Cooling Water and Closed Loop Filtration

Even with good water treatment and maintenance practices cooling tower systems are subject to considerable fouling due to their inherent “air washing” tendencies. Dirt and airborne particulate can accumulate dramatically in even the “cleanest of systems. We consider these particles suspended rather than dissolved solids. Particulate in the tower system can create problems from decreasing evaporation and heat transfer efficiency, to blockage of water flow resulting in system shut down. Less obvious consequences include fostering increased microbial growth and erosion of system metals through abrasion. Tower location and design combined with environmental factors such as nearby excavation will significantly influence the soil load on a particular system. While mechanical cleaning is typically performed annually we support more frequent cleanings.

To minimize the negative consequences of dirt fouling many operators will opt to install filtration systems. A wide variety of filtration products are available. In fact the largest problem in implementing a filtration program is selecting a type and model from the numerous choices. Most tower filtration systems can be divided into two types – those that work by weight (centrifugal separators) and those that work by particle size (cartridge or sand filters) each is discussed briefly.

Centrifugal Separators - These products, dominated by Lakos but also available through Alpha Laval, Rosedale and others work by swirling the water and relying on particle weight to remove it form the system. They are frequently combined with a bag type filter on the discharge to keep removed particulate from clogging the drain and allowing for continuous purge. Less expensive options include periodic purging using a timer and automated valve, or simply employing a manual blowdown. As they rely on particle weight to “swing” particles heavier than water to the removal chamber, these systems work well for particles accumulated within the system such as scale and rust. They work less effectively against fine dust and sand as the lighter the particle, the less likely to be removed. Without question these systems are at their best when they filter 100% of the system flow and purge to a closed recovery housing. Full flow systems are more likely to be encountered if they are part of initial equipment as they are costly and effect pressure and flow rate-engineering design. When used as a retrofit they are typically designed to handle 10% of the system-recirculating rate as a side stream. Side stream systems are designed to work on a pressure differential of 10 psi. It is critical to ensure this differential exists prior to considering a separator. Upon installation it is important to have good pressure differential measurements. Usually the outlet valve is restricted until a 10-psi differential is achieved to reach maximum part8icle removal. It is not unusual to encounter existing separator systems that have bad gauges or no gauges at all with the valves open at their maximum. Their performance can be dramatically improved simply by regulating this pressure differential. If a closed recovery housing is to be employed an additional 10-15 psi differential is required to ensure flow from the separator discharge through the housing, and back to the system.

Particle Filters - These filtration systems range in design from strainer baskets, to cartridges, and include ultra purification such as reverse osmosis working on the molecular level. Simply put the “holes” are too small for the particles to pass through. Cartridge filters typically on closed loops are the most widespread filtration method used beyond pump strainers. These systems are widely employed for rust and dissolved iron removal in closed loops. Most filtration experts recommend a 10% side stream with one 14-inch cartridge for every 3-5 gpm. in the side stream. Most filters in place in the commercial market place are grossly undersized using this guideline. Using a 600 gpm closed loop the side stream will be 60 gpm requiring a filter housing holding 12 or more 14 inch cartridges. When implementing a filter program pressure differential, side stream flow, inlet and outlet port sizing, and temperatures should all be taken into consideration. In closed loops that have become fouled the water will appear black. To determine the extent take a sample and allow it to sit for 24 hours in a clear container then place a magnet against the particles that settle. There can frequently be considerable amounts of dissolved iron even in relatively clean looking samples. It is sometimes a good practice to use declining micron sizes when a new particle filter is installed. Larger particles will be trapped early, as the system gets cleaner, larger micron cartridges can be replaced with smaller ones.

If properly designed and implemented, filtration can provide numerous benefits contributing to trouble free operation and increased system efficiency. As a general rule, separators, sand filters, and strainers with automatic backwash accessories are most likely to be appropriate for tower systems. Particle filters such as cartridges are better suited for closed loops. A common mistake to avoid is selecting plastic filters for a two-pipe system as they melt when the loop is changed from cooling to heating. If the filtration system is allowed to stagnate for extended periods, microbiological growth with the filter as a reservoir can be a concern. Perhaps of greatest importance, is to enlist the assistance of a knowledgeable filtration specialist to select and engineer the appropriate filter for the system and objectives to be met.