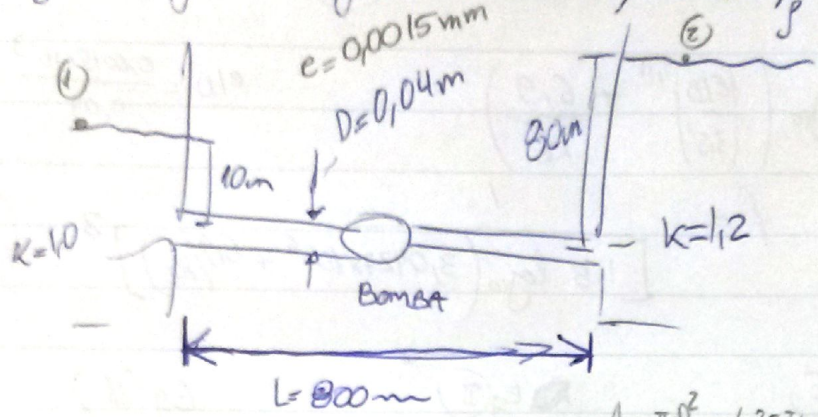
$\rho = 999\ kg/m^3$ $\quad g = 9,8\ m/s^2$ $\quad \nu = \frac{\mu}{\rho} = 1,14\times10^{-6}\ m^2/s$

$H_B = 425 - 1,3\times10^4 Q^2$

[m] $\quad [m^3/s]$



$A = \frac{\pi D^2}{4} = 1,257\times10^{-3}\ m^2$

Hip.:
- Permanente
- INCOMPR.
- Perdas Darcy
- Reserv. Grande
- V uniforme na seção

Bernoulli Modificado ① → ②

ESCOLHI POR TEREM INFO. CONHECIDAS

$P_1 = P_2 = P_{atm}$ $\quad P_1 = P_2 = P_{atm}$

$$P_1 + \rho g H_1 + \frac{\rho V_1^2}{2} + \rho g H_{BOMBA} = P_2 + \rho g H_2 + \frac{\rho V_2^2}{2} + \Delta P_{PERDAS}$$

$\frac{\rho V_1^2}{2}$ → 0 RESERV. GRANDE

$\frac{\rho V_2^2}{2}$ → 0 RESERV. GRANDE

CURVA BOMBA $\quad$ CURVA SISTEMA

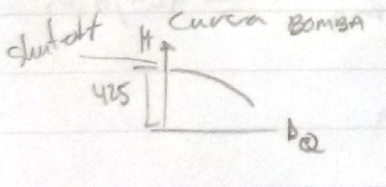
$$H_{BOMBA} = (H_2 - H_1) + \Delta H_{PERDAS}$$

$$\Delta H_{PERDAS} = f\frac{L}{D}\frac{V^2}{2g} + \sum K\frac{V^2}{2g}$$

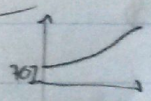
$A = \frac{\pi D^2}{4}$

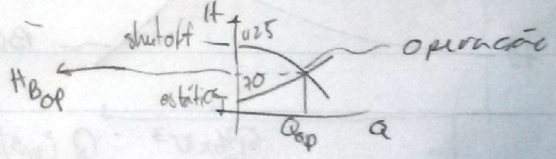
$$425 - 1,3\times10^4 Q^2 = (80-10) + f\frac{800}{0,04}\cdot\frac{Q^2}{A^2}\frac{1}{2\cdot9,81} + (1,0+1,5)\frac{Q^2}{A^2}\frac{1}{2\cdot9,81}$$

$$425 - 1,3\times10^4 Q^2 = (70) + 6,455\times10^8 f Q^2 + 8,069\times10^4 Q^2 \quad \text{EQ I}$$



curva do sistema





EQ I tem f e Q $\quad$ chutar f → calcular Q

calcular f ← calcular Re

VER Pag. seguinte

$Re = \frac{Q/A \cdot D \cdot \rho}{\mu} = \frac{Q \cdot 2{,}792 \times 10^{7}}{}$ (II)

$$\frac{1}{\sqrt{f}} = -1{,}8 \log_{10}\left(\left(\frac{\varepsilon/D}{3{,}5}\right)^{1{,}11} + \frac{6{,}9}{Re}\right)$$

$\varepsilon/D = \frac{0{,}00015 \times 10^{-3}}{0{,}04} = 3{,}75 \times 10^{-5}$

$$f = \frac{1}{\left[1{,}8 \log_{10}\left(3{,}0427 \times 10^{-6} + 6{,}9/Re\right)\right]^2} \quad \text{(III)}$$

PROCESSO	Eq (I)	Eq (II)	Eq (III)
CHUTE f	Q [m³/s]	Re	novo f
(0,020)	$5{,}225 \times 10^{-3}$	$1{,}46 \times 10^{5}$	0,0167
0,0167	$5{,}713 \times 10^{-3}$	$1{,}595 \times 10^{5}$	0,0164
0,0164	$5{,}76 \times 10^{-3}$	$1{,}608 \times 10^{5}$	0,0164

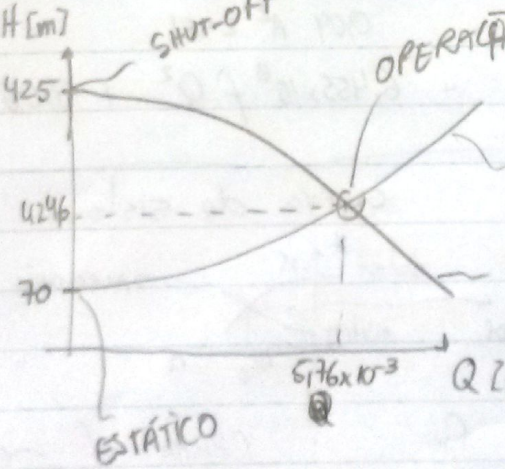
↓ f NÃO MUDOU

⇓ PARAR

SOLUÇÃO $Q = 5{,}76 \times 10^{-3}\ m^3/s$

$f = 0{,}0164$ $\quad$ $Re = 1{,}608 \times 10^{5}$

FORA DE ESCALA!!



$H_0 = 425 - 1{,}3 \times 10^{4} (5{,}76 \times 10^{-3})^2 =$

$= 424{,}6\ m$