Worldwide Network

We provide prompt installation, commissioning, on-board test and warranty service with our worldwide sales and service network.

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Electro-Cleen™ System
Ballast Water Treatment System

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“Making a clean environment with our technology”

2000  
• Established Techcross Inc.  
• Established R&D center

2002  
• Achieved KT mark from Ministry of Science & Technology  
• Won award for the contribution to the environment by Seoul Metropolitan and Ministry of Environment

2004  
• Registered patent #0425773 ‘Electrolysis Disinfection System for Sewage Treatment’  
• Registered utility model #0357600 ‘Electrolysis Disinfection System for Drinking Water Treatment’

2006  
• Achieved ISO 14001: 2004  
• Developed Electro-Cleen™ System (Electrolysis Disinfection, Patented with KORDI)  
• Achieved IMO Basic Approval on Active Substances for Ballast Water Management System for the first in the world  
• Launched a barge ship for land-based test  
• Contracted for Electro-Cleen™ System with a Greek ship owner

2007  
• Completed full scale land-based test and shipboard test

2008  
• Achieved Final Approval by IMO  
• Achieved Type Approval Certificate by MLTM (ECS-300)  
• Established worldwide sales & service network / Completed exclusive production facility for ECS in Asan City  
• Contracted to install ECS on 10 container ships  
• Contracted sales distributorship with Marubeni Group and Ataka Diaki Engineering in Japan, KOMAC and Jiangxi Marine Valve Plant in China

2009  
• Established Busan Engineering Center  
• Achieved Ex-Proof Type Approval Certification by MLTM  
• Installed ECS on 11 vessels (Bulk carrier, Container, Chemical Tanker and PC Tanker)

2010  
• Achieved Type Approval Certificate by MLTM (ECS-600)  
• Installed ECS to 317K VLCC first in the industry  
• Installed ECS on 98K Post Panamax.

2011  
• Contracted to deliver more than 40 ships.
Status on Ballast Water Management Convention

As of February 1st 2011, 27 states, representing 25.32% of world merchant shipping tonnage, ratified Ballast Water Management Convention.

Techcross satisfies California standards

Techcross Inc. satisfies California’s standards with highest efficacy test data. California SB497 is 1,000 times stricter than IMO regulation. This standard is also equal to Clean Water Act Section 401 of New York states.

Global ballast water risks protected by “World No.1 Electro-Cleen™ System”

Table 1. Summary of Electro-Cleen™ Systems for assessment of efficacy

<table>
<thead>
<tr>
<th>System</th>
<th>IMO</th>
<th>CA</th>
<th>IMO</th>
<th>CA</th>
<th>IMO</th>
<th>CA</th>
<th>IMO</th>
<th>CA</th>
<th>IMO</th>
<th>CA</th>
<th>IMO</th>
<th>CA</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 50 μm</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N/A</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>10 - 50 μm</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>&lt; 10 μm (bacteria)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

**Systems with at least one replicate in compliance with the performance standards are denoted by a “Y”. Non-compliance is denoted by an “N” and those systems with data in metrics not directly comparable to the performance standards were designated as “unknown”. A blank cell or hashing indicates that no data was available.**

Table 2. Summary of environmental assessment and approval of Electro-Cleen™ System

<table>
<thead>
<tr>
<th>Active Substance</th>
<th>Environmental Related Approvals</th>
<th>CA TRC Compliant</th>
</tr>
</thead>
<tbody>
<tr>
<td>hypochlorite, hypobromite, ozone, hydroxyl radicals, hydrogen peroxide</td>
<td>IMO Basic and Final</td>
<td>Y</td>
</tr>
</tbody>
</table>

**CA Ocean Plan instantaneous maximum for Total Residual Chlorine = 60 micrograms/liter (μg/l)**

Source by 2009 ASSESSMENT OF THE EFFICACY, AVAILABILITY AND ENVIRONMENTAL IMPACTS OF BALLAST WATER TREATMENT SYSTEMS FOR USE IN CALIFORNIA WATERS.
Electro-Cleen™ System (ECS) is the most effective BWTS using electrolysis technology. ECS is different from typical electro chlorination system. Treatment process of system which uses electro chlorination is electrochemical generation of the biocide solution on board and high concentration of hypochlorite solution is injected directly into the ballast pipeline.

ECS uses electrolysis, however, with the application of electric currents, electric potential increases disinfection efficacy by destroying cell membrane of micro-organisms generating voltage. In addition, OH- radical generated during the electrolysis procedure by titanium electrodes also disinfects micro-organisms. Through electrolysis, enough amount of TRO is generated, preventing the re-growth of micro-organisms and maintaining efficacy

Hypochlorite

Dissolves by radiation disinfects cell nucleus remaining only nano-seconds

Radical

Disinfects cell nucleus

OH- Radical

Disinfects cell nucleus

Holes on cell walls

Disinfection mechanism by electric potential

Disinfection mechanism by radical

Hypochlorite

When the seawater passes through the Electro-Chamber Unit after ballast pump, disinfectants such as Hypochlorite generated by electrolysis disinfect harmful microorganisms in the seawater. Whereas, residual chlorine prohibits the re-growth of microorganisms in the ballast tank.
ECS Models

“Various types & capacity range of ECS models by flow rate for your vessels”

Advantage of ECS

- Powerful disinfection system, meets higher standards (California)
- ECS meets California’s standards (SB497) which is 1000 times stricter than IMO’s.
- Neither of organism grew back in 30 days according to KORDS re-growth test nor 50 days according to Techcross R&D Center.
- Treating once at ballasting
- Residual chlorine in treated water keeps water clean, thus retreatment at deballasting is not required.
- Easy to operate and save so much expense.

- Low power consumption
  ECS uses maximum 3.4 kw to treat 100m³/h of 8PSU sea water (7.3kw for 100m³/h of 3PSU sea water).
  - No need for an extra generator.

- Low operation cost
  - No operation ECS, only a little fuel cost is needed.
  - The Electrode Module as key components has an expected life of 8,000 to 10,000 hours and used for nearly 20 years.

- No filtration required
  - ECS complies with IMO standards without filtration which causes flow interruption.
  - Maximum flow loss is only 0.2 Bar.

Mass production available

With several years’ worth of know-how, Techcross accumulated engineering ability to accept all of customers demands.
Mass production system is set up so as to produce more than 2,900 sets of ECS 300 per year by factory automation and vendor diversification.
Installation References

**Bulk Carrier Retrofit**
- **Vessel Type**: 93k Bulk Carrier
- **Date**: January, 2011
- **Ballast Pump Capacity**: 1,200 m³/h x 2 sets
- **Shipyard**: China

**Bulk Carrier New Building**
- **Vessel Type**: 99k Bulk Carrier
- **Date**: November, 2010
- **Ballast Pump Capacity**: 1,800 m³/h x 2 sets
- **Shipyard**: Japan

**Tanker Ex-proof Type**
- **Vessel Type**: 8.5k Chemical Tanker
- **Date**: October, 2009
- **Ballast Pump Capacity**: 300 m³/h x 2 sets
- **Shipyard**: Japan

**Tanker on deck solution**
- **Vessel Type**: 12.8k Product / Chemical Tanker
- **Date**: October, 2009
- **Ballast Pump Capacity**: 300 m³/h x 2 sets
- **Shipyard**: Korea