WATER TREATMENT FOR CLOSED HEATING & COOLING SYSTEMS

Closed recirculating systems are used in a variety of industrial and commercial situations. The most commonly used are found in refrigeration and air-conditioning systems where chilled water is circulated from the chiller to the air handling equipment. Another common system would be the hot water system.

A system is considered “closed” if it does not employ open evaporation for cooling and has a water loss of less than 5% of the circulating rate. In terms of water treatment these systems required little maintenance, because once charged with chemicals, they normally remain charged. Closed system treatment programs differ from those of open recirculating systems in that they are primarily concerned with corrosion with less emphasis placed on deposit formation and microbiological growth.

CORROSION

The objectives of a closed system water treatment program are to minimize corrosion, prevent metal loss and prevent the formation of corrosion by-products. The less makeup a system requires, the more attainable are these goals. Once the corrosion inhibitor is added, it will theoretically passivate the metal surface and remain in the system protecting it against future attack.

Although it might initially appear that the rapid depletion of corrosive dissolved oxygen would render chemical treatment of a closed system unnecessary, closer examination reveals that these systems are rarely oxygen free – the result of constant oxygen leakage through valves, pipe joints, and pump packing.

In addition to that caused by the presence of the dissolved gases, closed systems are often constructed of a variety of dissimilar metals which result in galvanic corrosion.

The corrosion inhibitors most commonly used are nitrites and molybdenum. As in the case of cooling water, chromates have been discontinued for environmental reasons. Many industry experts prefer molybdenum as it is less subject to biological fouling. Typical industry standards would target 500-1200 ppm nitrite and 80-120 ppm. Molybdenum. In either case the addition of preventive biocides improves a program.

DEPOSITION

Mineral salt deposition is usually not a primary consideration in closed systems because the makeup water requirements are generally low and no evaporation or concentration of the recirculating water occurs. In most instances, scaling becomes a problem when the system continually suffers excessive water losses and a water supply containing high hardness levels is used as a makeup source. Hot water systems are more likely to scale than chilled water systems.

In systems where deposition is a problem, the severity is complicated by the fact that the closed system has no blowdown and consequently deposits are not removed once they have formed. They remain in the system and either cause erosion-corrosion by contributing to abrasion of pump impellers and seals or settle in low velocity areas blocking lines or fouling heat transfer surfaces. Accumulated deposits increase corrosion by accelerating under-deposit corrosion attack.

Under certain circumstances, inhibitors as phosphonates and polymers may be used to control a marginal scaling condition. If a closed system is fouled by particulate it is advisable to circulate iron cleaners combined with filtration and purge the system. Subsequent treatment with corrosion inhibitor is recommended.

MICROORGANISMS

Although extensive microbiological growth is not usually encountered in a closed recirculating system, its presence can adversely affect a corrosion control program. Biological growth can impede effective heat transfer and cause blockage. Microbial under deposit corrosion can create intense localized pitting and corrosion resulting in leaks. This is particularly costly if it occurs on evaporator tubes. Routine addition of biocides is the best preventive method available, however fouled systems should be chemically cleaned, filtered and/or purged, and retreated.