



GUIDE FOR

**BALLAST WATER TREATMENT
NOVEMBER 2019**

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

© 2019 American Bureau of Shipping. All rights reserved.
1701 City Plaza Drive
Spring, TX 77389 USA

Foreword (1 November 2019)

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 for Ballast Water Treatment* (November 2019) has been revised to include provisions from the Code for Approval of Ballast Water Management Systems (BWMS Code) (2018) and other supporting IMO documents.

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**

CONTENTS

SECTION	1	General.....	8
	1	Application	8
	3	Objective/Scope.....	8
	5	Basis of Notation	8
	7	Classification Symbol and Notation.....	9
	7.1	Systems Installed Under Survey (1 August 2014).....	9
	7.3	Systems Not Installed Under Survey.....	9
	9	Governmental Regulations (1 August 2016).....	10
	9.1	United States Coast Guard Type Approval.....	10
	11	Alternatives.....	10
	13	Definitions	10
		FIGURE 1 Scope of BWT Guide (1 August 2016).....	13
SECTION	2	Classification and Documentation.....	14
	1	Plans and Documentation.....	14
	1.1	Ship Plans and Operational Manuals.....	14
	1.3	Required Specific Certification and Documentation.....	16
	3	Engineering Review (1 August 2016).....	18
	5	Surveys.....	18
		TABLE 1	14
		TABLE 2	16
SECTION	3	General Requirements (1 August 2014).....	19
	1	Ballast Water Discharge Standards	19
	3	System Certification and IMO Member State Type Approval.....	19
	5	ABS Approval of BWMS (1 August 2016).....	19
	5.1	Certification Requirements.....	19
	5.3	Certification Under the ABS Type Approval (TA) Program.....	20
	7	Record Keeping and Reporting.....	20
	7.1	Ballast Water Management Plan (BWMP) (1 August 2016).....	20
	7.3	Ballast Water Record Book.....	21

TABLE 1 Summary of Convention D-2 Discharge Standards..... 19

SECTION	4 System-Related and Installation Criteria.....	22
1	General (1 August 2016).....	22
3	Common Criteria.....	22
3.1	BWMS Locations.....	23
3.3	Ventilation Systems (1 August 2016).....	24
3.4	BWMS Installations in Hazardous Areas on the Deck of Oil Carriers, Chemical Carriers or Tank Barges (1 August 2016).....	26
3.5	BWMS Installations in Steering Gear Compartments (1 August 2016).....	28
3.6	Structural Considerations (1 August 2014).....	29
3.7	Corrosion Effects.....	30
3.9	Ballast System.....	30
3.11	Electrical System (1 August 2014).....	33
3.13	Instrumentation (1 August 2016).....	33
5	Mechanical Separation Systems.....	33
7	Physical Treatment Systems.....	34
7.1	Cavitation and Ultrasound Systems.....	34
7.3	Thermal Systems.....	34
7.5	Inert Gas De-oxygenation Systems.....	34
7.7	Ultraviolet (UV) Disinfection Systems (1 August 2014)...	34
9	Chemical Treatment/Active Substances Systems.....	35
9.1	Prepared Chemical Treatment Systems (1 August 2016).....	35
9.3	Ozone Injection Systems.....	37
9.5	Electrochlorination Systems (1 August 2014).....	38
11	Combination Treatment.....	39
13	Other Treatment Types.....	39
15	Special Fire Fighting Equipment and Arrangements.....	39
15.1	General.....	39
15.3	Recording in the Ship's Manual.....	39
16	Special Personnel Protective Equipment and Arrangements (1 August 2016).....	40
17	Sediment Control.....	40

FIGURE 1 Example of a BWMS Compartment Installed in a
Steering Gear Compartment (1 August 2016)..... 29

SECTION	5 Considerations for Oil, Gas, and Chemical Carriers and Tank Barges.....	41
1	Basic Requirements (1 August 2016).....	41
1.1	Tank Barges.....	41
3	BWMS Equipment Locations and Suitability (1 August 2016).....	41

	3.1	Definition of Hazardous Areas.....	41
5	5	Ventilation Requirements (<i>1 August 2014</i>).....	42
	7	Piping System.....	42
	7.1	General.....	42
	7.3	Interconnection Considerations.....	42
9	9	Safety Assessment (<i>1 August 2014</i>).....	43
SECTION	6	Operational Management.....	44
	1	Operating and Safety Manuals (<i>1 August 2014</i>).....	44
	3	BWM Officer.....	44
	5	Personnel Duties and Training.....	44
SECTION	7	Survey Requirements.....	46
	1	Initial Survey.....	46
	1.1	General.....	46
	1.3	Shipboard Function Test.....	47
	1.5	Validating Compliance with Regulation D-2 During BWMS Commissioning.....	47
	3	Surveys After Construction.....	48
	3.1	Annual Survey.....	48
	3.3	Special Periodical Survey.....	48
	3.5	Additional Survey.....	49
SECTION	8	Ballast Water Management Plan (<i>1 August 2014</i>).....	50
	1	General	50
	3	Development of Ballast Water Management Plan.....	50
	3.1	General Information.....	50
	3.3	Contents of Plan (<i>1 August 2016</i>).....	51
	5	Ballast Water Management Plan Template.....	51
APPENDIX	1	Acceptable Arrangement for Sampling System Piping in a Non-Hazardous Area Connected to a BWMS in a Hazardous Area of an Oil or Chemical Tanker (<i>1 August 2016</i>).....	52
		FIGURE 1 Acceptable Interconnection Arrangement of BWMS Sampling System Piping (<i>1 August 2016</i>).....	53
		FIGURE 2 Arrangement Details inside the Cabinet (<i>1 August 2016</i>) ..	54
APPENDIX	2	Acceptable Isolation Arrangement of a BWMS Dosing Piping System on Oil or Chemical Tankers (From a Non-hazardous Area to a Hazardous Area) (<i>1 August 2016</i>)	55
		FIGURE 1 Acceptable Interconnection Arrangement for BWMS Dosing Piping.....	56

APPENDIX 3 Acceptable Isolation Arrangement of a BWMS Dosing Piping System on Oil or Chemical Tankers (From a Non-hazardous Compartment to a Non-hazardous Area Routed Through a Hazardous Area) (1 August 2016)	57
FIGURE 1 (1 August 2016)	57
APPENDIX 4 BWMS in a Non-hazardous Area Serving Ballast Tanks in a Hazardous Area	60
1 General Guidelines for All Installations (1 August 2016)	60
3 Using a Loop Seal	61
3.1 Non-hazardous Area.....	61
3.3 Hazardous Area.....	61
5 Using a Water Column.....	62
5.1 Non-hazardous Area.....	62
5.3 Hazardous Area.....	62
6 Using a Spool Piece	63
6.1 Non-hazardous Area.....	63
6.2 Hazardous Area.....	63
7 Using a Double Block and Bleed Assembly (1 August 2016)	64
9 BWMS in the Engine Room Serving a Non-hazardous Aft Peak Tank and Simultaneously Serving Hazardous Ballast Tanks in the Cargo Block	65
APPENDIX 5 BWMS Installations on Dedicated Articulated Tug-Barge (ATB) Combinations (1 August 2016)	66
1 General	66
3 Requirements for All Installations	66
5 Configurations of BWMS	67
Figure 1(1 (1 August 2016).....	69
Figure 2 (1 August 2016).....	70
Figure 3 (1 August 2016).....	71
APPENDIX 6 Additional Arrangements for the Placement of Electrical Equipment in Hazardous Areas(1 August 2014).....	72
APPENDIX 7 Ballast Water Management Plan (1 August 2014)	74



SECTION 1 General

1 Application (1 November 2019)

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 (**as amended**) 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, a vessel having a ballast water management system (BWMS) installed for conducting ballast water management which complies fully with the requirements of this Guide and the applicable Rules and has been installed under survey by ABS Surveyors may be assigned the Ballast Water Treatment (**BWT**) or the Ballast Water Treatment Plus (**BWT+**) classification notation as specified in 1/7 of this Guide.

Where a vessel is fitted with a BWMS 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, a BWMS installed on board a vessel is to be an IMO Member State type-approved and certified system and the installation of this system is to 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 BWMS 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 BWMS 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 1/13 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 (1 November 2019)

This Guide contains the provisions for BWMS and the optional classification notation **BWT** or **BWT +** for vessels classed with ABS. This Guide is intended for use in conjunction with the appropriate ABS Rules. BWMS 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.279(70), “ Guidelines for Approval of Ballast Water Management Systems (G8)”, adopted 28 October 2016
- IMO Resolution MEPC.300(72), “Code for Approval of Ballast Water Management Systems”, adopted on 13 April 2018.
- IMO Resolution MEPC.169(57) “ Procedure for Approval of Ballast Water Management systems that Make Use of Active Substances (G9)”, adopted on 4 April 2008
- IMO Resolution MEPC.127(53), “ Guidelines for Ballast Water Management and Development of Ballast Water Management Plans (G4)”, adopted on 22 July 2005
- IMO Resolution MEPC.209(63), “ Guidelines on Design and Construction to Facilitate Sediment Control on Ships (G12)”, adopted on 2 March 2012
- IMO Resolution MEPC.173(58), “ Guidelines for Ballast Water Sampling (G2)”, adopted on 10 October 2008

7 Classification Symbol and Notation

7.1 Systems Installed Under Survey (1 August 2014)

7.1.1 IMO Member State Type Approved BWMS

Where requested by the Owner, vessels having an IMO Member State type-approved BWMS installed, under survey by an ABS Surveyor and in accordance with this Guide may 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 BWMS 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. See 3/5 for the requirements of ABS Approval of BWMS.

7.3 Systems Not Installed Under Survey (1 November 2019)

Vessels equipped with a BWMS where the installation was not conducted under survey by an ABS Surveyor may obtain the voluntary **BWT** notation, provided that the BWMS 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 BWMS is to be demonstrated to an ABS Surveyor by a shipboard function test (7/1.3), and documentation confirming that the BWMS has been type-approved in accordance with *IMO Resolution MEPC.174(58) Guidelines for Approval of Ballast Water Management Systems (G8)* or *Resolution MEPC.279(70) 2016 Guidelines for Approval of Ballast Water Management Systems (G8)* for systems approved prior to 28 October 2018 and installed prior to 28 October 2020, and type-approved in accordance with *IMO Resolution MEPC.279(70)* for systems approved after 28 October 2018 or installed after 28 October 2020. *Resolution MEPC.300(72) Code for Approval of Ballast Water Management Systems (BWMS Code)*, adopted 13 April 2018 and effective 13 October 2019, revoking *MEPC.279(70)*. This documentation indicates compliance with the ballast water performance standard contained in *Regulation D-2* of the *Convention* to be submitted to ABS.

9 Governmental Regulations (1 August 2016)

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. See below.

9.1 United States Coast Guard Type Approval (1 November 2019)

In 2012 the United States Coast Guard (USCG) issued “Federal Register/Vol. 77, No. 57/, March 23, 2012/ Rules and Regulations; 33 CFR Part 151; 46 CFR Part 162 Standards for Living Organisms in Ships” Ballast Water Discharged in U.S. Waters”, which states the following:

- 1) Ships required to meet these USCG ballast water discharge standards are to use a ballast water management system (BWMS) tested and approved in accordance with 46 CFR 162.060.
- 2) To comply with USCG requirements any BWMS, irrespective of certification under the IMO BWM Convention, is required to undergo USCG Type Approval.
- 3) The USCG regulations include a provision for the use of existing data generated during testing for approval under the IMO BWM Convention, but the tests and evaluations are to at least be the same or equivalent to those in 36 CFR 162.060. To get a USCG Type Approval, a BWMS manufacturer is to work with a USCG accepted independent laboratory (IL) for all of the required tests and evaluations, even in the case where existing data is to be used. In such a case, the IL would evaluate the existing data to determine whether the tests and evaluations meet USCG requirements. For tests and data that have been assessed to not meet Coast Guard requirements, the IL performs all tests and evaluations necessary. Finally, the IL submits a test report asserting that the BWMS has met the USCG requirements, even if the testing and evaluation was performed by another test organization for type approval under the BWM Convention.

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 subject 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 (1 November 2019)

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

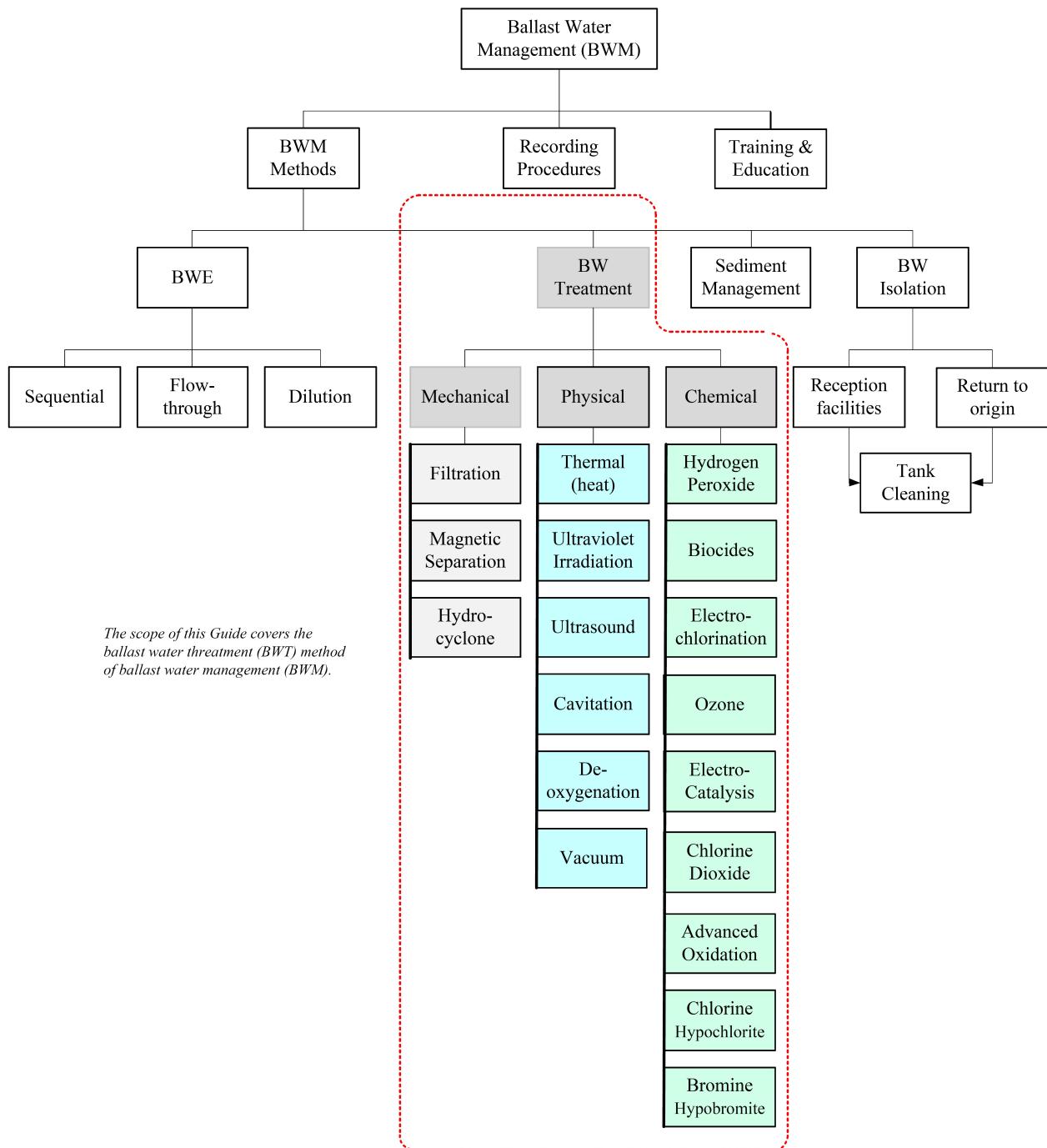
- *2008 G8 compliant* means a ballast water management system that was type approved prior to 28 October 2018 and installed upon a vessel prior to 28 October 2020 using Guidelines provided in *Resolution MEPC.174(58)*
- *2016 G8 compliant* means a ballast water management system that was type approved after 28 October 2016 using Guidelines provided in either *Resolution MEPC.279(70)* or *Resolution 300(72)*.
- *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, 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 Treatment System (BWTS) Refers to Ballast Water Management System.**
- *BWMS Code* means *Resolution MEPC.300(72) Code for Approval of Ballast Water Management Systems*. All references to 2016 G8 should be read to mean references to the BWMS Code after the BWMS Code became effective 13 October 2019.
- *BWMS Code compliant* means a ballast water management system that is type approved after 13 October 2019.
- *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.
- *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 hazards, and example Rule cites are given in 4-1-1/1.9.4 of the *Marine Vessel Rules*. See 5/3.1.
- *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 BWMS 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 BWMS 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 Marine Vessels (Marine Vessel Rules)* and other ABS 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 BWMS made by an IMO Member State in accordance with the *Convention Guidelines G8, G9 and G10*. An approved BWMS 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 (1 August 2016)





SECTION 2 Classification and Documentation

1 Plans and Documentation

1.1 Ship Plans and Operational Manuals

2/1.1 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 a specific treatment system.

TABLE 1 (1 November 2019)

Type of Ship Plans and Manuals	Additional Description	Placed Onboard Vessel for Survey (S)
General arrangement drawings of the BWMS	Installation arrangement drawings on the ship including location and layout	----
Arrangement and capacity of ballast tanks and pumps		----
Ballast piping system drawings ⁽¹⁾	Layout, filling arrangement, and booklet of construction details of piping system	----
Location of ballast water sampling facilities ⁽¹⁾		----
Electrical circuit drawings and main power cable drawings ⁽¹⁾		----
Power calculation document	Including electrical load analysis	----
Hazardous area installations and hazardous area plans	For oil, gas and chemical carriers, tank barges or MODUs, as if applicable	----
Control, monitoring and safety system documentation ⁽¹⁾	Especially where the controls and monitoring of the BWMS have been connected to or integrated with the vessel's control and monitoring system(s)	----
Documentation in accordance with Section 4-9-3 of the <i>Marine Vessel Rules</i>	BWMS with computer-based systems	----
Local instrumentation arrangement plan ⁽¹⁾		----
Structural plans	Showing installation details of attachment, supports and foundations of principal components of the BWMS	----

Type of Ship Plans and Manuals	Additional Description	Placed Onboard Vessel for Survey (S)
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.	S
Safety documentation for hazardous chemicals	In recognized industry format, such as MSDS, CHRIS Code, Cole-Palmer	-----
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	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	-----
Personnel Protection Equipment arrangements	PPE required by 4/16	S
Firefighting measures	Verification plans. See 4/3.1.1.ii and 4/3.4	S
Ballast water management plan (BWMP)	BWMP is specific to the ship and in a standard format per <i>G4 Guidelines</i> and resolution MEPC.306(73)	S
BWMS operating and safety manual ⁽¹⁾ ⁽⁴⁾	Manual specific to the actual installation onboard the ship; see 6/1 of this Guide	S
Shipboard function test plan for sea or quay trial ⁽²⁾	Function test of the installed BWMS at the sea trial or quay trial in the presence of ABS Surveyor; function test plan per Regulation E-1 of the <i>Convention Guidelines</i> ; see 7/1.3 of this Guide	S
Ballast water record book	Ballast water record book is to be specific to the ship	S
BWMS maintenance book ⁽³⁾	BWMS maintenance book is to be specific to the ship and is to include the manufacturer's recommended items, frequencies and methods used for maintenance.	S

- Notes:
- 1 The BWMS design is to be consistent with the current flag Administration's TA.
 - 2 Shipboard function test plan is to be reviewed for acceptance by an ABS Surveyor prior to commencement of the test.
 - 3 A review by an ABS Surveyor will be carried out to verify that the BWMS maintenance book reflects the manufacturer's recommended items, frequencies and methods used for maintenance. Electronic maintenance records will also be considered acceptable.
 - 4 The operating and safety manual is to be reviewed in accordance with 6/1.

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 2/1.3 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 (1 November 2019)

Type of Document for BWMS	Additional Description	Placed Onboard Vessel for Survey (S)
Type Approval Certificate of BWMS	<i>2008 G8 Guidelines</i> , paragraph 8.1.1 if <i>2008 G8 compliant</i> . Information for the Certificate is to include main particulars of BWMS, approved application, limiting conditions and others as stipulated in <i>G8 Guidelines</i>	S
	<i>2016 G8 Guidelines or BWMS Code</i> , paragraph 8.2.1 if 2016 G8 compliant or BWMS Code compliant. Information for the Certificate is to include main particulars of BWMS, approved application, limiting conditions and others as stipulated in <i>G8 Guidelines</i> .	
Results of test analysis for BWMS	Copy of test results showing the effectiveness and ability to meet IMO discharge standards per <i>2008 G8 Guidelines</i> , paragraph 6.5.4 if <i>2008 G8 compliant</i> .	S
	Copy of test results showing the effectiveness and ability to meet IMO discharge standards per <i>2016 G8 Guidelines or BWMS Code</i> , Part 7, paragraph 7.1.8.	
International Ballast Water Management Certificate	In accordance with the Convention Regulation E-2	S
Documentation verifying IMO Basic Approval of BWMS to <i>G9 Guidelines</i> , if applicable	In a suitable format: i.e., Basic Approval application and GESAMP BWWG review report, etc.	---
Documentation verifying IMO Final Approval of BWMS to <i>G9 Guidelines</i> , if applicable	In a suitable format: i.e., Final Approval application and GESAMP BWWG review report, etc.	---
Statement confirming BWMS type tested in accordance with the environmental testing specifications of the Convention	<i>2008 G8 Guidelines</i> , paragraph 8.1.2 if <i>2008 G8 compliant</i> .	S
	<i>2016 G8 Guidelines or BWMS Code</i> , Part 3, paragraph 3.4 if <i>2016 G8 compliant</i> or <i>BWMS Code compliant</i> .	---

Type of Document for BWMS	Additional Description	Placed Onboard Vessel for Survey (S)
Equipment manuals for major components of BWMS	<i>2008 G8 Guidelines</i> , paragraph 8.1.3 if <i>2008 G8 compliant</i> ; manual should include equipment list and specifications from the BWMS manufacturer	S
	<i>2016 G8 Guidelines or BWMS Code</i> , Part 1, paragraph 1.3.1.3 if 2016 G8 compliant or BWMS Code compliant; manual should include equipment list and specifications from the BWMS manufacturer	
Operations and technical manual	Manual is specific to the ship and approved by the Administration per <i>2008 G8 Guidelines</i> , paragraphs 8.1.4 if <i>2008 G8 compliant</i> .	S
	If 2016 G8 compliant or BWMS Code compliant, Paragraph 8.2.2; ship-specific not required from the BWMS manufacturer.	
Installation specifications	<i>2008 G8 Guidelines</i> , paragraphs 8.1.5 and 5.1.8 if <i>2008 G8 compliant</i> from the BWMS manufacturer	S
	<i>2016 G8 Guidelines, or BWMS Code</i> , Part 1, paragraphs 1.3.1.5 and 1.3.1.6 if 2016 G8 compliant or BWMS Code compliant from the BWMS manufacturer	
Installation commissioning procedures	<i>2008 G8 Guidelines</i> , paragraph 8.1.6 if <i>2008 G8 compliant</i> or paragraph 8.2.5 if 2016 G8 compliant or BWMS Code compliant from the BWMS manufacturer	S
	<i>2016 G8 Guidelines or BWMS Code</i> , paragraph 8.2.5 if 2016 G8 compliant or BWMS Code compliant from the BWMS manufacturer	
Initial calibration procedures	<i>2008 G8 Guidelines</i> , paragraph 8.1.7 if <i>2008 G8 compliant</i> from the BWMS manufacturer	S
	<i>2016 G8 Guidelines or BWMS Code</i> , Part 1, paragraph 1.3.2.7 if 2016 G8 compliant or BWMS Code compliant from the BWMS manufacturer	

Type of Document for BWMS	Additional Description	Placed Onboard Vessel for Survey (S)
Documentation relating to the environmental and public health effects of the BWMS	BWM.2/Circ.28, paragraph 3.1.13.7 and <i>2008 G8 Guidelines</i> , Part 1, Paragraph 1.6.4 if 2008 G8 compliant; BWMS manufacturer is to provide information to ship owner	---
	<i>BWM.2/Circ.28, paragraph 3.1.13.7 and 2016 G8 Guidelines or BWMS Code</i> , Part 1, Paragraph 1.6.4 if 2016 G8 compliant or BWMS Code compliant; BWMS manufacturer is to provide information to ship owner	
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	---

3 Engineering Review (1 August 2016)

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 arrangements for hazardous area installations and hazardous area plans for oil, gas and chemical carriers, tank barges, and MODUs, 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 BWMS 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 7/3.



SECTION 3 General Requirements (1 August 2014)

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 3/1 TABLE 1. 3/1 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 Standard
Size \geq 50 μm in minimum dimension	< 10 viable organisms/m ³
10 \leq Size < 50 μm in minimum dimension	< 10 viable organisms/milliliter
Size < 10 μm in minimum dimension	No limit
Toxicogenic <i>Vibrio cholera</i> (O1 and O139)	< 1 cfu * / 100 milliliters, or < 1 cfu * / gram (wet weight) zooplankton samples
<i>Escherichia coli</i>	< 250 cfu * / 100 milliliters
Intestinal Enterococci	< 100 cfu / 100 milliliters

Note: * cfu = colony forming units

3 System Certification and IMO Member State Type Approval (1 November 2019)

The BWMS 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)*" if 2016 G8 compliant or the IMO's *BWMS Code* if *BWMS Code* compliant. These processes are to verify that the treatment system meets the IMO discharge standards (3/1 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)*".

5 ABS Approval of BWMS (1 August 2016)

5.1 Certification Requirements

To receive the **BWT** notation, the BWMS installed onboard is to receive a Type Approval Certificate issued by an IMO Member State. For a system that makes use of active substances, documentation relating to the IMO Basic Approval and Final Approval are required to be submitted to ABS.

To receive the **BWT+** notation, the BWMS installed onboard a vessel, in addition to the IMO Member State type-approval, is to 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 is to include, but is not limited to, material tests, assembly verification and operational testing. See also 3/5.3 below.

For obtaining ABS certification, the acceptability of an IMO Member State Type Approval (TA) by ABS will be subject to the following requirements:

- i) The approval of a BWMS installation or the issuance of an ABS PDA/TA Certificate, will be subject to the condition that the documentation submitted includes the current valid flag Administration TA Certificate, Instruction Manual with the associated original approved piping schematics, along with its related components positively identified in the vendor's/manufacturer's submission for review or approval.
- ii) The approval of a BWMS installation will only be considered subject to, and only if, the exact configuration of the entire system, with each of its components has been included in the schematics to be approved, as identified in the documentation in 3/5.1.i above.
- iii) The acceptance of any deviation from the original flag Administration TA will be subject to the submission of documentation to ABS, issued by the TA issuing flag Administration or an RO on behalf of the TA issuing flag Administration with the endorsement of the flag Administration certifying that the deviation is acceptable within the framework of the original flag Administration TA certification. Such certification of acceptance will not be valid if issued by an RO only, in lieu of issuance of certification by an RO on behalf of the TA issuing flag Administration.

5.3 Certification Under the ABS Type Approval (TA) Program

BWMS and associated components that are IMO type-approved 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:

- i) *Product Design Assessment.* Upon application, the system and components of the BWMS are to be design assessed.
- ii) *Manufacturing Assessment.* Upon satisfactory assessment, evaluation of the manufacturing facility and process 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 the 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)*. See 4/3.9.3.i for the requirements of the main BWMS components as defined in 1/7.1.2 of this Guide

7 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.

7.1 Ballast Water Management Plan (BWMP) (1 August 2016)

7.1.1 General Requirements

Regulation B-1 of the Convention requires all vessels to have on board and implement a BWMP approved by the vessel's Flag Administration. The BWMP is specific to each vessel and is to be prepared in accordance with the *MEPC.127(53) "Guidelines for ballast water management and development of ballast water management plan (G4)"*. The plan is to include a detailed

description of the actions to be taken to implement the ballast water management requirements and supplemental ballast water management practices.

A BWMP template is provided in Appendix A7 to assist in the development of a suitable BWMP for ballast water management operations. See Section 8. A new, generic ballast water reporting form has been developed to include entries of treatment of ballast water required by the IMO guidelines.

The BWMP is to be written in the working language of the vessel. If the language used is not English, French or Spanish, a translation into one of these languages is to be made. The plan is to be readily accessible and available for examination upon request by the authorities such as the port State authorities.

7.1.2 Maintenance of Ballast Water Management Plan

The BWMP is to be reviewed periodically by the Owner, operator, ballast water management officer or Master and maintained up to date. Any changes to the provisions of the BWMP are to be submitted for review and approval to ABS.

Suitable briefing and training are to be provided to the vessel's crew on changes/updates made to the BWMP, particularly for those related to the operational and/or safety aspects of the ballast water management operation

7.3 Ballast Water Record Book

Vessels are to 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 are to 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 is to be retained by the Company for a minimum period of three years. The ballast water record book is to be readily available 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 (1 August 2016)

In order to minimize the risk associated with the discharge of harmful aquatic invasive species resulting from ballast water transfers, the BWMS is to 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. BWMS is to 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 BWMS is installed on board a vessel.

To receive the **BWT** or **BWT+** notation, the BWMS is to be designed, constructed and installed such that:

- i) It is suitable for operation by shipboard personnel and is of sufficient capacity for the vessel's 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 BWMS is to comply with the following, unless additional measures acceptable to ABS have been provided:

- i) (*1 August 2016*) The treatment rated capacity (TRC) is to be sufficient to meet the ship's ballast capacity and normal ballast operations rate. The maximum flow rate at which a BWMS is operated as specified by the Type Approval certificate is to be clearly reflected in the BWMS shipboard operating manual.
- ii) Capable of operating effectively at the minimum discharge rate of the ballast pumps or stripping system
- 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) Does not adversely affect any parts, materials, equipment, structures or coatings
- vii) (*1 August 2014*) Does not exceed the electrical generating capacity of the shipboard power supply under all anticipated ballasting or de-ballasting operating conditions.
- viii) Does 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) Has suitable bypasses or overrides to protect the safety of the ship and personnel in the event of an emergency (See 4/3.9.9)

- xii) (1 August 2014) Complies with all limitations, requirements, restrictions and conditions identified in the Type Approval certificate issued by the IMO Member State.
- xiii) (1 August 2016) Where a vacuum may occur in the ballast piping due to height differences, a suitable means of protection is to be provided (e.g., P/V valves or breather valves), and their intakes/ outlets are to be located in a safe area on the open deck.
- xiv) (1 August 2016) If servicing hazardous ballast tanks and installed in a hazardous area, among the other requirements indicated in this Guide, the BWMS is to comply with Appendix A6. If installed in a non-hazardous area, the BWMS is to comply with Appendices A1 through A5 of this Guide, as applicable.

3.1 BWMS Locations

3.1.1 General (1 August 2016)

- i) A BWMS may be installed in various locations throughout a vessel. The acceptability of the location and arrangements depend on the type of treatment system under consideration, the installation specifications and the type of vessel involved. Each installation is to be carefully evaluated to verify that potential safety concerns and pollution hazard issues are adequately addressed.
- ii) Regardless of the location, all BWMS installations are to be in accordance with all relevant requirements listed in this Guide, ABS Rules and Guides, and international regulations, standards, guidelines and recommendations. If BWMS are installed on existing vessels, plans are to be submitted to verify that the installed BWMS will not impede the firefighting measures provided for the vessel.
- 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 *Marine Vessel Rules*.
- iv) New or retrofitted enclosed deckhouse is to comply with the *Marine Vessel Rules* in Section 3-2-11 for structural requirements and Section 3-2-15 for deck openings.
- v) For tankers 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/5B and 5C of the *Marine Vessel Rules*.

3.1.2 BWMS Located in Non-Hazardous Areas (1 August 2014)

3.1.2(a) When the BWMS is installed in a space that is considered to be non hazardous and the BWMS serves ballast tanks that are considered to be non-hazardous, then the BWMS may be installed in the locations indicated in 4/3.1.2(b), unless specifically prohibited due to the treatment method involved:

3.1.2(b) The BWMS may be installed in the following locations.

- i) Machinery space or engine room
- ii) Void spaces with or without direct access or adjacent to the machinery room
- iii) Dedicated compartment
- iv) Other locations subject to special considerations

3.1.2(c) If the BWMS serves ballast tanks that are considered to be hazardous, the arrangement of the ballast piping cannot permit the ballast water from the ballast tanks to be returned to the space containing the BWMS. See also 5/7.3 of this Guide and 5C-1-7/1.7.2 of the *Marine Vessel Rules*.

3.1.2(d) Gas carrier ballast spaces, including wet duct keels used as ballast piping, and non-hazardous spaces, may be connected to a BWMS located in a machinery space. See 5C-8-3/7.4 of the *Marine Vessel Rules* and 5/3 of this Guide.

3.1.3 BWMS Located in Hazardous Areas (1 August 2016)

3.1.3(a) When the ballast tanks are considered to be hazardous, then the BWMS maybe installed in the locations indicated in 4/3.1.3(b). These spaces are to be considered hazardous spaces by virtue of ballast piping originating from hazardous ballast tanks entering such spaces. See 5C-1-7/1.7.2 of the *Marine Vessel Rules*.

3.1.3(b) The BWMS may be installed in the following locations.

- i) Void space not adjacent to a cargo tank but with ballast piping. See 4/3.1.3(a)
- ii) Void space adjacent to a cargo tank. See 5C-1-7/1.7.2 of the *Marine Vessel Rules*, or
- iii) Enclosed compartment on the cargo deck
- iv) Other locations subject to special considerations

3.1.3(c) The BWMS may be installed in the pump room of oil or chemical carriers subject to the system configuration, arrangements, locations and isolation arrangements being specifically accepted by ABS. See 4/3.3.2.ii and Section 5 of this Guide.

3.1.4 Arrangements

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

- i) Based on the BWMS to be installed, is determined to be suitable for the service intended
- ii) Treated as “other machinery spaces” with respect the fire protection. Such compartments are considered to be entered frequently during operation of the BWMS and are required to be installed with two escape routes. See SOLAS Ch. II-2 Reg.13.4.2.Compartments used for housing BWMS, where the maximum travel distance to the door of the compartment is 5 m or less, may be provided with a single escape route.
- iii) Positioned outside of any combustible, corrosive, toxic or hazardous areas unless alternative arrangements are specifically approved
- iv) Arranged with no direct access to accommodation spaces, service space, machinery space, control stations or other spaces containing sources of ignition, unless alternative arrangements are specifically approved
- v) Watertight integrity of all bulkhead openings and penetrations to be maintained
- vi) Watertight integrity of all deck openings and penetrations to be maintained
- vii) Minimize the extent of bulkhead and deck openings and penetrations
- viii) Additional restrictions and requirements may apply to installations of BWMS serving ballast tanks of oil and chemical carriers. See Section 5 for additional details.

3.1.5 BWMS with Treatment Processes that May Create a Hazard (1 August 2014)

The location of the installation of a BWMS with treatment process that may create a hazard will be subject to specific additional safety measures as required by ABS.

3.3 Ventilation Systems (1 August 2016)

3.3.1 BWMS Installed in Non-Hazardous Areas (1 August 2016)

- i) Where the BWMS is installed in a machinery space such as an engine room, the equipment is to be located in a well-ventilated area.
- ii) Where the BWMS is installed in a separate compartment that is not considered to be a hazardous area and does not serve any ballast tanks considered to be hazardous, the space is to be fitted with an independent mechanical extraction ventilation system providing at least six (6) air changes per hour or as specified by the BWMS manufacturer, whichever is greater. See also 4/3.5 for the requirements for installations in steering Gear compartments.

3.3.2 BWMS Installed in Hazardous Areas

The space containing the BWMS that serves ballast tanks that are considered to be hazardous is to comply with the following ventilation requirements or as specified by the BWMS manufacturer, whichever is greater or unless alternative arrangements are specifically approved:

- i) *Separate hazardous compartment other than a cargo pump room.* Where the BWMS with ballast water piping is installed in a separate compartment that is located within a hazardous area and the BWMS treats the ballast water in the ballast tanks that are considered as hazardous, the installation of the BWMS in the separate compartment is to be provided with the following arrangements:
 - The compartment is to be considered, a hazardous area without any sources of release (i.e., cargo piping with flanged connections, valves etc.) within the separate compartment. See 5C-1-7/5.3.2(b) of the *Marine Vessel Rules*.
 - The ventilation rate is to comply with the requirements of 4/3.3.2.ii.a.
- ii) Where the BWMS is installed in a separate compartment, cargo pump room or ballast pump room that is considered to be a hazardous area or compartments, associated with 4/3.5 below, the ventilation system for the space is to provide:
 - a) At least twenty (20) air changes an hour if there are no sources of release (i.e., cargo piping with flanged connections, strainers, etc.) within the space with or without ballast piping. If the detection of gas reaches a maximum of 30% of LFL of the cargo and/or exceeding of the toxicity limit of the involved chemicals or generated gases,* as applicable, the BWMS is to automatically shut down.
 - b) For oil carriers:
 - 1) At least thirty (30) air changes per hour if there are sources of release within the space, where if the detection of gas reaches a maximum of 30% of LFL of the cargo and/or exceeding of the toxicity limit of the involved chemicals or generated gases,* as applicable, the BWMS is to automatically shut down, or
 - 2) At least twenty (20) air changes per hour if there are sources of release within the space, where if the detection of gas reaches a maximum of 10% of LFL of the cargo and/or exceeding of the toxicity limit of the involved chemicals or generated gases,* as applicable, the BWMS is to automatically shut down.
 - c) For chemical carriers
 - 1) At least thirty (30) air changes per hour if there are sources of release within the space, where if the detection of gas reaches a maximum of 30% of LFL of the cargo and/or exceeding of the toxicity limit of the involved chemicals or generated gases,* as applicable, the BWMS is to automatically shut down. Such hazardous areas include cargo pump rooms and other compartments specified in paragraph 12.1.1, with the exemption of chemical cargoes addressed under 11.1.2 and 11.1.3 of the IBC Code.
 - 2) At least forty five (45) air changes per hour for hazardous cargo pump room spaces containing sources of release of specific chemicals being categorized such that compliance with paragraph 15.17 in the “Special Requirements” of the IBC Code is required

Note: * See 5C-1-7/25.1.1 Gas-safe (Non Hazardous) Space: Gas-safe space is a space in which the entry of gases would produce hazards with regard to flammability or toxicity. Also see 5C-1-7/20, 5C-9-13/2, 5C-8-1/2.24 and 5C-9-21/4.11 of the *Marine Vessel Rules* and 5/3.1 of this Guide.

3.3.3 Additional Requirements

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

Notwithstanding the requirements of 4/3.3.1 and 4/3.3.2, where the BWMS is installed in a separate compartment and either uses, prepares or stores chemicals or generates gases that are considered to be toxic or flammable, the following are to be complied with:

- i) The ventilation system is to provide a minimum of 30 air changes per hour, where if the detection of gas reaches a maximum of 30% of the LFL and/or exceeding of the toxicity limit of the involved chemicals or generated gases the BWMS is to automatically shut down or at an LFL specified by the manufacturer, whichever is more stringent, and
- ii) Where the products in the vapor form are heavier than air, the exhaust extraction is to be taken from the bottom of the compartment. See 5/3.1 of this Guide.

3.4 BWMS Installations in Hazardous Areas on the Deck of Oil Carriers, Chemical Carriers or Tank Barges (1 August 2016)

This Paragraph details the requirements for installations in hazardous compartments and non-hazardous compartments as well as BWMS compartments located within steering gear compartments.

- i) When BWMS compartments are installed on the deck of an existing vessel, specific plans are to be submitted to ABS verifying that the arrangements provided for firefighting on the deck of the vessel will not be compromised. The plans for submission are to verify that the firefighting requirements of 3-5-2/3, 3-2-11/11, 5C-8-11, 5C-1-7/27, and Section 4-7-3 of the *Marine Vessel Rules*, and SOLAS Ch-2, Reg. 10, as applicable, are unaffected by the installation of BWMS compartments on deck.
- ii) For all BWMS compartments a ‘Warning Notice’ is to be placed outside the entrance of the compartment requiring the start of mechanical ventilation prior to personnel entering the compartment.
- iii) An interlock is to be provided for the compartment ventilation such that the electrical power supply to the BWMS cannot be energized while the ventilation is not in operation.

3.4.1 Requirements for Non-hazardous BWMS Compartments

When a BWMS is installed in more than one compartment and where some of the components of the BWMS are installed in a separate compartment located in a hazardous area, the interior of the compartment may be considered and designated as non-hazardous, subject to the provisions of the following arrangements:

- i) There are no portions of the BWMS’s ballast water piping installed within the compartment.
- ii) There are no sources of release (i.e., cargo piping with flanged connections, valves etc.) within the compartment.
- iii) The compartment arrangements include separation from the hazardous space by two gastight self-closing doors without hold back arrangements forming an air-lock capable of maintaining an over-pressure. See 5C-1-7/31.7.1(a) of the *Marine Vessel Rules*
- iv) All ventilation inlets and outlets are routed such that they are located outside of the hazardous area.
- v) The relative overpressure or air flow is to be continuously monitored and so arranged that in the event of a ventilation failure (loss of relative overpressure or loss of air flow) an audible and visual alarm is given at a manned control station and the electrical supply of all equipment (not necessarily of the certified safe type) is to be automatically disconnected. See 5C-1-7/31.7.1(b) of the *Marine Vessel Rules*

- vi) The mechanical ventilation system is to have at least twenty (20) air changes per hour or as required by the BWMS manufacturer, whichever is greater, that will maintain the separate compartment under a positive pressure relative to the external hazardous area.
- vii) The external surface of the floor of the separate compartment is at a height of 2.4 m (8 ft) above the main deck tank top or, alternatively, a cofferdam is installed between the floor of the separate compartment and the main deck tank top with provisions for man entry into the internal cofferdam space for inspection.
- viii) Where the external surface of the floor of the separate compartment is at a height of 2.4 m (8 ft) above the main deck tank top, an air lock with two gas-tight doors would not be required.

Note: * For designating compartments on the deck of MODUs, reference is to be made to 4-3-6 of the MOU Rules.

3.4.2 Requirements for Hazardous BWMS Compartments

Where a vessel's cargo is a combustible liquid, having a flashpoint at or below 60°C (140°F) (closed cup test), and the ballast water originating from hazardous areas enters into such compartments, and there are no sources of release (i.e., cargo piping with flanged connections, valves, etc.) within the compartment, the interior of the compartment is to be considered as hazardous (Zone 2(3)) and the compartment will be subject to the provisions of the following considerations:

- i) Mechanical exhaust ventilation is to be provided with at least 20 air changes per hour. See 4/3.3.2.ii.a
- ii) The components of the BWMS and other equipment located in the compartment are to be suitable for hazardous areas (Zone 2).
- iii) A spherical volume with a radius of 3 meters, with the ventilation exhaust outlet as the center is to be considered as hazardous (Zone 2).
- iv) The ventilation natural intake is to be located in a non-hazardous area.
- v) The intake for the exhaust fan of non-sparking construction is to be from below or near the floor plates and the floor plates are to be of the open grating type to allow the free flow of air.
- vi) Since the BWMS compartment is regarded as a hazardous area Zone 2, the entrance may be located in a hazardous area Zone 2.
- vii) The entrance door is to be of the self-closing type with no hold back arrangements, with a notice "Door to be kept closed at all times"
- viii) An appropriate clearance is to be maintained from the deck with or without a cofferdam. The external surface of the floor of the compartment is to be maintained at a sufficient height above the main deck tank top to facilitate inspection, with provisions for man entry into the internal spaces between the external surface of the floor and the main deck tank top. See also 5/1.1.iii of this Guide for installations on tank barges.
- ix) The requirements of Appendix A6 are to be complied with.

Notes:

- 1 Zone 0 is an area in which an explosive gas atmosphere is present continuously or is present for long periods. See 3.15.1 of IEC 60092-502.
- 2 Zone 1 is an area in which an explosive gas atmosphere is likely to occur in normal operation. See 3.15.2 of IEC 60092-502.
- 3 Zone 2 is an area in which an explosive gas atmosphere is not likely to occur in normal operation but, if it does occur, will persist for a short period only. See 3.15.3 of IEC 60092-502.

4 See also 5/3 of this Guide.

3.5 BWMS Installations in Steering Gear Compartments (1 August 2016)

The steering gear compartment on vessels are in general not to be used for any other purpose other than for which they have been designed.

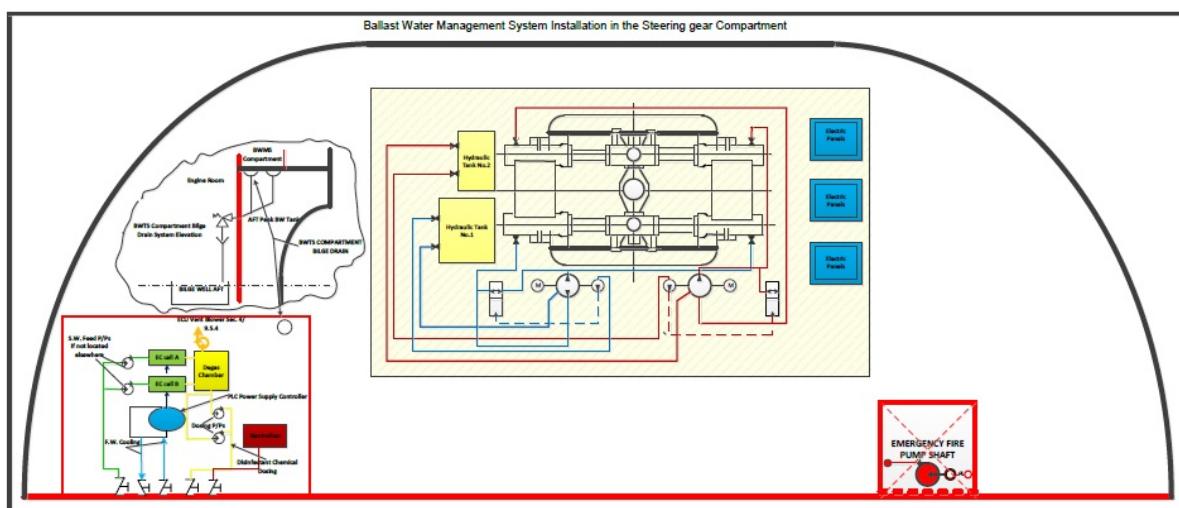
- i) Steering gear compartments:
 - a) Are to meet with the requirements of 4-3-4/1.7 of the *Marine Vessel Rules*. See also SOLAS II-1/29.13
 - b) Normally provided with access to the emergency fire pump, considering that the emergency fire pump is located in the steering gear room space in most cases
 - c) Are normally part of the emergency escape routes on vessels
- ii) If the BWMS cannot be installed in other locations detailed in 4/3.1, ABS may consider the installation of BWMS in steering gear compartments on a case by case basis. See 4/3.5 FIGURE 1 as an example.

For such cases the following requirements are to be complied with:

- a) The BWMS is to be installed in a separate dedicated compartment that may be located within the steering gear compartment.
- b) Ballast water piping is not permitted to be routed through this separate compartment or through the other spaces in the steering gear compartment.
- c) The location of the compartment is to be such that the items identified in 4/3.5.i are not compromised under all conditions of operation or failure of the BWMS. Furthermore, the location of the compartment should not impede the escape routes of the vessel, where applicable.
- d) The BWMS that may be considered for installation in this compartment are to be of the non-combustion type and are limited to the following types:
 - Stored or prepared chemicals and generated gasses
 - Ozone generation/injection
 - Side stream biocide generation and injection (Electrochlorination systems that generate biocide by using a small slip stream.)
 - De-oxygenation by nitrogen injection
 - Other technologies on a case-by-case basis
- e) The small bore process chemical disinfectant, neutralizing chemical, slipstream seawater and freshwater cooling piping as applicable may be permitted to enter the separate compartment.
- f) To prevent liquid spray in case of leakages spraying on to the steering gear and its associated components and/or in to the emergency fire pump space, if applicable, the process liquid and the seawater or fresh water piping as applicable is to be generally routed from the BWMS compartment through the bulkhead between the BWMS compartment and the engine room.
- g) The bulkhead penetration of the BWMS piping between the BWMS compartment and the engine room is to be of an approved type and have the same fire integrity as the division penetrated.
- h) Any hazardous gases evolved as part of the BWMS process, such as hydrogen are to comply with 4/9.5.4 of this Guide.

- i) A positive closing stop valve is to be installed in the BWMS compartment in each pipe at the bulkhead penetration between the BWMS compartment and the engine room.
- j) The mechanical ventilation for the compartment is to be independent from the ventilation system of the steering gear compartment, and/or the ventilation of the emergency fire pump room, if applicable, except that:
 - The ventilation supply may be from within the space of the steering gear compartment.
 - The ventilation outlet is to be routed to the weather deck
- k) The compartment is to comply with all the applicable sections of this guide.
- l) For systems that use seawater or freshwater as part of their processes, the separate compartment within the steering gear compartment is to be fitted with a bilge alarm.
- m) Bilge water may be drained in to the main machinery space; all such drains are to be fitted with a valve operable from above the freeboard deck or a quick-acting, self-closing valve. The valve is to be located in an accessible and visible location and preferably in the main machinery spaces. See 4-6-4/3.7.1 of the *Marine Vessel Rules* and in particular 4/9.1.1.xii of this Guide.
- n) Gravity drains which terminate in engine room spaces protected by fixed gas extinguishing systems are to be fitted with means to prevent the escape of the extinguishing medium.
- o) The compartment is to be installed with appropriate fire detection and fire-fighting provisions.
- p) Alternative routing of process piping may be accepted on a case-by-case basis.

FIGURE 1
Example of a BWMS Compartment Installed in a Steering Gear Compartment
(1 August 2016)



3.6 Structural Considerations (1 August 2014)

The treatment unit and related equipment are to 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 *Marine Vessel Rules*, and international regulations, standards, guidelines and recommendations.

The installation of a ballast water management system on a new or existing vessel is not to 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 is to be designed, constructed and surveyed as indicated in this Guide and the *Marine Vessel Rules*, Part 3 "Hull Construction and Equipment" and Part 5C "Specific Vessel Types".

3.7 Corrosion Effects

BWMS 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 are to be compatible with the coating system (*G9 Guidelines*, Paragraph 3.4)
- ii) Data-set on the corrosivity to the materials or equipment of normal ship construction should be provided (*G9 Guidelines*, Paragraph 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 (1 August 2016)

The ballast systems are to provide a reliable means of filling, transferring and draining ballast tanks employing a BWMS 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 is to comply with all criteria for ballast systems as indicated in this Guide and Part 4 of the *Marine Vessel Rules*. Additional ballast system piping requirements for oil, gas, and chemical carriers, including safety arrangements, are to comply with the relevant sections of Part 5C of the *Marine 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.

BWMS designs and installations on MODUs are to comply with the requirements of this Guide, the ABS *MOU Rules* and the IMO *Code for the Construction and Equipment of Mobile Offshore Drilling Units*, as applicable.

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 *Marine Vessel Rules*.

3.9.3 Piping Components Materials and Design (1 August 2016)

- i) The materials and design of all BWMS piping components (see definition in 4-6-1/3.5 of the *Marine Vessel Rules*) are subject to the requirements of Sections 4-6-1 and 4-6-2 of the *Marine Vessel Rules*.
 - a) The main components of a BWMS, as defined by 1/7.1.2 of this Guide, such as filters subjected to or rated at a pressure greater than 6.9 bars as defined in 4-4-1/1.1 TABLE 1 and 4-4-1/1.9 TABLE 2 of the *Marine Vessel Rules*, are required to be ‘Unit Certified’ to the satisfaction of an ABS Surveyor for all installations.
 - b) Piping and piping components associated with these main BWMS components will be required to meet the requirements of 4-6-1/5 TABLE 1 and 4-6-1/7.1.4 TABLE 2 of the *Marine Vessel Rules*.
- ii) In addition, BWMS piping using miscellaneous nonmetallic 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 *Marine Vessel Rules*. However, special considerations may be given to the fire endurance and flammable spread requirements (4-6-3/5.11 and 4-6-3/5.13 of the *Marine 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 firefighting arrangements and/or a metallic enclosure covering the nonmetallic 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 nonmetallic 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 nonmetallic 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 *Marine 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

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

Piping is to be arranged such that samples are to be taken from the ballast water discharge piping as close to the point of discharge as feasible. BWMS that employ treatment during discharge operations is to 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 (1 August 2014)

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. Alternatively, the remote control valves may remain in the last ordered position upon loss of power, provided that there is a readily accessible manual means to close the valves upon loss of power. 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 *Marine Vessel Rules*.

3.9.8 Ballast Water Stripping

For BWMS 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 the measurements of the TRO (total residual oxidants) level in the ballast system are taken, which may cause an adjustment to 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 stripping eductor in the cargo pump room (hazardous space). See 5/7.3 of this Guide.

3.9.9 Bypass Arrangements (1 August 2014)

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 independently from the BWMS in the event of emergency. Any bypass of the BWMS is to activate an alarm, and the bypass event is to be recorded by the BWMS Control Equipment.

3.11 Electrical System (1 August 2014)

3.11.1 General

Unless specifically stipulated otherwise in this Guide, the electrical system and electrical equipment are to be in accordance with the applicable electrical requirements of the *Marine Vessel Rules*. Special consideration is to be given to specific equipment in accordance with Appendix A6.

3.11.2 Electrical Load Analysis

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

3.11.3 Computer-Based Systems

If a BWMS is installed with a computer-based control system, then the computer-based system is to comply with the requirements of Section 4-9-3 of the *Marine Vessel Rules* as a Category II system. See 4-9-3/9.5 TABLE 2 and 4-9-3/11.9 TABLE 3 of the *Marine Vessel Rules*.

Changes or upgrades of ABS approved computer-based control systems are to comply with the requirements of 4-9-3/5.1.9 of the *Marine Vessel Rules*.

Where it is determined that improper operation of the computer based system may result in an unsafe situation with respect to the treatment process, a detailed failure mode and effects analysis (FMEA) may be required at the discretion of ABS.

3.13 Instrumentation (1 August 2016)

3.13.1 Local Instrumentation

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

Local instrumentation is to indicate ballast operating conditions and status of the ballast water treatment equipment. For installations where the BWMS equipment is not located in the same space as the ballast pumps, the operational status of the ballast pumps is to be indicated near the BWMS equipment. The local instrumentation 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 1) 4/3.13.1.i) and 4/3.13.1.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 4/3.13.1.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 is to be provided at the ballast control station. Where applicable, the selection of a tank level gauging system and its integration with the BWMS is to be specially considered to verify the system compatibility such that the level gauging system works correctly with the BWMS.

5 Mechanical Separation Systems

BWMS utilizing mechanical separation are to comply with the following:

- i) (1 August 2014) The maximum pressure loss across the BWMS during normal operating conditions 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 back washing, 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 back washed 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 BWMS include cavitation, thermal (heat), inert gas, ultrasound, and ultraviolet (UV) disinfection. 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 is not to 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 will be subject to a review of all plans, energy balances, structural considerations and operations. Equipment installed for the application of heat to ballast water is subject to all relevant requirements in the *Marine Vessel Rules*.

7.5 Inert Gas De-oxygenation Systems (1 June 2018)

The design, construction and operational criteria for a BWMS supplying inert gas to ballast tanks are to comply with 5C-1-7/25.43.1(f) to 5C-1-7/25.43.1(l), 5C-1-7/25.43.2(b) and 5C-1-7/25.43.2(e), 5C-1-7/25.43.3, and 5C-1-7/25.43.5 of the *Marine Vessel Rules*. The height of pressure and vacuum valves are to be set in accordance with 4-6-4/9.3.2(a) of the *Marine Vessel Rules*. Where inert gas is injected directly into the ballast piping, equivalent arrangements for safety, monitoring and controls specified in the aforementioned 5C-1-7/25.43 of the *Marine Vessel Rules* are to be provided as far as practicable.

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 is not to impair or prevent the ballast water flow to the farthest ballast tank at maximum capacity. Inert gas BWMS are required to comply with all applicable criteria as specified in this Guide, the above-referenced section of the *Marine Vessel Rules*, and international regulations and standards.

7.7 Ultraviolet (UV) Disinfection Systems (1 August 2014)

Ultraviolet disinfection BWMS are required to comply with all applicable criteria in this Guide, the *Marine 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 a High-High temperature alarm and automatic system shut down
- ii) A UV intensity meter
- iii) Means to prevent the accumulation of air in the top of the lamp enclosure or treatment chamber
- iv) A means to prevent operating the UV lamps without water in the treatment chamber in order to avoid overheating 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.
- v) 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 *Marine Vessel Rules* and the manufacturer's specifications.

A 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 (1 August 2016)

9.1.1 General

BWMS employing a chemical treatment are required to comply with all the criteria specified 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 are to be designed, constructed, operated and maintained in accordance with the applicable requirements in Sections 4-6-1 through 4-6-7 of the *Marine Vessel Rules*, and if applicable, criteria established by a vessel's 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 the containment system for all liquid chemicals that are stored and used are to be such that it prevents 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.
- iii) Chemicals provided as a gas are to comply with 4-6-7/7.3 and 4-6-7/7.5 of the *Marine Vessel Rules*.
- iv) (1 August 2014) In addition to 4/9.1.1.i above, a safe means is to be provided to transfer the stored chemicals into operation.

- v) An approved gas detection system shall be installed in all spaces housing the chemicals and chemical treatment systems, to provide a safe environment, proper air supply, ventilation, and leakage detection. Alarm levels will be based on a case-by-case basis acceptable to ABS.
- vi) (*1 August 2014*) A high temperature, a high pressure alarm and automatic shutdown are to be provided, for any BWMS equipment which may be rendered unsafe due to an increase in temperature or pressure.
- vii) (*1 August 2014*) A low pressure alarm and automatic shutdown are to be provided as applicable.
- viii) Chemical level indication, alarms, and automatic shutdown are to be arranged at remote and local control stations
- ix) 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 chemical treatments are to be compatible with the chemical. Chemical treatments shall not induce or accelerate the corrosion of any BWMS or ballast system component.
- xii) (*1 August 2014*) Chemical storage tanks and other associated 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 as manholes, drain valves, gauge glass, filter, pumps, etc. Drains from such spill trays or chemical dosing sampling/vent piping are not to be led to the engine room bilges or engine room sludge tanks.
- xiii) (*1 August 2014*) Where applicable “Gas Detection Arrangements” and “Potential Discharge to Ballast Tanks”, are to comply with 4/9.5.6 and 4/9.5.7 of this Guide.

9.1.2 Safety Assessment

A safety assessment study specific to the BWMS to be installed and the specific type of vessel under consideration (chemical carrier, oil carrier, gas carrier, container vessel, bulk carrier, etc.) 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:

9.1.2(a) The scope of the safety assessment is to include at a minimum the following:

- 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
- vii) Toxicity of chemicals or gasses associated with the treatment process
- viii) Flammability of chemicals or gasses associated with the treatment process

9.1.2(b) Specifically, this safety assessment is to address at a minimum the following:

- i) *Adequacy of the chemical containment system*
- ii) *Ventilation system*

- iii) *Fire protection and extinction of those spaces where the chemicals or preparations are stored, as applicable*
- iv) *Vessel-specific details concerned with the loading of the ballast water treatment chemicals onto the vessel*
- v) *The handling and application of chemicals or preparations into the BWMS*
- vi) *The development of vessel-specific health and safety procedures for the normal operation of the BWMS, and*
- vii) *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 applied 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 resulting from the safety assessment is to be documented in the vessel's BWMP.

Safety assessments approved by ABS for a specific BWMS installed on a specific type of vessel would be considered in lieu of a safety assessment submission for each of such specific BWMS installations on these specific type of vessels.

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 button pressed.
- iii) Permanent warning plates are to be installed near any areas into which the oxygen or ozone could escape.

- iv) (1 August 2014) A Safety Assessment is to be conducted. See the applicable requirements of 4/9.1.2 of this Guide.

9.5 Electrochlorination Systems (1 August 2014)

9.5.1 Installation Arrangement

Where the electrochlorination unit (ECU) of the BWMS is approved to be installed in hazardous areas, refer to Section 5 and Appendix A6.

9.5.2 Piping Arrangements

Arrangements are to be provided such that the ECU chamber is always filled with water to avoid creating an explosive atmosphere in the event of ingress of flammable fluid into the ECU chamber, and also to avoid excessive surface temperature in the event of a water level drop. This may be achieved by the arrangement of piping, by placing the ECU at a lower position so that it acts similar to a water trap.

Overflow protection for ballast tanks is to be in accordance with 4/9.1.1.x.

9.5.3 Ventilation Requirements

Where the ECU is installed in a compartment, other than those compartments in 4/9.5.1, the ventilation requirements are to comply with 4/3.3.1. The equipment is to be interlocked with the ventilation system so that the ECU cannot be operated unless the ventilation system is in operation. Failure of the ventilation is to give an audible and visual alarm at a manned location.

9.5.4 ECU Vents

The all-welded exhaust piping 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.

9.5.5 Additional Control Arrangements

The following additional control arrangements are to be provided:

- i) An interlock arrangement is to be provided such that the ECU cannot be energized if water flow is less than an acceptable flow rate as identified in the BWMS Manual.
- ii) Interlocks, with water level or leakage detection, are to be provided so that in the event of a drop in the water level the electrical power to the ECU is shut down.
- iii) An independent safety shutdown is to be provided such that excessive temperature or pressure in the ECU shuts down the power supply. This safety shutdown system is to be independent of the control system.
- iv) The arrangements required in items i) through iii) are not to have any overrides or bypasses to defeat the intended safety measures.

9.5.6 Gas Detection Arrangements (1 August 2016)

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.

A BWMS designed on the basis of a full flow electrochlorination process, may preclude the installation of hydrogen gas detection arrangements, subject to:

- i) The results of the Safety Assessment required in 4/9.5.8 below, demonstrating that the amount of hydrogen gas generated is far below the threshold values for which the hydrogen gas evolved may be considered as explosive, and.
- ii) The BWMS TA issuing flag Administration having certified the installation of the BWMS without the inclusion of hydrogen gas detection arrangements.

9.5.7 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 in the safety assessment. See 4/9.5.8. 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.).

9.5.8 Safety Assessment

A Safety Assessment is to be conducted. See the applicable requirements of 4/9.1.2 of this Guide.

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

BWMS involving a process other than those specifically addressed in 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 systems and equipment capable of extinguishing the type and scale of fire likely to occur in association with the installed BWMS.
- ii) *(1 August 2014)* If installed in a separate compartment, for the application of structural fire protection requirements, the BWMS space is to be treated as a machinery space other than a Category A space.
- 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 firefighting equipment or system being provided in accordance with other Rule requirements, the same is to be clearly identified and addressed to the satisfaction of ABS.

15.3 Recording in the Ship's Manual

The special firefighting 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.

16 Special Personnel Protective Equipment and Arrangements (1 August 2016)

Based on the Safety Assessment identified by the requirements in 4/9.1.2 along with the guidance of IMO BWM.2/Circ.20 and the requirements of the IBC and IGC Codes where applicable, a suitable number of protective suits, gloves, boots, gas masks, hermetically sealed filters, etc. are to be located at appropriate locations in the vicinity of the BWMS.

17 Sediment Control

Ballast water tanks and their internal structures should be designed to minimize accumulation of sediments and allow 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 BWMP.



SECTION 5 Considerations for Oil, Gas, and Chemical Carriers and Tank Barges

1 Basic Requirements (1 August 2016)

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, Chapters 1, 2, 8, and 9 of the *Marine Vessel Rules* and Sections 5-2-3, 5-2-4, and 5-2-5 of the *ABS Rules for Building and Classing of Steel Barges*, as applicable.

1.1 Tank Barges

- i) Tank barges may not be designed with a designated pump room as is found on Oil and Chemical carriers. Normally a BWMS would be installed in a deck house with the ballast pumps being of the submerged type.
- ii) The ballast tanks are often wing tanks surrounding the cargo tanks alongside the centerline of the vessel, with fore and aft voids located at the bow and stern of the barge.
- iii) The requirement for tank barges carrying Low Flashpoint Liquids (at or below 60°C (140°F) Closed Cup Test) in 4-1-3/11.1 of the *Rules for Building and Classing of Steel Barges* requires electrical installations to meet the requirements 5C-1-7/31 of the *Marine Vessel Rules*, except that compliance with 5C-1-7/31.5.2.i of the *Marine Vessel Rules* is not required.

3 BWMS Equipment Locations and Suitability (1 August 2016)

- i) The BWMS, to the extent possible, is to be located in a non-hazardous area.
- ii) Electrical equipment installed in hazardous areas is to comply with Appendix A6 of this Guide and 4-8-3/13 and 4-8-4/27.3 of the *Marine Vessel Rules*.*

Note: * The application of IEC 60092-502:1999 may be considered for vessels built prior to 1 January 2007, subject to the submission of plans, verifying that the hazardous areas of such vessels, comply in entirety with IEC 60092-502:1999 as a single concept for hazardous area classification for the entire vessel. The combination of IEC 60092-502:1999 with NEC or API standards etc. is not acceptable.

- iii) When a BWMS is installed in the engine room of a gas carrier, to prevent the migration of gas into the engine room upon failure of a fuel containment system primary barrier, the BWMS is to be automatically shut down and isolated upon gas detection in the inter-barrier space.

3.1 Definition of Hazardous Areas

Hazardous area:

- Is an area in which an explosive gas atmosphere is, or may be expected to be present, in quantities that require special precautions for the construction, installation and use of electrical equipment.
- When a gas atmosphere is present, consideration may also be given to the following hazards that may also be present: toxicity, asphyxiation, corrosivity, reactivity and low temperature.
- For the requirements for toxic cargoes see 5C-9-21/5.5 of the *Marine Vessel Rules*.
- Hazardous Areas (IACS UR M74)

- i) Tankers carrying flammable liquids other than liquefied gases having a flashpoint not exceeding 60°C, for example crude oil, oil products, chemical products. See 4.2 of IEC 60092-502:1999
- ii) Cargoes heated to temperatures (TH) above their flashpoint (FP) and cargoes heated to temperature within 15°C of their flashpoint: TH ≥ (FP – 15°C). See 4.3.2 of IEC 60092-502:1999

5 Ventilation Requirements (1 August 2014)

The ventilation systems serving hazardous spaces containing BWMS equipment are to comply with the requirements in 4/3.3.2 of this 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 *Marine Vessel Rules*.

7.3 Interconnection Considerations (1 June 2018)

A 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-1-7/1.7.2 of the *Marine 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) (1 August 2016) 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. See Appendices A1 through A5 of this Guide.
- iv) (1 August 2016) Where the ballast water does not need to be treated before it is discharged (except for neutralization), the arrangements for stripping eductors situated in the cargo area using water power from the machinery spaces are to comply with the applicable arrangements required in A4/3, A4/5, A4/6 or A4/7 of this Guide. See 5C-9-3/5.1 of the *Marine Vessel Rules* for chemical carriers and 5C-1-7/5.3.2(c) of the *Marine Vessel Rules* for oil carriers.
- v) 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 this Guide.

Notes:

- 1 For guidance purpose, Appendix A1 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.
- 2 (1 August 2016) Appendix A2 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. Also see Appendix A3 for interconnections between a non-hazardous compartment on a hazardous deck and a non-hazardous engine room.
- 3 (1 August 2016) Appendix A4 provides acceptable arrangements for interconnections where the BWMS is in a non-hazardous area and serves hazardous ballast tanks in the cargo area of tankers. The ballast pumps in these arrangements are to be used only for ballasting or for driving stripping/deballasting eductors located in hazardous

areas. Also see Appendix A5 for similar interconnections between a tug and a barge in an articulated Tug-Barge (ATB) configuration.

- 4 (1 August 2014) Appendix A6 specifies additional arrangements for the placement of electrical equipment in hazardous areas such as cargo pump rooms

9 Safety Assessment (1 August 2014)

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
- viii) Failure modes and safeguards

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 resulting from this safety assessment is to be documented in the vessel's BWMP.



SECTION 6 Operational Management

1 Operating and Safety Manuals (1 August 2014)

Detailed operating and safety manuals are to be provided on board the vessel as indicated in 2/1.1 TABLE 1 and key elements of the manuals are to be included in the ship's 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, guidance on procedures to be followed in the event of a fault or failure of the system, and guidance on troubleshooting procedures to be followed.

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 are to 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 for verifying that all applicable ballast water handling, treatment and maintenance procedures of the BWMS are followed and for recording and maintaining the appropriate logs and records.

5 Personnel Duties and Training

To assist in the implementation of the BWMP, the vessel's BWM Officers and crew are to be trained in the operation of the installed BWMS that they serve and be familiar with the duties assigned and the tasks expected of 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
- Documentation requirements – BWMP, ballast water management activity logs, and ballast water record book

ii) Ship-Specific (1 August 2016)

- Details of the installed BWMS-features, components, system processes, control and monitoring, etc.
- Operating procedures of the BWMS
- Maintenance requirements and procedures as detailed by the BWMS manufacturer
- 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
- Storage of sediment

Information on 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 BWMP.



SECTION 7 Survey Requirements

1 Initial Survey

1.1 General

1.1.1 Classification (1 August 2014)

An initial survey of the BWMS is to be conducted by an 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.

See 1/7 and 4/3.11.3 of this Guide and 4-9-3/9.3.4(b) of the *Marine Vessel Rules*.

1.1.2 Specific Verification of Documentation (1 August 2016)

1.1.2(a) (1 November 2019)

The initial survey is also to confirm that the following documentation is on board the vessel (per 2008 *G8 Guidelines*, Paragraph 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 BWMP
- ix) Ballast water record book specific to the vessel

1.1.2(b) (1 November 2019)

The initial survey is also to confirm that the following documentation is on board the vessel (per 2016 *G8 Guidelines/BWMS Code*, paragraph 8.2)

- i) for the purpose of information, a copy of the Type Approval Certificate of BWMS
- ii) the operation, maintenance and safety manual of the BWMS
- iii) the ballast water management plan of the ship
- iv) installation specifications, e.g. installation drawing, Piping and Instrumentation diagrams, etc.; and
- v) installation commissioning procedures

1.1.3 Other Items (*1 November 2019*)

The initial survey is also to verify the following (per *G8 Guidelines*, Paragraph 8.2 if 2008 *G8 Compliant* or paragraph 8.3 if 2016 *G8 compliant* or *BWMS Code compliant*):

- i) The BWMS installation has been carried out in accordance with the manufacturer's technical installation specifications.

This verification is to include a consistency check for the entire system layout between:

- The ABS Engineering approved plans
- The vessel's physical layout of the installed piping, piping components and equipment

- ii) The BWMS is in conformity with the Type Approval Certificate of the BWMS issued by the IMO Member State 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 (*1 November 2019*)

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 the ability of the BWMS installation to operate consistently and continuously during the ship's normal ballast operations at the treatment rated capacity in a shipboard test cycle reflecting the manufacturer's specific installation criteria. The normal ballast operational cycles are to include ballasting, de-ballasting and stripping. The duration of each test cycle is to be to the satisfaction of the Surveyor.ction test is to mainly demonstrate the ability of the BWMS installation to operate consistently and continuously during

A shipboard function test plan is to be prepared and submitted to ABS Survey for acceptance prior to the testing. Refer to paragraph 5.1.9 of the *2008 G8 Guidelines* for *2008 G8 compliant installations* or content requirements of the test plan.

"The documentation submitted for approval should include at least a recommended test and checkout procedure specific to the BWMS.

"This procedure should specify all the checks to be carried out in a functional test by the installation contractor and should provide guidance for the surveyor when carrying out the on board survey of the BWMS and confirming the installation reflects the manufacturer's specific installation criteria"

It is not the purpose of the "Shipboard Function Test" to demonstrate the biological efficacy of the installed BWMS.

1.5 Validating Compliance with Regulation D-2 During BWMS Commissioning (*1 November 2019*)

As directed by the vessel flag Administration, biological testing to validate compliance with regulation D-2 may be required for 2008 *G8 compliant* BWMS, 2016 *G8 compliant* BWMS per paragraph 8.1 of 2016 *G8*, and *BWMS Code compliant* BWMS per paragraph 8.1 of *BWMS Code*.

The MEPC Committee provided guidance for validating compliance of a BWMS with regulation D-2 following installation (refer to *BWM.2/Circular.70 Guidance for the commissioning testing of ballast water*

management systems, as may be revised) and IMO Resolution A.1120(30), Survey Guidelines Under the Harmonized System of Survey and Certification (HSSC), 2017 (as may be amended), Annex 4, Survey Guidelines under the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004.

"verifying that an operational test of the ballast water management system was carried out based on the installation commissioning procedures and that documented evidence is provided which shows compliance of the treated discharge ballast water during the above mentioned test with regulation D-2 through sampling and analysis based on applicable guidelines developed by the Organization"

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 BWMS 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 BWMS, have been properly recorded and that the ballast water management plan is current.
- iii) *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 the BWM officer, and crew training, is current.
- iv) *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 BWMS of the vessel are operating properly. This includes examination of records of the proper functioning or failure of the BWMS.
- v) *(1 August 2016) Operation of the Ballast Water Management System.* On inspection of the records detailed in items 7/3.1.ii and 7/3.1.iv above, if it is found that
 - During an Annual BWMS Survey, the BWMS has not been in operation since the last applicable Survey and/or
 - During the Surveyors BWMS planned maintenance examination it is found that the BWMS has not been subject to the manufacturer's recommended maintenance schedule the entire "Function Test" required by 7/1.3 is to be performed to the satisfaction of the Surveyor.

If the operational status of the ship does not permit the ship to perform any part of the "Function Test" during the Annual Survey, such part tests will be performed at the ship's next convenient port to the satisfaction of the Surveyor.

3.3 Special Periodical Survey

In addition to the annual survey requirements, the BWMS equipment is to be surveyed in accordance with the ABS *Rules for Survey After Construction (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 BWMS to verify continuing full compliance of the Convention, requirements of this Guide, and relevant ABS Rules.



SECTION 8 Ballast Water Management Plan (*1 August 2014*)

1 General

The vessel is to maintain a Ballast Water Management Plan (BWMP) on board for use by the vessel's Master and crew and the port State authorities. The plan is to include:

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

In addition, the BWMP is to include a listing and the details of any exemptions issued by the Administration in accordance with Regulation A-4 of the Convention and, where appropriate, a list of any additional measures issued by a Party to the Convention that are relevant to the vessel's trade. Detailed descriptions of any actions required by the vessel's crew to comply with the additional measures are to be included in the BWMP.

3 Development of Ballast Water Management Plan

3.1 General Information

The IMO Resolution MEPC.127(53) "Guidelines for ballast water management and development of ballast water management plans (G4)" provides specific guidance and a standard format for preparing a vessel-specific BWMP. Appendix II of the Annex to the Convention provides a standard form for a ballast water record book.

Appendix 1 of the IMO Resolution A.868(20) "Guidelines for the control and management of ship's ballast water to minimize the transfer of harmful aquatic organisms and pathogens" contains a ballast water reporting form which is suitable for use in instances where ballast water exchange is intended. When a treatment method is used as a ballast water management practice, the following specific information related to the treatment system and ballast treatment activities are required to be recorded:

- BWMS installed onboard the vessel including general information of treatment method(s), make and model of system,
- Ballast water treatment operation history including date/time of operation, estimated volume treated in tanks that are intended to be discharged at port of arrival
- Information of second ballast water treatment, if applicable
- Events involved in failures/malfunctions of the BWMS that affected the treatment of ballast water

Given the above requirements, a new generic ballast reporting form has been developed to include all the above required record entries for instances where a treatment system is used for ballast water operations. This form can be found in the BWMP template.

3.3 Contents of Plan (1 August 2016)

The BWMP is to contain the information required by Regulation B-1 of the Convention. The plan is to contain, at least, the following information:

- Ship particulars
- Index of sections for referencing the contents of the plan
- Introduction or explanation of the need for ballast water management and for reporting to port States
- Description of ship's ballast water system including ballast water sampling points
- Description of the management method(s) used on board for ballast water management and sediment control
- Safety procedures for the ship and the crew. See 4/16, "Special PPE and Arrangements".
- Operational and safety restrictions
- Procedures for disposal of sediments
- Methods of communication
- Duties of ballast water management officer
- Ballast water recording requirements
- Information on crew training and familiarization, including training record
- Information of any exemptions granted to the vessel under Regulation A-4
- Supporting documentation including copies of reference document on ballast water management regulations and existing national, regional or local quarantine requirements for ballast water management
- Ship's ballast water record book including copies of the completed ballast water record forms and ballast water handling logs

5 Ballast Water Management Plan Template

An editable template of a vessel's BWMP that may be modified to suit a specific vessel is given in Appendix A7.



APPENDIX 1 **Acceptable Arrangement for Sampling System Piping in a Non-Hazardous Area Connected to a BWMS in a Hazardous Area of an Oil or Chemical Tanker (1 August 2016)**

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 and/or toxic liquids or vapors from the cargo block ballast system.

The ballast tanks detailed in this Appendix are considered as hazardous if they are adjacent to cargo tanks.

The details of the arrangements are to be as 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 forward 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 audible and visual alarm at a manned location such as the ECR, CCR, navigation bridge, etc., upon detection of 30% of the (LFL) lower flammable limit and/or exceeding of toxicity limit of any possible gases involved. Upon an activation of the alarm, all electrical power to the cabinet is to be automatically disconnected. See 5C-9-13/2 and 5C-9-21/4.1.1 of the *Marine Vessel Rules*.
- 4) A sensor to detect water leakage is to be installed in the cabinet. The sensor is to initiate an audible and visual 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 deck and the vent is to be fitted with a 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 *Marine Vessel Rules*)
- 6) A positive closing 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 5C-1-7/17.9.iii of the *Marine Vessel Rules*) A warning plate stating "Keep valve closed when not performing measurements" is to be posted near the valves.
- 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 non-hazardous 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 non-hazardous space are to be as short as possible.
- 13) Any component or equipment located in the hazardous area (i.e., cargo block) is to be suitable for the location and service (e.g., intrinsically safe or explosion proof, etc.).
- 14) Arrangements are to be provided to transfer ballast water drained from sampling systems back to the ballast water system in the hazardous area.
- 15) A safety relief valve is to be installed for each sampling pipe in the hazardous area.

FIGURE 1
Acceptable Interconnection Arrangement of BWMS
Sampling System Piping (1 August 2016)

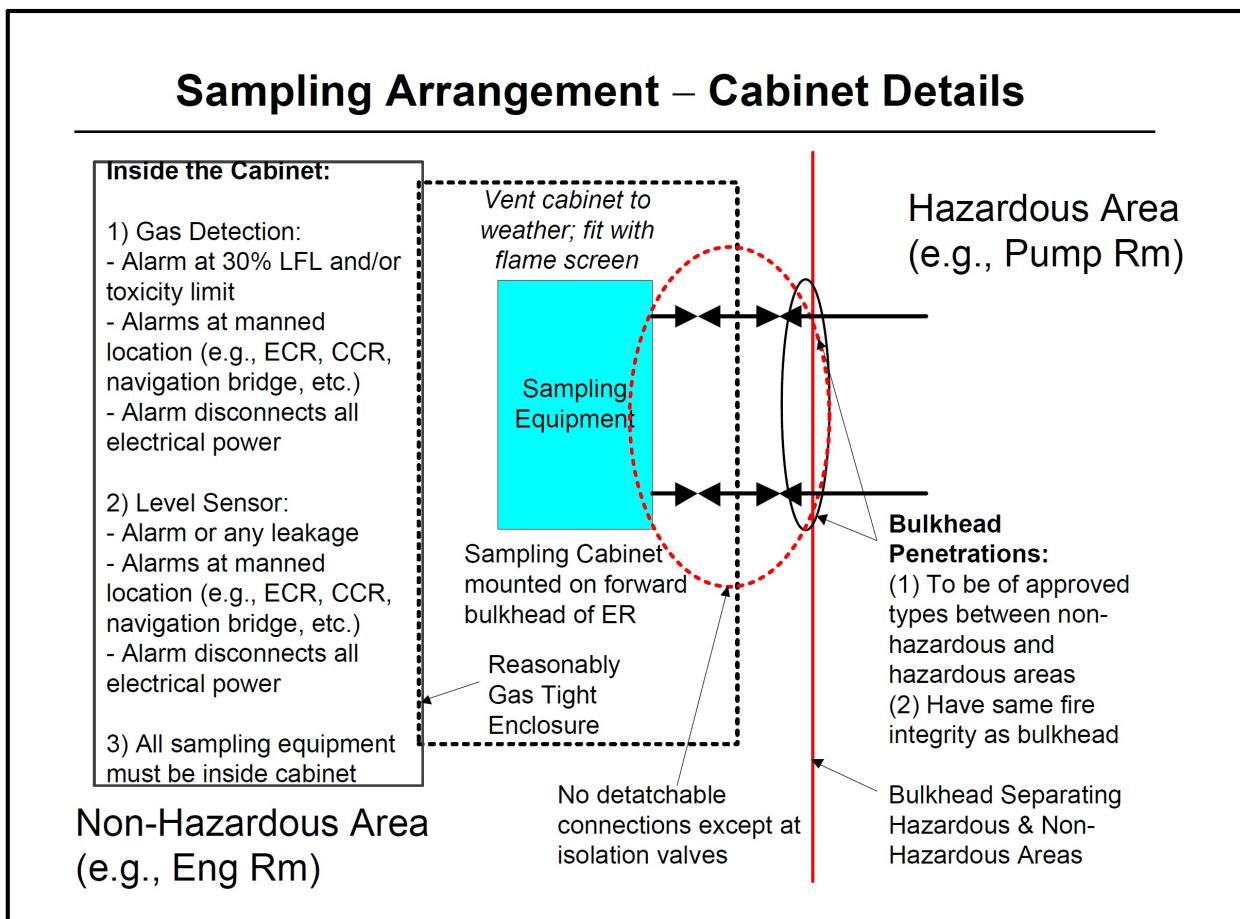
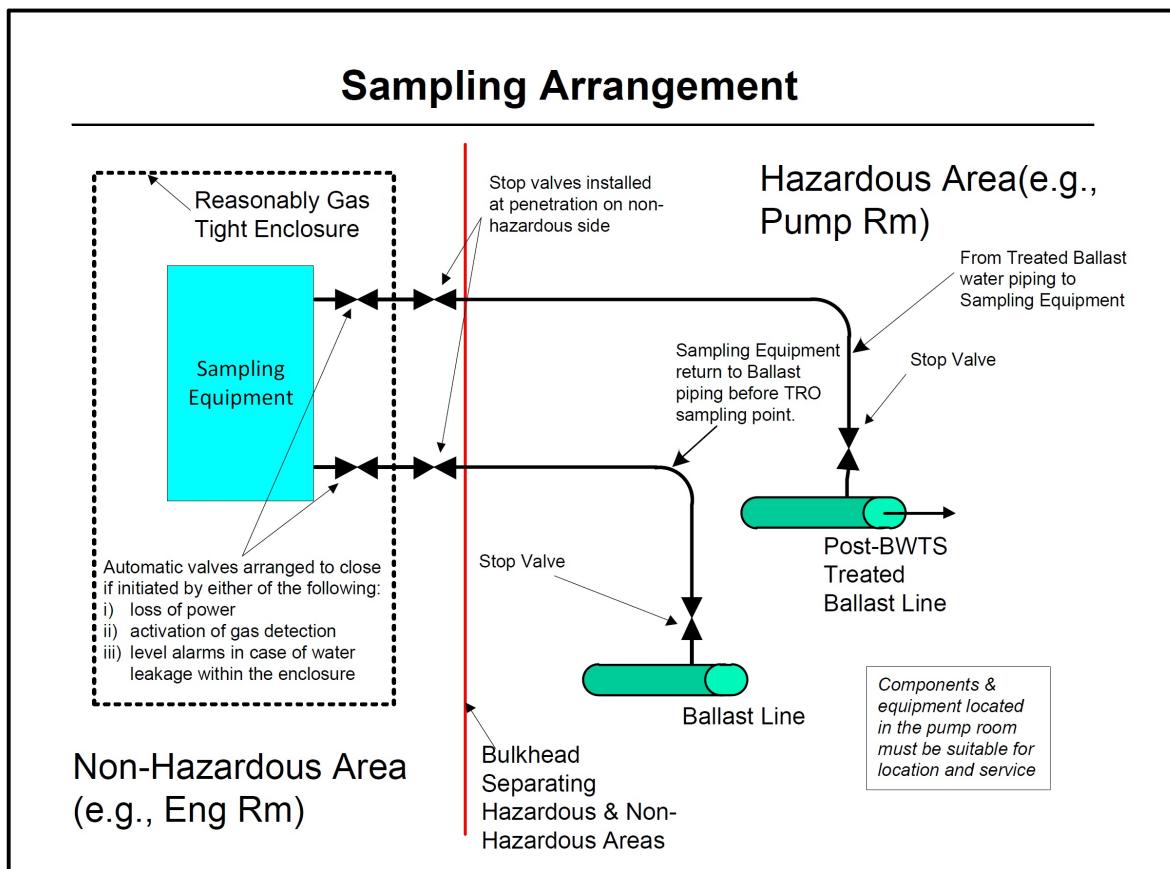


FIGURE 2
Arrangement Details inside the Cabinet (1 August 2016)





APPENDIX 2 **Acceptable Isolation Arrangement of a BWMS Dosing Piping System on Oil or Chemical Tankers (From a Non-hazardous Area to a Hazardous Area) (1 August 2016)**

This Appendix presents an acceptable isolation arrangement of BWMS dosing units located in a nonhazardous 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 or toxic liquids or vapors from the hazardous areas.

The ballast tanks detailed in this Appendix are considered as hazardous if they are adjacent to cargo tanks. The arrangement details are as follows:

- 1) All bulkhead penetrations of the dosing piping between non-hazardous 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 non-hazardous and hazardous 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 is 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 soft-seated valves governed by *API 598* or *MSS SP-61*).

Hazardous Area

- 7) An 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 passive in-line loop seal, a water (liquid) seal, or a fail-safe actively operated block and vent arrangement as in A4/7 of this Guide, provided it is established that it is:
 - a) Capable of preventing the back flow of vapors against at least a 60 inch (1.52 m) H₂O head of pressure,
 - b) Suitable for the service when considering the dosing agent involved (gas, liquid, etc.), and
 - c) Operates passively or fail-safe actively, as applicable. 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 or on the weather deck in the hazardous area. See A4/3, A4/5, and A4/7 of this Guide.

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.).

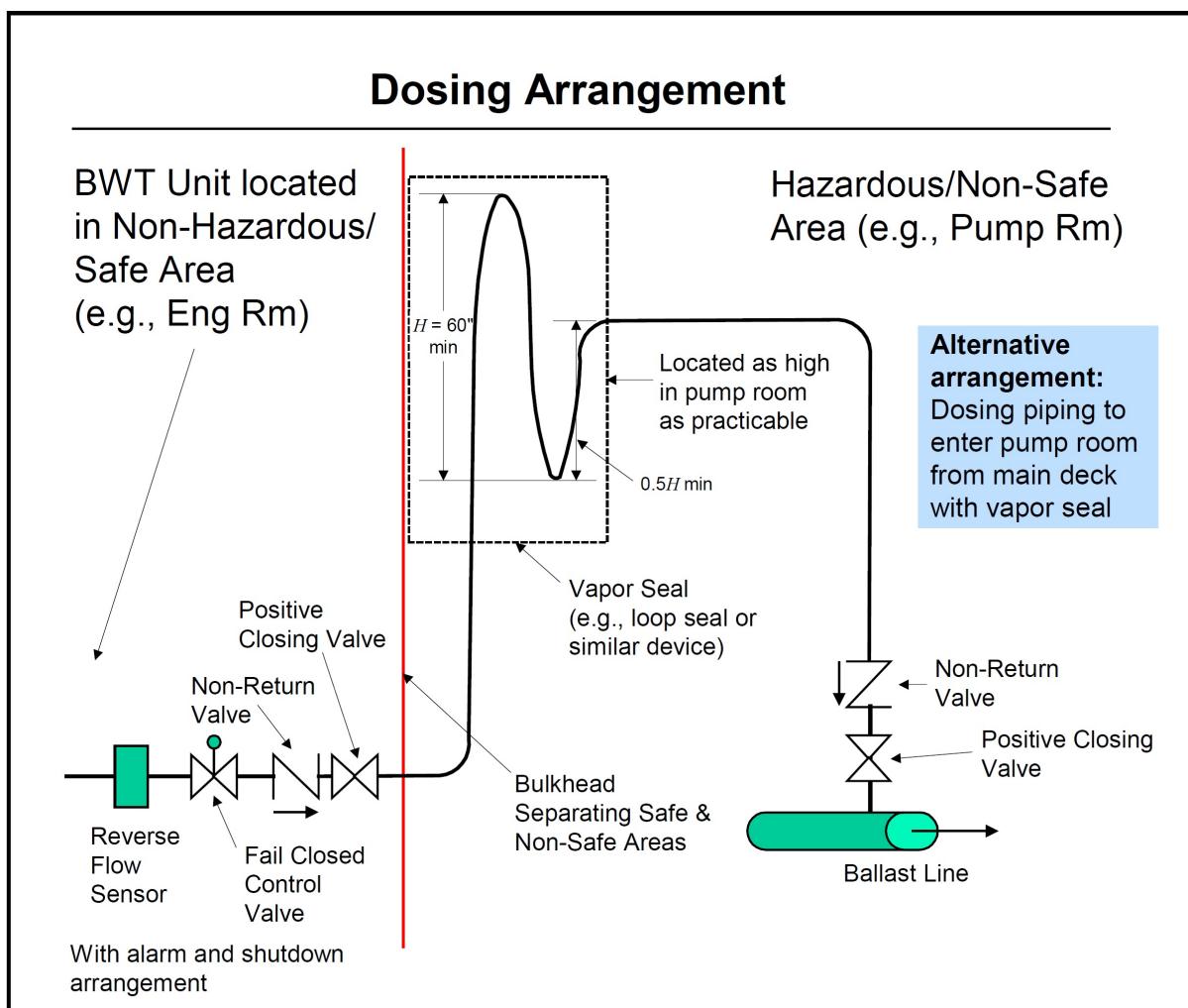
- 8) Means are to be provided to prevent any liquid seal from freezing where exposed to the weather.
- 9) A stop/check valve or a combination of a stop valve and a check valve is to be installed at the connection of the dosing line to the ballast piping.
- 10) The valve mentioned in item 9 are to be suitable for both liquids and gases with "zero" leakage (e.g., bubble-tight soft-seated valves governed by API 598 or MSS SP-61)

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

Notes:

- 1 (1 August 2014) Fixed gas detection arrangements are to be provided for ballast tanks. Arrangements are to be provided such that the positive closing valve at the bulkhead is closed upon detection of 30% of the (LFL) lower flammable limit and/or exceeding of toxicity limit of any possible gases involved, 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".

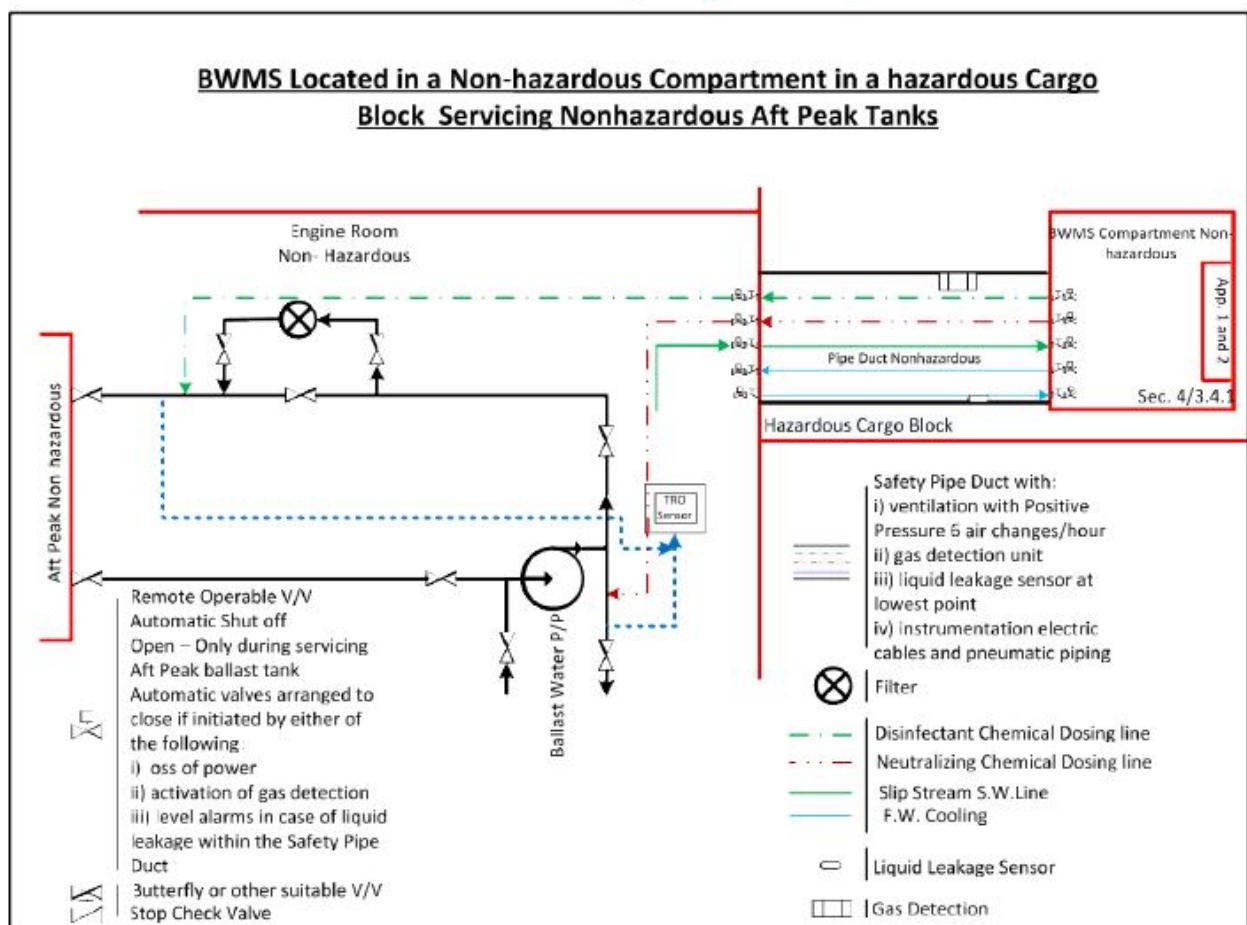
FIGURE 1
Acceptable Interconnection Arrangement for BWMS Dosing Piping



APPENDIX 3 **Acceptable Isolation Arrangement of a BWMS Dosing Piping System on Oil or Chemical Tankers (From a Non-hazardous Compartment to a Non-hazardous Area Routed Through a Hazardous Area) (1 August 2016)**

This Appendix details acceptable isolation arrangements for a BWMS dosing piping system, routed through a hazardous cargo block area, the BWMS installed in a non-hazardous compartment located in a hazardous cargo block area, serving among other hazardous ballast tanks in the cargo block, a non-hazardous Aft Peak Tank adjoining an engine room. The BWMS located in the non-hazardous compartment may be of the slip stream ECU type, also identified in 4/3.5.

FIGURE 1 (1 August 2016)



Non-hazardous Areas (Compartment in the Cargo Block and Engine Room)

- 1) Remote operable valves with automatic shutoff features are to be installed in both the non-hazardous areas for the chemical disinfectant, neutralizing chemical, slipstream seawater and freshwater cooling piping.

The remote operable valves are to be arranged so that:

- a) They remain closed at all times except when ballast operations are in progress,
 - b) Are to be of the fail safe type with the capability of manual operation with local status indication and remote status indication at the BWMS control station.
- 2) A stop/check valve or a combination of a positive closing stop valve and a check (i.e., non-return) valve is to be installed in the non-hazardous area at the bulkhead separating hazardous and non-hazardous areas.
- 3) The manual valves indicated in 2 above are to prevent unintended backflow. However, in lieu of non-return check valves other suitable valves may be used subject to adequate technical justification being submitted for acceptance by ABS.
- 4) All bulkhead penetrations by piping between non-hazardous and hazardous areas are to be of an approved type and have the same fire integrity as the division penetrated.

Hazardous Area

- 5) The chemical disinfectant, neutralizing chemical, slip stream water, fresh water cooling, (pneumatic piping and instrumentation cabling if required) are to be routed through the safety pipe duct when traversing the hazardous area.
- 6) The gas tight safety pipe duct is to include sealed inspection openings with gas tight bolted covers.
- 7) The safety pipe duct is to be installed with gas detection, liquid leakage detection and mechanical ventilation of at least six (6) air changes an hour that will maintain the safety pipe duct under positive pressure relative to the external hazardous area.
- 8) The gas detection and liquid sensing equipment in 7 above are to be of certified safe type. The instrumentation cabling used is to comply with 4-8-4/27.9 of the *Marine Vessel Rules*.
- 9) The certification of gas detection and liquid sensing equipment required in 8 are to be certified for Zone 2 if the safety pipe duct is routed through Zone 2* only. However if sections of the safety pipe duct are routed through Zone 1 areas, then the gas detection and liquid sensing equipment is to be certified for Zone 1*.

Note: *For the Zone concept, refer to the "Note" in 4/3.4.2.

- 10) The ventilation is to be arranged so as to enable ventilation of the entire length of the pipe duct, the ventilation inlet and outlet are routed such that they are located outside of the hazardous area.
- 11) The relative overpressure or air flow is to be continuously monitored and so arranged that in the event of a ventilation failure (loss of relative overpressure or loss of air flow) associated with either the safety pipe duct or the non-hazardous compartment housing the BWMS, an audible and visual alarm is given at a manned control station with simultaneous automatic shutoff of the BWMS and the remote operable valves.
- 12) The automatic shutoff and alarm initiation in 11 above is also to be initiated upon detection of 30% (LFL) lower flammable limit of applicable gases and/or toxic vapors involved or in the case of liquid leakage detection within the pipe duct.

Alternative Location of Safety Pipe Duct in Non-Hazardous Area

- 13) If the entire safety pipe duct, including the individual pipe penetrations are routed through non-hazardous areas beyond the boundaries of the designated hazardous areas in 5C-1-7/31.5 of the *Marine Vessel Rules*, the following requirements would not be applicable.

- a)* The Ventilation and gas detection in Item 7.
- b)* Certification of the liquid sensing equipment in Item 9.

However, automatic shutoff of the BWMS and the remote operable valves in Item 1 would still be required in case of ventilation failure of the non-hazardous compartment located in the hazardous deck.

Other devices and arrangements in lieu of the arrangements detailed above may be considered acceptable and would be subject to case by case approvals by ABS.



APPENDIX 4 **BWMS in a Non-hazardous Area Serving Ballast Tanks in a Hazardous Area**

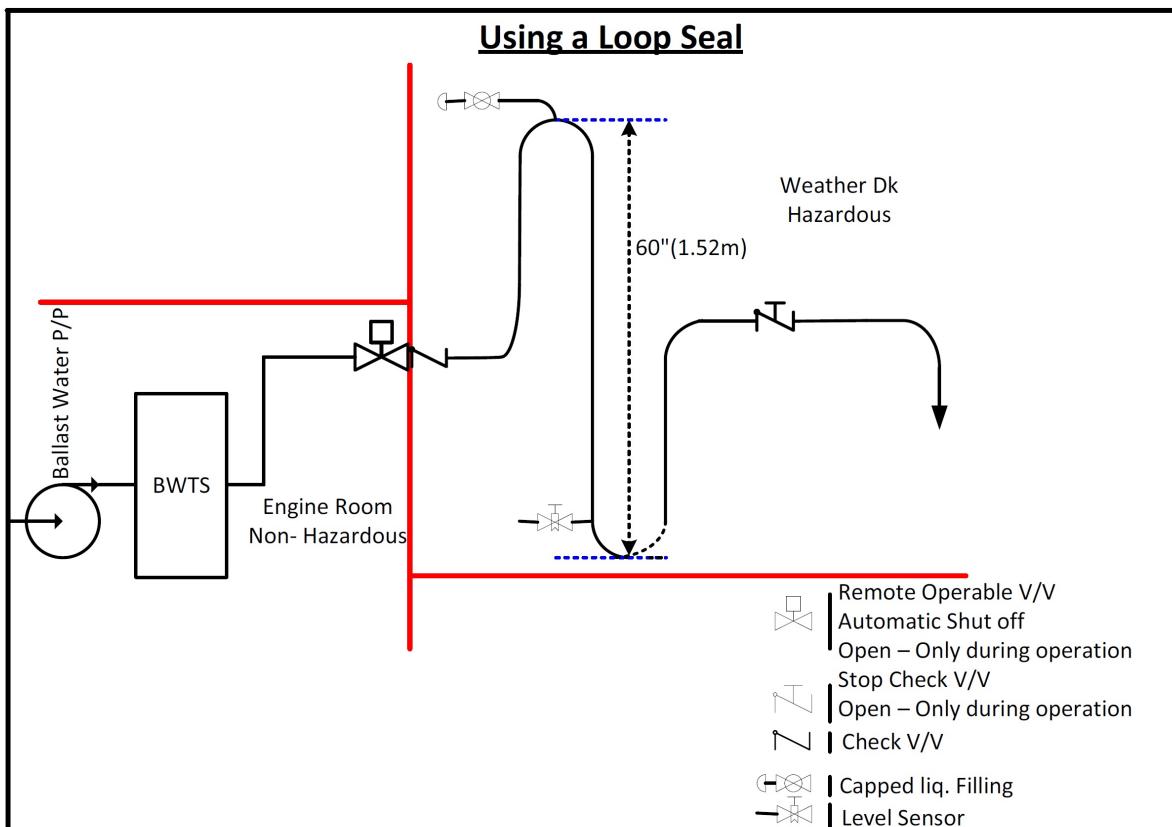
This Appendix presents examples of acceptable arrangements for a BWMS and ballast water pumps installed in an engine room while serving hazardous ballast water tanks in the cargo block of an oil or chemical tanker.

The size of the ballast piping associated with ballasting and deballasting on a vessel would determine the type of arrangement that could be suitably considered for a specific vessel.

1 General Guidelines for All Installations (1 August 2016)

- 1) Ballast piping (except small-bored sampling piping as shown in A1/ FIGURE 1 and dosing piping in A2/ FIGURE 1 and A3/ FIGURE 1) is not to penetrate the common bulkhead between the engine room and the cargo pump room.
- 2) The ballast water is to flow in one direction only from the engine room (non-hazardous area) to the ballast tank (hazardous area) (i.e., The ballast pumps may be used for only filling the ballast tanks and/or for driving eductors in the hazardous area to strip/deballast the ballast tanks where the ballast water does not need treatment before it is discharged).
- 3) The valves to the ballast tanks are to be arranged so that they remain closed at all times except when ballasting or when driving eductors in the hazardous area to strip/deballast ballast tanks. Remote operable valves, where provided, are to be of the fail safe type with the capability of manual operation with an indication of its status locally and remotely at the BWMS control station.
- 4) The ballast water piping penetrations are to be watertight and of the approved type in accordance with 4-6-2/9.7.1 of the *Marine Vessel Rules*.
- 5) The ballast tanks are to be fitted with means of detecting hydrocarbon, other flammable and/or toxic vapors, as applicable. See 5C-1-7/20,5C-9-13/2 and 5C-9-21/4.11 of the *Marine Vessel Rules*. Automatic shutdown of the BWMS is to be actuated upon detection of 30% (LFL) lower flammable limit of applicable gases and/or toxic vapors involved.
- 6) Depending on the type of BWMS used, other additional arrangements may be required at the discretion of ABS.

3 Using a Loop Seal



3.1 Non-hazardous Area

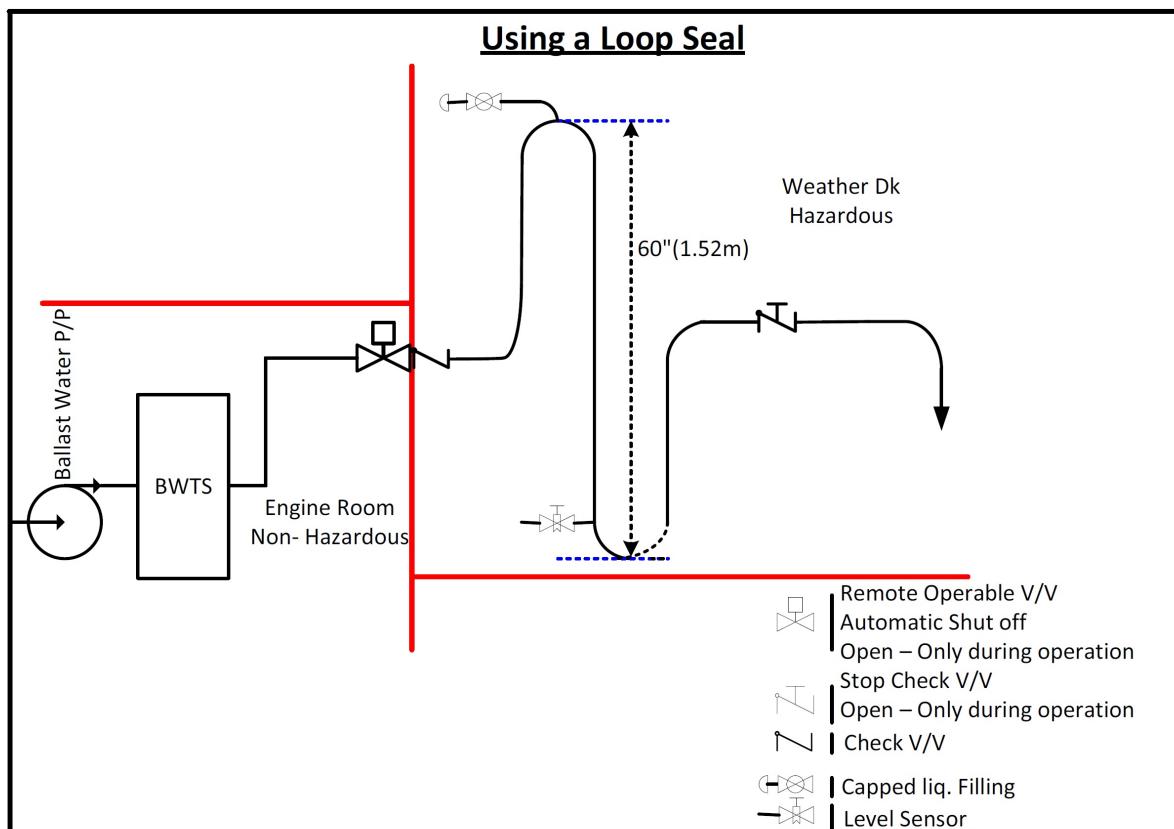
- 1) A remote operable valve is to be installed in the ballast piping leading to the ballast tanks in the cargo area. This valve is to be located just aft of the forward most bulkhead between the hazardous weather deck area and the non-hazardous area.

3.3 Hazardous Area

- 1) A check valve is to be installed where the discharge piping exits the engine room. This valve is to be located in the hazardous area just forward of the forward most bulkhead between the hazardous weather deck area and the non-hazardous area.
- 2) A loop seal of at least 1.52 m (60 inches) height to prevent the passage of vapors from entering the ballast piping in the non-hazardous area is to be installed outside the engine room in the hazardous area.
- 3) In addition to item 2, the loop seal is to be arranged so that the water in the seal is kept free of cargo vapors and liquids through the use of a stop check valve in the ballast fill line and, if applicable, in the eductor supply line. The locked stop check valve may be kept open only during the BWMS operation.
- 4) A pressure sensor or liquid level sensor is to be provided at an appropriate location on the loop seal which is to activate an alarm at a manned location if the liquid level column drops below 1.52 m (60 inches).
- 5) Suitable arrangements are to be installed to replenish the water in the loop seal to its normal safe 1.52 m (60 inches) height after a drop in level is detected.

- 6) The remote operable valve, the ballast water pump and the BWMS are to be automatically shut down/closed in the case of loss of power, in the case of detection of hydrocarbon, or other flammable and/or toxic vapors, as applicable, in the ballast tanks and/or pump room and, if applicable, hydrogen gas detection in the ballast tanks depending on the BWMS used.
- 7) Means are to be provided to prevent any liquid seal from freezing where exposed to the weather.

5 Using a Water Column



5.1 Non-hazardous Area

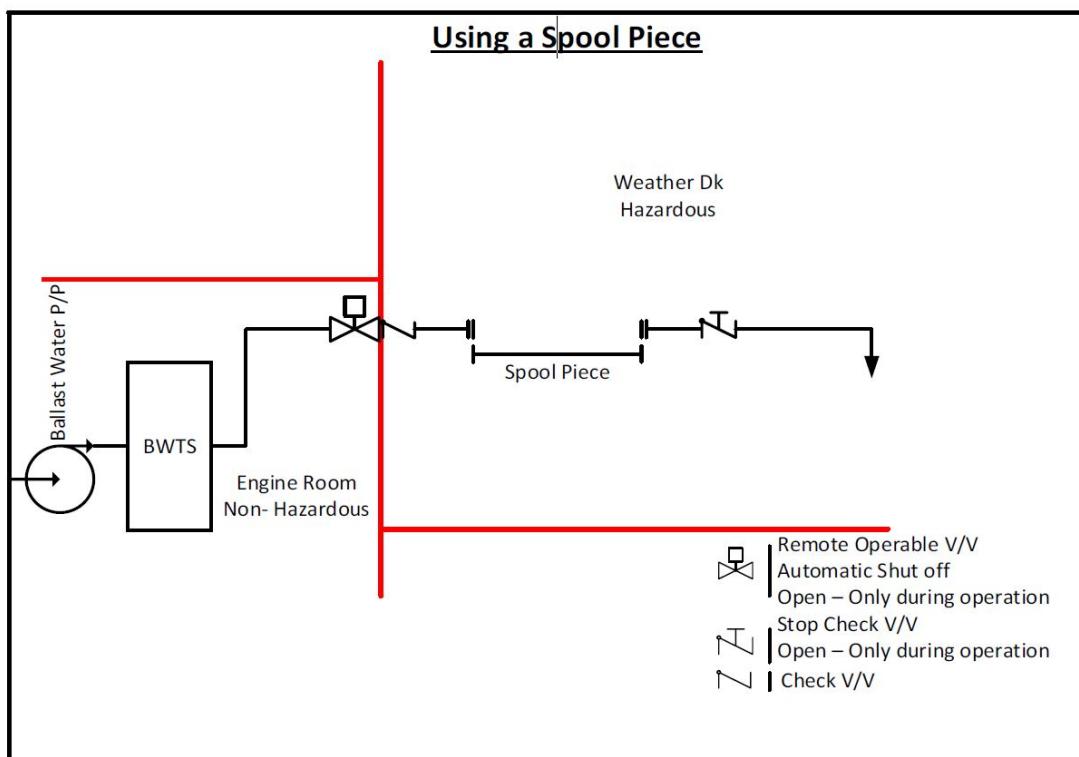
- 1) A remote operable valve is to be installed in the ballast piping leading to the ballast tanks in the cargo area. This valve is to be located just aft of the forward most bulkhead separating the hazardous weather deck area and non-hazardous areas and is to be arranged to remain closed at all times other than when the ballast pump is in operation.

5.3 Hazardous Area

- 1) A check valve and a vertical section of piping are to be provided in the hazardous area forward of the bulkhead separating the hazardous weather deck area and non-hazardous areas. The arrangement is to create a water column of at least 1.52 m (60 inches) tall.
- 2) A pressure sensor or liquid level sensor is to be provided and is to activate an alarm at a manned location if the liquid level drops below the 1.52 m (60 inches) height.
- 3) Suitable arrangements are to be installed to replenish the water column to its normal safe water column after a drop in the water column level is detected. Means are to be provided to prevent any liquid seal from freezing where exposed to the weather.
- 4) A stop check valve is to be installed in the ballast water piping or if applicable, in the eductor supply line on the main deck and forward of the water column. The locked stop check valve may be kept open only during the BWMS operation.

- 5) The remote operable valve, the ballast water pump and the BWMS are to be automatically shut down/closed in the case of loss of power, in the case of detection of hydrocarbon, or other flammable and/or toxic vapors, as applicable, in the ballast tanks and/or pump room and, if applicable, hydrogen gas detection in the ballast tanks depending on the BWMS used.

6 Using a Spool Piece (1 June 2018)



6.1 Non-hazardous Area

A remote operable valve is to be installed in the ballast piping leading to the ballast tanks in the cargo area. This valve is to be located just aft of the forwardmost bulkhead between the hazardous weather deck area and the non-hazardous area.

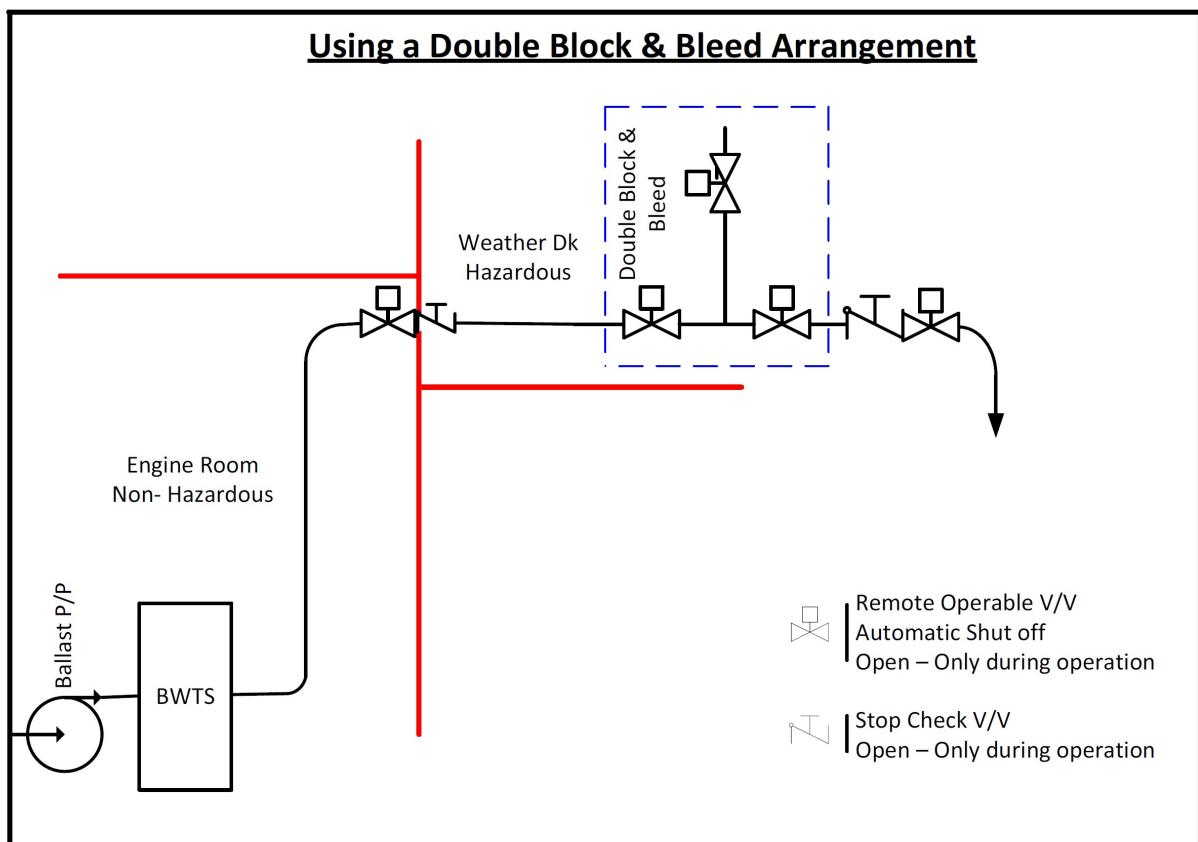
6.2 Hazardous Area

A check valve is to be installed where the discharge piping exits the engine room. This valve is to be located in the hazardous area just forward of the forwardmost bulkhead between the hazardous weather deck area and the non-hazardous area.

A spool piece is to be removed when the BWT is not in use to prevent the passage of vapors from entering the ballast piping in the non-hazardous area and is to be installed outside the engine room in the hazardous area. Also, the locked stop check valve may be kept open only during operation of the BWMS.

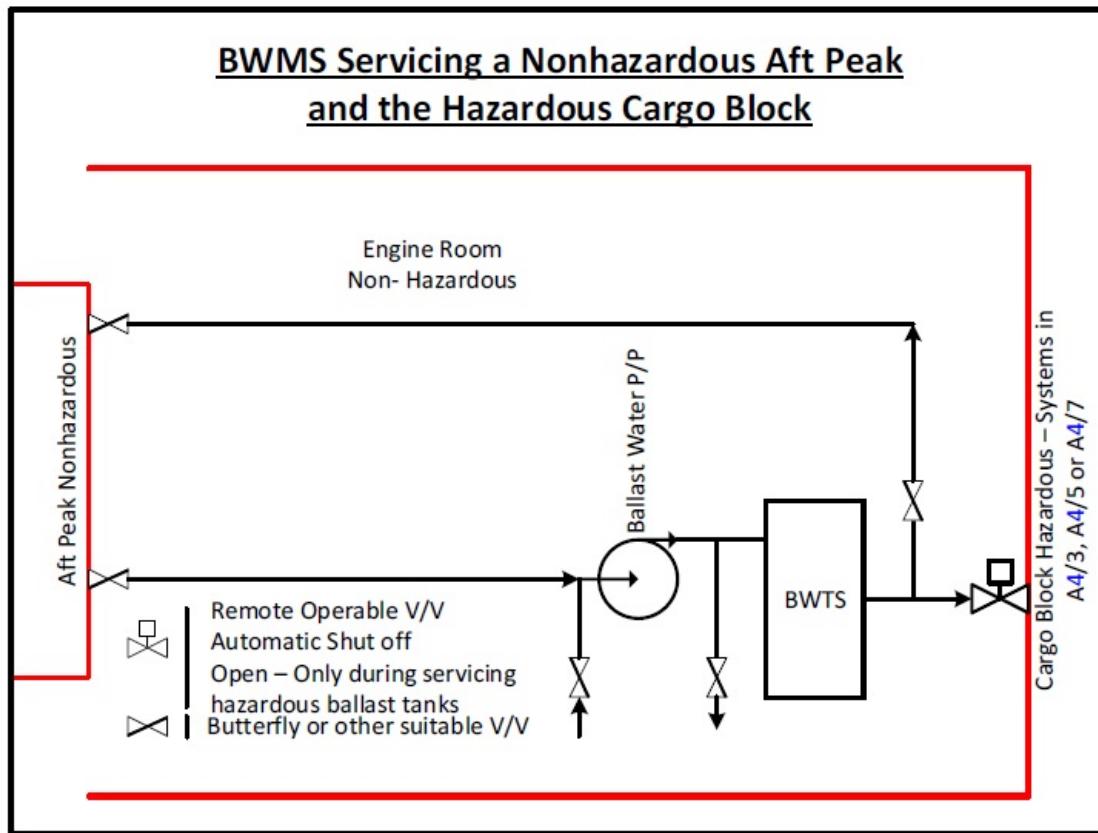
The remote operable valve, the ballast water pump and the BWMS are to be automatically shut down/closed in the case of loss of power, or upon detecting hydrocarbons or other flammable and/or toxic vapors, as applicable, in the ballast tanks and/or pump room. Depending on the BWMS used, the BWMS are to be automatically shut down/closed upon detection of hydrogen gas in the ballast tanks, if applicable.

7 Using a Double Block and Bleed Assembly (1 August 2016)



- 1) In lieu of the water column arrangements addressed in A4/5.3.1, A4/5.3.2, and A4/5.3.3 above, a block and bleed system located on the main deck (i.e., in the hazardous area), and arranged to automatically go into the "block and bleed" mode when the ballast pump is not in operation, upon loss of power or upon detection of flammable (hydrocarbon, hydrogen, etc.) and/or toxic vapors, as applicable, in the ballast tanks and or pump room may be considered as an equivalent arrangement for separating the hazardous weather deck area from the non-hazardous areas.
- 2) The "block and bleed" valve controls are to comply with the intent of 5C-1-7/25.19.1 of the *Marine Vessel Rules*.

9 BWMS in the Engine Room Serving a Non-hazardous Aft Peak Tank and Simultaneously Serving Hazardous Ballast Tanks in the Cargo Block



- 1) The schematic above indicates a ballast pump and the BWMS installed in the engine room serving a non-hazardous aft peak ballast tank and simultaneously serving hazardous ballast tanks in the cargo block. The arrangements for interconnections between the BWMS and the hazardous cargo block may be considered as those depicted in A4/3, A4/5, or A4/7.
- 2) The remote operable valve in the engine room, the ballast water pump and the BWMS are to be automatically shut down/closed in the case of detection of hydrocarbon, or other flammable and/or toxic vapors, as applicable, in the ballast tanks and/or pump room, and if applicable, hydrogen gas detection in the ballast tanks depending on the BWMS used.



APPENDIX 5 BWMS Installations on Dedicated Articulated Tug-Barge (ATB) Combinations (1 August 2016)

1 General

This Appendix presents examples of acceptable arrangements for BWMS installations in Articulated Tug Barge combinations:

- In the cargo pump room/hazardous area on the barge or in other suitable locations, or
- In a suitable location on the tug, or
- Partly on the tug and partly on the barge

The examples of BWMS installations in the schematics detailed in this Section are acceptable configurations, which include expected requirements for compliance specified in this Guide:

The details considered in this section refer to tank barges with hazardous cargoes.

Where the installation of the BWMS does not follow the normal configuration of the BWMS as approved by the flag Administration Type Approval (TA) certification, specific documentation is to be submitted to ABS wherein, a statement is made by the (TA) approving flag Administration, approving the deviation from the original approved configuration. Refer to BWM.2/Circ.44 dated 29 May 2013 and 3/5.1 of this Guide.

Since these combinations entail two independent vessels, with their own specific statutory certification needs, proposals are to be submitted to ABS for evaluation of the certification that may be required.

3 Requirements for All Installations

- i) The crossover hose piping between the tug and the barge is to be installed on either side with a screw down non-return valve and a remote operable automatic shutdown valve, that is to automatically shut off when a low pressure is detected in the crossover hose piping, in the event of power failure on either the Tug or the barge or for initiating a manual shutdown in sea state conditions unsuitable for ballasting operations, and/or other events identified by a detailed Safety Assessment submitted to the satisfaction of ABS. To ensure proper functioning of the automatic shutoff valves, if applicable, means are to be provided to prevent siphoning, by the installation of vacuum breakers, vent pipes, pressure retaining devices PRV, orifices, etc.
- ii) Hoses, hose connections, hose inspection and testing used for the crossover piping in BWTS operations should be specially designed and constructed for the product being handled and the purpose for which they are being used.
- iii) Hoses should be certified for suitability for their intended use and are to be permanently marked with the information required by appropriate international standards.
- iv) For the assessment of the suitability of hoses, reference may be made to "Ship to Ship Transfer Guide for Petroleum, Chemicals and Liquefied Gasses, 2013" Section 9.2. In particular the standards:
 - EN 13765 Thermoplastic Multi-layer (Non-vulcanized) Hoses and Hose Assemblies for the Transfer of Hydrocarbons, Solvents and Chemicals, 2010
 - EN 1765 Rubber Hose Assemblies for Oil Suction and Discharge Services, 2004 (Refer also to BWM Convention G5/7.4)

- v) Hose connectors either on the tug or on the barge are to have appropriate arrangements for Quick Connect/Quick Disconnect possibilities.
- vi) Permanent arrangements are to be installed for fresh water flushing/air purging of the ballast water piping, disinfectant chemical and neutralizing chemical piping before the disconnection of crossover hose piping to prevent pollution.

Appendix 5, Figure 1

- i) In A5/5 Figure 1, the tug may have taken on ballast at a different location without a BWMS installed onboard before moving to a new location, where the barge installed with a UV type BWMS is to ballast her tanks and where the two vessels combine to form an ATB combination.
- ii) The transition of ballast water piping via the non-hazardous areas on the tug, routed through the non-hazardous area on the barge, into the hazardous area on the barge is to comply with the requirements addressed in A4/1, A4/3, A4/5, and A4/7 of this Guide.
- iii) Where the ballast in the ballast tanks on the tug is transferred after treatment by the BWMS on the barge in to the ballast tanks of the barge, any discharge from the BWMS filtration backwash is to be routed to a sediment retaining tank to prevent organism transfer from the previous location where the tug was ballasted.
- iv) The sediment collected is to be sent to shore reception facilities in compliance with Article 5 of the BWM Convention.

Appendix 5, Figure 2

- i) In A5/5 Figure 2, the Slip Stream type BWMS is installed on the tug only and in addition to treating the ballast water in the tug's ballast tanks the system treats the ballast water in the barge ballast tanks.
- ii) The transition of the dosing piping via the non-hazardous areas on the tug, routed through the non-hazardous area on the barge, into the hazardous area on the barge is to comply with the requirements addressed in Appendix A2 of this Guide.
- iii) The barge ballast system is to be installed with its own BWMS filter as detailed in the BWMS manufacturer's BWMS Type Approval certification issued by the relevant Administration.

Appendix 5, Figure 3

- i) In A5/5 Figure 3, the Full Flow type BWMS is installed on the Tug only and in addition to treating the ballast water in the tug's ballast tanks the system may be used for ballasting the barge's ballast tanks.
- ii) The ballast in the ballast tanks on the barge is treated with neutralizer before discharge. The neutralizer dosing piping for the ballast in the barge ballast tanks originates from the tug's BWMS.
- iii) The transition of ballast piping via the non-hazardous areas on the tug, routed through the non-hazardous area on the barge, into the hazardous area of the barge is to comply with Appendix A4 of this Guide.
- iv) The transition of neutralizer dosing piping via the non-hazardous areas on the tug, routed through the non-hazardous area on the barge, in to the hazardous area on the barge is to comply with Appendix A2 of this Guide.

5 Configurations of BWMS

Various configurations of BWMS may be acceptable to ABS subject to:

- i)* The submission of an acceptable Risk Analysis for the crossover piping between the tug and barge,
- ii)* A statement of acceptability from the flag Administration of the tug and the barge,
- iii)* A statement of compliance from the Administration issuing the Type Approval Certification for the BWMS, if the proposed configuration of the BWMS differs from the original approved configuration.

Figure 1(1 August 2016)

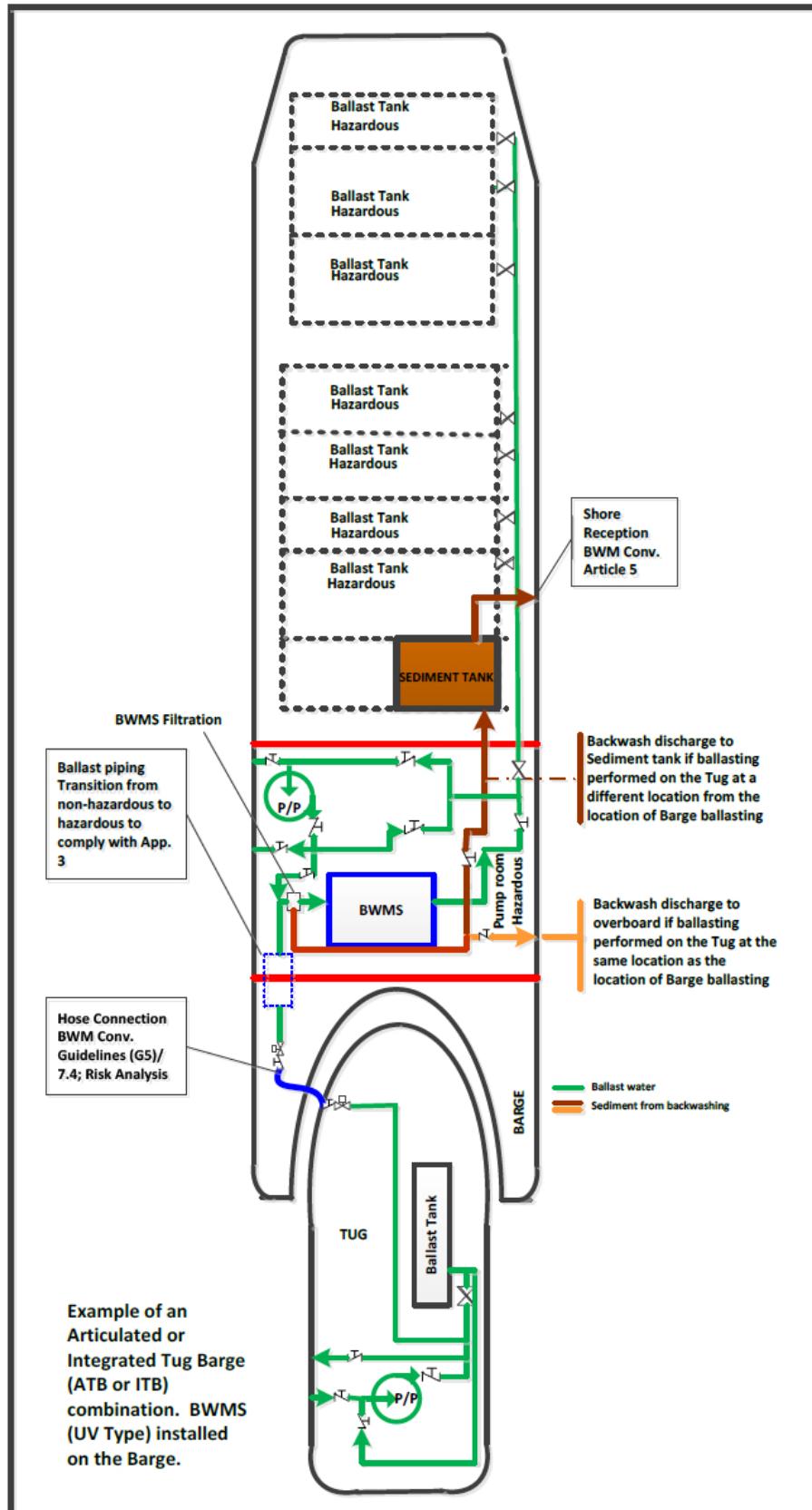


Figure 2 (1 August 2016)

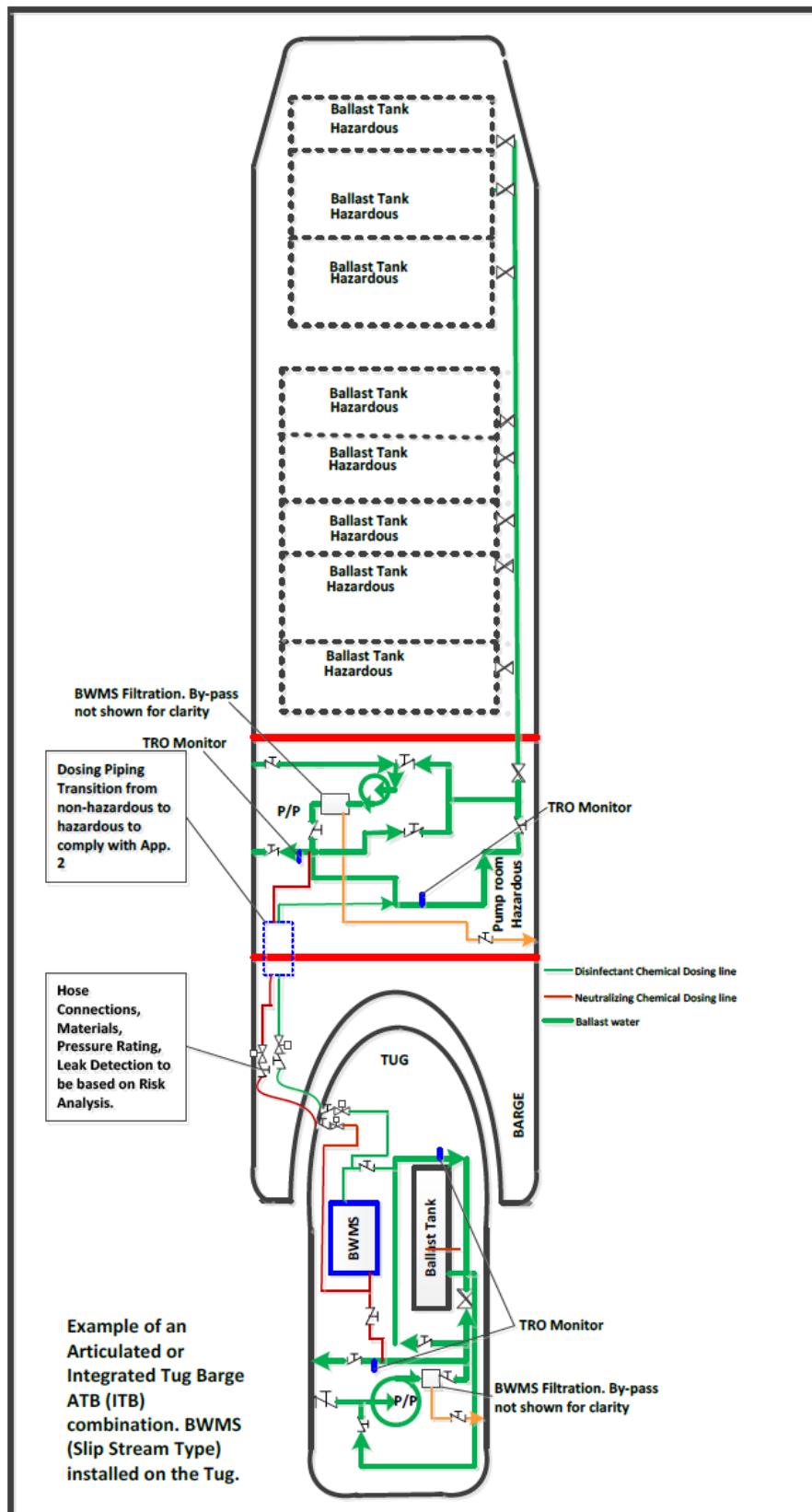
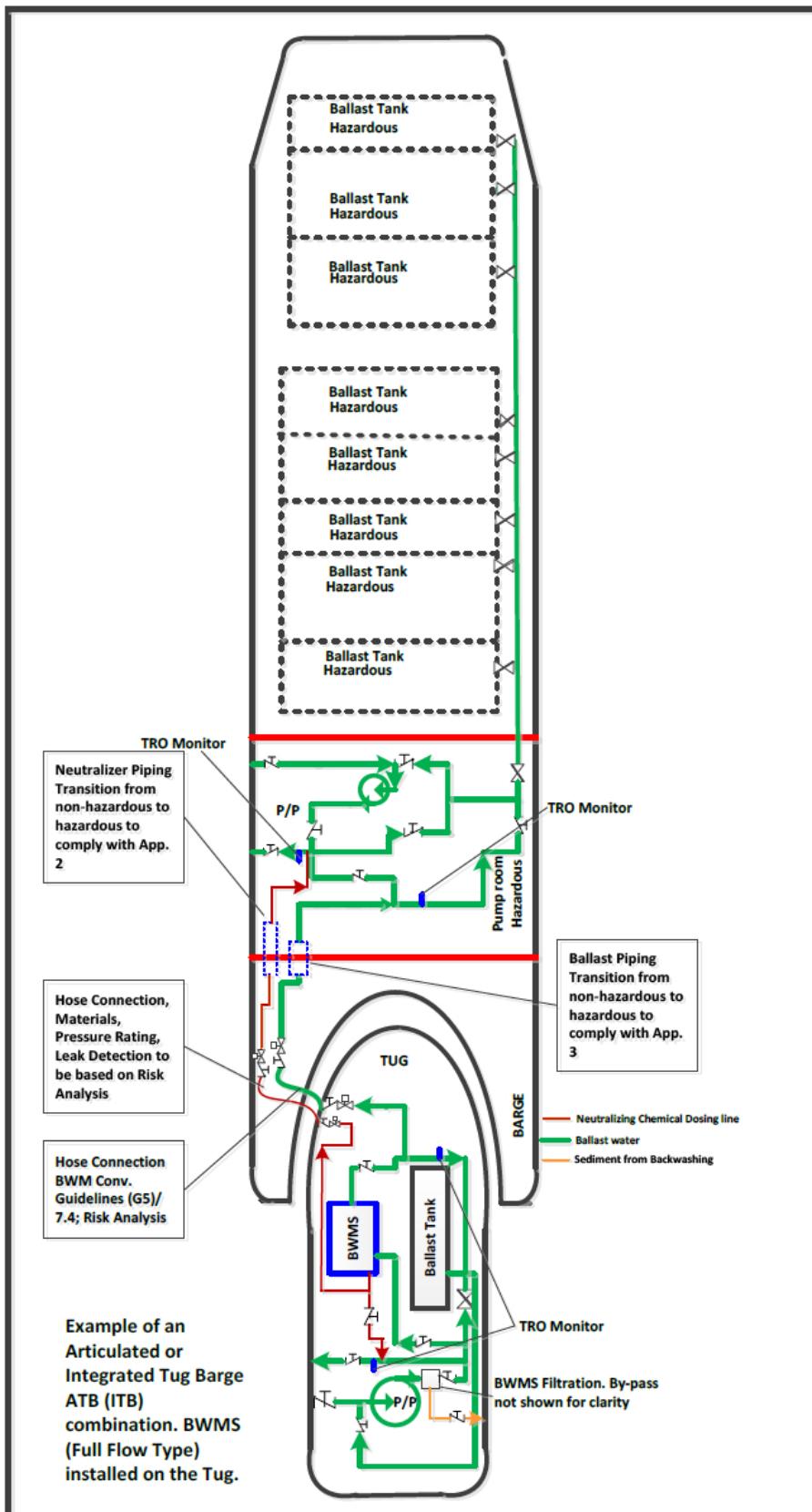


Figure 3 (1 August 2016)





APPENDIX 6 Additional Arrangements for the Placement of Electrical Equipment in Hazardous Areas (1 August 2014)

Additional arrangements for the placement of electrical equipment in hazardous areas such as cargo pump rooms in accordance with the special considerations mentioned in 5/3.

- 1) An interlock is to be provided for disallowing any maintenance on the BWMS when the system is energized.
- 2) An interlock is to be provided for the pump room ventilation such that the electrical power supply to the BWMS cannot be energized while the ventilation is not in operation. This also means that in the event of a failure in the ventilation while the BWMS is in operation, the electrical power to the BWMS in the pump room is to automatically shut down. Failure of ventilation is to give an audible and visual alarm at a manned location.
- 3) Ventilation arrangements are to comply with 4/3.3.2.ii.
- 4) An interlock is to be provided such that any detection of 30% (LFL) lower flammable limit of hydrocarbon gas or other flammable and/or toxic gases associated with the cargo in the Ballast Water Tanks or in the Pump Room will immediately shut down the BWMS and detection of hydrocarbon (or other flammable and/or toxic) gas to give an audible and visual alarm at a manned location.
- 5) The circuit feeding the BWMS in the pump room is to be monitored continuously for ground faults and is to give an audible and visual alarm at a manned location.
- 6) Equipotential bonding is to be provided for the BWMS [i.e., the BWMS is to be earthed to the metal hull (see 5.4 of IEC 60092-502)].
- 7) All cables installed in the pump room other than those of intrinsically-safe circuits are to be sheathed with a nonmetallic impervious sheath in combination with braiding or other metallic covering.
- 8) The failure of pressurization where applicable for certified-safe type components of a BWMS is to result in the shutdown of the power supply of the BWMS. The BWMS shutdown device and power supply are to be located outside the pump room space.
- 9) Alarms, monitoring and interlocks associated with pressurized equipment (i.e., components of the BWMS) are to be periodically tested to confirm correct operation. The inspection and testing methods are to be documented in the BWMS operating manual.
- 10) An operating manual describing safe operations of the equipment, safe testing and maintenance of the equipment is to be provided. It is to be kept updated and available in a location known to the operating personnel. The operating manual is to include, but not limited to, the following aspects;
 - i) Any maintenance work on the certified-safe type electrical equipment that may necessarily violate the condition of the safety certification, such as opening of such equipment, is to be carried out while the power supply to the equipment is securely disconnected from the non-hazardous area. Methods to ascertain the disconnection while the maintenance work is on-going is to be described.

- ii)* Inspection and maintenance is to be carried out only by experienced and authorized personnel. Appropriate refresher training is to be given to such personnel on a regular basis.
- iii)* All electrical equipment located in hazardous areas and in the spaces which may become hazardous on loss of pressurization, together with any associated non-hazardous-area apparatus (such as zener safety barriers) required for the protection of the equipment, is to be listed on a schedule.

The schedule is to include the following details:

- a)* Location
- b)* Zonal classification of location
- c)* Type of equipment
- d)* Manufacturer
- e)* Type reference
- f)* Test authority and certificate number, or reference and date of manufacturer's declaration
- g)* Type of protection
- h)* Apparatus group
- i)* Temperature class
- j)* Ambient temperature range for which equipment is suitable
- k)* Ingress protection (IP) rating
- iv)* Hazardous area equipment certification that may be subject to acceptance by the flag Administration of the vessel.



APPENDIX 7 **Ballast Water Management Plan (1 August 2014)**

The ballast water management plan template is a separate document consisting of the following Sections:

- SECTION 1** General Information
- SECTION 2** Ballast Water Management Plan Template
- ANNEX 1** Ballast Water System Drawings and Data
- ANNEX 2** Information of Ballast Water Management System Installed Onboard
- ANNEX 3** Ballast Water Record Book
- ANNEX 4** Ballast Water Recordkeeping Forms
- ANNEX 5** Supporting Documents
- ANNEX 6** Ballast Water Management Training Records
- ANNEX 7** Exemptions Granted by Port State Authorities