



Shippensburg Pump Company, Inc.

BOILER FEED • CONDENSATE • DEAERATOR • VACUUM

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Spray Tray Style Deaeration

Henry's Law states that the concentration of the dissolved gas in the solution is directly proportional to the partial pressure of that gas in the free space above the liquid.

—Betz Handbook of Industrial Water Conditioning

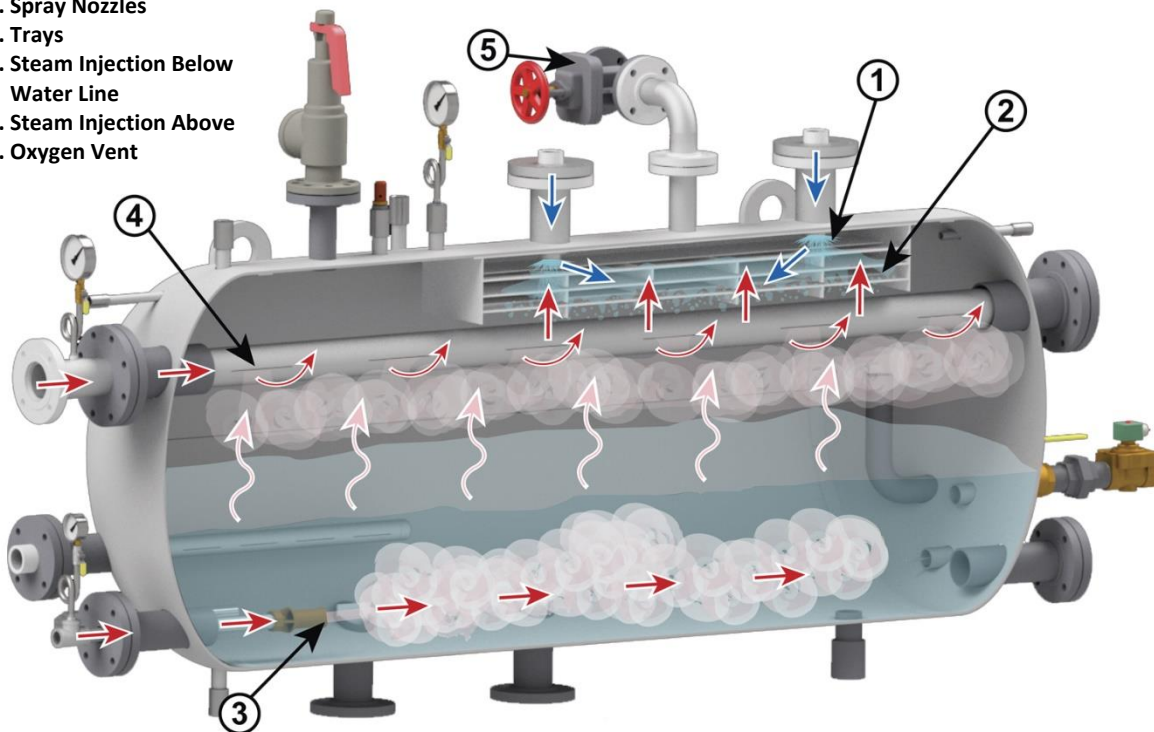
The Shipco® design is a proven way to remove oxygen and non-condensable gases from boiler feed water. Heating causes oxygen to release its chemical bond to water. However, released oxygen will stay in water and re-condense unless it is displaced by another gas (i.e., steam). Per Henry's Law, the steam must have a higher partial pressure below the water than the gas above in order to displace oxygen and other non-condensable gas. Shipco® uses a trifold counter flow redundancy in the spray nozzles, trays, and injection ports to guarantee deaeration.

Incoming water is introduced to the deaeration compartment through spray nozzles where it fans into a thin film of water (**Fig. 1**). Since the entire compartment is full of steam during steady state, this water film reaches saturation temperature almost instantaneously. This differs from a traditional vent condenser by optimizing for water heat rather than steam condensation.

Figure

1. Spray Nozzles
2. Trays
3. Steam Injection Below Water Line
4. Steam Injection Above
5. Oxygen Vent

Deaerator with Internal Spray Tray

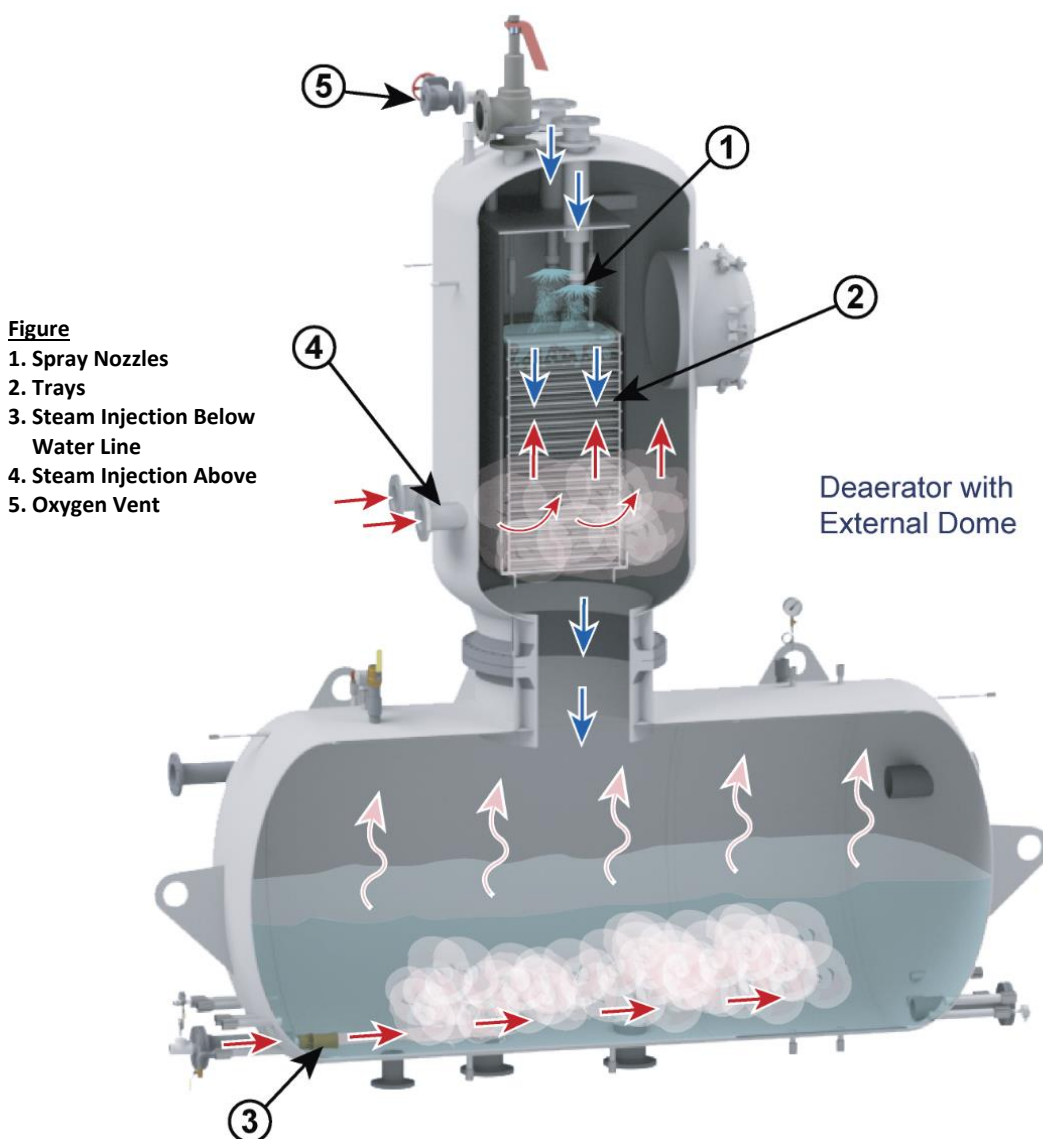


Customized Steam Solution Providers Using the Technology of Tomorrow...Today!

Next, the water film falls to the tray section or cascades (**Fig. 2**). The tray dimensions are critical to maintaining partial pressures and displacing oxygen and non-condensable gases without restricting the flow of water or steam. This is where Shipco® counter flow and parallel flow designs differ. While both designs heat water, only Shipco® counter flow applies Henry's Law to displace the undesired gases with steam.

While induced transients are outside the testing requirements for deaerators, they do exist and Shipco® designs to mitigate their influence. By injecting steam below the water line (**Fig. 3**), Shipco® ensures that the water reservoir percolates continuously, scrubbing it with steam and breaking the surface tension to release oxygen. This maintains deaeration when liquid flow stagnates and it counteracts the heat lost to the room while providing redundancy to the spray nozzles and trays.

Shipco® splits the steam injection load to prevent water hammer during turndown. The injection port below the water line is sized to maintain a continuous stream which prevents water from back filling the steam line. The injection port above the water line (**Fig. 4**) modulates to match the incoming water supply.



Each stage in the deaerator forces undesired gases higher in the tank with the flow of steam where it finally vents away from the feed water through an orifice (**Fig. 5**). Rather than supplying an orifice plate like other manufacturers, Shipco® supplies a full size atmospheric vent connection with an orifice drilled through the gate valve. As a safety feature, this gate valve can be opened to operate the deaerator atmospherically or to manually vent for servicing.

Concerning sulfites and chemical deaeration, refer to Shipco® literature on recommended chemical injection points.

