



Pall Corporation

AccuSep™ Inorganic Membranes

The Possibilities are Endless

Filtration. Separation. Solution.SM

AccuSep™ Inorganic Membranes - New From Pall Corporation

Dr Pall's invention to manufacture porous stainless steel medium by sintering stainless steel powder without the need for resin binders or compression was the foundation on which Pall Corporation was built. Pall's continued leadership in porous inorganic materials manufacturing has now resulted in the commercialization of Pall's new AccuSep™ inorganic membrane product line.

You no longer have to settle for high priced, pressed sintered metal media or brittle ceramic membrane technology for your higher temperature or aggressive service filtration and separation applications. AccuSep Membranes, developed under license with Bechtel Jacobs Company LLC utilizing US Department of Energy (DOE) Inorganic Membrane technology, address the industry's long-standing need for higher-performance, more-economical inorganic membranes.

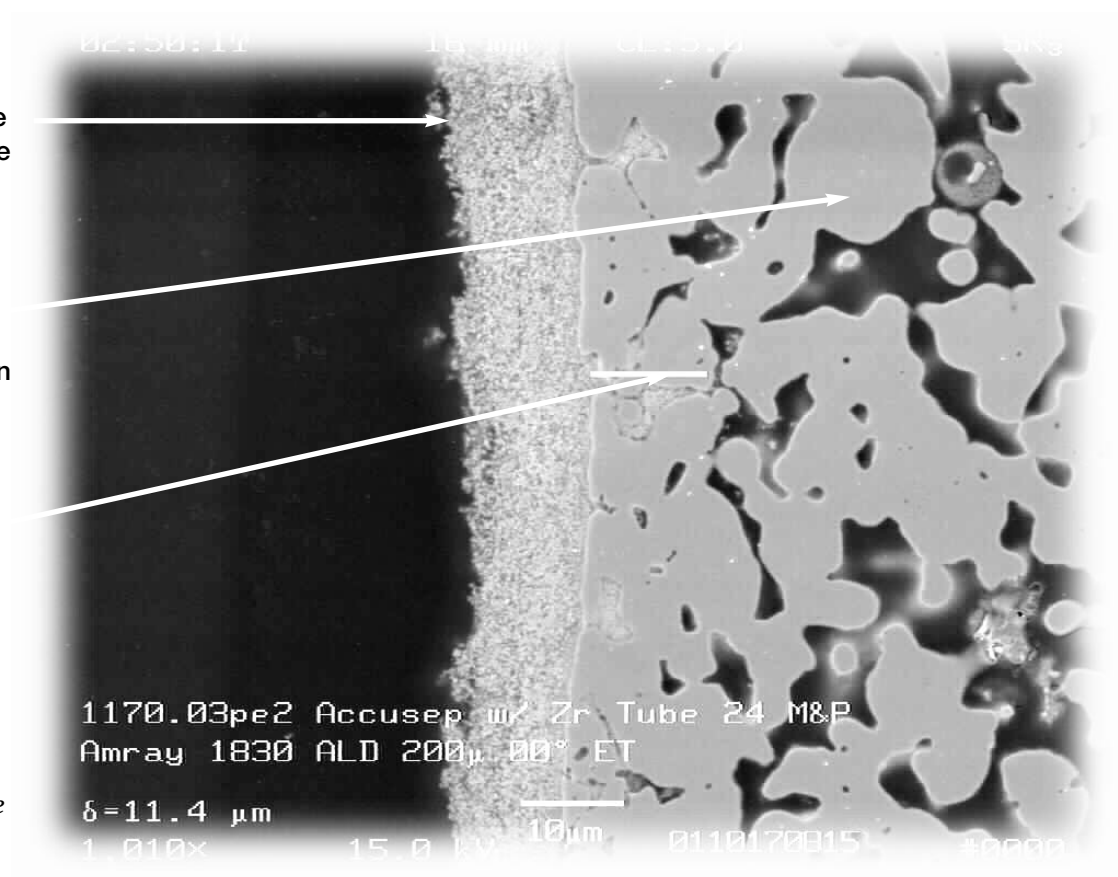
10 micron thick
.1 micron pore size
Zirconia membrane

316 L AccuSep
support tube

42% void, 2 micron
retention

10 micron depth
of penetration

Figure 1
Photomicrograph
illustrating
Zirconia coated
stainless steel
AccuSep membrane



How Is AccuSep Technology Unique?

Figure 2

Yttria stabilized
Zirconia deposited
on Pall AccuSep
tubular element

Photo courtesy
of Trans Ionics
Corporation



- Microfiltration
- Nanofiltration
- Ultrafiltration
- Gas/Gas Separation

Most Economical Choice

Because they are produced in a fully automated and high volume fashion, AccuSep membranes are extremely economical to produce. This will allow the industry to adopt inorganic membranes where they were previously considered not cost effective.

Uniform Pore Structure

A narrow pore size distribution is critical for most membrane separations. Figure 3 illustrates the tight pore size distribution of a relatively coarse grade AccuSep Membrane.

AccuSep Membranes are unique in the following three ways:

Widest Array of Engineered Pore Structures

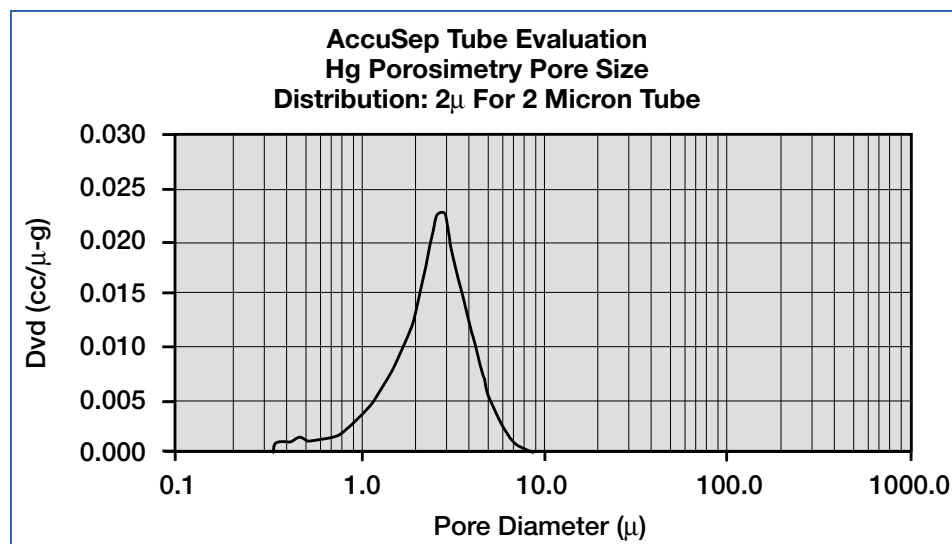
Using this proprietary technology, an AccuSep Membrane can be prepared where the mean pore size is in the Angstrom range or coarser. Therefore AccuSep membranes can be applied for use in:

The permeability of AccuSep Membranes can also be tailored for specific applications.

When optimized as a filtration device, an AccuSep Membrane is up to 3 times more permeable than a conventional sintered porous metal medium with a similar removal efficiency.

Figure 3

Pore size distribution - 2 micron
AccuSep filter



Commercially Available AccuSep Products

AccuSep filter elements are available today as tubular microfilters. They are available in the following diameters, grades and materials of construction.

Standard Nominal Outer Diameters:

1/2 inch (13 mm) and 3/4 inch (19 mm)

Standard Lengths: Up to 8.0 ft (2.4 m) long.

These are the first of many AccuSep products that will be commercialized. The other AccuSep products now under development span the entire filtration and separations spectrum.

Table 1.
Commercially Available AccuSep Membrane

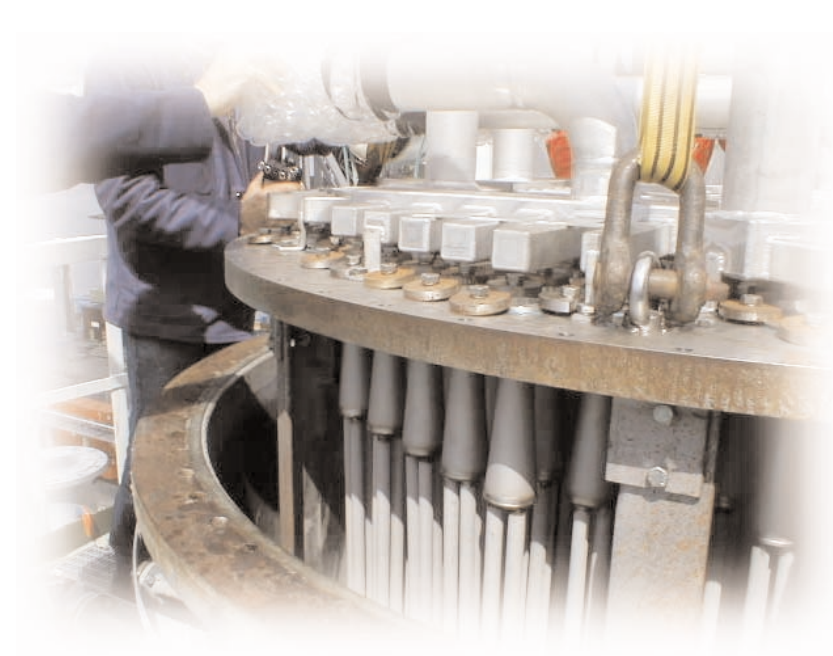
Available Alloys Micron	Available Liquid Rating In Microns at 99.98% Removal Efficiency ⁽¹⁾	Available Gas Rating In Microns >99.99% Removal Based Upon Extrapolation of Liquid Removal Rating
304L Stainless Steel 310 SC Stainless 316L Stainless Steel Hastelloy X Inconel 600	5.0 2.0	0.5 0.3
Nickel		0.003 ⁽²⁾
316L Stainless Steel	0.8	
316L Stainless Steel/Zirconia Hastelloy X/Zirconia	0.1 ⁽³⁾	

1. Liquid removal ratings are based upon modified F2 test method and actual particle count data.

2. 10⁹ removal at 0.003 microns based upon a NaCl aerosol test.

3. 0.1 micron mean pore size.

Figure 4
Pall jet pulse blowback system utilizing Accusep tubular filters. Filter tubesheet with filters being installed into the pressure vessel.



What Formats and Materials of Construction Are Possible?

AccuSep elements are only available in a seamless, tubular format. This format allows AccuSep™ elements to be packaged into systems with extremely small footprints while providing high surface area.

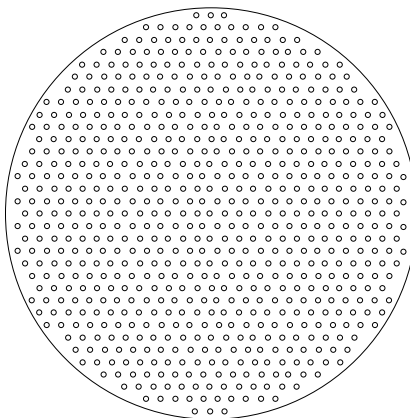
Raw materials can be most any inorganic material available in powder form.

In contrast to organic membranes, inorganic membranes can be deployed for high temperature and aggressive chemical applications. Separation processes can be significantly improved by operating at the extreme temperature and pressure ranges that these inorganic membranes can withstand.

Figure 5
AccuSep Technology allows a more economical packing density

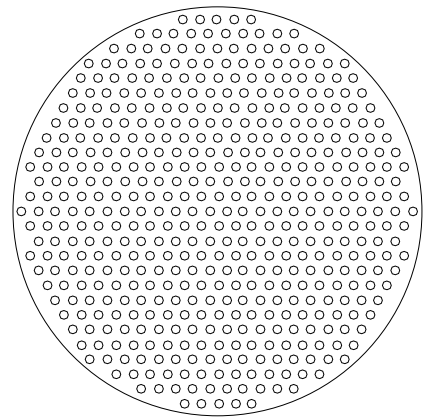
Comparison: 36 inch Diameter Vessel

Filter Area - 552 sq ft/51.3 sq meter
36 inch/91cm Vessel Diameter
0.50 inch/12.7mm O.D. AccuSep Filters



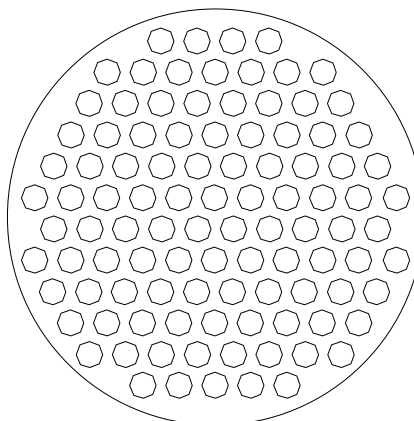
703 AccuSep Tubes
0.75 inch/1.9cm Spacing

Filter Area - 378 sq ft/35.1 sq meter
36 inch/91cm Vessel Diameter
0.75 inch/19.05mm O.D. AccuSep Filters



482 AccuSep Filters
0.75 inch/1.9cm Spacing

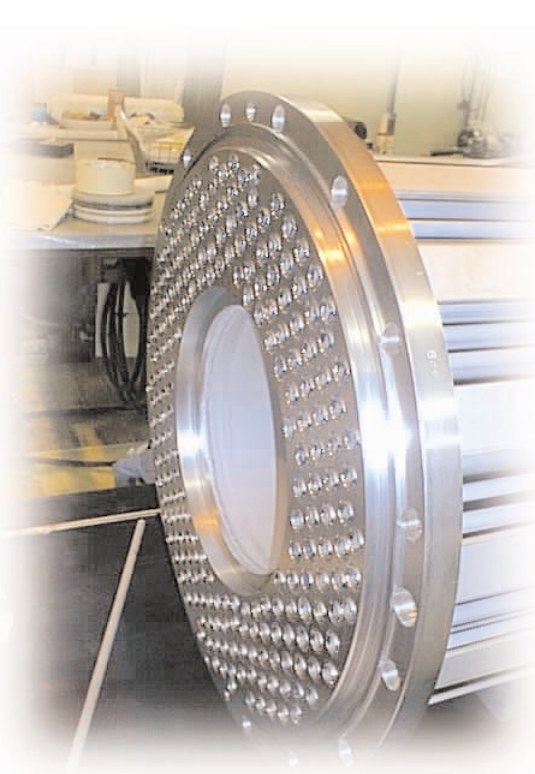
Filter Area - 254 sq ft/23.6 sq Meter
36 inch/91cm Vessel Diameter
2.375 inch/60.3mm O.D. Traditional Filters



102 Traditional Filters
0.75 inch/1.9cm Spacing

AccuSep Membranes - An Enabling Product Platform

Figure 6
*Pall AccuSep
microfiltration crossflow
bundle under
construction*



AccuSep Inorganic Membranes can revolutionize the purification and separation processes found within the refining, petrochemical, food, beverage and power generation industries.

Pall has undertaken several joint development programs with universities, government labs, and industry for:

- Hydrogen Separation/Recovery
- Carbon Dioxide Removal
- Olefin Recovery from Paraffins
- Oxygen/Nitrogen Separation

AccuSep membranes are so versatile, they provide the ideal platform for creating unique separation and purification process.

How Can the Current Products Be Deployed?

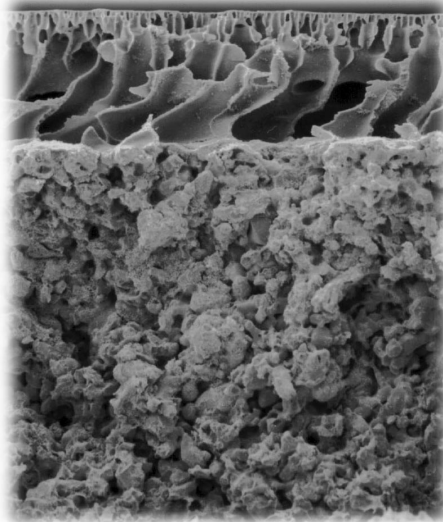
The current AccuSep™ microfiltration tubes can be deployed as:

Typical Use	Configuration
Cross flow element OEM Product Membrane support for additional functional coatings	Single Tube, Double Open Ended
Backwashable filter element	Single/multi-tube, single open ended, tube flare connection on the open end
Blowback filter element	Single/multi tube assembly, single open ended, with a blowback venturi joined to the open end Retrofits existing porous metal or polymeric bag house filters
Filter element	Multi-tube or larger assembly, double open ended, gasket seals
Filter element	Multi-tube or larger assembly, single open ended, threaded open end

Figure 7

Zeolite membrane deposited on 0.8 micron AccuSep tubular membranes

SEM photos courtesy of Noble/Falconer Group, Dept. of Chemical Engineering, University of Colorado.

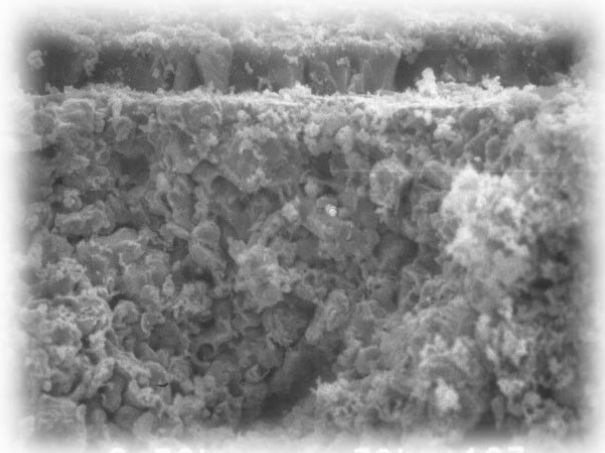


AccuSep
Membrane

Figure 8

Accusep metallic substrate coated with high temperature polymeric membrane

AccuSep
Membrane



Choose Pall as Your Filtration and Separation Provider

When you select Pall as your filtration and separation technology provider, you are selecting a company with a rich history of technological innovation.

Technological leadership and Pall Corporation have been synonymous since our founding by Dr. David Pall, who was awarded the 1990 American National Medal of Technology. Today, our global network of research specialists continue to deliver

innovative products and filtration and separations solutions worldwide.

Premier Provider Of Engineered Porous Materials

No other company offers such a wide array of porous polymeric and inorganic materials as Pall. This enables us to select or create the optimal filtration and separation product for your application-without bias.

Figure 9
AccuSep membrane coated with palladium.

Photo courtesy of
Worcester Polytechnic
Institute

Broad Technical Resources

Throughout its existence, Pall has invested heavily in research and development. This investment has paid off - not only for us, but for our customers as well.



Applications Expertise

As the industry's largest filtration and separations company, we are in a position to leverage our applications expertise to develop the most innovative solutions.

Integrated Manufacturing

At Pall, we're involved in every aspect of materials engineering, including the selection of raw materials, creation of the membrane structure, and proprietary surface modifications. We also have pressure vessel fabrication and system assembly expertise.

Worldwide Support

Pall operates manufacturing sites around the world in North America, Europe, and Asia. This ensures timely and cost effective supply of Pall filtration and separation products.

Pall AccuSep Inorganic Membranes: The Measurable Differences

Now is the time to take advantage of Pall AccuSep Membranes as the tool to revamp your filtration and separation processes. Call us at 1.888.873.7255 to discuss how Pall AccuSep technology can be deployed within your process.

You can also complete and return the attached reply card or contact us on the web at www.pall.com/accusep.



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Filtration. Separation. Solution.SM

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