

$$T = 8500 \text{ Nm}$$

Load - one direction, light impact

$$L = 60 \text{ mm B type}$$

$$P_{\text{sheff}} = 1500 \text{ MPa} \rightarrow \text{taking the weaker}$$

$$P_{\text{sheff}} = 200 \text{ MPa}$$

one way load
light

$$P_{\text{all}} = 0.7 \cdot P_0 = 9.7 \cdot 150$$

$$P_{\text{all}} = 105 \text{ MPa}$$

From table 4.3-7 $T = \frac{\tau \cdot d \cdot d}{2}$

$$\tau = 600 \text{ MPa}$$

$$d = 60$$

diameter of the shaft

$$T = \frac{\tau \cdot l_e \cdot b \cdot d}{2} = 7.9 \cdot 10^{12} \text{ Nmm}$$

$$\Rightarrow l_e = \frac{2T}{\tau \cdot b \cdot d} = \frac{2 \cdot 8500000}{60 \cdot 10^3 \cdot 18 \cdot 60} = 2.62 \cdot 10^5$$

From table about parallel keys:

$$b = 18 \text{ mm}, h = 11 \text{ mm}$$

MUB

$$T = \frac{P_h \cdot l_e \cdot t_2 (d + t_2)}{2} = 238022 \text{ Nmm}$$

SHAFT

$$T = \frac{P_h \cdot l_e \cdot t_1 (d - t_1)}{2} = 105 \cdot 7 \cdot 7 \cdot (60 - 7) = 4364 \text{ Nmm}$$

$$l_n = \frac{2T}{P_h \cdot t_2 \cdot (d + t_2)} = \frac{2 \cdot 8500000}{200 \cdot 0.7 \cdot 7 \cdot (60 + 7)} = 42.9 \text{ mm} \approx 43 \text{ mm}$$

$$l_g = \frac{2T}{P_h \cdot t_1 \cdot (d - t_1)} = \frac{2 \cdot 8500000}{105 \cdot 7 \cdot (60 - 7)} = 43.64 \text{ mm} \approx 44 \text{ mm}$$

$$l = 44 \text{ mm}$$

table

recommended length $l = 50 \text{ mm}$

$$B = 18 \times 11 \times 60$$

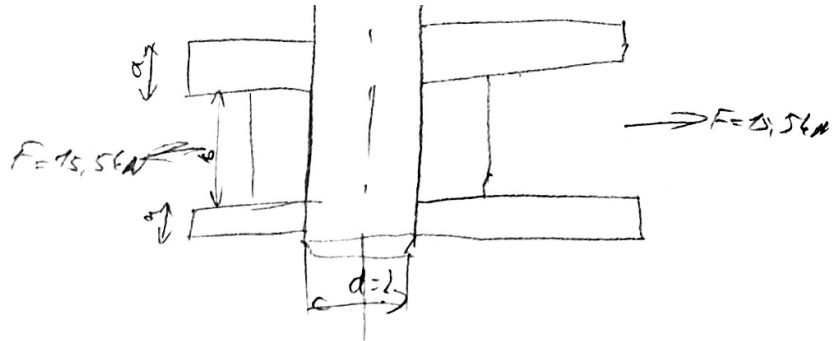
or

$$B = 18 \times 11 \times 50$$

Task 2: $M = F \cdot \left(a + \frac{L}{2}\right)$

$$M = 15500 \left(12 + \frac{30}{2}\right)$$

$$M = 418500 \text{ Nmm}$$



$$a = 12 \text{ mm}$$

S355J3

$$b = 30 \text{ mm}$$

Pulsating force

Bending Stress

$$\sigma_p = \frac{M}{W_b} \leq \sigma_{all}$$

Section Modulus

$$W_b = 0,1 \cdot d^3$$

$$\sigma_{all} = 140 \text{ MPa}$$

$$\tau_{all} = 60 \text{ MPa}$$

$$P_{all} = 24 \text{ MPa}$$

$$P_i = \frac{F}{b \cdot d} \leq P_{all}$$

$$d = \frac{15500}{0,030 \cdot 24 \cdot 10^6} = 0,0215 \text{ m}$$

$$P_a = \frac{F}{2 \cdot a \cdot d} \leq P_{all}$$

$$d = \frac{15500}{2 \cdot 0,012 \cdot 24 \cdot 10^6} = 0,0269 \text{ m}$$

$$\underline{\underline{d = 26,9 \text{ mm}}}$$

$$\sigma_p = \frac{M}{0,1 \cdot d^3} = \frac{418500}{0,1 \cdot 0,0269^3} = 53,75 \text{ MPa}$$

$$n = \frac{\sigma_{all}}{\sigma_p} = \frac{140}{53,75} = 2,6 \checkmark$$

$$\tau_a = \frac{F}{2A} = \frac{F}{\pi \frac{d^2}{4} \cdot 2} = \frac{2F}{\pi d^2} = \frac{2 \cdot 15500}{\pi \cdot 0,0269^2} = 13,64 \text{ MPa}$$

$$n = \frac{\tau_{all}}{\tau_a} = \frac{60 \text{ MPa}}{13,64 \text{ MPa}} = 4,4 \checkmark$$