



Ship Propulsion Protection in Maritime Environments

altair[®]

Gas Turbine Filtration
for the Marine Industry



The World's Most Diversified Filtration Company

Parker is the world's most diversified filter company and we know how to develop and produce high quality gas turbine air inlet filters. We offer an extensive portfolio from cartridges and vCells to pocket and panel filters. With extensive knowledge gained through nearly 50 years of making inlet filters and gas turbine inlet filtration solutions as well as a variety of media options to meet a multitude of challenges, we deliver filters that perform in the most demanding environmental conditions.

When it comes to selecting the right filter for your need, our **altair®** filter portfolio offers extremely high levels of turbine protection for a wide range of environments. Our filter elements are designed to fit a range of new and retrofit systems and are available in various sizes and materials of construction.



Founded in 1966, **altair** became known as a specialist in offshore filtration while skillfully branching into other areas of filtration. Acquired by General Electric in 2006 and renamed GE Air Filtration, we continued the **altair** brand while utilizing the GE expertise in gas turbine design to further refine the right criteria for proper inlet filtration. The **altair** name and history is now a key product and brand for Parker.

Experts In Salt Protection

As one of the world's leading suppliers of air inlet filtration systems for offshore and marine gas turbines, Parker is at the forefront of engine salt protection technology. For nearly 50 years we have been developing and refining our offshore and marine product range to provide the optimum protection against all maritime contaminants. In order to do this we have worked closely with our customers to gain an intimate understanding of their operating environments.

As well as listening carefully to what our customers tell us, Parker has also conducted significant levels of research into the marine environment, both independently through our R&D programs and collaboratively with academic institutions. In addition, we have carried out air sampling on naval ships, cruise ships, and fast ferries throughout the world enabling



us to produce an extensive database of offshore environmental conditions.

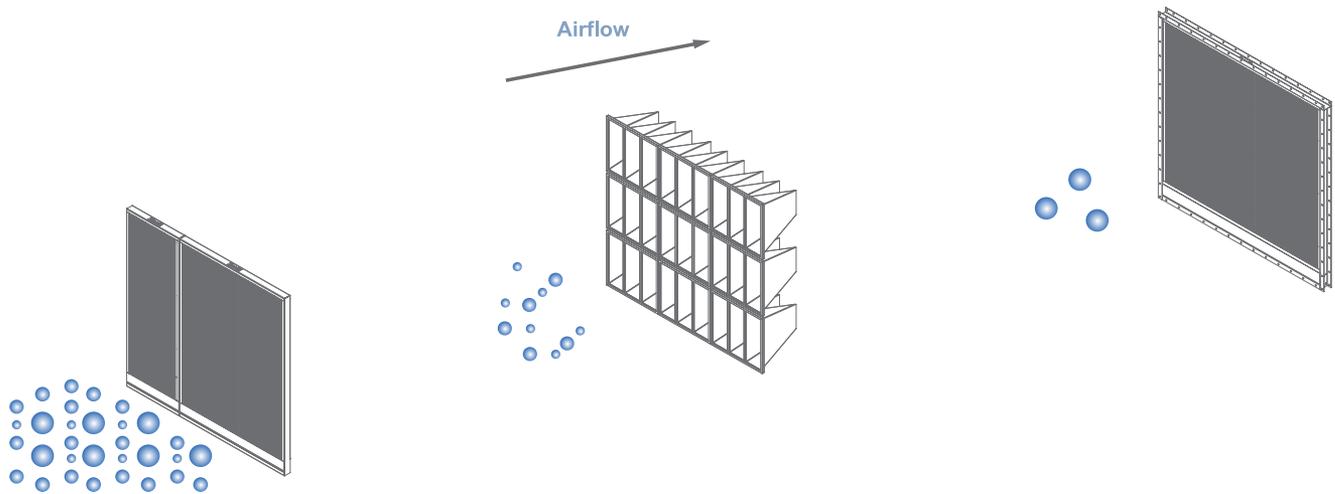
Through these efforts Parker has developed a range of world-class products, expressly designed to protect turbines operating in offshore, marine and coastal locations. We are also committed to the ongoing and continuous improvement of all our products, working in partnership with our customers to provide the highest levels of protection for turbines operating in the challenging marine environment.



Learn more about marine challenges.
Get your copy of The Book of Salt by
visiting www.parker.com/gtf

SRS Technology – Solution To Salt-Based Challenges

The ingestion of airborne salt has long been proven to be a major contributing factor in both decreased turbine performance and reduced engine lifetime. **altair** systems utilize Parker's unique SRS Technology process to protect the turbine from damage. This process, which is the result of nearly 50 years' experience in marine and offshore filtration, removes both solid and liquid contaminants in all weather conditions and at all levels of humidity. Removing the particulate from the system substantially reduces the possibility of salt leaching or becoming re-entrained in the air stream.



Stage 1

Stage 1 is referred to as the bulk water removal stage. The majority of the liquid including rain, sea spray and coarse aerosols entering the inlet is removed and drained away using a vane separator.

Stage 2

Stage 2 is the coalescence stage. Fine aerosols that have penetrated Stage 1 are coalesced to form larger droplets that can be easily removed by the third stage. Dust and other solid particulate are also removed. As all marine and offshore pre-filters and high efficiency filters in the range are optimized for coalescence as well as dust filtration, this dual function can be carried out without compromise.

Stage 3

Stage 3 is typically a vane separator or similar, which removes any concentrated saline solution that has passed through Stages 1 and 2. Not only is this entrained liquid captured, it is removed from the inlet by a manometrically-sealed drainage system.

Key Benefits

- Exceptional salt removal performance minimizes turbine corrosion
- Increased engine power due to low inlet pressure loss
- Robust construction and shock-resistant design tested to military standards
- Range of filter and coalescer options to match your specific application
- Reduced maintenance time and lower costs with long-life filter designs

altairNeptune – Advanced Protection

The **altairNeptune**® filtration system represents the most advanced engine inlet protection technology for the marine environment. Incorporating the familiar three-stage vane/coalescer/vane approach in a supercompact unit, this system protects marine gas turbines around the world.

The **altairNeptune** system provides increased flexibility in ship design. With the ability to operate at velocities as high as 3000 FPM (15 m/s), the filtration system is more than 50% smaller than conventional three-stage designs. Additional equipment such as snow hoods and anti-ice protection can be easily added to the system.



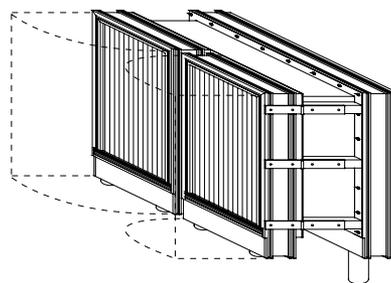
Key Benefits

- Over 50% smaller than conventional 3-stage designs
- Reduced radar signature
- Meets and exceeds all relevant engine pressure loss specifications
- Shock-tested to meet national military standards for international naval use
- Extended filter system life
- Low maintenance

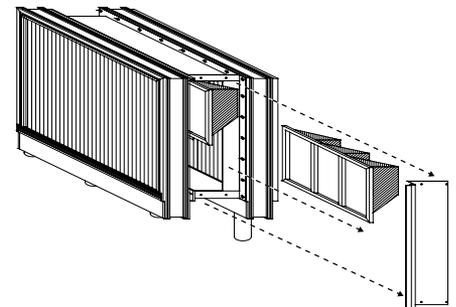
Ease Of Access

Since space on board a ship can be very limited, the compact design of the unit offers increased flexibility to minimize the area occupied by the filtration system. A number of access options are available. These illustrations show just two possibilities.

Front Access (hinged)



Side Access



altairNeptune Filter Elements

The **altairNeptune** range of filter elements includes three cleanable high efficiency bag filters offering performance levels to suit different applications.

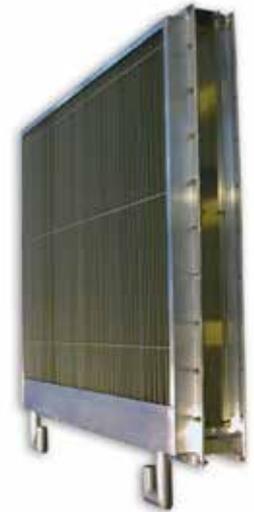


Filter Type	Product Name	Performance
High efficiency filter 	HV600	Very high efficiency altair filter designed to operate at velocities of up to 1150 FPM (6 m/s). Outstanding salt removal performance with low pressure loss.
	HV1000	High efficiency altair filter combining high salt efficiency, low pressure loss and excellent dust capture. Operates at velocities of up to 1900 FPM (10 m/s).
	HV1500	High efficiency altair filter operating at velocities of up to 3000 FPM (15 m/s). Designed for environments with high levels of small particulate.

altairVega – A Proven Choice

For nearly 50 years, the **altairVega**[®] filtration system has been protecting ship propulsion gas turbines around the world. Utilizing three stages, the system delivers high levels of performance against sea spray, salt aerosols, particulate and “green seas”.

The well-proven vane/coalescer/vane approach delivers superior levels of protection to marine turbines. This flexible style makes the **altairVega** system a proven choice in a variety of configurations.

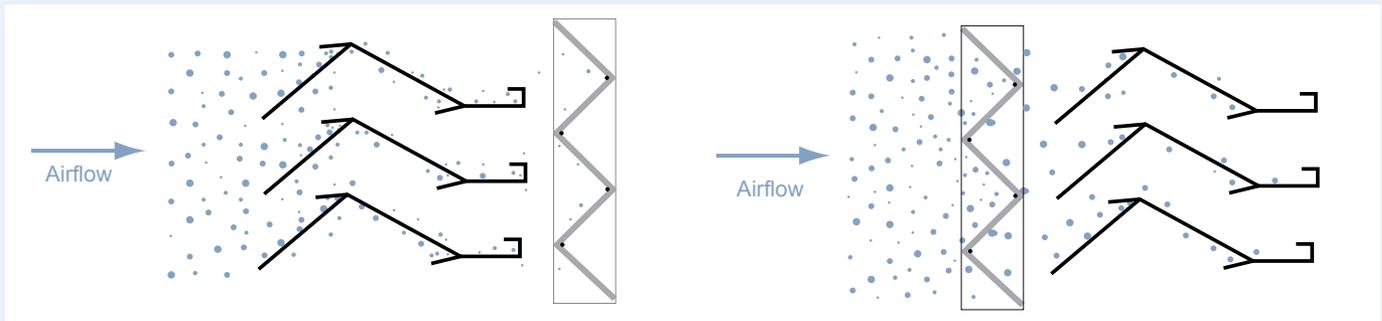


Key Benefits

- Low inlet pressure loss
- Exceptional small-droplet removal capability
- Excellent water-handling capacity
- Customizable to specific environments and operating conditions utilizing a wide range of filter/coalesce options

For Diesel Engine And HVAC Applications

In addition to the three-stage gas turbine system, the **altairVega** unit is available in single- and two-stage designs to suit other requirements.



Vane separator/filter coalescer (Single-stage HVAC) – In this configuration, bulk water and coarse droplets are removed by the separator and any fine droplets that pass through are coalesced by the filter and drain away under gravity. It is suitable for environments where there may be surges of bulk water. This option operates at velocities up to 880 FPM (4.5 m/s).

Filter coalescer/vane separator (Two-stage Diesel Engine Inlets) - This design is suited to damp or humid environments. Fine mist coalesces on the filter and the resulting droplets are captured by the vane separator. Additional weather protection upstream of the filter/coalescers is recommended when using this option. This version is suited to velocities up to 1200 FPM (6 m/s).

altairVega Filter Elements

The **altairVega** range of filter elements consists of two cleanable coalescer/filter elements (GT2 & HV850) and the disposable HV600 high efficiency bag filter/coalescer. All three elements offer superior coalescence performance and salt removal capabilities.



Filter Type	Product Name	Performance
High efficiency filter 	HV600	Very high efficiency marine coalescer, this altair bag filter captures over 97% of particles of 1 micron and above while still providing excellent coalescence properties
	HV850	An altair bag/filter coalescer providing outstanding levels of dust-holding at velocities of up to 1700 FPM (8.5m/s); ideal for cruise ship applications
	HVGT2	Well-proven altair coalescer/filter panel that offers low pressure loss, good particulate efficiency, and the ability to reduce salt ingress to well below engine manufacturers' guidelines

The Choice of Major Gas Turbine Engine Suppliers & Trusted By Military Navies Around The World

When it comes to protecting the engines of crucial naval ships, the top engine suppliers turn to **altair** for their filtration system needs. **altair**Neptune and **altair**Vega systems have been installed on major military navies worldwide and continue to be selected for new ship programs.

Not only do **altair** filtration systems meet the specifications of OEM engine suppliers such as GE and Rolls-Royce but continuous innovation in salt and water removal has helped earn the trust of key Naval decision-makers.



It's not just for navies. **altair**® filtration systems protect cruise ships, yachts and fast ferries as well.

Anti-Ice Systems

The risk of coalescer filter icing can be reduced by the use of an anti-ice system. Normally there is limited availability of energy so anti-ice is referred to as being a condensate anti-icing or limited anti-icing (not full anti-icing). Limited anti-icing provides sufficient heat to increase the temperature of the combustion air by approximately 10°F (5.6°C), taking air beyond the critical temperature/humidity zone where icing is most likely. The anti-ice system most often selected is the compressor bleed type. Hot air from the gas turbine compressor is evenly distributed over the coalescer filters through a high pressure manifold.

Shock & Vibration

Parker has extensive knowledge of shock and vibration standards such as MIL-S-901D and MIL-STD-167-1. Compliance is achieved through testing or DDAM.

Emergency Protection – Blow-In And Bypass Doors

Gas turbines can be kept operational for short periods of time even in the event of a total blockage of the filter or ductwork. Blow-in doors (BIDs) or bypass doors are designed to provide an alternative, non-filtered air path. In normal conditions, the door is tightly closed against a standard or trace-heated seal which prevents the ingress of water, salt particles and dust. Parker offers three door designs, from a simple spring-loaded door requiring manual closure to a fully-automatic, pneumatically-operated system. The size of the door is calculated by PARKER engineers according to our standard design practices and available space in the ship design.



Inertial Spin Tube (For High Dust Environments)

Spin tubes are an inertial dust extraction device, designed to provide additional dust removal capability in coastal and inland waters. They can be used either as primary protection to the coalescer filters or in combination with our traditional vane demister. The spin tube is typically located downstream of the first stage vane separator and upstream of the coalescer. The spin tube module requires an extraction fan and control system.

Export Control

Parker has proven experience in the management of export controlled technology and hardware and employs a rigid compliance program to help mitigate the ever-changing regulatory landscape. We consider compliance at all stages of our process from initial inquiry through to shipment. We are proud of our reputation and the ability to support some of the most difficult and demanding platforms in the world.

World-Class Technical Facilities And Capabilities

Fully equipped laboratories enable Parker engineers to perform sophisticated product development and thoroughly challenge the filter system before it is released to our customers. We consider all likely airborne hazards such as water, salt, sand, dust, hydrocarbons, snow and ice to help extend time between compressor water washes. This is a critical part in reducing operating costs, especially on rotating machinery tasked with delivering to your customer.

Tests performed in our laboratories include:

- Pressure loss
- Dust holding capacity with ASHRAE and ISO A2 fine
- EN779 performance
- Combined (prefilter and final filter) dust holding capacity with ASHRAE and ISO A2 fine
- Wet saturation test
- Fog and mist testing
- 72 hour wet loss of efficiency and burst
- Humidity testing
- Media hydrostatic head testing, flat sheet and pleated
- Heat aging evaluation
- Adhesive pull testing
- Filter “bucket” testing
- We can test hot to 135° C (275° F)
- We can test cold to -70° C (-94° F)
- Dry salt testing
- Wet salt testing
- Gasket hydrostatic head testing
- ARAMCO testing
- Transportation/rough handling
- Acoustic testing

Our Filters Are Externally Verified And Come With An Independently Validated Test Certificate.

- External EN779 2002 on discharged filter
- External EN779 2012
- External EN1822 2009 where applicable, on discharged filter
- External ASHRAE 52.2 initial efficiency on discharged filter
- External shaker table transportation load testing



Our mobile test rig helps customers evaluate environment and filter technology, on-site, in any condition.



Our outside test rigs allow us to evaluate filters for up to 6 months and measure a variety of factors, including initial DP, fractional efficiency, and reaction to mist and fog.



The Neptune test rig allows us to test for water removal capability, a key concern for those located offshore or in a tropical location where heavy rainfall is a factor.

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For more information, contact your **Parker Hannifin Gas Turbine Filtration** representative:

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