Nitric acid design with maximum energy recovery offered for a wide range of plant capacities.

STAMI
NITRIC ACID
Dual Pressure Technology

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The challenge
A nitric acid plant design up to 2000MTPD (100% HNO₃) for single-train capacities.

Stamicarbon’s solution
A nitric acid technology with maximum energy recovery, reliable operation and minimal greenhouse gas emissions.

THE PROCESS

Air is filtered and compressed to ca. 5 bar(a) and mixed with evaporated ammonia.

The ammonia/air mixture is introduced in the ammonia burner. NH₃ is oxidized to NO on Pt/Rh gauzes and small amounts of N₂ and N₂O are formed as side products.

The produced NO is oxidized to NO₂ in the gas phase of the downstream sections which then will lead to the formation of HNO₃. The heat released by the oxidation reaction is first used to produce high pressure steam and to heat tail gas up.

Downstream the waste heat boiler, the nitrous gas is further cooled down below its dew point. A weak acid solution is condensed in the low-pressure cooler condenser and sent to the oxidation/absorption column. The remaining nitrous gas is compressed to 11 bar(a) by the NOₓ compressor and again, cooled down below its dew point to form a more concentrated acid solution in the high-pressure cooler condenser.

The remaining gas enters at the bottom of the oxidation/absorption column which consists of a series of sieve trays.

The acid leaving at the bottom of the absorption column is introduced in the bleacher where last traces of dissolved NOₓ are eliminated by means of air, obtaining a colorless nitric acid solution of about 58-63% wt.

The overhead vapor of the absorption/oxidation column, so-called tail gas, still contains traces of NOₓ and N₂O. To remove these to an acceptable level the tail gas is heated to about 480°C and introduced into a tertiary abatement system. In this system two catalyst beds are installed where subsequently N₂O and NOₓ are converted to water and nitrogen.

The tail gas is expanded in the expansion turbine where the in-line compressor train configuration allows the usage of the released power to drive the air and the NOₓ compressors. Additional power needed is provided by a steam turbine.

Benefits
- N₂O decomposition is favored by high tail gas temperature and takes place without the addition of an external agent like natural gas.
- Maximum energy recovery:
  - Extra power generation in the expansion turbine.
  - Additional heat recovery step before releasing the tail gas to atmosphere.
- Corrosion prevention design.
**Consumption Figures**

<table>
<thead>
<tr>
<th>Operating range</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>NH₃ consumption</td>
<td>70 - 110</td>
</tr>
<tr>
<td>Pt losses (incl. recovery)</td>
<td>0,03</td>
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<tr>
<td>HP steam export, 45bar, 450°C</td>
<td>&gt; 800</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>ppm vol</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOₓ</td>
<td>&lt; 20</td>
</tr>
<tr>
<td>N₂O</td>
<td>&lt; 20</td>
</tr>
<tr>
<td>Cooling Water</td>
<td>100</td>
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<tr>
<td>Process Water</td>
<td>0,3</td>
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</tbody>
</table>

**Dual pressure technology for nitric acid production process scheme**

- Compressor Train
- Burner
- Tail Gas Heater
- Waste Heat Boiler
- Absorption Column
- Bleaching Column
- N₂O/NOx Abatement Reactor