- Note that a part of these guidelines may possibly affected by certain patent rights, laid open patent applications, utility model rights, or laid open applications for utility model registration.

- ClassNK shall bear no responsibility whatsoever for checks related to such possible infringements of any patent rights, laid open patent applications, utility model rights or laid open applications for utility model registration.

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### Revision History

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<td>7</td>
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Introduction

Threats to the marine environment may be broadly categorized into four categories: (1) invasion of certain types of marine life into other, different marine ecological systems; (2) pollution of the marine environment from onshore sources; (3) over-exploitation of marine resources by things such as overfishing, etc.; and (4) the physical destruction of the marine habitat. Out of the four, the first one, the invasion of certain types of marine life into other marine ecological systems, is largely attributed to the global movement of ships resulting in the carriage of marine life adhering to hulls and/or being caught up in ballast water from one location to another.

According to a report issued by the International Maritime Organization (IMO), between 3 to 5 billion tons of ballast water is transported globally by ships all over the world every year. Ships take in ballast water which includes plankton, bacteria, and other living creatures found in a specific area into their ballast tanks, and then discharge the water containing these living organisms once they reach their destination. It is strongly believed that this process is having serious adverse effects on the integrity marine ecosystems worldwide.

At the 26th Session of the Marine Environment Protection Committee (MEPC) held in September 1988, Canada presented a research report related to the "existence of indigenous organisms within and outside ship's ballast water discharged into the Great Lakes and their effects", which expressed concern about the exotic species found in the Great Lakes and requested information related to this issue be submitted. The United States also expressed similar concerns. In the ensuing years, numerous discussions took place which finally culminated with the adoption of a new "International Convention for the Control and Management of Ship’s Ballast Water and Sediments (hereinafter referred to the Convention)" in February 2004.

One of the ballast water management methods stipulated in the Convention is the use a ballast water treatment system. Consequently, ClassNK published the “Guidelines on the Installation of Ballast Water Treatment Systems”, which contains information related to the selection of ballast water treatment systems, indicates important items to be considered as well as applicable regulations related to installation. The Guidelines also describe the procedure for the approval of ballast water treatment systems by our Society.

There have been numerous requests from industry for the establishment of some kind of specific notation to be affixed to ship classification characters to distinguish ships which have installed a ballast water treatment system before the Convention comes into effect. Therefore, these guidelines have been amended to introduce two ways for indicating the installation of a ballast water treatment system when the audit corresponding to the Initial Survey specified in the Convention is carried out: the affixation of a new notation “Ballast Water Treatment System” (abbreviated as “BWTS” to ship classification characters and the issuance of an “Appraisal Certificate”. Furthermore, ships which have the notation BWTS affixed to their classification characters will undergo an audit corresponding to a Periodical Survey after they have been delivered in order to confirm the condition of any installed ballast water treatment system.

Finally, since there is still some time before the Convention takes effect, many of the topics it deals with are still being discussed to some degree. Interpretations that differ from those laid out in these guidelines eventually may become applicable requirements, in which case, please kindly accept our humble apologies.
# Guidelines on the Installation of Ballast Water Treatment Systems

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Guidelines on the Installation of Ballast Water Treatment Systems

Chapter 1 International Convention for the Control and Management of Ship’s Ballast Water and Sediments

1.1 What is the International Convention for the Control and Management of Ship’s Ballast Water and Sediments?

The formal name of the ballast water management convention is the "International Convention for the Control and Management of Ships Ballast Water and Sediments." The convention consists of 22 Articles and an Annex that consists of five Regulations numbered from A to E. Furthermore, 14 guidelines have been developed as an appendix to the Convention. The key point of this convention is to control the transfer of sediments and ballast water that include harmful aquatic organisms or pathogens. Ballast exchange methods are prescribed in Regulation D-1, and standards related to the water quality of ballast water to be ensured are prescribed in Regulation D-2 of the Convention. The application date of Regulation D-2 is determined according to the date of construction of the ship and the quantity of ballast contained in that ship. Once the Convention enters into force, a ship has to conduct Ballast Water Management in accordance with regulation D-1 or Regulation D-2. However, all vessels are required to follow Regulation D-2 in the future. The respective dates that Regulation D-2 will come into effect are shown in the following chapter.

On the other hand, systems for controlling and managing ballast water to comply with Regulation D-2 will become necessary. Regulation D-2 specifies the number of marine organisms or microbes permissible in discharged ballast water.

1.2. Conditions for entry into force of the Convention

Article 18 of the Convention states that "This Convention shall enter into force twelve months after the date on which not less than thirty States, the combined merchant fleets of which constitute not less than thirty-five percent of the gross tonnage of the world's merchant shipping, have ratified it."
Chapter 2 Application

2.1 Application

The Convention applies to
(1) ships entitled to fly the flag of a Party to the Convention (hereinafter “a Party”); and
(2) ships not entitled to fly the flag of a Party but which operate under the authority of a Party.

In principle, allowances for gross tonnage (international gross tonnage) do not exist in the provisions of the Convention. Accordingly, the Convention shall apply, in principle, to all ships that are registered to Parties to this Convention. However, the Convention does not apply to the following ships:
(1) Ships not designed or constructed to carry ballast water and ships that carry only permanent ballast water (that is not discharged) in sealed tanks
(2) Ships of a Party which operate only in waters under the jurisdiction of that Party, or ships which operate only in waters under the jurisdiction of another Party
(3) Ships that operate only in waters under the jurisdiction of that Party and on the high seas
(4) Warships

2.2 Application date of the Ballast Water Performance Standard

Under the Convention, regardless of the date of entry into force of the convention, application date of Regulation D-2 for the ballast water management method is specified. During the 65th session of the Marine Environment Protection Committee (MEPC 65) which was held in March 2013, a draft assembly resolution was approved, allowing ships originally required to comply with the ballast water performance standard by the entry into force date of the Convention to be exempted from the requirement until its first renewal survey for International Oil Pollution Prevention (IOPP) Certificate following the date of entry into force of the Convention. During the 28th session of the IMO Assembly (A28) which was held from 25 November to 4 December 2013, the revised application date was adopted as Resolution A.1088(28).

The application dates in accordance with the resolution are shown in the following table, taking a case as an example where the convention comes into effect on or after 1 January 2017.

Table 1 Application date of the Ballast Water Performance Standard

<table>
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<tr>
<th>Constructed (= Keel lay)</th>
<th>Ballast Water Cap. V (m³)</th>
<th>2016</th>
<th>2017</th>
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<td>Before the date of entry into force of the Convention</td>
<td>All vessels</td>
<td></td>
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<tr>
<td>On or after date of entry into force of the Convention</td>
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<td></td>
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<td>by the completion date of the construction</td>
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Note: *1: Ships shall comply with Reg. D-2 by the first renewal survey for IOPP Certificate following the date of entry into force of the Convention.
Chapter 3 Definitions

3.1 Definitions

For the purpose of this Guideline, the following definitions are to apply.

(1) “Ballast Water” means water with its suspended matter taken on board a ship to control trim, list, draught, stability or stresses of the ship.

(2) “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.


(5) “Ballast water management system” means any system which processes ballast water such that it meets or exceeds the ballast water performance standard in regulation D-2. The ballast water management system includes ballast water treatment system, all associated control equipment, monitoring equipment, and sampling facilities.

(6) “Ballast water treatment system” means equipment which mechanically, physically, chemically, or biologically processes, either singularly or in combination, ballast water in order to remove, render harmless, or avoid the uptake or discharge of harmful aquatic organisms and pathogens within ballast water and sediments.

(7) “Dangerous ballast pipes” means pipes for suction and delivery of ballast in a dangerous ballast tank (ballast tank adjacent to cargo oil tank or ballast tank connected by pipe to cargo oil tank having an opening).

(8) “Dangerous gas” means any gas which may develop an explosive and/or toxic atmosphere being hazardous to the crew and/or the ship, e.g. hydrogen (H₂), hydrocarbon gas, ozone (O₃), chlorine (Cl₂) and chlorine dioxide (ClO₂), etc.

(9) “Hazardous areas” means an area in which an explosive gas atmosphere is or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of equipment. Category of hazardous area is to comply with IEC 60092-502.

(10) “Dangerous liquid” means any liquid that is identified as hazardous in the Material Safety Data Sheet or other documentation relating to this liquid.
Chapter 4 Approval Flow of Ballast Water Treatment Systems

Under the Convention, ballast water treatment systems are required to be type approved systems. This chapter describes the basic flow for obtaining type approval.

4.1 Approval flow of ballast water treatment system

The Administration approves the ballast water treatment system in accordance with the Guidelines for approval of ballast water management systems (G8). The discharge standard values are specified in Regulation D-2 of the Convention.

If active substances for the management system are used, IMO approval shall be taken separately, in accordance with the procedure for approval of ballast water management systems that make use of active substances (G9). The procedure for approval of ballast water management systems that make use of active substances is a two-step approval system consisting of Basic Approval and Final Approval.

4.2 G8 Approval

The Guidelines for Approval of Ballast Water Management Systems (G8) broadly specify the main requirements for approval of drawings, shore tests, shipboard tests, and environmental tests. Figure 1 gives an overview of the shore test. During the shore test, 200 m$^3$ of test water is treated and analyzed after five days. The water is checked to confirm that it satisfies the standard values specified in Regulation D-2. Two kinds of water are selected from sea water, fresh water or brackish water. Each kind of water is subjected to five tests consecutively, to confirm that the standard values are satisfied. Shipboard tests are carried out for a period of six months under normal ballast water management of the ship. Electrical equipment used mainly in treatment systems is the subject of environmental tests, and general environmental tests of the ship are conducted.

![Fig. 1 Overview of shore test.](image-url)
4.3 G9 Approval

Approval of the IMO is required for the procedures shown in Fig. 2 and Fig. 3, in accordance with the procedures for approval of the ballast water management system (G9) for using active substances when active substances are used in the ballast water treatment system. The application for approval is to be submitted to the IMO through the Administration.

![Flow chart for basic approval](image1)

**Fig. 2** Flow for basic approval.

![Flow chart for final approval](image2)

**Fig. 3** Flow for final approval.
The inspection includes verification of the effects on the environment after evaluating the effects of active substances on the marine environment, hull and crew members. The verification is to be performed by the Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), which is an IMO technical group. If the verification is satisfactory, GESAMP reports the Final Approval to the IMO MEPC, and the matter is deliberated at the MEPC. Although MEPC gives the approval of the system, it may impose restrictions in some instances.
Chapter 5 Ballast Water Treatment Systems

5.1 Basic specifications of ballast water treatment systems

Figure 4 shows a general ballast water treatment method.

The ballast water is generally passed through a filter for physical treatment to remove living organisms and dirt of size 50 microns and above. Some systems use cavitation devices as physical treatment. Later, the ballast water is sterilized to kill microbes by chemical treatment using chemicals and the treated water is filled in ballast tanks. Methods include emitting ultra-violet rays in water, reducing the oxygen content in water, adding active substances such as ozone and using its sterilizing ability, sterilizing water by using chemicals, and so on. Subsequently, the water is discharged overboard, but for a system in which re-treatment or neutralization is necessary, the water is discharged overboard after such treatment has been performed.

5.2 Overview of typical systems

The ballast water treatment systems of various treatment methods obtained the approval of G8 and G9 are introduced here to give an overview of typical systems.

5.2.1 Filtration and chemicals

Figure 5 shows an overview of the filtration and chemicals treatment method. Large aquatic organisms are removed together with dirt in the first stage filter, and aquatic organisms and fungi which were not removed by filter are sterilized by chemical which is kept onboard. This treatment method may need neutralization process of residual chemicals during discharge of ballast water.

Fig. 4 Conceptual flow of general treatment method in a ballast water treatment system.

Fig. 5 Overview of treatment system using filtration and chemicals.
5.2.2 Filtration and TiO2/UV
Figure 6 shows an overview of the TiO2/UV treatment method. Large aquatic organisms are removed together with dirt in the first stage filter. Subsequently, light is emitted on titanium dioxide, and the radicals generated sterilize aquatic organisms and other fungi. An atom or a molecule with an unpaired electron is a radical. By radiating light of a specific wavelength, titanium dioxide generates active oxygen and hydroxyl radicals (OH radical), which has strong disinfection. In addition, some system uses ultraviolet rays to sterilize. Micro-organisms, fungi, etc. may regenerate in the tanks because this treatment system does not use chemicals. Therefore, ballast water needs to be treated by the ballast water treatment system again before it is discharged.

Fig. 6  Overview of treatment system using filtration and TiO2/UV.

5.2.3 Filtration, cavitation and electrolysis
Figure 7 shows an overview of the filtration, cavitation and electrolysis treatment method. The uptake ballast water is passed through filters and large aquatic organisms and dirt more than 50 microns are removed. Cavitation damages the cell membranes of organisms, and nitrogen gas purified onboard and hydroxyl ions generated by electrolysis are added to sterilize and to kill aquatic organisms and fungi. There are no active substances that are brought into the ship from outside the ship.

Fig. 7  Overview of treatment system using filtration, cavitation and electrolysis.
5.2.4 Gas (Inert gas, Ozone, etc.)
Figure 8 shows an overview of the gas treatment method. When filling ballast water, inert gas is blown into the ballast water using a Venturi tube, the oxygen concentration of water is reduced, and ballast water is sterilized. The oxygen concentration of inert gas is lower than 0.1%, and this is lower than inert gas used for oil tankers (lower than 5%). In addition, some system uses ozone which has strong disinfection. These treatment methods may need neutralization process or water quality adjustment during discharge of ballast water.

Fig.8 Overview of treatment system using gas (inert gas, ozone, etc.).

5.2.5 Electrolysis
Figure 9 shows an overview of the electrolysis treatment method. The call nucleus is destroyed by hypochlorite (sodium hypochlorite) and free radicals in the electrolytic device. Hypochlorite remains in the ballast water to prevent regeneration of micro-organisms in the ballast tanks. For this reason, the hypochlorite that remains during discharge of ballast water has to be neutralized by adding sodium thiosulphate.

Fig. 9   Overview of treatment system using electrolysis.
5.2.6 Magnetic separation
Figure 10 shows an overview of the magnetic separation treatment method. This is a treatment system for aquatic organisms, micro-organisms, and microbes in which magnetic powder is fed to the ballast water during its filling, water is agitated and magnetic separation performed. No chemicals for sterilization are used. The aqueous ingredients in ballast water are also unchanged, and re-treatment of discharged water, neutralization, etc., are not necessary.

Fig.10 Overview of treatment system using magnetic separation.
Chapter 6 Standards for Installation of Ballast Water Treatment Systems

6.1 Precautions related to installation location

The ballast water treatment system is generally expected to be installed in the machinery space for installing ballast pump, the cargo pump room and ballast pump room, or an enclosed compartment installed on the exposed deck. In such a case, the points to be considered and the installation standards to be followed are mentioned here.

6.1.1 Machinery space

If the system is to be installed in the machinery space, a study must be conducted to consider the maintenance space for the system, as well. If the system uses chemicals, these chemicals must be stored at least in accordance with the requirements specified in G9 and G8. Some systems additional requirements imposed with respect to heat source management, ventilation, etc. of the storage containers as conditions of approval.

6.1.2 Cargo pump room and ballast pump room

If the system is installed in a cargo pump room and ballast pump room, the pump room may be considered a hazardous area. In such a case, the treatment system and electrical equipment to be installed are required to be explosion-proof. From the approved systems, there are also some explosion-proof type systems.

6.1.3 Exposed deck

Care should be taken to check the increase in gross tonnage of ships in service when an enclosed compartment is installed on the exposed deck. In tankers, ships carrying dangerous chemicals in bulk, and ships carrying liquefied gases in bulk, the space on the exposed deck may be treated as a hazardous area, therefore, explosion-proof treatment system and electrical equipment may need to be specially provided in such cases.

6.2 General requirements

Relevant requirements and points to be considered for installation of the ballast water treatment system are mentioned here.

6.2.1 Requirements related to construction and technical performance

1 The ballast water management system is not to be contained nor use any substance of a dangerous nature, unless adequate arrangements for storage, application, mitigation, and safe handling, acceptable to the Society, are provided to mitigate any hazards introduced thereby.

2 In case of any failure compromising the proper operation of the ballast water management system, audible and visual alarm signals are to be given in all stations from which ballast water operations are controlled.

3 All working parts of the ballast water management system that are liable to wear or damage are to be easily accessible for maintenance. The routine maintenance of the ballast water management system and troubleshooting procedures are to be clearly defined by the manufacturer in the operating and maintenance manual.

4 For maintenance or overhaul of the ballast water management system other than the purpose mentioned in 3 above, the ballast water management system is to be designed to allow for breaking of a protective seal.
The ballast water management system is to be so constructed that an audible and visual alarm is always activated whenever the ballast water management system is in operation for purposes of cleaning, calibration or repair, and these events are to be recorded by the control equipment.

In the event of an emergency, suitable by-passes or overrides to protect the safety of the ship and personnel are to be installed.

Any bypass of the ballast water management system as above is to be activated an alarm, and the bypass event is to be recorded by the Control Equipment.

The ballast water treatment system is to be robust and suitable for working in the shipboard environment, is to be of a design and construction adequate for the service for which it is intended and is to be so installed and protected as to reduce to a minimum any danger to persons onboard, due regard being paid to hot surfaces and other hazards. The design is to be regarded to materials used in construction, the purpose for which the equipment is intended, the working conditions to which it will be subjected and the environmental conditions onboard.

The ballast water treatment system is to be provided with simple and effective means for its operation and control. It is to be provided with a control system that is to be such that the services needed for the proper operation of the ballast water treatment system are ensured through the necessary automatic arrangements.

The ballast water treatment system is to be, if intended to be fitted in locations where flammable atmospheres may be present, of explosion-protected construction. Any moving parts, which are fitted in hazardous areas, are to be arranged so as to avoid the formation of static electricity.

The ballast water management system is to incorporate control equipment that automatically monitors and adjusts necessary treatment dosages or intensities or other aspects of the ballast water management system of the vessel, which while not directly effecting treatment, are nonetheless required for proper administration of the necessary treatment.

The control equipment is to incorporate a continuous self-monitoring function during the period in which the ballast water management system is in operation.

The monitoring equipment is to be capable of recording the proper functioning or failure of the ballast water management system.

The control equipment is to be able to store data for at least 24 months, and is to be able to display or print a record for official inspections as required. In the event the control equipment is replaced, means is to be provided to ensure the data recorded prior to replacement remains available on board for 24 months.

Simple means are to be provided aboard ship to check on drift by measuring devices that are part of the control equipment, repeatability of the control equipment devices, and the ability to re-zero the control equipment meters.

6.2.2 Requirements related to installation of the system

Where the system uses active substances indicating possible unacceptable adverse effects to human health and the equipment in “ballast water management system using active substances or preparations”, the following requirements (1) to (9) are to be satisfied. The following requirements may be appropriately relaxed depending of the active substances.

(1) For the system using active substances, at least two sets of full protective clothing, gloves, boots, and tight-fitting goggles or face shields are to be provided onboard. The equipment is to be kept at lockers in readily accessible places.

(2) Underneath chemical storage tanks, piping flange joints connected to the tanks and pumps, drain pans are to be provided.

(3) The materials used for the chemical storage tanks, piping and fittings are to be resistant to such chemicals.
(4) Chemical storage tanks are to have sufficient strength and be constructed such that maintenance and inspection can be easily performed.

(5) Chemical storage tank air pipes are to be led to a safe area on open deck.

(6) High water level alarms are to be provided in chemical storage tanks, audible and visual alarm signals are to be given at near chemical storage tanks, in addition to the spaces mentioned in 6.2.1-2 above.

(7) An operation manual containing chemical injection procedures, alarm systems, measures in case of emergency, etc, is to be kept onboard.

(8) Handling procedures are to be in accordance with the Material Safety Data Sheet and BWM.2/Circ.20.

(9) Additional requirements may be required, when the Society considers such necessary.

Where the system generated dangerous gas in “ballast water management system using active substances or preparations”, the following requirements (1) to (9) are to be satisfied.

(1) The system is, in general, not to be located in any spaces where crews normally work.

(2) Gas detection equipment is to be fitted in the spaces where dangerous gas could be present. The gas detection device is to be designed and tested in accordance with IEC 60079-29-1 or recognized standards acceptable to the Society. In the event of leakage, an audible and visual alarm is to be activated at the following spaces.
   (a) The spaces mentioned in 6.2.1-2.
   (b) The local manual control of the system.

(3) As far as practicable, pipes flowed dangerous gas is to be joined by welding.

(4) The arrangements used for gas relieving, i.e. degas equipment or equivalent, are to be provided with monitoring measures with independent shutdown. The open end of the gas relieving device is to be led to a safe area on open deck.

(5) The pipes for dangerous gas are not to pass through accommodation spaces and control stations.

(6) Operation of the ballast water management system in the spaces is to be interlocked with ventilation such that the ventilation is to be in operation at all times.

(7) The ventilation line of a space where dangerous gas could be present is to be led to a safe area on open deck.

(8) At least two portable instruments for measuring gas concentrations are to be provided.

(9) Additional requirements may be required, when the Society considers such requirements necessary.

The ballast water management system is to be operated at a flow rate which does not exceed the Treatment Rated Capacity specified in the Type Approval Certificate.

The valves in the by-pass line which trigger the by-pass operation are to be remote-controllable by control equipment or fitted with open/close indicator for automatic detection of the by-pass event.

Design and installation of ballast water management system is to comply with followings in addition to corresponding part of NK Rules.

(1) Related piping of ballast water treatment system is to comply with followings.
   (a) Piping is to be in accordance with approval conditions for ballast water management systems in G9 and G8.
   (b) The ballast water management system and related piping and equipment are to be installed in such a way that cleaning, inspection, maintenance and operation can be easily performed.
   (c) When fresh water is supplied to the system for treatment or maintenance, etc., measures are to be adopted to ensure that sea water does not contaminate the fresh water system.
(d) Where a vacuum may occur in the ballast line due to the height difference, a suitable protection means is to be provided, e.g. P/V valves or breather valves, and their outlets are to be led to safe area on open deck.

(e) The length of pipe and the number of connections are to be minimized in piping system containing dangerous gases/liquids in high concentration.

(f) Pipe joints specified in above (e) are to be of welded type except for connections to shut off valves, double walled pipes or pipes in ducts equipped with mechanical exhaust ventilation. Alternatively it is to be demonstrated that risk of leakage is minimized and the formation of toxic or flammable atmosphere is prevented.

(g) Location of pipe system specified in above (e) is to be away from heat sources and protected from mechanical damage.

(2) For ships fitted with dangerous ballast tanks, when the ballast water is sometimes passed through a system for measuring total residual oxidants or total residual chlorine before discharge, the requirements for installing the system in non-hazardous area such as engine room are as given below.

(a) The sampling facility is to be located within a gas tight enclosure (hereinafter, referred to as a cabinet), and the following (i) through (iii) are to be complied.

(i) In the cabinet, a stop valve is to be installed in each sample pipe.

(ii) Gas detection equipment is to be installed in the cabinet and the valves specified in (i) above are to be automatically closed upon activation of the gas detection equipment.

(iii) Audible and visual alarm signals are to be activated at the spaces specified in 6.2.2-2.(a) and (b) when the concentration of explosive gases reaches a pre-set value, which should not be higher than 30% of the lower flammable limit (LFL) of the concerned product.

(b) The inside diameter of pipe penetrating a bulkhead is not exceeded 12mm.

(c) Pipes penetrating a bulkhead are to be constructed of corrosion resistant material.

(d) The penetration of pipes between hazardous area and non-hazardous area is to be welded on both sides.

(e) The measuring system is to be installed as close to the bulkhead as possible, and the length of measuring pipe is to be as short as possible.

(f) Stop valves are to be located in the non-hazardous area, in both the suction and return pipes close to the bulkhead penetrations. A warning plate stating “Keep valve closed when not performing measurements” is to be posted near the valves. Furthermore, in order to prevent backflow, a water seal or equivalent arrangement is to be installed on the hazardous area side of the return pipe.

(g) A safety valve is to be installed on the hazardous area side of each sampling pipe.

(h) If safety valve is installed in the sampling system, hydrostatic test is to be carried out at a pressure greater than that required to open the valve, or at a pressure greater than the operating pressure of cargo pump and ballast pump if no valve is provided.

(i) No opening is to be provided in the non-hazardous area for the sampling line.

(j) The sampled ballast water is to be returned to a part of the system or to the ballast tank.

(3) The electric equipment of ballast water management system is to comply with followings.

(a) The relevant electric equipment of ballast water management system is to have a degree of protection suitable for the installed location in accordance with Sec. H2.1.3-4(3) of Part H of the Guidance for the Survey and Construction of Steel Ships of ClassNK.

(b) When the electric equipment is to be installed in a hazardous area of a tanker, ship carrying dangerous chemicals in bulk, or a ship carrying liquefied gases in bulk, the equipment is to comply with Chapter 4, Part H of the Rules for the Survey and
Guidelines on the Installation of Ballast Water Treatment Systems

(c) Total capacity of generator is to cover maximum power demand when operating the ballast water management system, including the ballasting under the normal seagoing conditions, loading/unloading cargoes and entering/leaving a port.

(4) For tankers, the additional requirements below are to be complied with.

(a) For tankers carrying flammable liquids having a flashpoint not exceeding 60 °C or products listed in the IBC Code having a flashpoint not exceeding 60 °C or cargoes heated to temperature above their flashpoint and cargoes heated to temperature within 15 °C of their flashpoint, in general, two independent ballast water management system may be required - i.e. one for ballast tanks in hazardous areas and the other for ballast tanks in non-hazardous areas.

(b) The interconnection of ballast piping between hazardous areas and non-hazardous areas may be accepted if an appropriate isolation arrangement is applied. Means of appropriate isolation are as follows.

(i) Two screw down check valves in series with a spool piece (refer to Fig.11), or
(ii) Two screw down check valves in series with a liquid seal at least 1.5m in depth (refer to Fig.11), or
(iii) Automatic double block and bleed valves (refer to Fig.11).

(c) Ballast water originating from a hazardous area is not to discharge into a non-hazardous area, except as given by 6.2.2-5.(2). Examples of appropriate isolation arrangements are shown in Fig.12 and Fig.13. Isolation arrangements are to be fitted on the exposed deck in the hazardous area.

Fig.11   Means of appropriate isolation
(5) Requirements of ventilation are to be following (a) and (b).

(a) Ballast water treatment system not in hazardous areas:
   (i) A ballast water treatment system that does not generate dangerous gas is to be
       located in an adequately ventilated area.
   (ii) A ballast water treatment system that generates dangerous gas is to be located
        in a space fitted with a mechanical ventilation system providing at least 6 air
        changes per hour or as specified by the ballast water treatment system
        manufacturer, whichever is greater.
   (iii) The arrangement is to be complied with the requirements mentioned in Part R.

Fig. 12 Ballast water management system which does not require after-treatment

Fig. 13 Ballast water management system which require after-treatment (Injection type)
Chapter 5.2.1 of Rules for the Survey and Construction of Steel Ships.
(iv) Ventilation openings are to be led to a safe area on open decks.

(b) Ballast water treatment system in hazardous areas
   (i) A ballast water treatment system, regardless of whether or not it generates
dangerous gas, is to be located in a space fitted with mechanical ventilation
complying with relevant requirements, e.g. IEC60092-502, Part N and Part S of
Rules for the Survey and Construction of Steel Ships.
   (ii) To comply with above (a)(iii) and (iv).

(6) Where the ballast water treatment system is installed in an independent compartment, the
compartment is to be following (a) and (b).
   (a) Provided with fire integrity equivalent to other machinery spaces.
   (b) Positioned outside of any combustible, corrosive, toxic, or hazardous areas unless
otherwise specifically approved.

(7) A risk assessment may be conducted to ensure that risks, including but not limited to those
arising from the use of dangerous gas affecting persons on board, the environment, the
structural strength or the integrity of the ship are addressed.

6.2.3 Requirements of Sampling Facilities for Ballast Water
Installation of the sampling facilities for ballast water is required in accordance with the Guidelines
for Ballast Water Sampling (G2), MEPC.173 (58) in the convention. The methods and requirements
of sampling facilities for ballast water are defined in G2. The main requirements of ballast water
sampling facilities on the ballast discharge line are described in 1 through 3 below. Furthermore,
other requirements as detailed are to comply with G2.
1 Samples are to be taken from the ballast discharge line, as near to the point of discharge as
practicable, during ballast water discharge whenever possible.
2 The sampling point is to be installed in a straight part of the discharge line as near to the ballast
water discharge overboard as practicable.
3 The sampling port is to be concentric to the discharge pipe.
Chapter 7 Appraisal Certificates

7.1 General

1 The Society will issue an Appraisal Certificate to ships fitted with a ballast water treatment system according to the flow described below.
   (1) Submission of the application and relevant drawings and documents
   (2) Submission of the onboard test procedure
   (3) Confirmation of installation condition and function test of the system onboard

2 The convention has not yet entered into force at this point of time. However, if the Society is given authorization by the administration of the flag State, an International Ballast Water Management Certificate can be issued by carrying out a confirmation of the drawings and documents onboard and of there being no abnormalities in the operating condition of the system after the convention enters into force.

7.2 Submission of Plans and Documents

Prior to the commencement of installation of the ballast water treatment system, the relevant drawings and documents listed below are to be submitted to the Society.

1 Drawings and documents required by the convention
   (1) Ballast Water Management Plan

2 Drawings and documents related to the ballast water treatment system
   (1) Drawings of ballast water treatment system
   (2) General arrangement drawing (related to arrangement of system)
   (3) Arrangement of ballast piping
   (4) Arrangement and construction of sampling points
   (5) Electrical drawings (electrical wiring diagram, arrangement of electrical equipment, investigation table of electrical power, short circuit calculations, list of explosion protected electrical equipment, etc.)
   (6) Other items (drawings required after study of general arrangement drawings, etc.)

3 Shipboard test procedure
7.3 Shipboard confirmation and test

7.3.1 Confirmation of drawings and documents onboard
The drawings and documents listed below are to be checked onboard.

1. Drawings and documents required by the convention
   (1) Ballast water management system
   (2) Ballast Water Record Book

2. Drawings and documents related to the ballast water treatment system
   (1) Type Approval Certificate (G8)
   (2) Confirmatory certificates of environmental tests of electrical machinery and
       instrumentation in the system
   (3) Manuals of main equipment constituting the system
   (4) Operating and technical manuals of the system (including technical information,
       procedures of operation and back-up in the event of trouble with the system)
   (5) Specifications
   (6) Installation and trial procedures
   (7) Initial calibration procedure

7.3.2 Onboard testing
The installation inspections and performance tests listed below are to be conducted onboard.

(1) Installation condition based on the specifications
(2) Confirmation of ballast water treatment system and type certificate
(3) Installation and modification condition of ballast piping
(4) Position of intake and discharge ports
(5) Bulkhead penetration of pipes
(6) Function test (functional checks of control equipment, monitors, and alarm devices)
(7) Leakage test of pipes
(8) Safekeeping condition such as chemicals
(9) Other equipment required by Ballast Water Management Plan
Chapter 8 Class Notation and Audits

8.1 General

8.1.1 Application
This Chapter applies to ships classed with NIPPON KAIJI KYOKAI (hereinafter referred to as “the Society”) which intend to install a ballast water treatment system onboard and which have submitted an application for the affixation of a notation to their classification characters.

8.1.2 Class Notation
“Ballast Water Treatment System” (abbreviated to BWTS) is to be affixed to the classification characters of ships which have installed a ballast water treatment system onboard in accordance with this Chapter.

8.1.3 Termination of Class Notation
The Society will withdraw the class notation specified in 8.1.2 in cases where the Society determines that the relevant ballast water treatment system is not being maintained. Requirements based on this Chapter are optional and are not conditions for maintaining class.

8.1.4 Kinds of Audits
The kinds of audits are specified in the following (1) to (3):
(1) Initial Audit
(2) Periodical Audit
(3) Occasional Audit

8.1.5 Timing of Audits
The timing of audits is specified in the following 1 to 3:
1 Initial Audits are to be carried out at the time the application for the audit is made.
2 Periodical Audits are to be carried out at the times of Annual Surveys, Intermediate Surveys and Special Surveys for Classification (e.g. those times given in 1.1.3-1(1) to (3), Part B of the Rules for the Survey and Construction of Steel Ships).
3 Occasional Audits are to be carried out on the following occasions at times other than Initial Audits or Periodical Audits.
   (1) In cases where the ballast water treatment system of ships are changed or replace
   (2) In cases where any conversion affecting the ballast water treatment system of ships are carried out
   (3) In cases where any applications for audits are submitted by owners
   (4) Other occasions when Occasional Audits are considered to be necessary

8.1.6 Periodical Audits carried out in advance and Postponement
The requirements for Periodical Audits carried out in advance are to be in accordance with the provisions relevant to Periodical Surveys for Classification (e.g. 1.1.4 or 1.1.5, Part B of the Rules for the Survey and Construction of Steel Ships).

8.1.7 Ships Laid-up
Ships laid-up are not subject to those Periodical Audits specified in 8.1.4(2).
8.1.8 Preparation for Audits and other related issues

1 In cases where ships are to be audited in accordance with this chapter, it is the responsibility of the Owners to notify the Surveyors of the locations where they wish to undergo such audits. Surveyors are to be advised of audits a reasonable time in advance so that such audits can be carried out at proper times.

2 All such preparations required for registration, periodical and other surveys specified in this chapter as well as those which may be required by the Surveyors in accordance with the provisions given in this chapter are the responsibility of the Owners or their representatives.

3 Applicants for audits are to arrange supervisors who are well conversant with all of the audit items required for the preparation of such audits and who are able to provide all necessary assistance to the Surveyor according to their requests during such audits.

4 Audits may be suspended in cases where necessary preparations have not been made, any appropriate supervisor is not present, or the Surveyor considers that the safety needed for the execution of the audit is not ensured.

5 In cases where repairs are considered to be necessary as a result of audits, the Surveyor is to notify the audit applicants of his or her findings. Applicants, upon receiving such notification, are to obtain Surveyor verification after carrying out any necessary repairs.

8.2 Initial Audits

8.2.1 General
During Initial Audits, the ballast water treatment systems of ships are to be examined in order to ascertain to comply with the following 8.2.2 and 8.2.3.

8.2.2 Submission of Plans and Documents

1 At Initial Audits, the relevant plans and documents specified in 7.2 are to be submitted to the Society.

2 Notwithstanding the requirement specified in 1 above, it is not necessary to submit a separate set of those documents specified in 1 above for Initial Audits at Classification Surveys during Construction.

3 Submission of additional plans and documents may be required in cases where deemed necessary by the Society.

8.2.3 Items of Audit
At Initial Audits, the items specified in the following 1 and 2 are to be examined:

1 Confirmation that documents specified in 7.3.1 are kept onboard

2 Confirmation through the installation inspections and performance tests specified in 7.3.2 that the ballast water treatment system is installed properly.

8.3 Periodical Audits
At Periodical Audits, the items specified in the following 1 and 2 are to be examined:

1 At Classification Annual Surveys, the items specified in the following (1) and (2) are to be examined:
   (1) Confirmation that the ballast water treatment system is in good order
   (2) Confirmation that relevant documents are maintained appropriately

2 At Classification Intermediate and Special Surveys, in addition to those items specified in 1 above, control systems, displays, and alarm devices are also to be examined in order to ascertain that they are in good working order.
8.4 Occasional Audits

8.4.1 General
In cases where the ballast water treatment systems of ships are changed, Occasional Audits are to be carried out and such ballast water treatment systems are to be confirmed as complying with the requirements given in 8.2.
Chapter 9 Procedure for Approval of Ballast Water Treatment System

9.1 General

9.1.1 Scope
The requirements of this chapter apply to testing and inspection for the approval of a ballast water treatment system (hereinafter referred to as a “BWTS” in this chapter) in accordance with the requirements of the ballast water management convention. The term “approval” here is the approval based on testing and survey, etc. required by the Guidelines for Approval of Ballast Water Management Systems (G8), MEPC.174 (58) shown in chapter 4 in these guidelines.

9.2 Application

9.2.1 Application Form
The manufacturer, who intends to obtain the approval, is to submit an application (Specimen Form 1) filled in with necessary data and information to the Society (Head Office).

9.2.2 Documents
1. The documents listed (1) through (14) below, each in triplicate, are to be submitted together with the application specified in 9.2.1.
   (1) Documents describing the manufacturing plant outline
   (2) Document related to the manufacturing plant’s quality control standards
   (3) Records of manufacture and delivery of the BWTS
   (4) Complete description of the BWTS
   (5) Construction drawings (with all dimensions necessary for evaluation) of the BWTS
   (6) Drawings of the main components (showing clearly the employed materials) used in the BWTS
   (7) BWTS’s operational instructions
   (8) BWTS’s routine maintenance and trouble-shooting procedures
   (9) Process description of the treatment of the ballast water
   (10) Technical installation specifications of the BWTS
   (11) Record of the Basic and Final Approval of Active Substances and Preparations (in the case of a system that makes use of active substances)
   (12) Approval test plan (provided with the place and scheduled date of test)
   (13) Test records (if any preliminary test was carried out)
   (14) Other documents which are considered necessary by the Society

2. Notwithstanding the requirements in 1 above, submission of part or all of the documents may be omitted if the manufacturer has previously obtained approval from the Society in the past, and the duplicated items are included therein.

3. The record required in 1 (11) above is an original or a duplicate copy issued by a competent organization deemed by the Society.
9.3 Confirmation Survey of Manufacturing Factory or Facility

9.3.1 Confirmation Survey of Manufacturing Factory or Facility
When judged necessary, the Society may carry out a confirmation survey of the facilities, manufacturing techniques, product quality control, and internal inspection of the manufacturing factory or facility based on the data specified in 9.2 in order to verify the factory’s or facility’s ability to manufacture BWTS of stable quality.

9.4 Approval Tests for Ballast Water Treatment System

9.4.1 Test Items
The testing specified in the following (1) through (4) are to be conducted:
(1) Shipboard Testing
(2) Land-based Testing
(3) Environmental Testing
(4) Other testing required by the Society

9.4.2 Shipboard Testing
1 A shipboard test cycle includes steps (1) through (4) below.
   (1) The uptake of ballast water of the ship;
   (2) The storage of ballast water on the ship;
   (3) The treatment of the ballast water in accordance with paragraph 9.4.2.4 by the BWTS, except in control tanks; and
   (4) The discharge of ballast water from the ship.
2 In evaluating the performance of BWTS installation(s) on a ship or ships, the information and results shown 3 through 11 below are to be submitted.
3 The amount of ballast water tested in the test cycle onboard is to be consistent with the normal ballast operations of the ship, and the BWTS is to be operated at the treatment rated capacity for which it is intended to be approved.
4 The discharge of treated ballast water in three consecutive valid test cycles of is to comply with Regulation D-2.
5 Valid tests are indicated by uptake water, for both the control tank and ballast water to be treated, with viable organism concentrations exceeding 10 times the maximum permitted values in Regulation D-2.1 and control tank viable organism concentrations exceeding the values of Regulation D-2.1 on discharge.
6 The sampling regime is to comply with items (1) and (2) below.
   (1) For the control tank
       (a) Three replicate samples of influent water, collected over the period of uptake (beginning, middle, and end).
       (b) Three replicate samples of discharge control water, collected over the period of discharge (beginning, middle, and end).
   (2) For treated ballast water
       (a) Three replicate samples of discharge treated water collected at each of three times during the period of discharge (3 x beginning, 3 x middle, and 3 x end).
   (3) Sample size is to comply with items (a) through (c) below.
       (a) For the enumeration of organisms greater than or equal to 50 micrometers or more in minimum dimension, samples consisting of at least one cubic meter are to be collected. If samples are concentrated for enumeration, the samples are to be concentrated using a sieve with a mesh no greater than 50 micrometers in size in the diagonal direction.
(b) For the enumeration of organisms greater than or equal to 10 micrometers and less than 50 micrometers in minimum dimensions, samples of at least one liter are to be collected. If samples are concentrated for enumeration, the samples are to be concentrated using a sieve with a mesh no greater than 10 micrometers in size in the diagonal direction.

(c) For the evaluation of bacteria, a sample of at least 500 milliliters is to be taken from both the influent and the treated water. In the absence of laboratory facilities onboard, toxicogenic tests based on requirements are to be conducted in an appropriately approved laboratory. However, this may limit the applicability of this test.

7 The test cycles including invalid and unsuccessful test cycles are to span a trial period of not less than six months.

8 Three consecutive test cycles are to comply with Regulation D-2, and these cycles are to be validated in accordance with paragraph 9.4.2.5. Any invalid test cycle does not affect the consecutive sequence.

9 The source water for test cycles is to be characterized by measurement of salinity, temperature, particulate organic carbon, and total suspended solids in the water.

10 For system operation throughout the trial period, the information items (1) through (6) below are to be recorded.

   (1) All ballast water operations including volumes and locations of uptake and discharge, and if heavy weather was encountered and where;
   (2) The possible reasons or causes for the occurrence of an unsuccessful test cycle, or a test cycle discharge failing Regulation D-2 is to be investigated;
   (3) Scheduled maintenance performed on the system;
   (4) Unscheduled maintenance and repair performed on the system;
   (5) Engineering parameters monitored as appropriate to the specific system; and
   (6) Functioning of the control and monitoring equipment.

11 Changes in the numbers of test organisms during treatment and during storage in the ballast tank are to be measured using the methods described in Part 4 of the Annex, Guidelines for Approval of Ballast Water Management Systems (G8), MEPC.174 (58).

9.4.3 Land-based Testing

1 A land-based test cycle includes steps (1) through (4) below.

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

2 The test set-up including the ballast water treatment system is to be operated as described in the provided documentation during at least 5 valid replicate test cycles. Each test cycle is to take place over a period of at least 5 days.

3 Testing is to occur using different water conditions sequentially as provided for in paragraphs 9.4.3.15 and 9.4.3.16.

4 The BWTS is to be tested at its rated capacity or as given in paragraphs 9.4.3.11 through 9.4.3.13 for each test cycle. The equipment is to function to specifications during this test.

5 The analysis of treated water discharge from each test cycle is to be used to determine that the average of discharge samples does not exceed the concentrations of Regulation D-2.

6 The analysis of treated water discharge from the relevant test cycle(s) is to be used to evaluate the toxicity of the discharged water for BWTS that makes use of active substances and also for those BWTS 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 are to be conducted in accordance with the procedure for approval of
ballast water management systems that make use of active Substances as revised (resolution
MEPC.169 (57)).

7 The test set-up for approval tests is to 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 is
therefore to include at least items (1) through (3) below.
(1) The complete BWTS to be tested;
(2) Piping and pumping arrangements; and
(3) The storage tank that simulates a ballast tank, constructed such that the water in the tank
should be completely shielded from light.

8 The control and treated simulated ballast tanks are each to satisfy the following (1) through (4)
below.
(1) Have a minimum capacity of 200 m³;
(2) Contain normal internal structures, including lightening and drainage holes;
(3) Follow standard industry practices for design, construction and surface coatings for ships;
and
(4) Incorporate the minimum modifications required for structural integrity on land.

9 The test set-up is to 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.

10 The test set-up is to be included facilities to allow sampling as described in paragraphs 9.4.3.24
and 9.4.3.25 and provisions to supply influents to the system, as specified in paragraph 9.4.3.17
and/or 9.4.3.18. The installation arrangements are to be provided in accordance with Section 7
of the Guidelines for Approval of Ballast Water Management Systems (G8), MEPC.174 (58).

11 In case that in-line treatment system is downsized for land-based testing, the criteria for such
equipment are to comply with items (1) through (3) below.
(1) Equipment with a TRC (Treatment Rated Capacity) equal to or smaller than 200 m³/h is
not to be downscaled.
(2) Equipment with a TRC larger than 200 m³/h but smaller than 1,000 m³/h may be
downscaled to a maximum of 1/5 scale, but may not be smaller than 200 m³/h.
(3) Equipment with a TRC equal to, or larger than, 1,000 m³/h may be downscaled to a
maximum of 1/100 scale, but may not be smaller than 200 m³/h.

12 The manufacturer of the equipment is to demonstrate through the use of mathematical
modeling and/or calculations, that any downscaling will not affect the ultimate functioning and
effectiveness of the equipment onboard a ship of the type and size for which the equipment will
be certified.

13 In-tank treatment system is to be tested on a scale that allows verification of full-scale
effectiveness. The suitability of the test set-up is to be evaluated by the manufacturer and
approved by the Society.

14 Larger scaling may be applied and lower flow rates used than provided for in 9.4.3.11, if the
manufacturer can provide evidence from full-scale shipboard testing and in accordance with
9.4.3.12 that scaling and flow rates will not adversely affect the ability of the results to predict
full-scale compliance with the standard.
For any given set of test cycles (5 cycles is considered one set) a salinity range is to be chosen. Given the salinity, the test water used in the test setup described above is to be had dissolved and particulate content in one of the following combinations.

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<tbody>
<tr>
<td>&gt;32 PSU</td>
<td>&gt;1 mg/l</td>
<td>&gt;1 mg/l</td>
<td>&gt;1 mg/l</td>
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<tr>
<td>3~32 PSU</td>
<td>&gt;5 mg/l</td>
<td>&gt;5 mg/l</td>
<td>&gt;5 mg/l</td>
</tr>
<tr>
<td>&lt;3 PSU</td>
<td>&gt;5 mg/l</td>
<td>&gt;5 mg/l</td>
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At least two sets of tests cycles are to be conducted, each with a different salinity range and associated dissolved and particulate content as prescribed in paragraph 9.4.3.15. Tests under adjacent salinity ranges in the above table are to be separated by at least 10 PSU.

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 is to comply with paragraph 9.4.3.18 below.

The influent water is to comply with (1) through (3) below.

(1) Test organisms of greater than or equal to 50 micrometers or more in minimum dimension are to be present in a total density of preferably $10^6$ but not less than $10^5$ individuals per cubic meter, and are to consist of at least 5 species from at least 3 different phyla/divisions.

(2) Test organisms greater than or equal to 10 micrometers and less than 50 micrometers in minimum dimension are to be present in a total density of preferably $10^4$ but not less than $10^3$ individuals per milliliter, and are to be consisted of at least 5 species from at least 3 different phyla/divisions.

(3) Heterotrophic bacteria are to be present in a density of at least $10^4$ living bacteria per milliliter.

The following bacteria do not need to be added to the influent water, but are to be measured at the influent and at the time of discharge.

(1) Coliform bacteria;
(2) Enterococcus group of bacteria;
(3) Vibrio cholerae; and
(4) Heterotrophic bacteria.

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

Changes in the numbers of test organisms by treatment and during storage in the simulated ballast tank are to be measured using methods described in Part 4 of the Guidelines for Approval of Ballast Water Management Systems (G8), MEPC.174 (58).

It is to be verified that the treatment system performs within its specified parameters, such as power consumption and flow rate, during the test cycle.

Environmental parameters such as pH, temperature, salinity, dissolved oxygen, TSS, DOC, POC, and turbidity (Nominal Turbidity Unit) are to be measured at the same time that the samples described are taken.

Samples used during the test are to be taken at times and locations as follows:

Immediately before entry into the treatment system, immediately after treatment by the equipment, and upon discharge.

The control and treatment cycles are to be run simultaneously or sequentially. Control samples are to be taken in the same manner as the equipment test as prescribed in paragraph 9.4.3.24.
and upon influent and discharge. A series of examples are included in figure 11.

26 Facilities or arrangements for sampling are to 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.

27 Samples described in paragraphs 9.4.3.24 and 9.4.3.25 are to be collected in triplicate on each occasion.

28 Separate samples are to be collected as described in (1) through (4) below.
   (1) Organisms of greater than or equal to 50 micrometers or more in minimum dimension;
   (2) Organisms greater than or equal to 10 micrometers and less than 50 micrometers in minimum dimension;
   (3) Coliform, enterococcus group, Vibrio cholerae and heterotrophic bacteria; and
   (4) Toxicity testing of treated water, from the discharge, for BWTS that make use of active substances and also for those BWTS 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.

29 For the comparison of organisms of greater than or equal to 50 micrometers or more in minimum dimension against Regulation D-2, at least 20 liters of influent water and 1 m³ of treated water, three samples each respectively, are to be collected. If samples are concentrated for enumeration, the samples are to be concentrated using a sieve with a mesh no greater than 50 micrometers in size in the diagonal direction.

30 For the evaluation of organisms greater than or equal to 10 micrometers and less than 50 micrometers in minimum dimension, at least 1 liter of influent water and at least 10 liters of treated water are to be collected. If samples are concentrated for enumeration, the samples are to be concentrated using a sieve with a mesh no greater than 10 micrometers in size in the diagonal direction.

31 For the evaluation of bacteria, at least 500 milliliters of influent and treated water are to be collected in sterile bottles.

32 The samples are to be analyzed as soon as possible after sampling, and analyzed live within 6 hours or treated in such a way so as to ensure that proper analysis can be performed.

33 The efficacy of a proposed system is to be tested by means of standard scientific methodology in the form of controlled experimentation, i.e. “tests”. Specifically, the effect of the BWTS on organism concentration in ballast water is to be tested by comparing treated ballast water, i.e. “treated groups”, to untreated “control groups” as described below.

   - One test is to consist of a comparison between control water and treated water. Multiple samples, but at a minimum of three, of control and treated water within a single test cycle are to be taken to obtain a good statistical estimate of the conditions within the water during that test. Multiple samples taken during a single test cycle are not to be treated as independent measures in the statistical evaluation of treatment effect, to avoid “pseudo-replication”.

34 If in any test cycle the average discharge results from the control water is a concentration less than or equal to 10 times the values in Regulation D-2, the test cycle is invalid.

35 Statistical analysis of BWTS performance is to consist of t-tests, or similar statistical tests, comparing control and treated water. The comparison between control and treated water will provide a test of unexpected mortality in the control water, indicating the effect of an uncontrolled source of mortality in the testing arrangement.

9.4.4 Environmental Testing
Equipment is to be operated satisfactory on completion of each of the operating environment tests
listed 1 through 6 below.

1 Vibration tests
   (1) A resonance search is to be made over (a) and (b) below ranges of oscillation frequency and amplitude. This search is to be made in each of the three orthogonal planes at a rate sufficiently low to permit resonance detection.
      (a) 2 to 13.3 Hz with a vibration amplitude of 1 mm
      (b) 13.2 to 80 Hz with an acceleration amplitude of 0.7 g
   (2) The equipment is to be vibrated in the above-mentioned planes at each major resonant frequency for a period of two hours.
   (3) In the absence of any resonant frequency, the equipment is to be vibrated in each of the planes at 30 Hz with an acceleration of 0.7 g for a period of two hours.
   (4) After completion of the tests specified in paragraph (2) or (3) a search is to again be made for resonance and there should be no significant change in the vibration pattern.

2 Temperature tests
   (1) Equipment that may be installed in exposed areas on the open deck, or in an enclosed space not environmentally controlled is to be subjected, for a period of not less than two hours, to the test conditions described in (a) and (b) below.
      (a) A low temperature test at -25°C
      (b) A high temperature test at 55°C
   (2) Equipment that may be installed in an enclosed space that is environmentally controlled including an engine-room is to be subjected, for a period of not less than two hours, to the test conditions described in (a) and (b) below.
      (a) A low temperature test at 0°C
      (b) A high temperature test at 55°C
   (3) At the end of each of the tests referred to in subparagraphs (1) and (2) above, the equipment is to be switched on and it should function normally under each respective test condition.

3 Humidity tests
   (1) Equipment is to be left switched off for a period of two hours at a temperature of 55°C in an atmosphere with a relative humidity of 90%. At the end of this period, the equipment is to be switched on and is to be operated satisfactorily for one hour under the test conditions.

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

5 Fluctuation in power supply
   (1) Equipment is to be operated satisfactorily with the fluctuations in power supply indicated in (a) and (b) below.
      (a) A voltage variation of ±10% together with a simultaneous frequency variation of ±5%
      (b) A transient voltage of ±20% together with a simultaneous frequency transient of ±10%, with a transient recovery time of three seconds

6 Inclination test
   (1) The BWTS is to be designed to operate when the ship is upright and when inclined at any angle of list up to and including 15° either way under static conditions and 22.5° under dynamic conditions (rolling) either way and simultaneously inclined dynamically (pitching) 7.5° by bow or stern. The Society 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 is to be documented in the Approval
7 Reliability of electrical and electronic equipment
   (1) The electrical and electronic components of the equipment are to be of a quality guaranteed
       by the manufacturer and suitable for their intended purpose.

9.5 Test Witnessing by the Society’s Surveyor

9.5.1 Test Witnessing by the Society's Surveyor
The Society’s Surveyor is to be present, as a rule, to witness the approval test when the test is being
carried out.

9.6 Approval

9.6.1 Test Records
The manufacturer is to prepare records of the approval test after completion of the test, to obtain
verification by the Society’s attending surveyor and then to submit them, in triplicate, to the Society.

9.6.2 Notification of Approval
The Society, when satisfied upon examination of the submitted documents and the attending
surveyor’s report, will issue a certificate of approval specifying the approval number, approval date,
items of approval and approval conditions, and put approval stamps on the documents as deemed
necessary by the Society out of those submitted in accordance with 9.2 and 9.6.1, and return them
back to the applicant.

9.6.3 Renewal of Approval
1 The term of validity of the approval in the preceding 9.6.2 will be 5 years.
2 In cases where renewal of the validity is intended, the manufacturer is to submit the necessary
documents together with the existing certificate in accordance with the requirements of 9.2
newly. In this case, the documents specified in 9.2 may be limited to the portion subjected to
modification only.
3 When approval has been granted to an application with partial changes in the content of
approval, the Society may require additional tests for approval.

9.6.4 Revocation of Approval
When any of the following cases (1) to (4) applies, the Society will revoke the type approval and
give notice to the manufacturer, accordingly.
   (1) When the plant or system for which the approval was granted is no longer deemed suitable for
       the approval in line with the implementation or revision of international conventions, laws, and
       regulations.
   (2) In cases where the validity of approval is overdue and no application for renewal of the
       approval has been submitted.
   (3) When serious shortcomings are found in the structure or quality of the plant or system already
       approved after it has been installed onboard ship.
   (4) When an application for revocation is made by the manufacturer.
9.7 Examination of Products

9.7.1 Examination of Products
For each component of a system supplied to an individual ship after obtaining approval by the Society, the following tests and examinations are to be carried out in the presence of the Surveyor in order to confirm that the products have been manufactured to the same specifications as those used for the approval test of the system. However, where the quality management system of the manufacturers who produce each component of the system is one to the satisfaction of the Society, the frequency of the Surveyor’s attendance at the examination of the product may be reduced based upon the provisions set forth in B2.1.4-6 of the Guidance for the Survey and Construction of Steel Ships of the Society.

(1) Visual inspection;
(2) Dimensional inspection and examination of construction;
(3) Performance tests of safety devices and alarms; and
(4) Other tests as considered as necessary by the Society.

9.8 Announcement of Approval

9.8.1 Announcement of Approval
The system approved by the Society is to be marked with the following items.
(1) Type and name of product
(2) Mark to prove that the product is approved by the Society. It may be marked simply with “NK”.
(3) Name of manufacturer
(4) Approval number
Fig. 11  Diagrammatic arrangement of possible land-based tests.
Form 1

**Ballast Water Treatment System**  
**Application for Approval**  
(☐Initial, ☐Renewal, ☐Modification)  
Ref. No./Date of Application

To: Nippon Kaiji Kyokai

Name of Applicant: 
Address: 
Phone. No./Fax. No.: 
Name of the Person in Charge:

We hereby apply for approval of the following system in accordance with Chapter 9, the *Guidelines on the Installation and Approval of Ballast Water Treatment Systems*.

<table>
<thead>
<tr>
<th>Names/Types of System:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type approval Nos., If Available:</td>
</tr>
<tr>
<td>Particulars:</td>
</tr>
<tr>
<td>Names of Manufacturer and Production Site:</td>
</tr>
<tr>
<td>Address of Manufacturer:</td>
</tr>
<tr>
<td>Drawings and Documents Attached</td>
</tr>
<tr>
<td>Drawings:</td>
</tr>
<tr>
<td>Documents:</td>
</tr>
<tr>
<td>Dates of Tests/Inspections and Places:</td>
</tr>
</tbody>
</table>

Notes:  
1. Use additional sheets if necessary.  
2. ☐ Tick off where appropriate.
Chapter 10 Frequently Asked Questions

10.1 FAQ related to piping

<table>
<thead>
<tr>
<th>Q.</th>
<th>A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.1.1 When a fire pump is also used as a ballast pump, is it possible to install a bypass line so as to not pass through the ballast water treatment system?</td>
<td>A bypass line may be provided.</td>
</tr>
</tbody>
</table>

10.2 FAQ related to equipment

<table>
<thead>
<tr>
<th>Q.</th>
<th>A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.2.1 Can a ballast water treatment system (BWTS), which is type approved by the government of a flag state, be installed onboard a ship flying the flag of a different flag state?</td>
<td>In principle, the type approval of each flag state is necessary.</td>
</tr>
<tr>
<td>10.2.2 Where do we submit the application for type approval of BWTS?</td>
<td>Please submit the application with the relevant documents referring to Part 9 “Procedure for Approval of Ballast Water Treatment Systems” in these guidelines.</td>
</tr>
<tr>
<td>10.2.3 Can be a BWTS approved by ClassNK be installed onboard all vessels?</td>
<td>The BWTS can be installed on the vessels flagged in countries where the Administration has delegated its authority to ClassNK.</td>
</tr>
<tr>
<td>10.2.4 Can be a BWTS approved by ClassNK be installed onboard Japanese flag vessels?</td>
<td>Japanese flag vessels are required to install a BWTS approved by the Japanese Government.</td>
</tr>
<tr>
<td>10.2.5 If the BWTS is approved by an organization other than ClassNK, do the approval tests need to be run again?</td>
<td>If the tests are carried out in accordance with Part 9 on these guidelines, the same tests need not be run again.</td>
</tr>
<tr>
<td>10.2.6 Can ClassNK approve the active substances for use in a BWTS based on G9?</td>
<td>Approval of the IMO is required in accordance with G9 on the use of active substances when active substances are used in the BWTS. The application for approval is to be submitted to the IMO through the Administration.</td>
</tr>
</tbody>
</table>
### 10.3 Other FAQs

<table>
<thead>
<tr>
<th>Q.</th>
<th>A.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>10.3.1</strong> What are the requirements for a system that can generate flammable gas when ballast water treatment system is used?</td>
<td>The generated amount, frequency and the like, of flammable gas may sometimes be studied in the approval tests of G8 and G9. Installation requirements and additional equipment requirements when such equipment is fitted on board will be separately studied considering the above.</td>
</tr>
<tr>
<td><strong>10.3.2</strong> Is preferential tripping of the ballast water treatment system permissible?</td>
<td>Based on H2.3.6-2(2) of Part H, of the Society's <em>Guidance for the Survey and Construction of Steel Ships</em>, if measures have been adopted to re-start immediately after a preferential trip, then preferential trip of the ballast pump may be approved. The same treatment as that permitted for the ballast pump may be allowed for use in the ballast water treatment system.</td>
</tr>
<tr>
<td><strong>10.3.3</strong> Are there restrictions on the installation location of chemicals tank?</td>
<td>In principle, the limitations imposed for approval described in G8 and G9 are to be adhered to. Separate safety measures may be demanded by the Society depending on the riskiness of the chemicals.</td>
</tr>
<tr>
<td><strong>10.3.4</strong> If the ballast treatment system is installed in an independent enclosed compartment, what is the structural fire protection category of the said compartment?</td>
<td>This compartment may be treated as &quot;Other machinery space&quot;, similar to the ballast pump room.</td>
</tr>
<tr>
<td><strong>10.3.5</strong> How should a hazardous area for dangerous ballast piping be treated?</td>
<td>The internal parts of dangerous ballast piping defined in Part D of the Society's <em>Rules for the Survey and Construction of Steel Ships</em> are treated as a Zone 1 hazardous area. However, Part H of the same rules does not treat the flanges and valves of dangerous ballast piping as gas emission sources, therefore, it is not necessary to consider the leak of flammable gas from these parts. Accordingly, even if dangerous ballast piping is led into a compartment in a non-hazardous area, if there is no opening from the dangerous ballast pipe, the said compartment may be treated in principle, as a non-hazardous area.</td>
</tr>
</tbody>
</table>
| **10.3.6** What is the latest status of the ratification on the Ballast Water Convention? | The latest status can be checked below site.  
URL:  