Rules for Classification and Construction

VI Additional Rules and Guidelines

11 Other Operations and Systems

10 Guidelines on Ballast Water Management
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Section 1    General Requirements and Guidance

A Scope and Application

A.1 Scope

The International Maritime Organization (IMO) has developed legislation that regulates management of ballast water from ships with the aim to minimize the risk of introducing non-native species through the discharge of ballast water and sediments into other coastal regions. The “International Convention for the Control and Management of Ships’ Ballast Water and Sediments, 2004” (hereafter referred to as BWM Convention) provides for different methods to achieve this objective, see Fig. 1.1.

![Diagram of Ballast Water Management methods]

Depending on ballast water capacity and construction date of the ship, the applicable method is specified in an implementation schedule in BWM Convention Regulation B-3 ‘Ballast Water Management for Ships’ and its supporting Circulars.

These Guidelines define GL requirements for the Ballast Water Management Plan in Section 2, while Sections 3 and 4 set out requirements for Ballast Water Exchange and Ballast Water Management Systems (BWMS) using the respective treatment technologies.

The BWM Convention requires that BWMS using treatment technologies are to be type approved by an IMO member state. In addition, there are classification related issues with respect to the system itself and the integration into a ship that need to be addressed separately under a plan approval process as outlined in Section 4.
A.2 Application

The provisions of these guidelines apply to new and existing ships according to the due dates specified in the BWM Convention, Regulation B-3, as amended.

Three phases may be distinguished:

Phase 1: Until entry into force of the BWM Convention
- D-1, D-2, D-4 voluntarily or as required by national administrations

Phase 2: Transitional period after entry into force of the BWM Convention, but before ship’s due date for D-2 compliance
- D-1 standard required, depending on ballast water capacity and construction date (refer to BWM Convention for details)

Phase 3: After entry into force of the BWM Convention and after ship’s due date for D-2 compliance
- D-2 or D-4 requirements are mandatory (due date as specified in the BWM Convention)

B Definitions and Terminology

The definitions as stated in the Convention, its appendices and related IMO documents apply to these Guidelines.

Throughout these Guidelines the following abbreviations/terminology are used:

BW : Ballast Water
BWE : Ballast Water Exchange
BWMS : Ballast Water Management System
BWMC : Ballast Water Management Convention
BWMP : Ballast Water and Sediment Management Plan

Compliance documents:
1. Statement of Compliance – SoC:
   issued by GL until the BWM Convention has entered into force
2. International Ballast Water Management Certificate – IBWMC:
   issued by GL on behalf of the Flag Administration after the BWM Convention has entered into force and if the flag state is signatory to the Convention
3. Document of Compliance – DoC:
   issued by GL on behalf of the Flag Administration after the BWM Convention has entered into force and if the flag state is not signatory to the Convention

C Documentation

The documentation required for the approval of the Ballast Water Management Plan, Ballast Water Exchange and Ballast Water Management Systems is listed in Sections 2, 3 and 4 respectively. To facilitate a smooth and efficient approval process documents should be submitted electronically via GLOBE. In specific cases and following prior agreement with GL they can also be submitted in paper form in triplicate.

1 Detailed information about GLOBE submission can be found on GL’s website www.gl-group.com/globe.
D Further Rules and Guidelines to be considered

D.1 GL Rules and Guidelines
The requirements in these Guidelines supplement GL Rules applicable for seagoing ships, in particular GL Rules for Classification and Surveys (I-0), Machinery Installations (I-1-2), Electrical Installations (I-1-3), Automation (I-1-4), Liquefied Gas Carriers (I-1-6), Chemical Tankers (I-1-7) and Test Requirements for Electrical / Electronic Equipment and Systems (VI-7-2).

D.2 National Regulations
National regulations remain unaffected by the provisions of these guidelines. In addition to internationally agreed requirements individual Flag Administrations may have in place further or different requirements for ballast water management. It is recommended that owners/ operators monitor national requirements in the trading areas of their vessels.

D.3 International Regulations
Upon entry into force, the International Convention for the Control and Management of Ship’s Ballast Water and Sediments, as amended, and related IMO Guidelines and Circulars.

E Classification and Class Notations

E.1 Classification
The provisions in GL Rules for Classification and Surveys (I-0), Section 2 apply.

E.2 Characters of Classification and Notations
For phases 1 and 2 as described in A.2 above the following class notations may be applied for:

BWM (D1) : for ships complying with the IMO D-1 exchange standard and with GL requirements in Section 3.
BWM (D2) : for ships complying with the IMO D-2 performance standard and with GL requirements in Section 4.
BWM (Tr) : for ships complying with the IMO D-2 performance standard and with GL requirements in Section 4 as well as having obtained a GL BWMS Approval.

The previously assigned class notations regarding BWM continue to be valid until an owner applies for one of the above class notations.

The above mentioned class notations and the class notations BWM-S and BWM-F as introduced in the BWM Guideline VI-11-10, edition 2001 will be discontinued after entry into force of the BWM Convention and after ship’s due date for D-2 compliance.

E.3 Surveys for maintenance of class
Class notations BWM (D1), BWM (D2) and BWM (Tr) ordered after this Guideline edition has entered into force require initial and periodic surveys. Details of surveys are given in Section 3, C.4 and Section 4, D.7.
Section 2 Ballast Water and Sediment Management Plan (BWMP)

A General

On the basis of the BWM Convention and related IMO Guidelines and Circulars, the BWMP provides assistance to ships' masters in preventing, minimizing and ultimately eliminating the risk of introducing harmful aquatic organisms and pathogens from ships' ballast water and associated sediments whilst ensuring the safe operation of the ship.

A specific BWMP needs to be prepared and approved for every ship that carries ballast water and falls under the scope of the BWMC.

The BWMP should be written in the working language of the ship. If the language used is not English, an English translation should be submitted for approval.

B Content of the Ballast Water Management Plan

B.1 Introduction

At the beginning of each BWMP, wording should be included to reflect the regulations which are relevant for the intended compliance, and should contain a brief introduction for the ship’s crew, explaining the need for ballast water management, and the importance of accurate record keeping.

As required by the BWMC, the following notes have to be included:

This Ballast Water Management Plan has been approved by the Administration and no alteration or revision shall be made to any part of it without the prior approval of the Administration. National Regulations in the Annex are not subject to approval and should be updated independently from class by the master onboard.

This Ballast Water Management Plan may be inspected on request by an authorized authority.

B.2 Ship specific particulars

The following data should be included:

- Ship’s name
- Ship type
- IMO number
- Classification society and registration number
- Call sign
- Flag
- Port of registry
- Owner
- Gross tonnage
- Main dimensions
- Total ballast water capacity
- No. and capacity of ballast pumps
B.3 Plans and diagrams

B.3.1 Tank arrangement and capacities

The BWMP has to include a plan and profile of the ship or a schematic drawing showing the ballast tank arrangement. A table is to be included, showing for each tank the applicable BWE methods and the available ballast water pumps. A second table is to be also included showing the rated and if applicable the reduced capacity pumps available for ballast water management.

B.3.2 Piping and pumping arrangements

A piping diagram of the ballast system and a layout diagram of the ballast control system are to be included. The diagrams have to show the valve positions as well as identification number, position and capacity of each ballast pump. For vessels with unusual arrangement of air pipe heads or overflows such as, but not only, common air pipes, or air pipe heads arranged on closed deck, a drawing or diagram sufficiently clarifying such arrangements are to be included.

If the vessel should be equipped with BWMS, it should be clearly indicated in the ballast system diagrams.

B.3.3 Ballast water sampling points

A list or set of diagrams shall clearly show sampling and access points in pipelines and tanks, so that the responsible officer can quickly assist port state control to obtain the required ballast water and/or sediment samples.

A note should be added that sampling of ballast water is primarily a matter for the authorized authority, and there is unlikely to be any need for crew members to take samples except at the express request, and under the supervision, of the authorized authority.

B.4 Safety considerations

B.4.1 General

In the BWMP it should be pointed out that various circumstances may affect the ship safety during the ballast water exchange process. Ballast water exchange should only be carried out if it has been demonstrated to be safe, especially in terms of structural strength and stability. Attention has to be paid, but not limited to:

- Weather conditions
- Officer and crew training
- Free surface effects and sloshing loads in slack tanks
- Maintenance of sufficient stability according to trim and stability booklet
- Permissible seagoing strength limits of shear force and bending moments according to trim and stability booklet
- Minimum forward and aft draughts with respect to slamming and propeller immersion
- Bridge visibility

In the BWMP information on safety measures and precautions to be observed during tank entry for control or sediment management have to be included.

B.4.2 Weather

The BWMP has to include a list which identifies circumstances under which ballast water exchange should not be undertaken (e.g. sea state, wind speed) assisting the master in the decision whether ballast
water exchange can be safely carried out en route or not. It has to be pointed out that the decision whether ballast water exchange should be conducted rests in the responsibility of the ship's master.

Areas affected by seasonal heavy weather (typhoons, hurricanes, cyclones) or icing conditions should be avoided as far as possible and other shipping routes chosen.

B.4.3 Officer and crew training

This section provides information needed to ensure that appropriate crew and officer training can be carried out before starting a journey. The following points should be familiar to all personnel responsible for the BWE operation:

- the ship's pumping system in detail, including all arrangements of air and overflow pipes for coordination of the crew working on deck, the pumps involved;
- air pipe heads are not to be used for BWE purposes unless specifically type approved
- functional design of air pipe heads approved for the flow-through BWE method and of overflow pipes (bypass arrangement, blockage of air/overflow pipes, freezing or unintentional closure should be kept under surveillance);
- knowledge of expected time spans for ballast water exchange at sea (this requires knowledge of the ships' operational plan, the routing and the time schedule for passages and ports)
- different methods of ballast water exchange, the risks involved and possible consequences for the ships' stability and strength and the advantages of each method, the possibility of using treatment alternatives or ballast water retention.
- ballast pump capacity restrictions, if any.
- procedures for recording, sampling and sounding to provide a proper record as required in the regulations.
- procedures for safe entry into ballast water tanks for control or sediment removal.

B.4.4 Free surface effects and sloshing loads in slack tanks

This section informs the responsible personnel for BWE about the negative influence of the free surface effect. It should explicitly inform about the tanks or tank pairs with the greatest free surface moments and should include information about possible measures to reduce the negative effect such as selection of suitable BWE method and retention on board.

The sections has to include safety warnings on ballast water transfer or exchange operations, which can generate significant structural loads by sloshing action in partially filled tanks. If operations include partially filled tanks, consideration should be given to carrying out the operation in favourable sea conditions such that the risk of structural damage is minimized.

B.4.5 Stability considerations

In this section information on the stability limits applicable to the vessel is to be included, such as the minimum required GM as function of the draught and the corresponding trim range according to the stability booklet.

Compliance with the stability limits considering the free surface effects should be assured for every stage of the voyage.

Information on the required bridge visibility as function of draught and trim should be included in this section.

B.4.6 Strength considerations

In this section information on the strength limits applicable to the vessel in regard of longitudinal and torsional strength and approved minimum forward draft is to be included. Compliance with the approved strength limits is to be assured for every stage of the voyage.

Additional considerations regarding the effects of tank over pressurization are to be included in this section.
B.4.7 Loading instrument
As far as applicable to the selected exchange method the officer of any ship should be advised to pre-calculate the stability and strength curves for every step during a ballast water exchange operation using a loading instrument on board.

B.5 Procedures for managing ballast water
This section gives guidance on ballast handling procedures. The preferred method or methods of ballast water handling should be stated here, e.g. ballast water exchange at sea through sequential method, flow-through method, dilution method, ballast water treatment or discharge to reception facilities.

The section has to inform about precautionary practices for avoiding unnecessary discharge of ballast water and minimizing the uptake of aquatic organisms and sediments.

The vessel’s staff should be familiar with the requirements of the port authorities with respect to ballast water and sediment management and treatment procedures, including information that will be needed to obtain entry clearance.

A ballast handling plan for a voyage with ballast should be prepared in advance. The safety information in B.4 should be taken into account when preparing the voyage plan. If there are no safe options under any circumstances or conditions, the restrictions should be stated here. Such a statement will assist a master when responding to enquiries from port state authorities.

B.5.1 Sequential method
If the sequential method should be applicable to one or several tanks, this section has to include a short description of the particularities of the method, such as that it involves the removal of large amounts of ballast water from the ship in a dynamic situation and the subsequent replacement by fresh ballast water to achieve at least a 95 per cent volumetric exchange. It should be pointed out that this is a different procedure from ballasting in port since at sea additional loads may act on the ship structure simultaneously, depending on the sea state.

It is recommended that the original condition is restored after each cycle of discharge and filling. The decision on whether to start ballasting operations or proceed with the next exchange step should be made by taking into account the ship’s position, weather forecast, machinery performance and degree of crew fatigue. If any of these factors are considered unfavourable the ballast water exchange should be suspended or halted.

Heeling effects due to asymmetrical emptying or filling have to be taken into account. Actual operations must be managed so that lists do not develop during pumping.

The steps have to meet stability and strength requirements, trim and draught requirements to avoid slamming and propeller emersion while changing ballast, and to maintain the bridge visibility within tolerable limits.

It is as important to avoid excessive under pressure in a tank as a result of emptying, as it is to avoid excessive overpressure when filling. For this purpose:

- all self-acting appliances such as air heads or pressure-vacuum valves have to be kept in proper working condition and free from obstructions hampering the flow of air in and out
- all manually operated appliances such as ventilation louvers have to be checked before the start of any pumping operations with the respective tanks.

If the sequential method should be applicable for one or several tanks, exchange sequences of ballast water are to be demonstrated at least for the conditions according to B.10.

B.5.2 Flow-through method
If the flow-through method should be applicable to one or several tanks, this section has to include a short description of the particularities of the method, whereby tanks are flushed by pumping-in additional sea water to achieve at least a 95 per cent volumetric exchange. It is recommended to pump through three times the volume of the tank. This method has the advantage that it can be used in weather conditions which would be marginal for use of the sequential method, since there is little change to the condition of the ship. However, the flow-through method introduces certain other risks which must be considered before using this procedure.
Care should be taken when the flow-through method is used for partially filled tanks. For safety reasons it has to be checked whether it is possible to first empty the tank and refill it. Otherwise the tank has to be filled completely and water pumped through the filled-up tank, if the vessel’s condition allows doing so. In any case, the change of the condition of the vessel has to be observed similar to the sequential method, i.e. sufficient longitudinal strength, stability, mean draught, bow draught, bridge visibility etc. has to be checked.

Each step has to be checked for conformity with strength and minimum stability requirements of the ship and documented.

If the flow-through method should be applicable for one or several tanks, exchange sequence of ballast water has to be demonstrated at least for the conditions according to B.10.

B.5.3 Dilution method

If the dilution method should be applicable to one or several tanks, this Section has to include a short description of the particularities of the method, consisting of simultaneously filling fresh ballast water at the top of the tank and discharging at the same rate from the bottom maintaining constant water level in the tank throughout the ballast water exchange process. As for the flow-through method it is recommended to pump through three times the volume of tank.

This method offers similar benefits as the flow-through method in regard of stability and strength, but it is better suited for partially filled tanks. In the cases when the ballast water in partially filled tanks will be exchanged permanent control on the filling and discharging rates has to be assured in order to maintain the constant ballast water level for the complete process.

If the dilution method should be applicable for one or several tanks, exchange sequences of ballast water are to be demonstrated at least for the conditions according to B.10.

B.5.4 Ballast water treatment

If the vessel is provided with BWMS a short description of the functional principle and a reference to the operational and technical manuals held on board is to be included.

After the due date of the vessel is reached (according to the D-2 implementation scheme) the operation of BWMS complying with the D-2 performance standard eliminates the need for ballast water exchange.

B.5.5 Other methods

If other ballast water management procedures are planned, it should be ensured that these methods are acceptable to the port authorities and sufficiently described in the BWMP.

B.6 Sediment and biofouling management

B.6.1 Sediment management

Residuals of sediment taken in the ballast water tanks can contain an assortment of microorganisms, including resting stages. When tanks are later filled with ballast water the accumulated sediment and associated biota may be re-suspended and discharged at subsequent ports of call.

Ballast water tanks and their internal structure should be designed to minimize accumulation of sediments and allow for easy cleaning and maintenance, as required by BWM Convention, Guideline G12. Structural measures alone are not sufficient to reduce the uptake of sediment, therefore information on procedures for minimizing the uptake of sediments is to be included as required by BWM Convention, Guideline G4, Part A, Paragraph 1.1.3.

The volume of the settled down sediments should be regularly monitored and regularly removed in accordance with the Ballast Water Management Plan. Removal of sediment from ballast tanks should preferably be undertaken under controlled conditions in port, at a repair facility or in dry dock.

B.6.2 Biofouling management plan

Biofouling is the accumulation of microorganisms, plants, algae, or animals on immersed or wetted surfaces. The aquatic species attached to the ship’s hull or other structures and transported to other places or ports could cause damage to the local environment and species.
A Biofouling Management Plan (BFMP) is currently not required by the BWM Convention, but there is an increasing number of Flag States and Port State Authorities which require information, procedures and recording possibilities to be provided on board.

For information required to be included in the BFMP, reference is made to the IMO, MEPC.207(62) - 2011 Guidelines for the Control and Management of Ships’ Biofouling to Minimize the Transfer of Invasive Aquatic Species.

The BFMP should be prepared as a separate document and the BWMP has to refer to it.

The acceptance of the BFMP prepared according to IMO, MEPC.207(62) should be clarified with the respective port state authorities.

B.7 Methods of communication

In this section instructions and procedures for communication and co-ordination of the discharge of ballast in waters of coastal States are to be included. The master should contact the ships company or the port state authorities well before arriving in territorial waters and obtain the latest discharge and reporting requirements.

B.8 Duties of appointed ballast water management officer

To facilitate the administration of BWM procedures on board, a responsible officer should be appointed. His duties are to be documented. These typically include but are not limited to:

- Ensuring that the ballast water treatment or exchange follows procedures laid down in the BWMP
- Preparing the ballast water declaration form prior to arrival in port
- Being available to assist the port state control for any sampling that may need to be undertaken
- Maintaining the ballast water handling log
- Other duties related to ballast water and sediment handling specified by the company
- Operational responsibility during ballast water exchange
- Informing the Master about the ballast water exchange progress

B.9 Ballast water record book

Each ship shall have on board a ballast water record book that may be an electronic record system, or that may be integrated into another record book or system. A sample template is included in the GL BWM Model Booklet and can be downloaded from the GL website.

Ballast Water Record Book entries are to be maintained on board the ship for a minimum period of two years after the last entry has been made and thereafter in the Company’s control for a minimum period of three years.

In the event of the discharge of Ballast Water pursuant to regulations A-3, A-4 or B-3.6 of the BWMC or in the event of other accidental or exceptional discharge of Ballast Water not otherwise exempted by the Convention, an entry shall be made in the Ballast Water Record Book describing the circumstances of, and the reason for, the discharge.

The Ballast Water Record Book is to be kept readily available for inspection at all reasonable times and, in the case of an unmanned ship under tow, may be kept on the towing ship.

Each operation concerning Ballast Water has to be fully recorded without delay in the Ballast Water Record Book. Each entry has to be signed by the officer in charge of the operation concerned and each completed page shall be signed by the master. The entries in the Ballast Water Record Book have to be written in the working language of the ship. If that language is not English, the entries have to contain English translations.

B.10 Exchange sequences

Depending on the BWE method(s) applicable for each vessel, one or more exchange sequences are to be included in the BWMP as guidance for the master.

For all ballast water exchange steps compliance with the vessel’s stability limits, permissible trim range, permissible draughts, bridge visibility, and strength requirements have to be demonstrated.
B.10.1 Exchange sequences using the sequential method

For ships which have at least one ballast water tank, for which the sequential method is applicable, exchange sequences based on the following loading conditions are to be included:

- the normal ballast condition and, if applicable, the heavy ballast condition
- the loading condition containing the greatest volume of ballast water on board the vessel
- a loading condition with ballast water on board which is critical regarding stability, floating position and/or strength

The exchange sequence of ballast water has to summarise the following information at the start and end point of each step:

- ballast water volume for each tank
- involved pumps
- estimated time span
- strength values in relation to permissible values
- stability information under consideration of free surface effects during filling or discharging
- draught values at F.P. and A.P.
- bridge visibility

B.10.2 Exchange sequences using the flow-through or the dilution method

If the flow-through or the dilution methods are applicable to all ballast water tanks a step by step procedure has to be generated, including the order in which tanks are to be processed. This may be done in table form, where for each step the tank, its volume, the available pumps and the estimated time for three exchanges is stated for the loading condition with greatest ballast water volume on board.
Section 3  Ballast Water Exchange for Compliance with the D-1 Standard of the BWM Convention and Assignment of Class Notation BWM (D1)

A  General
For vessels without class notation BWM (D1), but ordered with documentation confirming the compliance with the D-1 Standard of the BWM Convention the design requirements in part C of this Section are to be observed and an approved Ballast Water Management Plan as required by regulation B-1 of the BWM Convention has to be provided.

For vessels with class notation BWM (D1) an approved Ballast Water Management Plan is required according to Section 2.

B  Documentation
This subsection lists the minimum documentation required for review or approval, taking into account the ballast water exchange methods applicable to a particular vessel.

B.1  Structure
B.1.1 Structural drawings according to GL Rules for Hull Structures (I-1-1), Section 1, G and GL Rules for Classification and Surveys (I-0), Section 2, D.2 as applicable.
B.1.2 For bulk carriers constructed according to the IACS Common Structural Rules for Bulk Carriers (CSR-BC), drawings according to CSR-BC, Chapter 1, Section 2, Table 1 as applicable.
B.1.3 For tankers constructed according to the IACS Common Structural Rules for Double Hull Oil Tankers (CSR-T), drawings according to CSR-T, Section 3, Paragraph 2 as applicable.
B.1.4 In addition to the drawings required in B.1.1, B.1.2 or B.1.3, information has to be provided regarding the applicable ballast water exchange method for all tanks and the corresponding design pressure according to GL Rules for Hull Structures (I-1-1), Section 4, A.3.

B.2  Machinery and systems
B.2.1 Machinery and systems drawings according to GL Rules for Machinery Installations (I-1-2), Section 11, A.2 as applicable.
B.2.2 In addition to the drawings required in B.2.1 calculations of pressure losses according to GL Rules for Hull Structures (I-1-1), Section 4, A.3.
C Design Requirements

For design requirements to be fulfilled in regard of ballast water exchange and sediment management reference is made to the BWM Convention, in particular Sections A to E and

Resolution MEPC.173(58) - Guidelines for Ballast Water Sampling (G2),
Resolution MEPC.124(53) - Guidelines for Ballast Water Exchange (G6),
Resolution MEPC.149(55) - Guidelines for Ballast Water Exchange Design and Construction Standards (G11) and
Resolution MEPC.209(63) - 2012 Guidelines on Design and Construction to Facilitate Sediment Control on Ships (G12).

C.1 Structure

The longitudinal and local strength of the vessel is to be within the approved strength limits at each stage of the ballast water exchange.

In general the principles and requirements of GL Rules GL Rules for Hull Structures (I-1-1) as applicable are to be observed. For bulk carriers and tankers constructed according to the IACS Common Structural Rules, the applicable CSR are to be observed.

C.1.1 Longitudinal strength

C.1.1.1 For all ship types GL Rules for Hull Structures (I-1-1), Section 5, and in particular for ballast water exchange, B.4 is to be observed.

C.1.2 Local strength

C.1.2.1 For tank structures of all ship types GL Rules for Hull Structures (I-1-1), Section 4 applies. In regard of ballast water exchange and the design pressure loads, GL Rules for Hull Structures (I-1-1), Section 4, A.3 and D are to be observed.

C.1.2.2 The design bottom slamming pressure during sequential ballast water exchange operations (the effect of different tank filling levels on the ship’s draught) GL Rules for Hull Structures (I-1-1), Section 4, B.6 is to be observed.

C.2 Stability

C.2.1 During all stages of the ballast water exchange process, compliance with the applicable stability criteria is to be assured.

C.2.2 For minimum stability requirements for all vessels SOLAS 74/78 as amended by IMO Resolution MSC. 216(82) (thereafter referred to as SOLAS 2009), Chapter II-1, Part B, Regulations 4 and 5 is to be observed.

C.2.3 Depending on the ship type, additional or alternative stability criteria may be required by the Administration.

C.2.4 Bridge visibility according to SOLAS 2009, Chapter V, Regulation 22 is to be maintained during all stages of the ballast water exchange.

C.2.5 During all stages of the ballast water exchange the draught at the fore perpendicular should be in compliance with requirements of GL Rules for Hull Structures (I-1-1), Section 4, B.6 and the propeller is to be sufficiently submerged to assure adequate manouevrability of the ship.

C.3 Machinery and systems

C.3.1 For all ship types GL Rules for Machinery Installations (I-1-2), Section 11 applies. In regard of ballast systems, Machinery Installations (I-1-2), Section 11, P is to be observed.
C.3.2 All ballast water tanks are to be provided with a sufficient number of air/overflow pipes according to GL Rules for Machinery Installations (I-1-2), Section 11, R, assuring sufficient cross-sectional area to prevent over or under pressure during ballast water exchange in order not to exceed the design values according to GL Rules for Hull Structures (I-1-1), Section 4, A.3 and D. For ships with cargo spaces equipped for taking ballast water in heavy ballast conditions, additional provisions for air pressure control may be considered.

C.3.3 For ballast water exchange using the flow-through method, provisions are to be made to prevent overflow through the air pipe heads unless the air pipe heads are type approved for this operation.

C.3.4 For ballast water exchange using the dilution method, provisions are to be made to maintain constant water level during the exchange process.

C.3.5 For the arrangement of sampling possibilities reference is made to the BWM Convention and Resolution MEPC.173(58) - Guidelines for Ballast Water Sampling (G2).

C.4 Surveys

If a compliance document is requested an initial/implementation survey ¹ has to be carried out. Moreover, periodic surveys (annual, intermediate, class renewal) are to be carried out to maintain the validity of the compliance document. The compliance document is voluntary as long as the BWM Convention has not been ratified and the vessel has not reached the due date after the BWM Convention has entered into force.

For vessels with class notation BWM (D1) a compliance document is mandatory.

This survey shall verify that an approved Ballast Water Management Plan, a Ballast Water Record Book and any associated structure, equipment, systems, fitting and arrangements are onboard.

¹ Initial survey is applicable for new buildings; implementation survey for retrofits. All surveys for ships in service can be ordered by the owner via the GL webpage tool 'fleet online'.
Section 4  Ballast Water Management Systems for Compliance with D-2 Standard of the BWM Convention

A  General

This Section covers GL requirements for BWMS installed onboard to meet the D-2 performance standard.

BWMS are to be type approved by a flag administration according to IMO Resolution MEPC.174(58) – G8 Guidelines. BWMS which make use of active substances are to comply with MEPC.169 (57) – G9 Guidelines.

The deadline for installation of a BWMS using treatment technologies depends on the ballast water capacity and the keel laying date of the ship. Refer to the International Convention for the Control and Management of Ship’s Ballast Water and Sediments, 2004 – Regulation B-3, as amended.

Fig. 4.1 below outlines the four modules (A to D) of the approval process covered by these Guidelines.

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Module A: Type Approval by Flag Administration or RO

A BWMS requires Type Approval by a Flag Administration or RO before being installed on board a ship. This is documented in the form of a Type Approval Certificate. However, there are classification related issues with respect to the system itself and the integration into a ship that need to be addressed separately under a GL Approval process. These issues are addressed in the corresponding process modules B to D in Fig. 4.1.

Module B: Optional GL BWMS Approval

This GL BWMS Approval is optional and typically applied for by the BWMS manufacturer. Under this approval, which covers aspects not addressed by the Flag Administration Type Approval, conformity with GL Rules is verified. Examples include electromagnetic compatibility, pressure vessels and material selection. As part of the GL BWMS Approval process some aspects of the ship specific drawing approval in module C are already examined, thereby facilitating improved time efficiency in module C. Successful verification is documented in the form of a GL Approval Certificate.
Module C: Ship specific drawing approval

The objective of this module is to verify compliance of the on board installation with GL Rules, mainly regarding piping systems, electrical installations and control and monitoring equipment. Successful verification is documented in an Approval Letter.

Module D: Onboard surveys

The onboard surveys consist of an initial / implementation survey (to confirm that the BWMS installation complies with the approved drawings, a functional test of the installation taking due account of the ship’s operating profile), and periodic surveys, see D.7.

Successful completion of the process shown in Fig. 4.1 will be documented by a compliance document (refer to Section 1, B)

The compliance document is a precondition to apply for the voluntary class notation BWM (D2) or BWM (Tr) which is issued for ships equipped with BWMS or equivalent means of complying with the D-2 Standard (Refer to Section 1, E.2).

The different outcomes of the approval process modules described above, i.e.(i) GL Approval Certificate, (ii) SoC, IBWMC, DoC or (iii) class notations BWM (D2) or BWM (Tr), require different documents to be submitted for approval, review or information. These are listed in Tables 4.1 and 4.2 of subsection B below. GL may require further documentation if deemed necessary.

B Documents to be submitted

B.1 Documents related to GL BWMS Approval

The documents listed in Table 4.1 are to be submitted for the optional GL Approval of a BWMS, see also module B in Fig. 4.1.

Table 4.1 Documents to be submitted for GL Approval of BWMS

<table>
<thead>
<tr>
<th>Statutory Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Type Approval Certificate (TAC) of the BWMS of the issuing Administration</td>
</tr>
<tr>
<td>2 Operation and technical manuals of the BWMS</td>
</tr>
<tr>
<td>3 Equipment manuals for major components of the BWMS</td>
</tr>
<tr>
<td>4 For BWMS which apply a treatment method generating or emitting harmful gases, e.g. hydrogen, a hazard analysis may be required (incl. an indication of suitable means for the monitoring and release of the gases identified in the hazard analysis in the relevant diagrams and arrangement drawings)</td>
</tr>
<tr>
<td>5 Safety data sheets for process chemicals (active substances and neutralization chemicals)</td>
</tr>
<tr>
<td>6 Arrangement of storage and handling of process chemicals (e.g. ventilation, gas detection, temperature monitoring), if applicable</td>
</tr>
<tr>
<td>7 Documentation relating to the corrosive effects of the BWMS on tank coatings, steel plating or ballast water piping</td>
</tr>
<tr>
<td>8 Installation specification, commissioning and calibration procedure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Classification related documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 Piping and instrumentation diagram (P&amp;I) including parts list, material specification, pipe dimensions</td>
</tr>
<tr>
<td>10 Design drawings of pressure vessels (filter, reactors, heat exchangers) indicating operational data (pressure, temperature). Design details of pressurized parts (volume, material specification, weldment details)</td>
</tr>
</tbody>
</table>

Note: It is recommended that subcontractors apply for drawing approval individually.
11 Switchboard layout, circuit diagrams, power supply and list of components

12 For monitoring and control system: block diagram, wiring diagrams and list of components

13 Reports of environmental tests carried out on electrical and electronic equipment of BWMS according to GL Guidelines Test Requirements for Electrical / Electronic Equipment and Systems (VI-7-2)

14 If installed in hazardous areas: electrical equipment list specifying type of equipment, manufacturer, place of installation, degree of explosion protection and ingress protection. Moreover, copies of certificates of conformity relating to any topic in the electrical equipment list

15 Description of Quality Assurance System of BWMS manufacturer and suppliers of main components, e.g. ISO 9001 certification

16 Certificates issued by other classification societies and related test reports (BWMS or individual components), if any

**B.2 Documents related to ship integration of BWMS**

**B.2.1 Documents required for class notation BWM (D2) and D-2 compliance certificate**

Table 4.2 below specifies the drawings, plans and technical particulars to be verified for compliance with the BWM Convention, as amended, and GL Rules. Refer also to Fig. 4.1, Module C. Classification requirements shall, inter alia, protect other ship systems from potential adverse effects emanating from the BWMS.

**Table 4.2 Documents to be submitted for issuance of D-2 compliance certificates and assignment of class notation BWM (D2)**

<table>
<thead>
<tr>
<th>Statutory documents</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Type Approval Certificate of the Ballast water management system (BWMS) of the issuing Administration</td>
<td></td>
</tr>
<tr>
<td>2 Operation and technical manuals of the BWMS specific to the ship</td>
<td>A</td>
</tr>
<tr>
<td>3 BWM Plan (Resolution MEPC.127(53))</td>
<td>A</td>
</tr>
<tr>
<td>4 Ballast Water Record Book</td>
<td>R</td>
</tr>
<tr>
<td>5 Piping and Instrumentation diagram (P&amp;I) of the BWMS specifying the connections to the ballast system</td>
<td>A</td>
</tr>
<tr>
<td>6 Equipment manual for major components of the BWMS</td>
<td>I</td>
</tr>
<tr>
<td>7 Hazard analysis if the BWMS or the storage tanks for process chemicals could emit harmful gases, e.g. hydrogen</td>
<td>I</td>
</tr>
<tr>
<td>8 Safety data sheets for process chemicals (active substances and neutralization chemicals)</td>
<td>I</td>
</tr>
<tr>
<td>9 Arrangement of storage and handling of process chemicals (e.g. ventilation, gas detection, temperature monitoring)</td>
<td>R</td>
</tr>
<tr>
<td>10 Installation specification, commissioning and calibration procedure</td>
<td>I</td>
</tr>
<tr>
<td>11 Structure of the ballast water tanks (Refer to BWMC, B-5, Guideline G12, para. 4 )</td>
<td>A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Classification related documents</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>12 Arrangement of compartments containing BWMS</td>
<td>R</td>
</tr>
<tr>
<td>13 Supporting ship structure/ foundations for BWMS, including storage tanks if applicable</td>
<td>A</td>
</tr>
<tr>
<td>14 Piping and Instrumentation diagram (P&amp;I) of the BWMS including parts list, material specification, pipe dimensions</td>
<td>A</td>
</tr>
</tbody>
</table>
B.2.2 Documents required for class notation BWM (Tr)

In addition to the documents listed in Table 4.2 the BWMS must have obtained a GL BWMS Approval (documents listed in Table 4.1 refer).

C Requirements for GL Approval of BWMS

For the optional GL Approval of BWMS compliance with the following requirements is to be demonstrated.

C.1 Piping systems and pressure vessels

For the selection of materials and the design of piping systems and pressure vessels forming part of the BWMS the Rules for Machinery Installations (I-1-2), Sections 1, 8, 11 and 15 apply.

C.2 Electrical installations, monitoring and control equipment

C.2.1 For electrical and electronic equipment the requirements in GL Rules for Electrical Installations (I-1-3), Sections apply, in particular Sections 1, 2F, 3A, 4H, 5, 6, 12, 20 and 21.

Test requirements laid down in GL Guidelines Test Requirements for Electrical / Electronic Equipment and Systems (VI-7-2), Section 3 apply. Regarding EMC requirements, tests B.21 (conducted emissions) and B.22 (radiated emissions) are to be carried out as a minimum.

If the BWMS is to be installed in hazardous areas, an electrical equipment list is to be submitted. This equipment list is to specify type, manufacturer, place of installation, certified degree of explosion protection (explosion group and temperature class) and the ingress protection (IP-degree) of every electrical installation in the hazardous area. Certificate copies of conformity are to be submitted for information relating to each item in the electrical equipment list. The requirements in GL Rules for Electrical Installations (I-1-3), Section 17 apply.
D Requirements for Ship Specific Approval

This subsection sets out requirements relating to document approval and survey for the BWMS and its integration into the ballast water system of the ship.

D.1 Hazard analysis

If the BWMS or the storage tanks for process chemicals could emit harmful gases, e.g. hydrogen, a hazard analysis is to be conducted to identify potential hazards and define appropriate control measures.

The hazard analysis is to be a self contained document addressing design and operational aspects of the BWMS and consider inter alia (refer to IMO MSC 83, INF2):

- BWMS installation location
- Storage and handling of process chemicals (including ventilation, high/low temperatures)
- Fire hazards
- Ballast water tanks

D.2 Piping systems and pressure vessels

D.2.1 For the selection of materials and the design of piping systems and pressure vessels forming part of the BWMS, GL Rules for Machinery Installations (I-1-2), Sections 1, 8, 11 and 15 apply.

D.2.2 Where BWMS generate gases that may constitute a fire or explosion hazard, e.g. hydrogen, or have toxic properties, the means to monitor, control and discharge these gases are to be indicated in the piping and instrumentation diagram.

D.2.3 Regular ballast water operation is to be ensured in the case of malfunctioning of a BWMS, e.g. by means of a bypass. Alternative measures such as redundant arrangement of BWMS will be considered on a case by case basis.

D.2.4 Valves in the by-pass line are to be fitted with a position indicator for monitoring of the by-pass event in the log device of the BWMS. This event is to be alarmed at suitable locations, see item B.3.5 below, and, inter alia, recorded for 24 months. If automatic bypassing in case of emergency stop/shut down of the BWMS is not provided, the by-pass valve shall be remotely controlled from the location where the BWMS alarms are activated.

D.2.5 Ballast water that is stored in or passes through the cargo area of tankers (e.g. in ballast water tanks adjacent to cargo tanks) is considered to be hazardous and is not to enter into, or be routed through, any non-hazardous area, e.g. the engine room. BWMS treating water from a tanker’s cargo area are not to be installed in the engine room.

D.2.6 Plastic pipes without L3 test (refer to GL Rules for Machinery Installations (I-1-2), Section 11, B.2.6) may be accepted if the following measures are provided to prevent uncontrolled flooding of the engine room:

1. metallic isolation valves are fitted (at the connections between the BWMS and the ballast main) which are
   i) operable from a safe location outside the space, e.g. fire control station, and
   ii) of fail-safe-closing type (A screw-down non-return valve is accepted at the BWMS discharge side.)
2. the specification of the plastic material is confirmed by GLHO based on flag administration’s written acceptance to be provided.

D.2.7 If small pipes from a tanker’s cargo area are led to the machinery spaces (e.g. chemical feed line, Total Residual Oxydants (TRO) measuring line or neutralisation agent line) they are subject to special approval. Appropriate measures against back flow are to be provided.
D.3 Electrical installations, monitoring and control equipment

D.3.1 For electrical and electronic equipment the requirements in GL Rules for Electrical Installations (I-1-3) apply, in particular Sections 1, 2F, 3A, 4H, 5, 6, 12, 20 and 21. In addition, Sections 14, 15, 16, 17 or 18, depending on the relevant ship type, are to be observed.

D.3.2 If a GL Approval Certificate has not been issued, compliance with tests B.21 (conducted emissions) and B.22 (radiated emissions) according to GL Guideline Test Requirements for Electrical / Electronic Equipment and Systems (VI-7-2), Section 3 is to be demonstrated.

D.3.3 An electrical load analysis of the ship is to be submitted to verify that power supply for the BWMS is adequate. A wiring diagram is to specify the integration of the system into the ships electrical power distribution system.

D.3.4 Data communication with other ship systems shall not adversely affect the functionality of these other systems. Remedial measures have to be documented and related proofs to be furnished.

D.3.5 All visual and audible alarms are to be activated in a suitable location, e.g. cargo control room, deck office or engine control room (ships alarm monitoring system). Continuous ship’s ballast operations shall be safeguarded taking due account of ongoing cargo operations and the implications for the ship’s stability and strength.

D.3.6 Installation in hazardous areas

D.3.6.1 If the certified safe level of explosion protection has not been established as part of a GL Approval of the BWMS, an electrical equipment list is to be submitted. This equipment list is to specify type, manufacturer, place of installation, certified degree of explosion protection (explosion group and temperature class) and the ingress protection (IP-degree) of every electrical installation in the hazardous area. Certificate copies of conformity are to be submitted for information relating to any item in the electrical equipment list.

D.3.6.2 If harmful gases could be released by the BWMS or from stored active substances, these have to be considered in the hazardous area classification plan. Electrical equipment of certified safe type is to be applied in these areas.

D.4 Measures to meet Treatment Rated Capacity (TRC)

The BWMS is always to be operated at a flow rate which does not exceed the TRC specified in the flag administration Type Approval Certificate (TAC).

The TRC applicable is to be indicated in the operational and technical manual specific to the ship and in the BWMP.

In case the installed ballast water pump capacity is higher than the total TRC of the BWMS, flow control measures such as regulating valve, spectacle flange with orifice, blocking device for ballast water pump start, ballast water pump motor control, etc. are to be specified in the operational and technical manual and the BWMP.

D.5 Requirements related to the place of installation

D.5.1 A ballast water management system may be installed in various locations throughout a ship. The type of ship and the type of treatment system is to be observed for the location and piping arrangement. Each installation must be carefully evaluated to verify potential safety concerns and pollution hazards. Moreover, the cargo transported needs to be considered, refer to Section 15.17 in the “Special Requirements” of the IBC Code.

D.5.2 The BWMS shall fulfil all the requirements applicable to the installation space, e.g. regarding explosion proof design.
D.5.3 Ventilation of the installation space
Where the BWMS is installed in the machinery space or pump room the equipment is to be located in a well ventilated area.

In case the BWMS is installed in a separate compartment the ventilation system shall be separated from other ventilation systems and shall be arranged such that a single failure cannot cause a complete ventilation failure for the treatment room.

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

D.5.4 Additional requirements for tankers with cargoes with a flashpoint below 60 deg. C
The BWMS installation place shall be of the exhaust type ventilation and give minimum 30 air changes per hour. If the gases stored, generated or evaporated from liquid state are heavier than air the ventilation exhaust duct shall be led to the bottom of the BWMS installation space. Alternatively, overpressure ventilation can be considered which is to be continuously monitored and so arranged that in the event of a ventilation failure an audible and visual alarm is given at a manned control station and the electrical supply of all equipment not of the certified safe type is to be automatically disconnected.

D.5.5 A supporting structure for the BWMS is to be provided, taking into consideration all operational conditions of the BWMS.

D.6 Handling and storage of chemicals used for BWMS
The BWMS manufacturer's instructions for handling and storage of process gases and chemicals, in particular the safety data sheets for active substances and neutralization chemicals, are to be observed at all times. This may lead to the application of further GL rules, in particular:

Rules for Machinery Installations (I-1-2), Section 12, E, Table 12.1. - Fixed fire extinguishing system
Rules for Ventilation (I-1-21), Section 1, D.6 - Ventilation systems, non sparking fans
Rules for Electrical Installations (I-1-3), Section 1 - Explosion protection

Moreover, national regulations for the storage of chemicals are to be observed.

D.7 Surveys

D.7.1 Factory Acceptance Test (FAT)
A Factory Acceptance Test (FAT) of the BWMS is not required. However, individual components such as pressure vessels (e.g. reactors, filters) or flexible pipes are subject to final inspection by a GL surveyor at the manufacturer's workshop.

If a FAT in the presence of a surveyor is requested by the shipyard or the owner, the test programme is to be agreed between the manufacturer and GL Head Office.

D.7.2 Guidance on initial / implementation survey and compliance document
If a compliance document is requested, an initial/implementation survey has to be carried out.

Moreover, periodic surveys (annual, intermediate, class renewal) are to be carried out to maintain the validity of the compliance document. The compliance document is voluntary as long as the BWM Convention has not been ratified and the vessel has not reached the due date after the BWM Convention has entered into force.

For vessels with class notation BWM (D2) or BWM (Tr) a compliance document is mandatory.

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1 Initial survey is applicable for new buildings; implementation survey for BWMS retrofits. All surveys for ships in service can be ordered by the owner via the GL webpage tool 'fleet online'.
The survey scope is based on the BWMC as amended, e.g. IMO – BWM.2 / Circ. 7 annex 5.

The major items of an initial and implementation survey are:

- Verification that the installation of piping and electrical systems complies with the approved drawings
- Review of component inspection certificates (e.g. for pressure vessels)
- Verification of documents to be kept on board (see Table 4.2, items 1, 2, 3, 4, 5, 8).
- Calibration reports where required are to be verified based on the sensor’s serial number
- Witnessing of functional tests according to manufacturer’s commissioning procedure. Where commissioning was performed without a surveyor present, final GL inspection can be carried out based on the manufacturer’s commissioning report on a case by case basis.
- Issuance of Compliance Certificate