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- Deaeration is one of the best ways to remove oxygen and carbon dioxide in boiler feedwater.
- Deaerators also hold hot condensate returning from the system, thus reducing the fuel spend.

Do I Need a Deaerator?

Water is a universal solvent that contains dissolved or soluble gasses, which are highly corrosive when exposed to boilers and boiler system components. Water comes in contact with various minerals in the ground, which when dissolved end up in a boiler's feedwater and need to be removed. Deaeration is one of the best ways to remove oxygen and carbon dioxide in boiler feedwater. Other impurities can be controlled through a good water treatment program, including proper chemicals and dosing of the substances.

When water and steel are combined, the resulting chemical reaction begins to dissolve the steel. Dissolved or soluble oxygen contained within the boiler's feedwater accelerates the rate of corrosion. The attack on a boiler's waterside surface often is evident in the form of blisters. Beneath these blisters are small holes that penetrate the tube metal until it fails and leaks. This process happens quickly. If the free oxygen is not contained or eliminated from the feedwater, a new boiler can completely fail in a matter of a few months.

Even though oxygen is 10 times more corrosive than carbon dioxide, carbon dioxide is 40 percent more corrosive when working in conjunction with oxygen. It's important to rid the boiler system of these gasses as completely as possible to preserve boiler life as well as to optimize boiler run time. This is accomplished by applying heat in the proper way.

Carbon dioxide forms in the boiler's feed tank when the water is heated. The amount of carbon dioxide formation depends upon the amount of carbonates in the feedwater, especially bicarbonate. Carbon dioxide can be completely removed from the system by applying heat in conjunction with maintaining a pH in the boiler water between 9 and 12.5. Oxygen also loses its solubility in water when it is heated.

Water possesses a high degree of surface tension that tenaciously holds things in place unless a surfactant is applied or some other means is imposed on the water to reduce the tension, which is how deaeration works.

Deaeration begins by reducing the surface tension through a system that either sprays or films (spreads out) the water for eventual gas bubble release. The water is then heated, which causes the gasses to lose their solubility and form the bubbles. Next is a mechanical agitation or scrubbing process that liberates the gasses, allowing them to flow into the atmosphere.

Another key benefit of deaerators is their ability to hold hot condensate returning from the system. This significantly reduces the fuel spend. For every 10 degrees of improvement, there is a 1% gain in boiler system efficiency.

There are several different types of deaerators available:

- **Spray type.** The normal capacity ranges from 7,000 to 280,000 pounds of steam per hour. This type requires far less head room compared to the others. Its assembly consists of several moving parts, which may require more mechanical maintenance in the field over the life of the equipment, thereby affecting routine operating cost and reliability.
- **Packed Column type.** Typical capacity of this type is 1,500 to 135,000 pounds of steam per hour. Unlike in the Spray type, a Packed Column type deaerator has two separate vessels: one for deaerating (the column) and one for holding the deaerated feedwater (storage tank). Similar to the Spray type, it also is equipped as a complete package with the stand, pumps and controls.

- **Tray type.** These can be quite large, not only in capacity, but in physical size as well. This type of deaerator typically supports large industrial watertube boilers, and is similar to the Column type in that it has a separate column or tank where deaeration takes place. Unlike the Column, however, which has stainless steel rings for reducing surface tension and providing a means of contact for the (heating) steam, the Tray has stainless steel separators that serve the same purpose.

Each of these deaerators eliminates oxygen to 0.005 CC/liter (7 PPB), so selection should be made based on head room, floor loading limits, capacity and system requirements, as well as budget.

Deaeration is recommended to achieve a highly efficient and long-lasting boiler system. To learn more about deaerators, watch the [Basic Deaerator Science Revealed webinar](#) or contact your local [Cleaver-Brooks representative](#).