

MARINE SYSTEMS

Solutions for decarbonizing and improving efficiency in the marine industry through clean propulsion, emission reduction and on board energy saving technologies.



Clean Fuels

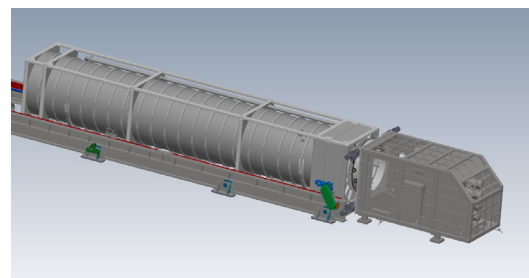
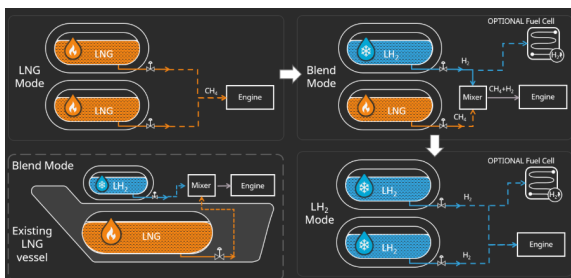
Enabling the transition to low- and zero-carbon propulsion through LNG and liquid hydrogen (LH₂). On, or below, deck, shop built, modular liquid Fuel Gas Supply Systems (FGSS).

Comprise all elements for storage and delivery of **natural gas, hydrogen or hybrid natural gas/hydrogen blends** to the ships' engines.



Suitable for vessels of all classifications and for both new build and retrofit.

Liquid hydrogen (LH₂) is the pathway to zero emission shipping



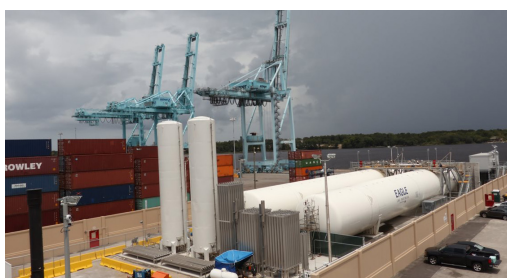
Hybrid LNG/LH₂ system

Practical, low-risk, economic transition from LNG to hydrogen.

- Protects current LNG investments
- Enables gradual decarbonisation
- Avoids costly future redesigns or stranded assets

Exchangeable liquid H₂ solution

- Containerized solution in 40ft or 45ft ISO frame
- Marine and road certification
- Tanks filled at LH₂ terminal
- Full for empty exchange solution with simple, fast changeover
- Stainless steel double wall Type C tanks with multi-layer insulation and high-quality vacuum insulation
- Class approved



Bunkering Stations LNG, LH₂

Coastal receiving, storage and distribution terminals with jetty fueling module.

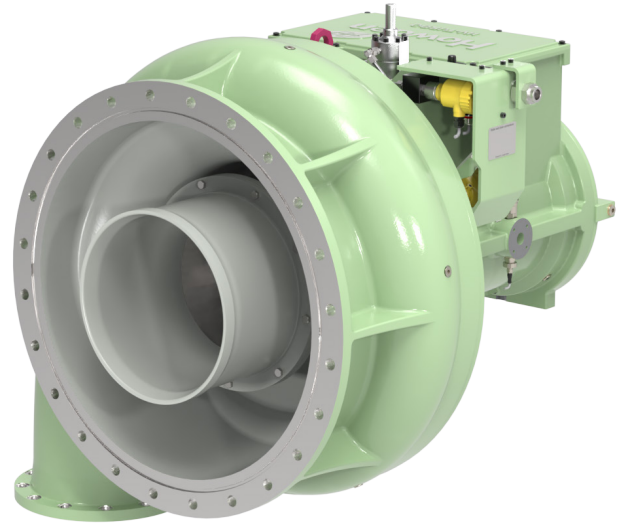
- Modular storage capacity
- Custom design according to customer specification
- Solutions for coastal and inland water corridors
- Designed according to climatic conditions and geographic locations

Emission Reduction

Exhaust Gas Recirculation (EGR)

Significantly reduces the formation of Nitrogen Oxides (NO_x) in marine diesel engines. The EGR blower is a single-stage turbo unit with oil lubricated bearings, direct driven with an asynchronous motor and a variable frequency drive:

- Full compliance with IMO NO_x Tier III standards
- Reduces the formation of NO_x in two-stroke marine diesel engines, by up to 80%
- Compact design, delivers high flow and reduces the number of blowers required
- High efficiency and variable speed regulation
- Small footprint



Carbon Capture

Innovative, proven phase-change technology capturing >90% of exhaust CO₂ and producing purified liquid CO₂.

Integrated solution for economical on-board storage and reuse, with simultaneous removal of NO_x, SO_x, and other pollutants.

Lower total cost and energy consumption, enabling scalable decarbonization for both new build and retrofit vessels.



Carbon Capture

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

Liquid Hydrogen

- o Integrated solution
- o Tank storage diameters
- o Fixed & swappable
- o Over 90% of global
- o Expert design to be

Exhaust Gas Recirculation (EGR)

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

Power Generation and Waste Heat Recovery (WHR)

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



Energy Savings



Emission Reduction



Clean Propulsion



Clean Fueling

Propulsion

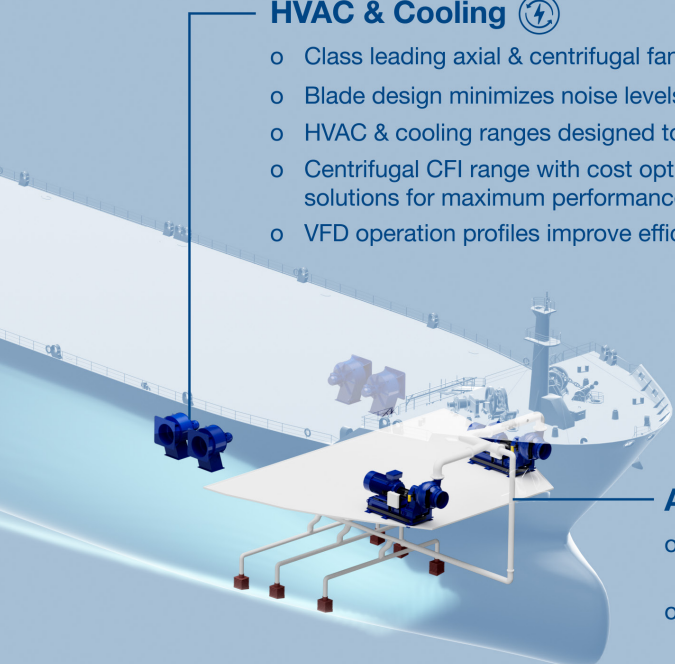
Incorporating cryogenic tanks, fuel gas supply system & bunkering technology.
 Tank diameters up to 7.8m, with capacities ranging from 40 – 1700m³.
 Tanks positioned on or below deck.
 Vacuum insulated LH₂ tanks manufactured by Chart.
 Fully class compliant & meet IGF code.

HVAC & Cooling

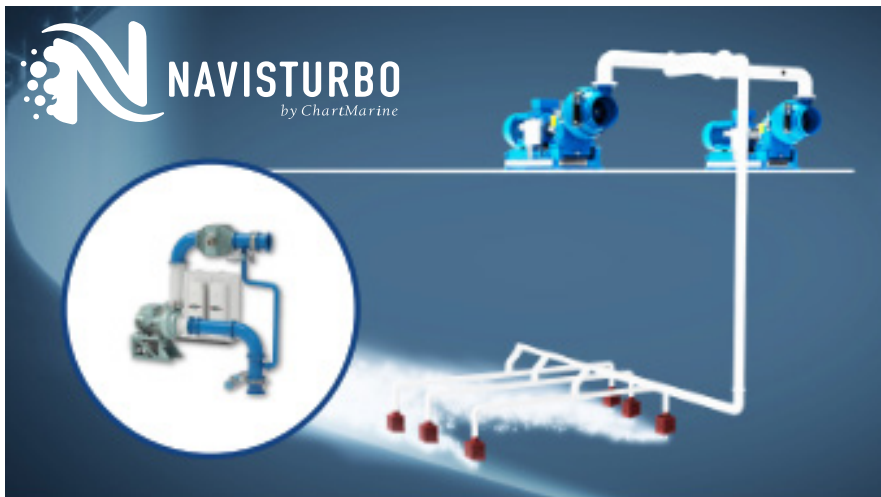
- o Class leading axial & centrifugal fan performance.
- o Blade design minimizes noise levels with up to 6dB reduction versus competitors.
- o HVAC & cooling ranges designed to meet the rigor of commercial marine & naval applications.
- o Centrifugal CFI range with cost optimized standard products &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

Air Lubrication Turbo Blowers

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



Energy Efficiency Technologies



NAVISTURBO by ChartMarine

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

NAVISTURBO by ChartMarine; the most efficient compressors for air lubrication systems (ALS) with the smallest footprint. Incorporating in-house centrifugal compression technology, hardware and digital monitoring software. NAVISTURBO by ChartMarine can be used in all air lubrication systems, regardless of vessel type.

Two compressor configurations are available for air lubrication systems:

- **Turbo compressor for Engine Supported Air Lubrication (ESAL)**
In this configuration, the air used to lubricate the ship's hull is supplied by the scavenge air system, reducing electrical power demand and improving overall system efficiency.
- **Integrally geared turbo compressors** Equipped with Dual Point Control™ functionality to efficiently deliver air to the ALS.

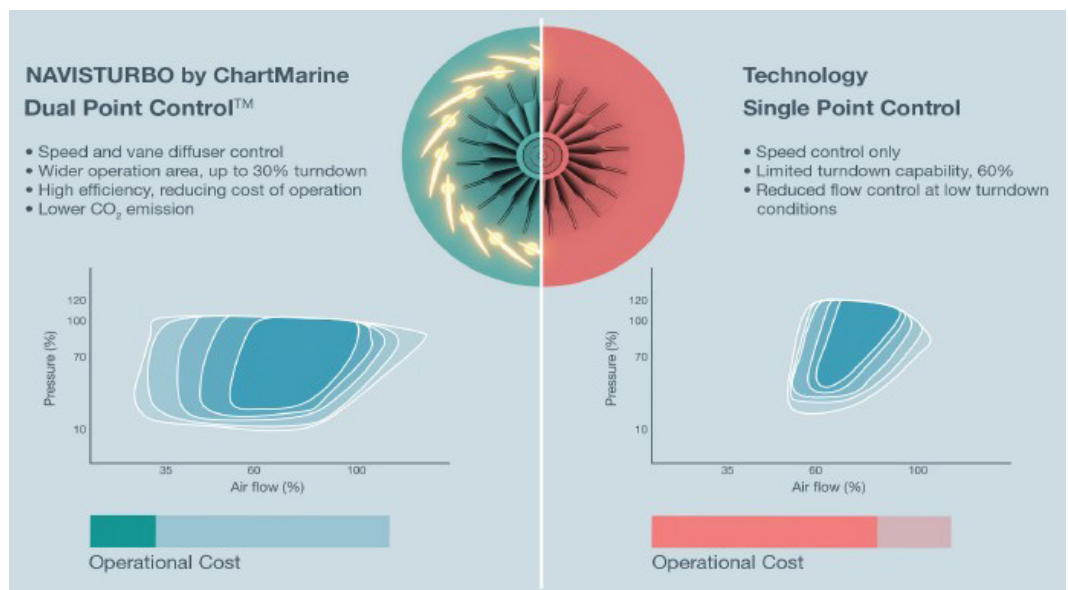
Optimizing ALS

Compare turbo compressor technology with screw compressors in terms of performance, energy efficiency, cost and maintenance. Scan the code to request our white paper.

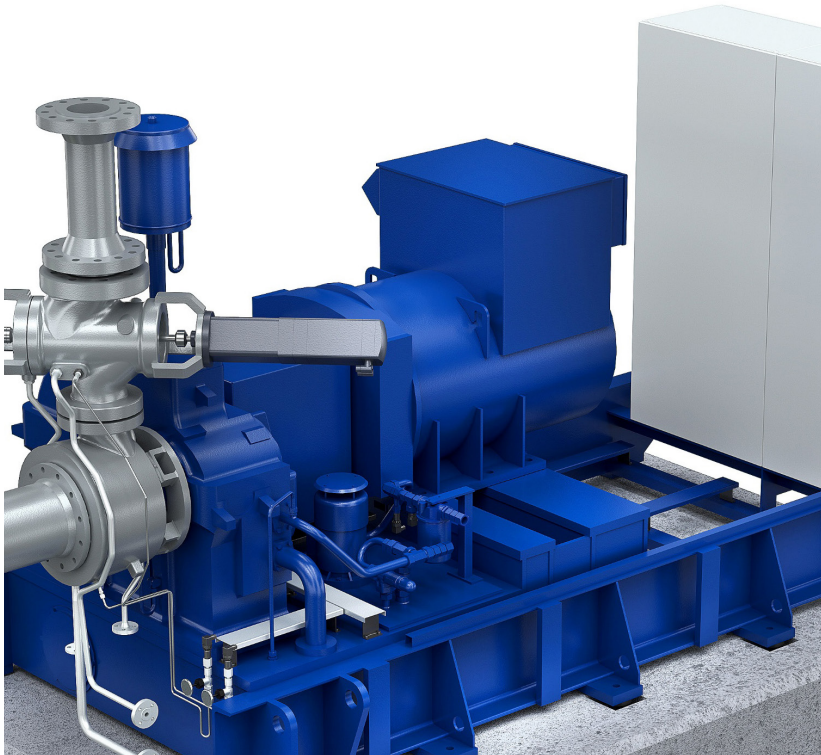


Dual Point Control™

technologies adjust both the impeller speed and diffuser vane position to maintain optimal airflow and pressure providing strong turndown capability within a compact installation footprint.



Waste Heat Recovery



Circa 1% fuel savings. 1 to 3 years expected ROI. Improved CII rating.

Convert high pressure steam into rotary energy by utilising a steam turbine as a generator drive for power generation or mechanical drive for rotating equipment, such as compressors and pumps.

- Fully automatic with instant start for immediate energy savings (calculated average of 1 hour additional uptime per vessel sailing)
- Partial load efficiency – high performance is maintained across a load profile from 10 to 100%
- Turbine wheel is milled from solid reducing vibration, extending service life and maintenance intervals
- Integrated gearbox reduces size and weight
- Modular/single skid solution fits in a standard hatch and delivers space/weight savings, simplified installation and easy integration with existing equipment

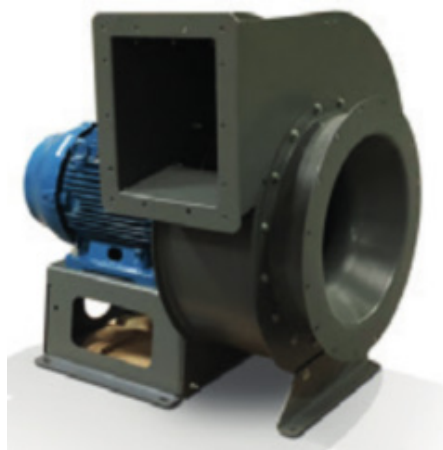
Ventilation and Cooling

Howden axial and centrifugal fans are used on vessels of all classifications for cooling and ventilation providing unrivaled performance in the harshest environments and applications where noise and vibration are critical risk factors and shockproof reliability is vital.

- Engine room ventilation
- HVAC systems
- Emergency extraction

Axial / Centrifugal Fans Low to medium-duty fans

- Low energy consumption
- Outstanding reliability



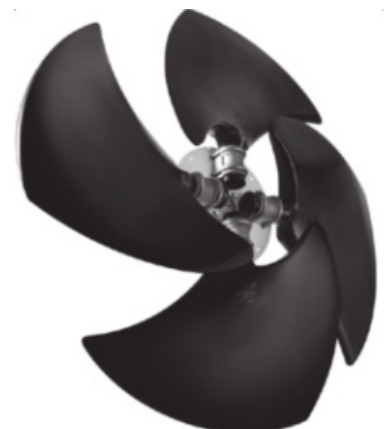
Centrifugal Fans Medium-duty fans

- Optimized operating expenses
- High temperature resistance



Cooling Fans

- High aerodynamic efficiency
- Lowest noise levels available





Principal technology and components are designed and built in-house and we support customers throughout the complete project lifecycle.

Contact us to learn more

ChartMarine

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