WATER TREATMENT NEWS

Does Your Chiller Need Cleaning? Do It Right!

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As cooling season winds down, mechanical service companies and facility engineers are shutting down chillers for their annual inspection. Most expect that the condenser tubes will be free of scale and deposition and will require only a light brushing before returning the unit to service or preparing it for seasonal storage. This is a reasonable expectation.

Modern water treatment technology enables cooling system operators to maintain cooling water heat exchange surfaces in completely clean condition. "High stress" scale inhibitors utilizing next generation phosphonate/polymer technology are capable of providing clean conditions. More and more facility managers are taking advantage of new treatment technology to push cooling water chemistry limits to save on water and sewerage costs.

But what is a blessing can also be a curse. Operating a cooling system under highly stressed conditions can save money in reduced water and sewer costs, but if control of either bleed-off or chemical feed is lost for even a short period of time, scale can quickly form on condenser tubes. With the quality of many make-up sources deteriorating, even a slight loss of control can result in scaled tubes.

The engineer whose chiller comes down scaled has a decision to make: should he clean the condenser off-line using a potentially dangerous chemical cleaner, or opt to try to clean the machine on-line? On-line cleaning is possible, but excellent bleed-off and inhibitor feed control are essential. If lack of control is what caused the scale in the first place, correcting that is necessary before an on-line cleaning program is initiated.

Off-line cleaning offers one big advantage over an on-line program—instant removal of the scale provides immediate savings in electrical costs that were elevated due to decreased heat transfer rates. Scale 1/16" thick can cost tens or evn hundreds of thousands of dollars per year in wasted electricity in a centrifugal chiller. Even under tight control, on-line cleaning can take months to complete, while an off-line cleaning can be completed in a day. A few thousand dollars spent in cleaning the chiller off-line will be recouped in weeks, if not days.

Once the decision is made to clean the condenser off-line, the engineer has more decisions to make. First, what is the best cleaning chemical to use? Both the chemical make-up of the scale and the metallurgy of the system being cleaned need to be considered in deciding which cleaner to use. Scales that consist primarily of calcium carbonate are most effectively cleaned using a hydrochloric acid based cleaner. If a significant amount of silica is present in the deposit, a cleaner with hydrochloric acid, along with a silica-specific polymer or hydrofluoric acid should be used. For iron-bound scale, hydrochloric alone may do the job, or it may require the addition of iron-chelating acids like phosphoric, gluconic or citric.

All of these cleaners are compatible with the metallurgy in a conventional chiller system, which includes mild steel, copper and brass. But if the job involves cleaning a galvanized tower or evaporative condenser, hydrochloric acid should not be used, as it will destroy the galvanizing. For these applications, a sulfamic acid based cleaner is recommended.

If a hydrochloric acid product is the choice, the engineer can further decide between using a conventional full-strength cleaner and one of the so-called "safe" cleaners. The most recent edition of this publication researched the chemistry of these products and reviewed the claims made by companies that sell them, and found that the products are not as safe as their makers would have you believe. Being simply less-concentrated hydrochloric acid solutions, they would more correctly be termed "safer" cleaners. Their primary advantage is that they fume less during handling than conventional-strength cleaners. They provide good results when used to clean calcium carbonate based scales, but are more costly to use as their usage rate is approximately double that of conventional products. Further, personnel using the "safer" products need to follow the same safety and discharge procedures required with the use of conventional acid cleaners.

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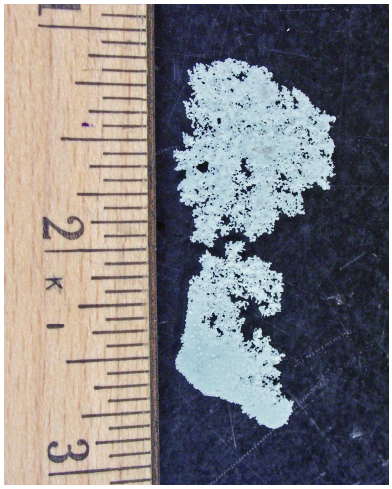
A key step in completing a successful cleaning job is determining the exact chemical composition of the scale. This can only be accomplished through analysis of the deposit by a qualified water treatment laboratory. The deposit analysis report will usually provide all the information necessary to choose the correct cleaner for the job. Sometimes, however, the amounts of iron, silica, phosphate, sulfate and other components present in the deposit make the product selection more difficult. In these cases, some laboratories take the deposit analysis process one step further and conduct a series of scale cleaner efficacy studies.

The lab requires a 4-ounce deposit sample to conduct a cleaner efficacy study. Laboratory personnel divide the sample into portions of equal weight, and expose the sample portions to different cleaning chemicals. When the samples have been exposed for a predetermined amount of time, they are compared to determine which cleaner provided the most complete dissolution. If visual comparison is inconclusive, the remaining solid residue can be weighed to make an accurate determination of the most effective cleaner.

One of two identical scale samples used in a scale cleaner efficacy study to determine which cleaner would remove the scale most effectively.

This is one of the samples after 10 minute exposure to cleaner"A." This product was only minimally effective at dissolving the sample.



The second sample after 10 minute exposure to cleaner "B." Cleaner "B" was the product of choice for this cleaning project.

When the correct cleaning product has been identified, the engineer is ready to perform the cleaning process. Volume 24-1 of The Water Treatment News, published in spring 2006, details the correct off-line chiller cleaning procedure. The engineer should refer to that volume and carefully follow the procedure to assure that the job is completed satisfactorily, his personnel are protected against injury, and damage to his chiller and related equipment are prevented. He should strictly follow the procedures for draining and flushing the chiller to assure he is in compliance with local discharge regulations.

By carefully following the steps outlined here, the facility engineer will restore his cooling system to peak operating efficiency. The time, effort and money spent on the off-line cleaning process will be quickly returned in reduced electrical consumption. Doing it right—selecting the right cleaner and following the correct procedures—pays off.

Do you need to clean your chiller?
Ask your Chemtex representative
to help you
do it right!