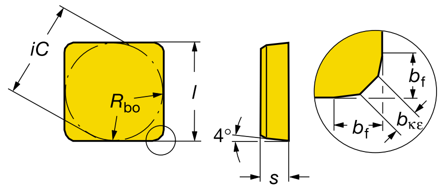
	Insert code	Coromant grades P Steel							M Stainless steel							K Cast iron							Dimensions, mm			
		4020	4030	4040	SM30				SM30							3040	H1P						l_a	s	iW	b_s
18	LNCX 18 06 AZ L-11	☆	☆	☆	☆				☆							☆							18,77	6,4	10	2,0
																							18,62	6,4	10	2,0
																							18,62	6,8	10	2,2
	Wiper																						iW	s	b_s	R_{bo}
18	LNCX 18 06 AZ L-1W																☆						9,28	10,5	10	400

When ordering, please note that letters R and L in the ordering code indicate right hand (R) and left hand (L) styles.

Ordering example: 10 pieces LNCX 18 06 AZ L-11 4020

Inserts for AUTO-F R/L260.4, R/L260.42

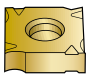




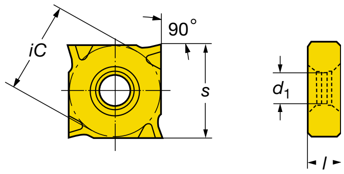
	Insert code	Coromant grades P Steel							M Stainless steel							K Cast iron							Dimensions, mm				
																H1P	H13A						l=iC	s	b_f	$b_{\kappa\varepsilon}$	R_{bo}
12	SBAN 12 03 ZZ															☆	☆						12,7	3,18	1,2	0,7	2960

Ordering example: 10 pieces SBAN 12 03 ZZ H1P

Inserts for slitting cutter 331.31



331.31

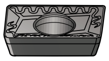


Insert code		Coromant grades P Steel SM30	Coromant grades M Stainless steel H13A	M SM30	Coromant grades K Cast iron H13A	Dimensions, mm l	iC	s	d_1
3,0	331.31-3012-31	☆	☆	☆	☆	3,0	12,7	12,3	5,0
3,5	331.31-3512-31	☆	☆	☆	☆	3,5	12,7	12,3	5,0
4,5	331.31-4512-31	☆	☆	☆	☆	4,5	12,7	12,3	5,0
6,5	331.31-6512-31	☆	☆	☆	☆	6,5	12,7	12,3	5,0

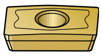
Ordering example: 10 pieces 331.31-3012-31 SM30

A

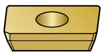
Inserts for U-MAX long edge milling cutter R215.44



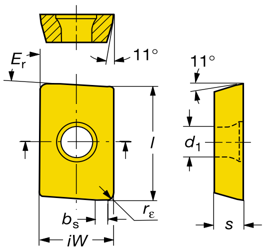
R215.44 -WL



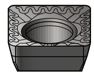
R215.44 -WH



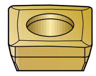
R215.44 -AAH
-AAM



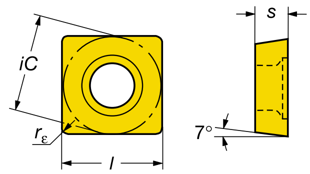
Tolerances, mm s = ±0,025
iW = ±0,05 (-WL, -WM -AAM)
iW = ±0,013 (AAH)



SPMT -WL



SPMT -WH



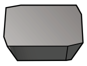
A

Size	Insert code	P 530	P 4030	P 4040	P SM30	P	M 530	M 4040	M	M	M	K H13A	K 3040	N	N	S H10F	S	H	H	l	iW	d_1	s	b_s	$r_ε$	E_r°
09	R215.44-090204M-WL		☆	☆	☆			☆				☆	☆												0,4	
	090208M-WL	☆	☆	☆	☆		☆	☆				☆	☆												0,8	
	090216M-WL											☆								9,5	6,3	2,9	2,38	–	1,6	87
	090224M-WL											☆													2,4	
	090231M-WL				☆																				3,1	
	R215.44-090208M-WH		☆	☆	☆			☆												9,5	6,3	2,9	2,38	–	0,8	
	R215.44-090208-AAM				☆															9,5	6,3	2,9	2,38	–	0,8	87
	R215.44-090208-AAH											☆				☆				9,5	6,3	2,9	2,38	–	0,8	87
	090231-AAH															☆									3,1	
15	R215.44-15T304M-WL		☆	☆	☆			☆				☆	☆											–	0,4	
	15T308M-WL	☆	☆	☆	☆		☆	☆				☆	☆											–	0,8	
	15T316M-WL		☆	☆				☆				☆	☆			☆								–	1,6	
	15T324M-WL		☆	☆				☆					☆											–	2,4	
	15T331M-WL		☆	☆				☆				☆	☆							15,4	9,5	4,0	3,97	–	3,1	87
	15T3PPM-WL			☆				☆				☆												1,4	0,4	
	R215.44-15T308M-WH		☆	☆	☆			☆												15,4	9,5	4,0	3,97	–	0,8	87
	15T3PPM-WH			☆				☆																1,4	0,4	
	R215.44-15T308-AAM				☆															15,4	9,5	4,0	3,97	–	0,8	87
	15T331-AAM				☆																				3,1	
	R215.44-15T308-AAH											☆				☆				15,4	9,5	4,0	3,97	–	0,8	87
	15T331-AAH											☆				☆									3,1	

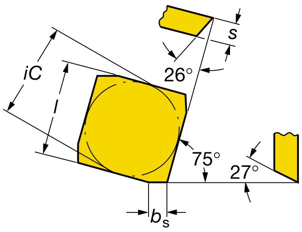
Size	Insert code	P 530	P 4030	P 4040	P SM30	P	M 530	M 4040	M	M	M	K H13A	K 3040	N	N	S H10F	S	H	H	iC = l	s	$r_ε$
09	SPMT 09T308-WL		☆	☆	☆			☆				☆				☆				9,5	3,97	0,8
	SPMT 09T308-WH		☆	☆	☆			☆				☆								9,5	3,97	0,8

Ordering example: 10 pieces R215.44-090204M-WL 4030

Inserts for aluminium machining cutters – 265.2 and 265.23

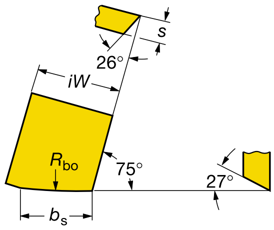


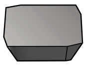
SFAN



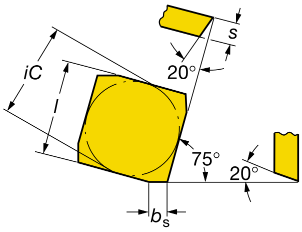
Wiper

SFCX

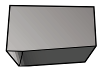




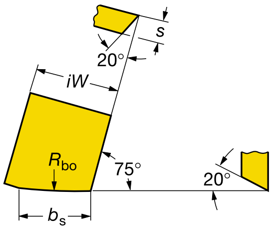
SECN



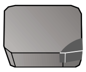
Wiper



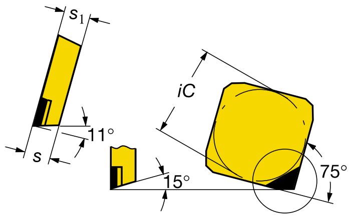
SECX

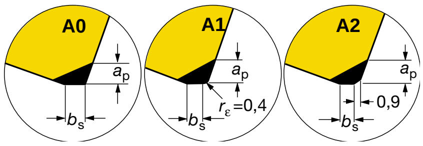


Diamond tipped

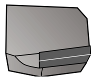


SPCN

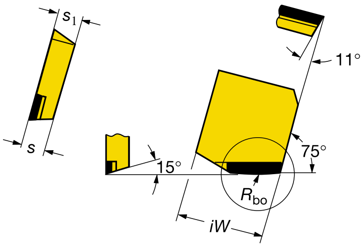


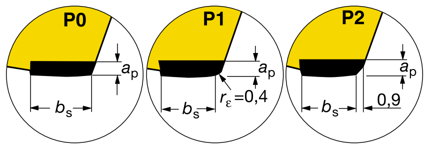


Wiper



SPCX





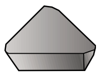
	Insert code	Coromant grades N Aluminium H13A	CD10	H10	Dimensions, mm $l=iC$	iW	s	b_s	R_{bo}		
12	SFAN 12 03 EF R	☆		☆	12,7	–	3,18	2,5	–		
	12 03 EF L	☆		☆							
	SFCX 12 03 EF R-1			☆	–	12,7	3,18	10	500		
	12 03 EF L-1			☆							
12	SECN 12 03 EE R	☆		☆	12,7	–	3,18	2,5	–		
	SECX 12 03 EE R-1			☆	–	12,7	3,18	10	500		
	Diamond tipped				iC	iW	s	s_1	a_p	b_s	R_{bo}
12	SPCN 12 03 ED R-A0		☆		12,7	–	3,18	3,25	2,5	2,6	–
	12 03 ED L-A0		☆								
	12 03 ED R-A1		☆		12,7	–	3,18	3,25	2,5	2,3	–
	12 03 ED L-A1		☆								
	12 03 ED R-A2		☆		12,7	–	3,18	3,25	2,5	1,9	–
	12 03 ED L-A2		☆								
	SPCX 12 03 ED R-P0		☆		–	12,7	3,18	3,25	1,5	6,0	375
	12 03 ED L-P0		☆								
	12 03 ED R-P1		☆		–	12,7	3,18	3,25	1,5	5,6	375
	12 03 ED L-P1		☆								
	12 03 ED R-P2		☆		–	12,7	3,18	3,25	1,5	5,3	375
	12 03 ED L-P2		☆								

Ordering example: 10 pieces SFAN 12 03 EF R H13A

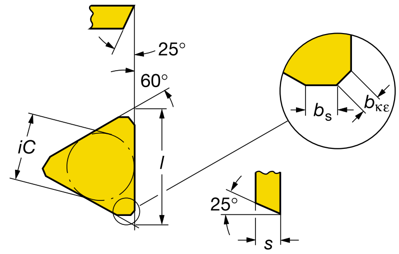
When ordering, please note that letters R and L in the ordering code indicate right hand (R) and left hand (L) styles.

For more information about insert seat, see page A 171.

Inserts for T-MAX AL R/L262.2



TFAN

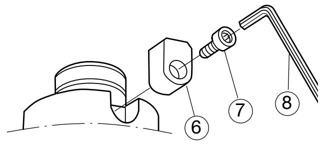


	Insert code	Coromant grades N Aluminium H10	Dimensions, mm l	iC	s	b_s	$b_{\kappa\varepsilon}$
22	TFAN 22 03 PF R	☆	22,0	12,7	3,18	2,5	0,7
	22 03 PF L	☆					

Ordering example: 10 pieces TFAN 22 03 PF R H10

When ordering, please note that letters R and L in the ordering code indicate right hand (R) and left hand (L) styles.

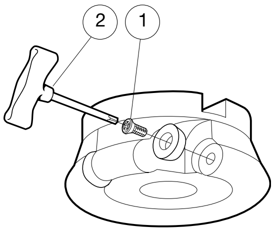
T-MAX 145, T-MAX 190, T-MAX 290, U-MAX R252.44, U-MAX R250.24



Varilock coupling

Varilock size	6 Driving key	7 Screw	8 Key (mm)
50	5631 010-01	3212 010-257	174.1-864 (3,0)
63	5631 010-02	3212 010-358	3021 010-050 (5,0)
80	5631 010-03	3212 010-360	3021 010-050 (5,0)

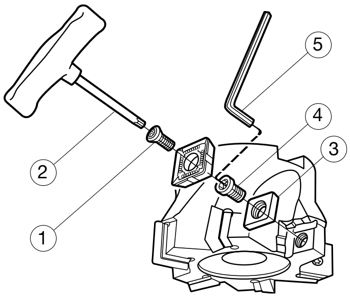
R250.24



Cutter	D_c mm	1 Insert screw	2 Key (Torx Plus)	Torque value Nm	Molycote
R250.24- ‘	**40 ▼ 80**	5513 020-09	5680 048-01 (15IP)	3,0	5683 010-01

Ordering example: 10 pieces 5513 020-09

R290.90



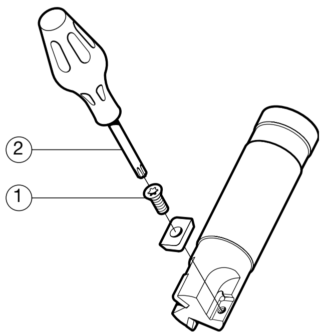
Cutter	D_c mm	1 Screw	2 Key (Torx Plus)	3 Shim	4 Shim screw	5 Key (mm)	Arbor[1)] screw
R290.90	**50 ▼ 250**	5513 020-32	5680 048-04 (20IP)	5322 460-01	5512 090-02	3021 010-040 (4,0)	5512 060-15

[1)] Only for cutter Ø 50 mm.

Ordering example: 10 pieces 5513 020-06

U-MAX endmills

R215.44



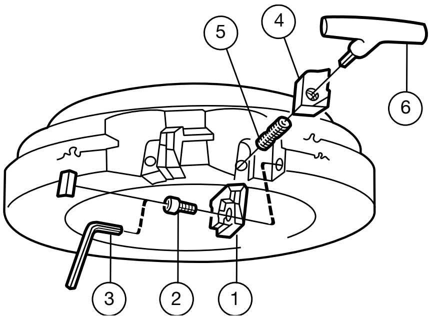
Cutter	D_c mm		1 Screw	2 Key (Torx Plus)	**Accessories[1)]** Torx bit	Torque value (Nm)	Torque wrench	Molykote
R215.44-	**12 ▼ 16**	**-09**	5513 020-21	5680 046-03 (7IP)	5680 085-02	0,9	5680 086-02	5683 010-01
R215.44-	**20**	**-09**	5513 020-03	5680 046-03 (7IP)	5680 085-02	0,9	5680 086-02	5683 010-01
R215.44-	**25**	**-15**	5513 020-16	5680 046-05 (10IP)	5680 085-05	2,0	5680 086-05	5683 010-01
R215.44-	**32 ▼ 40**	**-15**	5513 020-30	5680 046-05 (10IP)	5680 085-05	2,0	5680 086-05	5683 010-01

[1)] Accessories, must be ordered separately.

Ordering example: 10 pieces 5513 020-21

Modulmill

R/L260.22, R/L285.1, R/L285.2



A

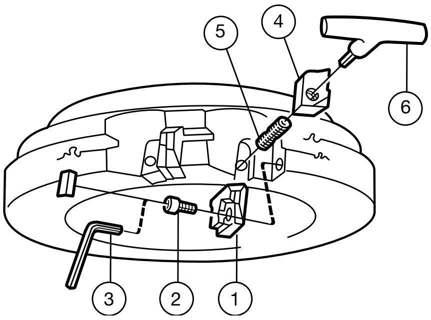
Cutter		Ø mm			1 Seat	2 Screw	3 Key (mm)	4 Wedge	5 Screw	6 Key (mm)
45°	R/L260.22-	400 ▼ 500	-15	R L	260.22-390 260.22-391	5512 041-01	265.2-818 (2,38)	260.22-292A[1] 260.22-293A[1]	5516 010-01[1]	265.2-821 (4,0)
	R/L260.22-	400 ▼ 500	-25	R L	260.22-390 260.22-391	5512 041-01	265.2-818 (2,38)	260.22-290A[1] 260.22-291A[1]	5516 010-01[1]	265.2-821 (4,0)
	R/L260.22-	400 ▼ 500	-30	R L	260.22-392 260.22-393	265.2-824	265.2-818 (2,38)	260.22-292A[1] 260.22-293A[1]	5516 010-01[1]	265.2-821 (4,0)
	R/L260.22-	400 ▼ 500	-40	R L	260.22-392 260.22-393	265.2-824	265.2-818 (2,38)	260.22-290A[1] 260.22-291A[1]	5516 010-01[1]	265.2-821 (4,0)
75° Negative	L285.1-	080 ▼ 100	-10	L	285.1-355	265.2-824	265.2-818 (2,38)	285.1-231	5516 010-02	265.2-817 (3,0)
	R/L285.1-	125 ▼ 500	-10	R L	285.1-356 285.1-357	265.2-824	265.2-818 (2,38)	285.1-232 285.1-233	5516 010-01	265.2-821 (4,0)
	R/L285.1-	125 ▼ 500	-20	R L	285.1-356 285.1-357	265.2-824	265.2-818 (2,38)	285.1-234 285.1-235	5516 010-01	265.2-821 (4,0)
75° Positive	L285.2-	080 ▼ 100	-10	L	285.2-341	265.2-824	265.2-818 (2,38)	285.2-215	5516 010-02	265.2-817 (3,0)
	R/L285.2-	125 ▼ 500	-10	R L	285.2-342 285.2-343	265.2-824	265.2-818 (2,38)	285.2-216 285.2-217	5516 010-01	265.2-821 (4,0)
	L285.2-	080 ▼ 100	-15	L	285.2-347	265.2-824	265.2-818 (2,38)	285.2-215	5516 010-02	265.2-817 (3,0)
	R/L285.2-	125 ▼ 500	-15	R L	285.2-348 285.2-349	265.2-824	265.2-818 (2,38)	285.2-216 285.2-217	5516 010-01	265.2-821 (4,0)
	R/L285.2-	125 ▼ 500	-20	R L	285.2-342 285.2-343	265.2-824	265.2-818 (2,38)	285.2-218 285.2-219	5516 010-01	265.2-821 (4,0)
	R/L285.2-	125 ▼ 500	-25	R L	285.2-348 285.2-349	265.2-824	265.2-818 (2,38)	285.2-218 285.2-219	5516 010-01	265.2-821 (4,0)
	L285.2-	080 ▼ 100	-30	L	285.2-337	265.2-824	265.2-818 (2,38)	285.2-221	5516 010-02	265.2-817 (3,0)
	R/L285.2-	125 ▼ 500	-30	R L	285.2-350 285.2-351	265.2-824	265.2-818 (2,38)	285.2-222 285.2-223	5516 010-01	265.2-821 (4,0)
	R/L285.2-	125 ▼ 500	-40	R L	285.2-350 285.2-351	265.2-824	265.2-818 (2,38)	285.2-224 285.2-225	5516 010-01	265.2-821 (4,0)
	R/L285.2-	125 ▼ 500	-50	R L	285.2-352 285.2-353	265.2-824	265.2-818 (2,38)	285.2-222 285.2-223	5516 010-01	265.2-821 (4,0)
	R/L285.2-	125 ▼ 500	-60	R L	285.2-352 285.2-353	265.2-824	265.2-818 (2,38)	285.2-224 285.2-225	5516 010-01	265.2-821 (4,0)

[1]Tightening torque for wedge screw 6 Nm.

Ordering example: 10 pieces 260.22-390

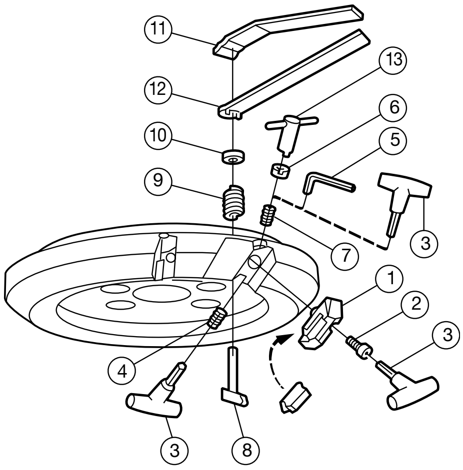
Modulmill

R/L282.2, R280.6



T-MAX 45

L260.7



Cutter		Ø mm		1 Seat	2 Screw	3 Key (mm)	4 Wedge	5 Screw	6 Key (mm)
90°	R282.2-	400 ▼ 500	-10 R	282.2-372	5512 041-01	265.2-818 (2,38)	282.2-242	5516 010-01	265.2-821 (4,0)
	R282.2-	400 ▼ 500	-20 R	282.2-372	5512 041-01	265.2-818 (2,38)	282.2-244	5516 010-01	265.2-821 (4,0)
	L282.2-	080 ▼ 100	-30 L	282.2-311	265.2-824	265.2-818 (2,38)	285.2-221	5516 010-02	265.2-817 (3,0)
	R/L282.2-	125 ▼ 500	-30 R L	282.2-312 282.2-313	265.2-824	265.2-818 (2,38)	285.2-222 285.2-223	5516 010-01	265.2-821 (4,0)
	R/L282.2-	125 ▼ 500	-40 R L	282.2-312 282.2-313	265.2-824	265.2-818 (2,38)	285.2-224 285.2-225	5516 010-01	265.2-821 (4,0)
Positive	R280.6-	080 ▼ 100	-30 R	280.6-306	265.2-824	265.2-818 (2,38)	285.2-220	5516 010-02	265.2-817 (3,0)
	R280.6-	125 ▼ 250	-30 R	280.6-308	265.2-824	265.2-818 (2,38)	285.2-222	5516 010-01	265.2-821 (4,0)
	R280.6-	125 ▼ 250	-40 R	280.6-308	265.2-824	265.2-818 (2,38)	285.2-224	5516 010-01	265.2-821 (4,0)

Ordering example: 10 pieces 282.2-372

Cutter	Ø mm		1 Seat	2 Screw	3 Key (mm)	4 Screw	5 Key (mm)	6 Nut	7 Screw
L260.7-	100 ▼ 400	-30	260.7-831M	3212 010-310 (4,0)	265.2-821	3214 010-409 (4,0)	3021 010-040	260.7-842	3214 010-408
L260.7-	125 ▼ 400	-40							

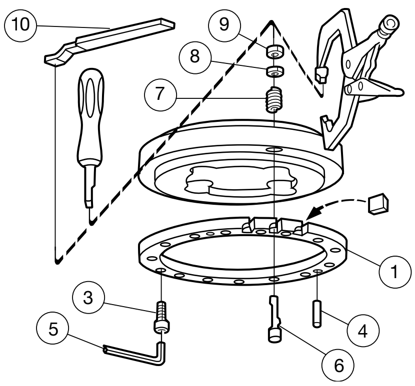
Cutter	Ø mm		8 Clamp	9 Spring	10 Bayonet washer	11 Indexing lever	Seat for wiper inserts	12[2)] Clamp removal key for bayonet washer	13[2)] Locking key for relocking shim location in event of the cutter re-setting
L260.7-	100 ▼ 400	-30	260.7-821	260.7-841	260.7-840	260.7-856M	5321-046-02	260.7-857[1)]	260.7-855M
L260.7-	125 ▼ 400	-40							

[1)]For cutters with diameter 100 mm, use key 260.7-858.
[2)]Accessories, must be ordered separately.

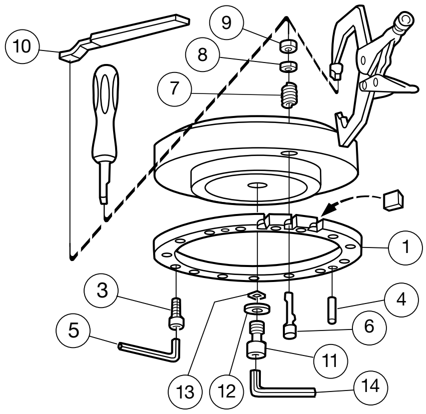
Ordering example: 10 pieces 260.7-830M

AUTO-F

R/L260.4

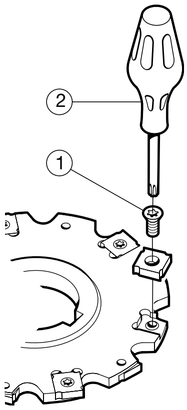


R/L260.42 Cap design



T-MAX slitting cutter

331.31



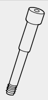
Cutter D_c mm	1 Seating ring	3 Screw	4 Taper pin	5 Key (mm)	6 Wedge	7 Spring
R/L260.4- 080A ▼ 200A -10 R/L	R260.4-D[1)] M-80 L260.4-D[1)] M-80	3212 010-349	3112 010-563	3021 010-040 (4,0)	260.4-821	5561 001-01
R/L262.42- 250A ▼ 500A -10 R/L	R260.4-D[1)] M-80 L260.4-D[1)] M-80	3212 010-349	3112 010-563	3021 010-040 (4,0)	260.4-821	5561 001-01

Cutter D_c mm	8 Cup spring	9 Bayonet washer	10 Indexing lever	11 Screw[2)]	12 Washer	13 Lock ring	14 Key (mm)
R/L260.4- 080A ▼ 200A -10 R/L	3846 010-033	260.4-831M	260.3-833M	–	–	–	–
R/L260.42- 250A ▼ 500A -10 R/L	3846 010-033	260.4-831M	260.3-833M	260.31-831	3411 011-170	260.31-840	3021 010-140 (14,0)

1) D = D_c = Cutter diameter.
2) Torque ≤120 Nm

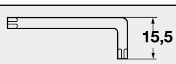
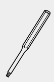
Ordering example: 2 pieces R260.4-080A M-80

Accessories[1)]

Cutter	 Location screw For location seating ring during assembly	 Key (mm)	 Puller screw For removing seating	 Key (mm)	 Wedge key For removing bayonet washer
R/L260.4, R/L260.42 R/L	68/781	3021 010-040 (4,0)	3214 010-309	174.1-863 (2,5)	260.3-835

1) Accessories, must be ordered separately.

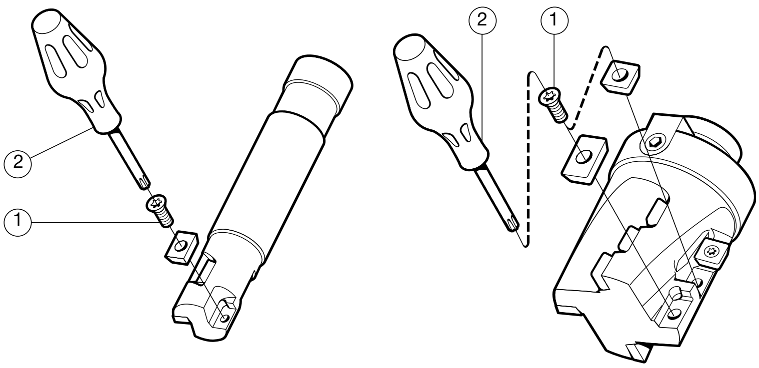
Ordering example: 2 pieces 68/781

Insert size 331.31	1 Screw for insert (length, mm)	2 Key (Torx)	 Key (Torx)	 Torx bit[1)]	 Torque wrench[1)]
3,0 3,5 4,5 6,5	5513 015-03 (4,15) 5513 015-04 (5,2) 5513 015-05 (7,1) 5513 015-06 (9,1)	5680 046-04 (9IP)	5680 043-11 (9IP)	5680 085-04	5680 086-04

1)Accessories, must be ordered separately.

Ordering example: 10 pieces 5513 015-03

U-MAX long edge milling cutter R215.44



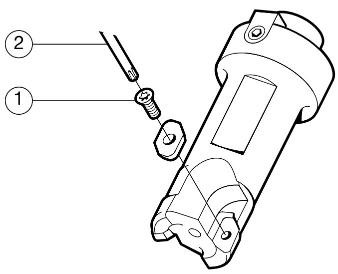
Spare parts for the Varilock coupling, see page A 209.

Cutter	D_c mm	1 Screw	2 Key (Torx Plus)	Torx bit[1]	Torque value (Nm)	Torque[1] wrench	Molykote
R215.44-	20	5513 020-21	5680 046-03 (7IP)	5680 085-02	0,9	5680 086-02	5683 010-01
R215.44-	25 ▼ 32	5513 020-03	5680 046-03 (7IP)	5680 085-02	0,9	5680 086-02	5683 010-01
R215.44-	40 ▼ 50	5513 020-30	5680 046-05 (10IP)	5680 085-05	2,0	5680 086-05	5683 010-01

[1] Accessories, must be ordered separately.

Ordering example: 10 pieces 5513 020-21

T-MAX aluminium router R775.44 and RA775.44



Spare parts for the Varilock coupling, see page A 209.

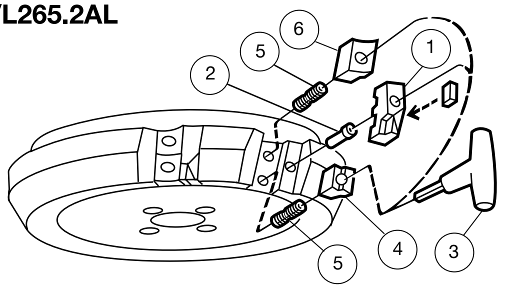
Cutter R775.44 Insert size by radius	Radius r_ε	1 Screw	2 Key (Torx Plus)	Torx bit[1]	Torque value (Nm)	Torque[1] wrench	Molykote
16	x 0,5 x 3,1 x 5,0	5513 020-02	5680 046-02 (15IP)	5680 085-06	3,0	5680 086-06	5683 010-01
22	x 0,5 x 3,1 x 6,35	5513 020-07	5680 048-04 (20IP)	–	5,0	–	5683 010-01
22	x12,7	5513 020-08	5680 046-07 (25IP)	–	7,5	–	5683 010-01

[1] Accesories, must be ordered separately.

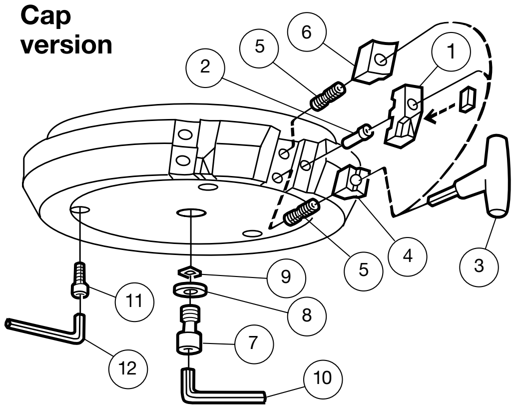
Ordering example: 10 pieces 5513 020-02

T-MAX AL facemill

R/L265.2AL



R/L265.23AL Cap version



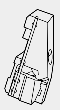
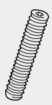
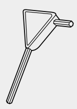
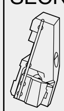
Cutter	1 Insert seat	2 Eccentric pin	3 Key (mm)	4 Wedge for insert	5 Screw	6 Wedge for seat
080E R R/L265.2- ▼ -20AL 100E L	265.2-872-1 265.2-873-1	265.2-874	265.2-821 (4,0)	265.2-866 265.2-867	269-823	265.2-870
125ME R R/L265.2- ▼ -20AL 500ME L	265.2-872-1 265.2-873-1	265.2-874	265.2-821 (4,0)	265.2-868 265.2-869	269-823	265.2-871
250ME R R/L265.23- ▼ -20AL 500ME L	265.2-872-1 265.2-873-1	265.2-874	265.2-821 (4,0)	265.2-868 265.2-869	269-823	265.2-871

Cutter	7 Screw[1]	8 Washer	9 Locking ring	10 Key (mm)	11 Screw	12 Key (mm)
080E R R/L265.2- ▼ -20AL 100E L	-	–	–	–	–	–
125ME R R/L265.2- ▼ -20AL 500ME L	-	–	–	–	–	–
250ME R R/L265.23- ▼ -20AL 500ME L	260.31-831	3411 011-170	260.31-840	3021 010-140 (14,0)	3212 010-414	3021 010-060 (6,0)

[1] Torque ≤120 Nm

Ordering example: 10 pieces 265.2-872-1

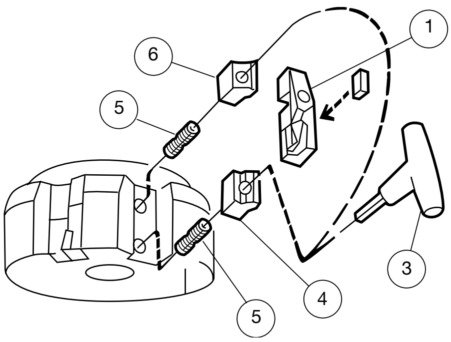
Optional parts

Cutter	For diamond inserts SPCN, SPCX  Insert seat	 Screw for radial setting	 Key (mm)	For 20° inserts SECN, SECX  Insert seat
080E R R/L265.2- ▼ -20AL 100E L	5321 036-011H 5321 036-021H	3214 010-255	170.3-860 (2,0)	5321 034-011 5321 034-021
125ME R R/L265.2- ▼ -20AL 500ME L	5321 036-011H 5321 036-021H	3214 010-255	170.3-860 (2,0)	5321 034-011 5321 034-021
250ME R R/L265.23- ▼ -20AL 500ME L	5321 036-011H 5321 036-021H	3214 010-255	170.3-860 (2,0)	5321 034-011 5321 034-021

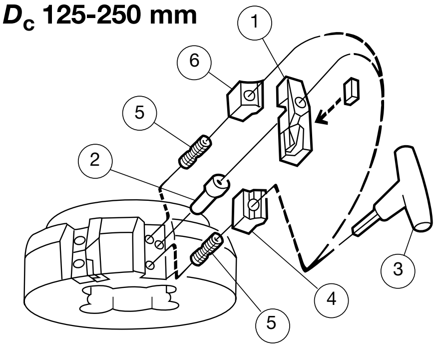
Ordering example: 10 pieces 5321 036-011H

T-MAX square shoulder facemill R/L262.2AL

D_c 80-100 mm



D_c 125-250 mm



Cutter D_c	1 Insert seat	2 Eccentric pin	3 Key (mm)	4 Wedge for insert	5 Screw	6 Wedge for seat
R/L262.2- 080A R ▼ -20AL 100A L	262.2-872-1 262.2-873-1	–	5680 012-01 (4,0)	265.2-866 265.2-867	269-827	262.2-874
R/L262.2- 125ME R ▼ -10AL 250ME L	262.2-872-1 262.2-873-1	265.2-874	265.2-821 (4,0)	265.2-866 265.2-867	269-827	262.2-874

Ordering example: 2 pieces 262.2-872-1

Servicing hints

T-Max AL cutters can be used either as fixed pocket or as adjustable cutters. The seat wedge (5) will secure the basic setting, but if a further setting of the insert is required the procedure is as follows:

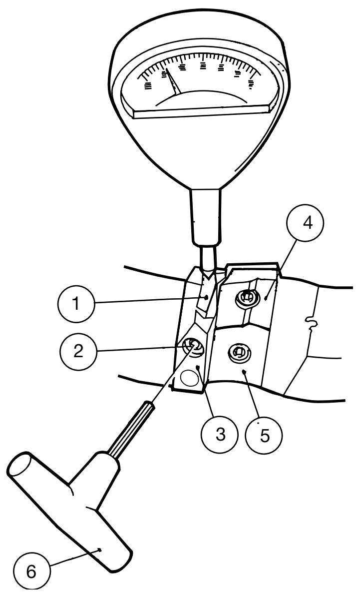
a. Set all seats (3) in a low position.
Clamp insert (1) loosely with the insert wedge (4).
Leave the seat wedge (5) unclamped.

b. Turn the eccentric pin (2) using the key (6) to move the seat and insert to a zero reading on the indicator.

c. Clamp the seat with wedge (5) and reclamp the insert by loosening and tightening the wedge (4).

Note. Push the insert radially into the pocket while clamping.

d. The setting should now be accurate. In case of a deviation from a zero reading, repeat the above procedure setting again and compensate by setting to a plus or minus reading before clamping the seat with the wedge (5).



How to choose cutting data

Example on how to find the values when calculating spindle speed (n) and table feed (v_f):

Conditions:	Cutter-	R245-125Q40-12M	
	Insert-	R245-12 T3 M-PM	GC4030
	Workpiece material:	SS1672-08	HB =180

Formulas to be used:

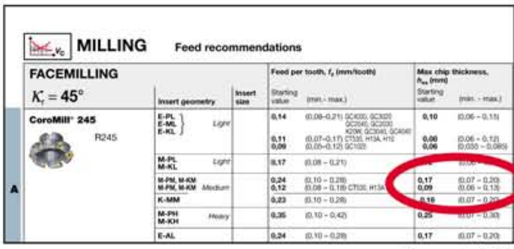
$$n = \frac{v_c \times 1000}{\pi \times D_c} \qquad v_f = z_n \times n \times f_z \qquad f_z = \frac{h_{ex}}{\sin \kappa_r}$$

v_c In order to get v_c, the max chip thickness (h_{ex}) for an operation and the Coromant Material Classification (CMC) code is needed.

The value h_{ex} is given in table on page A 222, Feed recommendations.

The cutter selected has a 45° entering angle (κ_r) and PM insert geometry will be used.

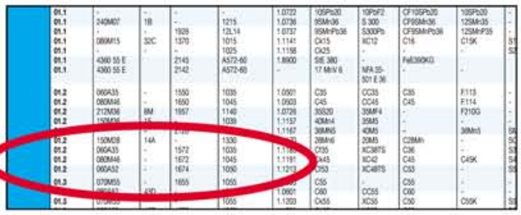
Max chip thickness (h_{ex}) for the operation is 0,17 mm



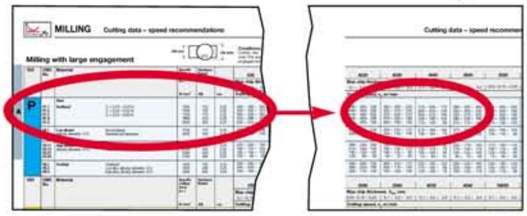
Page A 222

For the CMC code see material cross reference list in chapter E.

The material is SS1672-08 and corresponding CMC code is 01.2

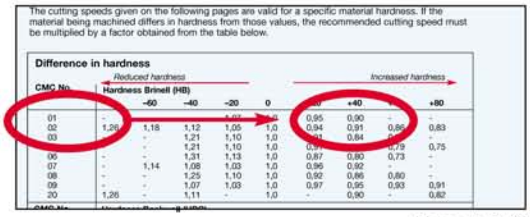

Page E 5

The cutting speed v_c is approx. 283 m/min for CMC 01.2 (between 325 and 270 m/min for h_{ex} = 0,10 and 0,20 mm respectively), see page A 229.


Page A 228

This cutting speed is valid for hardness HB150. If your hardness is HB180 a compensation factor of 0,92 for the deviation of +30 units is found on page A 253.

The compensated cutting speed becomes 0,925 x 283 m/min ≈ 262 m/min.



Page A 253

D_c Cutter diameter can be found in table on ordering page A 14, The cutter selected has a diameter, D_c, of 125 mm.

z_n Number of teeth is found on the same page and z_n is in this case 8.

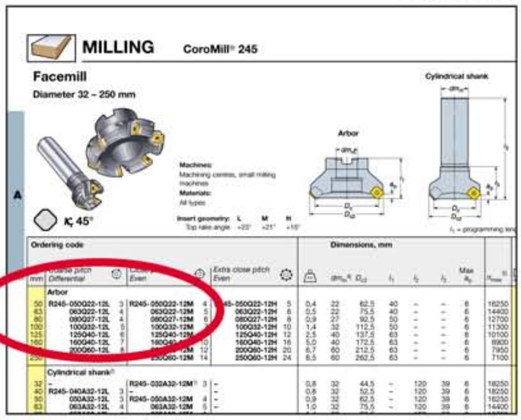
κ_r You will find the entering angle on the same ordering page. The selected cutter has a 45° entering angle.

f_z Feed per tooth for the cutter and selected insert geometry, can be found on page A 222.

Feed per tooth $f_z = \frac{0{,}17}{\sin 45°} = 0{,}24$ mm

n Revolutions per minute $n = \frac{262 \times 1000}{\pi \times 125} = 667$ rpm

v_f Table feed per minute $v_f = 8 \times 667 \times 0{,}24 = 1281$ mm/min



Page A 14

A

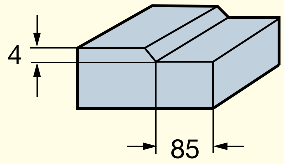
CALCULATE CUTTING DATA

FEED RECOMMENDATIONS

SPEED RECOMMENDATIONS

Facemilling

Example



Cutter:	R245-125Q40-12M	$z_n = 8$
Insert:	R245-12 T3 M-PM	GC4030
Workpiece material:	SS 1672-08 HB =150	CMC 01.2
a_e:	85 mm	
a_p:	4 mm	
κ_r	45°	

Calculate spindle speed (n)

$$n = \frac{v_c \times 1000}{\pi \times D_c}$$

$$n = \frac{283 \times 1000}{\pi \times 125} \approx 721 \text{ rpm}$$

To get v_c, first find h_{ex} value for -PM geometry on page A 222. The cutting speed v_c for h_{ex}= 0,17 mm is 283 m/min (between 325 and 270 m/min), see page A 229.

Calculate table feed (v_f)

$$v_f = z_n \times n \times f_z$$

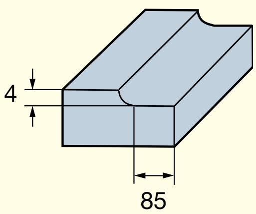
$$v_f = 8 \times 721 \times 0{,}24 \approx 1384 \text{ mm/min}$$

$$f_z = \frac{h_{ex}}{\sin \kappa_r}$$

$$f_z = \frac{0{,}17}{\sin 45°} \approx 0{,}24 \text{ mm/tooth}$$

Facemilling with round inserts

Example



Cutter:	R200-109Q32-16M	$z_n = 6$
Insert:	RCKT 16 06 M0-PM	GC4030
Workpiece material:	SS 1672-08 HB = 150	CMC 01.2
a_e:	85 mm	
a_p:	4 mm	

Calculate spindle speed (n)

$$n = \frac{v_c \times 1000}{\pi \times D_e} = \frac{283 \times 1000}{\pi \times 123} \approx 732 \text{ rpm}$$

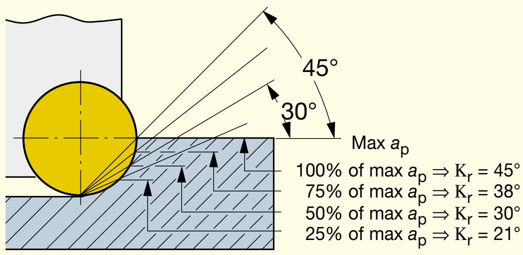
To get v_c, first find h_{ex} value for -PM geometry on page A 224. The cutting speed v_c for h_{ex}= 0,17 mm is 283 m/min (between 325 and 270 m/min), see page A 229.

$$D_e = D_c + \sqrt{iC^2 - (iC - 2a_p)^2} \qquad D_e = 109 + \sqrt{16^2 - (16 - 2 \times 4)^2} \approx 123 \text{ mm}$$

Calculate table feed (v_f)

$$v_f = n \times f_z \times z_n = 732 \times 0{,}34 \times 6 \approx 1493 \text{ mm/min}$$

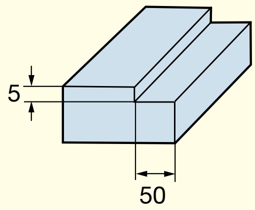
$$f_z = \frac{h_{ex}}{\sin \kappa_r} \qquad f_z = \frac{0{,}17}{\sin 30°} = 0{,}34 \text{ mm/tooth}$$



A

Slotting/facemilling with 90° entering angle

Example



Cutter:	R390-063Q22-17M	$z_n = 5$
Insert:	R390-17 04 08M-PM	GC1025
Workpiece material:	SS 1672-08 HB = 150	CMC 01.2
a_e:	50 mm	
a_p:	5 mm	

Calculate spindle speed (n)

$$n = \frac{v_c \times 1000}{\pi \times D_c} = \frac{250 \times 1000}{\pi \times 63} \approx 1263 \text{ rpm}$$

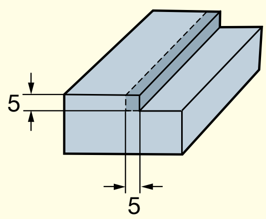
To get v_c, first find h_{ex} value for -PM geometry on page A 223. The cutting speed v_c for h_{ex} 0,15 is 250 m/min (between 280 and 230 m/min), see page A 228.

Calculate table feed (v_f)

$$v_f = n \times f_z \times z_n = 1263 \times 0{,}15 \times 5 = 947 \text{ mm/min}$$

Shoulder milling with 90° entering angle

Example



Cutter:	R390-063Q22-17M	$z_n = 5$
Insert:	R390-17 04 08M-PM	GC1025
Workpiece material:	SS 1672-08 HB = 150	CMC 01.2
a_e:	5 mm	
a_p:	5 mm	

Calculate spindle speed (n)

$$n = \frac{v_c \times 1000}{\pi \times D_c} = \frac{318 \times 1000}{\pi \times 63} \approx 1607 \text{ rpm}$$

To get v_c, first find h_{ex} value for -PM geometry on page A 223. The cutting speed v_c for h_{ex} 0,15 is 318 m/min (between 325 and 310 m/min), see page A 232.

Calculate table feed (v_f)

For sidemilling the feed can be increased with a compensation factor.

$$v_f = k1 \times z_n \times n \times f_z$$

$$v_f = 1{,}82 \times 5 \times 1607 \times 0{,}15 \approx 2193 \text{ mm/min}$$

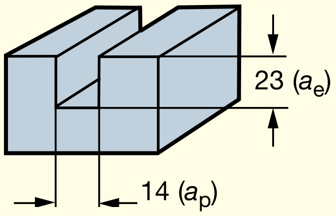
Find the compensation factor, k1, in the table below by calculating D_c/a_e

$$\frac{D_c}{a_e} = 12{,}6 \rightarrow k1 = 1{,}82$$

$\frac{D_c}{a_e}$	2	3	4	5	6	8	10	12	15	20	25	30	40	50	100
Factor k1	1,0	1,1	1,2	1,3	1,4	1,5	1,6	1,8	2,0	2,2	2,5	2,8	3,2	3,6	5,0

Side and facemilling

Example



Cutter:	N331.32-125S40FM	z_n = 10
Insert:	N331.1A-08 45 08H-PM	GC4030
Workpiece material:	SS 1672-08 HB =150	CMC 01.2
a_e:	23 mm	
a_p:	14 mm	

Calculate spindle speed (*n*)

$$n = \frac{v_c \times 1000}{\pi \times D_c}$$

This gives: $n = \frac{283 \times 1000}{\pi \times 125} \approx 720$ rpm

To get v_c, first find h_{ex} value for -PM geometry on page A 226.
The cutting speed v_c for h_{ex} 0,17 is 283 m/min (between 325 and 270 m/min), see page A 229.

Calculate table feed (v_f)

$$v_f = n \times z_c \times f_z$$

This gives:
$v_f = 720 \times 5 \times 0{,}22 \approx 792$ mm/min

z_c = Number of effective edges = $z_n/2$

For N331.32-125S40FM $z_n = 10$ $\rightarrow z_c = 5$

f_z = factor k1 $\times h_{ex}$

The factor k1 can be found in table below.

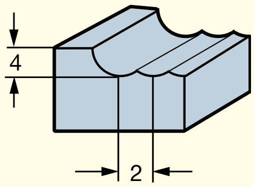
$\frac{D_c}{a_e}$	1	2	3	4	5	6	8	10	12	15	20	25	30	40	50	100
Factor k1	**1,0**	**1,0**	**1,1**	**1,2**	**1,3**	**1,4**	**1,5**	**1,6**	**1,8**	**2,0**	**2,2**	**2,5**	**2,8**	**3,2**	**3,6**	**5,0**

$\frac{D_c}{a_e} = \frac{125}{23} = 5{,}43 \rightarrow$ k1 = 1,3

$f_z = 1{,}3 \times 0{,}17 \approx 0{,}22$ mm/tooth

Profile milling

Example



Cutter:	R216-20A25-055	$z_n = 2$
Insert:	R216-20 T3 M-M	GC4040
Workpiece material:	SS 1672-08 HB =150	CMC 01.2
a_e:	2 mm	
a_p:	4 mm	

Calculate spindle speed (*n*)

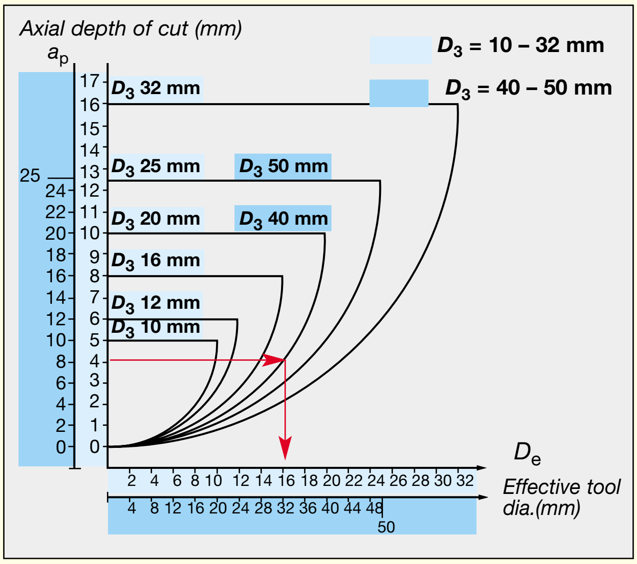
$$n = \frac{v_c \times 1000}{\pi \times D_e}$$

$$n = \frac{308 \times 1000}{\pi \times 16} \approx 6130 \text{ rpm}$$

To get v_c, first find h_{ex} value for -M geometry on page A 225.
The cutting speed v_c for h_{ex} 0,15 is 308 m/min (between 310 and 295 m/min), see page A 233.

Find effective diameter, D_e

Select axial depth of cut in this diagram.
Go horizontally across the diagram to the curve representing the tool diameter. Move down vertically to the axis and read the effective diameter.



Calculate table feed (v_f)

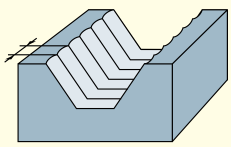
$$v_f = z_n \times n \times f_z$$

$v_f = 2 \times 6130 \times 0{,}1 \approx 1226$ mm/min

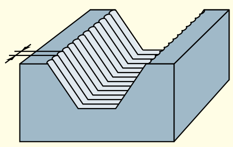
f_z according to table below. In stable conditions the feed can be increased. When working with long tools and difficult conditions the feed can be lowered.

Recommended feed, f_z mm								
Diameter, D_3	12	16	20	25	30	32	40	50
Start value	0,05	0,08	0,10	0,12	0,15	0,15	0,20	0,25
Range	0,05 – 0,10	0,08 – 0,15	0,10 – 0,20	0,12 – 0,25	0,15 – 0,35	0,15 – 0,35	0,20 – 0,40	0,25 – 0,40

Recommended radial steps and depth of cut for ball nose endmills



Large cuts
It is not recommended to exceed the values below for radial step and axial depth of cut.



Small cuts
With the same axial depth of cut as for large cuts, surface can be improved by decreasing the radial step.

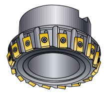
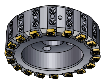
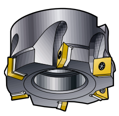
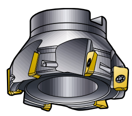
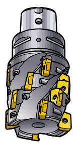
Cutter dia. D_3	**Max. recommended** Radial step	Depth of cut
12	5	6
16	6	8
20	10	10
25	12	12
30	15	12
32	16	12
40	20	15
50	20	

Cutter dia. D_3	Radial step		Radial step		Radial step	
12	1,0	0,02	1,5	0,05	2,0	0,08
16	1,0	0,02	2,0	0,06	3,0	0,14
20	2,0	0,05	3,0	0,11	4,0	0,20
25	3,0	0,09	4,0	0,16	5,0	0,25
30	3,0	0,08	4,0	0,13	5,0	0,21
32	3,0	0,07	4,0	0,13	5,0	0,20
40	4,0	0,10	6,0	0,23	8,0	0,40
50	4,0	0,08	6,0	0,18	8,0	0,32

FACEMILLING

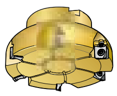
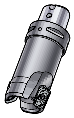
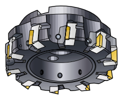
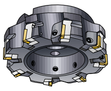
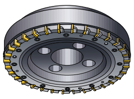
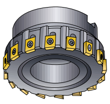
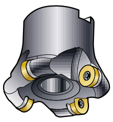
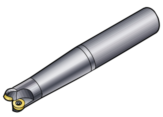
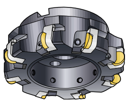
$\kappa_r = 45°$	Insert geometry		Insert size	Feed per tooth, f_z (mm/tooth) Starting value	(min.- max.)	Max chip thickness, h_{ex} (mm) Starting value	(min. - max.)
CoroMill® 245 R245 	E-PL, E-ML, E-KL	*Light*		0,14	(0,08–0,21) GC4030, GC3020 GC2040, GC2030 K20W, GC3040, GC4040	0,10	(0,06 – 0,15)
				0,11	(0,07–0,17) CT530, H13A, H10	0,08	(0,06 – 0,12)
				0,09	(0,05–0,12) GC1025	0,06	(0,035 – 0,085)
	M-PL, M-KL	*Light*		0,17	(0,08 – 0,21)	0,12	(0,06 – 0,15)
	M-PM, M-KM	*Medium*		0,24	(0,10 – 0,28)	0,17	(0,07 – 0,20)
	M-PM, M-KM	*Medium*		0,12	(0,08 – 0,18) CT530, H13A	0,09	(0,06 – 0,13)
	K-MM			0,23	(0,10 – 0,28)	0,16	(0,07 – 0,20)
	M-PH, M-KH	*Heavy*		0,35	(0,10 – 0,42)	0,25	(0,07 – 0,30)
	E-AL			0,24	(0,10 – 0,28)	0,17	(0,07 – 0,20)
	E	*Ceramic*		0,21	(0,10 – 0,30) CC6090	0,15	0,07 – 0,20
	E	*CBN*		0,14	(0,07 – 0,21) CB50	0,10	(0,06 – 0,15
	E	*PCD*		0,14	(0,07 – 0,21) CD10	0,10	(0,06 – 0,15
Modulmill 145 R/L260.22 	SEER-WL, SEHN	*Light*	12	0,17	(0,08 – 0,21)	0,12	(0,06 – 0,15)
	SEKN, SEKR-WM, SEMN		12	0,24	(0,1 – 0,28)	0,17	(0,07 – 0,20)
	SEKN, SEKR-WM		15	0,24	(0,1 – 0,28)	0,17	(0,07 – 0,20)
T-MAX 45 R260.7 	LNCX -11	*Medium*		0,35	(0,10 – 1,0)	0,25	(0,07 – 0,70)
	-31	*Medium*		0,35	(0,10 – 0,70)	0,25	(0,07 – 0,50)
	-32	*Medium*		0,35	(0,10 – 0,70)	0,25	(0,07 – 0,50)
AUTO R/L260.3 	TNHF-WL, TNEF-WL	*Heavy*		0,17	(0,08 – 0,21)	0,12	(0,06 – 0,15)
	TNHF-CA, TNEF-CA			0,24	(0,1 – 0,42)	0,17	(0,07 – 0,30)
	TNHF-65, TNEF-65			0,24	(0,1 – 0,28)	0,17	(0,07 – 0,20)
	TNJN, TNEN			0,35	(0,1 – 0,70)	0,25	(0,07 – 0,50)
	TNCN			0,24	(0,1 – 0,28)	0,17	(0,07 – 0,20)
$\kappa_r = 75°$							
Modulmill *Negative rake* R285.1 	SNKN			0,26	(0,10 – 0,31)	0,25	(0,1 – 0,30)
Modulmill *Positive rake* R285.2 	SPKR-WH		12	0,26	(0,10 – 0,31	0,25	(0,10 – 0,30)
	SPKN		12	0,18	(0,10 – 0,21)	0,17	(0,10 – 0,20)
	SPAN		12	0,18	(0,10 – 0,21)	0,17	(0,10 – 0,20)
	SPKR-WH		15	0,26	(0,10 – 0,31	0,25	(0,10 – 0,30)
	SPKN		15	0,18	(0,10 – 0,21)	0,17	(0,10 – 0,20)
	SPKR-WH		19	0,26	(0,10 – 0,31	0,25	(0,10 – 0,30)
	SPKN		19	0,18	(0,10 – 0,21)	0,17	(0,10 – 0,20)

FACEMILLING

Tool		Insert geometry		Insert size	Feed per tooth, f_z (mm/tooth) Starting value	(min. - max.)	Max chip thickness, h_{ex} (mm) Starting value	(min. - max.)
$\kappa_r = 75°$								
T-Line 	R/L260.75	**LNE** **LNE-PL1**	*Roughing*		**0,18**	(0,10 – 0,21)	**0,17**	(0,10 – 0,20)
AUTO-AF 	R/L260.8 R/L260.82	**N260.8-F** **N260.8-L**			**0,16**	(0,08 – 0,21)	**0,15**	(0,08 – 0,20)
$\kappa_r = 90°$								
CoroMill® 290 	R290	**M-PL** **M-KL**	*Light*		**0,08** **0,10**	(0,05 – 0,15) (0,08 – 0,15)	**0,08** **0,10**	(0,05 – 0,15) (0,08 – 0,15)
		E-PL **E-KL** **E-ML**	*Light*	r_ε = 0,8	**0,06** **0,08** **0,10**	(0,05 – 0,09) (0,07 – 0,12) (0,08 – 0,15)	**0,06** **0,08** **0,10**	(0,05 – 0,09) (0,07 – 0,12) (0,08 – 0,15)
		M-PM **M-KM** **M-KM**	*Medium*	r_ε = 0,8	**0,17**	(0,10 – 0,20)	**0,17**	(0,10 – 0,20)
	R290.90	**M-PL** **M-ML** **M-KL** **M-WL**	*Light*	r_ε = 2,0	**0,17**	(0,10 – 0,20)	**0,17**	(0,10 – 0,20)
		M-PM **M-MM** **M-KM** **M-WM**	*Medium*	r_ε = 2,0	**0,12**	(0,08 – 0,15)	**0,12**	(0,08 – 0,15)
		M-PH **M-KH** **M-WH**	*Heavy*	r_ε = 2,0	**0,25**	(0,10 – 0,30)	**0,25**	(0,10 – 0,30)
		E	*Ceramic*		**0,10**	(0,05 – 0,15)	**0,10**	(0,05 – 0,15)
		E	*CBN*		**0,10**	(0,05 – 0,18)	**0,10**	(0,05 – 0,18)
CoroMill® 390   	R390	**E-PL** **E-ML** **E-KL** **E-NL**	*Light*	11	**0,08** **0,10** **0,08** **0,20**	(0,05 – 0,12) (0,05 – 0,15) (0,05 – 0,12) (0,10 – 0,30)	**0,08** **0,10** **0,08** **0,20**	(0,05 – 0,12) (0,05 – 0,15) (0,05 – 0,12) (0,10 – 0,30)
		M-PL **M-KL**	*Light*	11	**0,08** **0,10**	(0,05 – 0,15) (0,08 – 0,15)	**0,08** **0,10**	(0,05 – 0,15) (0,08 – 0,15)
		E-PL **E-ML** **E-KL** **E-NL**	*Light*	17	**0,08** **0,10** **0,08** **0,20**	(0,05 – 0,12) (0,05 – 0,15) (0,05 – 0,12) (0,10 – 0,30)	**0,08** **0,10** **0,08** **0,20**	(0,05 – 0,12) (0,05 – 0,15) (0,05 – 0,12) (0,10 – 0,30)
		M-PL **M-KL**	*Light*	17	**0,08** **0,10**	(0,05 – 0,15) (0,08 – 0,15)	**0,08** **0,10**	(0,05 – 0,15) (0,08 – 0,15)
		E-PM **E-MM** **E-KM**	*Medium*	11	**0,10** **0,13** **0,12**	(0,08 – 0,15) (0,08 – 0,20) (0,12 – 0,20)	**0,10** **0,13** **0,12**	(0,08 – 0,15) (0,08 – 0,20) (0,12 – 0,20)
		M-PM **M-MM** **M-KM**	*Medium*	11	**0,10** **0,13** **0,12**	(0,08 – 0,15) (0,08 – 0,20) (0,12 – 0,20)	**0,10** **0,13** **0,12**	(0,08 – 0,15) (0,08 – 0,20) (0,12 – 0,20)
		E-PM **E-MM** **E-KM**	*Medium*	17	**0,10** **0,15** **0,15**	(0,08 – 0,15) (0,08 – 0,20) (0,12 – 0,20)	**0,10** **0,15** **0,15**	(0,08 – 0,15) (0,08 – 0,20) (0,12 – 0,20)
		M-PM **M-MM** **M-KM**	*Medium*	17	**0,10** **0,15** **0,15**	(0,08 – 0,15) (0,08 – 0,20) (0,12 – 0,20)	**0,10** **0,15** **0,15**	(0,08 – 0,15) (0,08 – 0,20) (0,12 – 0,20)
		M-PH **M-MH** **M-KH**	*Heavy*	11	**0,12** **0,16** **0,15**	(0,08 – 0,20) (0,08 – 0,22) (0,12 – 0,22)	**0,12** **0,16** **0,15**	(0,08 – 0,20) (0,08 – 0,22) (0,12 – 0,22)
		M-PH **M-KH**	*Heavy*	17	**0,20** **0,20**	(0,15 – 0,35) (0,15 – 0,35)	**0,20** **0,20**	(0,15 – 0,35) (0,15 – 0,35)
		H-PL **H-ML** **H-KL**	*Light*	18	**0,10** **0,10** **0,10**	(0,05 – 0,19) (0,05 – 0,19) (0,05 – 0,19)	**0,10** **0,10** **0,10**	(0,05 – 0,19) (0,05 – 0,19) (0,05 – 0,19)
		M-PM **M-MM** **M-KM**	*Medium*	18	**0,20** **0,20** **0,20**	(0,08 – 0,30) (0,08 – 0,30) (0,08 – 0,30)	**0,10** **0,10** **0,10**	(0,05 – 0,19) (0,05 – 0,19) (0,05 – 0,19)
		E	*PCD*	11	**0,15**	(0,10 – 0,25)	**0,15**	(0,10 – 0,25)
		E	*PCD*	17	**0,15**	(0,10 – 0,25)	**0,15**	(0,10 – 0,25)

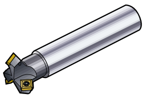
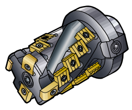
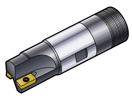
A

A

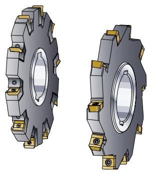
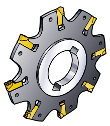
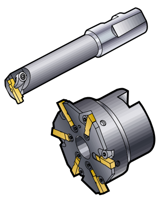
FACEMILLING $\kappa_r = 90°$	Insert geometry	Insert size	Feed per tooth, f_z (mm/tooth) Starting value	(min. - max.)	Max chip thickness, h_{ex} (mm) Starting value	(min. - max.)
CoroMill® Century R590 	**-NL** CD10		**0,15**	(0,05 – 0,30)	**0,15**	(0,05 – 0,30)
	-NL H10		**0,20**	(0,10 – 0,40)	**0,20**	(0,10 – 0,40)
CoroMill® 790 R790 	**H-NM**	16	**0,3**	(0,10 – 0,40)	**0,3**	(0,10 – 0,40)
	H-NL	22	**0,3**	(0,10 – 0,40)	**0,3**	(0,10 – 0,40)
	H-NM		**0,6**	(0,20 – 0,60)	**0,6**	(0,20 – 0,60)
Modulmill R282.2 	**TPKR -WH** **TPKN**	16	**0,25** **0,17**	(0,10 – 0,30) (0,10 – 0,20)	**0,25** **0,17**	(0,10 – 0,30) (0,10 – 0,20)
	TPKR -WH **TPKN**	22	**0,25** **0,17**	(0,10 – 0,30) (0,10 – 0,20)	**0,25** **0,17**	(0,10 – 0,30) (0,10 – 0,20)
Modulmill R282.2 	**BPKX**	15	**0,17**	(0,10 – 0,20)	**0,17**	(0,10 – 0,20)
	BPKX	19	**0,17**	(0,10 – 0,20)	**0,17**	(0,10 – 0,20)
AUTO-FS R/L262.4 R/L262.42 	**SBEN** **SBEX** *Finishing* **SBEX-11**		**0,17**	(0,1 – 0,3)	**0,17**	(0,1 – 0,2)
T-Line R260.90 	**CDE** *Roughing*		**0,17**	(0,1 – 0,2)	**0,17**	(0,1 – 0,3)
ROUND						
CoroMill® 200 R200 	**-PL** **-ML** *Light* **-KL**		**0,11**	(0,07 – 0,17)	**0,08**	(0,05 – 0,12)
	-PM **-KM** **-MM** *Medium* **-WM**		**0,24**	(0,10 – 0,28)	**0,17**	(0,10 – 0,20)
	-PH **-KH** *Heavy* **-WH**		**0,35**	(0,10 – 0,42)	**0,25**	(0,10 – 0,30)
	CBN	12	**0,14**	(0,07 – 0,21)	**0,10**	(0,05 – 0,15)
	Ceramic	12-16	**0,28**	(0,10 – 0,42)	**0,20**	(0,07 – 0,30)
CoroMill® 300 R300 	**E-PM** *Medium* **E-MM**	5 7 8 10 12	**0,12** **0,12** **0,17** **0,23** **0,23**		**0,08** **0,10** **0,13** **0,18** **0,18**	(0,05 – 0,12) (0,05 – 0,15) (0,05 – 0,20) (0,05 – 0,25) (0,05 – 0,25)
	M-PM *Medium* **M-MM**	12			**0,15**	(0,07 – 0,25)
Modulmill R280.2 	**RCMN**		**0,24**	(0,10 – 0,28)	**0,17**	(0,10 – 0,20)

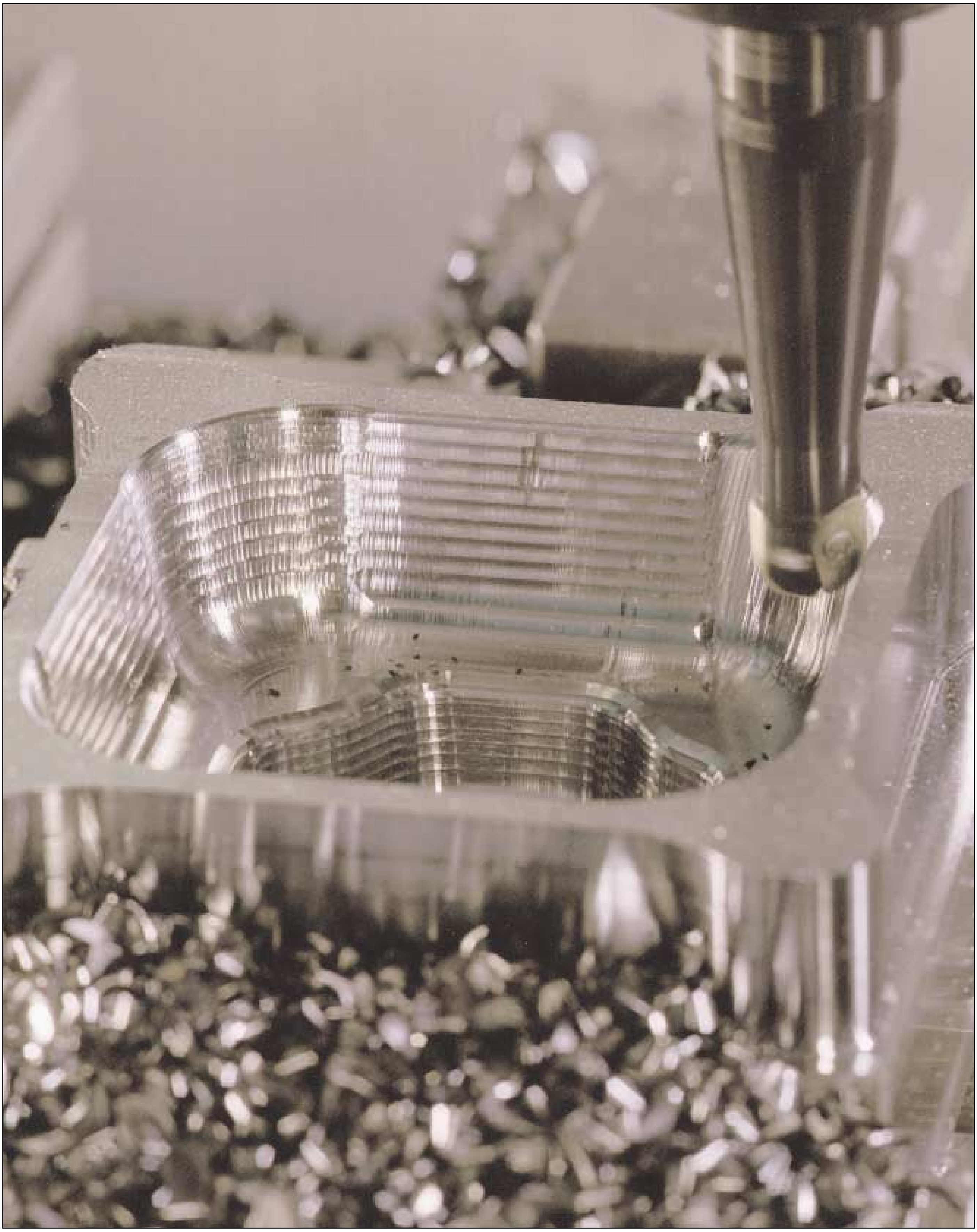
SANDVIK Coromant

PROFILING

Tool	Insert geometry	Insert size	Feed per tooth, f_z (mm/tooth) Starting value	Feed per tooth (min. - max.)	Max chip thickness, h_{ex}(mm) Starting value	Max chip thickness (min. - max.)
U-MAX *Chamfering endmill*  R215.64	SPMT-WL		0,17	(0,08 – 0,21)	0,12	(0,06 – 0,15)
	-WH		0,35	(0,10 – 0,42)	0,25	(0,07 – 0,30)
T-MAX *Long edge cutter*  R215.3	215.3		0,17	(0,10 – 0,20)	0,17	(0,10 – 0,20)
	-AAH		0,12	(0,08 – 0,15)	0,12	(0,08 – 0,15)
U-MAX 1) *Drilling endmill*  R216.2	216.2- 08 10 17		0,12	(0,08 – 0,15)	0,12	(0,08 – 0,15)
	15		0,17	(0,10 – 0,20)	0,17	(0,10 – 0,20)
CoroMill® Ball Nose  R216	-12 .. M-M		0,10	(0,08-0,15)	0,10	(0,08-0,21)
	-16 .. M-M		0,10	(0,08-0,15)	0,10	(0,08-0,21)
	-20 .. M-M		0,15	(0,08-0,18)	0,15	(0,08-0,25)
	-25 .. M-M		0,15	(0,08-0,18)	0,15	(0,08-0,25)
	-30 .. M-M		0,17	(0,08-0,20)	0,17	(0,08-0,28)
	-32 .. M-M		0,17	(0,08-0,20)	0,17	(0,08-0,28)
	-40 .. M-M		0,20	(0,10-0,30)	0,20	(0,10-0,42)
	-50 .. M-M		0,25	(0,10-0,30)	0,25	(0,10-0,42)
	-10 .. E-M		0,10	(0,05-0,15)	0,10	(0,05-0,21)
	-12 .. E-M		0,10	(0,05-0,15)	0,10	(0,05-0,21)
	-16 .. E-M		0,10	(0,05-0,15)	0,10	(0,05-0,21)
	-20 .. E-M		0,15	(0,05-0,18)	0,15	(0,05-0,25)
	-25 .. E-M		0,15	(0,05-0,18)	0,15	(0,05-0,25)
	-30 .. E-M		0,17	(0,05-0,20)	0,17	(0,05-0,28)
	-32 .. E-M		0,17	(0,05-0,20)	0,17	(0,05-0,28)
	-40 .. E-M		0,20	(0,05-0,25)	0,20	(0,05-0,35)
	-50 .. E-M		0,20	(0,05-0,25)	0,20	(0,05-0,35)
CoroMill® Ball Nose Finishing  R216F	-08 .. E-L		0,12	(0,10-0,25)	0,07	(0,05-0,18)
	-10 .. E-L		0,12	(0,10-0,25)	0,07	(0,05-0,18)
	-12 .. E-L		0,15	(0,15-0,35)	0,09	(0,07-0,22)
	-16 .. E-L		0,17	(0,15-0,35)	0,11	(0,07-0,25)
	-20 .. E-L		0,17	(0,15-0,35)	0,11	(0,07-0,25)
	-25 .. E-L		0,20	(0,15-0,40)	0,13	(0,07-0,29)
	-30 .. E-L		0,20	(0,15-0,40)	0,13	(0,07-0,29)
	-32 .. E-L		0,20	(0,15-0,40)	0,13	(0,07-0,29)

SLOT MILLING

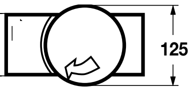
	Insert geometry	Insert size	Average chip thickness, h_m(mm) Recom-mended	(min. - max.)	Max chip thickness, h_{ex}(mm) Recom-mended	(min. - max.)
SIDE- AND FACEMILLS	-PL, ML, -KL, -WL, -NL	04, 05	**0,05**	(0,02 – 0,15)	**0,10**	(0,05 – 0,15)
CoroMill® 331		08, 11, 14	**0,06**	(0,03 – 0,15	**0,12**	(0,08 – 0,15)
N/R331.32 R331.35 R/L331.52 	-PM, -MM, -KM, -WM	04, 05	**0,07**	(0,04 – 0,18)	**0,13**	(0,08 – 0,20)
		08, 11, 14	**0,09**	(0,05 – 0,20)	**0,17**	(0,10 – 0,20)
	RCHT/RCKT -PL, ML, -KL		**0,11**	(0,07 – 0,17)	**0,08**	(0,05 – 0,12)
	-WM, -PM, -MM -KM		**0,24**	(0,10 – 0,28)	**0,17**	(0,10 – 0,20)
	-WH, -KH, -PH		**0,35**	(0,10 – 0,42)	**0,25**	(0,10 – 0,30)
T-MAX Q-Cutter *For slitting* 330.20 	**330.20** -AA	2 – 4	**0,030**	(0,01 – 0,12)	**0,06**	(0,02 – 0,08)
	-AA	5 – 6	**0,05**	(0,02 – 0,14)	**0,08**	(0,02 – 0,13)
	-XE		**0,05**	(0,02 – 0,14)	**0,08**	(0,02 – 0,13)
T-MAX grooving cutters 331.91 	**331.91**	1,10 – 3	**0,02**	(0,01 – 0,06)	**0,04**	(0,03 – 0,05)
		3,15 – 5	**0,03**	(0,02 – 0,08)	**0,06**	(0,02 – 0,08)



HSM – High Speed Machining with CoroMill ball nose endmill

To perform HSM applications it is important to use rigid and dedicated machine tools designed for the specific process of high speed machining.

Milling with large engagement



Conditions:
Cutter, dia. 125 mm, centered over the workpiece. Working engagement 100 mm

ISO	CMC No.	Material		Specific cutting force kc 1 N/mm²	Hardness Brinell HB	mc	530	1025
							Max chip thickness, h_{ex} mm	
							0,1 – 0,15 – 0,2	0,05 – 0,1 – 0,2
							Cutting speed, v_c m/min	
P		**Steel**						
	01.1	**Unalloyed**	C = 0,10 – 0,25 %	1500	125	0,25	430 – 390 – 350	340 – 310 – 255
	01.2		C = 0,25 – 0,55 %	1600	150	0,25	385 – 350 – 315	305 – 280 – 230
	01.3		C = 0,55 – 0,80 %	1700	170	0,25	365 – 330 – 300	290 – 260 – 215
	01.4			1800	210	0,25	315 – 290 – 260	250 – 230 – 185
	01.5			2000	300	0,25	235 – 210 – 195	185 – 170 – 140
	02.1	**Low-alloyed** (alloying elements ≤ 5 %)	Non-hardened	1700	175	0,25	300 – 275 – 245	240 – 215 – 180
	02.2		Hardened and tempered	2000	300	0,25	180 – 165 – 150	145 – 130 – 105
	03.11	**High-alloyed** (alloying elements > 5 %)	Annealed	1950	200	0,25	230 – 205 – 185	180 – 165 – 135
	03.13		Hardened tool steel	2150	200	0,25	190 – 170 – 155	150 – 135 – 110
	03.21			2900	300	0,25	165 – 150 – 135	130 – 120 – 100
	03.22			3100	380	0,25	105 – 95 – 85	80 – 75 – 60
	06.1	**Castings**	Unalloyed	1400	150	0,25	305 – 280 – 250	245 – 220 – 180
	06.2		Low-alloy (alloying elements ≤ 5 %)	1600	200	0,25	245 – 220 – 200	195 – 175 – 145
	06.3		High-alloy, alloying elements > 5 %)	1950	200	0,25	180 – 160 – 145	140 – 130 – 105

ISO	CMC No.	Material		Specific cutting force kc 1 N/mm²	Hardness Brinell HB	mc	530	1025
							Max chip thickness, h_{ex} mm	
							0,1 – 0,15 – 0,2	0,05 – 0,1 – 0,2
							Cutting speed, v_c m/min	
M		**Stainless steel**						
	05.11	Ferritic/martensitic	Non-hardened	1800	200	0,21	285 – 255 – 230	255 – 225 – 180
	05.12		PH-hardened	2800	330	0,21	205 – 185 – 165	180 – 160 – 130
	05.13		Hardened	2300	330	0,21	215 – 190 – 170	185 – 165 – 135
	05.21	Austenitic	Non-hardened	2000	200	0,21	265 – 240 – 215	250 – 225 – 180
	05.22		PH-hardened	2800	330	0,21	200 – 175 – 160	170 – 155 – 125
	05.51	Austenitic-ferritic (Duplex)	Non-weldable ≥ 0,05%C	2000	230	0,21	260 – 235 – 210	205 – 185 – 145
	05.52		Weldable < 0,05%C	2400	260	0,21	230 – 205 – 185	175 – 155 – 125
		Stainless steel – Cast						
	15.11	Ferritic/martensitic	Non-hardened	1700	200	0,25	255 – 230 – 205	225 – 200 – 160
	15.12		PH-hardened	2500	330	0,25	180 – 160 – 145	155 – 140 – 115
	15.13		Hardened	2100	330	0,25	195 – 175 – 155	170 – 155 – 120
	15.21	Austenitic	Austenitic	1800	200	0,25	255 – 225 – 205	235 – 210 – 170
	15.22		PH-hardened	2500	330	0,25	180 – 160 – 145	160 – 140 – 115
	15.51	Austenitic-ferritic (Duplex)	Non-weldable ≥ 0,05%C	1800	230	0,25	245 – 220 – 195	195 – 175 – 140
	15.52		Weldable < 0,05%C	2200	260	0,25	215 – 190 – 170	160 – 145 – 115

ISO	CMC No.	Material		Specific cutting force kc 1 N/mm²	Hardness Brinell HB	mc	CB50	6090
							Max chip thickness, h_{ex} mm	
							0,1 – 0,15 – 0,2	0,1 – 0,2 – 0,3
							Cutting speed, v_c m/min	
K	07.1	**Malleable cast iron**	Ferritic (short chipping)	800	130	0,28	– –	1190 – 975 – 805
	07.2		Pearlitic (long chipping)	900	230	0,28	– –	980 – 805 – 660
	08.1	**Grey cast iron**	Low tensile strength	900	180	0,28	845 – 725 – 620	1320– 1085– 890
	08.2		High tensile strength	1100	245	0,28	910 – 780 – 665	1045– 860– 705
	09.1	**Nodular cast iron**	Ferritic	900	160	0,28	– –	920 – 755 – 620
	09.2		Pearlitic	1350	250	0,28	495 – 420 – 360	760 – 625 – 515

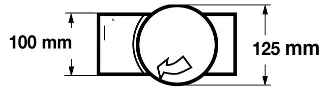
1) 45–60° entering angle, positive cutting geometry and coolant should be used.
2) Rm = ultimate tensile strength measured in MPa.

4020	4030	4040	3040	2030	2040	SM30
Max chip thickness h_{ex}, mm						
0,1 – 0,2 – 0,3	0,1 – 0,2 – 0,3	0,1 – 0,2 – 0,4	0,1 – 0,2 – 0,3	0,05 – 0,15 – 0,25	0,1 – 0,2 – 0,4	0,1 – 0,2 – 0,4
Cutting speed, v_c m/min						
490 – 405 – 330	365 – 300 – 245	310 – 255 – 170	390 – 320 – 260	325 – 265 – 220	295 – 240 – 165	265 – 230 – 170
440 – 360 – 295	325 – 270 – 220	280 – 230 – 155	350 – 285 – 235	290 – 240 – 195	265 – 215 – 145	240 – 205 – 150
415 – 340 – 280	310 – 255 – 210	260 – 215 – 145	330 – 270 – 220	275 – 225 – 185	250 – 205 – 135	225 – 195 – 145
365 – 300 – 245	270 – 220 – 180	230 – 190 – 125	290 – 235 – 195	240 – 200 – 165	220 – 180 – 120	195 – 170 – 125
270 – 220 – 180	200 – 165 – 135	170 – 140 – 95	215 – 175 – 145	175 – 145 – 120	160 – 130 – 90	145 – 125 – 90
345 – 285 – 230	255 – 210 – 170	215 – 180 – 120	275 – 225 – 185	225 – 185 – 155	205 – 170 – 115	185 – 160 – 120
205 – 170 – 140	155 – 125 – 105	130 – 105 – 70	165 – 135 – 110	135 – 110 – 90	125 – 100 – 70	110 – 95 – 70
300 – 245 – 200	195 – 160 – 130	165 – 135 – 90	205 – 170 – 140	170 – 140 – 115	155 – 130 – 85	140 – 120 – 90
215 – 180 – 145	160 – 130 – 110	135 – 110 – 75	170 – 140 – 115	140 – 115 – 95	125 – 105 – 70	115 – 100 – 75
190 – 155 – 125	140 – 115 – 95	120 – 100 – 65	150 – 125 – 100	125 – 100 – 85	110 – 90 – 60	105 – 90 – 65
120 – 95 – 80	85 – 70 – 60	75 – 60 – 41	95 – 75 – 65	75 – 65 – 50	70 – 55 – 38	65 – 55 – 41
350 – 290 – 235	260 – 215 – 175	220 – 180 – 120	280 – 230 – 190	230 – 190 – 155	210 – 170 – 115	190 – 165 – 120
280 – 230 – 190	205 – 170 – 140	175 – 145 – 95	220 – 180 – 150	185 – 150 – 125	170 – 140 – 95	150 – 130 – 95
205 – 170 – 140	150 – 125 – 100	130 – 105 – 70	160 – 135 – 110	135 – 110 – 90	120 – 100 – 70	110 – 95 – 70

2030	2040	4030	4040	SM30
Max chip thickness h_{ex}, mm				
0,05 – 0,15 – 0,25	0,1 – 0,2 – 0,3	0,1 – 0,2 – 0,3	0,1 – 0,2 – 0,4	0,1 – 0,2 – 0,4
Cutting speed, v_c m/min				
240 – 190 – 155	240 – 190 – 155	275 – 220 – 175	210 – 170 – 110	185 – 160 – 115
170 – 135 – 110	165 – 130 – 105	190 – 150 – 120	140 – 110 – 70	105 – 90 – 65
175 – 140 – 115	175 – 140 – 110	200 – 160 – 125	160 – 125 – 80	110 – 95 – 70
235 – 190 – 150	200 – 160 – 130	– – –	185 – 150 – 95	170 – 150 – 110
165 – 130 – 105	160 – 125 – 100	– – –	135 – 105 – 70	100 – 85 – 65
195 – 155 – 125	170 – 135 – 105	– – –	170 – 135 – 85	165 – 145 – 105
165 – 130 – 105	135 – 110 – 85	– – –	135 – 110 – 70	130 – 110 – 80
215 – 170 – 135	210 – 170 – 135	245 – 195 – 155	185 – 150 – 95	165 – 140 – 105
150 – 120 – 95	145 – 115 – 90	165 – 130 – 105	120 – 100 – 65	90 – 80 – 60
160 – 130 – 105	160 – 130 – 100	180 – 145 – 115	145 – 115 – 75	100 – 85 – 65
225 – 180 – 145	190 – 155 – 125	– – –	180 – 140 – 90	165 – 140 – 105
150 – 120 – 95	145 – 115 – 90	– – –	125 – 100 – 65	90 – 80 – 60
185 – 150 – 120	160 – 125 – 100	– – –	160 – 125 – 80	160 – 135 – 100
150 – 120 – 95	130 – 100 – 80	– – –	125 – 100 – 65	115 – 105 – 75

3020	3040	K20W	4020	4030	4040	H13A
Max chip thickness h_{ex}, mm						
0,1 – 0,2 – 0,3	0,1 – 0,2 – 0,4	0,1 – 0,2 – 0,3	0,1 – 0,2 – 0,3	0,1 – 0,2 – 0,3	0,1 – 0,2 – 0,4	0,1 – 0,2 – 0,4
Cutting speed, v_c m/min						
265 – 220 – 180	240 – 195 – 135	255 – 210 – 170	255 – 210 – 170	215 – 175 – 145	195 – 160 – 110	120 – 105 – 75
220 – 180 – 150	200 – 165 – 110	210 – 170 – 140	210 – 170 – 140	175 – 145 – 120	160 – 130 – 90	100 – 85 – 65
290 – 240 – 195	260 – 215 – 145	290 – 240 – 195	275 – 225 – 185	230 – 190 – 155	215 – 175 – 120	130 – 110 – 85
235 – 190 – 155	210 – 170 – 115	220 – 180 – 150	220 – 180 – 150	185 – 155 – 125	170 – 140 – 95	105 – 90 – 65
180 – 150 – 125	165 – 135 – 90	175 – 140 – 115	175 – 140 – 115	145 – 120 – 100	135 – 110 – 75	80 – 70 – 50
170 – 140 – 115	150 – 125 – 85	160 – 130 – 110	160 – 130 – 110	135 – 110 – 90	125 – 100 – 70	75 – 65 – 48

Milling with large engagement



Conditions:
Cutter, dia. 125 mm, centered over the workpiece. Working engagement 100 mm

A

ISO	CMC No.	Material		Specific cutting force kc 1 N/mm²	Hardness Brinell HB	mc	CD10	H10
							Max chip thickness, h_{ex} mm	
							0,1 –0,15 – 0,2	0,1 –0,15 – 0,2
							Cutting speed, v_c m/min	
N	30.11	Aluminium alloys	Wrought or wrought and coldworked, non-aging	400	60		1880 –1740 –1615	940 – 870 – 805
	30.12		Wrought or wrought and aged	650	100		1695 –1570 –1455	845 – 785 – 725
	30.21	Aluminium alloys	Cast, non-aging	600	75	0,25	1880 –1745 –1615	940 – 870 – 810
	30.22		Cast or cast and aged	700	90	0,25	1695 –1570 –1455	845 – 785 – 730
	30.3	Aluminium alloys	Al >99%	350	30		1890 –1755 –1625	945 – 875 – 810
	30.41	Aluminium alloys	Cast, 13–15% Si	700	130		755 – 700 – 650	380 – 350 – 325
	30.42		Cast, 16–22% Si	700	130		565 – 525 – 485	285 – 265 – 245
	33.1	Copper and copper alloys	Free cutting alloys, ≥1% Pb	550	110	0,25	945 – 875 – 810	470 – 435 – 405
	33.2		Brass, leaded bronzes, ≤1% Pb	550	90		940 – 875 – 810	470 – 435 – 405
	33.3		Bronze and non-leadad copper incl. electrolytic copper	1350	100	0,25	660 – 610 – 565	325 – 305 – 285

ISO	CMC No.	Material		Specific cutting force kc 1 N/mm²	Hardness Brinell HB	mc	1025	H13A
							Max chip thickness, h_{ex} mm	
							0,05 –0,15 – 0,2	0,1 –0,15 – 0,2
							Cutting speed, v_c m/min	
S		Heat resistant super alloys						
	20.11	Iron base	Annealed or solution treated	2400	200	0,25	65 – 60 – 55	60 – 55 – 50
	20.12		Aged or solution treated and aged	2500	280	0,25	50 – 43 – 40	44 – 41 – 38
	20.21	Nickel base	Annealed or solution treated	2650	250	0,25	65 – 55 – 50	55 – 55 – 49
	20.22		Aged or solution treated and aged	2900	350	0,25	40 – 34 – 32	35 – 33 – 30
	20.24		Cast or cast and aged	3000	320	0,25	49 – 42 – 39	44 – 41 – 38
	20.31	Cobalt base	Annealed or solution treated	2700	200	0,25	28 – 22 – 20	23 – 21 – 18
	20.32		Solution treated and aged	3000	300	0,25	20 – 16 – 14	17 – 15 – 13
	20.33		Cast or cast and aged	3100	320	0,25	18 – 14 – 13	16 – 14 – 13
		Titanium alloys[1]			Rm[2]			
	23.1		Commercial pure (99,5% Ti)	1300	400	0,23	140 – 120 – 110	125 – 115 – 110
	23.21		α, near α and α+β alloys, annealed	1400	950	0,23	75 – 65 – 60	65 – 60 – 55
	23.22		α+β alloys in aged cond., β alloys, annealed or aged	1400	1050	0,23	60 – 50 – 48	55 – 49 – 46

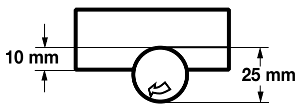
ISO	CMC No.	Material		Specific cutting force kc 1 N/mm²	Hardness Brinell HB	mc	CB50	6090
							Max chip thickness, h_{ex} mm	
							0,07 –0,12 – 0,2	0,07 –0,12 – 0,2
							Cutting speed, v_c m/min	
H	04.1	Extra hard steel	Hardened and tempered	4200	59 HRC	0,25	160 – 140 – 115	85 – 75 – 60
	10.1	Chilled cast iron	Cast or cast and aged	2200	400	0,28	310 – 270 – 215	160 – 140 – 115

CT530	1025	H10F	H13A					
Max chip thickness, h_{ex} mm								
0,1 –0,15– 0,2	0,1 –0,15– 0,2	0,1 –0,15– 0,2	0,1 –0,15– 0,2					
Cutting speed, v_c m/min								
1035– 960 – 890 930– 865 – 800	985 – 915 – 845 890 – 825 – 765	940 – 870 – 805 845 – 785 – 725	750 – 695 – 645 675 – 630 – 580					
1035– 960 – 890 930– 865 – 800	985 – 915 – 850 890 – 825 – 765	940 – 870 – 810 845 – 785 – 730	750 – 695 – 645 680 – 630 – 580					
1040– 965 – 895	995 – 920 – 855	945 – 875 – 810	755 – 700 – 650					
415– 385 – 355 310– 290 – 270	395 – 370 – 340 300 – 275 – 255	380 – 350 – 325 285 – 265 – 245	300 – 280 – 260 225 – 210 – 195					
520– 480 – 445 520– 480 – 445 365– 335 – 310	495 – 460 – 425 495 – 460 – 425 345 – 320 – 295	470 – 435 – 405 470 – 435 – 405 330 – 305 – 285	375 – 350 – 325 375 – 350 – 325 265 – 245 – 225					

H10F	2030	2040						
Max chip thickness, h_{ex} mm								
0,1 –0,15 – 0,2	0,05 –0,15 –0,2	0,05 –0,15 –0,25						
Cutting speed, v_c m/min								
55 – 50 – 47 40 – 37 – 35	65 – 55 – 50 46 – 40 – 37	65 – 55 – 46 46 – 40 – 34						
50 – 48 – 45 32 – 30 – 27 40 – 37 – 34	60 – 50 – 48 37 – 32 – 30 45 – 39 – 36	60 – 50 – 44 37 – 32 – 27 45 – 39 – 34						
22 – 19 – 17 15 – 14 – 12 14 – 13 – 12	26 – 21 – 18 19 – 15 – 13 17 – 14 – 12	26 – 21 – 17 19 – 15 – 12 17 – 14 – 11						
115 –105 – 100 60 – 55 – 50 49 – 45 – 42	130 –115 – 105 70 – 60 – 55 55 – 48 – 45	130 –115 – 95 70 – 60 – 50 55 – 48 – 42						

530	4020	3020	3040	1025				
Max chip thickness, h_{ex} mm								
0,07– 0,1 – 0,2	0,1 –0,15–0,25	0,1 –0,15–0,25	0,1 – 0,2 –0,25	0,07–0,12– 0,2				
Cutting speed, v_c m/min								
80 – 75 – 55	55 – 47 – 36	65 – 55 – 42	44 – 33 – 29	41 – 35 – 29				
155 – 140 – 110	100 – 90 – 70	120 – 105 – 80	85 – 65 – 55	75 – 70 – 55				

Milling with small engagement



Conditions:
Sidemilling, cutter dia. 25 mm.
Working engagement 10 mm.

ISO	CMC No.	Material		Specific cutting force kc 1 N/mm²	Hardness Brinell HB	mc	530 Max chip thickness, h_{ex} mm 0,1 –0,15 – 0,2 Cutting speed, v_c m/min	1025 Max chip thickness, h_{ex} mm 0,05 – 0,1 – 0,2 Cutting speed, v_c m/min
P		**Steel**						
	01.1 01.2 01.3 01.4 01.5	**Unalloyed**	C = 0,10 – 0,25 % C = 0,25 – 0,55 % C = 0,55 – 0,80 %	1500 1600 1700 1800 2000	125 150 170 210 300	0,25 0,25 0,25 0,25 0,25	500 – 490 – 480 450 – 440 – 430 425 – 415 – 405 370 – 360 – 355 275 – 265 – 260	365 – 360 – 345 330 – 325 – 310 310 – 305 – 290 270 – 265 – 255 200 – 200 – 190
	02.1 02.2	**Low-alloyed** (alloying elements ≤5 %)	Non-hardened Hardened and tempered	1700 2000	175 330	0,25 0,25	350 – 345 – 335 210 – 205 – 200	260 – 255 – 240 155 – 150 – 145
	03.11 03.13 03.21 03.22	**High-alloyed** (alloying elements >5 %)	Annealed Hardened tool steel	1950 2150 2900 3100	200 200 300 380	0,25 0,25 0,25 0,25	265 – 260 – 255 220 – 215 – 210 195 – 190 – 185 120 – 120 – 115	195 – 190 – 185 160 – 160 – 150 140 – 140 – 135 90 – 85 – 85
	06.1 06.2 06.3	**Castings**	Unalloyed Low-alloy (alloying elements ≤5 %) High-alloy, alloying elements >5 %)	1400 1600 1950	150 200 200	0,25 0,25 0,25	360 – 350 – 340 285 – 280 – 275 210 – 205 – 200	265 – 260 – 245 210 – 205 – 195 155 – 150 – 145

ISO	CMC No.	Material		Specific cutting force kc 1 N/mm²	Hardness Brinell HB	mc	530 Max chip thickness, h_{ex} mm 0,1 –0,15 – 0,2 Cutting speed, v_c m/min	1025 Max chip thickness, h_{ex} mm 0,05 – 0,1 – 0,2 Cutting speed, v_c m/min
M		**Stainless steel**						
	05.11 05.12 05.13	Ferritic/martensitic	Non-hardened PH-hardened Hardened	1800 2800 2300	200 330 330	0,21 0,21 0,21	340 – 335 – 325 245 – 240 – 235 255 – 250 – 240	275 – 270 – 260 195 – 190 – 180 205 – 200 – 190
	05.21 05.22	Austenitic	Non-hardened PH-hardened	2000 2800	200 330	0,21 0,21	320 – 310 – 305 235 – 230 – 225	270 – 265 – 255 190 – 185 – 175
	05.51 05.52	Austenitic-ferritic (Duplex)	Non-weldable ≥0,05%C Weldable <0,05%C	2000 2400	230 260	0,21 0,21	310 – 305 – 295 275 – 270 – 260	225 – 220 – 210 190 – 185 – 175
		Stainless steel – Cast						
	15.11 15.12 15.13	Ferritic/martensitic	Non-hardened PH-hardened Hardened	1700 2500 2100	200 330 330	0,25 0,25 0,25	305 – 295 – 290 215 – 210 – 205 235 – 225 – 220	245 – 240 – 230 170 – 170 – 160 185 – 180 – 175
	15.21 15.22	Austenitic	Austenitic PH-hardened	1800 2500	200 330	0,25 0,25	300 – 295 – 290 215 – 210 – 205	260 – 255 – 240 170 – 170 – 160
	15.51 15.52	Austenitic-ferritic (Duplex)	Non-weldable ≥0,05%C Weldable <0,05%C	1800 2200	230 260	0,25 0,25	295 – 285 – 280 255 – 250 – 245	215 – 210 – 200 175 – 175 – 165

ISO	CMC No.	Material		Specific cutting force kc 1 N/mm²	Hardness Brinell HB	mc	3020 Max chip thickness, h_{ex} mm 0,1 –0,15 – 0,25 Cutting speed, v_c m/min	3040 Max chip thickness, h_{ex} mm 0,1 – 0,2 – 0,3 Cutting speed, v_c m/min
K	07.1 07.2	**Malleable cast iron**	Ferritic (short chipping) Pearlitic (long chipping)	800 900	130 230	0,28 0,28	310 – 305 – 290 255 – 250 – 240	280 – 270 – 255 230 – 220 – 210
	08.1 08.2	**Grey cast iron**	Low tensile strength High tensile strength	900 1100	180 245	0,28 0,28	340 – 330 – 320 270 – 265 – 255	305 – 290 – 280 245 – 235 – 225
	09.1 09.2	**Nodular cast iron**	Ferritic Pearlitic	900 1350	160 250	0,28 0,28	210 – 210 – 200 200 – 195 – 185	190 – 185 – 175 180 – 170 – 165

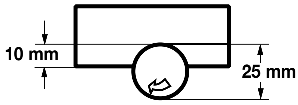
1) 45–60° entering angle, positive cutting geometry and coolant should be used.
2) Rm = ultimate tensile strength measured in MPa.

4020	4030	4040	3040	2030	2040	P10A	SM30
Max chip thickness h_{ex}, mm							
0,1– 0,15– 0,3	0,1– 0,15– 0,3	0,1– 0,2– 0,3	0,1– 0,15– 0,3	0,05– 0,15– 0,25	0,1– 0,2– 0,3	0,05– 0,1– 0,15	0,1– 0,2– 0,3
Cutting speed, v_c m/min							
570 – 560 – 525 515 – 505 – 470 485 – 475 – 445 425 – 415 – 390 315 – 305 – 285	425 – 415 – 390 380 – 375 – 350 360 – 350 – 330 315 – 305 – 285 230 – 225 – 215	360 – 345 – 330 325 – 310 – 295 305 – 290 – 280 265 – 255 – 245 200 – 190 – 180	455 – 445 – 415 410 – 400 – 375 385 – 375 – 355 335 – 330 – 310 250 – 245 – 230	350 – 335 – 320 315 – 300 – 290 295 – 285 – 270 260 – 250 – 240 190 – 185 – 175	340 – 330 – 315 310 – 295 – 280 290 – 275 – 265 255 – 245 – 235 185 – 180 – 170	500 – 385 – 300 450 – 335 – 250 – – – – – – – – –	300 – 290 – 280 270 – 260 – 250 255 – 245 – 240 220 – 215 – 210 165 – 160 – 155
400 – 395 – 370 240 – 235 – 220	295 – 290 – 275 180 – 175 – 165	255 – 240 – 230 150 – 145 – 140	320 – 310 – 290 190 – 185 – 175	245 – 235 – 225 145 – 140 – 135	240 – 230 – 220 145 – 140 – 135	400 – 285 – 200 330 – 245 – 180	210 – 205 – 195 125 – 120 – 120
350 – 340 – 320 255 – 245 – 230 220 – 215 – 200 135 – 135 – 125	225 – 220 – 205 185 – 185 – 170 165 – 160 – 150 100 – 100 – 95	190 – 185 – 175 160 – 150 – 145 140 – 135 – 125 85 – 85 – 80	240 – 235 – 220 200 – 195 – 185 175 – 170 – 160 110 – 105 – 100	185 – 175 – 170 150 – 145 – 140 135 – 125 – 120 85 – 80 – 75	185 – 175 – 165 150 – 140 – 135 130 – 125 – 120 80 – 80 – 75	325 – 255 – 200 – – – – – – – – –	160 – 155 – 150 130 – 130 – 125 115 – 110 – 110 70 – 70 – 65
410 – 400 – 375 325 – 320 – 300 240 – 235 – 220	305 – 295 – 280 240 – 235 – 220 175 – 175 – 160	260 – 245 – 235 205 – 195 – 190 150 – 145 – 140	325 – 315 – 295 260 – 255 – 235 190 – 185 – 175	250 – 235 – 225 200 – 190 – 185 145 – 140 – 135	240 – 230 – 220 200 – 185 – 180 145 – 135 – 130	– – – – – – – – –	215 – 205 – 200 170 – 165 – 160 125 – 120 – 115

2030	2040	4030	4040	SM30	P10A		
Max chip thickness h_{ex}, mm							
0,05 –0,15 – 0,25	0,1 –0,15 – 0,25	0,1 –0,15 – 0,25	0,1 – 0,2 – 0,3	0,1 – 0,2 – 0,3	0,05 – 0,1 – 0,15		
Cutting speed, v_c m/min							
265 – 250 – 240 185 – 175 – 170 195 – 185 – 175	285 – 280 – 265 195 – 190 – 180 205 – 200 – 190	325– 320– 305 225– 220– 210 235– 230– 220	250 – 240 – 230 165 – 160 – 150 190 – 180 – 170	210 – 200 – 195 120 – 115 – 110 125 – 120 – 115	200 – 170 – 150 – – – –		
255 – 245 – 235 180 – 170 – 160	240 – 235 – 220 190 – 185 – 175	– – – – – –	220 – 210 – 200 160 – 150 – 145	195 – 185 – 180 115 – 110 – 105	170 – 145 – 120 – –		
215 – 205 – 195 180 – 170 – 160	200 – 195 – 185 160 – 155 – 150	– – – – – –	200 – 190 – 180 160 – 155 – 145	190 – 180 – 175 145 – 140 – 135	– – – – – –		
235 – 225 – 215 160 – 155 – 145 175 – 165 – 160	255 – 245 – 235 170 – 165 – 160 190 – 185 – 175	290– 285– 270 195– 190– 185 215– 210– 200	225 – 210 – 200 145 – 140 – 130 175 – 165 – 155	185 – 180 – 175 105 – 100 – 95 115 – 110 – 105	– – – – – – – – –		
245 – 235 – 220 160 – 155 – 145	230 – 225 – 215 170 – 170 – 160	– – – – – –	210 – 200 – 190 145 – 140 – 135	185 – 180 – 170 105 – 100 – 95	– – – – – –		
205 – 195 – 185 165 – 160 – 150	190 – 185 – 175 150 – 150 – 140	– – – – – –	190 – 180 – 170 145 – 140 – 135	180 – 175 – 165 135 – 130 – 125	– – – – – –		

4020	4030	4040	P10A	H13A	CB50	6090	K20W
Max chip thickness h_{ex}, mm							
0,1 – 0,15–0,25	0,1 – 0,15–0,25	0,1 – 0,2 – 0,3	0,05 – 0,1 – 0,15	0,1 – 0,2 – 0,3	0,1 –0,15 – 0,2	0,1 – 0,2 – 0,3	0,1 – 0,2 – 0,3
Cutting speed, v_c m/min							
295 – 290 – 280 245 – 240 – 230 320 – 315 – 300 260 – 250 – 240	250 – 245 – 235 205 – 200 – 190 270 – 265 – 255 215 – 210 – 205	225 – 215 – 210 185 – 180 – 170 250 – 235 – 225 200 – 190 – 180	450 – 345 – 260 450 – 395 – 340 – – 400 – 320 – 255	135 – 130 – 125 110 – 110 – 105 145 – 145 – 140 120 – 115 – 110	– – – – – – 1080 –1045 –1010 1165 –1125 –1085	1385 –1330 –1275 1145 –1095 –1050 1535 –1470 –1410 1220 –1165 –1115	295 – 285 – 270 245 – 235 – 225 340 – 325 – 315 260 – 245 – 235
200 – 195 – 190 185 – 185 – 175	170 – 165 – 160 160 – 155 – 150	155 – 150 – 140 145 – 140 – 130	500 – 465 – 430 350 – 290 – 240	95 – 90 – 85 85 – 85 – 80	– 630 – 610 – 590	1075 –1030 – 985 890 – 850 – 815	200 – 195 – 185 185 – 180 – 170

Milling with small engagement



Conditions:
Sidemilling, cutter dia. 25 mm.
Working engagement 10 mm.

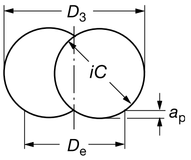
ISO	CMC No.	Material		Specific cutting force kc 1 N/mm²	Hardness Brinell HB	mc	530	1025
							Max chip thickness, h_{ex} mm	
							0,1 –0,15 – 0,2	0,1 –0,15 – 0,2
							Cutting speed, v_c m/min	
N	30.11	**Aluminium alloys**	Wrought or wrought and coldworked, non-aging	400	60		1165 –1145 –1125	1110 –1090 –1075
	30.12		Wrought or wrought and aged	650	100		1050 –1030 –1015	1000 – 985 – 970
	30.21 30.22	**Aluminium alloys**	Cast, non-aging Cast or cast and aged	600 700	75 90	0,25 0,25	1165 –1145 –1125 1050 –1030 –1015	1110 –1095 –1075 –
	30.3	**Aluminium alloys**	Al >99%	350	30		1170 –1150 –1135	1120 –1100 –1080
	30.41 30.42	**Aluminium alloys**	Cast, 13–15% Si Cast, 16–22% Si	700 700	130 130		470 – 460 – 455 350 – 345 – 340	445 – 440 – 430 335 – 330 – 325
	33.1 33.2 33.3	**Copper and copper alloys**	Free cutting alloys, ≥1 % Pb Brass, leaded bronzes, ≤1% Pb Bronze and non-leadad copper incl. electrolytic copper	550 550 1350	110 90 100	0,25 0,25	585 – 575 – 565 585 – 575 – 565 405 – 400 – 395	560 – 550 – 540 555 – 550 – 540 390 – 385 – 375
	CMC No.	**Material**		**Specific cutting force kc 1 N/mm²**	**Hardness Brinell HB**	**mc**	**1025**	**H13A**
							Max chip thickness, h_{ex} mm	
							0,05 –0,15 – 0,2	0,1 –0,15 – 0,2
							Cutting speed, v_c m/min	
S		**Heat resistant super alloys**						
	20.11 20.12	Iron base	Annealed or solution treated Aged or solution treated and aged	2400 2500	200 280	0,25 0,25	70 – 70 – 70 55 – 50 – 50	70 – 65 – 65 49 – 48 – 48
	20.21 20.22 20.24	Nickel base	Annealed or solution treated Aged or solution treated and aged Cast or cast and aged	2650 2900 3000	250 350 320	0,25 0,25 0,25	70 – 65 – 65 42 – 41 – 40 50 – 50 – 50	65 – 65 – 60 40 – 39 – 38 49 – 49 – 48
	20.31 20.32 20.33	Cobalt base	Annealed or solution treated Solution treated and aged Cast or cast and aged	2700 3000 3100	200 300 320	0,25 0,25 0,25	30 – 29 – 28 21 – 20 – 20 20 – 19 – 18	28 – 27 – 26 20 – 20 – 19 19 – 19 – 18
		Titanium alloys[1)]			Rm[2)]			
	23.1 23.21 23.22		Commercial pure (99,5% Ti) α, near α and α+β alloys, annealed α+β alloys in aged cond., β alloys, annealed or aged	1300 1400 1400	400 950 1050	0,23 0,23 0,23	150 – 145 – 140 80 – 75 – 75 65 – 60 – 60	140 – 140 – 135 75 – 70 – 70 60 – 60 – 60
	CMC No.	**Material**		**Specific cutting force kc 1 N/mm²**	**Hardness Brinell HB**	**mc**	**530**	**4020**
							Max chip thickness, h_{ex} mm	
							0,07 –0,12 – 0,2	0,07 –0,12 – 0,25
							Cutting speed, v_c m/min	
H	04.1	**Extra hard steel**	Hardened and tempered	4200	59 HRC	0,25	95 – 90 – 85	65 – 60 – 60
	10.1	**Chilled cast iron**	Cast or cast and aged	2200	400	0,28	180 – 175 – 165	125 – 120 – 115

H10F	**H13A**	**CD10**	**H13A**					
Max chip thickness, h_{ex} mm								
0,1 –0,15 – 0,2	0,1 –0,15 – 0,2	0,1 –0,15 – 0,2	0,1 –0,15 – 0,2					
Cutting speed, v_c m/min								
1060 – 1040 – 1025	845 – 830 – 820	2115 –2080 – 2045	1060 – 1040 – 1025					
955 – 935 – 920	765 – 750 – 740	1905 –1875 – 1845	955 – 935 – 920					
1060 – 1040 – 1025	845 – 835 – 820	215 –2080 – 2050	1060 – 1040 – 1025					
955 – 940 – 925	765 – 750 – 740	1910 –1875 – 1845	995 – 940 – 925					
1065 – 1045 – 1030	850 – 840 – 825	2130 –2095 – 2060	1065 – 1045 – 1030					
425 – 420 – 410	340 – 335 – 330	850 – 835 – 825	425 – 420 – 410					
320 – 315 – 310	255 – 250 – 245	640 – 630 – 620	320 – 315 – 310					
530 – 520 – 515	425 – 420 – 410	1060 –1045 – 1025	530 – 520 – 515					
530 – 520 – 515	425 – 415 – 410	1060 –1045 – 1025	530 – 520 – 515					
370 – 365 – 360	295 – 290 – 285	740 – 730 – 715	370 – 365 – 360					
H10F	**2030**	**2040**						
Max chip thickness, h_{ex} mm								
0,1 –0,15 – 0,2	0,05 –0,15 –0,2	0,05 –0,15 –0,25						
Cutting speed, v_c m/min								
60 – 60 – 60	65 – 65 – 65	65 – 65 – 60						
45 – 45 – 44	49 – 47 – 47	49 – 47 – 46						
60 – 60 – 55	65 – 60 – 60	65 – 60 – 60						
36 – 35 – 35	39 – 38 – 37	39 – 38 – 37						
45 – 44 – 43	48 – 47 – 46	48 – 47 – 45						
26 – 25 – 24	28 – 27 – 26	28 – 27 – 26						
18 – 18 – 17	20 – 20 – 19	20 – 20 – 19						
17 – 17 – 16	19 – 18 – 17	19 – 18 – 17						
130 – 125 – 125	140 – 135 – 135	140 – 135 – 130						
65 – 65 – 65	75 – 70 – 70	75 – 70 – 70						
55 – 55 – 55	60 – 60 – 55	60 – 60 – 55						
3020	**3040**	**1025**	**P10A**	**CB50**				
Max chip thickness, h_{ex} mm								
0,1 – 0,2 –0,25	0,1 – 0,2 –0,25	0,07–0,12 – 0,2	0,05 – 0,1 – 0,15	0,07–0,12 – 0,2				
Cutting speed, v_c m/min								
75 – 75 – 70	55 – 50 – 49	47 – 46 – 44	150 – 90 – 55	190 – 185 – 175				
145 – 140 – 135	100 – 95 – 95	90 – 85 – 85	– – –	355 – 345 – 330				

A

Important productivity parameters in HSM and 3D machining

Calculation of true cutting speed in HSM applications

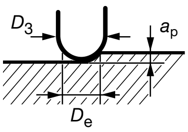


CoroMill 300

$$D_e = D_3 - iC + \sqrt{iC^2 - (iC - 2 \times a_p)^2}$$

CoroMill Ball nose

$$D_e = 2 \times \sqrt{a_p \times (D_c - a_p)}$$

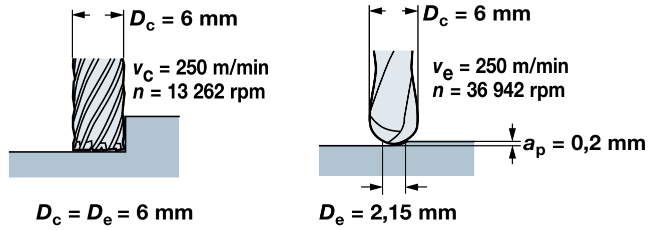


Effective cutting speed (v_e)

$$v_e = \frac{\pi \times n \times D_e}{1000} \quad \text{m/min}$$

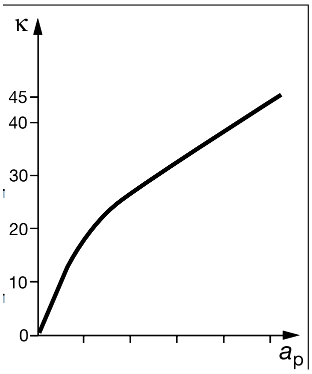
To get a correct v_c, v_f and an optimised productivity it is important to define the effective diameter in cut D_e.

True cutting speed and the consequence on rev/min and feed speed

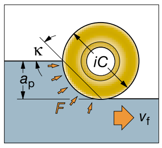


The linear dependence between cutting speed and feed rate results in "high feeds with high speeds". To compensate for a smaller diameter the spindle speed (rev/min) must be increased to keep the same cutting speed and the increased spindle speed gives higher feed speed v_f.

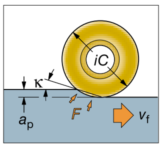
Round or radius insert cutters – the entering angle as a function of cutting depth a_p



Conventional machining



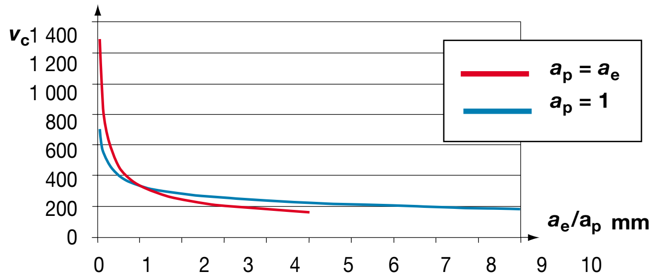
HSM, shallow cut



The typical shallow cut in HSM gives low cutting forces and deflection. The heat generated into the cutting material and component is heavily reduced. The chip thinning effect is dramatic and gives a possibility to increase speed and feed radically.

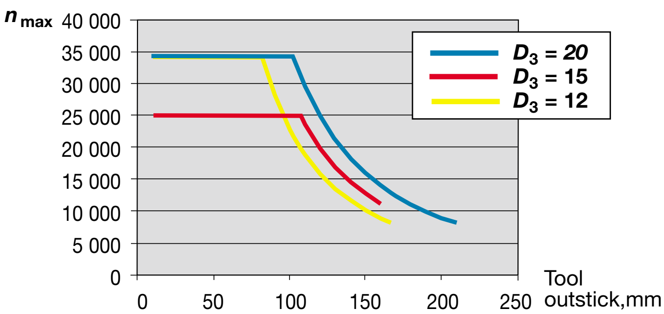
Compensated v_c due to low a_e/a_p

Ex. Solid carbide endmill dia.10 mm, alloy steel , 300 HB



In finishing with HSM it is possible to increase the cutting speed, v_c, with a factor of 3–5 compared with conventional milling. This is due to the extremly short contact time between the cutting edge and the component. The heat generated is very small and so is the amount of efficient work per revolution. This normally gives a very long tool life, which in turn opens for big productivity improvements, as the feed speed is dependant of the cutting speed v_c. Very typical a_e/a_p values in finishing with HSM ranges round 0,2/0,2 mm.

Max. rev/min, n_{max}, related to tool outstick

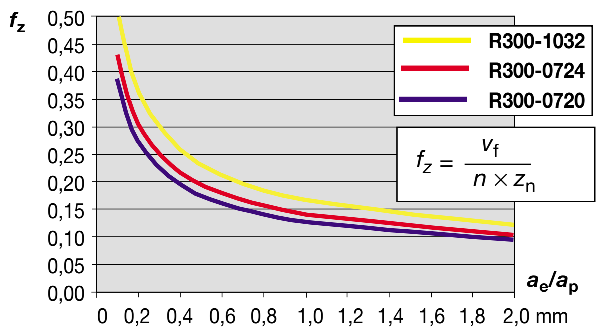


The graph shows three examples on max spindle speed, n_{max}, due to outstick and tool diameter for CoroMill 300. There are two critical factors for the n_{max} at HSM:

1. *Insert movement in the tip seat (n_{max} recommendations are always given with a safety factor).*
2. *The dynamic rigidity of the tool.*

The graph show the dynamic rigidity. This is also an important safety consideration in HSM which always should be taken into account.

Feed/tooth related to a_e/a_p in HSM



Graph showing an example of increased feed/tooth, f_z, for CoroMill 300 round insert cutters (three different sizes) according to formula above.
The thin chip at low depth of cut, gives a big productivity increase, especially in semifinishing and finishing operations with HSM technology.

U-Lock thread milling tools R331.96

ISO	CMC[1)] No.	Material		HB	GC1020	GC4125
					Cutting speed v_c, m/min	
P	**01.1 01.2 01.3**	**Unalloyed carbon steel**	C<0,15% C<0,35% C<0,60%	**125 150 200**	170 280 240	185 310 265
P	**02.1 02.2**	**Alloyed steel**	Annealed Hardened and tempered	**180 275 300 350**	200 160 140 120	220 175 155 130
P	**03.1 03.2**	**High alloyed steel**	Annealed Hardened	**200 225**	180 120	200 130
P	**06.1 06.2 06.3**	**Steel castings**	Non alloy Low alloy High alloy	**180 200 225**	280 170 1130	310 185 145
M	**05.1**	**Stainless steel Annealed**	Ferr./Mart.	**200**	240	265
M	**05.2**	**Stainless steel Annealed**	Austenitic	**175**	260	285
S	**20.11 20.12**	**Heat resistant alloys**	Annealed Aged } Iron base	**200 280**	200 –	220 –
S	**20.21 20.22 20.24**	**Heat resistant alloys**	Annealed Aged Cast } Nickel or cobalt base	**250 350 320**	– – –	– – –
H	**04 06.33**	**Hard steel**	Hardened steel Manganese steel, 12%	**55HRC 250**	– 110	 120
K	**07.1 07.2**	**Malleable iron**	Ferritic Pearlitic	**130 230**	220 130	240 145
K	**08.1 08.2**	**Cast iron**	Low tensile High tensile	**180 260**	260 210	285 230
K	**09.1 09.2**	**Nodular SG iron**	Ferritic Pearlitic	**160 250**	220 180	240 200
K	**10.1**	**Chilled cast iron**		**400**	30	35
N	**30.11 30.12**	**Aluminium alloys**	Non heat treatable Heat treatable	**60 100**	600 470	660 515
N	**30.21 30.22**	**Aluminium alloys (Cast)**	Non heat treatable Heat treatable	**75 90**	210 170	230 185
N	**33.1 33.2**	**Bronze/Brass alloys**	Lead alloys, Pb>1% Brass, red brass	**110 90**	600 520	660 570
N	**33.3**	**Bronze/Brass alloys**	Bronze and lead-free copper incl. electrolytic copper	**100**	480	530

1) Coromant Material Classification. See cross reference list section F.

❶ Select cutting speed, v_c, above according to workpiece material and insert grade

❷ Calculate revolution per minute: $n = \dfrac{v_c \times 1000}{\pi \times D_c \text{ (tool)}}$

❸ Select feed per revolution

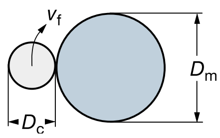
Insert size	Feed, f_r (mm/rev)
16	0,15-0,30
22	0,30-0,45

❹ Calculate linear feed according to formula:
$v_f = n \times f_r$

❺ Calculate interpolation feed rate and tool centre according to approximative formulas, see pages A 248 and A 249.

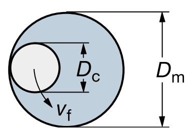
External

$$v_{f1} = v_f \sqrt{\frac{D_m + D_c}{D_m}}$$



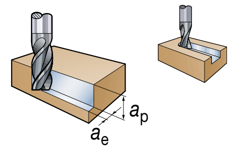
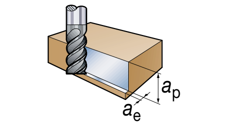
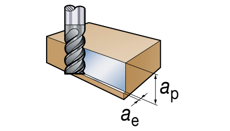
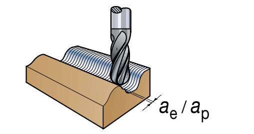
Internal

$$v_{f1} = v_f \sqrt{\frac{D_m - D_c}{D_m}}$$

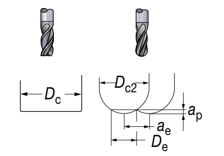
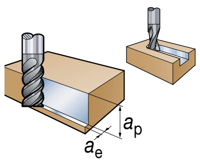
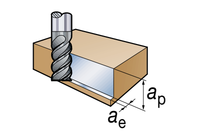
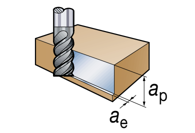
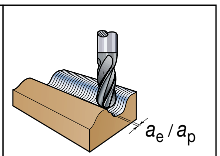


CoroMill® Plura cutting data

Speed recommendations

CoroMill® Plura GC1620 GC1630 H10F							
				$a_p \times a_e > D_c$	$a_p \times a_e < D_c$	$a_e \leq$ **0,05** $\times D_c$	$a_e \leq$ **0,05** $\times D_c$ or D_{c2} $a_p \leq$ **0,05** $\times D_c$ or D_{c2}
ISO	**CMC**	**HB**	**HRC**	v_e m/min	v_e m/min	v_e m/min	v_e m/min
P	**01.1**	**125**		155	200	375	690
	01.2	**150**		135	185	340	630
	01.4	**200**		120	140	255	470
	02.2	**250**		100	130	245	450
	02.2	**300**		90	120	220	410
	03.22	**400**		75	95	180	335
	03.22	**450**		65	85	160	300
M	**05.11**	**200**		60	90	165	300
	05.21	**200**		60	75	145	270
	05.51	**230**		45	55	110	200
K	**07.1**	**150**		135	180	330	610
	09.2	**200**		100	130	240	440
	08.1	**180**		85	110	210	385
N	**30.22**	**90**		1000	1100	1250	1300
S	**20.22**	**350**		265	300	510	1300
	23.22	**350**		220	255	420	1070
H	**04.1**		**50**	55	80	GC1610	
			55	-	55		
			60	-	40		

Feed recommendations

CoroMill® Plura GC1620 GC1630 H10F					
Metric	D_c or D_{c2} mm	f_z mm/tooth	f_z mm/tooth	f_z mm/tooth	f_z mm/tooth
		Plura Guide			
	0,5				
	1	0,002	0,002	0,013	0,023
	2	0,004	0,003	0,032	0,056
	3	0,006	0,007	0,039	0,07
	3,175	0,006	0,008	0,040	0,072
	4	0,008	0,014	0,045	0,08
	4,76	0,010	0,019	0,046	0,078
	5	0,011	0,021	0,046	0,078
	6	0,014	0,03	0,055	0,099
	6,35	0,015	0,031	0,056	0,102
	8	0,020	0,033	0,063	0,114
	9,525	0,025	0,050	0,069	0,124
	10	0,027	0,055	0,071	0,127
	12	0,036	0,071	0,077	0,139
	12,7	0,039	0,074	0,079	0,143
	15,875	0,054	0,089	0,089	0,160
	16	0,055	0,09	0,089	0,161
	19,05	0,073	0,105	0,097	0,175
	20	0,078	0,11	0,1	0,18
	25	0,11	0,11	0,11	—

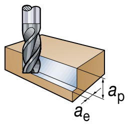
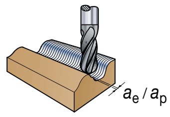
$$n = \frac{1000 \times v_c \text{ or } v_e}{\pi \times D_c \text{ or } D_{c2}} \quad \text{(rpm)}$$

$$v_f = n \times f_z \times z_n \quad \text{(mm/min)}$$

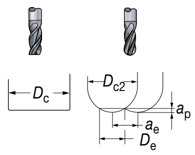
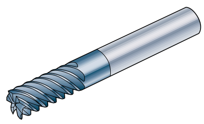
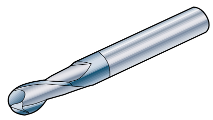
$$D_e = 2 \times \sqrt{a_p \times (D_{c2} - a_p)} \quad \text{(mm)}$$

CoroMill® Plura cutting data

Speed recommendations

CoroMill® Plura GC1610							
				$a_e < \mathbf{0,1} \times D_c$ $a_p < \mathbf{0,5} \times D_c$	$a_e < \mathbf{0,05} \times D_c$ $a_p < \mathbf{1} \times D_c$	$a_e < \mathbf{0,1} \times D_{c2}$ or D_e $a_p < \mathbf{0,1} \times D_{c2}$ or D_e	$a_e < \mathbf{0,01} \times D_{c2}$ or D_e $a_p < \mathbf{0,01} \times D_{c2}$ or D_e
ISO	**CMC**	**HB**	**HRC**	v_e m/min	v_e m/min	v_e m/min	v_e m/min
P	**03.22**	**400**		170	200	320	815
		450		150	180	280	715
K	**08.1**	**200**		265	300	510	1300
	09.2	**250**		220	255	420	1070
H	**04.1**		**48**	130	170	270	680
			52	120	155	210	600
			55	105	110	200	425
			58	75	90	145	370
			60	65	80	130	320
			62	60	65	100	265

Feed recommendations

CoroMill® Plura GC1610				
			$a_e < \mathbf{0,1} \times D_{c2}$ or D_e $a_p < \mathbf{0,1} \times D_{c2}$ or D_e	$a_e < \mathbf{0,01} \times D_{c2}$ or D_e $a_p < \mathbf{0,01} \times D_{c2}$ or D_e
Metric	D_c or D_{c2} (mm)	f_z mm/tooth	f_z mm/tooth	f_z mm/tooth
$n = \frac{v_e \times 1000}{\pi \times D_e}$ (rpm)	1	–	0,015	0,040
$v_f = n \times f_z \times z_n$ (mm/min)	2	–	0,035	0,055
$D_e = 2 \times \sqrt{a_p \times (D_{c2} - a_p)}$ (mm)	3	0,040	0,050	0,070
	3,175	0,041	0,055	0,072
	4	0,045	0,080	0,080
	4,76	0,037	0,088	0,088
	5	0,035	0,090	0,090
	6	0,030	0,100	0,100
	6,35	0,034	0,103	0,103
	8	0,055	0,115	0,115
	9,525	0,066	0,123	0,123
	10	0,070	0,125	0,125
	12	0,075	0,140	0,140
	12,7	0,078	0,144	0,144
	15,875	0,090	–	–
	16	0,090	0,160	0,160
	19,05	0,098	–	–

High security demands in HSM

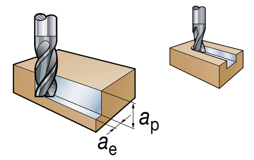
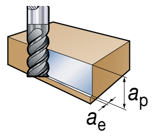
The machine tools used for HSM must be safely guarded, as splinters or parts of damaged tools might cause serious accidents. High speed machinery has to be "bullet proof".

Dry milling extends tool life

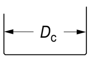
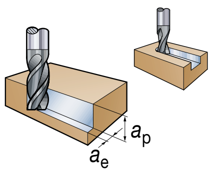
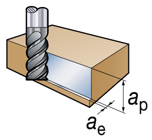
CoroMill Plura endmills are developed to withstand constant high cutting speeds and temperatures. Their tool life and reliability are, in most cases, much better suited to a dry environment. Tool life improvements of more than 40% are not unusual.

CoroMill® Plura cutting data

Speed recommendations

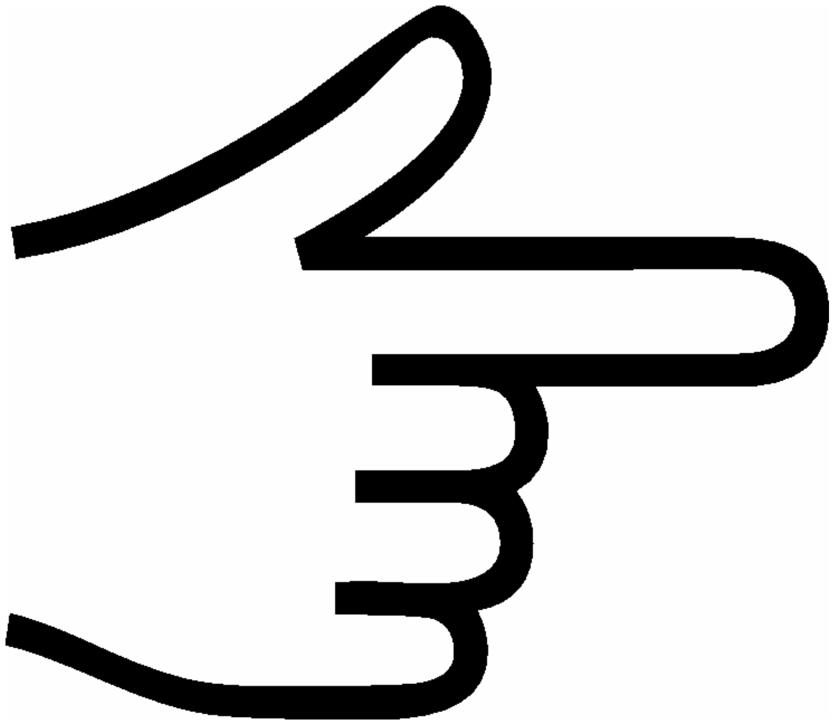
CoroMill® Plura GC1640					
				$a_p \times a_e \leq D_c$	$a_p \times a_e < 0,5 \times D_c$
ISO	**CMC**	**HB**	**HRC**	v_e m/min	v_e m/min
P	01.1	125		145	160
	01.2	150		135	145
	01.4	200		100	110
	02.2	250		85	95
	02.2	300		80	85
	03.22	350		75	80
M	05.11	200		65	70
	05.21	200		50	55
	05.51	230		35	40
K	07.1	150		130	14
	09.2	200		105	115
	08.1	250		70	75
S	20.22	350		25	25
	23.22	350		40	45

Feed recommendations

CoroMill® Plura GC1640			
Metric	D_c mm	f_z mm/tooth	f_z mm/tooth
$n = \dfrac{v_c \times 1000}{\pi \times D_c}$ (rpm)	6	0,013	0,019
$v_f = n \times f_z \times z_n$ (mm/min)	6,35	0,013	0,022
	8	0,016	0,035
	9,525	0,023	0,041
	10	0,025	0,043
	12	0,031	0,055
	12,7	0,035	0,057
	15,875	0,052	0,068
	16	0,053	0,069
	19,05	0,065	0,081
	20	0,069	0,085

This PDF document is divided into several files

Please click here to continue



SANDVIK Coromant