

AMERICAN WATER TREATMENT, INC.®

Since 1950

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Treatment Concerns and Proper Methods for Aluminum Alloys

Why do aluminum alloys require special consideration when designing a water treatment program?

There are obviously many benefits to using aluminum alloys in a closed loop system; their excellent heat transfer characteristics, the easy of which the material can be machined, their low weight and high strength, but there are also a few characteristics that make your water treatment specialist cringe when you tell him there is aluminum in your system.

Aluminum is amphoteric. That means that it is attacked by both low pH (acidic) and high pH (alkaline) conditions in your water system. This also means that the water chemistry of your closed loop system must be more closely monitored and treated differently than a system without aluminum. The broad range of safe pH for aluminum is 5 to 8.5, meaning that corrosion rates for aluminum are minimized between these pH's. The problem here is that a pH as low as 7.5 is corrosive to mild and carbon steels and ideally we want to keep the pH in a system with steel and copper between 8.5 – 11.0. As you can see that is outside of aluminum's "comfort zone"

Aluminum's amphoteric property also makes the selection of a corrosion inhibitor a little more difficult in that in order to form a protective and durable passive layer on the surfaces of the alloy, a material that will react quickly with the aluminum to form the aluminum oxide / inhibitor complex greatly shortens the list of candidate materials.

Aluminum oxide is readily soluble in water and in particular softened water, therefore if your loop water hardness is low, either naturally or by design, additional consideration must be made to ensure that the aluminum is not dissolved.

Finally, aluminum readily reacts with chlorides in water forming soft and quickly dissolved salts, so to completely protect your system you must be aware and compensate for chlorides higher than 100 ppm.

Ok, so what can American Water Treatment do to protect my aluminum parts?

First, we must look at your raw water, the water that you fill with system with. A basic water analysis will tell us a lot. We look at the natural pH and alkalinity, the conductivity, the total hardness and the chloride and iron content. If your tap water has a high pH or chloride content, we will typically recommend you use a prepared treated water product like our American #2990. This water is buffered, balanced and treated to be used as your system's sole source of makeup. #2990 is treated to protect your aluminum as well as your iron and copper alloys.

Assuming that your water does not have pH and chloride issues, we then will determine the best way to balance your system pH. The target pH is 8.0, with a control range of 7.8 – 8.5, well within aluminum's safe zone and still high enough to not cause acidic attack on your iron and copper alloys.

Once the pH is balanced the system should be treated with our American #290L. This product contains phosphonates, silicates, borates and our proprietary vapor-phase corrosion inhibitors. This blend of inhibitors hits all the metals that are found in common closed loops with the added, and most important, benefit of a vapor-phase inhibitor. VPCI's create passive films on all metal surfaces, regardless of species that are self repairing and highly durable. This is particularly important with aluminum because the VPCI film binds to the aluminum very quickly and tightly. An additional benefit of #290L is that it contains no nitrites, which if your system is open, will become food for bacteria that can attack all of your system metals.

TOTAL WATER TREATMENT SERVICES

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