

# **GUIDE FOR**

# **BALLAST WATER TREATMENT**

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American Bureau of Shipping Incorporated by Act of Legislature of the State of New York 1862

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### **Foreword**

The inadvertent transfer of harmful aquatic organisms and pathogens in the ballast water of ships has been determined to have caused a significant adverse impact to many of the world's coastal regions. The international maritime community, under the auspices of the International Maritime Organization (IMO) has developed several documents, including the "International Conventions for the Control and Management of Ship's Ballast Water and Sediments, 2004", (Ballast Water Management Convention), which are aimed at preventing the introduction of unwanted aquatic organisms and pathogens through the discharge of ballast water and sediments.

Upon entry into force, the Ballast Water Management Convention will apply to vessels registered in a country which is party to the Convention and to those vessels registered in other countries when operating in the waters of a country which is party to the Convention.

As a means to prevent, minimize and ultimately eliminate the risk to the environment, human health, property and resources arising from the transfer of harmful aquatic organisms and pathogens through the control and management of vessel's ballast water and sediment, as well as to avoid unwanted side-effects from that control, the Convention requires vessels to conduct a ballast water exchange or be fitted with an approved ballast water management system. It is noted that several studies have shown that the effectiveness of ballast water exchange varies and is dependent on the vessel type (design), exchange method (sequential, flow-through and dilution methods), ballasting system configuration, exchange location, weather conditions and vessel's trading pattern. For these reasons (and others), it has been determined that ballast water exchange does not provide adequate protective measures to prevent damage from organisms and pathogens carried in a vessel's ballast, even though exchange was considered to be acceptable as an interim solution.

The installation of ballast water management systems (or ballast water treatment systems), designed, reviewed, approved, installed and operated to satisfy an agreed upon ballast water discharge performance standard has been determined by the international marine industry to provide a more effective means to prevent, minimize and ultimately eliminate the transfer of organisms and pathogens via vessel ballast discharge, when compared to ballast water exchange.

This Guide for Ballast Water Treatment is provided for the use of designers, builders, owners and operators of vessels classed with ABS and specifies the requirement for obtaining the optional classification notations Ballast Water Treatment (BWT) and Ballast Water Treatment Plus (BWT+) for vessels equipped with an IMO Member State Type Approved ballast water management system. The BWT notation identifies that the IMO Member State Type Approved ballast water management system has been reviewed and installed in compliance with this Guide and serves to identify a level of compliance with the applicable regulations contained in the IMO "International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004", as well as those supporting IMO Guidelines referenced in the Convention addressing the ballast water management systems. The BWT+ notation is available for those vessels which are equipped with a ballast water management system that, in addition to being type approved by an IMO Member State and evaluated for compliance with the requirements in this Guide, has been fabricated under survey at the manufacturing facility by an ABS Surveyor.

This Guide is to be used in conjunction with other Rules published by ABS and the Guidelines published by the IMO.

Users of this Guide acknowledge and agree that ABS is not responsible for a vessel's operation pertaining to the ballast water management system(s) and shall bear no liability for such operations and guidelines that are considered to be applicable. While it is the intent of the Guide to be consistent with these relevant regulations and guidelines, it is the ultimate responsibility of the users of the Guide to refer to the most recent texts of those regulations and guidelines.

This Guide becomes effective on the first day of the month of publication.

Users are advised to check periodically on the ABS website www.eagle.org to verify that this version of this Guide is the most current.

We welcome your feedback. Comments or suggestions can be sent electronically by email to rsd@eagle.org.



# **GUIDE FOR**

# **BALLAST WATER TREATMENT**

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### SECTION 1 General

# 1 Application

The requirements in this Guide apply to vessels that are designed, equipped and intended to use the treatment method for conducting ballast water management in accordance with Regulation B-3 of the "International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004" (Convention), the associated IMO Guidelines and national regulations, addressing the use of a ballast water management system. At the request of the owner, those vessels having a ballast water management system (BWMS) installed for conducting ballast water management which comply fully with the requirements of this Guide and the applicable Rules and have been installed under survey by ABS Surveyors may be assigned the Ballast Water Treatment (BWT) or a Ballast Water Treatment Plus (BWT+) classification notation as specified in Section 1/7 of this Guide.

The installation of a ballast water management system and the related treatment requirements are voluntary until the BWM Convention enters into force. Where a vessel is fitted with a ballast water management system and the **BWT** or **BWT+** notation is not being pursued, the installed BWMS is to comply with the requirements in Sections 4 and 5 of the Guide and be verified by an ABS Surveyor during installation.

This Guide refers to relevant international regulations and guidelines that are considered to be applicable. While it is the intent of this Guide to be consistent with the regulations and guidelines, it is recommended that the users of this Guide refer to the most recent text of those regulations and guidelines.

# 3 Objective/Scope

In accordance with the Convention, the ballast water management system installed on board a vessel is to be an IMO Member State type approved and certified system and the installation of this system must have the prior approval/acceptance of the vessel's flag Administration. It is recognized that each BWMS is tested, approved and certified in its standard product configuration. However there are design and engineering issues, as well as special considerations relating to the class requirements that will need to be addressed, as every ship is unique due to its design and operational profile.

The objective of this Guide is to provide supplementary requirements regarding ballast water management systems that generally are not addressed by other ABS Rules or Guides. The requirements of this Guide may be applied to new or existing vessels.

It is recognized that the technology associated with ballast water management systems remains under development. Accordingly ABS is prepared to consider alternative arrangements to the requirements contained in the Guide, provided that substantiating information and/or a risk analysis is submitted for review.

As indicated in Section 1, Figure 1, ballast water treatment is one of the accepted ballast water management methodologies provided for within the Convention that is available for selection by the Owner.

### 5 Basis of Notation

This Guide contains the provisions for ballast water management systems and the optional classification notation **BWT** or **BWT+** for vessels classed with ABS. This Guide is intended for use in conjunction with the appropriate Rules found in the ABS *Rules for Building and Classing Steel Vessels (Steel Vessel Rules)* or ABS *Rules for Building and Classing Vessels Under 90 Meters (295 feet) in Length (Under 90 m Rules)*, as appropriate. 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.

- The International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004
- 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.150(55), "Guidelines on Design and Construction to Facilitate Sediment Control on Ships (G12)" adopted on 13 October 2006
- IMO Resolution MEPC.173(58), "Guidelines for Ballast Water Sampling (G2)", adopted on 10 October 2008

# 7 Classification Symbol and Notation

# 7.1 Systems Installed Under Survey

### 7.1.1 IMO Member State Type Approved BWMS

Where requested by the owner, vessels having an IMO Member State type approved ballast water management system installed, under survey by an ABS Surveyor and in accordance with this Guide will be assigned the Ballast Water Treatment, **BWT**, classification notation.

### 7.1.2 ABS Surveyed BWMS

Those vessels equipped with an IMO Member State type approved ballast water management system which has been fabricated under survey at the manufacturing facility by an ABS Surveyor, and reviewed and installed in accordance with the requirements of this Guide may be assigned the **BWT+** notation. Similarly, where a vessel is equipped with a BWMS which is composed of several components that are assembled at a shipyard or dockside facility may be assigned the **BWT+** notation, provided the main treatment components of the BWMS which result in the organisms and pathogens becoming ineffective or rendered harmless, have been fabricated under survey at the manufacturing facility by an ABS Surveyor or ABS type approved. See Section 3/7 for the requirements of ABS Approval of BWMS.

# 7.3 Systems Not Installed Under Survey

Vessels equipped with a ballast water management where the installation was not conducted under survey by an ABS Surveyor, may obtain the voluntary **BWT** notation, provided that the ballast water management system and the installation on board the vessel have been determined to comply with the design and installation criteria contained in this Guide.

The operation of the ballast water management system is to be demonstrated to an ABS Surveyor by a shipboard function test, and documentation confirming that ballast water management system has been type approved in accordance with *IMO Resolution MEPC.174(58)*, "Guidelines for Approval of Ballast Water Management Systems (G8)" as satisfying the ballast water performance standard contained in Regulation D-2 of the Convention is to be submitted to ABS.

# 9 Governmental Regulations

Several national Administrations have in place additional requirements pertaining to the management of ballast water for vessels operating in their territorial waters. These requirements may necessitate additional vessel features, performance standards, equipment, reporting and record keeping of which are not included in this Guide. Owners/operators are encouraged to remain current with these national Administration requirements.

### 11 Alternatives

Equipment, components, and systems for which there are specific requirements in this Guide, or its associated references, may incorporate alternative arrangements or comply with the requirements of alternative recognized standards, in lieu of the requirements in this Guide. This, however, is subjected to such alternative arrangements or standards being determined by ABS as being not less effective than the overall safety requirements of this Guide or associated references. Where applicable, requirements may be imposed by ABS in addition to those contained in the alternative arrangements or standards so that the intent of this Guide is met.

In all cases, the alternative equipment or system is subject to design review, survey under construction, test and trials, as applicable, by ABS for the purpose of verification of its equivalency to the requirements contained in this Guide.

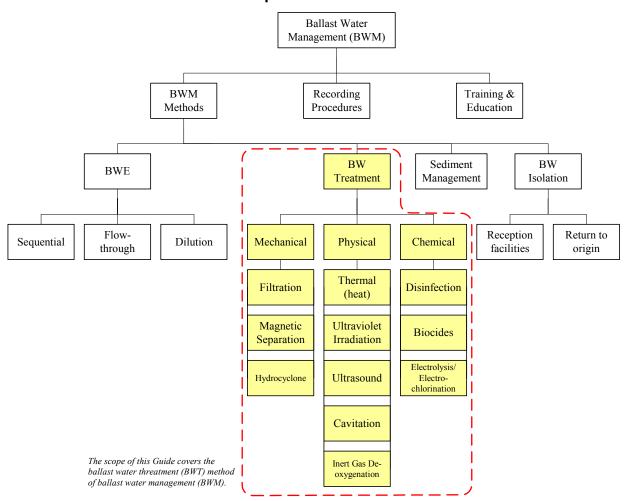
### 13 Definitions

The following definitions are to be applied to the terms used in this Guide:

- Administration is the Government of the State under whose authority the vessel is operating. With respect to a vessel entitled to fly a flag of any State, the Administration is the Government of the State. With respect to floating platforms engaged in exploration and exploitation of the seabed and subsoil thereof adjacent to the coast over which the coastal State exercises sovereign rights for the purposes of exploration and exploitation of its natural resources, including Floating Storage Units (FSUs) and Floating Production Storage and Offloading Units (FPSOs), the Administration is the Government of the Coastal State concerned.
- Active Substance means a substance or organism, including a virus or fungus that has general or specific action on or against harmful aquatic organisms and pathogens.
- Ballast Water is the water with its suspended matter taken onboard a vessel to control trim, list, draft, stability or stresses of the vessel.
- Ballast Water Capacity means the total volumetric capacity of any tanks, spaces or compartments on a vessel used for carrying, loading or discharging ballast water, including any multi-use tank, space or compartment designed to allow carriage of ballast water.
- Ballast Water Discharge means the ballast water as would be discharged overboard.
- Ballast Water Management (BWM) means mechanical, physical, chemical and biological processes of ballast water, either singularly or in combination to remove, render harmless, or avoid the uptake or discharge of harmful aquatic organisms and pathogens within the ballast water and associated sediments.
- Ballast Water Management Plan (BWMP) is a document describing the ballast water management process and procedures implemented on board individual vessels.
- Ballast Water Management System (BWMS) means any system which processes ballast water such that it meets or exceeds the ballast water discharge performance standard in Regulation D-2 of the Convention. The BWMS includes ballast water treatment equipment, all associated control equipment, monitoring equipment and sampling facilities.
- Ballast Water Tank is any tank, hold or space used for the carriage of ballast water.

- Ballast Water Treatment (BWT) Equipment refers to equipment which mechanically, physically, chemically or biologically processes ballast water, either singularly or in combination, to remove, render harmless or avoid the uptake or discharge of harmful aquatic organisms and pathogens within the ballast water and associated sediments. Ballast water treatment equipment may operate at the uptake or discharge of ballast water, during the voyage, or at a combination of the events.
- Company means the owner of the ship or any other organization or person such as the manager, or the bare boat charter, who has assumed the responsibility for operation of the vessel from the owner of the vessel and who on assuming such responsibility has agreed to take over all of the duties and responsibilities imposed by the International Safety Management Code.
- *Control Equipment* refers to the installed equipment required to operate and control the ballast water treatment equipment.
- The Convention means the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004.
- Gross Tonnage is the gross tonnage calculated in accordance with the tonnage measurement regulations contained in Annex I to the *International Convention on Tonnage Measurement for Ships, 1969* or any successor Convention.
- Harmful Aquatic Organisms and Pathogens are 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.
- Hazardous Areas are areas of a ship where flammable or explosive gases or vapors are normally present
  or likely to be present. The flammable or explosive atmosphere may be expected to exist continuously
  or intermittently. Hazardous areas are more specifically defined for certain machinery installations,
  storage spaces and cargo spaces that present hazard and example Rule cites are given in 4-1-1/1.9.4 of
  the Steel Vessel Rules.
- *Monitoring Equipment* refers to the equipment installed for the assessment of the effective operation of the ballast water treatment equipment.
- *Preparation* means any commercial formulation containing one or more Active Substances including any additives. This term also includes any Active Substances generated on board for the purposes of ballast water management and any Relevant Chemicals formed in the ballast water management system that makes use of Active Substances to comply with the Convention.
- Relevant Chemicals means transformation or reaction products that are produced during and after employment of the ballast water management system in the ballast water or the receiving environment and that may be of concern to the ship's safety, aquatic environment and/or human health.
- Rules are the ABS Rules for Building and Classing of Steel Vessels (Steel Vessel Rules) or the ABS Rules for Building and Classing Vessels Under 90 Meters (295 feet) in Length (Under 90 m Rules), as appropriate.
- Sampling Facilities refers to the means provided for sampling treated or untreated ballast water.
- Sediments are the matter settled out of ballast water within a vessel.
- Treatment Rated Capacity (TRC) is the maximum continuous capacity expressed in cubic meters 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.
- Type Approval refers to the IMO approval and certification regime of ballast water management systems made by an IMO Member State in accordance with the Convention Guidelines G8, G9 and G10. An approved ballast water management system is to have a valid Type Approval Certificate in the proper form and signed by that Member State.
- *Viable Organisms* are organisms and any life stages thereof that are living.

# FIGURE 1 Scope of BWT Guide





# **SECTION 2 Classification and Documentation**

### 1 Plans and Documentation

# 1.1 Ship Plans and Operational Manuals

Section 2, Table 1 below shows 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 ABS Surveyor at appropriate surveys are also annotated in the table.

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

### **TABLE 1**

Type of Ship Plans and Manuals	Additional Description	For Approval (AP) or Information (I)	Placed Onboard Vessel for Survey (S)
General arrangement drawings of the BWMS	Installation arrangement drawings on the ship including location and layout	AP	
Arrangement and capacity of ballast tanks and pumps		I	
Ballast piping system drawings	Layout, filling arrangement, and booklet of construction details of piping system	AP	
Location of ballast water sampling facilities		AP	-
Electrical circuit drawings and main power cable drawings		AP	
Power calculation document	Including electrical load analysis	AP	
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 system(s)	AP	-
Local instrumentation arrangement plan		AP	
Structural plans	Showing installation details of attachment, supports and foundations of principal components of the BWMS	AP	
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.	AP	S
Safety documentation for hazardous chemicals	In recognized industry format, such as MSDS, CHRIS Code, Cole-Palmer	I	

# **TABLE 1 (continued)**

Type of Ship Plans and Manuals	Additional Description	For Approval (AP) or Information (I)	Placed Onboard Vessel for Survey (S)
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	АР	-S
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	AP	
Ballast water management plan (BWMP)	BWMP is specific to the ship and in a standard format per <i>G4 Guidelines</i>	AP	S
BWMS operating and safety manual	Manual specific to the actual installation onboard the ship; see Section 6/1 of this Guide	AP	S
Shipboard function test plan for sea or quay trial	Function test of the installed BWMS at the sea trial or quay trial in the presence of ABS Surveyor; function test plan per paragraph 5.1.9 of <i>G8 Guidelines</i> ; see 7/1.3 of this Guide	АР	
Ballast water record book	Ballast water record book is specific to the ship	I	S

# 1.3 Required Specific Certification and Documentation

The ballast water management system installed onboard shall be type-approved by an IMO Member State, and in order to receive the Ballast Water Treatment, **BWT** or **BWT+**, notation, specific certificates and documentation of the treatment system are to be provided to ABS for record, information or reference, as appropriate. The certificate/documentation requirements are shown in Section 2, Table 2.

In accordance with the Convention, specific documents are to be retained onboard the vessel for presentation or inspection at appropriate surveys.

# **TABLE 2**

Type of Document for BWMS	Additional Description	For Record (R) or Information (I)	Placed Onboard Vessel for Survey (S)
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	S
Results of test analysis for BWMS	Copy of test results showing the effectiveness and ability to meet IMO discharge standards per <i>G8 Guidelines</i> , paragraph 6.5.4	I	S
International Ballast Water Management Certificate (after entry into force)	In accordance with the Convention Regulation E-2	I	S
Documentation verifying IMO Basic Approval of BWMS to <i>G9</i> <i>Guidelines</i> , if applicable	In a suitable format: i.e., basic approval application and GESAMPBWWG review report, etc.	R	
Documentation verifying IMO Final Approval of BWMS to <i>G9 Guidelines</i> , if applicable	In a suitable format: i.e., final approval application and GESAMPBWWG 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	S
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	S
Operations and technical manual	Manual is specific to the ship and approved by the Administration per <i>G8 Guidelines</i> , paragraphs 8.1.4, 5.1.3-7; from the BWMS manufacturer	R	S
Installation specifications	G8 Guidelines, paragraphs 8.1.5 and 5.1.8; from the BWMS manufacturer	R	S
Installation commissioning procedures	G8 Guidelines, paragraph 8.1.6; from the BWMS manufacturer	R	S
Initial calibration procedures	G8 Guidelines, paragraph 8.1.7; from the BWMS manufacturer	I	S
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, Section 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	

*Note:* Where "R" is indicated, submission of the documentation to ABS is mandatory, as it will be used as reference for the engineering review.

# 3 Engineering Review

Vessels having the **BWT** or **BWT+** notation are to comply with the applicable requirements contained in this Guide.

Hull plans showing the foundation and attachments to vessel'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.

Machinery plans showing the installation design of the BWMS on the vessel 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 ABS for oil, liquefied gas and chemical carriers if applicable.

# 5 Surveys

The primary function of Surveys is to determine and report on compliance with the applicable ABS Rules for ships and other marine structures.

An initial survey of the ballast water management system installed (see details in 7/1.1) and a shipboard function test (see requirements in 7/1.3) are required for the issuance of the **BWT** or **BWT+** notation.

Surveys after construction are required for retention of the **BWT** or **BWT+** notation. See requirements in Section 7/3.



# **SECTION 3 General Requirements**

# 1 Ballast Water Discharge Standards

The ballast water discharge standards required for issuance of the **BWT** or **BWT+** notation are as specified in *Regulation D-2, Ballast Water Performance Standard*, of the Convention and summarized below in Section 3, Table 1. Section 3, Table 1 annotates the acceptable concentration of viable organisms and the indicator microbes per unit volume of ballast water to be discharged.

TABLE 1
Summary of Convention D-2 Discharge Standards

Organism Size/Indicator Microbes	Discharge Regulation
Size ≥ 50 μm in minimum dimension	< 10 viable organisms/m <sup>3</sup>
$10 \le \text{Size} \le 50 \text{ μm in minimum dimension}$	< 10 viable organisms/milliliter
Size < 10 μm in minimum dimension	No limit
Toxicogenic Vibrio cholera (O1 and O139)	< 1 cfu * / 100 millilitres, or
	< 1 cfu * / gram (wet weight) zooplankton samples
Escherichia coli	< 250 cfu * / 100 millilitres
Intestinal Enterococci	< 100 cfu / 100 millilitres

*Note:* \* cfu = colony forming units

# 3 BWT Implementation Schedule

The **BWT** or **BWT+** class notation is available for application at any time. However, for guidance, the IMO implementation schedule for ballast water treatment for compliance with the Convention and D-2 ballast water performance standards is dependent on the year of ship construction and ballast water capacity, as specified in the Convention *Regulation B-3*, *Ballast Water Management for Ships*.

The implementation schedule for mandatory ballast water treatment is summarized below in Section 3, Table 2.

TABLE 2
Summary of Convention B-3 Compliance Schedule

Ballast Capacity	Build	*First Intermediate or Renewal Survey, whichever occurs first, after the anniversary date of delivery in the respective year								
$(m^3)$	Date	2009	2010	2011	2012	2013	2014	2015	2016	2017
<1,500	<2009		D-1 or D-2 D-							
	in 2009		Note: D-1; D-2 by 2 <sup>nd</sup> Annual but not beyond 31 Dec. 2011 or EIF, whichever is later							
	>2009		<b>D-2</b> (at delivery or EIF, whichever is later)							
≥1,500	<2009	D-1 or D-2								
or	in 2009	Note: <b>D-1</b> ; <b>D-2</b> by 2 <sup>nd</sup> Annual but not beyond 31 Dec. 2011 or EIF, whichever is later								
≤5,000	>2009		<b>D-2</b> (at delivery or EIF, whichever is later)							
>5,000	<2012	D-1 or D-2 D-2					D-2 *			
	≥2012	N/A D-2 (at delivery or EIF, whichever is later)								

# 5 System Certification and Type Approval

The ballast water management system installed onboard those vessels receiving the **BWT** or **BWT+** notation is to be a type approved and certified system 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 (Section 3, Table 1), has no adverse environmental impacts, and is suitable for shipboard applications.

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)*.

To receive the **BWT** notation, the ballast water management system installed onboard must receive a Type Approval Certificate issued by an IMO Member State. For system that makes use of active substances, documentations relating to the IMO Basic Approval and Final Approval are required to submit to ABS.

# 7 ABS Approval of BWMS

### 7.1 Certification Requirements

To receive the **BWT+** notation, the ballast water management system installed onboard a vessel shall, in addition to the IMO Member State type approval, be reviewed and approved by ABS for compliance with the applicable requirements of this Guide, ABS Rules, or other recognized standards, and be surveyed by an ABS Surveyor during the manufacture of the system and components. This survey shall include, but is not limited to, material tests, assembly verification and operational testing.

In lieu of a design review, a Product Design Assessment (PDA) is considered acceptable for the design approval of the system and components.

### 7.3 Certification Under ABS Type Approval Program

BWMS and associated components that can be consistently manufactured to the same design and specification may be approved under the ABS Type Approval Program. The ABS Type Approval Program is a voluntary option for the demonstration of compliance of a system or product with the Rules, Guides or other recognized standards. The ABS Type Approval Program consists of two components:

- *Product Design Assessment.* Upon application, the system and components of the BWMS are to be design assessed.
- *Manufacturing Assessment.* Upon satisfactory assessment, evaluation of the manufacturing facility and process under the Manufacturing Assessment phase is to be conducted to confirm its ability to consistently manufacture the main treatment components of the BWMS in accordance with the PDA.

Specific requirements and details regarding ABS Type Approval Program can be found in 1-1-4/7.7 and Appendix 1-1-A3 of the ABS Rules for Conditions of Classification (Part 1).

## 9 Record Keeping and Reporting

To receive the **BWT** or **BWT+** notation, record keeping and reporting are to be set up in compliance with the IMO Convention.

### 9.1 Ballast Water Management Plan (BWMP)

The Convention requires all vessels to have on board and implement a Ballast Water Management Plan approved by the vessel's Flag Administration (*Regulation B-1*). The Ballast Water Management Plan is specific to each vessel and includes a detailed description of the actions to be taken to implement the ballast water management requirements and supplemental ballast water management practices. A full description and standard format of the BWMP can be found in IMO *Guidelines for Ballast Water Management and Development of Ballast Water Management Plan (G4)*.

For guidance, a sample model of an acceptable ship-specific ballast water management plan can be found in the ABS *Guide for Ballast Water Exchange (BWE)*, which can be modified and updated for the development of a treatment based ballast water management plan.

### 9.3 Ballast Water Record Book

Vessels must also have a ship-specific Ballast Water Record Book (*Regulation B-2*) to record when ballast water is taken on board, circulated or treated for ballast water management purposes, and discharged. It is also used to record when ballast water is discharged to a reception facility and if accidental or other exceptional discharges of ballast water take place.

The ballast water logs shall be maintained onboard the vessel for a minimum of two years after the last entry has been made into the ballast water record book. The record book shall be retained by the Company for a minimum period of three years. The ballast water record book shall be kept readily for survey.

An electronic record system or integration of the ballast water logs into another record book is an acceptable alternative to the ballast water record book.

A standard form of the ballast water record book can be found in Appendix II of the Convention.



# SECTION 4 System Related and Installation Criteria

### 1 General

In order to minimize the risk associated with the discharge of harmful aquatic invasive species resulting from ballast water transfers, the ballast water management system must be effective under the range of typical vessel operating conditions without negatively impacting the safety of shipboard personnel or the vessel or the environment into which the ballast water is discharged. Ballast water management systems must meet international protocols under various environmental conditions, aquatic organisms, flow rates, volumes, and retention times. Due to the wide range of factors associated with ballast water treatment, various treatment methods have been developed, or are being developed, for shipboard installation. Type approval of a system, however, does not ensure that a given system will work on all vessels or in all situations. The provisions in this Section address the supplementary classification requirements that apply when a ballast water management system is installed on board a vessel.

To receive the **BWT** or **BWT+** notation, the ballast water management system (BWMS) must be designed, constructed and installed such that:

- *i*) it is proven safe for the shipboard personnel and vessel operations
- *ii)* it complies with the international regulations
- *iii)* it does not degrade the quality of local marine environments upon discharge.

### 3 Common Criteria

The design and installation of a ballast water management system is to comply with the following, unless additional measures, acceptable to ABS, have been provided:

- *i)* The treatment rated capacity (TRC) is to be sufficient to meet the ship's ballast capacity and normal ballast operations rate
- *ii)* Capable of operating effectively at the minimum discharge rate of the ballast pumps or stripping system
- *iii)* Capable of operating effectively with all connected ballast system pumps and eductors
- *iv)* Capable of effectively treating all ballast water regardless of tank location, size or structure
- v) Provide for ballast flow to the furthermost tank at maximum capacity stated in the ship's BWMS specification
- vi) Shall not adversely affect any parts, materials, equipment, structures or coatings
- vii) Shall not exceed the electrical generating capacity of the shipboard power supply under normal in port operating conditions
- viii) Shall not discharge hazardous vapors or byproducts to the atmosphere, other than as considered in the type approval of the BWMS
- ix) All parts of the BWMS are to be easily accessible for inspection and maintenance
- x) Have suitable bypasses or overrides to protect the safety of the ship and personnel in the event of an emergency (See 4/3.9.9)
- *xi)* Comply with all requirements, restrictions and conditions identified in the type approval certificate issued by the IMO Member State.

### 3.1 BWMS Locations

### 3.1.1 General

- i) A ballast water management system 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.
- *ii)* Regardless of the location, all BWMS installations shall be in accordance with all relevant requirements listed in this Guide, the ABS Rules and Guides, and international regulations, standards, guidelines and recommendations.
- *iii)* BWMS equipment enclosures may not be constructed on weather deck locations that will reduce the navigational bridge visibility below the requirements detailed in Section 3-6-1 and portlight details in 3-2-17/7 of the *Steel Vessel Rules*.
- *iv)* New or retrofitted enclosed deckhouse is to comply with the *Steel Vessel Rules* in Section 3-2-11 for structural requirements and Section 3-2-15 for deck openings.
- v) For tank ships transporting combustible, corrosive, or toxic cargo, the BWMS is required to comply with the criteria relevant to the cargo transported and the vessel arrangements as specified in Parts 5A and 5C of the *Steel Vessel Rules*.

### 3.1.2 Locations of BWMS not Involving Hazardous Areas

Ballast water management systems that do not serve ballast tanks considered to be hazardous may be installed in the following locations, unless specifically prohibited due to the treatment method involved:

- *i)* Machinery space or engine room
- *ii)* Void spaces with or without direct access or adjacent to the machinery room
- iii) Dedicated enclosure

### 3.1.3 Locations of BWMS Involving Hazardous Areas or with Process Creating a Hazard

Unless the system configuration, arrangements, locations and isolation arrangements have been specifically accepted by ABS, ballast water management systems that serve ballast tanks considered to be hazardous are to be installed in a void space, weather deck enclosure, or enclosed compartment on the cargo deck, complying the below compartment criteria.

In addition, treatment systems that are prohibited from being installed in areas such as typical machinery space due to the treatment method involved (e.g., treatment process creating a hazard) are to be installed in a void space, weather deck enclosure, or enclosed compartment on the cargo deck, complying the below compartment criteria:

- *i)* Determined to be suitable for the service intended
- *ii)* Treated as "other machinery spaces" with respect to the fire protection
- *iii)* Positioned outside of any combustible, corrosive, toxic, or hazardous areas unless 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 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 oil and chemical carriers. See Section 5 for additional details.

# 3.3 Ventilation Systems

### 3.3.1 BWMS not Involving Hazardous Areas/Concerns

- i) Where the BWMS is installed in the machinery space or engine room, the equipment is to be located in a well ventilated area.
- ii) Where the BWMS is installed in a separate space that is not located within 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.

### 3.3.2 BWMS Involving Hazardous Area/Concerns

Unless specifically approved otherwise, the space for a BWMS serving a hazardous area is to comply with the following requirements:

- i) Where the BWMS is installed in a separate compartment that is located within a hazardous area and treats the ballast water in the ballast tanks that are considered hazardous, but because of the system and enclosure arrangements (e.g., air lock access, ventilation outlets outside of hazardous area, etc.), the interior of the compartment is determined to be non-hazardous and does not contain any sources of release from a ballast tank that is considered to be hazardous, the following ventilation arrangements are to be provided:
  - A mechanical ventilation system that will maintain the space under a positive pressure relative to the external hazardous area
  - The relative overpressure or air flow is to be continuously monitored and so arranged that in the event of a ventilation failure an audible and visual alarm is given at a manned control station and the electrical supply of all equipment (not of the certified safe type) is to be automatically disconnected.
- *ii)* Where the BWMS is installed in a separate compartment that is considered to be a hazardous area, the ventilation system for the space is to provide:
  - At least twenty (20) air changes an hour if there are no sources of release (i.e., flanged connections, strainers, etc.) within the space,
  - At least thirty (30) air changes per hour if there are sources of release within the space, or
  - At least forty five (45) air changes per hour for hazardous space containing sources of release of specific cargoes being categorized such that compliance with Section 15.17 in the "Special Requirements" of the IBC Code is required.

### 3.3.3 Additional Requirements

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

### 3.5 Structural Considerations

The treatment unit and related equipment must 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 *Steel Vessel Rules*, and international regulations, standards, guidelines and recommendations.

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

Any modification to a vessel's structure, stability, or safety considerations, as a result of the ballast water treatment equipment, shall be designed, constructed, and surveyed as indicated in this Guide and the *Steel Vessel Rules*, Part 3 "Hull Construction and Equipment" and Part 5C "Specific Vessel Types".

Note: Careful attention to the BWMS design, foundation, supports, and distribution of weight is to be regarded as of the utmost 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.

### 3.7 Corrosion Effects

Ballast water management systems are not to deteriorate, degrade, or reduce the functional life expectancy of the ballast tank coatings or means of corrosion prevention. Additionally, the treatment method employed is prohibited from resulting in damage, deterioration, or degradation to ballast piping and integral joints that are protected against corrosion by means of a coating or lining.

Several official IMO documents address the potential corrosive effects that ballast water management systems may have on the ballast tanks (including coatings) and the ballast system. Shipyards, BWMS manufacturers, owners and operators are to consider and where appropriate, address the following:

- i) 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*, Section 3.4)
- *ii)* Data-set on the corrosivity to the materials or equipment of normal ship construction should be provided (*G9 Guidelines*, Section 4.2.1.4)
- *iii)* 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)
- iv) Documentation of preliminary assessment of the corrosion effects of the BWMS system (BWM.2/Circ.28)
- v) 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)

Copies of the documentation relating to the corrosion effects of the BWMS, including the test report or preliminary assessment report, which are a part of the IMO Member State's type approval dossiers are to be provided to ABS for reference.

## 3.9 Ballast System

### 3.9.1 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 4 of the *Steel Vessel Rules*. Additional ballast system piping requirements for oil, liquefied natural gas, and chemical carriers including safety arrangement are to comply with the relevant sections of Part 5C of the *Steel Vessel 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.

### 3.9.2 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 4-6-4/7.3 of the *Steel Vessel Rules*.

### 3.9.3 Piping Components Materials and Design

- i) The materials and design of all BWMS piping components (see definition in 4-6-1/3.5 of the *Steel Vessel Rules*) are subject to the requirements of Sections 4-6-1 and 4-6-2 of the *Steel Vessel Rules*.
- ii) In addition, BWMS piping using miscellaneous non-metallic components made of thermoplastic or thermosetting plastic material such as polyvinyl chloride (PVC), fiber reinforced plastic (FRP), etc., in general, are to comply with the requirements of Section 4-6-3 of the *Steel Vessel Rules*. However, special considerations may be given to the fire endurance and flammable spread requirements (4-6-3/5.11 and 5.13 of *Steel Vessel Rules*) subject to the additional requirements specified below for acceptance by ABS.

- a) The components of the ballast water treatment equipment are to be arranged on a skid. Modular installation design will be subject to special consideration.
- b) The inlet, outlet and drain pipes connected to the skid-mounted unit are to be made of steel or equivalent materials. However, fiber reinforced plastic pipe of approved type and suitable design, which has passed at least the level 3 (L3) fire endurance tests, is considered acceptable.
- c) Depending on the exact location of the installed skid-mounted unit within an approved space, local fire fighting arrangements and/or a metallic enclosure covering the non-metallic components may be required at the discretion of ABS.
- d) In case of emergencies, suitable remote operable bypasses are to be provided to isolate the complete non-metallic piping system on the skid-mounted unit from the rest of the ship's piping system.
- e) For the skid-mounted ballast water treatment equipment installed in hazardous locations, the requirements in this section are applicable in addition to the requirements specified in Section 5 of the Guide.
- f) The requirements of the vessel's Flag Administration for non-metallic components made of thermoplastic or thermosetting plastic material are to be satisfied.

### 3.9.4 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 5C-1-7/31.5.2 of the *Steel Vessel Rules* as applicable. A spherical distance within 3 m (10 feet) measured spherically with the vent outlet as the center is to be considered as hazardous.

### 3.9.5 Ballast Water Sampling Piping

Ballast water management systems 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 Section 5, and Parts 1 and 2 of the *G2 Guidelines*.

### 3.9.6 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.

### 3.9.7 Damage Stability Consideration

BWMS piping, where installed within zones of the assumed extent of damage under damaged stability conditions, is to comply with 4-6-4/1.5 of the *Steel Vessel Rules*.

### 3.9.8 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 5/7.3 of this Guide.

### 3.9.9 Bypass Arrangements

Suitable bypass and interlocking arrangements specifically accepted by ABS 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.

### 3.11 Electrical System

### 3.11.1 General

Unless specifically stipulated otherwise in this Guide, the electrical system and electrical equipment are to be in accordance with the electrical requirements of the *Steel Vessel Rules*.

### 3.11.2 Electrical Load Analysis

The total electrical load of a BWMS is to be such that under the normal in port operating conditions of ballasting or de-ballasting the electrical generating capacity installed on the vessel is adequately demonstrated by an electrical load analysis.

### 3.13 Instrumentation

### 3.13.1 Local Instrumentation

Local instrumentation and controls of the BWMS are to be fitted so as to enable safe 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 ballast water treatment 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 ballast water treatment equipment. The local instrumentation is to 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

### 3.13.2 Ballast Control Station Displays

Where remote control stations are fitted, the instrumentation parameters as indicated in 4/3.13.1 i) and iii) and the ballast tank level indications are to be displayed at the remote control station. Display of items in 4/3.13.1 ii) and iv) at the remote control station is advisable.

A tank level gauging system, where fitted, is to be capable of measuring the full height of all ballast tanks individually and provided at the ballast control station. The selection of a tank level gauging system and the connection between the level gauging system and the BWMS are to be specially considered to verify the system compatibility such that the level gauging system work correctly with the BWMS.

# 5 Mechanical Separation Systems

Ballast water management systems utilizing mechanical separation are to comply with the following:

- i) The maximum pressure loss across the BWMS is not to prevent or impair the ability of the ballast system to supply the most hydraulically remote ballast tank at an acceptable flow rate identified in the BWMS manual.
- ii) The arrangements for backwashing, including the flow rate, pressure differential, sizing and routing of the overboard discharge piping, etc., are to be designed such that all wastes will be adequately removed from the system when taking into account the maximum static head imposed when the vessel is at its maximum draft.
- *iii*) Arrangements (e.g., controls, procedures, etc.) are to be designed such that the separation system and associated piping will be backwashed and flushed clean upon completion of ballasting operations before the vessel departs the ballasting port; and if applicable, before the vessel departs the de-ballasting port.
- *iv)* The backwash is not to have an adverse impact on the local marine environment upon discharge when located downstream of an additional treatment measure, unless such arrangements have been approved by the IMO Member State in the type approval of the system.

# 7 Physical Treatment Systems

The primary physical treatments used in ballast water management systems include cavitation, thermal (heat), inert gas, ultrasound, and ultraviolet irradiation (UV). Additional criteria are included, as applicable, within the individual treatment subsection.

### 7.1 Cavitation and Ultrasound Systems

Any pressure loss across the cavitation or ultrasound treatment system shall not impair the ballast water flow to the furthest ballast tank at maximum capacity.

### 7.3 Thermal Systems

The application of thermal (heat) treatment for ballast water management systems shall require a review of all plans, energy balances, structural considerations and operations. Equipment installed for the application of heat to ballast water shall be subject to all relevant requirements in the *Steel Vessel Rules*.

## 7.5 Inert Gas De-oxygenation Systems

The design, construction and operational criteria for a treatment system supplying inert gas to ballast tanks are to comply with the ABS *Guide for Inert Gas System for Ballast Tanks*. Where inert gas is injected directly into the ballast piping, equivalent arrangements for safety, monitoring and controls specified in the ABS *Guide for Inert Gas System for Ballast Tanks* are to be provided.

Any interconnections of a shipboard inert gas system and a vendor supplied inert gas generator intended for ballast treatment is to be subject to special consideration, and arrangements for isolation, interlocks and controls are to be submitted for review.

Additionally, any pressure loss across the treatment shall not impair or prevent the ballast water flow to the furthest ballast tank at maximum capacity. Inert gas ballast water management systems are required to comply with all applicable criteria as specified in this Guide, the above-referenced Guide, *Steel Vessel Rules*, and international regulations and standards.

### 7.7 Ultraviolet Irradiation (UV) Systems

Ultraviolet irradiation ballast water management systems are required to comply with all applicable criteria in this Guide, the *Steel Vessel Rules*, and international regulations, standards, guidelines and recommendations.

Arrangements are to be provided such that the crew will not be exposed to excessive amounts of UV light during operation, maintenance or repairs of the system.

Additionally, the following arrangements are to be provided:

- *i)* A high temperature alarm and high-high temperature automatic shutdown
- ii) Means to prevent the accumulation of air in the top of the lamp enclosure or treatment chamber
- iii) A means to prevent operating the UV lamps without water in the treatment chamber in order to avoid over-heating the UV unit. Such means may include an interlock or an appropriate piping arrangement that maintains a constant flow of water through the treatment chamber to dissipate the heat, etc.
- *iv)* Protection of electrical equipment with respect to the degree of enclosure, insulation materials and maximum ambient temperatures in accordance with 4-8-3/1 of the *Steel Vessel Rules* and the manufacturer's specifications.

Document confirming the instrumentation, monitoring and control equipment for all vital parameters such as the UV dose, lamp power, intensity, etc., including the application conditions for effective assessment of the treatment operations, as specified in the IMO Member State's type approval is to be submitted to ABS.

# 9 Chemical Treatment/Active Substances Systems

### 9.1 Prepared Chemical Treatment Systems

### 9.1.1 General

Ballast water management systems employing a chemical treatment are required to comply with all criteria in this Guide, the ABS Rules and Guides, international standards, flag Administration criteria, recommendations or requirements specified in the chemical manufacturer's Material Safety Data Sheet (MSDS), and local standards involving the discharge of chemical substances. All equipment, piping and components storing, conveying, or creating flammable, toxic or corrosive chemicals as provided for, created by, or resulting from a BWMS must be designed, constructed, operated and maintained in accordance with Sections 4-6-1 through 4-6-7 of the *Steel Vessel Rules*, and flag Administration criteria.

These documents, standards, and criteria are to be reviewed and applied in conjunction with this Guide.

Additionally, the following arrangement/procedures as applicable to the specific chemical treatment system are to be satisfied:

- i) Implementation of a safe and secure means of transferring chemical onto the vessel. Such measures may include a containment that is impact resistant, leak-proof, airtight, and watertight. Volume, weight, and concentration standards may apply.
- ii) Design and installation of containment system for all liquid chemicals stored and in use. The containment system shall be designed to prevent any chemicals from escaping under the maximum inclination conditions and to accommodate the type and volume of chemical being used in the event the primary containment barrier fails.
- *Rules.* Chemicals provided as a gas shall comply with 4-6-7/7.3 and 4-6-7/7.5 of the *Steel Vessel Rules*.
- *iv)* A safe means is to be provided to apply the stored chemicals into operation.
- v) An approved gas detection system shall be installed in all spaces housing the chemicals and chemical treatments to provide a safe environment, proper air supply and ventilation, and leakage detection. Alarm levels will be based on a case-by-case basis acceptable to ABS.
- vi) A high temperature and pressure alarm is to be provided, with its shutdown conditions identified.
- vii) A low pressure alarm is to be provided, with its shutdown conditions identified.

- viii) Chemical level indication, alarms, and automatic shutdown are to be arranged at remote and local control stations
- *iv)* An adequate system capable of self-monitoring and recording of chemical dosages or treatment intensities is to be provided.
- x) An adequate means to prevent overflowing the ballast tanks and unintentional ballast discharge prior to discharge treatment or at any point during the ballast retention above acceptable residual limits is to be provided. Such measures may not impair the safety and stability of the vessel under all operating conditions.
- xi) All equipment, piping, components and coatings exposed to the chemical treatments shall be compatible with the chemical. Chemical treatments shall not induce or accelerate the corrosion of any BWMS or ballast system component.
- chemical storage tanks, and other components of the BWMS subject to leakage, if applicable, are to be provided with spill trays of ample size large enough to cover the leakage points such that manholes, drain valves, gauge glass, filer, pumps, etc.

### 9.1.2 Safety Assessment

A safety assessment study to address the risk to the vessel and its crew is to be conducted. The scope of the safety assessment is to include at least the following subjects:

- i) The loading and storage of chemicals or preparations onto the vessel
- ii) The transfer and application of chemicals or preparations from storage to the BWMS
- *iii)* The position of the BWMS and associated piping
- iv) Operation of the BWMS, specifically any potential impacts on the ship's crew
- v) Maintenance of the BWMS and safe work procedures
- vi) Spillages from the BWMS and emergency response plan

Specifically, this safety assessment is to address the adequacy of the chemical containment system, the ventilation system, fire protection and extinction of those spaces where the chemicals or preparations are stored as applicable, the vessel-specific details concerned with the loading of the ballast water treatment chemicals onto the vessel, the handling and applying of chemicals/ preparations into the BWMS, and the development of vessel-specific health and safety procedures for the normal operation of the BWMS; as well as the procedures to be followed in the event of a spillage on board or crew exposure to the treated ballast water, chemicals or preparations.

The 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 is to be reviewed by ABS to confirm the adequacy of the proposed arrangements. Relevant information resulted from the safety assessment is to be documented in the vessel's ballast water management plan (BWMP).

Additional guidance can be found in the IMO BWM.2/Circ.20, "Guidance to ensure safe handling and storage of chemicals and preparations used to treat ballast water and the development of safety procedures for risks to ship and crew resulting from the treatment process".

# 9.3 Ozone Injection Systems

### 9.3.1 Gas Detection

Ozone sensors are to be installed in the immediate vicinity of the ozone generating unit and along the route of the ozone piping where ozone gas could accumulate. The ozone sensors are to activate an alarm at a manned location when a concentration of 0.1 ppm or more is detected.

### 9.3.2 Ozone Pipe Routing

The routing of the ozone piping is to comply with the manufacturer's recommendations and is not to pass through accommodations or service spaces.

### 9.3.3 Specific System Arrangements

The arrangements of an ozone system are to comply with the following:

- i) Independent vents from the oxygen receiver safety relief valve and any ozone destructor unit are to be led directly to a place on the open deck where the discharges will not cause a safety or health hazard.
- *ii)* Arrangements are to be provided to automatically shut down the system immediately, close the power operated valves and stop all pumps under the following conditions:
  - a) High ambient oxygen concentration (25%);
  - b) High ambient ozone concentration (0.2 ppm);
  - c) The "ozone destructor" (VOD) not being available, if part of the approved system;
  - d) Activation of fire alarm in area of installation; and
  - *e)* Emergency stop push bottom pressed.
- *iii)* Permanent warning plates are to be installed near any areas into which the oxygen or ozone could escape.

### 9.5 Electrochloration Systems

### 9.5.1 Installation Arrangement

The electrochloration unit (ECU) of the electrochlorination BWMS is to be installed in an enclosed dedicated space unless specifically approved otherwise.

The owner is to confirm that the electrochlorination unit will not result in the generation of excessive amounts of chlorine gas. The selection process shall take into consideration of the vessel's operating conditions with specific reference to the pH of the ballast water to be treated by the treatment system.

### 9.5.2 Ventilation Requirements

The space in which the electrochlorination unit is installed is to comply with the ventilation requirements of 4/3.3.2ii). The ventilation fans are to be non-sparking, suitable for use in hazardous areas and interlocked with the equipment so that the fans will be in operation any time when the electrochlorination unit is in operation.

### 9.5.3 ECU Vents

The exhaust vents for any gases generated in the electrochlorination process that could be flammable or harmful to the crew are to be led directly to a place in the open deck where such discharges will not cause a fire or explosion hazard. Where the vented gas could be flammable, the area within 3 meters (10 feet) around the vent outlet is to be considered to be a hazardous area. If the vented gas could be toxic, the location of the vent outlet is to be based on a gas dispersion analysis.

### 9.5.4 Additional Control Arrangements

Where the potential exists for flammable gases to accumulate inside the ECU when the system is not in operation, the system controls are to be arranged such that the electrodes cannot be energized until the unit is full of water. Similar controls are to be provided for any other portions of the system where flammable gases could accumulate if electrical equipment is installed therein.

### 9.5.5 Gas Detection Arrangements

A fixed hydrogen gas detection system is to be provided in the space housing the ECU and arranged such that the activation of the gas detection alarm will result in an automatic shutdown of all electrical power to the BWMS and activation of the ventilation system.

### 9.5.6 Potential Discharge to Ballast Tanks

The potential of any flammable or toxic gas released into the ballast tanks due to the operation of the electrochlorination system and the associated concentration and volume are to be identified and assessed. Where the concentration and/or volume of any flammable or toxic gases released into the ballast tanks could present a danger to the vessel or a hazard to the crew, arrangements are to be provided for the safety of the vessel and crew (e.g., suitability of level gauging system in tank, venting location and arrangements, etc.).

### 11 Combination Treatment

Installation requirements for combination treatments are subject to all criteria and standards for the individual treatment methods applied to the combination treatment.

# 13 Other Treatment Types

Ballast water management systems involving process other than those specifically addressed in Subsections 4/5 through 4/9 above are subject to special consideration.

# 15 Special Fire Fighting Equipment and Arrangements

### 15.1 General

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

- *i)* 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.
- *ii)* The space containing the BWMS is to be such that the boundaries for the space will continue the fire for a period of at least one hour to guard against the inadvertent escape of flammable or toxic gases, and to minimize the likelihood of ignition or structural failure in the event of an escape or loss of containment of the fire.
- *iii)* 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 ABS.

Where such special instructions and/or requirements may interfere with the fire fighting equipment or system being provided in accordance with other Rule requirements, the same must be clearly identified and addressed to the satisfaction of ABS.

### 15.3 Recording in Ship's Manual

The special fire fighting instructions and/or requirements approved by ABS in 4/15.1 above are to be identified in the vessel's operating and safety manuals, and placards indicating the same are to be posted in appropriate locations.

# 17 Sediment Control

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 given in the *G12 Guidelines* are to be adhered to as far as practicable.

There are also practical steps or procedures that can be implemented in the ballast water operation for sediment control. The recommendations given in the *G4 Guidelines*, Part A, Section 1.3, are to be adhered to as far as practicable.

Details of the methods and operational procedures for the sediment management on board the vessel, including the disposal of sediments and the associated safety considerations, etc., are to be documented in the vessel's ballast water management plan (BWMP).



# SECTION 5 Considerations for Oil and Chemical Carriers

### 1 Basic Requirements

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 5C, Chapter 1 and Part 5C, Chapter 2 of the *Steel Vessel Rules*.

# 3 BWMS Equipment Locations

The ballast water management system, to the extent possible, is to be located in a non-hazardous area. Where a BWMS involves electrical equipment, the acceptance of placement in a hazardous location and the associated arrangements will be subject to special considerations and the concurrence of the vessel's flag Administration.

# 5 Ventilation Requirements

The ventilation systems serving spaces containing BWMS equipment are to comply with the requirements in 4/3.3 of the Guide.

# 7 Piping System

### 7.1 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 Section 5C-1-7 of the *Steel Vessel Rules*.

### 7.3 Interconnection Considerations

Piping system serving or having an opening into tanks or spaces that are considered to be hazardous is likewise to be regarded as contaminated and in general, is not permitted to enter machinery and other spaces normally containing sources of ignition as indicated in 5C-1-7/1.17.2 of the *Steel Vessel Rules* due to the potential migration of flammable liquids or vapors from the hazardous area into the non-hazardous area. In association therewith, the following requirements are applicable:

- i) Ballast piping serving ballast tanks considered to be hazardous is not to enter into or be routed through any non-hazardous areas.
- *ii)* Ballast piping serving hazardous areas is not to be interconnected with any piping system serving non-hazardous areas.
- iii) BWMS piping connected to ballast piping serving hazardous areas is not to be routed into non-hazardous areas unless specifically approved isolation arrangements are provided.
- *iv)* For BWMS equipment arranged with piping components made of thermoplastic or thermosetting plastic material, it is to comply with the requirements in 4/3.9.3 ii) of the Guide.

Notes:

- For guidance purpose, Appendix 1 provides a specifically approved example where the BWT sampling units are located in a non-hazardous area such as the engine room, which are connected to a ballast piping system serving a treatment unit installed in a hazardous area such as the cargo pump room.
- Appendix 2 provides another specifically approved sample arrangement where the BWT dosing units are located in a non-hazardous area such as the engine room, which serve a ballast system located in a hazardous area such as a cargo pump room.

# 9 Safety Assessment

Where determined to be necessary by ABS, a safety assessment study to address the risk to the vessel and its crew is to be carried out. The scope of the assessment study is to include at least the following subjects:

- *i)* Equipment locations and hazards associated with the location
- *ii)* System monitoring, control and safety systems
- iii) Operational procedures for the BWMS
- *iv)* Maintenance requirements for the BWMS
- v) Potential release from the BWMS
- vi) Interconnection between piping systems and hazards associated with the same
- vii) Vessel operations during ballasting and de-ballasting

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 ABS to confirm the adequacy of the proposed arrangements. Relevant information resulted from this safety assessment is to be documented in the vessel's ballast water management plan (BWMP).



# **SECTION 6 Operational Management**

# 1 Operating and Safety Manuals

Detailed operating and safety manuals are to be provided on board the vessel as indicated in Section 2, Table 1 and key elements of the manuals are to be included in the ship's Ballast Water Management Plan (BWMP), as appropriate. The manuals are to include the operational, safety and maintenance requirements, as well as occupational health hazards relevant to the ballast water treatment. The manuals are to include an outline of the system design conditions that are to be maintained over the life of the system to comply with the approved design. Details of special tools and gauges required for service or repair are to be provided in the manuals. Additionally, the operating manuals are to include detailed instructions for both local and remote control, and guidance on procedures to be followed in the event of a fault or failure of the system.

The operating and safety manuals are to be submitted for review by ABS to verify the presence of the above information, which is to be consistent with the design information and limitations considered in the vessel's classification and method of ballast water treatment. ABS is not responsible for the operation of the ballast water treatment system.

Any modifications made to an existing ballast water treatment system must be approved by ABS. The operating and safety manuals are to be updated accordingly and submitted to ABS for review.

### 3 BWM Officer

A BWM Officer is to be assigned on board the vessel for receiving the **BWT** or **BWT+** notation. This individual is responsible for the implementation of the BWMP and verifying that all applicable ballast water handling, treatment and maintenance procedures of the ballast water management system are followed and for recording and maintaining the appropriate logs and records.

# 5 Personnel Duties and Training

To assist in the implementation of the Ballast Water Management Plan (BWMP), the vessel's BWM Officers and crew must be trained in the operation of installed the ballast water management system (BWMS) that they serve and be familiar with the duties assigned and the tasks expected to them.

Specifically, the training should include the following, as appropriate:

- *i)* General Information
  - General nature of ballast water management;
  - Requirements of the ballast water management convention;
  - Information on ballast water management and sediment management practices;
  - General aspects of ballast water exchange;
  - General aspects of ballast water treatment technologies and approved treatment systems;
  - General safety considerations; and
  - Documentation requirements ballast water management plan, ballast water management activity logs, and ballast water record book.

## ii) Ship-Specific

- Details of the installed ballast water management system features, components, system processes, control and monitoring, etc.;
- Operating procedures of the BWMS
- Maintenance requirements and procedures;
- Safety aspects of the treatment system and safe work procedures employed onboard the vessel;
- Emergency response plan and preparedness;
- Safety precautions for tank entry for sediment removal;
- Procedures for safe handling and packaging of sediment; and
- Storage of sediment.

Information of the designated BWM Officer, personnel duties, and the training records of the crew assigned and engaged in the operation of the ballast water management system are to be included in the vessel's Ballast Water Management Plan (BWMP).



# **SECTION 7 Survey Requirements**

# 1 Initial Survey

### 1.1 General

### 1.1.1 Classification

An initial survey of the BWMS is to be conducted by ABS Surveyor to verify that the installation of the BWMS including any associated structure, fitting, arrangements and material are in compliance with the requirements of this Guide, as indicated in the approved drawings/plans.

### 1.1.2 Specific Verification of Documentation

The initial survey is also to confirm that the following documentation is on board the vessel (per *G8 Guidelines*, Section 8.1):

- *i)* A copy of the Type Approval Certificate of the BWMS together with a copy of the original test results for the BWMS
- ii) A statement from the IMO Member State, or from a laboratory authorized by the IMO Member State, confirming the electrical and electronic components of the BWMS have been type-tested in accordance with the specification for environmental testing contained in Part 3 of the 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
- v) Installation specifications of the BWMS
- vi) Installation commissioning procedures of the BWMS
- vii) Initial calibration procedures of the BWMS
- viii) A copy of the approved ballast water management plan
- *ix*) Ballast water record book specific to the vessel

The initial survey is also to verify the following (per G8 Guidelines, Section 8.2):

- The BWMS installation has been carried out in accordance with the manufacturer's technical installation specifications.
- *ii)* The BWMS is in conformity with the Type Approval Certificate of the BWMS issued by the IMO Member State or its representative.
- *iii)* The installation of the complete BWMS has been carried out in accordance with the manufacturer's equipment specifications.
- *iv)* Any operational inlets and outlets are located in the positions indicated on the drawings of the pumping and piping arrangements.
- v) 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.
- vi) The control and monitoring equipment operates correctly in accordance with the manufacturer's technical installation specifications.

### 1.3 Shipboard Function Test

After installation of the BWMS, a shipboard function test is to be carried out to the Surveyor's satisfaction at the sea or quay trial, as appropriate. The function test is to demonstrate mainly the ability of the BWMS installation to operate consistently with the ship's normal ballast operations at the treatment rated capacity in a shipboard test cycle and reflecting the manufacturer's specific installation criteria. There is no requirement to prove the biological efficacy of the installed BWMS.

A shipboard function test plan is to be prepared and submitted to ABS for approval prior to the testing. See paragraph 5.1.9 of the *G8 Guidelines* for content requirements of the test plan.

# 3 Surveys After Construction

This section presents the survey requirements for the retention of the **BWT** or **BWT+** notation.

## 3.1 Annual Survey

An Annual Survey is to be conducted to retain the **BWT** or **BWT+** notation status. At each annual survey, the ballast water management system is to be examined. The survey is to include the following, as applicable:

- i) A general, external examination of the structure, any equipment, systems, fittings, arrangements and material or process associated with the ballast water management plan, to confirm that they have been maintained and remain in compliance with the standards in this Guide.
- ii) Operation and maintenance records The Surveyor is to review the ballast water record book to confirm that the record book has been maintained and that the activities, including the maintenance of the ballast water management system, have been properly recorded and that the ballast water management plan is current.
- *Ballast water management* The Surveyor is to verify that an approved BWMP is onboard and the information including the operational and safety procedures, qualification of BWM officer, and crew training, is current.
- *Control and monitoring equipment* The Surveyor is to verify that control equipment that automatically monitors and adjusts the necessary treatment dosages or intensities or other aspects of the ballast water management system of the vessel are operating properly. This includes examination of records of the proper functioning or failure of the ballast water treatment system.

# 3.3 Special Periodical Survey

In addition to the annual survey requirements, the BWMS equipment is to be surveyed in accordance with the *Steel Vessel Rules*, Part 7 requirements for special periodical survey of hull, machinery, automation, and control systems, as applicable. 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.

# 3.5 Additional Survey

Additional survey, either general or partial, according to the circumstances, may be required after a change, replacement, or significant repair of the structure, equipment, systems and arrangements of the ballast water management system to verify continuing full compliance of the Convention, requirements of this Guide, and relevant ABS Rules



# APPENDIX 1 Acceptable Arrangement for Sampling System Piping in a Non-Hazardous Area Connected to a BWT in a Hazardous Area of an Oil or Chemical Tanker

This Appendix presents an acceptable arrangement for BWMS sampling units located in a non-hazardous area such as the engine room, which are interconnected to a ballast water management system in a hazardous area such as the cargo pump room of an oil tanker or chemical carrier via piping. This arrangement is considered to be suitable in providing the protection measures for addressing the possible migration of hydrocarbon or flammable liquids or vapors from the cargo block ballast system.

The arrangement details are s follows:

- 1. All sample monitoring devices, pumps and other related equipment for the sampling system are to be located within a reasonably gas tight enclosure (e.g., fully enclosed steel cabinet with a gasketed door); non-gasketed doors are not acceptable.
- 2. The sampling cabinet is to be mounted on the forward bulkhead separating the hazardous and non-hazardous areas (i.e., typically the fwd engine room bulkhead), except as specially permitted in item 12 below.
- 3. A gas detection device is to be installed in the cabinet and set to initiate an alarm at a manned location such as the ECR, CCR, navigation bridge, etc. upon detection of 30% of the (LEL) lower flammable limit of any possible gases involved. Upon an activation of the alarm, all electrical power to the cabinet is to be automatically disconnected.
- 4. A sensor to detect water leakage is to be installed in the cabinet. The sensor is to initiate an alarm at a manned location (e.g., ECR, CCR, navigation bridge, etc.). Upon an activation of the alarm, all electrical power to the cabinet is to be automatically disconnected.
- 5. The cabinet is to be vented to a non-hazardous area in the weather and the vent is fitted with flame screen. The area within one (1) meter around the vent outlet is to be considered hazardous. (See the intent of 4-8-4/27.3.3 (a) of the *Steel Vessel Rules*)
- 6. A stop (i.e., positive closing) valve is to be installed in each sample pipe at the bulkhead penetration, on the non-hazardous side of the bulkhead. (See the intent of 4-8-4/27.3.3 (a) of the *Steel Vessel Rules*)
- 7. An automatic fail-closed valve is to be installed in each sample pipe where the pipe enters the cabinet. This valve is to be located within the cabinet and arranged to close upon loss of power or activation of gas detection or float level alarms.
- 8. A stop valve is to be installed at the connection of the sampling lines to the ballast piping.
- 9. The valves mentioned in items 6, 7 and 8 above are to be suitable for both liquids and gases with "zero" leakage (e.g., bubble tight soft seated valves governed by *API 598* or *MSS SP-61*).
- 10. Bulkhead penetrations of sampling piping, between safe and hazardous areas, are to be of approved types and have the same fire integrity as the division penetrated.
- 11. The sampling lines are to be routed directly into the sampling cabinet, if possible. Where the sampling lines are not routed directly into the sampling cabinet, the arrangements are to be in accordance with item 12 below.

- 12. Where the cabinet cannot be mounted directly on the forward bulkhead or the sampling piping is not routed directly into the cabinet, the sampling pipes are to be of steel or other equivalent material and without detachable connections, except for the connection points for isolating valves at the bulkhead and the isolation valves within the cabinet. Runs of the sampling pipes within the safe space are to be as short as possible.
- 13. Any component or equipment located in the hazardous area (i.e., cargo block) must be suitable for the location and service (e.g., intrinsically safe or explosion proof, etc.).

FIGURE 1
Acceptable Interconnection Arrangement of BWT Sampling System Piping

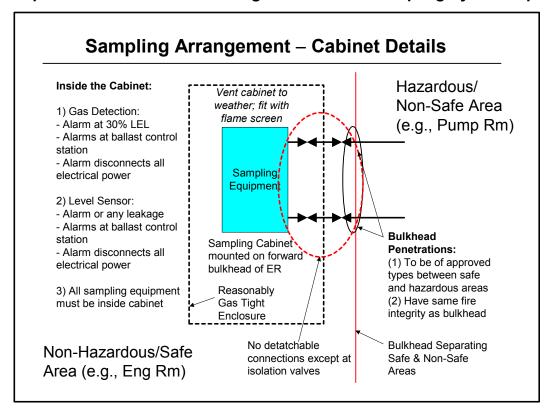
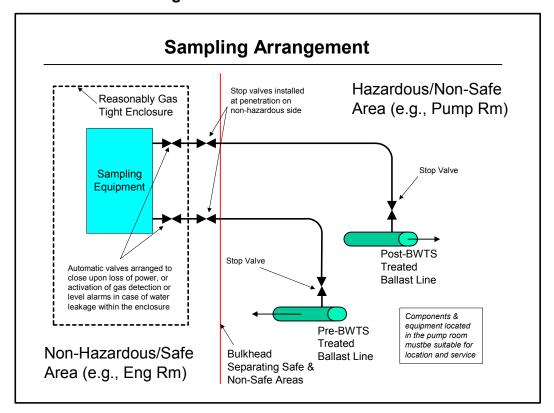


FIGURE 2 **Arrangement Details inside the Cabinet** 





# APPENDIX 2 Acceptable Isolation Arrangement of a BWT Dosing Piping System on Oil or Chemical Tankers

This Appendix presents an acceptable isolation arrangement of BWT dosing units located in a non-hazardous area such as the engine room, which are interconnected to a ballast water system in a hazardous area such as the cargo pump room of an oil or chemical carrier via piping. These recommended arrangements provide suitable protection measures in addressing the pollution hazards and safety concerns due to the potential migration of hydrocarbon or flammable liquids or vapors from the hazardous areas.

The arrangement details are as follows:

1. All sample monitoring Bulkhead penetration of the dosing piping, between safe and hazardous areas, is to be of an approved type and have the same fire integrity as the division penetrated.

### Non-hazardous Area

- 2. The dosing piping is to pass through the bulkhead separating the safe and non-safe areas at as high an elevation in the machinery space as possible. Preferably, just below the main deck.
- 3. A stop/check valve or a combination of a stop (i.e., positive closing) valve and a check (i.e., non-return) valve is to be installed just aft of the bulkhead separating hazardous and non-hazardous areas to prevent back flow into the dosing unit.
- 4. A system controlled, fail closed valve that is closed at all times other than when the dosing system in operation is to be installed in the dosing line directly behind the stop/check valve required in item 3 above.
- 5. A reverse flow monitor with an alarm and system shut down is to be fitted in the dosing line.
- 6. The valves mentioned in items 3 and 4 are to be suitable for both liquids and gases with "0" leakage (e.g., bubble tight valve).

### Hazardous Area

- 7. A passive in-line device capable of preventing the passage of vapors back through the dosing piping when the system is not operating is to be provided. This may be a loop seal, a water (liquid) seal, a block and vent arrangement, etc. provided it is established that it is:
  - a) Capable of preventing the back flow of vapors against at least a 60-inch H<sub>2</sub>O head of pressure,
  - b) Suitable for the service when considering the dosing agent involved (gas, liquid, etc.), and
  - c) Operates passively. The in-line device is to be located just forward of the bulkhead separating hazardous and non-hazardous areas and is to be installed as high as possible in the pump room.
  - Note: Where a water (liquid) seal is utilized, means are to be provided to properly maintain the liquid level at all times via arrangements which do not introduce additional hazardous/non-hazardous interconnection issues (e.g., air gap, etc.).
- 8. Means are to be provided to prevent any liquid seal from freezing where exposed to the weather.
- 9. A stop/check valve or a combination of a stop valve and a check valve is to be installed at the connection of the dosing line to the ballast piping.
- 10. The valve mentioned in items 9 are to be suitable for both liquids and gases with "zero" leakage (e.g., bubble tight valve)

Other devices and arrangements, installed in lieu of the water seal, can be considered.

Notes:

- Where fixed gas detection arrangements are provided for ballast tanks, arrangements are to be provided that the positive closing valve at the bulkhead is closed upon detection of 30% LEL within a ballast tank.
- 2 Placards are to be located at all relevant locations indicating "Valves to be closed when the system is not in operation".

FIGURE 1
Acceptable Interconnect Arrangement for BWT Dosing Piping

