

Cooling Treatment Programs— Continuing the Tradition of Advanced Cooling Water Treatment

Continuum* Alkaline Treatment (AT) Programs

Providing Comprehensive Deposit and Corrosion Control Under Alkaline Cooling Water Conditions

Continuum AT programs provide highly effective corrosion and deposit control over a broad alkaline pH range. The flexibility of an alkaline Continuum AT program provides a strategic approach to solve a wide variety of corrosion and deposition problems encountered in open recirculating cooling systems operating in the alkaline pH range.

Every cooling system operates under a unique set of conditions. Factors such as water chemistry, cooling water flow rates and temperatures, heat exchanger metallurgy, and heat flux influence the selection of a Continuum AT program. Your GE Water & Process Technologies representative can select the best formulation to fit your specific system conditions that provides optimal protection against deposits and corrosion throughout your entire cooling water circuit.

An improperly treated cooling system can cause serious problems. Deposition within heat exchangers can reduce the energy efficiency of your processes, possibly leading to unscheduled downtime, lost production, and extra cleaning or maintenance costs. Unchecked corrosion of heat exchange equipment within the cooling loop can also result in extra costs, either by increasing deposition from corrosion products or by causing failure of the heat exchangers. A Continuum AT program can help you avoid these higher operating costs by provid-

ing effective corrosion inhibition and deposit control in your cooling system.

Delivering Optimal Performance in Dynamic Systems

A complete and effective cooling program must be able to perform under a set of constantly changing dynamic conditions. That's why the treatment approach with a Continuum AT program is so successful.

Anyone can design a treatment program that may work "on paper" under theoretical conditions. However, unless the treatment program is designed to address "real-world" changes in operating water chemistry, pH, flows and temperatures, the program will fail. Standard, "off-the-shelf" cooling water treatment formulations cannot always meet the challenges created by changing cooling system conditions.

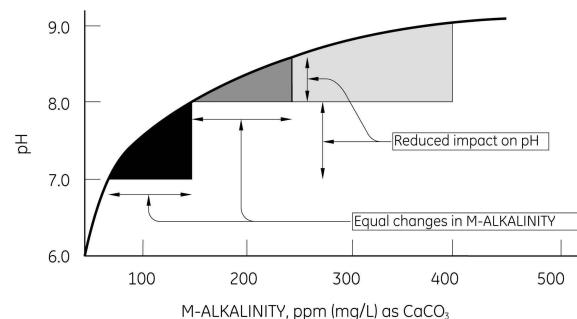


Figure 1



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One advantage to AT programs is that the cooling water is more highly buffered, making pH control much easier. As shown in Figure 1, minor changes in M-alkalinity have much less impact on pH in the range of 8.0 to 9.0 than in the neutral range of 7.0 to 8.0.

A Continuum AT program provides you with a return on your chemical treatment investment by improving overall plant efficiency and reliability, and by reducing operating costs. The savings potential with a Continuum AT program is significant, even in systems with constantly changing cooling water conditions.

Environmental and Safety Benefits

Continuum AT programs are designed to be environmentally compatible. Because they are designed to operate under alkaline pH conditions, acid feed to the cooling tower can be reduced or eliminated in some cases. The overall safety of the cooling tower chemical treatment program can be improved by minimizing exposure of plant personnel to acid.

Effective Corrosion Control

A Continuum AT program uses a unique combination of corrosion-inhibiting components, designed to take advantage of the alkaline pH conditions in cooling water. The goal of the program is to combine the appropriate active ingredients to meet both the chemical and mechanical needs of the system.

From a corrosion control standpoint, Continuum AT program components are selected based on the water chemistry encountered in the system. Specifically, treatment component requirements are

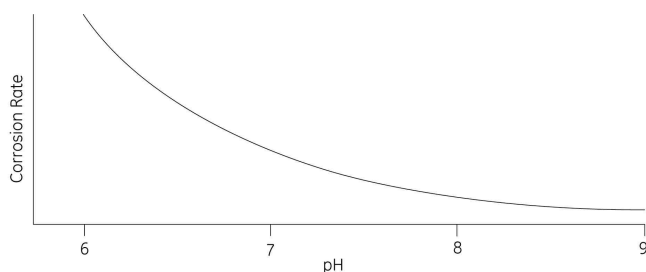


Figure 2: Alkaline Treatment programs take advantage of the fact that cooling water is less corrosive at higher pH.

determined by cooling water pH, alkalinity, and calcium concentration. Each component works in a different manner, but the idea is to slow down both the anodic and cathodic corrosion reactions, thereby reducing the overall rate of metal loss from heat exchanger surfaces.

The workhorse corrosion inhibitor in the Continuum AT program is an organic phosphate component. It is highly effective because it inhibits corrosion on mild steel under alkaline conditions by slowing both the anodic and cathodic corrosion reactions. A combination of zinc and/or molybdate may also be included in the program to augment corrosion control for mild steel metallurgy. A cathodic corrosion inhibition mechanism, working in concert with organic phosphate, provides a barrier against corrosion.

Equipment containing copper or copper-bearing alloys is protected against corrosion by incorporating azoles into the Continuum AT program. Azoles can also reduce corrosion by reacting with copper in the circulating water and keeping it from plating onto steel surfaces. Without azole, copper will deposit directly onto steel surfaces within the system causing pitting, a sure route to unnecessarily rapid failure of heat exchange equipment.

Keeping Your System Free of Deposits

Cooling water treatment programs must be able to control a wide variety of contaminants. Typically, a cooling system contains different materials that can cause deposit problems in heat exchange equipment. Silt, mud, iron corrosion products, calcium phosphate and calcium carbonate are common examples of deposit-forming materials found in cooling systems.

Deposit control in the Continuum AT program is obtained by using cost-effective, synthetic copolymer technology. A "third generation," patented copolymer functions as a deposit control agent via three mechanisms:

- Crystal modification
- Dispersion
- Complexation

Crystal modification and dispersion mechanisms require the copolymer to selectively adsorb onto suspended solids or growing crystals. In the case of a growing crystal, the adsorption of polymer results

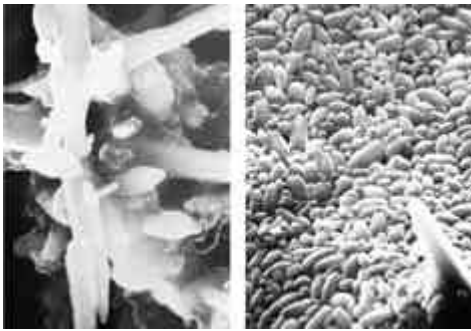


Figure 3: GE copolymer can modify crystal shapes and growth rates of calcium carbonate. This enables the particles to be dispersed more readily, resulting in cleaner heat transfer surfaces.

in slower crystal growth as well as a crystal structure that is less susceptible to deposition on heat transfer surfaces. When the copolymer absorbs onto a suspended solid such as silt, the surface charge is altered so that particles repel each other and remain in solution rather than depositing in the system exchangers. Copolymers can also produce a complexation reaction where calcium ions react directly with the copolymer, thereby maintaining these ions in a soluble form.

What this means to you is clean heat transfer surfaces, lower maintenance and cleaning costs, efficient process economics, and reliable plant operation.

The Full Treatment with Value-Added Services

A Continuum AT program not only provides effective control over deposits and corrosion in a cooling system, but also ensures maximum value for your treatment dollar by including a full range of value-added services:

- Detailed water analysis, using state-of-the-art instrumentation
- Ongoing treatment monitoring
- Complete deposit and metallurgical analysis
- Comprehensive operator training
- Computerized monitoring and control systems:
 - PaceSetter* systems for precise, economical program control.
 - InfoCalc* software for SPC monitoring and data management.

- Convenient, environmentally safe ChemSure* delivery services

In addition, every program is backed by GE Quality in Action—a formalized, ongoing corporate effort of continuous improvement that ensures that each customer receives the most innovative and highest quality products and services.

Getting to the Bottom-Line Benefits

At GE, we are committed to providing our customers with an explicit return on their investment. We look for opportunities to deliver a return that is equal to or greater than the cost of the treatment program.

Continuum AT programs provide:

- Cost-effective corrosion and deposit control throughout the entire cooling system
- Optimal metal surface cleanliness
- Improved heat transfer and energy efficiency
- Sharply reduced maintenance and downtime costs
- Increased equipment reliability
- Simplified operator control with the GE exclusive PaceSetter Plus and PaceSetter Model E monitoring and control systems
- Easy handling with advanced delivery services

Get exactly what your cooling system needs for energy-efficient performance with a unique, Continuum AT program from GE backed by a full range of value-added services and experience to help customers reduce operating costs, thereby improving profitability.