Special Edition
WATER BALLAST TREATMENT SYSTEM

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It is not enough to do your best; you must know what to do, and then do your best.
Quotation of W. Edwards Deming

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BALLAST WATER cover story

DESMI

company profile

DESMI was founded in 1834 by Henning Smith and is one of Denmark's oldest companies. However, despite its age, DESMI is known to be a modern and dynamic organisation which has constantly evolved to meet the needs of its customers and the changing business environment. Over the years various industrial products have been manufactured, but since mid 18th century, when the first types were introduced, pumps have been a permanent part of DESMI's range of products. Today DESMI develops and manufactures pump solutions for marine, industry and oil spill combating both locally and globally. The customer is one of its most important assets and stakeholders in the business no matter where in the world DESMI operates. The many years of experience within the iron and industrial area has placed DESMI in a strong position on the global market where its pumps and systems are sold to more than 100 countries annually via a well developed network of subsidiaries and distributors on six continents. DESMI's vision is to be leader within the areas where it operates and to continuously develop itself as a supplier of pump solutions locally as well as globally. Its subsidiaries throughout the world in conjunction with its factories in both Denmark and China bring DESMI closer to its customers, which characterises DESMI as a strong, global company. In order to meet future customer demands for more complete systems, including pumps, DESMI provides solutions and systems as well as single standard pumps or components. With focus on the individual needs from its customers DESMI provides solutions based on proven technology.

Your partner in liquid handling and environmental systems

Pumps on the seven seas

The shipping industry ties continents and people together. More than 100,000 merchant ships, many of which with DESMI pumps on board, daily transport huge amounts of commodities all over the world. DESMI's range of pumps is fundamental to applications that are essential for a ship's operation:

- Centrifugal pumps for cooling, ballast, fire and bilge applications for both fresh and seawater pumping.
- Cargo pumps for loading and unloading liquid cargo/gasses.
- The internal gear pumps ROTAN® which are used for pumping high-viscous liquids as e.g. lubrication and fuel oil.

DESMI's product range is based on the modular principle. This ensures a reliable and quick spare parts supply at competitive prices. The DESMI marine pump range is applicable to most types of vessels and is highly adaptable as regards design and material combinations. DESMI's reference list comprises leading shipyards and owners. It also covers a wide selection of the merchant and naval fleets from small vessels like trawlers, support vessels such as AHTS (anchor handling tug supply) to the biggest vessels in the world like container ships, cruise liners, frigates and air craft carriers. Whether it is for single pumps or complete pump packages – DESMI's staff will always endeavour to find the correct solution. Its world-wide network of distributors ensures prompt service whether it concerns new installations or retrofit. The DESMI 48 is an example of a concept specifically directed to the retrofit market. It offers to supply specific pump series for retrofit tasks within existing pump installations, direct from stock from its distribution centres in Europe and Asia. The concept also includes the replacement of pumps of alternative manufacture. EnergyCheck is an example of a concept focusing on saving energy in engine rooms. By using the right pumps and control in the system, one will be able to save energy - up to 1% of the ship's total fuel consumption - and money.

Good quality is ensured by DESMI's staff

DESMI's largest asset is its dedicated staff. Their key skills and combined competences ensure that the 'DESMI' of the future will continue to be based on good ethics and healthy values. Customer oriented behavior, humor and readiness to change are some of DESMI's key values.

DESMI ensures a good distribution network

Water is a condition of life, just as reliable supply and hygiene are important factors in modern industrial society. DESMI's staff designs, project manages and installs plants that ensure environmentally correct and safe transport of waste water and maintain a good environment when waste water is transported to central facilities. Sufficient and continuous supply of pure water is taken for granted in today's society. You seldom reflect on the question where the water comes from. DESMI pumps ensure a reliable supply and the correct pressure in water supply systems. Its engineers find the best solution for all pump jobs in connection with water supply. The cold winters in Denmark have always placed big demands on a reliable and dependable heat supply. The many years of experience within district heating are the solid base on which all tasks are solved – big as well as small. DESMI supplies process pumps and see to it that the heat is transported to the consumer with minimum energy consumption thus providing the customers with a cost effective operational solution as well as benefits to the environment. Sprinkler and fire pump systems protect property and save human lives. In Denmark DESMI is the leading supplier of complete systems as regards sizing, definition of system type and current product adaptation to national and international fire protection rules. Its many years of experience make DESMI the right partner whether it concerns new installations of complete pump solutions or renovation of pump supply systems.

Corporate social responsibility

Image, ethics and conduct, corporate social responsibility, environmental impact and UN Global Compact are all integrated in the overall DESMI group strategy as it is its conviction that respect for the individual and sustainable products and production must be the basis of continued growth of the group. In this respect DESMI has so far primarily focused on its own activities - but it is also convinced that its best opportunity to improve its impact on the external environment is by developing products and concepts that support a reduction in energy consumption and thus reducing their environmental impact. Consequently DESMI attach great importance to ensuring that ITS products are designed, manufactured, used and disposed of in an environmentally sound way. DESMI will seek to base its work on a corporate social responsibility within all group companies through the boards of these companies, working on ensuring that at any time all companies in the group can implement an environmental certification in accordance with the ISO 14001 standard.

High quality according to international standards

All DESMI products are developed, manufactured and marketed in accordance with international standards and its ISO 9001:2008 quality control system. They can also be supplied in accordance with the requirements of all leading marine classification societies. DESMI pumps are characterised by first-class design and are recognised by its customers as being reliable, efficient, functional and durable. Its product quality, ability to adapt solutions and a high level of technological expertise are all factors that make DESMI a serious partner focusing on energy optimisation, CO2 emission and a good working environment.

Extract of a memorable history:

1834: DESMI is founded by Goldsmith Henning Smith.

1844 – 1900: The first pumps are manufactured. DESMI has own foundry and makes steel constructions and steam engines.

1900 – 1935: DESMI manufactures church bells – still in use in many corners of the world.

1935 – 1970: DESMI manufactures among others cast products, kettles and boilers, machines and pumps.

1970: DESMI starts developing and selling oil spill combating equipment.

1978: The subsidiary DESMI Ltd. is established.

1993: DESMI takes over Danish Thrige Pumper and their German subsidiary, now DESMI GmbH Rotan Pumpengesellschaft.

1994: The subsidiary DESMI Inc. is established.

2002: DESMI Norge AS is established and K&R Pompen B.V. in the Netherlands is acquired.

2005: DESMI Pumping Technology (Suzhou) Co., Ltd. is established with own factory and offices under Danish management.

2006: The Danish Sales and Service Division of DESMI A/S operates as a separate subsidiary under the name of DESMI Danmark A/S.

2008: AFTI – Applied Fabric Technologies Inc. in the USA is acquired.

2009: Subsidiary in Ecuador, DESMI Ocean Guard A/S, and rep. offices in Korea and Singapore are established.

DESMI

DESMI GIANT OCTOPUS

Systems for recovery of oil spills

The subsidiary DESMI Ro-Clean A/S supplies the world with equipment for combating oil spills. Since the 1970's DESMI has been one of the leading companies within oil spill combating at sea, and the environmental equipment is a vital part of the oil spill contingency planning in more than 100 countries. Its reliability and high quality have been demonstrated in connection with many oil recovery operations all over the world. DESMI's oil spill equipment has been developed for oil recovery, but it is also suitable for many other applications including tank cleaning, unloading of ships - whether it is a question of emergency off-loading or ordinary unloading - together with permanent installation in, for example, oil waste tanks.

Proven technology:

- RO-BOOM – floating booms for offshore and inshore applications.
- DOP vertical Archimedes' screw pumps up to 250 m³/h / 1100 US gpm.
- 10 to 19 m / 33-62 ft harbour workboats.
- Weir, brush and disc skimmers.
- Floating booms with air and foam-filled chambers.
- Fire-booms.
- Equipment supplied to more than 100 countries.

DESMI Ro-Clean A/S is known as a specialist and a serious partner for combating oil spill.

POLAR BEAR

DESMI TARANTULA

DESMI BELT SKIMMERS

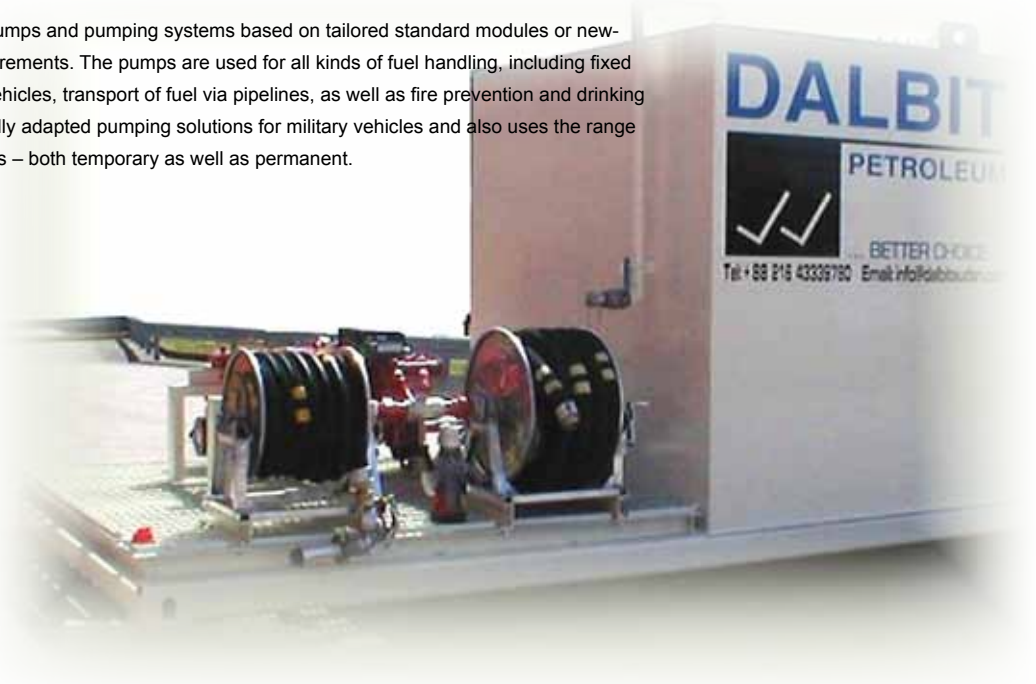
DESMI TERRAPIN

Systems for fuel handling

DESMI FHS Ltd. supplies specially manufactured pumps and pumping systems based on tailored standard modules or new-developed products all fulfilling special military requirements. The pumps are used for all kinds of fuel handling, including fixed and rotary wing aircraft refuelling, filling of fuel for vehicles, transport of fuel via pipelines, as well as fire prevention and drinking water supply. Internationally DESMI supplies specially adapted pumping solutions for military vehicles and also uses the range of NATO approved pumps for landbased installations – both temporary as well as permanent.

Systems for fuel handling:

- Capacity up to 66,000 l/min. / 17.500 US gpm.
- Pressure up to 40 bar / 600 psi.
- Possibility of electric, diesel or hydraulic operation.
- Flexible design.
- ATEX approved equipment.



International projects

DESMI Contracting A/S has specialised in project management and handling of turnkey solutions and diverse projects all over the world. For more than 30 years DESMI has undertaken project work in connection with international tenders and is known for supplying projects in time and to the full satisfaction of the customers. Its dedicated, competent and experienced project team – supported by local trading partners – is ready to co-operate with the customers during all project phases often leading to long relations. This ensures a successful and sustainable project implementation, which can last from a few weeks to several years. DESMI is a project management specialist and the goal is to assist its customers through all phases of a project and to ensure an appropriate project financing, e.g. via:

- Public means.
- Export credits.
- Banks.
- Donations.
- Various combinations.

DESMI Contracting A/S focuses on projects within utility, education and health, and supports other areas within public supply, energy, infrastructure, and environment.

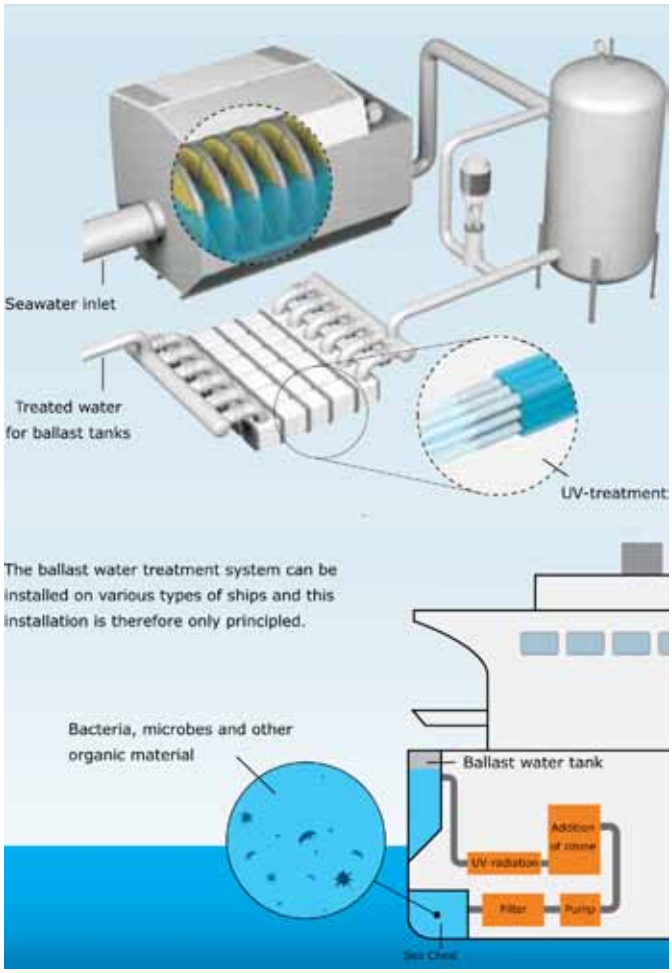
DESMI service concept

Reliable and economical operation is a crucial customer requirement on all DESMI products. In addition to the actual product DESMI also supply customer-adapted service and maintenance concepts and assist customers world-wide in maintaining and quickly repairing their systems in case of break-downs. Its service assistants are ready by the phone to answer both technical and practical questions. They are all specially trained within pumps, and they are prepared to share their knowledge in the form of education of its partners.

The DESMI service concept comprises:

- World-wide service – by phone or in person.
- 24/7 - 24 hour service 7 days a week.
- Specially trained staff – ready to educate and train your staff.
- Documentation of legal requirements and certifications.
- Customer adapted solutions.
- Spare parts solutions.
- Complete range of pumps.
- DESMI 48.

Ballast water treatment systems



IMO approved ballast watertreatment systems

DESMI Ocean Guard A/S is dedicated to developing ballast water treatment systems. The company is formed by three Danish companies: A. P. Moller – Maersk, Skjølstrup & Grønborg (UltraAqua) and DESMI. Each of the three companies contributes with valuable information for developing systems which do not only perform from an engineering point of view, but also from a practical, shipboard point of view. Developing systems which as a minimum fulfil the IMO and coming US requirements is the company's aim.
At the same time it is also important for DESMI Ocean Guard to develop systems which are simple and reliable, can work under normal operational conditions, and be operated and maintained by marine engineers.

Focus points:
- Able to fulfil IMO and coming US requirements for removal of living organisms in all water conditions
- Very low power consumption
- Includes in-situ generated ozone which combined with UV–radiation forms an extremelynefficient method for fulfilling IMOnrequirements
- Systems that can be operated by marinemengineers
- No residues will be formed when passingnthe DESMI Ocean Guard ballast water treatmentm system. Further the system ensures that no ozone is entering ballast tanks
- Reliable system with long intervals betweenninspection
- Low footprint in the engine room
- Low life cycle costs

More than two-third of the globe is covered by water. Water is a condition of life and all areas of the oceans have their own unique ecosystems that have developed in different directions since the dawn of time. Since we began using ships to transport goods, ballast has been a necessity. In the beginning stones were used as ballast, but since the introduction of steel ships and the possibility of integrating tanks, seawater has been used as ballast medium. Concurrently with the increasing world trade between the individual countries and continents millions of cubic metres of water have been "moved". These large quantities of water containing micro-organisms have been mixed in the different habitats, which has had hazardous consequences for the local maritime ecosystems.

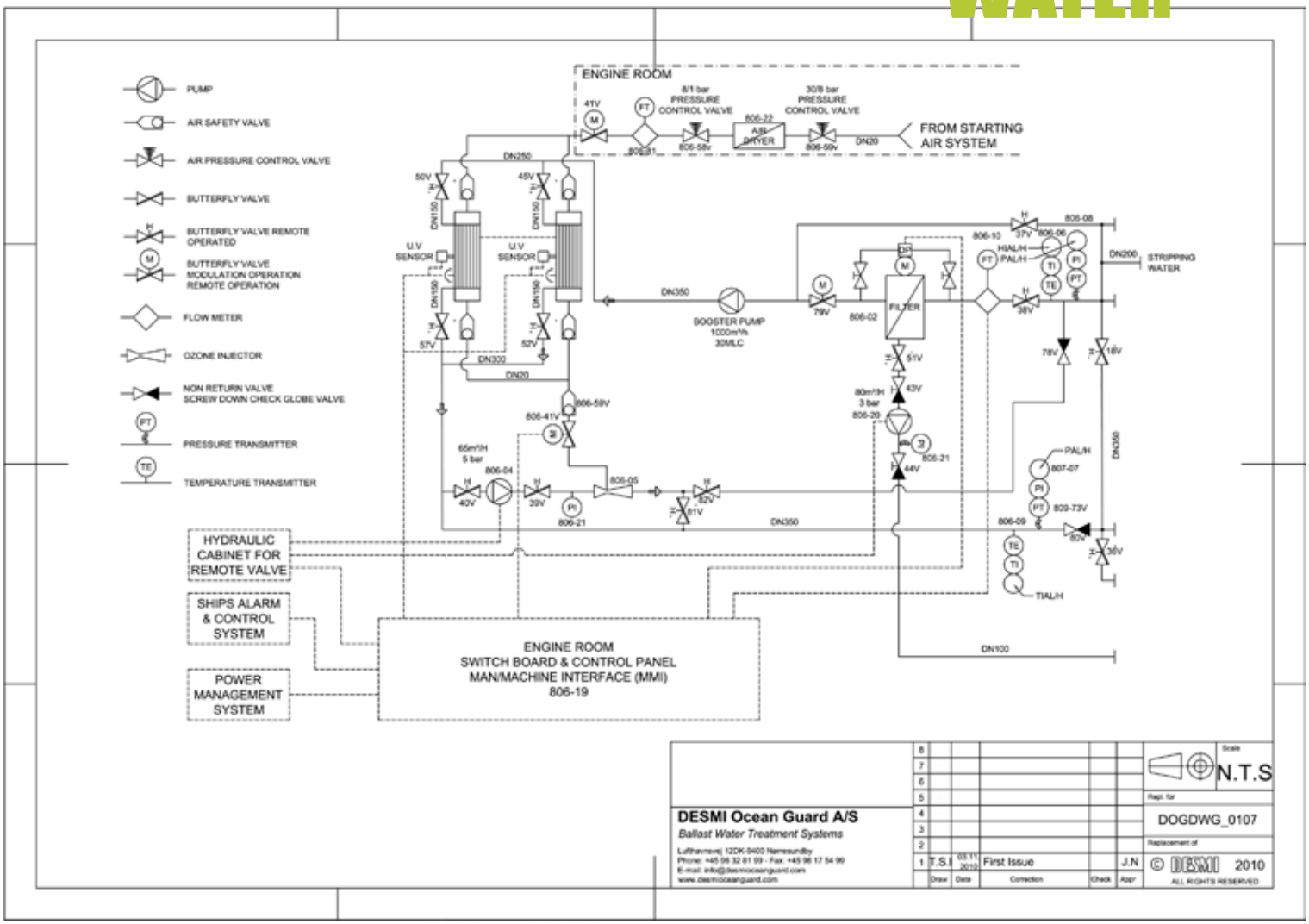
The IMO convention for control and management of ships' ballast water stipulates that vessels must remove all living organisms from the ballast water before emptying the water into the ocean.
This necessitates the use of a ballast water treatment system that purifies the ballast water when the ballast water tanks are filled and again when they are emptied.
DESMI A/S has joined forces with leading players and developed superior in all aspects a ballast water treatment system: DESMI Ocean Guard. Ships have various demands for ballast operation. Therefore, DESMI Ocean Guard has developed two solutions:

- **Low pressure system**
- **Pressurized system**

A typical way of filling the ballast water tanks is to open the various valves and let the sea water flow into the tanks (gravity filling). When the ballast tanks are almost filled, the ballast pumps are put into operation until ballast water flows from the valves on the air-head pipes on open deck. This means that the tanks are filled and that there are no free-moving surfaces that can affect the stability of the vessel.
Gravity filling is possible with DESMI Ocean Guard when using a non-pressurized filter. As such a nonpressurized filter takes up more space than a pressurized filter. This solution is mainly intended to be used in new-buildings. It is also possible to fill the ballast tanks by means of ballast pump(s) and a pressurized filter. This filter takes up very little space compared to its capacity and it is therefore suitable for retrofit solutions, but of course also for new-buildings.

One of the features of DESMI Ocean Guard is the comparatively low energy consumption (10 kW / 100 m3 treated water) and the low maintenance costs. The life time of wear parts is typically >12,000 hours.

DESMI Ocean Guard is designed as a full automatic system with a very simple man/machine interface.



Technical Description of the DESMI Ocean Guard Ballast Water Treatment System BWMS 400-P40

The system used in the final approval has a capacity of treating 400 cubic meters of water per hour. The system consists of the following parts:

- Filter, for removing particles, zooplankton and large algae
- UV lamps, for generating photolytic inactivating light and photochemical ozone generating light
- Ozone injector system, for injection of generated ozone into the ballast water flow

BWMS 400-P40 – system: For the base configuration, where space is a limiting factor, a pressurized filter will be used. This filter will use a mesh with a pore size of 40 micron. It will typically be installed right after the ballast pump. As shown in Figure 1, the filter removes particles in order to secure the efficiency of the succeeding disinfection step. It is only the incoming ballast water which will pass the particle filter, i.e. de-ballasted water is pumped directly into the succeeding process units. In the first step of the succeeding treatment process the water flows to the combined UV-unit which also generates ozone used in the second step of the treatment process. The UV unit exposes the water to a high dose of UVC irradiation from low pressure UV-lamps. In the second step of the succeeding treatment process, the water passes a venturi injector. The vacuum created by the venturi injector sucks dry atmospheric air through the ozone generating components via a pipeline to the injector for mixing with the water. When water is pumped through this unit, it injects ozone containing air and performs complete mixing of air and water.

During the further flow through the piping system the water and air/ozone mixture will allow the gaseous ozone to diffuse into the water phase and react with the organisms. Based on the relatively small ozone quantities used, the ozone concentration will be zero a short period after the injection. For extra safety reasons the off-gas will pass an ozone destructor before exhaust to the atmosphere. Finally, the treated water is directed to the ballast tanks.

Benefits of the DESMI Ocean Guard Ballast Water Treatment System

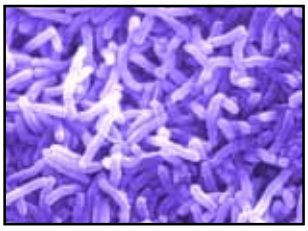
- Cost effective water treatment
- Well proven technology
- Low operational costs
- Developed according to IMO and US rules
- Simple installation
- Minimum footprint
- Simple operation
- No chemicals added
- Long lifetime UV lamp >12,000 h
- Filtration of sediments
- UV dosage
- Pressurized system
- Low-pressurized system
- Possibility for ballasting by gravity

What Do We Clean The Ballast Water For?

The Mnemiopsis Leidy, introduced to the Black and Azov Seas in the early 1980s has wiped out the anchovy and sprat fisheries causing a loss in the region of US dollars 200 mill. annually. This invader has now established itself in the Caspian Sea and is causing concern even in the Baltic Region.

Costs associated to repair and control of damages caused by the Zebra Mussel (Dreissena Polymorpha) is estimated at US dollars 500 million over a period of 10 years.

The Mitten Crab (Eriocheir Sinensis) became established in the San Francisco Bay in the 1990s and is now found in densities exceeding 10,000 individuals per square metres.



Vibrio Cholerae, the species of comma-shaped, motile bacillus is the cause of cholera infectious disease. The Vibrio that produces the heat-tolerant exotoxin which causes Cholera Epidemiology, transmitted through poorly treated water supplies.

The Northern Pacific Starfish was introduced to Australia by ballast water from Japan in the early 1980s causing severe damage to aquaculture and fishing industries and proving impossible to eradicate. The invasion has had a major economic impact, leading to an annual loss of millions of US dollars.

Asian Kelp - Undaria Pinnatifida - grows and spreads rapidly, both vegetatively and through dispersal of spores. Displaces native algae and marine life. Alters habitat, ecosystem and food web. May affect commercial shellfish stocks through space competition and alteration of habitat.

Escherichia Coli - Species of bacterium that inhabits the stomach and intestines. E. coli can be transmitted by water, milk, food, or flies and other insects. Mutations can lead to strains that cause diarrhea by giving off toxins, invading the intestinal lining, or sticking to the intestinal wall. Therapy consists largely of fluid replacement, though specific drugs are effective in some cases. The illness is usually selflimiting, with no evidence of long-lasting effects. However, one dangerous strain causes bloody diarrhea, kidney failure, and death in extreme cases. Proper cooking of meat, washing of produce, and pasteurization of cider prevent infection from contaminated food sources.

Intra Mare Hellas, the representavive of DESMI a.s in Greece/Cyprus

A leading marine sales and naval architect organization representing exclusively a number of marine equipment markets, worldwide known for the advanced technology and the quality of the products they manufacture.

The head office is based in Piraeus maintaining also a branch office in Limassol, Cyprus.

For the last years Intra Mare strongly invested into a continuous effort of offering more reliable and professional services to the maritime community through a qualified crew of naval architects and marine engineers, trained in a wide range of marine business.

Since its establishment, Intra Mare has been succefully involved into a vast and diverse range of newbuilding and retrofitting activities arising from Greek Markets interests, claiming one of the leading ranks within the Maritime Community.

Company's main activities are:

Exclusively representation of marine equipment manufacturers.

- Purchasing and contracting
- Design and specification of new constructors
- Service and technical support
- Spare parts trading

The extensive sales organization is supported through the company's in-house service department consisting of specialized engineers trained into the principals factories, able to carry out regular service on board, or individual repair jobs.

The Management and staff of Intra Mare do realize that being a member of the most active global Shipping Community can be linked to success only through seeking and comforting challenges.

Along this venture Human factor and Technology are mixed together and the only way to serve such a demanding environment is to stick to the long marine traditions, always aiming at the edge of technology.

This is the driving power of Intra Mare for planning the future and its commitment to its clients for more reliable services.

Martin Vendelbjerg Henriksen
Sales Engineer
DESMI A/S, Denmark

Mini interview on water ballast

There is a need for the harmonization of methodologies among the systems test facilities. What are the latest developments in this important topic that will improve the confidence among the shipping community to install treatment technologies onboard ships?

How can the regulatory and technical issues in ballast water management link together to ensure the same level of protection and to provide solutions that are environmentally, technically and financially effective

In coming years more approved and innovative technologies will be available, however, how will ship-owners choose the right system for their ships?

The most current development on this part and possibly the most influential prior to the ratification of the IMO D2 standard on ballast water treatment is a statement from the class society Det Norske Veritas. DNV states in a report from October of 2010 that even though a BWT system has obtained final and/or type approval for their respective systems it is not automatically approved by DNV. This cautionary statement is, as I understand it, a way of telling manufacturers of BWT technologies that there are no easy ways to enter this market. To even enter or to be competitive in the BWT market you will have to prove that you can comply with the standards set by IMO to the class societies.
DNV is here paving the way for streamlining the test procedures for BWT systems. This will, hopefully, ensure transparency of the market for the consumer of BWT systems.
As for the testing that is being conducted at this time around the world there are no real consistency in the testing methods. By this I mean that in order to comply with the IMO D2 standard, ones BWT system has be tested and pass in two out of three types of water to obtain approval .
The three types of water to choose from is salt, brackish and fresh water. Most everybody is obtaining their approval in salt and brackish water. This is mainly due to the fact that international shipping is primarily conducted in those types of water.
These two water types have the added benefit of being easier to fully treat in compliance with IMO D2 standards than natural fresh water is to the same extent. Fresh water is harder to fully treat by a number of different reasons, one of them being that the bacteria inherent in natural fresh water is harder to disinfect with UV light. And since a large portion of the BTW system manufacturers utilize UV light as disinfectant this poses a significant issue for all concerned.
And whilst looking at challenges in treating fresh water there are manufacturers that will meet limitations. Several BWT system manufacturers utilize electrolysis in their system for disinfecting purposes. The systems in question are in actual fact unable to treat fresh water if not a separate ionizing agent is introduced to the system. This will then add to the complicated nature of the systems and make them even more labor intensive in their operation.
Additionally there is more than one way to test in fresh water. It is legalistically ok to use “tap” fresh water and then add a specific amount of contaminants to this water and then treat this for approval testing purposes. This fresh water testing will not take into account for the extra load on the BWT system that for instance kiesel algae presents. Kiesel algae are present all over the world and are not part of the IMO D2 standard and therefore not subject to BWT. The kiesel algae have the shape of a grain of rice and the size of 50µ length wise and 10µ breadth wise. This will then produce an extra workload on the 50µ filters stipulated in the IMO D2 standard, since the filters will try to remove “non IMO regulated algae” from the ballast water. This means in worst case situations that the workload for the 50µ filter effectively will be doubled; in other words the treatment capacity is halved. Therefore great caution should be taken when sizing the 50µ filters.
In my opinion this will inevitably lead to a way of approving BWT systems by imparting an “area of operation” designation on each system. This designation will have to be contrived in such a way that the consumer can sort and choose systems by the different water types that they will operate in.
Or, to simplify things, the international community and the class societies might impose the current strictest regulations (US Coast Guard Californian rules) as the minimum requirements for the global commitment to BWT.
Within the Californian rules it is required, in order to be able to obtain approval, for the BWT systems to perform in and treat all three types of water. Also the Californian rules are about a thousand times stricter than the current IMO D2 standard. Combined this will make for an easier selection for the BWT consumer. This is due to the fact that the costumer then only has to relate to the most basic of parameters. These parameters will then be price, size, system efficiency and system complexity.

Ballast Water Management in the Baltic Sea.

As for Ballast Water Management in the Baltic Sea, regional extraordinary rules like the US Coast Guard Californian rules will most likely be applied. These rules I expect will also apply for Australia and the Great Barrier Reef, the European Union and other countries.
One of the reasons for these extraordinary steps within the Baltic Sea is that the Baltic Sea has a high mobility rate for invasive species. The high mobility rate is in basically the ease of which invasive species can spread in a body of water. The Baltic Sea has an average depth of around 60 meters. This average, relatively shallow, depth does nothing to stop invasive species from spreading. Within the IMO resolution for Ballast Water Treatment/Transportation a depth of 200 meters is stated as depth of which ballast water exchange can be conducted. This translates into a depth of which the risk of invasive species ability to spread is minimized. And thusly the depth accepted as the minimum depth a body of water has to have in order to guarantee against the mobility issue.
BIMCO is an organization comprised of Quote:“ship owners, managers, brokers, agents and many other stakeholders with vested interests in the shipping industry” within and around the Baltic Sea. This means that BIMCO would be in a unique position to lobby for a stricter BWT standard than originally proposed by the IMO. In any case BIMCO will most likely adopt the most stringent regional rule set for marine environment protection as they can.

cover story

DESMI Pumps & Systems

integrate

integrate
knowledge & technology

www.desmi.com

DESMI – Supplying the World with Pumps and Systems

DESMI develops, manufactures and supplies pumps and pump systems for marine and offshore related sectors.

- Centrifugal pumps
- Electric deep-well cargo pumps for LPG/C – LEG/C, molten sulphur carriers and product/chemical carriers
- DESMI ROTAN® internal gear pumps for high-viscous liquids

Hear more about our below concepts:

- **OptiSave™**
  Save up to 80% of the pump energy consumption and get your pumps for free!
- **DESMI 48 - Fast Track**
  Pumps up to 1000 m^3/h delivered within 5 days!

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