Scaling & Deposit Control for Industrial Cooling Towers

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UNDERSTANDING THE CAUSES OF SCALE FORMATION

Industrial cooling towers are vital in manufacturing, building comfort systems, chemical processing, and power generation. Understanding the many factors that influence scale formation is critical for developing an effective scale program.

Water Quality

The quality of makeup water used in cooling systems significantly influences scale formation. It is crucial to test the water's chemical composition, especially for elevated levels of minerals like calcium, magnesium, and silica, which increase the risk of scale formation during operation.

Water Temperature

As temperature increases, the solubility of minerals decreases, leading to the precipitation of scale-forming compounds. Measuring the temperature at the heat transfer zone is ideal. If not possible, add 20-30°F to the bulk water temperature to estimate the temperature at the heat transfer surfaces.

pH & Alkalinity

The pH and alkalinity levels of the cooling water have a direct impact on scale formation. Higher pH and alkalinity levels increase the potential for scale formation.

Cycles of Concentration (COC)

Systems running higher COC are more difficult to treat for potential scale formation. The elevated levels of dissolved solids require more complex chemical treatment strategies and chemical combinations to prevent scale deposition.

Biofouling

Cooling towers create an ideal environment for the growth of microorganisms and algae. The unchecked growth of microorganisms and biofilms creates nucleation sites where scale formation can begin to develop.

System Design & Operation

Inadequate design features, like insufficient heat exchange surface area or improper flow distribution, can lead to localized high-temperature zones, which promote scale formation. Improper system operation, such as inadequate blowdown or insufficient water treatment, will also increase scaling in the system.

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CHEMICAL TREATMENT PROGRAMS FOR SCALE PREVENTION

Once we have gathered the data for the system and makeup water, we can put together a scale control and prevention program. A successful scale prevention program will involve a combination of four major categories.

Scale Inhibitors

Scale inhibitors are chemical compounds that can be added to the cooling water to control scale formation. These work by interfering with the crystal growth process, preventing the formation of hard deposits. Polyphosphates, phosphonates, and certain organic polymers are commonly used as scale inhibitors in cooling tower systems.

Dispersants

Dispersants prevent scale formation by keeping the precipitated minerals in suspension, inhibiting their deposition on heat transfer surfaces. These chemicals disperse the small particles of scale-forming minerals throughout the water, preventing their agglomeration and subsequent deposition on the surfaces. Polymeric dispersants and phosphonate-based dispersants are widely used in industrial cooling systems.

Antiscalants

Antiscalants are specialized chemicals designed to prevent the formation of scale by inhibiting the crystallization of dissolved minerals. They work by binding to the mineral surfaces, disrupting the crystal lattice, and preventing the adherence of scale-forming compounds. These are effective in controlling various types of scale, including calcium carbonate, calcium sulfate, and silica.

Biocides

Biofilm formation in cooling towers can contribute to scaling problems. The use of biocides helps control microbial growth and the development of biofilms. Regular biocide treatment, coupled with proper water management practices, can significantly reduce the potential for scale formation.

Implementing a chemical treatment program, along with regular monitoring and maintenance, will help to ensure long-term reliability, efficiency, and economical operation of your cooling tower system.

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For more information on chemical blending services available to you, please contact us today.