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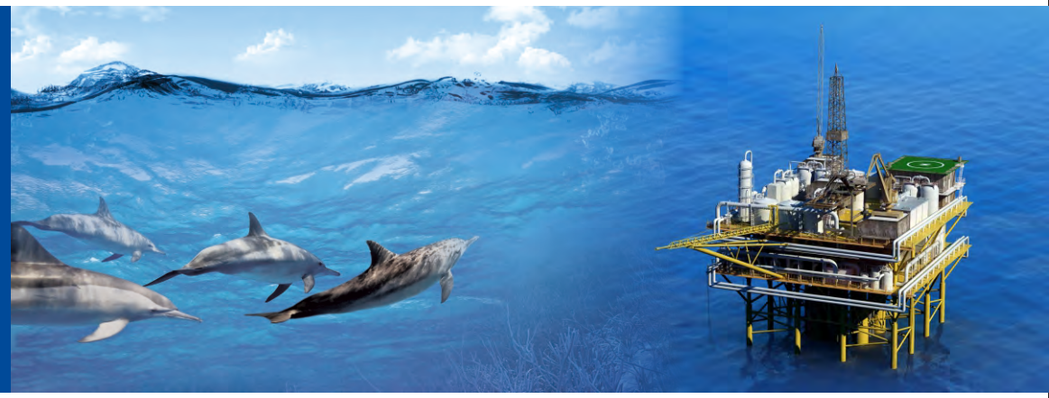
BALLAST WATER MANAGEMENT SYSTEM



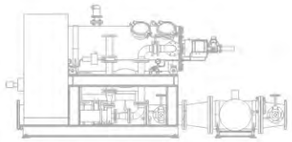
www.pactmarine.com

PACT marine™ BWMS
Background

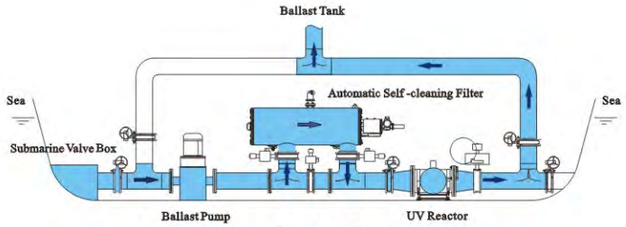
PACT is a multinational water treatment company, with Marine/Offshore as well as On-Land Water Treatment divisions, spanning Seawater Desalination, Offshore and Maritime Water Treatment, Municipal Wastewater, Industrial Wastewater and Potable Water Treatment areas, with the majority of clients coming from Fortune 500 enterprises.

Leveraging on PACT vast water treatment, automation and mechanical expertise and experience, PACT MARINE™ BWMS was developed in-house, utilizing a 40μm self-cleaning filter combined with medium pressure ultraviolet (MPUV) disinfection technology, with simple structure, superior performance, with design allowance to meet more stringent future discharge standards, offering a complete range (200-4000 m^3/hr) of ballast water management solutions to clients.

PACT marine™ BWMS
System Operating Principles

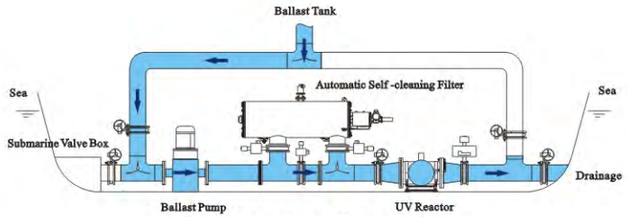


During ship ballasting, ballast water enters the BWMS from the ballast pump, through the filter, then the MPUV reactor for treatment, and then into the ballast tank. Passing through the filter, large inorganic particles, most of the zooplankton and phytoplankton would be removed, ensuring the effectiveness of MPUV disinfection downstream. 200-280nm wavelength UV irradiation of the MPUV reactor achieves disinfection of the residual plankton , bacteria and viruses in the ballast water by means of cellular damage.



Ballasting

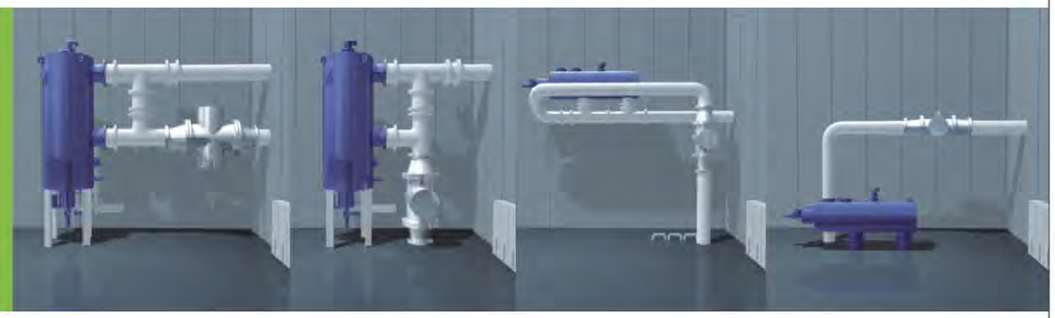
During de-ballasting, the ballast water is directly pumped into the MPUV reactor, bypassing the Filter, for secondary disinfection treatment before discharge.



De-Ballasting

PACT marOine™ BWMS

Features



- **Simple & Flexible**

  Simple structure, easy to install and operate; depending on spatial allowance, can be installed in containers, modules, loose in a vertical or horizontal format

- **Stable & Reliable Performance**

  System utilizes Israeli Filtration Technology; key components from reputable manufacturers well-known for their stability & reliability; global service network provides a reliable & comprehensive support worldwide

- **Design allowance to meet more stringent discharge requirements**

  Economy Mode - By adjusting MPUV intensity, system responds to incoming water quality to achieve discharge compliance with minimum energy OPEX

  Performance Mode system able to increase UV intensity at various settings to comply with more stringent discharge requirements due to considerable design allowance

  Suitable for all vessel types (Bulkers, Tankers, Boxships, Passenger Ships and other special purpose vessels)

PACT marOine™ BWMS

Self-Cleaning Filter Unit

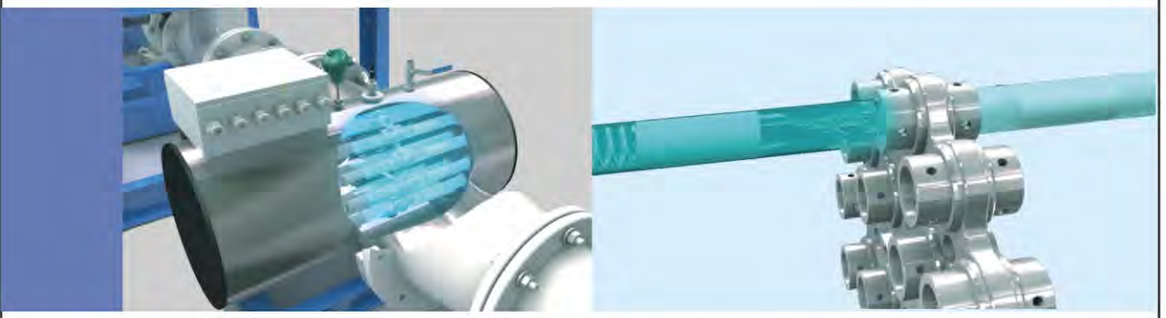
Filtersafe, with over 60 years of self-cleaning filter experience, possessing unique filter mesh structure and suction-based self-cleaning technology, utilizes a 40 μm self-cleaning filter, ensuring high performance of the MPUV disinfection downstream, and its filtration performance and stability has received adequate international market validation. Being the pretreatment unit of choice utilized by many BWMS technologies, the effect of upfront filtration will affect the entire system overall treatment performance.

- Minimize sediments entering ballast tanks, reducing ballast tank maintenance
- Unique filter structure, ensures high removal rate

  96% zooplankton (>50m) removal; 50% phytoplankton (10-50um) removal; 98% TSS (influent 2500ppm) removal
- Filter unit continues filtration during self-cleaning operation
- Short ballasting/de-ballasting time

PACT marine™ BWMS

Medium Pressure Ultraviolet (MPUV) Reactor



Being a relatively more mature disinfection technology, compared to other disinfection technologies, ultraviolet disinfection does not produce active substances, does not pose an occupational hazard to crew, more economical and environmentally friendly. PACT MARINE™ unique UV design philosophy enables the following: under Economy Mode, the BWMS adjusts the UV intensity according to incoming water quality; while under Performance Mode, the BWMS utilizes an increased UV intensity at a user prescribed setting. PACT MARINE™ MPUV Reactor in Economy Mode, compared to ordinary UV reactors, is lower in OPEX; while in Performance Mode, it is able to meet more stringent discharge requirements due to its considerable design allowance, without need for further system upgrade or modification, enabling flexible operation in different legislative regimes worldwide.

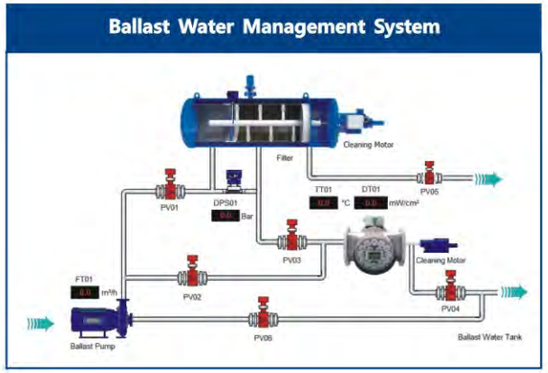
- Stable, reliable & highly adaptable performance, not affected by temperature, pH, salinity
- Equipped with temperature monitoring, BWMS alarms and aborts during abnormal operation, protecting system and vessel
- Equipped with scale removal sleeve cleaning mechanism
- Chemical-free operation, safe for crew and vessel

PACT marine™ BWMS

Control Unit

Validated under various stringent environmental challenge conditions, the control panel is able to withstand extreme temperatures, humidity, vibrations & erratic vessel movements. The Control Panel HMI is simply designed, intuitive to operate, allows for both manual and automatic operation, UV intensity adjustability, with equipment data monitoring, logging and extraction, comprehensive alarm(visual and aural) system and fault management protection capabilities.

- System sounds alarm when operating temperature, flowrate, water quality parameters and other environmental parameters shows large changes, and depending on actual circumstances, the system will decide on whether to stop operation
- UV intensity automatically compensates for lamp aging, sleeve scaling & water quality changes
- All operational action & data is automatically logged by BWMS Control Panel



PACT marOine™ BWMS

System Specifications and Models

Model: P200-P1250

Supply Voltage: 50/60Hz | 180-240VAC/1ph | 400-440VAC/3ph

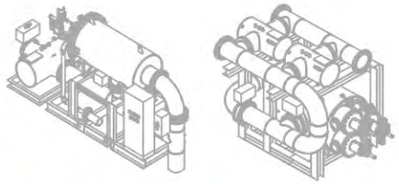
BWMS Treatment Flow-Rate: 200-4000 m^3/h

BWMS Design Pressure: 10 bar

BWMS Pressure Drop: 0.1-0.5 bar

Valve Actuation: Electrical/Hydraulic/Pneumatic (Options)

Model	Flow Range (m^3/h)	Footprint (mm)(L × W × H)		Power Rating (kW)
		Horizontal Layout	Vertical Layout	
P-200	100-200	2480x1300x1926	1150x1150x2490	27/36
P-300	250-300	2980x1300x1980	1290x1240x2540	30/48
P-500	350-500	3145x1300x2085	1490x1290x2690	54/72
P-750	550-750	3215x1300x2465	1890x1570x2890	65/84
P-1000	800-1000	3515x1300x2465	2140x1740x3050	75/108
P-1250	1100-1250	3895x1300x2465	2290x1790x3110	103/132
P-1500	1300-1500	2x P-750		2x P-750
P-2000	1600-2000	2x P-1000		2x P-1000
P-2500	2200-2500	2x P-1250		2x P-1250
P-3000	2600-3000	3x P-1000		3x P-1000
P-4000	3100-4000	4x P-1000		4x P-1000



PACT marOine™ BWMS

Factors Influencing BWM Solution Choice

Vessel Design Institutes, Dockyards & Vessel Owners should consider the following factors when deciding on the type of BWM solution to utilize:

◆ **Suitability**

Available Space in Engine Room or Deck, spare power capacity, must be considered for the appropriate BWM solution; ensure the chosen BWM solution can fulfill the vessel rated ballasting capacity requirements; crude tankers, chemical tankers and other special purpose vessels need to consider explosion-proof requirements

◆ **Reliability**

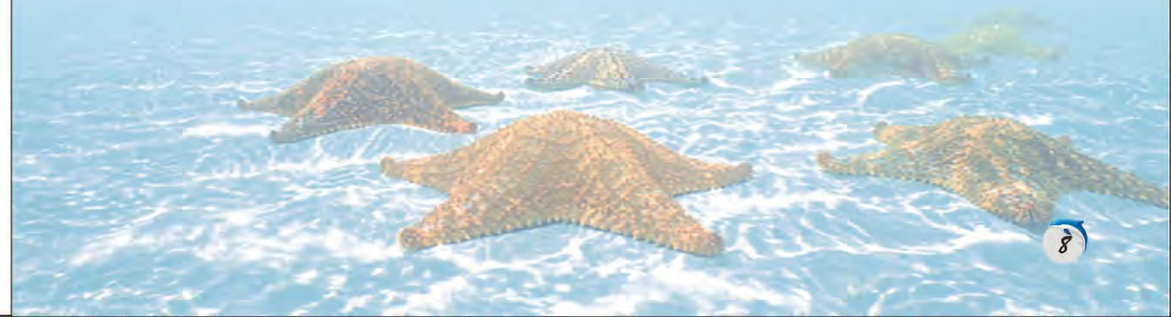
Chosen BWM solution needs to be safe, stable and reliable for long term operation, BWMS components need to be reliable; equipment should possess a flexible disinfection compensation mechanism, able to respond to occasional difficult influent water quality, more stringent discharge standards and ensure that the solution is able to always meet discharge requirements; not pose any potential safety hazard to vessel or crew

◆ **Ease of Operation**

BWMS should be structurally simple, easy & quick to install; intuitively clear, easy and simple to operate; fault reporting alarms should be clear, precise, consumables should be designed for easy change-out and maintenance; system should be designed with a high level of automation to minimize operator attention

◆ **Economical**

BWMS lifecycle cost: one time BWM solution investment, and long term O&M expenses. Need to also consider costs involving crew utility of BWMS, ship piping corrosion, and ballast tank corrosion preventive maintenance



PACT marOine™ BWMS

Influencing Factors

Factors influencing the vessel's choice of BWMS primarily are: Vessel & Route Factors.

Vessel Factor: Different vessel types have varying dependence on Ballast Water. For Bulkers & Tankers, ballast capacity is very large, and requires the BWMS to quickly complete ballasting and deballasting, making instantaneous treatment-discharge BWM solutions the right choice. For special purpose vessels (crude tankers, chemical tankers etc), whether a BWMS can meet fire and explosion proof safety requirements is mandatory.

Route Factor: Because of varying shipping routes, variations in water temperature and salinity, particularly in low temperature and salinity conditions, could result in inadequate performance of electrolysis-based BWMSs; high influent water turbidity, with resultant low UV Transmission (UVT), may affect UV-based BWMS performance, high performance filtration before UV disinfection can increase UVT under such circumstances; due to certain legislative regimes possibly requiring higher discharge standards than IMO's prescribed standard, and the possibly of trans-oceanic vessels calling on ports in these regimes, it is prudent to select a BWM solution which has the design allowance flexibility to meet the regime more stringent discharge requirements. For vessels traveling regional routes, it is not recommend to utilize a BWM solution that requires long residence time for sufficient disinfection.

PACT marOine™ BWMS

Service & Installation

Service Flow

LOI/PO ⇒ Survey/Mapping ⇒ Installation Design (3D Model) ⇒ Design Submittal ⇒ Drawings Approval ⇒ Delivery & Installation ⇒ Commissioning & Training ⇒ Warranty & After-sales Support

For most vessels, due to the simplicity of UV-based BWMS, a manual site-survey is sufficient for a speedy and high precision BWMS installation; for more complicated spatial arrangements, or installation of multiple units, a 3-D scanning of the installation site is required. In addition, for retrofits in which re-piping is not extensive, there is no need for dry-docking to commence the speedy retrofit.

A strong team with the ability to collect vessel information, conduct 3D modeling or solution design, stringent quality control on prefabricated pipe & fitting production to minimize on-site installation modification, providing more streamlined, economical installation solutions. standardized and maintenance-friendly internal piping design.

Besides having a maintenance-friendly design, intuitive & easy to operate, with a comprehensive alarm (visual and aural) system that is operator - friendly, easy to maintain, inspect and troubleshoot, PACT also possess an extensive international network which is able to respond effectively to customer needs worldwide.

Service network includes Greater China, Northeast Asia, Southeast Asia, Russia, Baltic, Middle - East, Mediterranean, North and South Africa, North and South America.