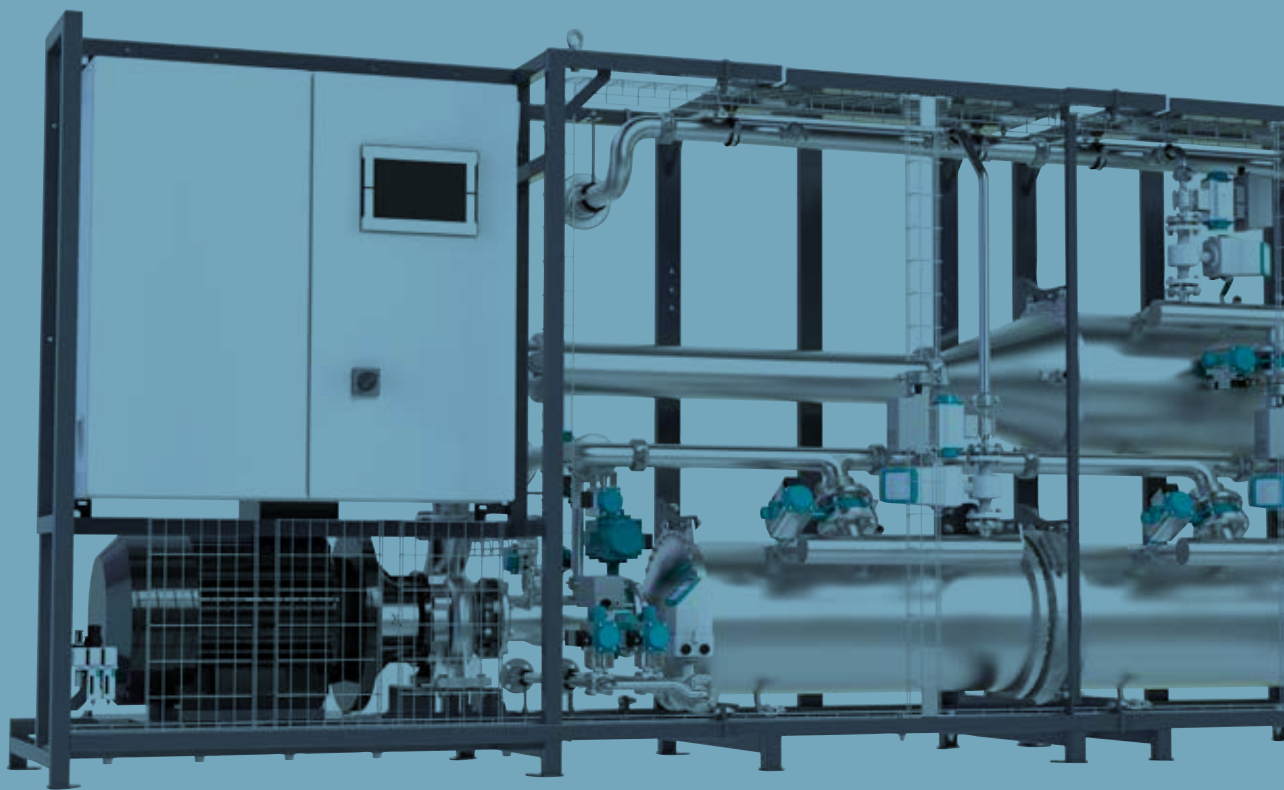


# LIQTECH



**Marine Scrubber  
Water Treatment System**





**LIQTECH**

# IMPROVING OUR FUTURE

The world is running out of clean water resources and it is essential that we treat the resources we have with respect and care. LiqTech has developed a unique ceramic membrane capable of removing oil, pathogens and heavy metals etc. from water, thus providing robust filtration solutions for essential applications.





## LiqTech & The IMO Sulphur Cap

As a pioneer and the leader in development, manufacturing and supply of revolutionary carbide ceramic technology for purification of liquids and gasses, we at LiqTech have committed ourselves to help solving the environmental challenges caused by the constantly improving global lifestyle.

We are here to clean water from unburned fuel oil, soot particles, ash and heavy metals, and to take an active role in reducing world pollution. We care about the future, and at the same time about growth. We see it as our mission to enable companies to grow stronger while meeting the environmental demands of tomorrow. That means the world to us.

LiqTech has developed a compact and efficient water treatment system for both closed-loop and hybrid scrubbers that outperforms discharge limits regulated by the IMO. Working with the market leaders for several years, we have successfully installed both retrofit and new-build systems on hundreds of vessels.

- ⊕ 12-18 Months Return on Investment
- ⊕ Minimal Sludge Production & Handling Costs
- ⊕ Market Proven
- ⊕ Ideal for Retrofit Installation
- ⊕ Future-Proof Solution
- ⊕ Selected by Market Leaders
- ⊕ Guaranteed Compliance with IMO Discharge Regulations
- ⊕ Un-Interrupted Operation on HSFO in SECAs



By installing a scrubber system, vessels can continue to operate on marine heavy fuel and avoid switching to significantly more expensive marine gas oil while operating in IMO-regulated areas.





## Benefits of the LiqTech System

- ⊕ Constant IMO compliance
- ⊕ Minimal sludge production and handling cost in combination with dewatering
- ⊕ Most robust membrane technology providing system durability
- ⊕ Mechanical separation, providing consistently high water quality
- ⊕ Highest recovery rate in the market
- ⊕ Capable of heavy metal removal
- ⊕ Fully automated solution
- ⊕ Flexible system for different sailing profiles
- ⊕ Modular system design for flexible installation and capacity upgrades
- ⊕ Low-pressure system with low energy consumption

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Low-pressure system with the highest recovery rate in the market, resulting in low energy consumption and high efficiency.

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250+ systems installed worldwide,  
and we have more than 20+ years of  
experience in the filtration industry.

## Selected by Market Leaders Worldwide

LiqTech's marine scrubber water treatment systems are installed on hundreds of vessels worldwide. Our references from industry leaders include vessels such as cruise ships, Ro-Ro passenger ships, Ro-Ro cargo ships, container ships, bulk carriers, tanker ships, etc.

The water treatment solution from LiqTech secures compliance with environmental requirements and reduces handling costs of scrubber sludge. We have experience with all types of alkali used (MgOH, MgO, NaOH, Na<sub>2</sub>CO<sub>3</sub>).

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We have long-term experience working with top marine scrubber manufacturers, shipowners, and shipyards, and we have a market-proven solution.



## Modular Design for Flexible Installation

With LiqTech's innovative modular design, it is easy to install the marine scrubber wastewater solution on retrofits and new builds. The solution makes it possible to further increase capacity after installation if needed.

- + Separation of filter skid for ease of installation
- + Possibility to increase capacity
- + Low maintenance

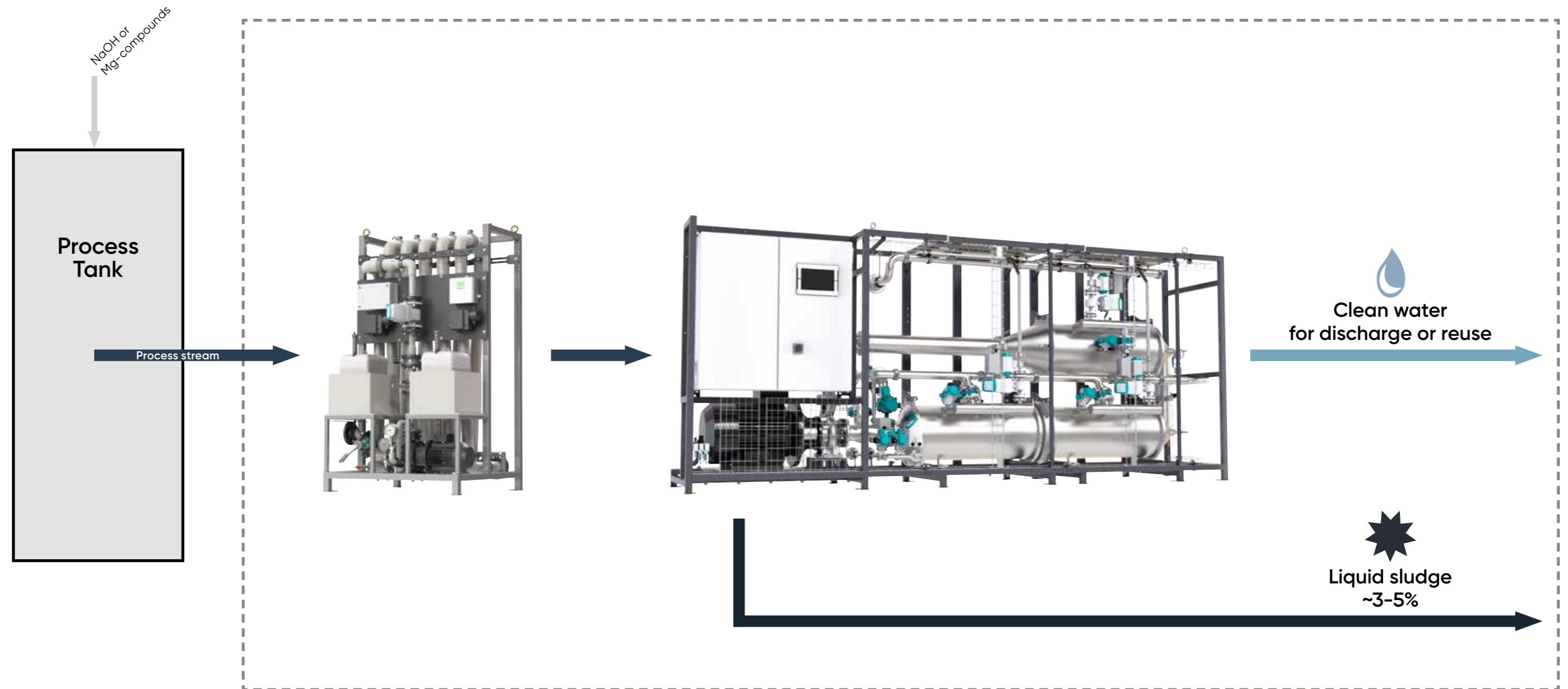


## Filtration Process for Marine Scrubbers

Our solution will treat the water from the scrubber tower, and then it is sent back to the scrubber tower for reuse or sludge tank. This enables the scrubber to run in a "closed-loop" with no wastewater discharged overboard. Instead, the SOx particle is filtered and concentrated in our ceramic membranes and can be further dewatered in a filter press (optional), providing bulk discharge of dry waste to a waste handling station while in port.

- ⊕ 3-24 m<sup>3</sup>/h
- ⊕ Up to 1500 mg/l TSS
- ⊕ Scrubber alkali Mg-compounds or NaOH

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\*These are not all configurations - please contact LiqTech for further information.

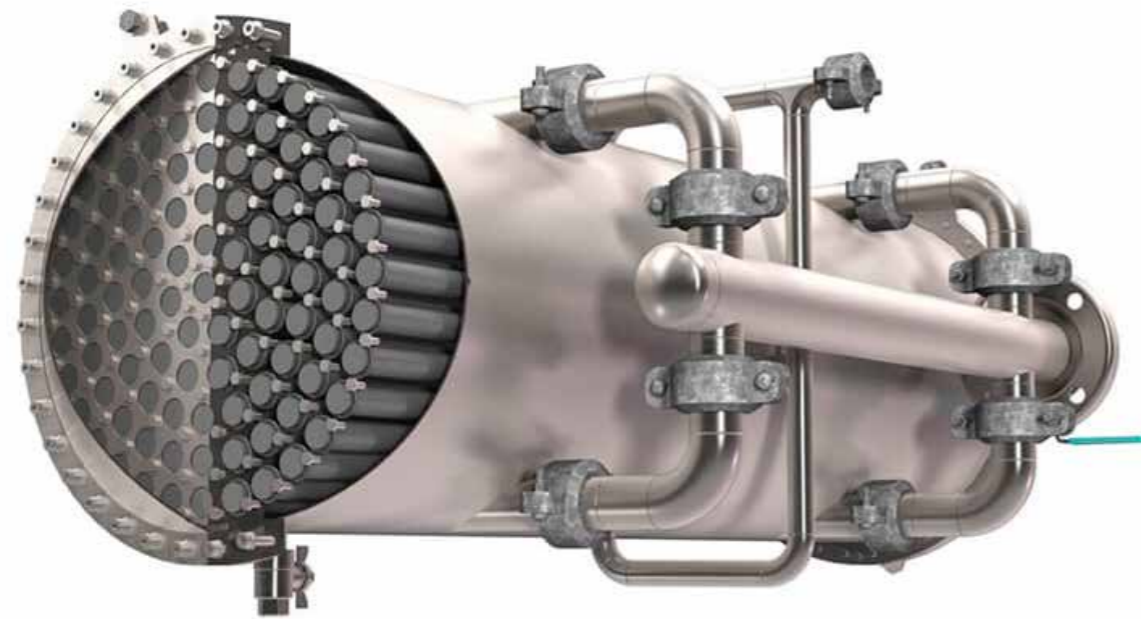




## Benefits of Ceramic Membrane Technology

For more than two decades we have manufactured products of recrystallized ceramic membranes. Our carbide membrane technology and systems will provide unique advantages for your business.

Our ceramic membrane is chemically inert, temperature resistant, has a high affinity to water (small footprint) and extreme hardness, which makes it a very durable product and perfect for wastewater. The ceramic membranes are placed in a housing for protection, ensuring an efficient filtration process.



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### Unmatched Flux

Ceramic membranes have the highest flux of any membrane



### Chemically Inert

Our systems can withstand the full pH spectrum of 0-14



### Small Footprint

One of the smallest footprints for complete systems in the market



### Efficient Cleaning

Any chemical can be used for cleaning, resulting in very low membrane fouling



### Excellent Thermal Properties

Our ceramic membranes can withstand temperatures of 800°C



### Robustness

SiC is the second hardest material in the world next to diamonds



### Unmatched Performance

High performance, low total cost of ownership and low maintenance



### Long Service Life - Less Maintenance

Fully automated system with less down time and stable operation



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**Our revolutionary ceramic membranes are based on 20 years of experience.**





## Efficient Cross-Flow Filtration

LiqTechs marine applications are installed with cross-flow filtration for reduced fouling and increased recovery rate.

LiqTech marine WTUs are low-pressure ultrafiltration systems installed with housings containing ceramic membranes arranged in a cross-flow configuration. Cross-flow filtration is a process in which the feed stream flows tangentially to the membrane surface. This tangential cross flow works as a rinsing mechanism due to the turbulence on the membrane surfaces, which helps redistribute particulate matter back into the feed water and maintain high flux. Thanks to the high cross-flow rate, fouling is reduced, and recovery is increased. The WTU can be customized to match various filtration needs.

### Cross Flow Filtration

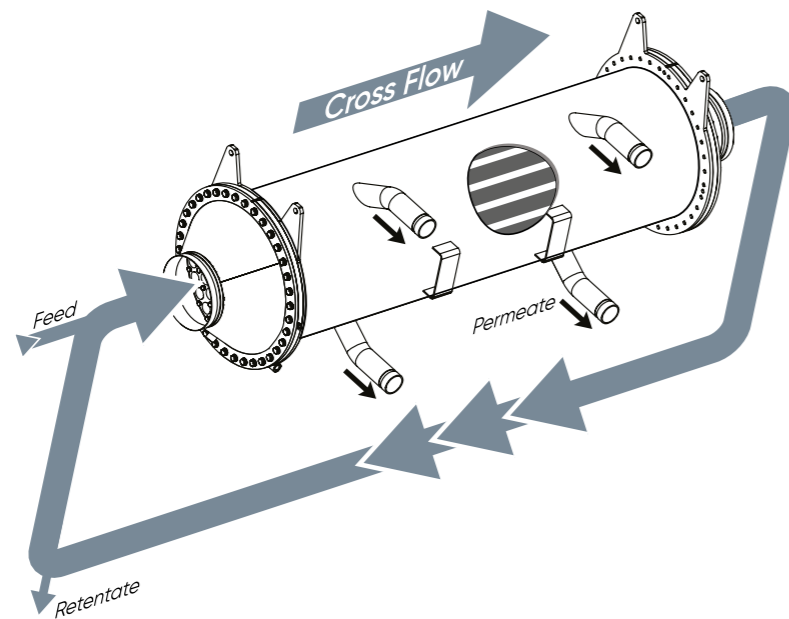
The pressure difference across the membrane drives clean water, i.e., permeate through the membrane. This process separates the feed water into two streams, named permeate and retentate. First, the permeate passes through the membrane layer. This is filtered liquid. The retentate is retained by the membrane layer and consists of rejected particles. The permeate is led to a permeate tank, while the retentate is upconcentrated and bled from the cross-flow loop. Due to the high cross-flow rate, the recovery is increased significantly, delivering a high concentration of liquid sludge.

The cross-flow generates a shear force on the membrane surface, which sweeps away particles and solutes, ensuring minimal solids build-up. This is essential as solids build-up can block the filter. Cross-flow prolongs membrane efficiency by reducing fouling and the need for chemical cleaning, meaning operational downtime. It is crucial to preserve a high cross-flow velocity to continually sweep away particles and solutes to maintain clean membrane surfaces, ensuring a high recovery rate.

Thanks to the robust properties of our silicon carbide ceramic membranes, they can operate at extremely high cross-flow velocities. In addition, silicon carbide (SiC) is the second hardest material in the world, ensuring a high degree of mechanical strength.

### Advantages of Cross Flow Filtration:

- ⊕ Reduces fouling
- ⊕ Reduces need for backwash & CIP
- ⊕ Reduces operational downtime
- ⊕ Delivers a high concentration of liquid sludge



Thanks to the high cross-flow rate, fouling is reduced, and recovery is increased.



## End to End Service

At LiqTech, we have everything in-house that is key to our customers because they want to work with filtration experts, and they want to work with a company who knows their technology and equipment in detail.

### Technical Sales Support

Our technical sales team is highly experienced and competent engineers with years of marine experience enabling us to discuss and advise on the best system configuration for any vessel type and size.

### Process Engineering Consulting & Chemistry

Through 20 years of manufacturing water filtration systems and filters, LiqTech process and chemical engineers are expert advisors in choosing the best filtration solution, chemicals and dosage suited for the application for both fresh and saltwater scrubbers. We provide the most reliable scrubber wastewater treatment systems available on the market.

### System Design

The LiqTech system is modular, enabling various treatment capacities to match the needed requirements in scrubbing. Our flexible systems meet your needs for different water purity, engine sizes, waste treatment and handling, and preferred choice of chemicals (Alkali).

The LiqTech system components may include:

- Prefiltration: Pipe-coagulation
- Dewatering system: Facilitates improved system performance, wash-water quality, waste volume limitations and handling of solids or liquids.

An OEM Scrubber manufacturer may have a unique filtration requirement in order to better match the scrubber and process, including water polishing. The LiqTech design team is happy to partner with you and optimize the complete closed-loop / hybrid-scrubber system to match your needs.

### Project Management


The LiqTech project management team has successfully delivered on schedule 250+ high-quality marine systems to our customers. The individual project managers are given ownership of separate projects, ensuring dedicated focus on client contacts and their systems. Leading up to factory acceptance test (FAT) and system delivery, or whenever a current status update in the building process is needed, that appointed person will always be available and ready to report to the client representative.

### Service & Commissioning

LiqTech will support our systems and your ship for as long as it sails. We support you by:

- Providing technical support to shipyards, shipowners, scrubber manufacturers and installers, who will enjoy in-depth, expert assistance from our highly qualified team of marine service engineers during the entire process, from sales to operations and repair.
- Providing live demonstrations and in-house training
- Performing pre-shipment FAT on every system, ensuring every delivered system works according to specifications.
- Providing on-ship system commissioning for every system
- Continuously upgrading our control module operating system and provide our customers with these upgrades, ensuring the best possible operating performance.
- Providing 24-7 support, so you can have complete confidence in your LiqTech system. The team is always ready to assist through remote service and support on system installation, commissioning, system status and preventative maintenance.

With our extensive experience collaborating with shipowners, scrubber manufacturers, shipyards and installers, your closed-loop or hybrid scrubber system will be fully supported by experts, meet your specific vessel needs, and meet or exceed compliance requirements.



Remote monitoring and control  
24/7 - anywhere in the world  
with highly skilled engineers.





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