higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

MEGANIESE TEKENE EN ONTWERP N6

20 April 2021

Hierdie nasienriglyn bestaan uit 9 bladsye.

Kopiereg voorbehou

VRAAG 1

1.1 $sin \propto = \frac{D-d}{2c}$

$sin \propto = \frac{0,36-0,24}{2(0,9)}$ ✓

$\propto = 3,82°$ ✓

$\theta = 180° - 2 \propto = 180° - 2(3,82°) = 172,36°$ ✓ (3)

1.2 $\frac{T_1}{T_2} = e^{\mu\theta}$

$T_1 = e^{(0,3)(3,01)}T_2$ ✓

$T_1 = 2,466T_2 \ldots\ldots\ldots\ldots (1)$ ✓

$v = \frac{\pi DN}{60} = \frac{\pi(0,24)(1\ 500)}{60} = 18,85 \text{ m/s}$ ✓

$P = (T_1 - T_2)v$

$70 \times 10^3 = (2,466T_2 - T_2)18,85$ ✓

$T_2 = 2\ 533,102 \text{ N}$ ✓

$T_1 = 2,466 \times 2\ 533,102 = 6\ 246,63 \text{ N}$ ✓ (6)

1.3 $\sigma_1 = \frac{T_1}{wt}$ maar $w = 3t$

$\therefore\ \sigma_1 = \frac{\pi}{3t^2}$ ✓

$2,5 \times 10^6 = \frac{6\ 246,63}{3t^2}$ ✓

$t = 28,86 \text{ mm} \quad \therefore t = 29 \text{ mm}$ ✓

$w = 3t = 3 \times 29 = 87 \text{ mm}$ ✓

$L = \frac{\pi}{2}[D+d] + \frac{(D-d)^2}{4c} + 2c$

$L = \frac{\pi}{2}[360+240] + \frac{(360-240)^2}{4(900)} + 2(900)$ ✓

$L = 2\ 747 \text{ mm}$ ✓ (6)

1.4 $N_B D_B = N_A D_A$

$N_B(0{,}36) = (1\,500)(0{,}24)$✓

$N_B = 1\,000$ r/min✓

$c = \frac{m}{2}[T_C + T_D]$

$320 = \frac{10}{2}[26 + T_D]$✓

$T_D = 38$ tande✓

$N_D T_D = N_C T_C$

$N_D(38) = (1\,000)(26)$✓

$N_D = 684{,}21$ r/min✓

$c = \frac{m}{2}[T_D + T_E]$

$450 = \frac{10}{2}[38 + T_E]$✓

$T_E = 52$ tande✓

$N_E T_E = N_D T_D$

$N_E(52) = (684{,}21)(38)$✓

$N_E = 500$ r/min✓ (10)

1.5 $PCD_D = mT_D$

$PCD_D = 10 \times 38 = 380$ mm✓

$PCD_E = mT_E$

$PCD_E = 10 \times 52 = 520$ mm✓

Kontroleer interferensie tussen rat C en D:

$R_{AMAX} = \sqrt{R^2 + 2R \times r \times sin^2 4 + r^2 \times sin^2 4}$

$= \sqrt{(190)^2 + 2(190)(130)sin^2(20) + (130)^2 sin^2 20°}$✓

$= 209{,}42$ mm✓

$R_{A\ actual} = \frac{380 + 10 + 10}{2} = 200$ mm✓

$R_{A\ MAX}$ is meer as $R_{A\ actual}$ dus geen interferensie nie. ✓

Kontroleer interferensie tussen rat D en E:

$R_{A\ MAX} = \sqrt{R^2 + 2R \times r \times sin^2 4 + r^2 \times sin^2 4}$

$= \sqrt{(260)^2 + 2(260)(190)sin^2 20 + (190)^2 sin^2(20)}$✓

$= 288{,}76$ mm✓

$R_{A\ actual} = \frac{520 + 10 + 10}{2} = 270$ mm✓

$R_{A\ MAX}$ is meer as $R_{A\ actual}$ dus geen interferensie nie. ✓ (10)

1.6 Moet vir kleiner rat C bereken word:

$C_v = \frac{6}{6+v}$ snelheidsfaktor

maar $v = \frac{\pi DN}{60}$

$= \frac{\pi(0{,}26)(1\,000)}{60}$ ✓

$= 13{,}614$ m/s✓

$\therefore C_v = \frac{6}{6 + 13{,}614}$ ✓

$= 0{,}3059$✓

$\sigma_w = C_v \times \sigma_B$ werkstres

$= 0{,}3059 \times (50 \times 10^6)$✓

$= 15{,}295$ MPa✓

$Y = 0{,}154 - \frac{0{,}912}{T}$ vormfaktor

$= 0{,}154 - \frac{0{,}912}{2{,}6}$ ✓

$= 0{,}119$✓

$F_T = \pi \times m \times b \times y \times \sigma$ vlakbreedte

$5\ 141{,}93 = \pi(0{,}01)(b)(0{,}119)(15{,}295 \times 10^6)$✓

$b = 89{,}92$ mm✓

$b_{min} = 2{,}5 \times \pi \times m$

$= 2{,}5 \times \pi \times 10$

$= 78{,}54$ mm✓

$b_{MAX} = 4 \times \pi \times m$

$= 4 \times \pi \times 10$

$= 125{,}66$ mm✓

Dit is geskik, want dit is binne die perke. ✓ (13)

1.7 $P = \frac{2\pi NT}{60}$

$70 \times 10^3 = \frac{2\pi(1\ 000)T}{60}$ ✓

$T = 668{,}45$ Nm✓ (2)

1.8 $F_t = \frac{2T}{PCD}$

$F_t = \frac{2(66{,}45)}{0{,}26}$

$F_t = 514{,}93$ N✓

$F_R = F_t tan\emptyset$

$F_R = 5\ 141{,}93 tan 20°$

$F_R = 1\ 871{,}51$ N✓

Vertikale reaksies:

$\Sigma cwm = \Sigma Acwm$

$F_R \times 300 + (120 \times 9{,}81)700 = R_R \times 800 + (T_1 + T_2)160$✓

$5\ 6145{,}3 + 1\ 177{,}2 \times 700 = 800R_R + 140\ 475{,}12$

$R_R = -24{,}08$ N✓

$\Sigma Fup = \Sigma Fdown$

$R_L + R_R = T_1 + T_2 + F_R + w_f$

$R_L + (-24{,}08) = 62\ 46{,}63 + 2\ 533{,}102 + 1\ 871{,}57 + 1\ 177{,}2$✓

$R_L = 11\ 852{,}522$ N✓

Buiging by linkerkantse laer:

$M_G = -(T_1 + T_2) \times L$

$= -(6\ 246{,}63 + 2\ 533{,}102) \times 0{,}16$✓

$= -1404{,}75$ Nm✓

Buiging by rat C:

$M_C = -(T_1 + T_2)L + R_L \times L$

$= -(6\ 246{,}63 + 2\ 533{,}10)0{,}46 + 11\ 852{,}522 \times 0{,}3$✓

$= -482{,}92$ Nm✓

Buitging by vliegwiel:

$M_F = R_R \times L$

$= -24{,}08 \times 0{,}1$✓

$= -2{,}408$ Nm✓

Horisontale reaksies:

$\Sigma cwm = \Sigma Acwm$

$R_L \times 800 = F_t \times 500$

$R_L \times 800 = 5\ 141{,}93 \times 500$✓

$R_L = 3\ 213{,}796$ N✓

$\Sigma Fup = \Sigma Fdown$

$R_L + R_R = F_t$

$3\ 213{,}706 + R_R = 5\ 141{,}93$✓

$R_R = 1\ 928{,}223$ N✓

Buiging by rat C:

$M_C = -3\ 213{,}706 \times 0{,}3$✓ $= -964{,}112$ Nm✓

Maksimum buiging is vertikaal en linkerlaer G:

$M_G = 1\ 404{,}757$ Nm✓ (19)

1.9 $T_e = \sqrt{M^2 + T^2}$

$= \sqrt{(1\ 404{,}757)^2 + (668{,}45)^2}$✓

$= 1\ 555{,}689$ Nm✓

$T_e = \frac{\pi}{16} D^3 \tau$

$1\ 555{,}689 = \frac{\pi}{16} D^3 (60 \times 10^6)$✓

$D = 50{,}92$ mm✓

$\therefore D = 55$ mm✓

$M_e = \frac{1}{2}[M + \sqrt{M^2 + T^2}]$

$= \frac{1}{2}[1\ 404{,}757 + \sqrt{1\ 404{,}757^2 + 668{,}45^2}]$✓

$= 1\ 480{,}223$ Nm✓

$M_e = \frac{\pi}{32} D^3 \sigma_n$

$1\ 480{,}233 = \frac{\pi}{32} D^3 (90 \times 10^6)$✓

$D = 55{,}127$ mm✓

$\therefore D = 60$ mm✓

Die geskiktediameter is 60 mm. ✓ (11)

1.10 Bearing G:

$R_G = \sqrt{{F_V}^2 + {F_H}^2}$

$= \sqrt{(11\ 852{,}522)^2 + (3\ 213{,}706)^2}$✓

$= 12\ 280{,}48$ N✓

Laer H:

$R_H = \sqrt{{F_V}^2 + {F_H}^2}$

$= \sqrt{(24{,}08)^2 + (1\ 928{,}223)^2}$✓

$= 1\ 928{,}373$ N✓ (4)

1.11 $F_T = \mu F_R$

$= 0{,}08(12\ 280{,}48)$✓

$= 928{,}238$ N✓

$T_f = F_T R$

$= 928{,}238 \times 0{,}03$✓

$= 27{,}847$ Nm✓

$P_f = \frac{2\pi N T_f}{60}$

$= \frac{2\pi(1\ 000)(27{,}847)}{60}$ ✓

$= 2{,}916$ kW✓

$F_T = \mu F_R$

$= 0{,}08(1\ 928{,}373)$✓

$= 154{,}27$ N✓

$T_f = F_T R$

$= 154{,}27 \times 0{,}03$✓

$= 4{,}628$ Nm✓

$P_f = \frac{2\pi N T_f}{60}$

$= \frac{2\pi(1\ 000)(4{,}628)}{60}$ ✓

$= 484{,}64$ W✓ (12)

1.12 $P = \frac{F_R}{A}$

$= \frac{928,238}{(0,09)(0,06)}$ ✓

$= 171,896$ kPa✓

$P = \frac{F_R}{A}$

$= \frac{154,27}{(0,09)(0,06)}$ ✓

$= 28,569$ kPa✓ (4)

[100]

TOTAAL: 100

Kopiereg voorbehou