Shell gas/liquid separation technology
High-capacity gas de-entrainment

Shell SMS\textsuperscript{†} and SMSM\textsuperscript{†} gas/liquid separators are Shell Global Solutions’ proprietary technologies for demisting gas. These technologies have been applied widely within the Shell Group and are available to non-Shell customers.

Description
SMS and SMSM gas/liquid separators are named after the configuration of the different internals used for each type of separator:
- schoepentoeter (S) – used as feed inlet device
- mist mat (M) – which acts as a coalescer and separator, depending on the gas flow rate
- swirl deck (S) – comprising several standard-design swirl tubes.

A second mist mat is used downstream of the swirl deck in SMSM gas/liquid separators for demisting secondary gas to increase gas/liquid separation efficiency further (see Figure 1).

Why use Shell gas/liquid separators?
The separators are designed to offer an optimum combination of capacity, efficiency and operational flexibility:
- high gas handling capacity (vessel gas $K$ value $\leq 0.25$ m/s)
- high liquid removal efficiency (SMS >98%, SMSM >99%)
- very high turndown ratio (factor of 10)
- ability to handle slugs.

$K$ value $= V_S \left( \frac{\rho_V}{\rho_L - \rho_V} \right)^{1/2}$ where $V_S =$ superficial vapour velocity in m/s $\rho_V$ and $\rho_L =$ vapour density and liquid density in kg/m$^3$.

Figure 1: The Shell SMSM gas/liquid separator.
Experience

Figure 2 shows the number and capacity of Shell gas/liquid separators installed to date. Typical process applications include:

- inlet/production separators in gas plants
- cold separators for low-temperature separation plants
- inlet scrubbers for glycol contactors and gas treating plants
- compressor suction drums in liquefied natural gas and natural gas liquids plants.

In some revamp projects, SMS and SMSM gas/liquid separators have been used to replace alternative technology and have improved plant performance significantly.

Continuous improvement programme

Using feedback from our customers combined with the results from our research, we are continuously improving the separation capabilities of the SMS and SMSM gas/liquid separators.

- Schoepentoeter optimisation allows re-entrainment suppression through improved distribution of the incoming gas across the vanes.
- More-sophisticated mist-mat designs increase capability to handle problematic aqueous–hydrocarbon fluid mixtures.
- Swirl-tube redesign has reduced the cut-off droplet size significantly.

Table 1: Examples of recent separator upgrading projects by Shell Global Solutions.

<table>
<thead>
<tr>
<th>Location</th>
<th>Business</th>
<th>Application</th>
<th>Pre-modification capacity MMNm³/day</th>
<th>Post-modification capacity MMNm³/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAM, Anjum, the Netherlands</td>
<td>Gas processing</td>
<td>Cold separator</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Statoil, Kollsnes, Norway</td>
<td>Gas processing</td>
<td>Cold separators</td>
<td>75</td>
<td>135</td>
</tr>
<tr>
<td>NAM L9, offshore the Netherlands</td>
<td>Gas production</td>
<td>Inlet scrubber upstream of triethylene glycol contactor</td>
<td>16</td>
<td>18¹</td>
</tr>
<tr>
<td>Brunei LNG, Brunei</td>
<td>Gas processing</td>
<td>Inlet scrubbers upstream of molecular-sieve dryers</td>
<td>Not applicable²</td>
<td></td>
</tr>
</tbody>
</table>

¹Debottlenecking for design gas throughput. ²Molecular-sieve dryer lifetime extended from two to five years.

Figure 2: Shell gas/liquid separators currently installed.

- More-sophisticated mist-mat designs increase capability to handle problematic aqueous–hydrocarbon fluid mixtures.
- Swirl-tube redesign has reduced the cut-off droplet size significantly.

Table 1 shows how these developments have resulted in significant performance improvements.