Maintenance Tips
Chiller Best Practices

A combination of proactive maintenance procedures and operating logs are important tools in achieving operation and efficiency of the chiller plant. Proactive maintenance procedures ensure that the system operates within the designed criteria. To assist with achieving optimum system efficiency and maintaining peak performance, a daily log is an excellent tool for tracking performance and detecting any changes that may affect the efficient operation. With this information, system deficiencies can be detected and acted upon. Without this information, system deficiencies may go undetected; thereby increasing operating costs and, in some cases become a risk of major equipment damage.

Daily Log

Maintaining system logs should include date, time logged; operator's name; evaporator and condenser enter-exit temperatures, refrigerant temperatures and pressures; oil temperature; level and pressure; motor voltage; amperage; weather conditions; plus other important factors depending on equipment manufacturer. Logs may vary depending on the type of chiller equipment manufacture. Please see third page of this document for a sample of a low-pressure chiller log.

Clean Tubes Provide For Efficient Heat Transfer

Heat transfer has the greatest impact on chiller performance; thus, a good water treatment program, together with a proactive maintenance program such as tube cleaning, is fundamental to maintaining good heat transfer.

Chiller efficiency declines rapidly when tubes are fouled. Contaminants, such as minerals, scale, mud, algae and other impurities, increase thermal resistance and reduce overall performance. The difference between the temperature of the condenser water leaving the heat exchanger or condenser, plus the saturated temperature of the refrigerant being cooled, is an indicator of heat transfer efficiency or approach temperature. An increasing approach temperature is a primary indicator that the heat transfer efficiency is decreasing.

Water Treatment

Impure containments such as scale, corrosion, and microbiological growth increase thermal resistance and reduce overall performance, thereby increasing energy costs. A proactive water treatment program will mitigate the effects of these contaminants.

Reduce Entering Water Temperature

Where possible, lowering the entering condenser water temperature can improve a chiller's efficiency. There are controls that allow the condenser water temperature to drop whenever ambient conditions permit. Lowering the Entering Condenser Water Temperature (ECWT) reduces the head pressure on the compressor, resulting in higher chiller efficiency. The lower (ECWT) lowers the pressure differential

between the condenser and evaporator, resulting in less energy or (kw) required per ton of cooling. There are some limitations with this process: 1) A minimum pressure differential must be maintained between the evaporator and condenser to ensure adequate refrigerant flow, thus maintaining proper oil movement within the chiller. A differential below the minimum requirements will cause low refrigerant trips resulting in lost oil to the refrigerant; 2) The lack of refrigerant in the evaporator affects the efficiency of the chiller through heat transfer; as the refrigerant level in the evaporator drops below the minimum requirements, some of the tubes are not covered by liquid refrigerant thereby decreasing the amount of heat transfer surface area. There is some energy trade-off-in order to achieve lower temperatures; the cooling tower fan will run longer. This control strategy should be applied by qualified technicians to ensure peak chiller operating efficacy. Manual adjustments of condenser water temperatures is not recommended; this can be misapplied causing operational issues, and, in some instances, increased energy.

Water Flow Rates

Flow rates should periodically be verified to ensure flow rates meet equipment optimum flow design. Too-low or too-high flow rates impact on the chiller's efficiency. Too high of a flow rate can also lead to tube erosion, vibration and noise.

Low Pressure Chillers

None-condensables such as air and moisture can leak into low-pressure chillers, because their evaporators are in a vacuum. These non-condensables become trapped in the condenser increasing condenser pressure and diminishing the efficiency of the chiller's operation. Purge units serve well to minimize the effect of non-condensables. However, frequent purging is an indication of a larger leak on the low-pressure side and should be identified and repaired. It is estimated that one (1) psi of air in a condenser equates to a three (3) present loss in chiller's efficiency.

Oil Analyses

Annual analysis can detect potential contamination problems before they become serious and worse, destructive. When the concentrations of the various metals used in the manufacturing of refrigeration equipment is known, any increase in these concentrations is an indication of wear or corrosion of the internal equipment components. Ideally, samples of oil should be sent to a laboratory for a chemical analysis called "Spectrochemical Analysis" to determine contaminants such as iron, aluminum, lead, copper, tin, zinc, etc. An increased concentration of these various metals is, again, an indicator of the wear or corrosion of internal equipment components.

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