USING BWMS IN HEAVY LIFT OPERATIONS

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Introduction

Making technology fit together with operational processes, safety regulations, new legislation and a practical approach something the shipping industry continuously struggles with.

The Ballast Water Management Convention (BWMC) is a good example of this. Contrary to what many believe the BWMC is a “Discharge Convention”, which means that it is the discharged ballast water that must comply with the BWMC – not the vessel. The crew will have to document what ballast water actions have been taken, but the vessel itself will not be D2 compliant – only the ballast water being discharged. This set-up leaves the shipowner with the freedom to change operational processes in collaboration with Ballast Water Management System (BWMS) suppliers to comply with the rules. However, it is not always possible to have a BWMS that fits 100% into the standard operating procedure of a vessel. Heavy Lift Vessels (HLVs) are an example of this.

Heavy Lift Vessels ballast operation

Heavy Lift Vessels – or HLVs – could be divided into three different types of vessels:

- Semi Submersibles / Dock Ships
- Flatbeds / Open Deck Cargo Ships
- Project Cargo Ships

Semi Submersibles and Dock Ships have a similar approach when it comes to ballast water because both types of vessels lower the cargo deck below the waterline and float the cargo on and off the HLV.

Flatbeds and Project Cargo Ships - lift or roll cargo onto the deck. This type of HLV takes care of shipments that cannot float.

From a ballast water perspective all three types of vessels are similar but for different reasons. All HLVs have large ballast water pumps and ballast tanks compared to other commercial vessels of the same size.

Semi Submersibles commonly have larger ballast pumps because more ballast water needs to be pumped in and out during the submerging process. Furthermore, the ballast water volume is typically smaller on Flatbeds and Project Cargo Ships compared to the same size Semi Submersibles.

Another reason for having large ballast pumps is because the cargo operation is a critical process and during that the vessel may be in a vulnerable position seen from a stability point of view.

Pumping large amounts of water into the ballast tanks can create large “free surface movement” in the ballast tanks and thereby, instability in the vessel. To address free surface movement, the ballast tanks must be filled and emptied quickly and in the right order to have an even and stable vessel. The large ballast pumps help to address this issue.

Getting ballast water in and out of the ballast tanks fast also minimizes the operation time.

Having equipment fail onboard an HLV during the loading or unloading procedure is for all three types of HLV critical and must be avoided.

BWM onboard an HLV

One of the issues with selecting a BWMS is that these systems are developed as a one-type-fits-all solution. A BWMS that works well on a Bulk Carrier or a Tanker might not work well with the operational requirements for an HLV.

Ballast water operations on vessels before installing a BWMS had a limited number of failure points, like the pumps or valves. These components are relatively rugged and durable components that the crew has experience in how to operate and overhaul. By introducing an advanced BWMS into the ballasting process, focus is taken away from ensuring the stability and balance of the ship and the safety of the cargo. The crew will have to make sure that the risk of the BWMS interrupting the cargo operation process is limited – however that can be difficult!

By adding a BWMS into the cargo operations procedure is adding a risk factor.

Before starting a BWMS it is necessary for some systems to adjust to the given seawater conditions (salinity, turbidity and temperature) to ensure that the process is effective. If consumables are necessary, these must be available. During the cargo operation, filter backflush may occur, and mandatory holding time can prolong the cargo operation because it is not possible to de-ballast water in the tanks.

To summarize, this means that the BWMS poses the following risks for HLVs:

- Needs to run during the cargo loading and discharge operations
- The extra risk of stopping the cargo loading process due to for example clogging of the filters
- Capacity depending of water quality

The above are potential risks that may disturb the cargo operation of the vessel at a critical phase or add operation limitations for the vessel.

Same Risk Area

IMO has defined “Same Risk Area” (SRA) to address ballast water treatment for a vessel that only trade in local waters. When an HLV carries out its cargo operation that involves ballasting and de-ballasting of a large amount of water in the cargo operating zone, the SRA rules will apply. When water is ballasted and de-ballasted in the SRA it is not necessary to treat the ballast water, given that the local water is not mixed with foreign water.

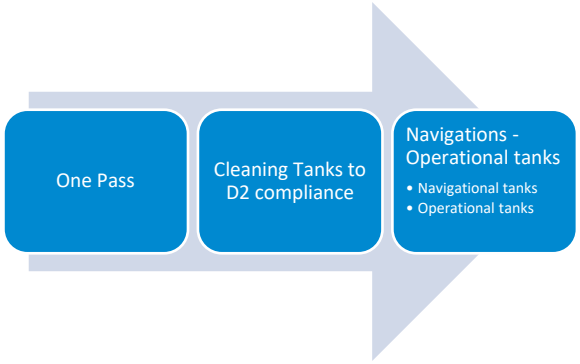
This is an IMO rule, other local rules that deviate may apply. The US has a similar approach as the IMO SRA has been taken with exempting vessels that exclusively operate within one Captain of the Port Zone – however some differences apply.

Same Risk Area

The concept of a "Same Risk Area" has been approved by the IMO. This means that, rather than making a risk assessment per ship route, it is possible to make a risk assessment for minor sea areas (following agreement among the authorities of all the countries affected); this would be considerably easier to handle for both shipowners and the authorities.

The Bawat BWMS

The Bawat BWMS offers a very different approach to ballast water treatment in many ways. The technology used is pasteurization. Pasteurization is a well-known and very efficient process to kill bacteria. Applied on ballast water, the water only needs one pass through the Bawat BWMS, and the water is treated. No further treatment or holding time is needed. This only feature gives the ship an opportunity to focus on treating only the needed amount of ballast water instead of treating all ballast water.



The main point is that due to the "one pass" feature D2 compliant water can be produced, and this water can be used to clean "non-compliant tanks" to "D2 compliant tanks". For HLVs, the vessel can be divided in "Navigation tanks" and "Operation tanks".

Navigation tanks
- Ballast tanks used during the voyage

Operation tanks
- Ballast tanks used only during cargo

The tank dedication may vary slightly from voyage to voyage. Operational tanks will typically be empty after cargo operation thus, they will only have to be flushed to compliance.

As operation tanks are D2 compliant on arrival and can be filled and emptied in same location, the Operation tanks can be operated with local water only, not using a BWMS. One should have in mind though that these are IMO waters only and local rules may apply. This means that the ballast water in the operational tanks can be operated using the existing ballast system only.

This feature redefines the need for ballast water treatment a lot. An example of this - an owner has a ship with a 2.500 m^3/h ballast water pump capacity. After a thorough analysis a 300 m^3/h Bawat BWMS was chosen and installed. Due to this, a Bawat BWMS has:

- A smaller footprint in the engine room
- Smaller pipes connecting the BWMS to the Ballast water system (DN250 vs. DN800)
- Much less CAPEX
- Much less OPEX
- Smaller weight, meaning more cargo capacity for the vessel

Further to the benefits of the One-pass process, the Bawat BWMS can treat the ballast water when the vessel is ballasting or de-ballasting, and even when shifting ballast water between tanks.

The Bawat BWMS offers more benefits following the different approach. The pasteurization process is a combination of heat and time. The process is invented by Louis Pasteur in the 1860 where he used it on wine and beer. Today it is widely used in the food industry and Bawat has taken it even further to the marine industry.

The Bawat BWMS utilizes waste heat from the vessel to power the pasteurization process. This make the OPEX even less.

Using waste heat means that with a Bawat BWMS ballast water treatment is to be conducted in-voyage. The Bawat BWMS is not in use during cargo operation.

The efficiency of the pasteurization process makes Bawat BWMS independent of the water quality.

The crew does not have to take turbidity, salinity or temperature of the ballast water into consideration when operating the BWMS. This provides the vessel with a more stable and foreseeable BWMS performance.

Potential heat sources on board a vessel – typically 25-30% of the energy in the fuel oil can be used as waste heat for the Bawat BWMS.

The higher the temperature of the cooling water, the better, because this means that it is easier to optimize the plate heat exchangers. The HT/Jacket Water Cooling System is an ideal source of heat.

The LT/Scavenge system provides the means of pre-heating the water before it is entered into the BWMS, thereby reducing the need for energy in the heating section of the BWMS. This means less CAPEX and footprint of the system.

A thermal boiler can be used as a back-up in case when neither the engine nor any other system can provide enough energy to pasteurize the ballast water.

No fine filter in the ballast water flow is required for a Bawat BWMS system as the pasteurization process is so efficient. Thus, clogging of filters and disruption of the cargo process due to filter reasons is avoided with the Bawat BWMS.

Stable and foreseeable ballast water capacity is especially important for HLV's as strength and stability of the vessels are sometimes critical during cargo operation.

Optimizing space and power requirements

The Bawat BWMS is installed as an add-on to the ballast water system of the vessel. The BWMS does not receive its water from the vessel ballast pumps but has a separate frequency-controlled pump, that feeds the BWMS. The Bawat BWMS is designed to meet the vessel's ballast water treatment needs, instead of the capacity of the ballast pumps, therefore a typical Bawat BWMS is less than 50% capacity of one ballast pump. In this specific case HLV's capacities are much less, as mentioned earlier.

The Bawat BWMS consists of proven standard marine components, making it simple and easy to maintain. Plate heat exchangers, a pump, valves, temperature and pressure sensors - all standard marine equipment that marine engineers are familiar with and know how to service and maintain. No special sensors, lamps, nor aggressive chemicals are necessary. The Bawat BWMS is designed for easy maintenance.

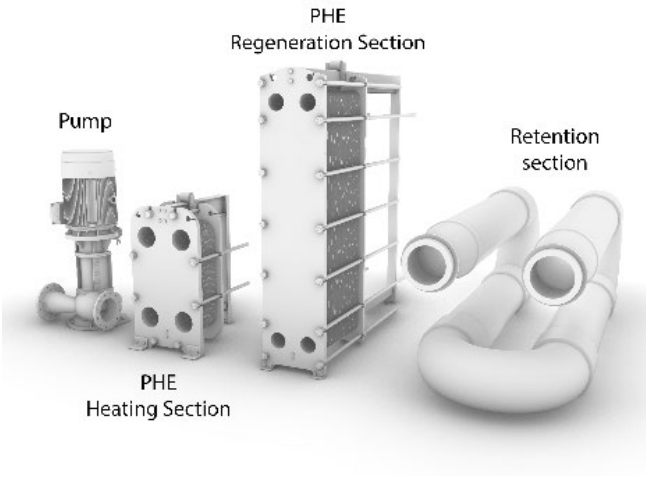


Figure 1, Bawat BWMS Components

Ballast Water Operations on an HLV with a Bawat BWMS

Figure 2 - examples of using the Bawat BWMS during the Operational process:

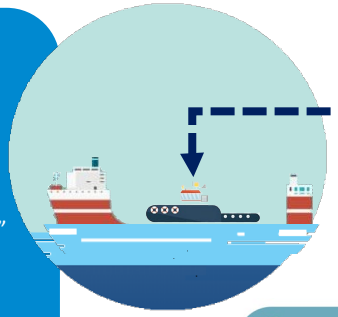
1. Before arriving in the loading port / In -Voyage

- All tanks are being cleaned/flushed using treated water from the BWMS obtaining D2 compliance prior to arrival
- Non-compliant ballast water is treated, and the untreated ballast tanks are flushed and cleaned.

BWMS ON

2. In the loading zone

- The vessel needs to go from "Ballast condition" to "Submerging condition"
- The vessel operates the ballast water using the vessel's existing ballast pumps only.
- Local untreated water is ballasted into "operation tanks"
- The local untreated water is discharged after the cargo loading operation is completed.
- None of this ballast water requires treatment by the BWMS
- The vessel leaves the loading zone in "Loaded Condition" with a mix of treated/untreated ballast water and treated/untreated ballast tanks. Some of the ballast tanks are empty and some contain ballast water.



BWMS OFF

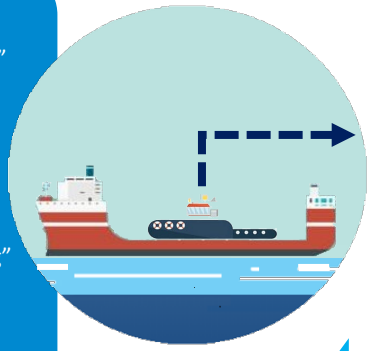
3. In voyage – Loaded condition

- BWMS utilizes waste heat from the engines to treat the ballast water.
- All tanks are being cleaned/flushed using treated water from the BWMS obtaining D2 compliance prior to arrival
- Non-compliant ballast water is treated, and the untreated ballast tanks are flushed and cleaned.
- The crew may prepare "Submerging Condition" by adding D2 compliant ballast water to voyage tanks to minimize the number of tanks with untreated water, before arrival.

BWMS ON

4. Cargo discharge zone

- The vessel needs to go from "Loaded Condition" to "Submerging Condition"
- All tanks are treated, and all ballast water is D2 compliant on arrival.
- The vessel operates the ballast water using the vessel's existing ballast pumps only. Local untreated water is ballasted into "cargo loading" ballast tanks. The local untreated water is discharged after the cargo loading operation is completed. None of this ballast water requires treatment by the BWMS. The vessel leaves the loading zone in "Loaded condition" with a mix of treated/untreated ballast water and treated/untreated ballast tanks. Some of the ballast tanks are empty and some contain ballast water.



BWMS OFF

Figure 2, Using Bawat BWMS on an HLV

Sediments in ballast tanks

Sediments in the ballast tanks are a challenge for many ships including HLVs. For example, a flatbed with a ballast capacity of 5.000 m^3/h conducting a load-out operation in a shallow-water port stirs up the bottom sediment in the loading area. A lot of this sediment end up in the ballast tanks. The sediment could, if possible, be flushed out in the SRA using local water only, reducing the need for running it through the BWMS.

Leaving sediment in the ballast tank can potentially lead to regrowth in the ballast tanks. As illustrated below, treated local water that is mixed with foreign sediment must be treated by a BWMS on discharge of the ballast water.

Today there are no clear rules regarding how much sediment can be left in the ballast tanks. The sediment is not the problem, however, if regrowth occurs and invasive species get mixed into the ballast water, the ballast water is no longer compliant when it is de-ballasted. The BWMS will have to have the ability to treat ballast water going in and out of the ballast tank, to make sure that the ballast water complies with the BWMS.

A vessel can have a fully functional and perfectly working BWMS that will discharge non-compliant ballast water if regrowth occurs in the sediment in the ballast tanks.

This is gaining a challenge where authorities and the shipping industry need to collaborate to find a practical approach to the legislations.

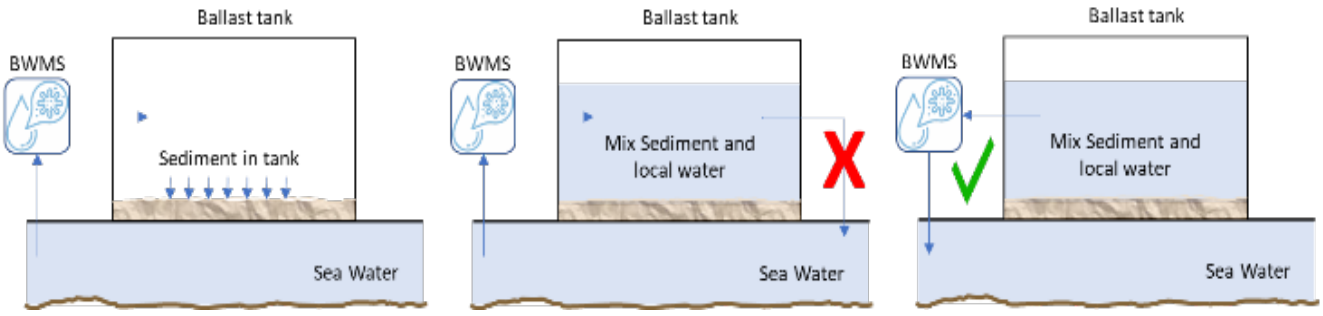
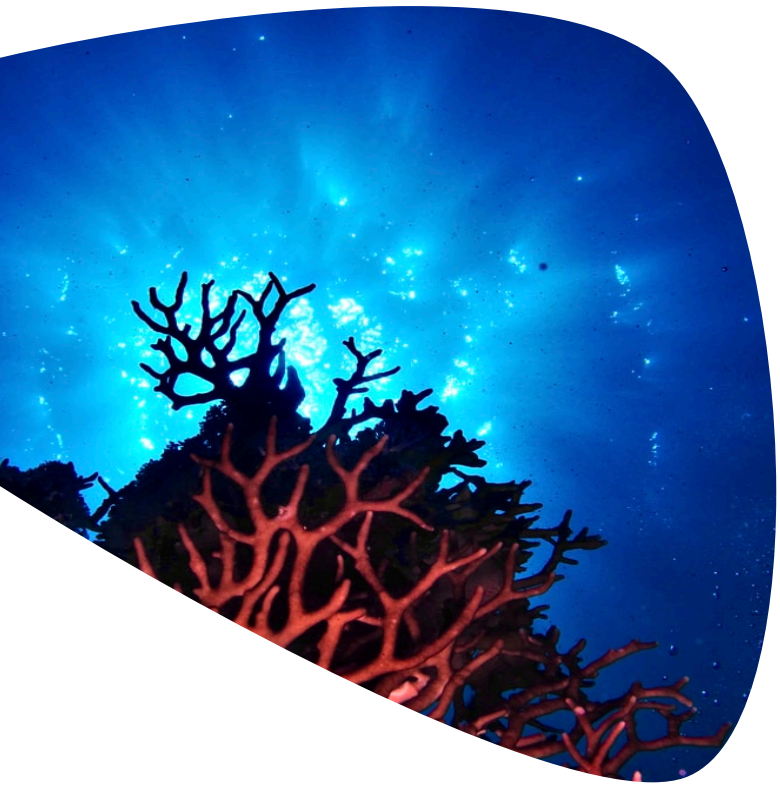


Figure 3, Ballast tank that contains foreign sediment and is mixed with local water, will have to be treated through the BWMS



Conclusion

The market for Ballast Water Management Solutions has developed and matured over the years and they are available to vessel owners almost tailormade for their operational set-up – they just need to find them. Selecting a one-type-fits-all approach is fine for a shipping company if all their vessels have the same operational pattern and are designed the same way.

Previously the selection of a BWMS was mostly driven by cost or technology. With the availability of the Bawat pasteurization technology there is an option that fits operational pattern for an HLV better.

By using a Bawat BWMS, an HLV can utilize the one-pass treatment approach, which means that the BWMS does not have to run during cargo operation. By leveraging this approach, the crew on an HLV will have one less risk factor during the cargo loading process. The BWMS works during the voyage and utilizes waste heat from the engines.

The Bawat BWMS has a small footprint compared to other BWMS for HLVs because the system is based on the need for ballast water treatment and not on the size of the ballast pumps. This again will cause the CAPEX to go down both on the installation and the system cost.

The components in the Bawat BWMS are simple and tried standard marine components, that easily can be maintained by the crew, as they already have similar equipment installed. Since the pasteurization process in the Bawat BWMS is driven by waste heat, the zero cost of energy in combination with utilizing standard marine components will drive OPEX down for the Bawat BWMS.

Several good reasons why the Bawat BWMS is the perfect choice for heavy lift vessels.