EXHAUST GAS SCRUBBER RETROFIT

ONE-STOP COMPREHENSIVE SOLUTION

EGS SCRUBBER

FAROHAR ENTERPRISES PRIVATE LIMITED

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Europe, Japan, Africa, Canada, USA, Philippines, Indonesia, Thailand, Hong Kong and others
THE FAROHAR ADVANTAGE

• Over 30 years collective competence & experience in Marine and Oil-Gas Industry
• Specialist outsourced services for oil-gas and marine industry
• Over 750 strong skilled workforce
• Headquartered in Singapore and operation center in India. Global presence in Europe, Japan, Africa, Canada, USA, Philippines, Indonesia, Thailand, Hong Kong and others
• Strategic alliances & joint ventures with leading specialists
• ISO 9001 & ISO 27001 certified. Highest degree of quality assurance and efficiency
• Best value and highest return on investment for clients
• Reasonable fees and no hidden charges
• Robust services contracts and warranties
• End-to-end turnkey execution from Assessment to Plant handover
• Expert Riding Teams and Supervisors
• Enroute Works cuts down Project time-cost by over 25%

OUR ACHIEVEMENT & CLIENTS

• 650+ Projects Executed
• 50+ Dry-Dockings Supported
• 200+ Satisfied Customers
• 10k+ Man-days of Incident Free Inspections
• 1.6m+ Engineering Design Hours
• 30k+ Tons of Steel Recycled
• 30+ Countries Touched

SOx REGULATIONS & COMPLIANCE

STAY AWAY FROM ECA
USE LOW SULPHUR
INSTALL SCRUBBER
CONVERT TO LNG

Global

SOx ECA

<table>
<thead>
<tr>
<th>Year</th>
<th>Sulfur, %</th>
</tr>
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<tbody>
<tr>
<td>2000</td>
<td>5</td>
</tr>
<tr>
<td>2005</td>
<td>4.5</td>
</tr>
<tr>
<td>2010</td>
<td>4</td>
</tr>
<tr>
<td>2015</td>
<td>3.5</td>
</tr>
<tr>
<td>2020</td>
<td>3</td>
</tr>
<tr>
<td>2025</td>
<td>2.5</td>
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**TYPICAL PROJECT STAGES**

- **Order Confirmation**
  - Receive Inputs
  - Date of Survey

- **Initial Study - 3 Days**
  - Likely Position of Installation
  - Locations of Scanning

- **3D Scanning & Survey - 3 Days**
  - Survey Report
  - Registered Scan Data

- **Feasibility Study**
  - Probable Locations
  - Preliminary Pipe Route

- **Procurement**
  - Contact Popular Manufacturers for Quotes and Timelines

- **Class Drawings Acceptance & Submission**
  - Basic
  - Structural
  - Piping
  - Electrical

- **Workshop Drawings**
  - Production of 3D Pipe Route
  - Isometric and Spool Drawings
  - Pipe Installation Drawings
  - Cable Duct / HVAC Duct Routing

- **Prefabrication Supervision**
  - Workshop Coordination
  - Workshop Supervision
  - Quality Inspection

- **Project Teams & Management**
  - Project Manager
  - Outfitting Lead
  - Riding Team

- **Installation & Commissioning**
  - Installation of Scrubber Unit in Drydock
  - Commissioning & Testing in Presence of Class Surveyor & Owners

- **Training & Follow up**
  - Training of Ship staff
  - Maintenance of scrubber systems according to MEPC.259 (68)

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**PROJECT TIMELINE**

<table>
<thead>
<tr>
<th>PROJECT PHASES</th>
<th>TIMELINE IN WEEKS (TOTAL 20)</th>
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<tbody>
<tr>
<td>DESK TOP FEASIBILITY &amp; 3D SCAN</td>
<td>1</td>
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<tr>
<td>PROCUREMENT</td>
<td></td>
</tr>
<tr>
<td>CLASS DRAWINGS – ACCEPTANCE &amp; SUBMISSION</td>
<td></td>
</tr>
<tr>
<td>WORKSHOP DRAWINGS, FABRICATION, CO-ORDINATION &amp; SUPERVISION</td>
<td></td>
</tr>
<tr>
<td>INSTALLATION: DEPENDENT ON SHIPYARD. TYPICALLY</td>
<td></td>
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<tr>
<td>COMMISSIONING &amp; TRAINING</td>
<td></td>
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</tbody>
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**1. FEASIBILITY STUDY & 3D SCANNING**

- **VEssel Analysis**
  - Trade Routes
  - Available Power / Space
  - M/E Backpressure

- **Vendor Analysis**
  - Suitability
  - Power / Space / Vent. requirements

- **Cost Analysis**
  - Equipment Cost
  - Modification Cost
  - Life Cycle Cost

**Survey / 3D Scanning / Data**

- **OPTION 1: DESK BASED**
  - Basic
  - Fast Execution
  - Non-conclusive on its own

- **OPTION 2: 3-D Scan (Recommended)**
  - Very Accurate
  - Complete Spatial Feasibility
  - Detailed Study for Conclusive Analysis
2. PROCUREMENT: POPULAR MANUFACTURERS - EGS

- WARTSILA
- ALFA LAVAL
- AEC MARITIME
- CLEAN MARINE
- MEP
- JET VENTURIE
- PANASIA
- POT
- YARA SCRUBBER

Designs approved by most Class Societies including: DNV-GL, LR, ABS, BV, IRS, RINA

3. CLASS DRAWINGS – ACCEPTANCE & SUBMISSION

Class Approvals: Approvals for Retrofit Drawings & Coordination for Class Survey onboard

<table>
<thead>
<tr>
<th>BASIC</th>
<th>STRUCTURAL DESIGN</th>
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<tr>
<td>GA, Machinery Layout, LSW Est., Stability Analysis</td>
<td>Foundation of Equipment, Funnel Modification</td>
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<table>
<thead>
<tr>
<th>PIPING DESIGN</th>
<th>ELECTRICALS</th>
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</thead>
<tbody>
<tr>
<td>Effluent Line &amp; Sludge Line</td>
<td>Load Analysis, Misc. SLDs</td>
</tr>
<tr>
<td>M/E Exhaust modification</td>
<td></td>
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</tbody>
</table>

4. WORKSHOP DRAWINGS, CO-ORDINATION & SUPERVISION

Pre-fab of Pipe Spool Production Design In 3D Environment

- 3D Pipe Route
- Cable Duct / HVAC Duct Routing
- Pipe Installation Drawings
- Isometric And Spool Drawings

Workshop Co-ordination

- Technical Specification For Retrofit
- Job Work Order & Workshop Selection

Supervision

- Quality Inspection (Critical For In-Situ Fabrication)
- Workshop inspection for pre-fab pipes

5. PROJECT TEAM & PROJECT MANAGEMENT

Typical Team Composition for a Scrubber Retrofit Engineering Design project of highly experienced and qualified professionals.

- Project Manager
  (Naval Architect or Marine Engineer)

- Outfitting Lead
  (Mechanical Engineer) + 2 Designers

- Riding Team
  Supervisor + Electrician + Fitters + Welders + Helpers

- Electrical & Automation Lead
  (Electrical Engineer) + 2 Designers

- Site Lead
  (Marine Engineer) + QC Inspectors
6. INSTALLATION & COMMISSIONING

- Choice or combination of yard-based or enroute works
- Feasibility & RPI studies by Farohar experts to determine best choice (optional additional service)
- Provision & management of expert riding teams for enroute installation
- Intelligent preparatory works to minimize installation investment & time
- High quality, high safety standards, minimal interruption of normal ship operations
- Efficient co-ordination with makers, owners, managers, class & shipboard teams
- Adequate trials, testing & commissioning works leading to class survey & passing
- Handover of operational installation

7. TRAINING & SUPPORT

- Client specific training on operation and maintenance of EGS plant & equipment
- Preparation of vessel specific computer-based training (CBT) application
- Shipboard & shorebased training sessions & modules can be provided
- Technical & logistical post-installation support (retainer or adhoc)
- Remote 24/7 support desk service

8. COMMERCIAL & CONTRACTUAL – GENERAL TERMS

- All works undertaken are strictly based on signed contracts drafted using internationally accepted terms and jurisdiction.
- Pre-requisites as defined in the contract must be properly provided by client including responsibilities of both the parties.
- Rates for vessel and/or out-station visits by Farohar personnel should be paid as per the contract. Working hours and overtime should be paid as per the contract. Estimates that are subject to change are clearly indicated.
- Approval will be sought from client prior to undertaking works with additional fees.
- All payments are in USD by bank transfer to Farohar’s designated account.
- Practical change management should be provided for within the contract.
- Strict mutually applicable NDA and IP protection terms.
- Payment terms 50% on signing and rest will be pro-rated on release of deliverables.
- GST at 18% shall be charged as per applicable government levy.
- Fees do not include class approval charges.

Given the multiple variables involved such as type of vessel, urgency, type of equipment, complexity of design and location, limitations/delays not of Farohar’s doing, etc. Specific monetary quotes can only be provided upon receipt of specific information from prospective client. Do contact Karma@Faroharltd.com with your requirements.

9. RELATED SERVICES FOR MARINE & OIL-GAS SECTORS

- Ballast water treatment system retrofit turnkey project
- Shell works & modifications: design, engineering, fabrication, onboard workds & follow ups
- Vessel valuation services
- Vessel performance data monitoring
- Digitization & e-library works for vessel/offshore establishments
- Marine ERP systems works-selection, implementation, optimization, audits, support
- Data population & data collection
- Data migration & conversion
- Creation of e-plans & drawings
- Ship design & modifications
- Turnkey project implementation for ports, jettys, storage facilities, etc.
10. SAMPLES FOR EGS

Equipment Placement in Point Cloud

Schematics Drawings

System Modeling in 3-D Environment

Schematics Drawings

System Modeling in 3-D Environment

3D Scanning of Seachest Area – EGS-BWTS