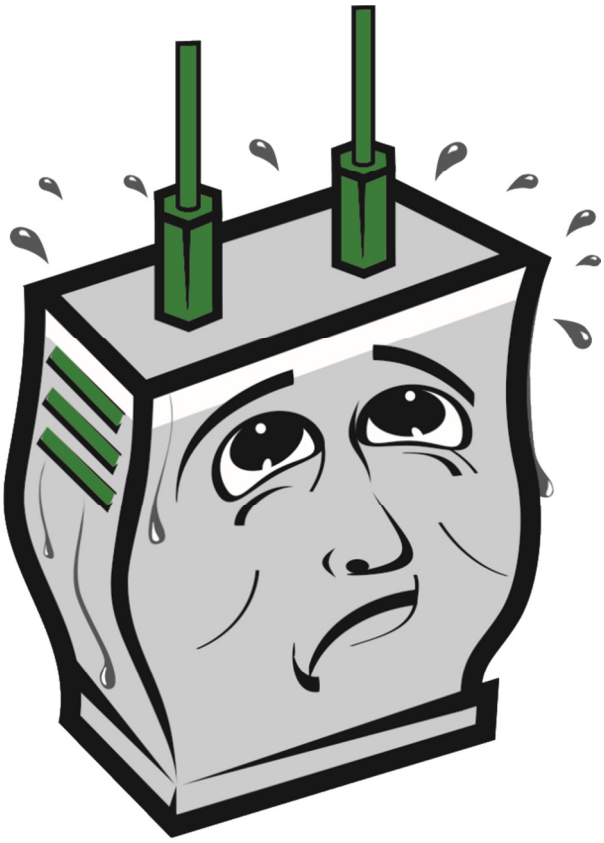
AXIOM INDUSTRIES LTD.

Demineralized water and corrosivity



Is demineralized water corrosive

NO! Read on for further explanation

Demineralized fill, make-up, and glycol dilution water is perfect for closed loop heating and cooling systems. Marginal water quality can lead to scaling, sediment deposits, accumulation of sludge, and increased corrosion rates.

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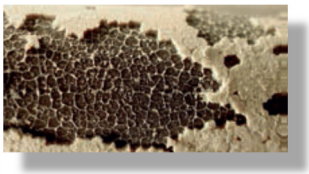
AXIOM INDUSTRIES LIMITED

PUROPAL demineralization products protect your hydronic heating system by...

1. Removing aggressive salts like chlorides, sulphates, and nitrates, which specifically attack metals like stainless steel, copper, and aluminum.
2. Removing scale-producing "hard ions" like calcium that permanently damage components and block heat transfer.
3. Lowering electrical conductivity, which reduces corrosion potential.

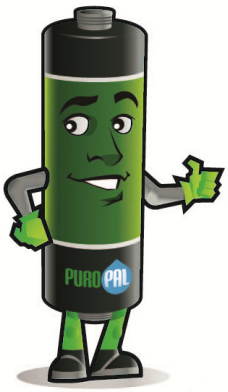
Possible consequences of using untreated tap water in heating systems:

Sludge



Lime scale build-up

Rust deposits



«But WAIT! Isn't demineralized water corrosive?»
«NO! Read on for further explaination»

THE FACTS
Recommended by European standards

Demineralizers have been used for over a decade in hydronic heating systems in Europe. In the German speaking world alone (Germany, Austria, Switzerland), many hundreds of thousands of new installations are treated this way every year.

The effectiveness of demineralization as a means of corrosion prevention has become so widely recognized in Europe that demineralization of fill water is required or recommended by current standards in Germany (VDI 2035, page 2), Switzerland (SWKI BT102-01), and Austria (ÖNORM H 5195-1).

How can these facts be reconciled with some accounts of demineralized or deionized water being aggressive?

THE THEORY
Galvanic corrosion

The most common form of corrosion is called galvanic corrosion. It mainly occurs when oxygen molecules (O_2) are in contact with metal in water. The oxygen molecules cause one metal (or one site of a metal) to give up electrons to another site, allowing metal ions to go into the solution and react with oxygen to form a metal oxide—that is, a corrosion by-product.

When the water is more conductive (meaning it contains more charged ions), this process is accelerated. When the water is less conductive, the process is slowed. So conductivity and dissolved O_2 are inversely related. The higher your conductivity, the lower the amount of dissolved O_2 is allowed before corrosion occurs.

pH–Acid corrosion and alkalinity

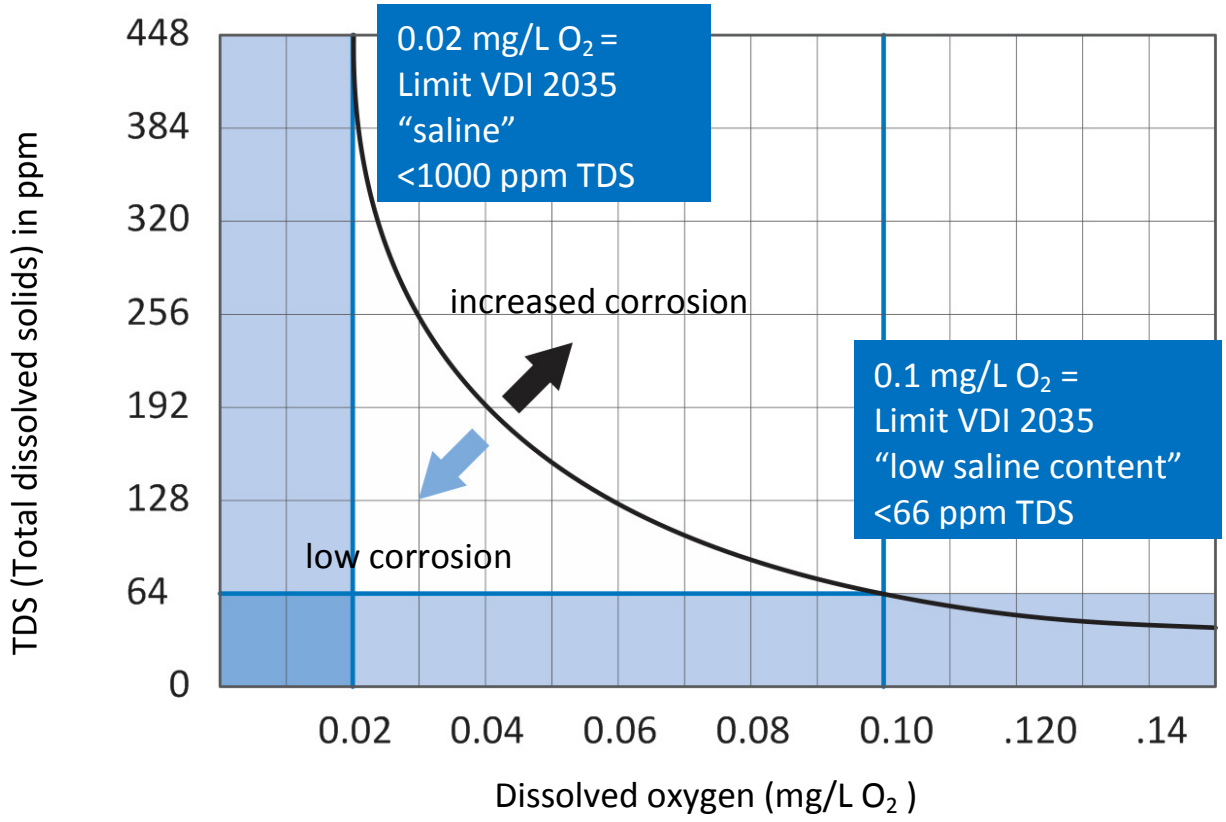
Besides dissolved oxygen and conductivity, there is another factor that determines corrosion, pH. In general an operating pH between 8.2-10 is ideal for most metals. An acidic pH (below 7) can cause acid corrosion.

Demineralization removes mineral ions (i.e. solids) from water, but is incapable of removing gasses. And as soon as water is free of gasses, it is "hungry" for gasses. So if the water is in contact with air, the gasses in the ambient air—Nitrogen (N_2), Oxygen (O_2), and Carbon Dioxide (CO_2)—immediately dissolve in the water. The solubility of gasses is governed by Henry's law. However, this law only applies to gasses. While people often speak of pure water being "hungry" for minerals, this is actually incorrect.

In demineralized water, acids can only come from gasses. An acid like hydrochloric acid (HCl) would not be able to form, because any available chlorine atoms are removed during demineralization. But a weak acid like carbonic acid could, because it is formed from CO_2 and H_2O, and demineralization cannot do anything to remove CO_2.

When CO_2 dissolves in demineralized water, forming carbonic acid, the pH of the water drops (typically to about 5 or 6). In an open-loop system, with consistent use of demineralized water, this would be a problem. Oxygen (O_2) from the ambient air would be constantly available, and pH would stay in this low range. Without any minerals to interact with, the oxygen would directly combine with metals causing corrosion. Fortunately, closed-loop systems work differently.

Corrosion as a function of oxygen and salinity in the heating water



Why use demineralized water for your heating system

Closed-loop hydronic systems are consistently observed to self-alkalinize. This means that pH naturally rises above 8.2 under normal conditions.

Similarly, closed-loop hydronic systems naturally stabilize their conductivity levels to within 32-64 ppm TDS (50-100 µS/cm). So while fill water from PUROPAL might be at a conductivity level near 0 ppm TDS (0µS/cm), the actual operating conductivity level will be closer to 64 ppm TDS (100µS/cm), an ideal level for corrosion prevention.

In a system filled with high-conductivity water due to dissolved minerals, this stabilization will also happen, but along the way, hard ions will precipitate on hot surfaces, damaging components, and aggressive salts will break up protective films, causing damage to various metals.

Long story short:
It pays to demineralize. And it pays to go with a company that knows water. When you choose, go with PUROPAL, the market leader in North America.