

NAVISTURBO by ChartMarine

Turbo compressors to secure optimal airflow in
air lubrication systems



NAVISTURBO by ChartMarine is a proprietary technological solution for creating the most efficient air lubrication systems with the smallest footprint incorporating in-house compression technology, hardware and digital monitoring software.

Compressor selection for air lubrication systems is critical to deliver optimal airflow and reduce the frictional resistance between the hull and water, while also minimizing electrical power consumption.

What is an air lubrication system?

Air lubrication technology is based on blowing micro air bubbles out under the hull of the vessel. The air bubble distribution across the hull's surface, reduces the resistance generated between the vessels and the water, thus generating an estimated fuel saving of up to 7-10 net.

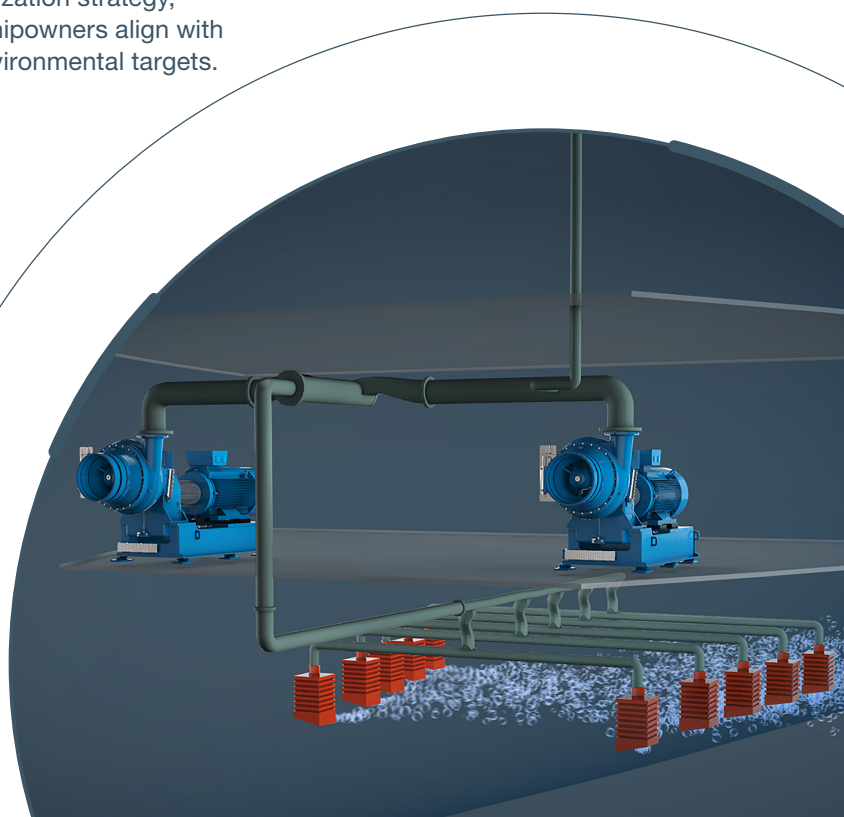
Air lubrication systems featuring NAVISTURBO by ChartMarine can be used in all types of vessel operations.

- Available for new builds and retrofits
- Applicable to the widest range of hull forms
- Minimized energy consumption in operation
- Low noise
- Intelligent control system compatible with Howden Uptime

Howden machines and compression expertise are highly prized and proven across a wide range of industries and applications. For NAVISTURBO by ChartMarine we have channeled that knowledge and experience to offer two compressor types that enable our engineers to match the specific requirements of our customers in terms of pressure, flow, footprint and location, to propose the optimal compressor solution.

Fleet owners who embrace air lubrication technology are seeing notable advantages, including:

- **Fuel efficiency**
Cut fuel consumption by up to 5-10%, supporting compliance with IMO MARPOL Annex VI, EEDI/EEXI fuel-efficiency standards, and helping vessels achieve better CII ratings through lower operational fuel use.
- **Environmental impact**
Reduce GHG emissions to meet IMO MARPOL Annex VI emissions limits and contribute toward the IMO 2030/2050 decarbonization strategy, helping shipowners align with global environmental targets.
- **Lower maintenance costs**
Less hull wear and tear due to reduced friction, indirectly supporting efficiency improvements relevant to EEXI/CII performance metrics, as well as long-term compliance with MARPOL Annex VI by maintaining optimal vessel condition and fuel performance.





Key benefits

- Lowest possible operating costs through aerodynamic optimization.
- Wide operating range with precise control of flow and pressure.
- Oil-free operation for enhanced system integrity and sustainability.
- Compact and efficient design with no gearbox required.



NAVISTURBO high speed drive compressor featuring Dual Point Control™

NAVISTURBO by ChartMarine is a high speed drive compressor purpose built for air lubrication systems and engineered for maximum efficiency and minimal operating costs. Its advanced impeller aerodynamic geometry, combined with Howden Dual Point Control™, ensures highest performance across a wide range of operating conditions.

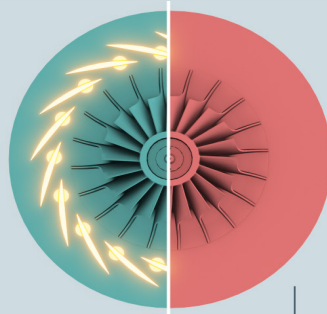
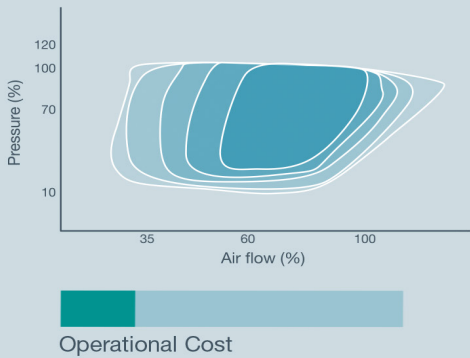
This intelligent control system dynamically adjusts both the impeller speed via a Variable Frequency Drive (VFD) and the diffuser vanes. The result is optimal efficiency at any combination of flow and pressure, with a remarkable flow turndown capability of up to 30%. This flexibility allows operators to fine-tune performance without compromising energy efficiency or system stability.

Permanent magnet motor, oil-free, gearbox-free

At the heart of the compressor is a high-speed, high-efficiency permanent magnet motor. Designed to achieve the required impeller rotational speed without a gearbox, it eliminates the need for oil lubrication ensuring a clean, oil-free environment and removing the risk of oil contamination. This not only enhances reliability but also reduces maintenance and environmental impact.

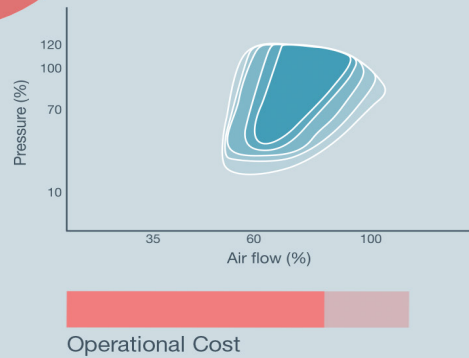
**NAVISTURBO by ChartMarine
Dual Point Control™**

- Speed and vane diffuser control
- Wider operation area, up to 30% turndown
- High efficiency, reducing cost of operation
- Lower CO₂ emission



**Technology
Single Point Control**

- Speed control only
- Limited turndown capability, 60%
- Reduced flow control at low turndown conditions



NAVISTURBO Single stage integrally geared turbo compressor featuring Dual Point Control™

The single stage integrally geared KA compressor is engineered for high efficiency and reliable performance in demanding air systems. Featuring a fixed-speed impeller driven through a gearbox, it utilizes Dual Point Control a combination of Variable Inlet Guide Vanes and Variable Vane Diffusers to deliver precise control over flow and pressure.

This advanced control mechanism enables the compressor to maintain optimal efficiency across a broad volumetric range. With the ability to achieve volumetric turndown to approximately 35% of design flow at constant pressure, the KA compressor adapts seamlessly to fluctuating air demands, ensuring consistent performance without energy waste.

Flexibility small footprint

The compressors' small footprint enhances installation flexibility, making it easier to position the air lubrication system anywhere onboard the vessel. This compact design also optimizes integration possibilities within existing vessel layouts, supporting both new builds and retrofit applications without major structural modifications.

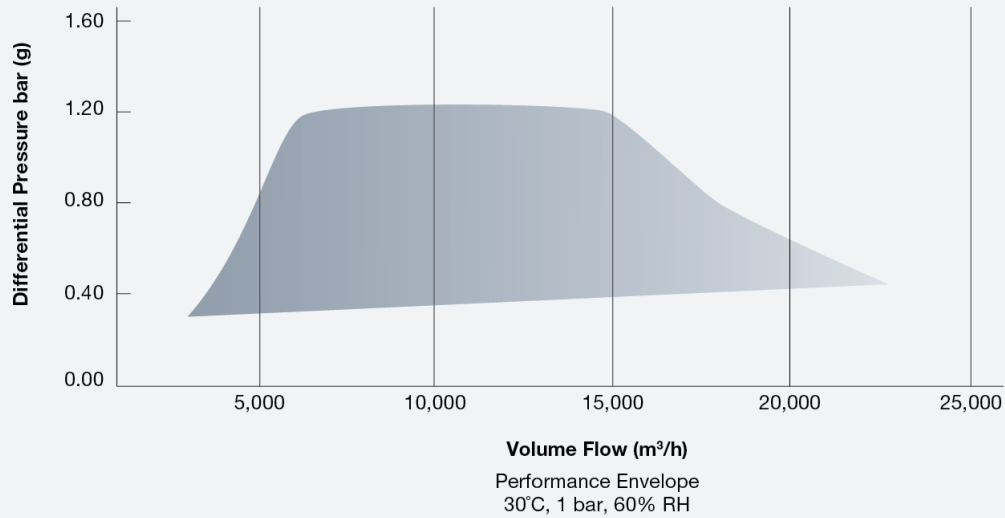


Key benefits

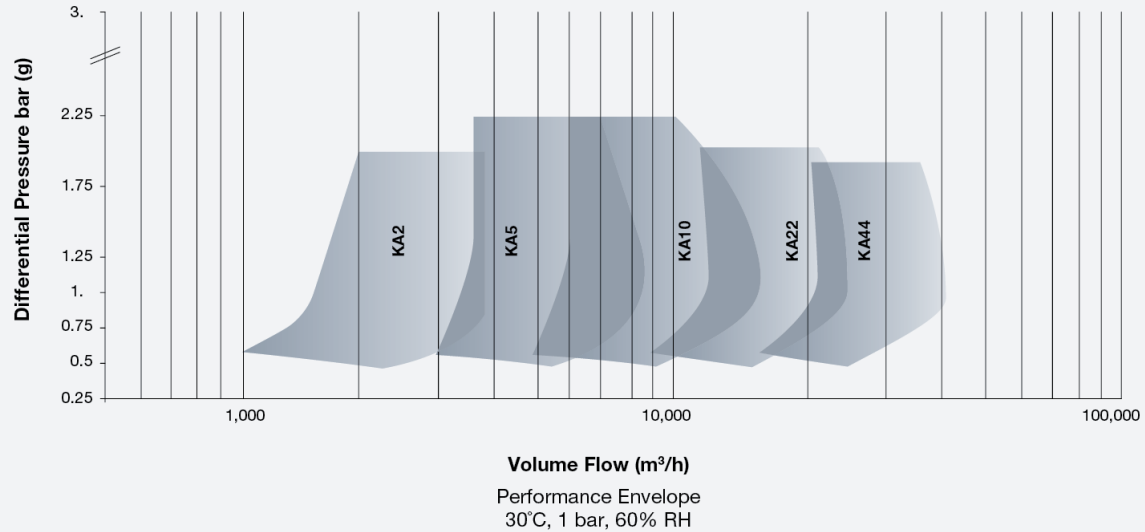
- High efficiency across a wide operating range.
- Volumetric turndown up to 35% at constant pressure.
- Dual Point Control for precise flow and pressure management.
- Optimized for variable load conditions, reducing energy costs.

Performance envelopes

High speed drive compressor



Single stage integrally geared compressor portfolio



Howden Uptime

Howden Uptime is a digital tool that gathers and analyzes the physical data on the operational performance of the compressor. Uptime is the only solution on the market where a “Digital Twin” makes it possible to identify areas of improvement in the compressor operation. All our compressors undergo mechanical and performance tests before leaving the

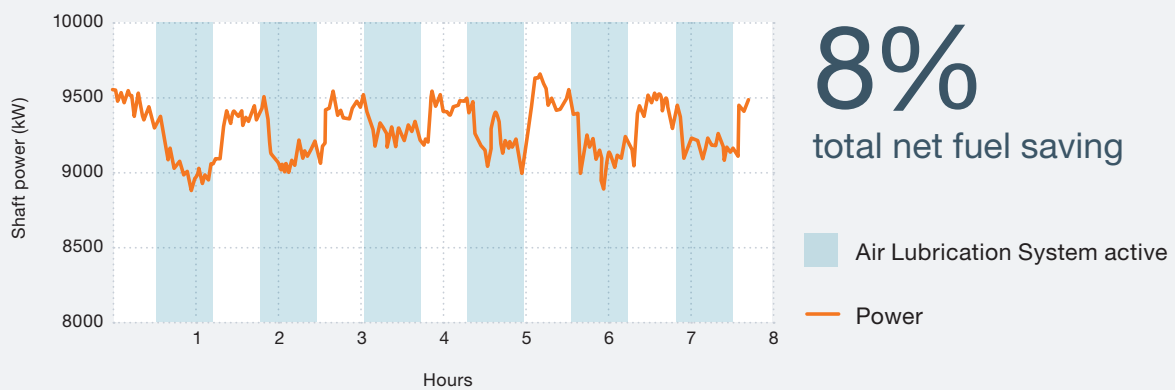
factory. Data from these tests are compared with the operational performance, providing a unique insight into the compressors’ performance, and identifying optimization opportunities. Compressor data is securely stored in the cloud and available via the Uptime dashboard anytime and anywhere.

Proven in operation

ChartMarines turbo compressors have been installed in multiple air lubrication systems across multiple vessel types and demonstrated reductions in propulsive power required.

Test results on a 83,000 gross tonnage cruise ship sailing across the Atlantic Ocean demonstrated significantly lower energy requirements during operation of the system. Two NAVISTURBO by ChartMarine turbo compressors are installed on the vessel achieving an overall 8% net fuel saving as verified by an independent 3rd party organization.

Real cruise ship test crossing the Atlantic Ocean with two NAVISTURBO by ChartMarine turbo compressors



ChartMarine product portfolio

Carbon Capture

- Turnkey solutions for on-board capture, storage & off-loading of high purity liquid CO₂.
- Amine-free cryogenic carbon capture technology & modular purification & liquefaction skid offerings.
- Proven carbon capture systems designed for flexible & energy efficient shipboard integration.
- System also captures NOx, SOx, particulates, and mercury, for proper disposal.
- Can provide beverage grade liquid CO₂ that can be stored onboard and sold, providing an additional revenue stream.

Exhaust Gas Recirculation (EGR)

- Reduces NOx formation by up to 80% in marine diesel engines.
- Variable speed regulation to ensure efficiency across engine loads.
- Turbo compressor to ensure high efficiency across all required pressure ratios.

Power Generation and Waste Heat Recovery (WHR)

- 10% overall emission reduction when incorporated with combined cycle recip. engines.
- Rapid startup (2 mins. to full load) without turbine pre-heating & permits unlimited start/stop cycles.
- Adjustable steam parameters, including saturated & super-heated steam.
- Available in single-stage & twin screw configurations starting from 100 kW & extending to multistage steam turbines up to 40 MW.
- Full range delivers minimised footprint & cost-effective WHR packaging with 2-3 year ROI.

Liquid Hydrogen & LNG Fuel Systems

- Integrated solution incorporating cryogenic tanks, fuel gas supply system & bunkering technology.
- Tank storage diameters up to 7.8m, with capacities ranging from 40 – 1700m³.
- Fixed & swappable tanks, positioned on or below deck.
- Over 90% of global vacuum insulated LH₂ tanks manufactured by Chart.
- Expert design to be fully class compliant & meet IGF code.

HVAC & Cooling

- Class leading axial & centrifugal fan performance.
- Blade design minimizes noise levels with up to 6dB reduction versus competitors.
- HVAC & cooling ranges designed to meet the rigor of commercial marine & naval applications.
- Centrifugal CFI range with cost optimized standard products & engineered to order solutions for maximum performance.
- VFD operation profiles improve efficiency, minimise noise & reduce fan size.

Air Lubrication Turbo Compressors

- Turbo compressors can be integrated into stand-alone & engine supported air lubrication designs.
- Dual point pressure & flow control ensures optimal electrical & air delivery efficiency, tuned to vessel speed and draft.
- Compressor technology increases lifespan, decreases maintenance time & cost, reduces vibration & minimises overall footprint.
- Improve vessel CII rating & potential to realise up to 10% net fuel savings on newbuild & existing fleet.
- Significant decreases in CO₂ emissions are realised.

Energy Savings

Emission Reduction

Clean Propulsion

Clean Fueling

ChartMarine's NAVISTURBO compressors are redefining efficiency at sea. Proven across multiple vessel types, they deliver real savings—like an 8% fuel reduction on an 83,000 GT cruise ship crossing the Atlantic, verified by an independent third party.



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