DAIHATSU DIESEL

AUS (AQUEOUS UREA SOLUTION) GENERATOR

for the SCR NOx reduction system

DAIHATSU DIESEL MFG.CO., LTD.
With DAIHATSU’S AQUEOUS UREA SOLUTION GENERATOR, high grade aqueous urea solution indispensable at sea, can be produced on-board easily from urea powder.

The IMO NOx Tier-III standards, applied to diesel engines installed on ships built in January 2016 or later, require a reduction in NOx emissions in NOx Emission Control Areas (NOx-ECA) compared to NOx Tier-I. One of the principle means of complying with these stringent standards is the Selective Catalytic Reduction (SCR) process, which requires an Aqueous Urea Solution (AUS) NOx reducing agent of a consistent high quality. Currently, ships are equipped with large on-board storage tanks containing enough AUS for the entire navigation of NOx-ECA. Instead, DAIHATSU DIESEL offers the AQUEOUS UREA SOLUTION GENERATOR, allowing you to produce AUS on demand, when and where you need it, and as always with DAIHATSU’s thorough after-sales service included.

### Advantages of the AUS Generator

1. **Dispense with large, space-consuming AUS storage tanks**
   - Large on-board tanks storing the entire voyage’s quota of AUS are no longer needed. Although a buffer tank will be required to provide AUS, this tank is far smaller than the aforementioned storage tanks.
   - The space of urea powder is up less than half the space of AUS.

2. **Save money on your AUS**
   - AUS produced from urea powder is cheaper than buying AUS already in its liquid form.

3. **Loading urea powder is easier than loading AUS**
   - In order to load AUS, an Intermediate Bulk Container (IBC) and pump are required to transfer the AUS from the container to the tank. With powder, these are not needed.

4. **The same high quality AUS every time**
   - Storing AUS for extended periods risks exposing it to temperature fluctuations that decrease its quality and shelf-life. Producing AUS from powdered urea when it is needed maintains the AUS quality and helps to prevent the SCR’s catalyst from becoming stained or obstructed.

5. **Optional eductor for putting urea powder into the AUS generator**
   - A sliding lid is fitted to the top of the AUS generator’s tank for the purpose of putting urea powder, but should the space above the generator be insufficient then an eductor can be used instead.

### Cost comparison between urea powder and AUS

<table>
<thead>
<tr>
<th>AUS unit price comparison (yen/ltr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUS market price</td>
</tr>
<tr>
<td>Price of AUS produced from urea powder</td>
</tr>
</tbody>
</table>

Comparison based on 2015 prices in Japan. Actual prices are subject to change.

* Comparison does not include the cost for water and electricity required for the generator.
AUS GENERATOR, as an SCR’s NOx reducing agent, requires urea and distillate water.

**Structure and Function**

The AQUEOUS UREA SOLUTION GENERATOR consists of a tank, pump, heating unit and filters arranged on a common base plate to form a unit. Through the process outlined below, valves, pump and heating unit are operated automatically to reach a fixed AUS concentration. The process is designed to take 3 - 3.5 hours.

1. Add the prescribed weight of urea powder into generator.
2. Close the lid and start the generator. The addition of distillate water and agitation automatically begins.
3. A sensor monitors the consistency, continuing the process until the prescribed AUS concentration has been reached.
4. After notifying the completion of the agitation procedure, the generator stops.
5. Once the available volume of the buffer tank and transfer lines has been confirmed, manual transfer of the AUS can begin.
6. The production cycle ends when all of the AUS has been transferred.

**Specifications**

<table>
<thead>
<tr>
<th>Model</th>
<th>DNS-300</th>
<th>DNS-500</th>
<th>DNS-1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of urea powder</td>
<td>kg</td>
<td>300</td>
<td>500</td>
</tr>
<tr>
<td>AUS concentration</td>
<td>% wt</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Required distillate water</td>
<td>Lit</td>
<td>450</td>
<td>750</td>
</tr>
<tr>
<td>Amount of AUS produced</td>
<td>Lit</td>
<td>675</td>
<td>1,120</td>
</tr>
<tr>
<td>Pump motor for agitation</td>
<td>kW</td>
<td>2.4</td>
<td>2.4</td>
</tr>
<tr>
<td>Heating Unit</td>
<td>Motor Value</td>
<td>Electric / Steam</td>
<td>Electric / Steam</td>
</tr>
<tr>
<td>Pump/heating unit power supply</td>
<td>DC200V 60Hz 3 phase</td>
<td>AC200V 60Hz 3 phase</td>
<td></td>
</tr>
<tr>
<td>External measurements</td>
<td>length</td>
<td>mm</td>
<td>2,100</td>
</tr>
<tr>
<td></td>
<td>width</td>
<td>mm</td>
<td>1,500</td>
</tr>
<tr>
<td></td>
<td>height</td>
<td>mm</td>
<td>1,400 *1</td>
</tr>
<tr>
<td>Weight</td>
<td>dry weight</td>
<td>kg</td>
<td>780</td>
</tr>
<tr>
<td></td>
<td>op. weigh</td>
<td>kg</td>
<td>1,530</td>
</tr>
</tbody>
</table>

*1: Height to top of tank

Specifications in this catalog are subject to change without notice.
AUS Generator Model Selection

From the above graph we can determine the most suitable AUS generator model. The red plot above signifies a diesel generator (D/G) averaging an output of 700kW in a NOx-ECA with, for example, a 4-day AUS production interval planned. From this plot we would select the DNS-500 generator as the most appropriate model. If, for the same output, a 2-day AUS production interval were preferred the resulting plot would be the one in green and the DNS-300 generator would be selected.

Produced AUS may also be used for the main propulsion engine’s SCR system. The blue plot on the graph to the right indicates the combined average output of 12,000 kW from a diesel generator and a main propulsion engine (M/E). The graph shows that operating the DNS-1000 twice a day would be enough to provide the necessary amount of AUS.

Case Study: Car Carrier’s AUS storage tank (for reference)
(Main engine rated output: 14,000kW; Time in NOx-ECA: 7 days)

<table>
<thead>
<tr>
<th>AUS Generator</th>
<th>Without DNS</th>
<th>With DNS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Tank Capacity</td>
<td>17.0m³</td>
<td>2.5m³</td>
</tr>
<tr>
<td>AUS Generator Model</td>
<td>—</td>
<td>DNS-1000</td>
</tr>
<tr>
<td>AUS Production interval</td>
<td>—</td>
<td>At sailing: twice a day At port: once every 4 days</td>
</tr>
</tbody>
</table>

Stainless steel independent tank

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• Please refer to our separate brochure for the “DAIHATSU AFTER-SERVICE NETWORK”.
• All information contained in this pamphlet is correct at the time of printing, but is subject to change without notice.

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