Presentation

Spray-type Deaerator

Start

Stork Thermeq BV
Presentation

Stork

Spray-type

Deaerator
### Deaerating process steps (1)

<table>
<thead>
<tr>
<th>Step</th>
<th>Item</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Spray-device</td>
<td>100% heating up</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Partial deaeration</td>
</tr>
<tr>
<td>2</td>
<td>Steam Charging Device (SCD)</td>
<td>Cooling steam to saturation temperature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Steam distribution</td>
</tr>
<tr>
<td>3</td>
<td>Vessel</td>
<td>Feedwater storage (no heating up)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Relief of non-condensable gases</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Finalization of deaeration</td>
</tr>
</tbody>
</table>
Deaerating process steps (2)

- sprayer
- steam
- vessel
Required temperature difference for \( \text{O}_2 < 10 \text{ ppb} \)
Typical vent-flow range
up to 1200 T/H and high O2 at inlet

Operating pressure (bara)

Ventflow per sprayer (kg/h)
Comparison; layout

**Typical layout**

Cascade or Spray/tray-type Deaerators
**Comparison; layout**

**Stork Spray-type**
- No vent condenser
- One vessel:
  - 1 top platform
  - min. insulation
  - min. piping
  - easy erection
  - low total height
  - earthquake optimal

**Cascade Spray/tray-type**
- Vent condenser or high losses
- Storage vessel + top tank:
  - more platforms
  - extended insulation
  - balance lines, more length
  - erection both tanks and piping
  - extra total height top tank
  - forces top tank to storage vessel critical for earthquake-design
Comparison; layout

Stork Spray-type

Cascade Spray/tray-type
<table>
<thead>
<tr>
<th><strong>Stork Spray-type</strong></th>
<th><strong>Cascade Spray/tray-type</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>heating-up with standard steamrake</td>
<td>additional heating storage tank required</td>
</tr>
<tr>
<td>operating range &gt; 1:30</td>
<td>operating range max. 1:4</td>
</tr>
<tr>
<td>no pressure difference in steam area</td>
<td>pressure difference storage vessel and top tank at high loads</td>
</tr>
</tbody>
</table>
**Comparison; operation**

**Stork Spray-type**
- water saturated with rising pressure; easy control
- simple pressure control
- rate pressure decrease limited by NPSH feedwater pump

**Cascade Spray/tray-type**
- water subcooled with rising pressure; sensitive control
- pressure control + feedforward
- rate pressure decrease is a critical item in design top tank
Retrofit spray-tray to Stork design

← Cascade-type Deaerator before retrofit

Stork Spray-type Deaerator after retrofit ↓
<table>
<thead>
<tr>
<th>Media</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flow to be deaerated</strong></td>
<td>condensate / feedwater</td>
</tr>
<tr>
<td></td>
<td>make-up / demin. water</td>
</tr>
<tr>
<td><strong>Heat supply to deaerator</strong></td>
<td>superheated steam</td>
</tr>
<tr>
<td></td>
<td>saturated steam</td>
</tr>
<tr>
<td></td>
<td>wet steam (.. 90 %)</td>
</tr>
<tr>
<td></td>
<td>steam/water mixture (.. 1% steam)</td>
</tr>
<tr>
<td></td>
<td>hot water (flashing in internals)</td>
</tr>
</tbody>
</table>
## Ranges

<table>
<thead>
<tr>
<th>Pressure</th>
<th>0.2 – 1.0 bara</th>
<th>Vacuum to 1.3 bara</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.2 – 20 bara</td>
<td>Overpressure</td>
</tr>
<tr>
<td>Capacity</td>
<td>2 – 120 T/H</td>
<td>Type DN150; spring</td>
</tr>
<tr>
<td></td>
<td>7 – 450 T/H</td>
<td>Type DN250; spring</td>
</tr>
<tr>
<td></td>
<td>60 – 660 T/H</td>
<td>Type 600; disc</td>
</tr>
<tr>
<td></td>
<td>120 – 1320 T/H</td>
<td>Type 1200; disc</td>
</tr>
<tr>
<td></td>
<td>600 – 6000 T/H</td>
<td>5x type 1200; disc</td>
</tr>
<tr>
<td>Diameter</td>
<td>1.6 – 5.0 m</td>
<td>Normal range</td>
</tr>
<tr>
<td>Length</td>
<td>Limits of workshop</td>
<td>Site assembly possible</td>
</tr>
</tbody>
</table>
Stork Thermq B.V.

From CR Bypass operation

Condensate

To HP- heaters

Conclusion
Deaerator LP-drum

- Condensate / make-up water
- LP- Steam

Heat source: Water / steam mixture
Natural / forced circulation

To drum

HRSG
Evaporator
Economizer
Deaeration by ECO-water

Heat source: Hot Eco-water

Condensate / make-up water

LP- Steam = 0

To drum

Economizer

HRSG

Stork Thermeq B.V.
Vacuum operation with gas

Heat source: Steam / Hot Eco-water

60 °C

LP- Steam = 0

Condensate / make-up water

Stork Thermeq B.V.
Overpressure with oil

HRSG

Oil fired

Economizer

LP - Steam supply

Condensate / make-up water

Heat source: Steam / Hot Eco-water

135 °C

To drum

Stork Thermeq B.V.
### Material selection

<table>
<thead>
<tr>
<th>Component</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessel</td>
<td>Carbon steel</td>
</tr>
<tr>
<td>Steam charging device</td>
<td>Carbon steel (principal)</td>
</tr>
<tr>
<td></td>
<td>Stainless steel</td>
</tr>
<tr>
<td></td>
<td>(erosion, high water content)</td>
</tr>
<tr>
<td>Flow baffles</td>
<td>Carbon steel</td>
</tr>
<tr>
<td>Spray baffle</td>
<td>Carbon steel</td>
</tr>
<tr>
<td>Sprayer</td>
<td>Stainless steel</td>
</tr>
</tbody>
</table>
Post Weld Heat Treatment

Client requirement
Quality
Saving on maintenance costs

Obligation
Code requirement
Dependent on wallthickness

Stork advice
Optimal measure against cracking based on worldwide experience

Relevant standards
NACE, VGB, S42
Disc type

Spring type (new)
Stork deaerator

Standard design:
Y-type steamrake

Alternative & combination
A / H type

Spray baffle
Large baffle
Small baffle
Vortex beaker
Investing in deaerators you want

Attractive prices

Flexible design, minimum height

Minimize the maintenance budget

Satisfaction on your decision for years and years

Stork spray-type Deaerators
End of Presentation