

BALLAST WATER TREATMENT SYSTEM INSTALLATION COST ASSESSMENT

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Abstract

The possibility to transfer invasive species from ship ballast water between different world regions today is clearly recognized. Also, it is quite clear that expected increase in world seaborne trade in the future will make the problem even more serious¹. Consequently, the International Maritime Organization IMO adopted the International Convention for the Control and Management of Ships Ballast Water and Sediments (BWMC) in February 2004. The main goal is to prevent the transfer of invasive species within different world regions by ballast water and sediments. The BWM convention will enter into force on 8 September 2017². According to regulations of the Convention, all new and existing ships in international trade are required to install Ballast Water Treatment System (BWTS). Although there were no such systems just a few years ago, the requirement in very short time created a completely new market. The main stakeholders in the market are ship owners, BWTS producers, and shipyards. Total costs include purchasing costs, installation costs, operating costs and maintenance costs³.

The paper presented analyses at most the Ballast Water Treatment System installation costs as well as other factors that have a relevant impact on the installation cost. In order to estimate the extent of the costs and efforts expected by different stakeholders, at the beginning of the paper the structure of the global fleet will be shown. In the second part of the paper, the basic parameters determining installation costs will be analyzed. Finally, at the end of the paper the validity of data, collected from different sources, will be examined as well as overall cost assessment. In the conclusion, the future market dynamics is estimated as well as possible impacts on the technology development of the ballast water treatment systems caused by estimated market forces.

Key words: BWM convention, BWTS market, BWTS installation costs, market development

¹ imo.org

² Ibidem

³ D. M. King, P. T. Hagan, M. Riggio & D. A. Wright (2012) Preview of global ballast water treatment markets, *Journal of Marine Engineering & Technology*, 11:1, 3-15, p. 9

1. Introduction

Almost all human activities related to the progress and development of civilization has more or less destructive impact on the environment. There are different pollutants which cause degradation of the environment. Ballast water is not the usual pollutant, it does not contain harmful substances, but the transfer of invasive species via ballast waters represents a serious problem. Problem of transferring ship ballast water is ecological, economical and health⁴. To prevent transfer of organisms and non-native species, in February 2004, the IMO adopted the International Convention for the Control and Management of Ships' Ballast Water and Sediments to regulate discharges and to reduce risk of introducing invasive species in new regions⁵. Once the convention has entered into force, ship owners will be required to install the approved ballast water treatment system. Beside many other costs, installation cost and factors influencing on it will be discussed. There are many factors that have an effect on total costs, such as treatment technology, vessel type and size, ballast capacity, suitability of ship to install the system. Installation can be done at sea or in dry dock, so that also will affect final price. Before installation, ship owners have to think about which technology is best for the specific vessel, which capacity of the system is needed and is it there sufficient space to install such system. All these factors mentioned more or less reflect on final ballast water treatment system installation cost.

2. World fleet structure

In order to estimate the number of ballast water treatment systems to be installed on ships, few statistic information papers will be examined. Also, it is important to know the distribution of ship types, sizes and age. According to the King⁶, it is estimated that more than 68 000 vessels will install BWTS on board before 2020. It is possible that older ships will not be part of the BWTS market because they will be retired or rerouted. On the other side, there are larger vessels that will need more than one ballast treatment system unit.⁷

Regardless of the mentioned information, the structure of the world fleet considering vessel type and age is shown in the following table. As it mentioned before, BWTS technology, capacity and method of installation depends on ship type so data given in next table shows the distribution of vessels by their type and age.

⁴ Understanding ballast water management, Guidance for shipowners and operators, Lloyd's Register, Third Edition, August 2016., p.3

⁵ Ibidem

⁶ D. M. King, P. T. Hagan, M. Riggio & D. A. Wright (2012) Preview of global ballast water treatment markets, Journal of Marine Engineering & Technology, 11:1, 3-15, p. 4

⁷ Ibidem

Table 1: Distribution of world fleet by type and age

SHIP TYPE	TOTAL NUMBER OF SHIPS	DISTRIBUTION OF SHIPS BY AGE			
		0-4	5-14	15-24	+25
General Cargo ships	11951	976	3402	2378	5195
Specialised Cargo ships	279	44	54	29	152
Container ships	5158	901	2752	1291	214
RO-RO Cargo ships	1459	176	576	348	359
Bulk Carriers	10979	3539	4891	1707	842
Oil and Chemical Tankers	10867	1604	5367	1935	1961
Gas Tankers	1768	361	704	378	325
Other Tankers	545	125	141	64	215
Passenger Ships	3012	238	708	775	1291
Offshore vessels	5620	1342	2290	448	1540
Service Ships	2472	310	490	373	1299
Tugs	987	130	298	92	467
TOTAL	55097	9746	21673	9818	13860

Source: Equasis statistics 2015

3. Determining BWTS installation costs

Ballast water treatment system installation cost can be estimated by analysis of different factors that affect on the complexity of installation. There are many factors that influence on complexity of BWTS installation and by that on installation cost, here are some of them⁸:

- type of BWTS
- ship type and operating profile
- ballast capacity
- space required and ship construction limitations
- integration with existing systems
- power availability
- availability of support

⁸ Understanding ballast water management, Guidance for shipowners and operators, Lloyd's Register, Third Edition, August 2016., p.15

Also, there are different ballast water treatment systems available on market. They come in different configurations, such as separate BWTS, interconnected in different locations within a vessel or containerized.

Before installation any of mentioned options, shipyards offer installation survey to define which type of system and technology is best for the specific vessel.

Also, there are different technologies on which ballast water treatment systems work. These technologies are derived from other industrial applications, but they are adjusted for use on board. There are two sequences of the process used in ballast water treatment. The first is called solid-liquid separation, where solid materials and larger microorganisms were separated. The second process is disinfection, and it is used to remove and inactive microorganisms. These two processes can be done by using different technologies shown in the following figure.

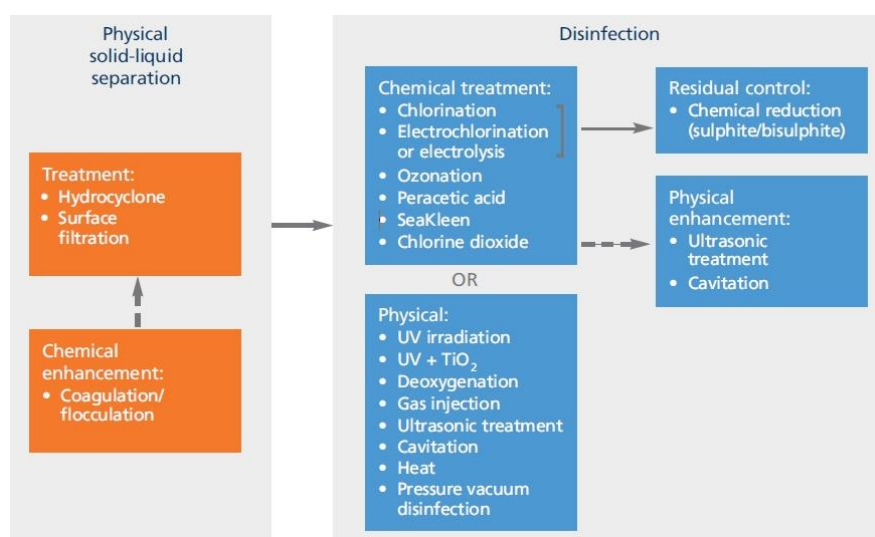


Figure 1: Typical ballast water treatment process

Source: Understanding ballast water management, Guidance for shipowners and operators, Lloyd's Register, Third Edition, August 2016

Also, another factor that impacts on installation cost of BWTS is the method of installation. It depends if the installation is done at sea or in dry dock. Certainly, installation at sea is more expensive, but if the vessel is in dry dock for long period, lost profit can exceed installation cost at sea.

According to King⁹, the most critical factor affecting BWTS installation costs is the space requirements of the BWTS and whether various components of a particular BWTS can be located in a single location on the ship or need to be placed in separate locations and linked together.

⁹ D. M. King, P. T. Hagan, M. Riggio & Da Wright (2012) Preview of global ballast water treatment markets, Journal of Marine Engineering & Technology, 11:1, 3-15, p. 12

4. Installation cost assessment

As mentioned before, total costs are formed from few separated segments. There are purchasing costs, installation cost, operating cost and maintenance cost. Installation cost is also composed of many elements. There are some usual components of installation cost¹⁰:

- design engineering
- design review
- purchasing support
- piping installation
- electrical installation
- steel fabrication
- QA/QC costs
- supervisor costs
- painting costs
- regulatory fees
- dry dock costs
- divers costs
- vessel downtime

Table 2 shows BWTS installation cost and it can be assumed how different factors influence on it, specifically type and size of the vessel and whether it is installed in dry dock or in service.

Table 2: Installation cost for different ship types/sizes and installation at shipyard or in service (US \$)

SHIP TYPE/SIZE	SHIPYARD/DRYDOCK (US \$)	IN SERVICE (US \$)
VLCC	67000 – 147000	96000 – 210000
Tanker TAPS Trade	63000 – 131000	92000 – 170000
General Cargo RO-RO	33000 – 132000	24000 – 185000
General Cargo Break Bulk	33000 – 114000	24000 – 140000
Container Vessel 8000 TEU	57000 – 143000	91000 – 197000
Container Vessel 2500 TEU	47000 – 115000	67000 – 140000
Bulk Carrier Panamax	54000 – 125000	85000 – 155000
Bulk Carrier Cape Size	73000 – 173000	74000 – 190000

Source: D. M. King, P. T. Hagan, M. Riggio & Da Wright (2012) Preview of global ballast water treatment markets, Journal of Marine Engineering & Technology, 11:1, 3-15, p. 11

Also, it can be discussed how different treatment technologies affect on costs. Next table is showing costs of systems considering different technologies.

¹⁰ D. M. King, M. Riggio, P.T. Hagan, Preliminary Cost Analysis of Ballast Water Treatment Systems 2009, MERC Ballast Water Economics Discussion Paper No 1., p. 5.

Table 3: BWTS installation cost for different treatment technologies (US \$)

SHIP TYPE/SIZE	BALLAST WATER TREATMENT TECHNOLOGY			
	Filtration and UV Light	Filtration and Chemical	Deoxygenation and Cavitation	Electrolysis and Electrochlorination
VLCC	67000 – 111000	136000 – 210000	113000 – 178500	99000 – 167500
Tanker TAPS Trade	63500 – 106000	119900 – 170500	97000 – 146000	96500 – 156000
General Cargo RO-RO	24500 – 48500	120900 – 164500	108500 – 185500	82500 – 136000
General Cargo Break Bulk	24500 – 48500	97000 – 140000	85000 – 136000	71400 – 124000
Container Vessel 8000 TEU	57500 – 103000	128500 – 197000	108500 – 167500	75500 – 121500
Container Vessel 2500 TEU	47000 – 74000	106000 – 139000	94000 – 140500	80500 – 116500
Bulk Carrier Panamax	54500 – 93500	115500 – 151000	96000 – 155000	87000 – 139500
Bulk Carrier Cape Size	62000 – 85000	132000 – 190300	139000 – 173000	79000 – 131500

Source: D. M. King, M. Riggio, P.T. Hagan, Preliminary Cost Analysis of Ballast Water Treatment Systems 2009, MERC Ballast Water Economics Discussion Paper No 1.

According to Full – Scale Design Study for BWTS, prepared by Northeast – Midwest Institute, Washington DC and the Lake Carriers’ Association, following information is gathered¹¹:

- shipyard labor rate: 50\$/hr
- shipyard engineering cost: 15% of the installation cost
- material markup: 15%
- contingency: 12% on material and labor

5. Conclusion

Data for this paper is gathered from different sources, and because of that it is not strictly precise but gives the range of the values that are more or less correct. Also, used literature has different age, so it is possible that some information is outdated. However, a good framework for understanding BWTS installation cost is given.

Already there are many shipyards that specialized the whole service for fitting BWTS on board. They provide planning, designing, installing and testing of BWTS, and also help ship owner with choosing the type of BWTS for a specific ship.

Global awareness for environmental protection is increasing more and more. Consequently, Ballast Water Management Convention (BWMC) is introduced in the maritime industry, and now with International Convention for the Prevention of Pollution from Ships (MARPOL) is consisting strong frame for environmental protection.

¹¹ Design Study Report, Full – Scale Design Studies of Ballast Water Treatment Systems, Northeast – Midwest Institute Washington, DC and Lake Carriers' Association, April 2002. p. 33

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