

ShipRight

Design and Construction

Approval of Installation of Ballast Water Treatment Systems on LR Classed Ships

September 2017

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■ Section 1 Introduction

1.1 Introduction

This document provides guidance for the approval of the installation of ballast water treatment systems (BWTSs) on board Lloyd's Register (LR) classed ships and is to be considered as a supporting document to the relevant Sections of the applicable LR Rules. This document provides information on what information will be required by LR to appraise a ballast water treatment system (BWTS) and guidance on good practice. This document is also intended to support clients by making clear the differences between statutory approval and class approval of a BWTS.

1.2 Ballast Water Management Convention

The International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) was adopted by the International Maritime Organization (IMO) on 13 February, 2004. The Convention entered into force on 8 September 2017. The Convention applies to all ballast water operations on all ships (unless provided otherwise). However, only ships of 400 gt and above, to which the Convention applies (as per Article 3), excluding floating platforms, FSUs and FPSOs, are subject to mandatory surveys. As per Article 3 of the Convention, the Convention does not apply to:

- ships not designed or constructed to carry Ballast Water;
- domestic ships (domestic flag);
- domestic ships (foreign flag with permission of domestic flag);
- ships which only operate in waters under the jurisdiction of one Party and on the high seas;
- warships, naval auxiliary or other ship owned or operated by a State; and
- permanent Ballast Water in sealed tanks on ships, that is not subject to discharge.

The BWM Convention requires that BWTSs comply with ballast water performance standard Regulation that testing and certification are to be carried out in accordance with IMO Resolution MEPC.174(58) or MEPC.279(70) where appropriate. In addition to complying with statutory requirements, BWTSs installed on ships classed by (or intended to be classed by) LR must comply with the applicable LR Rules, which may be:

- Lloyd's Register's *Rules and Regulations for the Classification of Ships* or
- Lloyd's Register's *Rules and Regulations for the Classification of Special Service Craft* or
- Lloyd's Register's *Rules and Regulations for the Classification of Naval Ships* or
- Lloyd's Register's *Rules for the Manufacture, Testing and Certification of Materials*.

According to the type of ship and which rule set applies, hereinafter referred to as the applicable LR Rules. The applicable LR Rules do not address the environmental performance of the BWTS, which is subject to the national and international statutory requirements.

1.3 What this ShipRight procedure contains

Ch 1, 2 The Different BWTS Categories of Approval and Surveys describes the various approvals necessary for the installation of BWTSs on ships classed by LR. This includes both the statutory requirements (IMO BWM Convention) as well as LR class requirements.

Ch 1, 3 Installation provides guidance and recommendations to be considered by those planning to install BWTSs on ships classed by LR. This guidance should be considered as supplementing the applicable LR Rules and all applications to install such systems are subject to the usual LR's design appraisal process.

■ Section 2

The Different BWTS Categories of Approval and Surveys

2.1 Approval categories

There are two separate and distinct approvals for BWTSs, statutory Type Approval (statutory approval) and class approval. Statutory approvals are within the jurisdiction of the Approving Administration and it is the Administration which defines the testing and acceptance criteria. Operators are responsible for ensuring compliance with the relevant ballast water discharge standards and sediment controls. The class approval is carried out against the applicable LR Rules.

Installation surveys are required to ensure that the BWTS is installed in accordance with the approved drawings and meets LR requirements. On-going surveys ensure that the system is maintained and operated correctly and that accurate records are kept on board.

2.2 Statutory Type Approval

2.2.1 IMO Type Approval (G8)

BWTSs intended for installation on LR classed ships will have IMO Type Approval (G8) (statutory Type Approval) from an Approving Administration in accordance with IMO Resolution MEPC.174(58) or MEPC.279(70) – *Guidelines for Approval of Ballast Water Management Systems (G8)*, (*Code of Approval of Ballast Water Management Systems*), where appropriate. This is a one-off approval of a specific design of BWTS.

IMO Type Approval (G8) indicates that the BWTS has achieved the ballast water discharge standard of Regulation D-2 in land-based and shipboard evaluations and did not cause unacceptable harm to the environment or public health.

As part of the IMO Type Approval (G8), systems that use an active substance (defined by the IMO as 'a substance or organism, including a virus or fungus, that has a general or specific action on or against harmful aquatic organisms and pathogens') require an additional Type Approval from the IMO in accordance with IMO Resolution MEPC 169(57) – *Procedure for Approval of Ballast Water Management Systems That Make Use of Active Substances (G9)*.

A number of Approving Administrations rely on LR as a Recognised Organisation (RO) to provide technical support when reviewing BWTSs for compliance with the G8 guidelines. It is to be noted that one or more IMO Type Approval certificates may exist for a BWTS from different administrations. For ship installations, what is important is the Type Approval from the Flag Administration. The Flag Administration may choose to issue a Type Approval certificate based on the Type Approval issued by the Approving Administration, or to recognise the Type Approval of the Approving Administration without issuing their certificates. IMO publishes the list of Type Approved BWTS, including information on the Approving Administrations.

Where LR is to undertake the statutory approval as a RO, then the BWTS manufacturer is responsible for:

- nominating the Approving Administration;
- arranging for land-based and shipboard testing;
- providing LR with all documentation required by IMO Resolution MEPC.174(58) or MEPC.279(70) where appropriate;
- obtaining both basic and final active substance approval from the IMO in accordance with G9, where applicable;
- providing documented evidence to LR for systems that do not use an active substance, explaining why G9 approval is not required;
- paying fees as agreed with LR.

2.2.2 Other statutory Type Approvals

LR is an approved independent Laboratory (IL) for USCG in approving BWTS. LR undertakes testing and evaluation of BWTS and provides reports to USCG in order for them to award USCG Type Approvals for the BWMS.

2.2.3 Statutory installation surveys

The statutory surveys listed in Section 8 of Resolution MEPC.174(58) or MEPC. 279(70) are to be carried out, where LR acts as a RO for the Approving Administration, these surveys may be carried out by an LR Surveyor acting on behalf of the Administration.

Other specific survey instructions are contained in the IMO interim survey guidelines contained in BWM.2/Circ.7.

2.3 Class approval of BWTS

Applicable LR Rules and Regulations:

- *Rules and Regulations for the Classification of Ships (Rules for Ships), Part 5, Chapter 25 Ballast Water Treatment System and Installation; and*
- *Rules and Regulations for the Classification of Special Service Craft (Rules for Special Service Craft), Part 15, Chapter 3, Section 13 Ballast water treatment system and installation.*

2.3.1 BWTS design approval

Class approval of the BWTS will take the form of a Machinery General Design Appraisal (MGDA) covering engineering systems and electrotechnical class requirements. This one-off approval is required for installation on LR classed vessels unless stated otherwise in this document. The MGDA is valid for five years and is only applicable to BWTS installed on LR classed ships. A BWTS that has a class approval issued by another class society must meet LR Rule requirements before being installed on an LR classed ship.

The MGDA maybe issued as a single certificate or as two linked certificates for engineering systems and electrotechnical.

BWTS manufacturers are to provide information on whether treated ballast water can generate dangerous gases such as hydrogen, chlorine dioxide, etc. or hazardous substances, can affect ballast water tank coatings or can result in accelerated corrosion of system coatings. LR will require a risk assessment to be carried out and may stipulate additional conditions in the MGDA where any of these risks are applicable.

Where risk assessment is to be used to support the approval of a BWTS, the risk assessment process is to be carried out in accordance with the LR ShipRight Procedure *Risk Based Designs and Annex 1 – Ballast Water Treatment Systems*. Ship specific installation risk assessment shall be required if the system arrangement deviates from the applicable LR Rules and Regulations specified in *Ch 1, 2.3 Class approval of BWTS*, or if the risk assessment of the BWTS identifies a need for further studies at the installation phase.

2.4 Class approval of a ship-specific installation

BWTS installations on board LR classed ships are to be approved by LR in accordance with the applicable LR Rules given in *Ch 1, 2.3 Class approval of BWTS*. The LR BWTS Type Approval or LR MGDA is to be submitted along with the ship-specific installation plans. If the BWTS does not have LR Type Approval or an LR MGDA, then a design appraisal against the Rules will be required for the particular BWTS model in each individual installation on board an LR classed ship.

The installation approval is to ensure that the installation-on board satisfies the applicable LR Rules and that the safety and reliability of essential systems and services of the ship are assured.

Where the installation plans meet the requirements of the LR Rules, a Design Appraisal Document (DAD) will be issued.

The LR BWTS installation DAD indicates that the ship-specific BWTS installation satisfies the requirements of the applicable LR Rules.

2.4.1 Class notation

The following class notations will be assigned where appropriate to ships which comply with the relevant criteria given for each notation.

- **BWTS** notation assigned to ships with a BWTS which is approved and installed in accordance with LR's Rules and Regulations.
- **BWTS*** notation assigned to ships with a BWTS which is Type Approved in accordance with LR's Type Approval procedures and approved and installed in accordance with LR's Rules and Regulations.

2.4.2 Class installation survey

All BWTSs installed on LR classed ships are to be surveyed by an LR Surveyor during the installation process.

The installation survey indicates that the BWTS installation has been surveyed and satisfies the LR Rules and the conditions of class.

2.5 LR BWTS Type Approval (Optional)

LR Type Approval is an impartial certification service providing independent third party Type Approval certificates attesting to a product's conformity with LR's Rule requirements.

Where a BWTS is Type Approved by LR, this confirms that the BWTS meets the requirements of the applicable LR Rules and it is assessed using LR Type Approval System Procedure TA14.

2.5.1 Output of LR Type Approval

LR Type Approval indicates:

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- that the BWTS satisfies the relevant LR Rules and that the BWTS has a statutory approval issued by the Approving Administration.
- that the BWTS satisfies LR's Test Specification No.1.
- that the BWTS manufacturer's production facility satisfies LR's Type Approval requirements.
- that the BWTS manufacturer's quality assurance system satisfies LR's Type Approval requirements.

2.5.2 Assistance on Type Approval services will be supplied by local LR Offices on request and further information is available on the LR Type Approval website:

<http://www.lr.org/en/services/type-approval/>

2.5.3 Documentation to be submitted for LR Type Approval

The BWTS manufacturer is responsible for submitting all necessary supporting documentation and for both implementing and then maintaining satisfactory production control systems.

The following documentation is to be submitted as part of the approval:

- a copy of the G8 statutory approval certificate for the BWTS;
- a copy of the G9 approval documentation including the GESAMP-BWWG report (for BWTSs using active substances);
- Technical documentation as per *Rules for Ships, Part 5, Chapter 25, Section 4* are to be submitted
- Any documents required to support the approval of scaled versions of the BWTS to be approved in accordance with BWM.2/Circ.33 – Guidance on Scaling of Ballast Water Management Systems;
- a copy of the manufacturers quality assurance certification (e.g., ISO 9001 certification);
- any other supporting documentation considered necessary by LR following a request for Type Approval services.

All documentation is to be in English. Translation costs will be incurred for documentation submitted in other languages which have to be translated by LR.

2.5.4 Validity of the LR BWTS Type Approval certificate

The Type Approval certificate is valid for five years and is subject to the BWTS conforming to the approval documentation referenced in the certificate. The manufacturer is to comply with LR's Type Approval requirements and the terms and conditions stated on the certificate.

Type Approval certificates can be extended for a further five years by making a request to LR. If the product and the place of production are the same as those specified in the original Type Approval certification, no additional documentation is required. The manufacturer is to issue a letter confirming this.

If a design modification is to be made, further design appraisal and/or testing will be required and an extension certificate will be issued upon satisfactory completion.

If changes are to be made after the Type Approval certificate has been issued, details must be submitted at the earliest opportunity, together with a statement of any impact that the changes have on the BWTS and the original Type Approval certification.

Major components used in the BWTS production must be of the type listed on the Type Approval certification. Manufacturers must notify LR of proposed changes to the location of test and production facilities.

In addition to advising LR, any design or system performance upgrade outside the scope of the statutory approval against IMO Resolution MEPC.174 (58) or MEPC.279(70) is to be brought to the attention of the Approving Administration.

LR reserves the right to withdraw a Type Approval certificate if:

- any subsequent design changes are deemed to adversely affect the provisions under which LR Type Approval certification was issued.
- a safety or any other feature of the product is found to be unsatisfactory in service.
- improper use is made of the certificate, or of LR's name, in marketing the product.
- LR's fees are not duly settled.
- the address of the production facility changes, without LR being notified.

■ Section 3

Installation

3.1 BWTS design and safety

To ensure that the ship's sea water ballast system remains operational in the event of a BWTS failure or emergency, a suitable BWTS by-pass which can be operated both locally and manually is to be installed.

BWTSs using chemicals/active substances are to have safety procedures which include, but are not limited to:

- loading chemicals;
- prevention of chemical tank overflow;
- safe handling and storage of chemicals on board;
- accidental spills and leakages;
- residual chemicals and by-product gases prior to discharge;
- chemical inhalation or contact with skin;
- management and disposal of wastes from filtered material.

Advice on the storage and handling of chemicals is contained in the IMO Circular BWM.2/Circ.20 and further guidance may be found in *Pt 5, Ch 25, 10.3 Chemical storage tank requirements* of the Rules for Ships.

Safety features to prevent accidental discharge or operation are to be incorporated into the design including level, temperature and pressure indication, gas detection (where applicable) and chemical dosage monitoring. All shutdown conditions are to be defined.

Provision of sampling points and the sampling process are to comply with the requirements of MEPC.173(58) – *Guidelines for Ballast Water Sampling (G2)*.

For BWTSs using chemicals/neutralising agents, the quantities of such chemicals to be carried are to be considered relative to the expected rate of consumption, capacity of the ballast water system and required endurance.

The discharge of treated ballast water is to be monitored to ensure that it does not exceed acceptable discharge limits to sea. The chemical toxicity and quality of ballast water discharge maybe regulated by local or national water quality regulations and can vary from port to port. These limits are to be adhered to where relevant in addition to the IMO D-2Standard. It is the responsibility of the Operator to be aware of any such restrictions and to comply with them.

3.2 Piping materials

Piping materials and valves are to comply with the applicable LR Rules given in *Ch 1, 2.3 Class approval of BWTS*.

For BWTSs using chemicals/active substances, materials are to be suitable for the chemicals and active substances proposed. In general LR would expect such installations to meet the materials and piping requirements of the LR Rules for Ships Carrying Liquid Chemicals, where applicable.

Plastic pipes proposed for connecting the BWTS with other shipboard sea water ballast piping are to meet the fire endurance requirements of *Pt 5, Ch 12, 5.4 Fire performance criteria* of the Rules for Ships, with reference to IMO Resolution A.753(18) for those Sections that cannot be isolated from the ballast system. Plastic pipes which do not comply with the fire endurance test requirements given in *Pt 5, Ch 12, 5.4 Fire performance criteria* of Rules for Ships are to comply with the requirement given in *Pt 5, Ch 25, 5.1.4 General* of Rules for Ships.

In addition, the use of plastic pipes is to comply with any additional requirements of the Flag & Approving Administrations.

3.3 Electrotechnical systems

Electrotechnical systems are to comply with the electrotechnical requirements of the applicable LR Rules given in *Ch 1, 2.3 Class approval of BWTS*.

Programmable electronic equipment is to be certified by a recognised authority as suitable for the environmental conditions in which it is intended to operate. This may be satisfied if it meets the requirements of LR Test Specification No.1.

3.4 Location

3.4.1 BWTS restrictions in hazardous areas

The installation of BWTSs in hazardous areas will be considered on a case-by-case basis, applying the requirements of the applicable LR Rules given in *Ch 1, 2.3 Class approval of BWTS*.

The transfer of ballast water from hazardous to non-hazardous areas is not permitted except for sampling.

By-products of treated ballast water in ballast water tanks located in non-hazardous areas are not to render the area hazardous.

Subject to acceptance by LR, the transfer of ballast water from machinery spaces to a hazardous area may be accepted but not vice versa.

Further information on space categorisation and installation requirements are given in *Pt 5, Ch 25, 10.4 BWTS space categorisation requirements* of Rules for Ships.

3.4.2 Installation in cargo pump room

For existing ships and ships under construction, installation of BWTS within cargo pump rooms should be avoided. If restrictions imposed by space prevent installation in locations other than the cargo pump room, then consideration may be given to installation in cargo pump rooms. In all such cases a suitable technical justification is to be provided.

Installation in cargo pump rooms may invalidate hazardous area classification of such spaces, consequently, the space will need to be re-assessed and certified.

If the installation is a potential source of hazardous gases then any equipment located in the space is to be recertified as applicable in accordance with the type of hazardous gases produced in such hazardous atmospheres. For existing ships, where space available for installation may be limited, consideration should be given to selecting a BWTS which can be split into various sub-components. These sub-components may then fit within the available spaces and with existing systems without needing any special consideration as a result of conflicting with statutory requirements or the applicable LR Rules.

Where the BWTS is to be installed within the pump room instead of within an independent compartment as ballast treatment room (BTR) then a risk assessment process meeting the requirements of the ShipRight Procedure Risk Based Designs is to be carried out in support of installing the BWT in the pump room. Categorisation of the ballast treatment room is to be submitted to LR along with technical and operational justification for the reasons preventing installation in non-hazardous or less hazardous locations. Reference is to be made to:

- operational requirements such as the ballast transfer rate;
- size and footprint of the BWTS;
- integration with existing pipe work;
- safe operation of the BWTS and other equipment within the pump room.

The following details related to the suitability of all equipment to be contained within the space must be submitted in accordance with the applicable LR Rules:

- safe-type certification details of all electrical equipment;
- the gas group and temperature class of equipment;
- ventilation arrangements;
- hazardous area zoning in accordance with recognised National or International Standard.

If the BTR is adjacent to a cargo pump room it should be categorised as a cargo pump room in accordance with SOLAS Chapter II-2, Regulation 4.5.1.1.

In all other cases, the BTR may be classified as an other machinery space, as minimum.

3.4.3 Aft peak tanks (APT) and fore peak tanks (FPT)

By-products of treated ballast water in APT are not to render the area above APT hazardous.

Ballast water can be transferred from an APT to a location in a hazardous area on the following conditions:

- The BWTS is located in a hazardous area.
- There is to be no ballast water supply from the hazardous area to the APT or engine room.
- If ballast water from the APT is to be discharged to a hazardous area, the ballast piping which conveys the ballast water into the hazardous area is to be provided with appropriate isolation arrangement defined in *Pt 5, Ch 25, 11.3 Ballast arrangement between hazardous and non-hazardous area* of Rules for Ships.
- All pipes from the APT to the hazardous area must be led above main deck level.
- Penetrations of engine room and pump room bulk-heads are not permitted.
- Where a removable spool piece is used, then it is to be removed following the completion of ballast transfer operations and the open pipe flanges secured with blanking plates suitable for the service pressure of the ballast system.

Oil tankers' FPTs are to be designated as a hazardous space in accordance with IACS Unified Requirement F44 (URF44) – Fore Peak Ballast System on Oil Tankers.

3.5 Stability and Loadline

When a BWTS is installed on an existing ship, the submitted report shall provide detailed calculations on additional weight and its centre of mass, together with the Surveyor's declaration regarding the completeness and accuracy of information.

If the difference between the existing and new calculated lightship particulars are within the acceptable tolerances (2% lightship displacement, 1% of longitudinal centre of gravity deviation) then the attending Surveyor will endorse the existing Trim & Stability Booklet/Loading Manual.

If the lightweight particulars are found to be outside the acceptable tolerances, then the vessel may be required to re-incline or a new Trim & Stability Booklet shall be submitted for approval.

An updated Damage Control Plan shall be submitted if the installation of the BWTS will change the vessel's watertight integrity, such as changing the air vents, unprotected penetration of watertight bulkheads or modifications to the ballast piping system. Based on the received information, LR will verify if stability documents need to be re-approved.

3.6 Ship Structural and Fire and Safety

Depending on the type of treatment system or the place of installation, ship structural and fire and safety aspects may need to be considered.

3.7 Installation and operation good practices

It is understood the BWTS may be of a skid or modular installation and may utilise different types of technologies and consumables. This means that it may be difficult to apply certain derived Rule sets. Goal based safety objectives may prove a useful tool for identifying potential hazards as part of risk assessment defined in *Ch 1, 2.3 Class approval of BWTS 2.3.1* and to assisting with highly complex, innovative solutions.

Some BWTS make use of or produce hazardous substances. Due diligence is to be exercised when operating such systems. They may have a detrimental effect on other ship systems and operations. Care must be taken when entering ballast water tanks when carrying out hot work, and when naked flames are near ballast water tank air vents during ballasting.

Section 4

References

4.1 References

1. IMO Resolution MEPC.174(58) – Guidelines for Approval of Ballast Water Management Systems (G8), adopted on 10 October, 2008.
2. IMO Resolution MEPC.279(70) – Guidelines for Approval of Ballast Water Management Systems (G8), adopted on 28 October, 2016.
3. IMO Resolution MEPC.169(57) – Procedure for Approval of Ballast Water Management Systems that make use of Active Substances (G9), adopted on 4 April, 2008.
4. IMO Resolution MEPC.173(58) – Guidelines for Ballast Water Sampling (G2), adopted on 10 October, 2008.
5. IMO Resolution A.753(18) – Guidelines for the Application of Plastic Pipes on Ships, adopted on 4 November 1993.
6. International Convention for the Control and Management of Ships' Ballast Water and Sediments, 13 February, 2004.
7. IMO BWM.2/Circ.20 – Guidance to Ensure Safe Handling and Storage of Chemicals and Preparations used to Treat Ballast Water and the Development of Safety Procedures for Risks to the Ship and Crew Resulting from the Treatment Process.
8. IBMW.2/Circ.7 – Interim Survey Guidelines for the purposes of the International Convention for the Control and Management of Ships' Ballast Water and Sediments under the Harmonized System of Survey and Certification (resolution A.948 (23)), 27 October 2006.
9. BWM.2/Circ.33 – Guidance on Scaling of Ballast Water Management Systems.
10. Lloyd's Register's Rules and Regulations for the Classification of Ships, July 2017.
11. Lloyd's Register's Rules and Regulations for the Classification of Special Service Craft, July 2017.
12. Lloyd's Register's Rules and Regulations for the Classification of Naval Ships, January 2017.
13. Lloyd's Register's Rules and Regulations for the Construction and Classification of Ships for the Carriage of Liquid Chemicals in Bulk, July 2017.
14. Lloyd's Register's ShipRight Procedure Risk Based Designs and Annex 1 – Ballast Water Treatment Systems.

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15. *Lloyd's Register's Rules for the Manufacture, Testing and Certification of Materials*, July 2017.
 16. Lloyd's Register Type Approval System Procedure TA14.
 17. Lloyd's Register Type Approval Procedure TA01.
 18. IACS Unified Requirement F44 (URF44) – *Fore Peak Ballast System on Oil Tankers*.

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www.lr.org/bwm

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