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Ballast Water Management System

[Customer First]

Global Premium Brand NK-03 BlueBallast System

Why Ozone?

Aqueous Solution for Life Matters

3,000 municipal plants world-wide

Extremely Short Half-Life Time

5.8 seconds in seawater, 30 minutes in fresh water and 54 minutes in gaseous state

Yes, NK-03 BlueBallast system

The NK-03 BlueBallast System is masterpiece for ballast water treatment



Safe and Strongest Oxidant, Disinfectant

Especially in aqueous solution

Flexible Application

Municipal and industrial wastewater, medical, food processing

Technically Proven System

First used as disinfectant by french municipality in 1899 and installed up to 1,000 for commercial and industrial use

NK-03 BLUEBALLAST SYSTEM DATA SHEET

| Model Number NK-03 | | 015 | 030 | 050 | 075 | 100 | 150 | 200 | 250 | 300 | 400 |
|-------------------------|-------------------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|
| Ballast Pump Capacity | m ³ /h | 150 | 300 | 500 | 750 | 1,000 | 1,500 | 2,000 | 2,500 | 3,000 | 4,000 |
| Total Ballast Capacity | m ³ /h | 300 | 600 | 1,000 | 1,500 | 2,000 | 3,000 | 4,000 | 5,000 | 6,000 | 8,000 |
| Total Footprint | m ² | 14.5 | 14.5 | 14.5 | 23 | 23 | 29.4 | 29.4 | 29.4 | 29.4 | 49.5 |
| Total Weight | Kg | 6,567 | 7,416 | 8,299 | 11,918 | 13,663 | 17,812 | 20,067 | 23,710 | 24,687 | 27,943 |
| Total Power Consumption | KW | 35.5 | 61.7 | 98.1 | 135.5 | 199.3 | 263.3 | 360.4 | 423.0 | 488.9 | 709.9 |
| Total Cooling Water | m ³ /h | 7.2 | 11.6 | 15.1 | 20.1 | 29.4 | 36.6 | 50.3 | 56.1 | 64.9 | 74.4 |

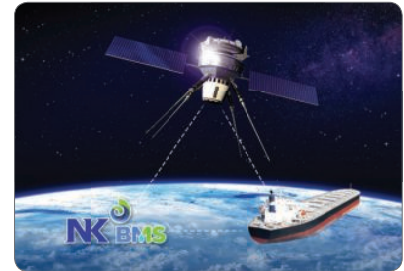
Key Features

NK-O3 BlueBallast System achieved optimization with **cost**, **time**, **space** and **system stability** by modularizing all equipments into O2 and O3 module.



Smart Remote Control Service

- Remote diagnostics of Ballast Treatment System
- Immediate A/S action
- Always keep the best condition using Smart Remote Control Service



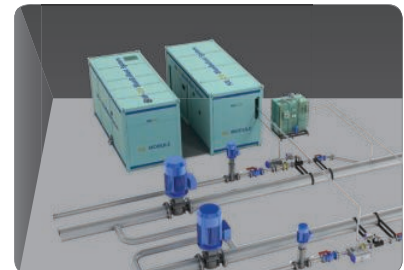
Minimized Installation Work and Space

- Simple and flexible installation
- Only minimized installation work without any trial and error
- The faster installation(only 2days) and commissioning period
- The lower installation cost
- Decreased at least 60% foot print



Best Application

- Better application by side stream to all type of vessle including submerged type
- No modification on existing ballast pipe
- Easy application for gravity operation(Ballasting/De-ballasting) without independent system
- No Filter and No pressure drop



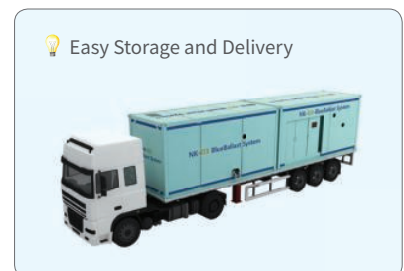
Smart Operation and Maintenance

- One-touch operation
- Only treats the incomming ballast during ballasting operation
- Effective operating and maintenance through centralized control
- Low maintenance cost
- Easy maintenance and operation by centralized control system



Cost Effective Logistics System

- No need additional packing box for transportation
- Safe and easy load and unload O2 and O3 Module
- Suitable storage as it is



System Description and Application

NK-O3 BlueBallast System is designed to produce and inject ozone with density of 2.5mg/L into the ballast water at proportionally according to ballast pump capacity and a percentage of the aquatic species, especially any bacteria and viruses in the ballast water, are killed by direct contact with the ozone. The remainder are killed or neutralized when the ozone reacts with other chemicals that occur naturally in seawater, to form hypobromous acid, a highly effective disinfectant in its own right. Both ozone and hypobromous acid disintegrate extremely rapidly – ensuring that there is no damage to the receiving waters into which the treated ballast water is discharged.

■ Oxygen and Ozone module

The module is composed of five integrated equipment. Air compressor, Oxygen and Ozone generator, Monitoring and Control system, Side stream injector and Neutralizer system. The air compressor produces compressed air by inhaling the air of the atmosphere and the oxygen generator (PSA type : Pressure Swing Adsorption) strips away the nitrogen from the compressed air and concentrating the oxygen. The ozone generator passes the concentrated oxygen through a high frequency electrical field and the ozone production is controlled by incoming ballast water flow rate.

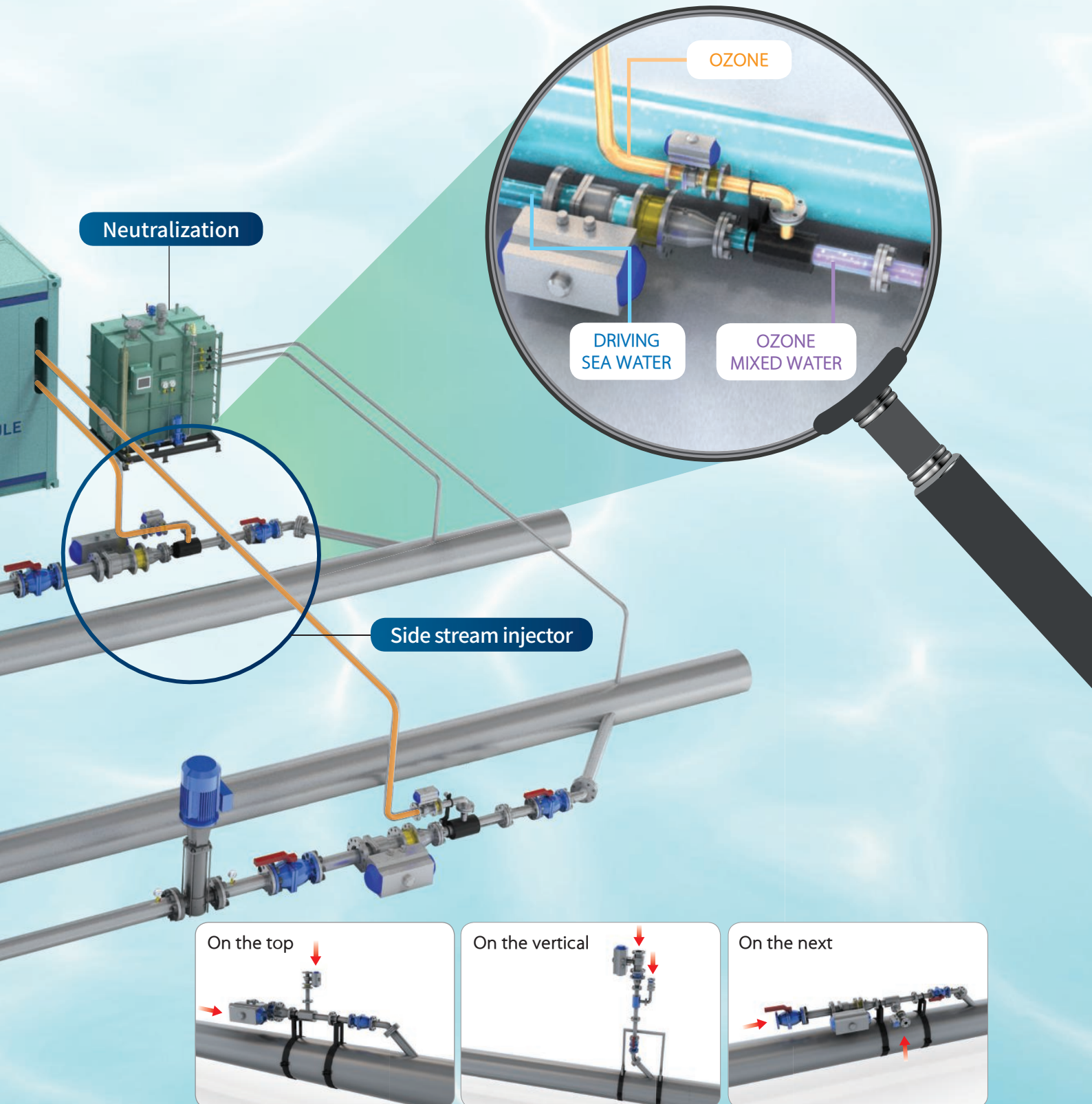
■ Neutralization module

This is designed to remove remained TRO (Total Residual Oxidant) at discharge of ballast water. The neutralizer dose is calculated by remained TRO concentration in discharged ballast water. If TRO value in treated ballast water is higher than the specific value, neutralizing liquid shall be injected to the de-ballast water line to control TRO value. In most of cases, Neutralizing liquid is not used 48 hours after injection of ozone due to ozone concentration goes down to 0.1 ppm naturally.



■ Side Stream Injector

Side stream injector module is purposely-built and is NK patented product. It diverts incoming ballast water into side-stream and injects ozone into side-stream right before ballast water re-enters main ballast stream. It optimizes the dosage of ozone to ensure high kill rate. This side stream injection introduces ozone quickly and uniformly to the ballast water and makes disinfection of ballast water much effectively.



One Stop Service



Assembly

NK BMS who considers the valuable customer as a top priority delivers the system after completion of piping, cabling and wiring connection at shop to save a time and cost when installation on board.

Factory Inspection and Test

The vessel is available to deliver to customers without any additional test on board by the thorough quality inspection and performance test at shop based on well-systemized process.



Remote Control Service

Through the Smart Remote Control service after vessel departure, NK BMS monitors system condition to maintain the best performance all around the world 24/7. Qualified NK BMS engineers are stayed in every main port of the world. so, we can provide instant and accurate service.





Unstoring

NK-O3 BlueBallast doesn't require any additional package for shipping, loading and storage.

Benefit of Logistic cost

NK-O3 BlueBallast can be shipped as is manufactured.



Test and Commissioning

NK-O3 BlueBallast can be entered into the trial running by crew's hands only after the simple adjustment and brief crew training.

Easy Installation

NK-O3 BlueBallast installation is easily completed by applying for O3 pipe. This leads dramatic time and cost minimization.

Ballasting and Deballasting Operation Mode

» Ballast mode

NK-03 BlueBallast System only treats the incoming ballast during ballasting operation.



» Deballast mode

If TRO value in treated ballast water is higher than the specific value, neutralizing liquid shall be injected to the de-ballast water line to control TRO value. Neutralizing liquid is not used after 48 hours because Ozone concentration goes down to 0.1 ppm.



INJE

» Gravity mode

Ballasting or deballasting is carried out using gravity instead of running the pump at sea level to reduce the power consumption of the ship.

■ Ballast mode



■ Deballast mode



CTOR

Flexible Installation

NK-O3 BlueBallast system which can be installed in various inner and outer spaces according to the shape of ship. It is more efficient because it can be installed simply in the space separated from the ballast tank.

General Cargo (Container/BC)

- Engine Room or Steering Gear Room
- Separate Room (ex : Engine Casing)
- Other Safety Area

Tanker

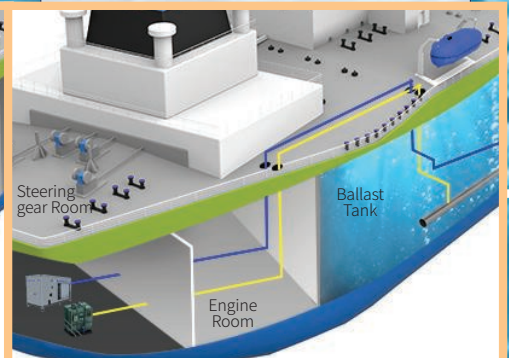
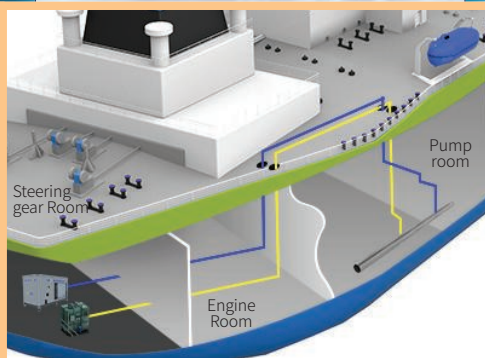
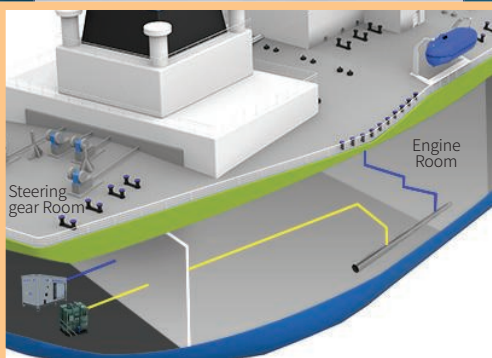
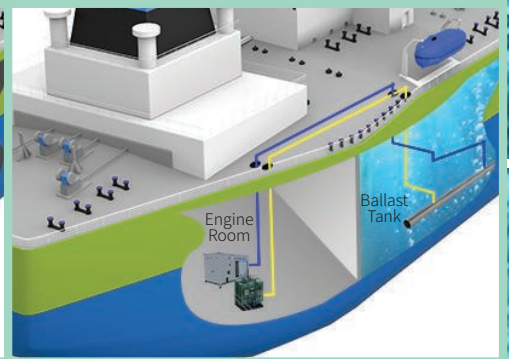
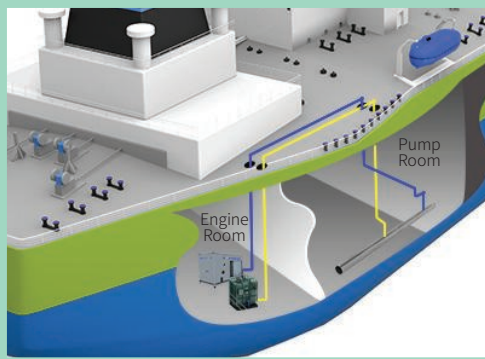
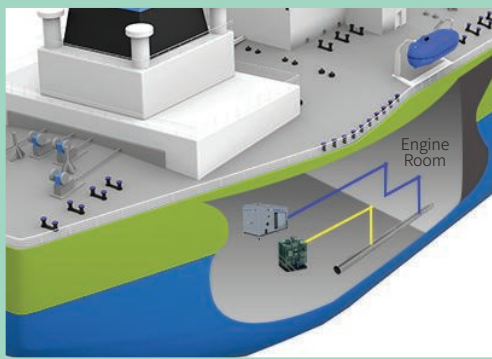
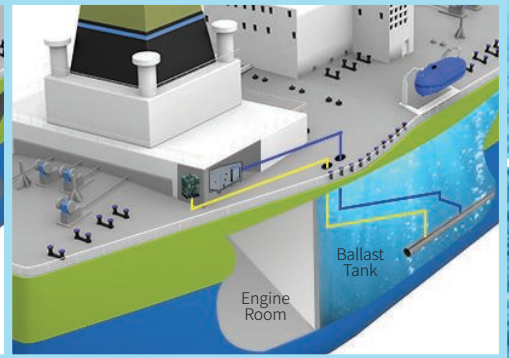
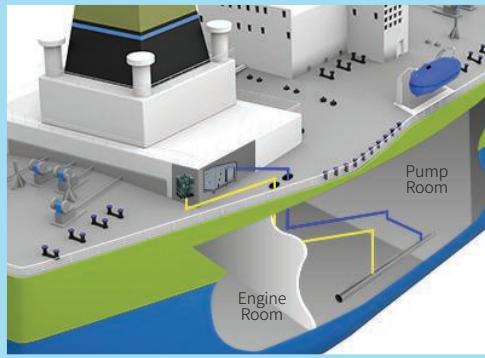
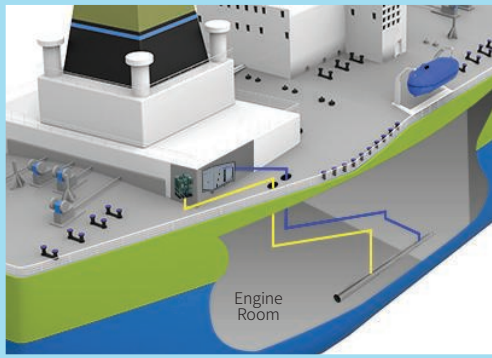
- Engine Room or Steering Gear Room
- Separate Room (ex : Engine Casing)
- Other Safety Area

Note / O3 Pipe Line via Deck.

Submerged Type Tanker

- Engine Room or Steering Gear Room
- Separate Room (ex : Engine Casing)
- Other Safety Area

Note / O3 Pipe Line via Deck to Ballast Tank



— Neutralizer Injection Line — Ozon Injection Line

Tip 1 You can choose area or location for installation at available space on-board

Tip 2 No necessary for replacement of original equipment

Tip 3 No necessary for hull modification

Tip 4 No need to consider pressure drop



Engine Casing

Engine Room

Steering Gear Room

Upper Deck



Comprehensive Retrofit Solution

[Total Solution]

Project consulting, budgeting, engineering, manufacturing, retrofit installation, commissioning

NK's capacity of undertaking the EPC Retrofit Service with the most economic cost and minimal time wherever the space are available saving modification of existing arrangement.



» Features

- 1 Integrated retrofit solution proposal
- 2 Qualified engineers with a wide range of experience
- 3 Feasibility study such as on board survey and 3D scanning
- 4 Certification and class

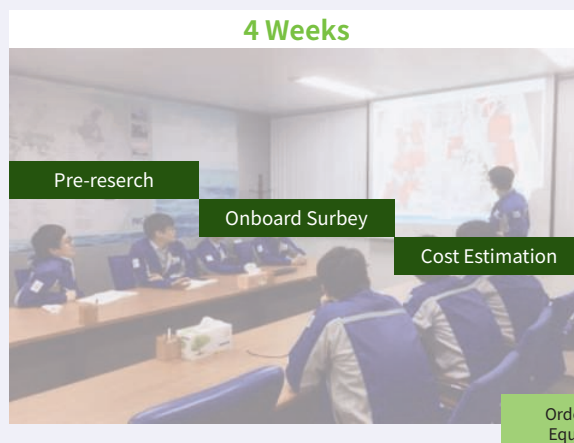
» NK BMS Retrofit Service Items

NK BMS provides comprehensive retrofit solution according to owner requirement.

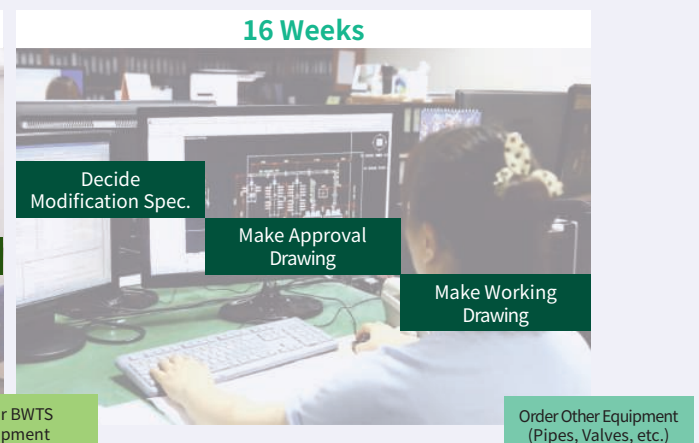
- Option.1** BWTS Equipment supply only
- Option.2** BWTS Equipment + Engineering Work
- Option.3** BWTS Equipment + Engineering Work + Installation Material Supplience
- Option.4** BWTS Equipment + Engineering Work + Installation Material Supplience + BWTS Installation Work

Process

» Engineering of BWTS



» Design and Manufacturing



Retrofitting History

NK BMS has provided BWTS retrofit solution more than 30 vessels so far.



| | |
|-----------------|---------------------------|
| Ship's Type | Chip Carrier |
| Capacity | 750m ³ /hr x 2 |
| Model | NK-O3 075 |
| Installation | Steering gear room |
| Retrofit Method | Drydock |



| | |
|-----------------|-----------------------------|
| Ship's Type | Bulk Carrier |
| Capacity | 2,500m ³ /hr x 2 |
| Model | NK-O3 250 |
| Installation | Engine room |
| Retrofit Method | Drydock |



| | |
|-----------------|-----------------------------|
| Ship's Type | LNG |
| Capacity | 2,900m ³ /hr x 2 |
| Model | NK-O3 300 |
| Installation | Engine room |
| Retrofit Method | Drydock |



| | |
|-----------------|-----------------------------|
| Ship's Type | CONTAINER |
| Capacity | 1,000m ³ /hr x 2 |
| Model | NK-O3 100 |
| Installation | Engine room |
| Retrofit Method | Drydock |



| | |
|-----------------|---------------------------|
| Ship's Type | COT |
| Capacity | 500m ³ /hr x 2 |
| Model | NK-O3 050 |
| Installation | Engine room |
| Retrofit Method | Drydock |

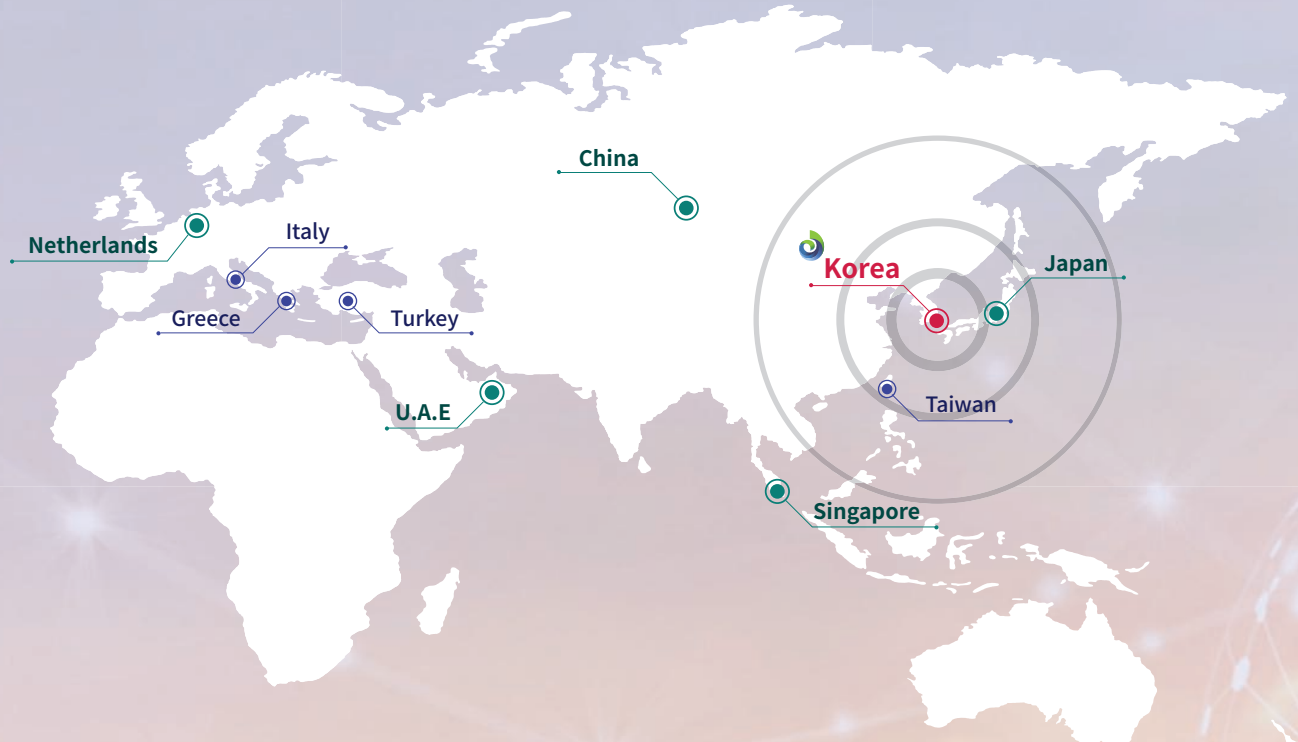
» BWTS Installation



» On-board and Performance Test



A/S Network



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