



# CLEANING SCALE FROM COOLING TOWER SYSTEMS

**When scale is present, the system's compressor works harder, drawing extra current. This increases energy costs, affects system longevity and prevents the equipment from achieving optimum capacity.**

By Doug Gildehaus, Nu-Calgon

**W**hen water is heated or evaporated, solid matter called scale often is left behind. This scale can affect the efficiency of water-cooled systems and the overall life of the equipment. Scale can form thick deposits on heat transfer areas, reducing water flow, decreasing heat transfer and causing high head pressure. The presence of scale also forces the system's compressor to work harder. Aside from increasing energy costs, the extra demand placed on the compressor can affect equipment lifetime and prevent the compressor from achieving optimum capacity. In fact, it does not take much scale: a 0.125" thick deposit can affect capacity by 20 percent.

Of course, not every deposit within a water-cooled system is scale. To determine if the deposit is scale, take a sample and place it into a glass beaker containing a few ounces of water and a

few teaspoons of acid. Stir the mixture. If the material bubbles and starts to break up — or completely dissolves — it is scale. If it does not bubble, the deposit could be corrosion byproducts, silica or another compound. Identifying the exact nature of the deposit would require additional testing by a chemical laboratory.

## Descaling Chemical Options

Several types of descalers are available. Generally, they fall into three categories:

- Hydrochloric acid.
- Methane sulfonic acid.
- Sulfamic acid.

**Hydrochloric Acid.** Also known as aqueous hydrogen chloride or muriatic acid, hydrochloric acid is a traditional, effective approach for cleaning scale from water-cooled

condensers and cooling towers.

A liquid acid, hydrochloric acid is both the most economical and strongest acid available for dissolving scale and iron oxide faster than any other options. Premium hydrochloric acid-based descalers have built-in pH color systems that change color to indicate the solution is still neutralizing the scale (or if more acid is needed to complete the job).

Among the disadvantages of hydrochloric acids is its high vapor pressure — strong odors that require safety precautions and ample ventilation. Also, with repeated use on galvanized metals and stainless steel surfaces, hydrochloric acids cause corrosion on these metals.

**Methane Sulfonic Acid.** A newer option for descaling cooling equipment, methane sulfonic acid is a strong, efficient and safe approach for liquid descaling of stainless steel materials. Its



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low odor and biodegradable chemistry make it more appealing and safer to use indoors with proper ventilation.

This acid can be used in many applications, including descaling steam tables, evaporative coils or geothermal systems. However, it can adversely affect galvanized surfaces on cooling towers, and its cost typically is higher than hydrochloric acid-based descalers. Nevertheless, it remains a good approach for descaling stainless steel surfaces.

**Sulfamic Acid.** A gentler treatment that is suited for use on aging equipment, sulfamic acid employs a weaker acid than hydrochloric or

methane sulfonic acids. This makes it a good choice for any equipment with galvanized surfaces.

One disadvantage of sulfamic acid is that it comes in a powder that must be dissolved first. Also, because the acid is weaker, it can take considerably longer to dissolve the scale.

### How to Clean the System

Determining the amount of chemical required to clean the system depends on how much scale there is and the type of acid used. For specific treatment guidelines, consult the label on the product used. In general, add no more than three doses of acid to the

water. If scale remains, then flush the system and treat it again.

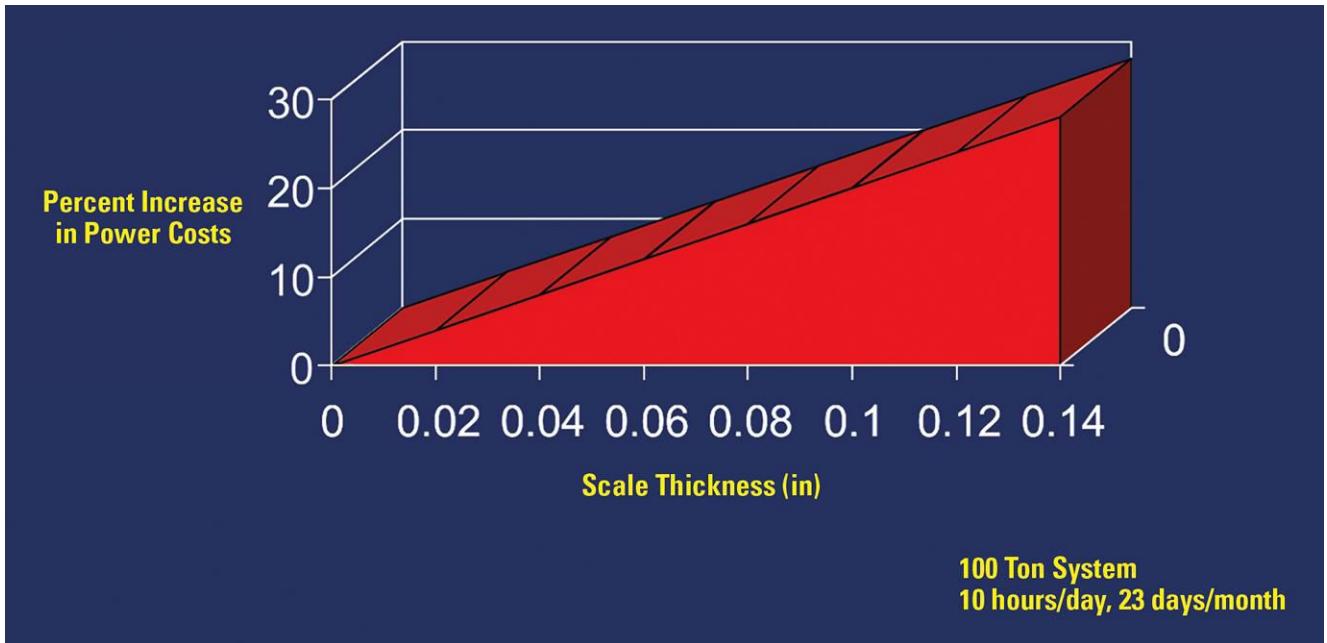
Before descaling the system, check and clean the spray nozzles or water-distribution holes. Also, drain and flush the sump, then refill it with fresh water and start the pump again. Shut the bleed if there is one. These steps will reduce the amount of treatment needed and prevent waste.

When cleaning with acids, always supervise the entire cleaning process. Typically, the acid solution should circulate in the system for several hours, depending on the amount of scale present. Make sure you do not leave the acid treatment in the system longer than necessary. For hydrochloric and methane sulfonic acids, never leave them in the system beyond six hours.

If the treatment has a pH color indicator, the color of the acid solution returning from the condenser will provide an indication of when the equipment is clean. Other treatments include litmus paper with the product to help determine whether the solution is at working strength. As a general rule, when the solution returning from the condenser does not contain any bubbles or foam for a period of time (approximately 30 minutes), then the lime scale has been removed.

No matter which acid is used, here are some cleaning tips:

- Wear protective gear such as chemical-resistant gloves, eye protection and a respirator. Descaling solutions should never touch your skin, eyes, etc.
- Three things can increase the speed of descaling: higher temperatures (no greater than 150°F [65°C]), greater solution strength and faster circulation rates. However, descaling should always be done in a safe manner with plenty of ventilation.
- Make sure you vent any closed system to prevent the buildup of gases. When the acid reacts with scale, it releases carbon dioxide gas,



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- which could build up pressure and rupture if not vented.
- Take care that the recirculating water containing acid does not become airborne.
- Ensure the solution is not drained or splattered on personnel, surrounding concrete, grass, plants, automobiles, buildings or other surfaces that could be affected by the acid.
- Repeated acid cleanings will eventually remove protective galvanizing from metal surfaces. Hot-dip galvanizing can withstand several cleanings before a large amount of the galvanizing is removed. By contrast, electroplated steel will lose its galvanized coating after one cleaning. As mentioned earlier, milder acid treatments like sulfamic acids are preferred for galvanized surfaces.
- Sometimes, metal has corroded to the extent that it is held in place by scale or corrosion byproducts. When cleaning these systems and the scale deposits are removed, leaks may develop.
- After you are finished cleaning, thoroughly flush the neutralized



Several types of descalers are available on the market. When selecting your descaler, consider the equipment's materials of construction.

acid solution from the system per local regulations. Also, check all lines to make sure they are not blocked by any loose or undissolved scale (or other materials).

Frequent descaling of a cooling tower due to scale-forming water can be hard on expensive equipment over its service life. Setting up a water treatment plan with the proper amount of chemical feed — a bleed from the cooling tower

sump — to inhibit scale and corrosion is a better approach. This simple and sensible maintenance program can be set up with a contractor. Applying regular dosing of water treatment chemicals can help keep the cooling tower clean and operating efficiently for years. **PC**

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