HELLENIC REGISTER OF SHIPPING

Guide for
Ballast Water Management

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SECTION 1 General

1.1 Introduction

In 2016, the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM), hereafter called the Convention, was ratified; with entry into force occurring on 2017-09-08. The Convention provides regulations for the prevention of transfer and introduction of harmful aquatic organisms and pathogens via ballast water.

At the request of the owner, those vessels intended to conduct either ballast water exchange or ballast water treatment, and which comply fully with the requirements of this Guide and the applicable HRS Rules and Regulations for the Classification and Construction of Steel Ships[1], may be assigned the additional class notation BWM as shown in Subsection 1.5. The requirements for the additional class notation BWM are supplementary to those given in the Convention.

1.2 The Convention

1.2.1 The Convention applies to ships flying the flag of a Party except:

i. ships not designed or constructed to carry ballast water
ii. ships operating exclusively in waters under the jurisdiction of a Party, unless the party determines that the discharge of ballast water from such ships would impair or damage their environment
iii. warships, naval auxiliary or other ships owned or operated by a Party
iv. ships with permanent ballast water not subject to discharge.

1.2.2 Exemptions from the management of ballast water may be granted to ships on voyages between specified ports or operated exclusively between specified ports or locations when ballast water is not mixed other than between these ports or locations. These exemptions shall be effective for a period not exceeding five years, subject to intermediate review. Moreover, BWM.2/Circ.32, dated 8 August 2011, specifies that provisions of the Convention are not applicable to the water in the hopper area of hopper dredgers.

1.2.3 Ships to which the Convention applies will be required to carry on board the following:

i. a "Ballast Water Management Plan" approved by the Administration, detailing safety procedures and actions to be taken to implement the ballast water management requirements

[1] hereinafter referred to as the HRS Rules

ii. a "Ballast Water Record Book" for the recording of each operation concerning ballast water management
iii. an "International Ballast Water Management Certificate" (for ships of 400 gross tonnage and above excluding floating platforms, FSUs and FPSOs) with a five year validity and subject to annual, intermediate and renewal surveys.

1.2.4 Port State Controls will be authorized to inspect ships verifying:

- validity of the certificate
- presence on board of documents required by the Convention
- compliance with the requirements of the Convention of the ballast water carried on board, performing samples.

1.2.5 For the management of ballast water, two main standards are defined by the Convention:

D-1: ballast water exchange with an efficiency of 95% volumetric exchange (for ships exchanging ballast water by the pumping through method, pumping through three times the volume of each ballast tank shall be considered equivalent)

D-2: allowable limits on viable organisms in ballast water to be discharged, defined as maximum number and size per cubic meter (less than 10 viable organisms per cubic meter greater than or equal to 50 micrometers in minimum dimension and less than 10 viable organisms per milliliter less than 50 micrometers in minimum dimension and greater than or equal to 10 micrometers in minimum dimension). Ballast water management, in compliance with the D-2 standard, will be performed by type approved systems.

1.3 Objective and Scope of the Guide

The International Maritime Organization (IMO) has developed rules to control and manage the ballast water of the ships in order to reduce the risk of intentional or accidental discharge of not-native species through ballast water or sediment into particular parts of marine environment.

The objective of this Guide is to provide supplementary requirements regarding either ballast water exchange at sea or ballast water treatment that generally are not addressed by HRS Rules and Regulations for the Construction and Classification of Steel Ships and thus, this Guide is expected to be used in conjunction with HRS Rules, as appropriate.

1.4 Application

1.4.1 The requirements in this Guide apply to new and existing vessels that are designed, equipped and intended to conduct either ballast water exchange at sea or ballast water treatment in accordance with the Convention.

1.4.2 The requirements shall not be regarded as substitute to those given for the assignment of main class and shall be supplementary.

1.4.3 The provisions of these guidelines apply to new and existing ships according to the due dates specified in Regulation B-3 of Convention. For special ship types, special considerations have to be taken in regard of relevant requirements.

1.4.4 Where a BWM system is fitted on a ship, the ship shall have the relevant notation, according to Paragraph 1.5, complying with the requirements of this Guide and verified by an HRS Surveyor during installation.

1.5 Class Notations

1.5.1 The following additional class notations may be applied individually or in combination:

BWM (E(...)): For ships complying with IMO D-1 exchange standard and with the requirements as they are described in SECTION 2 and SECTION 4 of these guidelines. The letter(s) in the bracket denotes the method(s) that has been applied (see Paragraph 1.5.2).

BWM (T): For ships complying with IMO D-2 performance standard, Guidelines for Approval of Ballast Management Systems (G8) and with the requirements as they are described in SECTION 3 and SECTION 4 of these guidelines.

1.5.2 The class notation **BWM(E(...))** is applicable for ships equipped by means of ballast water exchange. The exchange of the ballast water can take place by one or a combination of the following methods and each of them is indicated by the corresponding letter in the bracket of the notation:

- **d**: states for dilution method
- **s**: states for sequential method
- **f**: states for flow-through method

Ballast Water Exchange Systems designed and installed in accordance with this Guide will also comply with the International Maritime Organization (IMO) Regulations and Guidelines listed below:

- IMO Resolution MEPC.124 (53), "Guidelines for Ballast Water Exchange (G6)", adopted on July 22, 2005.
- IMO Resolution MEPC.127 (53), "Guidelines for Ballast Water Management and Development of Ballast Water Management Plans (G4)", adopted on July 22, 2005.
- IMO Resolution MEPC.149 (55), "Guidelines for Ballast Water Exchange Design and Construction Standards (G11)" adopted on 13 October 2006.
- IMO Resolution MEPC.150 (55), Guidelines on Design and Construction to Facilitate Sediment Control on Ships (G12)", adopted on 13 October 2006

1.5.3 The notation **BWM(T)** is granted to the vessels, having an IMO Member State approved system installed on board, under the survey by an HRS Surveyor and in accordance with these guidelines. Vessels where the system's installation was not conducted under survey by an HRS Surveyor may obtain the optional notation, provided that the system is designed and installed on board according to the criteria of these guidelines. In addition, the operation of the system is to be demonstrated to an HRS Surveyor by a shipboard function test and the documentation of water ballast management system is satisfying the performance standards of the Convention.

Ballast Water Management Systems designed and installed in accordance with this Guide will also comply, as applicable, with the International Maritime Organization (IMO) regulations and guidelines listed below:

- IMO Resolution MEPC.174(58), "Guidelines for Approval of Ballast Water Management Systems (G8)", adopted on 10 October 2008
- IMO Resolution MEPC.169(57) "Procedure for Approval of Ballast Water Management systems that Make Use of Active Substances (G9)", adopted on 4 April 2008
- IMO Resolution MEPC.127(53), "Guidelines for Ballast Water Management and Development of Ballast Water Management Plans (G4)", adopted on 22 July 2005
- IMO Resolution MEPC.209(63) , "Guidelines on Design and Construction to Facilitate Sediment Control on Ships (G12)", adopted on 2 March 2012
- IMO Resolution MEPC.173(58), "Guidelines for Ballast Water Sampling (G2)", adopted on 10 October 2008

1.6 Record Keeping and Reporting

1.6.1 Record keeping and reporting are to comply with the IMO Convention in order for a vessel to receive the BWM(E(...)) or the BWM(T) class notation.

1.6.2 Regulation B-1 of the Convention requires all vessels to have on board and implement a Ballast Water Management Plan (BWMP), developed in accordance with MEPC.127(53) "Guidelines for ballast water management and development of ballast water management plan (G4)". The plan shall be specific for each vessel and readily available for examination upon request by the authorities. The BWMP is to be reviewed periodically in order to maintain its currency. Any changes to the provisions of the BWMP are to be submitted for review and approval to HRS.

BWMP shall mainly include the following:

- Vessel particulars
- Vessel's ballast system design and description
- Safety considerations
- A detailed description of the implementation actions required by the crew for the ballast water management option(s) used on board
- Detailed procedures for the disposal of sediments (at sea and ashore)
- Other operational considerations such as communications with and reporting to coast or port State authorities, and the designation of a ballast water management officer onboard, responsible for the proper implementation of the BWMP

1.6.3 Regulation B-2 of the Convention requires that all vessels must maintain a Ballast Water Record Book. When taking on or discharging ballast water, as a minimum, the dates, geographical locations, ship's tank(s) and cargo holds, ballast water temperature and salinity as well as the amount of ballast water loaded or discharged should be recorded.

1.7 Definitions

1.7.1 Active Substance

Substance or organism, including a virus or a fungus that has a general or specific action on or against Harmful Aquatic Organisms and Pathogens

1.7.2 Ballast Water

Water with its suspended matter taken on board a ship to control trim, list, draught, stability or stresses of the ship

1.7.3 Ballast Water Management

Mechanical, physical, chemical, and biological processes, either singularly or in combination, to remove, render harmless, or avoid the uptake or discharge of Harmful Aquatic Organisms and Pathogens within Ballast Water and Sediments

1.7.4 Ballast Water Management System (BWMS)

Any system which processes ballast water such that it meets or exceeds the Ballast Water Performance Standard in Regulation D-2 of the Convention, including ballast water treatment equipment and all associated components

1.7.5 Ballast Water Capacity

The total volumetric capacity of any tanks, spaces or compartments on a ship used for carrying, loading or discharging Ballast Water, including any multi-use tank, space or compartment designed to allow carriage of Ballast Water

1.7.6 Ballast Water Discharge

Ballast Water Discharge means the ballast water as would be discharged overboard.

1.7.7 Ballast Water Management Plan (BWMP)

BWMP is the document referred to in Regulation B-1 of the Convention describing the ballast water management process and procedures implemented on board individual ships

1.7.8 Ballast Water Tank

Any tank, hold or space used for the carriage of ballast water as defined in Article 1 of the Convention

1.7.9 Ballast Water Treatment Equipment

Equipment which mechanically, physically, chemically, or biologically processes, either singularly or in combination, to remove, render harmless, or avoid the uptake or discharge of harmful aquatic organisms and pathogens within ballast water and sediments. Ballast water treatment equipment may operate at the uptake or discharge of ballast water, during the voyage, or at a combination of these events

1.7.10 Ballast Water Treatment System

Any system which uses mechanical, physical, chemical and biological processes, either singularly or in combination, to remove, render, or avoid the uptake or discharge of Harmful Aquatic Organisms and pathogens within Ballast Water and Sediments

1.7.11 Certificate

International Ballast Water management Certificate

1.7.12 Convention

It is the International Convention for the Control and Management of Ship's Ballast Water and Sediments, 2004

1.7.13 Gross tonnage

The gross tonnage calculated in accordance with the tonnage measurement regulations contained in Annex I to the International Convention on Tonnage Measurement of Ships, 1969 or any successor Convention

1.7.14 Harmful Aquatic Organisms and Pathogen

These are the aquatic organisms or pathogens which, if introduced into the sea including estuaries, or into fresh water courses, may create hazards to the environment, human health, property or resources, impair biological diversity or interfere with other legitimate uses of such areas

1.7.15 Hazardous areas

Areas of ship where the presence of an explosive gas atmosphere is, or may be expected to be present in quantities such as to require special precautions for the construction, installation and use of electrical apparatus

1.7.16 Monitoring Equipment

Refers to the equipment installed for assessment of the correct operation of the prototype ballast water treatment technology

1.7.17 Sampling Point

That place in the ballast water piping where the sample is taken.

1.7.18 Sampling Facilities

The means provided for sampling treated or untreated ballast water

1.7.19 Sediments

It refers to the matter settled out of Ballast Water within a ship

1.7.20 Ship

It means a vessel of any type whatsoever operating in the aquatic environment and includes submersibles, floating craft, floating platforms, FSUs and FPSOs

1.7.21 Treatment Rated Capacity (TRC)

The maximum continuous capacity expressed in cubic meters (m^3) per hour for which the BWMS is type approved. It states the amount of ballast water that can be treated per unit time by the BWMS to meet the standard in Regulation D-2 of the Convention

SECTION 2 Ballast Water Exchange

2.1 Introduction

2.1.1 General

2.1.1.1 Ballast water exchange introduces a number of safety issues, which affect both the ship and its crew. The following guidelines are intended to provide guidance on the safety and operational aspects of ballast water exchange at sea.

2.1.1.2 Due to the fact that there are different types of ships, these guidelines shall not address each ship type separately as it is impractical to do so. Ship-owners together with the Society are cautioned to consider the many variables that apply to their ships. Some of these variables include type and size of ship, ballast tank configurations and associated pumping systems, trading routes and associated weather conditions, Port State requirements and manning.

2.2 Methods Accepted

2.2.1 There are three methods of Ballast Water Exchange which have been evaluated and accepted by the International Maritime Organization. The three methods of ballast water exchange can be described as follows:

Sequential method – a process by which a ballast tank intended for the carriage of ballast water is first emptied and then refilled with replacement ballast water.

Flow-through method – a process by which replacement ballast water is pumped into a ballast tank intended for the carriage of ballast water, allowing water to flow through overflow or other arrangements.

Dilution method – a process by which replacement ballast water is filled through the top of the ballast tank intended for the carriage of ballast water with simultaneous discharge from the bottom at the same flow rate and maintaining a constant level in the tank throughout the ballast exchange operation.

The flow-through method and the dilution method are considered as “pump-through” methods.

2.2.2 Ballast Water Exchange Standard

2.2.2.1 The standards that are to be met in order to operate with ballast water exchange as a method of ballast water management are the following:

i. Vessels performing ballast water exchange must achieve a 95 percent volumetric exchange of ballast water.
ii. In order to achieve 95 percent volumetric exchange, vessels utilizing the flow-through or dilution methods ("pump-through" methods), must pump through three times the volume of each ballast water tank.
iii. Pumping through less than three times the volume may be accepted provided the ship can demonstrate that at least 95 percent volumetric exchange is met.

2.2.2.2 The BWM Convention, Reg. B-4, requires that vessels should conduct ballast water exchange:

- at least 200 nautical miles from the nearest land and in water at least 200 meters deep;
- if this is not possible, the exchange should be conducted as far from the nearest land as possible, and in all cases at least 50 nautical miles from the nearest land and in water at least 200 meters deep; or
- in sea areas designated by the port state.

In extraordinary conditions, such as adverse weather or equipment failure, the Master may make the decision not to perform ballast water exchange if he reasonably determines that in doing so the vessel's stability or the safety of the vessel its crew or passengers may be threatened.

2.3 Documentation to be submitted

2.3.1 The plans, drawings and documentation, presented in Table 2-1 below, are to be submitted for the review, approval or information as applicable. Specific documents shall be placed onboard during surveys. Due to the wide range of systems, any additional plans or supporting information may be required depending on the applicable method and system.

Table 2-1 Ballast Water Exchange, Documentation to be submitted

Type of Documentation	Additional Description	Submitted for Approval(A)/ Information (I)	Placed Onboard
Ballast Water Management Plan	BWMP is specific to the ship, following the standard format of G4 Guidelines	A	√
Ballast Water Record Book	BWRB is specific to the ship, following at least the standard format of Convention's Appendix II	I	√
Ballast Piping System Diagram and Booklet	Documents providing the standard construction details for the ballast piping system, including vents and overflows, valve arrangement and controls, and the means for determining the level in the ballast tanks	A	
Arrangement and capacity of ballast tanks and pumps		I	
Loading Manual and Trim & Stability Booklet[1]		I	
Location of ballast water and sediment sampling openings		I	
Filling/Discharge time calculations	Calculations demonstrating the adequacy of vents and overflows to prevent over- or under-pressurization of the ballast tanks	A	

[1]Approval of the loading manual and trim and stability booklet will be required in case altered loading conditions are employed (e.g. in sequential method)

2.4 Sequential Method

The sequential method entails completely emptying ballast tanks of the coastal waters and refilling with open-ocean water. Emptying of certain tanks may lead to significantly reduced stability, higher vessel structural stresses, high sloshing pressures and/or reduced forward drafts which may then increase the probability of bow slamming.

2.4.1 The vessel's loading condition and exchange sequences for the selected methods are to be verified by calculations to show compliance with the applicable requirements for ballast capacity, trim, stability, longitudinal and local strength.

2.4.2 Especially, the following items are to be evaluated.

2.4.2.1 Stability

The applied to the ship stability and trim requirements are to be met at every stage of the ballast water exchange under all loading conditions. When calculating stability, the free surface moments in all tanks are to be set to maximum.

The results of the intact stability calculations demonstrating compliance with the intact stability requirements during ballast water exchange shall be reviewed. If considered so, such results may be needed to be included in the stability booklet and submitted for approval.

At least one of the following typical loading conditions included in the stability booklet shall be included:

- standard ballast condition
- if applicable, the heavy ballast and the emergency ballast conditions
- a loading condition with cargo and ballast water onboard, for one of the stages (departure, mid-voyage, arrival) where the least safety margin(s) to the valid stability and/or strength limits occur.

2.4.2.2 Longitudinal Strength

The longitudinal and local strength of the vessel has to be within the approved strength limits as they are specified in the approved loading manual. In general, the principles and requirements of HRS Rules, Part 3, have to be observed, in respect of shear forces, torsional forces and bending moments.

At any longitudinal location, a typical output of longitudinal strength includes the following:

- Calculated still-water bending moment (SWBM) and still-water shear force (SWSF)
- Maximum and minimum values of SWBM and SWSF
- Calculated still-water torsional moment (SWTM), where applicable
- Maximum permissible value of SWTM, where applicable.

Under each loading condition, the calculation of longitudinal strength is to be conducted for each stage of ballast water exchange.

2.4.2.3 Sloshing in Tanks

In general, sloshing is unavoidable for a vessel using the sequential method. However, it can be controlled and its effect shall be minimized by avoiding partial filling of ballast tanks and performing the exchange in favorable sea conditions.

2.4.2.4 Visibility, Propeller Immersion and Drafts

Navigational bridge visibility shall be maintained at any case according to SOLAS, Ch.V/22. Furthermore, full propeller immersion requires a minimum aft draft. If full immersion cannot be achieved in a specific sequence of ballast water exchange, then the specific sequence and stage shall be identified in the Ballast Water Management Plan and may be accepted only if the sequence takes place in fair weather conditions. For the avoidance of slamming, the minimum forward draft as prescribed in the trim and stability booklet shall be also maintained.

When these criteria cannot be fulfilled, the guidelines of MSC/Circ.1145 "Precautionary Advice to Masters when undertaking Ballast Water Exchange Operations" have to be followed.

2.4.2.5 Pressurization of Tanks

Venting calculations are to be conducted to assess the maximum pressure in each tank during the filling phase and the minimum pressure during the de-ballasting considering the maximum pumping rates of the ballast pump.

The results of these calculations are to confirm that the tanks and holds will not be subjected to pressure or vacuum in excess of that for which the tank has been designed. These calculations are to be submitted for review.

2.5 Flow-through Method

2.5.1 The flow-through method does not typically alter stability, hull girder stress and vessel attitude. It therefore eliminates concerns of exceeding shear force and bending moment limits and concerns related to shallow forward and aft drafts and extreme trim. The following items are to be evaluated:

i. The capability of the ballast water system to provide ballast water exchange without the risk of the tank being subject to a pressure greater than for what it has been designed, shall be demonstrated by water flow calculations.
ii. The fixture utilized for the overflow is to be designed such that over-pressurization of a ballast tank or pumping equipment shall be prevented. Under-pressurization created by a large drop in pressure due to rapid change in the volume of the contents of the tank

is also to be avoided by verifying air vent pipes are open and properly sized prior to discharge.

iii. A flow-through method that has water flowing on the deck is not recommended. The use of collecting pipes, internal overflow pipes or interconnecting pipe/trunk arrangements between tanks is to be used to avoid water flowing on the deck.

iv. The flow-through method is not to be performed in low temperature weather conditions that would result in icing of the deck.

v. It is recommended that the inlet and outlet piping connections be located as remotely from each other as practicable. Aft and fore peak tanks are to be provided with additional pipe work to improve the mixing conditions, unless documentation can be provided to demonstrate adequate mixing.

vi. The installation of additional air pipes, access hatches (as an alternative to deck manholes), internal overflow pipes (to avoid overflowing on the deck), or interconnecting pipe/trunk arrangements between tanks, where applicable and possible, may be considered.

vii. In cases where the flow-through method alters stability or hull girder stress, the ballast water summary sequence table is to be submitted demonstrating that adequate strength and stability has been maintained.

2.6 Dilution Method

2.6.1 The dilution method has the advantages of the flow-through method with regard to maintaining the stability and strength and other similar benefits. By discharging water from the bottom of the ballast tanks, sediments are more easily removed. This method also avoids the use of air vent pipes and the removal of manhole covers to discharge water over the deck.

2.6.2 The following safety measures are to be taken:

i. Level monitoring system with alarms shall be provided where maintaining a constant level in a tank or hold is essential to the safety of the vessel during the ballast water exchange.

ii. The arrangements are to include the provision of a manual emergency stop for any operating ballast pump in case of valve malfunction or incorrect control actions.

2.7 Requirements for BWE system's arrangement

2.7.1 Piping System and Valves Arrangement

2.7.1.1 Piping system shall be in compliance with HRS Rules, Part 5, Chapters 8 and 9. Especially for the flow-through method and dilution method, the piping system shall be sufficiently designed in order to avoid any over-pressurization. In general, the pressure in the piping system and the tank shall not exceed the design pressure when tank or hold is over-flowing at the maximum pump capacity available.

2.7.1.2 Every ballast tank and hold shall be provided with isolating valves for filling/emptying purposes. The isolating valves shall be remained closed at all times except when ballasting, de-ballasting or ballast exchange operations are carried out.

2.7.2 Ballast Pumps

2.7.2.1 The provided ballast pumps shall be sufficiently designed in order to ensure the ballast water exchange. At least two pumps are required in order to maintain the ballast exchange operations under any conditions. Especially for the dilution method, additional provisions may be required in order to ensure the continuous flow of the ballast water.

2.7.2.2 Capacity of the ballast water pumps shall be sufficient in order to provide ballast water exchange of the greatest dedicated ballast water tank or group of ballast water tanks which are undergoing simultaneous exchange. Power demands of the ballast water pumps shall be included in the power balance calculations.

2.7.3 Control Systems

2.7.3.1 Ballast pumps and all valves fitted to the water ballast management system should be adequate for the continual monitoring of the ballast water operation, including the valve position, the pump level in tanks, line and pump pressure. When a central ballast control station for the remote operation of the ballast exchange process is provided, it shall include the following:

- valve position indicating system
- tank level indicating system
- draft and trim indicating system
- means of communication between the central ballast control station and local control stations for the ballast pumps and valves
- start/stop means of ballast pump
- flow/speed instrumentation of ballast water exchange.

2.7.3.2 The ballast pump and ballast valve control systems shall be independently of one another, maintaining the safe operation of the system. Their arrangement shall ensure that the loss of any one component will not cause loss of operation of other pumps or valves.

2.7.3.3 Beside the remote means, each pump shall be provided with local control in case of failure of remote means.

2.7.3.4 In case of emergency, each valve required for ballast water exchange shall be provided with independent means of control.

2.7.4 Sampling

i. The design of the ballast water system is to take into account the need for sampling ballast water and sediments by port State or other authorized organizations.
ii. The area immediately below any tank opening is to be kept free of obstructions that could impede the use of sampling equipment or free access.
iii. The sampling arrangements shall provide ease of sampling of ballast water and sediments without the need to enter potentially dangerous spaces or partially filled ballast tanks.
iv. In tank samples are to be taken via sounding or air pipes or manholes using pumps, sampling bottles or other water containers. Samples may also be taken from the ballast water discharge line.

SECTION 3 Ballast Water Management System

3.1 General

Ballast water management system indicates processes in order to reduce the concentration of viable organisms in the ballast water of ship. This system includes the ballast water treatment equipment, all associated control and monitoring equipment and any sampling facilities. This section is intended to provide guidance on the safety and operational aspects of ballast water treatment system on board.

Due to the variety of systems and ship's types, the following guidelines are not addressed for each ship or system type separately, but they are indicatively, covering the general requirements. Each system shall be considered separately, after the submission of the required documents, according to the type and its requirements. Some of the variables include type and size of ship, ballast tank configurations and associated systems, type of the installed system, Port State requirements and weather conditions.

3.2 Ballast Water Performance Standard

3.2.1 A ship performing Ballast Water Management in accordance with the regulations of the Convention shall discharge ballast water at an acceptable concentration of viable organisms and indicator microbes per unit volume as mentioned in Table 3-1.

Table 3-1 Summary of Discharge Limitations

Organisms	**Discharge Limitation**
Organisms≥50 μm in minimum dimension	< 10 viable organizations per m^3 of ballast water
10 μm≤Organisms≤50 μm in minimum dimension	< 10 viable organizations per ml of ballast water
indicator Microbes	
Toxicogenic Vibrio cholerae (O1 and O139)	1 colony forming unit (cfu) per 100 ml or less than 1 cfu/gr (wet weight)
Escherichia coli	<250 cfu per 100 ml
Intestinal Enterococci	<100 cfu per 100 ml

3.3 Methods accepted

The following methods are identified:

3.3.1 A Mechanical Separation Method which includes mechanical means for the removal of any substances or microorganisms in ballast water. Such system may include filtration or cyclonic separation.

3.3.2 A Physical Disinfection Method which includes the elimination or deactivation of microorganisms by using physical techniques such as:

- Coagulation/flocculation,
- Ultrasound
- Ultraviolet
- Heat
- Cavitation
- De-oxygenation

3.3.3 A Chemical or Biological Method which includes the elimination or deactivation of microorganisms by using chemicals techniques such as:

- Clorination
- Electro-clorination
- Advanced oxidation
- Ozonation

3.3.4 A Combination Method which will combine all the aforementioned methods.

3.3.5 Any prototype system or method may be identified if it is tested according to the International Standards and the ballast water discharge fulfils the limitations which are mentioned in Paragraph 3.2. Additional requirements may be requested, depending on the system's specifications.

3.4 Classification and Documentation

3.4.1 Documentation to be submitted

3.4.1.1 Ship plans and operational manual

Table 3-2 General Ship Plans and Operational Manuals, presents the general ship plans and operational manuals that are to be submitted for review, approval or information, as applicable. Specific documents that need to be placed onboard the ship for presentation to the surveyor at appropriate surveys are also annotated in the table.

Due to a wide range of treatment systems, HRS may require the submission of additional plans or supporting information as called for by a specific treatment system.

Table 3-2 General Ship Plans and Operational Manuals

Type of Documentation	Additional Description	Submitted for Approval(A)/ Record (R)/ Information (I)	Placed Onboard
Ballast Water Management Plan	BWMP is specific to the ship	A	√
Ballast Water Record Book	BWRB is specific to the ship	I	√
General Arrangement of the BWM system	The plan shall include the BWMS installation arrangement, including location of the systems and layout	A	
Location of ballast water sampling facilities		A	
Ballast Piping System Diagram	Layout, filling arrangement, and booklet of construction details of piping system	A	
Arrangement and capacity of ballast tanks and pumps		I	
Structural Drawings	Showing installation details of attachment, supports and foundations of principal components of the BWMS. Clear indication of the scantlings and details of welding	A	
Control, monitoring and safety system documentation	Especially where the controls and monitoring of the BWMS have been connected to or integrated with the vessel's control and monitoring	A	

Type of Documentation	Additional Description	Submitted for Approval(A)/ Record (R)/ Information (I)	Placed Onboard
	system(s)		
Electrical circuit drawing and main power cable drawings		A	
Power calculation document	Including electrical load analysis	A	
Storage tanks and day tanks containing chemicals and preparations used to treat ballast water	Include complete piping details of filling, drain system, vents, drip trays, and safety precautions, etc.	A	√
Leakage detection system and safety features associated with the generation of toxic or flammable gases	Safety features include sensor, alarms and shutdown settings, etc. together with proper suitable certification. Schematic plans detailing arrangement and location of sensor are to be provided	A	√
Safety assessment documentation, where applicable	For BWMS that employs active substances and preparations; include arrangement, handling and safety plans of auxiliary systems for the treatment system, as applicable	A	√
Safety documentation for process chemicals, in case they are hazardous	In recognized industry format, such as MSDS, CHRIS Code, Cole-Palmer	I	
BWMS operating and safety manual	Manual specific to the actual installation onboard the ship	A	√
BWMS Maintenance Book	BWMS maintenance book is to be specific to the ship and is to include the manufacturer's recommended items, frequencies and methods used for maintenance.	R	X
Local instrumentation arrangement plan		A	

3.4.1.2 Required Certification/Documentation

The ballast water management system installed onboard shall be type-approved by an IMO Member State. Specific certificates and documentation of the treatment system are to be provided for record, information or reference, as appropriate. The certificate/documentation requirements are shown in Table 3-3. In accordance with the Convention, specific documents are to be retained onboard the ship for presentation or inspection at appropriate surveys.

Table 3-3 Required Certification/Documentation for a Ballast Water Treatment

Type of Documentation	Additional Description	For Record (R)/ Information (I)	Placed Onboard
Type Approval Certificate of BWMS	G8 Guidelines, paragraph 8.1.1; Information for the Certificate is to include main particulars of BWMS, approved application, limiting conditions and others as stipulated in G8 Guidelines, Section 6	R	√
Results of test analysis for BWMS	Copy of test results showing the effectiveness and ability to meet IMO discharge standards per G8 Guidelines, paragraph 6.5.4	I	√
Documentation verifying IMO Basic Approval of BWMS to G9 Guidelines, if applicable	In a suitable format: i.e., Basic Approval application and GESAMP BWWG review report, etc.	R	
Documentation verifying IMO Final Approval of BWMS to G9 Guidelines, if applicable	In a suitable format: i.e., Final Approval application and GESAMP BWWG review report, etc.	R	
Statement confirming BWMS type tested in accordance with the environmental testing specifications of the Convention	G8 Guidelines, paragraph 8.1.2; from the BWMS manufacturer	I	√

Type of Documentation	Additional Description	For Record (R)/ Information (I)	Placed Onboard
Equipment manuals for major components of BWMS	G8 Guidelines, paragraphs 5.1.1 and 8.1.3; manual should include equipment list and specifications; from the BWMS manufacturer	R	√
Documentation relating to the environmental and public health effects of the BWMS	BWM.2/Circ.28, paragraph 3.1.13.7 and G8 Guidelines, Part 1, Paragraph 1.6.4; BWMS manufacturer is to provide information to ship owner	I	
Documentation relating to the corrosion effects of the BWMS on the ship's tank coatings, steel plating or ballast water system	BWM.2/Circ.28, paragraph 3.1.13.2; BWMS manufacturer is to provide information to ship owner	I	
Installation specifications	Documentation shall be provided by the system's manufacturer, according to G8 Guidelines, paragraphs 8.1.5, .6, .7	R	√
Installation commissioning procedures		R	√
Initial calibration procedures		I	√

3.4.2 Engineering Review

3.4.2.1 Hull plans showing the foundation and attachments to ship's structure for each component of the BWMS are to be submitted and approved. These plans are to clearly indicate the scantlings and details of welding.

3.4.2.2 Machinery plans showing the installation design of the BWMS on the ship including location, piping and electrical details/drawings, general arrangement and layout, installation and equipment plans are to be submitted and approved before proceeding with the installation. Plans are to include applicable arrangements for hazardous areas acceptable to HRS, if applicable.

3.5 System Certification and IMO Member State Type Approval

3.5.1.1 The BWMS installed onboard those vessels is to be a type-approved and certified in accordance with the testing, approval, and certification processes outlined in the IMO's "Guidelines for Approval of Ballast Water Management Systems (G8)". These processes are to verify that the treatment system meets the IMO discharge standards has no adverse environmental impacts, and is suitable for shipboard applications.

3.5.1.2 For the management systems employing an active substance(s), further requirements and additional approval procedures apply. A full description of the approval process can be found in IMO approved "Procedure for Approval of Ballast Water Management Systems that make use of Active Substances (G9)".

3.6 Requirements for the BWMS and installation

3.6.1 General

In order to minimize the risk associated with the discharge of harmful aquatic invasive species resulting from ballast water transfers, the BWMS must be effective under the range of typical vessel operating conditions without negatively impacting the safety of shipboard personnel, the vessel or the environment into which the ballast water is discharged. The provisions in this Section address the supplementary requirements that apply when a BWMS is installed on board a vessel.

3.6.2 Common requirements

3.6.2.1 The design and installation of a BWMS is to comply with the following:

i. The treatment rated capacity (TRC) is to be sufficient to meet the ship's ballast capacity and normal ballast operations rate. The maximum flow rate at which a BWMS is

operated as specified by the Type Approval certificate is to be clearly reflected in the BWMS shipboard operating manual

ii. Capable of operating effectively at the minimum discharge rate of the ballast pumps or stripping system and with all connected ballast system pumps and eductors

iii. Capable of effectively treating all ballast water regardless of tank location, size or structure

iv. Provide for ballast flow to the furthermost tank at maximum capacity stated in the ship's BWMS specification

v. Does not adversely affect any parts, materials, equipment, structures or coatings

vi. Does not exceed the electrical generating capacity of the shipboard power supply under all anticipated ballasting or de-ballasting operating conditions.

vii. Does not discharge hazardous vapors or byproducts to the atmosphere, other than as considered in the type-approval of the BWMS

viii. All parts of the BWMS are to be easily accessible for inspection and maintenance

ix. Has suitable bypasses or overrides to protect the safety of the ship and personnel in the event of an emergency

x. Complies with all limitations, requirements, restrictions and conditions identified in the Type Approval certificate issued by the IMO Member State.

3.6.3 Locations

A BWMS may be installed in various locations throughout a vessel. The acceptability of the location and arrangements depend on the type of treatment system under consideration, the installation specifications and the type of vessel involved. Each installation must be carefully evaluated to verify that potential safety concerns and pollution hazard issues are adequately addressed.

Regardless of the location, all BWMS installations are to be in accordance with all relevant requirements listed in this Guide, HRS Rules and international regulations, standards, guidelines and recommendations.

BWMS equipment enclosures may not be constructed on weather deck locations that will reduce the navigational bridge visibility

3.6.3.1 BWMS Located in Non-Hazardous Areas

When the BWMS is installed in a space that is considered to be non-hazardous and the BWMS serves ballast tanks that are considered to be non-hazardous, then the BWMS may be installed in the following locations:

- Machinery space or engine room
- Void spaces with or without direct access or adjacent to the machinery room

- Dedicated compartment
- Other locations subject to special considerations

If the system uses chemicals, these chemicals must be stored at least in accordance with the requirements specified in G8 and G9.

3.6.3.2 BWMS Located in Hazardous Areas

When the ballast tanks are considered to be hazardous, then the BWMS may be installed in the following locations:

- Void space not adjacent to a cargo tank but with ballast piping
- Void space adjacent to a cargo tank
- Enclosed compartment on the cargo deck
- Other locations subject to special considerations

These spaces are to be considered hazardous spaces by virtue of ballast piping originating from hazardous ballast tanks entering such spaces.

3.6.3.3 Arrangements

The arrangements of the location are to comply with the following compartment criteria:

i. Based on the BWMS to be installed, is determined to be suitable for the service intended
ii. Treated as "other machinery spaces" with respect the fire protection. Such compartments are considered to be entered frequently during operation of the BWMS and are required to be installed with two escape routes, see SOLAS Ch. II-2 Reg.13.4.2.3. Compartments used for housing BWMS, where the maximum travel distance to the door of the compartment is 5 m or less, may be provided with a single escape route
iii. Positioned outside of any combustible, corrosive, toxic or hazardous areas unless alternative arrangements are specifically approved
iv. Arranged with no direct access to accommodation spaces, service space, machinery space, control stations or other spaces containing sources of ignition, unless alternative arrangements are specifically approved
v. Watertight integrity of all bulkhead openings and penetrations to be maintained
vi. Watertight integrity of all deck openings and penetrations to be maintained
vii. Minimize the extent of bulkhead and deck openings and penetrations
viii. Additional restrictions and requirements may apply to installations of BWMS serving ballast tanks of tankers.

3.6.4 Ventilation Systems

3.6.4.1 BWMS Located in Non-Hazardous Areas

i. Where the BWMS is installed in a machinery space such as an engine room, the equipment is to be located in a well-ventilated area.

ii. Where the BWMS is installed in a separate compartment that is not considered to be a hazardous area and does not serve any ballast tanks considered to be hazardous, the space is to be fitted with an independent mechanical extraction ventilation system providing at least six (6) air changes per hour or as specified by the BWMS manufacturer, whichever is greater.

iii. Where the operating principle of the BWMS involves the generation of a dangerous gas, the following requirements are to be satisfied:

- A gas detection equipment is to be fitted in the spaces where dangerous gas is likely to be present, and an audible and visual alarm is to be activated at a local area and a manned BWMS control station in case of leakage. Gas detection device is to be designed and tested in accordance with IEC 60079-29-1 or recognized standards acceptable by HRS
- The ventilation line of a space where dangerous gas may be present is to be led to a safe area on open deck
- The arrangements used for gas relieving, i.e. degas equipment or equivalent, are to be provided with monitoring measures with independent shutdown. The open end of the gas relieving device is to be led to a safe area on open deck.

3.6.4.2 BWMS Located in Hazardous Areas

i. A BWMS, regardless of generating dangerous gas, is to be located in a space fitted with mechanical ventilation complying with relevant requirements, i.e. IEC60092-502, IBC code, IGC code.

ii. Where the operating principle of the BWMS involves the generation of a dangerous gas, the requirements mentioned in Sub-Paragraph 3.6.4.1-iii shall be satisfied.

3.6.4.3 Additional requirements

Additional ventilation requirements may apply depending on the type of treatment system utilized and the location involved.

3.6.5 Structural Considerations

3.6.5.1 The treatment unit and related equipment shall be efficiently supported and the adjacent structures are to be adequately stiffened as required. Structural considerations are subject to all relevant requirements listed in this Guide and the HRS Rules, and international regulations, standards and guidelines.

3.6.5.2 The installation of a ballast water management system is not to compromise the integrity of the vessel's hull, framing, decks, bulkheads, tank structures, existing equipment foundations or additional structural members. Moreover, the application of a BWMS is not to adversely affect the ballast loading conditions, loading instrumentation, intact and damage stability and fire safety.

3.6.5.3 Any modification to a vessel's structure, stability or safety considerations as a result of the ballast water treatment equipment is to be designed, constructed and surveyed as indicated in this Guide and the HRS Rules, Part 3 and Part 4.

3.6.5.4 BWMS design, foundation, supports, and distribution of weight shall be regarded as of significant importance for all BWMS installations, and especially for machinery space installations due to necessary openings in the machinery space, limited support for decks, and maintenance of side and bottom stiffness.

3.6.6 Corrosion Effects

3.6.6.1 BWMS shall not deteriorate, degrade or reduce the functional life expectancy of the ballast tank coatings or means of corrosion prevention. Additionally, the treatment method employed shall not result in damage, deterioration or degradation of ballast piping and integral joints that are protected against corrosion by means of a coating or lining.

3.6.6.2 The next IMO documents address the potential corrosive effects which BWMS may have on the ballast tanks -including coatings- and the ballast system. Where appropriate the following shall be considered:

- The active substances and preparations used for the BWMS as well as the treated ballast water must be compatible with the coating system (G9 Guidelines, Paragraph 3.4)
- Data-set on the corrosivity to the materials or equipment of normal ship construction should be provided (G9 Guidelines, Paragraph 4.2.1.4)
- Application should include corrosion testing of uncoated substrates and marine epoxy-coated steel; coating in accordance with IMP Performance Standard for Protective Coatings) (MEPC 59/2/16, Section 5.1)
- Documentation of preliminary assessment of the corrosion effects of the BWMS system (BWM.2/Circ.28)

- Long-term corrosion effects of the treated ballast water on the ballast system and other spaces (Annex to G8 Guidelines, Part 1, Paragraph 1.3)

3.6.7 Ballast System

3.6.7.1 General

The ballast systems are to provide a reliable means of filling, transferring and draining ballast tanks employing a ballast water management system through the provisions of redundancy, certification of BWMS pumps and suitable remote control, where fitted.

A ballast system design including piping, pumps, valves, and other piping equipment must comply with all criteria for ballast systems as indicated in this Guide and Part 5 of the HRS Rules.

Additional ballast system piping requirements for oil carriers including safety arrangement are to comply with the relevant sections of Part 5, Ch. 19, Section 14 of the HRS Rules.

Where the ballast system has a capacity exceeding the treatment rated capacity of an in-line BWMS, an appropriate flow control arrangement is to be provided for the ballast pumps.

3.6.7.2 Ballast Pumps

Any modification to the existing ballast pumps, installation of new ballast pumps, or installation of booster pumps are to comply with the requirements in Part 5 of the HRS Rules.

3.6.7.3 Piping Components Materials and Design

The materials and design of all BWMS piping components are subject to the requirements of Part 5, Chapters 8 and 9 of the HRS Rules and the following:

- Piping shall be in accordance with approval conditions for ballast water management systems in G8 and G9.
- The ballast water management system and related piping and equipment are to be installed in such a way that cleaning, inspection, maintenance and operation can be easily performed.
- In addition, BWMS piping using miscellaneous non-metallic components made of thermoplastic or thermosetting plastic material are to comply, in general, with the requirements of Part 5, Ch 8, Section 5 of the HRS Rules. Moreover, plastic type of approved type and suitable design which has passed at least level 3 (L3) fire endurance test may be considered acceptable but in any case, inlets, outlets and drain pipes connected to the treatment system shall be made of steel.
- In case of by-pass valve activation, an alarm shall be provided to a suitable location and the event has to be recorded by the control equipment of the treatment system.

- Piping system shall include means to discharge untreated water between the sea chest and the treatment system in the event of malfunction of the equipment. Instructions about the procedure shall be provided in the BWMP. Where a vacuum may occur in the ballast line due to the high difference, a suitable protection means is to be provided, e.g. P/V valves or breather valves, and their outlets are to be led to safe area on open deck.
- The length of pipe and the number of connections are to be minimized in piping system containing dangerous gases/liquids in high concentration.
- Pipe joints specified in above are to be of welded type except for connections to shut off valves, double walled pipes or pipes in ducts equipped with mechanical exhaust ventilation. Alternatively it is to be demonstrated that risk of leakage is minimized and the formation of toxic flammable atmosphere is prevented.

3.6.7.4 Vent Piping

The vent pipe location of a ballast water management system that vents explosive and toxic gases is to comply with the intent of Part 5, Chapter 9, Section 10 of the HRS Rules as applicable. A spherical distance within 3 m (10 feet) measured spherically with the vent outlet as the centre is to be considered as hazardous.

3.6.7.5 Ballast Water Sampling Piping

BWMS are required to include all necessary access, piping and equipment for ballast water sampling to maintain operational safety and regulatory compliance. The sampling system is to provide for compliance with Section 5 of the Resolutions MEPC.173(58) Guidelines for Ballast Water Sampling (G2).

Piping is to be arranged such that samples are to be taken from the ballast water discharge piping as close to the point of discharge as feasible. BWMS that employ treatment during discharge operations must use in-line sampling. Details regarding the sampling facility design as required for compliance are located in Par. 3.6.7.6, and Parts 1 and 2 of the G2 Guidelines.

3.6.7.6 Sampling lines and facility (IACS M74)

Ballast piping including sampling lines from ballast tanks considered as hazardous areas is not to be led to an enclosed space, regarded as a safe area, without any appropriate measures. However, a sampling point of ballast water containing dangerous gas may be located in a safe area for checking the performance of BWMS provided the following requirements are fulfilled.

i. The sampling facility is to be located within a gas tight enclosure (hereinafter, referred to as a 'cabinet'), and the following (i) through (iii) are to be complied.
   - In the cabinet, a stop valve is to be installed in each sample pipe.
   - A gas detection equipment is to be installed in the cabinet and the valves specified in i) above are to be automatically closed upon the activation of gas detection
   - Audible and visual alarm signals are to be given at a local area and a manned BWMS control station when the concentration of explosive gases reaches a pre-set value, which is not higher than 30% of the lower flammable limit (LFL) of the concerned product.

ii. The standard inside diameter of sampling pipes is not to exceed 12 mm

iii. The measuring system is to be installed as close to the bulkhead as possible, and the measuring pipe is to be as short as possible in safe areas

iv. Stop valves are located in both the suction pipe and return pipe near the penetrations of bulkhead at safe side. A warning plate stating "Keep valve closed when not performing measurements" is to be provided near the valve. Furthermore, in order to prevent the backflow, a water seal is to be installed on the hazardous area side of the return pipe

v. A safety valve is to be installed on the hazardous area side of a sampling line.

3.6.7.7 Remote Control Valves

Remote control valves, where fitted, are to be arranged so that they will close and remain closed in the event of a loss of control power or emergency shutdown. Additionally, remote control valves are to be provided with position indicators in the BWMS instrumentation display at the ballast control station.

3.6.7.8 Ballast Water Stripping

For ballast water management systems that employ a double passage method (i.e., treating the ballast water both at intake and at discharge), appropriate arrangements are to be provided such that, in the ballast stripping operation, the water stripped from the ballast tank can also be routed through all the required treatment equipment and processes identified in the IMO Member State's type approval for the ballast discharge operation without damaging or incapacitating the BWMS due to sediment and particles in the stripped ballast.

For chemical treatment systems that need to neutralize the residual oxidants in the ballast water before discharge, the driving fluid for any eductor involved in the stripping operation could affect the efficacy of the neutralization, depending on where the neutralizer is applied (before or after the eductor) and where are the measurements of the TRO (total residual oxidants) level in the ballast system which cause the adjustment of the amount of neutralizer needed. The effectiveness of the neutralization is to be appropriately addressed in the ballast water stripping design and operation. For oil and chemical carriers, protection measures are to be provided to address the interconnection of piping between the fire/general service pump in the machinery space (non-hazardous space) and the ballast eductor in the cargo pump room (hazardous space), see Paragraph 3.6.4 of this Guide.

3.6.7.9 Bypass Arrangements

Suitable bypass and interlocking arrangements specifically accepted by HRS are to be provided to isolate the BWMS from the ballast system piping such that the ballast system can be operated totally independent of the BWMS in the event of emergency.

In case of any by-pass or override operation of BWMS, an audible and visual alarm is to be given and these events are to be automatically recorded in control equipment.

The valves in the by-pass line which trigger the by-pass operation are to be remote-controllable by control equipment or fitted with open/close indicator for automatic detection of the by-pass event.

3.6.8 Electrical System

The electric equipment of the ballast water management system shall comply with the following:

i. When the electric equipment is to be installed in a hazardous area of a tanker, a ship carrying dangerous chemicals in bulk, or a ship carrying liquefied gases in bulk, the equipment is to comply with the Part 4 of the HRS Rules

ii. The total capacity of the generator is to cover maximum power demand when operating the ballast water management system, including the ballasting under the normal seagoing conditions, loading/Unloading cargoes and entering/leaving a port. The electrical generating capacity installed on the vessel is to be adequately demonstrated by an electrical load analysis

iii. All electrical and electronic system should be of a certified safety type, required by the applicable national or international standard. In addition, the equipment shall be environmentally tested according to G8 Guidelines, at a laboratory approved for this purpose by HRS or by a competent authority of the manufacturer's home country

iv. Any electrical equipment that is part of Ballast Water Management System should be located in a non-hazardous area, otherwise, it should be designed, manufactured and installed according to the Paragraph 1.2.6, Chapter 17, Part 6 of HRS Rules for its use in a hazardous area

v. All electrical equipment to be used aboard should be intrinsically safe. Pumps should be fitted with waterproof junctions at the point where the electrical lead passes into the pump body and all plugs should be waterproof with rubber casings.

3.6.9 Instrumentation

3.6.9.1 Local Instrumentation

Local instrumentation and controls of the BWMS are to be fitted so as to enable ease of operation, maintenance and effective control in the event of an emergency or failure of any remote controls.

Local instrumentation is to indicate ballast operating conditions and status of the ballast water treatment equipment.

For installations where the BWMS equipment is not located in the same space as the ballast pumps, the operational status of the ballast pumps is to be indicated near the BWMS equipment. The local instrumentation shall include:

i. Ballast pump operational status (e.g. pressure gauge)
ii. BWMS and equipment operational status
iii. Remote control valve, where fitted, position indication
iv. Necessary instrumentation for all BWMS equipment parameters and specific conditions, as applicable

3.6.9.2 Ballast Control Station Displays

Where remote means of control are fitted, the systems shall comply with Part 8, Chapter 1 of HRS Rules. Each remote control valve shall be arranged so that it will remain closed in case of emergency and they will be provided with position indicators, giving information at the respective control station.

A tank level gauging system, where fitted, is to be capable of measuring the full height of all ballast tanks individually and shall be provided at the ballast control station. If applicable, the tank level gauging system and its integration with the BWMS shall be verified that are compatible and works correctly.

In case of any failure compromising the proper operation of the ballast water management system, audible and visual alarm signals are to be given in all stations from which ballast water operations are controlled.

3.6.10 Special Fire Fighting Equipment and Arrangements

3.6.10.1 General

The requirements for fire safety are to be identified by the BWMS manufacturer and are to be based on the following principles:

- The provision of appropriate fire detection and extinguishing system and equipment capable of extinguishing the type and scale of fire likely to occur in association with the installed BWMS.
- The space containing the BWMS is to be such that the boundaries will continue the fire for a period of at least one hour, to guard against the escape of flammable or toxic gases, and to minimize the likelihood of ignition.
- The identification of fire risk of the BWMS, including the active substances or preparations used or generated, and the provisions of effective means to prevent and extinguish fires in the BWMS space is to be submitted for review by HRS.

3.6.10.2 Recording in Ship's Manual

The special fire fighting instructions and/or requirements specified in Paragraph 3.6.10 above are to be mentioned in the ship's operating and safety manuals, and respective signs shall be located in appropriate places onboard.

3.6.11 Sediment Control

3.6.11.1 Ballast water tanks and their internal structure should be designed to minimize accumulation of sediments and permit for easy cleaning and maintenance. Design guidance of ballast tanks and other design enhancements are provided in the G12 Guidelines. There are also practical steps or procedures that can be implemented in the ballast water operation for sediment control.

3.6.11.2 The recommendations given in the G4 Guidelines, Part A, shall be followed as far as practicable.

3.6.11.3 Ship's BWMP shall include the details of the methods and operational procedures for the sediment management on board the ship, including the disposal of sediments and the associated safety considerations.

3.7 Considerations for Tankers

3.7.1 Basic Requirements

3.7.1.1 The provisions in this Section address the special requirements associated with the treatment of ballast water from tanks located adjacent to cargo tanks or other hazardous areas on oil or chemical carriers and are to be applied in conjunction with the requirements in Part 4 of the HRS Rules.

3.7.2 BWMS Equipment Locations (IACS M74)

3.7.2.1 For tankers carrying flammable liquids having a flashpoint not exceeding 60°C or products listed in IBC Code, in general, two independent BWMS may be required - i.e. one for ballast tanks in hazardous areas and the other for ballast tanks in nonhazardous areas.

3.7.2.2 The possibility exists for BWMS to be located in non-hazardous areas, although serving tanks located in hazardous areas, only if the BWMS:

a) does not require after treatment, or
b) requires after treatment, but it is of the injection type.

3.7.3 Examples of permitted arrangements are shown in Figure 1 and Figure 2.Ventilation Requirements

3.7.3.1 The ventilation systems serving spaces containing BWMS equipment are to comply with the requirements in Paragraph 3.6.4 of the Guide.

3.7.4 Piping System

3.7.4.1 General

The design and installation of the piping system of a BWMS on an oil or chemical carrier are to comply with the applicable requirements in Part 4, Chapter 1, Section 9 of the HRS Rules.

3.7.4.2 Interconnection Considerations (IACS M74)

The interconnection of ballast piping between hazardous areas and in non-hazardous areas may be accepted if an appropriate isolation arrangement is applied. Means of the appropriate isolation are as follows:

a) Two screw down check valves in series with a spool piece, or

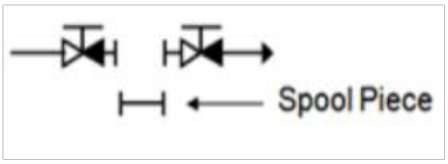

Figure 1 Check Valves in Series with a Spool Piece

b) Two screw down check valves in series with a liquid seal at least 1.5 m in depth, or

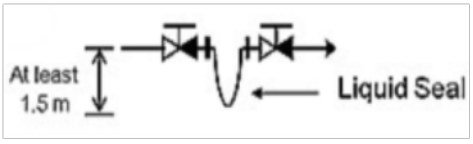

Figure 2 Check Valves in Series with a liquid Seal

c) Automatic double block and bleed valves and a non-return valve

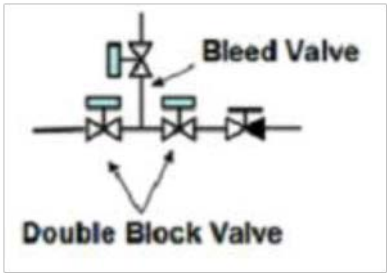

Figure 3 Automatic Double Block and Bleed Valves

Ballast water originating from a hazardous area is not to discharge in to non-hazardous area, except as allowed for sampling purposes.

Examples of appropriate isolation arrangement are shown in Figure 4 and Figure 5.

Means of the appropriate isolation is to be fitted on the exposed deck of hazardous area. For BWMS equipment arranged with piping components made of thermoplastic or thermosetting plastic material, it is to comply with the requirements in par. 3.6.7 of the Guide.

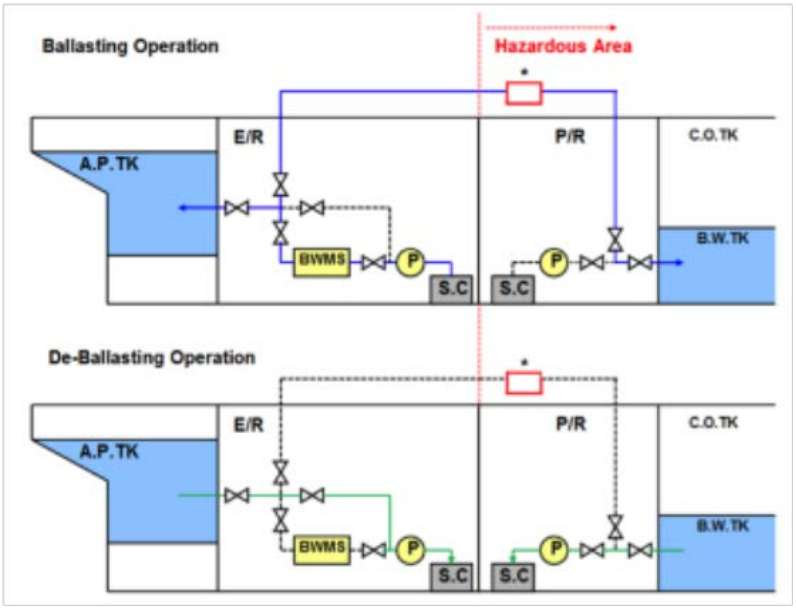

Figure 4 Ballast Water Management System which does not Require After Treatment.

* Appropriate Isolation Means: Two (2) screw down check valves in series with a spool piece or a liquid seal, or automatic double block and bleed valves

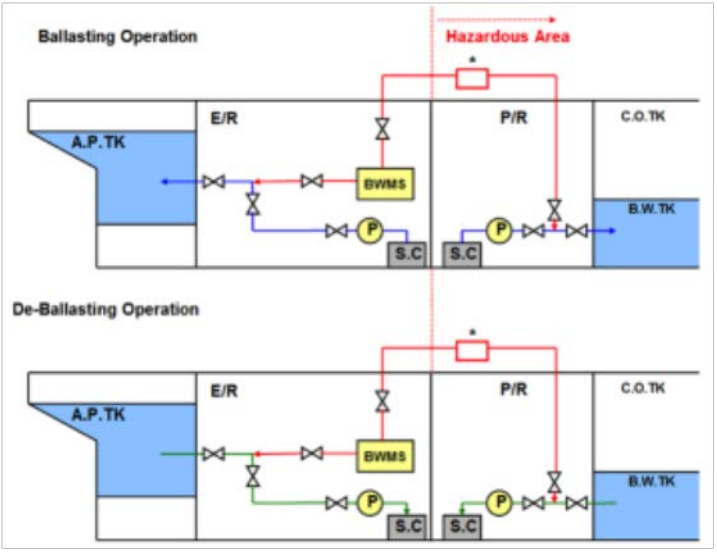

Figure 5 Ballast Water Management System Which Require After Treatment (Injection Type)

Ballast water originating from a hazardous area is not to discharge into a non-hazardous area, except when the requirements of reference to a paragraph above are satisfied.

3.7.5 Safety Assessment

3.7.5.1 Where HRS considers that is necessary, a safety assessment study to address the risk to the ship and its crew shall be performed, including at least the next items:

- BWMS installation location
- System monitoring, control and safety systems
- Operational procedures for the BWMS
- Maintenance requirements for the BWMS
- Potential release from the BWMS
- Interconnection between piping systems and hazards associated with the same
- Ship operations during ballasting and de-ballasting.

3.7.5.2 The risk/safety assessment should be undertaken prior to the installation of the BWMS, so that any mitigation measures identified during the assessment study can be rectified either prior to, or during installation. This safety assessment study is to be reviewed by HRS to confirm the adequacy of the proposed arrangements and relative information shall be included in the BWMP.

SECTION 4 Survey Requirements

4.1 Ballast Water Exchange Survey Requirements

4.1.1 Initial survey

4.1.1.1 The following documentation shall be verified to be onboard during the initial survey:

- Approved Ballast Water Management Plan
- Ballast Water Record Book

4.1.1.2 This survey shall verify that the BWMP required by regulation B-1 and any associated structure, equipment, systems, fitting, arrangements and material or processes comply fully with the requirements of the Convention. Additionally and where applicable, the ballast water exchange system, alarms, shutdowns and control equipment are to be tested under working conditions to the satisfaction of the Surveyor.

4.1.2 Annual survey

4.1.2.1 The following documentation shall be verified that have been maintained appropriately:

- Ballast Water Management Plan
- Ballast Water Record Book

4.1.2.2 A general examination of the controls and piping systems (including pipes, valves, pipe supports, etc.) shall be carried out. The sediment management arrangement shall be also examined.

4.1.3 Intermediate survey

4.1.3.1 Survey requirements (in addition to those of Annual survey) include:

- Verification that sampling points are accessible.
- Examination of the control systems, displays and alarm devises are in good working conditions

4.1.4 Renewal survey

4.1.4.1 Additionally, the mechanical and electrical components are to be examined, including but not limited to:

- Valves

- Seals
- Pumps
- Control panels
- Vents
- Air pipes
- Monitoring sensors (e.g. tank level indicating system)

4.1.4.2 The operation of the ballast water exchange system and sampling facilities shall be demonstrated and verified its good working condition.

4.2 Ballast Water Management Survey Requirements

4.2.1 Initial survey

4.2.1.1 In general, initial survey shall verify any associated structure, equipment, systems, fitting, arrangements and material or processes comply fully with the requirements of the Convention.

4.2.1.2 The initial survey is also to confirm that the following documentation is on board the vessel:

i. A copy of the Type Approval Certificate of the BWMS
ii. A statement from the Administration, or from a laboratory authorized by the Administration, to confirm that the electrical and electronic components of the BWMS have been type-tested in accordance with the specifications for environmental testing contained in Part 3 of the annex of IMO G8 Guidelines
iii. Equipment manuals for the major components of the BWMS
iv. A copy of the operations and technical manual for the BWMS specific to the vessel and approved by the IMO Member State, containing a technical description of the BWMS, operational and maintenance procedures, and backup procedures in case of equipment malfunction
v. Installation specifications and commissioning procedures of the BWMS
vi. Initial calibration procedures of the BWMS
vii. The Ballast Water Management Plan approved
viii. Ballast Water Record Book specific to the vessel

4.2.1.3 The initial survey is also to verify the following:

i. The BWMS installation has been executed in accordance with the manufacturer's technical installation and manufactures equipment specifications, by checking the

consistency between the approved plans and drawings and vessel's physical layout (installed piping, piping components and equipment)

ii. The BWMS is in conformity with the Type Approval Certificate of the BWMS issued by the IMO Member State.

iii. Any operational inlets, outlets ballast pumps and tank valves are in accordance with the drawings of the pumping and piping arrangements.

iv. The workmanship of the installation is satisfactory and, in particular, that any bulkhead penetrations or penetrations of the ballast system piping are to the relevant approved standards;

v. The correct operation, according to manufacturer's technical installation specifications, of the control and monitoring equipment (e.g. bypass alarms)

vi. Verification that the BWMS should be provided with sampling facilities so arranged in order to collect representative samples of the ship's ballast water

vii. Verification that the sampling facilities are arranged to collect representative samples of the ships ballast water upstream to the ballast discharge points and any other points necessary for sampling to ascertain the proper functioning of the equipment

viii. Verification that the control equipment that automatically monitors and adjusts the necessary treatment dosages or intensities or other aspects of the BWMS of the vessel operates properly.

4.2.1.4 Commissioning Test

After installation of the BWMS, a shipboard commissioning test is to be carried out to the Surveyor's satisfaction at the sea or quay trial, as appropriate.

The test shall demonstrate the ability of the BWMS installation to operate consistently and continuously during the ship's normal ballast operations at the treatment rated capacity in a shipboard test cycle reflecting the manufacturer's specific installation criteria.

The normal ballast operational cycles are to include ballasting, de-ballasting and stripping. The duration of each test cycle is to be to the satisfaction of the Surveyor.

A shipboard commissioning procedure is to be prepared and submitted to HRS for approval prior to testing. It is not the purpose of this test to demonstrate the biological efficacy of the installed BWMS.

4.2.2 Annual survey

4.2.2.1 The annual survey includes a general inspection of the structure, any equipment, systems, fittings, arrangements and material or processes associated with the Ballast Water Management plan required by Regulation B-1 to ensure that they have been maintained and remain satisfactory for the service for which the ship is intended.

4.2.2.2 Additionally, the survey shall include:

- Verification of the documentation mentioned in 4.2.1.2 is onboard and current
- Verification that the Ballast Water Record Book has been maintained and related activities are recorded properly
- Verification that maintenance of the BWMS has been carried out according to manufactures' recommended schedule
- Inspections of the BWMS for safety arrangements and emergency procedures
- Verification that the control equipment that automatically monitors and adjusts the necessary treatment dosages or intensities or other aspects of the BWMS of the vessel operates properly.

4.2.3 Intermediate survey

4.2.3.1 The intermediate surveys shall ensure that the equipment, associated systems and processes for Ballast Water Management fully comply with the applicable requirements of this Guide and are in good working order.

4.2.3.2 In addition to the annual survey requirements, verification that the control and monitoring equipment operates correctly including audible or visual alarms and bypass operation.

4.2.4 Renewal survey

4.2.4.1 Additionally, the operation of the BWMS in accordance with the manufacturer's technical installation specifications is to be demonstrated to the satisfaction of the attending surveyor.

4.2.4.2 For treatment systems using active substances, coating in tanks, pipes and valves in contact with active substance shall be examined.

4.2.4.3 The ballast water sampling points shall be also examined and performance of sediment removal according to BWM plan shall be verified.