Process-Gas Screw Compressors for Styrene Monomer Service

Major References
There are several styrene monomer processes on the market, where Styrene is mostly produced by the dehydrogenation of ethylbenzene with steam. The process-gas screw compressor is operating in this process in the off gas recovery unit under deep vacuum conditions.

The styrene process poses some challenges to the off gas compressor, such as:
- various operation conditions with different gas analysis and molecular weights;
- possible polymerisation of the process gas;
- part-load behaviour (flow variation);
- compression from deep vacuum with a pressure ratio range up to 9 in one single stage.

**Product information**

MAN Diesel & Turbo, with the widest product range in process-gas screw compressors, offers standard solutions for this application with complementary products to ensure the best customer benefits. Due to the positive displacement behaviour of the screw compressor, various influences such as changes in molecular weight of the process gas and operation case variations make the process-gas screw compressor the most suitable compressor selection for this application.

The compressor unit can be driven by a fixed- or variable-speed driver. For the styrene process, a steam turbine is often used to drive the unit to utilize the excellent flow control behaviour of a screw compressor by controlling the driver speed.

MAN Diesel & Turbo has developed a compressor type, for high volume flow and low pressure applications. The SKUEL type screw compressor is available in different sizes (different rotor diameters and lengths) and is selected according to the project plant size.
Benefits and features

Further to the above advantages, the following properties make MAN Diesel & Turbo the right choice for your project:

- horizontal compressor casing split, air-cooled
- specific compressor seal design for styrene service
- self-drained casing, with top suction nozzle and bottom discharge nozzle design
- discharge temperature control by injection of suitable liquid, usually condensate water
- possibility of additional inhibitor injection (prevention of polymerization)

References

Some examples of the MAN Diesel & Turbo process-gas screw compressor references for the styrene monomer application.

World records by MAN Diesel & Turbo

In 2006 and 2008 MAN Diesel & Turbo was the first company to sell process-gas screw compressor units for new styrene monomer plants with a volume flow of 77,000 m³/h, which is the world record.

<table>
<thead>
<tr>
<th>References</th>
<th>One unit</th>
<th>Two units</th>
<th>One unit</th>
<th>One unit</th>
<th>One unit</th>
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<tbody>
<tr>
<td>Unit type</td>
<td>SKUEL 643</td>
<td>SKUEL 816</td>
<td>SKUEL 816</td>
<td>SKUEL 816</td>
<td>SKUEL 816</td>
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<tr>
<td>Gas</td>
<td>H₂-rich gas</td>
<td>H₂-rich gas</td>
<td>H₂-rich gas</td>
<td>H₂-rich gas</td>
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<tr>
<td>Volume flow [m³/h, rated]</td>
<td>66,950</td>
<td>67,122</td>
<td>67,420</td>
<td>77,000</td>
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<tr>
<td>Molecular weight [kg/kmol]</td>
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<td>13 - 28</td>
<td>6.5 - 28</td>
<td>15.5 - 28</td>
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<tr>
<td>Suction pressure [bara]</td>
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<td>0.24</td>
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<tr>
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<td>1.7</td>
<td>1.6</td>
<td>1.5</td>
<td>1.9</td>
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<tr>
<td>Driver</td>
<td>Steam turbine</td>
<td>Steam turbine</td>
<td>Steam turbine</td>
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<tr>
<td>Shaft power [kW]</td>
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<td>1,900</td>
<td>1,630</td>
<td>1,720</td>
<td>2,011</td>
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</table>
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