Testing SHW System Antifreeze

The antifreeze solution in a closed-loop solar water heating system can last decades—if it isn't abused. So it's smart to test it every half decade or so to ensure that the solution is in good condition.

The chemical companies that make the heat-transfer fluid—propylene glycol—add buffers to the mixture to lower its acidity. The buffers give the glycol a wider margin of safety before it will become acidic from heating. Temperatures above about 285°F break down the buffers in most brands of propylene glycol, with the exception of Dowfrost HD, which is rated to 325°F.

On the pH scale, 7 is neutral and anything below that is acidic. A glycol mixture that drops below a pH of 7 is a cause for alarm and solutions below a pH of 6.4 will start to corrode the tubing in solar collectors and their pipes. This is first evidenced by pitting and, eventually results in pinhole leaks.

You need to go back to chemistry class for your testing tools. Litmus paper and its color chart make a low-cost tester that can easily be purchased online. The litmus test requires just a drop or two of the solution, easily obtained by slightly opening the drain/fill valves on antifreeze-based systems. The litmus paper will react to the glycol, turning a particular shade that, when read on the color chart, indicates the solution's pH.

Courtesy Chuck Marken

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A more expensive—but more accurate—tool is a pH meter, which gives a digital readout accurate to tenths on the pH scale. You'll need a little more of the glycol solution to immerse the meter tip, but the test is also easy and quickly accomplished.

Neglecting to test the pH of the solution in an antifreeze-based solar water heater has ruined many collectors. For each whole digit on the pH scale, the acidity rises or falls by a factor of ten. Any antifreeze system solution that's close to a pH of 7 should be changed.

It is also a good idea to check the freezing point of the solution unless you are sure of the antifreeze content. An inexpensive propylene glycol tester—a tube filled with tiny colored balls that float, depending on the freeze point—is used. The testers look exactly like those used to test car antifreeze (ethylene glycol), but are made specifically for propylene glycol. Auto supply stores usually stock them as the brand name Sierra, a company that makes propylene glycol.

If testing indicates the solution no longer provides freeze protection to the level you need in your climate, it's time to drain some of the solution and add more propylene glycol. In mild climates, a 30% solution (30% glycol; 70% distilled water) is typically used, which gives freeze protection to within a few degrees above 0°F, and burst protection to -20°F. But in most of the United States, a 50% solution is common, which gives freeze protection to -30°F and burst protection to -60°F. Extremely harsh winter climates call for a 60% solution.

—Chuck Marken