

**September 2017**

**A GUIDE TO BALLAST  
WATER MANAGEMENT**





# Introduction

Ballast water is important for safe and efficient operation of vessels; however it also leads to a variety of marine organisms being transported from one environment to another. Studies have revealed that invasion of such organisms causes harmful ecological, economic and health effects in the host environment.

To regulate the ballast water discharge from ships and to control the transfer of invasive species; The International Maritime Organization adopted the INTERNATIONAL CONVENTION FOR THE CONTROL AND MANAGEMENT OF SHIP'S BALLAST WATER AND SEDIMENTS (BWM Convention) in February 2004.

The purpose of the Convention is to prevent, minimize and ultimately eliminate the risk of introduction of Harmful Aquatic Organisms and Pathogens which use the ballast water as a hub.



The Ballast Water Management (BWM) Convention is applicable to new and existing ships that are designed to carry ballast water and are of 400 gross tonnages and above.

The BWM Convention has entered into force on 8th September 2017

In order to show compliance with the requirements of the Convention each ship shall have on board a valid Certificate, a Ballast Water Management Plan and a Ballast Water Record Book.

Through resolution MEPC.253 (67), IMO's MEPC agreed that owners who have already fitted a BWMS complying with the current G8 Guidelines should not have to replace the BWMS for the life of the ship or the life of the BWMS, whichever is the

sooner nor should they be penalized for non-compliance with the D2 standard provided the BWMS has been installed, operated and maintained in accordance with the manufacturer's recommendations.

Trial Period:

(i) The trial period would be for two (2) to three (3) Years after 8th September 2017.

(ii) As per MEPC 253(67), during the trial period, Port States would refrain from applying criminal sanctions or detaining the ship based on only sampling.

(iii) The methods considered mature enough for use in the context of port state control are identified in the trial.



**Application**



The Convention includes two regulations that define ballast water management standards; Regulation D-1 addresses the Ballast Water Exchange standard and Regulation D-2 details the Ballast Water Performance standard towards treatment of ballast water using Type Approved Ballast Water Management System.

D1 – Exchange: Ballast water exchange is based on the principle that organisms and pathogens contained in ballast water taken on board from coastal waters will not survive when discharged into deep oceans or open seas, as these waters have different temperatures, salinity and chemical composition.

Acceptable methods for ballast water exchange are the sequential method, the flow-through method and the dilution method.

- Sequential Method: A process by which a ballast tank is first emptied and then refilled with replacement ballast water. Efficiency is to be of at least 95 % volumetric exchange.

- Flow-through Method: A process by which replacement ballast water is pumped into a ballast tank, allowing water to flow through overflow or other arrangements. At least three times the tank volume is to be pumped through the tank.

- Dilution Method: A method by which replacement ballast water is filled through the top of the ballast tank with simultaneous discharge from the bottom at the same flow rate and maintaining a constant

level in the tank throughout the ballast exchange operation. At least three times the tank volume is to be pumped through the tank.

D-2- Performance standard defines the performance standard for the ballast water treatment system. This criterion is in the form of specific limits on aquatic life in the ballast discharge: Ships conducting ballast water management in accordance with this regulation shall discharge:

- Less than 10 viable organism per  $m^3 \geq 50\mu$  in minimum dimension, and

- Less than 10 viable organisms per ml  $< 50\mu$  and  $\geq 10\mu$  in minimum dimension, and

- Less than the following concentrations of indicator microbes:

- Toxicogenic *Vibrio cholera* less than 1 colony forming unit (cfu) per 100 ml, or less than 1 cfu per 1 gram zooplankton samples

- *Escherichia coli* less than 250 cfu per 100 ml

- Intestinal *Enterococci* less than 100 cfu per 100 ml



- Ballast Water exchange (D1) can be utilised by the sequential method where tanks are first emptied and then filled again, or

- The flow-through method or dilution method whereby tanks are overfilled by pumping in additional water.

The exchange procedure shall be carried out in an “open ocean condition” at least 200 nautical miles from the nearest land and in waters at least 200 metres in depth.

Due to limited biological efficiency the Exchange Standard (D-1) is to be regarded as an interim measure. The ballast water exchange method would be phased out and a type approved “Ballast Water Management System” is to be installed onboard.

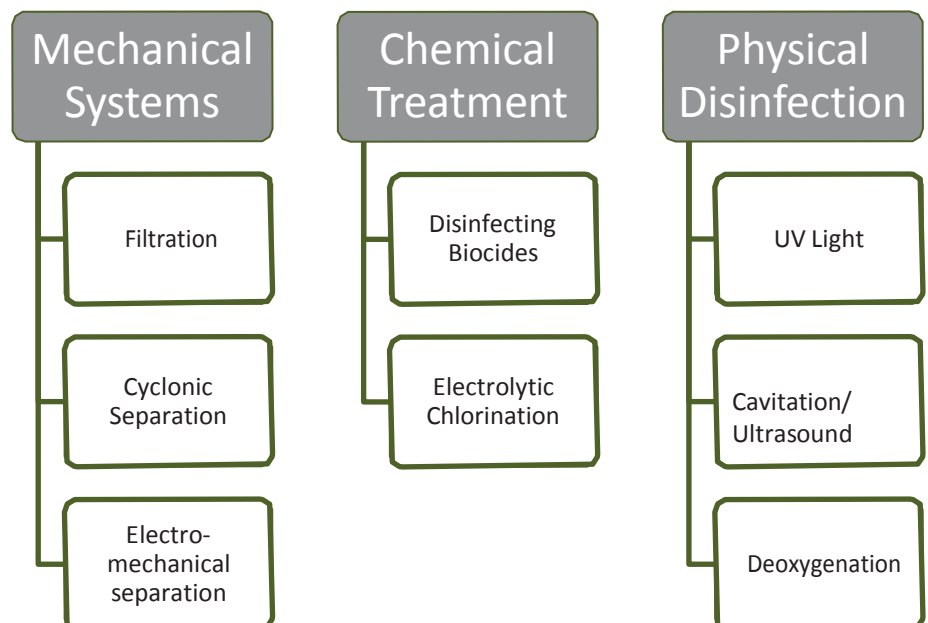
Compliance with the Performance Standard (D-2) seems to be achievable only by use of a BW treatment system. The application schedule of Regulation D-2 was amended at MEPC 71. Ships have to install BWTS by the applicable dates as per regulation B-3 of the BWM convention.



## Standards for Ballast Water Management

# Ballast Water Treatment

Commonly the following technologies for Ballast Water Treatment are applied, either singularly or in combination.







Filtration	<ul style="list-style-type: none"> <li>– Sediment and particles removal by disc and screen filters</li> <li>– Parallel assembly of many filter units</li> <li>– Filtration grade down to 100 / 50 / 20 µm</li> </ul>
Cyclonic separation	<ul style="list-style-type: none"> <li>– Separation of solid particles due to centrifugal forces</li> <li>– Acceleration of the water by internal flow direction inside the facility</li> </ul>
Electro-mechanical separation	<ul style="list-style-type: none"> <li>– A flocculent is injected that attaches to organisms and sediment.</li> <li>– Magnetic separation and filtration is used to remove the solid particles</li> </ul>
Disinfecting Biocides (Chemical additives)	<ul style="list-style-type: none"> <li>– Direct adding of chemical additives to the BW having disinfecting actions</li> <li>– Applicable for large volumes</li> </ul>
Electrolytic Chlorination	<ul style="list-style-type: none"> <li>– Electronically ionisation by means of electrical current</li> <li>– Generation of Chlorine/Chlorine Dioxide as disinfection</li> </ul>
UV Light	<ul style="list-style-type: none"> <li>– Inactivation of organisms and pathogens by Breaking the cell membrane</li> <li>– Low pressure drop in water system</li> </ul>
Cavitation / Ultrasound	<ul style="list-style-type: none"> <li>– Slit plates or venturi pipes generate cavitation bubbles</li> <li>– High local energy due to implosion of bubbles inactivate organisms</li> </ul>
De-oxygenation	<ul style="list-style-type: none"> <li>– Removal of dissolved oxygen in Ballast Water and replacement by inactive gases</li> </ul>

- UV and Electro chlorination types covers around 90% of the market
- Vessels such as for Suezmax which may have a problem of lack of extra power availability onboard, may consider Plain Chlorination (chemical injection) as it uses the least power for ballasting and de-ballasting.

Ballast Requirement	Pump capacity	BWMS Choice
Low	< 1000 m3	UV
Medium	1000 – 2000 m3	UV and EC
High	> 2000 m3	EC

- For using chlorination, the availability of chemicals at the envisaged ports also needs to be looked at.

- With regard to the issuance of International Ballast Water Management Certificates it may be noted that the Convention allows no phase-in period for ships constructed prior to 8th September 2017 to comply with its provisions. This would result in all ships of 400 gross tonnage and above to have on board an approved Ballast Water Management (BWM) Plan and be surveyed and certificated immediately 8th September 2017.
- To address this concern, MEPC vide their Circular BWM.2/Circ.40 dated 8th October 2012 advised the member states regarding issuance of International Ballast Water Management Certificates prior to 8th September 2017, provided it is annotated to state that validity begins 8th September 2017, combined with a statement issued to the Company when the BWM Plan was received thereby allowing the vessel to trade for three months with an unapproved BWM Plan on board.
- A company providing Ballast Water Treatment services must have the process approved by a Flag Administration. The Flag Administration may authorize a recognized organization like a classification Society to approve the treatment process on its behalf.
- IMO has provided the testing procedure in its “Guidelines for Approval of Ballast Water Management Systems” (G8 Guidelines). The approval involves shore based testing of a production model to verify whether the D2 standards are complied with, followed by a shipboard testing to check if the system works as desired in service.
- The revised G8 Guidelines MEPC.279(70) were adopted at MEPC 70 with the following timeline:
  - BWMS approved after 28th October 2018 should meet the G8 Guidelines MEPC.279(70)
  - BWMS installed onboard ships after 28th October 2020 should be approved under the revised G8 Guidelines MEPC.279(70)
- Salient points included in the revised G8 Guidelines MEPC.279(70) are:
  - Testing is to be carried out across a full range of salinities (fresh, brackish and marine) and through a temperature range of 0° C to 40° C (2° C to 40° C for fresh waters)
  - System Design Limitations are to be identified by the manufacturer, validated during testing and indicated on the Type Approval Certificate
  - Requires more onerous examination of the effects of total suspended solids (TSS) on BWMS’S ability to perform in waters found in worldwide shipping
  - Bypass activations are to be recorded in BWMS control & monitoring system
  - Definition of viability: Includes the reproduction ability of the organism as the benchmark
  - Installation Survey and Commissioning Procedures
- Every ballast water treatment system is to be type approved by the Flag State Administration. Further, in case the system makes use of an “active substance”, (active substances means any substance or organism that has a general or specific action on or against harmful aquatic organisms or pathogens) such as chemical system an additional approval procedure is to be followed, whereby the approval is granted by IMO exclusively.
- IMO carries out approval in accordance with “Procedure for Approval of Ballast Water Management Systems that make use of Active Substances” (G9 Guidelines)
- USCG Requirements: The United States has not ratified IMO’s BWM Convention and has established independent ballast water regulations.
- List of USCG approved BWMS can be found at <http://cgmix.uscg.mil/Equipment/EquipmentSearch.aspx>
- USCG has created an alternative management system (**AMS**) process, whereby IMO type-approved systems may be installed for up to 5 years after the required compliance date set by USCG

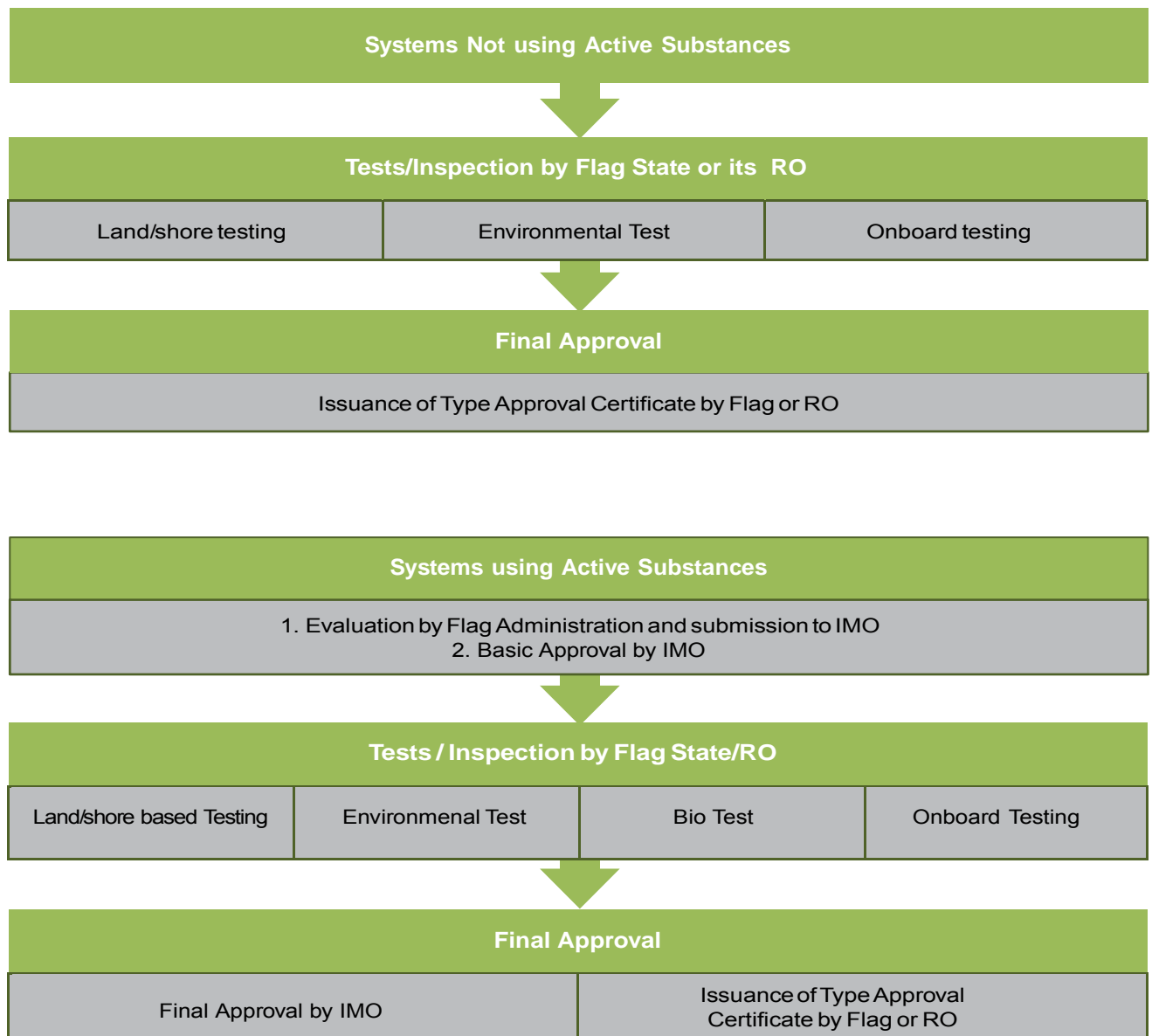




**Approval of  
Ballast Water  
Treatment  
System**



# Approval Process – flow diagram



# Being prepared for the future

Salient factors that need to be considered while designing ships with respect to Ballast Water Management:

<b>For Ballast Water Exchange</b>	<b>For Ballast Water Treatment</b>
<ul style="list-style-type: none"><li>• Piping/pumping system</li><li>• Sufficient tank structure to compensate additional pressures (as appropriate)</li><li>• Type, arrangement and location of Overflow arrangements with a view to minimize possible pressure components</li></ul>	<ul style="list-style-type: none"><li>• Reserve space (e.g. in the engine room) to arrange the treatment system. Where lack of floor space is a problem manufacturers provide various solutions, including splitting the plant into separate modules that allows decentralised fitting.</li><li>• possible additional pressure of the ballast pumps to cover the pressure losses of the ballast water treatment plant</li><li>• The capability of the ballast system to enable a monitored and flow controlled by-passing of the treatment plant in case of plant failure</li><li>• Additional power supply as demanded from the treatment systems</li></ul>



## Integration and Installation of BWTS on board

A ship related arrangement drawing and a piping diagram showing the integration of the Ballast Water Treatment System (BWTS) into the ship's ballast piping system for approval as well as the operating and technical manual shall be submitted.

If a BWTS uses active substances, additional arrangement drawings for operating compartments and storage rooms of these substances shall be submitted, including details of their equipment.

The rated capacity of BWTS is not to be less than the flow rate of the largest ballast pump. If the treated rated capacity (TRC) of ballast water specified by the manufacturer may be exceeded operationally, e.g. by parallel operation of several ballast pumps, appropriate references and restrictions shall be indicated in the ballast water management plan.

Proper installation and correct functioning of the ballast water management system is to be verified and confirmed by an IRS Surveyor prior to issuance of Certificate of Compliance.





# Services from IRS

IRS offers the following services related to Ballast Water Management and is committed to enabling ship owners and equipment manufacturers for compliance when the convention comes into force. Detailed Guidelines for Shipowners on Ballast Water Management is available on IRS website.

## Type Approval

- For systems using Non-Active substances: Type Approval certification on behalf of Administration
- For systems using Active substances : Technical assessment and assistance for submission to Administration and IMO in the type approval process

## Plan Approval

- Ballast Water Management Plans
- Ship Specific Installation Plans

## Training

- Seminars and class-room training regarding the Ballast Water Convention, Approval process, Documentation, Shipboard installation etc

## GET IN TOUCH

INDIAN REGISTER OF SHIPPING

52A Adi Shankaracharya Marg • Opposite Powai Lake  
Powai • Mumbai - 400 072

Telephone: +91 71199448/ +91 30519448

Fax: + 91 22 2570 3611 • Email: [ho@irclass.org](mailto:ho@irclass.org)

Website: [www.irclass.org](http://www.irclass.org)