$\rho := 62.3664\ \frac{lbm}{ft^3} = 0.036\ \frac{lbm}{in^3}$

$g_c := 386.088582677165\ \frac{lbm \cdot in}{lbf \cdot s^2}$

D (in)	C
0.030	0.69
0.030	0.69

$P\_in := 100\ psi$

$P\_out := 10\ psi$

$SG := 0.805$

$A := \frac{\pi}{4} \cdot D^2 = \begin{bmatrix} 7.069 \cdot 10^{-4} \\ 7.069 \cdot 10^{-4} \end{bmatrix} in^2$

Guess Values

$P_{in} := 1\ psi \cdot C$ $\quad P_{out} := 1\ psi \cdot C$ $\quad Q := 1\ gpm$

Constraints

$Q = C \cdot A \cdot \sqrt{2 \cdot g_c \cdot \frac{P_{in} - P_{out}}{SG \cdot \rho}}$

$stack(P_{in}, P\_out) = stack(P\_in, P_{out})$

Solver

$\begin{bmatrix} P_{in} \\ P_{out} \\ Q \end{bmatrix} := \mathbf{Find}(P_{in}, P_{out}, Q)$

$P_{in} = \begin{bmatrix} 100 \\ 55 \end{bmatrix} psi$

$P_{out} = \begin{bmatrix} 55 \\ 10 \end{bmatrix} psi$

$Q = 0.139\ gpm$

$P := \text{stack}(P_{in}, P\_out) = \begin{bmatrix} 100 \\ 55 \\ 10 \end{bmatrix} psi$

Check: $C \cdot A \cdot \sqrt{2 \cdot g_c \cdot \frac{P_{in} - P_{out}}{SG \cdot \rho}} = \begin{bmatrix} 0.139 \\ 0.139 \end{bmatrix} gpm$