

LifeASSURE™ PLA Series Filter Cartridge Installation Integrity Testing

The installation integrity test was developed to allow customers to provide proper installation and operation of LifeASSURE™ PLA series filter cartridges and capsules. The method, called a Pressure Hold Test, is based on gas flow through the water-wetted membrane and can be conducted with any number of LifeASSURE PLA series filters. The method can be conducted either manually, or with 3M Purification's CUNOCheck™ 2 automated integrity test instrument. The installation integrity test is intended to verify proper installation of filters and is not correlated to bacteria reduction.

1. Definition

The Pressure Hold Test (PHT) uses a sensitive pressure gauge to measure the decay of pressure across the filter membrane. This pressure decay occurs on a closed volume of gas on the upstream side of the membrane as the gas flows from an area of higher pressure (the upstream side of the membrane) to one of lower pressure (the downstream side).

The Pressure Hold Test uses the following equation:

$$DP = \frac{Q}{V_{hsg}} \times K$$

Equation 1.

Where:

- Q = Total maximum allowable gas flow rate for all cartridges installed (in cc/min)
- K = 14.7 psi (1013 mbar)
- V_{hsg} = Upstream filter housing volume (cc) less the volume occupied by the cartridge(s)
- DP = Allowable pressure loss (psi/min)

The allowable pressure loss for a given filter housing and LifeASSURE PLA series filter arrangement is calculated by determining:

1. V_{hsg}, the upstream filter housing volume (cc) less the volume occupied by the cartridge(s)
2. Q, the total maximum allowable diffusion rate for all cartridges installed (in cc/min).

Table 1 provides the diffusion rates for LifeASSURE PLA series filter grades. To determine the cumulative maximum allowable diffusion rate, multiply the rate in the table below by the number of 10" equivalent cartridge lengths in the filter housing. For example, a housing employing four (4) 30" long LifeASSURE PLA series grade PLA020 filters, would have a cumulative maximum allowable diffusion rate of 720 cc/min (60 cc/min/10" length x three 10" lengths per cartridge x 4 cartridges = 720 cc/min).

Table 1. Diffusion rates for LifeASSURE™ PLA series filters.

LifeASSURE™ PLA Series Grade	Test Pressure (psi)	Maximum Gas Flow Rate (cc/min/10" eq.)
PLA020	12	60
PLA045	6	30
PLA065	3	15
PLA080	1.5	7.5

Table 2 provides the upstream filter housing volume (cc), less the volume occupied by the cartridge(s), for standard 3M Purification Inc. filter housings. This measurement is from the inlet flange only. It is assumed that the upstream housing valve is installed at this flange. However, if additional piping is included beyond the flange and before the valve, its volume must be accounted for in the total upstream filter housing volume. Please consult 3M Purification Inc. Technical Sales or 3M Purification Inc. Scientific Applications Support Services (SASS) for assistance in calculating the housing volumes of non-3M Purification filter housings.

Table 2. Filter housing upstream volume.

3M Purification Inc. Filter Housing	Number of Filters	Upstream Volume (cc)*
A-style, 70235-01	one (1) 2.5"	186
A-style, 70235-02	one (1) 5"	317
1ZVS1	one (1) 10" = 1	2,274
1ZVS2	one (1) 20" = 2	3,702
1ZVS3	one (1) 30" = 3	5,130
1ZVS4	one (1) 40" = 4	6,558
1ZMS1	one (1) 10" = 1	2,274
1ZMS2	one (1) 20" = 2	3,702
1ZMS3	one (1) 30" = 3	5,130
1ZMS4	one (1) 40" = 4	6,558
3ZWB1	three (3) 10" = 3	13,712
3ZWB2	three (3) 20" = 6	21,782
3ZWB3	three (3) 30" = 12	30,465
3ZWB4	three (3) 40" = 15	37,644
5ZWB1	five (5) 10" = 5	18,475
5ZWB2	five (5) 20" = 10	29,230
5ZWB3	five (5) 30" = 15	40,055
5ZWB4	five (5) 40" = 20	50,310
8ZWB1	eight (8) 10" = 8	26,172
8ZWB2	eight (8) 20" = 16	40,954
8ZWB3	eight (8) 30" = 24	55,626
8ZWB4	eight (8) 40" = 32	69,598
12ZWB1	twelve (12) 10" = 12	50,768
12ZWB2	twelve (12) 20" = 24	78,716
12ZWB3	twelve (12) 30" = 36	106,624
12ZWB4	twelve (12) 40" = 48	133,222

NOTE: Single cartridge 3M Purification housing model ZMS (t-line connections) is identical in volume to the ZVS (in-line) model.

* Upstream volume is calculated from the inlet flange. If your filter assembly has additional piping beyond this flange, you must determine the its volume, add it to the upstream volume of your housing listed above and recalculate the allowable pressure decay using Equation 1 on the previous page.

Maximum allowable pressure decay values for standard 3M Purification Inc. filter housings are supplied in Table 3 on the following page. The pressure decay values given in Table 3 are based on a constant gas temperature in the housing during testing. If using a non-3M Purification housing, or if the upstream volume of your 3M Purification housing is greater than that listed in Table 2 (refer to * under Table 2.), you must calculate a new allowable pressure loss for your housing.

Table 3. Allowable pressure decay (psi/min).

3M Purification Inc. Housing Model	LifeASSURE™ PLA Series Grade			
	PLA020	PLA045	PLA065	PLA080
MINI CARTRIDGE HOUSINGS				
A-style, 70235-01, 2.5"	0.8	0.4	0.2	0.1
A-style, 70235-02, 5"	0.9	0.5	0.2	0.1
DISPOSABLE CAPSULES				
Capsule size = 2.5"	1.0	0.5	0.3	0.1
Capsule size = 5"	1.0	0.5	0.3	0.1
STANDARD CARTRIDGE HOUSINGS				
1ZVS1	0.4	0.2	0.1	0.0
1ZVS2	0.5	0.2	0.1	0.1
1ZVS3	0.5	0.3	0.1	0.1
1ZVS4	0.5	0.3	0.1	0.1
1ZMS1	0.4	0.2	0.1	0.0
1ZMS2	0.5	0.2	0.1	0.1
1ZMS3	0.5	0.3	0.1	0.1
1ZMS4	0.5	0.3	0.1	0.1
3ZWB1	0.2	0.1	0.0	0.0
3ZWB2	0.2	0.1	0.1	0.0
3ZWB3	0.3	0.1	0.1	0.0
3ZWB4	0.3	0.1	0.1	0.0
5ZWB1	0.2	0.1	0.1	0.0
5ZWB2	0.3	0.2	0.1	0.0
5ZWB3	0.3	0.2	0.1	0.0
5ZWB4	0.4	0.2	0.1	0.0
8ZWB1	0.3	0.1	0.1	0.0
8ZWB2	0.3	0.2	0.1	0.0
8ZWB3	0.4	0.2	0.1	0.0
8ZWB4	0.4	0.2	0.1	0.1
12ZWB1	0.2	0.1	0.1	0.0
12ZWB2	0.3	0.1	0.1	0.0
12ZWB3	0.3	0.1	0.1	0.0
12ZWB4	0.3	0.2	0.1	0.0

Once you have calculated the maximum allowable pressure decay for your LifeASSURE™ PLA series filter grade and filter housing combination, you are ready to perform the Pressure Hold Test.

2. Procedure

WARNING

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

- Do not exceed maximum operating pressure or temperature limits.
- Do not use product for continuous service with compressed gases.
- Do not use with or expose this product 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.

2. Procedure (cont'd)

1. Install the filter(s) in the housing and wet with clean, filtered water at ambient temperature at a flow rate of 3 gpm/10" cartridge length for 10 minutes.
2. Close inlet process valve and open outlet process valve to atmosphere.
3. Slowly pressurize the upstream side of the filter housing to the desired test pressure using a regulated supply of air or nitrogen (do not use CO₂) and allow the system to equilibrate for 5 minutes.
4. When water flow from the outlet valve ceases, close the air source valve and measure the pressure decay for 1 minute. Compare the result versus the value from Table 3.

3. Troubleshooting

If the test value is greater than that listed in Table 3, consider the following:

- Verify that you have selected the proper value for the LifeASSURE™ PLA series filter(s) you are using and the housing employed.
- Ensure that there are no air leaks in the housing and assembly by pressurizing the housing, without filters, for 5 minutes with both inlet and outlet process valves closed.
- Examine the filters and O-rings for damage. Replace if needed.
- Seat the filters firmly in the housing using water or other fluid to lubricate the O-rings.
- Wet the filters again, increasing the water flow rate, or increasing the system pressure by slightly closing the downstream process valve.

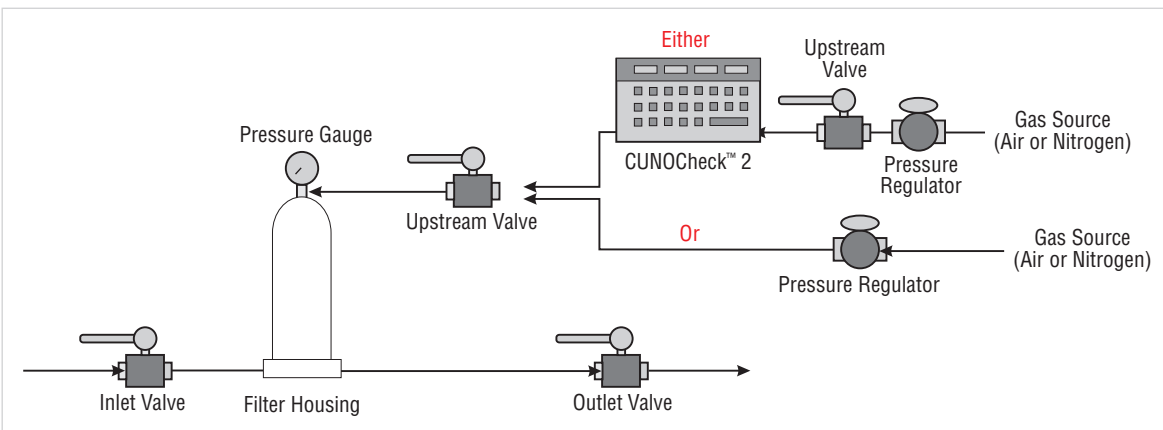


Figure 1. Pressure Hold Test.

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