

Flow out of tank through air hose:

$T_0 = 300\text{K}^\circ$
 $P_0 = 3.45 \times 10^5 \text{ Pa}$

Smallest $A = A^*$ at sonic conditions

Required $\dot{m} = 0.01 \text{ kg/s} = \rho^* a^* A^*$

$$\rho^* = \rho_0 \left[1 + \frac{\gamma-1}{2} \right]^{-\frac{1}{\gamma-1}} = 0.634 \rho_0$$

but $h_0 = c_p T_0 = 1004 \text{ J/kg}^\circ\text{K} \cdot 300^\circ = 301200 \text{ m}^2/\text{s}^2$

$$a_0 = \sqrt{(\gamma-1)h_0} = 347.1 \text{ m/s}$$

$$\rho_0 = \gamma P_0 / (\gamma-1)h_0 = 4.01 \text{ kg/m}^3$$

So $\rho^* = 0.634 \rho_0 = 2.542 \text{ kg/m}^3$

$$a^* = a_0 \left[1 + \frac{\gamma-1}{2} \right]^{-\frac{1}{2}} = 316.8 \text{ m/s}$$

$$A^* = \frac{\dot{m}}{\rho^* a^*} = \frac{0.01}{2.542 \cdot 316.8} = 1.24 \times 10^{-5} \text{ m}^2 = 0.124 \text{ cm}^2$$

$$r = 2 \text{ mm}$$

$$\text{diameter} = 4 \text{ mm} = 0.156 \text{ in.}$$