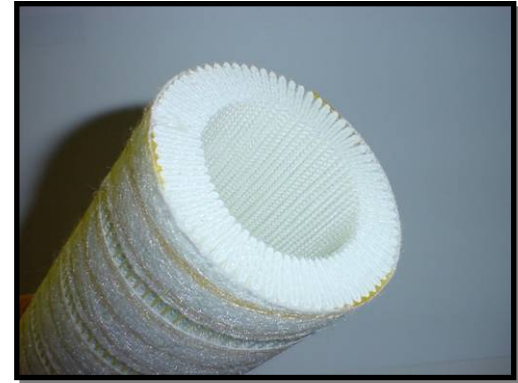


# Filter Adhesives

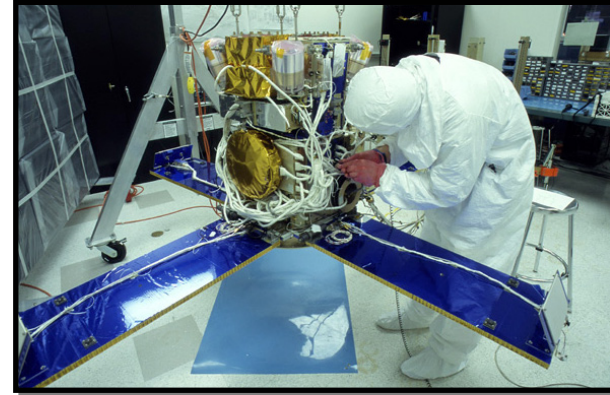


# Filter Adhesive Markets

## Air and Gas Filters



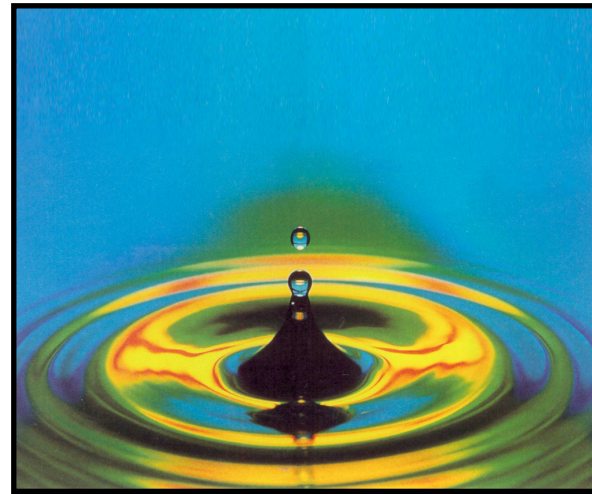
## HEPA Filters



## Chemical and Fluid Filters



## Reverse Osmosis Filters



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# ***Hardman Products and Services***

- **Value-Added Products**

**MONOPOXY<sup>®</sup>** one-component epoxies

**EPOCAP<sup>®</sup>** and **EPOWELD<sup>®</sup>** two-component epoxies

**KALEX<sup>®</sup>** Two-component polyurethanes

**ECLIPSE<sup>®</sup>** Light-cure systems

- **Technical Expertise**

- **Problem Solving Capabilities**



# Parts of a Filter

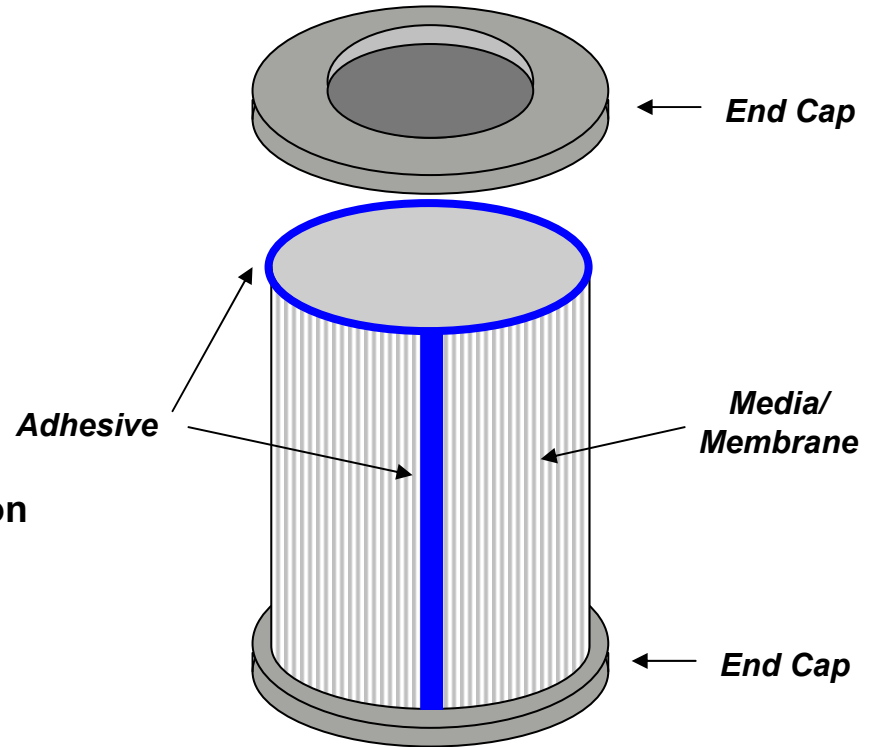
- **End Caps**

- Pre-formed
- Casted

- **Media**

- Fabric
- Membranes
  - Molecules & nano-sized separation

- **Adhesives**



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# *Functions of Filter Adhesives and Casting Compounds*



**End Cap Bonding**

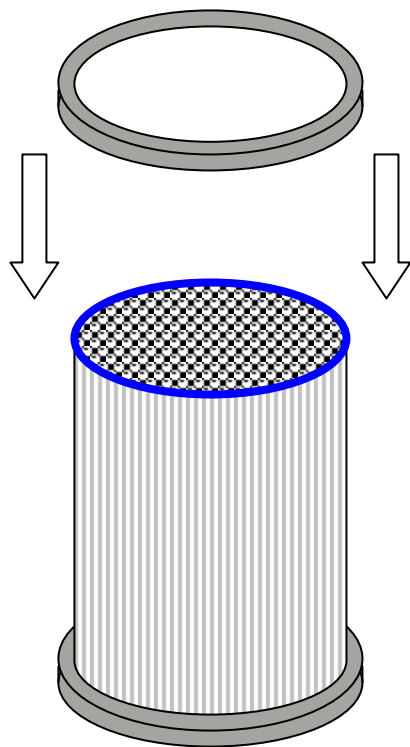


**End Cap Casting**

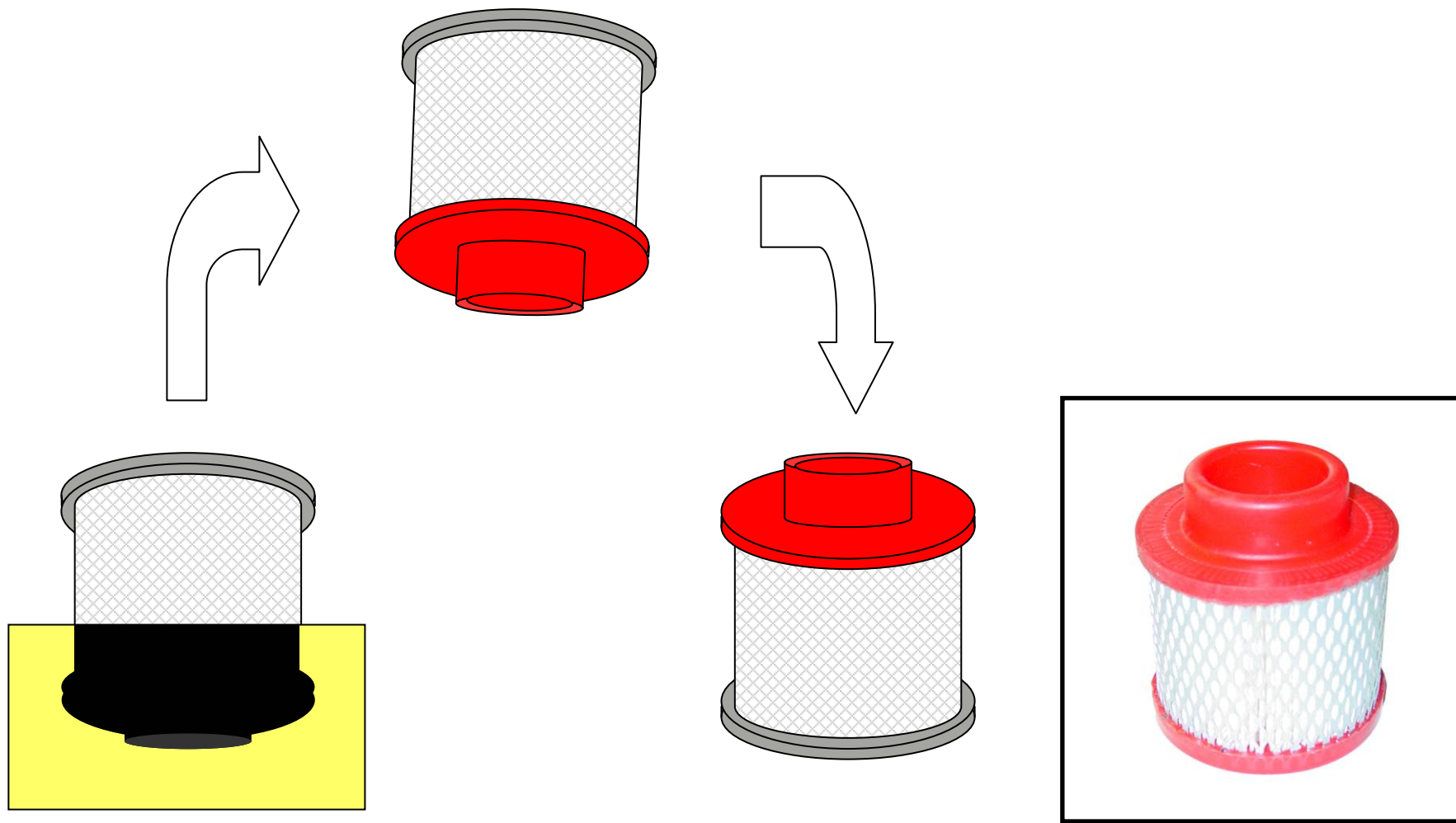


**Side Seam Sealing**

# End Cap Bonding

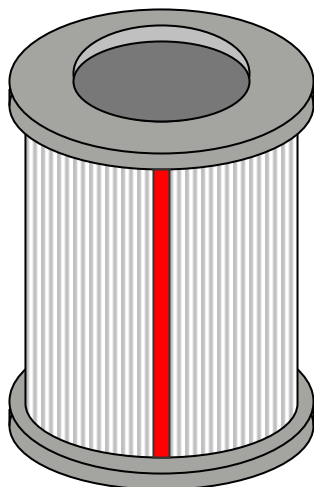
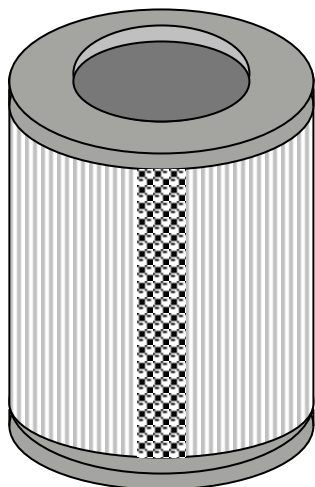


# End Cap Casting



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# Side Seam Sealing





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# Air and Gas Filter Adhesives



# Air and Gas Filters

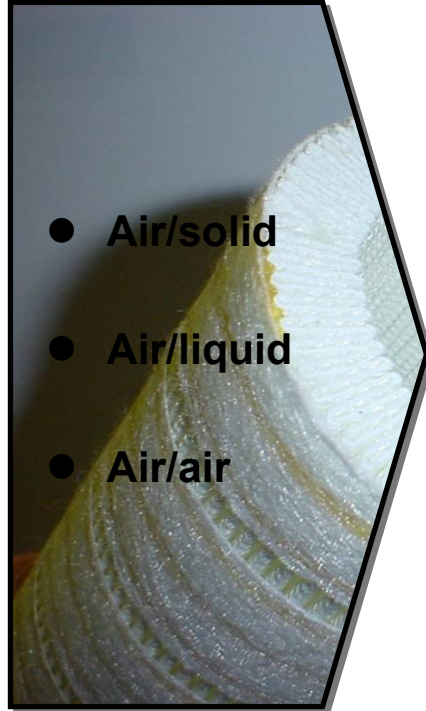
## Filter Types

- Air
- Gas Purification and Permeators
- Compressors and Separators
- Vacuum
- High Temperature



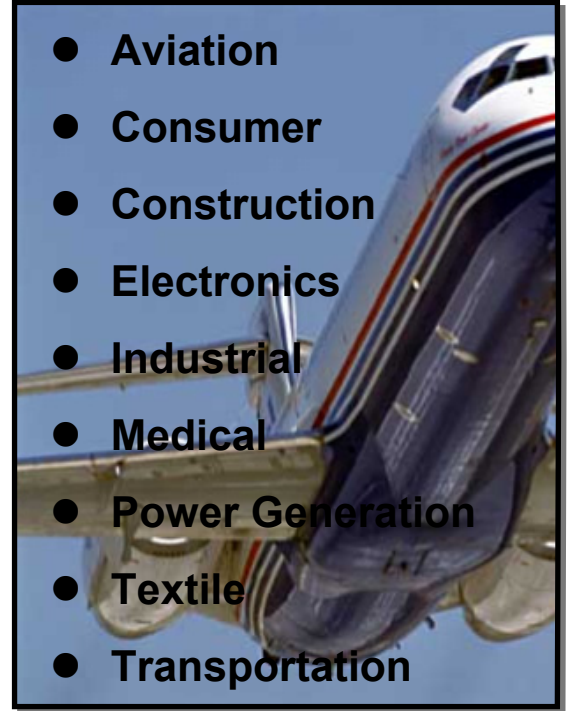
## For Filtering

- Air/solid
- Air/liquid
- Air/air



## Markets

- Aviation
- Consumer
- Construction
- Electronics
- Industrial
- Medical
- Power Generation
- Textile
- Transportation



# General Air Filters

*Air Filtration – separate air from air, liquid or solid*

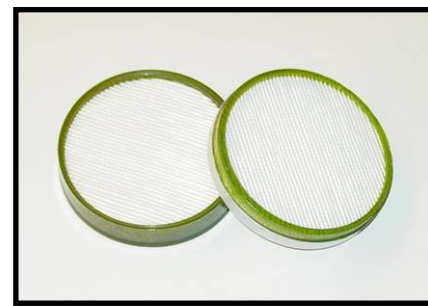
## ● Value-Added Products

**EPOCAP** two-component epoxies  
**KALEX** two-component urethanes  
**ECLIPSE** light-cure systems

- Excellent adhesion and mechanical properties
- Flame retardant products

## ● Typical Applications

- Spin casted filters (gas masks)
- Automotive air filters
- Aviation air filters
- Industrial air filters
- Commercial air filters
- Structural air filters






**KALEX 16605 sealing  
gas mask filters**



**Gas mask**

# General Air Filter Adhesives

Product	Application	Key Attribute 1	Key Attribute 2			
EPOCAP 16811A/B	General air filters	Good chemical resistance	Good penetration			●
EPOCAP 19414A /114B	Aviation air filters	FAR 25.853 flame retardency	Room temperature cure		●	●
KALEX 16605A/B	Spin casted filters (gasmasks)	Stable in water, mild acids, & solvents*	Flexible		●	
KALEX 16864A/B	General air filters	Tough and flexible	Fast cure and demolding time		●	
KALEX 17621A/16800B	Automotive air filters	Excellent Shear and peel strength	Faster version of KALEX 16805B		●	
KALEX 17621A/16805B	Automotive air filters	Excellent Shear and peel strength	Fast room temperature cure	●		
KALEX 17631A/B	Spin casted filters (gasmasks)	Similar to EPOCAP16605A/B	Tougher than EPOCAP 16605A/B, FDA		●	
KALEX 19410A/B	Industrial & commercial air filters	Flame retardent without phosphorus	Flexible			●
KALEX 19440A/B	General, Structural air filters	Excellent Shear and peel strength	Machinable, 1:1 mix ratio			●
KALEX 16855A/B	General air filters	Flame retardant				●
ECLIPSE 303	General air filters	UV-curable	Self leveling			●
ECLIPSE 703	General air filters	UV-curable	Semi-rigid, non sag			●

KEY :



= end cap bonding



= end cap casting



= side seam sealing



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# Gas Purification Filters and Permeators

*Gas Purification* – separate gas molecules

- **Gas Purification Process**

- Large scale: compress, distill as liquid, separate
- Small scale: compress, separate through permeators

- **Value-Added Products**

**EPOCAP** two-component epoxies








- High temperature tolerance to 150°C
- High pressure tolerance
- Oils and solvents

- **Typical Applications**

- Fuel tanks
- Laboratories: O<sub>2</sub>, N<sub>2</sub>
- Plants: CH<sub>4</sub>
- Medical: filters for emphysema



# Gas Purification Filter and Permeator Adhesives

Product	Application	Key Attribute 1	Key Attribute 2			
EPOCAP 17446A/B	Gas separation permeators	Low shrinkage, exotherm	Large castings			
EPOCAP 17451A/B	Hydrogen separation permeators	Rigid, excellent creep resistance	High temp. & pressure tolerance			
EPOCAP 17499A/17451B	Hydrogen separation permeators	Similar to EPOCAP 17451A/B	Longer work life than EPOCAP 17451A/B			
EPOCAP 3648A/101B	Tubular permeators	High temp. & pressure tolerance	Good tensile and flexural strength			



KEY :



= end cap bonding



= end cap casting



= side seam sealing

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# ***Compressors and Separators***

*Compressors* – separate compressed gas molecules

*Separators* – separate air molecules from fluids

- **Value-Added Products**




**EPOCAP** two-component epoxies  
**MONOPOXY** one-component epoxies

- Excellent chemical resistance
- Excellent resistance to oils, synthetic fluids
- High temperature tolerance
- High pressure tolerance




- **Typical Applications**

- Textiles: weaving of rugs
- Mining: air hammers, air powered equipment

# Compressor and Separator Adhesives

Product	Application	Key Attribute 1	Key Attribute 2			
EPOCAP 16620A /114B	Compressors & separators	Resistance to synthetic lubricants, oils	Room temperature cure	●		●
EPOCAP 19451A/25297B	Compressors & separators	Resistance to synthetic lubricants	Good thermal shock resistance	●		●
MONOPOXY 20283	General air filters in harsh environments	Excellent heat and chemical resistance	35,000 cPs, light gray	●		●
MONOPOXY 20408	General air filters in harsh environments	Excellent heat and chemical resistance	25,000 cPs, white, non yellowing	●		●
MONOPOXY 25333	General air filters in harsh environments	Excellent heat and chemical resistance	20,000 cPs, white (Improved 17613)	●		●
MONOPOXY 25340	General air filters in harsh environments	Excellent heat and chemical resistance	175,000 cPs, dark gray (Improved 20250)	●		●
MONOPOXY 25346	General air filters in harsh environments	Excellent heat and chemical resistance	Thixotropic, dark gray (Improved 20266)	●		●



KEY :  = end cap bonding     = end cap casting     = side seam sealing



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# ***Vacuum Filters***

*Vacuum Filtration – filter with the assist of a vacuum*

- **Value-Added Products**









**KALEX** two-component urethanes

- **Flame retardant systems**
- **Solvent, mild acid and oil resistant systems**
- **Room temperature to mild heat cure**

- **Typical Applications**

- **Manufacturing: collection particulates**
- **Consumer: vacuum cleaners**

# Vacuum Filter Adhesives

Product	Application	Key Attribute 1	Key Attribute 2			
<b>KALEX 25134A/B</b>	General air filters and permeators	Fast system for automated production	Low viscosity			
<b>KALEX 25170A/B</b>	General air filters and permeators	Thicker version of KALEX 25134A/B	Better oil & fuel res. than KALEX 25134A/B			
<b>KALEX 19410A/B</b>	Industrial & commercial air filters	Flame retardant without phosphorus	Flexible			
<b>KALEX 16605A/B</b>	Spin casted filters (gasmasks)	Stable in water, mild acids, & solvents*	Flexible			
<b>KALEX 17631A/B</b>	Spin casted filters (gasmasks)	Similar to KALEX16605A/B	Tougher than KALEX 16605A/B, FDA			



KEY :



= end cap bonding



= end cap casting



= side seam sealing

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# High Temperature Filters














*High Temperature* – harsh temperatures and environments

- Temperatures to 180°C
- Value-Added Products

**MONOPOXY** one-component epoxies

- High temperature and pressure tolerance
  - Excellent resistance to most solvents, fluids and chemicals
  - Excellent adhesion to metal and galvanized steel
  - Variety of viscosities and rheologies
- 
- Typical Applications
    - Affluent filters: dust, mining, kilns
    - Industrial compressed air filters
    - Automobile oil filters

# High Temperature Filter Adhesives

Product	Application	Key Attribute 1	Key Attribute 2			
<b>MONOPOXY 20283</b>	General air filters in harsh environments	Excellent heat and chemical resistance	35,000 cPs, light gray			
<b>MONOPOXY 20408</b>	General air filters in harsh environments	Excellent heat and chemical resistance	25,000 cPs, white, non yellowing			
<b>MONOPOXY 25333</b>	General air filters in harsh environments	Excellent heat and chemical resistance	20,000 cPs, white (Improved 17613)			
<b>MONOPOXY 25340</b>	General air filters in harsh environments	Excellent heat and chemical resistance	175,000 cPs, dark gray (Improved 20250)			
<b>MONOPOXY 25346</b>	General air filters in harsh environments	Excellent heat and chemical resistance	Thixotropic, dark gray (Improved 20266)			



KEY :



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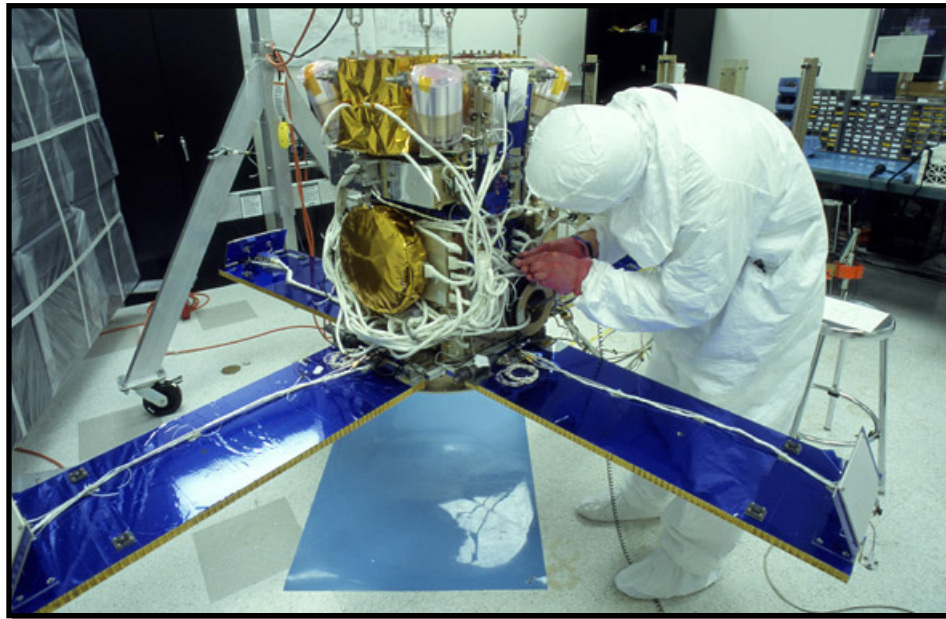


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# HEPA Filter Adhesives



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# HEPA Air Filters

**HEPA: High Efficiency Particle Arrestor**

- **Separates Particles (HEPA to Ulpa)**
  - From 95% @ 0.30 $\mu$  to 99.99+% @ 0.12  $\mu$
- **Value-Added Products**

**EPOCAP** two-component epoxies  
**KALEX** two-component urethanes

- **Excellent adhesion and mechanical properties**
- **Good chemical resistance**
- **Stable in water, mild acids and solvents**
- **Flame retardant products**
- **Variety of viscosities and rheologies**
- **Versatile room temperature or mild heat cure**

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# ***HEPA Filter Applications***

- **Typical HEPA Applications**

- **Commercial: vacuum cleaners**
- **Industrial: contamination control**
- **Asbestos abatement**
- **Food**













- **Clean Room Applications**

- **Semiconductors**
- **Electronics/disk drive**
- **Life sciences**
- **Biotech/biomed**
- **Medical: sterile environment**
- **Pharmaceutical: powder mixing**
- **Scientific/nuclear**



**Clean Room**

# HEPA Filter Adhesives

Product	Application	Key Attribute 1	Key Attribute 2			
EPOCAP 16811A/B	HEPA filters	Good chemical resistance	Good penetration			
KALEX 16605A/B	HEPA filters	Stable in water, mild acids, & solvents*	Green, flexible and fast curing			
KALEX 17631A/B	HEPA filters	Tougher than EPOCAP 16605A/B, FDA	1:1 system			
KALEX 19410A/B	HEPA, critical clean room filters	100% solids, no phosphorus	Low viscosity, fast curing			
KALEX 19454 M-1 A/B	HEPA, economical clean room filters	Versatile RT or heat cure	Low viscosity			
KALEX 25134A/B	HEPA filters	Fast system for automated production	Low viscosity			
KALEX 25170A/B	HEPA filters	Thicker version of KALEX 25134A/B	Better oil & fuel res. than KALEX 25134A/B			
KALEX 16855A/B	HEPA filters	Flame retardant	Good adhesion to galvanized metal			



KEY :



= end cap bonding



= end cap casting



= side seam sealing



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# Chemical and Fluid Filter Adhesives



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# ***Chemical and Fluid Filters***

## ● **Filtration for:**

- **Solvents**
- **Hydrocarbons**
- **Oils**
- **Gasoline**
- **Aviation Fuel Fluid**
- **Coolants**
- **High temperatures**
- **Water**

## ● **Typical Applications**

- **Chemical separation**
- **Hydrocarbon processing**
- **Automobile oil filters**
- **Automobile gasoline filters**
- **Aviation hydraulic fluid filters**
- **Equipment coolant systems**
- **Compressors**
- **Oil/water separators**

# Chemical and Fluid Filters

- Value-Added Products

**EPOCAP** two-component epoxies  
**MONOPOXY** one-component epoxies  
**KALEX** two-component urethane

- Variety of properties
- Variety of viscosities
- Excellent chemical resistance
- High temperature and pressure tolerance
- Good thermal shock resistance
- Low shrinkage
- Low creep
- Controlled penetration
- Fast gel times
- Long work life






Hydraulic Filters






Industrial Chemical Filters




# Chemical Filter Adhesives: Two-Component Epoxies

Product	Solvent	Hydrocarbon	Oil	Gasoline	Aviation Fuel Fluid	Hydraulic Fluid	Aviation Hyd. Fluid	Coolant	High temperature	Water	Key Attribute			
EPOCAP 13031A/79B	●	○	○	○	○	○	●	●	●	○	Low shrinkage. Creep, pressure & high T res.	●		
EPOCAP 14526A/B	●	●	●	●	○	●	●	●	●	●	Low shrinkage. Pressure & high T res.	●		
EPOCAP 16811A/B	○	●	●	●	○	○					Good penetration			●
EPOCAP 17446A/101B	●	●	●	●	●			●	●	●	Low shrinkage, exotherm. Large castings		●	
EPOCAP 17451A/B	●	●	●	●	●			●	●	●	Rigid. Excellent creep, high temp. & pressure res.		●	
EPOCAP 17499A/17451B	●	●	●	●	●			●	●	●	Longer work life than EPOCAP 17451A/B		●	
EPOCAP 19451A/25297B		○	●	○	○			●		○	Good thermal shock resistance	●		●
EPOCAP 20216A /EPOCURE 79B	●	●	●	●	○	●	●	●	●	●	Low shrinkage & fast gel time	●		
EPOCAP 25164A/101B	●	●	●	●	○	●		●	●	●	Low exotherm, long work life	●		



KEY :  = end cap bonding  = end cap casting  = side seam sealing

# Chemical Filter Adhesives: One-Component Epoxies

Product	Solvent	Hydrocarbon	Oil	Gasoline	Aviation Fuel Fluid	Hydraulic Fluid	Aviation Hyd. Fluid	Coolant	High temperature	Water	Key Attribute			
MONOPOXY 20283	●	●	●	●	●	●	●	●	●	●	35,000 cPs, light gray	●		●
MONOPOXY 20408	●	●	●	●	●	●	●	●	●	●	25,000 cPs, white, non yellowing	●		●
MONOPOXY 25333	●	●	●	●	●	●	●	●	●	●	20,000 cPs, white (Improved 17613)	●		●
MONOPOXY 25340	●	●	●	●	●	●	●	●	●	●	175,000 cPs, dark gray (Improved 20250)	●		●
MONOPOXY 25346	●	●	●	●	●	●	●	●	●	●	Thixotropic, dark gray (Improved 20266)	●		●



KEY :



= end cap bonding






= end cap casting



= side seam sealing

# Chemical Filter Adhesives: Two-Component Urethanes

Product	Solvent	Hydrocarbon	Oil	Gasoline	Aviation Fuel Fluid	Hydraulic Fluid	Aviation Hyd. Fluid	Coolant	High temperature	Water	Key Attribute			
KALEX 14536A/B		●	●	●	●	●			●	●	Low shrinkage, fast demolding time		●	
KALEX 25134A/B		○	●	○	○	●					Fast system for automated production		●	
KALEX 25170A/B		○	●	○	○						Thicker version of KALEX 25134A/B		●	



KEY :



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= end cap casting

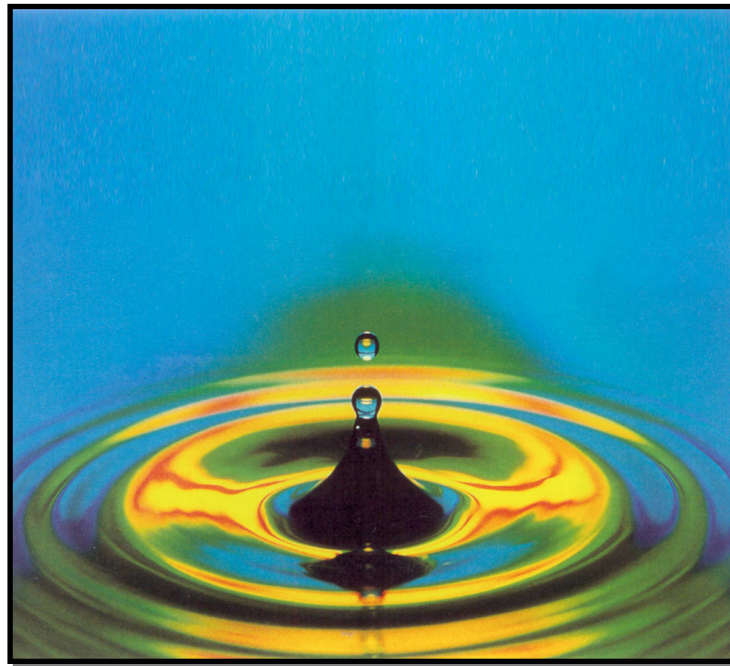


= side seam sealing

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# Reverse Osmosis Filter Adhesives



# Reverse Osmosis Filters

- Value-Added Products

**EPOCAP** two-component epoxies  
**EPOWELD** two-component epoxies  
**KALEX** two-component urethanes

- Excellent adhesion and mechanical properties
- FDA listed components
- Good chemical resistance
- Stable in water, mild acids and solvents
- Variety of viscosities and rheologies
- Versatile room temperature or mild heat cure

- Typical Applications

- Water Purification and desalination
- Wastewater treatment
- Chemical and biochemical processes






Reverse Osmosis Filter





# Reverse Osmosis Filter Adhesives

Product	Application	Key Attribute 1	Key Attribute 2			
EPOCAP 3648A (Black) /101B	Tubular RO filters	High tensile & flexural strength	High pressure and T resistance		●	
EPOCAP 3648A (Black) /25341B	Tubular RO filters	Low viscosity and long work life	Low exotherm and water resistance		●	
EPOCAP 3648A (Black) /25344B	Tubular and sheet RO filters				●	
EPOCAP 17446A/101B	Permeators	Low shrinkage, exotherm	Large castings.		●	
EPOCAP 17451A/B	Permeators	Rigid, excellent creep resistance	High temp. & pressure tolerance		●	
EPOCAP 25164A/101B	Tubular RO filters and permeators	Low exotherm & long work life	FDA Chapter 21 CFR 175 Part B		●	
EPOWELD 20348A/B	Tubular and sheet RO filters	Hard, rigid. High structural strength	FDA 175.105 and FDA 175.300		●	
EPOWELD 20362A/B	Tubular permeators	Thixotropic	FDA 175.300		●	
KALEX 16722A/B	Ultra, nano and RO filters	Hydrophobic, flexible	FDA 175.105 and FDA 175.300		●	
KALEX 17631A/B	Tubular RO filters	Flexible, fast curing	FDA Chapter 21 CFR 175 Part B		●	
KALEX 19417A/B	Ultra, nano and wet/dry RO filters	1:1 mix ratio	FDA 175.105 and FDA 175.300		●	
KALEX 19421A/19423B	Sheet RO filters	Hydrophobic. Excellent membrane wetting	FDA 175.105 and FDA 175.300		●	

KEY :



= end cap bonding



= end cap casting



= side seam sealing



# Filter Adhesives Selection Chart

Product	Air and Gas					HEPA		Chemical										R.O. & Permeator			
	Air	Gas Purification/Permeators	Compressors/Separators	Vacuum	High Temperature	HEPA	HEPA - Semiconductor	Solvent	Hydrocarbon	Oil	Gasoline	Aviation Fuel Fluid	Hydraulic Fluid	Aviation Hydraulic Fluid	Coolant	High Temperature	Water	Reverse Osmosis - Sheet	Reverse Osmosis - Tubular	Permeators	FDA
Two-Component Epoxy	EPOCAP 3648A (Black)/EPOCURE 101B	X			O			O	O	O	O	O		O	O	O	X	X	X	O	
	EPOCAP 3648A (Black)/EPOCURE25341B																X	X	X	O	
	EPOCAP 3648A (Black)/EPOCURE25344B																	X	X	X	O
	EPOCAP 13031A/EPOCURE 79B			O				X	O	O	O	O	X	X	X	X	O				
	EPOCAP 14526A/B	O			O			X	X	X	X	O	X	X	X	X	X				
	EPOCAP 16620A/EPOCURE114B	O		X				O	O	O	O	O		O	O	O					
	EPOCAP 16811A/B	X				X		O	X	X	X	O	O								
	EPOCAP 17446A/101B	O	X					X	X	X	X	X			X	X	X			X	
	EPOCAP 17451A/B		X					X	X	X	X	X			X	X	X			X	
	EPOCAP 17499A/EPOCAP 17451B		X					X	X	X	X	X			X	X	X			X	
	EPOCAP 19414A/EPOCURE114B	X														X	X				
	EPOCAP 19451A/EPOCURE 25297B	O		X	O		O		O	X	O	O			X		O				
	EPOCAP 20216A/EPOCURE 79B	O				O		X	X	X	X	O	X	X	X	X	X				
EPOCAP 20348A/B																	X	X		X	
EPOCAP 25164A/EPOCURE 101B	O	O			O		X	X	X	X	O	X		X	X	X			X	X	
EPOWELD 20348A/B																	X	X	X	O	
EPOWELD 20362A/B	O	O						O	O	O		O		O	O	X				O	
One-Component Epoxy	MONOPOXY 20283	O		X		X		X	X	X	X	X	X	X	X	X	X				
	MONOPOXY 20408	O		X		X		X	X	X	X	X	X	X	X	X	X				
	MONOPOXY 25333	O		X		X		X	X	X	X	X	X	X	X	X	X				
	MONOPOXY 25340	O		X		X		X	X	X	X	X	X	X	X	X	X				
	MONOPOXY 25346	O		X		X		X	X	X	X	X	X	X	X	X	X				
	Two-Component Polyurethane	KALEX 14536A/B	O				O		X	X	X	X	X				X	X			
KALEX 16605A/B		X			X		X											X		X	
KALEX 16722A/B		O			O		O										X			O	
KALEX 16864A/B		X			O		O										O				
KALEX 17621A/16800B		X						O	O	O	O										
KALEX 17621A/16805B		X						O	O	O	O										
KALEX 17631A/B		X			X		X										X		X	O	
KALEX 19410A/B		X			X		X	O													
KALEX 19417A/B		O															X	X		O	
KALEX 19421A/19423B		O															X	X		O	
KALEX 19440A/B		X			O		O														
KALEX 19454 M-1 A/B		O			O		X	O													
KALEX 25134A/B		O			X		X	O		O	X	O	O								
KALEX 25170A/B	O			X		X	O		O	X	O	O									
KALEX 25342A/B	X			O		X	O														
UV-Curable Polymers	ECLIPSE 303	X																			
	ECLIPSE 321	O			O	O		O	O			O	O								
	ECLIPSE 322	O			O	O		O	O			O	O								
	ECLIPSE 323	O			O	O		O	O			O	O								
	ECLIPSE 703	X																			

