



Pall Corporation

# Pall Backwash Filter Systems

For Solid/Liquid Separation

*Filtration. Separation. Solution.<sup>SM</sup>*

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## or solid/liquid separation,

traditional equipment such as settling tanks, precipitators, and belt and drum filters has failed to meet today's industrial challenges. However, modern advances in filtration have proved to be both efficient and economical in filling what once was a void. A "systems approach" to filtration is being adopted across a wide spectrum of industries, that takes into account stricter environmental regulations, the increasing emphasis on efficiency and economy, the push for finer and finer particle removal, and the need for greater safety standards to protect employees and equipment.

### **About Pall Corporation**

For more than 60 years, Pall Corporation has been solving complex contamination problems for diverse customers around the world. With revenues of more than \$2 billion, Pall is the largest and most diverse filtration, separations, and purifications company in the world. Our products and services allow customers to meet regulatory requirements and increase output while reducing total cost of ownership. Our enabling technologies help make customers' products better, safer, and even possible. Our separation technologies include: microfiltration, blowback, backwash, ultrafiltration, nanofiltration, reverse osmosis purification, oil/water separation, tangential flow and cross flow, and coalescer systems.

### **A Commitment to Customer Support and Product Excellence**

Pall recognizes that each application is unique and requires careful planning, layout, design, and testing prior to delivery. During the development phase, we work closely with our customers to understand their requirements. After installation, we monitor start-up to detect any possible problems and if detected, we resolve them quickly to get up to full-scale production speed in a hurry. We remain on standby to assist our customers should the need arise.

With offices in more than 30 countries, we are well-positioned to provide assistance to customers on the local level, as well as offer broad-based, worldwide support when needed. At the core of our support network is our Scientific and Laboratory Services (SLS) Department, an extensive global network of scientists and engineers who are experts in their field.

## Operation of the Pall Backwash Filter System

Vessel design, tubesheet assembly, piping, instrumentation, and valve selection all play an important role in the smooth functioning of the backwash filter equipment. Backwash is a central feature of Pall's filtration systems. Efficiency, economy, and ecology can be realized through the system's self-cleaning properties offered by backwash.

A porous filter medium, metallic, polymeric, ceramic, or carbon with suitable pore size, will efficiently collect solids on its surface, where they form a permeable cake. During backwash, at a predetermined filter pressure drop and/or time interval, a reverse flow of the system will be initiated, discharging the collected solids to recovery. The system will then be returned to full forward flow. The pressure drop just after backwash will remain essentially constant through backwash cycles.



*Pall backwash filter system in operation*

# Operation of the Pall Backwash Filter System

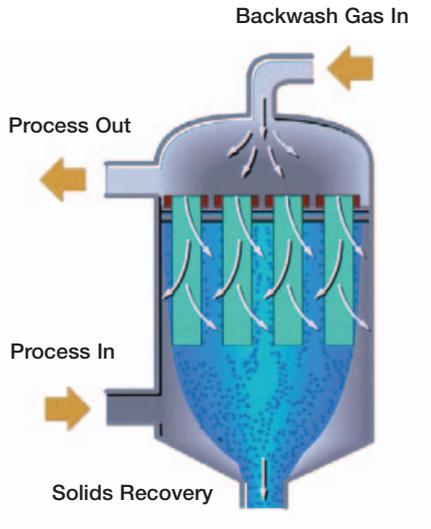


Figure 1. Gas assist method

## Gas Assist Method

The gas assist method is used with simplex or multiple-vessel systems. When process flow rates are high, or continuous, uninterrupted flow is required and multiple vessel systems are deployed. For backwash, one vessel is isolated and the downstream side of the vessel is pressurized with a controlled quantity of filtered air or other suitable gas (see Figure 1). The vessel drain port is rapidly opened, resulting in a hydraulic pulse that “bumps” the collected solids from the filter surface. Forward flow is restored to this vessel, and the remaining filter vessels are backwashed sequentially.

## Solids Concentration from Backwash Fluids

Whether the solids removed during backwash are waste products or considered valuable, further concentration of these solids in the backwash fluid facilitates either recovery or disposal. Pall has developed several practical methods of concentrating the solids discharged from self-cleaning filters during the backwash phase of the system's operation. The appropriate method depends on the unique requirements of the customer's process. Concentration ranges from a slurry up to dry cake discharge.

## Liquid Recovery

Generally, in a backwash cycle the volume of about one to two filter vessels is disposed of or recycled to somewhere else in the system. In many processes, however, the filtrate is too valuable for even a small quantity to be disposed of. Pall has developed a few simple methods to drain and recover such valuable liquids. One method, for example, is to utilize one or more scavenger filter cartridges near the center of the filter vessel. The scavenger elements help drain the liquid just prior to the backwashing stage. This technique is also useful for minimizing the volume of filtrate that is considered hazardous (see Figure 2).

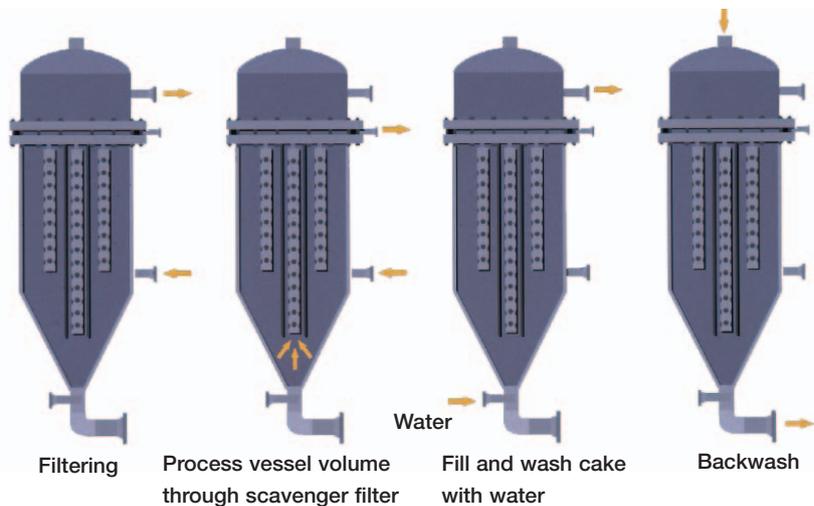


Figure 2. Liquid recovery from backwash fluids

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# The Benefits of Pall Backwash Filtration Systems

Pall backwash filtration systems are in operation all over the world, in a wide variety of applications. A partial list of proven benefits includes:

- High-efficiency operation (99.9%) improves product quality, maximizes solids recovery, and helps protect equipment, employees, and the environment
- The high temperature, pressure, and solids content that the systems can handle allows them to operate in a wide range of applications
- Our rugged products ensure process integrity and minimize maintenance and replacement costs
- Every system can be fully automated, for reduced labor and consistent performance; systems may also be configured for remote monitoring
- There are no moving parts, which reduces energy consumption, noise, and maintenance
- The compact size of even the most complex, high-volume backwash system minimizes product hold-up, backwash fluid volume, space requirements, and installation costs
- Every system, including filter media and assembly material, is designed to meet the requirements of a single specific customer. This degree of customization requires an understanding of the entire process, yielding more efficient operation, less waste, conformance to local environmental regulations, and longer filter service life.

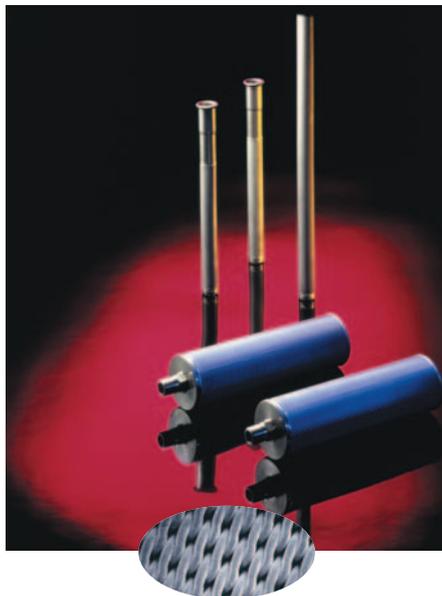


*Pall backwash filtration system*

# Pall Filters: The Heart of the Backwash System

As the actual filtering agent, the Pall filter or septum is the most important component of the backwash system. For backwash applications, Pall offers the broadest array of proprietary metal, synthetic fiber, and ceramic media in the industry. Depending upon your particular application, Pall has a medium and system that's right for you. The following Pall products are appropriate for backwash applications (see pages 8 and 9 for technical data).

## Pall Rigimesh® Stainless Steel Woven Wire Mesh Filters



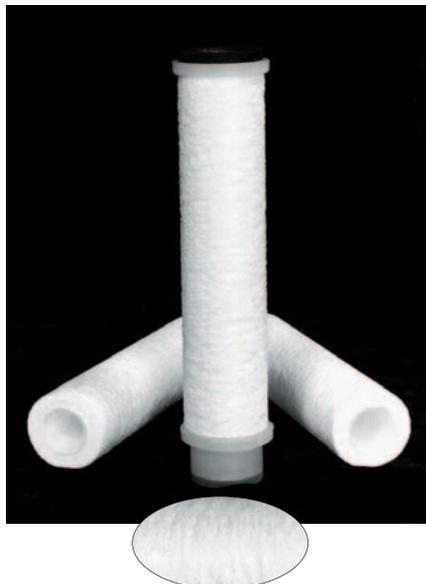
A process pioneered and patented by Pall Corporation permits the use of finer diameter wires in the manufacturing of the Rigimesh® stainless steel medium. This results in low pressure drop, more holes per unit area, and better dirt-holding capacity than that of any other woven metal filter. The medium is sintered for superior tensile, yield, shear, and fatigue strength, maintains a uniform pore size, and exhibits no media migration, even under high temperature and pressure. This medium is of particular value for handling oily waste.

## PSS® Series Stainless Steel Filters



The PSS® Series filter medium is composed of 316 low carbon stainless steel powder sintered together in an inert environment. The resulting fixed pore structure medium provides quantitative particle removal efficiency without media migration or particle unloading. The inherently high void volume of this medium offers low resistance to flow and high dirt-holding capacity. Additionally, these filters offer broad temperature and chemical compatibility with the ability to repeatedly clean the elements. PSS filters are used in a wide range of applications, especially aggressive environments where critical filtration levels are required.

## Hydro-Guard® R Series Filters with Cold Melt™ Technology



## PMM® Metal Membrane Filters



Combining the best qualities of Pall's S Series and Rigimesh media, the PMM® medium is a thin, sintered matrix of fine stainless steel powder within the porous structure of stainless steel woven wire mesh. The fine powder provides filtration down to 2 microns. The woven wire mesh support structure is exceptionally strong, yet thin enough to permit this medium to be pleated into high area filter elements, minimizing resistance to flow. The smooth surface and uniformity of the PMM membrane make it an excellent choice for solids separation in liquid service. It is ideal where precoating is required.

The Hydro-Guard R filter with Cold Melt technology has a rigid pore structure, which results in more consistent, reliable, and reproducible filtration. The absolute rated surface layer of the filter removes suspended particles such as iron and copper.

Hydro-Guard R filters with Pall's proprietary Cold Melt technology offer many benefits. This technology creates a filtration matrix with small, micro-thin fibers to remove particles and co-located large diameter fibers for added strength. The CoLD Melt process permits the creation of multiple filtration zones within a single filter cartridge. The multi-zone design produces a reverse gradient pore structure, which effectively captures particles and powdered resin on the outer surface of the cartridge. The interior sections have a more open pore structure to reduce pressure drop, avoid internal filter plugging, and focus the power of the backflush toward the captured particles on the filter surface.

## Hydro-Guard PBB Series Filters



*Hydro-Guard PPB filters are polypropylene pleated filters built with the highest purity materials (no fillers, talc, TiO<sub>2</sub>, or surfactants). Hydro-Guard PPB filters provide longer on stream life and reduced number of filter change-outs compared to other traditional filters. Their high surface area enables higher dirt-holding capacity and longer run times. Hydro-Guard PPB filters are designed for filtration use without powdered resins.*

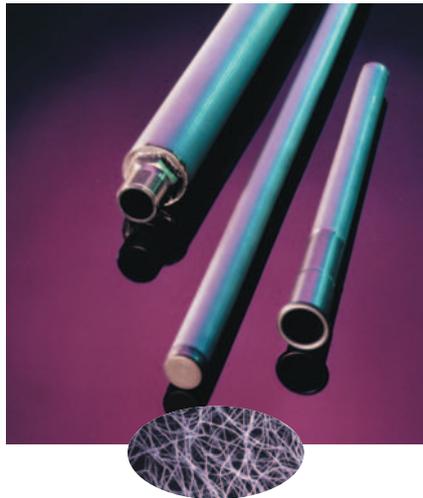
## Pall Accusep® Porous Metal Filters



*Accusep filter media offers the same high permeability as Pall's S Series PSS medium at a lower cost. Accusep filters are more economical for many applications because they are manufactured as continuous length, seamless 48 or 96 inch long tubes, as opposed to shorter modules that are welded together. In addition, an Accusep filter system can be smaller than other offerings, since more filter area can be packed into the vessel with their small 1/2" and 3/4" tube diameters. Accusep filters can be constructed from the following materials:*

- 316L stainless steel (standard)
- 304L stainless steel
- 310SC stainless steel
- Hastelloy X
- Inconel 600

## Pall PMF™ Metal Fiber Filters



*PMF™ filters are manufactured of very fine, short 316L stainless steel fibers. These filters are sintered at their points of contact to produce a uniform, strong, multi-layered medium with exceptionally high dirt-holding capacity. PMF filters are available with removal ratings from 2.5 to 40 microns. They are most suitable for removal of wax and gelatinous material in applications where contamination can be dissolved in a solvent prior to backwashing.*

# Why Pall Filters are the Optimum Choice

Pall filters are designed and manufactured for a long, productive, trouble-free service life. Their advantages include:

- **Optimum pore size distribution** to collect particles on the filter's surface and prevent particle penetration into the depth of the medium
- **Pore size uniformity** for full utilization of the filter surface
- **Strength and durability** to withstand the cyclic loads applied during reverse flow cleaning cycles
- **Chemical and thermal compatibility** with process conditions to ensure long life

**Table 1. Filter Elements**

Filter	Nominal Outer Diameters mm (in.)	Nominal Lengths m (in.)	Maximum Allowable Differential Pressure bar-d (psid)	Maximum Allowable Temperature °C (°F)
Rigimesh Filters (non-pleated elements)	25 (1)	0.6, 1.2, 1.75 (23), (46), (69)	4.2 forward (60)	400° (750°)
	60 (2-3/8)	0.6, 1.2, 1.75 (23), (46), (69)	3.5 forward (50)	400° (750°)
S Series PSS Filters (non-pleated element) <sup>(1)</sup>		<b>Grade S100</b>		
	60 (2-3/8)	0.5, 1, 1.5, 2 (20), (40), (60), (80)	0.8 forward (12)	400° (750°)
		<b>Grade S200</b>		
	60 (2-3/8)	0.5, 1, 1.5, 2 (20), (40), (60), (80)	2.4 forward (35)	400° (750°)
PMM Filters (non-pleated elements)	25 (1)	0.6, 1.2, 1.75 (23), (46), (69)	4 forward (60)	400° (750°)
	60 (2-3/8)	0.6, 1.2, 1.75 (23), (46), (69)	3.5 forward (50)	400° (750°)
PMM Filters (pleated elements)	64 (2-1/2)	0.4, 0.8, 1.2, 1.6 (16), (32), (48), (64)	8.5 forward (125)	400° (750°)
PMF Filters (pleated elements)	64 (2-1/2)	0.4, 0.8, 1.2, 1.6 (16), (32), (48), (64)	8.5 forward (125)	315° (600°)
Accusep Filters (non-pleated)		<b>Grade C020</b>		
	12.7 (1/2)	1.2 (48)	4.3 forward (63)	400° (750°)
	19 (3/4)	1.2 (48)	4.3 (63)	400° (750°)
		<b>Grade C050</b>		
	12.7 (1/2)	1.2 (48)	3.6 (52)	400° (750°)
	19 (3/4)	1.2 (48)	2.6 (38)	400°F (750°)
Hydro-Guard R Filters with Cold Melt technology and Hydro-Guard PPB Filters	6.4 (2-1/2)	254-2032 (10-80)	2.4 (35)	65.5 (150°)

(1) Standard cylinder configurations constructed of 316L stainless steel, closed at one end with solid stainless steel, with an appropriate fitting welded to the open end.

**Table 2. Filter Grades and Their Characteristics**

Filter	Grade	Removal Ratings <sup>(5)</sup> (Liquid Service) (in µm) at 99.98% Efficiency <sup>(3)</sup>	Clean Pressure Drop (Liquid Service) Aqueous Pressure Drop <sup>(2)</sup>		Recommended Flow Density Aqueous			
			psi/gpm/ft <sup>2</sup>	bar/(m <sup>3</sup> /h)/m <sup>2</sup>	gpm/ft <sup>2</sup>	(m <sup>3</sup> /h)/m <sup>2</sup>		
Rigimesh Filters	R	70	2 x 10 <sup>-4</sup>	5.7 x 10 <sup>-6</sup>	5-15	12-36		
	M	45	5 x 10 <sup>-4</sup>	14.1 x 10 <sup>-6</sup>	5-15	12-36		
	J	25	45 x 10 <sup>-4</sup>	1.28 x 10 <sup>-4</sup>	3-8	7-20		
	K	18	72 x 10 <sup>-4</sup>	2.04 x 10 <sup>-4</sup>	2-7	5-17		
S Series PSS Filters	S050	5	0.54	0.0153	0.5-2	1.2-4.9		
	S100	10	0.21	0.0059	0.75-5	1.8-12		
	S200	20	0.04	0.0011	2.00-7	5.0-17		
	S350	35	0.01	0.0003	3.0-10	7.0-24		
PMM Filters	M020 <sup>(4)</sup>	2	0.87	0.0246	0.1-0.75	0.025-1.85		
	M050 <sup>(4)</sup>	5	0.49	0.0138	0.1-0.75	0.25-1.85		
	M100 <sup>(4)</sup>	10	0.28	0.0078	0.2-1	0.5-2.5		
	M150	15	0.17	0.0048	0.5-3	1.2-7.3		
	M180	18	0.15	0.0037	0.7-4	1.7-10		
	M200	20	0.07	0.0020	0.7-4	1.7-10		
	M250	25	0.02	0.0006	1.0-5	2.5-12		
PMF Filters	FH025	2.5	0.194	0.0055	0.2-0.5	0.5-1.2		
	FH050	5	0.050	0.0014	0.5-2.0	1.2-5		
	FH080	8	0.035	0.001	0.6-3.0	1.5-7		
	FH100	10	0.020	0.00057	0.75-4.0	1.85-10		
	FH150	15	0.010	0.00028	1.0-5.0	2.5-12		
	FH200	20	0.006	0.00017	1.25-7.0	3-17		
	FH250	25	0.005	0.00014	3.0-8.0	7-20		
	FH300	30	0.004	0.00011	3.0-10.0	7-24		
Accusep Filters	C020	2.0	0.62	0.0177	0.86	0.0246	0.5-2	1.2-4.9
	C050	5.0	0.21	0.006	0.29	0.0083	0.5-2	1.2-4.9
Hydro-Guard R Filters with Cold Melt technology	HGCOLDR							
Hydro-Guard PPB Filters	HGPPB							

(2) Pressure drop in psi (bar) obtained by multiplying value shown by actual flow desired in gpm (m<sup>3</sup>/h), viscosity of liquid in centipoise (if other than 1 cp), all divided by total filtration area (ft<sup>2</sup> or m<sup>2</sup>) selected.

(3) Liquid removal efficiency ratings are based on a modified F2 test method and actual particle count data.

(4) Pleated cartridges only.

(5) The reported removal rating is for the filter medium without an established filter cake. Actual average removal ratings can be significantly lower (higher wt % at smaller particle size) depending on operational particle loading and size distribution.

(6) Contact Pall for technical data.

# Applications for Pall Backwash Filter Systems

Pall's backwash filter systems operate in a variety of applications found in the petrochemical, food and beverage, cosmetics, power generation, and pharmaceutical industries. These systems offer customers distinct benefits, including environmental protection, catalyst recovery or removal, system component protection, and improved product quality.



*Pall backwash filter system*

## Catalyst Recovery or Removal

In almost every process in which there is a catalytic reaction, fine catalyst must be recovered or removed to provide clean, solids-free liquid. Depending on the concentration of the catalyst, particle size, and especially the compatibility of the fluid properties, catalyst recovery and removal can be difficult indeed. In this application, however, very few separators are as efficient as Pall backwash filters. Hydrogenation is just one example of a process in which Pall filters have provided superior efficiency and economy.

## System Component Protection

At power generating stations, iron and iron oxide, organic matter, and degraded ion exchange resin can do incalculable damage. In these applications, Pall backwash systems are commonly fitted with Septra™ or Hydro-Guard filters, which eliminate resin leakage and reduce particulate matter in condensate to 0.5 ppb or less, protecting against fouling of downstream heat exchange surfaces, and retarding radiation field buildup. In oil refinery applications Pall backwash filters protect fix bed reactors from premature plugging. Backwash filters may also be used for slurry oil clarification.

## Improved Product Quality

In every industry, the final product must meet stringent quality and purity standards before it is sent to market. While simple solids separation techniques may allow a company to meet those standards, the greater the clarity of the product, the more appealing it will be to potential customers. Pall backwashable filters provide exceptional clarity, with no sacrifice of economy, in the filtration of consumer products in the food and beverage, pharmaceutical, cosmetic, and petroleum industries.

## Environmental Protection

Pall backwash systems can help to protect the environment and your employees by:

- Reducing operator exposure to dangers such as hazardous compounds or radiation, as dispersed solids are collected and discharged automatically
- Saving energy by reducing process time, as the need for recycling is eliminated
- Achieving lower waste disposal volume by reducing or eliminating the use of a filter aid



*Pall filter systems are designed to meet the strict standards of the food and beverage industry*

## Total Fluid Management<sup>SM</sup>

Pall is much more than a filter company. We are fluid management specialists who strive to make our customers' operations more successful. Our Total Fluid Management<sup>SM</sup> (TFM) program consists of a wide range of filtration products and services designed to help maintain a specified level of fluid cleanliness, leading to improved operations and reliability of the systems involved. To this end, we have developed a comprehensive program that leverages our strengths and provides true value to our customers.

We offer a variety of customized productivity and system services as part of our TFM program. A partial list of these services includes:

- Cleanliness/process audits
- Laboratory and pilot testing
- Customized product development
- Commissioning
- Equipment rental
- Remote monitoring
- Training seminars
- Reliability engineering
- Troubleshooting and system support
- System maintenance/service contracts

### Quality Assurance Program

All Pall manufacturing facilities operate under strict quality management systems that have met ISO 9000 standards for over a decade. Pall's backwash systems are built to the highest standards based upon a commitment to excellence that incorporates the latest ISO manufacturing standards. Pall's attention to quality translates into greater reliability of customers' operations.

For more information on Pall backwash filters or filtration systems, please contact your local Pall representative.



*Evaluation of a Pall backwash filter for catalyst recovery from a hydrogenated stream*



*SLS prototype backwash test assembly*



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