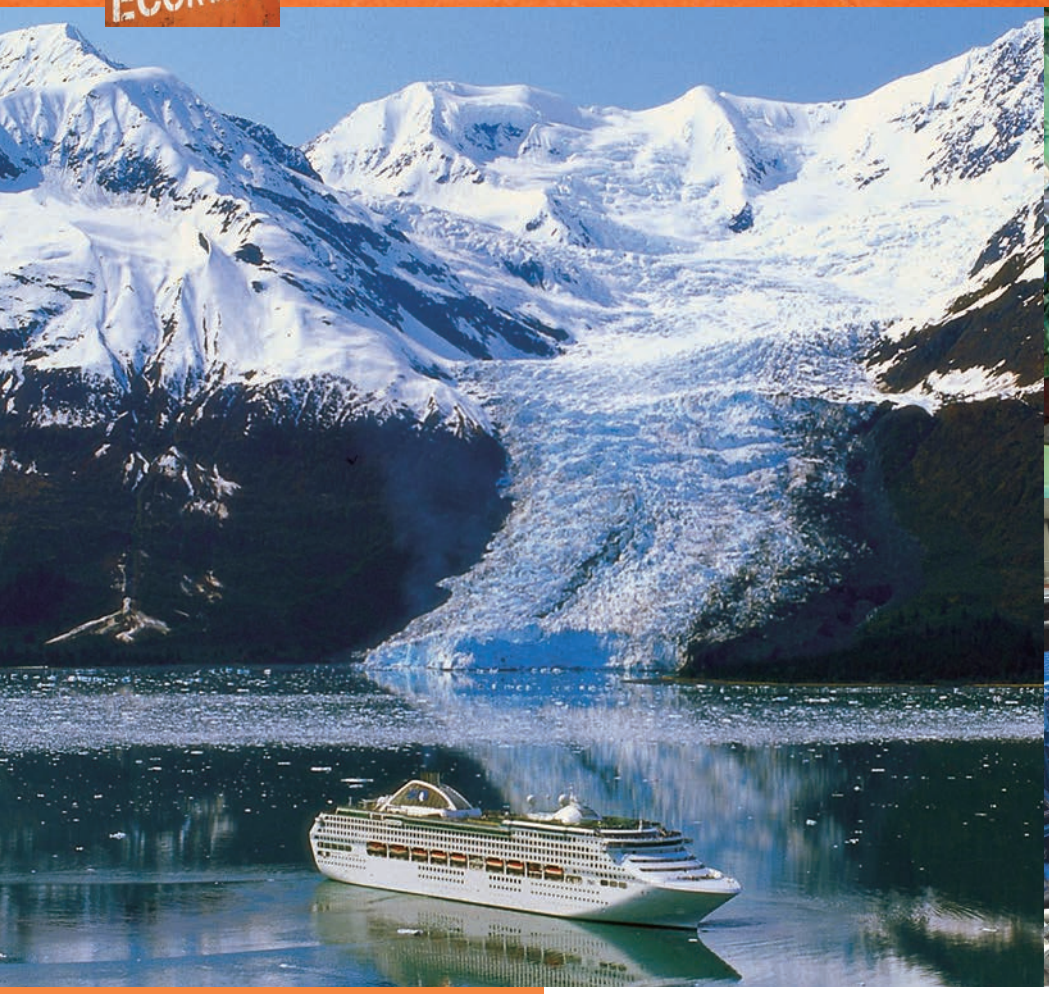
WÄRTSILÄ **Waste & Fresh Water Management**

ENERGY
ENVIRONMENT
ECONOMY

WASTE & FRESH WATER MANAGEMENT FOR MARINE APPLICATION



With over 40 years of experience in marine sanitation, Wärtsilä offer innovative water management solutions that meet all existing and anticipated standards.

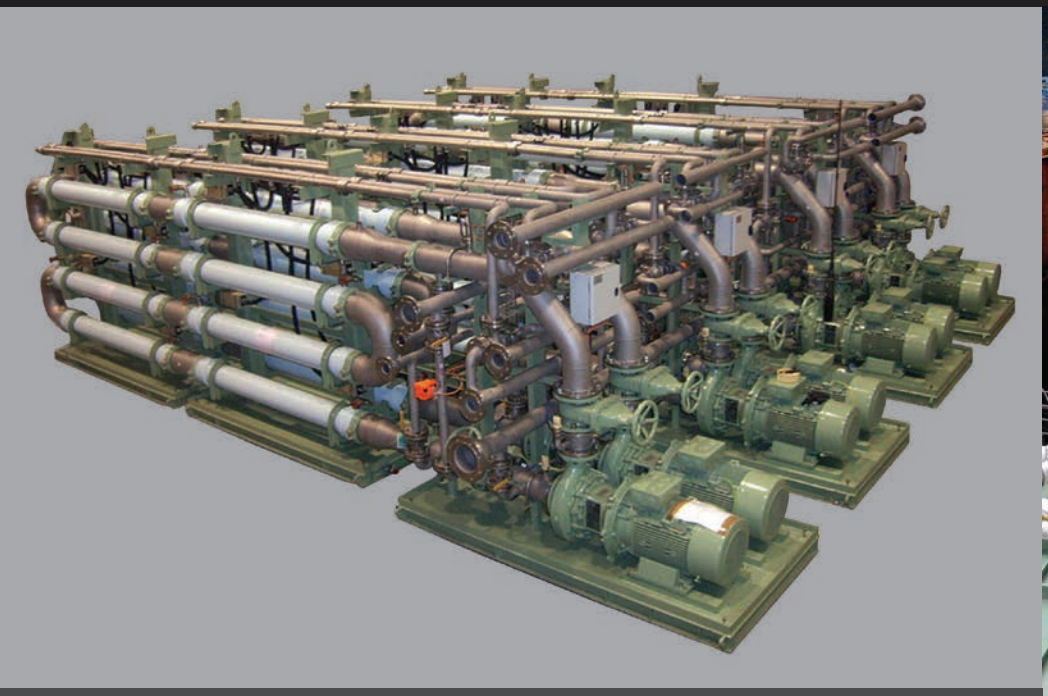
We have developed an enviable reputation for reliable machinery, backed up by an efficient spares and service capability.

Wartsila Water Systems Ltd (formerly Hamworthy Water Systems) is an innovative, market leading company providing technically advanced waste treatment systems in response to environmental needs and marine legislation. Wärtsilä are committed to supporting owners and operators providing design, products, turnkey installation and a global support network.

The Marine industry is increasingly focusing on environmental topics. In this technology arena Wartsila Water Systems continue to set the global standards in waste management by being the world's leading manufacturer of marine sewage treatment plants and fresh water generation.

WÄRTSILÄ

THE EFFICIENT, HYGIENIC END TO WASTE FOR MARINE APPLICATION



Wärtsilä Hamworthy MBR technology for cruise installation

MEMBRANE BIOREACTORS (MBR)

Wärtsilä Hamworthy's innovative MBR technology is based on biological degradation and membrane separation and allows for the treatment of grey and black water to satisfy the most stringent standards. The process produces the highest quality discharge without requiring any addition or generation of chemicals that are hazardous to the environment or ship operation. Effluent quality tests conducted by the US National Sanitary Foundation on Wartsila Hamworthy's MBR produced results exceeding the most stringent future legislative pollutant standards envisaged. The technology also achieved outstanding performance in Alaska under the scrutiny of the local authority, USCG and USEPA studies over the past seasons. The membrane permeate quality exceeds the most stringent coliform standards even without additional UV or chemical disinfection. The latest system optimisation have achieved over 25% savings on energy consumption and consumables, and over 50% reduction in operational man-hours. Satellite communication allows the MBR systems to be remotely monitored by specialists as part of our fleet support program.

MBR PRINCIPLES OF OPERATION

Black and grey water pass through the automatic screen press into the first stage bioreactor where the active biomass degrades organic material. The active biomass is pumped through an interstage filter fitted with fine mesh. The filtered biomass, free of any fibrous materials, is returned into the second stage bioreactor. Biomass is circulated through membrane modules to produce a trans-membrane pressure and scouring velocity. Clean permeate is taken from the membrane modules. The concentrated biomass is returned to the second stage bioreactor for discharge. The system is automated.

THERMAL DESALINATION PLANTS

Wärtsilä Serck Como's well-proven, multi-stage flash (MSF) principle is the most reliable thermal seawater desalination process in the world and is the only evaporation principle where heat transfer and evaporation are strictly separated.

Wärtsilä Serck Como designs and manufactures multi-stage flash desalination plants which are employed for producing fresh water from sea water, well water or industrial water. A special advantage of the multi-stage flash technology is that the specific heat consumption (or thermal efficiency) can be continuously adapted to the individual requirements of each cruise vessel.

We also offer multiple effect evaporators which are individually designed to the customer's specific requirements, plate type evaporators which utilise the waste heat from the main diesel engine jacket water, and rising film evaporators which are shell and tube type, single-stage units.

OILY WATER SEPARATORS

With the aid of Wärtsilä Oily Water Separator (OWS), the environmental aspects regarding bilge water issues are easily handled with minimum impact for the operation staff and with results that easily surpass legislative requirements.

The Wärtsilä OWS units are IMO and US Coast Guard approved and give the operator effective control over all bilge media as well as over any discharges made into the sea. The system guarantees a maximum oil content in the effluent of 5 ppm (parts per million) during continuous operation. The units are designed to conform to the highest safety standards, an essential factor for their competitiveness but also a substantial value in itself.

A complete Wärtsilä OWS consists of:

- Wärtsilä Oily Water Separator
- Solidpac solids dewatering unit (optional)
- Onsys feed pump system (standard on OWS 500 and OWS 2500)
- Bilge discharge monitoring system (optional)

VACUUM TOILET SYSTEMS

The Wärtsilä vacuum flush toilet has been designed to be mechanically simple, operationally reliable, and stylish in appearance.

Wärtsilä vacuum toilets use air to drive waste from the toilet to the treatment tank or intermediate collection tank. This contemporarily styled toilet has a built-in vacuum breaker and flush memory, is simple to install, and is supplied ready to connect. The control mechanism can be accessed without removing the bowl. By using only approximately 1 litre of water, the amount of wastewater is dramatically reduced.

We offer the following designs for Marine applications;

- AVT 13B – Bulkhead Mount
- AVT 13D – Deck Mount

PROVEN CAPABILITIES

At Wärtsilä we have strong marine references for waste water management:

PRINCESS CRUISES

In early 2010, Fincantieri and Carnival Corporation & plc reached an agreement to build two ships for Princess Cruises and are the latest luxury cruise ships to feature Wärtilä Hamworthy MBRs.

Each 3,600 passenger capacity, 141,000gt ship is fitted with two Wärtsilä Hamworthy MBR24 systems, to enable responsible operations anywhere in the world. The new ships are predicted to enter service in summer 2013 and 2014 and will be the largest newbuilds to date for Princess Cruises. The ship's design will be evolutionary, from the current Princess fleet and will offer new innovations in the fleet. The first of the two ships will become the new Royal Princess; the former Royal Princess left the Princess fleet in May 2011 when it joined P&O Cruises as MS Adonia and also features a Wärtsilä Hamworthy MBR system. The sister ship to the new Royal Princess will be named the Regal Princess.

Global and regional standards on wastewater discharge are becoming continuously more stringent. As these ships will spend part of their operating time in sensitive seas, having a Wärtsilä Hamworthy MBR system onboard allows the operator peace of mind as the system remains at the forefront of shipboard wastewater management and is designed in anticipation of upcoming regulations.

QUEEN VICTORIA

The Queen Victoria is a cruise ship operated by Cunard Line and is fitted with both a Wärtsilä Hamworthy MBR system, and a Wärtsilä Serck Como desalination plant comprising 'multi-stage flash' (MSF) evaporators.

Queen Victoria's wastewater is handled by two MBR320 Type III units, each capable of processing up to 320 m^3/day of black and grey water. Wärtsilä Hamworthy MBRs utilise a combination of biological treatment and side stream crossflow membrane technology to treat wastewater to better than the stringent standards the cruise ship must meet to operate in regulated waters.

Three Wärtsilä Serck Como MSF evaporators produce fresh water on the Queen Victoria: two with a capacity of 650 m^3/day and the other 400 m^3/day. Steam, engine jacket water or a combination of these can be used for heating. Capacities of these tailor-made MSF evaporators range from 100 tonnes/day to 1,000 tonnes/day – or even higher if the engine room arrangement allows, with steady production at sea water temperatures between 2°C and 32°C.

The power for the propulsion and the ship's systems is also provided by six Wärtsilä diesel engines.

AFTERSALES

Wärtsilä supports its customers throughout the lifecycle of their installations by optimizing efficiency and performance. We offer expertise, proximity and responsiveness for all our customers in the most environmentally sound way.

Our Services & Support solutions range from basic support, installation and commissioning, performance optimization, upgrades and conversions to service projects and agreements focusing on overall equipment performance and asset management.

We deliver aftersales support through our network of service centres in over 70 countries worldwide.

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