THE SOCIALIST REPUBLIC OF VIETNAM

QCVN 100: 2018/BGTVT

NATIONAL TECHNICAL REGULATION ON THE SEWAGE TREATMENT PLANT OF SHIPS

Hanoi 2018

Preamble

National Technical Regulation on the Sewage Treatment Plant of Ships (QCVN 100: 2018/BGTVT) is compiled by Vietnam Register, verified by the Ministry of Science and Technology, promulgated by the Minister of Transport under Circular No. 53/2018/TT-BGTVT dated October 28th 2018.

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1 GENERAL

1.1 Application and Scope

1.1.1 Application

1.1.1.1 This national technical regulation (hereinafter referred to as “the Regulation”) provides for technical requirements, surveys and testing of sewage treatment plants used onboard the ship (hereinafter referred to as “the Sewage Treatment Plant”), the installation of which is to be in compliance with requirements in 2.2.1-1(1)(a) Chapter 2 Part 7 Section II of National Technical Regulation on Marine Pollution Prevention Systems of Ships.

1.1.1.2 Requirements on nitrogen and phosphorous removal specified in Table 1 of the Regulation apply to passenger ships operating within a special area intending to discharge treated sewage effluent into the sea.

1.1.2 Scope

The present Regulation is to apply to organizations and individuals involving in activities relating to sewage treatment systems and falling under the application as specified in 1.1.1 above, including Vietnam Register (hereinafter referred to as "VR") and ones who manufactures, installs and operates the sewage treatment systems onboard the ship.

1.2 References, Definitions and Abbreviations

1.2.1 References

1.2.1.1 The International Convention for the Prevention of Pollution from Ships, 1973, as modified by the 1978 and 1997 Protocols (MARPOL).

1.2.1.2 MEPC.227(64): The Resolution No. 227(64) adoted by IMO on 5 October 2012 - 2012 Guidelines on Implementation of Effluent Standards and Performance Tests for Sewage Treatment Plants.

1.2.1.3 MEPC.284(70): The Resolution No. 284(70) adoted by IMO on 28 October 2016 - Amendments to the 2012 Guidelines on Implementation of Effluent Standards and Performance Tests for Sewage Treatment Plants (Resolution MEPC.227(64)).

1.2.1.4 National Technical Regulation on the Classification and Construction of Sea-going steel ships.

1.2.1.5 National Technical Regulation on Marine Pollution Prevention Systems of Ships.

1.2.1.6 National Technical Regulation for Inspection of Sea-Going Ship’s Products.

1.2.1.7 TCVN 6492: 2011 (ISO 10523: 2008): Water quality – Determination of pH.

1.2.1.8 TCVN 6001: 2008 (ISO 5815-1: 2003): Water quality - Determination of biochemical oxygen demand after n days (BODn) - Part 1: Dilution and seeding method with allylthiourea addition.

1.2.1.9 ISO 15705: 2002: Determination of the chemical oxygen demand index (ST-COD) - Small-scale sealed-tube method.

1.2.1.10 TCVN 6625: 2000 (ISO 11923: 1997): Water quality - Determination of suspended solids by filtration through glass-fibre filters

1.2.1.11 TCVN 6053: 2011 (ISO 9696: 2017): Water quality - Gross alpha activity - Test method using thick source.

1.2.1.12 ISO 29441: 2010: Water quality - Determination of total nitrogen after UV digestion - Method using flow analysis (CFA and FIA) and spectrometric detection.

1.2.1.13 TCVN 6994: 2011 (ISO 6878: 2004): Water quality - Determination of phosphorus - Ammonium molybdate spectrometric method.

1.2.1.14 TCVN 6187: 2009 (ISO 9308: 2000): Water quality - Detection and enumeration of Escherichia coli and coliform bacteria - Part 1: Membrane filtration method; Part 2: Most probable number method.

1.2.2 Explanation

For the purpose of the Regulation, the following definitions apply unless otherwise stated in each part:

1.2.2.1 *Sewage* means:

(1) Drainage and other wastes from any form of toilets and urinals;

(2) Drainage from medical premises (dispensary, sick bay, etc.) via wash basins, wash tubs and scuppers located in such premises;

(3) Drainage from spaces containing living animals; or

(4) Other waste waters when mixed with the drainages defined above.

1.2.2.2 *Grey water* is drainage from dishwater, galley sink, shower, laundry, bath and washbasin drains and does not include drainage from toilets, urinals, hospitals, and animal spaces, as defined in 1.2.2.1 above and does not include drainage from cargo spaces.

1.2.2.3 *Dilution* (Q_d) is dilution water, grey water, process water, and/or seawater introduced to the sewage treatment plant after the influent sample point and after the influent flow measurement device, see Fig. 1.

1.2.2.4 *Effluent* (Q_e) is treated wastewater produced by the sewage treatment plant, see Fig. 1.

1.2.2.5 *Flush water* is transport medium used to carry sewage or other wastes from toilets or urinals to the treatment system.

1.2.2.6 *Hydraulic loading is* system design flow rate of waste water (Qi) into the sewage treatment plant.

1.2.2.7 *Influent* (Q_i) is liquid containing sewage, grey water or other liquid streams, to be processed by the treatment plant, see Fig. 1.

1.2.2.8 *Sample point* is a point for manual collection of a representative sample of influent and effluent without opening tanks, voids or vents, see Fig. 1.

1.2.2.9 *Testing on board* is the testing, for the purpose of type approval, carried out on a sewage treatment plant installed on a ship.

1.2.2.10 *Testing ashore* is the testing ashore, for the purpose of type approval, carried out on a sewage treatment plant.

1.2.2.11 *Geometric mean* is the n^{th} root of the product of n numbers.

1.2.2.12 *Thermotolerant coliforms* mean the group of coliform bacteria which produce gas from lactose in 48 hours at 44.5°C. These organisms are sometimes referred to as "faecal coliforms"; however, the term "thermotolerant coliforms" is now accepted as more appropriate, since not all of these organisms are of faecal origin.

1.2.2.13 *Special area* is a sea area defined in Regulation 1.6 of Annex IV to MARPOL.

1.2.3 Abbreviations

1.2.3.1 IMO is International Maritime Organization.

1.2.3.2 The Convention is the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the 1978 and 1997 Protocols.

1.2.3.3 Annex IV is Annex IV of the Convention.

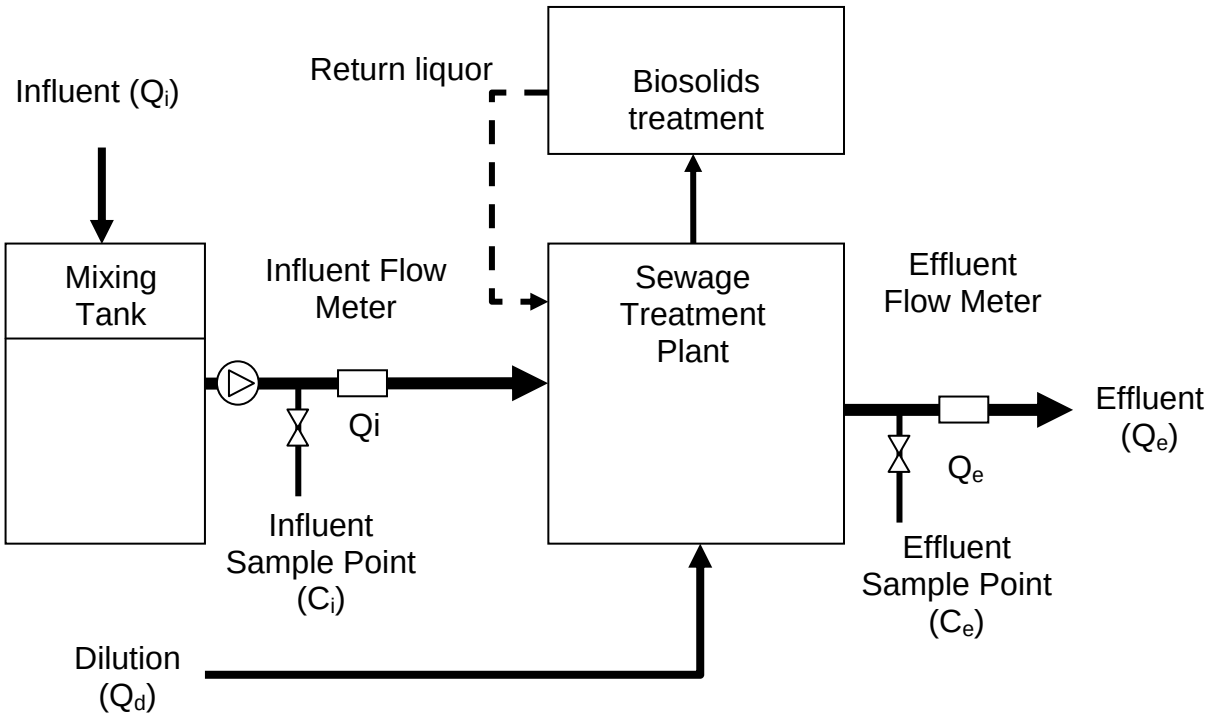

Fig. 1 System diagram of a sewage treatment plant

2 TECHNICAL REGULATIONS

2.1 General

2.1.1 Relevant requirements in National Technical Regulation on Classification and Construction of Sea-going Steel Ships and its amendments are to be applied to materials, equipment, installation and workmanship relating to sewage treatment plants which are provided in this Regulation unless otherwise stated.

2.1.2 An approved sewage treatment plant is to meet the technical specifications in section 2.2 of this Regulation. When ships are operating approved sewage treatment plants, the effluent is not to produce visible floating solids or cause discoloration of the surrounding water.

2.1.3 In meeting the effluent standards after treatment, an approved sewage treatment plant should not rely solely on dilution of wastewater. Where amounts of dilution (Q_d) are deemed essential to a treatment process, the effluent standards having concentration limits (mg/l) are to be adjusted proportionally using dilution compensation factor Qi/Q_e to take account of dilution.

In addition, for effluent standards in Table 1 having a percentage reduction, the geometric mean of the daily percentage reduction values is to be calculated using the accumulated flow Q_i and Q_e over each 24-hour test day, in terms of l/day, multiplied by the geometric mean of the corresponding concentration Ci and Ce for the same 24-hour test day, in terms of mg/l.

The overall percentage reduction over the entire test period n is:

$$PR = \sqrt[n]{PR_1 .PR_2 ...PR_n}.100$$

Where PR_n is the daily removal value.

$$PR_n = \frac{(\frac{(\mathrm{Q}_i)_n.\sqrt[s]{(C_i)_1.(C_i)_2...(C_i)_s}}{1000})_n - \frac{(\mathrm{Q}_e)_n.\sqrt[s]{(C_e)_1.(C_e)_2...(C_e)_s}}{1000})_n}{(\frac{(\mathrm{Q}_i)_n.\sqrt[s]{(C_i)_1.(C_i)_2...(C_i)_s}}{1000})_n}$$

Where:

n: the test day number;

s: the sample number collected on test day n.

2.2 Effluent standards

2.2.1 Effluent from sewage treatment plant and the determination method are to meet the requirements in the following Table 1.

Table 1 Effluent standards and determination method

Nos.	Parameters	Unit	Values [1]	Methods used [5]
1	pH	-	5 – 8.5	TCVN 6492:2011 (ISO 10523:2008)
2	BOD_5 (without nitrification)	mg/l	25 Q_i/Q_e	TCVN 6001:2008 (ISO 5815:1:2003)
3	Chemical oxygen demand (COD)	mg/l	125 Q_i/Q_e	ISO 15705:2002
4	Total Suspended Solids (TSS)	mg/l	35 Q_i/Q_e [2]	TCVN 6625:2000 (ISO 11923:1997)
5	Total Dissolved Solids (TDS)	mg/l	500 Q_i/Q_e	TCVN 6053:2011 (ISO 9696:2017)
6	Total nitrogen [3]	mg/l	$20Q_i/Q_e$ or at least 70 per cent reduction [4]	ISO 29441:2010
7	Total phosphorus	mg/l	$1.0Q_i/Q_e$ or at least 80 per cent reduction [4]	TCVN 6494:2011 (ISO 6878:2004)
8	Thermotolerant Coliform	MPN/ 100 ml	100	TCVN 6187:2009 (ISO 9308:2000)

Notes:

1 [1] The geometric mean.

2 [2] Where the sewage treatment plant is tested on board ship, the maximum total suspended solids content of the samples of effluent taken during the test period may be adjusted to take account of the total suspended solid content of the flushing water. In allowing this adjustment in maximum TSS, sufficient tests of TSS are to be ensured to be taken of the flushing water throughout the testing period to establish an accurate geometric mean to be used as the adjustment figure (defined as x). In no cases shall the maximum allowed TSS be greater than (35 plus x) Qi/Qe mg/l.

3 [3] Total nitrogen means the sum of total Kjeldahl nitrogen (organic and ammoniacal nitrogen) nitrate-nitrogen and nitrite-nitrogen.

4 [4] Reduction in relation to the load of the influent.

5 [5] Other equivalent methods may be accepted.

6 Zero or non-detected values: For thermotolerant coliforms zero values are to be replaced with a value of 1 thermotolerant coliform/100 ml to allow the calculation of the geometric mean. For total suspended solids, biochemical oxygen demand without nitrification and chemical oxygen demand values below the limit of detection are to be replaced with one half the limit of detection to allow the calculation of the geometric mean.

3 REGULATIONS ON MANAGEMENT

3.1 Regulations on the survey, test and certification

3.1.1 The sewage treatment plant is to be tested, inspected and type approved.

3.1.1.1 The procedure for the type approval of the sewage treatment plant is to be in line with relevant requirements specified in National Technical Regulation for Inspection of Sea-Going Ship's Products.

3.1.1.2 Organizations involved in testing of sewage sample are to comply with requirements in Article 5 of Decree No. 107/2016/ND-CP dated 01 July 2016 of the Government prescribing conditions for provision of conformity assessment services.

3.1.2 Testing of the operational performance of a sewage treatment plant is to be conducted in accordance with the following 3.2. The testing is to be conducted both on board and ashore. Where the sewage treatment plant has been tested ashore, the initial survey is to include installation and commissioning of the sewage treatment plant. Organizations involved in testing of sewage sample are to make a testing report and be responsible for the testing results.

3.1.3 It is acknowledged that the performance of sewage treatment plants may vary considerably when the system is tested ashore under simulated shipboard conditions or on board a ship under actual operating conditions. Where testing ashore demonstrates that a system complies with the standards, but subsequent onboard testing does not meet the standards, the reason is to be determined and taken into account when deciding whether to type approve the plant.

3.1.4 Only full-scale marine sewage treatment plants may be accepted for testing purposes. A range of the manufacturer's equipment sizes may be certified, employing the same principles and technology, but due consideration is to be given to limitations on performance which might arise from scaling up or scaling down. In the case of very large, very small or unique sewage treatment plants, certification may be based on results of prototype tests. Where possible, confirmatory tests are to be performed on the final installation of such sewage treatment plants.

3.1.5 A sewage treatment plant complying with resolutions MEPC.227(64) and MEPC.284(70) is considered to comply with this Regulation.

3.2 Requirements for the testing of sewage treatment plants

3.2.1 Raw sewage quality

3.2.1.1 Sewage treatment plants tested ashore – the influent is to be fresh sewage consisting of faecal matter, urine, toilet paper and flush water to which, for testing purposes primary sewage sludge has been added as necessary to attain a minimum total suspended solids concentration appropriate for the number of persons and hydraulic loading for which the sewage treatment plant will be certified.

The testing is to take into account the type of system (for example, vacuum or gravity toilets) and any water or grey water that may be added for flushing to the sewage before treatment. In any case the influent concentration of total suspended solids is to be no less than 500 mg/l.

3.2.1.2 Sewage treatment plants tested on board – the influent may consist of the sewage generated under normal operational conditions. In any case the average influent concentration of total suspended solids is to be not less than 500 mg/l.

3.2.1.3 Influent is to be assessed without the contribution of any return liquors, wash water, or recirculates, etc. generated from the sewage treatment plant.

3.2.2 Duration and timing of test

The duration of the test period is to be a minimum of 10 days and be timed to capture normal operational conditions, taking into account the type of system and the number of persons and hydraulic loading for which the sewage treatment plant will be type approved. The test is to commence after steady-state conditions have been reached by the sewage treatment plant under test.

3.2.3 Loading factors

3.2.3.1 During the test period, the sewage treatment plant is to be tested under conditions of minimum, average and maximum volumetric loadings.

(1) For testing ashore, these loadings are to be as laid down in the manufacturer's specifications. Fig. 2 shows suggested timings for sampling each loading factor.

(2) For testing on board, minimum loading is to represent that generated by the number of persons on the ship when it is alongside in port, and average and maximum loadings are to represent those generated by the number of persons on the ship at sea and to take account of meal times and watch rotations.

3.2.3.2 The assessment of the capability of the sewage treatment plant to produce an effluent in accordance with the standards prescribed by section 2.2 of the Regulation following minimum, average and maximum volumetric loadings is to be undertaken. The range of conditions under which the effluent standards were met is to be recorded on the technical file of the plant.

3.2.4 Sampling methods and frequency

3.2.4.1 It is to be ensured that the sewage treatment plant is installed in a manner which facilitates the collection of samples, see Fig. 1. Sampling is to be carried out in a manner and at a frequency which is representative of the effluent quality. Fig. 2 provides a suggested frequency for sampling, however, the frequency is to take account of the residence time of the influent in the sewage treatment plant. A minimum of 40 effluent samples are to be collected to allow a statistical analysis of the testing data (e.g. geometric mean, maximum, minimum and variance).

3.2.4.2 Influent sample point is to be upstream of any return liquors, wash water, or recirculates generated from the sewage treatment plant. Where such a sample point is not readily available on ships, the flows and concentrations of these return liquors, wash water, or recirculates generated from the sewage treatment plant are to be measured.

3.2.4.3 An influent sample is to be taken and analyzed for every effluent sample taken and the results recorded to ensure compliance with section 2.2 of this Regulation. If

possible, additional influent and effluent samples are to be taken to allow for a margin of error. Samples are to be appropriately preserved prior to analysis particularly if there is to be a significant delay between collection and analysis or during times of high ambient temperature.

3.2.4.4 Any disinfectant residual in samples is to be neutralized when the sample is collected to prevent unrealistic bacteria kill or chemical oxidation of organic matter by the disinfectant brought about by artificially extended contact times. Chlorine (if used) concentration and pH are to be measured prior to neutralization.

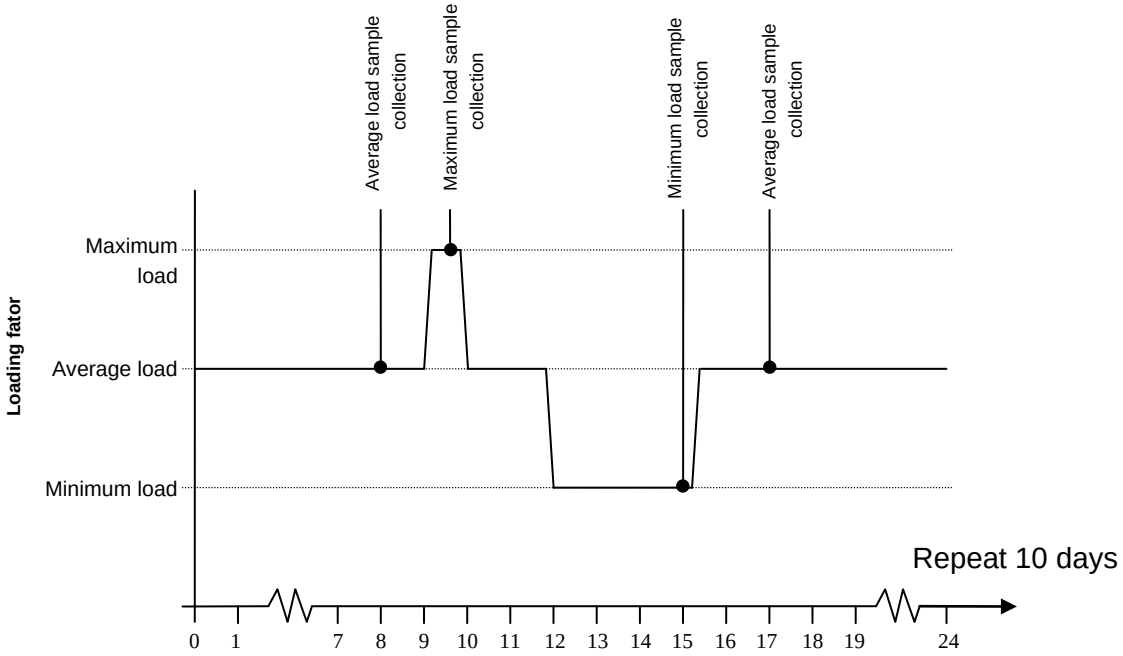

Fig. 2 Suggested hydraulic loading factors and sampling frequency for testing sewage treatment plants

(May be modified as necessary to take account of characteristics of individual sewage treatment plants)

3.2.5 Analytical testing of effluent

Consideration is to be given to the recording of other parameters in addition to those required (thermotolerant coliforms, total suspended solids, BOD_5 without nitrification, COD, pH and residual chlorine) with a view to future technological development. These parameters include total solids, volatile solids, settleable solids, volatile suspended solids, turbidity, total organic carbon, total coliforms and faecal streptococci.

3.2.6 Disinfectant residual

When chlorine is used as a disinfectant, it is to be satisfied that the best technical practice is used to keep the disinfectant residual in the effluent below 0.5 mg/l.

It is encouraged for the use of ozone, ultraviolet irradiation or any other disinfectants which minimize adverse environmental effects, whilst pursuing the thermotolerant coliform standard.

3.2.7 Environmental testing of the sewage treatment plant

The plant is to operate satisfactorily on completion of each of the following environmental tests:

3.2.7.1 Vibration tests

(1) A search is to be made for resonance over the following range of frequency and amplitude of acceleration. This search is to be made in each of the three planes at a rate sufficiently low to permit detection of resonance.

(a) 2 to 13.2 Hz with an amplitude of ± 1 mm;

(b) 13.2 to 80 Hz with an acceleration of ± 0.7g.

(2) The plant is to be vibrated in the planes at each major resonant frequency for a period of 2 hours;

(3) If there is no resonant frequency, the plant is to be vibrated in each of the planes at 30 Hz with an acceleration of ±0.7 g for a period of 2 hours;

(4) After completion of the tests specified in (2) or (3), a search is to again be made for resonance and there is to be no significant change in the vibration pattern.

3.2.7.2 Temperature tests

(1) Plant 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 2 h, to:

(a) a low temperature test at 0 °C;

(b) a high temperature test at 55 °C.

(2) At the end of each of the tests referred to, the plant is to be switched on and it is to function normally under the test conditions.

3.2.7.3 Humidity tests

Plant is to be left switched off for a period of 2 h at a temperature of 55 °C in an atmosphere with a relative humidity of 90%. At the end of this period the plant is to be switched on and is to operate satisfactorily for 1 hour.

3.2.7.4 Inclination test

The plant is to be capable of operating normally when the ship has a ±15° heel, or ±22.5° roll and/or ±7.5° pitch. The relaxation of the requirements for the said angles may be accepted when considering the type, dimensions and operational condition of the ship as well as functionality of the plant.

3.2.7.5 Reliability of electrical and electronic equipment

The electrical and electronic components of the plant are to be of a quality guaranteed by the manufacturer and suitable for their intended purpose.

3.3 Additional requirements

3.3.1 Any limitation on the conditions of operation is to be recorded on the technical file.

3.3.2 The manufacturer is to include in the operating and maintenance manuals, a list of chemicals and materials suitable for use in the operation of the sewage treatment plant.

3.3.3 Each sewage treatment plant is to be clearly labeled in accordance with 3.3.4 below, with the following informations:

(1) name of the manufacturer;

(2) type and model of the plant;

(3) date of manufacture;

(4) serial numbers.

3.3.4 The information specified in 3.3.3 above is to be displayed on the label firmly attached to the treatment plant or to be directly displayed on the plant. The label or the text on the plant is to be durable, resistant to corrosion resulted by the environment of water, salty vapor, direct sunlight, heat and any chemicals listed in 3.3.2. That label or the text is to be so arranged that to avoid intentionally removal or changing the content without leaving clear evidence.

3.3.5 Manufacturer's installation, operating and maintenance manuals are to be examined for adequacy and completeness. The ship is to have on board at all times a manual detailing the operational and maintenance procedures for the sewage treatment plant, including safety information about the chemicals and materials actually used in the operation of the sewage treatment plant.

3.3.6 Routine maintenance of the system is to be clearly defined by the manufacturer in the associated operating and maintenance manuals. All routine and repair maintenance are to be recorded.

3.4 Document management

3.4.1 Survey Document storage

All documents issued by VR for sewage treatment plants are to be kept and maintained in Vietnam Register Head Office in accordance with relevant rules.

4 RESPONSIBILITIES OF ORGANIZATIONS, INDIVIDUALS

4.1 Responsibilities of ship owners, ones who involved in manufacturing and installing the sewage treatment plants

4.1.1 To fully implement the requirements on the inspection and maintenance of good working conditions of sewage treatment plants specified by this Regulation.

4.1.2 To comply with requirements on the surveys of VR in accordance with this Regulation.

4.2 Responsibilities of Vietnam Register

4.2.1 Survey and type approval of sewage treatment plants.

To survey and type approve the sewage treatment plants in accordance with requirements in this Regulation.

4.2.2 To give instructions for implementation/application

To give instructions for the application of this Regulation to ship owners, ones who involved in manufacturing and installing the sewage treatment plants.

4.2.3 To amend and supplement the Regulation

Based on the fact, Vietnam Register is to have responsibility to petition the Ministry of Transport to revise this Regulation when needed or on a basis specified in Law on standards and technical regulations.

5 IMPLEMENTATION

5.1 It is the responsibility of Vietnam Register to carry out the survey, type approval of sewage treatment plants in accordance with requirements in this Regulation.

5.2 In case of inconsistency between the requirements in this Regulation and those in other rules, standards or technical regulations relating to sewage treatment plants, the requirements of this Regulation is to prevail over those of others.

5.3 In case the documents referred to in this Regulation are amended, supplemented or replaced, the latter is to prevail over the former.