

3-6

$$t = 20^\circ\text{C}$$

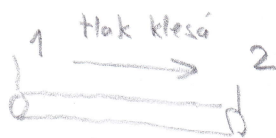
III vjd. nová ocel, $\epsilon_A = 4,6 \cdot 10^{-5} \text{ m}$

$$d = 150 \text{ mm}$$

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

$$\Delta p = 35 \text{ kPa (max)}$$

vodorovně



$$\frac{V_1^2}{2} + \frac{p_1}{\rho} + h_1 g = \frac{V_2^2}{2} + \frac{p_2}{\rho} + h_2 g + e_{dis}$$

$$V_1 = V_2$$

$$h_1 = h_2$$

$$p_1 - p_2 = 35 \text{ kPa}$$

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

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

$$\frac{\Delta p}{\rho} = e_{dis} = \lambda \frac{L}{d} \frac{V^2}{2}$$

$$V^2 = \frac{2d \Delta p}{\lambda e L}$$

Iterace: $v = 1 \text{ m/s}$ (první vstřel)

$$Re = \frac{v d \rho}{\zeta} = \frac{1 \cdot 0,15 \cdot 998}{1,002 \cdot 10^{-3}} = 149401$$

$$\epsilon_A = 0,046 \text{ mm}$$

$$\lambda = \frac{0,25}{\left\{ \log \left[\left(\frac{6,81}{Re} \right)^{0,9} + \frac{\epsilon_A/d}{3,7} \right] \right\}^2} = 0,01841$$

$$v = \left(\frac{2 \cdot 0,15 \cdot 35 \cdot 10^3}{0,01841 \cdot 998 \cdot 100} \right)^{1/2} = \sqrt{5,715} = 2,39 \text{ m/s}$$

Iterace: $v = 2,39 \text{ m/s}$ (druhý vstřel)

$$Re = 357069$$

$$\lambda = 0,01682$$

$$v = 2,50 \text{ m/s}$$

Iterace: $v = 2,50$ (třetí vstřel)

$$Re = 373503$$

$$\lambda = 0,01676$$

$$v = 2,51 \text{ m/s (iterace zkonvergovala)}$$

$$\dot{V} = v \cdot A = v \cdot \frac{\pi d^2}{4} = 2,51 \frac{\pi \cdot 0,15^2}{4} = 0,04436 \text{ m}^3/\text{s} = 44,36 \text{ l/s} = 2661 \text{ l/min}$$