

# APPENDIX/INDEX

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## Selecting and Designing a Filtration System

In designing or selecting a system for microporous filtration, it is worthwhile to spend some time defining a few specific parameters of the filtration problem:

- **What is to be filtered, liquid or gas?** For filtering of gases or sterile venting of vessels or gas lines, use a hydrophobic membrane such as PTFE. Chemical resistance tables can be used to help select a membrane material suitable to the liquid being filtered. Also check the compatibility of the filter holder and any O-rings with the filtrate.
- **What size are the smallest particles to be removed?** In general, a pore size just smaller than the smallest size particle to be removed is chosen. For example, 0.20  $\mu\text{m}$  pore size membrane is generally used for sterilizing culture medium, but a 0.10  $\mu\text{m}$  membrane is needed to ensure Mycoplasma removal.
- **At what pressures will the system be operated?** Check the specifications or assume a differential pressure of 2-5 psi ( $\sim 0.3 \text{ kg/cm}^2$ ) for a single holder. Be sure to account for the effects of pressure drop in a multi-holder system.
- **How will the filter holder be connected to the system?** Standard Luer, threaded, sanitary, and hose connectors are available depending on the model. Check the specifications for the product you choose.
- **What is the operating temperature?** Check the specifications for your filtration medium (membrane or other filter) and holder.
- **What size filter and holder do I need?** Estimate what volume you will be filtering and the amount of time you plan to allow for the filtration. By dividing the volume by the time in which you expect to complete this filtration you will get a desired minimum flow rate. Use the graphs at right to determine the flow rate per unit area for the differential pressure and membrane in your system (assume a pressure differential of 5 psi ( $\sim 0.3 \text{ kg/cm}^2$ ) if it is not known). Divide the desired flow rate by the flow rate per unit area to get a minimum filtration area in  $\text{cm}^2$ . Multiply this area by a factor of  $\sim 5$  to allow for clogging.

### ADJUSTMENTS

For gaseous filtrations that take place outside of standard temperature and pressure (20°C, one atmosphere), correct flow rates using the following formula:

$$F = F_0 \frac{293}{273+T} \frac{P + \Delta P/2}{1.03 + \Delta P/2}$$

$F$  = Corrected flow rate  
 $F_0$  = Flow rate from chart  
 $T$  = Temperature in °C  
 $P$  = Exit pressure in  $\text{kg/cm}^2$   
 $\Delta P$  = Pressure drop through the system in  $\text{kg/cm}^2$

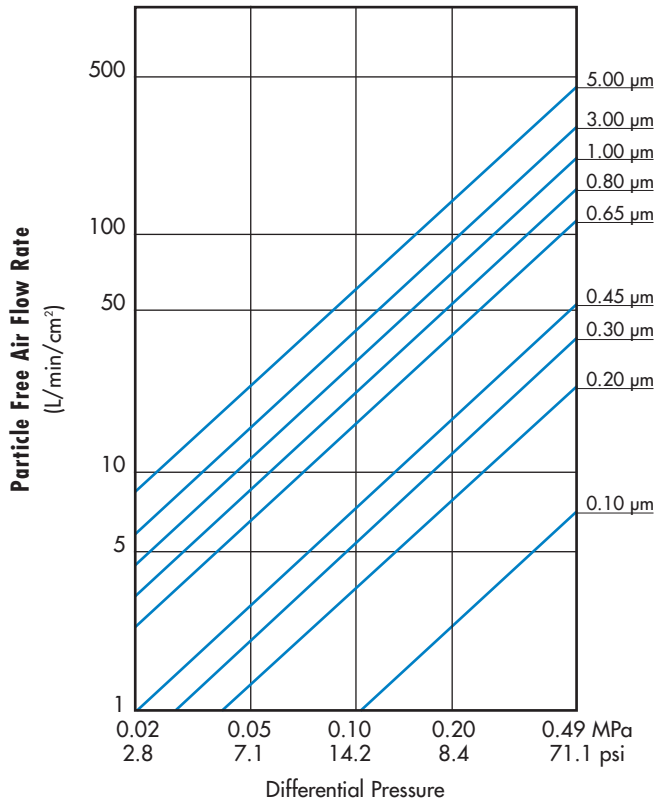
Liquid viscosity can have a significant effect on flow rate. Use this formula to correct for this effect:

$$\text{Flow rate} = \frac{A \cdot P}{V}$$

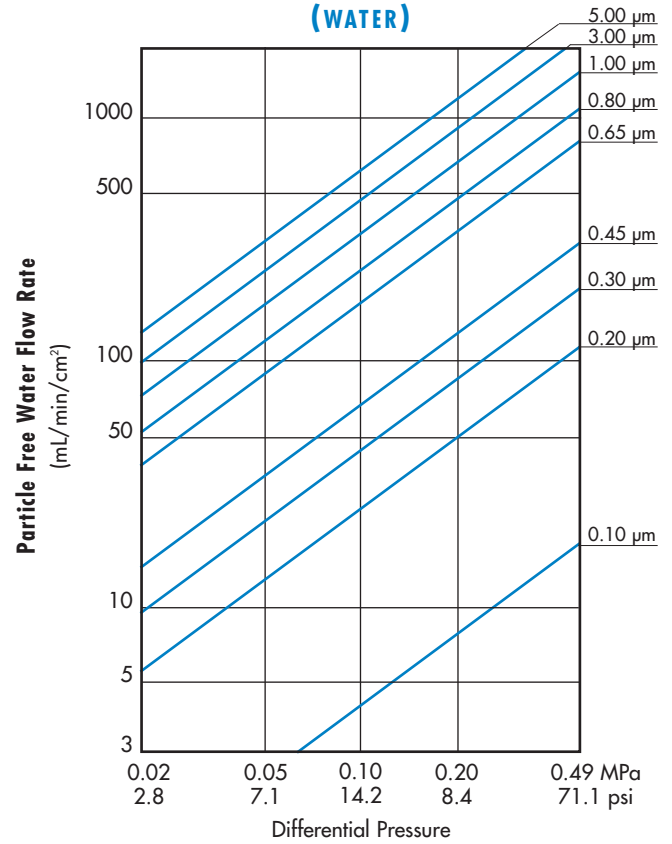
$A$  = Effective filtration area  
 $P$  = Differential pressure  
 $V$  = Viscosity

GRAPHS – FLOW RATE VS. DIFFERENTIAL PRESSURE

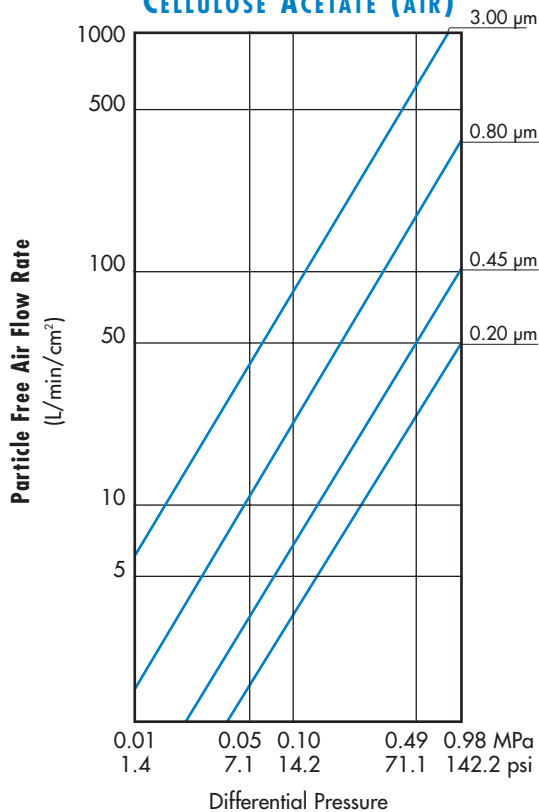
MIXED ESTER OF CELLULOSE (AIR)



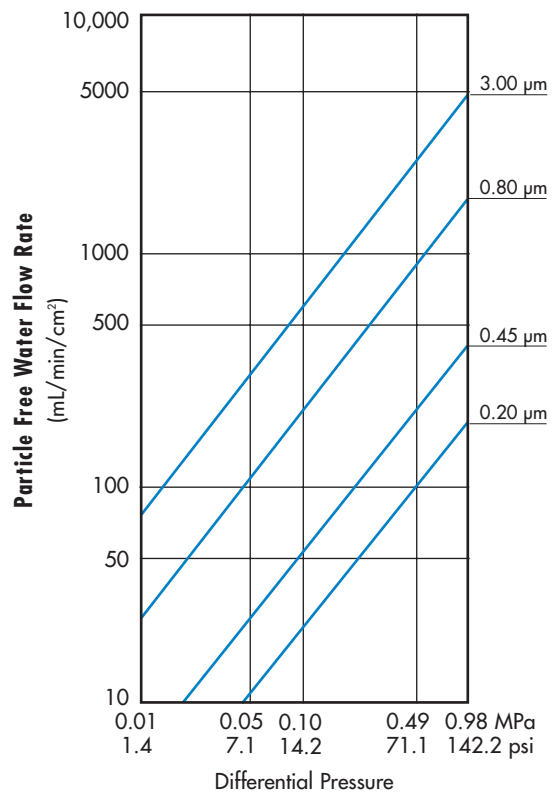
MIXED ESTER OF CELLULOSE (WATER)



CELLULOSE ACETATE (AIR)



CELLULOSE ACETATE (WATER)



## Chemical Compatibility

This guide should be used as a reference to select the proper membrane, O-ring and filter holder with regard to chemical compatibility.

Recommendations are based on a 24-hour static exposure to the test fluid at room temperature.

- O** – **Recommended.** No change in either water flow rate or bubble point will be observed.
- \*** – **Limited resistance.** Additional in-house testing is advised as swelling, discoloration or other minor changes may occur.
- x** – **Not recommended.** Significant changes in water flow rate and/or bubble point can be expected.
- – **Data not available.**

### CHEMICAL COMPATIBILITY – MEMBRANE FILTERS

Chemicals		Polymer/Product										
		MCE		CA	PCTE		PTFE	Supported PTFE	Hydrophilic PTFE	CMF Coated Cellulose acetate	37 mm monitor	37 mm monitor set
		White	Black		White	Black						
ACIDS	Glacial Acetic acid	x	x	x	o	x	o	o	o	x	x	x
	10% Acetic acid	o	o	o	o	o	o	o	o	o	*	*
	12 kmol/m <sup>3</sup> Hydrochloric acid (37%)	x	x	x	o	x	o	o	o	x	x	x
	6 kmol/m <sup>3</sup> Hydrochloric acid (19%)	o	x	x	o	o	o	o	o	x	*	*
	12 kmol/m <sup>3</sup> Nitric acid (53%)	x	x	x	o	x	o	o	o	x	x	x
	6 kmol/m <sup>3</sup> Nitric acid (26%)	o	x	x	o	x	o	o	o	x	x	x
	18 kmol/m <sup>3</sup> Sulfuric acid (96%)	x	x	x	x	x	o	o	x	x	x	x
	3 kmol/m <sup>3</sup> Sulfuric acid (16%)	o	o	x	o	o	o	o	o	x	*	*
	85% Phosphoric acid	o	o	x	o	x	o	o	o	x	*	*
	5% Boric acid	o	o	o	o	o	o	o	o	o	o	o
	50% Formic acid	*	x	x	o	x	o	o	o	x	x	x
	35% Hydrofluoric acid	o	x	x	o	x	o	o	o	x	x	x
60% Perchloric acid	x	x	x	o	x	o	o	o	x	x	x	
ALKALIS	6 kmol/m <sup>3</sup> Sodium hydroxide (26%)	x	x	x	x	x	o	o	o	x	x	x
	6 kmol/m <sup>3</sup> Potassium hydroxide (20%)	x	x	x	x	x	o	o	o	x	x	x
	6 kmol/m <sup>3</sup> Aqueous ammonia (11%)	x	x	x	x	x	o	o	o	x	x	x
ALCOHOLS	Methyl alcohol	x	x	*	o	x	o	o	o	o	x	x
	Ethyl alcohol	x	x	*	o	x	o	o	o	o	x	x
	Isopropyl alcohol	*	x	*	o	x	o	o	o	o	x	x
	Isobutyl alcohol	o	x	o	o	x	o	o	o	x	x	x
	n-Butyl alcohol	*	x	o	o	x	o	o	o	o	x	x
	Glycerin	o	o	o	o	o	o	o	o	o	o	o
	Amyl alcohol	*	x	o	o	x	o	o	o	o	*	*
	Benzyl alcohol	x	x	x	o	x	o	o	o	x	*	*
Ethylene glycol	*	x	o	o	o	o	o	o	x	*	x	

Continued on next page

## CHEMICAL COMPATIBILITY – MEMBRANE FILTERS (CONTINUED)

Chemicals		Polymer/Product										
		MCE		CA	PCTE		PTFE	Supported PTFE	Hydrophilic PTFE	CMF Coated Cellulose acetate	37 mm monitor	37 mm monitor set
		White	Black		White	Black						
ETHERS	Ethyl ether	○	○	○	*	×	○	○	○	○	*	×
	Isopropyl ether	○	○	○	○	×	○	*	○	○	×	×
	Tetrahydrofuran (THF)	×	×	×	×	×	○	*	○	×	×	×
	Dioxane	×	×	×	×	×	○	*	○	×	×	×
	Petroleum ether	○	○	○	○	○	○	○	○	○	○	×
ESTERS	Methyl acetate	×	×	×	×	×	○	*	○	×	×	×
	Butyl acetate	×	×	*	*	×	○	*	○	○	×	×
	Amyl acetate	×	×	*	○	*	○	*	○	○	×	×
KETONES	Acetone	×	×	×	×	×	○	○	○	×	×	×
	Methyl ethyl ketone (MEK)	×	×	×	×	×	○	*	○	×	×	×
	Methyl isobutyl ketone (MIBK)	×	×	×	×	×	○	*	○	×	×	×
	Cyclohexanone	×	×	×	×	×	○	○	○	×	×	×
HYDROCARBONS	Benzene	○	×	○	×	×	○	○	○	○	×	×
	Toluene	○	○	○	×	*	○	*	○	○	×	×
	Xylene	○	×	○	○	×	○	*	○	×	×	×
	n-Hexane	○	○	○	○	○	○	○	○	○	×	×
	Gasoline	○	○	○	○	○	○	*	○	○	*	×
	Kerosene	○	○	○	○	○	○	*	○	×	○	*
HALOGENATED HYDROCARBONS	Chloroform	○	○	×	×	×	○	*	○	×	×	×
	Methylene chloride	*	×	×	×	×	○	*	○	×	×	×
	Trichloroethylene	○	○	○	×	×	○	*	○	○	×	×
	Tetrachloroethylene	○	×	○	×	×	○	*	○	○	×	×
	Carbon tetrachloride	○	○	○	○	○	○	○	○	○	×	×
AMINES	Aniline	×	×	×	×	×	○	○	○	×	×	×
	Dimethyl formamide	×	×	×	×	×	○	○	○	×	×	×
	Diethyl acetamide	×	×	×	×	×	○	○	○	×	×	×
	Triethanolamine	×	×	○	○	×	○	○	○	×	×	×
CELLOSOLVES	Methyl cellosolve	×	×	×	○	×	○	○	○	×	×	×
	Butyl cellosolve	×	×	○	○	×	○	○	○	○	×	×
MISCELLANEOUS	Nitrogen	○	○	○	○	○	○	○	○	○	○	○
	Hydrogen	○	○	○	○	○	○	○	○	○	○	○
	30% Hydrogen peroxide	○	○	○	○	○	○	○	○	○	×	×
	Saline solution	○	○	○	○	○	○	○	○	○	○	○
	Dimethyl sulfate	×	×	*	×	×	○	○	○	×	×	×
	Nitrobenzene	×	×	×	×	×	○	○	○	×	×	×
	Methanol (1): Chloroform (1)	×	×	×	×	×	○	*	○	×	×	×
	Pyridine	×	×	×	×	×	○	*	○	×	×	×
	Acetonitrile	×	×	×	×	×	○	○	○	×	×	×
	Phenol	×	×	×	×	×	○	○	○	×	×	×
	Freon	○	○	○	○	○	○	*	○	○	○	○
	37% Formaldehyde	○	×	*	○	×	○	○	○	○	×	×
	Silicone oil	○	○	○	○	×	○	*	○	×	○	○
	n-Hexane (95): Ethyl acetate (5)	*	○	×	○	○	○	*	○	○	×	×
	Acetonitrile (70):Distilled water (30)	×	×	×	×	×	○	○	○	×	×	×
Petroleum oil	○	○	○	○	×	○	○	○	○	*	×	

○ - Recommended

\* - Limited resistance

× - Not recommended

- - Data not available

## CHEMICAL COMPATIBILITY: DISPOSABLE SYRINGE FILTER UNITS

Chemicals		AS Mixed cellulose esters with acrylic housing	CS Cellulose acetate with acrylic housing	CP Cellulose acetate with PP housing	HP Hydrophilic PTFE with PP housing	JP Hydrophobic PTFE with PP housing
ACIDS	3 kmol/m <sup>3</sup> Hydrochloric acid (10%)	O	*	*	O	O
	9 kmol/m <sup>3</sup> Hydrochloric acid (30%)	X	X	X	O	O
	1 kmol/m <sup>3</sup> Sulfuric acid (5%)	O	O	O	O	O
	4 kmol/m <sup>3</sup> Sulfuric acid (20%)	X	X	X	O	O
	1 kmol/m <sup>3</sup> Nitric acid (5%)	O	O	*	O	O
	4 kmol/m <sup>3</sup> Nitric acid (20%)	X	X	X	*	*
	3.5 kmol/m <sup>3</sup> Acetic acid (20%)	O	O	O	O	O
	Glacial acetic acid	X	X	X	O	O
	5 kmol/m <sup>3</sup> Hydrofluoric acid (10%)	X	X	X	O	O
	19 kmol/m <sup>3</sup> Hydrofluoric acid (35%)	X	X	X	O	O
	1 kmol/m <sup>3</sup> Chromic acid (10%)	*	*	*	*	*
1 kmol/m <sup>3</sup> Phosphoric acid (10%)	O	O	O	O	O	
ALKALIS	2.5 kmol/m <sup>3</sup> Sodium hydroxide (10%)	X	X	X	O	O
	2 kmol/m <sup>3</sup> Potassium hydroxide (10%)	X	X	X	O	O
	8 kmol/m <sup>3</sup> Aqueous ammonia (28%)	X	O	*	O	O
ALCOHOLS	Methyl alcohol	X	X	O	O	O
	Ethyl alcohol	X	*	O	O	O
	n-Propyl alcohol	*	O	O	O	O
	Isopropyl alcohol	*	O	O	O	O
	n-Butyl alcohol	*	O	O	O	O
	Amyl alcohol	*	O	O	O	O
	Benzyl alcohol	*	X	X	O	O
	Ethylene glycol	X	X	O	O	O
	Glycerin	O	O	O	O	O
ETHERS	Ethyl ether	X	X	*	*	*
	Isopropyl ether	X	X	O	O	O
	Tetrahydrofuran (THF)	X	X	X	*	*
	Dioxane	X	X	X	*	*
ESTERS	Methyl acetate	X	X	X	*	*
	Ethyl acetate	X	X	X	*	*
	Butyl acetate	X	X	X	*	*
	Amyl acetate	X	X	*	*	*
KETONES	Acetone	X	X	X	O	O
	Methyl ethyl ketone (MEK)	X	X	X	*	*
	Methyl isobutyl ketone (MIBK)	X	X	X	*	*
	Cyclohexanone	X	X	X	*	*
HYDROCARBONS	Benzene	X	X	*	*	*
	Toluene	X	X	*	*	*
	Xylene	X	X	*	*	*
	n-Hexane	X	X	*	*	*
	Gasoline	*	*	O	O	O
	Kerosene	O	O	*	*	*

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## CHEMICAL COMPATIBILITY: DISPOSABLE SYRINGE FILTER UNITS (CONTINUED)

Chemicals		AS Mixed cellulose esters with acrylic housing	CS Cellulose acetate with acrylic housing	CP Cellulose acetate with PP housing	HP Hydrophilic PTFE with PP housing	JP Hydrophobic PTFE with PP housing
HALOGENATED HYDROCARBONS	Chloroform	X	X	X	*	*
	Methylene chloride	X	X	X	*	*
	Trichloroethylene	X	X	*	*	*
	Carbon tetrachloride	X	X	*	O	O
	Trichloroethane	X	X	X	*	*
	Perchloroethylene	X	X	X	*	*
	Freon (TMC)	X	X	*	*	*
AMINES	Aniline	X	X	X	*	*
	Dimethyl formamide	X	X	X	*	*
	Diethyl acetamide	X	X	X	*	*
	Triethanolamine	X	O	O	O	O
CELLOSOLVES	Ethyl acetate cellosolve	X	X	X	*	*
MISCELLANEOUS	Acetonitrile	X	X	X	*	*
	Pyridine	X	X	X	*	*
	1 kmol/m <sup>3</sup> Sodium Hypochloride (6%)	X	X	X	O	O
	13 kmol/m <sup>3</sup> Formaldehyde (35%)	X	*	*	O	O
	Ferric chloride	O	O	O	O	O
	Copper sulfate	O	O	O	O	O
	Mineral oil	*	O	*	*	*
	Salt water	O	O	O	O	O
	3 kmol/m <sup>3</sup> Hydrogen peroxide (10%)	X	*	O	O	O
	Nitrobenzene	X	X	X	*	*
	Phenol	X	X	X	O	O
	Silicone oil	X	X	X	O	O
	Petroleum oil	*	*	O	O	O
	Acetonitrile (70): water (30)	X	X	X	O	O

O – Recommended    \* – Limited resistance    X – Not recommended    – – Data not available

## CHEMICAL COMPATIBILITY – CAPSULES

Chemicals	CCS	CCF	CCFH	CCP	CCG	
ACIDS	1 kmol/m <sup>3</sup> Acetic acid (5%)	○	○	○	○	○
	3.5 kmol/m <sup>3</sup> Acetic acid (20%)	○	○	*	○	○
	1 kmol/m <sup>3</sup> Chromic acid (10%)	✗	○	○	○	✗
	3 kmol/m <sup>3</sup> Hydrochloric acid (10%)	○	○	○	○	○
	11 kmol/m <sup>3</sup> Hydrochloric acid (35%)	○	○	✗	○	*
	5 kmol/m <sup>3</sup> Hydrofluoric acid (10%)	○	○	○	○	✗
	1 kmol/m <sup>3</sup> Nitric acid (5%)	○	○	○	○	○
	4 kmol/m <sup>3</sup> Nitric acid (20%)	○	○	○	○	○
	1 kmol/m <sup>3</sup> Phosphoric acid (10%)	○	○	○	○	○
	1 kmol/m <sup>3</sup> Sulfuric acid (5%)	○	○	○	○	○
4 kmol/m <sup>3</sup> Sulfuric acid (20%)	○	○	○	○	○	
ALKALIS	2.5 kmol/m <sup>3</sup> Sodium hydroxide (10%)	○	○	✗	○	○
	2 kmol/m <sup>3</sup> Potassium hydroxide (10%)	○	○	✗	○	○
	5 kmol/m <sup>3</sup> Aqueous ammonia (10%)	○	○	✗	○	*
	15 kmol/m <sup>3</sup> Aqueous ammonia (28%)	○	○	✗	○	○
ALCOHOLS	Methyl alcohol	○	○	○	○	○
	Ethyl alcohol	○	○	○	○	○
	n-propyl alcohol	○	○	○	○	○
	n-butyl alcohol	○	○	*	○	○
	Ethylene glycol	○	○	○	○	○
ETHERS	Ethyl ether	*	*	*	*	✗
	Dioxane	*	○	○	○	✗
	Tetrahydrofuran (THF)	✗	✗	✗	✗	✗
ESTERS	Amyl acetate	✗	*	*	*	✗
	Methyl acetate	✗	○	○	○	○
	Ethyl acetate	✗	○	○	○	○
	Butyl acetate	✗	○	○	○	○
KETONES	Acetone	✗	○	○	○	✗
	Methyl ethyl ketone (MEK)	✗	○	○	○	✗
	Methyl isobutyl ketone (MIBK)	✗	○	○	○	✗
HYDROCARBONS	n-Hexane	*	*	-	*	*
	Cyclohexane	*	*	*	*	*
	Benzene	*	✗	✗	✗	✗
	Toluene	✗	*	*	*	✗
	Xylene	✗	*	*	*	*
HALOGENATED HYDROCARBONS	Chloroform	✗	*	✗	*	✗
	Carbon tetrachloride	-	*	*	*	*
	Freon (TMC)	✗	*	-	*	✗
	Methylene chloride	✗	*	✗	*	✗
	Trichloroethylene	✗	*	*	*	✗
	Trichloroethane	✗	○	○	○	○
AMINES	Dimethyl formamide	✗	○	○	○	○
ALDEHYDES	Acetaldehyde	-	-	-	-	-
	13 kmol/m <sup>3</sup> Formaldehyde (35%)	○	○	*	○	○

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**CHEMICAL COMPATIBILITY – CAPSULES (CONTINUED)**

Chemicals		CCS	CCF	CCFH	CCP	CCG
CELLOSOLVES	Acetic cellosolve	X	O	O	O	O
MISCELLANEOUS	Acetonitrile	X	O	O	O	X
	Pyridine	X	O	O	O	O
	Nitrobenzene	-	-	X	-	-
	1 kmol/m <sup>3</sup> Sodium hypochlorite (6%)	X	O	O	O	O
	Ferric chloride	O	O	O	O	O
	Copper sulfate	O	O	O	O	O
	Mineral oil	O	O	O	*	O
	Salt water	O	O	O	O	O
	3 kmol/m <sup>3</sup> Hydrogen peroxide (10%)	O	O	O	O	O

O – Recommended

\* – Limited resistance

X – Not recommended

- – Data not available

## CHEMICAL COMPATIBILITY – CARTRIDGES

Chemicals		TCR	TCS TCS-G TCS-E	TCF TCFH	TCY TCYE	TCP TCPE TCPD	TC	TC (SUS type with NBR Gasket)	TCG	TCG-R (NBR Gasket)
ACIDS	20% Acetic acid	O	O	O	O	O	X	X	O	O
	10% Chromic acid	X	X	O	X	O	X	X	X	X
	3 kmol/m <sup>3</sup> Hydrochloric acid (10%)	X	O	O	X	O	X	X	O	X
	9 kmol/m <sup>3</sup> Hydrochloric acid (30%)	X	O	O	X	O	X	X	O	X
	10% Hydrofluoric acid	O	O	O	X	O	O	X	X	X
	1 kmol/m <sup>3</sup> Nitric acid (5%)	X	O	O	O	O	O	X	O	O
	4 kmol/m <sup>3</sup> Nitric acid (20%)	X	O	O	X	O	X	X	O	O
	10% Phosphoric acid	O	O	O	O	O	*	X	O	O
	1 kmol/m <sup>3</sup> Sulfuric acid (5%)	X	O	O	O	O	O	O	O	O
4 kmol/m <sup>3</sup> Sulfuric acid (20%)	X	O	O	X	O	X	X	O	X	
ALKALIS	2.5 kmol/m <sup>3</sup> Sodium hydroxide (10%)	X	O	O	X	O	X	X	O	X
	2 kmol/m <sup>3</sup> Potassium hydroxide (10%)	X	O	O	X	O	X	X	O	X
	15 kmol/m <sup>3</sup> Aqueous ammonia (28%)	O	O	O	X	O	X	X	O	O
ALCOHOLS	Methyl alcohol	O	O	O	O	O	*	*	O	O
	Ethyl alcohol	O	O	O	O	O	O	O	O	O
	n-Propyl alcohol	O	O	O	O	O	O	O	O	O
	n-Butyl alcohol	O	O	O	O	O	O	O	O	O
ETHERS	Dioxane	X	X	O	X	O	X	X	X	X
	Tetrahydrofuran (THF)	X	X	X	X	X	X	X	X	X
	Ethyl ether	X	X	X	X	X	X	X	X	X
ESTERS	Amyl acetate	X	X	X	X	X	X	X	X	X
	Methyl acetate	X	X	O	X	O	O	O	O	X
	Ethyl acetate	X	X	O	X	O	*	X	O	X
	Butyl acetate	X	X	O	X	O	O	X	O	X
KETONES	Acetone	X	X	O	X	O	X	X	X	X
	Methyl ethyl ketone (MEK)	X	X	O	X	O	X	X	X	X
	Methyl isobutyl ketone (MIBK)	O	X	O	O	O	X	X	X	X
HYDROCARBONS	n-Hexane	X	X	X	X	X	X	X	X	X
	Benzene	X	X	X	X	X	X	X	X	X
	Toluene	X	X	*	*	*	*	X	X	X
	Xylene	X	X	*	*	*	O	X	*	X
HALOGENATED HYDROCARBONS	Chloroform	X	X	X	X	X	X	X	X	X
	Carbon tetrachloride	*	-	*	*	*	*	X	*	X
	Freon (TMC)	X	X	*	X	*	-	-	X	X
	Methylene chloride	X	X	X	X	X	X	X	X	X
	Trichloroethylene	X	X	X	X	X	X	X	X	X
	Trichloroethane	X	X	O	O	O	*	X	O	X
AMINES	Dimethyl formamide	X	X	O	X	O	X	X	O	X

Continued on next page

**CHEMICAL COMPATIBILITY – CARTRIDGES (CONTINUED)**

Chemicals		TCR	TCS TCS-G TCS-E	TCF TCFH	TCY TCYE	TCP TCPE TCPD	TC	TC (SUS type with NBR Gasket)	TCG	TCG-R (NBR Gasket)
ALDEHYDES	35% Formaldehyde	○	○	○	○	○	○	○	○	○
CELLOSOLVES	Acetic cellosolve	✕	✕	○	✕	○	*	*	○	✕
MISCELLANEOUS	Acetonitrile	✕	✕	○	✕	○	✕	✕	✕	✕
	Pyridine	✕	✕	○	✕	○	✕	✕	○	✕
	6% Sodium hypochlorite	✕	✕	○	✕	○	✕	✕	○	○
	Ferric chloride	○	○	○	○	○	✕	✕	○	✕
	Copper sulfate	○	○	○	○	○	*	✕	○	○
	Mineral oil	○	○	○	○	✕	✕	✕	○	○
	Salt water	○	○	○	○	○	○	✕	○	○
	10% Hydrogen peroxide	○	○	○	*	○	○	○	○	○

○ – Recommended

\* – Limited resistance

✕ – Not recommended

– – Data not available

## CHEMICAL COMPATIBILITY – GASKETS / O-RINGS

Chemicals		EPR EPDM	SILICONE	NBR	CHLOROPRENE	FPM	PTFE	FEP Encap- sulated
ACIDS	20% Acetic acid	O	O	*	*	O	O	O
	10% Chromic acid	*	*	X	X	*	O	O
	3 kmol/m <sup>3</sup> Hydrochloric acid (10%)	O	O	O	O	O	O	O
	9 kmol/m <sup>3</sup> Hydrochloric acid (30%)	O	X	*	*	O	O	O
	10% Hydrofluoric acid	*	X	X	O	*	O	O
	1 kmol/m <sup>3</sup> Nitric acid (5%)	O	O	X	*	O	O	O
	4 kmol/m <sup>3</sup> Nitric acid (20%)	X	X	X	X	O	O	O
	10% Phosphoric acid	O	O	O	O	O	O	O
	1 kmol/m <sup>3</sup> Sulfuric acid (5%)	O	O	O	O	O	O	O
4 kmol/m <sup>3</sup> Sulfuric acid (20%)	O	O	O	O	O	O	O	
ALKALIS	2.5 kmol/m <sup>3</sup> Sodium hydroxide (10%)	O	X	O	O	O	O	O
	2 kmol/m <sup>3</sup> Potassium hydroxide (20%)	O	*	O	O	O	O	O
	15 kmol/m <sup>3</sup> Aqueous ammonia (28%)	O	O	X	O	O	O	O
ALCOHOLS	Methyl alcohol	O	O	X	O	*	O	O
	Ethyl alcohol	O	O	*	O	O	O	O
	n-Propyl alcohol	O	O	*	O	O	O	O
	n-Butyl alcohol	O	O	X	*	O	O	O
ETHERS	Dioxane	*	*	X	X	X	O	O
	Tetrahydrofuran (THF)	X	X	X	X	X	O	O
	Ethyl ether	X	X	X	X	X	O	O
ESTERS	Amyl acetate	*	X	X	X	X	O	O
	Methyl acetate	O	*	X	X	X	O	O
	Ethyl acetate	*	*	X	X	X	O	O
	Butyl acetate	*	X	X	X	X	O	O
KETONES	Acetone	O	*	X	X	X	O	O
	Methyl ethyl ketone (MEK)	*	*	X	X	X	O	O
	Methyl isobutyl ketone (MIBK)	X	O	X	X	X	O	O
HYDROCARBONS	n-Hexane	X	X	O	*	O	O	O
	Benzene	X	*	X	X	O	O	O
	Toluene	X	X	X	X	O	*	*
	Xylene	X	X	X	X	O	O	O
HALOGENATED HYDROCARBONS	Chloroform	X	X	X	X	O	*	*
	Carbon tetrachloride	X	X	X	X	O	O	O
	Freon (TMC)	-	-	X	-	-	O	O
	Methylene chloride	X	X	X	X	O	O	O
	Trichloroethylene	X	X	X	X	O	O	O
	Trichloroethane	X	X	X	X	O	O	O
AMINES	Dimethyl formamide	O	O	X	X	X	O	O
ALDEHYDES	35% Formaldehyde	O	O	O	O	O	O	O
CELLOSOLVES	Acetic cellosolve	*	O	X	X	X	O	O
MISCELLANEOUS	Acetonitrile	O	X	X	O	X	O	O
	Pyridine	X	X	X	X	X	O	O
	6% Sodium hypochlorite	O	X	*	O	O	O	O
	Ferric chloride	O	O	O	O	*	O	O
	Copper sulfate	O	O	O	O	O	O	O
	Mineral oil	X	*	O	O	O	O	O
	Salt water	O	O	O	O	O	O	O
	10% Hydrogen peroxide	*	O	X	*	O	O	O

O – Recommended

\* – Limited resistance

X – Not recommended

- – Data not available

## Sterile Membrane Cross Reference Conversion Guide

Advantec	Description	Millipore	Whatman	Pall	Catalog Page
A020H047A	White grid	GSWG 047 S1	7187 114	-	19
A045D047A	White grid	HAWG 047 S0	-	63077	19
A045F047A	White grid	HAWG 047 S2	7141 104	-	19
A045H047A	White grid	HAWG 047 S1	7141 114	66068, 66278	19
A045H047W	White grid	HAWG 047 S1	7141 114	66068, 66278	19
A065F047A	White grid	HCWG 047 S4	-	-	19
A065H047A	White grid	HCWG 047 S1	-	66426	19
A045R047A	Black grid	HABG 047 S1	7153 104	66378	20
A080R047A	Black grid	AABG 047 S1	-	-	20
A045W047A	Green grid	-	7155 104	66379	20

See individual listings for packaging configurations.

## Glass, Quartz, and Paper Cross Reference Conversion Guide

Advantec	Millipore	Whatman	ex-Schleicher & Schuell	Pall	Fisher	Ahlstrom	Catalog page
GA-55	APFA	GF/A	31	-	09-804-55A	111	30
GF-75	GFCP	GF/F	20	-	-	151	30
GB-100R	AP40	EPM 2000	1HV	A/E (Air)	-	-	30
GB-140	APFB	GF/B	32	-	09-804-55B	121	30
GC-50	AP40/APFC	GF/C	30/25	A/E (Water)	09-804-55C	131	30
GC-90	AP15	-	-	-	-	-	30
GD-120	APFD	GF/D	40	-	09-804-55D	141	30
GS-25	AP20	-	-	-	-	164	30
QR-100	-	QM-A	-	Micro Quartz	-	-	30
No. 1	FP105	4	410 or 1450cv	-	09-795F	631	24
No. 101	FP115	91	-	-	09-790-12F	-	24
No. 131	FP102	3	597	-	09-803-6G	238	24
No. 2	-	-	604	-	09-801-E	601	24
No. 231	FP104	2	-	-	-	-	24
No. 232	FP102	6	-	-	-	642	24
No. 235	-	5	-	-	09-803-5F	610	24

Comparisons of glass fiber filters are for those with closest similarity. Exact counterparts do not exist due to the nature of the depth type filter matrix.