OxySense Flow Meter

Users Guide

© Industrial Physics Product Integrity
OxySense
An Industrial Physics Product Integrity Brand
68 Branum Road, Devens, MA 01434. USA
Phone: (978) 772-0970
Website: www.oxysense.com
Email: PiSales@industrialphysics.com
Technical Support email: PiSupport@industrialphysics.com

Document Revised: July, 2020

Document Revised: July, 2020

Information in this document is subject to change without notice. Any reference to a company or data used as examples in this document may not be used for any purpose without express written permission is prohibited. All other company and product names are the trademarks or registered trademarks of their respective companies.

Always follow all local and national safety guidelines and any additional safety guidelines specific to your organization. Consult with your organization's safety officer prior to performing work.

Any descriptions of standards, protocols, practices, or procedures are given as guidance and may not fully align with the standards, protocols, practices, or procedures of your organization's quality assurance program. Consult with your organization's quality assurance officer prior to beginning work.

Table of Contents

1.0 Introduction 1
2.0 Flow Meter Assembly 2
2.1 Assembly Components 2
2.2 Flow Meter 2
2.3 Tube Fittings 3
3.0 Instructions 4
4.0 Considerations 8
4.1 Flow Rate 8
4.2 Using Pure Oxygen 8
5.0 Technical Support 9

List of Figures

Figure 2-1: Flow Meter Assembly (Side View) 2
Figure 2-2: Flow Meter (Front View) 2
Figure 2-3: Tube Compression Fittings 3

1.0 Introduction

A *flow meter* is used to control the flow rate of gas. We typically express the flow rate as a volume:time ratio (e.g. standard cubic feet per hour or SCFH), meaning that over a certain period of time, a certain amount of gas will have flowed.

Industrial Physics Product Integrity provides a flow meter for use with the OxySense® Permeation Chamber, an accessory designed for polymer film *oxygen transmission rate* (OTR) analysis. The reason being: polymer films are flexible. When using the permeation chamber, the chamber is purged with an inert gas. If the gas flows in to the chamber too quickly, the chamber will become pressurized, and, subsequently, the film inside may flex, bow, distort or rupture. The use of a flow meter is needed to prevent such things from happening.

This guide will discuss the following topics:

- Connecting the flow meter to the permeation chamber
- Purging the permeation chamber
- Suggested flow rates
- Using pure oxygen

2.0 Flow Meter Assembly

2.1 Assembly Components

The flow meter assembly (OxySense P/N: 300446-501) is composed of a flow meter, a wooden base, gas-tight tube compression fittings, and a brass check valve. The flow meter *inlet* is connected to a gas source (e.g. a compressed nitrogen cylinder). The *outlet* is connected to the permeation chamber. The flow of gas is regulated by the *adjustment knob* on the flow meter.

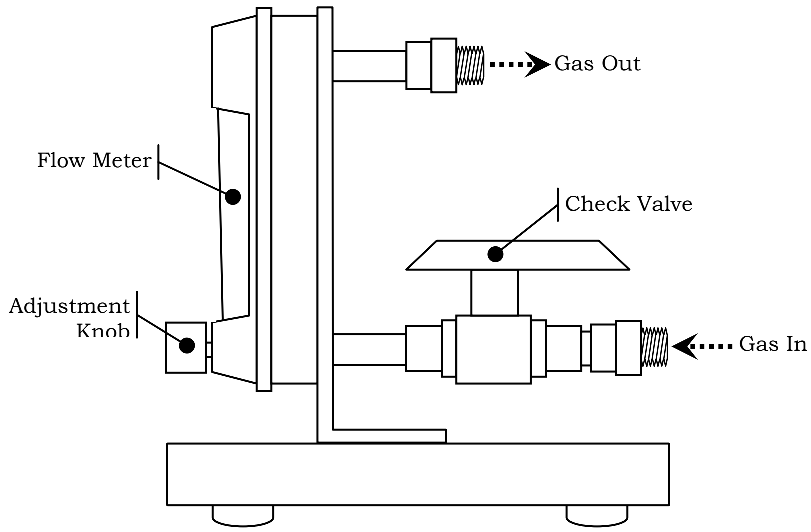


Figure 2-1: Flow Meter Assembly (Side View)

2.2 Flow Meter

The flow meter (*rotameter*) contains a floating *level indicator* that tells you the current gas flow rate. The flow rate reading is read from the level indicator's metallic, horizontal line. To increase or decrease the flow rate, turn the adjustment knob anti-clockwise or clockwise, respectively.

It is important to note that the markings on the flow meter are printed in increments of tenths of standard cubic feet per hour (SCFH). The highest marking is *1.0 SCFH* and the lowest marking is *0.1 SCFH*. You may convert this reading to liters per minute (LPM) by multiplying the SCFH value by *0.5* as *1 SCFH ≈ 0.5 LPM.*

$$LPM = SCFH \times 0.5$$

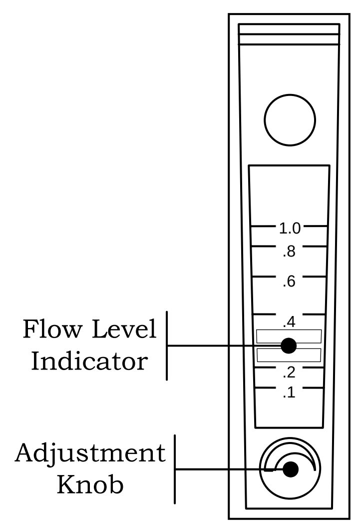


Figure 2-2: Flow Meter (Front View)

2.3 Tube Fittings

The flow meter assembly is shipped with gas-tight compression fittings located at the inlet and outlet. The fittings accommodate 1/4 inch (6 mm) outer diameter (O.D.) tubing. Tubing should be composed of a non-reactive material such as stainless steel or nylon.

Note that the provided compression nuts are different in design. The 9/16 in. (14.5 mm) nut at the inlet includes a front ferrule and back bushing. The 1/2 in. (13 mm) nut at the outlet includes a joined ferrule.

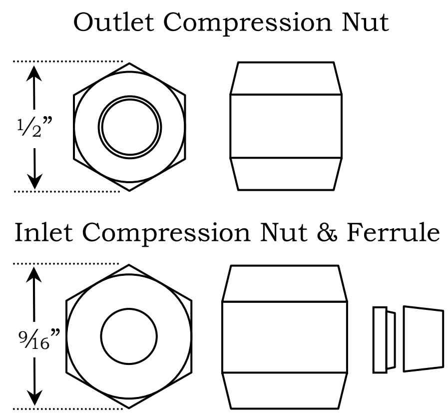
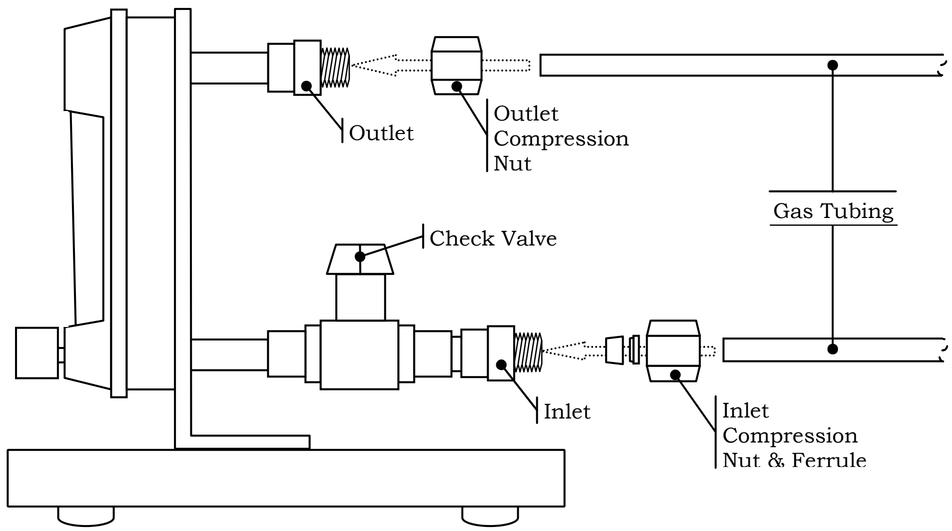


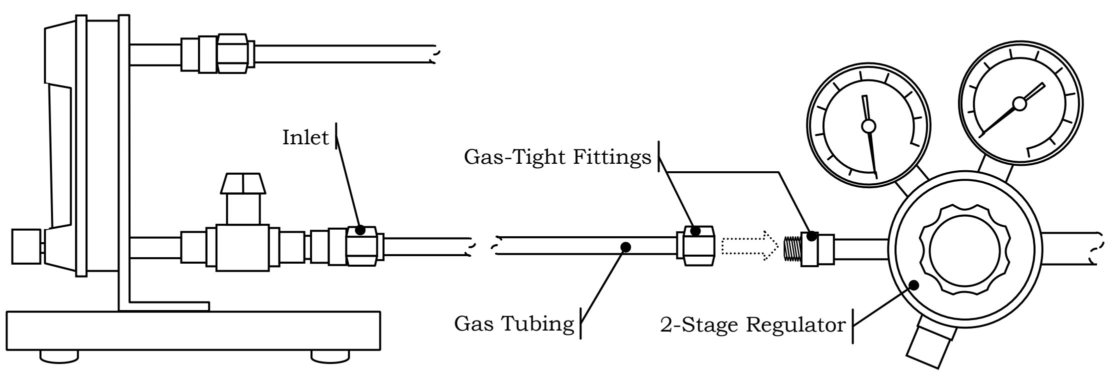
Figure 2-3: Tube Compression Fittings

3.0 Instructions

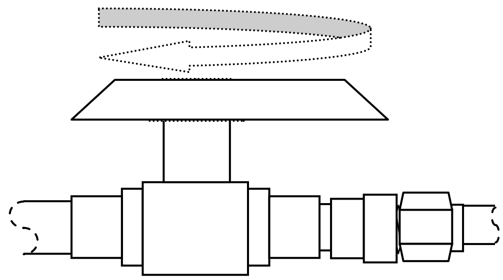
Step 1: Connect tubing to the flow meter's inlet and outlet with the provided gas-tight compression fittings. Insert tubing through nuts and ferrules (tubing is not provided). Firmly tighten fittings by turning clockwise using the appropriate size wrenches.



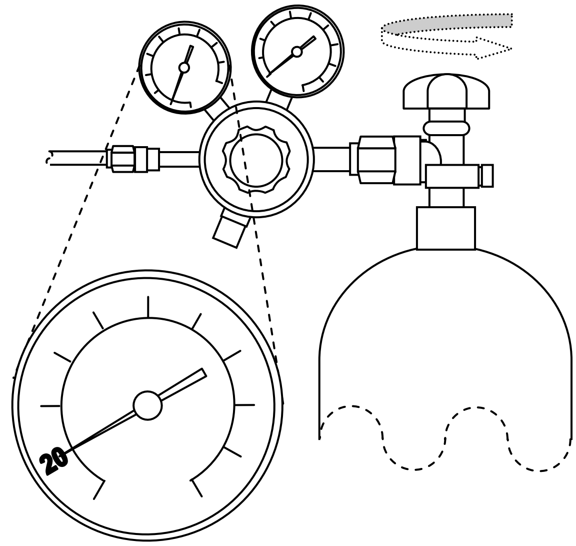
Step 2: Ensure that the main valve on the gas cylinder is closed at this time and that the appropriate 2-stage gas regulator is firmly attached to the tank. Connect tubing from the flow meter inlet to the regulator. Use gas-tight compression fittings (tubing and fittings for regulator connection are not included).



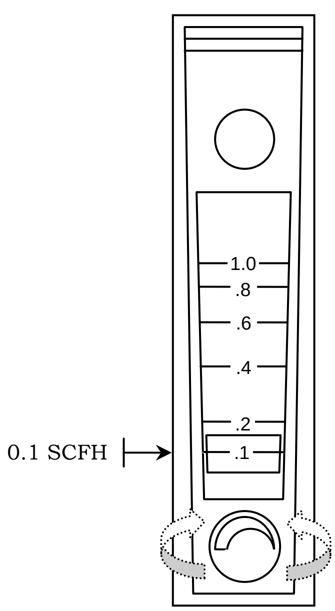
Step 3: Open the check valve on the flow meter by turning clockwise.



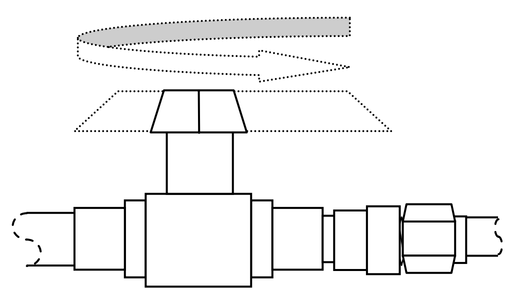
Step 4: Open the main valve on the gas cylinder to begin the flow of gas. Set the regulator pressure to 20 psig (140 kpag).



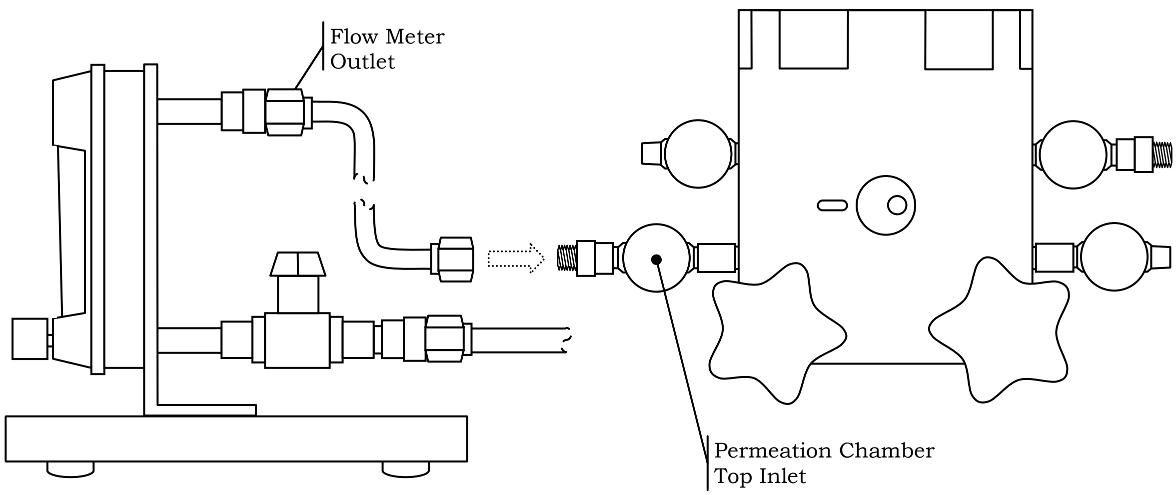
Step 5: Set the flow rate to 0.1 SCFH (0.05 LPM) by rotating the adjustment knob either clockwise or anti-clockwise.



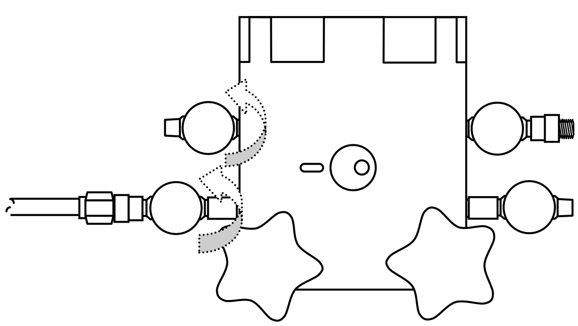
Step 6: Close the check valve on the flow meter by turning anti-clockwise.



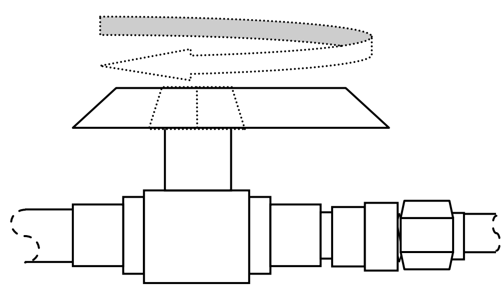
Step 7: Connect the flow meter outlet to the desired inlet on the permeation chamber. If purging the top of the chamber with pure nitrogen, connect to the top inlet. If purging the bottom of the chamber with pure oxygen, connect to the bottom inlet (See Section 4.2 Using Pure Oxygen).



Step 8: Fully open both the inlet and outlet valves on the permeation chamber by turning the valves anti-clockwise.



Step 9: To begin the flow of gas through the permeation chamber, open the check valve on the flow meter by turning clockwise.

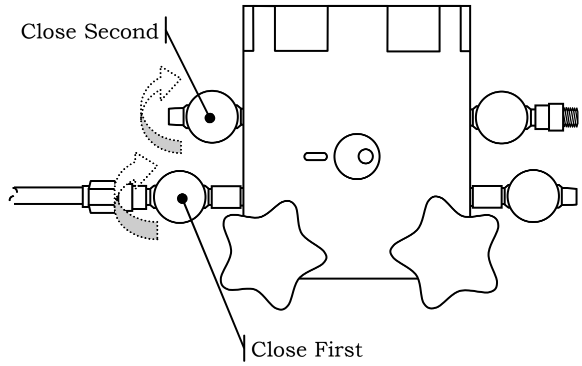


Step 10: If purging the top of the chamber, allow the gas to flow for at least 60 seconds. If purging the bottom of the chamber, allow the gas to flow for at least 4 minutes.

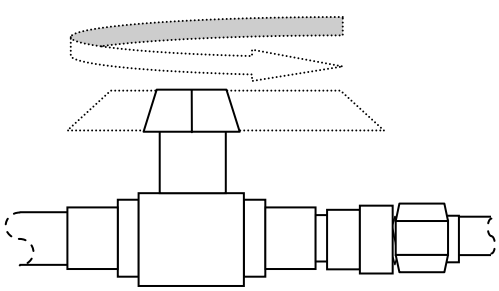
Top:
60 secs.

Bottom:
4 mins.

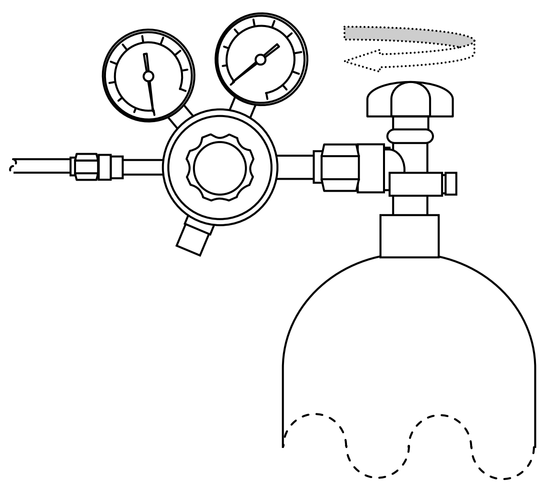
Step 11: After purging is complete, close the permeation chamber inlet and then the outlet valve by turning clockwise. You must close the inlet first, otherwise you will pressurize the chamber and cause damage to the film.



Step 12: Close the check valve on the flow meter by turning anti-clockwise.



Step 13: Close the main valve on the gas cylinder.



4.0 Considerations

4.1 Flow Rate

It is necessary to purge the permeation chamber at a low flow rate. Because the chamber has a relatively small internal volume, flow rates exceeding 0.2 SCFH (0.1 LPM) will pressurize the chamber causing the film to bulge, stretch, distort, and possibly rupture. It is recommended that the flow be set to 0.1 SCFH (0.05 LPM) to avoid accidental damage to the film. However, flow rates between 0.1 and 0.2 SCFH may be maintained without causing harm to the film or affecting the outcome of the test.

4.2 Using Pure Oxygen

When following the *dynamic accumulation* method for OTR determination, the limiting factor to obtaining a result is time. Low barrier films (50 cc/m^2/day or less) can take several days to several weeks to analyze when the concentration of oxygen in the bottom of the chamber is at atmospheric levels (≈20.8% v/v). In cases where time is a concern, the bottom half of the chamber may be purged with pure oxygen in order to accelerate the test. The same rules for purging the top part of the chamber apply when purging the bottom part of the chamber.

The final OTR result obtained from a test using either atmospheric oxygen (i.e. air) or pure oxygen will be identical. This is because the algorithm employed by OxySense to calculate OTR yields a result that is normalized to the oxygen concentration in the bottom of the chamber. In other words, the amount of oxygen that accumulates in the top of the chamber over a given length of time using pure oxygen will be greater than the amount of oxygen that accumulates using air over the same length of time, and the equation used to calculate OTR takes this in to account. The final calculated OTR value will always be the same regardless of the oxygen concentration in the bottom of the chamber.

WARNING: There is a safety hazard associated with pure oxygen gas. Always follow all local and national safety guidelines and any additional safety guidelines specific to your organization. Consult with your organization's safety officer prior to performing work.

5.0 Technical Support

For technical support, contact Industrial Physics Product Integrity

Email: PiSupport@IndustrialPhysics.com
Phone: +1 (978) 772.0970