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LAMBOS

MARITIME SERVICES LTD

BALLAST WATER MANAGEMENT

REGULATIONS & EQUIPMENT

Water Ballast Treatment Convention Market News

The Convention has not yet been ratified so this gives extra time for Ship Owners to decide their plan of action and examine their available options. Most of the Shipping Companies are cautious because the last months there were no significant developments regarding the Convention and few independent voices from the market reveal that the convention may not get ratified by IMO Committee in the near future and valuable time will be gained. Nevertheless, for the Vessels calling USA Ports the situation is different because of the USCG BWT Regulations.

The Convention raises new technical standards with the manufacturers of Ballast Treatment Systems participating in a road race to compete and get ahead of the deadlines. So the technologies used even if they are approved by IMO or Classification Societies are not tested considerably in the seaborne environment therefore there is no guarantee that they will work under the various conditions of Vessels operations. Another challenge is that these Systems require substantial power so in many cases the two main electrical generators on board are required to work concurrently in order to provide the required power level. Despite the above, for existing Vessels currently operating the big headache, besides cost of acquisition and installation which in many cases is considerable, is that of space availability. So Shipmanagers should install them in such a space that it will not impede Vessels day to day maintenance operations.

Some Ship Owners have already installed such systems in their newbuilding Vessels and they are operating them in order to gain experience in these systems and maybe any defaults to get revealed while in guarantee period. Others leave empty space in the Engine Room or in some Tankerships designs in deck/pump room and install only the proper pipings and electrical cables while in Shipyard with a view to avoid cost in this difficult period and in case the Convention will not be finally ratified. The situation remain the same with existing Vessels with some Shipowners having already installed WBT in order to secure lower prices since it is expected an increase on the prices when demand increases. In existing Vessels Ship Owners usually install the most compact systems and up to now and judging from our feedback from market there is a definite preference to UV and Ozone technology systems.

IMO Ballast Water Treatment Convention

The International Convention for the Control and Management of Ships' Ballast Water and Sediments has been adopted by IMO in 2004 to enter into force 12 months as from the date that not less than 30 States with combined merchant fleets of gross tonnage not less than 35% of the World's Merchant Fleet have ratified the Convention.

Up to August 2014 the Convention has been ratified by 40 States, excluding yet Greece, constituting 30,25% of the World's gross tonnage. The Convention requires during the years 2012 and up to the end of 2016 for even more than 60,000 Oceangoing Vessels to comply in order to avoid detentions for not compliance with Regulations. Therefore unless there is an extension for the window of compliance the present ratification process creates the requirement within a few years up to 2016 all Vessels to comply. However, if the Convention enters into force after 31 December 2016, the applicable date of compliance standard is first renewal survey for all ships. Ships built after entry into force will be required to have a treatment system installed at delivery.

USCG Ballast Water Treatment Regulations

United States Coast Guard has voted Ballast Water Treatment Regulations which affect the Vessels trading in US waters and prescribes the installation of Treatment Systems approved. All Vessels built after 1st December 2013 should install such systems and for existing Vessels with more than 5000 m^3 Water Ballast should install a Treatment System in their first scheduled drydocking after 1 January 2016.

As from 2012 all new Vessels with keels laid during this year are required to have Ballast Water Treatment Systems. The installation for a Newbuilding is straight forward in comparison with the existing Fleet where except of Space required there will be a need for the requirements of the new equipment therefore difficult decisions are to be made by Operators regarding the Type and Cost of the Equipment that will be installed onboard their Vessels.

It is worth mentioning that basis present estimates approximately 3 to 5 billion tonnes of ballast water is transported as ballast by Vessels trading internationally each year.

Types of Ballast Treatment Systems

There are various Treatment Techniques for Water Ballast and usually the Equipment available in the Market offer a Combination of these processes in order to achieve the requirements. Each Technique has advantages and disadvantages and most of them have not been yet evaluated thoroughly therefore the results are not conclusive presently.

1. Separation Method

(a) Hydro-clone

Solid particles are separated from the water by centrifugal forces. Only those particles with a specific gravity greater than that of water can be separated

(b) Filtering

Sediments and particles are removed with filters during ballast intake and usually are self-cleaning with a back-flushing cycle. These filtration systems create pressure drops and a reduced flow rate due to resistance in the filter elements and the self-cleaning procedures

(c) Coagulant

A superconducting magnetic separator is used to coagulate and remove the blue-green algae

2. Chemical & Biological Disinfection

(a) O3

Ozone is generated to disinfect the Ballast Water

(b) Chlorination

Chlorine is generated in various forms in order to disinfect the Ballast Water

(c) Electrolysis

Electrical current is applied directly to the ballast water flow in an electrolytic chamber, generating free chlorine, sodium hypochlorite and hydroxyl radicals, causing electrochemical oxidation through the creation of ozone and hydrogen

peroxide. This method is limited in effectiveness to seawater having a certain level of dissolved salt and could also create unwanted residuals.

(d) Chemical or Biological

Disinfecting biocides – pre-prepared or packaged disinfectants designed to be dosed into the ballast flow and kill the living organisms by chemical poisoning or oxidation. Typical biocides include chlorine, chloride ions, chlorine dioxide, sodium hypochlorite and ozone. Residual biocides in the ballast water must meet ballast discharge standards which may require neutralization techniques.

3. Physical Disinfection

(a) Oxidation

Large quantities of Oxygent are generated in order to disinfect the Water Ballast. Not well balanced this methoid may lead to excessive corrosion in Ballast Tanks.

(b) UV

UV radiation is used to attack and break down the cell membrane killing the organism outright or destroying its ability to reproduce. The effectiveness depends on how clear the ballast water is as this could limit the transmission of the UV radiation. UV lights are required to be maintained and power consumption needs to be considered.

(c) De-oxidation

Various methods are used to remove the dissolved oxygen in the ballast water and replace it with inactive gases, such as nitrogen or other inert gas. Removing the oxygen not only kills the aerobic organisms but it can also have benefits for corrosion prevention provided that the oxygen content is maintained at the correct levels. De-oxygenation can require a prolonged period in order to render the organisms and pathogens harmless to the receiving waters.

(d) Heat

Ballast water is treated with Heat generated by other Machineries onboard the Vessel in order to disinfect the Ballast Water.

4. Agitation

(a) Cavitation

Venturi pipes or slit plates are used to generate cavitation bubbles and this high energy bubble creation and collapse results in hydrodynamic forces.

(b) Ultrasound

Ultrasonic oscillations, or high frequency noise created to disrupt the cell walls of organisms effectively killing them.

Every treatment method has its advantages and disadvantages as mentioned above and several comments need to be clarified in order for the Buyer and the User to reach the suitable decision.

For example with the UV system: Lamp type, required minimum intensity and water clarity, size of UV Chamber, quantities of Carbon in water that may create problem to disinfection and actual current required for the process. Usually UV systems also require the use of fine filters that easily clog, which has happened some times during seatrials, filling filters with jelly fish.

For the Chemical, Ozone, Oxidation: Required minimum dosage rate, minimum holding time, possible pollution considerations and if chemicals will be generated onboard or supplied, space and quantities required, supply points availability. How much and if the Ballast Tanks will be corroded due to changes in the PH of Ballast Water.

For De-oxygenation: Quantity of inert gas required, Minimum treating time, Type of gas, fuel type and consumption to generate gas.

For any particular type of Cargo Vessel or Tanker, Operators will need to be aware of all modifications necessary to fit the Ballast Water Treatment Systems to existing Ships. It will be necessary to obtain schematic arrangements and equipment drawings from the System Supplier in order that the Technical Department to prepare timely a work plan, which however may alternatively be provided by the

Supplier, but the Operator will still need to provide the ship's ballast water system drawings, functional requirements and details of compartmental spaces where the equipment is to be installed and an Inspection onboard at least once will definitely be required.

Very important notwithstanding of the system is that it must be ensured that existing pumps onboard are able to produce the needed extra head to go through the BWTS, or else maybe extra pumps should be installed. Other challenge for BWT systems is that some systems fail in low water temperatures below 10°C or with salinity levels below 15PSU.

In general and to address effectively a contingency situation, many factors should be checked and evaluated such as the ship's position, weather forecast, machinery performance, stability, strength, and the degree of crew fatigue, before proceeding to the next sequence. If any factors are considered unfavourable to the ballast exchange, a decision should be made to either suspend exchange operations until conditions become more favourable or halt exchange operations.

Although equipment Manufacturers will have to obtain Flag State Certification for the approval of the System, they may not be fully conversant with all the Maritime Regulations and Codes of practice that need to be considered during their installation and operation (such as those relating to chemical hazards and confined space safety considerations). Owners' representatives should therefore carry out a review to ensure that regulations and codes of practice are not compromised.

The amount estimated for an average size Vessel including also the installation onboard at the usual Areas i.e. China, Black Sea and PG, is between USD 1 mil and USD 1,5 mil according to current Price Levels offered by Equipment Manufacturers and also Shiprepairers.

It is evident therefore from the above that both in respect of time and also costs involved the procedure is not straight forward and Operators will have to make certain tough decisions taking also into consideration that the prevailing difficult Freight Market is already causing headaches etc.

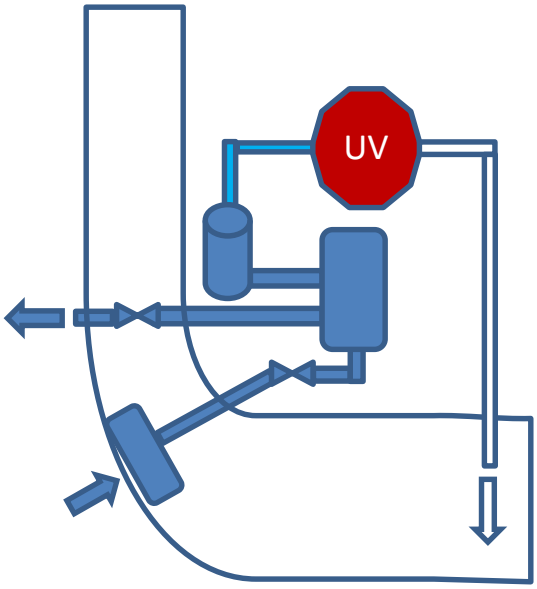
To update your information attached herewith you may find the List of BWT Equipment Manufacturers and which of them presently are approved by IMO and their main Technical Characteristics of their System as well.

Out of all the Systems we have already studied we consider that the good UV Systems will dominate the Market since they offer a good compromise in respect of proven Technology, cost offered and flexibility of the Systems.

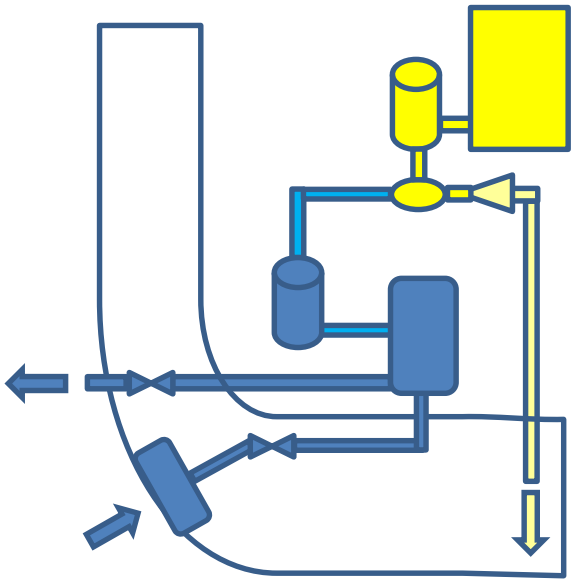
For your preliminary guidance certain basic Systems are illustrated here below to outline the respective installation involved.

Concluding it is evident from the above that for each existing Ship all necessary merits should be studied in detail in order to decide in cooperation with Manufacturers the most suitable Solutions in respect of Technical and cost saving, supply, installation and operation onboard of the System suitable for the Vessel concerned.

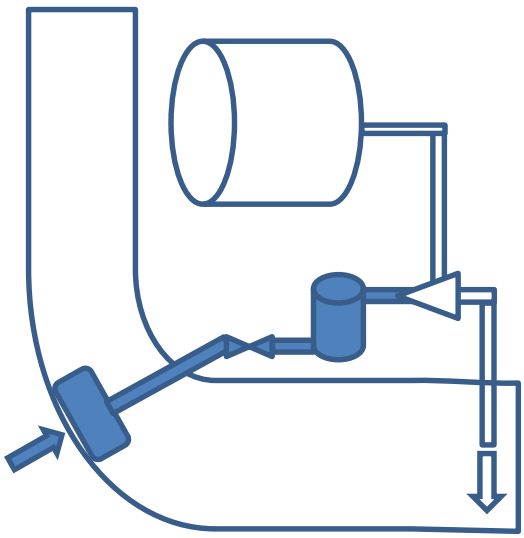
In consideration of the above we invite your attention that our Company with our experienced Principals are already fully updated on the Systems available and will be in a position to assist Owners with the necessary evaluations and submission in time of the Quotation and the relative information for Owners consideration.



Typical Configuration of UV Systems



Typical Configuration of Systems using Chemical or Biological Agents



Typical Configuration of Systems using Inert Gas Generator

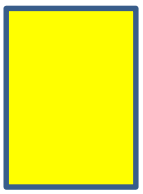
Valve

Pump

Filter

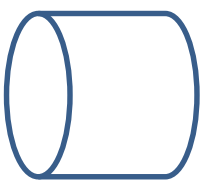
Sea Chest

Ventouri



Chemical or Biological Agents Tank

Ultraviolet Loght Chamber



Inert Gas Generator

Table with BWT Equipment Manufacturers and the respective Technology Utilized

		Separation Method			Chemical & Biogical Disinfection					Physical Disinfection			Agitation	
	Company Name	Hydroclone	Filter	Coagulant	O3	Chlorination	Electrolysis	Chem or Bio	Residual	UV	Deox	Heat	Cav	Ultrasound
1	**21ST CENTURY SHIPBUILDING CO LTD**		√							√				
2	ACCEPTA							√						
3	**ALFA LAVAL TUMBA AB**		√							√				
4	AQUA ENG. CO., LTD						√	√						
5	AQUAWORX ATC GMBH		√							√				
6	ATG UV TECHNOLOGY		√							√				
7	ATLAS-DENMARK		√				√							
8	AURAMARINE LTD		√							√				
9	BLUE FILTERS GMBH		√											
10	BRILLYANT MARINE						√							
11	COLDHARBOUR										√		√	√
12	DESMI OCEAN GUARD A/S		√		√					√				
13	**ECOCHLOR INC**					√								
14	ECOLOGIQ		√							√				
15	ELECTRICHLOR INC					√	√							
16	ELTRON WATER SYSTEM		√					√						
17	ENVIROMENTAL TECHNOLOGIES INC		√		√									
18	ERMA FIRST SA	√					√							
19	FERRATE TREATMENT TECHNOLOGIES							√						
20	GEA WESTFALIA SEPARATOR GROUP GMBH		√					√						
21	**HAMMAN AG / DEGUSSA GMBH**	√	√					√						
22	**HAMWORTHY GREENSHIP**	√					√							

		Separation Method			Chemical & Biogical Disinfection					Physical Disinfection			Agitation	
	Company Name	Hydroclone	Filter	Coagulant	O3	Chlorination	Electrolysis	Chem or Bio	Residual	UV	Deox	Heat	Cav	Ultrasound
23	HI TECH MARINE PTY LTD											√		
24	**HITACHI PLANT TECHNOLOGIES, LTD**		√	√										
25	HYDE MARINE INC		√							√				
26	**HYUNDAI HEAVY INDUSTRIES EcoBallast**		√							√				
27	**HYUNDAI HEAVY INDUSTRIES HiBallast**						√		√					
28	JFE ENGINEERING CORPORATION		√			√			√					
29	KATAYAMA CHEMICAL INC.		√					√						
30	KURARAY CO., LTD		√					√						
31	KWANG SAN CO LTD		√				√							
32	MAHLE NFV GMBH		√							√				
33	MARENCO TECHNOLOGY GROUP INC		√							√				
34	MARITIME SOLUTIONS INC.													
35	MEXEL INDUSTRIES							√						
36	MH SYSTEMS INC										√			
37	**MITSUI ENGINEERING & SHIPBUILDING**				√								√	
38	NANO IRON S.R.O.							√			√			
39	NEI TREATMENT SYSTEMS LLC										√		√	
40	**NK CO LTD**				√									
41	NUTECH 03				√									
42	**OCEANSAVER AS**		√				√				√		√	
43	OPTIMARIN AS		√							√				
44	**PANASIA CO., LTD**		√							√				
45	PINNACLE OZONE SOLUTIONS		√		√		√			√				

		Separation Method			Chemical & Biogical Disinfection					Physical Disinfection			Agitation	
	Company Name	Hydroclone	Filter	Coagulant	O3	Chlorination	Electrolysis	Chem or Bio	Residual	UV	Deox	Heat	Cav	Ultrasound
46	PRIMEZONE		√		√									
47	**QINGDAO HEADWAY TECHNOLOGY CO LTD**		√				√							√
48	QWATER		√											√
49	**UNITOR BWTS**		√		√		√						√	
50	**RWO**		√				√							
51	SEA KNIGHT CORPORATION							√			√			
52	**SEVERN TRENT DE NORA**		√				√		√					
53	Shinko Ind. Ltd. 1													
54	SIEMENS		√				√							
55	STX Metals Co. Ltd. 1													
56	**SUNRUI CORROSION & FOULING CONTROL**		√				√	√						
57	**TECHCROSS**						√							
58	THE JAPAN ASSOCIATION OF MARINE SAFETY		√		√									
59	**TECHWIN ECO CO., LTD**		√				√							
60	TG CORPORATION		√			√			√					
61	TROJAN MARINEX		√							√				
62	WUXI BRIGHTSKY ELECTRONIC CO. LTD1													
63	WILHELMSEN TECHNICAL SOLUTIONS		√				√						√	

1 Insufficient information

With Bold Letters are Systems with FINAL Approval by IMO up to August 2011

Ballast Water Treatment Systems that have received Final Approval from IMO (May 2014)

	Approval Date	Name of the Administration	Name of the ballast water management system
1	June 2008	Det Norske Veritas, on behalf of the Norwegian Administration	PureBallast System
2	10 June 2008	Federal Maritime and Hydrographic Agency, Germany	SEDNA® Ballast Water Management System (Using Peraclean® Ocean)
3	31 December 2008	Ministry of Land, Transport and Maritime Affairs, Republic of Korea	Electro-Cleen™ System
4	17 April 2009	Det Norske Veritas, on behalf of the Norwegian Maritime Directorate	OceanSaver® Ballast Water Management System
5	24 November 2009	Ministry of Land, Transport and Maritime Affairs, Republic of Korea	NK-O3 BlueBallast System (Ozone)
6	4 December 2009	Ministry of Land, Transport and Maritime Affairs, Republic of Korea	GloEn-Patrol™ Ballast Water Management System
7	5 March 2010	Ministry of Land, Infrastructure, Transport and Tourism of Japan	Hitachi Ballast Water Management System (ClearBallast)
8	28 January 2011	China Maritime Safety Administration	BalClor™ Ballast Water Management System
9	26 May 2010 and 25 March 2011	Inspection and Measurement Division, Maritime Bureau, Ministry of Land, Infrastructure, Transport and Tourism of Japan	JFE BallastAce® Ballast Water Management System
10	19 April 2011 Renewal 18 January 2013	The South African Department of Transport The South African Department of Transport	Resource Ballast Technologies System
11	2 September 2008 19 January 2010	Office of the Maritime Administration, Marshall Islands Merchant Shipping Directorate of Malta	NEI Treatment System VOS-2500-101
12	29 April 2009	Lloyd's Register, as delegated by the Administration of the United Kingdom	Hyde GUARDIAN™ ballast water management system
13	12 November 2009	Det Norske Veritas, on behalf of the Norwegian Maritime Directorate	OptiMarin Ballast System (OBS)
14	16 February 2011	China Maritime Safety Administration	Blue Ocean Shield Ballast Water Management System
15	10 March 2011	Det Norske Veritas, on behalf of the Norwegian Maritime Directorate	PureBallst 2.0 and PureBallast 2.0 Ex

Ballast Water Treatment Systems that have received Final Approval from IMO (May 2014)

	Approval Date	Name of the Administration	Name of the ballast water management system
16	16 March 2011	The Ministry of Land, Transport and Maritime Affairs, Republic of Korea	EcoBallast Ballast Water Management System (Hyundai Heavy Industries Co., Ltd.)
17	28 March 2011	China Maritime Safety Administration	BSKY™ Ballast Water Management System
18	6 June 2011	Inspection and Measurement Division, Maritime Bureau, Ministry of Land, Infrastructure, Transport and Tourism of Japan	FineBallast® OZ (the Special Pipe Hybrid Ballast Water Management System combined with Ozone treatment version)
19	27 July 2011	Federal Maritime and Hydrographic Agency, Germany	BalPure® BP-500
20	6 August 2011	Office of the Maritime Administrator, Republic of the Marshal Islands	NEI Treatment SystemVOS-500 to VOS-6000
21	31 October 2011	The Ministry of Land, Transport and Maritime Affairs, Republic of Korea	Purimar™ System
22	7 November 2011	Det Norske Veritas, on behalf of the Norwegian Maritime Directorate	OceanGuard™ Ballast Water Management System
23	11 November 2011	The Ministry of Land, Transport and Maritime Affairs, Republic of Korea	HiBallast™ Ballast Water Management System
24	22 December 2011	Det Norske Veritas, on behalf of the Norwegian Maritime Directorate	OceanSaver® Ballast Water Management System
25	10 May 2012	Hellenic Republic, Ministry of Development, Competitiveness and Shipping, General Secretariat of Shipping, Merchant Ships Inspection General Directorate, Design and Construction Directorate	ERMA FIRST BWTS
26	30 May 2012	Inspection and Measurement Division, Maritime Bureau, Ministry of Land, Infrastructure, Transport and Tourism of Japan	MICROFADE™ Ballast Water Management System
27	12 June 2012	China Maritime Safety Administration	Cyeco™ Ballast Water Management System
28	15 June 2012	The Ministry of Land, Transport and Maritime Affairs, Republic of Korea	AquaStar™ Ballast Water Management System
29	12 July 2012	The Ministry of Land, Transport and Maritime Affairs, Republic of Korea	ARA PLASMA BWTS Ballast Water Management System

Ballast Water Treatment Systems that have received Final Approval from IMO (May 2014)

	Approval Date	Name of the Administration	Name of the ballast water management system
30	20 September 2012	The Norwegian Maritime Authority	CrystalBallast® Ballast Water Management System
31	7 November 2012	The Danish Maritime Authority and the Danish Nature Agency	DESMI Ocean Guard OxyClean Ballast Water Management System
32	12 December 2012	The Norwegian Maritime Authority	MMC Ballast Water Management System
33	20 December 2012	The Netherlands Ministry of Infrastructure and the Environment	Wärtsilä AQUARIUS® UV ballast water management system
34	5 February 2013	China Maritime Safety Administration	BALWAT Ballast Water Management System
35	5 June 2013	French Ministry of Ecology Sustainable Development and Energy	BIO-SEA® Ballast Water Treatment System
36	26 June 2013	Inspection and Measurement Division, Maritime Bureau, Ministry of Land, Infrastructure, Transport and Tourism of Japan	JFE BallastAce
37	22 August 2013	China Maritime Safety Administration	HY™-BWMS
38	10 October 2013	China Maritime Safety Administration	NiBallast™ Ballast Water Management System
39	4 November 2013	China Maritime Safety Administration	Cyeco™ Ballast Water Management System
40	5 November 2013	Inspection and Measurement Division, Maritime Bureau, Ministry of Land, Infrastructure, Transport and Tourism of Japan	FineBallast MF
41	14 November 2013	The Norwegian Maritime Authority	KBAL Ballast Water Management System
42	2 December 2013	China Maritime Safety Administration	Seascape Ballast Water Management System