

Envirocleanse inTank™ Ballast Water Treatment System

ALWAYS
COMPLIANT



LOWER COST

LESS POWER DEMAND

NO FILTER



Envirocleanse inTank™ Ballast Water Treatment System

Envirocleanse, LLC, owned by Charter Brokerage – a **BERKSHIRE HATHAWAY** company – was founded in 2007 as a developer and provider of environmentally safe disinfection using electrochemical activation (ECA) for applications in the oil and gas fracking, food service, and medical industries.

Envirocleanse has developed a Ballast Water Treatment System (BWTS) in collaboration with Glosten Marine to prevent the transfer of harmful aquatic species via ship's ballast water. With patented nozzles inside the ballast tanks and a robust hypochlorite generator, the Envirocleanse inTank™ BWTS is the most advanced and sustainable system on the market.

The operational aspects of the inTank™ system guarantee verifiable compliance for the ship owner.

Advantages

No impact to cargo operations

- No filter means no backwashing and no downtime in port
- Treatment process takes place in transit

Minimal Crew Interface

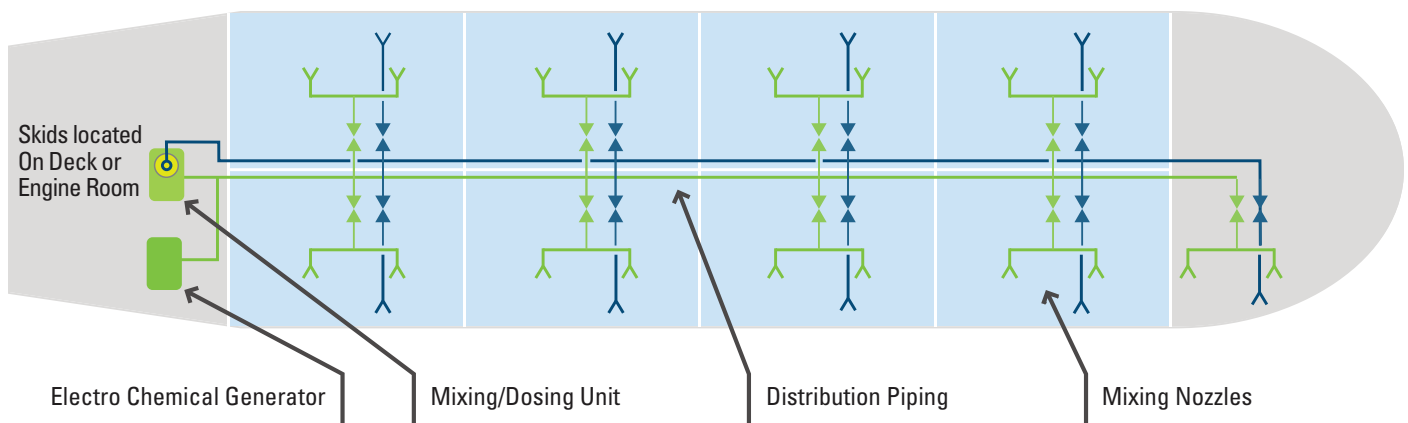
- Ease of system operations
- Does not require attention of crew while in port

Power Supply Not Impacted

- Continual dosing in transit allows smaller operating unit
- Uses power during non-peak demand times
- No need to repower a ship

Guaranteed Compliance

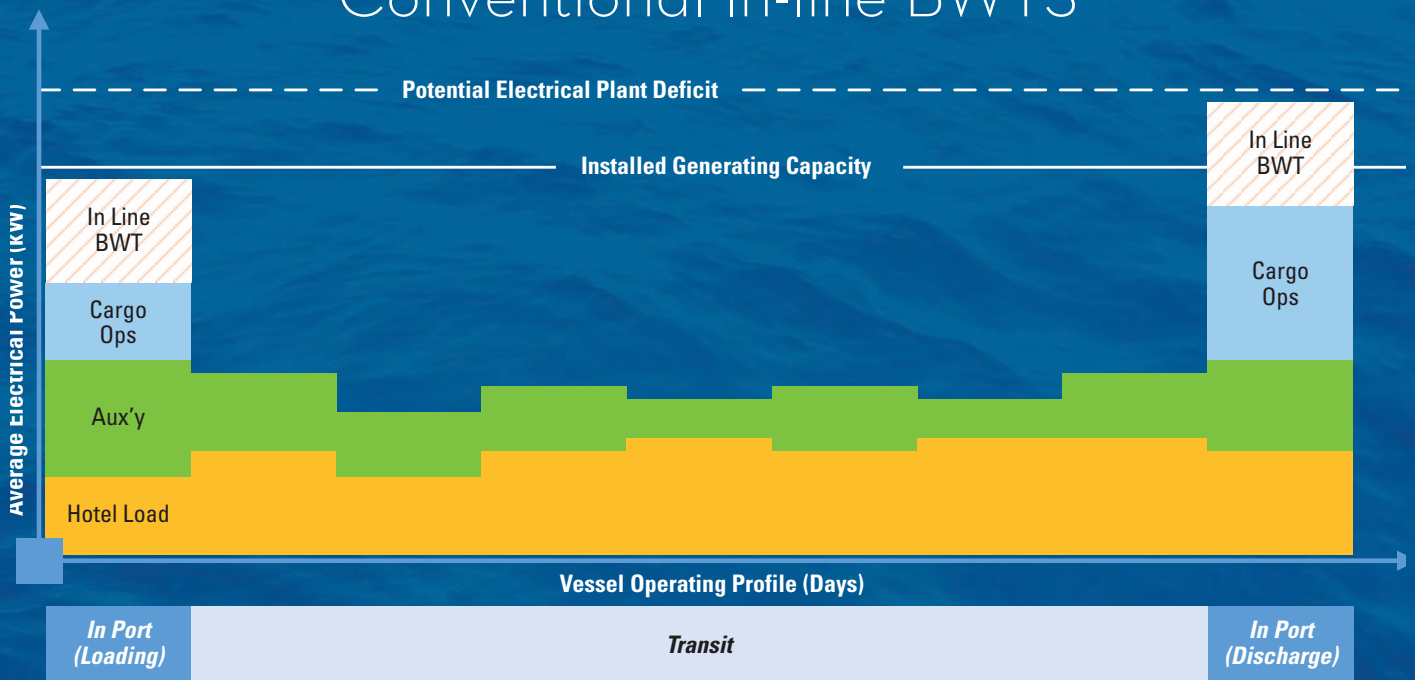
- No regrowth potential in transit
- Able to meet demands of challenging water



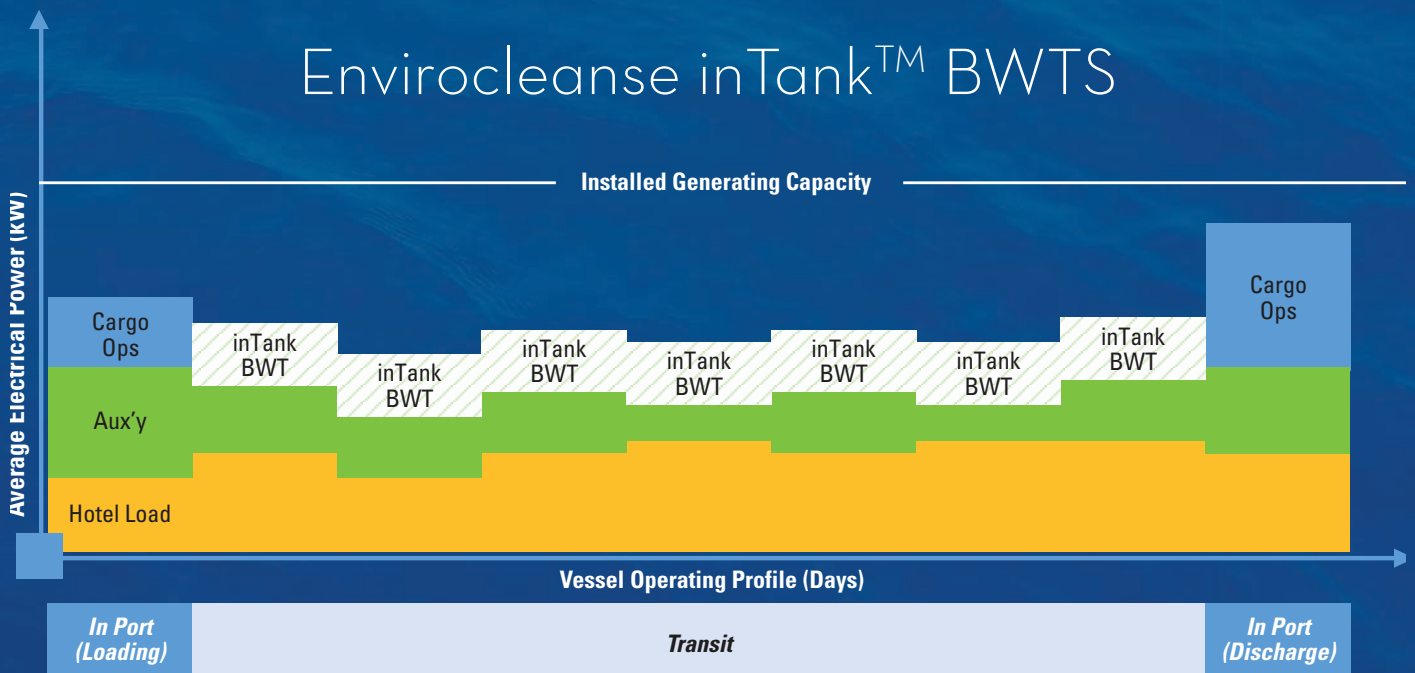
Treatment Overview

When a vessel uses the inTank™ BWTs, water is taken-up into ballast tanks with no change to existing operating procedures, i.e. no treatment occurs during uptake. The inTank™ BWTs process occurs during the voyage. A small portion of ballast water is suctioned from one ballast water tank at a time, passed through the circulation module, and returned to the same ballast water tank through in-tank mixing nozzles.

Conventional In-line BWTs



Envirocleanse inTank™ BWTs



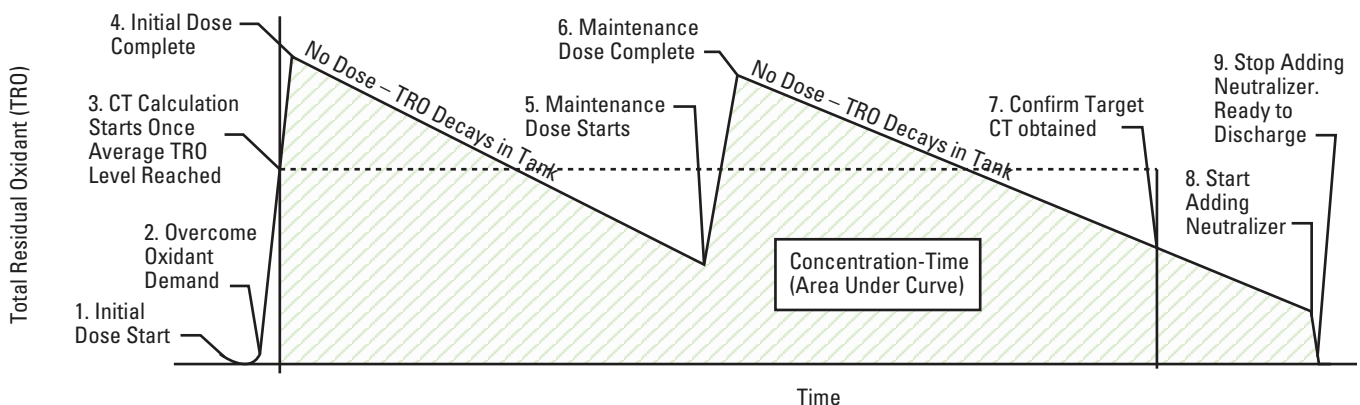
CT/Dosing

The inTank™ BWTS process ensures disinfection of ballast water tanks and piping through the application of a targeted CT, which is the product of disinfection Concentration (in milligrams per liter, mg/L) and disinfection contact Time (in hours) measured as total residual oxidant (TRO).

The CT approach is commonly employed in the wastewater treatment industry and for municipalities ensuring safe drinking water. The US Environmental Protection Agency (EPA) provides detailed guidance on CT calculation and application in its Disinfection Profiling and Benchmarking Guidance Manual.

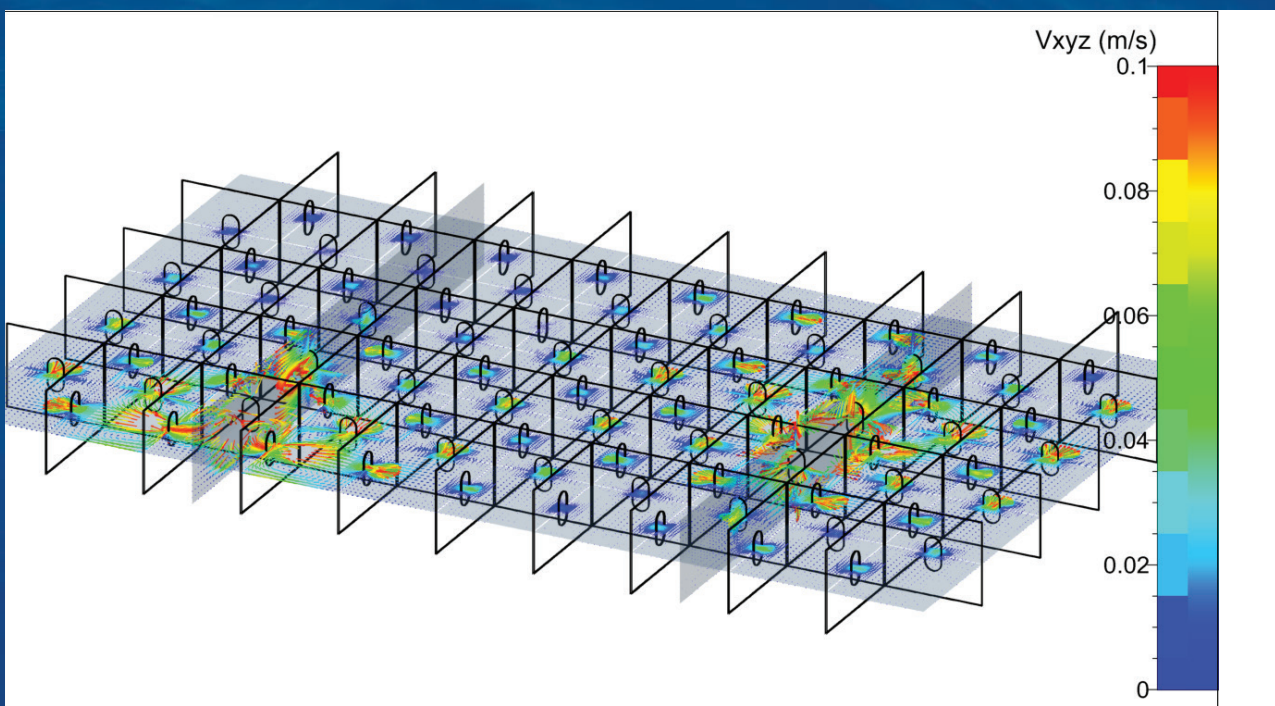
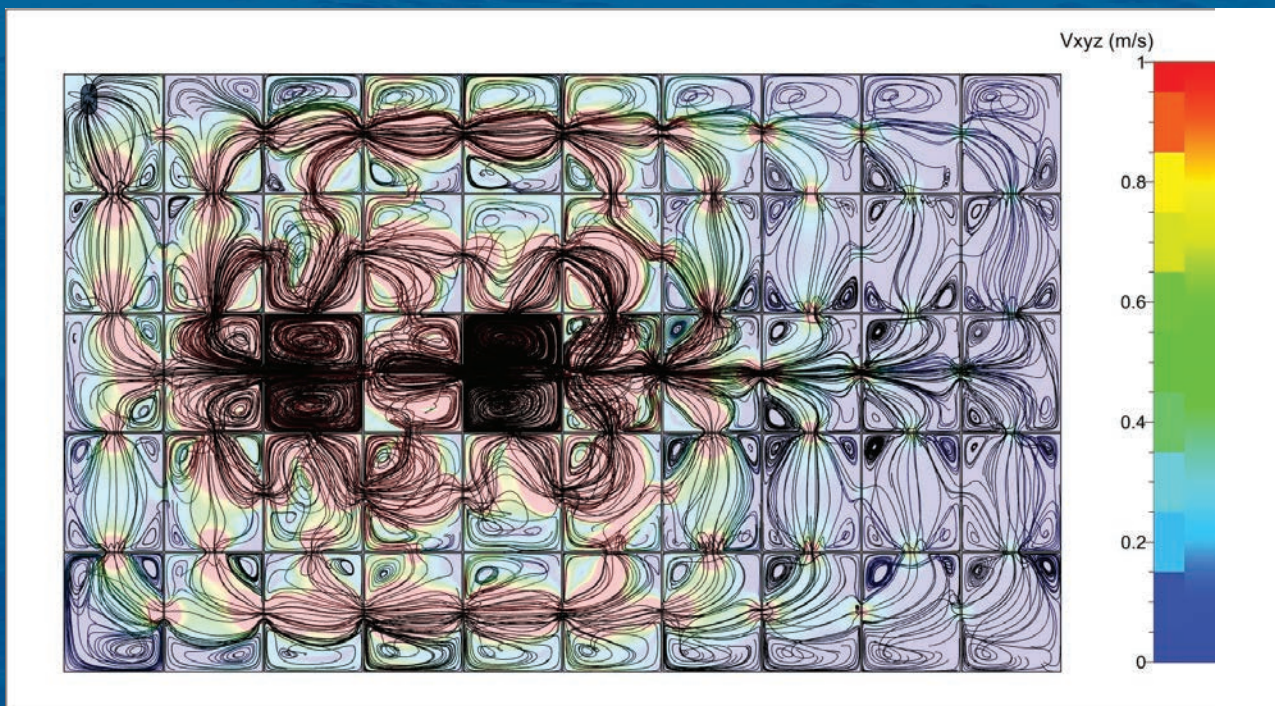
Envirocleanse has found that the effective CT for ballast water is an order of magnitude greater than that required to meet EPA drinking water standards.

Ballast water treatment requires inactivation of larger organisms that often have protective shells and resting stages. Ballast water treatment regulations are established to a numerical standard rather than a log-reduction of organisms. For organisms greater than 50 microns in size, the ballast water numerical standard is similar to a 4 or 5-log reduction, depending on the challenge water conditions.



Diffusion

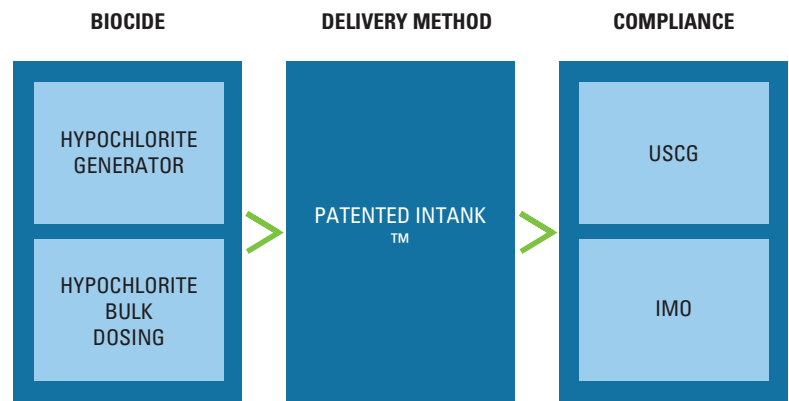
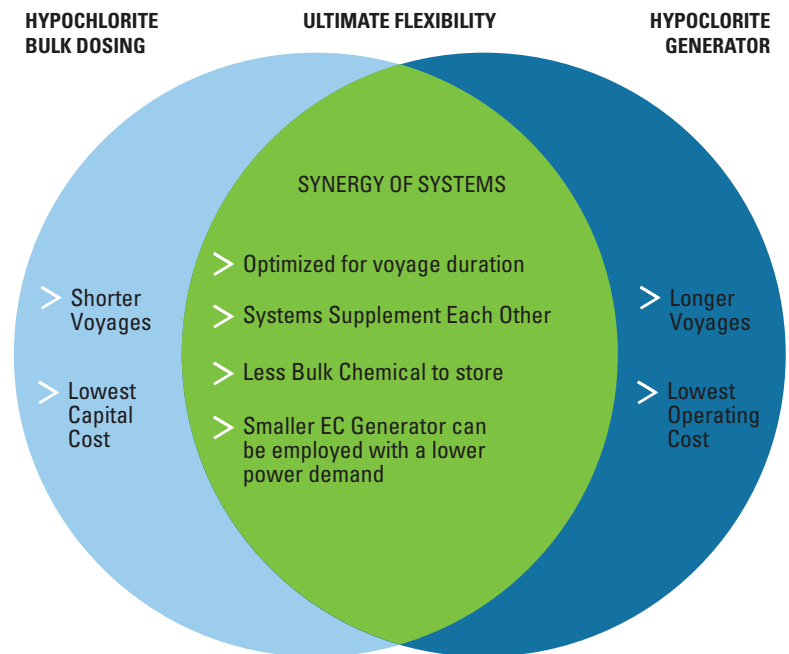
The inTank™ mixing system was studied at full-scale with tracer dyes and in computer simulations for all tank configurations. The EPA manual (US EPA 1999b) provides guidance on assigning a “baffling factor” based on a tank’s mixing efficiency. This factor accounts for dead zones and short circuiting of disinfectant application within a tank. Each inTank™ system will be engineered to meet or exceed EPA baffling factors to guarantee compliance.



One System / Two Options

The primary advantage of the Envirocleanse inTank™ system is its superior method of chemical delivery. Our patented nozzle, coupled with an inTank™ distribution piping system is able to treat each ballast tank individually by distributing the active ingredient, sodium hypochlorite (NaOCl). Envirocleanse offers multiple options to produce NaOCl: bulk dosing and an onboard, electro-chlorination generator. If the bulk-dosing option is selected, the user will simply maintain an adequate level of liquid NaOCl in a bulk-dosing tank. The system then distributes the chemical as needed when the ballast water treating cycle begins. In cases where the owner or operator chooses an on-site generator, seawater from the sea-chest is used to produce NaOCl that is similarly distributed to the ballast tanks. Both means provide a safe and reliable method to deliver the active substance into the ballast tank and ensure a compliant discharge.

Regardless of the production method, the chemistry and biological efficacy are identical thus giving the ship owner the ability to choose the most economical method based on vessel ballast capacity and expected voyage time. This is a feature no other system can offer to the industry.



Compliance Summary

We continually monitor tank conditions to ensure proper dosing

- **The assurance of regulatory compliance that is only possible with the inTank™ design is a compelling basis for an overall cost & risk reduction decision**

Utilizing a CT approach for oxidant dosing, efficacy is achieved by taking the oxidant demand of the specific water being treated into consideration. To illustrate, applying a single oxidant dose to all waters may result in over-treatment, equating to excessive chemical addition that impacts what is ultimately discharged to the aquatic environment. This adds risk of corrosion in ballast tanks as well as increased operating costs. A single oxidant dose may also result in under-treatment and regrowth, putting a vessel at risk of non-compliance with the ballast water discharge standards.



Bacteria and zooplankton populations can rebound within ballast tanks if oxidant levels decay to non-detectable concentrations for extended periods. To prevent such regrowth, particularly during long voyages, the inTank™ system may apply additional oxidant to maintain a minimum prescribed level during the voyage. Periodically, the system will circulate ballast water, checking oxidant levels, and adding additional oxidant as required to maintain the minimum control target concentration in each treated tank. By monitoring the residual TRO levels in-tank and applying only the oxidant dose needed to achieve the target CT, the inTank™ BWTS ensures environmental compliance and minimizes operational costs.

Less Electricity

- Expected to be significantly lower due to hitting dose exactly with the appropriately sized unit for in-transit treatment

Less Neutralizer Consumables

- Expected to be lower as it will track dosing

Less Maintenance

- Lower maintenance cost due to longer reactor life, no in-line filter, system simplicity



CapEx

Straight Forward engineering and installation effort

Less time in dry dock

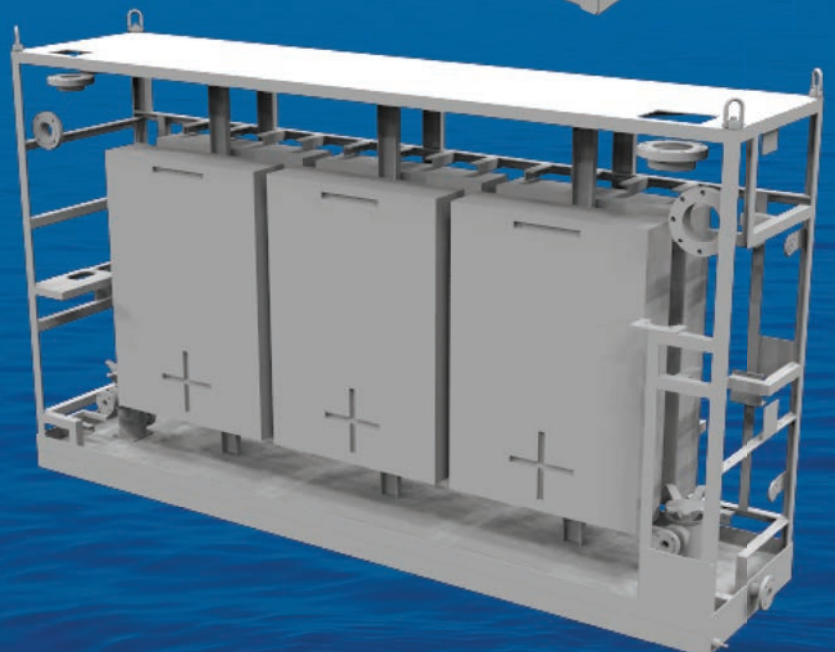
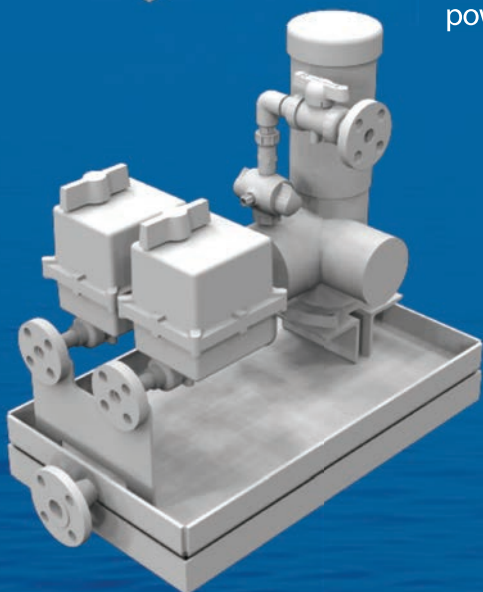
- The inTank™ installation is dispersed throughout the ship with no single location requiring any significant work. This allows multiple crews to work in different areas, expediting the installation process

Minimal impact on engine room

- Integration does not require engine room scanning
- Modular aspect of the system allows flexibility for multiple install locations outside of the engine room

No repower

- Lower overall power consumption from smaller units, combined with optimal use of non-peak demand power, means a ship will not have to upgrade its power generating systems



Lower System Cost

- Treating in transit allows a smaller system to be utilized to greater effect

Service

Ease of Business

Parts

Global inventories available for next day delivery

- Dock to Deck in 24 hours

Parts come complete with all necessary paperwork

In-depth installation instructions

Service

Training services provided for marine crew

- Classroom instruction
- Review IOM and P&ID
- Hands-on instruction
- Run an actual system, can be done at FAT
- On-line training and refresher courses available

24/7 call center available

- Technicians can be reached 24 hours a day

Maintenance

Worldwide network of agents to deliver parts and service ships

Consumables

Supplies available from global Envirocleanse inventories



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