

# LifeASSURE™ PFS Series Filter Cartridge Integrity Testing

## Introduction

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Integrity testing is the end user's method of confirming the structural integrity of a membrane filter before and after use. It is a non-destructive testing that has been correlated to bacteria retention and validates the performance of the filter cartridge. An "in specification" result confirms the porosity of filter membrane and that the cartridge is structurally integral.

Compressed gas and tank vent filters are typically sterilized in-place as part of the production process system to ensure the equipment has maintained sterility after *in situ* sterilization and that the equipment is ready to receive sterile product. Compressed gas and tank vent filters are non-product contact filters and are usually used over an extended period of time as compared to liquid filters that are typically discarded after a single product batch has been filtered. Hydrophobic compressed gas and tank vent filters are typically subjected to multiple sterilizations and; therefore, integrity tested multiple times as compared to filters used in liquid filtration applications.

Filter integrity can be determined by any of the following four test methods.

1. Forward Flow Integrity Test (FFIT)
2. Bubble Point Test (BPT)
3. Pressure Hold Test (PHT)
4. Water Intrusion Test (WIT)

Unlike the typical hydrophilic filter medium filters used for liquid filtration applications, compressed gas and tank vent filters are fabricated with hydrophobic filter medium. Hydrophobic filter medium prevents the bulk flow of aqueous based product through the filter at differential pressures below the intrusion pressure of the medium, while permitting the free passage of gas through the filter. Integrity testing of hydrophobic filters by three of the four conventional integrity test methods listed previously (FFIT, BPT and PHT) require the use of wetting agents, such as alcohol or an alcohol and water mixture, to thoroughly wet the filter membrane prior to integrity testing. All three of these tests must be performed off-line to prevent the wetting fluid from contaminating the sterile downstream side of the filter membrane.

The fourth integrity test (WIT) can be performed *in situ* using sterile water. This eliminates the use of wetting agents and does not require the penetration of the filter membrane by the wetting fluid.

All four tests can be conducted either manually or with an automated integrity test device, such as the CUNOCheck™ 2 Automatic Integrity Tester.

The following procedures provide the instructions for integrity testing 10" cartridges. Contact 3M Purification Inc. Technical Service for details on how to integrity test other cartridge and capsule configurations.

## Forward Flow Integrity Test

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### 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 wetting fluid filling the pores of the membrane. The rate of passage is proportional to the solubility of the gas in the wetting fluid, the surface tension of the wetting fluid, the differential pressure, the thickness of the membrane, and the surface area of the membrane. The diffusion rate is measured at the minimum completely retentive membrane bubble point pressure. The Forward Flow Integrity Test (FFIT) may be employed with multi-cartridge housings.

The FFIT is the preferred test method to determine if the membrane and cartridge are structurally integral. The diffusion rate is typically measured at a test pressure at or near the minimum completely retentive bubble point pressure. The FFIT has been shown to be both a quantitative measurement and to correlate to bacteria retention. The bubble point of the membrane can be a subjective determination and does not always correlate to bacteria retention.

The bubble point of a membrane containing small defects will not correlate to bacteria retention due to the limited sensitivity of the Bubble Point Test (BPT) method to detect these small defects. Only the bubble point of a completely membrane will correlate to bacteria retention.

Selecting a test pressure for the FFIT at the industry standard practice of 80% of the initial membrane bubble point does not ensure the integrity or the retention capability of the filter. This leaves a region between the test pressure and the membrane bubble point that

is not tested and; therefore, the integrity of the membrane can not be ensured in this region. This is analogous to testing at 80% of the expected membrane bubble point.

Therefore, membrane filters should be tested at a more aggressive test pressure to ensure both the integrity and the correct pore size of the membrane. It is, therefore, recommended that the FFIT be conducted at a test pressure at or near the minimum completely retentive membrane bubble point.

Integrity testing can be performed manually or using the CUNOCheck™ 2 Automated Integrity Tester. For more information about using the CUNOCheck 2 Automated Integrity Tester to perform an integrity test, refer to CUNOCheck 2 Operator Manual (70-0201-8694-9).

## 2. Procedure (Manual Testing — Figure 1)

### ⚠ WARNING

To reduce the risk associated with burn or system burst related injuries:

- Do not exceed maximum operating pressure or temperature limits described on the vessel dataplate.
- Do not use product for continuous service with compressed gases.
- Do not use with or expose capsule products to hot liquids (104 °F) or pressurized steam.

### ⚠ CAUTION

To reduce the risk associated with exposure to contaminants:

- Always use appropriate personal protective equipment (PPE) when installing, operating or changing the product as per your standard operating procedure.
- Ensure that inlet/outlet valves are closed and all system pressure has been relieved prior to opening the system to atmosphere.

A. Configure the system as shown in Figure 1.

B. Install the filter in the housing and flow wetting fluid (25% / 75% TBA — Tertiary butyl alcohol / water (v/v) @ 20 °C, 60% / 40% IPA — Isopropyl alcohol / water (v/v) @ 25 °C, or 70% / 30% IPA — Isopropyl alcohol / water (v/v) @ 25 °C) through the filter at a rate of approximately 1 gpm/10" cartridge for a minimum of 2 minutes. Valid integrity limits will be obtained when the wetting fluid temperature is maintained within  $\pm 2$  °C and concentration within  $\pm 2\%$  v/v.

C. Close inlet V1 and outlet valve V6 to isolate the housing. Drain all the wetting fluid from the upstream side of the filter by positioning V5 to direct flow to drain. Adjust the pressure regulator to deliver 3–5 psig of air or nitrogen (DO NOT USE CO<sub>2</sub>). Slowly open V3. Close V3 when wetting fluid discharge is no longer evident.

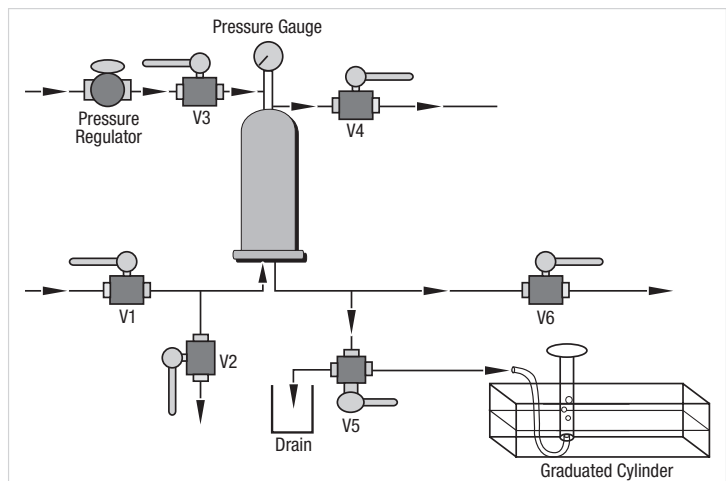


Figure 1. FFIT (manual method).

D. Connect one end of a flexible tube to the outlet port V5 and submerge the other end in a container of water\*. Position V5 to direct flow to the container of water.

\* **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.

E. Open V3 and slowly adjust the pressure regulator to pressurize the system to the specified FFIT pressure value and allow the system to equilibrate for a maximum of 2 minutes, or until steady bubbling is seen from the submersed end of the tube.

F. Place the opening of the tube under an inverted graduated cylinder or burette (calibrated in milliliters or cubic centimeters) of an appropriate size filled with and submersed under sterile water.

G. Measure the air flow for 3 minutes. Calculate the diffusion rate in cc/min.

H. When the test is complete, compare the result to the cartridge FFIT specification.

I. After the test is complete, flush the wetting fluid from the assembly with clean, filtered water and drain the water from the housing or adjust the pressure regulator to deliver 3–5 psig of air or nitrogen. Slowly open V3. Close V3 when wetting fluid discharge is no longer evident. Dry the cartridge before placing the cartridge in service.

J. If the diffusion rate is higher than the specification, consider the following questions and re-test if necessary:

- Was the filter completely wetted?
- Was the correct pore size filter installed?
- Was the temperature of the wetting and filter ambient?
- Was the stabilization time adequate?
- Was the test time adequate?
- Was the filter seated correctly in the housing and were the O-rings undamaged?

### 3. Procedure (Automated Testing — Figure 2)

#### ⚠ WARNING

To reduce the risk associated with burn or system burst related injuries:

- Do not exceed maximum operating pressure or temperature limits described on the vessel dataplate.
- Do not use product for continuous service with compressed gases.
- Do not use with or expose capsule products to hot liquids (104 °F) or pressurized steam.

#### ⚠ CAUTION

To reduce the risk associated with exposure to contaminants:

- Always use appropriate personal protective equipment (PPE) when installing, operating or changing the product as per your standard operating procedure.
- Ensure that inlet/outlet valves are closed and all system pressure has been relieved prior to opening the system to atmosphere.

A. Configure the system as shown in Figure 2.

B. Install the filter in the housing and flow wetting fluid (25% / 75% TBA — Tertiary butyl alcohol / water (v/v) @ 20 °C, 60% / 40% IPA — Isopropyl alcohol / water (v/v) @ 25 °C, or 70% / 30% IPA — Isopropyl alcohol / water (v/v) @ 25 °C) through the filter at a rate of approximately 1 gpm/10" cartridge for a minimum of 2 minutes.

C. Close inlet V1 and outlet valve V6 to isolate the housing. Drain all the wetting fluid from the upstream side of the filter by positioning V5 to direct flow to drain. Adjust the pressure regulator to deliver 3–5 psig of air or nitrogen (DO NOT USE CO<sub>2</sub>). Slowly open V3. Close V3 when wetting fluid discharge is no longer evident.

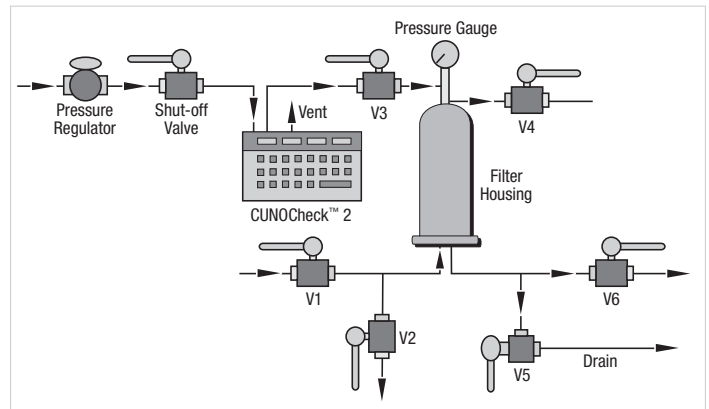


Figure 2. FFIT (automated method).

D. Close the housing inlet valve V1 and connect the CUNOCheck™ 2 Automated Integrity Tester at V3 and initiate the automated FFIT protocol. When prompted, program a stabilization time of 2 minutes and a test time of 3 minutes.

E. When the test is complete, compare the measured Forward Flow Integrity value against the acceptable limit for the filter cartridge under test.

F. After the test is complete, flush the wetting fluid from the assembly with clean, filtered water and drain the wetting fluid from the housing or adjust the pressure regulator to deliver 3–5 psig of air or nitrogen. Slowly open V3. Close V3 when wetting fluid discharge is no longer evident. Dry the cartridge before placing the cartridge in service.

G. Disconnect the CUNOCheck 2 Automated Integrity Tester from the housing.

LifeASSURE™ PFS Series Grade	FFIT Pressure — psi (bars)	FFIT Specification (cc/min) per 10" equivalent
PFS020	16 (1.1)	≤ 8.7 (25%/75% TBA/Water) @ 20 °C
		≤ 35.5 (60%/40% IPA/Water) @ 25 °C
		≤ 54.0 (70%/30% IPA/Water) @ 25 °C

**NOTE:** Valid integrity limits will be obtained when the wetting fluid temperature is maintained within ± 2 °C and concentration is maintained within ± 2% v/v.

# Bubble Point Test

## 1. Definition

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

The bubble point pressure measurement is **only 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 assemblies with 2 or more 10" equivalent cartridges, diffusion flow or pressure hold measurements are recommended.

The CUNOCheck™ 2 Automated Integrity Tester can be used to perform a BPT. When using the CUNOCheck 2 Automated Integrity Tester, follow the installation instructions for connecting the unit to the upstream valve as shown in Figure 4. Consult the appropriate 3M Purification Inc. literature for the filter cartridge bubble point value for the filter to be used and program this value into the CUNOCheck 2 Automated Integrity Tester when requested during the test set-up.

## 2. Procedure (Manual Testing — Figure 3)

### ⚠ WARNING

To reduce the risk associated with burn or system burst related injuries:

- Do not exceed maximum operating pressure or temperature limits described on the vessel dataplate.
- Do not use product for continuous service with compressed gases.
- Do not use with or expose capsule products to hot liquids (104 °F) or pressurized steam.

### ⚠ CAUTION

To reduce the risk associated with exposure to contaminants:

- Always use appropriate personal protective equipment (PPE) when installing, operating or changing the product as per your standard operating procedure.
- Ensure that inlet/outlet valves are closed and all system pressure has been relieved prior to opening the system to atmosphere.

A. Configure the system as shown in Figure 3.

B. Install the filter in the housing and flow wetting fluid (25% / 75% TBA — Tertiary butyl alcohol / water (v/v) @ 20 °C, 60% / 40% IPA — Isopropyl alcohol / water (v/v) @ 25 °C, or 70% / 30% IPA — Isopropyl alcohol / water (v/v) @ 25 °C) through the filter at a rate of approximately 1 gpm/10" cartridge for a minimum of 2 minutes.

C. Close inlet V1 and outlet valve V6 to isolate the housing. Drain all the wetting fluid from the upstream side of the filter by positioning V5 to direct flow to drain. Adjust the pressure regulator to deliver 3–5 psig of air or nitrogen (DO NOT USE CO<sub>2</sub>). Slowly open V3. Close V3 when wetting fluid discharge is no longer evident.

D. Connect a tube from the outlet port V5 to a container of sterile water\*.

\* **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.

E. Open V3. Using the pressure regulator, slowly pressurize the system with air or nitrogen (DO NOT USE CO<sub>2</sub>), 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 allowing 5–10 seconds between pressure increases to observe evidence of bubbling.

F. Observe any air flow from the tube connected to the downstream port. A modest flow of small bubbles is diffusion flow only. When a continuous flow of large bubbles appears, the filter's bubble point has been reached.

G. When the test is complete, compare the measured Bubble Point value against the acceptable Bubble Point value for the filter cartridge under test.

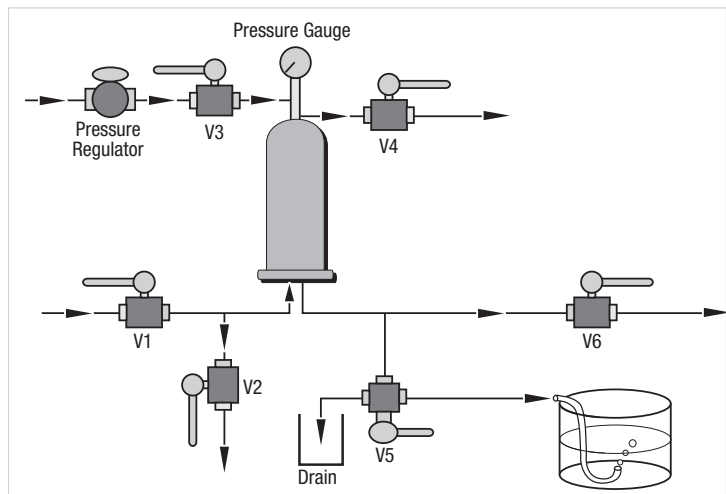


Figure 3. BPT (manual method).

- H. After the test is complete, flush the wetting fluid from the assembly with clean, filtered water and drain the water from the housing or adjust the pressure regulator to deliver 3–5 psig of air or nitrogen. Slowly open V3. Close V3 when wetting fluid discharge is no longer evident. Dry the cartridge before placing the cartridge in service.
- I. If the bubble point is less than the recommended value, consider the following questions and re-test if necessary:
- Was the filter completely wetted?
  - Was the correct pore size filter installed?
  - Was the temperature of the wetting fluid and filter ambient?
  - Was the filter seated correctly in the housing and were the O-rings undamaged?

### 3. Procedure (Automated Testing — Figure 4)

#### ⚠ WARNING

To reduce the risk associated with burn or system burst related injuries:

- Do not exceed maximum operating pressure or temperature limits described on the vessel dataplate.
- Do not use product for continuous service with compressed gases.
- Do not use with or expose capsule products to hot liquids (104 °F) or pressurized steam.

#### ⚠ CAUTION

To reduce the risk associated with exposure to contaminants:

- Always use appropriate personal protective equipment (PPE) when installing, operating or changing the product as per your standard operating procedure.
- Ensure that inlet/outlet valves are closed and all system pressure has been relieved prior to opening the system to atmosphere.

- A. Configure the system as shown in Figure 4.
- B. Install the filter in the housing and flow wetting fluid (25% / 75% TBA — Tertiary butyl alcohol / water (v/v) @ 20 °C, 60% / 40% IPA — Isopropyl alcohol / water (v/v) @ 25 °C, or 70% / 30% IPA — Isopropyl alcohol / water (v/v) @ 25 °C) through the filter at a rate of approximately 1 gpm/10" cartridge for a minimum of 2 minutes.
- C. Close inlet V1 and outlet valve V6 to isolate the housing. Drain all the wetting fluid from the upstream side of the filter by positioning V5 to direct flow to drain. Adjust the pressure regulator to deliver 3–5 psig of air or nitrogen (DO NOT USE CO<sub>2</sub>). Slowly open V3. Close V3 when wetting fluid discharge is no longer evident.

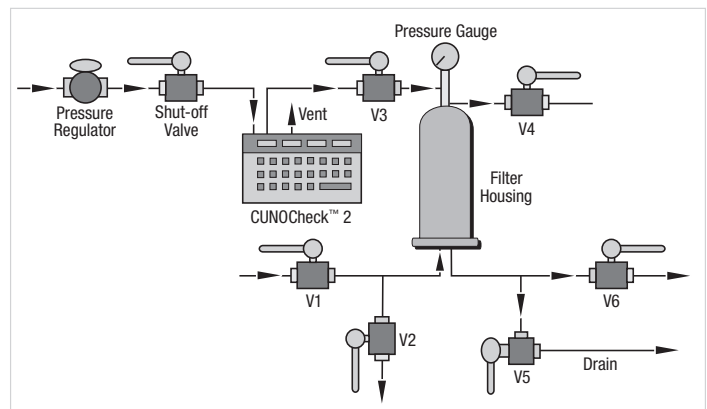


Figure 4. BPT (automated method).

- D. Disconnect the wetting fluid supply line and allow the wetting fluid to drain from the housing. Leave V5 or V6 open to atmosphere.
- E. Close V1 and connect the CUNOCheck™ 2 Automated Integrity Tester at V3 and initiate the automated BPT protocol.
- F. When the test is complete, compare the measured Bubble Point value against the acceptable limit for the filter cartridge under test.
- G. After the test is complete, flush the wetting fluid from the assembly with clean, filtered water and drain the water from the housing or adjust the pressure regulator to deliver 3–5 psig of air or nitrogen. Slowly open V3. Close V3 when wetting fluid discharge is no longer evident. Dry the cartridge before placing the cartridge in service.
- H. Disconnect the CUNOCheck 2 Automated Integrity Tester from the housing.

LifeASSURE™ PFS Series Grade	Minimum Bubble Point Pressure — psi (bars)
PFS020	16 (1.1)

# Pressure Hold Test

## 1. Definition

A variation of the FFIT 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 through the membrane. PHT values are dependent on the volume of the specific filter housing employed, less the volume of the installed cartridges. Therefore, they must be determined on a case by case basis. Please contact 3M Purification Inc. Technical Service for assistance, if necessary.

The CUNOCheck™ 2 Automated Integrity Tester can be used to perform a PHT. When using the CUNOCheck 2, follow the installation instructions for connecting the unit to the upstream valve as shown in Figure 6. Consult the appropriate 3M Purification Inc. literature for the test pressure and PHT value for the filter cartridge to be used or calculate the maximum allowable value using the following equation. Program these values into the CUNOCheck 2 Automated Integrity Tester when requested during the test set-up.

The following equation can be used to calculate the PHT value:

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

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

T = Time (typically 3 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 (Manual Testing — Figure 5)

### ⚠ WARNING

To reduce the risk associated with burn or system burst related injuries:

- Do not exceed maximum operating pressure or temperature limits described on the vessel dataplate.
- Do not use product for continuous service with compressed gases.
- Do not use with or expose capsule products to hot liquids (104 °F) or pressurized steam.

### ⚠ CAUTION

To reduce the risk associated with exposure to contaminants:

- Always use appropriate personal protective equipment (PPE) when installing, operating or changing the product as per your standard operating procedure.
- Ensure that inlet/outlet valves are closed and all system pressure has been relieved prior to opening the system to atmosphere.

- Configure the system as shown in Figure 5.
- Install the filter in the housing and flow wetting fluid (25% / 75% TBA — Tertiary butyl alcohol / water (v/v) @ 20 °C, 60% / 40% IPA — Isopropyl alcohol / water (v/v) @ 25 °C, or 70% / 30% IPA — Isopropyl alcohol / water (v/v) @ 25 °C) through the filter at a rate of approximately 1 gpm/10" cartridge for a minimum of 2 minutes.
- Close inlet V1 and outlet valve V6 to isolate the housing. Drain all the wetting fluid from the upstream side of the filter by positioning V5 to direct flow to drain. Adjust the pressure regulator to deliver 3–5 psig of air or nitrogen (DO NOT USE CO<sub>2</sub>). Slowly open V3. Close V3 when wetting fluid discharge is no longer evident.
- Disconnect the wetting fluid supply line and allow the wetting fluid to drain from the housing. Leave V5 or V6 open to atmosphere.

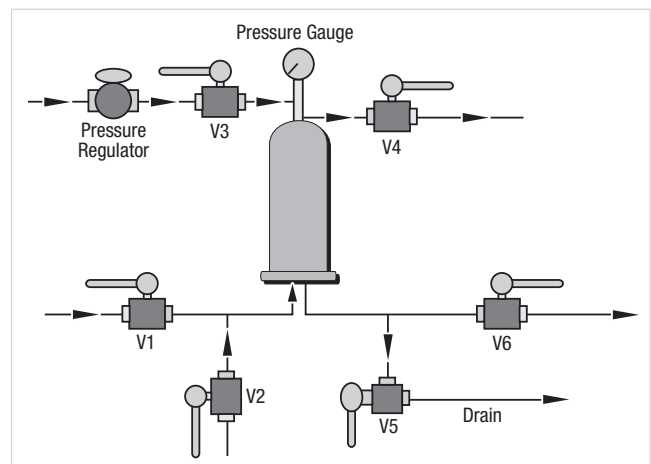


Figure 5. PHT (manual method).



- E. Open V3 and slowly adjust the pressure regulator to pressurize the system to the specified PHT pressure value and allow the system to equilibrate for a maximum of two minutes.
- F. Using a stopwatch, measure the pressure decay for 3 minutes. Calculate the pressure decay over the 3 minute period in psi/min.
- G. When the test is complete, compare the measured Pressure Hold value against the acceptable pressure hold value for the filter cartridge under test
- H. After the test is complete, flush the wetting fluid from the assembly with clean, filtered water and drain the wetting fluid from the housing or adjust the pressure regulator to deliver 3–5 psig of air or nitrogen. Slowly open V3. Close V3 when wetting fluid discharge is no longer evident. Dry the cartridge before placing the cartridge in service.
- I. If the pressure decay is higher than the specification, consider the following questions and re-test if necessary:
  - Was the filter completely wetted?
  - Was the correct pore size filter installed?
  - Was the temperature of the wetting fluid and filter ambient?
  - Was the stabilization time adequate?
  - Was the test time adequate?
  - Was the filter seated correctly in the housing and were the O-rings undamaged?
  - Are there any leaks on the upstream side of the filter?

### 3. Procedure (Automated Test — Figure 6)

#### ⚠ WARNING

**To reduce the risk associated with burn or system burst related injuries:**

- Do not exceed maximum operating pressure or temperature limits described on the vessel dataplate.
- Do not use product for continuous service with compressed gases.
- Do not use with or expose capsule products to hot liquids (104 °F) or pressurized steam.

#### ⚠ CAUTION

**To reduce the risk associated with exposure to contaminants:**

- Always use appropriate personal protective equipment (PPE) when installing, operating or changing the product as per your standard operating procedure.
- Ensure that inlet/outlet valves are closed and all system pressure has been relieved prior to opening the system to atmosphere.

- A. Configure the system as shown in Figure 6.
- B. Install the filter in the housing and flow wetting fluid (25% / 75% TBA — Tertiary butyl alcohol / water (v/v) @ 20 °C, 60% / 40% IPA — Isopropyl alcohol / water (v/v) @ 25 °C, or 70% / 30% IPA — Isopropyl alcohol / water (v/v) @ 25 °C) through the filter at a rate of approximately 1 gpm/10" cartridge for a minimum of 2 minutes.
- C. Close inlet V1 and outlet valve V6 to isolate the housing. Drain all the wetting fluid from the upstream side of the filter by positioning V5 to direct flow to drain. Adjust the pressure regulator to deliver 3–5 psig of air or nitrogen (DO NOT USE CO<sub>2</sub>). Slowly open V3. Close V3 when wetting fluid discharge is no longer evident.

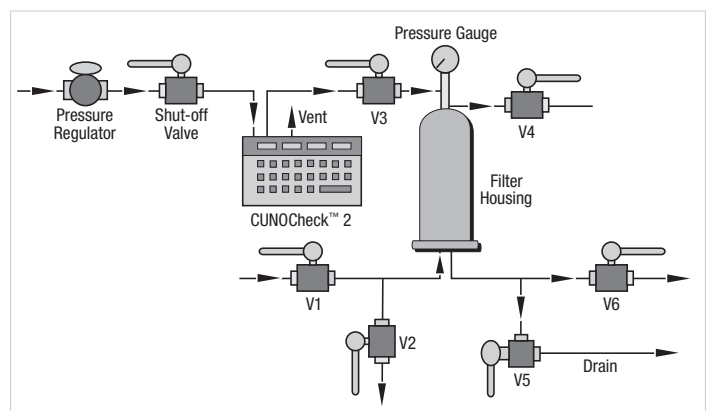


Figure 6. PHT (automated method).

- D. Disconnect the wetting fluid supply line and allow the wetting fluid to drain from the housing. Leave V5 or V6 open to atmosphere.
- E. Close V1 and connect the CUNOCheck™ 2 Automated Integrity Tester at V3 and initiate the PHT protocol. Close the housing inlet valve V1 and connect the CUNOCheck 2 Automated Integrity Tester at V3 and initiate the automated FFIT protocol. When prompted, program a stabilization time of 2 minutes and a test time of 3 minutes.
- F. When the test is complete, compare the measured Pressure Hold value against the acceptable limit for the filter cartridge under test.

- G. After the test is complete, flush the wetting fluid from the assembly with clean, filtered water and drain the water from the housing or adjust the pressure regulator to deliver 3–5 psig of air or nitrogen. Slowly open V3. Close V3 when wetting fluid discharge is no longer evident. Dry the cartridge before placing the cartridge in service.
- H. Disconnect the CUNOCheck™ 2 Automated Integrity Tester from the housing.

## Water Intrusion Test

### 1. Definition

The WIT is only used with hydrophobic filters. The pores of a hydrophobic filter will resist the passage of water up to a certain pressure. The pressure at which water will pass through the pores of a hydrophobic filter is inversely proportional to the size of the pore.

The WIT offers several advantages over the previously described conventional integrity tests that are usually conducted with an alcohol or alcohol water mixture.

- Safety — no flammability issues
- Contamination — no wetting fluid or alcohol contamination of product
- Time — no drying of the filter required before placing back into service

The CUNOCheck 2 Automated Integrity Tester can be used to perform a WIT. When using the CUNOCheck 2 Automated Integrity Tester, follow the installation instructions for connecting the unit to the upstream valve as shown in Figure 7. Consult the appropriate 3M Purification Inc. literature for the test pressure and WIT value for the filter cartridge to be used and program these values into the CUNOCheck 2 Automated Integrity Tester when requested during the test set-up.

### 2. Procedure (Automated Testing — Figure 7)

#### ⚠ WARNING

To reduce the risk associated with burn or system burst related injuries:

- Do not exceed maximum operating pressure or temperature limits described on the vessel dataplate.
- Do not use product for continuous service with compressed gases.
- Do not use with or expose capsule products to hot liquids (104 °F) or pressurized steam.

#### ⚠ CAUTION

To reduce the risk associated with exposure to contaminants:

- Always use appropriate personal protective equipment (PPE) when installing, operating or changing the product as per your standard operating procedure.
- Ensure that inlet/outlet valves are closed and all system pressure has been relieved prior to opening the system to atmosphere.

- A. Configure the system as shown in Figure 7.
- B. Install the filter(s) in the housing and close all valves.
- C. Open V4. Fill the upstream side of the system with water through either V1 or V2. When water emerges from V4, stop the water flow and close whichever valve was used to introduce the water to the system.
- D. When water stops flowing from V4 close V4.
- E. Connect the CUNOCheck 2 Automated Integrity Tester to the pressurized gas source, open the shut-off valve, and, using the regulator, adjust the pressure to the CUNOCheck 2 Automated Integrity Tester to the necessary level for the test being conducted.

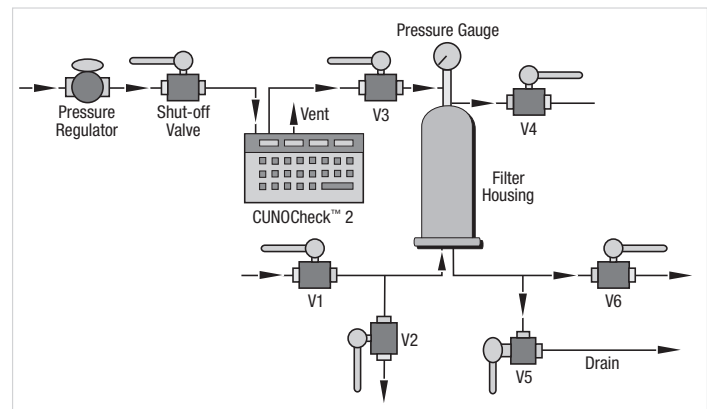


Figure 7. WIT (automated method).

- F. Close the housing inlet valve V1 and connect the CUNOCheck 2 Automated Integrity Tester at V3 and initiate the automated WIT protocol. When prompted, program a stabilization time of 5 minutes, a test time of 5 minutes and set the volume calculation to type “3”.
- G. When the test is complete, compare the test result to the WIT specification for the filter being tested.
- H. After the test is complete, drain the water from the housing and place the cartridge in service.



- I. Disconnect the CUNOCheck 2 Automated Integrity Tester from the housing.
- J. If the WIT value is higher than the specification, consider the following questions and re-test if necessary:
  - Was the filter dry and free of solvents or surfactants prior to starting the test?
  - Was the correct pore size filter installed?
  - Was the temperature of the water and filter ambient?
  - Was the temperature stable during the test period?
  - Was the water free of solvents and/or surfactants?
  - Was the stabilization time adequate?
  - Was the test time adequate?
  - Was the filter seated correctly in the housing and were the O-rings undamaged?
  - Are there any leaks on the upstream side of the filter?

LifeASSURE™ PFS Series Grade	WIT Pressure — psig (barg)	WIT Specification (cc/min) per 10" equivalent
PFS020	40 (2.76)	0.59

### Important Notice

The information described in this literature is 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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