

Metering orifice test data

P_{inlet} = pressure read from pressure transducer #1 (psi)

P_n = pressure read from pressure transducer #2 (psi)

T = ambient temperature (F) (taken when pressure transducer #2 stabilizes)

t = duration of oxygen flow (s)

$P_{inlet} =$ _____ (do not adjust during trials)

Trial #1

$P_1 =$ _____

$T_1 =$ _____

$t_1 =$ _____

Trial #2

$P_2 =$ _____

$T_2 =$ _____

$t_2 =$ _____

Trial #3

$P_3 =$ _____

$T_3 =$ _____

$t_3 =$ _____

Mass calculator based on experimental data

Given

English

$$V_{\text{receivingtank}} := 490 \text{ in}^3$$

$$P_{\text{ambient}} := 14.696 \text{ psi}$$

Metric

$$V_{\text{receivingtank}} = 8.03 \text{ L}$$

$$P_{\text{ambient}} = 1.013 \times 10^5 \text{ Pa}$$

$$R := 260 \frac{\text{J}}{\text{kg}\cdot\text{K}}$$

Input data (enter test data in yellow fields):

$$P_{\text{inlet}} := 1000 \text{ psi}$$

$$P_{\text{inlet}} = 6.895 \times 10^6 \text{ Pa}$$

$$P_1 := 320 \text{ psi}$$

$$P_1 = 2.206 \times 10^6 \text{ Pa}$$

$$P_2 := 416 \text{ psi}$$

$$P_2 = 2.868 \times 10^6 \text{ Pa}$$

$$P_3 := 512 \text{ psi}$$

$$P_3 = 3.53 \times 10^6 \text{ Pa}$$

Convert Fahrenheit to Kelvin

$$T_1 := 65 \text{ in fahrenheit}$$

$$T_{K1} := \left[\left(\frac{T_1 - 32}{9} \right) \cdot 5 + 273.15 \right] \cdot 1 \text{ K}$$

$$T_{K1} = 291.483 \text{ K}$$

$$T_2 := 65 \text{ in fahrenheit}$$

$$T_{K2} := \left[\left(\frac{T_2 - 32}{9} \right) \cdot 5 + 273.15 \right] \cdot 1 \text{ K}$$

$$T_{K2} = 291.483 \text{ K}$$

$$T_3 := 65 \text{ in fahrenheit}$$

$$T_{K3} := \left[\left(\frac{T_3 - 32}{9} \right) \cdot 5 + 273.15 \right] \cdot 1 \text{ K}$$

$$T_{K3} = 291.483 \text{ K}$$

$$t_1 := 10 \text{ s}$$

$$t_2 := 13 \text{ s}$$

$$t_3 := 16 \text{ s}$$

calculating mass (m) and mass flow rate ($m_{\dot{o}t}$) for the trials:

$$m_1 := V_{\text{receivingtank}} \cdot \frac{P_1}{R \cdot T_{K1}}$$

$$m_1 = 0.234 \text{ kg}$$

$$m_{\dot{o}t1} := \frac{m_1}{t_1}$$

$$m_{\dot{o}t1} = 0.023 \frac{\text{kg}}{\text{s}}$$

$$m_2 := V_{\text{receivingtank}} \cdot \frac{P_2}{R \cdot T_{K2}}$$

$$m_2 = 0.304 \text{ kg}$$

$$m_{\dot{o}t2} := \frac{m_2}{t_2}$$

$$m_{\dot{o}t2} = 0.023 \frac{\text{kg}}{\text{s}}$$

$$m_3 := V_{\text{receivingtank}} \cdot \frac{P_3}{R \cdot T_{K3}}$$

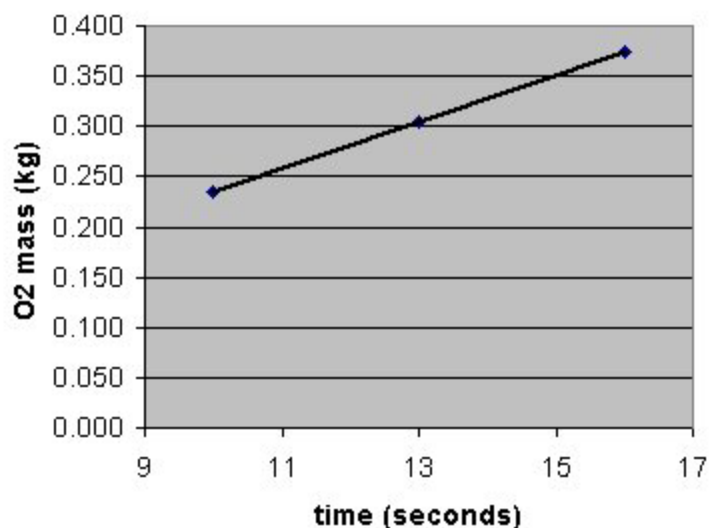
$$m_3 = 0.374 \text{ kg}$$

$$m_{\dot{o}t3} := \frac{m_3}{t_3}$$

$$m_{\dot{o}t3} = 0.023 \frac{\text{kg}}{\text{s}}$$

Plot results:

Metering orifice (mass vs. time)



$$m = 0.0233t + 0.0007$$
$$R^2 = 1$$

◆ #54 drill orifice
— Linear (#54 drill orifice)