



DESMI Ocean Guard CompactClean Ballast Water Management System

PROVEN TECHNOLOGY

DESMI

CompactClean

The Most Compact Ballast Water Management System on the Market!

DESMI Ocean Guard A/S is part of the DESMI Group, which was founded in 1834 by Henning Smith and is one of Denmark's oldest companies.

For decades DESMI has developed, sold and manufactured pumps for marine applications and today many DESMI pumps are used and installed on board ships all over the world.

The DESMI Group portfolio includes pumps, oil spill response solutions, pumping solutions for defence applications, energy saving systems, automation and contracting activities next to ballast water management systems.

The Smallest Footprints Ever!

Are you looking for a ballast water management system that can be **installed easily** and without relocating other equipment? CompactClean is the answer! Almost as easy as **plug and play!** It is the first ballast water management systems on the market that combines very low space with large flow rates. Only 3.0 m² / 30 sqft is necessary for a 1000 m³/h / 4403 gpm system + 0.84 m² / 9 sqft for the electrical panel, which can however be placed up to 100 m / 328 ft away from the system itself.

The operation of the system is based purely on mechanical treatment and therefore it **does not involve any use of chemicals** or active substances. This eliminates risks of hazards to crew, vessel or the environment.

First treatment step is filtration, second step is UV treatment. During de-ballasting, UV treatment is repeated, but the filtration step is skipped.

- ✓ The smallest footprint in industry
- ✓ Only system in the world with integrated stripping solution
- ✓ Filter and UV unit in seawater resistant Nickel-Alu-Bronze
- ✓ Automatic flow control and lamp dimming
- ✓ Worldwide service network
- ✓ Fully automated operation
- ✓ 2 hours' holding time on USCG TA Certificate
- ✓ IMO type approval according to the new BWMS code from IMO
- ✓ Operational without add-ons
- ✓ Graphic HMI touchscreen interface
- ✓ Automatic generation of PDF reports to authorities
- ✓ Patent pending highly efficient UV unit design
- ✓ Short delivery time
- ✓ Easy maintenance
- ✓ No salinity or temperature limitations
- ✓ Down to UV transmission of just 42% - Also in US Territory!
- ✓ 100% chemical free treatment



CompactClean has **no salinity or temperature limitations**. The CompactClean BWMS has both IMO and USCG type approval, and the BWMS operates in the exact same way both inside and outside US Territory at record-breaking low UV transmission values! This enables compliant performance anywhere in the world in even very dirty and challenging

water conditions. This superior performance comes from the unique and patent pending shape of the UV chamber, which has been carefully developed and optimised through hundreds of state-of-the-art CFD (Computational Fluid Dynamics) simulations.

New System Special Features

Smooth Port Operations

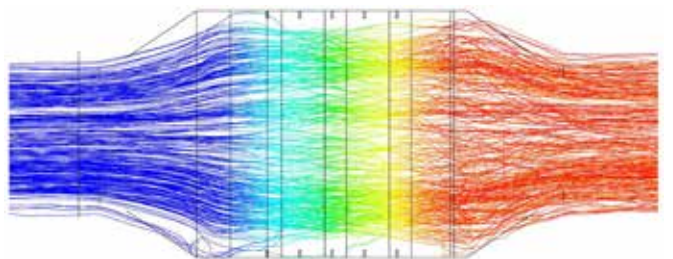
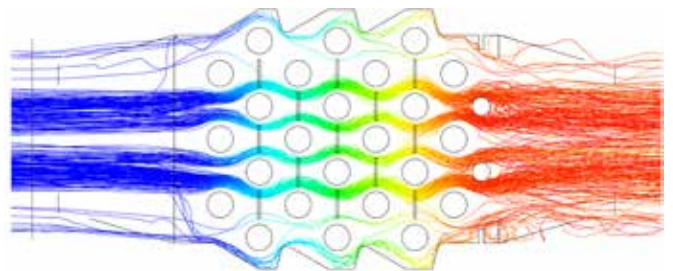
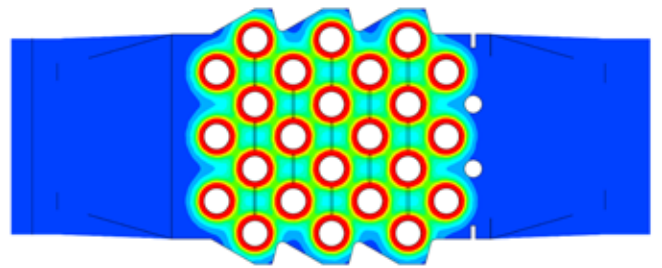
Automatic adjustment of treatment in order to cope with extremely challenging water, avoiding alarms and interrupted port operations in dirty and challenging water conditions.

CompactClean does not just raise an “out of compliance” warning in very dirty water conditions as some other systems. Instead, CompactClean automatically reduces flow through the system to ensure compliant treatment even under extreme conditions. This enables the vessel to carry on with its port operations instead of forcing the vessel to interrupt the ballast water discharge and you will save costs relating to delays in harbour.

High Efficiency Keeps your OPEX Down

Patent pending UV unit design with very high treatment efficiency reduces the power consumption.

The special shapes of the CompactClean UV chambers have been developed and optimised on the basis of hundreds of state-of-the-art CFD simulations. This ensures that each kW of generated UV light is utilized to the max. which means that the power consumption is as low as possible, resulting in reduced operational costs!



Easy Reporting to Authorities

Automatic generation of PDF report to authorities, documenting the performed treatment

With the IMO convention in force, vessel owners will experience increasing demands from authorities for documentation of performed ballast water management. Therefore, CompactClean features automatic generation of PDF reports that document the ballast water operations performed, including key parameters monitored during the treatment. The PDF files are automatically stored and can be transferred to a USB memory stick when inserted into the front of the electrical panel.



Integrated and Compliant Solution for Ballast Stripping Operations

The CompactClean filter back flush pump can be used as stripping pump during stripping of ballast tanks.

Use of ejectors for stripping of ballast tanks jeopardizes compliance with the IMO and USCG discharge standards, because untreated drive water is mixed with treated ballast water. In addition, the untreated drive water can introduce significant wear and tear of the system components. As the only system in the world, CompactClean solves this, as the system is fitted with a special filter back-flush pump that can be used as dedicated stripping pump during de-ballasting. One system, one pump: two problems solved!

Fully Automated with Easy Integration into Ship Automation System

CompactClean is PLC controlled and supports all generally used main types of communication interfaces.

With CompactClean the crew on board the vessel will hardly notice that they are treating the ballast water. The system is fully automatic and can be seamlessly integrated with already existing systems on the vessel. When wanting to take ballast water on board, press the "Start Ballast" button on the touch screen, and when discharging the ballast water press the "Start De-ballast" button on the touch screen. That's how simple it should be - that's how simple it is!

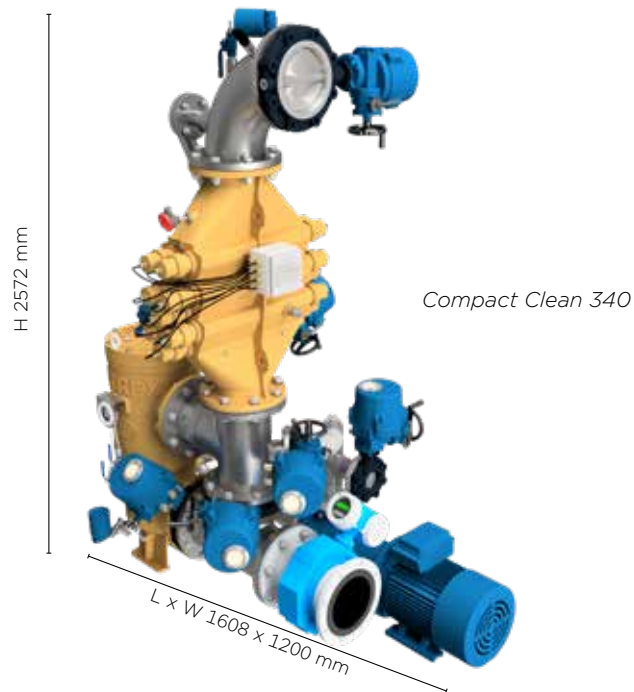
Long Lifetime of Components Gives you Reliable Treatment and Low OPEX

UV unit made of Nickel-Alu-Bronze material with superior corrosion resistance and proven very long lifetime.

The CompactClean UV units are made of cast Nickel-Alu-Bronze with proven sea-water corrosion resistance. DESMI has decades of good experience with sea water pumps in the same material: Proven Technology keeps the downtime and maintenance costs to a minimum!

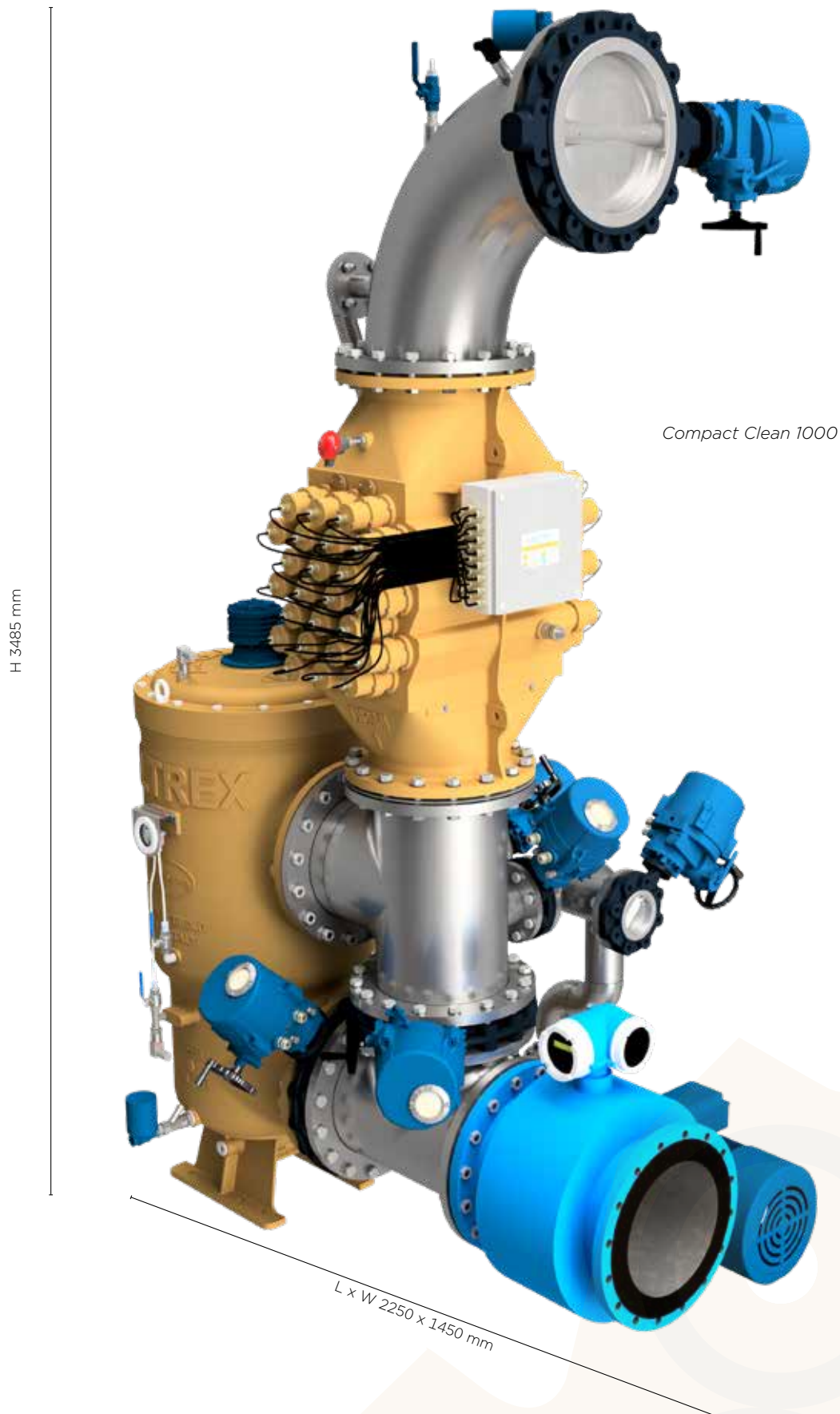


Standard Systems



Description	CC-135	CC-340	CC-500	CC-750	CC-1000	CC-1500	CC-2000	CC-2500	CC-3000
Max. capacity	135 m ³ /h, 595 gpm	340 m ³ /h 1498 gpm	500 m ³ /h 2201 gpm	750 m ³ /h, 3302 gpm	1000 m ³ /h, 4403 gpm	1500 m ³ /h, 6604 gpm	2000 m ³ /h, 8806 gpm	2500 m ³ /h, 11007 gpm	3000 m ³ /h, 13209
Min. capacity ballast operation	25 m ³ /h, 110 gpm	45 m ³ /h, 198 gpm	50 m ³ /h 220 gpm	65 m ³ /h, 286 gpm	95 m ³ /h, 418 gpm	126 m ³ /h, 555 gpm	126 m ³ /h, 555 gpm	126 m ³ /h, 555 gpm	126 m ³ /h, 555 gpm
Min. capacity deballast and stripping operation	5 m ³ /h, 22 gpm	9 m ³ /h, 39 gpm	13 m ³ /h, 57 gpm	19 m ³ /h, 84 gpm	26 m ³ /h, 114 gpm	38 m ³ /h, 167 gpm	52 m ³ /h, 229 gpm	64 m ³ /h, 282 gpm	76 m ³ /h, 335 gpm
Installed power	36 kW	78 kW	93 kW	131 kW	169 kW	245 kW	319 kW	395 kW	471 kW
Min. power	6 kW	11.5 kW	16.5 kW	24.6 kW	32 kW	48 kW	64 kW	80 kW	96 kW
Typical average power consumption	13 kW	25 kW	37 kW	55 kW	73 kW	109 kW	146 kW	182 kW	218 kW
Footprint (L x W x H)	1595x1125 x2035 mm, 63x44x80 in - 1.8 m ² , 19.3 sqft	1602 x 1232 x 2392 mm, 63x48x94 in - 2.0 m ² 21.5 sq ft	1807 x 1295 x 2614 mm, 71x51x103 in - 2.4 m ² 25.8 sq ft	2072 x 1364 x 3115 mm, 82x54x123 in - 2.9 m ² 31.2 sq ft	2067 x 1469 x 3389 mm, 81x58x133 in - 3.0 m ² 32.3 sq ft	2419 x 1557 x 3746 mm, 95x61x147 in - 3.8 m ² 40.9 sq ft	- - 6.0 m ² , 64.6 sq ft	- - 7.3 m ² , 78.6 sq ft	- - 7.5 m ² , 80.7 sq ft
Electrical Panel* (W x L x H) *Two (2) Electrical Panel for CC-2000, 2500 & 3000	600 x 600 x 1,806 mm, 24x24x71 in - 0.36 m ² 3.9 sqft	600 x 600 x 1,806 mm, 24x24x71 in - 0.36 m ² 3.9 sqft	600 x 700 x 2208 mm, 24x28x87 in - 0.42 m ² 4.5 sqft	600 x 1200 x 1803 mm, 24x47x71 in - 0.72 m ² 7.8 sqft	700 x 1200 x 2208 mm, 28x47x87 in - 0.84 m ² 9.0 sqft	700 x 1200 x 2208 mm, 28x47x87 in - 0.84 m ² 9.0 sqft	- - 2 x 0.84 m ² , 2 x 9.0 sq ft	- - 2 x 0.84 m ² , 2 x 9.0 sq ft	- - 2 x 0.84 m ² , 2 x 9.0 sq ft
Backflush/stripping pump capacity	7 - 25 m ³ /h	45 - 90 m ³ /h	45 - 90 m ³ /h	45 - 90 m ³ /h	90 - 130 m ³ /h	90 - 130 m ³ /h			

Many Sizes - for Your Specific Need





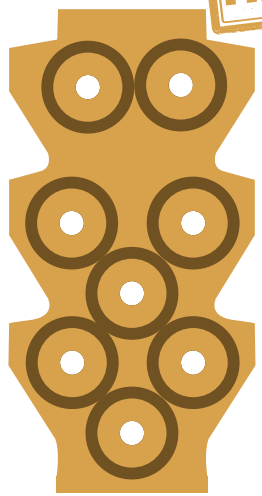
UV Transmission

The unique UV unit is designed and manufactured by DESMI. The special patent pending shape ensures the highest possible applied UV dose to all organisms in the treated water.

This enables IMO and USCG compliant management under even very adverse conditions with low UV transmission. The CompactClean UV unit is delivered in 6 sizes with max. flow rate from 135 m³/h / 595 gpm to 1500 m³/h / 6604 gpm. Systems with flow ranges up to 3000 m³/h / 13209 gpm can be delivered by installing two UV units in parallel.

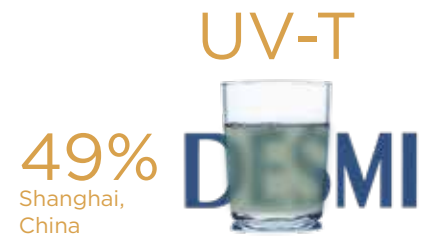


UV unit for 750 m³/h, 3302 gpm



UV unit for 340 m³/h, 1498 gpm

Selecting the Right Ballast Water Management System



What is UV transmission?

UV-T is a measure of the capability of UV light to penetrate water. When the UV-T is high, close to 100%, the water is very clear and the UV light can penetrate deep into the water. On the other hand, when the UV-T is low, the water is very unclear and the UV light can only penetrate a limited distance into the water.

Clearly, the UV-T of the water to be treated is of utmost importance. To kill or render an organism nonviable, a certain UV dose is required, and the applied UV dose is directly proportional with the UV intensity. Therefore, when the UV-T is low, significantly more UV power is needed to treat the water according to the required discharge standards.

Limitations of Ballast Water Management Systems

It should be acknowledged that all BWMS have limitations. Typically, chemical systems (e.g. electrooculography) have limitations related to the salinity of the water to be treated, its temperature or the amount of organic material contained in the water; whereas UV based BWMS have limitations with regard to the UV transmission of the water to be treated. In other words, all BWMS have special circumstances under which they cannot be expected to treat the water according to the IMO and USCG discharge standard. The trick for the ship owner is to select a BWMS that will work under normal operational conditions.

UV transmission of Ballast Water

The UV-T found in different ports around the world varies significantly. Some ports are located at river estuaries, which means that the water in the port is fresh water containing high amounts of sediments, organic particles and dissolved organic compounds. This makes the UV-T very low. Other ports are located on islands in the middle of an ocean, and here the UV-T is typically high. In the same port the UV-T can vary from day to day depending on tide, weather (rain and strong wind), and season.

Port	UV-T
Istanbul, Turkey	95%
San Pedro, CA, USA	95%
Vera Cruz, Mexico	94%
Halifax, NS, Canada	94%
Rotterdam, Netherlands	93%
Port of Singapore	93%
Skagen, Denmark	92%
Brisbane, Australia	92%
Porto Grande, Cape Verde	92%
Wallhamn, Sweden	91%
Houghton, MI, USA	91%
Melbourne, Australia	87%
Erie, PA, USA	87%
Zeebrugge, Belgium	85%
Gothenburg, Sweden	85%
Charleston, SC, USA	84%
Tanjung Pelepas, Malaysia	83%
Baltimore, MD, USA	83%
Hong Kong, China	80%
Houston, TX, USA	74%
Hamburg, Germany	69%
Antwerp, Belgium	66%
Bremerhaven, Germany	60%
Shanghai, China*	55%
New Orleans, USA	54%
Lisbon, Portugal*	53%
Brunswick, GA, USA	51%
Southampton, England	51%
Shanghai, China*	49%
Lisbon, Portugal*	41%

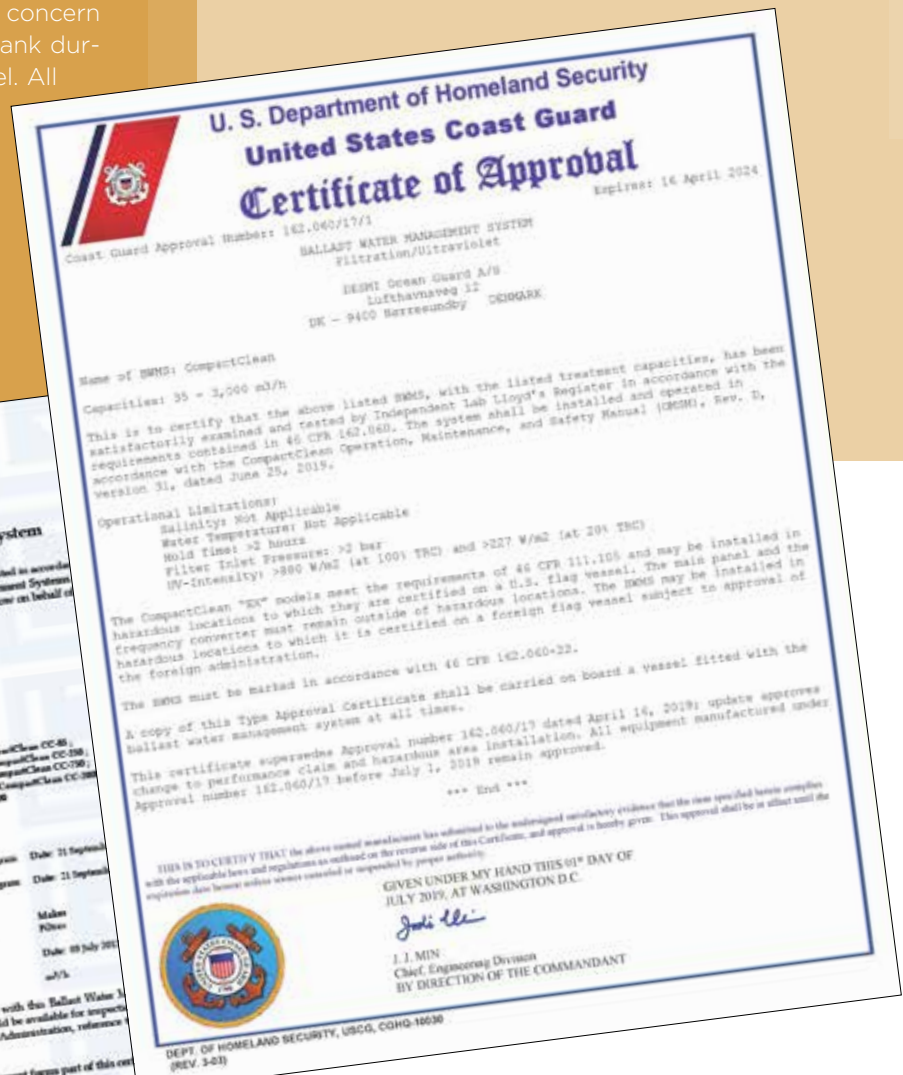
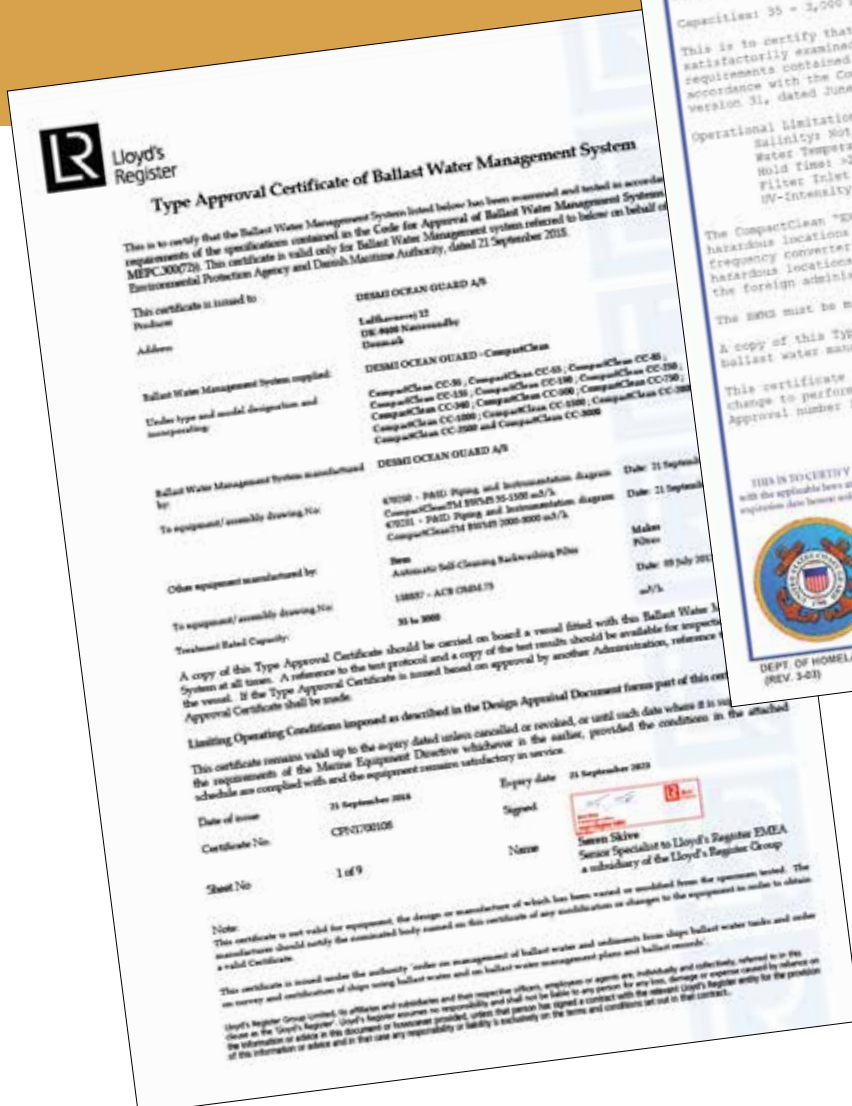
* In the same port the UV-T can vary from day to day depending on tide, weather (rain and strong wind), and season.
Source: DHI & DESMI Ocean Guard

Type Approvals

The CompactClean BWMS has IMO, USCG and Lloyds Register type approval, and the BWMS operates in the exact same way both inside and outside US Territory.

Same operating mode all over the world

The CompactClean system does not need a special US operation mode to meet the USCG requirements in US territory. With just one operation mode used globally, there is no need for knowing the de-ballast location at the time of ballast uptake, in order to determine if the BWMS should be operated in IMO or US mode. Likewise, there are no issues related to mixing IMO and USCG treated ballast water when water is treated in one mode during ballast operation, but then pumped to a tank with remains of water treated in another mode. Mixing of ballast water treated in different modes is also a concern when water is moved internally from tank to tank during a voyage to compensate for consumed fuel. All these issues represent serious complications to the ship operator when using BWMS that must be switched to one operation mode in US and another in the rest of the world. With CompactClean this issue has been solved.



Safety on Board any ship - Including Oil and Chemical Tankers

The CompactClean BWMS is available in an ATEX and IECEX certified version, making installation in hazardous zones on board oil, chemical or gas tankers possible. The EX certification notation is:

Ex II 2G Ex IIB T4 Gb

and is based on the following components:

- UV sensor: Ex ia
- Temperature: Ex ia
- Pressure: Ex ia
- Water level: Ex ia
- Junction Box: Ex d
- Valves: Ex d
- Motors: Ex d
- UV lamp assembly: Ex d
- Pumps (mechanical ATEX approval)
- Flow meter: Ex d ia [ia]



DESMI guarantees a distance of up to 100 m / 328 ft. between the main panel and the Ballast Water Management System.

Safe Zone



Hazardous Zone (zone 1)

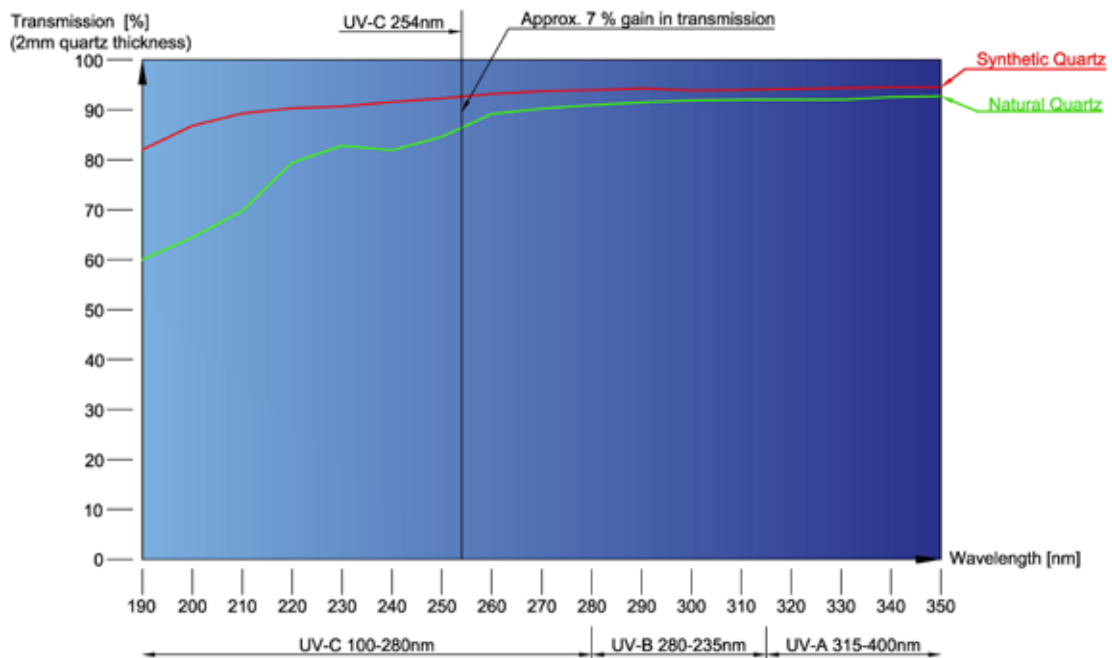


High UV Efficiency

The medium-pressure UV lamps in the reactor employ specially designed lamp tubes of synthetic quartz.

Combined with the reactor's internal design, this ensures optimal UV dosage and high efficiency.

The synthetic quartz tubes support transmission of a broader wavelength spectrum and provide more UV light during disinfection.



The System is Delivered with a Standard Electrical Panel. Additional Remote HMI Screen on e.g. Bridge or in Engine Control Room can be Added

The BWMS is delivered with a main panel that can be placed in any convenient place. The main panel is equipped with an HMI screen, from which the system is controlled and alarms are visualized.

All operations can be done from a secondary screen in the deck control office or on the bridge, if option for installing remote control screens is used.

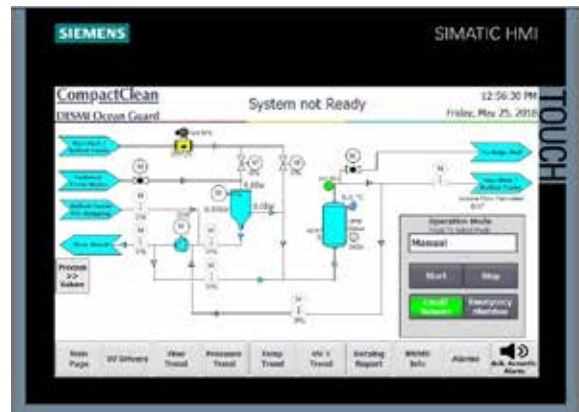
Standard fully automated operating modes for treatment are:

- Ballast
- De-Ballast
- Stripping

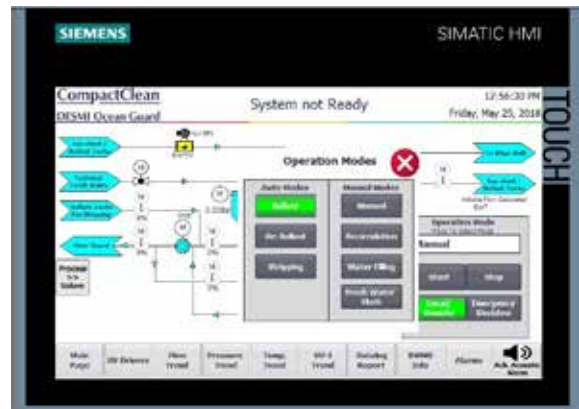
Other automated modes which can be selected are:

- Water Filling
- Recirculation

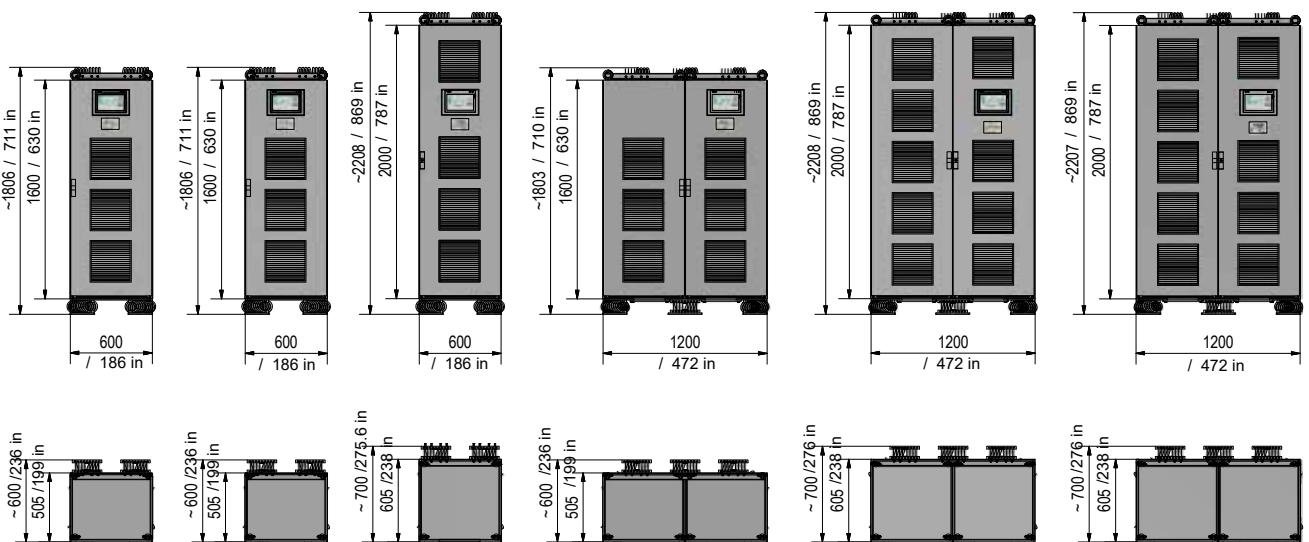
On the HMI screen, the operator can switch between several screen views (main page, active alarms, alarm history, PI-D page and UV drivers) to display all relevant information. During operation, the status of all components and sensors can be monitored, and operational values such as flow, pressure, temperature and UV intensity can be viewed instantaneously; and trend curves can be displayed to see the development over time.



Main page



PI-D page



441399 MAIN PANEL 135 WEIGHT: 240 kg / 573 lbs	441400 MAIN PANEL 340 WEIGHT: 260 kg / 573 lbs	441401 MAIN PANEL 500 WEIGHT: 332 kg / 732 lbs	441402 MAIN PANEL 750 WEIGHT: 570 kg / 1256.6 lbs	441403 MAIN PANEL 1000 WEIGHT: 650 kg / 1433 lbs	441404 MAIN PANEL 1500 WEIGHT: 760 kg / 1674.5 lbs
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System Configurations

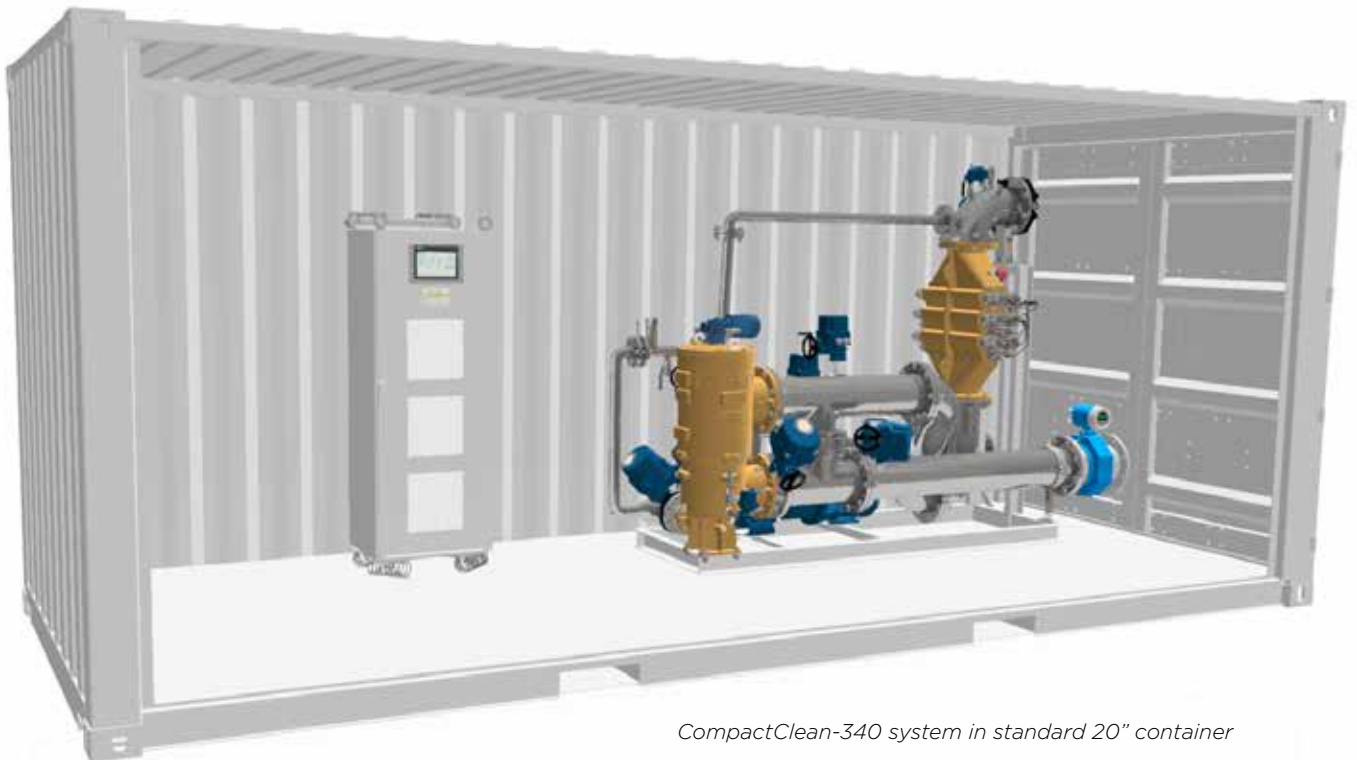
Our systems can be delivered as **loose components, skid-mounted** or **containerized**.

Loose components mean that the system will be assembled on board the vessel, and this is often necessary for retrofit projects or installation of large systems.

We often deliver **skid-mounted systems** as they are the optimum solution for new buildings and small to medium-size systems.

Complete **containerized systems** are a third option, which is used for retrofit on container vessels or on the deck of tankers with no space available elsewhere.

Containerized systems can also be used as port-based systems for treatment of ballast water from a ship without a BWMS installed, or a malfunctioning BWMS.



CompactClean-340 system in standard 20" container

System Delivery, Components Delivery & Containerized Delivery



Electrical Panel



UV-unit



Filter



*Loose Component Delivery
Product pictures are not scalable*



Frequency Converter



Stripping Pump



Skidmounted delivery

Easy
installation
on board
ships



Training Packages

DESMI Ocean Guard offers various training packages for CompactClean Ballast Water Management Systems. It is of utmost importance that the crew has been familiarized with the system and has sufficient knowledge to operate and maintain the system - this ensures problem-free ballast operations.

The training can be tailored to specific needs and is available as on board training modules or at our shore training facilities. Finally, our CBT (Computer Based Training) program is available as online modules.

Various Training Packages

- ✓ On board Training, Crew change and Commissioning
- ✓ DESMI Training Facility
- ✓ CBT - Computer Based Training (e-learning)



We Offer Our Services Throughout the Projects

Besides our products we also offer complete engineering including ship inspection, 3D laser scanning, preparation of drawings and if needed we can offer prefabrication of piping, installation and commissioning plus service agreements where we take care of keeping your ballast water management systems running flawlessly.

Engineering package

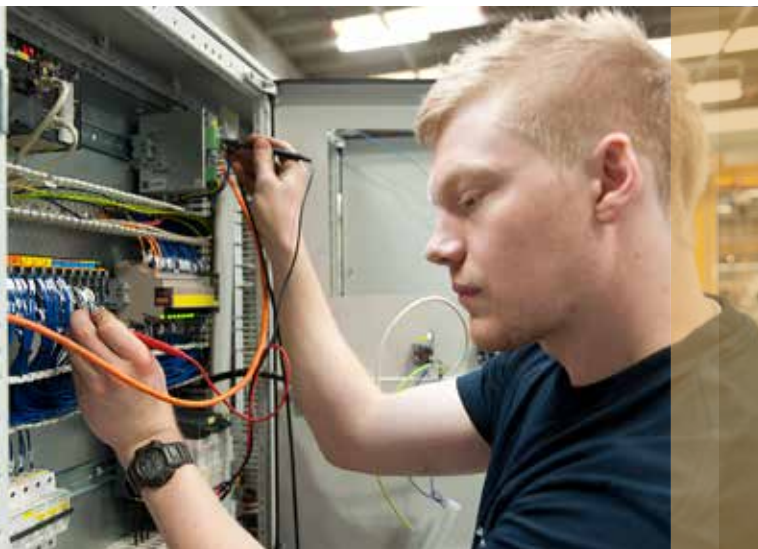
The engineering package includes finding space for and integrating our CompactClean™ BWMS on your vessel. This includes ship inspection, development of 3D CAD drawings and generation of production drawings.

Phase 1: Scanning, processing and producing a 3D as built environment

- Work preparation
- Measuring on board (3D laser scanning, 1 day)
- Inspection of possible locations for installation of equipment
- Check tie-in location into existing piping
- Check wire routings, cable penetrations, available space for additional breakers in main switchboard
- Check for structural modifications in case required
- Processing of laser scans after shipboard visit

Phase 2: Engineering

- Concept model of proposed system, modeled in the available space. Delivered as screenshots in a .pdf file.
- First proposal of possible lay-out and installation
- Update ballast water diagram to new situation



Our BWMS Services

- ✓ Ship Inspections
- ✓ Engineering
- ✓ Delivery of systems
- ✓ Installation and commissioning
- ✓ Service Agreements

Phase 3: After approval of location of the treatment system by Client:

- Preparation of documents for Class approval
- Material specification of piping and valves
- Updated ballast water diagram with treatment system included
- Updated Load Balance
- Updated Single Line diagram
- Additional Class requirements will be discussed on case by case basis

- Routing of piping
- Isometric drawings for fabrication of piping including material specification
- Production drawings for all necessary foundations
- Overview drawings for installation
- Part lists of all materials needed for the installation but outside the scope of supply of the CompactClean system, including cable lists, valves, bolts, nuts, gaskets, pipe supports.
- Installation guide with instructions.



Contract for Supply of CompactClean Ballast Water Management Systems (BWMS) to the Entire Fleet of Turkish Shipowner MISHA Shipping.

MISHA Shipping is a privately held Turkish company with both shipping and shipyard activities. The vessels are shallow-draft dry cargo vessels primarily designed for operations in Russian inland waters, Black Sea and Mediterranean ports, as well as a new generation of sea-river vessels optimized for navigation in Volga and Don channels and unrestricted navigation at sea.

MISHA shipping went through a thorough selection process before the CompactClean system was chosen. Some of the reasons presented are:

"Initially we have studied pros and cons between UV systems and Electrochlorination systems and ended up with UV types which do not have any salinity or temperature limitations since our fleet sails into rivers and icy waters."



Reliability of the maker: ... Having more than 180 years of history, we rely on DESMI to be in the market also in the future.

One of the features of DESMI's CompactClean system that we really like is the dry-running protection backed up with a recirculation system by the back flush pump which comes standard and can also be used as a stripping pump during stripping of ballast tanks.

We found DESMI's CompactClean system having one of the smallest foot print in the market, fits perfectly into our crowded engine rooms".

The contract includes delivery of 10 CompactClean BWMS in sizes from 340 to 750 m³/h.



CompactClean Installation on Board PROVIDANA

The 1000 m³/h / 4403 gpm installation of DESMI Ocean Guard's CompactClean system was conducted in Chengxi Shipyard on the vessel Providana owned by Masterbulk Pte Ltd.

The installation was a full integration of the system, which included:

- A full 1000 m³/h / 4403 gpm CompactClean ballast water management system
- An additional valve package and control system
- Frequency converters on the ballast water pumps
- Deck office operative system
- Internet uplink system



Kevin Leach-Smith, Vice President, Operations, Masterbulk Pte. Ltd.:

"We chose DESMI's CompactClean system because of the very small footprint and our trust in DESMI as a well-established supplier of marine equipment."

"An installation like this is a large project and requires good cooperation between the owner, technical manager, shipyard and system supplier. All parties did a professional job in making this BWMS installation a smooth and efficient process."

Ship's name	MV "PROVIDANA"
Ship type	General cargo/Container Carrier/(DNV) I.D. no. 26604
IMO number	9380788
Built	OSHIMA Shipbuilding Co.,Ltd.-Japan / Ship Hull No. 10508
Flag	Singapore
LOA	212.5 metres / 697 feet
GT	39,258 MT
DWT	54,810 MT
Ballast cap.	17,833 MT

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INDUSTRY

ENVIRO-CLEAN

DEFENCE & FUEL

UTILITY