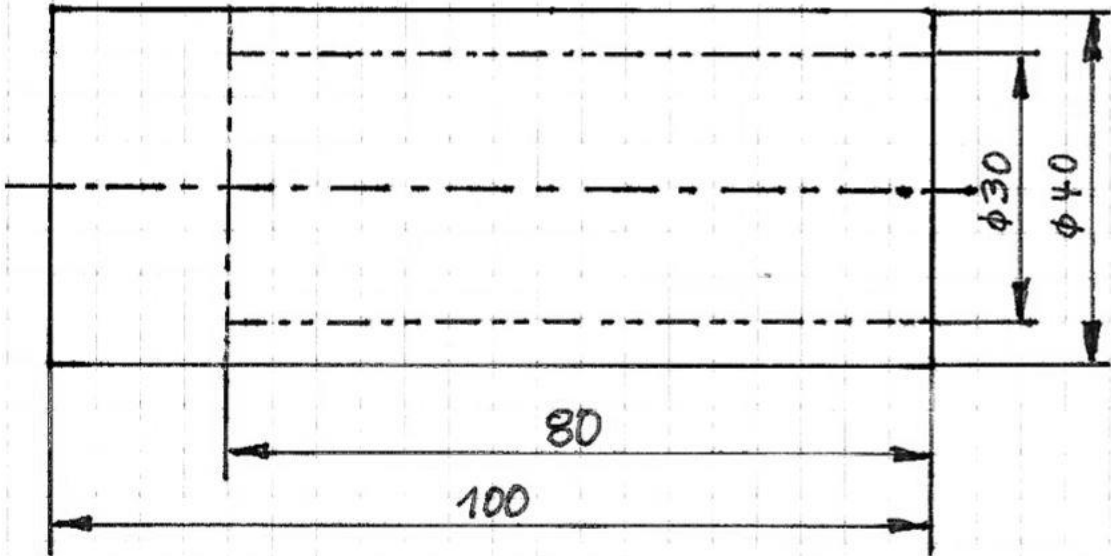


Date:

Calculation main productive time -turning

The shaft, made from free cutting steel 36SMn14, shown here has to be roughed on a manual turning machine with a carbide tool. The cutting depth/adjustment _____ mm and the feed rate is _____ mm⁻¹. The approach is 1mm. The cutting velocity is $V_c = 160$ m/min and the rotational speed is 1273 min⁻¹. Calculate the main productive time!



Note!

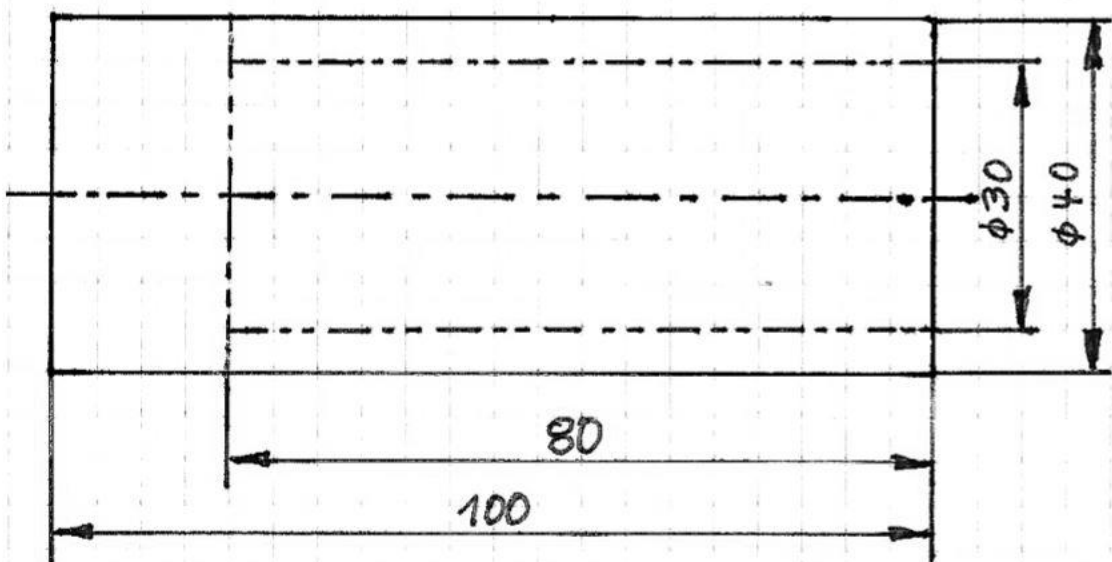
Determine the adjustment per cut and the feed with the table book.

Date:

Calculation main productive time - turning

Given

- Shaft made of free cutting steel
- Roughing
- Manual turning machine
- Carbide tool
- $n = 1273 \text{ 1/min}$
- $V_c = 160 \text{ m/min}$
- $D = 40\text{mm}$, $d_e = 30\text{mm}$, $l_e = 80\text{mm}$
- Approach = $l_a = 1\text{mm}$
- Feed rate = $f = ? \text{ 1/mm}$
- Cutting depth = $a_p = ?$

ISOMain productive time $t_p \Rightarrow$ Pg 324TB, cutting data turning \Rightarrow Pg 320

Date:

Calculation main productive time - turning

Given

- Shaft made of free cutting steel
- Roughing
- Manual turning machine
- Carbide tool
- $n = 1273 \text{ 1/min}$
- $V_c = 160 \text{ m/min}$
- $D = 40\text{mm}$, $d_e = 30\text{mm}$, $l_e = 80\text{mm}$
- Approach = $l_a = 1\text{mm}$
- Feed rate = $f = 0.45 \text{ 1/mm}$
- Cutting depth = $a_p = 4\text{mm}$

ISO

Main productive time t_p

Cutting data during turning

Standard values for turning with carbide and (carbide) tools

Groups of cutting tool material	v_c cutting velocity n rotational speed f feed a_p cutting depth d external diameter d_m mean diameter (pages 324, 325)	Transverse turning	Cylindrical turning	
		$n = \frac{v_c}{\pi \cdot d_m}$	Roughing	Finishing
		$n = \frac{v_c}{\pi \cdot d}$	$a_p = 1 \dots 2 \text{ mm}$	$a_p = 2 \dots 6 \text{ mm}$
Workpiece material		Feed rate f in mm		
Material group	average Tensile strength R_m in N/mm^2 or hardness HB	0.2 ... 0.1	0.6 ... 0.25	0.25 ... 0.1
		Cutting velocity v_c^{31} in m/min		
Structural steel	$R_m \leq 500$	210 - 280 - 350	150 - 220 - 300	280 - 340 - 400
	$R_m > 500$	160 - 230 - 300	100 - 170 - 240	220 - 290 - 350
Free-cutting steel	$R_m \leq 570$	180 - 250 - 320	130 - 200 - 270	240 - 300 - 360
	$R_m > 570$	130 - 200 - 270	100 - 160 - 220	200 - 250 - 360
Case hardened steel	$R_m \leq 570$	200 - 270 - 320	150 - 210 - 260	250 - 320 - 300
	$R_m > 570$	160 - 220 - 270	110 - 160 - 210	200 - 270 - 340
Quenched & tempered steel, plain	$R_m \leq 650$	180 - 250 - 320	120 - 190 - 240	220 - 300 - 380
	$R_m > 650$	110 - 200 - 280	110 - 150 - 200	190 - 250 - 310

Date:

Calculation main productive time - turning

Given

- Shaft made of free cutting steel
- Roughing
- Manual turning machine
- Carbide tool
- $n = 1273 \text{ 1/min}$
- $V_c = 160 \text{ m/min}$
- $D = 40\text{mm}$, $d_e = 30\text{mm}$, $l_e = 80\text{mm}$
- Approach = $l_a = 1\text{mm}$
- Feed rate = $f = 0.45 \text{ 1/mm}$
- Cutting depth = $a_p = 4\text{mm}$

Main productive time when turning with constant velocity

Main productive time during cylindrical turning and transverse turning

t_p	main productive time	l_{oi}	overrun idle travel
d, d_s	outside, initial diameter	L	total travel
d_1	shoulder-, internal diameter	f	feed per revolution
d_m	mean diameter ¹⁾	n	rotational speed
d_e	final diameter	i	number of cuts ²⁾
l	workpiece length	v_c	cutting velocity
l_a	approach	a_p	cutting depth

Main productive time

$$t_p = \frac{L \cdot i}{n \cdot f}$$

$l_a = l_{oi} = 1 \dots 2 \text{ mm}$

Calculating travel L , mean diameter d_m and rotational speed n

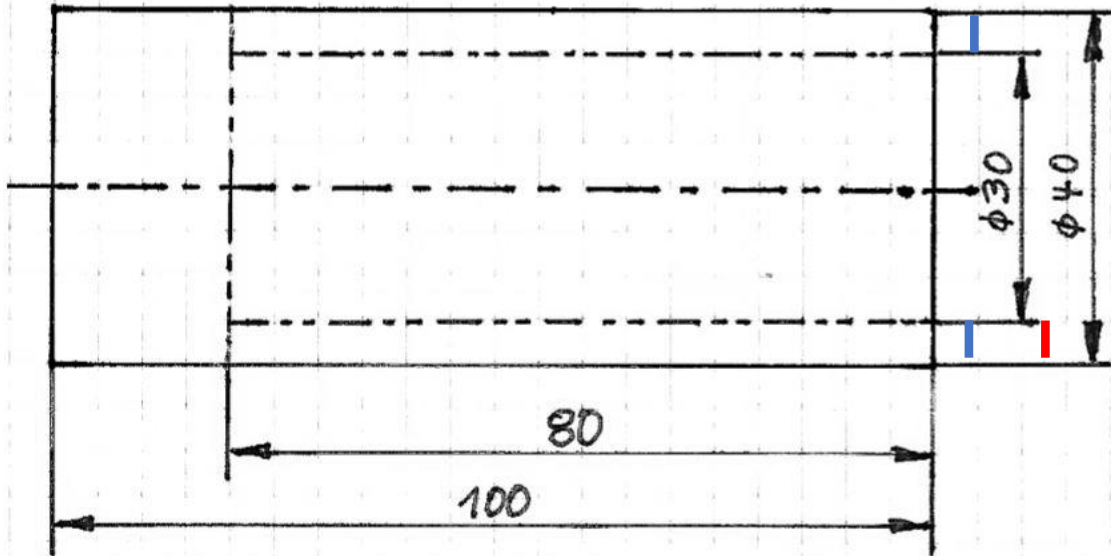
Cylindrical turning

Transverse turning

Cylindrical turning		Transverse turning		
without shoulder	with shoulder	Solid cylinder without shoulder	Solid cylinder with shoulder	Hollow cylinder
$L = l + l_a + l_{oi}$	$L = l + l_a$	$L = \frac{d}{2} + l_a$	$L = \frac{d - d_1}{2} + l_a$	$L = \frac{d - d_1}{2} + l_a + l_{oi}$
$n = \frac{v_c}{\pi \cdot d}$	$i \approx \frac{d_s - d_e}{2 \cdot a_p}$	$d_m = \frac{d}{2}; n = \frac{v_c}{\pi \cdot d_m}$	$d_m = \frac{d + d_1}{2}; n = \frac{v_c}{\pi \cdot d_m}$	

Date:

Calculation main productive time - turning



$$T_h = (L \cdot i) / (n \cdot f) = ?$$

$$L = l + l_a = 80\text{mm} + 1\text{mm} = 81\text{mm}$$

i = allowance / cutting depth

$$= ((d_a - d_e) / 2) / a_p$$

$$= (d_a - d_e) / 2 \cdot a_p$$

$$= (40\text{mm} - 30\text{mm}) / (2 \cdot 4\text{mm})$$

$$= 1.25 \Rightarrow \text{choose } l = 2$$

$$T_h = (L \cdot i) / (n \cdot f) = (81\text{mm} \cdot 2) / (1273 \text{ min}^{-1} \cdot 0.45\text{mm})$$

$$= 0.28 \text{ min} = 16.8 \text{ sec}$$