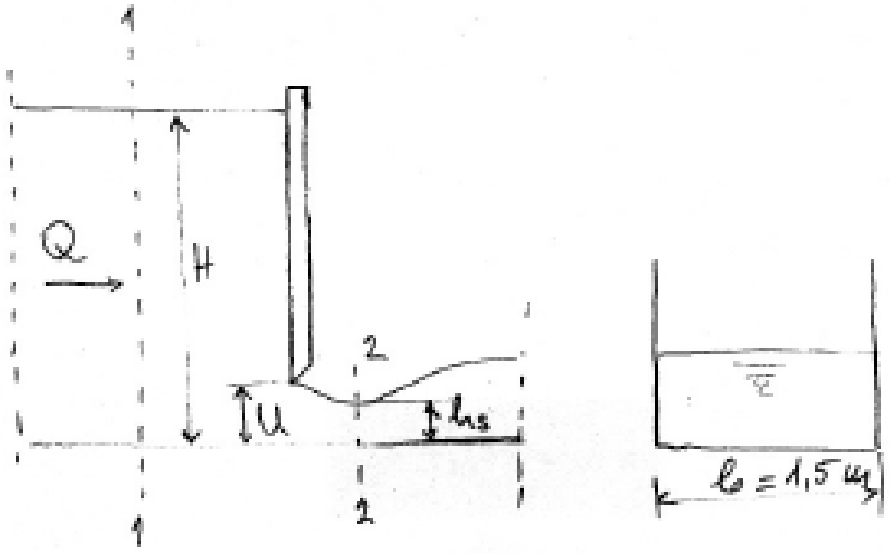
(2.)



$Q = 1,355\ m^3/s$

$C_v = 0,97$

$C_k = 0,65$

a) $h_s = 0,1355\ m$

$u = ?$

$H = ?$

$E_1 = E_2 + \Delta E$

$$H_1 + \frac{v_1^2}{2g} = h_s + \frac{v_2^2}{2g} + \xi \frac{v_2^2}{2g}$$

$$C_k = \frac{h_s}{u} \Rightarrow u = \frac{h_s}{C_k} = \frac{0,1355}{0,65} = 0,208\ m$$

$$C_v = \sqrt{\frac{1}{1+\xi}}, \quad C_v^2 = \frac{1}{1+\xi}, \quad 1+\xi = \frac{1}{C_v^2}, \quad \xi = \frac{1}{C_v^2} - 1$$

$$\xi = \frac{1}{0,9409} - 1 = 0,063$$

$$v_1 = \frac{Q}{A_1} = \frac{1,355}{1,5 \cdot H} = \frac{0,903}{H}$$

$$v_2 = \frac{Q}{A_2} = \frac{1,355}{1,5 \cdot h_s} = \frac{1,355}{1,5 \cdot 0,1355} = 6,67\ \frac{m}{s}$$

$$H + \frac{0,8154}{H^2 \cdot 2 \cdot 9,81} = 0,1355 + \frac{44,49}{2 \cdot 9,81} + 0,063 \cdot \frac{44,49}{2 \cdot 9,81}$$

$$H + \frac{0,0415}{H^2} = 2,698$$

$$H = 2,698 - \frac{0,0415}{H^2}$$

(2) $H = 2,698$

$$H' = 2,698 - \frac{0,0415}{2,698^2} = 2,692$$
$$H'' = 2,698 - \frac{0,0415}{2,692^2} = 2,691$$

$H = 2,692$ m ✓

d) $P_1 + I_1 - (P_2 + I_2) = K$

$$\frac{H}{2} \cdot \rho g\,(1,5 \cdot H) + \rho Q V_1 - \frac{l_s}{2} \cdot \rho g\,(1,5 \cdot l_s) - \rho Q V_2 = K$$

$$\frac{2,692}{2} \cdot 1000 \cdot 9,81 \cdot 1,5 \cdot 2,629 + 1000 \cdot 1,355 \cdot 0,335 -$$
$$- \frac{0,1355}{2} \cdot 1000 \cdot 9,81 \cdot 1,5 \cdot 0,1355 - 1000 \cdot 1,355 \cdot 6,67 = K$$

$K = 52071 + 453,925 - 135,085 - 9037,85$

$K = 43352$ N

$K = 43,352$ kN $= P_u$ ✓

$$P_1 = \frac{H}{2}\,\rho g\,(1,5 \cdot H) = \frac{2,698}{2} \cdot 1000 \cdot 9,81 \cdot 1,5 \cdot 2,698 =$$

$= 53556,74$ N

$P_1 = 53,557$ kN ✓

$$\frac{P_u}{P_1} = \frac{43,352}{53,557} = 0,81$$

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