Given:

Isobutane is piped through a piping network with an inside diameter of 2 in.

Required:

If the volumetric flow rate at a particular point is 225 gallons per minute (gpm), what is the mass flow rate? What is the average velocity of the fluid?

Solution:

The inside diameter of the pipe is defined as

$$ID := 2\,in$$

The volumetric flow rate is defined as

$$V' := 225\,gpm$$

Going to Table A-3E(a) @ isobutane shows

$$\rho_{iso} := 37.1\,\frac{lbm}{ft^3}$$

The mass flow rate is then found by

$$\boxed{m' := \rho_{iso} \cdot V' = 18.6 \cdot \frac{lbm}{s}}$$

The cross sectional area is found by

$$A_p := \frac{\pi}{4} \cdot ID^2 = 3.142 \cdot in^2$$

The average velocity of the fluid is then

$$\boxed{V_{avg} := \frac{V'}{A_p} = 22.98 \cdot \frac{ft}{s}}$$