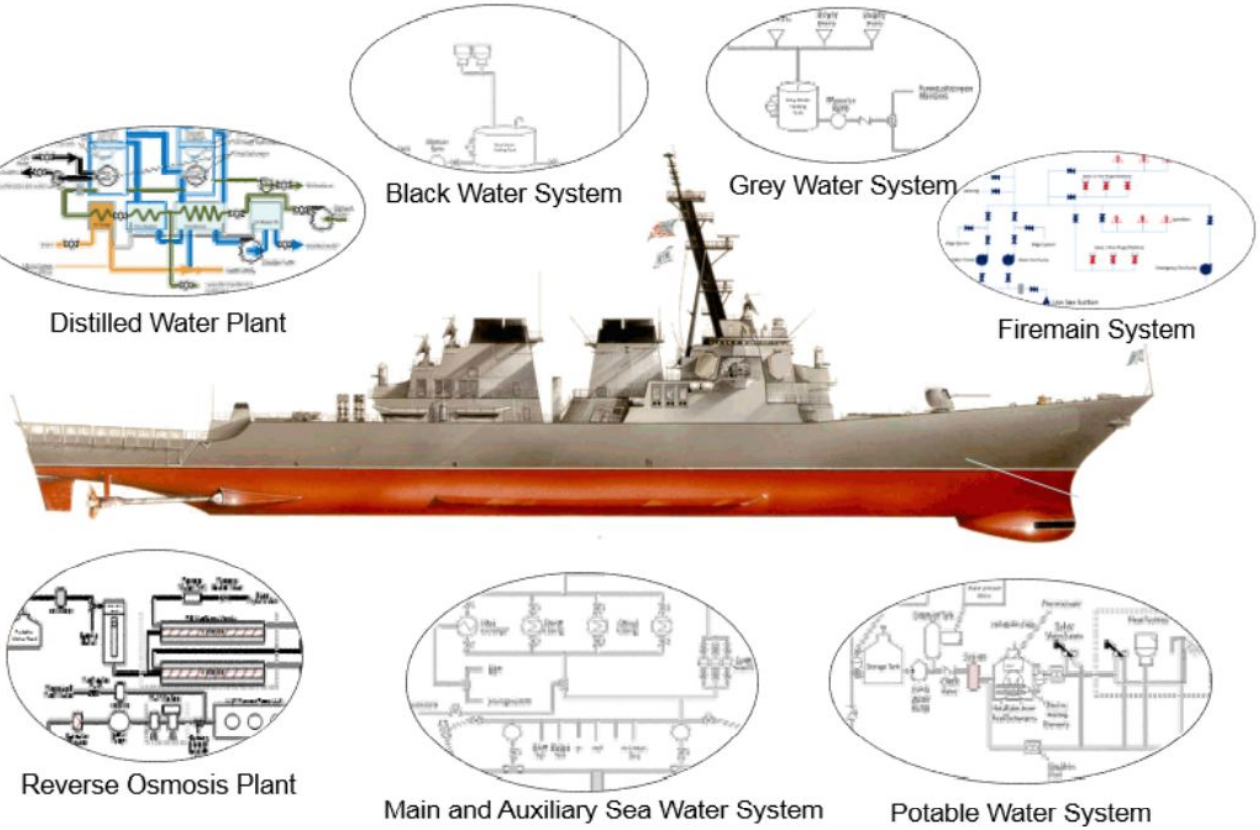
SY486K MICS Lecture 3

Maritime Water Systems

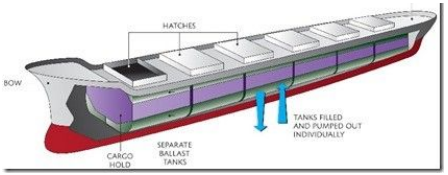
CDR Brien Croteau, USNA Cyber Science Department, January 2023

Outline

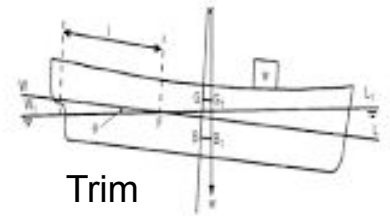
- Ballast
- Cooling
- Fire Mains
- Potable Water
- Wastewater



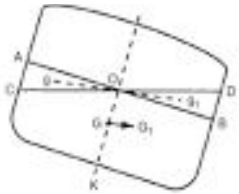
Ballast



Ballast is used in ships to provide moment to resist the lateral forces on the hull. Insufficiently ballasted boats tend to tip or heel excessively in high winds. Too much heel may result in the vessel capsizing. If a sailing vessel needs to voyage without cargo, then ballast of little or no value will be loaded to keep the vessel upright. Some or all of this ballast will then be discarded when cargo is loaded. The advantage of water ballast is that the tanks can be emptied, reducing draft or the weight of the boat (e.g. for transport on ground) and water added back in (in small boats, simply by opening up the valves and letting the water flow in) after the boat is launched or cargo unloaded.

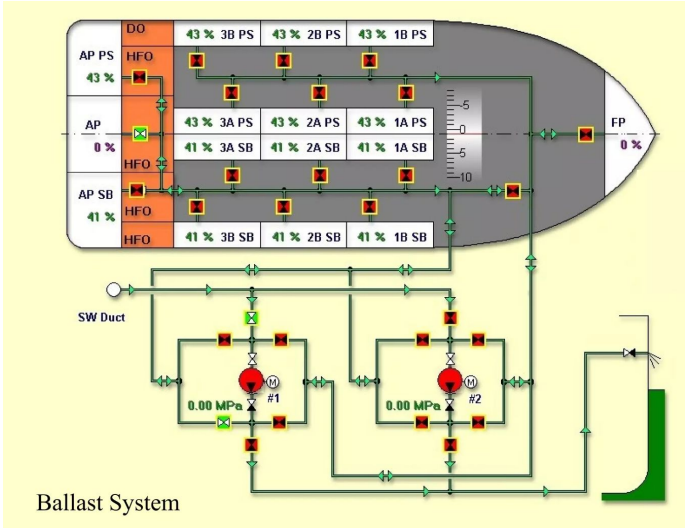


Trim

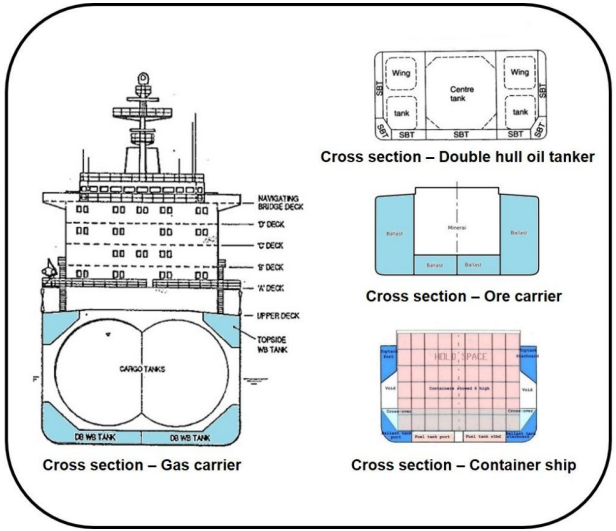


List

https://www.youtube.com/watch?v=oKp8csBhMgg



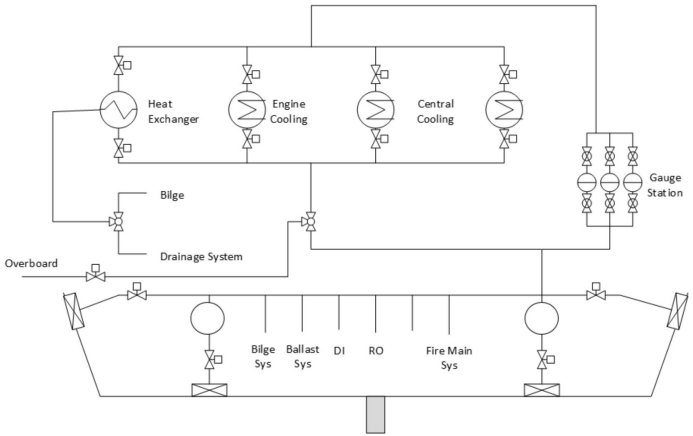
Ballast System

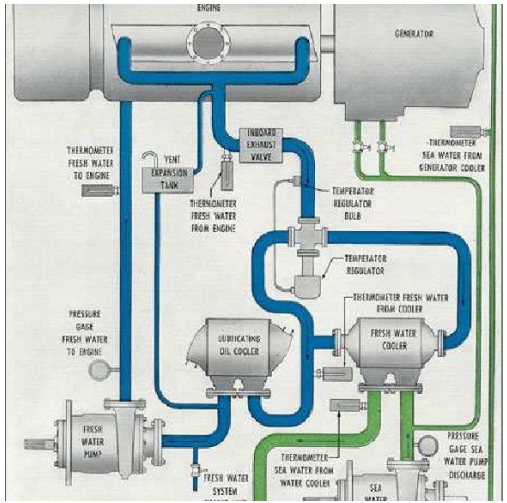


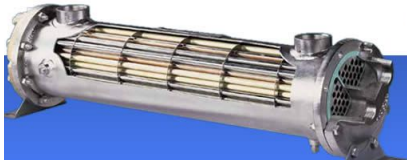
Cooling

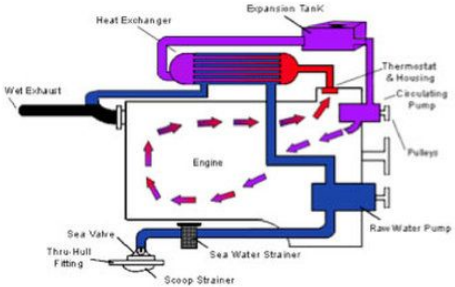
https://www.youtube.com/watch?v=ii11V201oFI

The main and auxiliary seawater cooling systems pull water off the vessel through hull valves to provide cooling water to heat exchangers. These valves are located sufficiently below the water line to prevent vapor locking the pumps.Key components to the main and auxiliary seawater systems are the main feed pumps, inductors, strainers, electro-hydraulic through hull valves, expansion tanks, pipping, heat exchangers, and any subsystems used to prevent internal pipe biological growth. Without main and auxiliary seawater cooling systems such as propulsion, power generation, and compressed air, a vessel would shortly shut down.

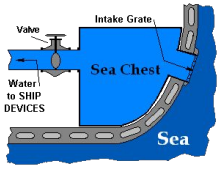




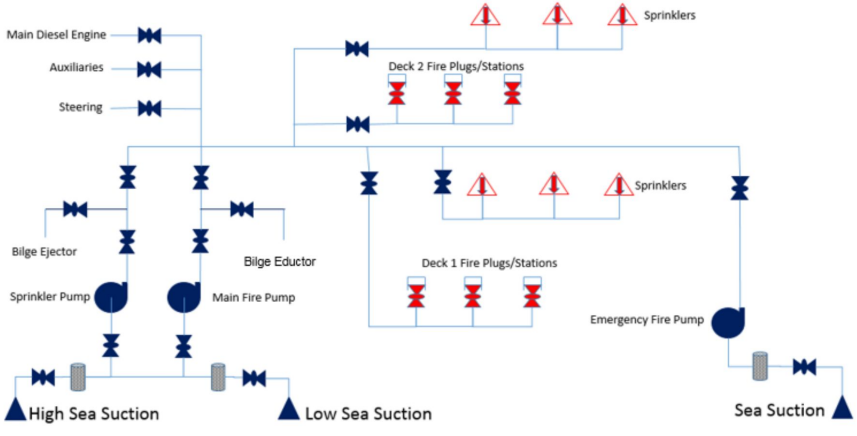


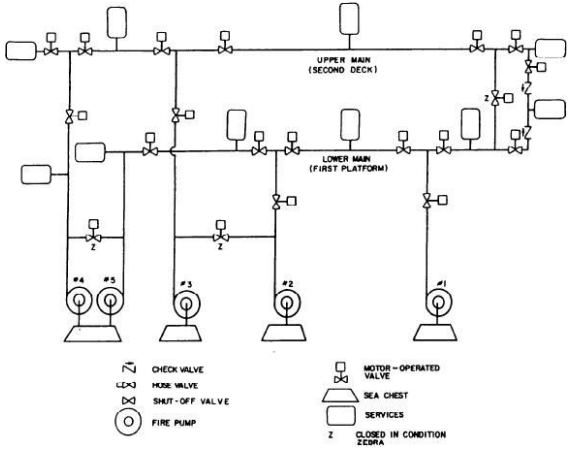


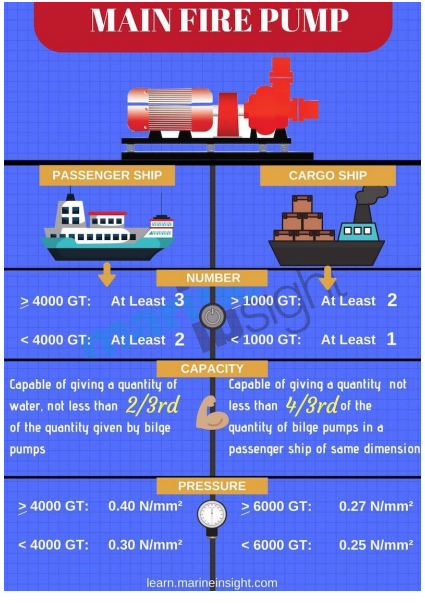
Firemain



The firemain can draw seawater from the main seawater system, or it may have its own through hulls. The firemain will use the fire pump to constantly maintain pressure on a ship's fire main piping system and sprinkler system. The firemain may also be cross-connected to the main seawater engine and generator supplies as a backup should the main seawater pumps fail. The fire pump is a critical piece of ship's survivability. In a duplexed pump system (two pumps), one pump will be primary and the other will be on standby during services. In the event the primary fails the secondary will turn on.



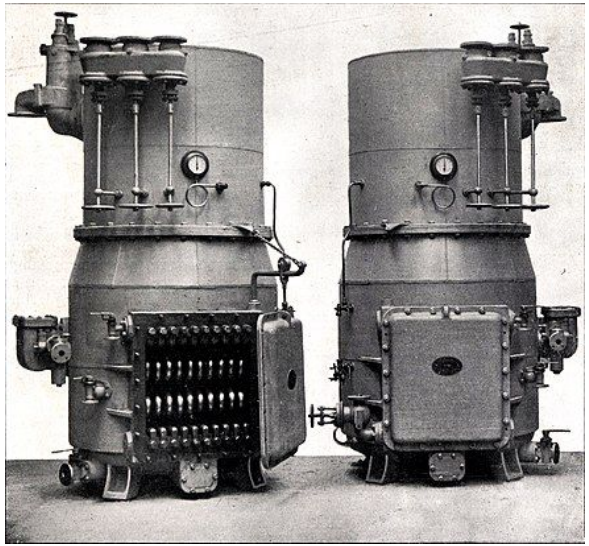


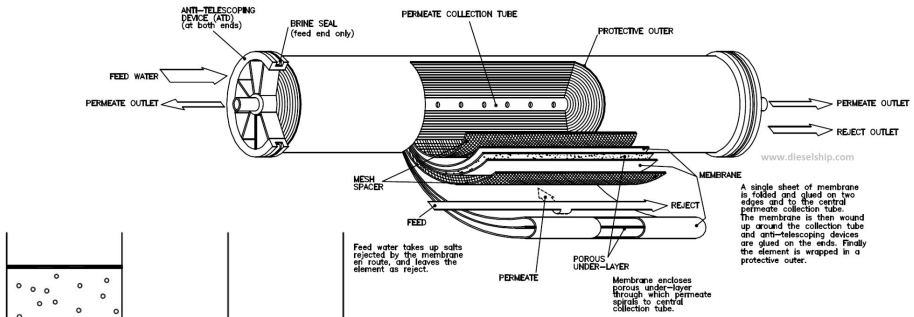


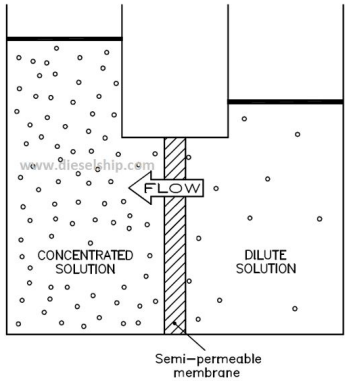
Potable Water

https://www.youtube.com/watch?v=8k56ffiNJ8M

Freshwater may be obtained from shore mains supply or water barge. Alternatively, the majority of ships employ an evaporator system that uses distillation, or a pressurised filtering system which uses reverse osmosis to convert seawater into potable water.





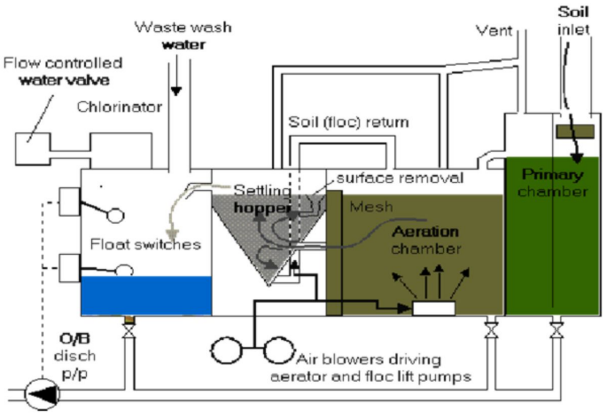


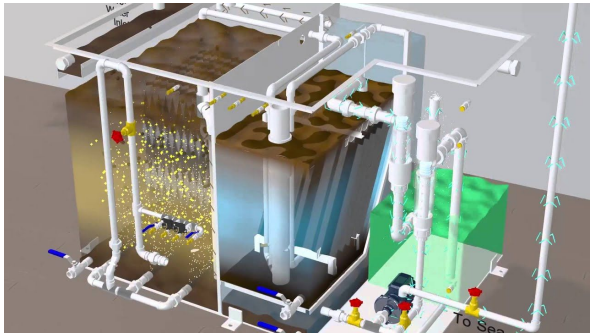
Wastewater

https://www.youtube.com/watch?v=5Z7bTmZVPTI

Greywater refers to wastewater generated from streams without fecal contamination, i.e., all streams except for the wastewater from toilets.

Blackwater in a sanitation context denotes wastewater from toilets which likely contains pathogens that may spread by the fecal-oral route. Blackwater can contain feces, urine, water and toilet paper from flush toilets.





Research Topics

Potential Research Topics

1. Ballast
2. Cooling - Sasha
3. Fire Mains - PJ
4. Fresh Water - Ariel
5. Wastewater

Example Slides shell