7822 Conser Place | Overland Park, KS 66204 | 888-381-5581 | USDeaerator.com | Fax: 913-381-8648

U.S. Deaerator Company. For all your deaerator, boiler feed, condensate, and water heating equipment needs.

DEAERATION - WHY & HOW

For more than 30 years, the name US Deaerator has been associated with the art of conditioning water to prevent corrosion, including heating and deaeration. This discussion deals with why US Deaerators are necessary and how they function.

WHY

Corrosion of iron or steel is influenced by three fundamental factors:

1. Temperature
2. pH value
3. Oxygen content

Temperature and pH value control the activity or aggressiveness of corrosion (high temperatures and low pH values increase aggressiveness). The oxygen content is a large factor in determining the extent or amount of corrosion. **FIGURE 1** illustrates the expected oxygen content of raw water at various temperatures.

Iron goes into solution in pure water to a slight extent, according to the formula $Fe+2H2O \rightarrow Fe(OH)2+H2$, but the ferrous hydrate Fe(OH)2 formed is alkaline and raises the pH value. At a definite pH value, further dissolving of iron is stopped. However, if oxygen is present, it immediately oxidizes the ferrous hydrate forming ferric hydrate Fe(OH)3, which is insoluble and precipitates, permitting more iron to go into solution and thus the reaction continues until all oxygen is dissipated.

It is evident therefore, that the removal of oxygen and carbon dioxide from solution is important and essential when conditioning water for industrial use. This is particularly true when boiler feed water and process water are used at elevated temperatures.

HOW

Deaeration is the mechanical removal of dissolved gases from a fluid by applying mechanical agitation and heat to the water. The process of deaeration is most frequently applied in boiler feed water heaters to protect piping, boilers and condensate equipment from corrosion. In other applications, deaeration of cold water is necessary to protect pipe lines and equipment from corrosion, as well as to provide oxygen-free water required in some processes.

US Deaerator operation at sub-atmospheric pressures as is the case with cold water deaerators, requires evacuation or vacuum be applied to create a boiling condition.

Since US Deaerator Feed Water Heaters were first installed, continual improvement has been maintained to meet the new requirements of higher stream pressures and more advanced boiler design and practice.

Mechanical Agitation: The heated water must be mechanically agitated, by spraying, cascading over trays, or by atomization, to expose maximum surface contact to the steam scrubbing atmosphere, thus permitting complete release and removal of gases. When water is broken down into fine droplets or thin films, the distance that the gas bubble must travel for release is greatly decreased. Thorough agitation also overcomes tendencies of surface tension and viscosity to retain the gas bubbles and increase the rate of gas diffusion from the liquid to the surrounding atmosphere. The US Deaerator equipment, therefore, must provide the most efficient mechanical agitation possible to meet modern requirements of gas removal. Since a normal warranty of "less than 0.005 cc per liter of oxygen" means less than 7 pounds in a billion pounds of water, the importance of effective agitation cannot be overstressed.

Complete Gas Removal: Adequate steam must be passed through the water to scrub out and carry away the gases after release. Extremely low partial gas pressure must be maintained since Henry's Law states that the amount of gas which will dissolve in a liquid is proportional to the partial gas pressure in the atmosphere contacting the liquid. It is mandatory that the volume of scrubbing steam be high to produce the low partial gas pressure, and it is equally mandatory that these conditions prevail throughout the deaerating sections.

DEAERATOR TYPES

US Deaerator manufactures 3 types of deaerators: Tray, Atomizing and Cold Water. All of these types efficiently employ the cardinal principles outlined above.

TRAY TYPE

US Deaerator tray type is the most widely used for heating and deaerating boiler feed water in industrial power plants. Water is heated to full saturation temperature with a minimum pressure drop and minimum vent, thereby assuring best thermal efficiency. Deaeration is accomplished by spreading the heated water over multiple layers of trays designed to provide maximum spilling or weir edge, thereby giving intimacy of surface contact with scrubbing steam. The US Deaerator design provides a deaerating efficiency unequalled in other tray type designs.

ATOMIZING TYPE

US Deaerator atomizing type deaerator is used in marine applications since it is unaffected by normal roll and pitch of the vessel. The atomizing type employs a high velocity steam jet to atomize and scrub the preheated water. The breakup of water into fog like particles assures maximum surface exposure and intimacy of contact necessary for complete deaeration.

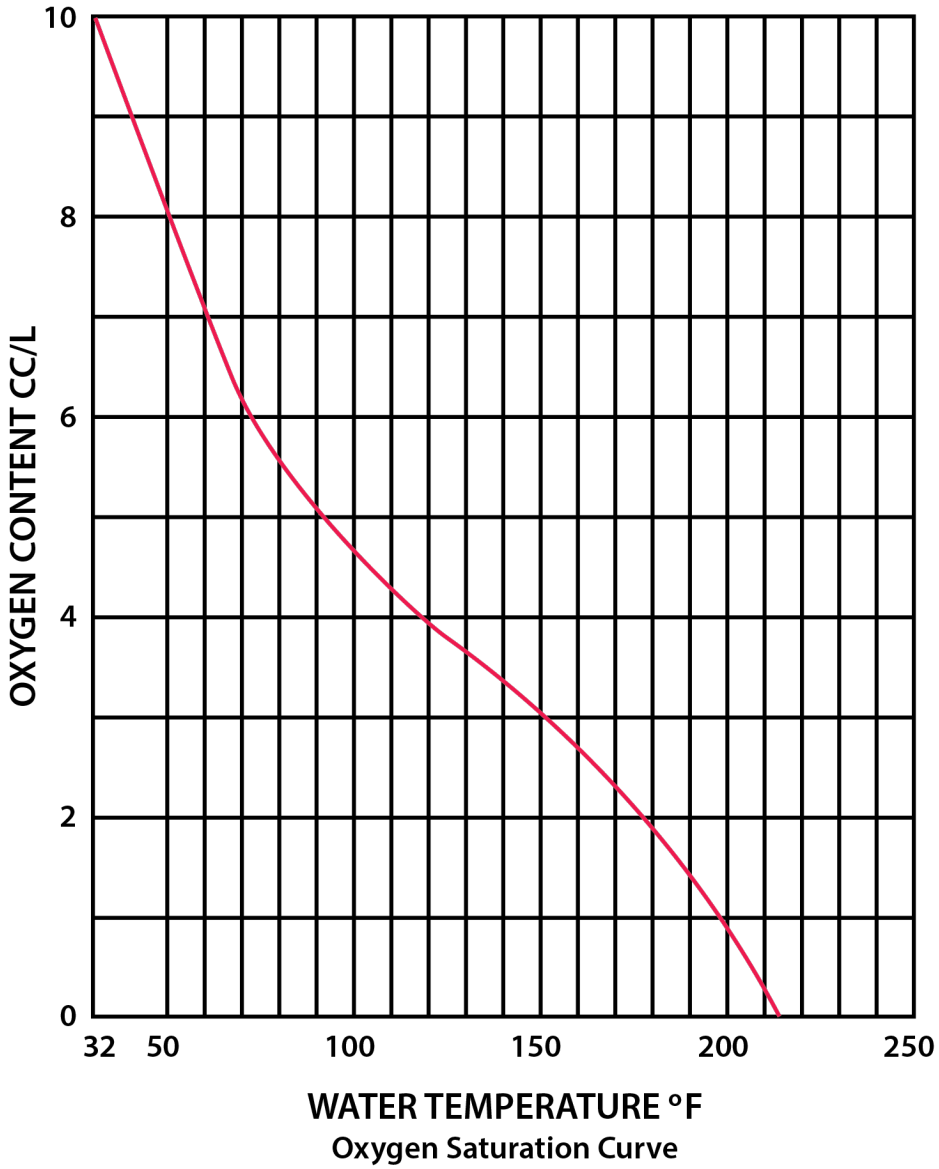
COLD WATER TYPE

US Deaerator cold water deaerators are used primarily to eliminate corrosive gases from cooling water, demineralization systems, and industrial water supplies without the addition of heat. The boiling condition is accomplished by pressure reduction with vacuum-producing equipment. Surface contact with scrubbing vapor is provided by a packing or Raschig rings.

CONCLUSION

The necessity for US Deaerator and the deaeration of boiler feed and process water has become so recognized that even small plants now assure longer equipment life and reduced maintenance by employing some type of deaeration. Deaeration today is an important factor in the successful and economical operation of any modern boiler plant, regardless of its size.

FIGURE 1



Oxygen Saturation Curve