



**ERMA FIRST**  
ESK ENGINEERING SOLUTIONS S.A  
Ballast Water Treatment System

**WE RESPECT  
THE DIFFERENCES**



# EXPERIENCE THE BALLAST WATER MANAGEMENT SYSTEM



ERMA FIRST S.A has developed an autonomous and reliable system for the treatment of ballast water according to the D-2 standards of the convention. The system uses an **advanced filtration** and **cyclonic separation** stage for the removal of large organisms and sediment in combination with an **electrolytic cell** for the production of free chlorine eliminating the remaining viable organisms. The system operates only in ballasting and it is based on a modular design.

## The ERMA FIRST Ballast Water Treatment System consist of:

### A 200 microns mesh self-cleaning pre-filter:

The pre-filter is efficiently removing larger particles and organisms from the sea water, having a very low pressure drop, even in very high sediment uptake. The filter basket cleaning is based on the Bernoulli principle. A disk moved by a piston generates high local increase in fluid velocity between the flushing disk as it moves into the screen and the filter insert. The resulting drop in pressure gives contact free cleaning of the screen and the particle escape via a flushing valve, which when opened, creates a pressure difference with the working pressure, thus discharging the particles.

### 20 microns Hydrocyclones.

The innovative, state-of-the-art Hydrocyclones are operating without any moving parts, through using the centrifugal forces induced by the internal structural geometry of the cyclones, capable of achieving a separation efficiency of **100% for 20 microns, 80% for 10 microns and 60% for 5 microns** of organisms and particles, providing much cleaner water to the disinfection stage, at a stable capacity, while the separated particles are removed through an ingenious self-drain effect, eliminating clogging risks through ballasting operations.

### Advanced Technology Electrolysis Cells.

By using specially coated titanium electrodes and small modular units absorbing very low power, the ERMA FIRST advanced technology electrolysis cells produce - among other substances – a very small concentration of sodium hypochlorite for the disinfection of the ballast water, while having a very low hydrogen production as by-product. ERMA FIRST electrolysis cells can operate in a wide range of salinities and temperatures, without using any additional chemicals.





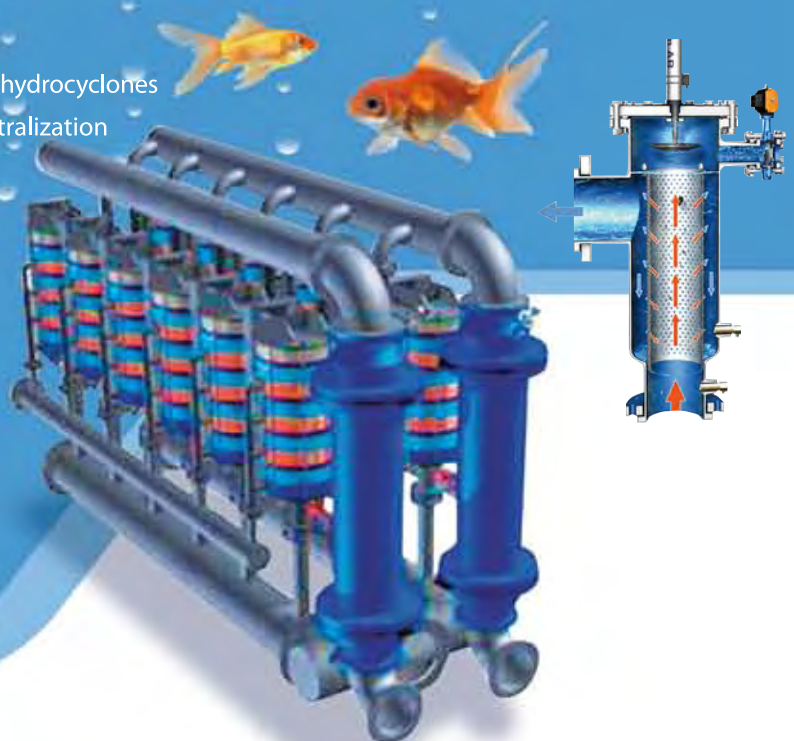
### Neutralization Unit.

Operated only during de-ballasting, neutralization of any residual sodium hypochlorite in the ballast tanks is effected through a direct dosing of sodium bisulfite in the de-ballasting stream, in case the residual sodium hypochlorite is above 0.2 mg/lit. Two chlorine sensors control the neutralization process, while a small sodium bisulfite tank is used.

### The Treatment Process

During Ballasting, the vessel's Ballast Pump is delivering sea water to the pre- filter, where sediments and particles larger than 200  $\mu\text{m}$  are retained. Then the Ballast Water passes from the hydrocyclones, where particles of larger than 10  $\mu\text{m}$  are separated using the centrifugal force effect. After the above process, Ballast water free from particles and sediments enters the electrolytic cell, where specially coated electrodes are producing low concentration free chlorine for the disinfection of the ballast water from micro-organisms. The product of this process flows to the ballast tanks so that the residual oxidants disinfect any harmful organisms taken on board.

During de-ballasting, the pre-filtering equipment, hydrocyclones and electrolytic cells are by-passed, and only neutralization of the total residual chlorine is performed by adding aqueous sodium bisulfate solution to the treated ballast water through a dosing pump.



## TROUBLE- FREE OPERATION

One of the biggest problems associated with Ballast Water Treatment systems on board is their unstable performance in difficult sea water conditions such as:

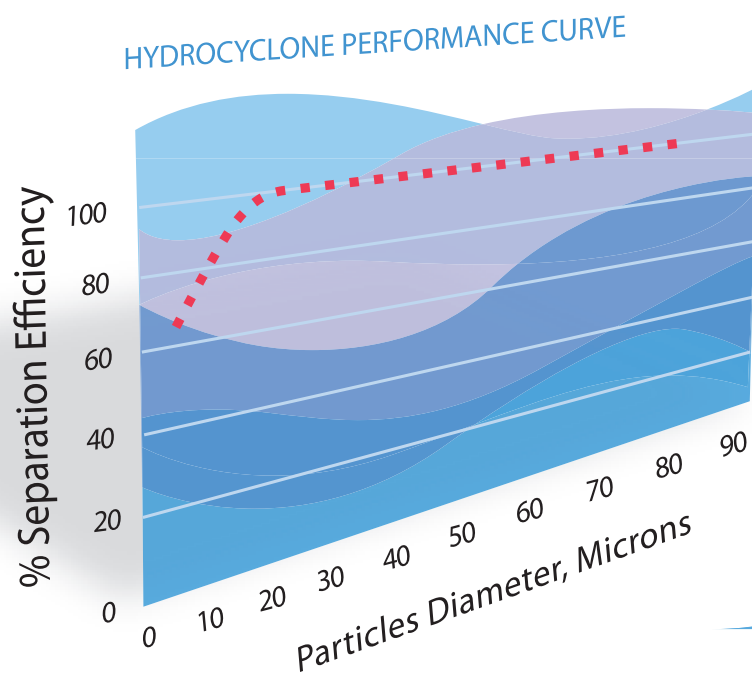
- Very high sediment quantity.
- Dirty river waters with high turbidity.
- Very high number of micro-organism and bacteria in sea/river waters.

ERMA FIRST provides a UNIQUE solution to the above harsh conditions that can be frequently anticipated in regions such as heavy sediment River Estuaries, Dirty Waters, Heavily Polluted waters: **The innovative Hydrocyclone design.**

## Innovative Hydrocyclone

The hydrocyclone is comprised of specially-machined disks, made of synthetic material, stacked vertically, incorporating **mini-cyclone geometries** that enable efficient separation of micro-organisms and sediments **larger than 10 microns**, by using **centrifugal forces** induced due to the water movement inside it.

**The combined effect of fluid velocity and centrifugal forces enable separation of particles from water through an overflow stream and an underflow where sediments are draining back the ballast water origin.** Thus, even in very dirty-sedimentated waters, the hydrocyclone needs **no backflushing** and provide at all times **STABLE water flow** capacities, with **STABLE pressure drop** surpassing clogging risks as associated with typical back-flushing filters.



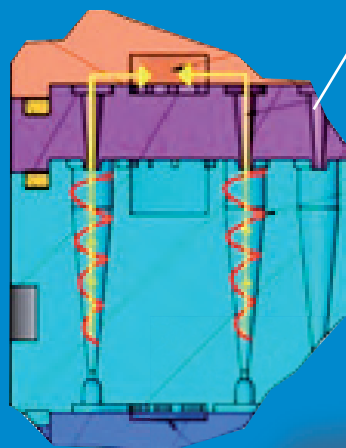
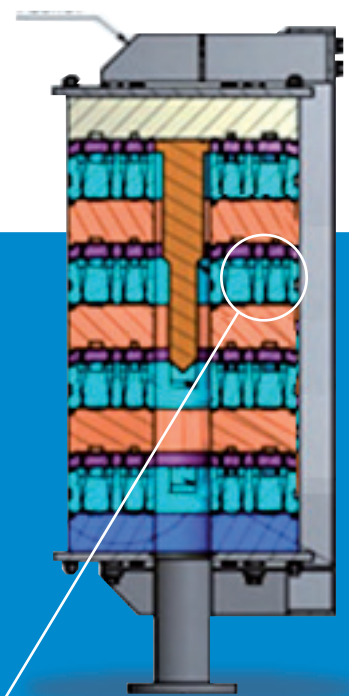
ERMA FIRST BWTS, through the innovative hydrocyclones, which allow particles of only less than 10 microns to enter the Ballast Tanks, is the only Ballast Water Treatment system that provides THE MOST CLEAN SEA WATER to both the ballast tanks and to the disinfection unit, thus further eliminating re-growth, reducing sediment amount in the BW tanks (further minimizing maintenance costs in Drydock) and reducing energy consumption of the disinfectant unit (i.e. electrolysis cells).

### Benefits for the Owner:

- STABLE flow capacity at all water sediment load conditions.
- No need for back-flushing.
- No clogging risks & emergency situations on board during ballasting.
- Simplicity of operation ( no crew involvement ) –self-drain action.
- No Maintenance Costs associated with Hydrocyclone operation (no moving parts).
- Redundancy & Uninterrupted operation at all sea conditions
- Cleaner water inside ballast tanks – improving lifetime of coatings and minimizing maintenance costs.

### Benefits for the Shipyard:

- Very small size of Hydrocyclones – easy installation.
- Very small pressure drop of Hydrocyclones – very easy retrofit, no need for ballast piping modifications.
- No Power consumption required for the hydrocyclones.
- No clogging risks during sea trials.

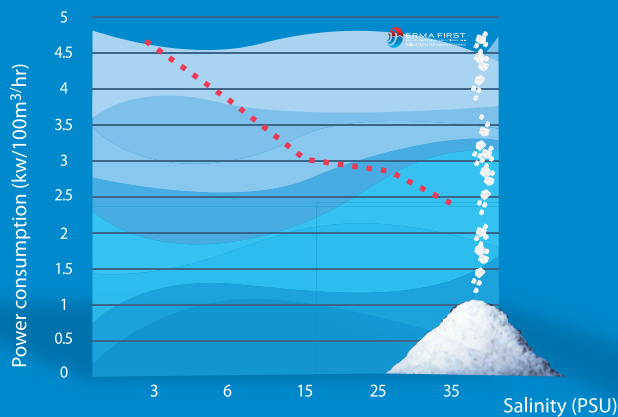


Sediment follows the red pattern while clean water escapes from the top, following the yellow pattern.

## ENERGY EFFICIENCY

Due to the Hydrocyclones performance and the Advanced Electrolysis cells technology, ERMA FIRST BWTS operates at **very low power consumption** to all salinity range.

At a salinity of 15 PSU (brackish water), ERMA FIRST BWTS consumes only 3kW / 100 m<sup>3</sup>/hr of Ballast Pump Capacity, whereas in normal salinity waters (i.e. 33 PSU), ERMA FIRST BWTS operates at less than 3 kW/100 m<sup>3</sup>/hr.



## Benefits for the Owner:

- Very small associated fuel & operating costs.
- Reduced carbon footprint – responding to future energy efficiency requirements.
- Easy retrofits, without requirement for additional power generation.

## Benefits for the Shipyard:

- Very small power consumption means easy adaptation to existing energy-balanced designs.
- IDEAL for energy efficient modern designs, contributing to low EEDI.
- Very low Installation Costs – no need for high power reserves or large transformers/rectifiers.

## Eliminating Corrosion Risk

ERMA FIRST BWTS has been extensively tested against Ballast Tanks Epoxy Coating degrading and Bare Steel, Copper Nickel and Stainless Steel Corrosion potential. Corrosion Tests has been performed as per IMO MEPC. 59.2.16, under continuous 6 months exposure of coated, scratched and bare steel substrates in constant sodium hypochlorite content of 10 mg/ltr, well high above actual exposure of the water ballast tanks.



The results prove that ERMA FIRST is **an absolutely safe system, with no detrimental effects** to either ballast epoxy coating quality or acceleration of bare steel corrosion rate. In further, ERMA FIRST has received Letters from various recognized Marine Paint Manufacturers, confirming compatibility with epoxy coatings used for ballast water tanks.

### HIGH BIOLOGICAL EFFICACY

ERMA FIRST BWTS has been developed and tested in the most reputable Institutes and Recognized Laboratories as follows:

#### THE ROYAL NETHERLANDS INSTITUTE FOR SEA RESEARCH (THE NIOZ)

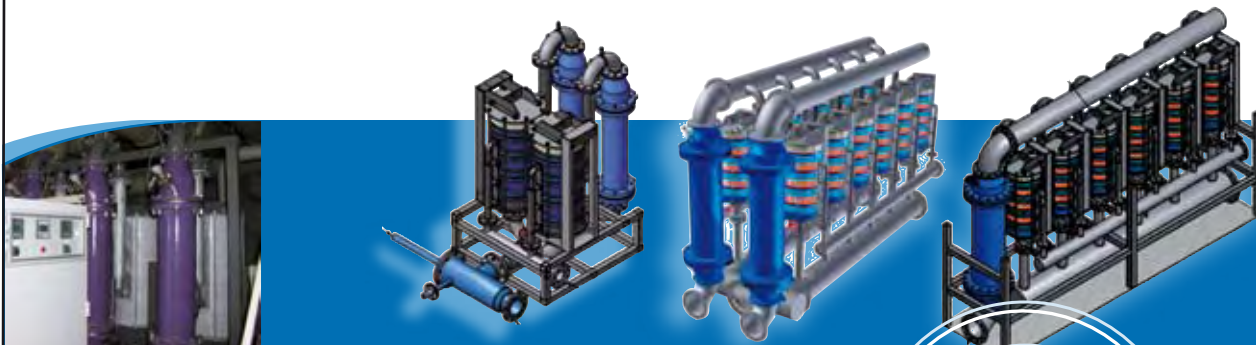
ERMA FIRST BWTS has successfully performed the Land-based tests at the reputable facilities of The Royal Netherlands Institute for Sea Research (NIOZ) with great success reaching outstanding performance standards, in most cases one order of magnitude lower than the D-2 standards. . NIOZ test facility is one of the most challenging facilities for ballast water treatment systems testing as concerning the special sea water conditions of Wadden Sea.

#### Benefits for the Owner:

- Land-based tests in REAL sea water conditions (no artificial waters used) and in heavy sediment environment – proven biological efficiency.
- Sampling Methods monitored by Recognized Sampling
- Specialists & Lloyds Register – Reliability of Test Results.
- Harsh Testing water conditions ensure future compliance even at stricter standards.



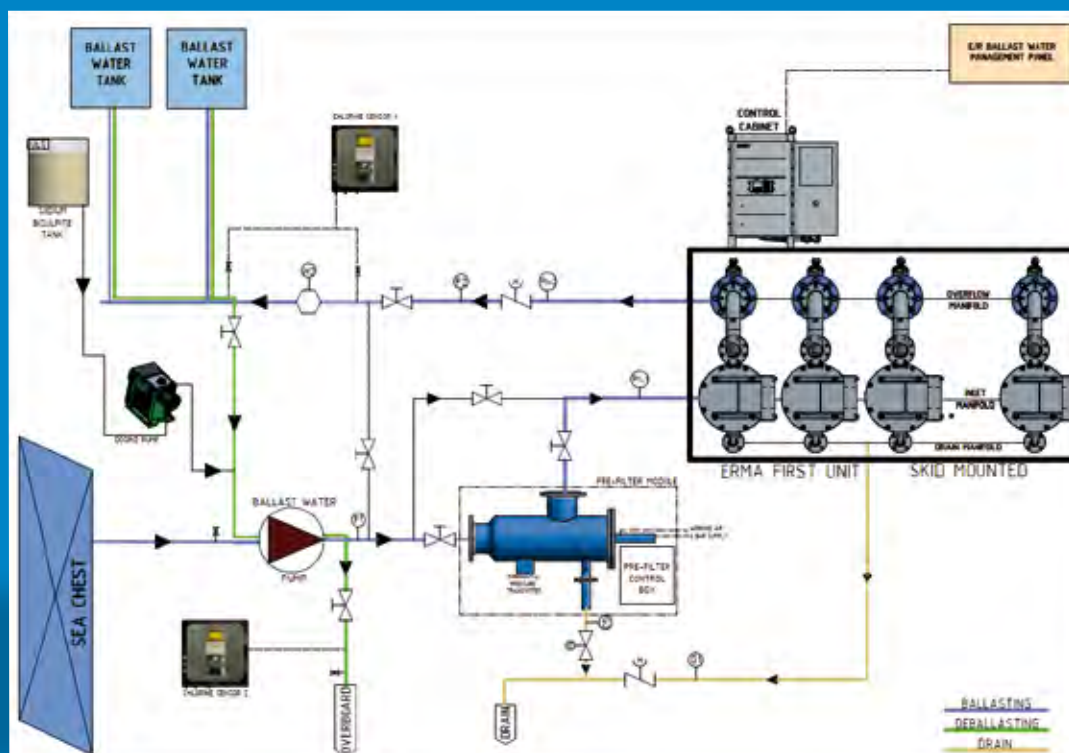
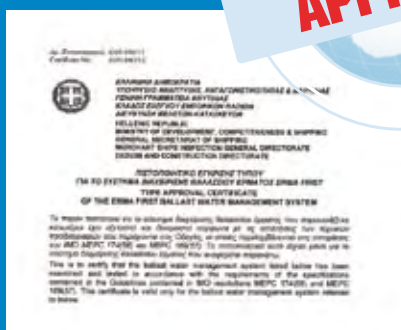




**TYPE  
APPROVED**

## TYPE APPROVAL

On May 2012, ERMA FIRST received TYPE APPROVAL from the Greek Administration and Class Approval from Lloyd's Register.





## INSTALLATION FLEXIBILITY

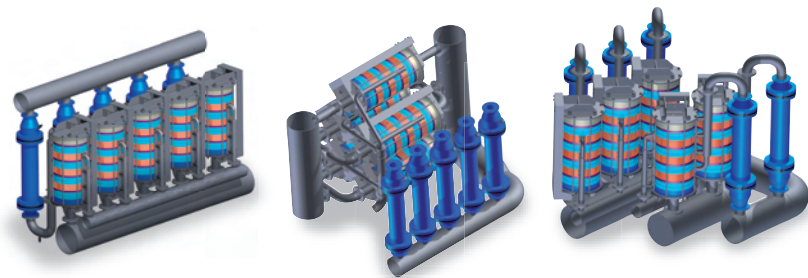
ERMA FIRST is a compact system comprised of modular parts offering flexibility in various installation patterns, being easily accommodated in existing Ballast Water System Piping designs or in retrofit cases.

The system can be delivered on a skid-mounted unit, pre-piped, pre-wired in factory and the installation requirements are minimal, making ERMA FIRST a very attractive solution with significant savings in installation labour and material costs.

The simplicity of the system is limiting pipe connections down to the following:

- One line-in – Inlet (Cyclones) Manifold
- One line-out – Outlet (Overflow) Manifold connected to the pipe discharge to BW Tanks
- One Drain line – common for cyclones and pre-filter drainage

The pre-filter and cyclones can also be installed in horizontal position in case limitations exist on board regarding available height.



### ERMA FIRST - TECHNICAL DATA

BW Pump Capacity	m <sup>3</sup> /hr	100	200	300	400	500	600	700	800	900	1000	1200	1500	2000	2500
Pre-filter Dimensions {H x w}*	mm	1100 x 597	1480 x 727	1480 x 727	1800 x 883	1800 x 883	2270 x 803	2270 x 803	2270 x 803	2600 x 928	2600 x 928	2850 x 928	2850 x 928	3000 x 1103	3700 x 1203
ERMA FIRST Skid-Unit Footprint	m <sup>2</sup>	0.87	1.72	2.6	3.43	4.2	4.9	6.5	5.8	6.5	7.72	8.9	12.50	16.10	20.58
Power Consumption**	kw	3	6	9	12	15	18	21	24	27	30	36	45	60	75

\*Pre-filter dimensions refer to max installation length and max installation width    \*\* Power Consumption at 15 PSU

# WORLDWIDE NETWORK



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ERMA FIRST ESK ENGINEERING SOLUTIONS S.A  
Schisto Industrial Park (VIPAS): Block 13, Keratsiniou – Skaramagas Ave,  
18863, Perama-Greece, T: +30 210 4093000, F: +30 210 4617423,  
[www.ermafirst.com](http://www.ermafirst.com), [info@ermafirst.com](mailto:info@ermafirst.com)