



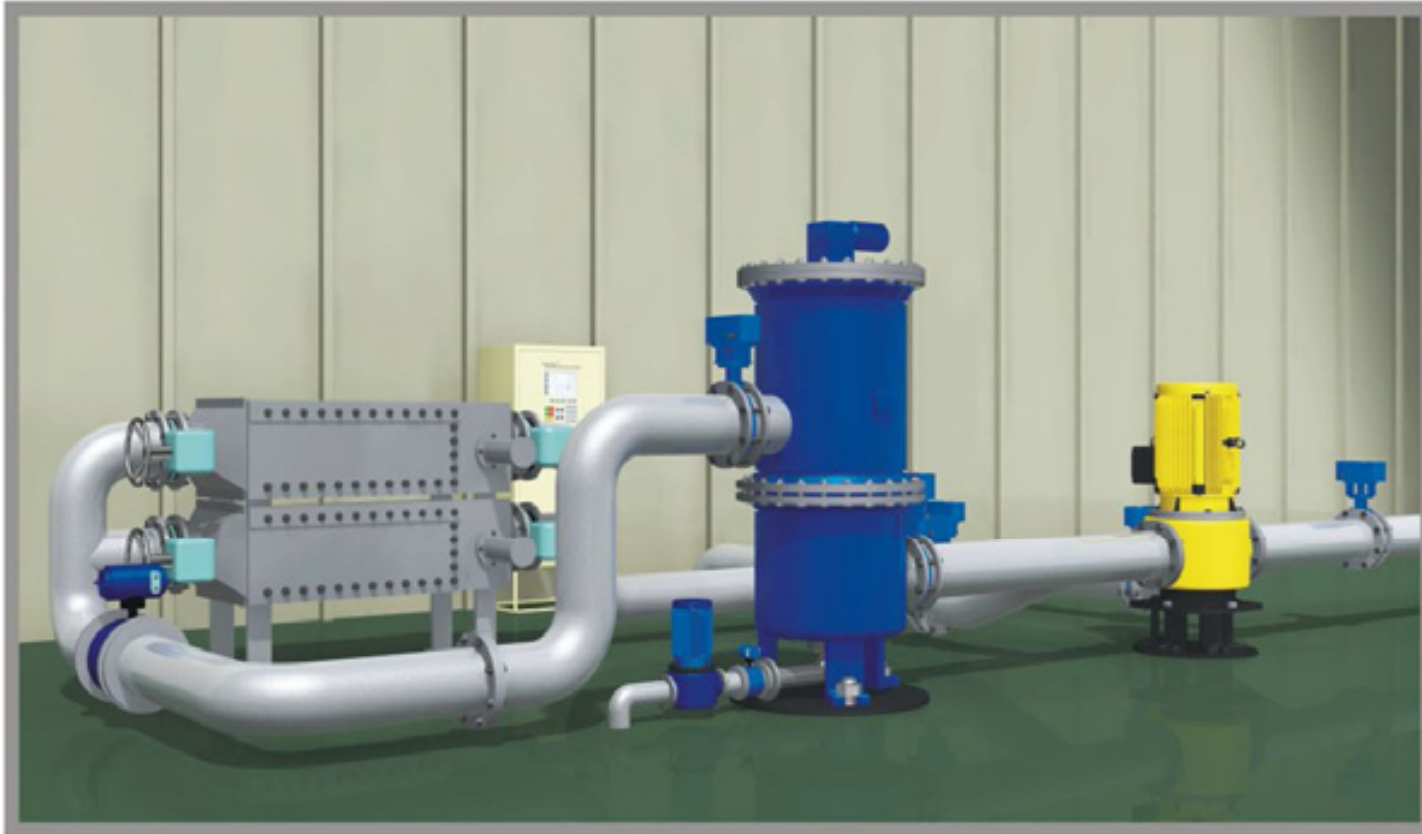
Ballast Water Management System





CONTENTS

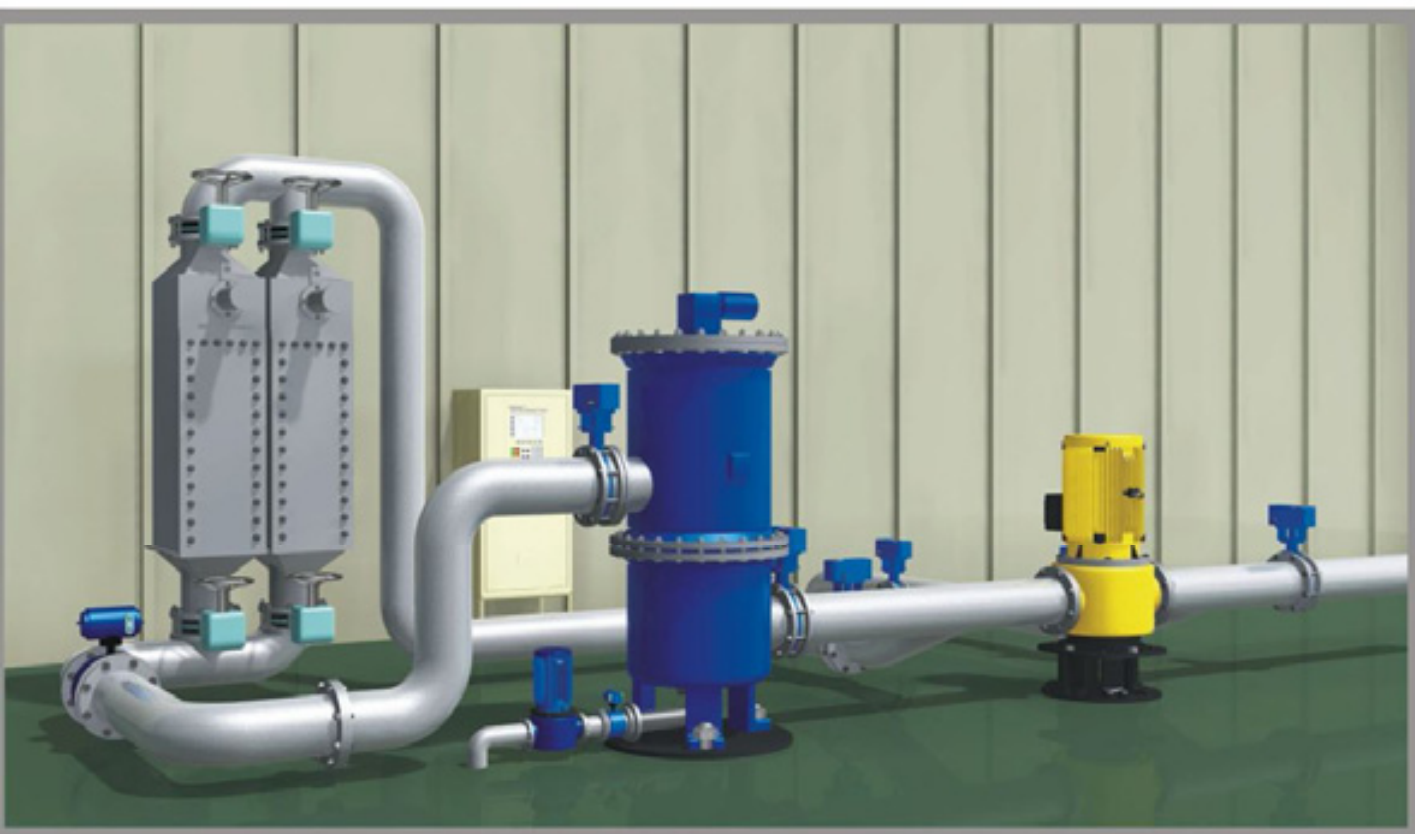
NO.01/02	Product Display
NO.03	Certificates
NO.04	OceanGuard™ BWMS
NO.04/05	Advantages of OceanGuard™ BWMS
NO.06	Biological Efficiency of OceanGuard™ BWMS
NO.07	System Diagram of OceanGuard™ BWMS
NO.08	EUT Unit Technical Specification of OceanGuard™ BWMS
NO.09/10/11	Auto-Back flushing Filter of OceanGuard™ BWMS
NO.12/13	AEOP Technology of OceanGuard™ BWMS
NO.14	Test Process of OceanGuard™ BWMS
NO.14	OceanGuard™ BWMS onboard MV SITC YOKOHAMA and VS465
NO.15/16	Global Service Network



6000m³/h, Horizontal Installation



Skid Installation



6000m³/h, Vertical Installation



Skid Installation

BLUE OCEAN-YOUR DREAM, OUR MISSION



Ballast Water Management System

OceanGuard™ Ballast Water Management System is researched and developed by Headway Technology Co., Ltd. and Harbin Engineering University together. Its unique structure and reasonable design stabilize vessels during the drainage of ballast water, and poses no threat to marine life in surrounding waters, thus protecting marine ecological environment.

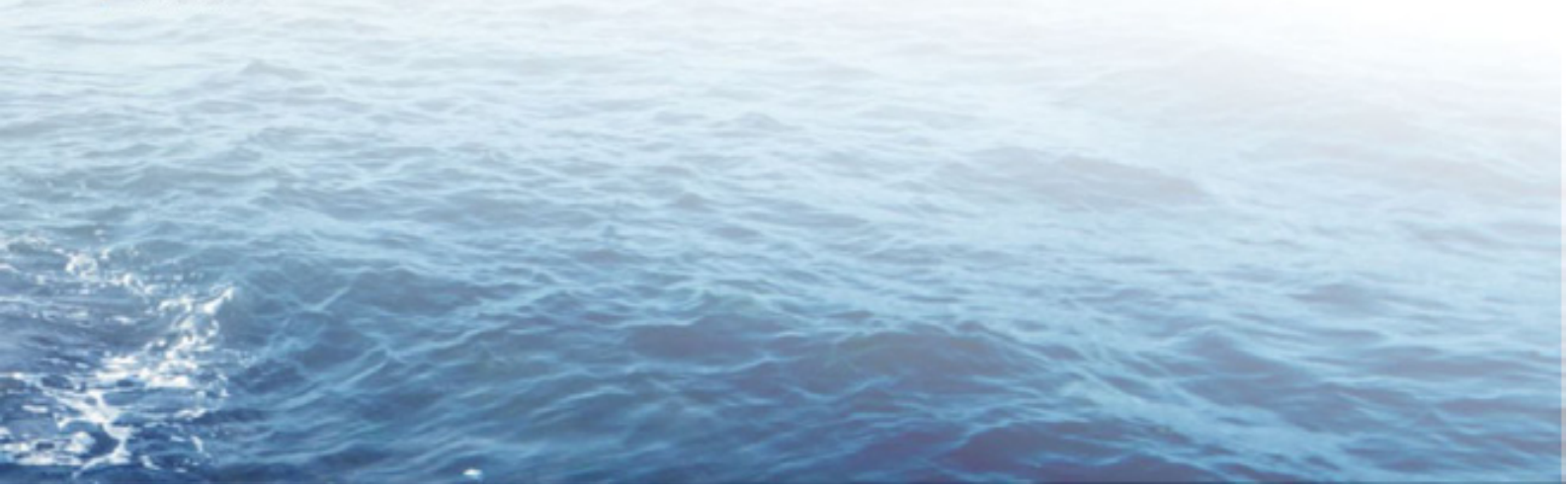
Advantages of OceanGuard™ BWMS

Technology of Advanced Electrocatalysis Oxidation Process (AEOP)

Hydroxyl radicals produced in the process of management by AEOP technology will disappear after several nanoseconds. These radicals have high sterilization efficiency, which are able to kill different bacteria, viruses, algae and dormant ovum in ballast water effectively (broad spectrum sterilization) in a chained mode. The sterilization process can be completed within EUT Unit. The concentration of TRO (total residual oxidation) can be controlled within 2ppm, so that the TRO can carry out advanced management on the water in ballast tanks.

No corrosion to Ships

Hydroxyl radicals produced by OceanGuard™ Ballast Water Management System will disappear after several nanoseconds. The whole sterilization management is completed within EUT Unit. Through the management, TRO concentration is within 2ppm. According to results of long-term operation, the system is proved to be safe and reliable, and water treated by OceanGuard™ BWMS causes no corrosion to the hull.



Satisfy Requirements

Fully meet IMO regulation and California requirement.

Compact Design; High-Quality Spares

Compact design, small footprint, easy installation and maintenance free. **OceanGuard™** BWMS can be fitted on various vessels with different internal structures. High-quality materials and spare parts with long lifespan are used for all the components.

Single Way Treatment

The whole process only needs the inflow treatment during ballasting rather than the discharge treatment, so that it is proper for all the vessels.

Energy-saving

Low operating costs. Energy consumption is only appr. 17kwh for the treatment of 1000 m³ of ballast water.

Explosion-proof

OceanGuard™ obtained Explosion-proof Certificate, which can be fitted in the pump room of oil tanker, liquid gas carrier, etc.

Wide Scope of Application

OceanGuard™ BWMS shows excellent performance in fresh water and sea water. The discharged treated ballast water has no any harm to the environment in the surrounding waters.



Biological Efficiency of OceanGuard™ BWMS

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

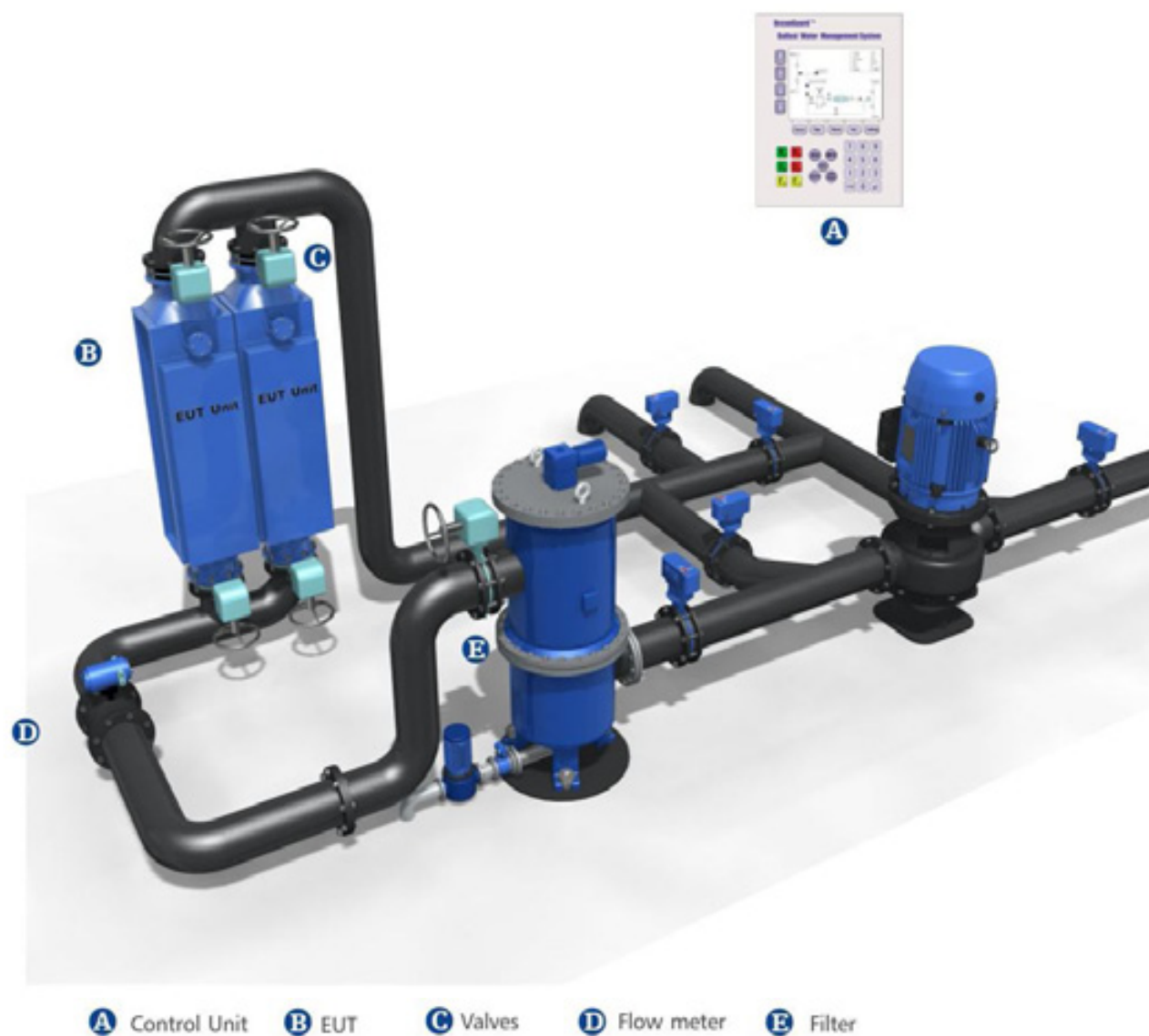
Organism	Unit	Influent water	In treated water on Day 0	In treated water on Day 5	IMO Regulation	Requirement of California
>50µm	Ind./m ³	213304	0	0	<10	0
>10-50µm	Ind./l	2.023X10 ⁶	0	0	<10 ⁴	<10
E-coli bacteria	cfu/100ml	2200	<1	<1	<250	<126
Enterococci	cfu/100ml	91	<1	<1	<100	<33

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



System Diagram of OceanGuard™ BWMS



EUT Unit Technical Specification of OceanGuard™ BWMS

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.

➔ For other models, please contact Headway.



Auto-Back Flushing Filter of OceanGuard™ BWMS



Filter

OceanGuard™ BWMS adopts full auto-back flushing filter, which can realize the simultaneous operation of filtration and back flush. The filtration precision is 50µm. It can remove organisms larger than 50µm in ballast water to prevent micro organisms and sediments entering ballast tank.

Advantages of Filter

- Most proper model is equipped, which make sure excellent filtration performance.
- Auto-back flushing and filtration can be operated simultaneously.
- Excellent performance without blockage has been proved from test results in different waters.
- Simple structure, easy installation.
- Low pressure loss, no need to install booster pump.

Filtration step is of essential importance in the process of Ballast Water Management.

According to relevant requirements of International Convention for the Control and Management of Ship's Ballast Water and Sediments issued by IMO in 2004, both ballast water and sediments are important contents for the management. Therefore, through practical survey of sediments including sludge in the ballast tank, it can be concluded that sediments in ballast tank not only become the seedbed of organisms, but also cause serious corrosion to the hull. The following pictures are sediments and corrosion comparison of the same ballast tank, in which the first is the ballast tank before installing OceanGuard™ BWMS, and the second is the ballast tank after two years operation of OceanGuard™ BWMS.



Before repair



After repair

Before repair, sediments in ballast tank without installing BWMS.

After repair, ballast tank after two years operation with **OceanGuard™** BWMS.

R&D Process

After ten years of research and development, by cooperation with Harbin Engineering University and other scientific research institutes, Headway got over the core technologies of fully auto-back flushing filter which is specially developed for BWMS in the aspects of production process and industrialization technology of key materials and key components, etc. Headway obtained the patent for this technology, and successfully developed fully auto-back flushing filters with the capacities from 100 tons/h to 4000 tons/h.

► In 2002

Set up the project for auto-back flushing filter special for ballast water, and commenced R&D.

► In 2005

Succeed in developing 50μm Cylindrical Wedge Wire (V-Wire) Screen element, which is made of stainless steel and corrosion resistant.

► In 2006

Succeed in developing the 50μm cone-shaped Wedge Wire (V-Wire) Screen element, which is made of stainless steel and corrosion resistant material.

► In 2007

Complete the construction of test base for auto-back flushing filter special for ballast water.

Test Results of Filter

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

Test Base in Zhoushan

Comparison of performance tests between **OceanGuard™** filter & other filters.

Test base in Zhoushan: Pictures from On-site Tests



- A** Suction port of experimental facilities
- B** Outflow water through filtering management



AEOP Technology of OceanGuard™ BWMS

OceanGuard™ BWMS is developed by Headway Technology Co., Ltd. together with Harbin Engineering University.

OceanGuard™ BWMS adopts Advanced Electrocatalysis Oxidation Process (AEOP) to kill microbes, bacteria, viruses and dormant ovum in water by using special semiconductor materials under electron excitation and the hydroxyl radicals ($\cdot\text{OH}$) formed by water molecules. Hydroxyl radical ($\cdot\text{OH}$) produced in AEOP is one of the most active substances with very strong oxidizability. It can have different kinds of chemical reactions with almost all biological macromolecules, microorganisms and other organic pollutants instantaneously. Besides, it has extremely fast reaction rate and strong negative charge electron affinities. The final products of reaction are CO_2 , H_2O and traces of inorganic salt without any hazardous residuals. Therefore, the treated water can be discharged overboard without any pollution. The chemical reaction which involves hydroxyl radical is free radical reaction, and it is extremely fast. Generally, the reaction rate with organics is over $10^9 \text{ L} / (\text{mol}\cdot\text{s})$.

Moreover, the form and existence time of hydroxyl radicals is quite short, which is less than 10^{-12} s , so that the high efficiency and effectiveness of OceanGuard™ BWMS can be guaranteed.

EUT Unit

EUT Unit is the core of OceanGuard™ BWMS. Each single unit has the treatment capacity from 100-3000m³/h. The Unit comprises of two parts: Electrocatalysis Unit and Ultrasound Unit. The Electrocatalysis Unit is able to produce large numbers of hydroxyl radicals and other highly active oxidizing substances to kill all organisms in ballast water within several nanoseconds. The whole sterilization process is completed inside the EUT Unit. During the treatment process, the Ultrasound Unit can clean the surface of Electrocatalysis Unit regularly to keep the long-term treatment effectiveness of the electrocatalysis material.

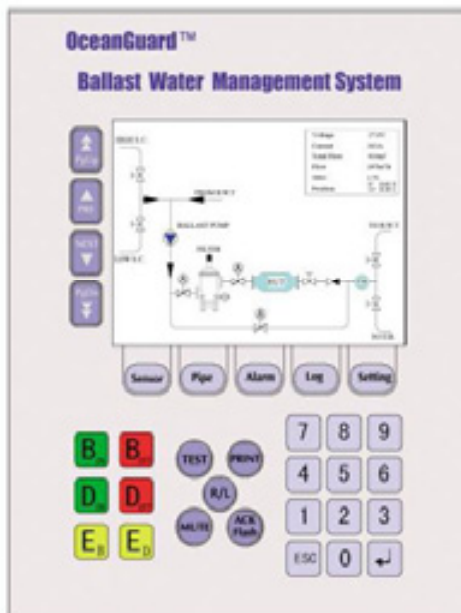




Control Unit

Control Unit is responsible for regulating the entire system including collection of various signals from the sensors, management of alarm signals and controls of system startup and shutdown. It contains all procedures for the system operation, displays the system working condition, including the working condition of various parts as well as data and status reported by real time inspection from various sensors.

Advantages of Control Unit



- Both local and remote controls.
- Alarm information can be output to the vessel's control system.
- Siemens LED screen, which can display the operation status of each facility in real time.
- Siemens PLC, which can collect and deal with all related data of BWMS in real time.
- Keep and store effective data for 24 months, which can be printed out at any time.
- One-key operation.

OceanGuard™

Ballast Water Management System

The only ballast water management system from China which completed pilot test and land based tests successfully in NIVA Facility.



Pilot Test in NIVA Facility in September, 2008.



Scientist from NIVA Facility during the Pilot Test.



Land based Test in NIVA Facility in July, 2009.



Overview of OceanGuard™ Ballast Water Management System under supervision of DNV in NIVA Test Site.

OceanGuard™ BWMS onboard MV SITC YOKOHAMA and VS465



OceanGuard™ BWMS on board
MV SITC YOKOHAMA



OceanGuard™ BWMS on board
VS465



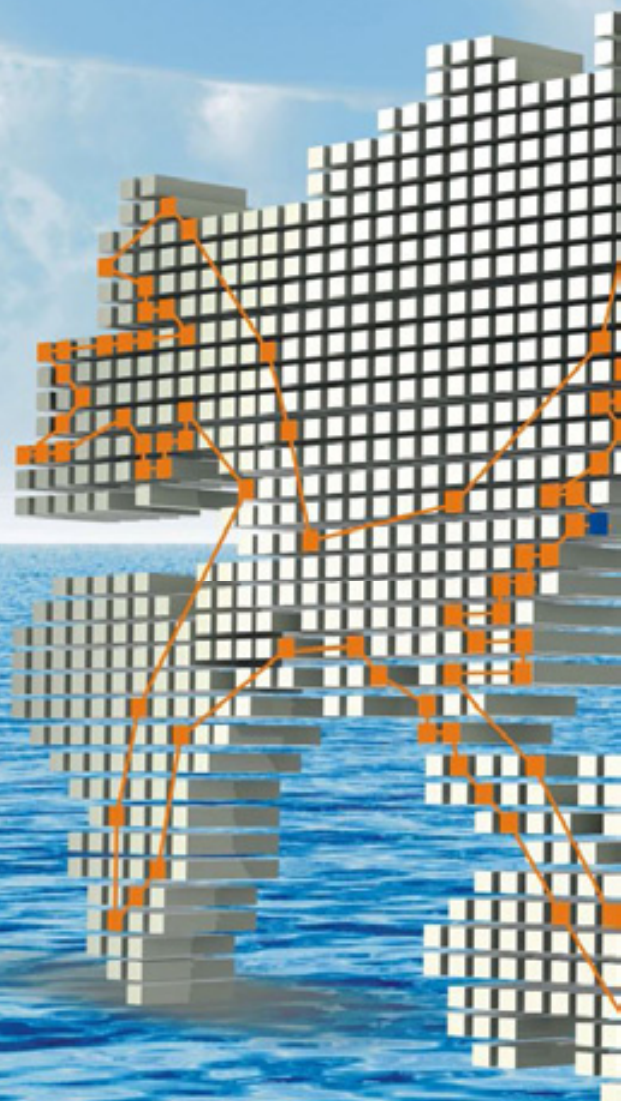
Shipboard test under supervision of CCS.



Shipboard test under supervision of DNV.

Global Service Network

Headway has established 120 service bases in 56 countries, forming a complete global service network, guaranteeing after-sales service and technical support.



ARGENTINA  <p>Headway Argentina S.A. - Buenos Aires</p>	CANADA  <p>Headway Canada Inc. - Toronto</p>	GERMANY  <p>Headway Germany GmbH - Berlin</p>	IRAN  <p>Headway Iran Co. - Tehran</p>	MEXICO  <p>Headway Mexico S.A. - Mexico City</p>
AUSTRALIA  <p>Headway Australia Pty Ltd - Sydney</p>	CANADA  <p>Headway Canada Inc. - Toronto</p>	GREECE  <p>Headway Greece S.A. - Athens</p>	Italy  <p>Headway Italy S.p.A. - Milan</p>	MONACO  <p>Headway Monaco S.A. - Monaco</p>
BANGLADESH  <p>Headway Bangladesh Ltd. - Dhaka</p>	CHILE  <p>Headway Chile S.A. - Santiago</p>	GREECE  <p>Headway Greece S.A. - Athens</p>	JAPAN  <p>Headway Japan Co. - Tokyo</p>	MOROCCO  <p>Headway Morocco S.A. - Casablanca</p>
BELGIUM  <p>Headway Belgium NV - Brussels</p>	CHINA  <p>Headway China Co. - Beijing</p>	HONG KONG  <p>Headway Hong Kong Co. - Hong Kong</p>	KOREA  <p>Headway Korea Co. - Seoul</p>	PAKISTAN  <p>Headway Pakistan Co. - Karachi</p>
BRAZIL  <p>Headway Brazil S.A. - São Paulo</p>	EGYPT  <p>Headway Egypt S.A. - Cairo</p>	INDONESIA  <p>Headway Indonesia Co. - Jakarta</p>	Korea  <p>Headway Korea Co. - Seoul</p>	PANAMA  <p>Headway Panama S.A. - Panama City</p>
BRAZIL  <p>Headway Brazil S.A. - São Paulo</p>	EGYPT  <p>Headway Egypt S.A. - Cairo</p>	INDIA  <p>Headway India Co. - New Delhi</p>	LIBANON  <p>Headway Lebanon Co. - Beirut</p>	PHILIPPINE  <p>Headway Philippines Co. - Manila</p>
BRAZIL  <p>Headway Brazil S.A. - São Paulo</p>	ESTONIA  <p>Headway Estonia Co. - Tallinn</p>	INDIA  <p>Headway India Co. - New Delhi</p>	LITHUANIA  <p>Headway Lithuania Co. - Vilnius</p>	ROMANIA  <p>Headway Romania Co. - Bucharest</p>
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Blue Ocean

YOUR DREAM, OUR MISSION

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