Chemical Compatibility Guide and Life Expectancy for the SolVac™ Filter Holder

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Introduction

The 47 mm SolVac filter holder is used to remove contaminating particulate material and degas mobile phase solvents. The SolVac filter holder allows spill-proof filtration directly from the manufacturer's solvent bottle to the receiving vessel, eliminating pour-and-wait filtration for large volumes of solvents compared to the traditional glass funnel system. This permits a more productive use of the technician's time. The SolVac filter holder is less likely to spill aggressive solvents than traditional glass funnel systems or disposable cups. The patented magnetic seal is reliable and leak proof, eliminating the possibility of membrane shifting or tearing which can occur with aluminum clamps or threaded holders.

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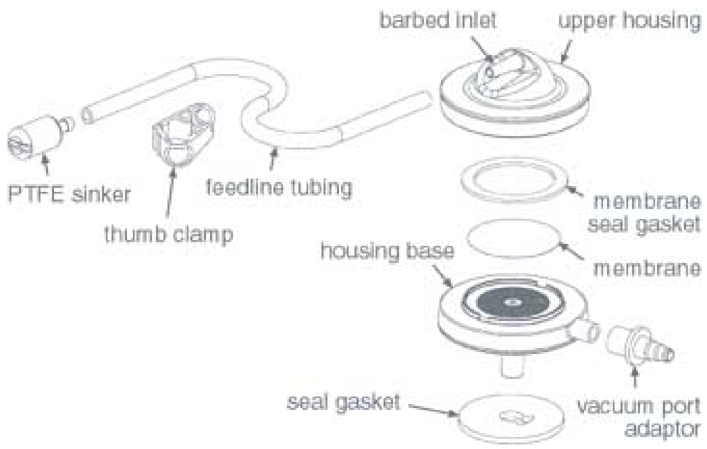
Chemical Compatibility for the Components of the SolVac Filter Holder



The chemical compatibility of the SolVac filter holder is dependent on the chemical compatibility of the different polymers used in the construction of each component. The upper housing and housing base with built-in membrane support are constructed of high quality polypropylene. The Ultra Chemical-resistant Tygon® feedline tubing is made of high quality polyolefins. The sinker is made of virgin PTFE, and the vacuum port hose barb adaptor is made of polyethylene. The seal gasket and membrane seal gasket are both made of polyethylene.

Polypropylene, like most polyolefins, is highly resistant to most chemicals. Most organic chemicals, with few exceptions, and many inorganic chemicals produce little or no effect on the polypropylene housing of the SolVac filter holder. However, polypropylene dissolves in high boiling aliphatic and aromatic hydrocarbons at high temperatures. Strong oxidizing agents, such as chlorosulfonic acid, oleum, fuming nitric acid and nitric bromine attack polypropylene at room temperature. For more information see following Chemical Compatibility Chart.

Tygon feedline tubing is a material produced by copolymers of vinyl acetate and vinyl chloride. This material has good chemical resistance to a wide range of chemicals, including inorganic solutions, detergents, alcohols, and aliphatic hydrocarbons such as oils and waxes. However, it can be attacked by aromatic and chlorinated hydrocarbons, organic materials derived from them, and highly polar organic solvents such as ketones, esters, cyclic ethers, nitro compounds, and halogens. For more information see following Chemical Compatibility Chart.

The PTFE sinker generally exhibits excellent chemical resistance to almost all known organic and inorganic solvents. The seal gasket does not have direct contact with solvents, but can be attacked by their vapors. Several types of filter media require the use of a membrane seal gasket. Both seal gaskets are made of closed cell polyethylene. At room temperature polyethylene resin has a high chemical resistance to most known solvents, especially to polar compounds. For more information see following Chemical Compatibility Chart.

Chemical Compatibility Chart

	SolVac™ Holder Housing PolyPropylene	**Seal Gasket and Membrane Seal Gasket (Closed cell PE foam**	**Tubing Tygon® feedline tubing 2075**	**Sinker Virgin PTFE**	**Overall Rating**
Acids					
Acetic Acid, Glacial	G	G	E	E	R
Acetic Acid, 90%	G	--	E	E	R
Acetic Acid, 30%	G	--	E	E	R
Acetic Acid, 10%	G	G	E	E	R
Hydrochloric Acid, Conc. (35%)	E	G	E	E	R
Hydrochloric Acid, 6N (20%)	E	G	E	E	R
Hydrochloric Acid, 1N (3.3%)	E	G	E	E	R
Nitric Acid, Conc. (67%)	NR	NR	E	E	NR
Nitric Acid, 6N (27%)	E	G	E	E	R
Sulfuric Acid, Conc. (96%)	F	G	E	E	LR
Sulfuric Acid, 6N (16%)	E	G	E	E	R
Alcohols					
Amyl Alcohol	E	E	E	E	R
Benzyl Alcohol	E	E	E	E	R
Butanol	E	E	E	E	R
Ethanol	E	E	E	E	R
Isoproponal	E	E	E	E	R
Methanol	E	E	E	E	R
Bases					
Ammonium Hydroxide, 3N (5.7%)	E	E	E	E	R
Ammonium Hydroxide, 6N (11.4%)	E	E	E	E	R
Potassium Hydorxide, 3N (15%)	E	E	E	E	R
Sodium Hydroxide, 3N (11%)	E	E	E	E	R
Sodium Hydroxide, 6N (22%)	E	E	E	E	R
Esters					

Amyl Acetate	F	E	NR	E	NR
Butyl Acetate	F	E	NR	E	NR
Cellosolve Acetate	F	G	NR	E	NR
Isopropyl Acetate	G	G	NR	E	NR
Methyl Acetate	G	G	NR	E	NR
Ethyl Ether	G	F	NR	E	NR
Tetrahydrofuran	G	G	NR	E	NR
Tetrahydrofuran/water (50/50, v/v)	E	G	--	E	LR
Glycols					
Ethylene Glycol	E	E	E	E	R
Glycerol	E	E	E	E	R
Propylene Glycol	E	G	E	E	R
Aromatic Hydrocarbons					
Benzene	F	G	NR	E	NR
Toluene	F	G	NR	E	NR
Xylene	F	G	NR	E	NR
Halogenated Hydrocarbons					
Carbon Tetrachloride	F	G	NR	E	NR
Chloroform	F	G	NR	E	NR
Ethylene Dichloride	F	G	NR	E	NR
Methylene Chloride	F	G	NR	E	NR
Tetrachloroethylene	NR	NR	NR	E	NR
Ketones					
Acetone	E	E	G	E	R
Cyclohexane	G	G	F	E	NR
Methyl Ethyl Ketone	E	G	F	E	R
Oils					
Cottonseed	E	E	G	E	R
Peanut	G	--	--	E	R
Miscellaneous					
Acetonitrile	E	E	F	E	R
Dimethyl Formamide	E	E	E	E	R
Dimethyl Sulfoxide	E	E	G	E	R
Formaldehyde, 37%	E	E	F	E	R
Formaldehyde, 4%	E	E	F	E	R
Hexane	E	E	NR	E	NR
Kerosene	E	G	NR	E	NR
Pyridine	E	G	F	E	R
18 Megohm	E	E	E	E	R

Test Methods: The data presented in this chart is a compilation of testing by Pall with certain chemicals, manufacturer's data, or compatibility recommendations from the Compass Corrosion Guide, by Kenneth M. Pruett. This data is intended to provide expected results when filtration devices are exposed to chemicals under static conditions for 72 hours at 25 °C (77 °F), unless otherwise noted.

This chart is intended only as a guide. Accuracy cannot be guaranteed. Users should verify chemical compatibility under actual use conditions. Chemical compatibility with a specific filter under actual use conditions is affected by many variables including temperature, pressure, concentration, and purity. Various chemical combinations prevent complete accuracy.

Component Rating

E = excellent resistance
G = good resistance
F = fair resistance
NR = not resistant
-- = not sufficient data Overall Rating
R = resistant
LR = limited resistance (for short-term exposure)
NR = not resistant

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Life Expectancy for the Components of the SolVac Filter Holder

The high-quality polypropylene material that is used for the construction of the SolVac filter holder housing is extremely durable. It has excellent chemical, mechanical and stress cracking resistance. The nature of the chemicals and frequency of its applications determine the expected life of the housing. With proper handling and normal daily usage for filtration of non-aggressive solvents, these parts typically last for one year or more.

In cases where very aggressive solvents are frequently being filtered, the life expectancy for these parts can be significantly shorter. In the case of wear or damage to the membrane seal rim of the upper housing and the membrane seal area of the lower housing, air can be drawn in through the magnetic seal which can greatly diminish flow and eventually cause the device not to filter. In such a case, it is time to replace the SolVac filter holder.

The seal gasket and membrane seal gasket are made of closed cell polyethylene foam. Over time, an indentation from the bottle edge will become permanent in the seal gasket. Once this occurs, the gasket will not provide a secure seal. The flow rate can be greatly diminished and may eventually halt due to insufficient vacuum. At this point, replace the seal gasket located on the bottom of the housing base. The estimated number of uses with a new seal gasket will typically range from 20 to 40. This number will vary depending on the shape and sharpness of the mouth on the receiving vessel, the strength of the vacuum source, the accumulation of time while under vacuum, and the aggressiveness of the chemicals being filtered.

The life expectancy of the feedline tubing also greatly depends on the nature of the solvent(s) being filtered. At any sign of wear or damage, the feedline tubing should be replaced.

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Extractables

The SolVac filter holder simplifies the filtration process compared to traditional glass funnel systems. It is a convenient device to remove contaminating particulate and degas mobile phase solvents for High Performance Liquid Chromatography (HPLC). HPLC is a very sensitive analytical technique. That is why it is important to preserve the purity of the mobile phase solvents. Any extractables added to the solvent from the filtration apparatus are undesired artifacts that may jeopardize analytical results. Therefore, UV absorbing extractables analysis is performed to verify that a product intended for use with the HPLC applications will not contribute a significant amount of UV-extractable material to the final filtrate. The six most widely used mobile phase solvents were filtered through a SolVac filter holder followed by HPLC analysis of the filtrate for UV absorbing extractables content.

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Material and Methods

Test Procedure

Six new SolVac filter holders (PN 4020, lot #0798) were used for the extractable study.

500 mL of each solvent was filtered through a new SolVac filter holder. Three-milliliter aliquots from each filtrate were taken and analyzed on HPLC for extractables.

Test Solvents

1. Acetonitrile (ACN), HPLC grade (EM Scientific P/N AX0145-1, lot #37310)
2. Methanol (MEOH), HPLC grade (EM Scientific P/N MX0475-1, lot #37161725)
3. 18 Megahom Water
4. Tetrahydrofuran (THF), HPLC grade (EM Scientific P/N TX0279-6, lot #37282)
5. Hexane, HPLC grade (EM Scientific P/N HX0290P-1, lot #37280742)
6. 1-Methyl-2-pyrrolidinone (NMP), HPLC grade (B&J P/N 304-1, lot #BS383)

HPLC Conditions

HPLC analysis was performed on filtrate samples with a Waters System (Milford, MA, USA) consisting of a 616 Fluid Pump, 717 Plus Autoinjector, 600S Controller, 996 Photodiode Array Detector (PDA) and Millennium 2010 Software. The column was a NovaPak 4 µm C18, 4.6 mm x 150.0 mm. Mobile phase fluids, acetonitrile, water, and methanol were HPLC-grade solvents supplied by EM Science (Gibbstown, NJ, USA).

The filtrate samples and solvent blanks, 100 µL were analyzed under gradient mobile phase conditions. Initial conditions were held for three minutes, 95% water: 5% acetonitrile, and linearly altered over 40 minutes to the final conditions, 100% acetonitrile: 0% water, which were retained for five minutes. The system was equilibrated for 10 minutes before re-injecting. The wavelengths of interest, 214, 254, and 280 nm, were acquired simultaneously with the PDA Detector.

Results

Figures 1-6 are HPLC chromatograms of the samples from six solvents filtered through the SolVac filter holder. To eliminate redundancy, only UV absorption data at 280 nm are presented. None of the chromatograms exhibit any trace of extractables leached from the SolVac filter holder to the final filtrate. However, in a couple of cases (THF and Hexane), the tubing actually exhibited some swelling in physical size, implying a lack of chemical compatibility.

Figure 1: Acetonitrile (ACN) Solvent

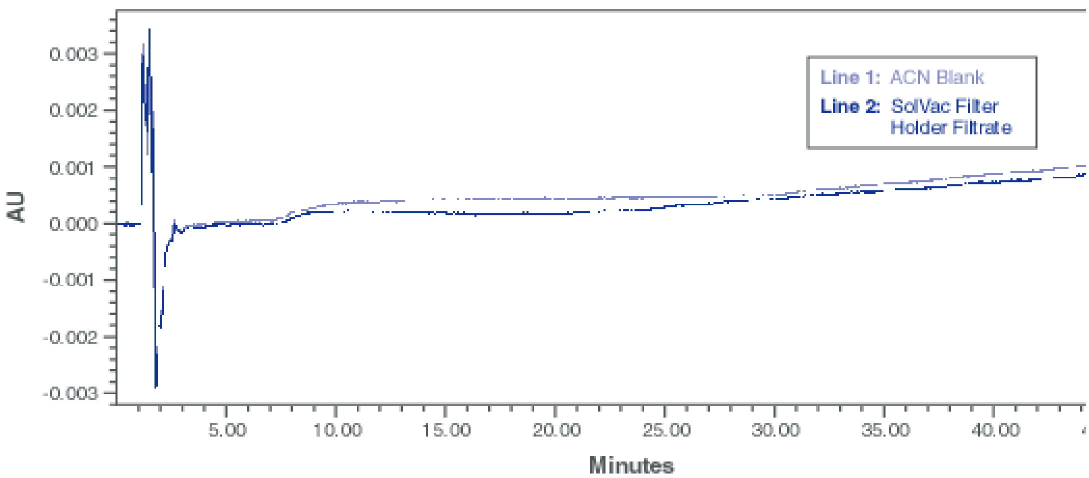


Figure 2: Methanol Solvent

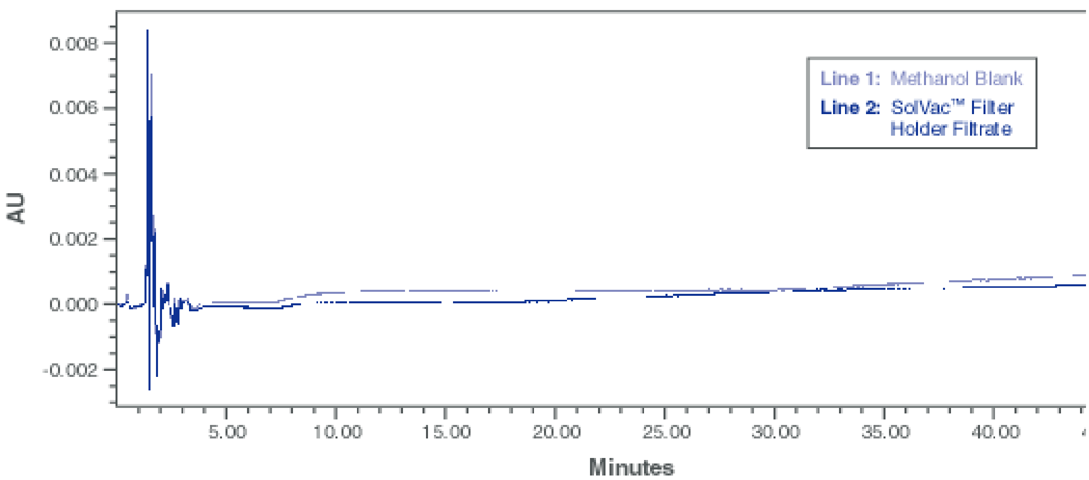


Figure 3: 18 Megahom Water

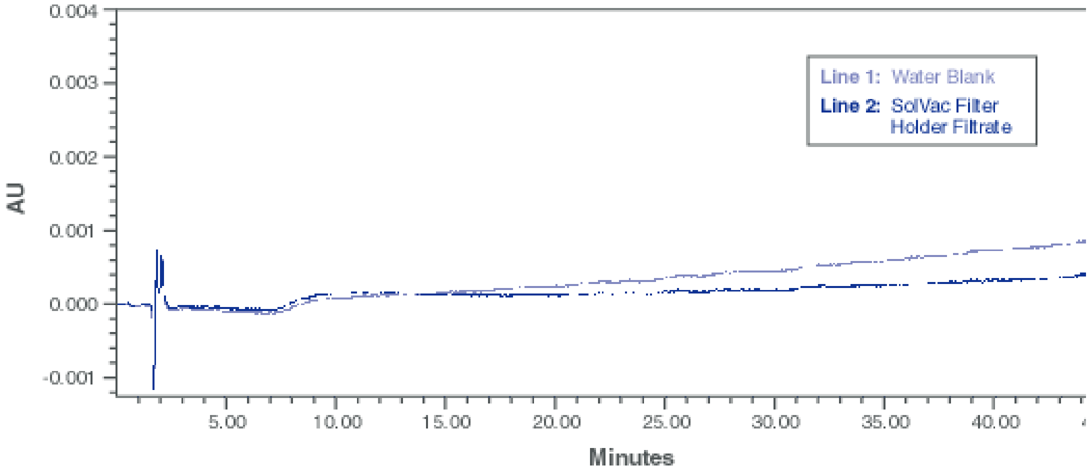


Figure 4: Tetrahydrofuran (THF) Solvent

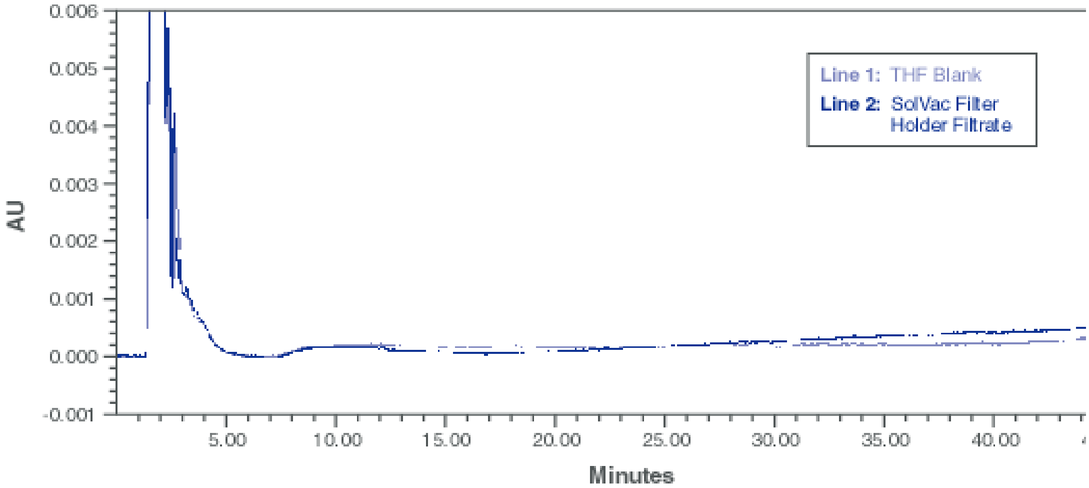


Figure 5: Hexane Solvent

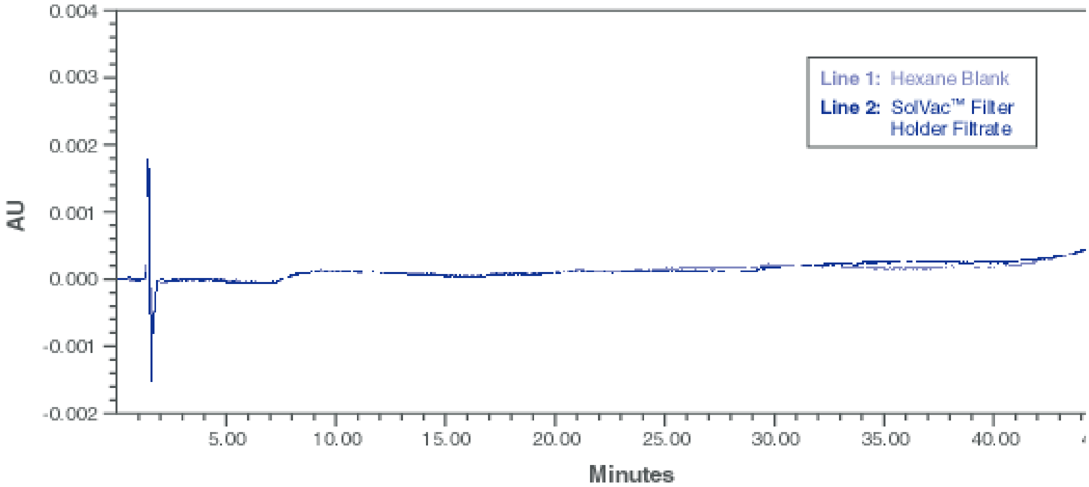
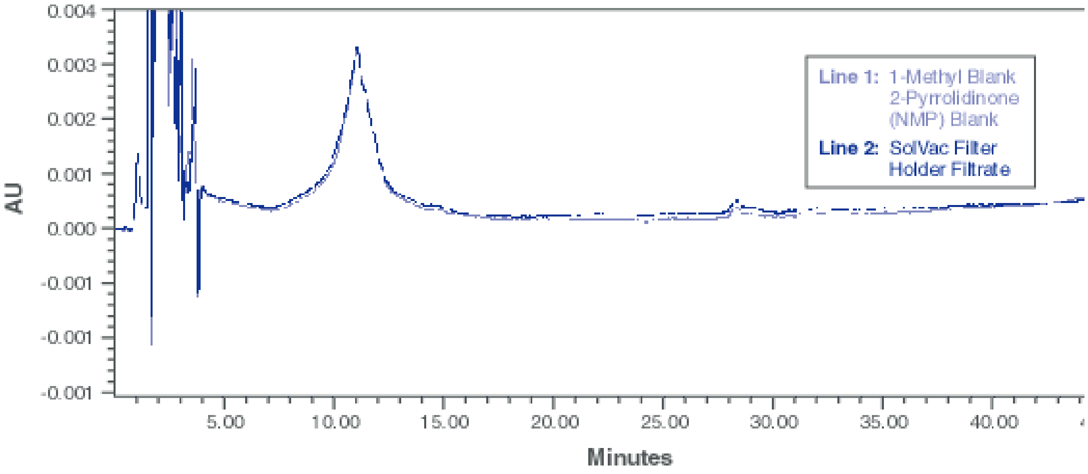


Figure 6: 1-Methyl-2-Pyrrolidinone (NMP) Solvent



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Conclusion

The SolVac filter holder has great potential in the analytical chemistry laboratory. The spill-proof, convenient filtration from the manufacturer's solvent bottle to receiving vessel eliminates the pour-and-wait filtration necessary when using traditional glass funnel systems and allows the technician to be more productive. The durable polypropylene construction and excellent chemical compatibility with common HPLC mobile phase solvents, such as acetonitrile and methanol, ensure long lasting, convenient, and reliable use of this filter holder in the laboratory.

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