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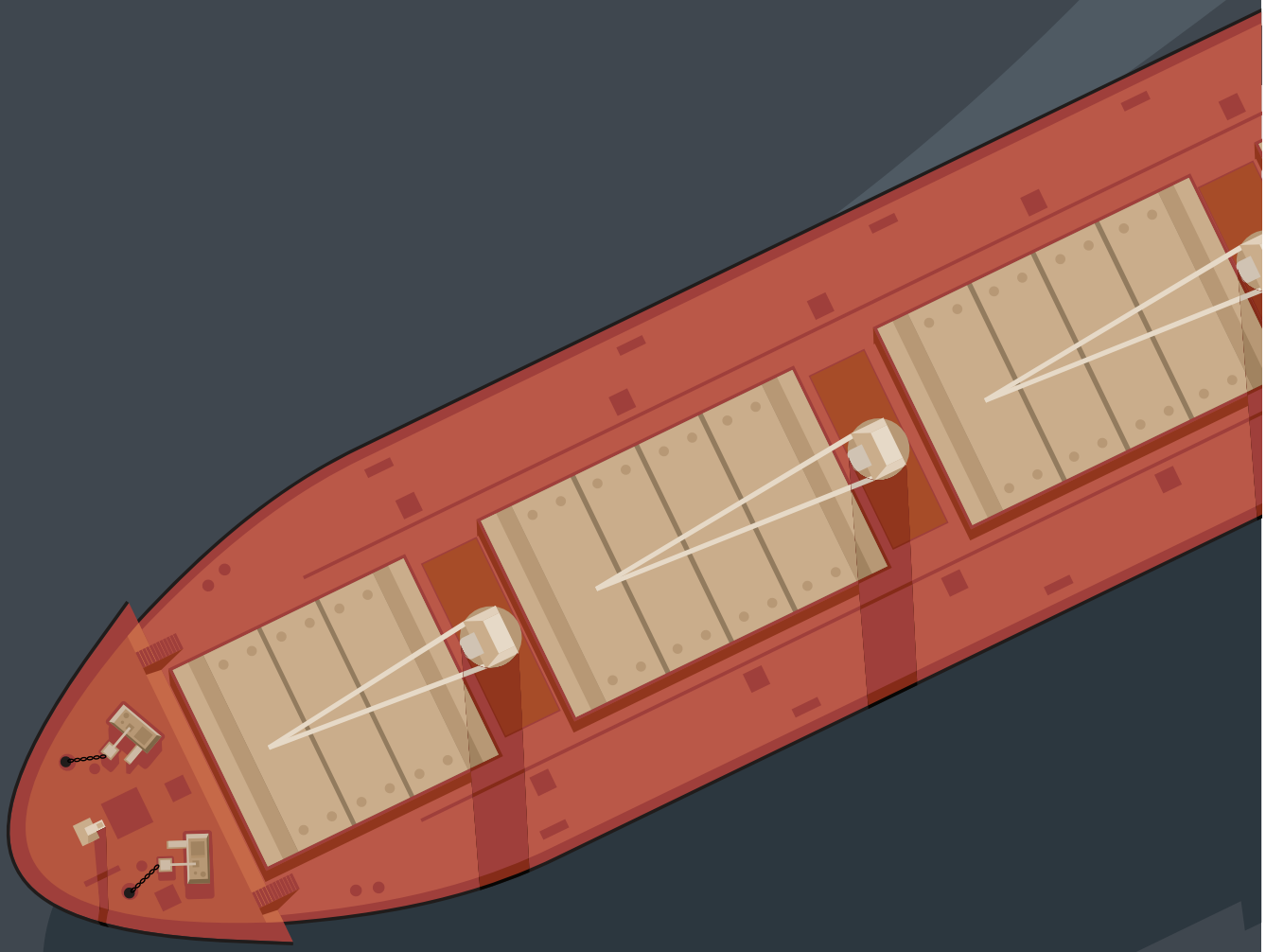

Ballast Water Management

Part 2:
Ballast water treatment systems

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There are several types of ballast water treatment systems (BWTS) available on the market or currently in development. They work on the principles of one or a combination of mechanical, physical and chemical.

Types of treatment systems

Most ballast water treatment systems use a two-step process, usually mechanical filtration followed by disinfection.

Common methods include:

- Filter and ultraviolet (UV): systems filter the particulates and bigger organisms followed by UV disinfection.
- Filter and electrolysis: systems filter the particulates and the bigger organisms followed by injection of active substances[1] generated from the electrolysis.
- Filter and chemical injection: systems filter the particulates and the bigger organisms followed by injection of a chemical solution.
- Ozone: disinfection through injection of O_3.
- Inert gas and ultrasonic: diffusing inert gas directly into the ballast tank to deoxygenate the water and using ultrasonic shockwaves to treat anaerobic organisms and bacteria.

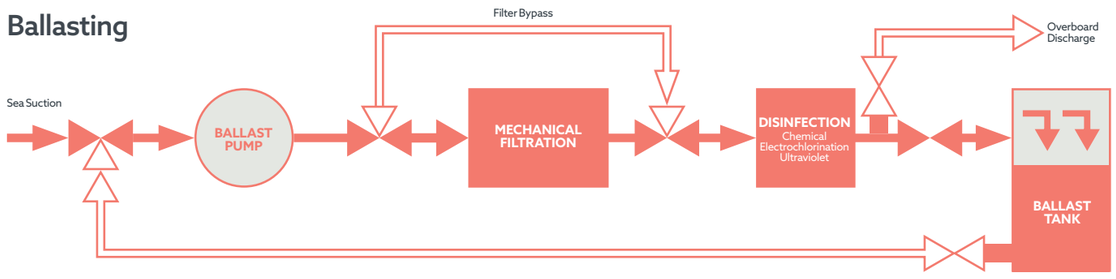
Basic principles of operation

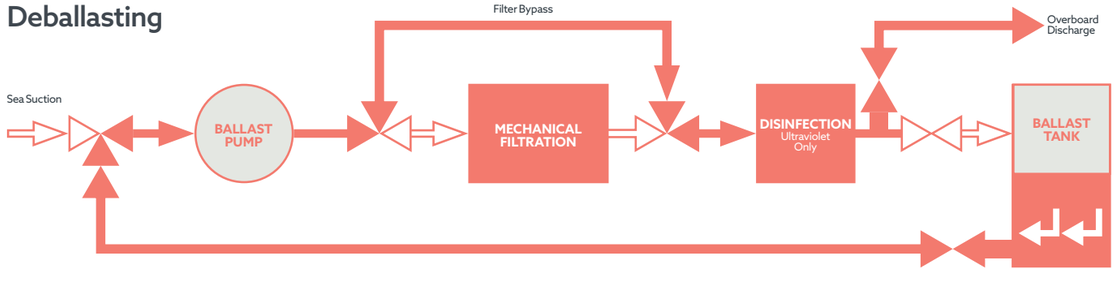
On intake the ballast water is filtered before passing through disinfection unit, typically chemical injection, electro-chlorination or UV.

Upon discharge, the filter is bypassed and, depending on type, the ballast water will be pumped directly overboard. Chemical and electro-chlorination systems cannot provide secondary treatment (i.e. disinfection at discharge).

At present, the only system that has the ability to disinfect during deballasting is ultraviolet. This is because UV is the only technology that has an instant disinfection effect and does not generate harmful residual substances in the seawater when discharging overboard.

[1]IMO defines an 'active substance' as "a substance or organism, including a virus or a fungus, that has a general or specific action on or against harmful aquatic organisms and pathogens"



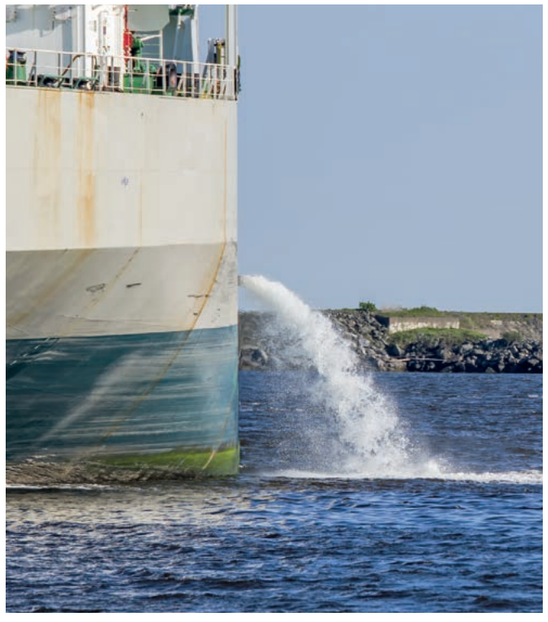


Choosing a treatment system

A common message from experts in the industry is that there is no "one size fits all" or a "plug and play" solution.

Just as importantly, treatment plant installation projects must be properly planned. A typical project timescale from initiation to commissioning is several months. This requires careful planning of the selection process of treatment plants, lead times of equipment and workforce (or dry dock) availability and system designs for pipelines and electrical power.

Selecting the right plant and system for retrofitting on a particular vessel takes careful consideration. Such a system would not have been considered at time of original build and therefore no dedicated space would have been allocated. The system must be matched to the operational demands of the vessel and typical factors to think about include:



Vessel's trade

- Will the vessel be trading in US waters and therefore need to comply with Federal and State requirements as well as satisfying the IMO BWM Convention?
- How long is a typical ballast leg of a voyage? Is it long enough to allow sufficient treatment but not so long to be at risk of regrowth?
- Will the vessel operate in freshwater, seawater or brackish water?
- What are the expected water conditions and water quality and temperatures in trading areas?
- If operating in areas where the local rules require organisms to be killed rather than rendered non-viable, is the treatment system capable of this and can the vessel provide the additional power needed?

Pumping rates

- Will pumping rates be adversely affected when using the treatment system for both ballasting and deballasting operations?

Tank layout

- If the vessel has top side tanks that rely on gravity deballasting, can the treatment system cope?

Power demands

- Can the vessel's existing electrical generation capacity meet the demands of the treatment system?
- Is there sufficient power capacity for the treatment system to run at full load at the same time as operating cargo cranes or cargo pumps or when maintaining power to reefers?

Space

- Is there enough space on the vessel to fit the treatment system and associated pipework?
- Is there room and means for safe access for the crew to access and maintain the system?

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Reliability

- Does the supplier and the treatment system have a reputation for being reliable?
- Are the materials and components used for the system and pipework up to a satisfactory quality and resistant to corrosion?

Support

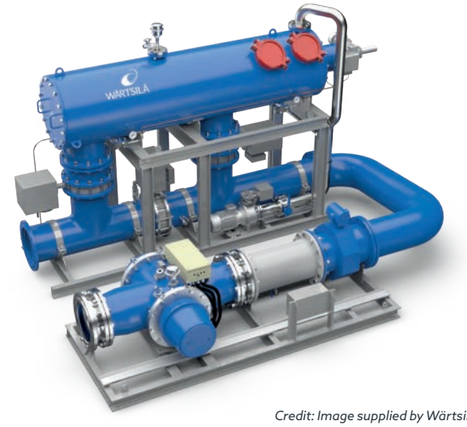
- Does the treatment plant manufacturer provide an effective after-sales service?
- Are spare parts and consumables readily available?

Training

- Does the treatment system come with suitable and usable manuals so the vessel's engineers can properly operate and maintain?
- What training is required to competently and confidently use and maintain the system?

Operational limitations

- What are the limitations of the treatment system? These operational limitations are listed on the Type Approval certificate and include water condition, temperature and minimum holding times.



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Sampling

Collecting a representative sample of ballast water on board a vessel or being discharged is challenging.

Organisms existing within the water can be affected by the method of sampling, therefore increasing the risk of drawing a sample that is not representative. This has significant implications if a sample is taken by Port State Control officials and is subsequently tested and found to be in breach of the relevant discharge standards.

There is currently no standard sampling method mandated by the IMO, although guidelines can be found in:

- BWM.2/Circ.42/Rev.1: Guidance on ballast water sampling and analysis for trial use in accordance with the BWM Convention and Guidelines (G2)
- European Maritime Safety Agency (EMSA) document *"BWM – Guidance for best practices on sampling"* **www.emsa.europa.eu/news-a-press-centre/external-news/download/5567/3472/23.html**

EMSA suggest that samples should be taken from the discharge line through designated sampling points. The sampling should be from a straight part of the discharge line as near to the ballast water discharge overboard as practicable.

But there might be instances where this is not possible and samples are taken directly from the ballast tanks, such as gravity discharge of top side tanks.

EMSA states that the best practice for a representative sampling is in-line sequential sampling during discharge. Two samples should be taken during a period of 10 minutes maximum with at least 5 minutes between the two samples. The samples should not be taken during the first and last 5 minutes of the discharge. The valves should be fully open and provide a flow rate less or equal to 50 litres/min. The result should then be the average of the values of these samples.

The test method may be subject to a maximum holding time and samples should be fully analysed within this limit.

Credit: Image supplied by Wärtsilä.

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