porvair
filtration group

Filtration and Separation Solutions for the Decarbonisation Industry

World Class Filtration Solutions

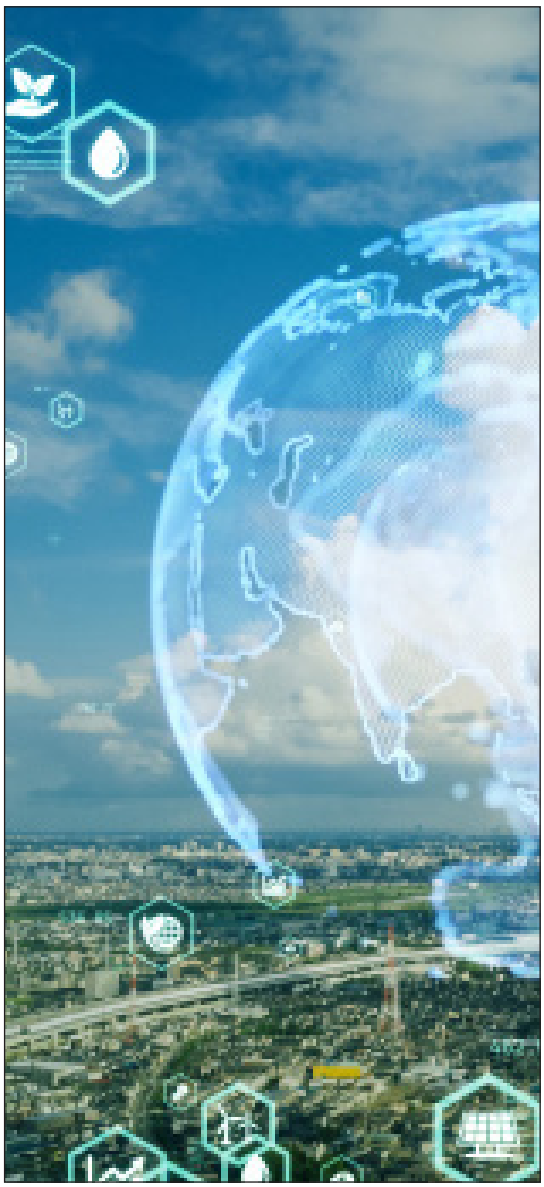
Porvair Filtration Group

Porvair Filtration Group is an international leader in the development and supply of materials and products for applications in filtration and separation.

Porvair manufactures in the UK and USA and has an extensive network of sales offices and distribution channels throughout the world. Our expertise is broad and deep, with products used in markets such as:

- Aerospace and Defence
- Food and Beverage
- Gasification
- Microelectronics
- Nuclear
- Pharmaceutical
- Porous Media and OEM Materials
- Printing
- Process
- Decarbonisation
- Water

Our ongoing success is based on a dedication to technical excellence and superior customer service. Our future will continue to be built on our investment in research and development to provide innovative new products that exceed the expectations of our customers in solving the challenges they face.



Climate change is, currently, the most persistent environmental challenge being faced. World leaders agree the need to drop global warming to well below 2°C, indeed to strive to get below 1.5°C. Achieving net zero requires rapid and unprecedented actions across the economy, including technology innovation. Such innovations, such as hydrogen and sustainable biofuels, increasingly serve towards achieving global decarbonisation goals within the energy and transportation sector.

Porvair Filtration Group supplies a comprehensive range of filtration and separation products to the energy and transportation market and is continuously adapting its range to cover a wide portfolio of net zero processes and technologies.

We supply a comprehensive range of filter media, assemblies, and filter elements for use within the sustainable fuels synthesis transport and hydrogen industries. Applications include:

- Sustainable aviation fuel synthesis
- Sustainable land and sea transport fuels
- Green hydrogen production
- Hydrogen distribution and storage
- Control systems for hydrogen-powered technologies
- Fuel cell operation

Effective filtration and material compatibility is vital to ensure that all systems are free from contaminants. High performance is essential to meet and exceed expectations, guaranteeing safety, long service life, reliability, and cost effectiveness in the most demanding of situations.

Our unrivalled experience and extensive materials range ensures that we can supply a fully engineered solution for manufacturing, storage, distribution and control applications.

Core Competencies

- **Material selection and manufacturing**

  Our experience in separation and filtration materials, fluid/gas dynamics and manufacturing ensure fit-for purpose materials and fabricated products.

- **Design and engineering**

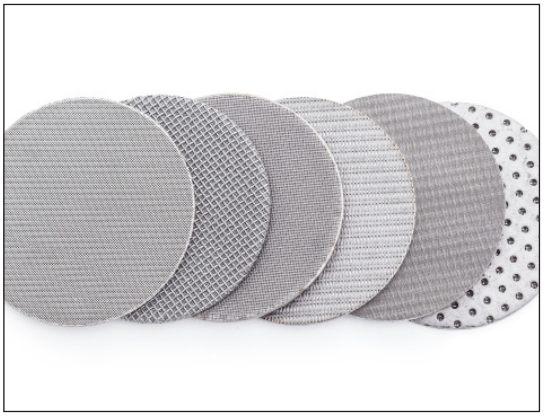
  Our strength in design, engineering and prototyping enables us to provide the optimum custom-designed solution for any application.

- **Project management**

  Our understanding of regulatory requirements, deliverables and timescales means your product will meet market demand, placing you ahead of the competition.

- **Quality and reliability**

  Our high expectation for quality, coupled with our commitment to continuous improvement, ensures that our raw materials are carefully selected and our manufacturing processes are optimally controlled to regulatory standards.



Sustainable Aviation Fuels

We recognise the current drive towards the decarbonisation of the aviation industry and identify Sustainable Aviation Fuels (SAF) production as a key role in achieving global net zero target.

We engineer solutions which incorporate filter media and cartridges in custom designed assemblies to meet the exacting system specifications. These can be adapted for many fuel synthesis applications including the most demanding ASTM approved SAF synthesis processes such as: the Hydro treated Esters and Fatty Acids (HEFA); syngas production and the Fischer Tropsch (F-T) and; the Alcohol to Jet (AtJ) method.

Custom engineered solutions for these processes include:

- Microfil™ Absolute Rated Pleated Glass Fibre Cartridge Filters
- Fluorofil™ ePTFE Membrane Cartridge Filters
- Liquid / Gas Coalescer
- Sinterflo® P Metal Powder Filter Elements
- Sinterflo® F Metal Fibre Filter Elements
- Liquid / Liquid Coalescer
- Polyfil™ Absolute Rated Pleated Pre-filter Elements

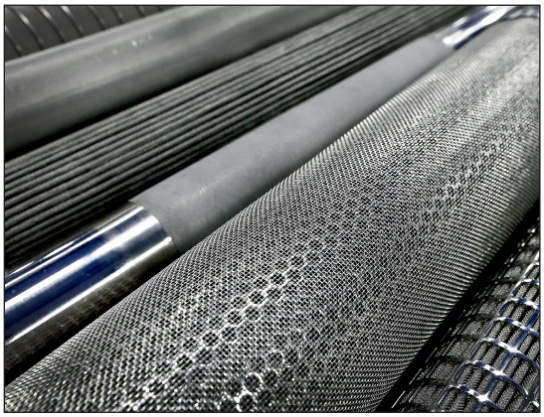
Sustainable Land and Sea Transport Fuels

Porvair Filtration provides engineering solutions for applications in the methane conversion into liquid synthetic fuels for Sustainable Diesel Fuels (SDF) such as biogasoline and biodiesel, be it via the direct partial combustion of methane to methanol or the F-T processes and the accompanying conversion of the syngas to liquids

Synthetic fuels may be sourced from a range of sustainable raw feedstock such as waste oils, agriculture, and other biomass groups. The processing of these feedstocks, especially the less conventional waste oils fuels, require pre-filtration as well as the product/by-product purification. Whether for the gas, liquid or removal of solid residues from process streams, Porvair Filtration assemblies are specially designed to meet the physiochemical conditions, engineering designs, and regulatory specifications identified with the industrial processes filtration requirements.

Custom engineered solutions for these processes include:

- Microfil™ Absolute Rated Pleated Glass Fibre Cartridge Filters
- Fluorofil™ ePTFE Membrane Cartridge Filters
- Liquid / Gas Coalescer
- Sinterflo® P Metal Powder Filter Elements
- Sinterflo® F Metal Fibre Filter Elements
- Liquid / Liquid Coalescer
- Polyfil™ Absolute Rated Pleated Pre-filter Elements



Green Hydrogen Production

Porvair Filtration supplies a range of filter media, membranes, and filter assemblies applicable for use in the green hydrogen production technologies. These systems are adaptable to meet the purification needs of: feedwater (whether sea water, ground water, surface water) filtration for general process efficiency and membrane protection, filtration of the electrolyte (AEL & AEM types), dehydration of produced hydrogen (and oxygen where appropriate).

The filtration assemblies can be designed to suit the high temperature conditions of the solid oxide (SOE) electrolyser and the need to protect the ceramic electrolyte and the proton exchange membrane (PEM) electrolyser technologies including the protection of critical aspects of downstream BOP systems employed for post drying and deoxygenation of the H_2.

Custom engineered solutions for these processes include:

Filtration of electrolyte:

- Sinterflo® SMF Sintered Metal Fibre Elements (Hastelloy®)

H_2O separation from H_2/ O_2:

- Fluorofil™ ePTFE Membrane Cartridge Filters
- Polyfil™ Absolute Rated Pleated Pre-filter Elements
- Sinterguard® HPB

Hydrogen Distribution and Storage

Solid particulate and water droplets may be encountered at varying levels of contamination wherever hydrogen gas or indeed cryogenic liquid hydrogen is transported or distributed, whether in tanks or via a piping system or grid network. Porvair supplies systems able to filter the particulate and separate the water droplets / aerosols from the hydrogen gas as well as the removal of particulate from cryogenic liquid hydrogen.

These units and assemblies, specially designed to withstand conditions of high pressures or ultra low temperatures and engineering challenges within the strict regulatory requirements, are solutions that can be employed in hydrogen process flow systems for upstream and downstream pressurised tanks, gas compressors and boosters, heat exchangers and pumps, for example.

Custom engineered solutions for these processes include:

H_2O separation from gaseous H_2:

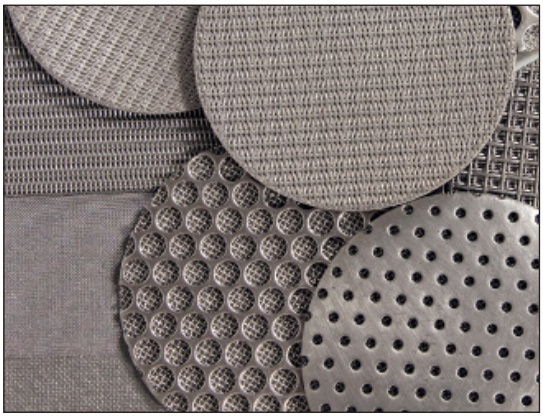
- Fluorofil™ ePTFE Membrane Cartridge Filters
- Polyfil™ Absolute Rated Pleated Pre-filter Elements
- Porvair Sinterguard® HPB

Particulate separation from gaseous H_2:

- Polyfil™ Absolute Rated Pleated Pre-filter Elements
- Sinterflo® F Metal Fibre Filter Elements

Particulate separation from cryogenic LH_2:

- Sinterflo® P Metal Powder Filter Elements
- Sinterflo® F Metal Fibre Filter Elements



Compressed Hydrogen (GH_2) Utilisation

The compression of hydrogen (GH_2) to high pressures ranging from 250 bar(g) to 1400 bar(g) is achieved through a number of techniques to achieve the storage and refuelling utilisations for a hydrogen gas based network. The need for cleanliness and dryness of the hydrogen gas is of paramount importance.

The necessary build tolerances for the clearances on conventional compression equipment (recip. piston, diaphragm, linear) given the gas characteristics demand a high efficiency inlet filtration performance with a corresponding outlet filtration to remove any compression generated contaminant. Hydrogen purity may vary with the application where an IC engine will tolerate a lower purity a fuel cell will demand a greater purity of GH_2.

The need to ensure the hydrogen is clean and dry (oil free also if the equipment is lubricated) to this high degree of efficiency is due the extent of compression as even a low concentration at the lower pressure will become more significant at the higher pressure. This is to be considered when the hydrogen gas is to be used for refuelling of vehicles at refilling stations for example to ensure the protection of the critical tight tolerance components in the system and its use in a fuel cell.

Porvair Filtration supplies a range of filter media, membranes, and filter assemblies applicable for use in the protection of the compressors and refilling stations. These systems specific to meeting the cleanliness levels and filtration efficiency to meet the requirements of equipment manufacturers as well as specifications such as ISO 14687 (<1 mg / kg) using both HEPA grade filter media as well as surface media membrane materials to provide the protection (99.9%>0.3 micron) The requirements for the dehydration (<5 mmol mol^{-1}) of the hydrogen are of equal importance and achieved through the use of coalescence and adsorption techniques.

Our list of products includes:

Hydrogen pre-compression

- Fluorofil™ ePTFE Membrane Cartridge Filters
- Polyfil™ Absolute Rated Pleated Pre-filter Elements

Hydrogen post compression:

- Carbofil™ Activated Carbon Filter Cartridges / Absorber
- Sinterflo® P Metal Powder Filter Elements
- Sinterflo® F Metal Fibre Filter Elements

H_2-powered technologies

Control systems for hydrogen-powered land, sea and air transport technologies employ our filters in processes such as for purifying gas pre- hydrogen fuel cell and hydrogen tank storages, filters post storage to remove condensates and other particulate contaminant. These are in addition to systems control filters employed for our aerospace solutions.

Our products provide effective filtration for automobiles, passenger transport, trucks, trains, ships and aircraft equipment, vital to ensure that all systems are free from contaminants and to guarantee safety, long service life, reliability and cost-effective operation in the most demanding conditions.

The development and incorporation of fuel cells into different technologies will require the adoption of similar protection devices as the electrolysers with the need to protect sensitive components from particulate and moisture such as on the cooling circuit and in the fuel stack itself preventing degradation of the catalyst and membrane.

Our filters/separators may also be used to vent motors and power electronic systems whilst also providing a level of protection from the ingress of particulate and droplets.

Our list of products includes:

- Main System Pleated filter elements
- Power electronics coolant and air management system manifolds and filters
- In-line and last chance filters (controlled cleanliness standard)
- Hydrophobic Breather Vents
- Differential pressure/system operation indicators
- Interting systems
- Filter kits

Cryogenic Hydrogen (LH_2) Utilisation

The refrigeration of hydrogen to form liquid hydrogen (LH_2) by the liquefaction process requires the hydrogen temperature to be reduced below its boiling point of 20.25 K (-252.9 °C / -423.2°F) (at atmospheric conditions). This is achieved through a series of refrigeration / compression / expansion stages which all require constant maintenance of product purity in terms of both particulate and moisture content.

The LH2 can then be distributed and transported to its point of use, which maybe aircraft or other transport fuel systems.

The need for purity of the LH_2 product is inherent as with any cryogenic fluid, the component criticality is high and therefore required a commensurate level of protection to ensure reliable long term operability.

Porvair Filtration supplies a range of metallic filter media and filter assemblies ideally suited to these ultra-low temperature operations utilising an all stainless steel construction using Porvair Sinterflo® filter media technology and proprietary manufacturing processes.

The purity of the LH_2 should reflect and have maintained the level that was provided in the previous GH_2 form from whence it originated and therefore the filtration afforded in the liquid state and upon vaporisation is assured.

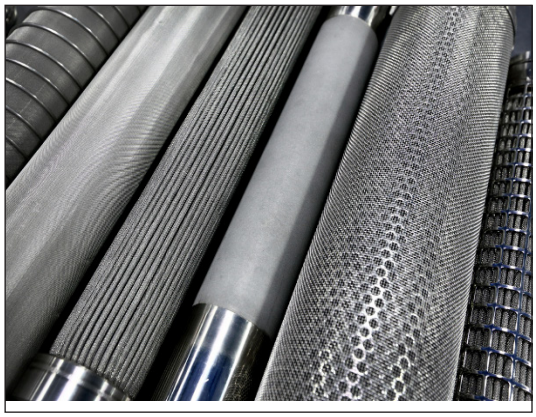
Custom engineered solutions for these processes:

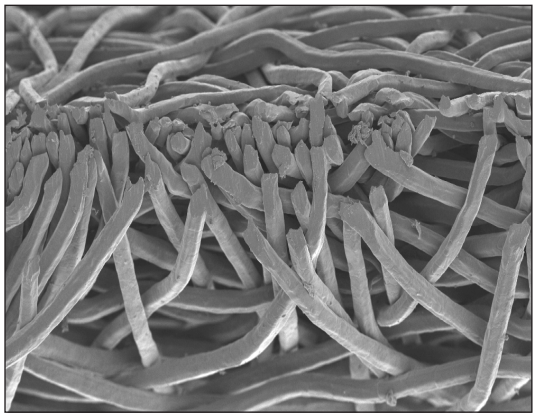
Liquefaction stage

- Sinterflo® F Metal Fibre Filter Elements
- Sinterflo® M Metal Mesh Filter Elements
- Sinterflo® MC Metal Mesh Composite Filter
- Sinterflo® P Metal Powder Filter Elements

Vaporisation stage

- Sinterflo® F Metal Fibre Filter Elements
- Sinterflo® M Metal Mesh Filter Elements
- Sinterflo® MC Metal Mesh Composite Filter
- Sinterflo® P Metal Powder Filter Elements
- Fluorofil™ ePTFE Membrane Cartridge Filters (> -150C)
- Polyfil™ Absolute Rated Pleated Pre-filter Elements (> -20C)





We have a policy of continuous improvement in all areas of our business. Listening to customers' present and future requirements is a vital part of our operations and a key part of driving change. We understand that product development involves building multidisciplinary teams, both within our company, and in partnership with our customers.

This continuous development of products and materials is vital to enable us to offer new and better solutions.

We have a fully equipped test house and laboratory, and our experienced design engineers use the latest technologies to give full structural assurance capability.

Research and Development

Development plays a fundamental part in our operations and has resulted in us continually developing custom designed products based on our established porous polymeric and sintered metal media (Sinterflo®) technologies.

We operate across many filtration and separation markets and there is significant interaction in terms of product research and development.

Our new product development team is drawn from scientists and engineers from across all divisions, encouraging new ideas and new solutions. The success of this approach has been in the interaction of chemists and engineers working together to find practical solutions to some extremely complex scientific challenges identified in the chosen market areas.

Manufacturing

Our filters, filtration systems and a range of porous materials are produced at our sites worldwide. Our production capabilities include the complete element or cartridge construction, along with the build of entire housings and assemblies.

We boast specialist fabrication skills and techniques in all of our manufacturing sites around the world and extensive ISO cleanroom facilities.

Engineering

From initial design concept through to manufacture and validation to in-service support, our highly experienced team of dedicated engineers work to develop the optimal filtration solution. Our knowledge and strong ethos of working closely with our customers, ensures that we supply filtration solutions that meet specific market requirements.

Quality

Our policy is to provide products and services that consistently satisfy the commitments made to our customers by complying with their requirements, working together as a team and achieving continual improvement in our skills, systems, processes and performance.

We have a dedicated team of quality professionals with many years' experience in the definition, implementation and maintenance of quality management systems meeting multiple industry requirements. This extends across the workforce through a strong quality culture and a philosophy of 'getting it right first time' driven from the top of our organisation.

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