

4-4

(staré potrubí)

$$V = 14 \text{ m}^3/\text{h}$$

$$3-13 \quad \rho = 998 \text{ kg/m}^3$$

$$\zeta = 1,002 \cdot 10^{-3} \text{ Pa}\cdot\text{s}$$

$$\text{Zkorodovaná utina} \quad \underline{\underline{e_A = 3 \text{ mm}}}$$

$$d = 50 \text{ mm}$$

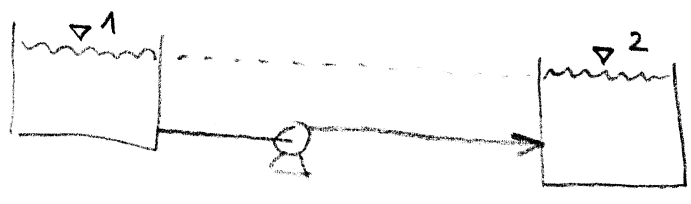
$$L = 100 \text{ m}$$

$$p_1 = p_2 = p_{\text{atm}}$$

(nové potrubí)

$$\text{nový plast} \quad e_A = 0,01 \text{ mm}$$

$$d = 70 \text{ mm}$$



a) staré potrubí: $h_1 = h_2, v_1 = v_2 = 0$ $e_c = e_{\text{dis}}$ (Bernoulliho rovnice)

$$v = \frac{V}{A} = \frac{V \cdot 4}{\pi d^2} = \frac{4 \cdot 14 / 3600}{\pi \cdot 0,05^2} = 1,981 \text{ m/s}$$

$$Re = \frac{v d \rho}{\zeta} = \frac{1,981 \cdot 0,05 \cdot 998}{1,002 \cdot 10^{-3}} = 98634$$

$$\lambda = \frac{0,25}{\left\{ \left[\log \left[\left(\frac{0,81}{Re} \right)^{0,99} + \frac{3}{50} \right] \right\}^2 \right.} = 0,0784$$

↑
o.k. pro
HODNĚ dle
potrubí

$$e_c = e_{\text{dis}} = \lambda \frac{L}{d} \frac{v^2}{2} = 0,0784 \frac{100}{0,05} \frac{1,981^2}{2} = \underline{\underline{307,67 \text{ J/kg}}}$$

b) nové potrubí $e_c = e_{\text{dis}} \Rightarrow 307,67 = \lambda \frac{L}{d} \frac{v^2}{2} \Rightarrow v^2 = \frac{2 \cdot d \cdot 307,67}{\lambda L}$

$$v^2 = \frac{2 \cdot 0,07 \cdot 307,67}{\lambda \cdot 100} = \frac{0,43074}{\lambda}$$

Iterace 1: $v = 1,981 \text{ m/s}$ (odhad)

$$Re = \frac{1,981 \cdot 0,07 \cdot 998}{1,002 \cdot 10^{-3}} = 138116$$

$$\lambda = 0,01763$$

$$v = \left(\frac{0,43074}{0,01763} \right)^{1/2} = 4,94 \text{ m/s}$$

Iterace 2: $v = 4,94 \text{ m/s}$

$$Re = 344420$$

$$\lambda = 0,01552$$

$$v = 5,26 \text{ m/s}$$

Iterace 3: $v = 5,26 \text{ m/s}$

$$Re = 366730$$

$$\lambda = 0,01541$$

$$v = 5,25 \text{ m/s}$$

Iterace 4: $v = 5,25 \text{ m/s}$ (jen pro kontrolu)

$$Re = 368822$$

$$\lambda = 0,01540$$

$$v = 5,25 \text{ m/s} \quad (\text{iterace o.k.})$$

$$\dot{V} = v \cdot \frac{\pi d^2}{4} = 5,25 \frac{\pi \cdot 0,07^2}{4} = 20,36 \cdot 10^{-3} \frac{\text{m}^3}{\text{s}} =$$

$$= 73,29 \text{ m}^3/\text{hod}$$