

Spray-type Deaerators



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General

Many decades of experience have given the Stork spray-type deaerator a unique place in the deaerating industry. The patented design has been used world-wide in power plants and industrial installations to the full satisfaction of our customers. Continuous improvements and flexibility make it possible to provide highly competitive solutions for power plant design.

Operation principle

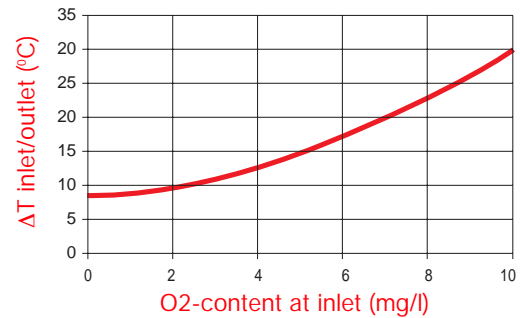
The operation of the deaerator is based on physical deaeration which takes place in two steps: Pre-deaeration in which water is sprayed in a part of the steam space (area 1); Final-deaeration in the water tank where steam is brought in close contact with the water to be deaerated (area 2).

The pre-deaeration (area 1) is achieved by the Stork spraying device. Under all kind of operating conditions, the sprayer assures heating up of the condensate to saturation temperature and a very large area for mass transfer. As the solubility of oxygen in water at saturation conditions is practically zero, oxygen transfers from the water droplets to the surrounding steam. As the steam condensates on the water, the concentration of oxygen in the direct vicinity of the sprayer is increased making it possible to vent a small amount of steam with a relatively high oxygen concentration.

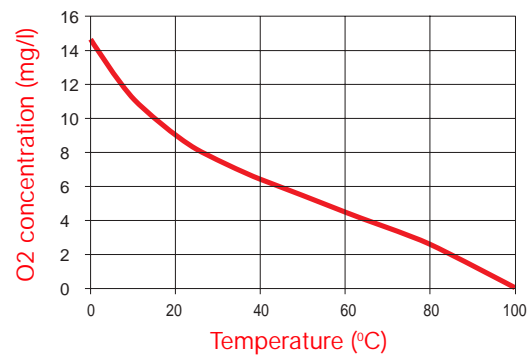
Final deaeration (area 2) in the water tank is achieved by injection of steam in the water tank. Depending on the conditions steam, pressurized hot water, steam/water mixture can be used for deaeration.

A proper designed steam device, taking into account the hydro-dynamics in the water tank, will result in good contact between water and steam, allowing the oxygen to move from the water to the steam in accordance with Henry's law.

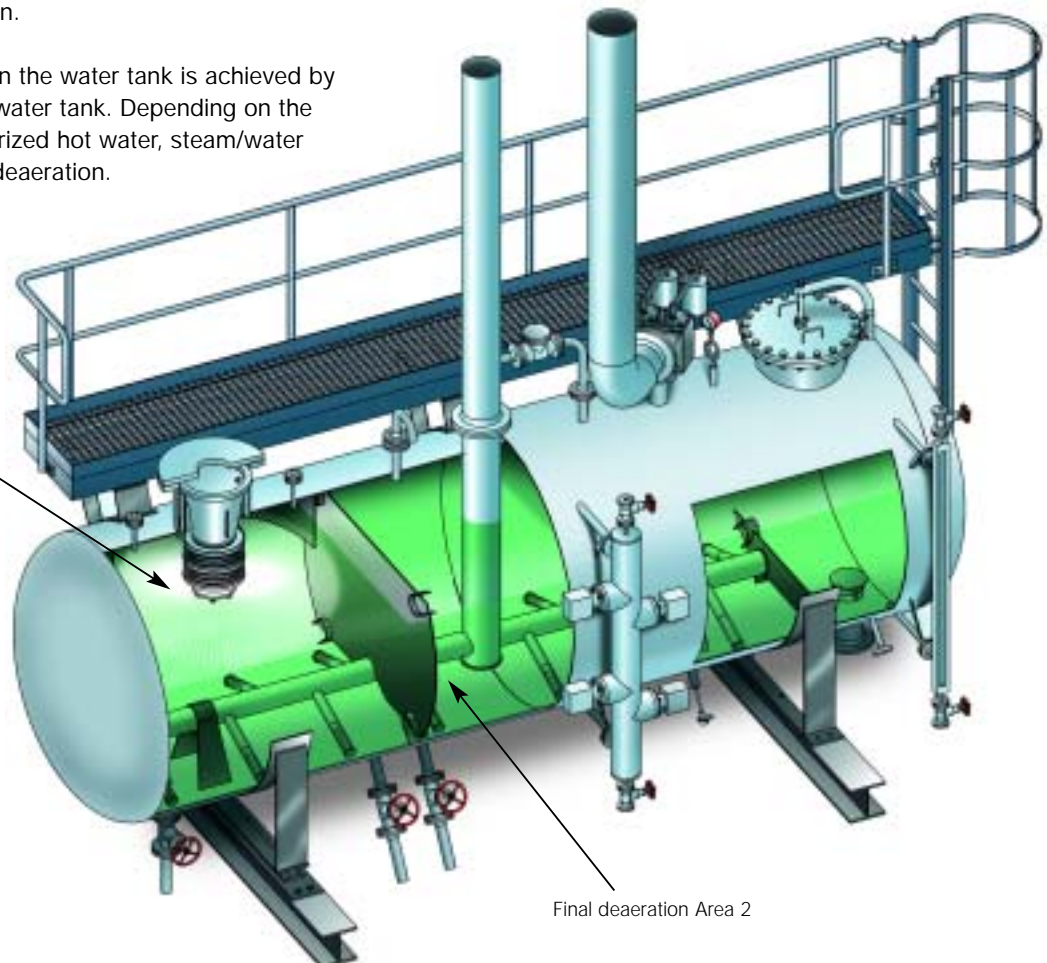
1) Required temperature difference for O₂ < 10 ppb



2) O₂ concentrations in saturated demi-water



Pre deaeration Area 1



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Applications

Conventional power plants

The Stork spray-type deaerator has been developed for application in conventional power plants.

A principal scheme is given in figure 1.

Co-generation power plants

Based on the principles of deaerators for conventional power plants we developed special Stork spray-type deaerators for/and connections to Heat Recovery Steam Generator (HRSG) installations.

The Stork spray-type deaerator provides a high degree of flexibility concerning the place in the cold end of a HRSG. Application of a Stork spray-type deaerator gives the system designer several options for the connection to the system and the choice of the most suitable deaerating medium, or media. The Stork spray-type deaerator is especially suitable for this kind of application compared to tray-type deaerators. This because of its ability to operate with steam/water mixtures, its greater flexibility with respect to fast load changes, sliding pressure operation and wider operating ranges.

Depending on the client preferences and/or over-all efficiency considerations, the Stork spray-type deaerator can be installed in various ways in the boiler system. The principal difference between the various possibilities is set by the choice of deaerating medium, such as:

- LP steam
- Pressurized hot water
- Steam/water mixtures

Some possibilities are best illustrated by the figures on the right side of this page. The figures 2 and 3 show two basic configurations in the cold end of a HRSG.

Figure 2 Economiser hot water deaeration (vacuum)

Figure 3 Evaporator bundle, natural or forced circulation

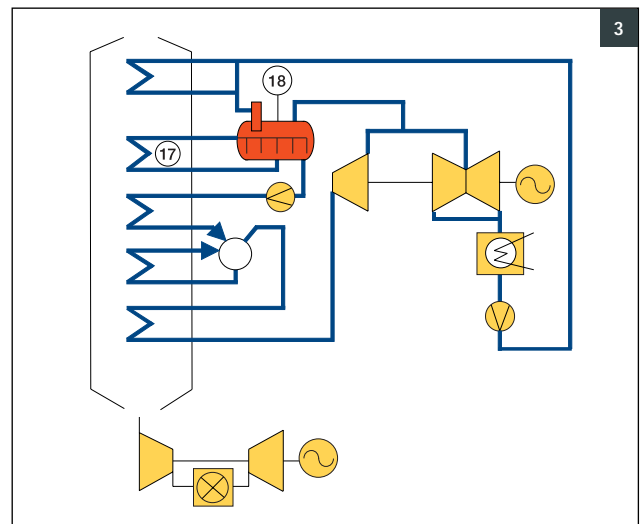
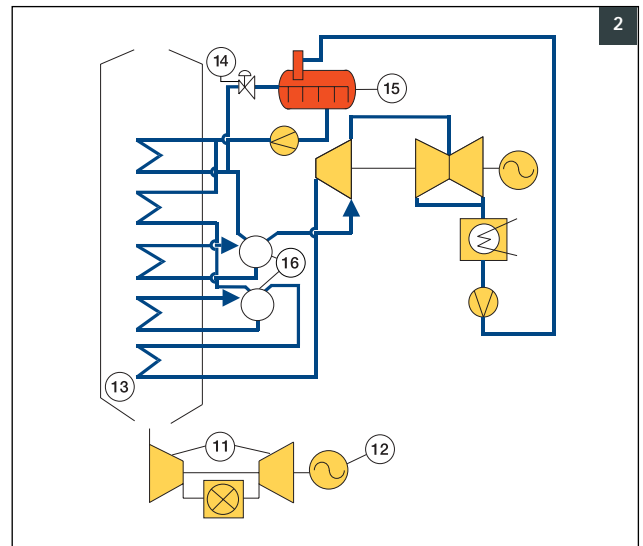
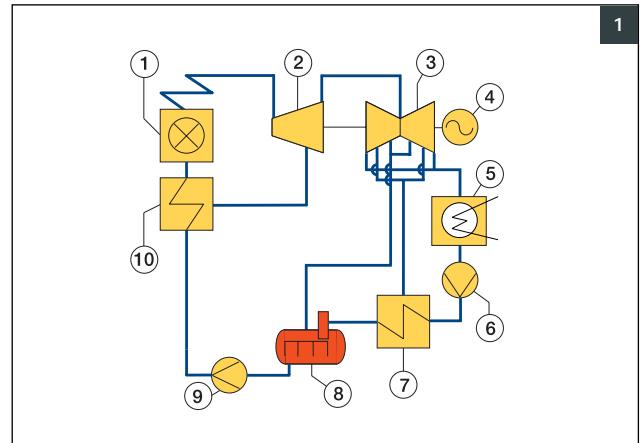
Typical operating ranges of the Stork spray-type deaerator

Operating pressure ranges (bara)	Temperature difference* (°C)	
	min.	max.
$0.2 < P_o < 0.5$	3	30
$0.5 < P_o < 1$	5	50
$P_o > 1$	8	>100

* Temperature difference between incoming condensate and feed water outlet temperature.

All the above mentioned values are typical values.

Please contact Stork Thermeq if you have more specific questions about your particular situation or visit our website.



1. Boiler
2. HP-steam turbine
3. LP-steam turbine
4. Generator
5. Condenser
6. Condensate pump
7. LP-preheater
8. Deaerator (conventional)
9. Boiler feed water pump
10. HP-preheater
11. Gas turbine
12. Generator
13. Heat Recovery Steam Generator
14. Hot-water control valve
15. Deaerator (vacuum)
16. LP/HP-drum
17. Evaporator bundle for Deaerator
18. Deaerator/LP-drum

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Features

- Reduction of oxygen concentrations to levels below 5 ppb over wide operating ranges (10 to 110%);
- High reliability/availability;
- Single shell design;
- Deaerated water available as soon as the deaerator is pressurised;
- Possible deaerating media: (superheated) steam, steam/water mixtures, hot-water or combinations here of;
- Sliding pressure operation possible, from vacuum (0.2 bara) to several bar over pressure;
- Robust design, allowing very rapid load changes;
- Low vent losses, 10 to 70 kg/s depending on amount of incoming oxygen;
- Capacity range at the outlet from 10 to 6000 ton/hour, special models possible.

Advantages

Lower Total Cost of Ownership, due to:

- Simple, robust design resulting in minimal maintenance;
- Steam consumption savings by a very small vent flow, no vent condenser necessary

Single shell design, resulting in:

- Compact construction with low overall height;
- Lower insulation and piping costs compared to other designs;
- Simple erection;
- High earthquake resistance;



Stork Thermeq B.V.
P.O. Box 33, 7550 AA Hengelo, The Netherlands

Visiting address:
Langelermaatweg 12, 7553 JD Hengelo, The Netherlands
Tel.: +31 74 240 1724
Fax: +31 74 242 4790
e-mail: info.thermeq@stork.com
Website: www.thermeq.nl