



Beyond the Flanges



Proactive steps ensure total HVAC system performance.

While the chiller is the heart of a chilled water system, its support system of components and controls are equally critical to maintain and manage to ensure the highest system efficiency levels are attained.

Emphasis is often placed on the chiller since it is the most visible and typically the highest energy element of a chilled water system. Yet, if you look beyond the flanges, there's an opportunity to improve delivery of chilled water to the airside or process loads and maximize system efficiency.



In large building and facilities, chilled water cooling systems can yield many advantages, including refrigerant and maintenance containment, energy efficiency, and low installed cost. Those advantages can also be magnified when building owners work with a partner to maintain the full system over the lifetime of the system to reap additional

rewards. The full system means that we need to look beyond the chiller itself to other key components such as chilled and condenser water pumps, cooling towers, heat exchangers, and hydronic specialties including water pressure regulators, air separators, and chemical feed pots. Controls are also critical to the system because they operate water valves, control set points and schedule equipment.

Maintenance issues for the larger chilled water system, including those at the component level, may indeed originate at the chiller. Yet, real detective work may be necessary to identify the root cause since trouble may start somewhere in the ancillary components of the chilled water system.

Water Pumps

Chilled water pumps deliver the cold water to the building/process loads and then carry the heated water back to the chiller for re-cooling. Condenser water pumps circulate the cooling water between the chiller water cooled condenser and cooling tower (or other heat rejection device). Pumps not sequencing properly or low flow conditions may fault a chiller and not be understood until operation is restored.

Common centrifugal impeller pump types include end-suction and split case construction. Service considerations are pump and motor bearing lubrication and water seal cooling on larger pumps.

Motor-pump shaft alignment is important and should be checked periodically as heavy piping and supports may shift over time.

For Optimum Performance Look Beyond the Chiller



Providing positive suction pressure is important to prevent capitation and air erosion. Pressure regulator stations maintain water loop pressure and air separators remove unwanted air from the chilled water.

Cooling towers

Condenser water transfers the unwanted heat load removed by the chiller and the chiller's compressor work (heat of compression) to the cooling towers. These towers come in several common types: forced or induced draft and counterflow or crossflow. Typically, towers are constructed of steel, fiber-glass reinforced plastic (FRP), wood or concrete. Service requirements across all types of cooling towers are consistent. Fan motors, gear or belt drives, and water make-up float assemblies all require routine maintenance and inspection. Tower basins as well as fill and distribution pans all need periodic cleaning.

Airside

This is where the heat load is transferred to the chilled water loop via a chilled water coil. Coils are part of an air handler unit, which also contains air filters, fans, mixing boxes/dampers, and other air handling devices. Coils are commonly constructed of copper tubes and aluminum fins requiring routine service such as air filter replacement and fin cleaning. Drain pans and lines also need to be cleaned of accumulated biological growth and dirt to sustain proper indoor air quality. Dirty coils can significantly curtail efficient heat transfer and hike energy use since operators typically must lower chilled water temperatures to overcome the reduction in heat transfer.



Hydronic Specialties

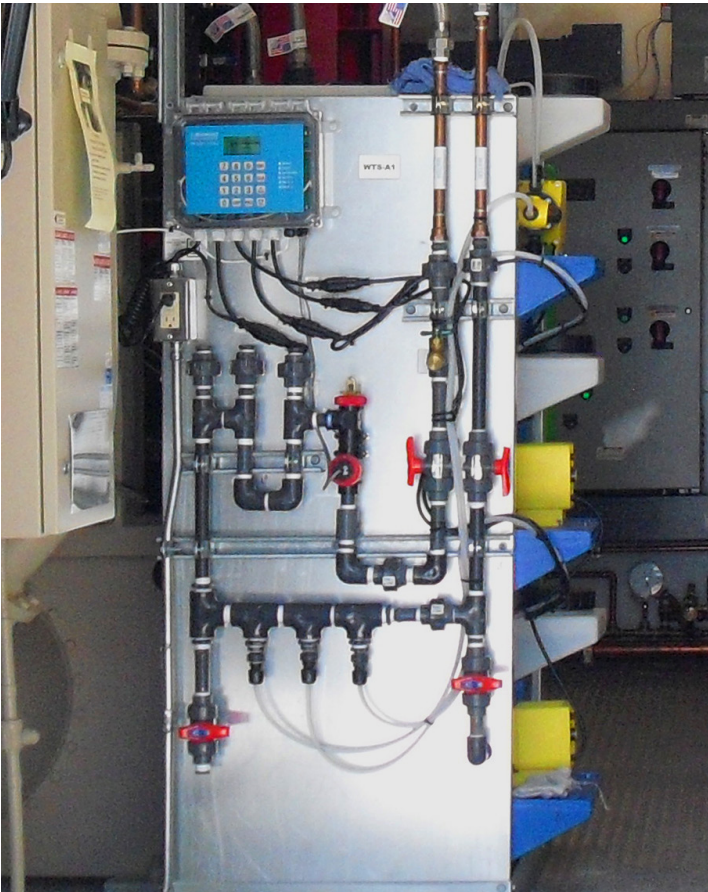
Pressure water feed and relief stations should be checked periodically to ensure proper water loop pressure. Pressure that's too low may prevent circulation to high level air handler coils or pump cavitation. While they require minimal attention, a regular check of expansion tanks and air separators is wise. Chemical feed pots are used to introduce chemicals or glycol to closed loop systems. Heat exchangers are used to isolate different loops and are used in economizer systems. Larger heat exchangers are field cleanable, yet that can be a time-consuming task due to the complexity of the procedure.

Water Treatment

Water loops require treatment for the prevention and control of corrosion, scale presence, and biological growth. Closed chilled water system loops are not exposed to the atmosphere, but still need inhibitors to control corrosion. Open cooling tower systems are more demanding. Cooling towers act like a large air washer and require regular maintenance to combat corrosion problems. Many water treatment approaches are successfully used in systems today, including chemical, magnetic, and ozone types.

Fouled water and scaled pipes inhibit heat transfer at the chiller and cooling coils. A miscue in water treatment can quickly damage the chiller's tubes – a substantial and major

performance issue. Therefore, regular eddy current testing of tubes is a good practice, along with consistent, effective water treatment. Because cooling towers evaporate large amounts of water with some drift to the atmosphere, control of biological matter is also an important health issue. Several antimicrobial growth products are available that will help minimize biological growth in the cooling tower basin.



Controls

New digital-based controls are fairly low maintenance other than occasional software updates and calibration. Older pneumatic systems employ air compressor/driers, which require specific routine service. Moisture in a pneumatic system can be detrimental to proper operation causing expensive clean-up costs. Dampers and water control valves also should be checked for operation and lubed where necessary. Controlling the chiller plant pump sequence, air handler scheduling and exhaust fan operation can all impact chiller operation and performance. Chilled water temperature pull down rates need to be slow and steady. Fast temperature and/or flow changes can cause erratic and inefficient chiller operation. On variable flow systems, minimum flows should be confirmed.

Summary

The complexity of service tasks and frequency varies for all equipment and components; the manufacturers’ operation and maintenance manuals should be consulted for specific guidance. To sustain efficient and reliable operation, a building owner who relies on a chilled water system would benefit from a professional service technician’s advice and eye. Developing and executing a service schedule plan will help minimize unscheduled and costly shutdowns, while safeguarding the investment in equipment.

The extensive support system can often impact the chiller’s operation and are not always immediately apparent without digging deeper. The first steps to operating a highly efficient chilled water system is understanding what’s installed, how it operates, and what the right service plan approach is to optimize performance over the full life of the equipment. Proper commissioning and establishing an energy baseline can also help in noting any service trends that require attention.

