DESMI Ocean Guard

- Ballast Water Treatment Systems

DESMI Pumps & Systems

integrate

knowledge & technology

DESMI

Introduction to
DESMI Ocean Guard Ballast Water Treatment System

More than two-third of the globe is covered by water.

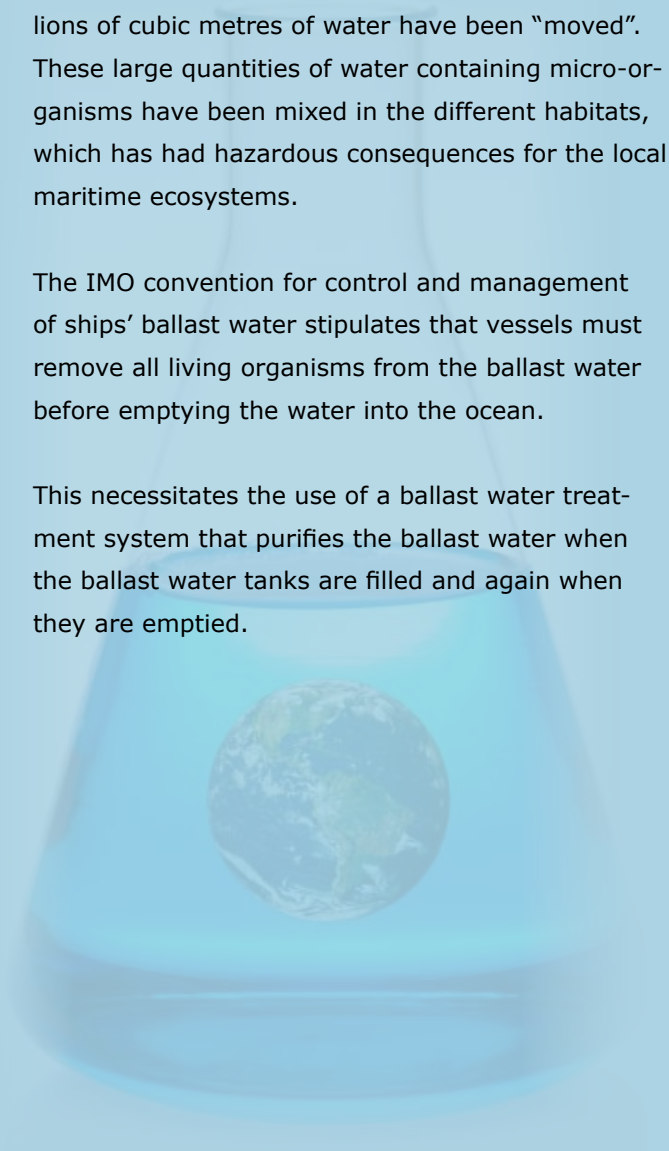
Water is a condition of life and all areas of the oceans have their own unique ecosystems that have developed in different directions since the dawn of time.

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 non-pressurized filter takes up more space than a pressurized filter. This solution is mainly intended to be used in new-buildings. See fig. 1 page 5.

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. See fig. 1 page 5.

One of the features of DESMI Ocean Guard is the comparatively low energy consumption (10 kW / 100 m^3 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.

Benefits of the DESMI Ocean Guard Ballast Water Treatment System is:

- 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

Main Components Forming the System

Filtration System

Filter for pressurized systems is available in sizes ranging from 40m³/h to 5400m³/h.

Filter for Low-Pressure Systems

Available in sizes up to 3600m³/h.

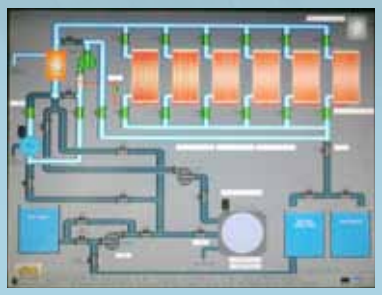
UV Reactors

Are the core component in the system. Each unit measures approx. 300x300x2000 and is capable of treating approx. 133m³/h by pressurized system. For low-pressure system the capacity is 200 m³/h. The reactors is stacked in up to six units giving a capacity of 800m³/h per stack.
For bigger system more stacks are added operating in parallel.

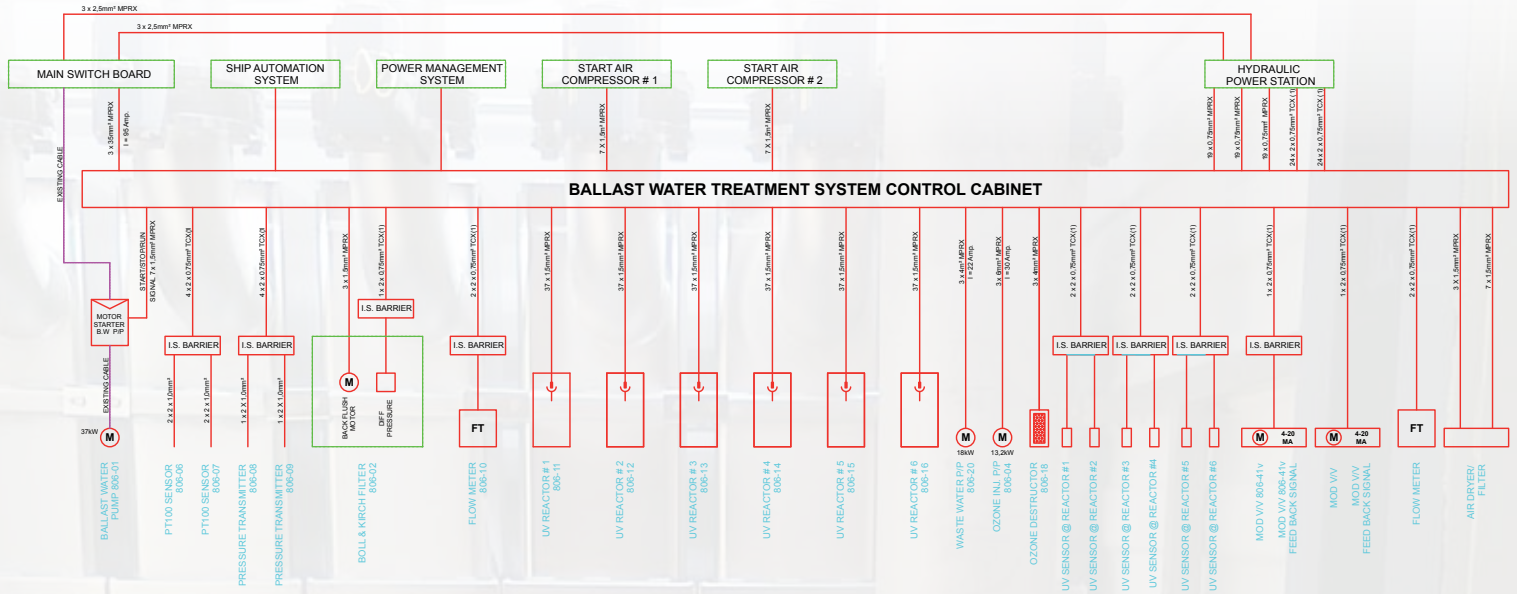
Complete Overview

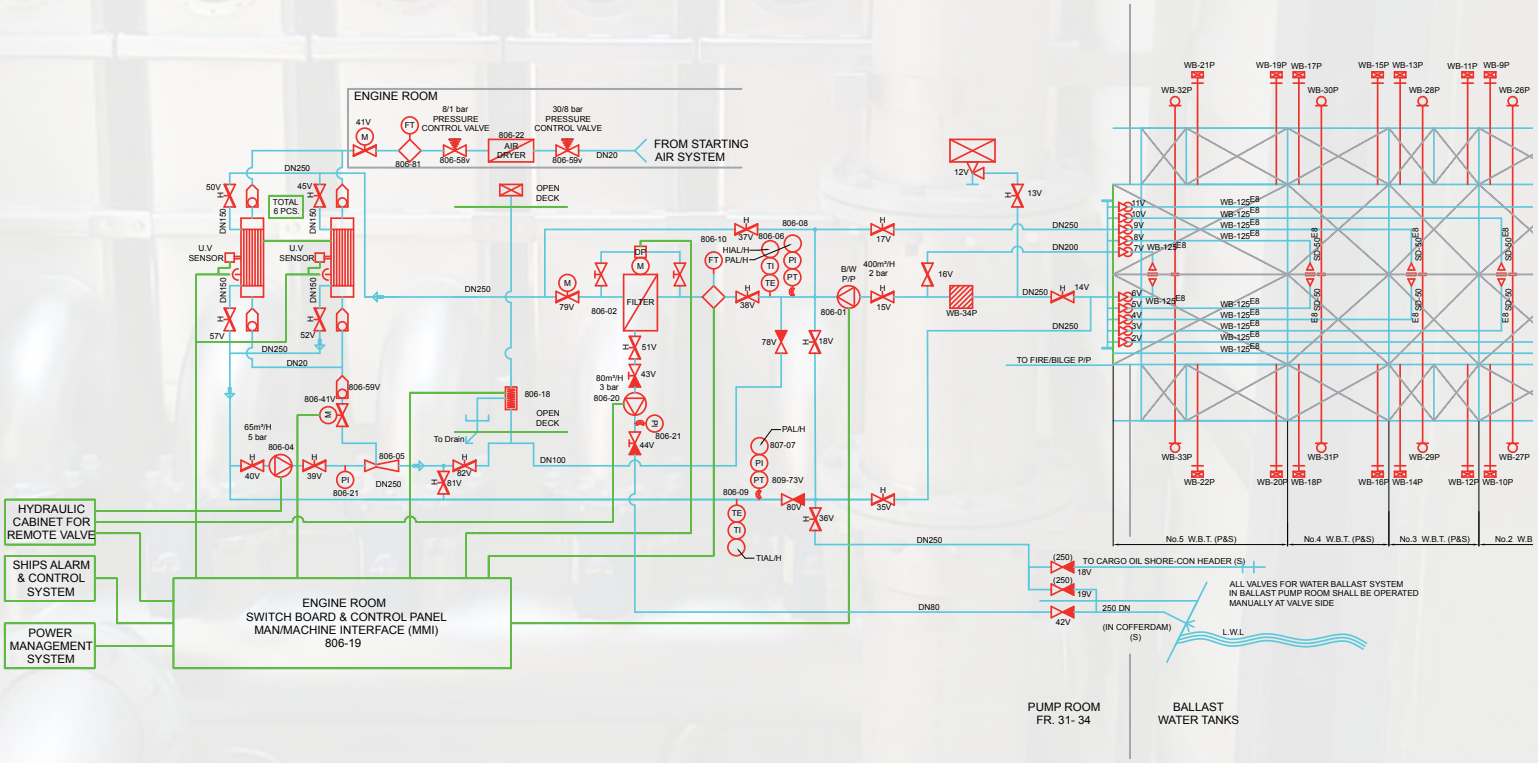
The system is controlled via a touch screen and mimic pictures providing complete overview of the system incl. each component in the system.

Logging of events, alarms etc. is also included.



Typical System Drawings





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

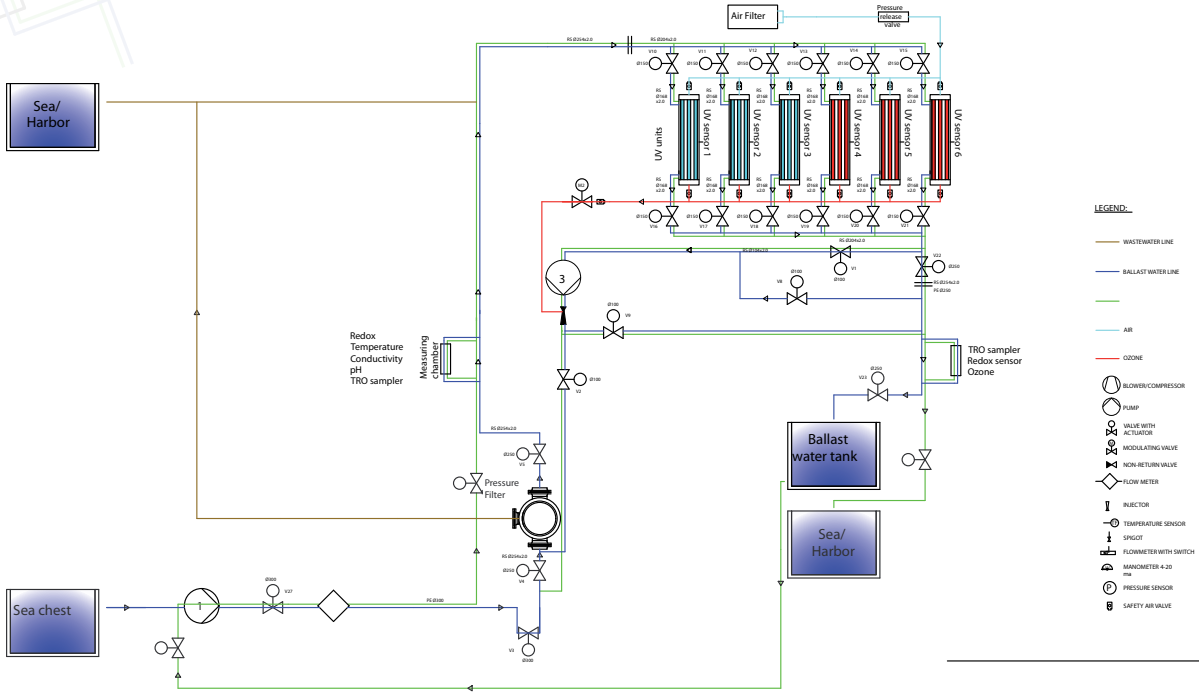
BWMS 400-P40 – system: For the base configuration, where space is a limiting factor, a pressurized filter will be used. This filter will use a mesh with a pore size of 40 micron. It will typically be installed right after the ballast pump.

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-reactor, which also generates ozone used in the second step of the treatment process. The UV reactor 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.



What Do We Clean The Ballast Water For?

Below you will find some examples of aquatic bio-invasions causing major impact, but there are hundreds of other serious invasions which have been recorded around the world:

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.

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.

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.

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.

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.

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 self-limiting, 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.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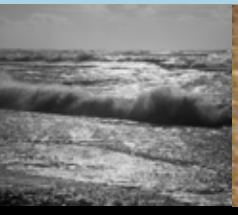
Valid from 31.08.2010



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