

Integrity Testing LifeASSURE™ BA Series Filters

SAFETY INFORMATION

Read, understand, and follow all safety information contained in these instructions and the instructions provided with the original filtration system, prior to installation and use. Retain for future reference.

EXPLANATION OF SIGNAL WORD CONSEQUENCES	
WARNING:	Indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury and/or property damage.
CAUTION:	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury and/or property damage.

WARNING:	
To reduce the risk associated with system burst related injuries:	
<ul style="list-style-type: none"> • Do not use if fluid pressure exceeds rating described on the pressure vessel dataplate. • Do not use with fluids at temperatures exceeding the rating described on the pressure vessel dataplate. • Do not use for continuous service with compressed gases. 	

CAUTION:	
To reduce the risk associated with exposure to contaminants:	
<ul style="list-style-type: none"> • Always use appropriate personal protective equipment (PPE) when installing or servicing the filtration system. • Ensure that all system pressure has been relieved prior to opening the system to atmosphere. 	
To reduce the risk associated with eye, skin, and respiratory and digestive tract injuries from chemical cleaners/sanitizers during system maintenance:	
<ul style="list-style-type: none"> • Do not get chemical cleaners/sanitizers in eyes, on skin, or on clothing. Do not ingest or inhale. • Wear appropriate PPE including eye and face protection, protective gloves, and an appropriate NIOSH-approved filter mask. 	

Note: It is important to make an aseptic connection and to close the outlet port immediately after the system has been integrity tested to prevent contamination.

INTRODUCTION

The integrity test is the customer's method to validate the performance of a membrane filter at its retention rating. Three methods are commonly employed:

- a) Measuring the bubble point pressure.
- b) Measuring the diffusion flow.
- c) Pressure hold, an alternative to measuring diffusion flow.

BUBBLE POINT PRESSURE (Refer to Figure 1)

1. Definition

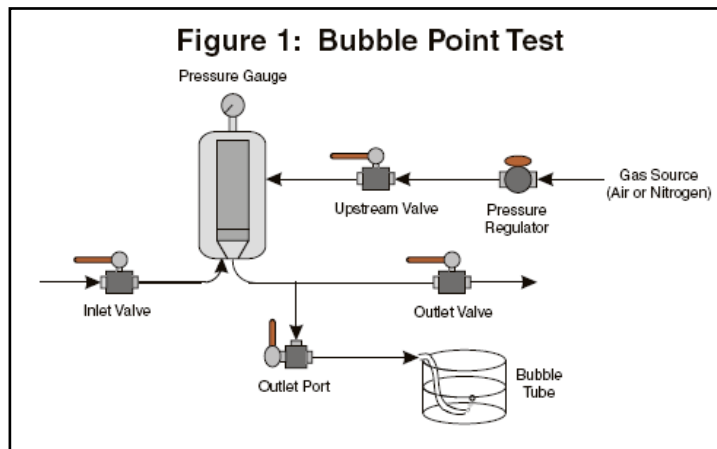
The bubble point is the minimum gas pressure required to overcome the surface tension holding water in a membrane filter's largest pore.



The bubble point pressure measurement is recommended for single 10" cartridge filters or smaller. When more filter area is on line, it becomes difficult to distinguish diffusional flow from the true bulk flow which occurs at the bubble point pressure. For setups with 2 or more 10" equivalent cartridges, please use the diffusion flow or pressure hold measurements.

2. Procedure

- a) Install the filter in the housing and wet with clean filtered water at ambient temperature and at a flow rate of about 3 gpm (11 liters/min) per 10" cartridge for 10 minutes or more.
- b) Close inlet and outlet valves to isolate the housing.
- c) Connect a tube from the outlet port to a container of water.*
- d) Using the upstream valve, slowly pressurize the system with a regulated supply of air or nitrogen (DO NOT USE CO₂), raising the pressure 5 psi (0.34 bar) per minute. When within 5 psi (0.34 bar) of the expected bubble point pressure, make only very gradual 1 psi (0.07 bar) increases.
- e) Observe any air flow from the tube connected to the downstream port. A modest flow of small bubbles is diffusional flow only. When flow of large bubbles appears, the filter's bubble point has been reached.
- f) If the bubble point is less than the recommended value, consider the following:
 - Was the filter completely wetted out?
 - Was the filter wet with water only?
 - Was the correct pore size filter installed?
 - Was the temperature of the water and filter ambient?
 - Was the filter seated correctly in the housing and were the o-rings undamaged?



LifeASSURE™ BA Series	Minimum Bubble Point Pressure - psi (bars)
BA045	24 (1.7)
BA065	16 (1.1)

DIFFUSION FLOW TEST (Refer to Figure 2)

1. Definition

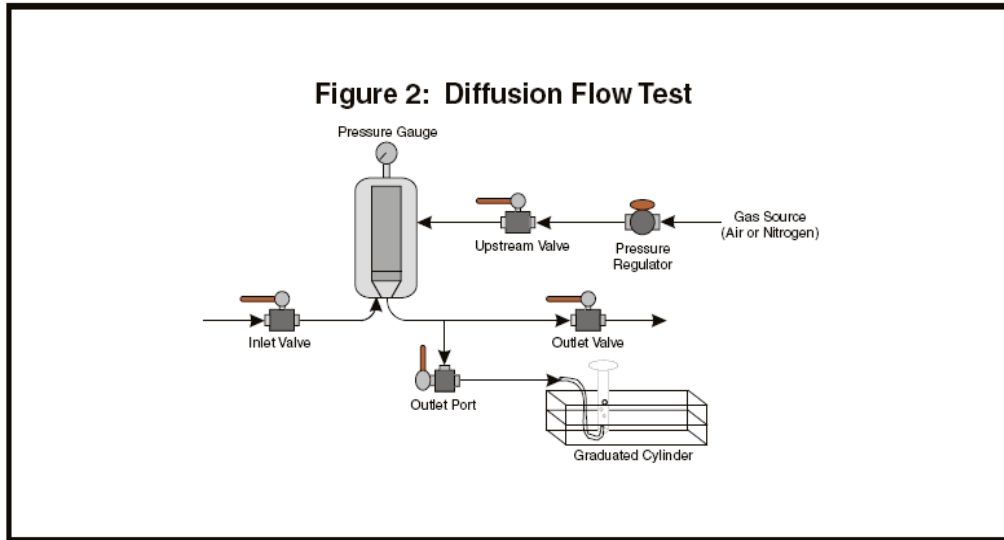
According to Fick's Law of Diffusion, when a differential gas pressure exists across a wetted membrane, the gas molecules will "diffuse" through the water filling the pores of the membrane. The rate of passage is proportional to the solubility of the gas in the wetting solution, the differential pressure, the thickness of the membrane, and the surface area of the membrane. The diffusion rate is measured at a pressure just below (typically 80% of) the bubble point pressure. If no bulk flow exists, there are no pores large enough to compromise the filter's integrity. The Diffusion Flow Test (DFT) may be employed with any number of installed cartridges.

2. Procedure

- a) Install the filter(s) in the housing and wet with clean filtered water at ambient temperature and at a flow rate of about 3 gpm (11 liters/min) per 10" equivalent for ten minutes or more.
- b) Close inlet and outlet valves to isolate the housing.

*It is important to make an aseptic connection and to close the outlet port immediately after the system has been integrity tested to prevent contamination.

- c) Connect a tube from the outlet port to a container of water (see precautionary note following the bubble point pressure method above) and a regulated supply of air or nitrogen (DO NOT USE CO₂).
- d) Using the upstream valve, slowly pressurize the system to the recommended DFT pressure value (which is typically 80% of the membrane's bubble point pressure), and allow the system to equilibrate for a minimum of one minute, or until a steady flow of gas exits the outlet port into the water-filled vessel.
- e) Place the opening of the tube under an inverted graduated cylinder filled with water.
- f) Measure the air flow for 5 minutes. Calculate the diffusion rate in cc/min.
- g) If the diffusion rate is higher than the specification, consider:
 - Was the filter completely wetted out with water only?
 - Was the correct pore size filter installed?
 - Was the temperature of the water and filter ambient?
 - Was the stabilization time adequate?
 - Was the filter seated correctly in the housing and were the o-rings undamaged?



LifeASSURE™ BA Series	DFT Pressure – psi (bars)	Minimum Bubble Point Pressure - psi (bars)
BA045	20 (1.4)	< 15
BA065	13 (0.9)	< 15

PRESSURE HOLD TEST (see Figure 3)

1. Definition

A variation of the DFT is the Pressure Hold Test (PHT). Instead of measuring the diffusion rate of gas across the membrane, the PHT uses a sensitive pressure gauge to measure the decay of pressure in a closed volume on the upstream side of the membrane as the gas diffuses.

Automatic integrity testers may be used to perform the PHT. When using an automatic integrity tester, follow the manufacturer's instructions for connecting the unit into the upstream valve as shown in Figure 3.

The PHT uses the following equation:

$$P = \frac{D(P_a)}{T V_{hsg}}$$

D = Manufacturer's maximum allowable diffusion rate for all the installed filters in cc/min (see DFT specifications)

T = Time (typically 5 minutes)

P_a = Atmospheric pressure

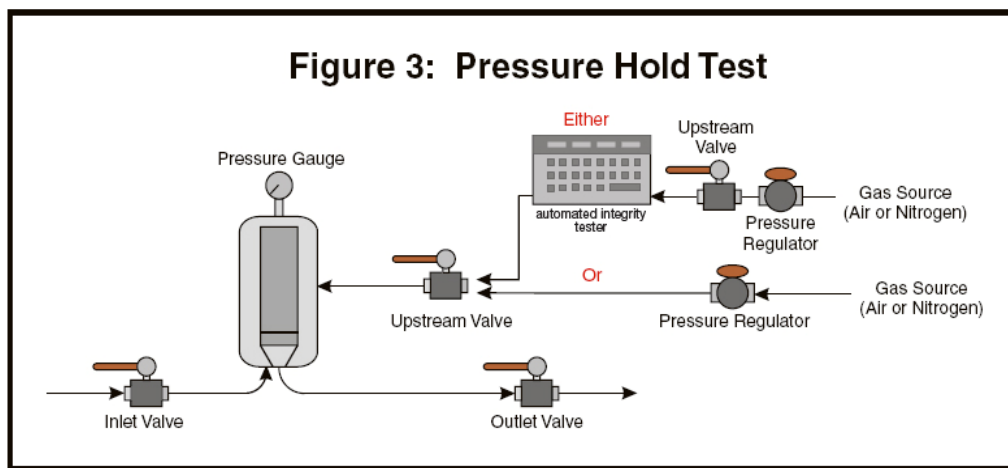
V_{hsg} = Upstream housing volume (cc) less the volume occupied by the cartridge(s)

P = Allowable pressure loss

2. Procedure (Not Using an Automatic Integrity Tester)

- a) Install the filter in the housing and wet with clean filtered water at ambient temperature and at a flow rate of about 3 gpm (11 liters/min) per 10" equivalent for 10 minutes or more.
- b) Close inlet valve and open the outlet valve to atmosphere.
- c) Using the upstream valve, slowly pressurize the system to the recommended DFT pressure value using a regulated supply of air or nitrogen (DO NOT USE CO₂) and allow the system to equilibrate for a minimum of one minute.
- d) When water flow from the outlet valve ceases, close off the upstream valve and measure the total pressure drop for 5 minutes. Compare versus the value recommended for the particular housing and filter in use.

Since PHT values are dependent on the volume of the housing less the volume of the installed cartridges, they must be determined on a case by case basis. Please contact 3M Purification Inc. Technical Service for assistance, if necessary.



Important Notice:

The test results described in this literature are accurate to the best of our knowledge. A variety of factors, however, can affect the performance of the product(s) in a particular application, some of which are uniquely within your knowledge and control. **INFORMATION IS SUPPLIED UPON THE CONDITION THAT THE PERSONS RECEIVING THE SAME WILL MAKE THEIR OWN DETERMINATION AS TO ITS SUITABILITY FOR THEIR USE. IN NO EVENT WILL 3M PURIFICATION INC. BE RESPONSIBLE FOR DAMAGES OF ANY NATURE WHATSOEVER RESULTING FROM THE USE OF OR RELIANCE UPON INFORMATION.**

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