

OceanGuard™ Ballast Water Management System



About OceanGuard Ballast Water Management System

- In response to an urgent need to resolve one of the greatest threats to the world's oceans, the OceanGuard™ BWMS was developed by Qingdao Headway Technologies, a market leader of advanced environmental and clean ocean technologies based in Qingdao, China.
- The OceanGuard™ system has proven to be one of the most cost effective, environmentally sustainable, and clean ocean friendly solutions in the market.
- The OceanGuard™ uses an energy saving, chemical-free, Advanced Oxidation Process (AOP) treatment method that can deliver highly efficient biological results in eliminating invasive marine organisms, bacteria, and aquatic species and effectively sterilize ballast water tanks using both ultrasound and electro-catalysis methods.
- Designed to handle both sea water and fresh water, the OceanGuard™ system is extremely economical and efficient in terms of unit treatment capacity, power consumption, maintenance, and space requirement.
- Due to its compact and modular design, the OceanGuard™ is easy to install, operate and maintain especially on board vessels with limited deck space and small size crew.

Key Features and Advantages:

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| • Low up front capital and installation cost | • Superior technology |
| • Energy saving | • IMO type approved |
| • Extremely low power consumption in terms of unit treatment capacity | • Complete integration into vessel's existing ballast system |
| • Low maintenance cost and cost of ownership | • Global support |
| • Chemical free - environmentally sustainable | • Can handle both salt and fresh water |
| • Modular, scalable design and ideal for small footprint | • Corrosion proof |
| | • Explosion proof for tankers and LNG's |

Diagram of Ballast Water Management System



Land and Ship Based Test Results

Data from landbased tests of OceanGuard™ BWMS carried out in NIVA Facility under supervision of DNV and CCS in Sep., 2009

Organism	Unit	Influent water	In treated water on Day 0	In treated water on Day 5	IMO Regulation	Requirement of California
>50µm	Ind./m ³	213304	0	0	<10	0
>10-50µm	Ind./l	2.023X10 ⁵	0	0	<10 ⁴	<10
E-coli bacteria	cfu/100ml	2200	<1	<1	<250	<126
Enterococci	cfu/100ml	91	<1	<1	<100	<33

Data from shipboard tests of OceanGuard™ BWMS carried out onboard MV SITC YOKOHAMA in Nov., 2009

Organism	Unit	Influent water	In treated water on Day 0	In treated water on Day 5	IMO Regulation	Requirement of California
>50µm	Ind./m ³	3214	0	0	<10	0
>10-50µm	Ind./l	3.22X10 ⁵	5.7	0.7	<10 ⁴	<10
E-coli bacteria	cfu/100ml	230	<1	<1	<250	<126
Enterococci	cfu/100ml	42.3	<1	<1	<100	<33

Proven Technology and Innovation

AOP Patented Technology

The system is based on Advanced Oxidation Process (AOP) technology, an environment friendly electro-catalyses process complemented by filtration and ultrasonic treatment.

The core treatment processing components of the system are the Electro Catalysis Ultrasonic Treatment (EUT) unit and Ultrasound unit. The EUT's main function is to generate highly active hydroxyl radicals and other highly active oxidizing substances, oxidize the ballast water contaminants, and convert them into inorganic compounds such as water, carbon dioxide, and salts. The hydroxyl radicals ($-OH$), despite their very short active existence, create a strong oxidizing instant effect and destroy any microorganism, bacteria, or any other bio-organic pollutants, completely sterilizing the ballast water in the tank.

The OceanGuard™ system's state of the art automatic back flush filter provides filtration with $50[\mu m]$ precision and up to 4000 [m3] range capacity. The system's control unit is equipped with a visual display to perform management functions such as recording, monitoring, and alarm settings to full functional operation and regulatory compliance.

Compact and Modular Design

Due to its compact, scalable and modular design, the OceanGuard™ is easy to install, operate, and maintain especially on board vessels with limited machinery room and small size crew.



6000 m3 /h, Horizontal Design



Skid Installation



6000 m3/h, Vertical Installation



Skid Installation

Filtration System



Ocenguard BWMS adopts full auto-back flushing filter, which can realize the simultaneous operation filtration and back flush operation. The filtration precision is 50[μm] which can safely remove organisms larger than 50[μm]. Capacity range of the filter unit is 300 to 4000 [m3].

- Auto-back flushing and filtration can be operated simultaneously
- Simple structure, easy installation and maintenance
- Low pressure loss – no need for a booster pump
- Can be used in both seawater and freshwater

S/N	Test Site	POC (mg/L)	DOC (mg/L)	TSS (mg/L)	Salinity (PSU)	Data Resource
1	NIVA Facility, Norway	5.6-8.5	6.6-7.3	50-83.5	21.2-22.6	Report of Landbased Tests(Cycles 1-5)
2	NIVA Facility, Norway	2.5-2.6	2.4-2.6	11.6-16.3	32.0-32.8	Report of Landbased Tests (Cycles 6-10)
3	New Port, Mashitou, Zhoushan	8.2	2.97	312.6-342.3	26-28	Report of Landbased Tests
4	Xiangyu, Xiamen	0.6-0.7	1.33	31.8	30-31	Report of Shipboard Tests
5	Xiangyu, Xiamen	0.79	2.72	26	27.9	Report of Shipboard Tests
6	Xiangyu, Xiamen	0.86	2.66	53.1	25.5	Report of Shipboard Tests
7	Shidao, Weihai	1.05	2.11	36.3	28	Report of Shipboard Tests
8	Xiangshan, Ningbo	7.42	2.6	148.6-160.5	21.9-29.2	Report of Shipboard Tests
9	Qingdao Port	6.45	2.5	27.21-30.28	28-31	Report of Shipboard Tests
10	Wai Gaoqiao Port, Shanghai	5.89	3.25	109.9	0.1	Report of Shipboard Tests

On the right: Pictures from on-site test of performance comparison between OceanGuard™ filter & other filters.



A Suction port of experimental facilities

B Outflow water through filtering management



EUT Unit



The Electro-catalysis Ultrasonic Treatment Unit (EUT) comprises of 2 parts: The Electro-catalysis unit and the Ultrasound Unit. The Electro catalysis unit is able to produce a large number of hydroxyl radicals and other highly active oxidizing substances that would immediately destroy any microorganism, bacteria, or any other bio organic pollutants completely sterilizing the ballast water in the tank. During the treatment process, the ultrasound unit will **constantly to** ensure the quality and integrity of the electrocatalysis material. Unit capacity ranges from 100 to 1500 [m3]

- Highly effective biological results
- Energy saving - low power consumption
- Economical – low maintenance and operation costs
- Chemical free – environmentally sustainable solution

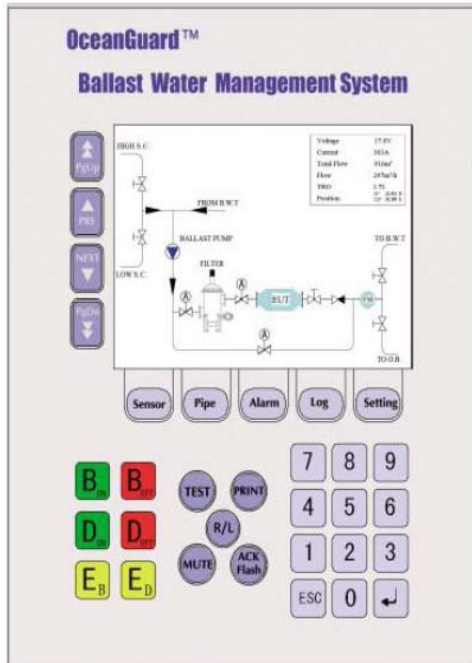
Model	Capacity Range (m ³ /h)	Rated Capacity (m ³ /h)	Power* (kw)	Dimension(mm*mm*mm)
HMT-100	30-120	100	2	370x380x1400
HMT-200	80-250	200	3.5	510x380x1400
HMT-300	150-350	300	5	510x380x1735
HMT-500	300-550	500	7	569x416x1815
HMT-600	350-700	600	10	600x470x1900
HMT-800	400-950	800	13.5	620x470x1900
HMT-1000	600-1200	1000	17	640x570x2100
HMT-1200	800-1400	1200	20	730x570x2100
HMT-1500	1000-1700	1500	25	730x620x2200
HMT-2000	1500-2300	2000	33.5	880x620x2200
HMT-2500	2000-2800	2500	42	1030x640x2210
HMT-3000	2200-3500	3000	50	1460x620x2200
*****	*****	*****	*****	*****
HMT-6000	4500-6500	6000	100	1460x1240x2200
*****	*****	*****	*****	*****
HMT-9000	6500-10000	9000	150	2060x1280x2210

* Power consumption under normal working conditions.



Control Unit

The control unit, equipped with visual display **would enable is responsible for** operating the entire treatment process. The unit can perform continuous data recording, by collecting signals from the sensors and controlling the alarm functions to ensure proper and accurate operation. The system is fully integrated with three sensors controlling the water flow and salinity, metering pump, filtering unit, and Total Residual Oxidant (TRO).



- Both local and remote control alarm information
- High quality LED visual display
- Recording and reporting functions
- Real time data collection and analysis
- Data can be stored up to 24 month



System Quality and Certifications

The OceanGuard™ BWMS is a fully certified ballast water management system meeting all IMO-MEPC-60 requirements, regulations, and guidelines.

The OceanGuard™ **and was** granted both CCS and DNV type approval certification.

The OceanGuard™ was also evaluated by the California State Land Commission and was selected as one of few systems that met the rigorous testing criteria and demonstrated the potential to meet California's standards 100% of the time in shipboard testing.

The OceanGuard™ is explosion proof certified and approved for installation on board tankers and LNG's



Key Customers

- Container Ships
- Tankers
- LNG's
- Cruise Ships
- Bulk Carriers
- Car Carriers

