PETI80 Ordinary exam 2019

Task 1:

a) $F_a = (m_{dp} \cdot h_{dp} + m_{dc} \cdot h_{dc}) \cdot g \cdot k = 674{,}4\ kN$

$SF = 2{,}4$

b) $\frac{2}{3} m_{dc} \cdot h_{dc} \cdot g \cdot k \geq F_N + WOB$

$\Rightarrow WOB = 89{,}3\ kN$

c) $\frac{1}{SF} = \sqrt{\left(\frac{\Delta p}{p_y}\right)^2 + \left(\frac{K_E}{K_y}\right)^2 + \left(\frac{M}{M_y}\right)^2}$

$\Rightarrow \Delta p = 353{,}8\ bar$

d) $F_T = \frac{K_T - 1}{1 - K_T^{-n}} (F_A + M \cdot g)$

$F_T = 76{,}8\ kN$

$\eta \cdot E_M = F_T \cdot v \cdot n \Rightarrow E_M = 649\ kW$

Task 2:

DDH: $N_2 = 250$

$N_3 = 798$

a) $\Delta p_{ds} = (N_2 \cdot h_{dp} + N_3 h_{dc}) \cdot 10^{-4} \cdot \rho_{mR}^{0,8} \cdot \mu_{mR}^{0,2}$

$\Delta p_{ds} = 128 \text{ bar}$

b) $\Delta p_N = \dfrac{V_N^2 \cdot \rho_m}{C_D^2 \cdot 2} = 145 \text{ bar}$

$\Delta p_{tot_F} = \Delta p_{ds} + \Delta p_{SE,ann} = 133 \text{ bar}$

$V_N = 152 \text{ m/s}$, $\Delta p_N = 52\%$ Ok

$\Delta p_p = \Delta p_{tot_F} + \Delta p_N = 278 \text{ bar}$

$F_N = Q_m \cdot \rho_m \cdot V_N = 7,8 \text{ kN}$

$d = \sqrt{\dfrac{4 \cdot \eta_E \eta_T \eta_m E_M}{3 \pi L n \cdot p_p}} = 5,2''$

$\Rightarrow D = 5''$

$Q_{mp} = 3 \eta_v \cdot \dfrac{\pi d^2}{4} \cdot L n = 1573 \text{ l/min}$

$p_p = \eta_{tot} \cdot E_M / Q_{mp} = 304 \text{ bar}$

$n = \dfrac{Q_m}{Q_{mp}} = 1,65 \Rightarrow n = 2$

# Task 3:

a) $\Delta P_B = \left(P_F - \rho_G \cdot g h\right) - \rho_m g h = 484 \text{ bar}$

b) $\Delta P_c = \rho_m \cdot g \cdot 0.4h = 111 \text{ bar}$

$\Delta P_{BC} = \rho_c \cdot gh - \rho_m \cdot gh = 179 \text{ bar}$

c) $\Delta P_{CC} = \rho_c \cdot g \cdot 1060 + \rho_m g \cdot 1610 - \rho_p \cdot g \cdot 2480$

$\Delta P_{CC} = 70.8 \text{ bar}$

d) $\Delta P_{BD} = \Delta P_B \cdot SF = 726 \text{ bar}$

$\Delta P_{CD} = \Delta P_C \cdot SF = 133 \text{ bar}$

DDH $\Rightarrow$ $m_c = 47 \text{ lb/ft}$ , $A_i = 38.19 \text{ l/m}$

$SF_C = 3.49$

$SF_B = 1.53$

e) $F_{adm} = m_c \cdot gh \left(1 - \frac{\rho_m}{\rho_s}\right) = 1430.4 \text{ KN}$

$F_{ac} = m_c g h \left(1 - \frac{\rho_m}{\rho_s}\right) + A_i h_c (\rho_c - \rho_m) g$

$F_{ac} = 2082 \text{ KN}$

$SF_c = 2.6$

# Task 4:

a) $p_b = p_{dp} + \rho_m \cdot g h = 360,7 \text{ bar}$

$$h_K = L_{dc} + \frac{V_K + Q_m \Delta t - A_{an\,dc} \cdot L_{dc}}{A_{an\,dp}} = 190 \text{ m}$$

b) $$\rho_K = \rho_m - \frac{p_{an} - p_{dp}}{g \cdot h_K} \left(1 + \frac{Q_m \cdot \Delta t}{V_K}\right) = 671,7 \text{ kg/m}^3$$

$$\rho_{Km} = \frac{p_b + \Delta p}{g h} = 1285,5 \text{ kg/m}^3$$

c) $$\Delta t_{ds} = \frac{V_{ds}}{Q_m} = 33,8 \text{ min}$$

$$\Delta t_{an} = \frac{V_{an}}{Q_m} = 433,7 \text{ min}$$

$$\Delta t_{tot} = 2 \Delta t_{an} + \Delta t_{ds} = 901,2 \text{ min}$$

e) $$p_{dp\text{-}Cir} = 22,3 \text{ bar}$$

$$p_{dp\text{-}Cir_{Km}} = 20,4 \text{ bar}$$