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Cooling Water Treatment vs. Cooling Systems, Part 5

By Paul Puckorius

Factors that Affect Cooling System Operation

As I have noted throughout this series, a thorough knowledge of the cooling water equipment and the cooling system operation is required prior to determining or selecting a water treatment program.

In my last column, I began discussing cooling system operation and its impact on your water treatment plans. As I noted, the critical factors to consider include:

- Continuous operation or periodic shutdown.
- Whether an entire system needs treatment or simply individual units such as chillers, heat exchangers or cooling towers.

Table 1. Water velocities, particularly of the heat transfer equipment, should be identified and recorded.

In addition, knowledge of operation of each individual cooling water equipment is important and should include information on the water velocities and water temperatures.

Water Velocities. The water velocity through heat transfer equipment is critical and can lead to deposit and corrosion. Water velocities through the tubes of heat exchangers should be designed to be 3 to 5 ft/sec or more. Lower velocities lead to deposits and corrosion, with 1 to 2 ft/sec creating a serious condition in that water treatment may not be able to protect the equipment.

Water on the shell side of heat exchangers as well as jacketed vessels can have velocities of less than 1 ft/sec, leading to heavy deposits and extensive corrosion (table 1). The velocities, particularly of the heat transfer equipment, should be identified and recorded. These velocities should be determined during cooling system operation and compared to the design specifications and to the metallurgy.

Remember to determine the minimum velocity that occurs during operation. This will greatly influence water treatment requirements and water quality.

Water Temperatures. Water temperatures are another important piece of information needed to identify potential problems and directly influence the required water quality and treatment.

Information on the maximum bulk water temperatures occurring during cooling system operation is needed for all heat transfer equipment. This means every heat exchanger in your facility. Tabulate this data to determine the most likely equipment to be affected. This includes the maximum bulk water temperature at any hour during operation -- even if only for a few minutes or hours during the day.

High bulk water temperatures can lead to scale deposits and likely will require specialized water quality and treatment. But, what is "high water temperature"? Unfortunately, the water quality must be involved with the temperature to determine the critical bulk water temperatures in the cooling water system equipment. However, a general guideline is given in the table 2.

Table 2. Information on the maximum bulk water temperatures occurring during cooling system operation is needed for all heat transfer equipment.

Skin Temperatures. Measured on the water side of heat transfer surfaces, skin temperatures are an important indicator of potential deposits. However, many facilities do not have the capability to measure skin temperatures. As a general rule, skin temperatures can exceed bulk water temperatures by 10 to 40°F (5.5 to 22°C) and are dependent upon the temperatures of the fluid or gas that is being cooled.

Summary

Do you know your system? Detailed information is needed on all cooling-water-contacted equipment prior to ever considering water quality or water treatments. In this five-part series, I have discussed some of the most important information needed about your cooling water system. The design, materials of construction and operating conditions are critical factors that will greatly influence the selection of acceptable water treatment chemicals. Future columns will identify the next step in developing an effective, protective and economical water treatment program for your cooling system.

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