



Pall Corporation

www.pall.com

Filtration Solutions For Commercial Aircraft

Improve Fluid Cleanliness
Reduce your Costs



Filtration. Separation. Solution.sm

Improved Reliability of Engine Lube Systems

On any Powerplant, the lubricant fluid is a natural repository for particulate contamination. This contamination comes from several sources.

- ▶ Built-in Debris
- ▶ Wear debris generated during operation
- ▶ Environmental contamination during maintenance

If this contamination is not removed it will be recirculated through the fluid system and cause numerous problems.

Problems Caused by Contamination

Cause	Effect
Component wear, e.g., fatigue wear on bearings	Significantly reduced bearing life
Water Contamination during engine storage	Corrosion
High temperature and contaminant	Fluid Oxidation and deposit formation, coke formation

Benefits Of Fine Filtration

Fine filtration removes harmful contaminants from the lube system and this will:

- ▶ Improve operating reliability and performance
- ▶ Increase component service life
- ▶ Reduce maintenance costs

Applications

Pall has been supplying lube and fuel elements to the major aerospace engine OEM's since the 1970's. These parts have to undergo a stringent qualification test program to meet the OEM specification requirements.

Pall engine applications include:

CF6, GE90, CFM56 series, GP7200, GENx, LEAP-X, JT8, JT9, PW2000, PW4000, PW6000, GTF1000, RB211, Trent, V2500 and XWB.

Improved Reliability of Engine Fuel Systems

The fuel system can contain particulate, water and biological contamination. This can cause both immediate and longer-term damage.



Microscopic examination of contamination found in used fuel filter elements

Problems Caused by Contamination

Fuel system contamination can:

- ▶ Block or erode nozzles and valves
- ▶ Cause wear of fuel system components
- ▶ Cause leakage (e.g. particles trapped under valves)
- ▶ Cause corrosion of fuel system components
- ▶ Foul sensors
- ▶ Gum together surfaces
- ▶ Cause fuel degradation

Benefits Of Fine Filtration

- ▶ Improves fuel system and component reliability
- ▶ Maintains appropriate system fluid cleanliness
- ▶ Reduces maintenance costs



Improved Reliability of Hydraulic Systems

The hydraulic systems that control aircraft require equipment performance with long term reliability and state-of-the-art technology. By removing particulate contamination, Pall's advanced filtration solutions provide consistent cleanliness in fluid systems throughout their expected life cycle.

Problems Caused by Contamination

Cause	Effect
Component wear, eg abrasive wear on pumps	Increased pump leakage, higher temperatures, lower pump pressures and reduced efficiency
Valve Erosion and stiction	Jerky valve movement, valve hysteresis, valve jamming
Water Contamination	Corrosion, high acid levels in hydraulic fluid

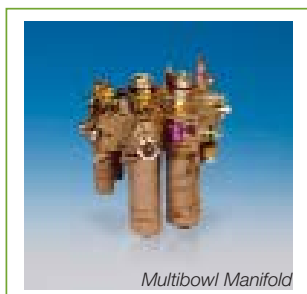
Benefits Of Fine Filtration

Fine filtration removes harmful contaminants from the hydraulic system and this will:

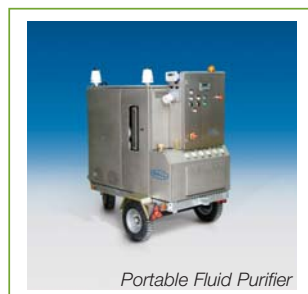
- ▶ Improve component reliability
- ▶ Increase component service life
- ▶ Reduce maintenance costs

Applications

Palls Filters are qualified for all the major civil and military aircraft programs. OEMs include: Airbus, Boeing (military and commercial), Embraer, Gulfstream, Cessna, Lockheed, Northrop and Sukhoi among others.



Multibowl Manifold



Portable Fluid Purifier



Water Sensor



Cleanliness Monitor

Ground Support Equipment

To complement the flight-approved filter solutions, Pall offers a range of products for ground support equipment (GSE) and test rigs.

Fluid Recycling

For commercial operators, hydraulic, lubrication and cooling fluids account for a significant part of their annual operating costs. Airlines therefore require a process to extend fluid service life and also reduce the procurement and disposal costs due to waste fluids.

The portable fluid purifier provides an environmentally friendly solution to remove free and dissolved water and gases, solvents and particulate contamination.

Fluid Cleanliness Monitor

Monitoring the cleanliness of lubricants, hydraulic fluids or fuels, can provide advance warning of a pending component malfunction and/or system failure.

The PCM400 is a portable diagnostic monitoring device which displays the fluid cleanliness level. Unlike other instruments the results are not affected by the presence of air, water or high particulate levels

Water Sensor

The water sensor measures moisture content in the fluid as a percent of the water saturation level of the fluid. It provides a display showing % saturation or ppm. The sensors can be portable or they can be permanently installed in the fluid system

Flushing Filters

To remove damaging debris on a single pass basis, during initial 'Green Run' or flushing of fluid systems, it is necessary to employ high efficiency, fine filtration. This minimizes the possibility of catastrophic component failure and reduces component wear and damage to component surfaces.

Improved Cabin Air Quality

Pall 'true HEPA' cabin air filters remove dust, allergens and microbes ('microbes' includes viruses and bacteria) from the air recirculated into the cabin and cockpit. This helps to provide a safe, healthy and comfortable environment for the passengers and crew.

Pall Cabin Air Features

- ▶ True HEPA filters (>99.999% microbial removal efficiency)
- ▶ High dirt holding capacity
- ▶ Minimum pressure loss
- ▶ High collapse strength
- ▶ High adsorption capacity for odors / VOCs (with optional carbon filters)

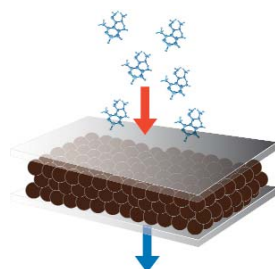
Benefits

- ▶ Reduced weight
- ▶ Extended filter element service life
- ▶ Fewer filter changes / reduced maintenance costs
- ▶ Control of microbial and viral contaminants without the need for chemical additives, coatings, or other surface treatments.

Applications

Pall provides cabin air filters for all the major commercial aircraft programs including: Airbus, Boeing, Bombardier, Embraer, GlobalExpress and Saab.

The solution can be either the complete cabin air filter assembly (including housing and HEPA filter element) or the cabin air filter element only.



Carbon Adsorbent
for VOC Removal

Improved Reliability of Avionics Cooling (E/E) Systems

With the increased dependence on electronic systems and fly-by-wire technology in modern commercial aircraft, the avionics (electronic equipment) cooling system plays an important role in the overall system reliability.

It is essential that the avionics (E/E) cooling air is dry and free from contamination.

Pall System Features

- ▶ Fine filtration efficiency (significantly better than the ARINC international standard of 400-micron absolute)
- ▶ Removal of fine particulate contamination, such as carbon, down to 1µm
- ▶ Long filter element service life
- ▶ Centrifugal separation device gives constant protection, irrespective of water load
- ▶ Hydrophobic filter elements - not affected by moisture
- ▶ Centrisep® inertial separator is self-cleaning, virtually maintenance-free

Benefits

- ▶ Increased E/E system reliability, reduced component failures due to contamination
- ▶ Protection of the critical components within the avionics cooling bay

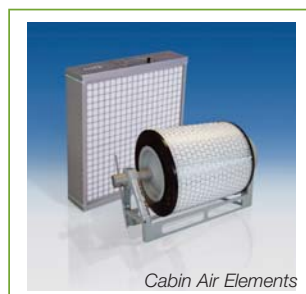
Applications

Pall provides avionics cooling filters for all the major commercial aircraft programs, including: Airbus A300/310 and A319/320/321, Boeing 737, 747, 757, 767, 777 and 787, Jetstream 61 and SAAB 340/2000

The solution can be either a filter assembly (including a disposable barrier filter) or a self-cleaning Centrisep panel.



Cabin Air Assemblies



Cabin Air Elements



Avionics Cooling Element



EE Cooling Centrisep Panel

Advanced Engine Bleed Air Solutions

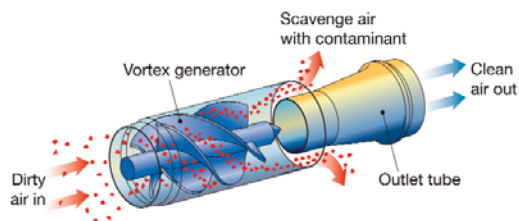
Engine bleed air is used for a variety of secondary functions within the aircraft, such as de-icing and pneumatic actuation. It is therefore essential that this bleed air is free from contamination.

Problems Caused by Contamination

- ▶ Malfunction of bleed air system and components
- ▶ Small sticky particles cause valve stiction
- ▶ Large particles can plug orifices

Benefits of Pall Filtration Solutions

- ▶ Improved cleanliness of engine bleed air
- ▶ Improved system performance
- ▶ Reduced component failures and associated costs
- ▶ Reduced maintenance costs



Centrisep® Principle of Operation

Applications

Pall provides pneumatic air filters for a number of programs including: RB 211, CFM56 and PW500 engines, ERJ145 and F100 aircraft.

Potable Water Systems – Point-of-Use Water Filters

Potable water systems are often contaminated with particulate matter and microorganisms. The Pall point-of-use (POU) water filter is designed to offer immediate, validated protection for passengers and crew against waterborne pathogens.

Features

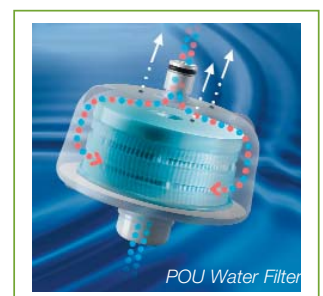
- ▶ Sterilizing grade membrane provides protection from waterborne micro-organisms
- ▶ Bacteriostatic additive to reduce retrograde contamination
- ▶ Vented housing for pressurized aircraft systems
- ▶ Fully recyclable materials
- ▶ Maximum lifetime - meets aircraft maintenance schedules

Benefits of Pall POU Filter

- ▶ Provides instantaneous protection
- ▶ Reduces the risk of waterborne infection
- ▶ Cost-Effective
- ▶ Qualified to international aerospace standards
- ▶ Suitable for pressurized water systems (built-in air venting)
- ▶ Design based on technology widely used in hospitals
- ▶ Environmentally friendly

Applications

The point-of-use water filter has been qualified for the Airbus A380 aircraft. Other applications for this technology are currently being pursued.



With Pall, your operations are supported by a company with the experience, commitment, R&D, people and service you expect from the worlds largest dedicated filtration and separation company.

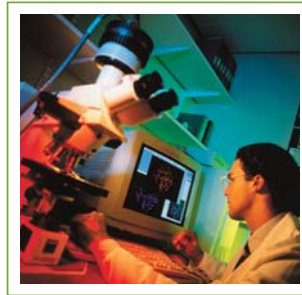
Pall Corporation provides solutions to meet the critical needs of customers across a broad spectrum of industrial markets. Our expertise is in defining the correct filtration or fluid processing solution for your fluid systems and customizing our products to suit your applications.

Research and Development

Pall has a policy of continual research and development. It has developed an array of core materials and technologies that can be combined and manipulated in many ways to solve complex fluid separation challenges.

Scientific and Laboratory Services

A principal element in Pall's customer support operations is our Scientific and Laboratory Services (SLS) group. Technical specialists with extensive experience can determine the best solution to your contamination problems.



Design and Engineering

Designing a filtration system is a complex process that requires significant knowledge and experience. Every filter design is tailored to the specific aircraft program. Pall's design and engineering expertise ensures that optimum performance is achieved in the smallest envelope with the lowest weight possible.

Quality

The policy of Pall Aerospace is to design and manufacture products to the highest standards of quality, safety and reliability. Pall Aerospace holds quality approvals from the leading authorities including; FAA, EASA, ISO, AS and AECMA.



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ENABLING A
GREENER
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and more sustainable future, visit www.pall.com/green.

Visit us on the Web at www.pall.com/aerospace

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