

# TECHNICAL BRIEF

## BevASSURE™ II INTEGRITY TESTING

### 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:

1. Measuring the bubble point pressure.
2. Measuring the diffusion flow.
3. 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.

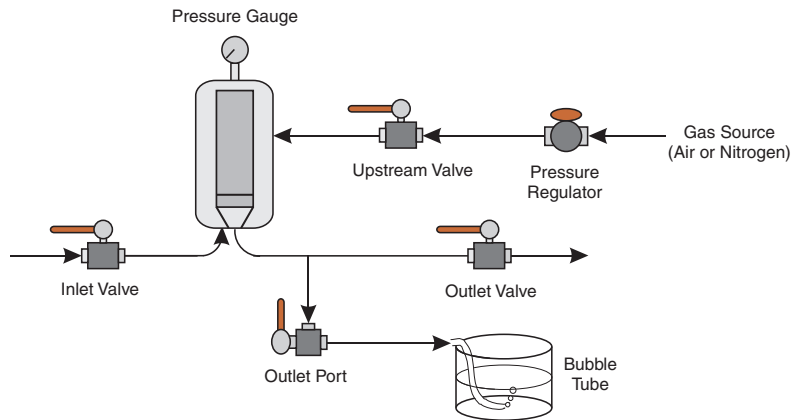
The bubble point pressure measurement is recommended for single 10-inch cartridge filters or smaller. When more filter area is on line, it becomes difficult to distinguish diffusional flow from the true bulk flow which occurs at the bubble point pressure. For setups with 2 or more 10-inch equivalent 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 CO<sub>2</sub>), raising the pressure 5 psi (.34 bar) per minute. When within 5 psi (.34 bar) of the expected bubble point pressure, make only very gradual 1 psi (.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 wet 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?

\* 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.

**Figure 1: Bubble Point Test**



| BevASSURE™ II Grade | Minimum Bubble Point Pressure - psi (bars) |
|---------------------|--|
| BA045               | 24 (1.7)                                   |
| BA065               | 16 (1.1)                                   |

**DIFFUSION FLOW TEST (Refer to Figure 2)**

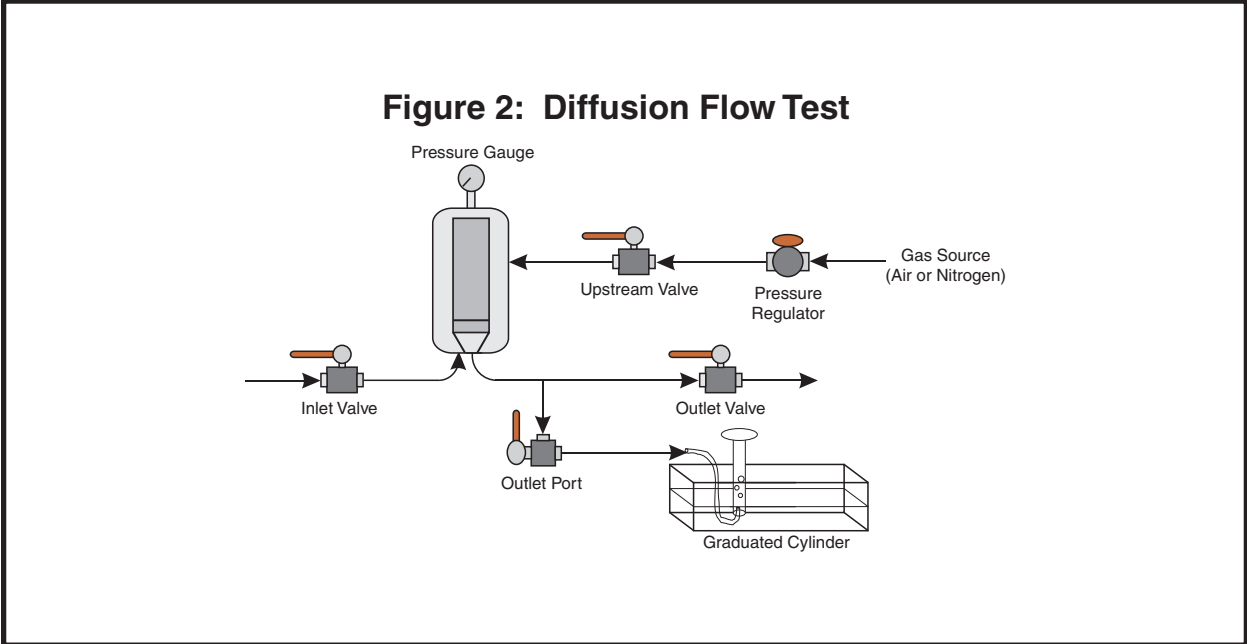
**1. Definition**

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.
- 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 CO<sub>2</sub>).
- 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 wet 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?



| BevASSURE™ II Grade | DFT Pressure - psi (bars) | DFT Specification (cc/min) per 10" equivalent |
|---------------------|---------------------------|---|
| 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 such as Cuno's Microcheck™ 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:

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

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

T=Time (typically 5 minutes)

P<sub>a</sub>=Atmospheric pressure

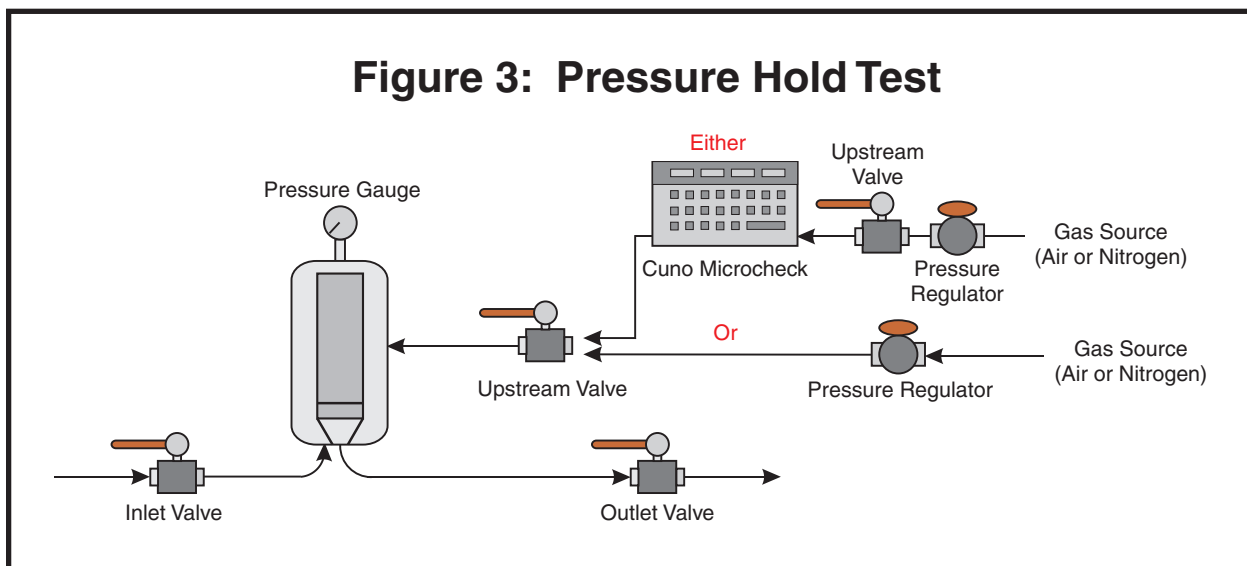
V<sub>hsg</sub>=Upstream housing volume (cc) less the volume occupied by the cartridge(s)

ΔP=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 CO<sub>2</sub>) 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 Cuno Technical Service for assistance, if necessary.



CUNO Filtration Asia Pte Ltd  
18 Tuas Link 1 (3<sup>rd</sup> Floor)  
Singapore 638599

CUNO Pacific Pty Ltd  
140 Sunnyholt Road  
Blacktown, NSW 2148  
Australia

CUNO Latina Ltda  
Rua Amf Do Brasil 251  
18120 Mairinque-Sp  
Brazil

## Cuno Incorporated

400 Research Parkway  
Meriden, CT 06450, U.S.A.  
Tel: (800) 243-6894  
(203) 237-5541  
Fax: (203) 630-4530  
www.cuno.com

Cuno Filtration Shanghai Co, Ltd  
No. 2 Xin Miao San Rd,  
Xin Miao Town,  
Song Jiang District,  
Shanghai, China. 201612

CUNO K.K.  
Hodogaya Station  
Building 6F  
1-7 Iwai-cho, Hodogaya-ku  
Yokohama 240 Japan

CUNO Ltd  
21 Woking Business Park  
Albert Drive  
Woking, Surrey GU215JY  
United Kingdom