Technical information and applications: Filter components for the

Aerospace industry

Introduction

Sefar's high-precision filtration products are used with great success in many different very demanding appliances in, for example, the aerospace industry. Sefar woven filter fabrics are not only found in kerosene coalescer systems but may also be used in hydraulic filters, in installations for de-icing, sound suppression, lightning strike protection and as insulating layers to reduce galvanic corrosion.

Many components such as hydraulic filters, dead-end filters etc. are still constructed from stainless steel components and filter mesh. Some, but not all, of these components can be replaced by polymeric (filter) material which results in a significant weight reduction of the component. This can lead to the reduction of both fuel consumption and environmental pollution.

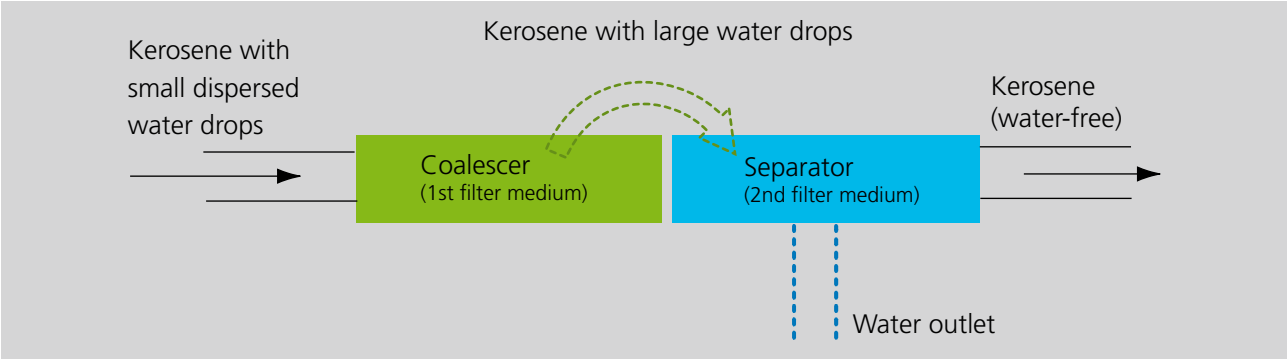
A) Particle and water removal from kerosene/fabrics for coalescers

Modern aircraft contain thousands of liters of kerosene that must be free of particles and water in order to guarantee trouble-free operation of the engines. Fuel contains a certain amount of dissolved (approximately 60 parts per million [ppm]) and free water that has to be removed in order to prevent the water from freezing and blocking the fuel delivery system. Typically, fabrics with mesh width of less than 70 micrometer are used. These fabrics perform the dual function of water and particle removal.

Function of a coalescer

Coalescer systems are used to remove water from jet and other types of fuel (e.g. diesel). The small and dispersed water droplets combine at the coalescer surface (1st filter medium) to form larger drops that – by flow and/or gravity – move to the separator. The fuel flows through the separator (2nd filter medium) where the now larger-sized water drops are retained by the hydrophobic surface and are drained off.

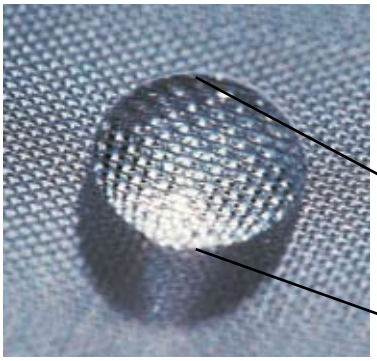
The coalescer filter medium itself usually consists of pleated elements made of a glass fiber material that is impregnated with phenolic resin. The surface of the separator often consists of a hydrophobic woven filter material which is supported by a stainless steel cartridge.



Schematic presentation of a liquid/liquid coalescer system

Sefar solution for coalescers

Sefar fabrics are used as filter media in separators in-line after the coalescer.
The high water repellency, high throughput rates and precise mesh openings of Sefar's monofilament fabrics guarantee outstanding reliability and performance when fitted on a coalescer separator system.



Separator element containing Sefar's hydrophobic filter fabric

Hydrophobic surface

As the coalescer/separator has to retain water droplets that by nature are hydrophilic, the separation fabrics usually have a water repellant (hydrophobic) coating in order to enhance water removal.This hydrophobic coating may be achieved by conventional wet chemical procedures or by low-temperature plasma treatment. Sefar offers both coating technologies.

Filter solutions

SEFAR PETEX® and NITEX® filter fabrics are designed and manufactured to fulfill the demanding requirements of the aerospace industry.
Typical fabrics used in coalescer applications:

SEFAR PETEX® 07-21/12
SEFAR PETEX® 07-20/13
SEFAR PETEX® 07-33/21
SEFAR PETEX® 07-37/31
SEFAR NITEX® 03-48/31
SEFAR NITEX® 03-50/31
SEFAR NITEX® 03-75/34
These fabrics can be treated with a hydrophobic coating.

This is just a small selection of SEFAR PETEX® and NITEX® products available for use in coalescer systems. To see the whole range of fabric solutions please consult our «Sefar Open Mesh» brochure, available for download under www.sefar.com.

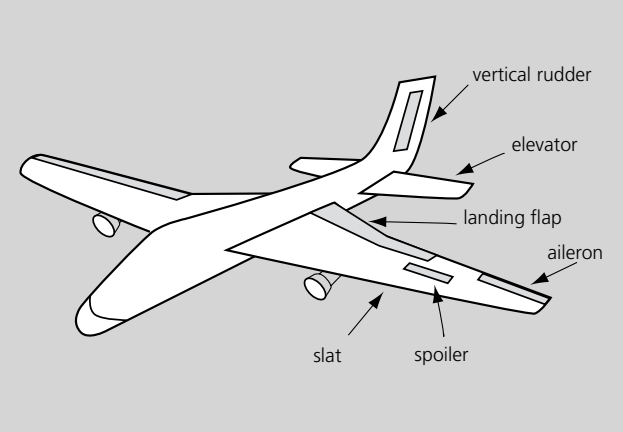
B) Hydraulic filters

Various hydraulic systems are installed in airplanes. They are mounted in the elevators, tail planes, ailerons, vertical rudders, spoilers, landing flaps, equipment for raising/lowering the landing gear as well as in steering and braking equipment. In order to guarantee the reliable function of the hydraulic system and the corresponding hydraulic component, filter and filter elements are integrated in order to remove particles present in hydraulic fluids or which originate from within the hydraulic and piping system.

Last-chance filters represent the last filter device downstream of a main system filter and are located before the actual hydraulic component. Their vital function is to remove particles and thus prevent them from blocking the hydraulic component.
Due to the harsh conditions caused by high pressure and aggressive hydraulic oils, the hydraulic filters and last-chance filters used in airplanes are nearly all made of stainless steel. Many different stainless steel

fabrications – from open- or closed-mesh woven steel to sintered steel filters are utilized. Typically, open-weave meshes with higher mesh counts such as 200 mesh, 400 mesh or 625 mesh are used as primary filter media in cartridge filters, while closed-weave meshes are applied in high-end filters.

Weight reduction, and the resulting cost reduction due to decreased fuel consumption, is an important focus in the aerospace industry.
New high temperature resistant polymers such as PEEK are available.
Many hydraulic filterelement manufacturers have the possibility of replacing stainless steel filters with polymer based filters wherever possible.



-> Locations, where woven fabrics are utilized

Stainless steel		**Polyamide filter**		**Polyester filter**		**PEEK filter**	
Mesh	weight	Type	weight	Type	weight	Type	weight
42	340	06-465/48	120	07-465/49	135	17-300/36	165
80	390	06-225/38	90	07-224/42	97	17-220/56	36
200	160	03-85/35	49	07-85/46	29	17-115x145/58	17
400	130	03-38/22	35	07-37/31	28	17-35/22	39
625	130	03-15/10	40	07-15/9	45	–	–

Weight comparison of stainless steel versus nearest polyamide, polyester and PEEK fabrics (weight is indicated in [g/m2]

C) Sound suppression

The aerospace industry has taken considerable effort to reduce aircraft noise during recent years. However, the Internatio-nal Civil Aviation Organization (ICAO) has set new aircraft noise standards that take effect in 2006 which will be even tougher than those applied today. This decision will force the aerospace industry to take even stronger efforts to decrease the airplanes noise level.
Sefar woven fabrics may also be used as sound suppressing elements, alone or in combination with various different structural elements in noise-reducing devices.
Since the sound-suppressing elements may vary in structure from manufacturer to manufacturer no general recommendation as to which fabric to choose can be given. However, as a decision aid the following criterium may help:

Acoustic resistance

Noise-reducing capabilities do not only depend on the structure and composition of the sound-suppressing element but are also influenced by the fabric itself. Due to their precise mesh openings, consistent thickness and air permeability, Sefar's woven fabrics contribute to the improved noise-reduction properties of sound-suppressing elements.
As the acoustic resistance of a woven fabric correlates to its air permeability, the selection of the appropriate fabric may be done based on air permeability or Rayl [cgs] values.

Environmental conditions: as the sound suppressing structures in airplan es may be exposed to considerable variations in temperature, heat resistant materials such as PEEK fabrics would be a most suitable choice.

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