



Unique Group

Marine & Subsea

White Paper

# Ultra-compact Marine Scrubbers



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# Introduction

## Ultra-compact Marine Scrubbers from Kamelia Cleantech

With IMO 2020 already in effect, ideally shipowners should have already decided their path to compliance and be maximising the benefits of their chosen compliance method. Whether it is switching to Very Low Sulphur Fuel Oil (VLSFO) or installing ship scrubbers, shipowners must have a futureproof strategy, especially for the aftermath of the pandemic.

System cost and large footprint have been some of the major concerns for all vessel owners and operators in choosing SOx Scrubbers. To address this, Kamelia Cleantech, A Unique Group Company, has developed a novel scrubber concept enabling flexibility in terms of space, shape, and size for all types of vessels.



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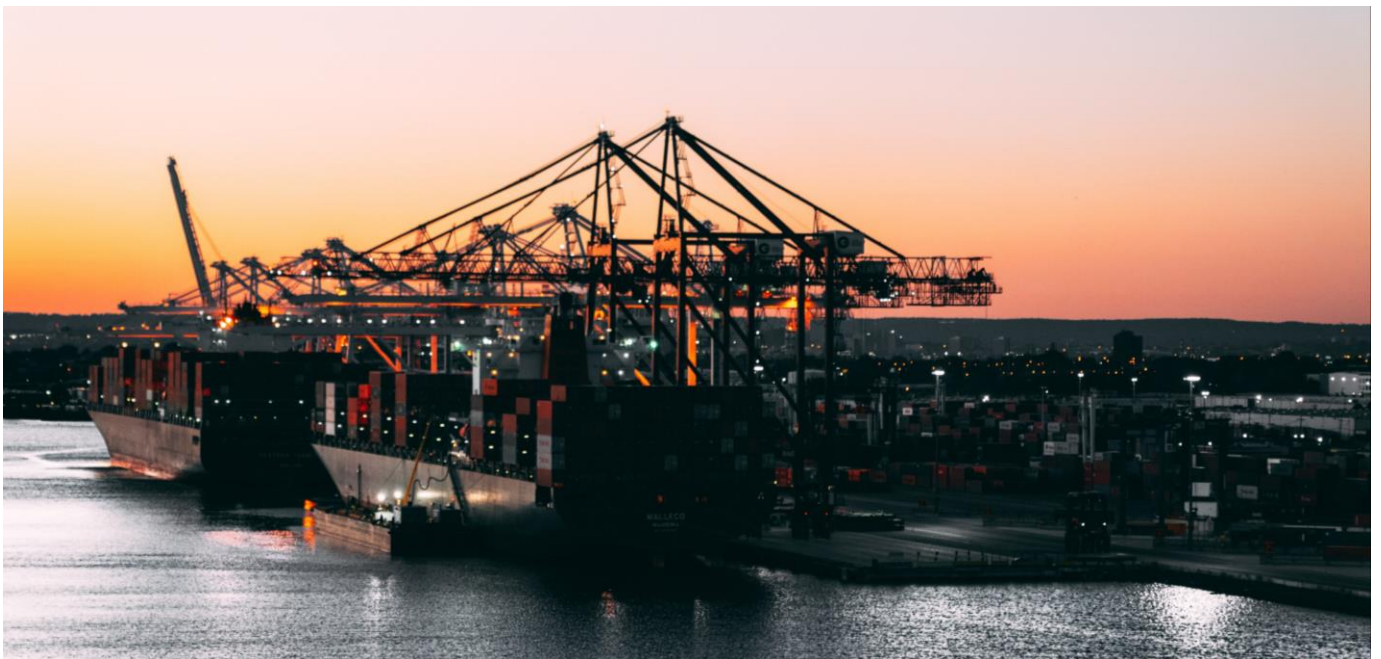
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# The Challenge

## Scrubbers are only for Large Vessels

The unstable supply and price of Very Low Sulphur Fuel Oil (VLSFO) have been one of the deciding factors for shipowners investing in scrubbers. Exhaust Gas Scrubbers are the only alternative for ship owners who wish to use Heavy Fuel Oil (HFO). Installation of scrubber systems, has therefore, seen a huge surge in interest among many shipowners and operators between 2018 and early 2020.

However, many believe that scrubbers can only be a lucrative investment for larger vessels and not for smaller vessels (smaller than a Panamax or Suezmax for example). Shipowners are hesitant in choosing scrubbers because of the cost and the space requirement from their ships. There are not many scrubber technologies available that are compact enough to save on material costs and not encroach on usable space for ships of all sizes. Building a compact scrubber that ensures optimum performance and efficiency is an engineering challenge that Kamelia Cleantech has successfully solved.



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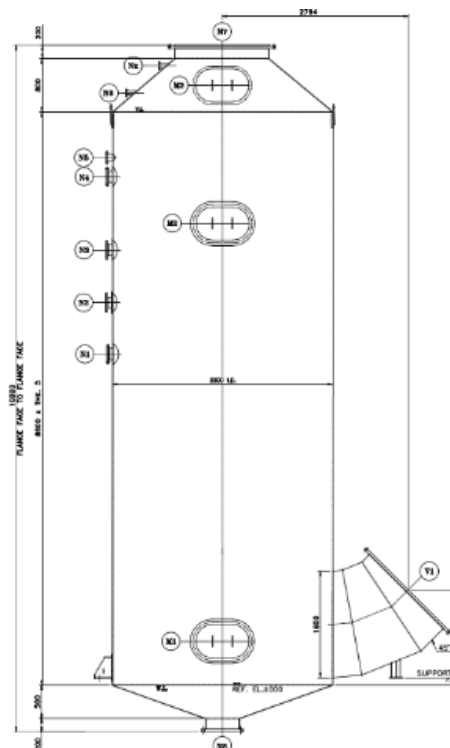
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# The Solution

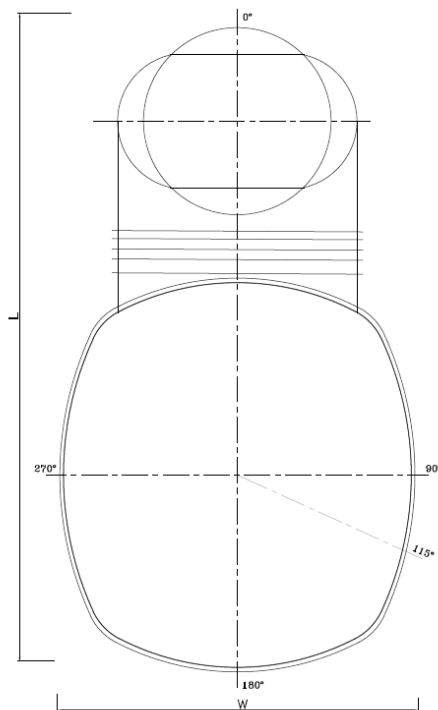
## Futureproof Ultra-compact SOx Scrubbers

Kamelia Cleantech has developed an ultra-compact Marine Scrubber designed in accordance with ASME U code. The mechanical integrity of the design is checked with rigorous calculations using PV Elite software. Our scrubbers are the most lightweight and most compact in the market. The different sections of the scrubber are welded, not flanged, to ensure a leak-free configuration and cost-effective design.

Despite its compact design, the backpressure to the engine is minimized due to the optimised internal design and scrubber's cylindrical geometry, allowing the engine to run at higher loads without affecting its performance at open seas, when compared with equivalent-sized rectangular (box) type designs.



Ultra-compact and lightweight scrubbers that can be customised to fit your vessel to ensure NO CARGO LOSS.



Top view drawing of Kamelia Cleantech Oval Scrubber



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# The Solution

## Enclosure-less Scrubbers for Industry-leading Efficiency

Our scrubbers can be installed with or without an enclosure and are designed to withstand wind loads and wave loads required by Class. When installed without an enclosure, the top section of the scrubber should be supported by surrounding steel structures at two locations. These locations can be rotated according to vessel geometry at the design phase. Installing the tower without an enclosure will save installation time and cost.

Manufactured in high-grade steel alloys, the construction materials are selected to withstand the harsh environment caused by wet scrubbing and high temperatures at the inlet.

The scrubber can be completely bypassed, which ensures ease of maintenance and safety for the engines. Our system relies on state-of-the-art software, to ensure that it is running as efficiently as possible, as well as continuously monitoring gas exhaust and water discharge.

### Fully customisable in all shapes and sizes

Maintenance areas of the tower can be positioned as per client request. If the client requires, manholes and all the scrubber nozzles can be fixed close to the exhaust gas inlet pipe to minimise maintenance space requirement. The maintenance area can also be partially inside an enclosure to facilitate easy access in any seagoing condition.



Most customisable scrubber in the market. Available in U-Line, I-Line, Oval and Rectangular scrubbers.

# The Solution

## Enclosure-less Scrubbers for Industry-leading Efficiency

### Small-fit high-performance scrubbers

The scrubbing tower consists of an inlet and main scrubber body with a packed bed and several spray levels. This ensures optimum mixing between the scrubbing water and the exhaust gases, enabling efficient scrubbing with a minimum amount of scrubbing water. Some spray levels can be closed in low load operation and fuel with lower sulphur content (e.g. 2.5%S).

The scrubber tower is equipped with a demister to limit the number of water droplets leaving the scrubber with the exhaust stream. This demister is fitted with cleaning nozzles, both above and below the demister, to reduce fouling and backpressure issues for the engines.

### Intelligent software

Kamelia Cleantech recently introduced KCS 1000; a new version of our scrubber control software, that is based on Marine Artificial Intelligence (AI). Our reliable control system uses the latest technology available in the market that helps optimise vessel operation.

- Reduction of water and power consumption by 60% at low load.
- Designed to be user-friendly, minimum crew intervention.
- Remote monitoring enables data analytics and predictive maintenance to ensure aftersales support is available in the right place, at the right time.



Our new software, KCS 1000, is an advanced and adaptive that requires minimum crew intervention.

# The Solution

## Reap Maximum Benefits with Our Scrubbers

Kamelia Cleantech provides client confidence in the following benefits:

### Reduced steel requirement by 60%

This is made possible by designing our scrubber in accordance with ASME U code and optimising on PV Elite software. Substantial amounts of steel are also saved by having a shorter inlet, efficient design and arrangement of internals, and by not having an unnecessary scrubber enclosure. This is made possible through the expertise and engineering knowledge of our experienced technical team, careful consideration of structural stress and stability requirements, installation, and insulation requisites as well as painting/coating.

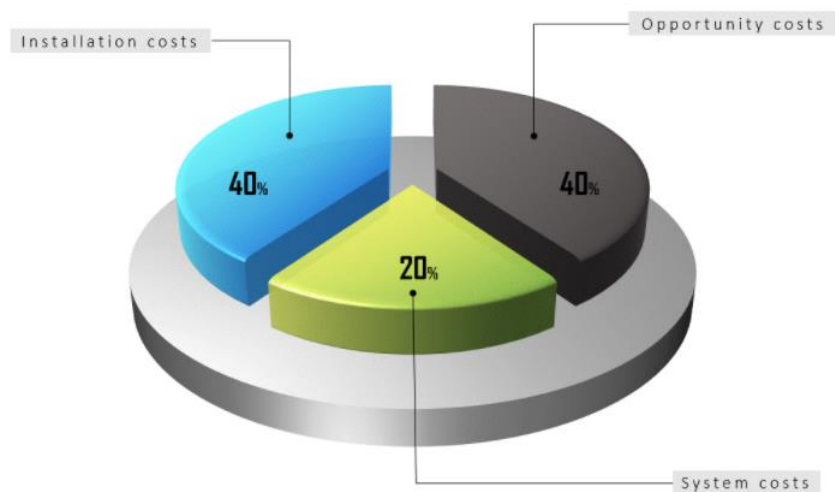
### Faster installation time: Up to 60 % reduction in installation time

Scrubber system installation time usually takes around 45 days. However, by using our unique enclosure-less design together with our revolutionary work-on-voyage concept and augmented reality we are able to considerably decrease vessel downtime and save approximately 60%-yard time out of charter.

### Greater cost savings/Shorter ROI

Kamelia Cleantech's informed approach enables savings on material, installation, and docking costs. A faster installation time also means minimal vessel downtime and greater opportunity cost savings. Customers will also have substantial OPEX savings due to our intelligent systems and flexibility in operation.

COST BREAKDOWN FOR A LARGE CONTAINER VESSEL



Typical cost breakdown for a large container vessel



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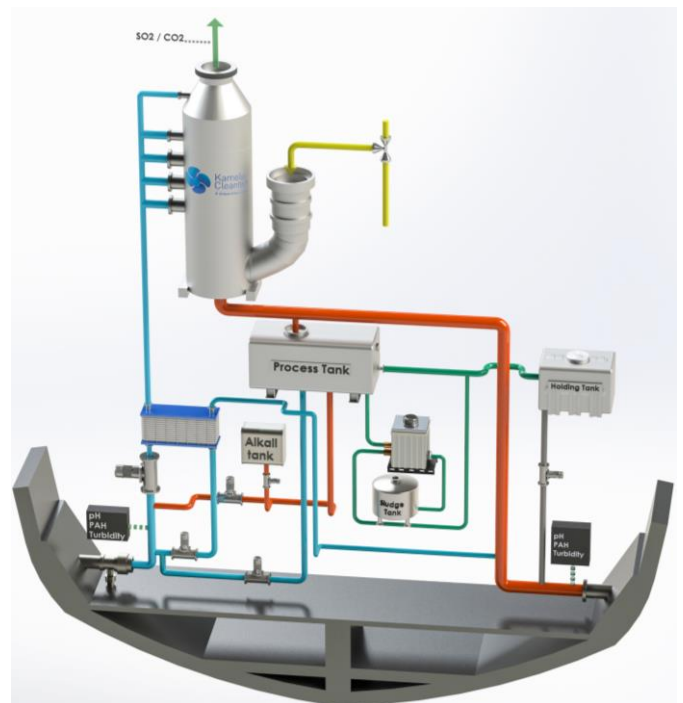
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# Conclusion

## Kamelia Cleantech Scrubbers for Maximised Benefits

The aftermath of the pandemic will require everyone to efficiently utilise their available resources and save costs wherever possible. With the current, lower spread of fuel prices, opting for LSFO could result in a short-term accomplishment of monetary savings. However, oil prices are expected to rebound once the world recovers from COVID-19, as well as OPEC being likely to continue its efforts to support oil prices. Further down the line, the upward pressure on oil prices could also intensify due to the major reductions in CAPEX by oil companies seen at present. Given the current volatility in the market, shipowners and operators have the option of a futureproof, long-term savings strategy by choosing to install exhaust gas scrubbers.

Choosing the right supplier is as important as choosing the right compliance option. Kamelia Cleantech understands the need for a long-term cost-saving solution, whilst not compromising on the quality, efficiency and performance of the system. We are well positioned to aid shipowners and operators of both small and large vessels to achieve significant savings and a higher return on investment with our technology. We believe it is our ethical and moral obligation to leave a cleaner environment and a better future for generations to come.



Kamelia Cleantech's U-Line Hybrid System







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