The Application on Regulation for Ballast Water Treatment
General

• It is estimated that shipping transfers about 10 billion tones of ballast water each year around the world.

• The invasion of foreign species through ship’s ballast water is a worldwide economical and ecological threat.
The IMO Convention

• The International Maritime Organization (IMO) and other international bodies to take action to address the transfer of harmful organisms by ship’s ballast water.

• On February 13, 2004, IMO adopted a new convention (Control and Management of Ship’s Ballast Water and Sediment) in which ballast water exchange and/or ballast water treatment will be required on all vessels.
Ballast Water Management procedures

1. Ballast Water Exchange Standard
   (Regulation D-1)
   -- Tentative Measures until comply with D-2

2. Ballast Water Performance (treatment) Standard
   (Regulation D-2)--- Ballast Water should be treated
   -- Not come into force yet

At the moment most new ships are still following D-1 standard, but the space for installing B.W. treatment should be considered.
1. **Sequential method**

--- 95% of Ballast water from ballast tank discharge to overboard then filling clean deep sea water to the tank one by one.

--- Limited by ship’s stability

--- For some kinds of ship, this method can’t be used, such as container vessel, multi-purpose vessel, RoRo vessel and PCTC vessel etc.
2. Flow through (Over flow) Method

---Pumping through at least 3 times clean deep sea water to replace ballast water in ballast tanks

---This technique is not effective in removing organisms from ballast water.

- There are some limitation in both methods

- It is therefore extremely important to develop the effective ballast water treatment systems as soon as possible, in order to replace Ballast Water Exchange (D-1)
Ballast Water Performance Requirement

- Less than 10 viable organisms per cbm >50µm
- Less than 10 viable organisms per ml >10µm - <50µm
- Bacteria - Similar to existing bathing water
  - Vibrio cholerae: 1 cfu/100ml
  - Escherichia coli: 250 cfu/100ml
  - Intestinal Enterococci: 100 cfu/100ml
The technology for ballast water treatment

1. Mechanical treatment methods
   such as filtration and separation
2. Physical treatment methods
   such as sterilization by ozone, inert gases, oxidation, ultra-violet light, electric currents and heat treatment
3. Chemical treatment methods
   such as adding biocides to ballast water to kill organisms
4. Various combinations of the above
Ballast Water Treatment system

RWO

Disinfection-Unit

Flushing pump

Filter

CleanBallast! SYSTEMS
Ballast Water Treatment system

PureBallast System

Advanced Oxidation Technology
Ballast Water Treatment system

NEI

Inert Gas

Gas Super-saturation
Ballast Water Treatment system

BOLLFILTER
Ballast Water Treatment system

New Technology

ECU & PRE 300 ton/h Combined model

Electrolysis/ electrochlorination
Ballast Water Treatment system

Container with test system installed at Texel, Netherlands

Filtration + Ultraviolet irradiation
Ballast Water Treatment system

EcochlorTM System

Chlorination
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: BW exchange or Treatment (D-1 or D-2)  
: BW Treatment D-2
Acc. to International Conventions, the application of D-2 come into force:

- **12 months after** ratification by **30 States** and Whose fleets not less than **35%** of world merchant shipping tonnage.

- Now It is ratified by **18 States** which occupies **15.27%** world shipping tonnage. So the application date will be delay about 2-3 years.

- Some **Ship Owners have required** to install the B.W. treatment system on the new ships
How to **install**

the B.W. treatment system
The problems of ballast water treatment for ship design

1. Up to now, more than 30 systems are developed or under development
   --- But only 6 systems have been Type approved by Administration/Class

2. Too many different kinds and different operation types of ballast water treatment systems and the less experience for using these equipments
   --- We don’t know which one is the best
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The problems of ballast water treatment for ship design

3. Consideration of the treatment capacity and the size of equipment
--- Generally the engine room space is limited, the size of equipment is very important, especially for small vessel

4. More electric power consumption
--- Because of additional equipment such as back flushing pump, Disinfection-Unit, AOT Unit and other equipments etc.

5. High price
--- The price of the new equipment is very high, because it takes huge money and time in research and development.
--- After more and more BW treatment systems used in the ship building, the price will be reduced.
Example 1

19100DWT MULTI-PURPOSE VESSEL
PRINCIPAL PARTICULARS

- Length overall: abt. 166.00 m
- Breadth: 22.90 m
- Depth: 13.90 m
- Draught (Scantling): 9.50 m
- Capacity of water ballast tanks: 9650 m³
- Application Date for D-2 standard: 2017
It is Owner’s requirement to install BW treatment system

Reason:

- The new regulation will be come into force in the future for all ships
  --- It is easier to install the B.W. treatment system for new vessel than the existing ones
- The vessel will be navigated in the special area that is very dirty
  --- Where there are a lot of mud and sand in the ballast water as well as organisms
  --- After the vessel navigating in that area for a few years, there are many sediment in the ballast tanks
  --- To be cleaning it by owner

Acc. to the special requirements from ship owner we select RWO CleanBallast! SYSTEMS in this vessel
Flushig pump

Disinfection-Unit

Filter

Filter: 5m x 3m x 2m
Disinfection-Unit: 1.9m x 1.6m x 2.6m
Control box: 1.8m x 0.8m x 2.2m
19100DWT MULTI-PURPOSE VESSEL

PRINCIPAL PARTICULARS for RWO CleanBallast! SYSTEMS

- **Number:** 2 sets
- **Capacity:** 350m³/h (each)
- **Filter:** 2 sets
- **Capacity:** 330 m³/h (each)
- **Delivery pressure:** 0.60 MPa
- **Flushing pump:** 2 sets
- **Electric power consumption:** 110 kW (each)
- **Disinfection-Unit:** 2 sets
- **Electric power consumption:** 20 kW (each)
- **Total electric power consumption:** abt. 130 kW X 2
- **Pressure loss:** 0.08 MPa
- **Total price:** One million USD
Advantage:

- Big filter with Flushing pump
  
  Big filter---- means good filtration performance

  Flushing pump----The flushing pump will be automatic started to back washing the filter to keep filter cleaning---It’s profit for operation

- It is suitable to use for ship in dirty area.

Disadvantage:

- Big size
- Big electric consumption
- High discharge resistance (Pressure loss)
- High price
19100DWT MULTI-PURPOSE VESSEL

Size: 5m x 3m x 2m
Disinfection-Unit

Size: 1.9m x 1.6m x 2.6m
1. Mechanical filtration to remove suspended solids, sediments and certain organisms during ballasting
2. Disinfection to reduce the number of organisms before filling ballast water tanks
3. Second disinfection to reduce the number of organisms according to the future Performance Standard D2 at ballast water discharge
SYSTEM DRAWING

RWO

From ballast tank

Ballast water pump

Discharge overboard

Sea chest

Ballast tank

Air vent

Disinfection

Filter

Algae Monitor

Drain

Flushing pump
Ballast water treatment
ENGINE ROOM LAYOUT

The space for installing BW Treatment system

19100DWT MPV
ENGINE ROOM LAYOUT

The space for installing BW Treatment system

19100DWT MPV
Example 2

400,000 DWT ORE CARRIER
400,000 DWT ORE CARRIER

PRINCIPAL PARTICULARS

- Length overall: abt. 360.00 m
- Breadth: 65.00 m
- Depth: 30.40 m
- Draught (Scantling): 22.00 m
- Capacity of water ballast tanks: 190,700 m³
- Application Date for D-2 standard: 2017
Ballast Water Treatment system

PureBallast System

Advanced Oxidation Technology
PRINCIPAL PARTICULARS for Alfa Laval PureBallast SYSTEMS

Number: 2 sets
- Capacity: 4000m³/h (each)
- Filter: 2 sets
  - Pressure drop: 0.005-0.05 MPa
- Wallenius AOT Unit: 2 sets
  - Electric power consumption: 510 kW (each)
  - Working pressure: 0.25-0.6 Mpa
- Total electric power consumption: abt.(510+6)kW X 2 =1026kW
Example 2:

400,000 DWT ORE CARRIER

The preparative space for installing BW Treatment system

The size base on Alfa Laval PureBallast System
The consideration of using ballast water treatment in ship design

- The suitable capacity of total ballast water in the vessel
  --- as less as possible
- Select good performance for the system
  --- High efficiency
  --- Safety and durable
  --- Big capacity and less electric consumption
  --- Smaller size and simple structure
  --- Easily for installation and maintenance
  --- Lower cost
Using permanent ballast for some kind of vessels in order to reduce the quantity of water ballast

--- For example, the container vessel, normally part of ballast water to be used at loading condition in order to increase the stability. We can use permanent ballast instead of this part of ballast water.

--- Otherwise, the specific gravity of permanent ballast (such as steel, iron, stone and concrete etc.) is heavier than sea water. It’s better for ship’s stability.
The consideration of using ballast water treatment in ship design

- The suitable capacity for ballast pump and suitable time for Ballasting /de-ballasting

--- The capacity of BW treatment system should be minimized because it is related to the engine room space, electric power consumption, and the equipment price etc.

--- The pump capacity is base on Ballasting /de-ballastning time. If the time longer, the pump capacity will be reduced. It should be agreed by Ship Owner
The consideration of using ballast water treatment in ship design

- **The pump delivery pressure will be increased**
  --- Because of additional discharging resistance when BW through the BW treatment system
  --- For new vessel there is no problem, but for existing vessels, the original pump delivery pressure will be not enough for installing some kinds of BW treatment system that has high additional resistance in the system. The original ballast pumps should be replaced.

- **More electric power consumption**
  --- The power of Aux. engine may be increased
  --- It is a big problem for existing vessels.

- **Find suitable space for installing B.W. treatment equipment**
  --- It may be had some problems for small vessel
  --- Specially for existing vessel
Ozone Treatment System

Equipment Installation

On the superstructure
Inert Gas treatment system

- TECO Pat Cantrell
- 40,000 DWT Bulker
- Trades US Gulf and East Coast
- 2 x 1,000 m³/hr Pumps
- Double-Bottom and Lower Wing Tanks
Inert Gas treatment system

- 12" Diameter Venturis in Machinery Space
- 2,500 m³/hr Inert Gas Generator

In the double bottom on low wing tank
filtration treatment system

In the engine room
Filtration and Oxidation Treatment system

In a car carrier
In operation 2003

6.18 Ø750 DN400
500 m³/h 50μ

In the engine room
Filtration and Oxidation Treatment system

The Benrad AOT (Advanced Oxidation Technology) unit

In the engine room
CONCLUSION

The above mentioned is only examples

- There are many other different problems for different kinds of B.W. Treatment system. We need study and develop these systems in the ship design to comply with the new regulation.
- We hope more and more Ballast Water Treatment system will be approved by Administration or Class and can be used in ship building.
- We believe that Ballast Water Treatment system will be easier to install on ship as same as other marine equipment In the future.
THANKS