

**RUSSIAN MARITIME REGISTER OF SHIPPING**

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# GUIDELINES

ON APPLICATION OF THE REQUIREMENTS  
OF INTERNATIONAL CONVENTION  
FOR THE CONTROL AND MANAGEMENT  
OF SHIPS BALLAST WATER AND SEDIMENTS,  
2004



Saint-Petersburg  
2017

Guidelines on application of the requirements of International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004, have been approved in compliance with valid regulations and is coming into force since its publication (except for Section 4 Part I).

These Guidelines have been prepared on the basis of the Regulations of International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004, thereto related Guidelines and IMO procedures taking into account amendments, resolutions, circular letters and unified interpretations of IMO and IACS valid at the date of publication, as well as revisions and amendments developed immediately before publication.

The Guidelines are intended for inspectors, ship crews and shipowners.

In case of discrepancies between the Russian and English versions, the Russian version shall prevail.

## CONTENTS

<b>PART I. TECHNICAL SUPERVISION.</b> . . . . .	5
1 General . . . . .	5
1.1 Application . . . . .	5
1.2 Definitions and explanations. . . . .	9
2 Approval of Ballast Water Management Plan. . . . .	15
2.1 Application . . . . .	15
2.2 General requirements . . . . .	15
2.3 Documents submitted for BWM Plan approval. . . . .	16
2.4 Scope of monitoring during approval of Ballast Water Management Plan . . . . .	16
3 Approval of type of ship ballast water and sediments management systems . . . . .	17
3.1 General . . . . .	17
3.2 Documents submitted for type approval of BWMS. . . . .	18
3.3 Prototype Ballast Water Treatment Technology Programme (PBWTT programme) . . . . .	19
3.4 Supervision for BWMS testing . . . . .	20
3.5 Approval and certification procedures for BWMS type approval . . . . .	20
4 Ships surveys for ballast water management . . . . .	21
4.1 Types of surveys . . . . .	21
4.2 Technical documentation . . . . .	22
4.3 Issued certificates . . . . .	23
<b>PART II. DESIGN, EQUIPMENT AND DEVICES OF SHIPS FOR BALLAST WATER AND SEDIMENTS MANAGEMENT</b> . . . . .	24
1 General . . . . .	24
2 Technical requirements for ballast system in compliance with regulation D-1 of the Annex to the Convention. . . . .	24
3 Technical requirements for BWMS in compliance with regulation D-2 of the Annex to the Convention. . . . .	25
4 Technical requirements for BWMS in compliance with regulation D-3 of the Annex to the Convention. . . . .	27
5 Requirements for sampling facilities . . . . .	29
6 Technical requirements for BWMS components to facilitate sediments control and removal . . . . .	29

<b>APPENDIX 1. Test and performance specifications for approval of ballast water management systems . . . . .</b>	<b>30</b>
<b>APPENDIX 2. Specification for environmental testing for approval of ballast water management systems . . . . .</b>	<b>40</b>
<b>APPENDIX 3. Sample analysis methods for the determination of biological constituents in ballast water. . . . .</b>	<b>43</b>
<b>APPENDIX 4. Practical recommendations regarding sampling techniques and procedures for use during assessing the compliance with convention. . . . .</b>	<b>45</b>
<b>APPENDIX 5. Guidance on scaling of ballast water management systems . . . . .</b>	<b>52</b>

# **PART I. TECHNICAL SUPERVISION**

## **1 GENERAL**

### **1.1 Application**

**1.1.1** Provisions of these Guidelines shall apply during surveys of the ship and ship equipment for compliance with International Convention for the Control and Management, 2004 (hereinafter referred to as "the Convention") and IMO resolutions considering IMO and IACS unified interpretations.

**1.1.2** In compliance with Article 3 the Convention requirements specify that unless expressly provided otherwise in this Convention, this Convention shall apply to:

**.1** ships entitled to fly the flag of a Party; and

**.2** ships not entitled to fly the flag of a Party, but which operate under the authority of a Party.

**1.1.3** In compliance with Article 3 this Convention shall not apply to:

**.1** ships not designed or constructed to carry ballast water;

**.2** ships of a Party which only operate in waters under the jurisdiction of that Party, unless the Party determines that the discharge of ballast water from such ships would impair or damage their environment, human health, property or resources, or those of adjacent or other states;

**.3** ships of a Party that only operate in waters under the jurisdiction of another Party, subject to the authorization of the latter Party for such exclusion. No Party shall grant such authorization if doing so would impair or damage their environment, human health, property or resources, or those of adjacent or other states. Any Party not granting such authorization shall notify the Administration of the ship concerned that this Convention applies to such ship;

**.4** ships that only operate in waters under the jurisdiction of one Party and on the high seas, except for ships without an authorization granted according to 1.1.3.3, unless such Party determines that the discharge of ballast water from such ships would impair or damage their environment, human health, property or resources, or those of adjacent of other States;

**.5** any warship, naval auxiliary or other ship owned or operated by a State and used, for the time being, only on government non-commercial service. However, each Party shall ensure, by the adoption of appropriate measures not impairing operations or operational capabilities of such ships owned or operated by it, that such ships act in a manner consistent, so far as is reasonable and practicable, with this Convention; and

**.6** permanent ballast water in sealed tanks on ships, that is not subject to discharge;

**.7** provisions of the Convention are not applicable to the water in the hopper area of hopper dredgers in compliance with IMO BWM.2/Circ.32 (as such water is not covered by the "ballast water" definition in compliance with the Convention definitions and is used for operation process of the hopper dredges).

**1.1.4** With respect to ships of non-Parties to this Convention, Parties shall apply the requirements of this Convention as may be necessary to ensure that no more favourable treatment is given to such ships.

**1.1.5** Unless otherwise specified, the ballast water discharge shall be performed by the ballast water control and management in compliance with the provisions of the Annex to the Convention.

**1.1.6** For ships to which the Convention requirements of regulation B-3 of the Annex to the Convention or any other measures adopted by the Party in compliance with Article 2.3 (about more strict measures adopted by the Party) and Section C are applied, according to regulation A-3 of the Annex to the Convention these requirements shall not apply to:

**.1** uptake or discharge of ballast water and sediments necessary for the purpose of ensuring the safety of a ship in emergency situations or saving life at sea; or

**.2** accidental discharge or ingress of ballast water and sediments resulting from damage to a ship or its equipment:

**.2.1** provided that all reasonable precautions have been taken before and after the occurrence of the damage or discovery of the damage or discharge for the purpose of preventing or minimizing the discharge; and

**.2.2** unless the shipowner, company or officer in charge wilfully or recklessly caused damage; or

**.2.3** uptake and discharge of ballast water and sediments when being used for the purpose of avoiding or minimizing pollution incidents from the ship; or

**.2.4** uptake and subsequent discharge on the high seas of the same ballast water and sediments; or

**.2.5** discharge of ballast water and sediments from a ship at the same location where the whole of that ballast water and those sediments originated and provided that no mixing with unmanaged ballast water and sediments from other areas has occurred. If mixing has occurred, the ballast water taken from other areas is subject to ballast water management in compliance with the Annex to the Convention.

**1.1.7** For the ships for which the Convention requirements are applied in compliance with regulation A-4 of the Annex to the Convention the exemptions may be granted as follows:

.1 a Party or Parties, in waters under their jurisdiction, may grant exemptions to any requirements to apply regulations B-3 or C-1 of the Annex to the Convention, in addition to those exemptions contained elsewhere in this Convention, but only when they are:

.1.1 granted to a ship or ships on a voyage or voyages between specified ports or locations; or to a ship which operates exclusively between specified ports or locations;

.1.2 effective for a period of not more than 5 years subject to intermediate review (survey);

.1.3 granted to ships that do not mix ballast water or sediments other than between the ports or locations specified in 1.1.7.1.1.1; and

.1.4 granted based on the Guidelines on risk assessment developed by IMO (refer to IMO resolution MEPC.162(56));

.2 exemptions granted according to 1.1.7.1 shall not be effective until after communication to IMO and circulation of relevant information to the Parties;

.3 any exemptions granted under this regulation shall not impair or damage the environment, human health, property or resources of adjacent or other States. Any State that the Party determines may be adversely affected shall be consulted, with a view to resolving any identified concerns;

.4 any exemptions granted under this regulation shall be recorded in the ballast water record book.

1.1.8 According to regulation A-5 of the Annex to the Convention for pleasure craft solely intended for recreation or competition or craft intended primarily for search and rescue, less than 50 m in length overall, and with a maximum ballast water capacity of 8 m<sup>3</sup>, the Administration shall determine the equivalent compliance with this Annex to the Convention taking into account the Guidelines for Ballast Water Management Equivalent Compliance (G3) (refer to IMO resolution MEPC.123(53)).

1.1.9 As to the requirements for ballast water control and management for ships in accordance with IMO resolution A.1088 (28) considering the date of entry into force of the Convention on 8 September 2017, the date of the first survey to renew the International Oil Pollution Prevention Certificate (IOPP Certificate) after 8 September 2017 shall be considered the date of entry into force of regulation D-2 of the Annex to the Convention for each ship specified in regulation B-3 of the Annex to the Convention. Prior to the date of entry into force of regulation D-2, the requirements of regulation D-1 of the Annex to the Convention shall be met on board that shall be confirmed in the International Ballast Water Management Certificate (form 2.5.4).

According to regulation B-3.7 of the Annex to the Convention other methods of ballast water management may also be applied as alternatives to

the abovementioned methods, provided that such methods ensure at least the same level of environmental protection and human health, and are approved in compliance with IMO resolution MEPC.206(62):

.1 a ship constructed before 2009:

.1.1 with a ballast water capacity of between 1,500 and 5,000 m<sup>3</sup>, inclusive, shall conduct ballast water management that at least meets the standard specified in regulation D-1 or regulation D-2 of the Annex to the Convention until 2014, after which time it shall at least meet the standard specified in regulation D-2 of the Annex to the Convention;

.1.2 with a ballast water capacity of less than 1,500 or greater than 5,000 m<sup>3</sup> shall conduct ballast water management that at least meets the standard specified in regulation D-1 or regulation D-2 of the Annex to the Convention until 2016, after which time it shall at least meet the standard specified in regulation D-2 of the Annex to the Convention;

.2 a ship to which 1.1.9.1 applies shall comply with specified requirement not later than the first intermediate or renewal survey, whichever occurs first, after the anniversary date of delivery of the ship in the year of compliance with the standard applicable to the ship.

In compliance with IMO circular BWM.2/Circ.29/Rev.1 the "anniversary date of delivery of the ship in the year of compliance" shall be interpreted:

for 1.1.9.1.1.1 of the Guidelines (for regulation B-3.1.1 of the Annex to the Convention) — the first intermediate or renewal survey, whichever occurs first, after the anniversary date of delivery of the ship in 2014;

and for 1.1.9.1.2 of the Guidelines (for regulation B-3.1.2 of the Annex to the Convention) — the first intermediate or renewal survey, whichever occurs first, after the anniversary date of delivery of the ship in 2016;

.3 a ship constructed in or after 2009, but before 2012, with a ballast water capacity of 5,000 m<sup>3</sup> or more, shall conduct ballast water management in compliance with regulation D-2 standard of the Annex to the Convention;

.4 a ship constructed during or after 2009, but before 2012, with a ballast water capacity of 5,000 m<sup>3</sup> or more shall be required to comply with 1.1.2.

In compliance with IMO circular BWM.2/Circ.29/Rev.1 it shall be interpreted that ships constructed during or after 2009, but before 2012, with a ballast water capacity of 5,000 m<sup>3</sup> or more shall be required to comply with regulation D-2 standard of the Annex to the Convention not later than the first intermediate or renewal survey, whichever occurs first, after the anniversary date of delivery of the ship in 2016.

.5 a ship constructed in or after 2012, with a ballast water capacity of 5,000 m<sup>3</sup> or more shall conduct ballast water management in compliance with regulation D-2 standard of the Annex to the Convention.



.6 the requirements of this regulation shall not apply to the ships that discharge the ballast waters to the reception facility designed considering the Guidelines for such facilities developed by IMO.

.7 as alternative to the requirements of 1.1.9.1 — 1.1.9.5 above the other methods of the ballast water management in compliance with regulations D-3 and D-4 of the Annex to the Convention can be adopted provided that these methods ensure at least the same protection level of the environment, human health, property or resources, and are approved by the Marine Environment Protection Committee (MEPC).

The detailed procedure for the approving other methods of the ballast water management in compliance with regulation B-3.7 of the Annex to the Convention is specified in IMO resolution MEPC.206(62).

**1.1.10** The requirements of regulation B-3 of the Annex to the Convention are not applied to the ships that discharge ballast waters to reception facilities designed taking into account the Guidelines (G5) of IMO resolution MEPC.153(55).

## **1.2 Definitions and explanations**

**1.2.1** For the purpose of these Guidelines the following definitions and explanations are used:

**Administration** means the Government of the State under whose authority the ship is operating. With respect to a ship entitled to fly under a flag of any State, the Administration is the Government of that 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/FSOs) 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 a fungus, that has a general or specific action on or against harmful aquatic organisms and pathogens.

**Ballast water** means water with its suspended matter taken on board a ship to control trim, list, draught, stability or stresses of the ship.

**Land-based Testing** means a test of the Ballast Water Management System carried out in a laboratory, equipment factory or pilot plant including a moored test barge or test ship to confirm that the BWMS meets the standards set by regulation D-2 of Annex to the Convention.

**Shipboard testing** means a full-scale test of a complete BWMS carried out on board a ship according to these Guidelines, to confirm that the system meets the standards (refer to regulation D-2 of the Annex to the Convention).

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

**Harmful aquatic organisms and pathogens** means aquatic organisms or pathogens which, if introduced into the sea, including estuaries, or into fresh water courses, may cause injury or damage to the environment, human health, property or resources, impair biological diversity or interfere with other legitimate uses of such areas.

**Secretary-General** means the IMO Secretary-General.

**Anniversary date** means the day and the month of each year corresponding to the date of expiry of the International Certificate for the Ballast Water Management.

**Viable organisms** means organisms and any life stages thereof that are living.

**Major conversion** means a conversion of a ship in accordance with regulation A-1 of the Annex to the Convention:

- .1 which changes its ballast water carrying capacity by 15 % or greater; or
- .2 which changes the ship type; or
- .3 which, in the opinion of the Administration, is projected to prolong its life by 10 years or more; or
- .4 which results in modifications to its ballast water system other than component replacement-in-kind. Conversion of a ship to meet the provisions of regulation D-1 of the Annex to the Convention shall not be deemed to constitute a major conversion for the purpose of Annex to the Convention.

**Segregated ballast** means the ballast water introduced into a tank which is completely separated from the cargo oil and fuel oil system and which is permanently allocated to the carriage of ballast or to the carriage of ballast cargoes other than oil or noxious liquid substances.

**Maritime Environment Protection Committee (MEPC)** means IMO authority authorized to perform the basic and final approval of the active substances use in the BWMS.

**Company** means the shipowner or any other organization or person such as the manager, or the bareboat charterer, who has assumed the responsibility for operation of the ship from the owner of the ship and who on assuming such responsibility has agreed to take over all the duties and responsibilities imposed by the International Safety Management Code (ISM Code).

**Convention** means the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004.

**Control equipment** means the installed equipment required to operate and control the ballast water treatment equipment.

**Treatment rated capacity (TRC)** means the maximum continuous capacity, in m<sup>3</sup>/h, 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 Annex to the Convention.

**Sediments** means matter settled out of Ballast Water within a ship.

**Monitoring equipment** means the equipment installed for assessment of the correct operation of the prototype ballast water treatment technology.

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

**Ballast water capacity** means the total volumetric capacity of any tanks, spaces or compartments on a ship used for carrying, loading or discharging ballast water, including any multi-use tank, space or compartment designed to allow carriage of ballast water.

**From the nearest land** means from the baseline from which the territorial sea of the territory in question is established in accordance with international law except that, for the purposes of the Convention, "from the nearest land" off the north-eastern coast of Australia shall mean from a line drawn from a point on the coast of Australia in latitude 11°00' S, longitude 142°08' E to a point in latitude 10°35' S, longitude 141°55' E thence to a point latitude 10°00' S, longitude 142°00' E thence to a point latitude 9°10' S, longitude 143°52' E thence to a point latitude 9°00' S, longitude 144°30' E thence to a point latitude 10°41' S, longitude 145°00' E thence to a point latitude 13°00' S, longitude 145°00' E thence to a point latitude 15°00' S, longitude 146°00' E thence to a point latitude 17°30' S, longitude 147°00' E thence to a point latitude 21°00' S, longitude 152°55' E thence to a point latitude 24°30' S, longitude 154°00' E thence to a point on the coast of Australia in latitude 24°42' S, longitude 153°15' E.

**Ballast Water Management Plan (BWM Plan)** means the document referred to in regulation B-1 of the Annex to the Convention describing the ballast water management processes and procedures on board individual ships.

**Constructed in respect of a ship** means a stage of construction, according to regulation A-1 of the Annex to the Convention, where:

- .1 the keel is laid; or
- .2 construction identifiable with the specific ship begins; or

.3 assembly of the ship has commenced comprising at least 50 t or 1 % of the estimated mass of all structural material, whichever is less; or

.4 the ship undergoes a major conversion.

Preparation means any commercial formulation containing one or more active substances including any additives. This term also includes any active substances generated onboard for purposes of ballast water management and any relevant products of transformation or reaction formed during treatment, and which in case of the discharge can create problems for the aquatic environment and human health.

Prototype Ballast Water Treatment Technology (PBWTT) means any integrated system of ballast water treatment equipment in compliance with regulation D-4 of the Annex to the Convention participating in a programme for testing and evaluation with the potential of meeting or exceeding the ballast water performance standard specified in regulation D-2 of the Annex to the Convention including treatment equipment, all associated control equipment, monitoring equipment and sampling facilities. PBWTT may be a mechanical, physical, chemical, or biological unit process, either singularly or in combination that may or may not use active substances that remove, render harmless, or avoid the uptake or discharge of harmful aquatic organisms and pathogens within ballast water and sediments. PBWTT may operate at the uptake or discharge of ballast water, during the voyage or in any combination of these phases.

Discharge of ballast water at the same location means ballast water discharge at the same harbour, mooring or anchorage where the ballast water uptake was carried out (refer to 5.2 of the Guidelines (G3)).

Certificate means the International Ballast Water Management Certificate (form 2.5.4).

Ballast Water Management System (BWMS) means any system which processes ballast water such that it meets or exceeds the ballast water performance standard in regulation D-2 of the Annex to the Convention. BWMS includes ballast water treatment equipment, all associated control equipment, monitoring equipment and sampling facilities. BWMS may use processes of water treatment based on the mechanical, physical, chemical, or biological unit process, either singularly or in combination that may or may not use active substances that remove, render harmless, or avoid the uptake or discharge of harmful aquatic organisms and pathogens within ballast water and sediments.

Ballast Water Management System (BWMS), installed on a ship means the BWMS with the contractual delivery date or in the absence of such a date — the BWMS actually delivered to the ship with the actual date of delivery of the BWMS to the ship.

**Relevant chemicals** means transformation or reaction products that are produced during and after employment of the ballast water management system in the ballast water or in the receiving environment and that may be of concern to the ship's safety, aquatic environment and/or human health.

**Sampling facilities** refers to the means provided for sampling treated or untreated ballast water.

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

**Ship** means a ship of any type whatsoever operating in the aquatic environment and includes submersibles, floating craft, floating platforms, FSUs/FSOs and FPSOs.

**Ballast water tank** means any tank, hold or space used for the carriage of ballast water.

**Ballast water management** 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 ballast water and sediments.

### 1.2.2 Abbreviations

IMO — International Maritime Organization.

MEPC — Maritime Environmental Protection Committee.

ISM Code — International Safety Management Code.

TRC — Treated Rated Capacity.

BWM Plan — Ballast Water Management Plan.

PBWTT — Prototype Ballast Water Treatment Technology.

Register, RS — Russian Maritime Register of Shipping.

BWMS — Ballast Water Management System.

Guidelines (G2) — Guidelines for ballast water sampling (G2) adopted by IMO resolution MEPC.173(58).

Guidelines (G3) — Guidelines for ballast water management equivalent compliance (G3) adopted by IMO resolution MEPC.123(53).

Guidelines (G4) — Guidelines for ballast water management and development of ballast water management plans (G4) adopted by IMO resolution MEPC.127(53).

Guidelines (G5) — Guidelines for ballast water reception facilities (G5) adopted by IMO resolution MEPC.153(55).

Guidelines (G8) — Guidelines for approval of ballast water management systems (G8) adopted by IMO resolution MEPC.174(58) and MEPC.279(70).

Guidelines (G9) — Procedure for approval of ballast water management systems that make use of active substances (G9) adopted by IMO resolution MEPC.169(57).

Guidelines (G10) — Guidelines for approval and oversight of prototype ballast water treatment technology programmes (G10) adopted by IMO resolution MEPC.140(54).

Guidelines (G12) — Guidelines on design and construction to facilitate sediment control on ships (G12) adopted by IMO resolution MEPC.209(63).

## **2 APPROVAL OF BALLAST WATER MANAGEMENT PLAN**

### **2.1 Application**

**2.1.1** In compliance with regulation B-1 of the Annex to the Convention each ship shall have and implement on board the BWM Plan.

**2.1.2** The BWM Plan shall be developed and approved by the Administration or recognized organization acting on its behalf in compliance with the Guidelines (G4).

**2.1.3** Upon authorization of the Administration (if any), the BWM Plan shall be subject to initial review and approval by the RS Head Office (RHO) or by the RS Branch Office authorized by RHO.

**2.1.4** In compliance with IMO circular BWM.2/Circ.40 the MEPC decided that for practical reasons the BWM Plans approved in accordance with IMO resolution A.868(20), shall remain valid until the BWM Plans requires revision due to the installation of BWMS complying with regulation D-2 of the Annex to the Convention.

### **2.2 General requirements**

**2.2.1** The BWM Plan shall comply with regulation B-1 of the Annex to Convention and IMO resolution MEPC.127(53), shall be specific to each ship and shall at least:

.1 detail safety procedures for the ship and the crew associated with ballast water management as required by Convention;

.2 provide a detailed description of the actions to be taken to implement the ballast water management requirements and supplemental Ballast Water Management practices as specified in this Convention;

.3 detail the procedures for the disposal of sediments:

.3.1 at sea; and

.3.2 to shore;

.4 include the procedures for coordinating shipboard ballast water management that involves discharge to the sea with the authorities of the State into whose waters such discharge will take place;

.5 designate officer in charge of ensuring that the BWM Plan is properly implemented, contain provisions for familiarization procedure with the BWM Plans and provisions for training;

.6 contain the reporting requirements for ships provided for under this Convention; and

.7 be written in the working language of the ship. If the language used is not English, French or Spanish, a translation into one of these languages shall be included.

### **2.3 Documents submitted for the BWM Plan approval**

**2.3.1** In all other cases copies of the following documents shall be submitted:

- .1** all valid stability details;
- .2** loading manuals;
- .3** ballast tank arrangement;
- .4** ballast capacity plan;
- .5** arrangement of holes for access to the ballast tanks indicating their dimensions;
- .6** air, overflow and sounding pipes (with pipelines ID);
- .7** ballast, ballast stripping systems arrangement;
- .8** arrangement of other systems used during ballast replacement (drainage, fire water etc.);
- .9** technical specification of pumps used during ballast replacement;
- .10** technical specifications of system for remote control of the ballast system components, and ballast tanks level measuring system;
- .11** diagrams indicating the location of ballast water sampling points;
- .12** technical description of ballast water treatment equipment.

### **2.4 Scope of monitoring during BWM Plan approval**

**2.4.1** During review and approval of the BWM Plan the Register performs:

- .1** review and check of the submitted BWM Plan for compliance with IMO resolution MEPC.127(53);
- .2** the conclusion letter is issued based on the results of the review and approval. In case of the positive results of the submitted BWM Plans review the title page of the Plan is provided with stamp "Approved by Russian Maritime Register of Shipping under the authority of Maritime Administration", refer to Section 8 of Part I "General regulations for technical supervision", Rules for technical supervision during construction of ships and manufacture of materials and products for ships.



## **3 APPROVAL OF TYPE OF SHIP BALLAST WATER AND SEDIMENTS MANAGEMENT SYSTEMS**

### **3.1 General**

**3.1.1** This Section contains recommendations for the RS surveyors relating to the process of type approval of BWMS.

**3.1.2** The requirements of this Section result from the requirements of the Convention, IMO resolutions MEPC.209(63) and MERC.174(58). According to IMO resolution MEPC.279(70), the BWMS installed on ships on or after 28 October 2020 shall be approved taking into account the Guidelines (G8), 2016, as amended by IMO resolution MEPC.279(70). The BWMS installed prior to this date shall be approved taking into account either the Guidelines (G8) adopted by IMO resolution MEPC.174(58), or preferably, the Guidelines (G8), 2016, as amended by IMO resolution MEPC.279(70). Requirements for the Ballast Water Replacement at Sea, requirements of Part II "Hull", Part IV "Stability", Part VIII "Systems and pipelines" of the Rules for the Classification and Construction of Sea-Going Ships etc., and can be used by the organizations recognized by the Register, designers, ship builders, shipowners and ship operators at the stage of the ballast water and sediments management systems designing and approval.

**3.1.3** The BWMS approval procedure includes supervision for testing as per scope sufficient to prove that the system design, equipment and adjustments ensure meeting the requirements of the specified standard (refer to regulations D-1 to D-4 of the Annex to the Convention), and upon installation on board the ship BWMS approval procedure shall ensure meeting the requirements of Convention regulations.

**3.1.4** The BWMS approval for compliance with the specified standard shall be performed for the specific ballast water capacities, flow rates, salinity or temperature regimes, or other limiting conditions or circumstances as appropriate, based on the submitted documented its compliance with all requirements of the specified standard based on the tests. Tests carried out under supervision of the representatives of another Administration or recognized organization acting on its behalf can be considered.

**3.1.5** Prior to approval by the Administration or recognized organization acting on its behalf in compliance with the Guidelines (G8), the BWMS that make use of active substances shall be subject to the IMO approval (basic or final approval) in compliance with the Guidelines (G9).

**3.1.6** Type approval of BWMS based on new technologies under regulation D-4 of the Annex to the Convention shall be performed based on the type tests of the reviewed technology under the RS-approved programme which requirements

and approval procedure are specified in Section 3 of Part I hereto, and further test results approval by MEPC.

### **3.2 Documents submitted for type approval of BWMS**

**3.2.1** The documentation submitted for type approval of BWMS shall include application with enclosed:

**.1** description of the BWMS, and its components and devices:

diagrammatic drawing of the typical or required pumping and piping arrangements;

sampling facilities, identifying the operational outlets for treated ballast water and any waste streams as appropriate and necessary.

Special consideration shall be given to installations intended for ships that have unusual pumping and piping arrangements;

**.2** equipment manuals, supplied by manufacturers, containing details of the major components of the BWMS and their operation and maintenance;

**.3** generic operations and technical manual for the complete BWMS. This manual shall cover the arrangements, the operation and maintenance of the BWMS as a whole and shall specifically describe parts of the BWMS which are not covered by the manufacturer's equipment manuals;

**.4** operations section of the manual including normal operational procedures and procedures for the discharge of untreated water in the event of malfunction of the ballast water treatment equipment, maintenance procedures, and emergency action necessary for securing the ship;

**.5** methods for the conditioning of treated water prior to discharge shall be provided.

Assessment of discharged water shall include a description of the effect of treatment on the ship's ballast water, in particular the nature of any treatment residuals and by-products and the water's suitability for discharge into coastal waters.

A description shall also be provided of any actions necessary to monitor, and if necessary "conservation", treated water prior to discharge in order that it meets applicable water quality regulations; if it can reasonably be concluded that the treatment process could result in changes to the chemical composition of the treated water such that adverse impacts to receiving waters might occur upon discharge, the documentation shall include results of toxicity tests of treated water.

The toxicity tests shall include assessments of the effects of hold time following treatment, and dilution, on the toxicity;

**.6** description of BWMS side streams (e.g., filtered material, centrifugal concentrate, waste or residual chemicals) including a description of the actions planned to properly manage and dispose of such wastes;

.7 technical section of the manual including adequate information (description and diagrammatic drawings of the monitoring system and electrical/electronic wiring diagrams) to enable faultfinding.

This section shall include instructions for keeping a maintenance record;

.8 technical installation specification defining, inter alia, requirements for the location and mounting of components, arrangements for maintaining the integrity of the boundary between safe and hazardous spaces and the arrangement of the sample piping; and

.9 recommended test and checkout procedure specific to the BWMS.

This procedure shall specify all the checks to be carried out in a functional test by the installation contractor and shall 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.

**3.2.2** For type approval of other BWMS it is necessary to submit documentation in a scope sufficient to prove that its design, equipment and adjustments ensure meeting of the requirements of the specified standard in accordance with the specified regulation:

.1 in case of approval of the BWMS that make use of active substances in compliance with regulation D-3 of the Annex to the Convention the applicant shall add to the list of documentation specified in 3.2.1 the evidences that the BWMS has been granted the IMO final approval in compliance with the Guidelines (G9);

.2 in case of the BWMS approval in compliance with regulation D-4 of the Annex to Convention the applicant shall add to the given list of documentation the evidences of the approval procedure of execution relating the technology prototype for the ballast water treatment specified in the Guidelines (G10).

### **3.3 Prototype Ballast Water Treatment Technology Programme (PBWTT programme)**

According to regulation D-4 of the Annex to the Convention the PBWTT programme shall be approved by the Administration or by the Register on its behalf in compliance with the Guidelines (G10). The intention of regulation D-4 is to provide opportunities to test and evaluate promising ballast water treatment technologies aboard ships with the potential to meet or exceed the performance standards specified in regulation D-2 of the Annex to the Convention.

The PBWTT programme shall contain the following three main steps:

.1 programme application, submission and approval;

.2 installation survey and Statement of Compliance; and

.3 performance evaluations and reporting.

The Guidelines (G10) include general recommendations on design and construction, technical procedures for overall performance testing and evaluation, procedures for the issue of a Statement of Compliance in accordance with regulation D-4 of the Annex to the Convention and Administration oversight responsibilities.

### **3.4 Supervision for BWMS testing**

In compliance with type approval procedure of BWMS the Administration or RS acting on its behalf shall supervise its testing that shall be carried out in compliance with the procedures specified in Appendices 1 to 4 to these Guidelines.

Sampling and analysis shall be performed by the authorized organizations (laboratories) approved by national bodies assigned by the Administration.

### **3.5 Approval and certification procedures for BWMS type approval**

**3.5.1** During BWMS type approval the applicable requirements of Part I "General Regulations for Technical Supervision" and Part II "Technical Documentation" of the Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships shall be followed.

On behalf of the Administration the Register shall issue Type Approval Certificate of BWMS (form 2.5.5) for specified application for which the BWMS is approved (for specific ballast water capacities, flow rates, salinity or temperature regimes, or other limiting conditions or circumstances as appropriate) based on the BWMS satisfactory compliance with all test requirements specified in the Appendices to these Guidelines and those required by the Guidelines (G8).

**3.5.2** The approval shall take the form of a Type Approval Certificate of BWMS (form 2.5.5), specifying the main particulars of the apparatus and any limiting conditions on its usage necessary to ensure its proper performance. A copy of the original test results of the BWMS shall be attached to such a Certificate. The Type Approval Certificate of BWMS shall be issued acting on behalf of the Administration for the specific application for which the BWMS is approved, e.g., for specific ballast water capacities, flow rates, salinity or temperature regimes, or other limiting conditions or circumstances, as appropriate.

A copy of the Type Approval Certificate of BWMS shall be carried on board ships fitted with such a system at all times.

**3.5.3** The Register acting on behalf of the Administration may issue the Type Approval Certificate of BWMS based on tests previously conducted under the supervision of another Administration. Such a Certificate shall identify that it was issued by the Administration based on a Type Approval Certificate previously issued by another Administration that supervised conduction of the tests on the BWMS. A copy of the original test results shall be attached to the Type Approval Certificate of BWMS.

**3.5.4** During type approval of BWMS the documents about information reporting on type approved BWMS required by IMO resolution MEPC.228(65) shall be issued and then submitted to the Administration on which behalf the type approval has been carried out for the subsequent submission to IMO.

## **4 SHIPS SURVEYS FOR BALLAST WATER MANAGEMENT**

### **4.1 Types of surveys**

**4.1.1** Ships of 400 gross tonnage and above to which the Convention applies, excluding submersibles, floating craft, floating platforms, FSUs/FSOs and FPSOs, in compliance with regulation E-1 of the Annex to the Convention shall be subject to surveys specified below:

.1 an initial survey before the ship is put in service or before the Certificate required under regulation E-2 or E-3 of the Annex to the Convention shall be issued for the first time. This survey shall verify that the BWM Plan required by regulation B-1 of the Annex to the Convention and any associated structure, equipment, systems, fitting, arrangements and material or processes comply fully with the requirements of the Convention;

.2 a renewal survey at intervals specified by the Administration, but not exceeding five years, except where regulations E-5.2, E-5.5, E-5.6 or E-5.7 of the Annex to the Convention are applicable. This survey shall verify that the BWM Plan required by regulation B-1 of the Annex to the Convention and any associated structure, equipment, systems, fitting, arrangements and material or processes comply fully with the applicable requirements of the Convention;

.3 an intermediate survey within three months before or after the second Anniversary date or within 3 months before or after the third Anniversary date of the Certificate, which shall take the place of one of the annual surveys specified in 4.1.1.4. The intermediate surveys shall ensure that the equipment, associated systems and processes for ballast water management fully comply with the applicable requirements of the Convention and are in good working order. Such intermediate surveys shall be endorsed on the Certificate issued under regulation E-2 or E-3 of the Annex to the Convention;

.4 an annual survey within three months before or after each Anniversary date, including a general inspection of the structure, any equipment, systems, fittings, arrangements and material or processes associated with the BWM Plan required by regulation B-1 of the Annex to the Convention to ensure that they have been maintained in compliance with the Convention provisions, and the ship remains prepared for navigation, and is not hazardous for the environment, people health, property or resources, and remains satisfactory for the service for which the ship is intended. Such annual surveys shall be endorsed on the Certificate issued under regulation E-2 or E-3 of the Annex to the Convention;

.5 an additional survey, either general or partial, according to the circumstances, shall be made after a change, replacement, or significant repair of the structure, equipment, systems, fittings, arrangements and material necessary to achieve full compliance with the Convention. The survey shall be

such as to ensure that any such change, replacement, or significant repair has been effectively made, so that the ship complies with the requirements of the Convention. Such surveys shall be endorsed on the Certificate issued under regulation E-2 or E-3 of the Annex to the Convention;

.6 an occasional survey whenever an accident occurs to a ship or a defect is discovered which substantially affects the ability of the ship to conduct ballast water management in compliance with the Convention to determine whether a survey as required by 4.1.1.1 to 4.1.1.1.5 is necessary.

4.1.2 The Administration shall establish appropriate measures for ships that are not subject to the provisions of 4.1.1 in order to ensure that the applicable provisions of this Convention are complied with.

4.1.3 After completion of any survey in compliance with 4.1.1.1 to 4.1.1.6, no change shall be made in the structure, equipment, fittings, arrangements or material associated with the BWM plan required by regulation B-1 of the Annex to the Convention and covered by the survey, unless approved by the Administration, except the direct replacement of such equipment or fittings.

#### **4.2 Technical documentation**

4.2.1 During initial surveys of the ships after construction for compliance with the Convention it is necessary to check documentation for the compliance with Part V "Technical Supervision during Construction of Ships" of Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships (depending on whether this can be applied to the performed procedure).

In addition to the above mentioned the ship shall be checked for the availability of the following documentation:

.1 approved BWM Plan complying with regulation B-1 of Annex to the Convention;

.2 Ballast Water Record Book that can be electronic registration system or part of another record book or system, and at least containing information specified in the Appendix II to the Annex to the Convention. The record Book is kept and stored in compliance with regulation B-2 of Annex to the Convention;

.3 analysis results confirming satisfactory operation of the ballast water treatment equipment (if applicable);

.4 documentation with regard to the provisions of IACS unified requirement (UR) M74 (Rev.1, May 2016) applicable for BWMS installed in ships contracted for construction on or after 1 January 2017, or a request for review/approval by the Register, acting on behalf of the Administration, of the documentation on installation of BMWS submitted on or after 1 January 2017.

4.2.2 The availability of the documentation in compliance with 4.2.1, as well as the following documentation shall be checked during Certificate renewal surveys, intermediate and annual surveys:

.1 valid Certificate of the ballast water management and complete set of the previous survey reports;

.2 documentation on board confirming performance of the applicable procedures for ballast water and sediments management in compliance with the approved BWM Plan;

.3 absence of the documentation confirming the unapproved amendments in design, equipment, arrangements, devices or materials, excluding direct replacement of such equipment or arrangements;

.4 absence of the overdue or unfulfilled requirements of the Convention.

#### **4.3 Issued certificates**

4.3.1 On behalf of the Administration, and upon results of the initial surveys or renewal surveys, as well as on the results of the ballast water management systems survey the Register shall issue the following documents:

.1 International Ballast Water Management Certificate (form 2.5.4) shall be issued to all ships that have the right to sail under the state flag of the Convention Party with 400 gross tonnage and above, excluding submersibles, floating craft, floating platforms, FSUs/FSOs and FPSOs, and performing voyages to ports or to the offshore terminals under jurisdiction of other Convention Parties. Validity period of the International Certificate is specified in regulation E-5 of Annex to the Convention.

In compliance with IMO circular BWM.2/Circ.40 the International Ballast Water Management Certificate can be issued prior to entry into force of the Convention provided it is annotated to state that validity begins from the entry-into-force date.

.2 Type Approval Certificate of Ballast Water Management System (form 2.5.5) shall be issued for all system types after type approval in compliance with the Convention, and Section 3 Part I hereto. This Certificate is issued for maximum 5 years.

For BWMS that make use of the active substances or preparations it is provided that these systems can be subject to the cancellation procedure of the type approval, and the Type Approval Certificate of BWMS shall become invalid prior to expiration of the Certificate validity period.

.3 for the ships that do not require the International Ballast Water Management Certificate (form 2.5.4), the Certificates may be issued in compliance with 1.11, Part III "Survey of Ships in compliance with International Conventions, Codes, Resolutions and Rules for the Equipment of Sea-Going Ships" of the Guidelines on Technical Supervision of Ships in Service. Validity period of these Certificates is specified in 1.7 Part III "Survey of Ships in compliance with International Conventions, Codes, Resolutions and Rules for the Equipment of Sea-Going Ships" of the Guidelines on Technical Supervision of Ships in Service.

# **PART II. DESIGN, EQUIPMENT AND DEVICES OF SHIPS FOR BALLAST WATER AND SEDIMENTS MANAGEMENT**

## **1 GENERAL**

**1.1** Ballast system, including the BWMS shall comply with the applied requirements of Part II "Hull", Part IV "Stability", Part VIII "Systems and piping", Part IX "Machinery", Part XI "Electric equipment", Part XV "Automation" of the Rules for the Classification and Construction of Sea-Going Ships, as well as regulations D-1 — D-4 of the Annex to the Convention.

**1.2** All ships specified in 3 to 5 of regulation B-3 of the Annex to the Convention shall without harm to safety or operational efficiency be designed and built such that to minimize inlet and undesirable catching of sediments, to make easier sediments removal, and to ensure safe access for sediments removal, and their sampling considering the Guidelines (G2).

**1.3** Ships specified in regulation B-3.1 of the Annex to the Convention, as far as this can be ensured, shall comply with 1.1.1.

## **2 TECHNICAL REQUIREMENTS FOR BALLAST SYSTEM IN COMPLIANCE WITH REGULATION D-1 OF THE ANNEX TO THE CONVENTION**

**2.1** It is recommended to use these requirements considering design features of ships and applied safety requirements without prejudice for their operation characteristics.

**2.2** Ballast systems operated in compliance with regulation D-1 of the Annex to the Convention shall comply with the following requirements:

.1 shall be operable;

.2 comply with requirements of 8.7 Part VIII "Systems and piping" of the Rules for the Classification and Construction of Sea-going Ships;

.3 if the ship has control and/or registration equipment for all operations with the ballast water, and data are automatically registered by the equipment, then they shall be in the format that can be easy stored on board, and quickly presented to the inspecting authorities and authorized organizations;

.4 the ballast water sampling shall be performed in compliance with Section 6 of this Part and the Guidelines (G2);



.5 design of the sea chests shall be such that to minimize sediments accumulation. For this purpose, upper, as well as lower sea chests shall be provided.

**2.3** For the ballast system of ships operated in compliance with regulation D-1 of the Annex to the Convention it is recommended to provide piping for ballast water transfer from the ship to the reception facilities from both sides. The drainage branch pipes shall be installed in easy for hoses connection places, have identification plates, and blank flanges.

### **3 TECHNICAL REQUIREMENTS FOR BWMS IN COMPLIANCE WITH REGULATION D-2 OF THE ANNEX TO THE CONVENTION**

This Section shall detail the general technical requirements which a BWMS shall meet, and requirements for the control and monitoring equipment.

#### **3.1 General technical requirements for BWMS**

**3.1.1** BWMS operated in compliance with regulation D-2 of the Annex to the Convention shall comply with the following requirements:

**.1** BWMS shall have approved suitable equipment for the ballast water treatment ensuring the ballast water discharge in compliance with regulation D-2 of the Annex to the Convention.

If such equipment for the ballast water treatment makes use of the active substances or preparations, then their storage and use on board shall be performed in the compliance with the Manual approved by the Administration only. The Manual shall specify the proper measures of for storage, application, mitigation, and safe handling of the active substances or preparations to mitigate any hazards introduced thereby.

**.2** in case of any failure compromising the proper operation of the BWMS, audible and visual alarm signals shall be given in all stations from which ballast water operations are controlled;

**.3** all working parts of the BWMS that are liable to wear or to be damaged shall be easily accessible for maintenance.

The routine maintenance of the BWMS and troubleshooting procedures shall be clearly defined by the manufacturer in the operating and maintenance manual. All maintenance and repairs shall be recorded;

**.4** the ballast water treatment equipment shall be provided with simple and effective means for its operation and control. It shall be provided with a control system that shall be such that the services needed for the proper operation of the ballast water treatment equipment are ensured through the necessary automatic arrangements;

.5 to avoid interference with the BWMS, the following items shall be included:

.5.1 every access of the BWMS for maintenance or repair shall require the breaking of a seal;

.5.2 if applicable, the BWMS shall be so constructed that a visual alarm is always activated whenever the BWMS is in operation for purposes of cleaning, calibration, or repair, and these events shall be recorded by the control equipment;

.5.3 in the event of an emergency, suitable by-passes or overrides to protect the safety of the ship and personnel shall be installed; and

.5.4 any by-pass of the BWMS shall activate an alarm, and the bypass event shall be recorded by the control equipment;

.6 facilities shall be provided for checking the performance of the BWMS components that take measurements and registration in compliance with the manufacturer's instructions.

A calibration certificate certifying the date of the last calibration check shall be retained on board for inspection purposes.

Only the manufacturer or persons authorized by the manufacturer shall perform the accuracy checks.

### **3.2 Additional requirements for equipment used for the ballast water treatment for oil tankers**

**3.2.1** The ballast water treatment equipment shall, if intended to be fitted in the dangerous areas of the oil tankers, comply with the relevant safety regulations for such areas.

Any electrical equipment that is part of the BWMS installed in the explosion dangerous areas of the oil tankers shall be certified as explosion-proof and suitable for use in such areas.

Any moving parts, which are fitted in the explosion dangerous areas of the oil tankers, shall be arranged so as to avoid the formation of static electricity.

### **3.3 Requirements for control and monitoring equipment**

**3.3.1** The BWMS that make use of active substances shall incorporate control equipment that automatically monitors and adjusts necessary treatment dosage of active substance and maximum permissible transfer concentration within the approved criteria or other parameters of the BWMS of the ship, which while not directly effecting treatment, are nonetheless required for proper administration of the necessary treatment.

**3.3.2** The control equipment shall incorporate a continuous self-monitoring function during the period in which the BWMS is in operation.

**3.3.3** The monitoring equipment shall record the proper functioning or failure of the BWMS.

**3.3.4** To facilitate compliance with regulation B-2 of the Annex to the Convention, the control equipment shall also be able to store data for at least 24 months, and shall be able to display or print a record for official inspections as required.

In the event the control equipment is replaced, means shall be provided to ensure the data recorded prior to replacement remains available on board for 24 months.

**3.3.5** It is recommended that simple means be provided aboard ship that are part of the control equipment to check on the following:

- drift by measuring devices repeatability;
- repeatability of the control equipment devices;
- the ability to re-zero the control equipment meters.

## **4 TECHNICAL REQUIREMENTS FOR BWMS IN COMPLIANCE WITH REGULATION D-3 OF THE ANNEX TO THE CONVENTION**

### **4.1 General**

**4.1.1** To comply with the Convention the BWMS that makes use of or generates active substances, relevant chemicals or free radicals during the ballast water treatments shall be safe in terms of the ship, its equipment and the personnel, and shall comply with the following requirements.

**4.1.2** The requirements shall not cover the procedure for approval of the active substances and preparations that make use of viruses or fungi for use in BWMS.

### **4.2 Technical requirements**

**4.2.1** General technical requirements, which BWMS shall meet to receive the type approval in compliance with regulation D-3 of the Annex to the Convention, and which include the technical requirements for BWMS in compliance with regulations D-2 of the Annex to the Convention, shall continuously ensure the ship ballast water discharge complying with the quality standard specified in regulation D-2 within the entire service life of the ship.

**4.2.2** BWMS operation can be based on the following principles:

.1 active substances and preparations may be added to the ballast water or be generated in the BWMS.

BWMS description shall include a chemical identification and description of the active substance or preparation even if generated on board.

A chemical identification shall be provided for any relevant chemicals.

Data of the active substances and preparations shall include information on the properties or actions of the preparation including any of its components.

BWMS shall not contain or use dangerous substances not approved for use by IMO.

However, if the ballast water is still toxic at the time of discharge into the environment, the organisms in the receiving water may suffer unacceptable harm. Both the active substance or preparation as well as the ballast water discharge shall be subjected to toxicity testing in order to protect the receiving environment or human health from toxic effects due to the discharges. Toxicity testing is needed to determine if an active substance or preparation can be used and under which conditions the potential of harming the receiving environment or human health is acceptably low;

.2 any system which makes use or generates the active substances, relevant chemicals or free radicals during the treatment process to eliminate organisms in order to comply with the Convention shall receive IMO final approval in compliance with the Guidelines (G9).

**4.2.3** BWMS shall use automatic adjustment of the active substances and preparations supply.

The manufacturer's instructions for use of the active substances and preparations shall include information relating their expected use and application. Concentration of the active substances in BWMS, rules for preparation prior to the injection to the ballast water, and minimum permissible concentration of the active substances shall be also described in the BWMS manufacturer's instructions.

Rules for preparation on board shall be developed and submitted considering the existing IMO Codes and Guidelines.

The procedure for ballast water treatment shall comply with the specified minimum permissible concentrations of the active substances and minimum discharge force, if available.

The system shall ensure that maximum dosage and maximum allowable discharge concentration are not exceeded at any time.

**4.2.4** BWMS shall be provided with measures ensuring the safe on-board handling and storage of the chemicals to treat ballast water, using existing IMO conventions, codes and guidelines.

The instructions shall describe conditions of the proper storage and treatment with consequences of decomposition and loss of chemical activity during storage, they shall be included in the manufacturer's instructions.

## **5 REQUIREMENTS FOR SAMPLING FACILITIES**

**5.1** The BWMS shall be provided with sampling facilities so arranged in compliance with the Guidelines (G2) to collect representative samples of the ship's ballast water.

**5.2** Sampling facilities, whenever practicable to do so, shall be installed in the BWMS discharge line near the discharge point.

## **6 TECHNICAL REQUIREMENTS FOR BWMS COMPONENTS FOR SEDIMENTS CONTROL AND REMOVAL**

**6.1** The requirements are common for BWMS designed in compliance with regulations D-2 to D-4 of the Annex to the Convention, and, to the extent practicable, regulations D-1, to ensure safety and to minimize inlet and undesirable catching of sediments, to make easier sediments removal, and to ensure safe access for sediments removal, and their sampling in compliance with regulation B-5 of the Annex to the Convention.

These requirements cover spaces designed to carry the ballast water of ship BWMS, and shall comply with the Guidelines (G12) and this Section.

**6.2** Ballast water tanks and their internal structures shall be designed to avoid the accumulation of sediment in a ballast tank. When designing ballast tanks the provisions of the Guidelines (G12) shall be taken into account.

**6.3** When practical, equipment to remove suspended matter at the point of uptake shall be installed.

## TEST AND PERFORMANCE SPECIFICATIONS FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS

### (Part 2, Guidelines (G8))

The Administration or RS acting on its behalf shall determine the sequence of land-based and shipboard testing.

The testing body (laboratory) involved by the Register during the land-based and shipboard testing shall have the RS Recognition Certificate of Testing Laboratory (form 7.1.4.3).

### 1 SHIPBOARD TESTS

#### 1.1 Test cycles

A shipboard test cycle shall include:

- .1 uptake of ballast water of the ship;
- .2 storage of ballast water on the ship;
- .3 treatment of the ballast water in accordance with 1.2.3 by BWMS, except in control tanks; and
- .4 discharge of ballast water from the ship.

#### 1.2 Shipboard testing procedure

In evaluating the performance of BWMS installation(s) on a ship or ships, the following information and results for approval with the Administration or RS acting on its behalf:

- .1 test plan to be provided prior to testing;
- .2 documentation that the BWMS capacity within the range of the TRC for which it is intended;
- .3 the amount of ballast water tested in the test cycle on board shall be consistent with the normal ballast operations of the ship and the BWMS shall be operated at the TRC for which it is intended to be approved;
- .4 documentation of the results of 3 consecutive, valid test cycles showing discharge of treated ballast water in compliance with regulation D-2 of the Annex to the Convention;
- .5 valid tests are indicated by uptake water, for both the control tank and ballast water to be treated, with viable organism concentration exceeding 10 times the maximum permitted values in regulation D-2.1 of the Annex to

the Convention and control tank viable organism concentration exceeding the values of regulation D-2.1 of the Annex to the Convention on discharge;

**.6** sampling shall be performed in compliance with the provisions of the Guidelines (G2) (refer to Appendix 4):

**.6.1** for the control tank:

**.6.1.1** three replicate samples of influent water, collected over the period of uptake (e.g., beginning, middle, end); and

**.6.1.2** three replicate samples of discharge control water, collected over the period of discharge (e.g., beginning, middle, end);

**.6.2** for treated ballast water: Three replicate samples of discharge treated water collected at each of 3 times during the period of discharge (e.g., 3 x beginning, 3 x middle, 3 x end);

**.6.3** sample sizes are:

**.6.3.1** for the enumeration of organisms greater than or equal to 50  $\mu\text{m}$  or more in minimum dimension, samples of at least 1  $\text{m}^3$  shall be collected. If samples are concentrated for enumeration the samples shall be concentrated using a sieve no greater than 50  $\mu\text{m}$  mesh in diagonal dimension;

**.6.3.2** for the enumeration of organisms greater than or equal to 10  $\mu\text{m}$  and less than 50  $\mu\text{m}$  in minimum dimension, samples of at least 1 l shall be collected. If samples are concentrated for enumeration the samples shall be concentrated using a sieve no greater than 10  $\mu\text{m}$  mesh in diagonal dimension;

**.6.3.3** for the evaluation of bacteria a sample of at least 500 ml shall be taken from the influent and treated water;

**.6.4** samples shall be taken from the drainage pipeline as close as possible to the discharge point during the ballast water discharge. Exclusion is the case when the top side ballast tanks are drained directly via the side drainage valves, not via the ballast pumps. In such cases sampling is performed from the tank;

**.6.5** when the ballast system design excludes sampling from the drainage pipeline. Sampling during estimation of the compliance with regulation D-2 of the Annex to the Convention via manholes, sounding or air pipes is not recommended, as in this case the accurate estimation of the organisms concentration in the discharge is impossible. So, under this sampling method underestimation or overestimation of the organisms concentration is possible;

**.6.6** sampling directly from the tanks can be used only in case when the ballast water treatment is performed during their uptake before tank entrance. If any part of the ballast water treatment process is performed during its discharge, then sampling from tanks is prohibited;

**.7** for any sampling procedure the following principles shall be met to ensure authenticity:

**.7.1** sampling procedure shall ensure sample representation for the entire ballast water discharge from any separate tank or any combination of tanks from which discharge is ensured;

**.7.2** consider possibility of the discharge suspended solids effect on the sampling results;

**.7.3** sampling shall be performed by safe and practical method;

**.7.4** samples shall be taken, sealed, stored, carried and treated under conditions ensuring possibility of their use to check compliance with the Convention;

**.8** the test cycles including invalid and unsuccessful test cycles shall span a trial period of not less than 6 months;

**.9** the applicant is requested to perform three consecutive test cycles that comply with regulation D-2 of the Annex to the Convention and which are valid in accordance with 1.2.5. Any invalid test cycle does not affect the consecutive sequence;

**.10** the source water for test cycles shall be characterized by measurement of salinity, temperature, particulate organic carbon and total suspended solids;

**.11** For system operation throughout the trial period, the following information shall also be provided:

**.11.1** documentation of all ballast water operations including volumes and locations of uptake and discharge, and if heavy weather was encountered and where;

**.11.2** the possible reasons for the occurrence of an unsuccessful test cycle, or a test cycle discharge failing the D-2 standard shall be investigated and reported to the Register;

**.11.3** documentation of scheduled maintenance performed on the system;

**.11.4** documentation of unscheduled maintenance and repair performed on the system;

**.11.5** documentation of engineering parameters monitored as appropriate to the specific system; and

**.11.6** documentation of functioning of the control and monitoring equipment.



## **2 LAND-BASED TESTING**

### **2.1 Land-based testing objectives, limitations and criteria for evaluation**

**2.1.1** The land-based testing shall serve to determine the biological efficacy and environmental acceptability of the BWMS under consideration for type approval. The approval testing aims to ensure replicability and comparability to other treatment equipment.

**2.1.2** Any limitations imposed by the BWMS on the testing procedures specified in this Section shall be duly noted and evaluated by the Administration or RS acting on its behalf.

### **2.2 Test cycles**

**2.2.1** The test set-up including the ballast water treatment equipment shall operate as described in the provided documentation during at least 5 valid replicate test cycles. Each test cycle shall take place over a period of at least 5 days.

**2.2.2** A land-based test cycle shall include:

- .1** uptake of ballast water by pumping;
- .2** storage of ballast water for at least 5 days;
- .3** treatment of ballast water within the BWMS, except in control tanks; and
- .4** discharge of ballast water by pumping.

### **2.3 Testing conditions**

**2.3.1** Testing shall occur with different dissolved and particulate content sequentially as specified in 2.6.1 and 2.6.2.

**2.3.2** The BWMS shall be tested at its rated capacity or as specified in 2.5.1 to 2.5.3 for each test cycle. The equipment shall function to specifications during this test.

**2.3.3** The analysis of treated water discharge from each test cycle shall be used to determine that the average of discharge samples does not exceed the concentrations of regulation **D-2** of the Annex to the Convention.

The analysis of treated water discharge from the relevant test cycle(s) shall also be used to evaluate the toxicity of the discharged water for BWMS that make use of active substances and also for those BWMS that do not make use of active substances or preparations but which could reasonably be expected to result in changes to the chemical composition of the treated water such that adverse impacts to receiving waters might occur upon discharge. Toxicity tests of the treated water discharge shall be conducted in accordance with 5.2.3 to 5.2.7 of the Guidelines (G9).

### **2.4 Land-based set-up**

**2.4.1** The test set-up for approval tests shall be representative of the characteristics and arrangements of the types of ships in which the equipment is

intended to be installed. The test set-up shall therefore include at least the following:

- .1 complete BWMS to be tested;
- .2 piping and pumping arrangements; and
- .3 holding tank that simulates a ballast tank, constructed such that the water in the tank shall be completely shielded from light.

**2.4.2** The control and treated simulated ballast tanks shall each include:

- .1 minimum capacity of 200 m<sup>3</sup>;
- .2 normal internal structures, including lightening and drainage holes;
- .3 standard industry practices for design, construction and surface coatings for ships; and
- .4 minimum modifications required for structural integrity.

**2.4.3** The test set-up shall be pressure-washed with tap water, dried and swept to remove loose debris, organisms and other matter before starting testing procedures, and between test cycles.

**2.4.4** The test set-up shall include facilities to allow sampling as specified in 2.7.3 and 2.7.4 and provisions to supply influents to the system, as specified in 2.6.2 and/or 2.6.3. The installation arrangements shall conform in each case with those specified and approved under the procedure specified in 3.1.

## **2.5 Ballast water treatment equipment scaling**

**2.5.1** In-line treatment equipment in-line ballast water treatment equipment located according to «in-line treatment» scheme (refer to Fig. 3.2) may be downsized for land-based testing, but only when the following criteria are taken into account:

- .1 equipment with a TRC equal to or smaller than 200 m<sup>3</sup>/h shall not be downscaled;
- .2 equipment with a TRC larger than 200 m<sup>3</sup>/h but smaller than 1,000 m<sup>3</sup>/h may be downscaled to a maximum of 1:5 scale, but may not be smaller than 200 m<sup>3</sup>/h; and
- .3 equipment with a TRC equal to, or larger than, 1,000 m<sup>3</sup>/h may be downscaled to a maximum of 1:100 scale, but may not be smaller than 200 m<sup>3</sup>/h.

**2.5.2** The manufacturer of the equipment shall demonstrate by using mathematical modelling and/or calculations, that any downscaling shall not affect the ultimate functioning and effectiveness on board a ship of the type and size for which the equipment will be certified.

**2.5.3** Size of the selected ballast water treatment equipment located and tested according to "in-tank treatment" scheme (refer to Fig. 3.2) shall allow verification of full-scale effectiveness. The suitability of the selected test set-up shall be evaluated and approved by the Administration and RS acting on its behalf.

**2.5.4** Larger decrease in scaling may be applied and lower flow rates used than specified in 2.5.2, if the manufacturer can provide evidence from full-scale shipboard testing and in accordance with 2.5.1 that scaling and flow rates will not adversely affect the ability of the results to predict full-scale compliance with the regulation D-2 of the Annex to the Convention.

When applying 2.5.1 to 2.5.4 the Guidelines requirements relating scaling of the BWMS in Appendix 5 shall be also followed.

**2.6 Land-based test design — inlet and outlet criteria**

**2.6.1** For any given set of test cycles (5 replicates is considered a set) a salinity range shall be chosen. Given the salinity, the test water used in the test set up described above shall have dissolved and particulate content in one of the following combinations:

Table 2.6.1

	Salinity		
	> 32 PSU <sup>1</sup>	3 — 32 PSU <sup>1</sup>	< 3 PSU <sup>1</sup>
Dissolved Organic Carbon (DOC)	> 1 mg/l	> 5 mg/l	> 5 mg/l
Particulate Organic Carbon (POC)	> 1 mg/l	> 5 mg/l	> 5 mg/l
Total Suspended Solids (TSS)	> 1 mg/l	> 50 mg/l	> 50 mg/l
<sup>1</sup> PSU is practical salinity unit. It is used in oceanography. Note. PSU > 32 is salinity of ocean water. Conditionally, it can be assumed that 1 PSU is 1 ppm (1‰) or 1g of salt per 1 l of water.			

**2.6.2** At least 2 sets of tests cycles shall be conducted, each with a different salinity range and associated dissolved and particulate content as specified in 2.6.1. Tests under adjacent salinity ranges specified in Table 2.6.1 shall be separated by at least 10 PSU<sup>1</sup>.

**2.6.3** Test organisms may be either naturally occurring in the test water, or cultured species that may be added to the test water. The organism concentration shall comply with 2.6.4.

**2.6.4** The influent water shall include:

.1 test organisms of greater than or equal to 50 µm or more in minimum dimension shall be present in a total density of preferably 10<sup>6</sup> but not less than 10<sup>5</sup> individuals per 1 m<sup>3</sup>, and shall consist of at least 5 species from at least 3 different phyla/divisions;

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<sup>1</sup>For example, if one set of test cycles is carried out at > 32 PSU and a second set at 3 — 32 PSU, the test cycle in the 3 — 32 PSU range needs to be at least 10 PSU less than the lowest salinity used in the test cycle in the > 32 PSU range.

.2 test organisms greater than or equal to 10  $\mu\text{m}$  and less than 50  $\mu\text{m}$  in minimum dimension shall be present in a total density of preferably  $10^4$  individuals but not less than  $10^3$  individuals per 1 ml, and shall consist of at least 5 species from at least 3 different phyla/divisions;

.3 heterotrophic bacteria shall be present in a density of at least  $10^4$  living bacteria per 1 ml; and

.4 the variety of organisms in the test water shall be documented according to the size classes mentioned above regardless if natural organism assemblages or cultured organisms were used to meet the density and organism variety requirements.

**2.6.5** The following bacteria do not need to be added to the influent water, but shall be measured at the influent and at the time of discharge:

.1 coliform;

.2 enterococcus group;

.3 vibrio cholerae; and

.4 heterotrophic bacteria.

**2.6.6** If cultured test organisms are used, then it shall be ensured that local applicable quarantine regulations are taken into account during culturing and discharge.

## **2.7 Land-based monitoring and sampling**

**2.7.1** Change of numbers of test organisms by treatment and during storage in the simulated ballast tank shall be measured using methods specified in Part 4 of the Annex to the Guidelines (G8).

**2.7.2** It shall be verified that the treatment equipment performs within its specified parameters, such as power consumption and flow rate, during the test cycle.

**2.7.3** Environmental parameters shall be measured concurrently with sampling in compliance with Part 2 of the Annex to the Guidelines (G8).

**2.7.4** Samples during the test shall be taken immediately before the treatment equipment, immediately after the treatment equipment and upon discharge.

**2.7.5** The control and treatment cycles may be run simultaneously or sequentially. Control samples shall be taken in the same manner as the equipment test (refer to 2.7.4) and upon influent and discharge (refer to Fig. 3.2).

**2.7.6** Facilities or arrangements for sampling shall be provided to ensure representative samples of treated and control water can be taken that introduce as little adverse effects as possible on the organisms.

**2.7.7** Samples specified in 2.7.4 and 2.7.5 shall be collected in triplicate on each occasion.

**2.7.8** Separate samples shall be collected for:

**.1** organisms of greater than or equal to 50 µm or more in minimum dimension;

**.2** organisms greater than or equal to 10 µm and less than 50 µm in minimum dimension;

**.3** for coliform, enterococcus group, vibrio cholerae and heterotrophic bacteria; and

**.4** toxicity testing of treated water, from the discharge, for BWMS that make use of active substances and also for those BWMS that do not make use of active substances or preparations but which could reasonably be expected to result in changes to the chemical composition of the treated water such that adverse impacts to receiving waters might occur upon discharge.

**2.7.9** For the comparison of organisms of greater than or equal to 50 µm or more in minimum dimension against the D-2 standard of the Annex to the Convention, at least 20 l of influent water and 1 m<sup>3</sup> of treated water, in triplicate respectively, shall be collected. If samples are concentrated for enumeration, the samples shall be concentrated using a sieve no greater than 50 µm mesh in the diagonal dimension.

**2.7.10** For the evaluation of organisms greater than or equal to 10 µm and less than 50 µm in minimum dimension, at least 1 l of influent water and at least 1,0 l of treated water shall be collected. If samples are concentrated for enumeration, the samples shall be concentrated using a sieve no greater than 10 µm mesh in the diagonal dimension.

**2.7.11** For the evaluation of bacteria, at least 500 ml of influent and treated water shall be collected in sterile bottles.

**2.7.12** The samples shall be analysed as soon as possible after sampling, and analysed live within 6 h or treated in such a way so as to ensure that proper analysis can be performed (refer to Appendix 3).

**2.7.13** The efficacy of a proposed system shall be tested by means of standard scientific methodology in the form of controlled experimentation, i.e. "experiments". Specifically, the effect of the BWMS on organism concentration in ballast water shall be tested by comparing treated ballast water, i.e. "treated groups", to untreated "control groups".

**2.7.14** If in any test cycle the average discharge results of control water samples measurements is a concentration less than or equal to 10 times the values in regulation D-2.1 of the Annex to the Convention, the test cycle is invalid.

### **3 REPORTING OF TEST RESULTS**

**3.1** After approval tests have been completed, a report shall be submitted to the Register acting on behalf of the Administration. This report shall include information regarding the test design, methods of analysis and the results of these analyses.

**3.2** The results of biological efficacy testing of the BWMS shall be accepted if during the land-based and shipboard testing conducted in compliance with 2.2 and 2.3, Part 2 of the Annex to the Guidelines (G8) it is shown that the system has met the standard specified in regulation D-2 of the Annex to the Convention in all test cycles (refer to 4.7, Part 4 of the Annex to the Guidelines (G8)).

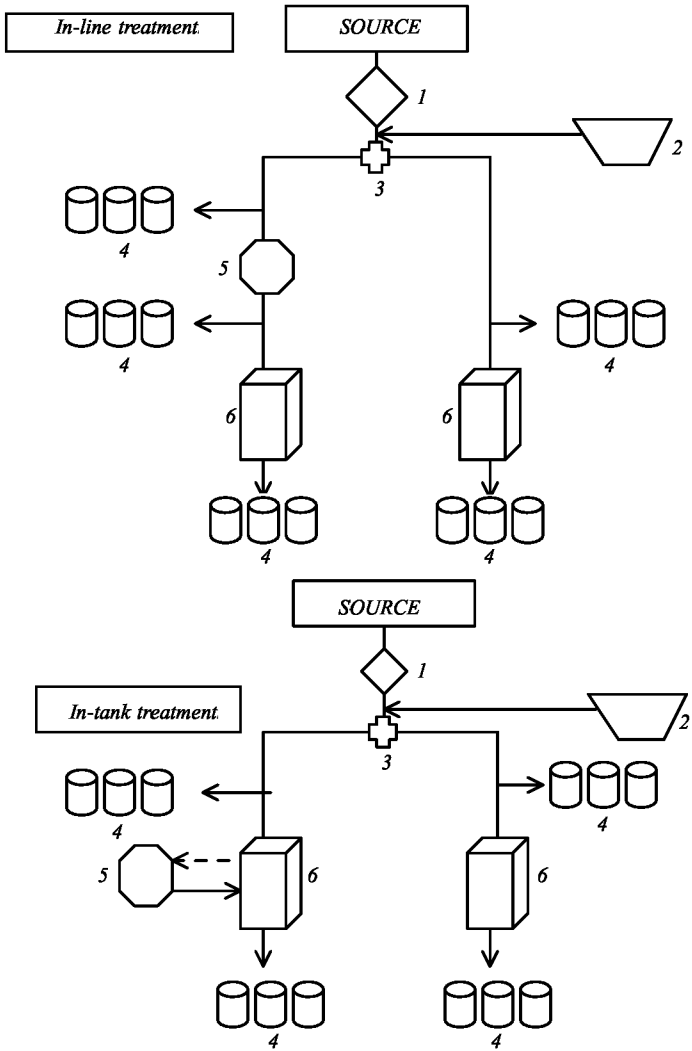


Fig. 3.2  
Diagrammatic arrangement of possible set-ups for land-based tests:

1 — pump; 2 — feed tank; 3 — feed-line; 4 — sample tanks; 5 — treatment system;  
6 — simulated ballast water tank

## **SPECIFICATION FOR ENVIRONMENTAL TESTING FOR APPROVAL OF BALLAST WATER MANAGEMENT SYSTEMS**

### **(Part 3, Guidelines (G8))**

## **1 TEST SPECIFICATIONS**

**1.1** The electrical and electronic sections of **BWMS** in the standard production configuration shall be subject to the programme of environmental tests set out in this specification at a laboratory approved for the purpose by the Administration or by the competent authority of the manufacturer's home country.

**1.2** Evidence of successful compliance with the environmental tests specified below shall be submitted to the Administration or **RS** acting on its behalf by the manufacturer together with the application for the **BWMS** type approval.

## **2 TEST SPECIFICATION DETAILS**

**2.1** Equipment shall operate satisfactorily on completion of each of the operating environment tests listed below.

## **3 VIBRATION TESTS**

**3.1** A resonance search shall be made over the following ranges of oscillation frequency and amplitude:

**.1** 2 to 13,3 Hz with a vibration amplitude of  $\pm 1$  mm; and

**.2** 13,2 to 80 Hz with an acceleration amplitude of  $\pm 0,7g$ .

This search shall be made in each of 3 orthogonal planes at a rate sufficiently low to permit resonance detection.

**3.2** The equipment shall be vibrated in the above-mentioned planes at each major resonant frequency for a period of 2 h.

**3.3** In the absence of any resonant frequency, the equipment shall be vibrated in each of the planes at 30 Hz with an acceleration of 0,7g for a period of 2 h.



3.4 After completion of the tests specified in 3.2 or 3.3 a search shall again be made for resonance and there shall be no significant change in the vibration pattern.

#### **4 TEMPERATURE TESTS**

4.1 Equipment that may be installed in exposed areas on the open deck, or in an enclosed space not environmentally controlled shall be subjected, for a period of not less than 2 h, to:

- .1 a low temperature test at  $-25\text{ }^{\circ}\text{C}$ ; and
- .2 a high temperature test at  $55\text{ }^{\circ}\text{C}$ .

4.2 Equipment that may be installed in an enclosed space that is environmentally controlled including an engine-room shall be subjected, for a period of not less than 2 h, to:

- .1 a low temperature test at  $0\text{ }^{\circ}\text{C}$ ; and
- .2 a high temperature test at  $55\text{ }^{\circ}\text{C}$ .

4.3 At the end of each of the tests specified above, the equipment shall be switched on and it shall function normally under the test conditions.

#### **5 HUMIDITY TESTS**

5.1 Equipment shall be left switched off for a period of 2 h at a temperature of  $55\text{ }^{\circ}\text{C}$  in an atmosphere with a relative humidity of 90 %. At the end of this period, the equipment shall be switched on and shall operate satisfactorily for 1 h under the test conditions.

#### **6 TESTS FOR PROTECTION AGAINST HEAVY SEAS**

6.1 Equipment that may be installed in exposed areas on the open deck shall be subjected to tests for protection against heavy seas in accordance with IP 56 of publication IEC 529 or its equivalent.

#### **7 FLUCTUATION IN POWER SUPPLY**

7.1 Equipment shall operate satisfactorily with:

- .1 a voltage variation of  $\pm 10\%$  together with a simultaneous frequency variation of  $\pm 5\%$ ; and

.2 a transient voltage of  $\pm 20$  % together with a simultaneous frequency transient of  $\pm 10$  %, with a transient recovery time of 3 s.

## **8 INCLINATION TEST**

**8.1** The **BWMS** shall be designed to operate when the ship is upright and when inclined at any angle of list up to and including  $15^\circ$  either way under static conditions and  $22,5^\circ$  under dynamic conditions (rolling) either way and simultaneously inclined dynamically (pitching)  $7,5^\circ$  by bow or stern. The Administration may permit deviation from these angles, taking into consideration the type, size and service conditions of the ship and operational functioning of the equipment. Any deviation permitted shall be documented in the Type Approval Certificate.

## **9 RELIABILITY OF ELECTRICAL AND ELECTRONIC EQUIPMENT**

**9.1** The electrical and electronic components of the equipment shall be of a quality guaranteed by the manufacturer and suitable for their intended purpose.

## **SAMPLE ANALYSIS METHODS FOR THE DETERMINATION OF BIOLOGICAL CONSTITUENTS IN BALLAST WATER**

### **(Part 4, Guidelines (G8))**

#### **1 SAMPLE PROCESSING AND ANALYSIS**

**1.1** Samples taken during testing of **BWMS** are likely to contain a wide taxonomic diversity of organisms, varying greatly in size and susceptibilities to damage from sampling and analysis.

**1.2** When available, widely accepted standard methods for the collection, handling (including concentration), storage, and analysis of samples shall be used. These methods shall be clearly cited and described in test plans and reports. This includes methods for detecting, enumerating, and identifying organisms and for determining viability (as defined in these Guidelines).

**1.3** When standard methods are not available for particular organisms or taxonomic groups, methods that are developed for use shall be described in detail in test plans and reports. The descriptive documentation shall include any experiments needed to validate the use of the methods.

**1.4** It is reasonable that sampling and analysis shall be performed by special recognized organizations. They can include laboratories of **Rospotrebnadzor**, **Roscompybolovstvo** and scientific institutes of **Russian Academy of Sciences** involved in study of seas and oceans.

#### **2 SAMPLE ANALYSIS FOR DETERMINING EFFICACY IN MEETING THE DISCHARGE STANDARD**

**2.1** Sample shall be completely analysed by the approved laboratory within storage time specified by the test method.

Sample analysis is meant to determine the species composition and the number of viable organisms in the sample. Different samples may be taken for determination of viability and for species composition.

**2.2** Viability of an organism can be determined through live/dead judgement by appropriate methods including, but not limited to morphological change, mobility, staining using vital dyes or molecular techniques.

**2.3** A treatment test cycle shall be deemed successful if:

.1 it is valid in compliance with 1.2.5 or 2.7.14, Appendix 1 of these Guidelines, as applicable;

.2 the average density of organisms greater than or equal to 50  $\mu\text{m}$  in minimum diameter in the replicate samples is less than 10 viable organisms per  $1\text{ m}^3$ ;

.3 the average density of organisms less than 50  $\mu\text{m}$  and greater than or equal to 10  $\mu\text{m}$  in minimum diameter in the replicate samples is less than 10 viable organisms per 1 ml;

.4 the average density of vibrio cholerae (serotypes O1 and O139) is less than 1 cfu per 100 ml, or less than 1 cfu per 1 g (wet weight) zooplankton samples;

.5 the average density of E. coli in the replicate samples is less than 250 cfu per 100 ml; and

.6 the average density of intestinal enterococci in the replicate samples is less than 100 cfu per 100 ml.

2.4 It is recommended to consider standard and innovative methods<sup>1</sup>.

### **3 SAMPLE ANALYSIS FOR DETERMINING ECO-TOXICOLOGICAL ACCEPTABILITY OF DISCHARGE**

3.1 Toxicity tests of the treated water discharge shall be conducted in compliance with 5.2.3 to 5.2.7 of the Guidelines (G9).

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<sup>1</sup>Suggested sources may include but not be limited to:

.1 The Handbook of Standard Methods For the Analysis of Water and Waste Water;

.2 ISO standard methods;

.3 UNESCO standard methods;

.4 World Health Organization;

.5 American Society of Testing and Materials (ASTM) standard methods;

.6 United States EPA standard methods;

.7 Research papers published in peer-reviewed scientific journals;

.8 MEPC documents.

**PRACTICAL RECOMMENDATIONS REGARDING SAMPLING  
TECHNIQUES AND PROCEDURES FOR USE DURING ASSESSING  
THE COMPLIANCE WITH CONVENTION**

**(Guidelines (G2))**

**1 SAMPLING FROM THE BALLAST WATER DISCHARGE LINE**

**1.1** The advantage in sampling the biota present in the ballast water discharge line is that this is most likely to accurately represent the concentration of substances and organisms in the actual discharge, which is of primary concern in assessing compliance with the discharge regulations.

**1.2** The disadvantages of this method are that, on most ships, in-line sampling shall be carried out in the engine room, where space may be limited, and operations with the sampled water volume may be impeded.

**1.3** In order to undertake an accurate measurement on the organism concentration in the ballast water, it is recommended to install an "isokinetic" sampling facility. Isokinetic sampling is intended for the sampling of water mixtures with secondary immiscible phases (i.e. sand or oil) in which there are substantial density differentials. Since most organisms are relatively neutrally buoyant, true isokinetic sampling is unnecessary. However, it may be useful for describing and determining geometric parameters of sampling facilities. Isokinetic sampling is necessary to ensure that a sample contains the same proportions of the various organisms as the flow stream being sampled. During isokinetic sampling the sampling arrangement does not alter the profile or velocity of the flowing stream at the moment or point at which the sample is separated from the main flow stream. During isokinetic sampling the sampling arrangement does not alter the profile or the flow velocity at any moment of time or at the sampling point from the main flow stream. To achieve isokinetic sampling conditions, the sampling arrangement shall separate a subsection of the main flow so that not to discourage water flow at the sampler entry port and to ensure water entry only in the cross-section of the sampler opening. In other words, flow streams in the main flow of the pipe shall not diverge or converge as they approach the opening of the sampler.

#### **1.4 Technical specifications for design of in-line sampling facilities**

**1.4.1** Through computational fluid dynamics modelling, it has been shown that the isokinetic diameter calculation can provide guidance for sizing of sample ports for sampling of organisms. Simulations showed that flow transitions from the main stream were best for sample port diameters between 1,5 and 2,0 times the isokinetic diameter. Ports sized in this range had smooth transitions and pressure profiles that allowed for direct sampling without the need of a pump to ensure sample collection. The isokinetic sample port diameter shall therefore be determined generally according to the following equation:

$$D_{iso} = D_m \sqrt{Q_{iso}/Q_m}$$

where  $D_{iso}$  and  $D_m$  = diameters of the sample port opening and the main flow in the discharge line, respectively; and  
 $Q_{iso}$  and  $Q_m$  = respective volumetric flow rates through the two pipes. It is recommended that sample port size be based on the combination of maximum sample flow rate and minimum ballast flow rate that yields the largest isokinetic diameter.

**1.4.2** The opening of the sampling pipe shall be chamfered to provide a smooth and gradual transition between the inside and outside pipe diameters.

**1.4.3** The length of the straight sampling pipe section facing into the flow may vary, but generally shall be not less than one diameter of the sampling pipe. The sampling arrangement shall be oriented so that its opening is facing upstream, and the sampling pipe section with the sampling port is parallel to the flow direction as well as concentric to the discharge pipe that may require sampling pipes to be L-shaped if installed along a straight section of discharge pipe.

**1.4.4** The need to be able to service the pipe of the sampling arrangement shall be provided, taking into account the safety of ship. The sampling pipe shall be retrievable or in a system that can be isolated from the discharge pipe. It is recommended that samplers be designed to be removed between sampling intervals or can be cleaned prior to sampling.

**1.4.5** The sample pipe and all associated parts of the sampler that come into contact or near proximity with the ballast piping shall be constructed of galvanically compatible materials and generally corrosion resistant. Any corrosion of the sampling system will affect sample flow rates and potentially sample representativeness.

**1.4.6** If flow control is required, ball, gate and butterfly valve types shall be avoided as they may cause organism mortality. For flow control, it is recommended that diaphragm valves or similar valve types be used to minimize sharp velocity transitions. Ball valves shall be applied in such a manner that they are either fully open or fully closed.

## **1.5 Technical specifications for installation of a sample point in the ballast water discharge line**

**1.5.1** The sample taken shall be removed from the main pipeline at a location where the flowing stream at the sample point is representative of the contents of the stream. The sample facility shall be placed at a point where the flow in the main pipe is fully mixed and fully developed.

**1.5.2** The sampling point shall be installed in a straight part of the discharge line as near to the ballast water discharge overboard as practicable. The sampling facility shall be positioned such that a representative sample of ballast water is taken. It is recommended that the position of the sample point is established using methods such as computational fluid dynamics.

## **2 SAMPLING FROM BALLAST WATER TANKS**

**2.1** In-tank sampling may be appropriate for assessing regulation D-1 of the Annex to the Convention compliance. There may be circumstances when in-tank sampling to provide an indication of compliance or non-compliance with the ballast water performance standard of regulation D-2 of the Annex to the Convention may be found appropriate. Regulation D-2 of the Annex to the Convention compliance shall be assessed at ballast water discharge, whenever this is possible.

### **2.2 Manholes**

**2.2.1** Sampling of ballast water via manholes allows direct access to ballast tanks.

**2.2.2** The disadvantages of this type of sampling access include the need for opening and closing manholes and hatches. Further, overlaying cargo may prevent access for sampling. Also, hatches and horizontal openings inside tanks are not aligned one below the other, which means that although the tank may have three or more decks, only the top deck may be accessible for sampling. Further, in some ships, access hatches and vertical openings are on the side of the tank and thus are not accessible unless the tank is empty. Another disadvantage is ladders and platforms may inhibit access to the full depth of the tank. Sampling from some certain parts of the ballast water tank may result in a lack of representation of the whole ballast water discharge.

**2.2.3** Samples shall be collected using scientific sampling equipment including plankton nets and pumps, as appropriate, for the sampling and analytical method intended for use.

**2.2.4** Whenever possible samples shall be taken from multiple water depths inside the ballast tank.

**2.2.5** When employing plankton nets:

.1 the sample shall be taken in a vertical net haul from the deepest sampling point accessible in the tank;

.2 all plankton nets shall be lowered to the maximum accessible depth inside the ballast tank and retrieved at a speed of approximately 0,5 m/s; and

.3 multiple vertical net hauls may be needed to meet the required sample volume. The water volume sampled may be measured by flow meters in the opening of the net or by noting the sampling depth and net opening diameter.

**2.2.6** When employing pumps:

.1 pump intake pipes shall be lowered to multiple depths (if possible) for different samples to obtain a vertical sample; and

.2 the water volume sampled may be measured by flow meters in the hose or by using larger containers to measure the pumped water volume.

**2.3** Sounding pipes or air pipes

**2.3.1** Sampling by sounding pipes, when available, could be appropriate due to accessibility. However, there are some limitations when using this point to test for compliance. The use of sounding pipes will be more effective when the ship's sounding pipes are perforated along their length, ensuring better mixing of ballast water and that within the sounding tube. However, care must be taken if initial water samples from a sounding pipe indicate no or insufficient exchange even though the ship's records document otherwise. Experience has shown that in some cases water within unperforated sounding pipes is not affected during an exchange.

**2.3.2** Samples shall be collected using sampling equipment, as appropriate.

**2.4** Use of pumps

**2.4.1** Pumps of various types may be used to sample via sounding or air pipes.

**2.4.1.1** The use of pumps may be limited, when the vertical distance from the pump to the water level in tank exceeds 10 m.

**2.4.1.2** Pump intake pipes shall be lowered to multiple depths (if possible) for different samples to obtain a vertical sample. The water volume sampled may be measured by flow meters in the hose or by using larger containers to measure the pumped water volume.

**2.4.2** In principle, intrinsically safe pumps shall be used in all circumstances.

**2.4.3** Pumps that do not contribute to the mortality of organisms shall be preferred.



### 3 SAMPLE DATA FORM

3.1 The following minimum information is recommended for sample documentation:

Table 3.1

Sampling date	
Particulars of ship	Name of ship: Distinctive number or letters Port of registry: Gross tonnage: IMO number: Date of construction: Ballast water capacity:
Identification of sampled tank <sup>1</sup>	
Type and position of sampled tank <sup>1</sup>	
Capacity of sampled tank <sup>1</sup>	(m <sup>3</sup> )
Type of ballast water management undertaken	(type of exchange or treatment)
Make of ballast water management system	
Date of ballast water management undertaken	
Sample identification code	(including number of replicate)
Sample type	(larger, smaller plankton, microbes)
Sampling techniques used	net (including depth of vertical net haul, net opening size, mesh size) pumps (including sampling depth, pumping capacity, in l/min) bottle (including sampling depth, bottle capacity, in l) specify other sampling technique, if used
Sampling time/start	
Sampling end time	
Origin of water sampled <sup>1</sup>	(lat/lon/port)
Type of sampling access point	
Location of sampling access point	
Water volume sampled	(by volume)

<sup>1</sup>If appropriate.

Table 3.1 — continued

In case sample is concentrated on board specify filter or net sizes (if applicable)	( $\mu\text{m}$ )
Preservative (if used)	
Transport to laboratory	cooling container, dark storage, etc.
Sample results	

Other information as necessary shall be included in the table.

#### 4 HEALTH AND SAFETY ASPECTS

**4.1** As shipboard and port State control procedures on health and safety aspects already exist there is no need to develop new procedures for the purpose of ballast water sampling. In general, ship procedures, especially for entry into enclosed spaces, shall be followed if more stringent than national regulations. However, the following paragraphs provide some additional guidance.

**4.2** Worker health and safety shall be a primary consideration during all the sampling operations as ships and ports are hazardous environments in which to work. Any sampling operation shall be undertaken after consideration of the specific risks associated with the ballast water being sampled. Appropriate personal protective equipment connected with the work shall be worn as necessary.

**4.3** In the event sampling involves entry into confined spaces, Recommendations for entering enclosed spaces aboard ships (resolution IMO A.864(20)) and relevant IACS recommendations on confined space safe practice ([www.iacs.org.uk](http://www.iacs.org.uk)), and standard industry practice on man entry into enclosed spaces shall be consulted (e.g., International Safety Guide for Oil Tankers and Terminals (ISGOTT)).

**4.4** All electrical equipment, including torches, shall be intrinsically safe for use on board ships when required. Safety limitations on the use of mobile telephones, etc., shall always be observed. Standard industry practice on the use of electrical equipment including mobile telephone shall be consulted (e.g., ISGOTT).

**4.5** All electrical equipment to be used aboard shall be checked to ensure that it is intrinsically safe. Pumps in particular shall be fitted with waterproof junctions at the point where the electrical lead passes into the pump body and all plugs shall be waterproof with rubber casings. If there is any doubt about an electrical supply or equipment aboard a ship, advice from the ship's master or a member of the port company electrical staff shall be sought.

## **5 MAINTENANCE, STORAGE, LABELLING AND TRANSPORTATION**

**5.1** Samples shall be handled and stored as appropriate for the intended analytical method. The sample collection data form and chain of custody record shall be kept with each individual sample.

**5.2** Sample Sealing: tape shall be used to seal the sample jar lid to the jar.

**5.3** Sample data forms: prior to the beginning of the sampling programme, a suitable set of recording forms based on Section 4 shall be designed which incorporate all the sample information required to meet the aims of the programme. Details of each sample shall be entered on the forms as soon as practicable.

**5.4** Labelling of sample containers: each sample container shall be labelled by, e.g., using a waterproof permanent marker and additional vegetal paper which may be deposited inside the sample container, if appropriate. The information recorded shall include but not be limited to the date, ship name, sample identification code, tank numbers and preservative if used. Codes may be used for some of these details as long as they are included on the sample data forms.

## GUIDANCE ON SCALING OF BALLAST WATER MANAGEMENT SYSTEMS

(refer to IMO circular BWM.2/Circ.33)

### 1 REFERENCE IN THE GUIDELINES (G8)

1.1 In addition to the definitions given in the Guidelines (G8), the following terms are defined:

.1 **Base unit** means a ballast water treatment equipment as defined in the Guidelines (G8).

.2 **Scaled unit** means a ballast water treatment equipment that is based on the base unit but has been modified to accommodate a higher or lower treatment rated capacity (**TRC**).

1.2 An equipment review and certification of a scaled system shall be undertaken by the Administration. Such a review shall be accompanied with the following documents:

.1 mathematical modelling and/or calculations demonstrating that any parameters that shall affect system performance are equivalent between base and scaled units; and

.2 the results of the environmental tests specified in Part 3 of the Annex to the Guidelines (G8), for each configuration of scaled units, shall such tests be required by the Administration.

1.3 The assumptions made for the scaling of the base unit shall be verified for each scaled unit (i.e. specific models of a series, e.g., 250 m<sup>3</sup>/h, 500 m<sup>3</sup>/h, 1,000 m<sup>3</sup>/h) by testing to the requirements of Part 2 of the Annex to the Guidelines (G8) for shipboard tests. The time required in 2.2.2.7 of the Guidelines (G8) may be reduced from 6 to 3 months.

1.4 The same consideration shall be given for scaled systems (i.e. specific models of a series, e.g., **TRC** = 250 m<sup>3</sup>/h, 500 m<sup>3</sup>/h, 1,000 m<sup>3</sup>/h) that are tested according to the requirements for land-based tests.

1.5 In case where all specific models of a series are tested according to the requirements for land-based tests, the model with the worst performance shall be tested according to the requirements for shipboard tests, to demonstrate the ability of the model to operate in normal ships' conditions.

**1.6** Combinations of base and scaled units that have been verified for compliance with 1.2 to 1.5 shall be regarded as several units mounted in parallel and do not fall within the scope of this Annex.

**1.7** Where the results of testing are unsatisfactory in compliance with 1.2 to 1.5, each scaled system shall be tested according to the requirements for land-based and shipboard tests.

**1.8** If scaling and shipboard testing is intended to be utilized to type-approve a system beyond its currently approved TRC without land-based testing then the following process applies:

**.1** the documentation specified in 1.5 shall identify the key internal and external performance parameters (e.g., dosage concentration, UV intensity, filter flux density, etc.) required to achieve the system's efficacy, and also specify the physical/environmental conditions and design parameters that affect these;

**.2** validated mathematical model and/or calculations shall be used to predict that the key performance parameters will be achieved in the scaled unit design and that the fundamental mechanism of operation is not changed;

**.3** it shall be verified through shipboard testing that the scaled unit achieves the critical values of the key performance parameters utilizing the design determined by the model and/or calculations specified in 1.8.2;

**.4** modelling shall address the efficacy and environmental impact of the system. The actual chemical analysis for by-products shall be performed during shipboard testing, if necessary.

**1.9** A representative number of scaled systems capacities, taking into account the treatment technology, shall be tested according to the requirements for shipboard tests.

## **2 REFERENCE IN THE GUIDELINES (G9)**

**2.1** When scaling from systems that have received basic or final approval from MEPC in compliance with the Guidelines (G9), the manufacturer of the Administration shall ensure that any conditions specified in final approval of the base unit are still applied in the scaled system or systems.

## **3 ISSUING OF TYPE APPROVAL FOR SYSTEMS USING SCALED UNITS**

**3.1** The Type Approval Certificate issued by the Administration shall include each and every scaled system if the scaling is done according to these procedures.

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