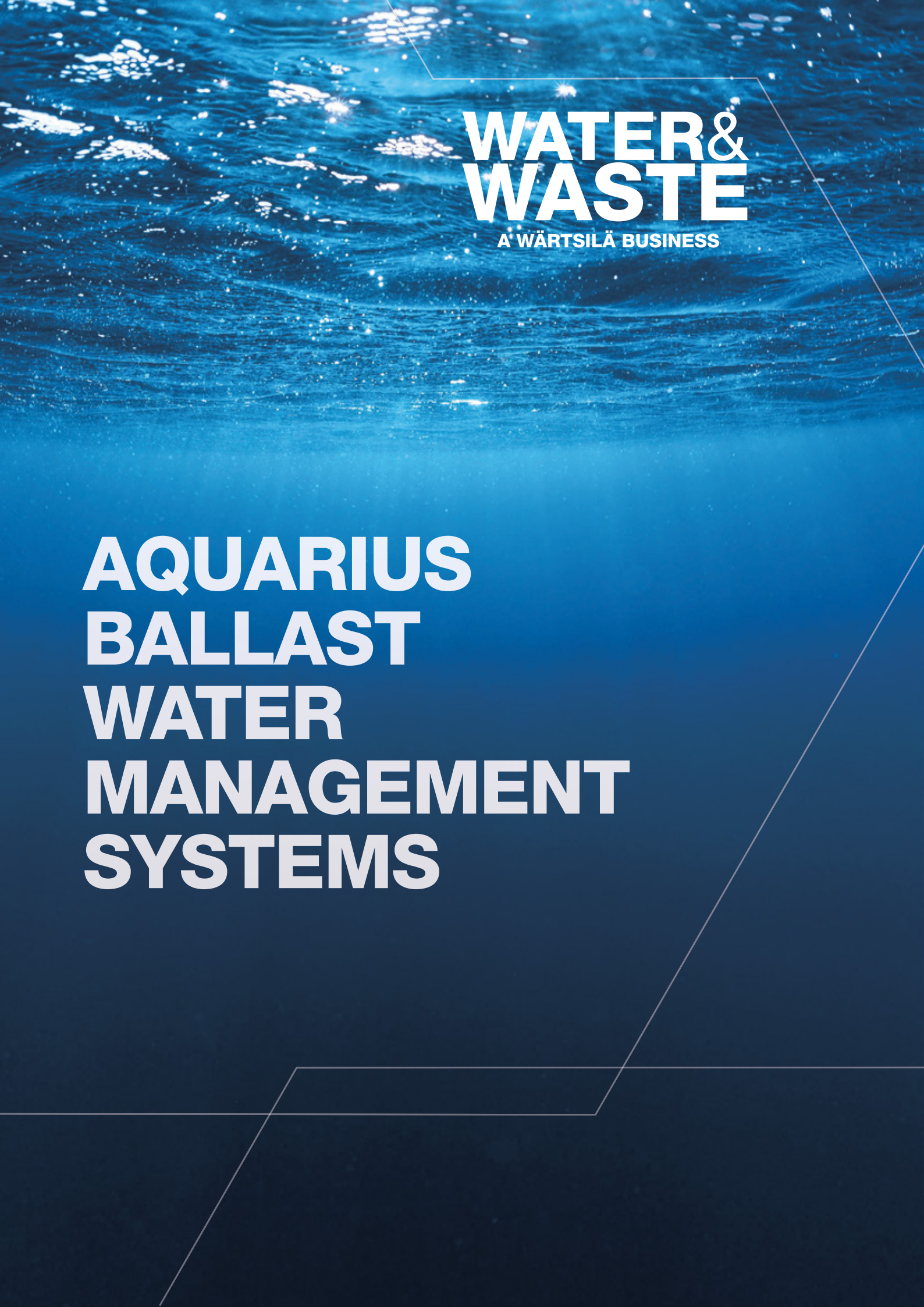




**WATER&
WASTE**

A WÄRTSILÄ BUSINESS

**AQUARIUS
BALLAST
WATER
MANAGEMENT
SYSTEMS**



“Providing a green passport for global trade”

Wärtsilä's Aquarius UV and EC ballast water management systems (BWMS) for newbuild and retrofit projects provide a low-risk path to compliance. Our approach covers all stages from fleet evaluation to operation and maintenance and lifecycle support. Wärtsilä's tailored turnkey solutions help minimise the environmental footprint of your fleet, improve operational efficiency and ensure compliance with IMO and USCG standards.

Ballast water regulations

It is estimated that approximately seven billion tons of ballast water is transported globally each year. At any given time, ballast water can contain an estimated 7,000 species

of organisms, including microscopic plants, animals, bacteria and viruses. These organisms can become invasive species, causing a change in the ecosystem balance. The purpose of a BWMS is to minimise the transfer

of non-indigenous harmful aquatic organisms and pathogens from one area of the world to another.

Ballast water management is regulated by the Ballast Water Management (BWM) Convention, which was adopted by the IMO in 2004 and entered into force globally in September 2017. By September 2024, all ships need to comply with both the IMO's D-2 Performance Discharge Standard and, if operating in US waters, the USCG 46 CFR 162.060 standard.

AQUARIUS UV / UVX

Aquarius UV is an ultraviolet BWMS that provides a safe, flexible and robust treatment process. It uses a simple and efficient two-stage process in which seawater is first passed through a back-washing filter before passing through a UV chamber, where UV light is used to disinfect the water prior to it entering the ballast tanks. On discharge, water from the tanks passes through the UV chamber a second time. The system can be used across the full range of ship operating and environmental conditions.

Aquarius UV systems use no active substances or chemicals and are easy to integrate, operate and maintain. The solution is type approved according to

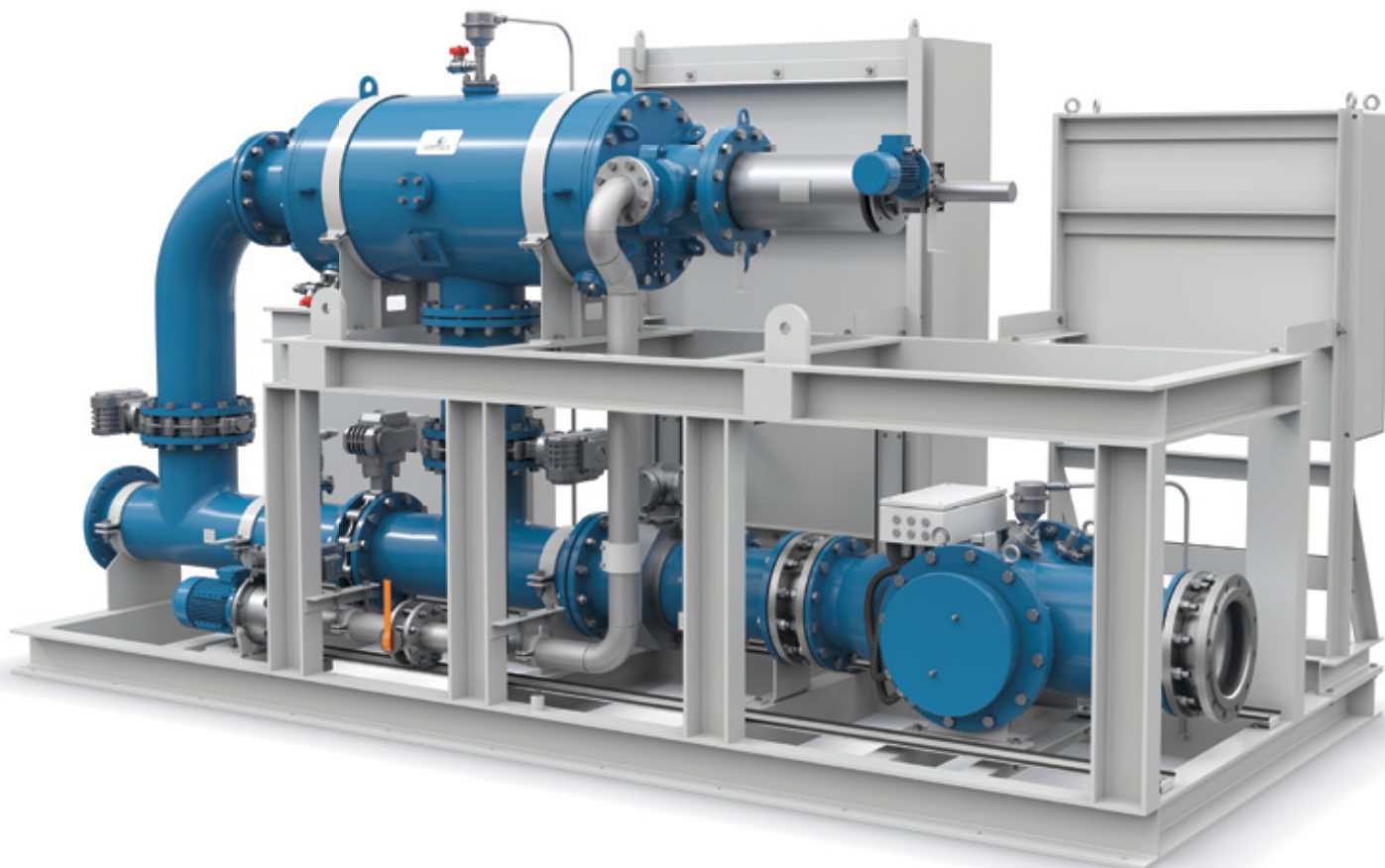
the latest IMO and USCG standards. The system is typically installed in the vessel's engine room, but we also offer a UVX version for installation in hazardous areas on tankers.

Flexible supply options

We offer tailored solutions to fit the specific needs of each individual vessel in terms of arrangement and access. The Aquarius UV can be supplied as a loose component kit, a modular arrangement or a bespoke single-skid design. Wärtsilä's global services organisation can support you with retrofit feasibility studies and engineering and commissioning.

KEY BENEFITS

- IMO & USCG type approved
- Flexible integration for retrofitting
- Long UV lamp life
- No active substances, no salinity limit
- Intelligent PLC control ensuring safe, economical automatic operation
- Ex-compliant version available for Zone 1 installations



TYPE APPROVED



TECHNICAL DATA – AQUARIUS UV/UVX

Model	Capacity (m³/hr)		Filter size (mm)			Dry weight (kg)	UV size (mm)			Dry weight (kg)
	Min. TRC*	Max. TRC*	L	W	H		L	W	H	
AQ-125-UV	12.5	125	2300	600	820	310	860	820	530	100
AQ-300-UV	30	300	2450	750	1030	475	1340	1000	670	230
AQ-500-UV	50	500	3100	750	1030	600	1340	960	670	250
AQ-750-UV	75	750	3200	1270	1390	1255	1300	1150	740	398
AQ-1000-UV	100	1000	3500	1270	1390	1315	1300	1150	740	398

*(treatment rated capacity)

PRESSURE DROP

- Normal operation: 0.3 barg
- Backflush set point: 0.8 barg

Model	Power panels	L (mm)	W (mm)	H (mm)	Panel weight (kg)	Total weight (kg)	UV total power (kW)	UVX total power (kW)	Control panel size (mm)		
									L	W	H
AQ-125-UV	1	1200	500	1360	280	280	19	20	1000	300	1000
AQ-300-UV	1	1200	500	1740	450	450	48	48			
AQ-500-UV	1	1200	500	1960	550	550	63	63			
AQ-750-UV	2	1200	500	1960	1 x 500 1x 450	950	92	92			
AQ-1000-UV	3	1200	500	1960	3 x 550	1650	99	99			

Proven filtration combined with robust UV treatment

During uptake the ballast water passes through a screen filter which removes particulates, sediment, zooplankton and phytoplankton over 40/25* microns in size. Automatic backflushing ensures and maintains filtration efficiency.

The filtered ballast water is directed to a disinfection chamber, where medium-pressure UV lamps in a cross-flow arrangement disinfect the water before

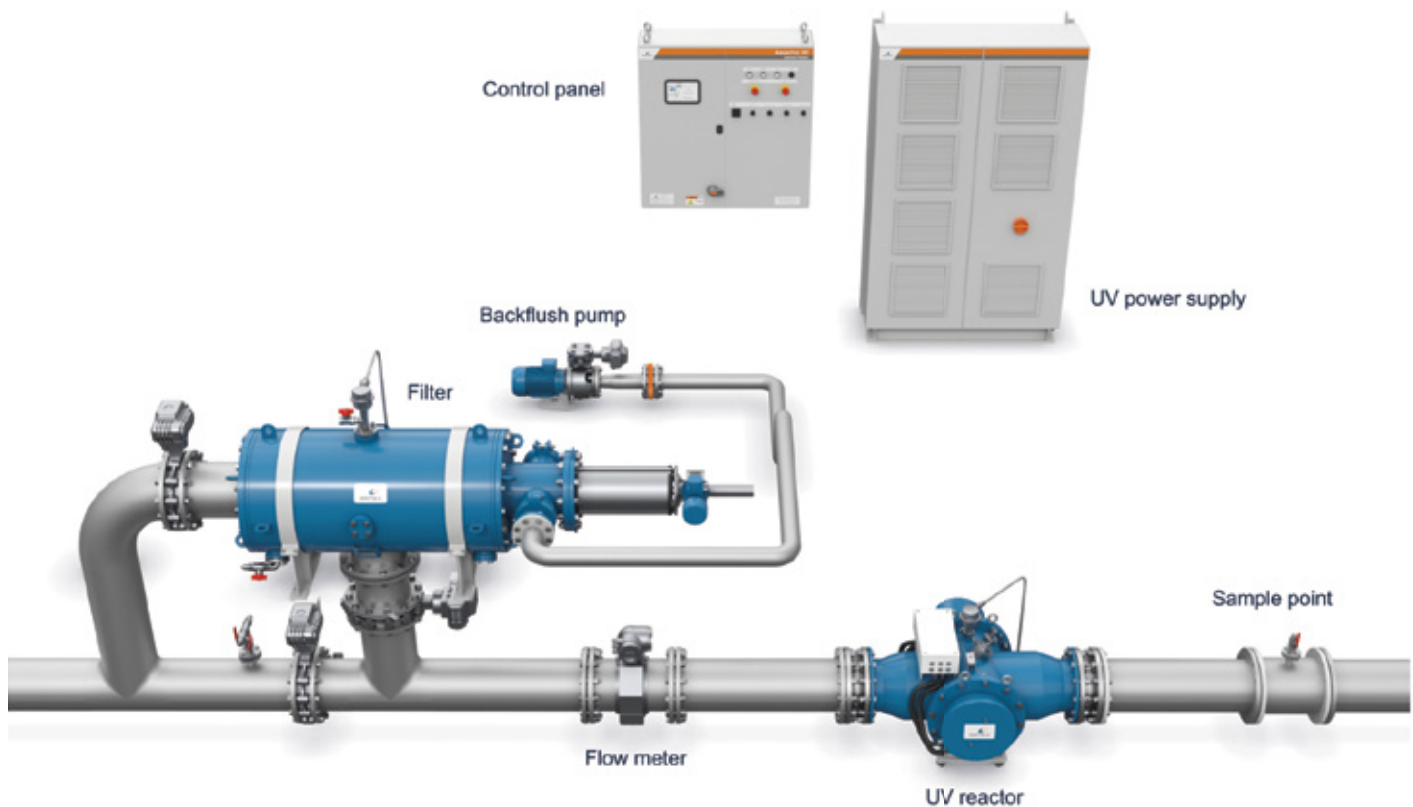
it is directed to the ballast tanks. To maintain maximum effectiveness, the UV lamps are fitted with an automatic wiper system which prevents fouling and the accumulation of deposits on lamp sleeves.

The UV light intensity is continuously monitored during operation to ensure that the desired dose for maximum treatment efficiency is achieved. During discharge, the ballast water is pumped from the tanks back through

the UV disinfection chamber for final treatment before being discharged overboard. The filter is bypassed during discharge.

*25-micron filters, available as standard up to 500 m3/hr (Manta filters only)

SCOPE OF SUPPLY



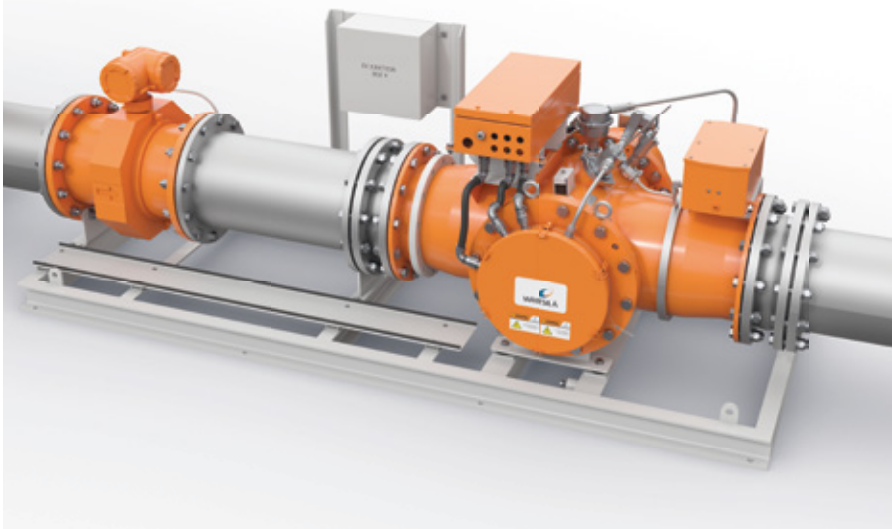
AQUARIUS UVX

For vessels that require a hazardous-area installation, Wärtsilä Water & Waste can provide an Ex and IECEx rated BWMS. This system complies with Directive 2014/34/EU and IECEx scheme rules (IECEx 02). Operationally the UVX system is the same as our standard UV system, the difference being that components are tested and rated in accordance with Ex and IECEx guidelines. To ensure a compliant installation, the filter, UV chamber, flowmeter and associated valves are installed in the Zone 1 hazardous area. The remaining equipment – the power supply unit and main control panel – are installed in the vessel's safe area.

Hazardous-area components for the UVX system



Filter system



UV chamber and flowmeter

“Aquarius UVX – ensuring compliance and safety on the seas”



AQUARIUS EC / ECX

The Aquarius EC is one of the safest and most robust electro-chlorination based BWMS on the market. Designed and built by Wärtsilä, the Aquarius EC treats ballast water using a simple and efficient two-stage process where seawater is first passed through a back-washing filter before passing through a static mixer, where disinfectant generated from the side-stream electrolysis unit is injected. This ensures a maximum level of 10 ppm in the treated ballast water.

The Aquarius EC is easy to integrate, operate and maintain and is type approved according to the latest IMO and USCG regulations. Its Treatment Rated Capacity (TRC) is up to 4000

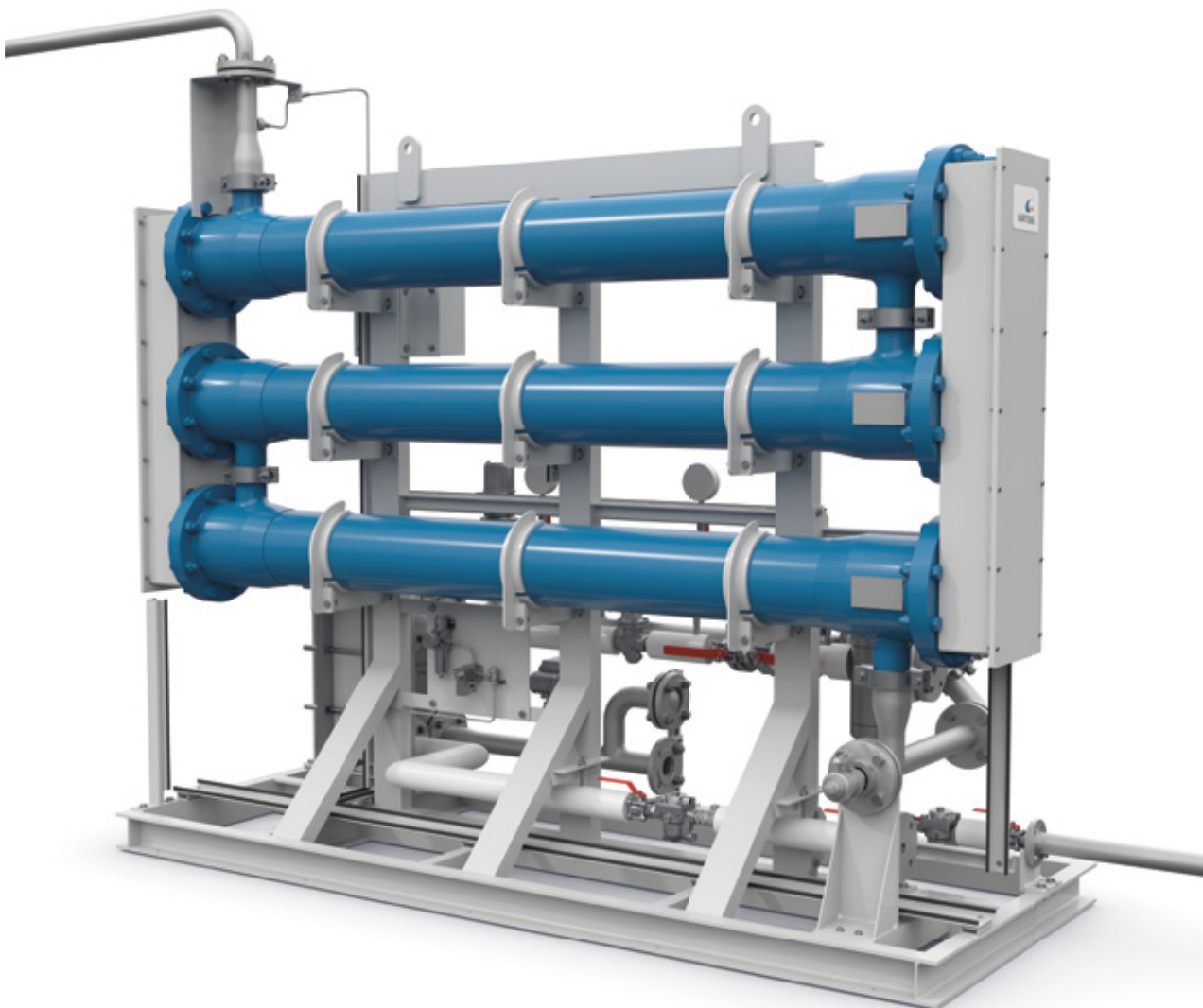
m³/h for a single system. The system is typically installed in the vessel's engine room, but we also offer an ECX version for installation in hazardous areas on tankers.

FLEXIBLE SUPPLY OPTIONS

We offer tailored solutions to fit the specific needs of each individual vessel in terms of arrangement and access. The Aquarius EC can be supplied as a loose component kit, a modular arrangement or a bespoke single-skid design. Wärtsilä's global services organisation can support you with retrofit feasibility studies and engineering and commissioning.

KEY BENEFITS

- IMO & USCG type approved
- Flexible integration for retrofitting
- No salinity or temperature limits
- Safe, sustainable and economical in-situ disinfectant generation
- Efficient dosing controls
- Intelligent PLC control ensuring safe, economical automatic operation
- Ex-compliant version available for Zone 1 installations



TYPE APPROVED



TECHNICAL DATA – AQUARIUS EC/ECX

Model	Capacity (m³/hr)		Total footprint (m²)	Installed power (kW)	Filter size (mm)			Dry weight (kg)	Total weight (kg)
	Min. TRC*	Max. TRC*			L	W	H		
AQ-550-EC	55	550	11.4	38	3100	0750	1030	600	4695
AQ-1200-EC	120	1200	14.5	75	3500	1300	1400	1500	1500
AQ-1650-EC	16.5	1650	15.8	104	3100	1700	1900	3300	3300
AQ-2500-EC	250	2500	15.5	161	3600	1750	2100	3100	3100
AQ-3300-EC	330	3300	16.5	202	4000	1750	2100	3600	3600
AQ-4000-EC	400	4000	16.7	245	3500	2200	2200	5084	5084

*(treatment rated capacity)

NOTE 1: Assumed operating conditions: Installed power at 15°C & 15PSU

NOTE 2: Power panel size will be confirmed during the specification phase

PRESSURE DROP

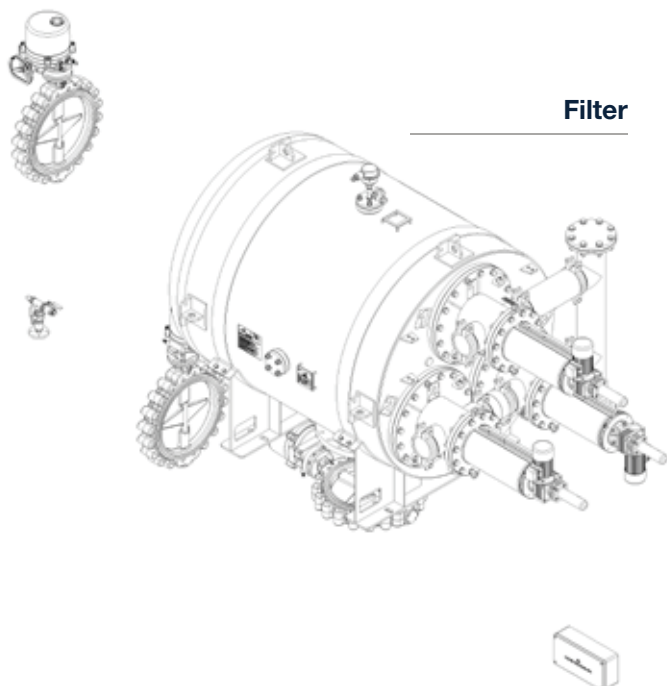
- Normal operation: 0.3 barg
- Backflush setpoint: 0.8 barg

CONTROL PANEL (FLOOR MOUNTED)

- W 1340 mm x D 1950 mm x H 412 mm
- Weight: 250 kg

MATERIALS

- Supporting framework: Mild steel
- Static mixer: Powder-coated mild steel
- Filter: Epoxy-coated mild steel/Duplex 904L screen
- Module pipework: Galvanised steel/composite
- Consumables: Sodium bisulphite
- Sensor: total residual oxygen reagent



Proven filtration and electro-chlorination

During uptake the ballast water passes through a screen filter which removes particulates, sediment, zooplankton and phytoplankton over 40 microns in size. Automatic filter cleaning ensures and maintains filtration efficiency.

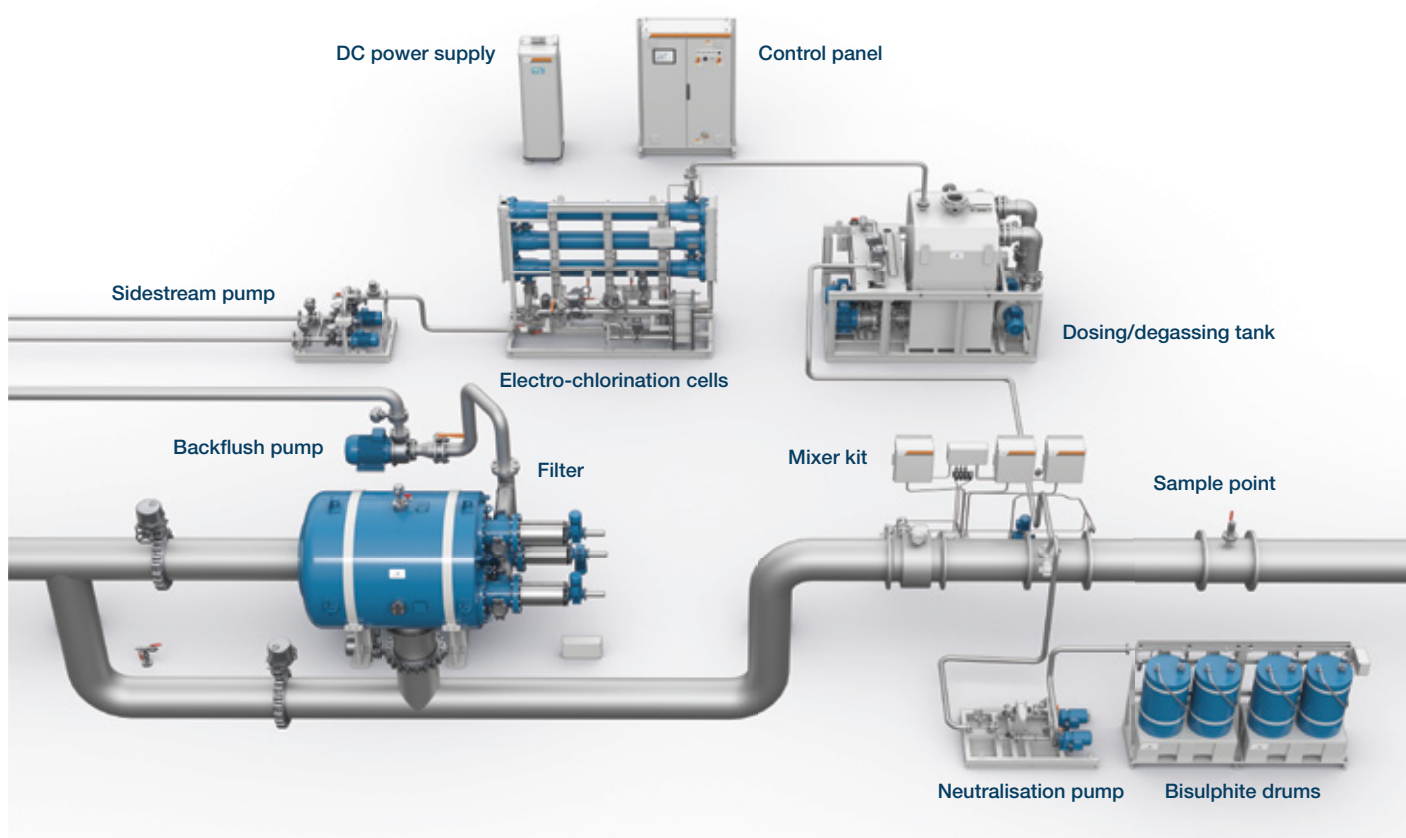
Disinfectant TRO (total residual oxidant) is produced by an EC cell module

comprising electrolytic cells specifically designed to generate sodium hypochlorite from seawater. The sodium hypochlorite is pumped into the main ballast line, where it is mixed with filtered ballast water for efficient disinfection before being pumped into the ballast tanks. Ballast water TRO concentration is monitored to ensure the correct hypochlorite dose. During discharge, the filter is bypassed and

the residual concentration of TRO in the treated ballast water is monitored before being discharged overboard.

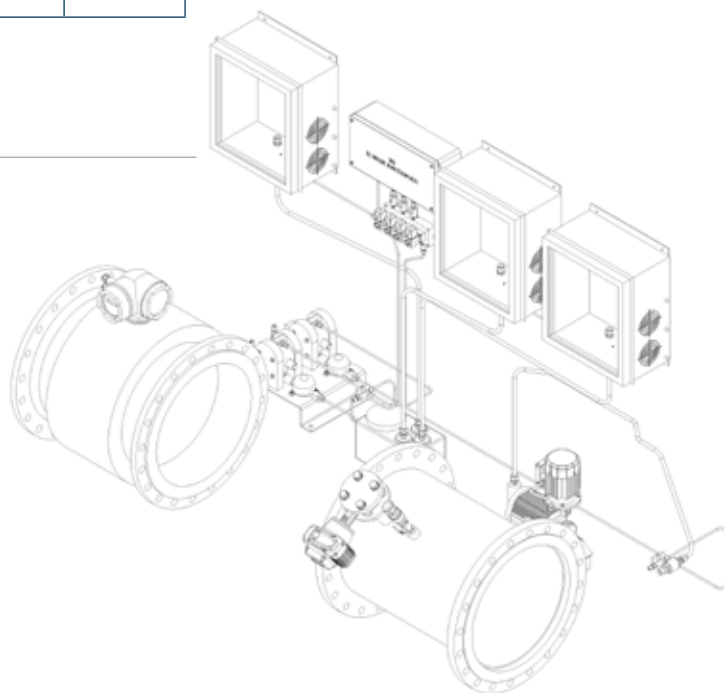
If required, the treated ballast water can be neutralised by injecting sodium bisulphite into the main ballast line during discharge. This process is continuously monitored to ensure compliance with MARPOL discharge limits.

SCOPE OF SUPPLY

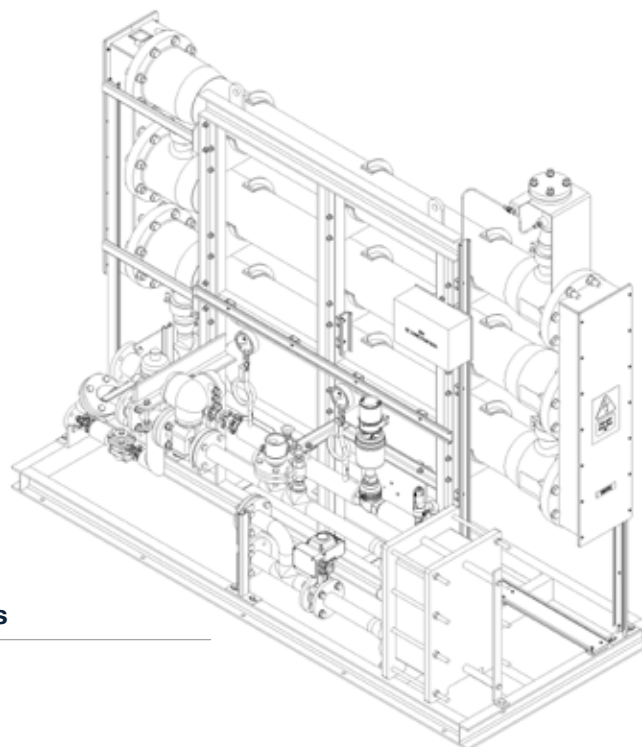


Model	Flange connection size (BS EN 1092-1 / DIN 2501-1 PN10)		Dry weight (kg)
	Mixer inlet/outlet	Flowmeter inlet/outlet	
AQ-550-EC	DN300	DN300	300
AQ-1200-EC	DN400	DN400	400
AQ-1650-EC	DN450	DN450	400
AQ-2500-EC	DN600	DN600	610
AQ-3300-EC	DN600	DN600	610
AQ-4000-EC	DN600	DN600	610

Static mixer



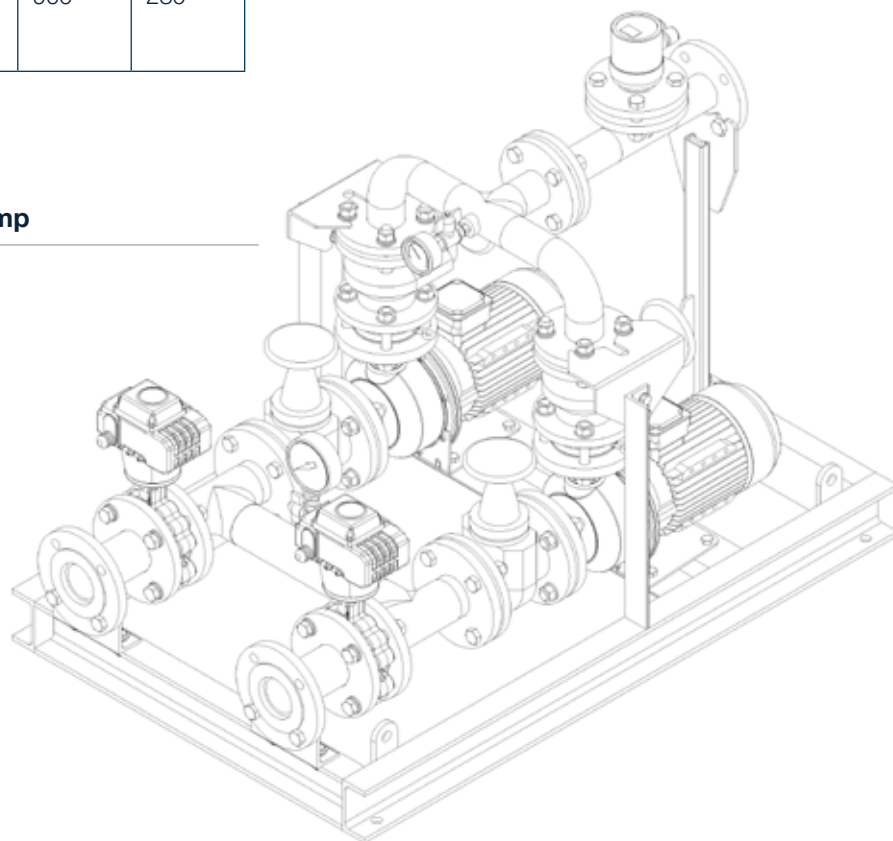
Model	EC cell size (mm)			Dry weight (kg)
	L	W	H	
AQ-550-EC	2700	1000	1500	585
AQ-1200-EC	2700	1000	1800	760
AQ-1650-EC	2700	1000	2200	930
AQ-2500-EC	2700	1000	1900	930
AQ-3300-EC	2700	1000	2400	1180
AQ-4000-EC	2700	1000	2900	1200



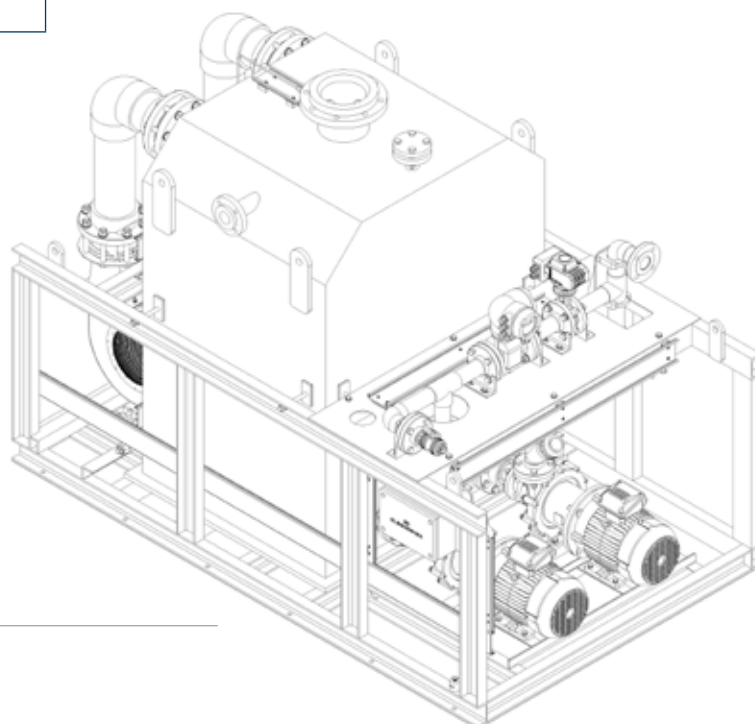
Electro-chlorination cells

Model	Capacity (m³/hr)	Pump size (mm)			Dry weight (kg)
		L	W	H	
AQ-550-EC to AQ-4000-EC	5–20	1200	800	900	280

Sidestream pump



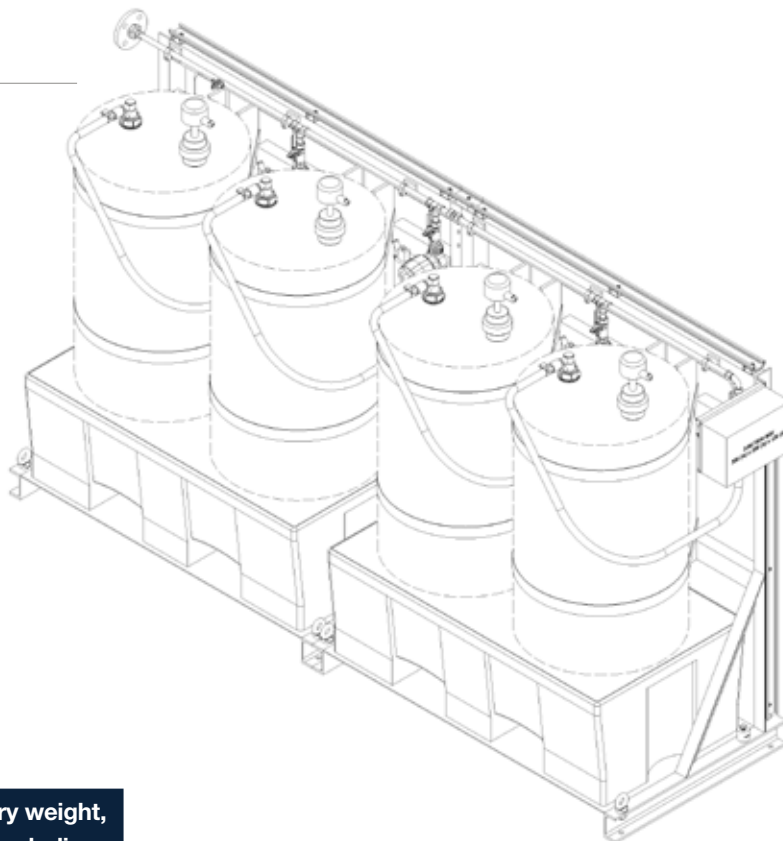
Model	Tank size (mm)			Dry weight (kg)
	L	W	H	
AQ-550-EC to AQ-4000-EC	2550	1550	1900	1400



Dosing/degassing

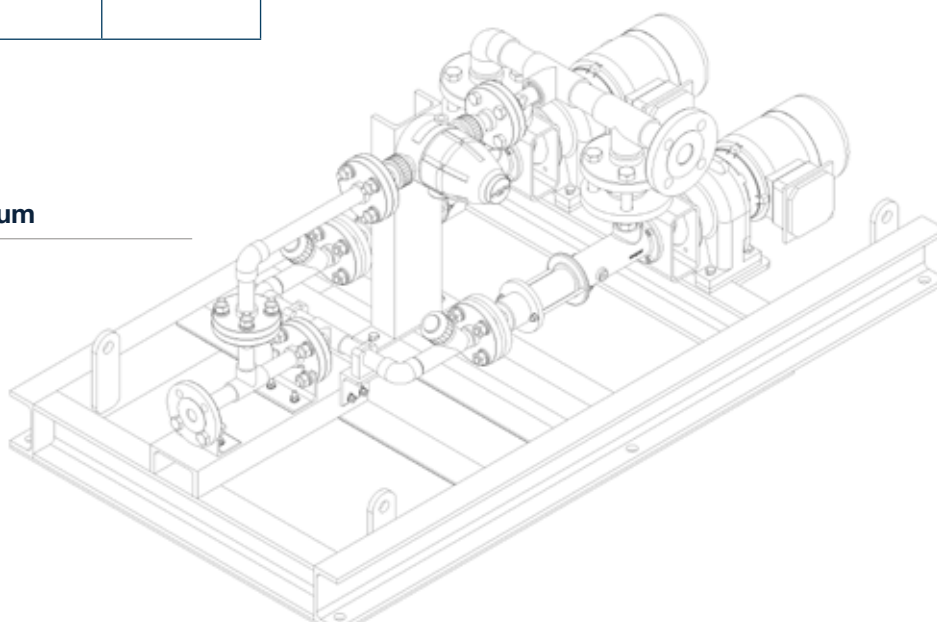
Model	Neutraliser size (mm)			Dry weight (kg)
	L	W	H	
AQ-550-EC to AQ-4000-EC	1300	700	500	145

Neutraliser

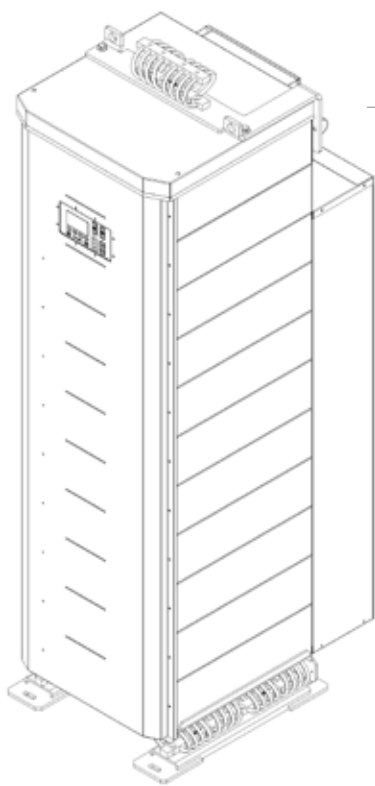


Model	Drum size (mm)			Dry weight, excluding drums (kg)
	L	W	H	
AQ-550-EC to AQ-4000-EC	3080	810	1700	500

Neutraliser drum



Model	Panels	L (mm)	W (mm)	H (mm)	Panel weight	Total weight	EC total installed power	ECX total installed power
AQ-550-EC	1	710	520	1100	216	216	37.85	39.13
AQ-1200-EC	1	710	520	1800	355	355	75.26	76.64
AQ-1650-EC	1	710	520	1940	386	386	103.89	102.17
AQ-2500-EC	2	710	520	1800	216	432	161.33	163.47
AQ-3300-EC	2	710	520	1940	355	710	202.01	202.65
AQ-4000-EC	3	710	520	1800	216	648	245.88	246.7



Electrical panels

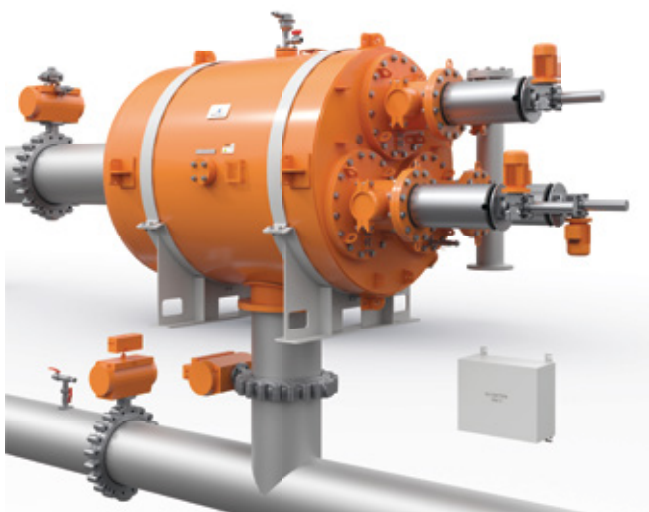
“Aquarius EC –
treating high ballast
water volumes with
a low operational
impact”



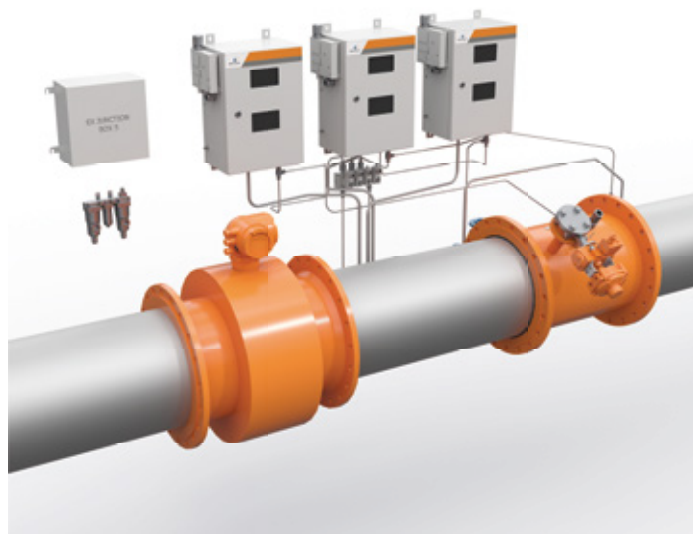
AQUARIUS ECX

For vessels that require a hazardous-area installation, Wärtsilä Water & Waste can provide an Ex-rated BWMS that complies with Directive 2014/34/EU. Operationally the ECX system is the same as our standard EC system, the difference being that the treatment components are tested and rated in accordance with Ex guidelines. To ensure a compliant installation the filter and mixer components are installed in the Zone 1 hazardous area. The remaining equipment is installed in the vessel's safe area as per the standard EC system.

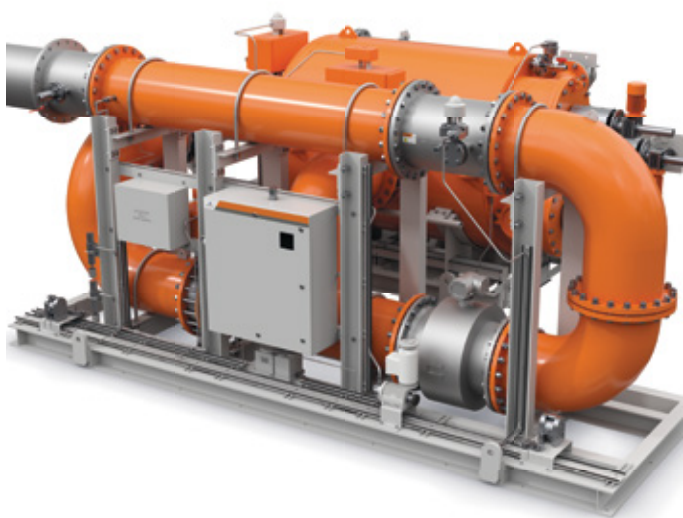
Hazardous-area components for the ECX system



Filter system



Mixer kit and sample point



Skidded version of filter, mixer kit and sample point

SELECTION CRITERIA

Criterion	UV	UVX	EC	ECX
Treatment capacity 25–2000 m³/hr	x	x		
Treatment capacity 1000– 2000 m³/hr	x	x	x	x
Treatment capacity 2000–4000 m³/hr			x	x
Suitable for freshwater operation	x	x	x	x
Full power treatment in uptake and discharge	x	x		
Suitable for ATEX applications (non-US flag)		x		x
Suitable for IECEx applications (US flag)		x		
Fully automatic operation (integrated PLC)	x	x	x	x
Suitable for Zone 1 IIC T4 environments		x		x
40-micron sediment filtration	x	x	x	x
25-micron sediment filtration	x	x		
Capable of handling high solids and TSS loads	x	x	x	x
Full 904 duplex screen filter	x	x	x	x
Low backflush volume vs. TRC	x	x	x	x
Critical components supplied duty/standby			x	x
Power consumption (full load) per 1000 m³ (kW)	99	99	63	63
Power consumption (nominal load) per 1000 m³ (kW)	99	99	54	54
Available as single-skid plug & play installation	x	x		
Modular/kit design for extra flexibility	x	x	x	x
Suitable for aft peak treatment	x		x	
Chemical (active substance) free treatment	x	x		
Remote console	x	x	x	x

FIVE STEPS TO A PROVEN, COMPLIANT BWMS

Wärtsilä Water & Waste follows the below process when specifying, designing and installing your BWMS.

STEP 1. Data collection and system selection

This involves gathering the relevant vessel data such as pump capacity, operational profile, class, flag and other pertinent data to help determine equipment type, size and scope of supply. If requested, we can supply a high-level feasibility study outlining the available options.

STEP 2. Vessel survey, 3D scan and design

The next step is to perform a 3D laser scan of the proposed installation site to support development of complete mechanical and electrical engineering documents and system installation plans. Following this the connections to existing pipework are planned, avoiding conflicts with existing structures/equipment and identifying suitable equipment locations. The design phase can include all the required documentation for class approval to simplify the process and ease your burden. Aside from the main pipework penetrations, some of this work can be conducted prior to the drydock phase to shorten the drydock time.

STEP 3. Procurement and manufacturing

All the equipment, required pipework, valves, cabling and other components are manufactured and delivered ready for installation. Wärtsilä Water & Waste collaborates with several trusted and highly experienced partners to perform system installations. During this phase the required base frames, mountings and associated fixings required for the installation are prefabricated.

STEP 4. Installation

Materials are transferred onto the vessel and the installation is performed according to the design specifications. Installation can be performed by the shipyard under supervision or carried out by a trusted Wärtsilä partner. In both cases Wärtsilä Water & Waste will ensure that the installation design plan is followed. All wiring will be completed, and power taken from a new or existing

breaker on the vessel. The system then goes through an installation readiness check prior to commissioning.

STEP 5. Commissioning

Commissioning including dry and wet commissioning can be performed by Wärtsilä or a trusted partner. This step includes demonstration for the relevant class society and operation and maintenance training for crews. Following commissioning, all vessels must complete commissioning testing before being issued their International Ballast Water Certificate by the relevant flag authority. This testing must be carried out by an independent laboratory, and Wärtsilä can support you in finding a suitable service provider.



LIFECYCLE SUPPORT SERVICES

Wärtsilä Water and Waste's in-house technical service specialists provide lifecycle support covering installation, commissioning, operation and preventative maintenance complemented by our team of highly experienced service and commissioning engineers.

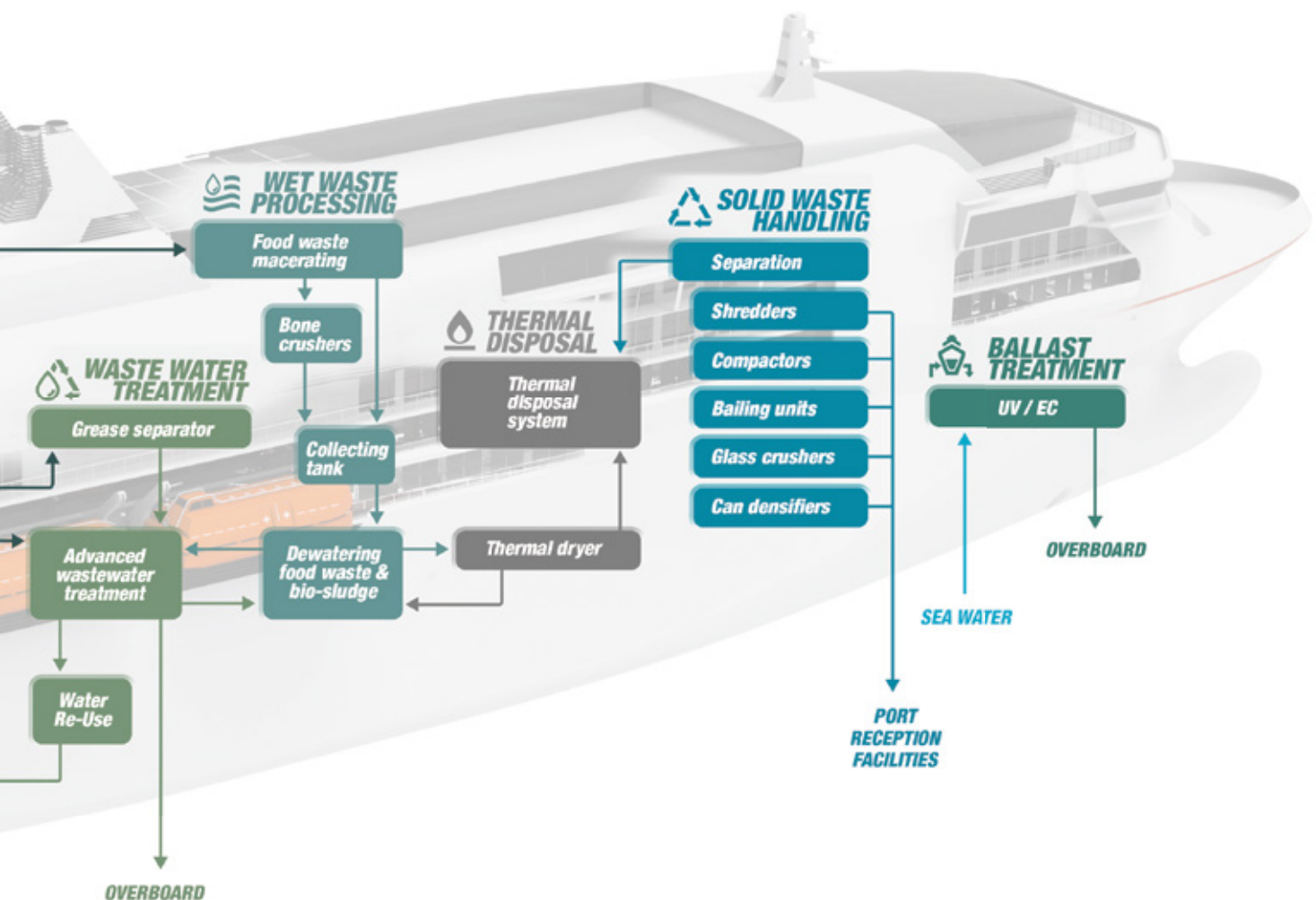
Our lifecycle support services include:

- scheduled maintenance
- repairs
- remote support
- obsolescence management
- modernisations and upgrades
- installation and commissioning
- inspections

A SOLUTION TO EVERY CHALLENGE

Ballast water management systems are part of Wärtsilä's wider water and waste offering, which provides shipyards and vessel owners and operators with solutions to all their water, waste and wastewater challenges.

Our offering also includes treatment systems for wastewater and wet and dry waste as well as freshwater generation systems.



WÄRTSILÄ WATER & WASTE OFFERS A WIDE RANGE OF ENVIRONMENTAL SOLUTIONS FOR THE MARINE AND OFFSHORE INDUSTRY.

Our broad range of dedicated and proven environmental products include wastewater treatment systems (conventional biological sewage treatment plants and advanced membrane bioreactors), ballast water management systems, freshwater generators (reverse osmosis plants and evaporators) and vacuum toilets and vacuum collecting systems. All our solutions meet existing and anticipated regulations, including regulations for environmentally sensitive areas.

<https://www.wartsila.com/waw/about>

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