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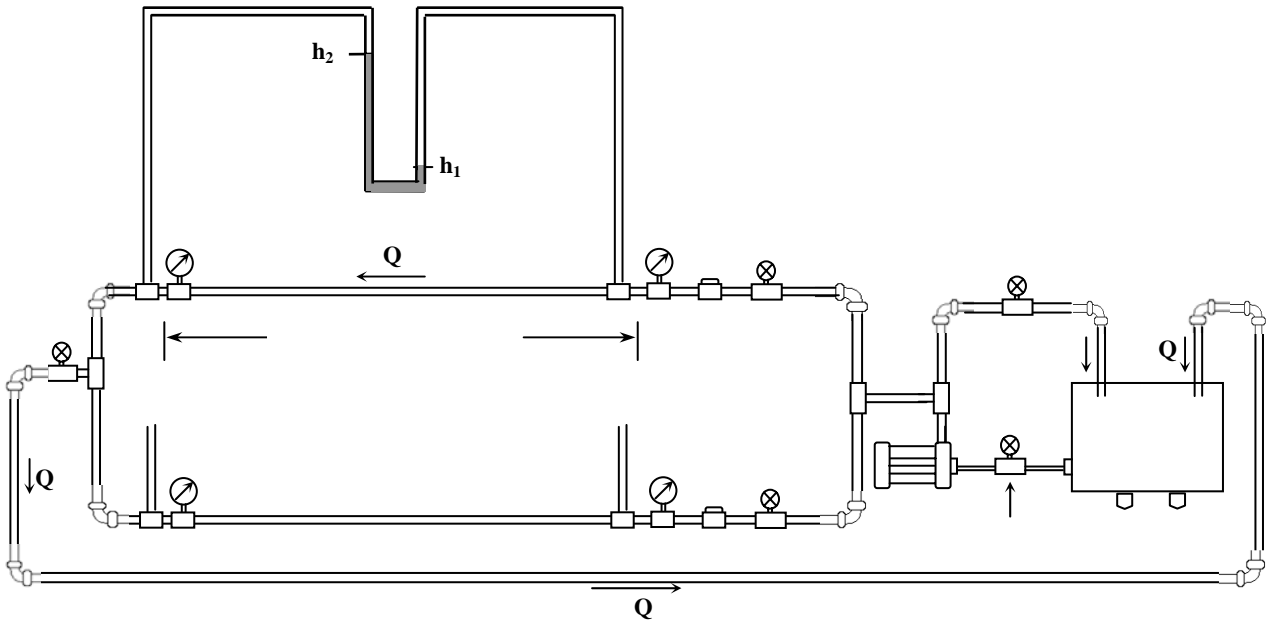
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$$h_f = \frac{(P_1 - P_2)\text{bar} \times 100}{9.81}$$

$$h_f = \frac{(h_1 - h_2)\text{mm}}{1000} \times \left(\frac{13.56 - 1}{1} \right)$$

$$h_f = 1.22 \times 10^{10} \frac{L}{D^{4.87}} \left(\frac{Q}{C_{HW}} \right)^{1.852}$$

$$h_f = 4.094 \times 10^6 \times K_S \times L \times \frac{Q^{1.9}}{D^{4.9}}$$

$$h_f = 8.263 \times 10^7 \times f \times L \frac{Q^2}{D^5}$$

$$R_N = 1.273 \times 10^6 \times \frac{Q}{D}$$

$$\frac{e}{D}$$

$$f = \frac{64}{R_n}$$

Universal Equation

$$A = \left[2.457 \ln \left(\frac{1}{\left(\frac{7}{R_n} \right)^{0.9} + 0.27 \left(\frac{e}{d} \right)} \right) \right]^{16}$$

$$B = \left(\frac{37530}{R_n} \right)^{16}$$

$$f = 8 \left[\left(\frac{8}{R_n} \right)^{12} + \frac{1}{(A + B)^{1.5}} \right]^{1/12}$$

(f)

$$R_N \leq 2000 :$$

$$R_N \geq 4000 :$$

(Moody Diagram)

(Chirchhill)

$$\hat{h}_f = Fh_f$$

$$F = \frac{1}{m+1} + \frac{1}{2N} + \frac{\sqrt{m-1}}{6N^2}$$

$$F = \frac{2N}{2N-1} \left\{ \frac{1}{m+1} + \frac{\sqrt{m-1}}{6N^2} \right\}$$

F

$$Q = \frac{V}{T}$$