Deionized Water Myths

Distilled water involves some form of evaporation process from the feed water with subsequent condensation of that water vapor. The typical process is to heat the water to make steam (sometimes with a negative pressure assist) and then cool the vapor stream at some remote place to make distilled water. Deionized water is water, which has been passed through a bed of resin beads, which have selective anodic and cathodic sites chemically bonded to them--in effect; the ions from the dissolved and disassociated minerals are attracted to the ionic sites on the beads. The treated water will have less ionic load after the minerals are removed from the feed stream.

Distilled water, depending on the feedstock and the process involved, usually has a fair amount of dissolved gasses and also contains some of the volatile components from the feed water (such as volatile organic components).

To make ultra pure water, distilled water is often degassed and then treated with deionizing resins. The rationale behind this is the deionizing resins are fairly expensive and do not have a large capacity to extract ions, so using distilled water as a feedstock greatly prolongs the life of the resin beds. After distillation, deionization and degassing, the water can be considered ultra pure. In some applications, and if the feed water is very clean, that is, has a very low ionic component load, then reverse osmosis can sometimes be used to remove some of the minerals before deionization instead of distillation. Reverse osmosis is fundamentally a hyper filtration process whereby molecules are filtered out to some extent. [I know, this is an oversimplification, but this is a mixed audience.] There is a fair amount of operation involved in reverse osmosis and depending on the quality of the feed water, chemical flocculation or preconditioning of the water is mandated. I should point out that regardless of treatment, softening of the water is usually a first step to prevent scaling of the treatment system.

Ultra pure water has a very low conductivity and is a very aggressive solvent, which will attack stainless steels and even glass. Really pure water is actually difficult to work with and store -- it readily absorbs gasses and requires Teflon coated containers under inert gases.

For critical cooling applications, you are basically looking to prevent scale formation on heated or cooled surfaces.

The typical scale components of “hard” water are magnesium and calcium carbonates; these compounds have a narrow band of solubility in water as dependent on temperature--if the temperature is heated above 90C or cooled below 2C the carbonates tend to precipitate out of the water and deposit on your expensive equipment as a scale deposit. Scale reduces the coolant flow and disrupts the transfer of heat in the system, both undesirable and potentially damaging conditions. Distilled water is probably sufficient for your application and is much less expensive than deionized water. Also, the dissolved gasses and small amount of ionic load inherent in distilled water will help to protect your metal contact surfaces from corrosion by the water.

If, for some reason, the distilled water is eating your equipment (watch the welds!), you may have to go to another coolant fluid, perhaps a chlorinated or fluorinated hydrocarbon. Tin-plating the water contact surfaces is also a very effective means of protecting components from corrosion by water, and tin and tin oxides are very insoluble in water. However, since your equipment was designed to be water cooled, I suspect distilled water will meet your needs.

Dale Woika
Surface Conversion Sciences - Bellefonte, PA, USA