



Cutting data

How to choose cutting data

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

Conditions:	Cutter-Insert-Workpiece material:	R245-125Q40-12M R245-12 T3 M-PM SS1672-08	GC4030 HB = 180
Formulas to be used:		$n = \frac{v_c \times 1000}{\pi \times D_c}$	$v_f = z_n \times n \times f_z$
			$f_z = \frac{h_{ex}}{\sin \kappa_r}$

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 128, 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 128

For the CMC code see material cross reference list on pages 157.

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

Page 157

The cutting speed v_c is approx. 283 m/min for CMC 01.2 (between 325 and 265 m/min for $h_{ex} = 0,10$ and $0,20$ mm respectively), see page 130

Page 130

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 120.

The compensated cutting speed becomes $0,925 \times 283$ m/min ≈ 262 m/min.

Page 120

D_c Cutter diameter can be found in table on ordering page 22, 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 6.

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 128.

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

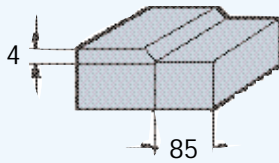
n Revolutions per minute $n = \frac{262 \times 1000}{\pi \times 125} = 667$ rpm

v_f Table feed per minute $v_f = 6 \times 667 \times 0,24 = 1281$ mm/min

Page 22



Facemilling



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)

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

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

To get v_e , first find h_{ex} value for -PM geometry on page 128.
The cutting speed v_e for GC4030, $h_{ex} = 0,17$ mm is 283 m/min (between 325 and 265 m/min), see page 130.

Calculate table feed (v_f)

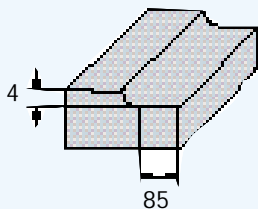
$$v_f = z_n \times n \times f_z$$

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

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

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

Facemilling with round inserts



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)

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

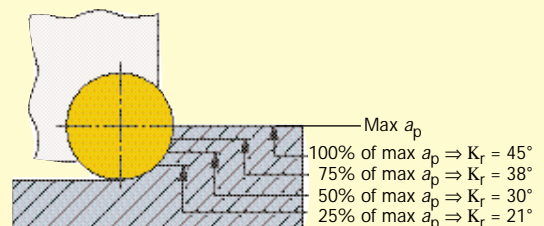
To get v_e , first find h_{ex} value for -PM geometry on page 128.
The cutting speed v_e for GC4030, $h_{ex} = 0,17$ mm is 283 m/min (between 325 and 265 m/min), see page 130.

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

Calculate table feed (v_f)

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

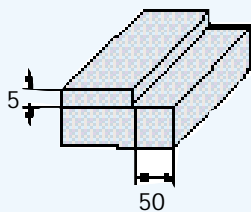
$$f_z = \frac{h_{ex}}{\sin \kappa_r} \quad f_z = \frac{0,17}{\sin 30^\circ} = 0,34 \text{ mm/tooth}$$





Cutting data - Example of how to calculate

Slotting/facemilling with 90° entering angle



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)

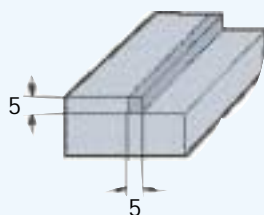
$$n = \frac{v_e \times 1000}{\pi \times D_c} = \frac{250 \times 1000}{\pi \times 63} \approx 1263 \text{ rpm}$$

To get v_e , first find h_{ex} value for -PM geometry on page 129.
The cutting speed v_e for GC1025, h_{ex} 0,15 is 250 m/min (between 275 and 225 m/min), see page 131.

Calculate table feed (v_f)

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

Sidemilling with 90° entering angle



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)

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

To get v_e , first find h_{ex} value for -PM geometry on page 129.
The cutting speed v_e for GC1025, h_{ex} 0,15 is 250 m/min (between 275 and 225 m/min), see page 131.

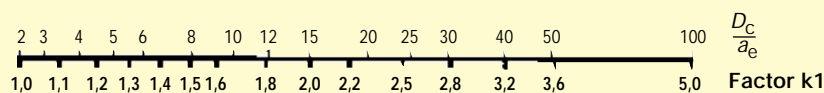
Calculate table feed (v_f)

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

$$v_f = k1 \times z_n \times n \times f_z \quad v_f = 1,82 \times 5 \times 1263 \times 0,15 \approx 1723 \text{ mm/min} \quad (f_z = h_m \sqrt{\frac{D_c}{a_e}})$$

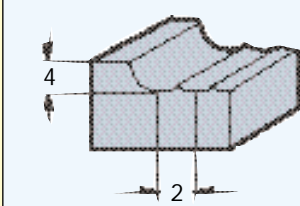
Find the compensation factor, $k1$, in the table below by calculating D_c/a_e

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





Ball nose endmilling



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)

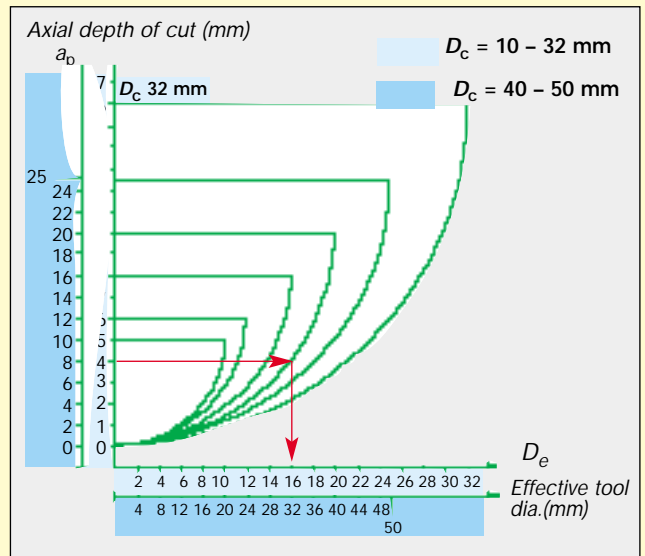
$$n = \frac{v_e \times 1000}{\pi \times D_e}$$

$$n = \frac{327 \times 1000}{\pi \times 16} \approx 6505 \text{ rpm}$$

To get v_e , first find h_{ex} value for -M geometry on page 128.
 The cutting speed v_e for GC4040, h_{ex} 0,07 is 327 m/min (between 330 and 315 m/min), see page 135.

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)

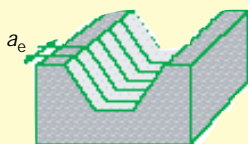
$$v_f = Z_n \times n \times f_z$$

$$v_f = 2 \times 6505 \times 0,1 \approx 1301 \text{ mm/min}$$

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

Recommended feed, f_z mm								
Diameter, D_c	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 and axial depths of cut for ball nose endmills



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





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

Cutter dia. D_c	Max. recommended under ideal conditions	
	Radial depth of cut (a_e)	Axial depth of cut (a_p)
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_c	a_e			a_e	a_e	a_e
		a_e	a_e			
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



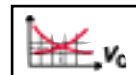
Cutting data - Feed recommendations

FACEMILLING AND ENDMILLING $K_r = 45^\circ$		Insert geometry	Feed per tooth, f_z (mm/tooth)		Max chip thickness, h_{ex} (mm)		
			Starting value	(min. - max.)	Starting value	(min. - max.)	
 CoroMill 245 R245	E-PL } E-ML } E-KL }	<i>Light</i>	0,14	(0,08 – 0,21)	GC4030, GC3020 CT530, H13A GC1025	0,10	(0,06 – 0,15)
			0,11	(0,07 – 0,17)		0,08	(0,05 – 0,12)
			0,09	(0,05 – 0,12)		0,06	(0,035 – 0,085)
		M-PL } M-KL }	<i>Light</i>	0,17	(0,08 – 0,21)	0,12	(0,06 – 0,15)
				M-PM } M-KM }	<i>Medium</i>	0,24	(0,1 – 0,28)
M-PH } M-KH }	<i>Heavy</i>	0,35	(0,10 – 0,42)	0,25		(0,07 – 0,30)	
E-AL			0,24	(0,10 – 0,28)	0,11	(0,04 – 0,30)	
 T-MAX 45 R/L260.7	LNCX-11 } -31 } -32 } LNMX-11 }	<i>Medium</i>	0,35	(0,10 – 1,0)	0,25	(0,07 – 0,70)	
			0,35	(0,10 – 0,70)	0,25	(0,07 – 0,50)	
			0,35	(0,10 – 0,70)	0,25	(0,07 – 0,50)	
			0,35	(0,10 – 1,0)	0,25	(0,07 – 0,70)	

RADIUS

 CoroMill 200 R200	-PL } -KL }	<i>Light</i>	0,11	(0,07 – 0,17)	0,08	(0,05 – 0,12)
	-WM } -PM } -KM }	<i>Medium</i>	0,24	(0,10 – 0,28)	0,17	(0,10 – 0,20)
	-WH } -KH } -PH }		<i>Heavy</i>	0,35	(0,10 – 0,42)	0,25
 CoroMill 200 R200	-PL } -KL }	<i>Light</i>		0,11	(0,07 – 0,17)	0,08
	-WM } -PM } -KM }	<i>Medium</i>	0,24	(0,10 – 0,28)	0,17	(0,10 – 0,20)
	-WH } -KH } -PH }		<i>Heavy</i>	0,35	(0,10 – 0,42)	0,25
 Coromant ball nose endmill R216	-12			0,05	(0,05-0,10)	0,04
	-16		0,08	(0,08-0,15)	0,06	(0,06-0,11)
	-20		0,10	(0,10-0,20)	0,07	(0,07-0,14)
	-25		0,12	(0,12-0,25)	0,08	(0,08-0,18)
	-30		0,15	(0,15-0,35)	0,11	(0,11-0,25)
	-32		0,15	(0,15-0,35)	0,11	(0,11-0,25)
	-40		0,20	(0,20-0,40)	0,14	(0,14-0,28)
	-50		0,25	(0,25-0,40)	0,18	(0,18-0,28)

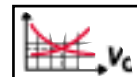
Cutting data - Feed recommendations



FACEMILLING AND ENDMILLING $K_r = 90^\circ$		Insert geometry	Feed per tooth, f_z (mm/tooth)		Max chip thickness, h_{ex} (mm)		
			Starting value	(min. - max.)	Starting value	(min. - max.)	
 CoroMill 290 R/L290	E-PL } E-KL }	Light	0,06	(0,05 - 0,09) 1025	0,06	(0,05 - 0,09)	
			0,08	(0,07 - 0,12) H13A, 530	0,08	(0,07 - 0,12)	
		0,10	(0,08 - 0,15) 4030, 3020	0,10	(0,08 - 0,15)		
		M-PL M-KL M-WL	Light	0,12	(0,08 - 0,15)	0,12	(0,08 - 0,15)
	M-PM M-KM M-WM	Medium	0,17	(0,10 - 0,20)	0,17	(0,10 - 0,20)	
		M-PH M-KH M-WH	Heavy	0,25	(0,10 - 0,30)	0,25	(0,10 - 0,30)
 CoroMill 390 R390	E-PL } E-KL }	Light	0,06	(0,03 - 0,10) 530	0,10	(0,03 - 0,15)	
			0,08	(0,03 - 0,12) 1025, H13A	0,10	(0,03 - 0,15)	
	M-PL } M-KL }	Light	0,08	(0,05 - 0,15) 1025, 530, 4030	0,08	(0,05 - 0,15)	
			0,10	(0,08 - 0,15) 4040, 3040	0,10	(0,08 - 0,15)	
M-PM M-KM	Medium	0,10	(0,08 - 0,18) 4030, H13A,	0,10	(0,08 - 0,18)		
		0,12	(0,08 - 0,20) 530, 3040	0,12	(0,08 - 0,20)		
0,15	(0,10 - 0,20) 1025, 4040	0,15	(0,10 - 0,20)				
 CoroMill 390 R390	E-PL } E-KL }	Light	0,06	(0,03 - 0,10) 530	0,10	(0,03 - 0,15)	
			0,08	(0,03 - 0,12) 1025, H13A	0,10	(0,03 - 0,15)	
	M-PL } M-KL }	Light	0,08	(0,05 - 0,15) 1025, 530, 4030	0,08	(0,05 - 0,15)	
			0,10	(0,08 - 0,15) 4040, 3040	0,10	(0,08 - 0,15)	
M-PM M-KM	Medium	0,10	(0,08 - 0,18) 4030, H13A,	0,10	(0,08 - 0,18)		
		0,12	(0,08 - 0,20) 530, 3040	0,12	(0,08 - 0,20)		
0,15	(0,10 - 0,20) 1025, 4040	0,15	(0,10 - 0,20)				
 U-MAX ¹⁾ Drilling endmill R216.2	216.2-08 10 17 15		0,12	(0,08 - 0,15)	0,12	(0,08 - 0,15)	
			0,17	(0,10 - 0,20)	0,17	(0,10 - 0,20)	

¹⁾ f_z , starting value is valid for full slot milling.

Cutting data - cutting speed recommendations



Basic grades									
4040		1025		3040		530		SM30	
Feed/tooth (f_z , mm/tooth) or max chip thickness (h_{ex} , mm)									
0,1- 0,2- 0,4		0,05- 0,1- 0,2		0,05- 0,1- 0,2		0,1- 0,2- 0,4		0,1- 0,2- 0,4	
Cutting speed, v_c m/min									
305- 225- 170 275- 225- 155 260- 215- 145 225- 185- 125 165- 135- 95	340- 305- 255 305- 275- 225 285- 260- 215 250- 225- 185 185- 165- 135	385- 315- 260 350- 285- 235 330- 270- 220 285- 235- 195 215- 175- 145	425- 385- 350 385- 350- 315 365- 325- 295 315- 285- 260 235- 210- 195	265- 225- 165 235- 205- 150 225- 195- 145 195- 165- 125 145- 125- 90					
215- 175- 120 155- 125- 85 125- 100- 65	235- 215- 175 165- 155- 125 135- 125- 100	275- 225- 185 190- 155- 130 155- 125- 105	300- 275- 245 210- 190- 175 170- 155- 140	185- 160- 115 130- 115- 85 105- 90- 65					
165- 135- 90 135- 110- 75 115- 95- 65 75- 60- 41	180- 165- 135 150- 135- 110 130- 115- 95 80- 75- 60	205- 170- 145 170- 140- 115 145- 120- 100 95- 75- 65	225- 205- 185 185- 170- 155 165- 150- 135 105- 95- 85	140- 120- 85 115- 100- 75 105- 85- 65 65- 55- 41					
220- 180- 120 175- 145- 95 125- 105- 70	245- 220- 180 195- 175- 145 140- 125- 105	275- 225- 185 220- 180- 145 160- 135- 110	305- 275- 250 245- 220- 200 175- 160- 145	190- 165- 120 150- 130- 95 110- 95- 70					
Basic grades									
4040		1025		530		4030			
Feed/tooth (f_z , mm/tooth) or max chip thickness (h_{ex} , mm)									
0,1- 0,2- 0,4		0,1- 0,15- 0,2		0,1- 0,15- 0,2		0,1- 0,2- 0,3			
Cutting speed, v_c m/min									
200- 160- 105 115- 90- 55 115- 95- 60	210- 185- 165 120- 105- 95 125- 110- 100	285- 255- 225 165- 145- 130 170- 155- 135	245- 195- 115 140- 115- 90 145- 115- 95						
185- 145- 95 110- 85- 55	195- 175- 155 115- 105- 90	265- 235- 215 155- 140- 125	- - - - - -						
180- 145- 95 160- 125- 85	190- 170- 155 170- 150- 135	260- 235- 205 230- 205- 185	- - - - - -						
180- 145- 95 90- 70- 46 100- 80- 50	190- 170- 150 95- 85- 75 105- 95- 85	255- 230- 205 125- 115- 105 145- 125- 115	255- 180- 145 110- 90- 70 125- 100- 80						
180- 145- 95 90- 75- 46	190- 170- 150 95- 85- 75	255- 230- 205 125- 115- 105	- - - - - -						
135- 105- 65 135- 105- 65	135- 125- 110 140- 125- 115	190- 170- 150 195- 175- 155	- - - - - -						
Basic grades									
H13A									
Feed/tooth (f_z , mm/tooth) or max chip thickness (h_{ex} , mm)									
0,1- 0,15- 0,2									
Cutting speed, v_c m/min									
60- 55- 50 44- 41- 38									
55- 55- 49 35- 33- 30 44- 41- 38									
23- 21- 18 17- 15- 13 16- 14- 13									
125- 115- 105 65- 60- 55 55- 49- 46									

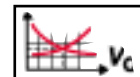


Cutting data - cutting speed recommendations

Facemilling, square shoulder facemilling

ISO	CMC No.	Material	Specific cutting force k_c 1	Hardness Brinell	mc	Basic grades			
						3020	3040		
						Feed, f_z or h_{ex}			
						0,1- 0,2-	0,3 0,1- 0,2- 0,4		
						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	265- 215- 180 220- 180- 145	240- 195- 135 195- 165- 110	
	08.1 08.2	Grey cast iron	Low tensile strength High tensile strength	900 1100	180 245	0,28 0,28	290- 235- 195 235- 190- 155	260- 215- 145 210- 170- 115	
	09.1 09.2	Nodular cast iron	Ferritic Pearlitic	900 1350	160 250	0,28 0,28	180- 145- 125 165- 135- 115	165- 135- 90 150- 125- 85	
	-H	CMC No.	Material		Specific cutting force k_c 1	Hardness Brinell		Basic grades	
					N/mm ²	HB	mc	4020	3040
								Feed, f_z or h_{ex}	
							0,07- 0,1- 0,12	0,07- 0,12- 0,2	
						Cutting speed, v_c m/min			
	04.1	Extra hard steel	Hardened and tempered	4200	59 HRC	0,25	65- 55- 48	47- 41- 33	
	10.1	Chilled cast iron	Cast or cast and aged	2200	400	0,28	125- 110- 90	90- 75- 65	
-N	CMC No	Material		Specific cutting force k_c 1	Hardness Brinell		Basic grades		
				N/mm ²	HB	mc	H10	CD10	
							Feed, f_z or h_{ex}		
							0,1- 0,15- 0,2 0,1- 0,15- 0,2		
							Cutting speed, v_c m/min		
		30.11	Aluminium alloys	Wrought or wrought and coldworked, non-aging	400	60		935- 870- 805	1875-1740- 1615
		30.12		Wrought or wrought and aged	650	100		845- 785- 725	1695-1565- 1455
		30.21 30.22	Aluminium alloys	Cast, non-aging Cast or cast and aged	600 700	75 90	0,25 0,25	940- 870- 805 845- 785- 725	1880-1745- 1615 1695-1570- 1455
	30.3			350	30		945- 875- 810	1890-1755- 1625	
	30.41 30.42	Aluminium alloys	Cast, 13-15% Si Cast, 16-22% Si	700 700	130 130		375- 350- 325 285- 265- 245	755- 700- 645 565- 525- 485	
	33.1 33.2 33.3	Copper and copper alloys	Free cutting alloys, $\geq 1\%$ Pb Brass, leaded bronzes, $\leq 1\%$ Pb Bronze and non-leadad copper incl. electrolytic copper	550 550 1350	110 90 100	0,25 0,25	470- 435- 405 470- 435- 405 325- 305- 285	945- 875- 810 940- 875- 805 655- 610- 565	

Cutting data - cutting speed recommendations



Basic grades														
4030			4040			H13A			690			CB50		
Feed/tooth (f_z, mm/tooth) or max chip thickness (h_{ex}, mm)														
0,1- 0,2- 0,4			0,1- 0,2- 0,4			0,1- 0,2- 0,4			0,1- 0,2- 0,3			0,1- 0,15- 0,2		
Cutting speed, v_c m/min														
215- 175- 115 175- 145- 95			195- 160- 105 160- 130- 85			120- 105- 75 95- 85- 65			545- 445- 365 455- 370- 305			- - - -		
230- 190- 125 185- 155- 105			215- 175- 115 170- 135- 95			130- 110- 85 105- 90- 65			595- 485- 400 475- 395- 325			845- 725- 365 675- 575- 305		
145- 120- 80 135- 110- 75			135- 105- 75 125- 100- 65			80- 70- 50 75- 65- 48			375- 305- 255 345- 285- 235			- - 495- 420- 360		
Basic grades														
1025			530			CB50								
Feed/tooth (f_z, mm/tooth) or max chip thickness (h_{ex}, mm)														
0,07- 0,1-0,12			0,07- 0,1- 0,12			0,07- 0,12- 0,2								
Cutting speed, v_c m/min														
41- 37- 35			80- 55- 70			160- 140- 115								
75- 70- 65			155- 140- 135			305- 265- 215								
Basic grades														
CT530			H13A			1025								
Feed/tooth (f_z, mm/tooth) or max chip thickness (h_{ex}, mm)														
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- 955- 885 930- 865- 800			750- 695- 645 675- 625- 580			985-915-845 885-825-765								
1035- 955- 885 930- 865- 800			750- 695- 645 675- 625- 580			985-915-845 890-825-765								
1040- 965- 895			755- 700- 650			995-920-855								
415- 385- 355 310- 285- 265			300- 280- 260 225- 210- 195			395-365-340 295-275-255								
515- 480- 445 515- 480- 445 365- 335- 310			375- 350- 325 375- 345- 325 265- 245- 225			495-455-425 495-455-425 345-320-295								



Cutting data - cutting speed recommendations

Endmilling

ISO	CMC No.	Material	Specific cutting force k_c 1	Hardness Brinell	mc	Basic grades		
						4020	4030	
						Feed, f_z or h_{ex}		
						0,1- 0,2- 0,3	0,05- 0,1- 0,15	
						Cutting speed, v_c m/min		
P		Steel						
	01.1	Unalloyed	C = 0,10 – 0,25 % C = 0,25 – 0,55 % C = 0,55 – 0,80 %	1500	125	0,25	490- 405- 330	430- 425- 415
	01.2			1600	150	0,25	440- 360- 295	385- 380- 375
	01.3			1700	170	0,25	415- 340- 280	365- 355- 350
	01.4			1800	210	0,25	365- 295- 245	320- 315- 305
	01.5			2000	300	0,25	265- 220- 180	235- 230- 225
	02.1	Low-alloy (alloying elements ≤ 5%)	Non-hardened Hardened and tempered	1700	175	0,25	345- 285- 230	305- 295- 290
	02.2			2000	275	0,25	245- 195- 165	215- 215- 205
	02.2			2300	350	0,25	195- 160- 130	175- 165- 165
	03.11	High-alloy (alloying elements > 5%)	Annealed Hardened tool steel	1950	200	0,25	295- 245- 200	230- 225- 220
	03.13			2150	200	0,25	245- 175- 145	190- 185- 185
	03.21			2900	300	0,25	185- 155- 125	165- 165- 155
03.22	3100			380	0,25	115- 95- 75	105- 100- 100	
06.1	Castings	Unalloyed Low-alloy (alloying elements ≤ 5%) High-alloy, alloying elements > 5%	1400	150	0,25	350- 285- 235	310- 305- 295	
06.2			1600	200	0,25	275- 225- 185	245- 240- 235	
06.3			1950	200	0,25	205- 165- 135	180- 175- 175	
ISO	CMC No.	Material	Specific cutting force k_c 1	Hardness Brinell	mc	Basic grades		
						2030	2040	
						Feed, f_z or h_{ex}		
						0,05- 0,15- 0,25	0,1- 0,2- 0,3	
						Cutting speed, v_c m/min		
M		Stainless steel						
	05.11	Ferritic/martensitic	Non-hardened PH-hardened Hardened	1800	200	0,21	240- 190- 155	235- 190- 155
	05.12			2800	330	0,21	170- 135- 105	165- 130- 105
	05.13			2300	330	0,21	175- 140- 115	175- 135- 110
	05.21	Austenitic	Non-hardened PH-hardened	2000	200	0,21	235- 185- 150	200- 160- 125
	05.22			2800	330	0,21	165- 130- 105	155- 125- 100
	05.51	Austenitic-ferritic (Duplex)	Non-weldable ≥ 0,05%C Weldable < 0,05%C	2000	230	0,21	195- 155- 125	165- 135- 105
	05.52			2400	260	0,21	165- 130- 105	135- 105- 85
	15.11	Stainless steel - Cast	Non-hardened PH-hardened Hardened	1700	200	0,25	215- 170- 135	210- 170- 135
	15.12			2500	330	0,25	145- 115- 95	145- 115- 90
	15.13			2100	330	0,25	160- 125- 105	160- 125- 100
	15.21	Austenitic	Austenitic PH-hardened	1800	200	0,25	225- 175- 145	190- 155- 125
15.22	2500			330	0,25	145- 115- 95	145- 115- 90	
15.51	Austenitic-ferritic (Duplex)	Non-weldable ≥ 0,05%C Weldable < 0,05%C	1800	230	0,25	185- 145- 115	155- 125- 100	
15.52			2200	260	0,25	150- 120- 95	125- 100- 80	
ISO	CMC No.	Material	Specific cutting force k_c 1	Hardness Brinell	mc	Basic grades		
						1025	H10F	
						Feed, f_z or h_{ex}		
						0,05- 0,1- 0,15	0,05- 0,1- 0,15	
						Cutting speed, v_c m/min		
-S		Heat resistant super alloys						
	20.11	Iron base	Annealed or solution treated Aged or solution treated and aged	2400	200	0,25	70- 70- 65	65- 60- 60
	20.12			2500	280	0,25	55- 50- 50	46- 45- 45
	20.21	Nickel base	Annealed or solution treated Aged or solution treated and aged Cast or cast and aged	2650	250	0,25	65- 65- 65	60- 55- 55
	20.22			2900	350	0,25	42- 42- 41	36- 36- 35
	20.24			3000	320	0,25	50- 50- 50	45- 44- 44
	20.31	Cobalt base	Annealed or solution treated Solution treated and aged Cast or cast and aged	2700	200	0,25	30- 29- 29	26- 26- 25
	20.32			3000	300	0,25	21- 21- 20	19- 18- 18
	20.33			3100	320	0,25	20- 19- 19	18- 17- 17
	23.1	Titanium alloys ¹⁾	Commercial pure (99,5% Ti) α , near α and $\alpha + \beta$ alloys, annealed $\alpha + \beta$ alloys in aged cond., β alloys, annealed or aged	1300	Rm ²⁾	0,23	145- 145- 145	130- 125- 125
	23.21			1400	950	0,23	75- 75- 75	65- 65- 65
	23.22			1400	1050	0,23	65- 65- 60	55- 55- 55

¹⁾ 45-60° entering angle, positive cutting geometry and coolant should be used.

²⁾ Rm = ultimate tensile strength measured in MPa.

Cutting data - cutting speed recommendations



Basic grades						
4040	1025	3040	530	SM30		
Feed/tooth (f_z , mm/tooth) or max chip thickness (h_{ex} , mm) Feed, f_n mm/r						
0,05- 0,1- 0,15	0,05- 0,15- 0,25	0,05- 0,1- 0,15	0,05- 0,11- 0,2	0,08-0,15-0,25		
Cutting speed, v_c m/min						
365- 350- 335 330- 315- 305 310- 295- 285 275- 260- 250 200- 195- 185	365- 350- 335 330- 315- 305 310- 295- 285 275- 260- 250 200- 195- 185	465- 350- 335 415- 315- 305 395- 295- 285 345- 260- 245 255- 195- 185	510- 495- 475 460- 450- 430 435- 425- 405 375- 370- 355 275- 275- 260	300- 295- 285 270- 265- 255 255- 245- 240 225- 215- 210 165- 160- 155		
255- 245- 235 180- 175- 165 145- 140- 135	255- 245- 235 180- 175- 165 145- 140- 135	325- 245- 235 225- 175- 165 185- 140- 135	355- 350- 335 250- 255- 235 205- 195- 190	210- 205- 195 145- 145- 140 120- 115- 115		
195- 185- 175 160- 155- 145 140- 135- 130 85- 85- 80	195- 185- 175 160- 155- 145 140- 135- 130 85- 85- 80	245- 185- 175 205- 155- 145 175- 135- 130 110- 85- 80	270- 265- 255 225- 220- 210 195- 190- 185 125- 120- 115	160- 155- 150 135- 130- 125 115- 115- 110 75- 70- 65		
265- 250- 240 205- 200- 190 155- 145- 140	265- 250- 240 205- 200- 190 155- 145- 140	330- 250- 240 265- 200- 190 195- 145- 140	365- 355- 340 290- 285- 275 215- 205- 195	215- 210- 205 170- 165- 160 125- 125- 115		
Basic grades						
4040	1025	530	4030			
Feed/tooth (f_z , mm/tooth) or max chip thickness (h_{ex} , mm)						
0,05- 0,12- 0,2	0,05- 0,12- 0,2	0,05- 0,1- 0,15	0,05- 0,1- 0,15			
Cutting speed, v_c m/min						
245- 235- 225 135- 135- 125 145- 140- 135	255- 245- 235 145- 140- 135 150- 145- 140	350- 340- 335 195- 195- 185 210- 200- 195	305- 295- 285 170- 165- 165 175- 175- 170			
225- 220- 210 135- 125- 125	235- 230- 220 140- 135- 130	325- 315- 310 190- 185- 180	- - - -			
220- 215- 205 195- 190- 185	235- 225- 215 205- 200- 190	315- 310- 300 280- 275- 265	- - - -			
220- 215- 205 110- 105- 100 125- 115- 115	230- 225- 215 115- 110- 105 125- 125- 115	315- 305- 300 155- 155- 145 175- 170- 165	275- 265- 260 135- 345- 130 150- 145- 145			
220- 215- 205 110- 105- 105	230- 225- 215 115- 110- 105	315- 305- 300 155- 155- 150	- - - -			
165- 155- 150 165- 160- 155	170- 165- 155 175- 165- 160	230- 225- 220 235- 230- 225	- - - -			
Basic grades						
H13A						
Feed/tooth (f_z , mm/tooth) or max chip thickness (h_{ex} , mm)						
0,05- 0,1- 0,15						
Cutting speed, v_c m/min						
65- 65- 65 50- 49- 48						
65- 65- 65 40- 40- 39 50- 49- 49						
28- 28- 27 20- 20- 19 20- 19- 19						
145- 140- 135 75- 75- 70 60- 55- 55						



Cutting data - cutting speed recommendations

Endmilling

ISO	CMC No.	Material	Specific cutting force k_c 1	Hardness Brinell	mc	Basic grades			
						3040	4030		
						Feed, f_z or h_{ex}			
						0,1- 0,2- 0,3	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	280- 265- 255 230- 220- 210	245- 235- 225 205- 195- 185	
	08.1 08.2	Grey cast iron	Low tensile strength High tensile strength	900 1100	180 245	0,28 0,28	305- 290- 275 245- 235- 225	270- 255- 245 215- 205- 195	
	09.1 09.2	Nodular cast iron	Ferritic Pearlitic	900 1350	160 250	0,28 0,28	190- 185- 175 175- 170- 160	170- 165- 155 155- 150- 145	
	-H	CMC No.	Material		Specific cutting force k_c 1	Hardness Brinell		Basic grades	
					N/mm ²	HB	mc	530	3040
								Feed, f_z or h_{ex}	
							0,07- 0,1- 0,12	0,07- 0,1- 0,12	
							Cutting speed, v_c m/min		
	04.1	Extra hard steel	Hardened and tempered	4200	59 HRC	0,25	95- 90- 90	55- 55- 55	
	10.1	Chilled cast iron	Cast or cast and aged	2200	400	0,28	175- 175- 175	105- 100- 100	
-N	CMC No.	Material		Specific cutting force k_c 1	Hardness Brinell		Basic grades		
				N/mm ²	HB	mc	H10F	H13A	
							Feed, f_z or h_{ex}		
							0,05- 0,1- 0,15		0,05- 0,1- 0,15
							Cutting speed, v_c m/min		
		30.11 30.12	Aluminium alloys	Wrought or wrought and coldworked, non-aging Wrought or wrought and aged	400 650	60 100		1075- 1055- 1035 965- 955- 935	860- 845- 830 775- 760- 745
		30.21 30.22	Aluminium alloys	Cast, non-aging Cast or cast and aged	600 700	75 90	0,25 0,25	1075- 1065- 1040 970- 955- 935	860- 845- 830 775- 765- 750
		30.3			350	30		1085- 1065- 1045	865- 850- 835
	30.41 30.42	Aluminium alloys	Cast, 13-15% Si Cast, 16-22% Si	700 700	130 130		435- 425- 415 325- 315- 315	345- 340- 335 260- 255- 250	
	33.1 33.2 33.3	Copper and copper alloys	Free cutting alloys, $\geq 1\%$ Pb Brass, leaded bronzes, $\leq 1\%$ Pb Bronze and non-leadad copper incl. electrolytic copper	550 550 1350	110 90 100	0,25 0,25	540- 530- 520 535- 530- 520 375- 370- 365	430- 425- 415 430- 425- 415 300- 295- 290	

Cutting data - cutting speed recommendations



Basic grades							
4040		HM		H13A			
Feed/tooth (f_z, mm/tooth) or max chip thickness (h_{ex}, mm)							
0,1- 0,2- 0,3	0,05- 0,14- 0,25	0,05-0,15-0,25					
Cutting speed, v_c m/min							
225- 215- 205 185- 175- 170	165- 165- 155 135- 135- 130	135- 135- 125 115- 110- 105					
245- 235- 225 195- 185- 180	185- 175- 170 145- 145- 135	150- 145- 140 120- 115- 110					
155- 145- 140 145- 135- 130	115- 115- 105 105- 105- 100	95- 90- 85 85- 85- 80					
Basic grades							
1025							
Feed/tooth (f_z, mm/tooth) or max chip thickness (h_{ex}, mm)							
0,07- 0,1- 0,12							
Cutting speed, v_c m/min							
47- 46- 46							
90- 85- 85							
Basic grades							
530		1025					
Feed/tooth (f_z, mm/tooth) or max chip thickness (h_{ex}, mm)							
0,05- 0,1- 0,15	0,05- 0,1- 0,15						
Cutting speed, v_c m/min							
1185- 1165- 1145 1165- 1045- 1030	1125- 1110- 1090 1025- 1000- 985						
1185- 1165- 1145 1165- 1045- 1030	1130- 1110- 1090 1015- 1000- 985						
1190- 1170- 1150	1135- 1115- 1095						
475- 465- 460 355- 350- 345	455- 445- 435 340- 335- 330						
595- 585- 575 595- 585- 575 415- 405- 400	565- 555- 545 565- 555- 545 395- 385- 380						



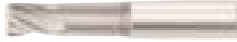
Cutting data

Solid endmills

High speed machining (HSM) with grade GC1010



R216.22-...L 1010



R216.24-...L 1010

Materials			
ISO	CMC No	HB	Cutting speed v_c m/min
P	01.1	Unalloyed steel	125
	01.2	Unalloyed steel	150
	02.1	Low alloy steel	175
	02.2	Low alloy steel	330
	03.11	High alloy steel	200
M	05.11	Stainless steel	200
	05.21	Stainless steel	200
	05.51	Stainless steel	230
	20.22	Heat resistant alloys	350
	23.22	Titanium alloys	350
K	04	Hard steel	HRC55
	04	Hard steel	HRC63
	07.1	Malleable cast iron	130
	07.2	Malleable cast iron	230
	09.1	Nodular SG iron	160
	09.2	Nodular SG iron	250
	08.1	Cast iron	180
	08.1	Cast iron	300-500
	30.22	Aluminium alloys (cast)	90
	30.22	Aluminium alloys (cast)	1000

D_c mm	Feed/tooth f_z mm/z
3	0,03–0,04
4	0,04–0,07
5	0,05–0,09
6	0,05–0,10
8	0,06–0,11
10	0,07–0,12
12	0,08–0,13
16	0,09–0,16

Calculations

Table feed

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

Cutting speed

$$v_c = \frac{n \times \pi \times D_c}{1000} \quad \text{m/min}$$

Spindle speed

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



Solid endmills

Copy milling – high speed machining (HSM), grades GC1010 and GC1020



R216.42-...L 1010



R216.64-...L 100



R216.42-...N 1020



R216.42-...H 1010



R216.42-...L 1010




R216.44-...L 1020



R216.62-...L 1010



R216.44-...L 1010

Materials			Coromant grade GC1010	Coromant grade GC1020	 $a_p \leq 0,05 \times D_c$	
ISO	CMC No	HB	Effective cutting speed v_e m/min	Effective cutting speed v_e m/min		
P	01.1	Unalloyed steel	125	300–500	240–400	
	01.2		150	250–450	200–360	
	02.1	Low alloy steel	175	200–400	160–320	
	02.2		330	180–330	140–260	
	03.11		200	200–330	160–260	
M	05.11	Stainless steel	200	150–200	120–160	
	05.21		200	120–170	100–140	
	05.51		230	100–150	80–120	
	20.22		Heat resistant alloys	350	40– 70	30– 60
	23.22		Titanium alloys	350	70–120	50– 90
K	04	Hard steel	HRC55	150–250	120–200	
	04		HRC63	90–150	70–120	
	07.1	Malleable cast iron	130	200–450	160–360	
	07.2		230	300–450	240–360	
	09.1		160	400–500	320–400	
	09.2	Nodular SG iron	250	200–350	160–280	
	08.1	Cast iron	180	300–500	240–400	
	30.22	Aluminium alloys (cast)	90	1000	800	

D_c mm	Feed per tooth f_z mm/z
2	0,015–0,020
3	0,03 –0,04
4	0,04 –0,07
5	0,05 –0,09
6	0,05 –0,10
7	0,06 –0,10
8	0,06 –0,11
9	0,06 –0,12
10	0,07 –0,12
12	0,08 –0,13
14	0,08 –0,15
16	0,09 –0,16
18	0,09 –0,16
20	0,09 –0,16

Calculations

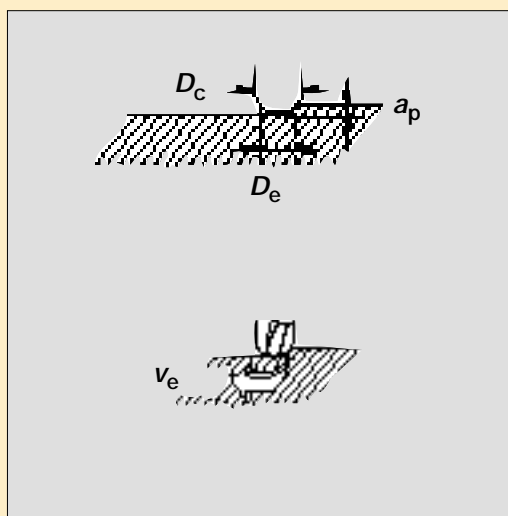


Table feed

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

Resultant cutting speed

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

Spindle speed

$$n = \frac{v_e \times 1000}{\pi \times D_c} \text{ rpm}$$

Effective cutting diameter

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

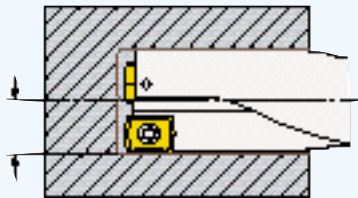


Terminology and formulas

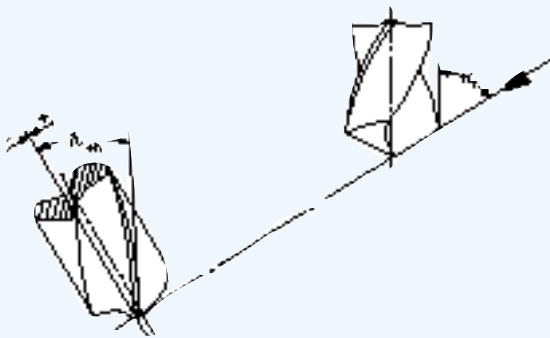
Designation acc. to ISO	Terminology	Unit
D_c	Drill diameter	mm
a_p	Cutting depth	mm
l_1	Programming length to outer corner	mm
l_{1s}	Programming length to chisel edge	mm
l_2	Total length	mm
l_3	Max. operating length to outer corner	mm
l_{3s}	Max. operating length to chisel edge	mm
l_4	Recommended max. operation length	mm
v_c	Cutting speed	m/min
n	Spindle speed	r/min
v_f	Feed speed	mm/min
f_n	Feed per rev.	mm/r
f_z	Feed per tooth	mm/z
k_c	Specific cutting force	N/mm ²
$k_{c0,4}$	Specific cutting force for $f_z = 0,4$	N/mm ²
k_{cfz}	Specific cutting force for feed per edge	N/mm ²
F_f	Feed force	N
$F_{f\mu}$	Feed force caused by friction	N
M_c	Torque	Nm
$M_{f\mu}$	Torque caused by friction	Nm
P_c	Net power (cutting power)	kW
$P_{f\mu}$	Power caused by friction	kW
κ_r	Tool cutting edge angle	Degrees
λ_{sh}	Tool normal rake angle	Degrees
q	Cutting fluid quantity	l/min
p	Cutting fluid pressure	Mpa

Cutting depth, a_p

Solid drilling



Tool cutting edge angle, κ_r Tool normal rake angle, λ_{sh}

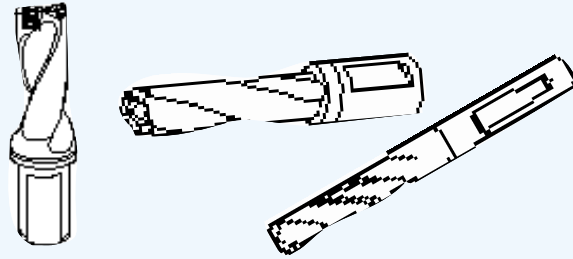


Specific cutting force for feed per edge, k_{cfz}

$$k_{cfz} = k_{c0,4} \left(\frac{0,4}{f_z \times \sin \kappa_r} \right)^{0,29} \times \left(1 + \frac{6 - (\pm \lambda_{sh})}{100} \right) \text{ (N/mm}^2\text{)}$$



Formulas



Coromant U, Coromant Delta, Coromant Delta-C

Cutting speed (m /min)	$v_c = \frac{\pi \times D_c \times n}{1000}$
Feed speed (m/min)	$v_f = f_n \times n$
Feed force (N) ¹⁾	$F_f = 0,5 \times a_p \times f_n \times k_{cfz} \times \sin \kappa_r$
Torque (Nm) ¹⁾	$M_c = \frac{D_c \times f_n \times k_{cfz} \times a_p}{2000} \left(1 - \frac{a_p}{D_c} \right)$
Net power (kW) ¹⁾	$P_c = \frac{a_p \times f_n \times k_{cfz} \times v_c}{60 \times 10^3} \left(1 - \frac{a_p}{D_c} \right)$

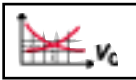
¹⁾ Feed force, torque and power at idling is not included in these formulas.

The power requirement is calculated on the basis of an unused tool, i.e. tool without wear. For a tool with normal wear, the power requirement is 10-30% higher, depending upon the size of the drill.

Specific cutting force k_c for $f_z = 0,4$ for different materials

CMC No.	Material	HB	Specific cutting force, $k_{c,0,4}$ ¹⁾
			N/mm ²
01.1	Unalloyed steel	C = 0,15%	1900
01.2		C = 0,35%	2100
01.3		C = 0,60%	2250
02.1	Low alloy steel	Non-hardened	180
02.2		Hardened and tempered	275
02.2		Hardened and tempered	300
02.2		Hardened and tempered	350
03.1	High alloy steel	Annealed	200
03.2		Hardened	325
05.11	Stainless steel	Martensitic/ferritic	200
05.21		Austenitic	175
06.1	Steel castings	Unalloyed	180
06.2		Low alloyed	200
06.3		high alloyed	225
04	Hard steel	Hardened steel	55 HRC
06.33		Manganese steel 12%	250
07.1	Malleable cast iron	Ferritic	130
07.2		Pearlitic	230
08.1	Grey cast iron	Low tensile strength	180
08.2		High tensile strength	260
09.1	Nodular cast iron	Ferritic	160
09.2		Pearlitic	250
10	Chilled cast iron	400	3000
20.11	Heat resistant alloys	Fe-base, annealed	200
20.12		Fe-base, aged	280
20.21, 20.31		Ni- or Co-base, annealed	250
20.22, 20.32		Ni- or Co-base, aged	350
20.24, 20.33		Ni- or Co-base, cast	320
30.11	Aluminium alloys	Non heat treatable	60
30.12		Heat treatable	100
30.21	Aluminium alloys, cast	Non heat treatable	75
30.22		Heat treatable	90
33.1	Copper and copper alloys	Lead alloys, Pb > 1%	110
33.2		Brass, red brass	90
33.3		Bronze and leadfree copper including electrolytic copper	100

¹⁾ The $k_{c,0,4}$ -values are valid for: $f_z = 0,4$ mm/z, $\kappa_r = 90^\circ$, $\lambda_{sh} = +6^\circ$



Cutting data

Coromant Delta-C drills — R415.5

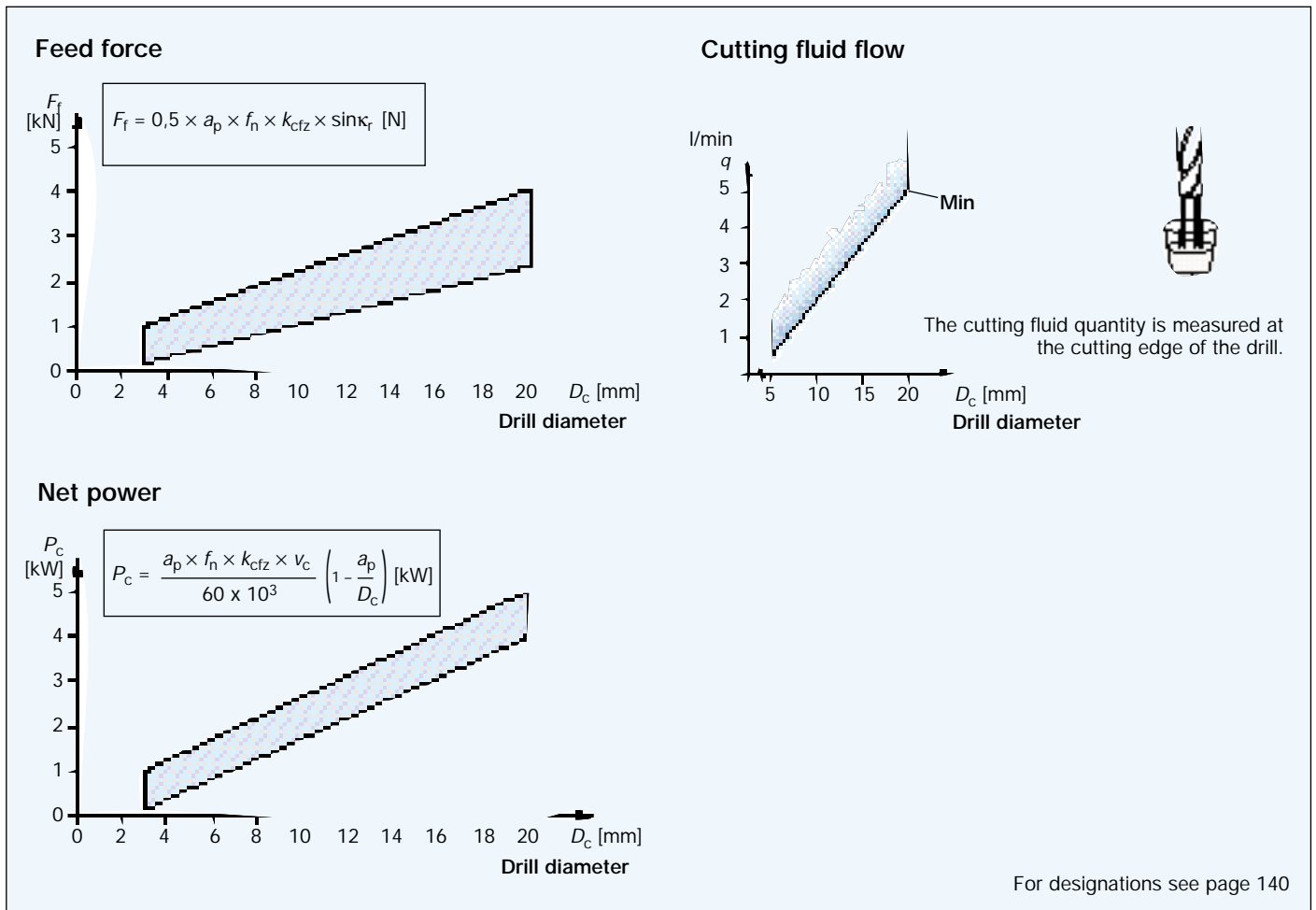
ISO	Material			Coromant grades	Cutting speed v_c m/min	Drill diameter, mm			
						3,00—6,00	6,01—10,00	10,01—14,00	14,01—20,00
						Feed f_n mm/r			
P	Unalloyed steel			1010/1020/ 1040	70—110	0,10—0,17	0,13—0,22	0,15—0,25	0,18—0,35
	01.0	125	C = 0,05–0,10%						
	01.1	125	C = 0,10–0,25%						
	01.2	150	C = 0,25–0,55%						
	01.3	170	C = 0,55–0,80%						
	High carbon steel								
	01.4	210	Carbon tool steel	60—100	0,10—0,17	0,13—0,22	0,15—0,25	0,18—0,30	
	Low alloy steel			1010/1020/ 1040	60—110 50— 90 40— 70	0,10—0,17	0,13—0,20	0,15—0,22	0,18—0,28
	02.1	180	Non-hardened						
	02.2	275	Hardened and tempered						
	02.2	350	Hardened and tempered						
	High alloy steel			1010/1020/ 1040	30— 70 30— 60	0,08—0,12	0,10—0,16	0,14—0,25	0,16—0,28
03.11	200	Annealed							
03.21	325	Hardened tool steel							
Extra hard steel			1020	30— 50 15— 25	0,06—0,10	0,08—0,12	0,10—0,15	0,12—0,18	
04.1	43–47 HRC	Hardened and tempered							
	47–60 HRC								
Steel castings			1010/1020/ 1040	50—100 40—100	0,10—0,17	0,14—0,22	0,16—0,27	0,18—0,30	
06.1	180	Unalloyed							
06.2	200	Low-alloy (alloying elements <5%)							
M	Stainless steel			1020	35— 60 ¹⁾	0,08—0,10	0,08—0,14	0,10—0,18	0,12—0,20
	05.11	200	Non-hardened						
	05.11		Ferritic/Martensitic	1030	35— 60 ¹⁾	0,08—0,14	0,10—0,22	0,14—0,28	0,16—0,30
	05.21	180	Austenitic	1020	35— 60 ¹⁾	0,08—0,10	0,08—0,14	0,10—0,18	0,12—0,20
	05.21			1030	35— 60 ¹⁾	0,08—0,14	0,10—0,22	0,14—0,28	0,16—0,30
	Stainless steel			1030	35— 60	0,08—0,14	0,10—0,22	0,14—0,28	0,16—0,30
	15.21	200	Austenitic castings						
	Heat resistant super alloys —Nickel base			1020	10— 25 ¹⁾	0,06—0,10	0,08—0,12	0,08—0,12	0,10—0,14
	20.21	250	Annealed or solution treated						
	20.22	350	Aged or solution treated and aged						
	20.24	320	Cast or cast and aged						
	Titanium alloys			1020	20— 40 ¹⁾	0,06—0,10	0,08—0,16	0,14—0,25	0,16—0,28
23.21	R_m ²⁾ 950	α , near α and $\alpha + \beta$ alloys, annealed							
23.22	1050	$\alpha + \beta$ alloys in aged conditions, β alloys, annealed or aged							
K	Malleable cast iron			1010/1020/ 1040	70—100 60— 90	0,15—0,25 0,15—0,20	0,20—0,35 0,18—0,30	0,30—0,50 0,25—0,50	0,30—0,50 0,25—0,50
	07.1	130	Ferritic (short chipping)						
	07.2	230	Pearlitic (long chipping)						
	Grey cast iron			1010/1020/ 1040	70—100 60— 90	0,15—0,25 0,15—0,25	0,20—0,35 0,20—0,30	0,30—0,50 0,25—0,50	0,30—0,50 0,25—0,50
	08.1	180	Low tensile strength						
	08.2	260	High tensile strength						
	Nodular cast iron, SG iron			1010/1020/ 1040	70— 95 65— 90	0,15—0,25 0,15—0,20	0,20—0,30 0,18—0,30	0,25—0,50 0,25—0,50	0,25—0,50 0,25—0,50
	09.1	160	Ferritic						
	09.2	250	Pearlitic						
	Aluminium alloys			1010/1020/ 1040	80—120	0,15—0,25	0,20—0,40	0,30—0,50	0,40—0,60
	30.11	60	Wrought or wrought and coldworked, non aging						
	30.21	75	Cast, non-aging						
Copper and copper alloys			1010/1020/ 1040	80—120	0,15—0,25	0,20—0,40	0,30—0,50	0,40—0,60	
33.1	110	Free cutting alloys, $\geq 1\%$ Pb							
33.2	90	Brass, leaded bronzes, $\leq 1\%$ Pb							

¹⁾ Internal cutting fluid supply is recommended when drilling stainless steel as a good supply of coolant at the cutting edges is essential for chip evacuation and tool life.

²⁾ R_m = ultimate tensile strength measured in MPa.



Coromant Delta-C drills — R415.5



The graphs show nominal values which should not be regarded as strict recommendations. The values may need adjusting depending on the machining conditions e.g., the type of material.

Note that only net power ratings are given. Allowance must be made for the efficiency of the machine and the cutting edge wear.

Machining recommendations

Austenitic stainless steel

For these applications, grade GC1030 with **internal coolant** supply is required. Use high feed rate.

If chip control is difficult to obtain with recommended cutting data, reduce the feed towards minimum value.

Use the highest coolant pressure/quantity as possible. Rich mixture will improve performance.

Steel

With grade, GC1040, good performance is now achieved with **external coolant** supply.

With grade, GC1020, it is possible to drill hardened steel CMC 03.21 (250—450 HBN).

When drilling in extra hard steel CMC 04.1 (43 – 60 HRC) with GC1020 use shortest possible flute length.

The new grade GC1010 – has very good wear resistance in general drilling of Steel. Suitable for higher speeds.

Cast iron

First choice in general drilling – GC1020. With external coolant supply, use grade GC1040. For higher speeds, use GC1010 for better wear resistance.

General

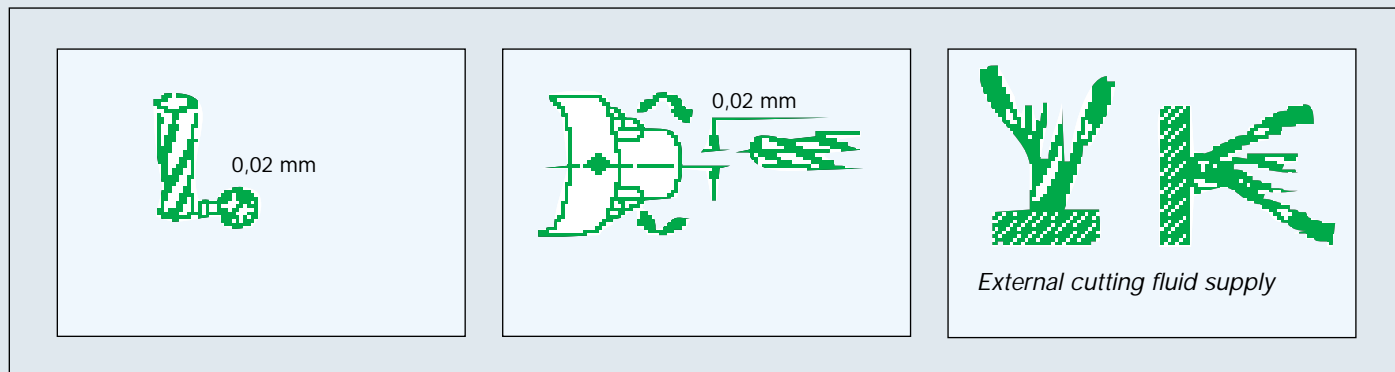
Drilling against inclined surfaces, pre-drilled holes or workpieces with crossholes is not recommended.



Delta C drills – R415.5

Set up recommendations

To attain the tolerances quoted, the total run out between the centre line of the drill and the workpiece must not exceed 0,02 mm. These tolerances are valid for both rotating and stationary drills.

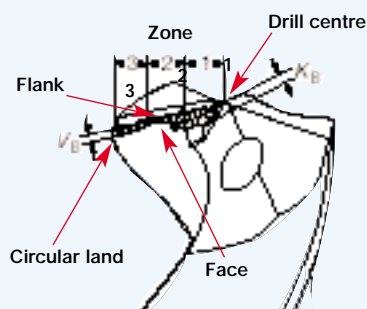


Recommended maximum wear

Drill diameter D_c mm	Flank wear V_B mm			Crater wear K_B mm		
	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3
3,00 - 6,00	0,20	0,20	0,20	0,20	0,20	0,20
6,01 - 10,00	0,20	0,20	0,25	0,25	0,25	0,25
10,01 - 14,00	0,25	0,25	0,25	0,30	0,30	0,30
14,01 - 17,00	0,25	0,25	0,30	0,30	0,30	0,30
17,01 - 20,00	0,30	0,30	0,35	0,35	0,35	0,35

Chipping of the cutting edge should not exceed "maximum wear" recommendations in order to allow for regrinding and to obtain maximum tool life.

Wear definition



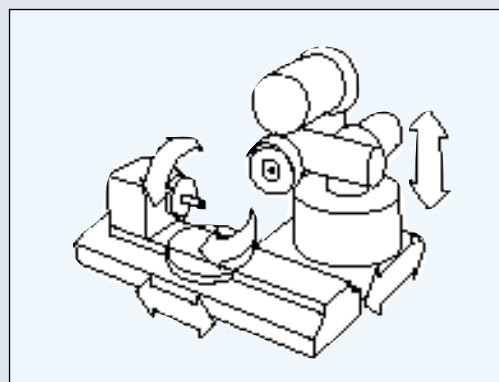
Regrinding instructions

Both cutting edges have to be ground symmetrically around the centre of rotation of the drill.

FIRST CHOICE

First choice regrinding method requires at least a 5-axis CNC-machine of one of the following types: ANCA TG7 (RG7, MG7), Walter Helitronic Power, Jungner, Makino Seiki (CNJ2 - 30).

For more details on regrinding by a CNC-machine please contact your Sandvik Coromant representative.



SAFETY INFORMATION

Precautions when grinding and brazing of cemented carbide, see back inside cover.



Coromant Delta drills — R411.5

ISO	CMC No.	Material	HB	Grade	Cutting speed v_c m/min	Drill diameter, mm				
						9,50-14	14,01-17	17,01-30,40		
						Feed f_n mm/r				
P	01.0	Unalloyed steel	Non-hardened	0,05-0,10% C	80-170 90-200	P20	75-100	0,14-0,22	0,15-0,25	0,18-0,31
	01.1		Non-hardened	0,10-0,25% C						
	01.2		Non-hardened	0,25-0,55% C						
	01.3		Non-hardened	0,55-0,80% C						
	01.4		High carbon & carbon tool steel	125-225 150-225 180-225	70-90		0,15-0,23			
	02.1	Low alloy steel	Non-hardened	150-260	P20	55-90	0,14-0,22	0,18-0,26	0,20-0,28	
	02.2		Hardened	220-400		35-65				0,14-0,22
	03.11	High alloy steel	Annealed	150-250	P20	40-70	0,15-0,20	0,18-0,25	0,20-0,27	
	03.22		Hardened steel	250-400		40-60				0,15-0,20
	04.1	Extra hard steel	Hardened and tempered	HRC 43-47 47-60	P20	25-40 15-30	0,10-0,15	0,12-0,17	0,15-0,20	
06.1	Steel castings	Unalloyed	90-225	P20	70-90	0,17-0,23	0,19-0,25	0,20-0,26		
06.2		Low alloyed (alloying elements < 5%)	150-250		50-75				0,15-0,21	0,17-0,23
M	05.11	Stainless steel	Ferritic, Martensitic	13-25% Cr	150-270	K20	25-55	0,14-0,21	0,17-0,24	0,18-0,27
	05.21	Stainless steel	Austenitic	Ni > 8%, 18-25% Cr	150-270	K20	25-55	0,14-0,20 ¹⁾	0,16-0,23 ¹⁾	0,19-0,25 ¹⁾
K	07.1	Malleable cast iron	Ferritic (short chipping)	110-145	K20	75-120	0,15-0,26	0,18-0,30	0,21-0,39	
	07.2		Pearlitic (long chipping)	150-270		75-110				0,15-0,25
	08.1	Grey cast iron	Low tensile strength	150-220	K20	85-115	0,19-0,31	0,23-0,39	0,26-0,46	
	08.2		High tensile strength	200-330		55-100				0,19-0,30
	09.1	Nodular cast iron	Ferritic	125-230	K20	65-105	0,16-0,26	0,20-0,35	0,23-0,41	
	09.2		Pearlitic	200-300		55-95				0,15-0,25
	30.12	Aluminium alloys	Wrought solution treated and aged	75-150	K20	95-150	0,21-0,33	0,18-0,41	0,18-0,41	
	30.21		Cast	40-100						
33.1	Copper and copper alloys	Free cutting alloys (Pb ≥ 1%)	50-160	K20	45-150	0,16-0,29	0,20-0,35	0,25-0,44		
33.2		Brass and leaded bronzes (Pb ≤ 1%)								

¹⁾If chip control is difficult to achieve with the recommended cutting data, reduce the feed to 0.08 - 0.10 mm/rev.



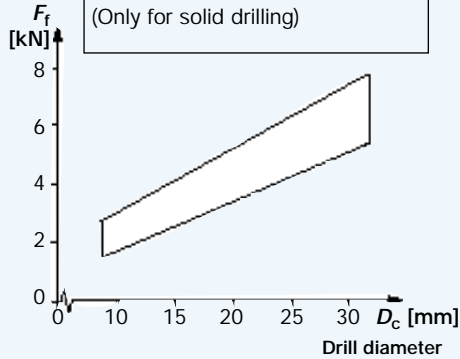
General recommendations

Coromant Delta drills — R411.5

Feed force

$$F_f = 0,5 \times a_p \times f_n \times k_{cfz} \times \sin \kappa_r \text{ [N]}$$

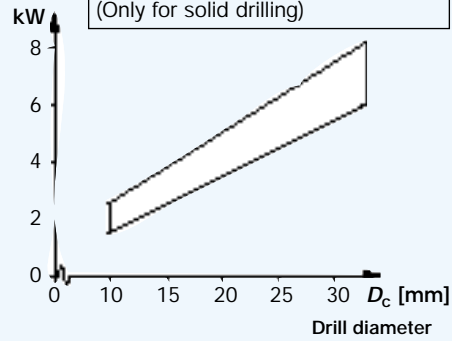
(Only for solid drilling)



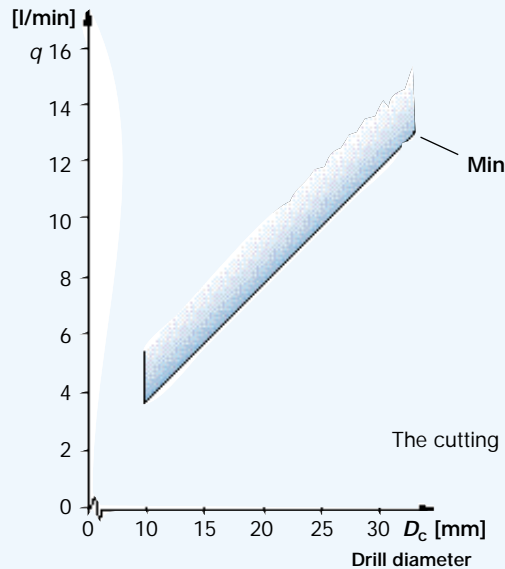
Net power

$$P_c = \frac{a_p \times f_n \times k_{cfz} \times v_c}{60 \times 10^3} \left(1 - \frac{a_p}{D_c}\right) \text{ [kW]}$$

(Only for solid drilling)



Cutting fluid flow



The cutting fluid quantity is measured at the cutting edge of the drill.

For designations see page 140

The graphs show nominal values which should not be regarded as strict recommendations. The values may need adjusting depending on the machining conditions e.g., the type of material.

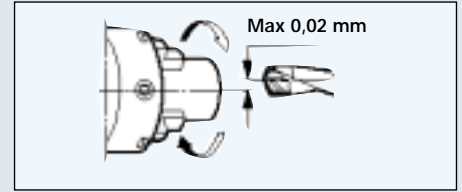
Note that only net power ratings are given. Allowance must be made for the efficiency of the machine and the cutting edge wear.



Delta drills – R411.5

Set up recommendations

When using a stationary drill, the total run out between the centre line of the drill and the workpiece must not exceed 0,02 mm to obtain the tolerance quoted.

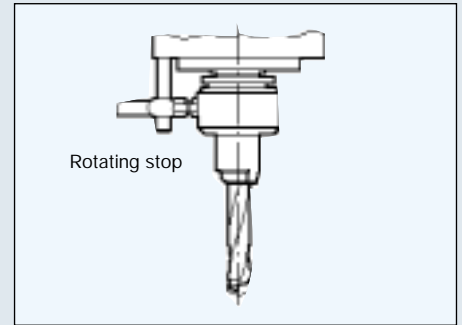


Drilling with holder and housing for cutting fluid supply

When using a holder with a housing for cutting fluid supply a rotating stop to prevent the housing from rotating must be used.

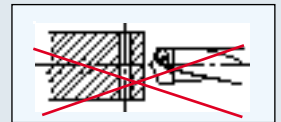
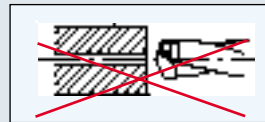
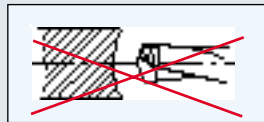
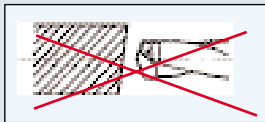
If the bearing seizes, the housing will rotate and consequently the supply tubing will be pulled round with the housing which could cause a serious accident.

If the holder has not been used for a long time check that the holder rotates in the housing before the machine spindle is started.



Limitations

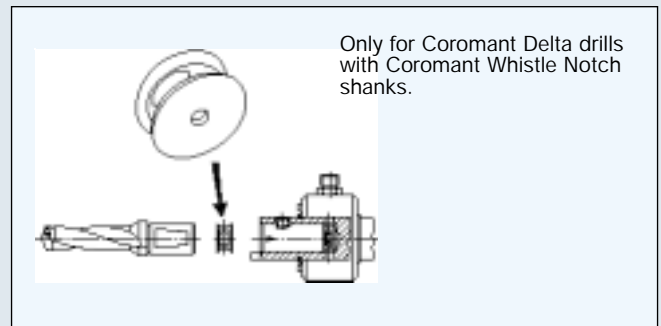
Drilling against non flat surface, pre-drilled holes or workpiece with cross holes are not recommended.



Coolant volume compensator

When using a drill holder with housing for cutting fluid supply together with a Coromant Delta drill, a coolant volume compensator must be used.

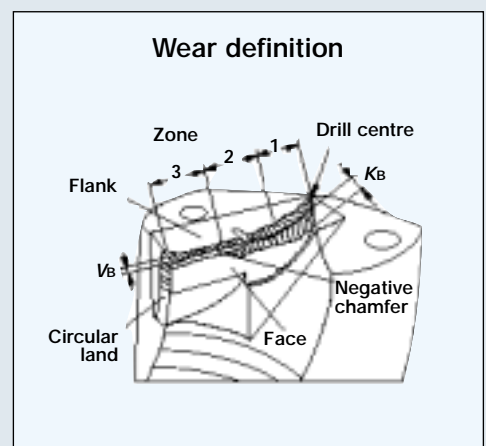
Drill diameter D_c mm	Ordering code
9,50-14,00	5691 020-01
14,01-17,00	5691 020-02
17,01-30,40	5691 020-03



Recommended maximum wear

Drill diameter D_c mm	Flank wear V_B mm			Crater wear K_B mm		
	Zone			Zone		
	1	2	3	1	2	3
9,50 - 14,00	0,25	0,25	0,25	0,30	0,30	0,30
14,01 - 17,00	0,25	0,25	0,30	0,30	0,30	0,30
17,01 - 20,00	0,30	0,30	0,30	0,35	0,35	0,35
20,01 - 24,00	0,30	0,30	0,40	0,35	0,35	0,35
24,01 - 30,40	0,35	0,35	0,45	0,40	0,40	0,40

Chipping of the cutting edge should not exceed "maximum wear" recommendations in order to allow for regrinding and to obtain maximum tool life.





Cutting data

Coromant U R416.2 and T-MAX U R416.9

ISO	CMC No.	Material	HB	Drill dia D_c mm	Feed f_n mm/r	Geometry / Grade								
						Bad conditions			Normal conditions <i>FIRST CHOICE</i>			Good conditions		
						v_c m/min	⊖	⊕	v_c m/min	⊖	⊕	v_c m/min	⊖	⊕
P	01.0	Unalloyed steel Non hardened 0,05–0,10% C	80–170	12,7–17,0	0,04–0,08	160–215	-53/1120	-53/1020 T-53/1020	230–345	-53/3040	-53/1020	275–380	-53/3040	-53/1020
				17,5–25,4	0,04–0,08		-53/1020			-53/3040			-53/3040	
				26,0–30,0	0,05–0,08		-53/1020			-53/3040			-53/3040	
				31,0–41,3	0,07–0,10		-53/1020			-53/3040			-53/3040	
				42,0–80,0	0,08–0,12		-53/1020			-53/3040			-53/3040	
	01.1	Non hardened 0,05–0,25% C	90–200	12,7–17,0	0,04–0,08	145–190	-53/1120	-53/1020 T-53/1020	225–315	-53/3040	-53/1020	250–345	-53/3040	-53/1020
				17,5–25,4	0,04–0,08		-53/1020			-53/3040			-53/3040	
				26,0–30,0	0,05–0,10		-53/1020			-53/3040			-53/3040	
	01.2	Non hardened 0,25–0,55% C	125–225	12,7–17,0	0,04–0,10	120–160	-53/1120	-53/1020 T-53/1020	190–265	-53/3040	-53/1020	210–290	-53/3040	-53/1020
				17,5–25,4	0,04–0,14		-53/1020			-53/3040			-53/3040	
	01.3	Non hardened 0,55–0,80% C	150–225	12,7–17,0	0,04–0,10	110–145	-53/1120	-53/1020 T-53/1020	170–250	-53/3040	-53/1020	200–275	-53/3040	-53/1020
				17,5–25,4	0,06–0,14		-53/1020			-53/3040			-53/3040	
01.4	High carbon & carbon tool steel	180–275	12,7–17,0	0,04–0,10	110–145	-53/1120	-53/1020 T-53/1020	170–250	-53/3040	-53/1020	200–275	-53/3040	-53/1020	
02.1	Low-alloy steel Non hardened	150–260	12,7–17,0	0,04–0,10	115–155	-53/1120	-53/1020 T-53/1020	180–265	-53/3040	-53/1020	210–290	-53/3040	-53/1020	
			17,5–25,4	0,06–0,12		-53/1020			-53/3040			-53/3040		
02.2	Hardened	220–450	12,7–17,0	0,04–0,10	80–110	-53/1120	-53/1020 T-53/1020	90–150	-53/1120	-53/1020	170–230	-53/3040	-53/1020	
			17,5–25,4	0,06–0,14		125–210		-53/3040	-53/3040					
03.11	High-alloy steel Annealed	50–250	12,7–17,0	0,04–0,08	105–140	-53/1120	-53/1020 T-53/1020	115–180	-53/1120	-53/1020	200–275	-53/3040	-53/1020	
			17,5–25,4	0,04–0,14		160–250		-53/3040	-53/3040					
03.21	Hardened steel	250–450	12,7–17,0	0,04–0,10	70–95	-53/1120	-53/1020 T-53/1020	80–130	-53/1120	-53/1020	145–200	-53/3040	-53/1020	
			17,5–25,4	0,06–0,12		110–180		-53/1020	-53/3040					
06.1	Steel castings Unalloyed	90–225	12,7–17,0	0,04–0,08	125–170	-53/1120	-53/1020 T-53/1020	140–200	-53/1120	-53/1020	225–310	-53/3040	-53/1020	
			17,5–25,4	0,04–0,08		195–280		-53/3040	-53/3040					
06.2	Low alloyed (alloying elements ≤ 5%)	150–250	12,7–17,0	0,04–0,10	100–130	-53/1120	-53/1020 T-53/1020	110–160	-53/1120	-53/1020	180–250	-53/3040	-53/1020	
			17,5–25,4	0,06–0,12		155–225		-53/3040	-53/3040					
M	05.11	Stainless steel Ferritic, Martensitic 13–25% Cr	150–270	12,7–17,0	0,04–0,10	110–145	-53/1120	-53/1020	120–170	-53/1120	-53/1020	190–265	-53/3040	-53/3040
				17,5–25,4	0,04–0,14		170–240		-53/3040	-53/3040				
				26,0–30,0	0,08–0,18		170–240		-53/3040	-53/3040				
				31,0–41,3	0,10–0,20		170–240		-53/3040	-53/3040				
	05.21	Austenitic Ni > 8% 13–25% Cr	150–275	12,7–17,0	0,04–0,10	90–150	-53/1120	-53/1020	120–190	-53/1120	-53/1020	140–250	-53/1120	-53/1020
				17,5–25,4	0,04–0,12		170–240		-53/1020	-53/3040				
05.51 05.52	Austenitic Ferritic (duplex)	180–320	12,7–17,0	0,04–0,10	80–110	-53/1120	-53/1020	90–130	-53/1120	-53/1020	105–145	-53/1120	-53/1020	
			17,5–25,4	0,04–0,12		170–240		-53/1020	-53/3040					
			26,0–30,0	0,08–0,14		-53/1020			-53/1020			-53/1020		
			31,0–41,3	0,10–0,16		-53/1020			-53/1020			-53/1020		
			42,0–80,0	0,11–0,18		-53/1020			-53/1020			-53/1020		

Insert positioning: ⊕ = Central

⊖ = Peripheral





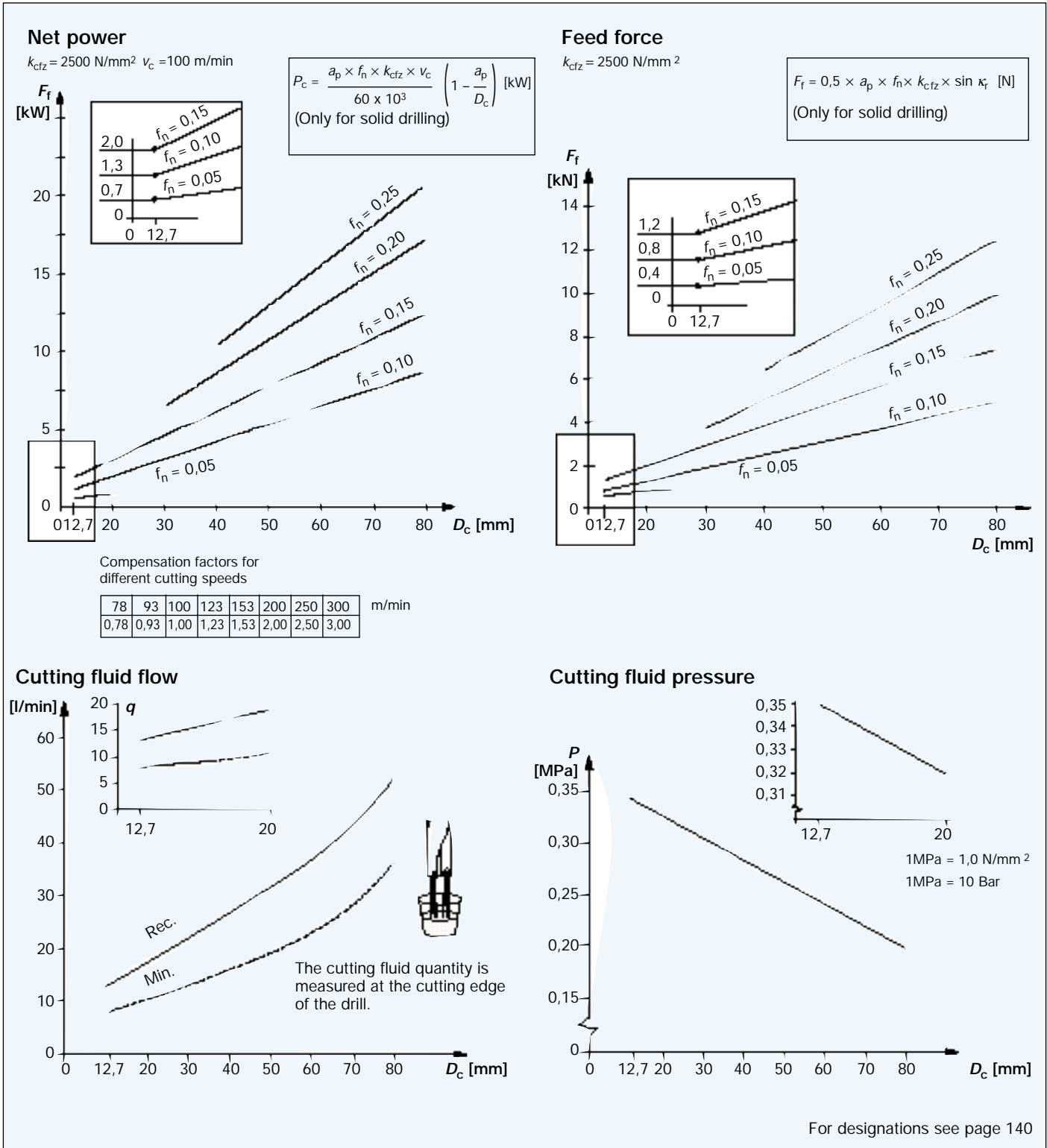
ISO	CMC No.	Material	Drill dia	Feed	Geometry / Grade											
					HB	D _c mm	f _n mm/r	Bad conditions			Normal conditions FIRST CHOICE			Good conditions		
								v _c m/min			v _c m/min			v _c m/min		
M	15.21	Stainless steel Austenitic castings	12,7-17,0 17,5-25,4 26,0-30,0 31,0-41,3 42,0-80,0	0,04-0,08 0,04-0,12 0,05-0,12 0,06-0,14 0,06-0,14	70- 95	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/1020	80-140	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/1020	110-155	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/1020			
	20.21 20.22 20.24	Heat resistant alloys Ni based	12,7-17,0 17,5-25,4 26,0-30,0 31,0-41,3 42,0-80,0	0,03-0,08 0,04-0,08 0,06-0,10 0,08-0,12 0,09-0,14	18- 24	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/1020	20- 80	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/1020	64- 88	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/1020			
	23.21 23.22	Titanium alloys α, near α and α + β alloys in annealed or aged conditions	12,7-17,0 17,5-25,4 26,0-30,0 31,0-41,3 42,0-80,0	0,04-0,10 0,08-0,14 0,12-0,16 0,14-0,18 0,16-0,20	36- 48	-53/1120 -53/H13A -53/H13A -53/H13A -53/H13A	-53/1020 -53/H13A -53/H13A -53/H13A -53/H13A	40-120	-53/1120 -53/H13A -53/H13A -53/H13A -53/H13A	-53/1020 -53/H13A -53/H13A -53/H13A -53/H13A	96-132	-53/1120 -53/H13A -53/H13A -53/H13A -53/H13A	-53/1020 -53/H13A -53/H13A -53/H13A -53/H13A			
K	07.1	Malleable cast iron Ferritic (short chipping)	12,7-17,0 17,5-25,4 26,0-30,0 31,0-41,3 42,0-80,0	0,04-0,14 0,10-0,18 0,14-0,20 0,16-0,26 0,18-0,28	90-120	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/1020 T-53/1020	140-210	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/3040 -53/1020	170-230	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/1020 -53/3040 -53/1020			
	07.2	Pearlitic (long chipping)	12,7-17,0 17,5-25,4 26,0-30,0 31,0-41,3 42,0-80,0	0,04-0,10 0,08-0,14 0,12-0,18 0,14-0,20 0,15-0,22	70- 90	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/1020 T-53/1020	105-155	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/3040 -53/1020	125-170	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/1020 -53/3040 -53/1020			
	08.1	Grey cast iron Low tensile strength	12,7-17,0 17,5-25,4 26,0-30,0 31,0-41,3 42,0-80,0	0,04-0,14 0,10-0,18 0,14-0,20 0,16-0,26 0,18-0,28	135-180	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/1020 T-53/1020	210-280	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/3040 -53/1020	225-310	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/1020 -53/3040 -53/1020			
	08.2	High tensile strength	12,7-17,0 17,5-25,4 26,0-30,0 31,0-41,3 42,0-80,0	0,04-0,10 0,08-0,14 0,12-0,18 0,14-0,20 0,15-0,22	80-110	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/1020 T-53/1020	125-210	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/3040 -53/1020	170-230	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/1020 -53/3040 -53/1020			
	09.1	Nodular cast iron Ferritic	12,7-17,0 17,5-25,4 26,0-30,0 31,0-41,3 42,0-80,0	0,04-0,10 0,08-0,14 0,12-0,18 0,14-0,20 0,15-0,22	80-110	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/1020 T-53/1020	125-195	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/3040 -53/1020	155-215	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/1020 -53/3040 -53/1020			
	09.2	Pearlitic	12,7-17,0 17,5-25,4 26,0-30,0 31,0-41,3 42,0-80,0	0,04-0,10 0,08-0,14 0,12-0,18 0,14-0,20 0,15-0,22	70- 95	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/1020	110-180	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/3040 -53/1020	145-200	-53/1120 -53/1020 -53/1020 -53/1020 -53/1020	-53/1020 -53/3040 -53/1020			
	30.12	Aluminium alloys Wrought or wrought and aged	12,7-17,0 17,5-25,4 26,0-30,0 31,0-41,3 42,0-80,0	0,04-0,12 0,06-0,16 0,10-0,18 0,12-0,22 0,14-0,26	270-360	-53/1120 -53/H13A -53/H13A -53/H13A -53/H13A	-53/1020 -53/H13A -53/H13A -53/H13A -53/H13A	300-400	-53/1120 -53/H13A -53/H13A -53/H13A -53/H13A	-53/1020 -53/H13A -53/H13A -53/H13A -53/H13A	320-440	-53/1120 -53/H13A -53/H13A -53/H13A -53/H13A	-53/1020 -53/H13A -53/H13A -53/H13A -53/H13A			
	30.21	Cast, non aging	12,7-17,0 17,5-25,4 26,0-30,0 31,0-41,3 42,0-80,0	0,04-0,12 0,06-0,16 0,10-0,18 0,12-0,22 0,14-0,26	270-360	-53/1120 -53/H13A -53/H13A -53/H13A -53/H13A	-53/1020 -53/H13A -53/H13A -53/H13A -53/H13A	300-400	-53/1120 -53/H13A -53/H13A -53/H13A -53/H13A	-53/1020 -53/H13A -53/H13A -53/H13A -53/H13A	320-440	-53/1120 -53/H13A -53/H13A -53/H13A -53/H13A	-53/1020 -53/H13A -53/H13A -53/H13A -53/H13A			
	30.22	Cast or cast and aged	12,7-17,0 17,5-25,4 26,0-30,0 31,0-41,3 42,0-80,0	0,04-0,12 0,06-0,16 0,10-0,18 0,12-0,22 0,14-0,26	225-300	-53/1120 -53/H13A -53/H13A -53/H13A -53/H13A	-53/1020 -53/H13A -53/H13A -53/H13A -53/H13A	250-350	-53/1120 -53/H13A -53/H13A -53/H13A -53/H13A	-53/1020 -53/H13A -53/H13A -53/H13A -53/H13A	280-385	-53/1120 -53/H13A -53/H13A -53/H13A -53/H13A	-53/1020 -53/H13A -53/H13A -53/H13A -53/H13A			
	33.1	Copper and copper alloys Free cutting alloys (Pb ≥ 1%)	12,7-17,0 17,5-25,4 26,0-30,0 31,0-41,3 42,0-80,0	0,04-0,12 0,06-0,16 0,10-0,18 0,12-0,22 0,14-0,26	225-300	-53/1120 -53/H13A -53/H13A -53/H13A -53/H13A	-53/1020 -53/H13A -53/H13A -53/H13A -53/H13A	250-350	-53/1120 -53/H13A -53/H13A -53/H13A -53/H13A	-53/1020 -53/H13A -53/H13A -53/H13A -53/H13A	280-385	-53/1120 -53/H13A -53/H13A -53/H13A -53/H13A	-53/1020 -53/H13A -53/H13A -53/H13A -53/H13A			
33.2	Brass and leaded alloys (Pb ≤ 1%)	12,7-17,0 17,5-25,4 26,0-30,0 31,0-41,3 42,0-80,0	0,04-0,12 0,06-0,16 0,10-0,18 0,12-0,22 0,14-0,26	160-215	-53/1120 -53/H13A -53/H13A -53/H13A -53/H13A	-53/1020 -53/H13A -53/H13A -53/H13A -53/H13A	180-240	-53/1120 -53/H13A -53/H13A -53/H13A -53/H13A	-53/1020 -53/H13A -53/H13A -53/H13A -53/H13A	190-265	-53/1120 -53/H13A -53/H13A -53/H13A -53/H13A	-53/1020 -53/H13A -53/H13A -53/H13A -53/H13A				

Insert positioning: = Central

= Peripheral



Coromant U and T-Max U drills



The graphs show nominal values which should not be regarded as strict recommendations. The values may need adjusting depending on the machining conditions e.g., the type of material.

Note that only net power ratings are given. Allowance must be made for the efficiency of the machine and the cutting edge wear.

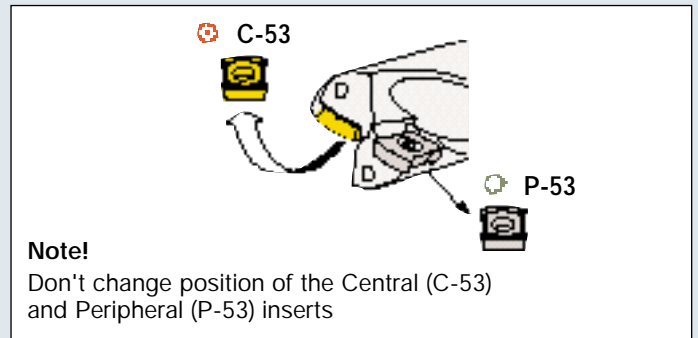


Coromant U drills

Set up recommendations

Mounting of inserts into Coromant U drills
(D_C 12,7 – 17,0 mm)

It is most important that the inserts are mounted in the correct position, as shown in the picture to the right.

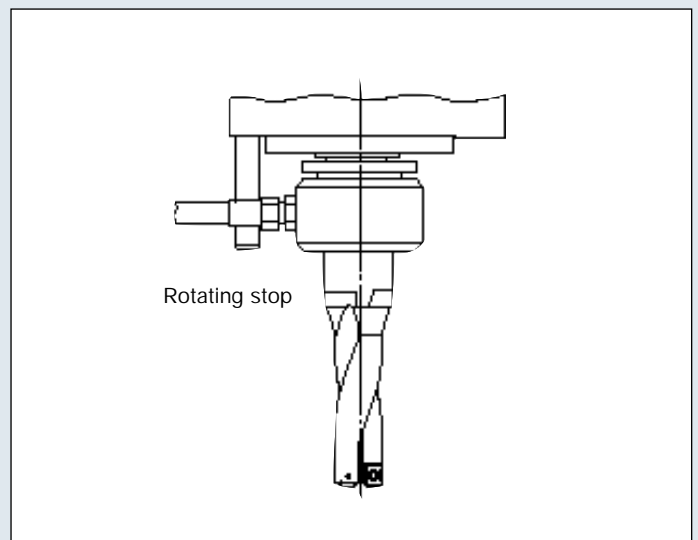


Drilling with holder and housing for cutting fluid supply

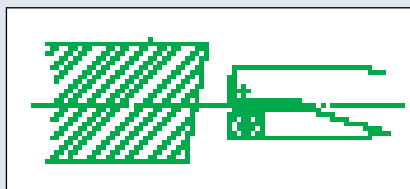
When using a holder with a housing for cutting fluid supply, a rotating stop to prevent the housing rotating must be used.

If the bearing seizes, the housing will rotate and the supply tubing will be pulled round with the housing, potentially causing a serious accident.

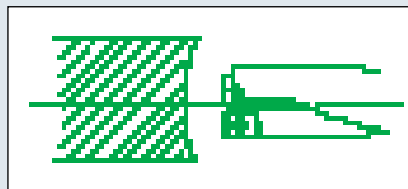
If the holder has not been used for a long time check that the holder rotates in the housing before the machine spindle is started.



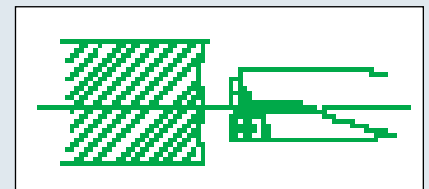
Rotating drill



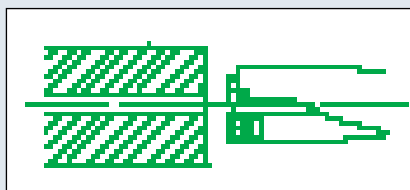
Surface of part to be drilled should preferably be flat. If angularity exceeds 2° , it may be necessary to reduce feed to 1/3 of that recommended.



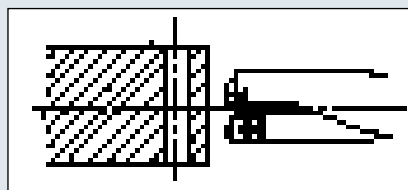
A concave surface is not generally recommended due to the possibility of deflecting the drill off centre. Reduce feed to 1/3 of that recommended.



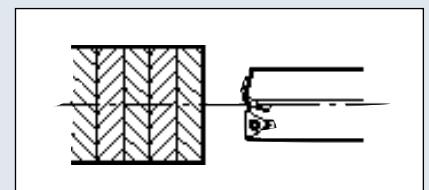
If an irregular component face is encountered, the entry feed must be reduced to prevent chipping of the cutting edges. This may also be the case when breaking through.



A predrilled component must not have a hole larger than 1/4 of the finished size, otherwise the drill will deflect.



If the component has a cross hole more than 1/4 the dia of the drill, then the feed must be reduced when passing.



R416.01 stack drill can be used to bore more than one work piece.



General recommendations

Radial adjustment with Coromant U drills

Rotating drill

Adjustable holders for Coromant U drill with ISO shank
For shank size 20, 25 and 32 mm, i.e. standard drill dia 12,7 – 30 mm

Improved hole tolerances

With this type of holder the manufacturing tolerances of the drill and insert can be eliminated and the hole tolerance on a $3 \times D_c$ drill improved from $+0,3/-0,1$ mm down to less than $\pm 0,1$ mm.

Note: Do not exceed the adjustment range for the drill. It may be necessary to lower the feed/rev(f_z).

Useful for mixed small batch production

A standard drill can be adjusted for intermediate hole sizes up to next standard size.
One basic holder can be used for several shank diameters by just changing the adjustment slide.

For ordering information, see page 102.

Rotating drill

Radial adjustment: $-0,2/+0,7$ mm

Diameter: $-0,4/+1,4$ mm

Max. radial adjustment:
see page 102.



Adjustable Varilock adaptors for Coromant U drills

By using the adjustable holder, Coromant U drills (from 12,7–58 mm) with integrated Varilock coupling or drills with ISO or Whistle Notch shank and Varilock adaptor, (see page 102) can be adjusted radially within $-0.15/+0.35$.

Handling instructions for radial adjustment of Coromant U drill

1. Assemble adjustable adaptor and basic holder
2. Screw the front clamping drawbolt into the Varilock integrated Coromant U/Varilock adaptor.
3. Place the basic holder and adaptor into the presetting fixture and mount the drill, combined with clamping mechanism, into the adaptor making sure it is located correctly.
4. Adjust the drill to required hole diameter with the radially positioned adjustment screw. Always adjust from min to max diameter of the adjustment range to avoid backlash.
5. Lock the front clamping screw firmly.

For 1. and 2. see technical information – Toolholding systems

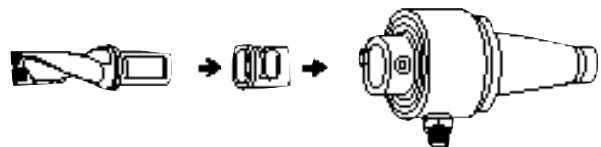


Rotating drill with Coromant Whistle Notch shank

By using the eccentric sleeve, rotating U-drills within the diameter range 17,5 to 41 mm, can be radially adjusted to eliminate the manufacturing tolerance of the drill diameter.

For ordering information see Rotating Tools catalogue.

U-drill with Whistle Notch shank



Mounting of sleeve

- Mount the eccentric sleeve on the drill shank.
- Align the slot in the sleeve with the Whistle Notch on the drill shank.
- Change drill holder to the next larger size.
- Change the clamp screw to the longer one delivered with the sleeve.
- Mount the drill and the sleeve in the drill holder.
- Locate the slot in the sleeve and the Whistle Notch on the drill shank in the same position as the clamp screw in the holder.

To adjust the diameter

- Loosen the clamp screw in the holder.
- Use the Torx screw driver in the hole in the sleeve flange to adjust the diameter.
- To increase the diameter, turn the eccentric sleeve clockwise.
- To decrease the diameter, turn the eccentric sleeve counter clockwise.
- Tighten the clamp screw after adjustment.



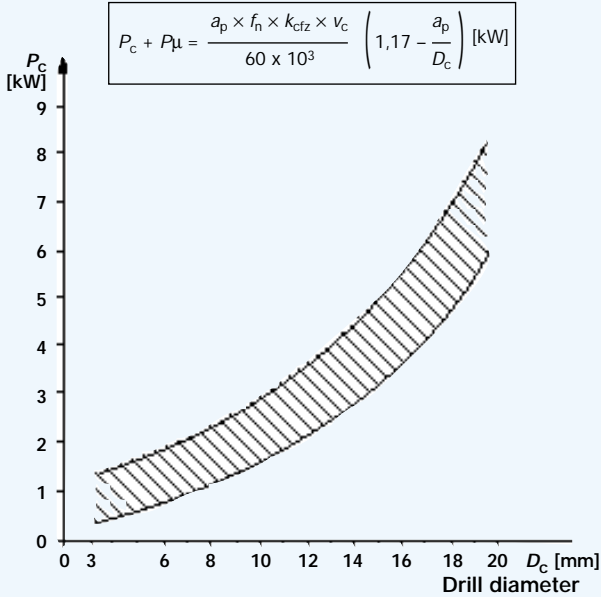
Gun drills – 428.9

ISO	CMC No	Material	Specific cutting force k_c 0,4 N/mm ²	Hardness Brinell HB	Cutting speed v_c m/min	Drill diameter, mm			
						0,98-3,00	3,00-6,30	6,30-12,50	12,50-35,00
						Feed f_n mm/r			
P	01.1	Unalloyed steel Non-hardened 0,05-0,25% C	2000	90-200	60-120	0,003-0,010	0,005-0,030	0,015-0,055	0,020-0,110
	01.2	Non-hardened 0,25-0,55% C	2100	125-225	50-120	0,003-0,010	0,005-0,030	0,015-0,055	0,020-0,110
	01.3	Non-hardened 0,55-0,80% C	2180	150-225	40-100	0,003-0,010	0,004-0,025	0,010-0,050	0,020-0,100
	02.1	Low alloy steel Non-hardened	2100	150-260	40-120	0,003-0,010	0,004-0,030	0,010-0,055	0,020-0,110
	02.2	Hardened	2775	220-400	40-120	0,003-0,010	0,004-0,025	0,010-0,050	0,020-0,100
	03.11	High alloy steel Annealed	2500	150-250	40-100	0,003-0,010	0,004-0,025	0,010-0,050	0,020-0,100
	03.21	Hardened tool steel	3750	250-350	50-100	0,003-0,010	0,005-0,025	0,015-0,050	0,030-0,100
	06.1	Steel castings Unalloyed	1800	90-225	50-120	0,003-0,010	0,005-0,030	0,015-0,055	0,020-0,110
06.2	Low alloyed alloying elements \leq 5%	2100	150-250	40-100	0,003-0,010	0,004-0,025	0,010-0,050	0,020-0,100	
M	05.11	Stainless steel Ferritic, Martensitic 13-25% Cr	2300	150-270	40-90	0,003-0,008	0,004-0,025	0,010-0,040	0,020-0,100
	05.21	Austenitic Ni > 8%, 18-25% Cr	2450	150-270	40-90	0,003-0,008	0,004-0,025	0,010-0,040	0,020-0,100
K	07.1	Malleable cast iron Ferritic short chipping	950	110-145	70-90	0,005-0,010	0,008-0,030	0,020-0,070	0,050-0,190
	07.2	Pearlitic long chipping	1100	150-270	60-90	0,004-0,010	0,005-0,030	0,010-0,070	0,030-0,190
	08.1	Grey cast iron Low tensile strength	1100	150-220	60-90	0,004-0,010	0,005-0,030	0,010-0,070	0,030-0,190
	08.2	High tensile strength	1400	200-330	15-90	0,003-0,010	0,003-0,030	0,005-0,070	0,010-0,190
	09.1	Nodular cast iron Ferritic	1050	125-230	70-90	0,005-0,010	0,008-0,030	0,020-0,070	0,050-0,190
	09.2	Pearlitic	1750	200-300	60-90	0,004-0,010	0,005-0,030	0,010-0,070	0,030-0,190
	30.21	Aluminium alloys Cast	750	40-100	65-300	0,005-0,015	0,005-0,040	0,020-0,070	0,030-0,150
	33.1	Copper and copper alloys Free cutting alloys (Pb \geq 1%)	700	50-160	65-300	0,005-0,015	0,005-0,040	0,020-0,070	0,030-0,150
33.2	Brass and leaded bronzes (Pb \leq 1%)	700	50-160	65-300	0,005-0,015	0,005-0,040	0,020-0,070	0,030-0,150	



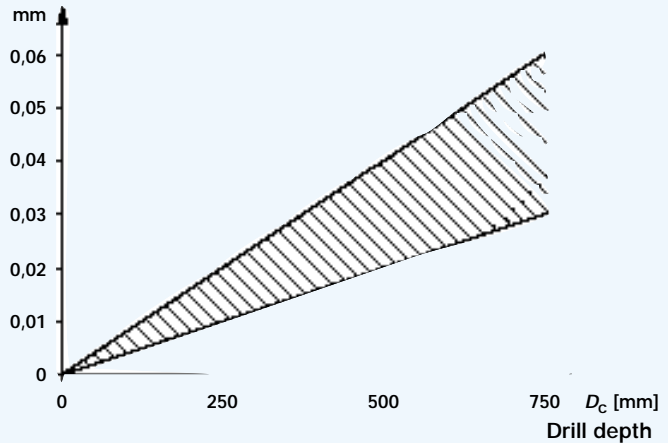
Gun drills – 428.9

Net power

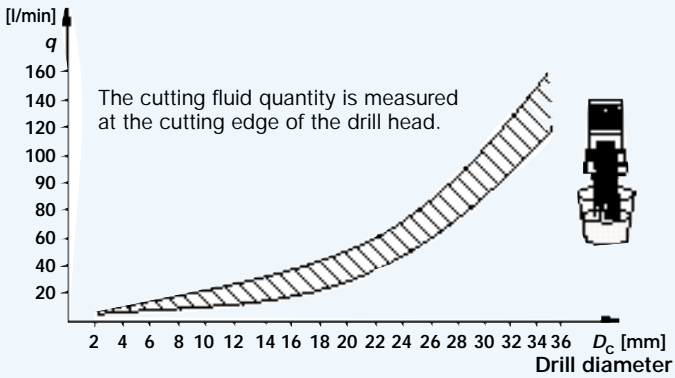


Straightness

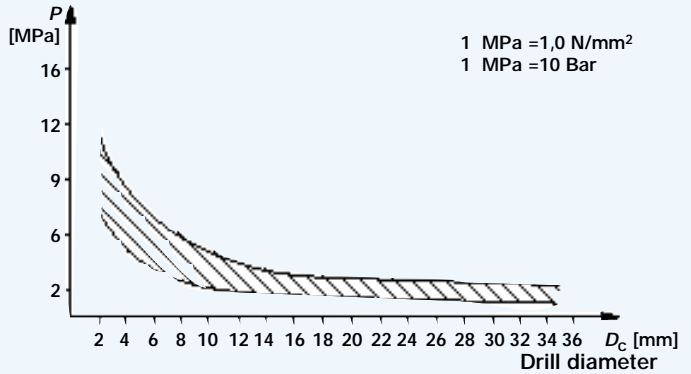
- Hole straightness depends on various factors e.g.
- Hole diameter and depth.
 - Machining method and cutting parameters.
 - Material quality and homogeneity.
 - Machine condition.
 - Drill bush.



Cutting fluid flow



Cutting fluid pressure



For designations see page 140

The graphs show nominal values which should not be regarded as strict recommendations. The values may need adjusting depending on the machining conditions e.g., the type of material.

Note that only net power ratings are given. Allowance must be made for the efficiency of the machine and the cutting edge wear.