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Ships and marine technology — Ballast water management systems (BWMS) — Procedures for commissioning and testing BWMS using electrolytic methods

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Foreword

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This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*.

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Introduction

A ballast water management system (BWMS) using electrolytic methods typically applies a combination of filtration (if applicable) and an electrolysis process to treat ballast water during uptake in port or while in voyage. Treatment systems are typically used to meet either Regulation D-2 of the International Maritime Organization (IMO) BWM Convention[10] or the relevant ballast water discharge standard (BWDS) of a port state administration, e.g. the US. Coast Guard (USCG),[28] or both. A neutralization process may also be applied by a BWMS using electrolytic methods prior to or during the discharge of ballast water, to ensure that maximum allowable discharge concentrations of active substances do not exceed the requirements of either the IMO or port states, or both.

Commissioning of a BWMS occurs after the initial installation on board a ship. The commissioning process verifies correct installation, proper function and nominal operation of the BWMS to the satisfaction of the owner and the Administration. It is required by the Code for Approval of Ballast Water Management Systems (BWMS Code)[13] that installation commissioning procedures are completed prior to the issuance of the International Ballast Water Management Certificate. It is also required by Survey Guidelines under the Harmonized System of Survey and Certification (HSSC)[19] that a survey after installation of a BWMS be carried out to confirm satisfactory installation and operation of the BWMS. Additionally, commissioning testing to validate the installation of a BWMS is now mandatory for all parties to the Convention[10] according to IMO Circular BWM.2/Circ.70/Rev. 1,[22] effective 1 June, 2022. This testing includes biological assessments for the two organism size classes of ≥ 50 µm and ≥ 10 µm to < 50 µm, where “the commissioning test is successful if the indicative analysis indicates that the discharge samples do not exceed the D-2 standard for the size classes analysed.”[22]

This document has been developed based on the treatment process employed by BWMS using electrolytic methods and is aligned with IMO Circular BWM.2/Circ.70/Rev.1.[22] It also provides requirements and detailed procedures to perform commissioning and testing of BWMS using electrolytic methods. It includes:

— procedures for installation inspection to verify correct installation of the BWMS;

— procedures for function tests to verify correct functionality of the BWMS; and

— procedures for the commissioning test, which incorporates a long cycle operation with collection and analyses of ballast water samples, to verify proper operation and sample analysis.

Ships and marine technology — Ballast water management systems (BWMS) — Procedures for commissioning and testing BWMS using electrolytic methods

1 Scope

This document provides requirements and procedures for commissioning a ballast water management system (BWMS) using electrolytic methods following installation on board a ship. It specifies safety measures, procedures for commissioning (including installation inspection, function test, training of the ship's crew) and a commissioning test according to BWM.2/Circ.70/Rev.1.[22] This commissioning process ensures the health and safety of personnel involved in commissioning, verifies proper function and operation, and provides procedures for sampling and analysis. This document also provides requirements on the documentation of commissioning.

This document focuses on the commissioning of a BWMS using electrolytic methods after initial installation on board a ship, but it can also apply to other necessary surveys of a BWMS and readiness evaluation of land-based or shipboard testing for type approval required by either IMO or a port state, or both.

NOTE A survey of the installed equipment and associated documentation is conducted by a Recognized Organization (RO) according to the BWMS Code (MEPC.300(72)[13]), and the Harmonized System for Survey and Classification (HSSC)[19]. Installation checkout and commissioning is normally completed by the manufacturer or their technical representative according to manufacturer requirements, while verification of discharge samples is conducted by a ballast water testing organization.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 11711-1, *Ships and marine technology — Aquatic nuisance species — Part 1: Ballast water discharge sample port*

ISO 11711-2, *Ships and marine technology — Aquatic nuisance species — Part 2: Ballast water sample collection and handling*

ISO 23314-2, *Ships and marine technology — Ballast water management systems (BWMS) — Part 2: Risk assessment and risk reduction of BWMS using electrolytic methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11711-1, ISO 11711-2, ISO 23314-2 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
commissioning
procedures performed in accordance with manufacturer specifications, IMO requirements, the Administration and *recognized organizations* (3.14), after the completion of the installation of a ballast water management system, to verify that its function and operation meet the design and construction requirements and that it complies with Regulation D-2 of the Convention[10] prior to delivery to the ship owner

3.2
commissioning test
examination and evaluation to validate the installation of a ballast water management system by demonstrating that its mechanical, physical, chemical and biological processes are working properly

Note 1 to entry: Compliance with the ballast water discharge standard as per port state rules can also be verified during commissioning testing, if necessary.

[SOURCE: IMO BWM.2/cir.70/Rev.1[22]]

3.3
alarm
alert to the operator through visual and audible indication that an operating parameter is not within range, or a component or subsystem is not functioning correctly

Note 1 to entry: For the purposes of this document, a warning alarm typically does not shut down the ballast water management system and will continue until acknowledged by the operator. Such an alarm can indicate inadequate treatment or exceedance of *system design limitations* (3.21).

Note 2 to entry: In this document, a critical alarm will result in system shutdown without operator intervention.

3.4
long cycle operation
procedure that is conducted to verify the capability of a ballast water management system to maintain long-term stable performance without activation of system shutdown

3.5
function test
examination and evaluation of the functionality, control, and safety equipment of the ballast water management system or its components to ensure that it performs according to the specified task and meets the required standards

3.6
control and monitoring equipment
equipment that is installed for the effective operation and control of the ballast water management system and the assessment of its effective operation

[SOURCE: IMO BWMS Code,[13] 2018, 3.4]

3.7
major component
component that directly affects the ability of the ballast water management system to meet the ballast water performance standard described in Regulation D-2 of the Convention[10] (D-2 standard)

[SOURCE: IMO BWMS Code,[13] 2018, 3.9]

3.8
side-stream electrolysis
process that diverts a small portion of ballast water to the electrolysis unit for the generation of active substances

3.9
full flow electrolysis
process where all ballast water flows through the electrolysis unit for the generation of active substances

3.10
independent shutdown
system shutdown initiated from an additional sensor, system, or trigger that is independent of the ballast water management system *control and monitoring equipment* (3.6)

3.11
limited space
structurally complex or obstructed space that has limited access to entry due to adjacent arrangement of equipment, piping and structures, e.g. space under lowest deck in engine room

3.12
enclosed space
confined space
space that has limited openings for entry and exit, inadequate ventilation and is not designed for continuous worker occupancy

[SOURCE: IMO Resolution A.1050(27),[18] 2011, 2.1]

3.13
ballast water management room
BWMR
space containing equipment belonging to the ballast water management system (BWMS)

Note 1 to entry: A space containing remote controls for the BWMS or a space dedicated to the storage of liquid or solid chemicals for BWMS is not considered as a BWMR.

[SOURCE: IACS UR F45,[26] 2021, 1.2.3, modified — "need not be " replaced with "is not" in Note 1 to entry.]

3.14
recognized organization
RO
organization that has been assessed and found to comply with the RO Code, and entrusted with inspections and surveys by a flag state

[SOURCE: IMO Resolution MEPC.237(65) RO Code,[12] 2013, 1.1]

3.15
ballast water testing organization
company, organization or institute, independent of the ballast water management system manufacturer or supplier, that provides services to collect and analyse the samples of ballast water in accordance with IMO circular BWM.2/Circ. 70/Rev.1 and to the satisfaction of the Administration and *recognized organization* (3.14)

Note 1 to entry: See the ISO 11711 series for guidance on equipment and procedures for sampling and analysis of ballast water.

3.16
self-monitoring parameter
parameter that is automatically monitored by control and monitoring equipment of the ballast water management system (BWMS) and indicates the functionality of BWMS, e.g. pressure, total residual oxidants (TRO) level, flow rate

3.17
ambient water
water from a natural, local source

[SOURCE: IMO BWM.2/Circ.78,[23] 2023, 2.3]

3.18
indicative analysis
compliance test that is a relatively quick indirect or direct measurement of a representative sample of the ballast water volume of interest

Note 1 to entry: An indirect, indicative analysis can include measurements whose parameters do not provide a value directly comparable to the D-2 Standard,[10] including biological, chemical or physical parameters. The practicalities, associated error, and limitations of these methods should be understood before they are used in *commissioning testing* (3.2).

Note 2 to entry: A direct measurement, which is directly comparable to the D-2 standard of the Convention[10] can also be indicative if it has a large confidence interval or high detection limits.

[SOURCE: IMO BWM.2/Circ.42/Rev.2,[20] 2020, 2.4]

3.19
detailed analysis
compliance test that is likely to be more complex than *indicative analysis* (3.18) and is a direct measurement of a representative sample used to determine the viable organism concentration of a ballast water volume of interest

Note 1 to entry: The measurement result of detailed analysis should provide a direct measurement of viable organism concentration in the ballast water discharge which is directly comparable to the D-2 Standard[10] (number of viable organisms per volume).

Note 2 to entry: The measurement result of detailed analysis should be of sufficient quality and quantity to provide a precise measurement of organism concentration (±[X] organisms per volume) for the size categories in the D-2 Standard.[10]

Note 3 to entry: Detailed analysis should use a measurement method with an adequate detection limit for the purpose for which it is being applied.

[SOURCE: IMO BWM.2/Circ.42/Rev.2,[20] 2020, 2.5]

3.20
compliance monitoring device
CMD
instrument and its associated indicative analytical methodology typically used as a rapid assessment of the concentration of viable (or living) organisms in treated water for the purpose of determining compliance or non-compliance with a discharge standard

[SOURCE: IMO BWM.2/Circ.78,[23] 2023, 2.1]

3.21
system design limitation
SDL
water quality and operational parameter, determined in addition to the required type approval testing parameters, that are important to its operation, and, for each such parameter, a low and/or a high value for which the ballast water management system (BWMS) is designed to achieve the performance standard of Regulation D-2

Note 1 to entry: The SDL should be specific to the processes being employed by the BWMS and should not be limited to parameters otherwise assessed as part of the type approval process.

Note 2 to entry: The SDL should be identified by the manufacturer and validated under the supervision of the Administration, taking into account guidance developed by IMO (BWM.2/Circ.69),[21] and in accordance with BWMS Code.[13]

[SOURCE: IMO BWMS Code,[13] 2018, 3.14]

3.22
power management system
PMS
automatic control system that monitors, controls, and optimizes the generation, distribution, and utilization of electrical power aboard a ship to ensure stable and efficient power supply by functions such as automatic synchronization of generators, load distribution, overload control, and fault protection

3.23
alarm monitoring system
AMS
automatic system that continuously monitors the status of critical shipboard equipment and systems, detects anomalies by sensors and monitoring devices, and triggers *alarms* (3.3) when potential hazards or hazardous situations are identified to ensure safety of the ship and crew

3.24
integrated automation system
IAS
automatic control system that integrates various operational and monitoring functions into a unified platform and typically achieves functions such as power management, navigation, safety monitoring, control of deck machinery and environmental equipment, aiming to enhance operational efficiency, safety and reliability of the ship

4 Safety during commissioning

4.1 General

Personal safety is the most important consideration during the commissioning of the ballast water management system (BWMS). This is owing to the extremely complex environment on board a ship and the fact that either the BWMS, ship, or both, is not fully functional during the commissioning stage. Moreover, potential risks are amplified by other unknown factors such as issues in the installation process or changes in the operating environment. The shipyard shall provide safety briefings and identify required personal protective equipment (PPE). Hazards that can pose risks to safety and health of personnel when performing the commissioning of BWMS using electrolytic methods include, but are not limited to:

— dust,

— noise,

— fire,

— heat,

— flooding,

— falling objects,

— height from the ground,

— electrical shock,

— limited space,

— enclosed space,

— hazardous areas where dangerous gas can be present,

— active substances generated by the BWMS,

— dangerous gas generated by the BWMS,

— chemicals and reagent used by BWMS using electrolytic methods, and

— unfamiliarity with ships.

To minimize the risks to the personnel who are involved in commissioning, adequate protective measures shall include:

— safety training (see 4.2);

— wearing suitable PPE (see 4.3);

— satisfactory ventilation in the space where a BWMS is operated and upon entry to any enclosed space and/or hazardous area (see 4.4); and

— implementation of fire safety and flooding handling procedures (see 4.5).

4.2 Safety training

4.2.1 General

Before commissioning is undertaken, safety training shall be completed by personnel responsible for commissioning of the BWMS. Safety training provides all essential information on personal safety and health on board ships, taking into account the identified hazards and protective measures. The content of safety training is given in 4.2.2.

NOTE In general, the safety training is specific to a ship and shipyard, and is required for all personnel working on site.

4.2.2 Content of safety training

The content of safety training shall include, but is not limited to:

— firefighting measures, e.g. use of portable fire extinguisher and other shipboard firefighting equipment;

— identification of warning signs and shipboard audible alarm information;

— exits and emergency escape routes;

— emergency contact information, e.g. use of shipboard telephone station and contact information of responsible personnel on board the ship;

— emergency procedures, e.g. emergency evacuation, muster locations;

— common first aid instructions, e.g. location and use of eye washing station, location and use of first aid kit to treat minor injuries like wounds, bleeding, burns and broken bones etc.;

— knowledge of hazardous gas generated by BWMS using electrolytic methods, as specified in related safety data sheets (SDS), including properties, first aid measures, accidental leakage measures and firefighting measures;

— knowledge of chemicals generated and used by BWMS using electrolytic methods, as specified in related SDS, including properties, first aid measures and firefighting measures; and

— protocol for entry into enclosed space.

4.3 Personal protective equipment (PPE)

When commissioning BWMS using electrolytic methods, personnel shall be equipped with appropriate PPE to safeguard against injuries and illnesses arising from various workplace hazards, including physical, electrical and chemical hazards (see 4.1). The PPE is expected to be properly selected and correctly worn in accordance with international and national standards to provide maximum protection. The minimum