FLUE GAS SYSTEM

THE MOST ECONOMIC AND ADEQUATE WAY TO PRODUCE INERT GAS ON BOARD IS TO MAKE USE OF THE FLUE GAS FROM THE SHIP BOILERS.

The flue gas is passed through the scrubber for cleaning and cooling before entering the cargo tanks. The type of scrubber used is important with regards to efficiency of extraction of soot and SO2. A poor scrubber will produce poor inert gas which again will cause corrosion and settlement of soot in the cargo tanks. With an efficient scrubber, the use of the inert gas will reduce the corrosion in the tanks considerably. A scrubber with an outside venturi section equipped with an adjustable venturi has proven itself to be most efficient. The venturi section ensures an optimal soot extraction of all the different grades of soot particles during all running conditions.

**Scrubber plant:**

1st stage: Precooler with water injection, this stage cools the high temperature flue gas.

2nd stage: Venturi scrubber removes the soot particles. It is possible to manually adjust the venturi pressure drop. When soot particles are greater than 1 micron the soot extraction efficiency will be higher than 98.5%. After leaving the venturi scrubber the inert gas is bubbled through a water bed before entering the washing tower.

3rd stage: Washing tower cools and effective removes the SO2 gas. Packed bed sections ensure a large surface contact area between water and gas for maximum extraction of SO2 from the flue gas.

Drop eliminator mounted in top of washing tower to prevent free water entering the inert gas supply piping.

**Capacity Ranges**

<table>
<thead>
<tr>
<th>Type</th>
<th>Capacity Range (m3/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FGS 1000</td>
<td>(2000-5000)</td>
</tr>
<tr>
<td>FGS 1400</td>
<td>(5000-10000)</td>
</tr>
<tr>
<td>FGS 1600</td>
<td>(10000-15000)</td>
</tr>
<tr>
<td>FGS 2000</td>
<td>(15000-23000)</td>
</tr>
<tr>
<td>FGS 2200</td>
<td>(23000-28000)</td>
</tr>
</tbody>
</table>

**Brief Description**

- Flue gas from ship boilers are used to produce clean and soot free inert gas.
- Efficient cooling by precooler and scrubber tower.
- High pressure centrifugal blowers positioned downstream flue gas scrubber provide inert gas to cargo tanks.
- System capacity is automatically controlled by deck pressure set-point in software.
- Maritime Protection Pressure Vacuum Breaker ensure safe loading and off loading.
- Maritime Protection Deck Water Seal ensures safe sealing of inert gas and prevent back flow of cargo gases to safe area.

Flue gas from the boilers form the basis for the inert gas production. The hot and dirty gases are drawn into the precooler where the first step is to cool the flue gas before entering the flue gas scrubber where second stage cooling and cleaning take place. The cooled and cleaned inert gas is then distributed to cargo tanks by high pressure centrifugal blowers.

Before entering the cargo tanks the inert gas must pass the deck water seal which prevent backflow of cargo gases. Gas freeing can be performed by closing the scrubber isolating valves and open the fresh air valve, the system can be use to gas free the cargo tanks after inerting. The different modes (IG and fresh air) can easily be selected in the LCD control panel.

**Operation & Maintenance**

- Graphical LCD operator terminal. All major process parameters displayed on the screen.
- The flue gas already contains less than 5% oxygen and no further treatment is therefore necessary.
- Easy inspection and easy replacement of scrubber components by entering man hole.

**Options**

- Multiple LCD operator terminals.
- System signal and operation available for ships IAS via MODBUS or ETHERNET communication.
- Topping up generator (TUG) MPG 400 (500 m3/h).

**LCD operator terminal**

From the terminal you can:

- Start and stop the FG scrubber system.
- Monitor valve positions and motor running status.
- Monitor process and status indication.
- Monitor alarm and change alarm set points.
- Change controller set points and parameters.
### TECHNICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>TYPE</th>
<th>INERT GAS CAPACITY [m³/h]</th>
<th>SEAWATER CONSUMPTION [m³/h]</th>
<th>POWER CONSUMPTION [kw]</th>
<th>DIMENSION SCRUBBER ØxWxH [mm]</th>
<th>WEIGHT [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>FGS-1000</td>
<td>2000-5000</td>
<td>30-75</td>
<td>25-60</td>
<td>1000x1590x4100</td>
<td>2000</td>
</tr>
<tr>
<td>FGS-1400</td>
<td>5000-10000</td>
<td>75-150</td>
<td>60-120</td>
<td>1400x2510x4450</td>
<td>3200</td>
</tr>
<tr>
<td>FGS-1600</td>
<td>10000-15000</td>
<td>150-225</td>
<td>120-180</td>
<td>1600x2830x4600</td>
<td>3700</td>
</tr>
<tr>
<td>FGS-2000</td>
<td>15000-23000</td>
<td>225-345</td>
<td>180-275</td>
<td>2000x3740x5000</td>
<td>4800</td>
</tr>
<tr>
<td>FGS-2200</td>
<td>23000-28000</td>
<td>345-420</td>
<td>275-335</td>
<td>2000x4300x5000</td>
<td>5700</td>
</tr>
</tbody>
</table>

### GAS COMPOSITION

<table>
<thead>
<tr>
<th>SO₂</th>
<th>N₂</th>
<th>NOₓ</th>
<th>CO₂</th>
<th>GAS OUTLET TEMPERATURE</th>
<th>GAS OUTLET HUMIDITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>= Max 150ppm</td>
<td>= Balance</td>
<td>= Max 100ppm</td>
<td>= Approx. 14%</td>
<td>Max 5°C above seawater temperature</td>
<td>100% saturated</td>
</tr>
</tbody>
</table>

Oxygen content about 3%, dependent on Flue gas available.

### Service:

Service and/or repairs can be carried out in a short notice, worldwide.

### After Sales:

When spare parts or consumables are needed, our After Sales Department is at your service 24 hours a day.

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**MARITIME PROTECTION IS A HIGHLY REPUTATED COMPANY IN THE SHIPPING INDUSTRY AND ONE OF THE LEADING SUPPLIERS OF INERT GAS SYSTEMS. MARITIME PROTECTION INERT GAS SYSTEMS HAVE BEEN INSTALLED ON MORE THAN 1,000 OIL TANKERS, PRODUCT TANKERS, BARGES, FPSO’S AND GAS CARRIERS WORLD WIDE. MARITIME PROTECTION IS FULLY OWNED BY WILHELMSEN TECHNICAL SOLUTIONS.**

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