

Approach Temperatures – Key Indicator to Chiller Performance

Most facilities track chiller performance data on a daily basis. Logs are filled out and filed. Unfortunately, the data is not reviewed until it is too late. The most critical information that should be looked at on a daily basis is the condenser and evaporator water liquid approach temperatures.

Approach temperature is defined as the difference in temperature between the liquid water leaving temperature and the liquid refrigerant temperature. The difference in temperature is a method to determine the efficiency of the chiller (condenser & evaporator). Each machine comes with a “designed approach temperature” from the factory. New machines with enhanced tubes are now operating at about 0.6-1.0 degree full load design approach temperatures. Many of the newer chillers have a screen display (Figure 1) showing the approach temperatures making it simple. It should be noted, approach temperatures will vary depending on the chiller load, incoming water temperature, water flow, refrigerant charge, and scaled and/or fouled tubes.

Increased approach temperatures indicate that the machine is not as efficient in increasing energy costs and loss of tonnage capacity. This is of particular concern during the warmer summer months when efficiency and capacity is needed. When approach temperatures increase, it is normally the result of scaled or fouled tubes. As you add scale or fouling, the heat must be transferred through this media as well as the tubes. The greater the thickness of scale or fouling media the greater the efficiency loss. Many publications put the cost at 3-10% depending on the degree of scale or fouling. For example, a typical 750 ton chiller at \$0.10/kw operating at 50% average load the added cost could be between \$5,500 to \$18,750, annually.

The other issue is the impact the deposits or fouling have on pitting type corrosion. Biological fouling can result in biologically induced underdeposit corrosion as illustrated in Figures 2 and 3. This is a quick and very damaging type of corrosion. The importance of good water treatment and monitoring of the approach temperatures not only reduces energy costs, but provide early warning that the water treatment program is not working to protection of the condenser tubes.

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Figure 1: Many newer Chillers have approach temperatures already displayed.

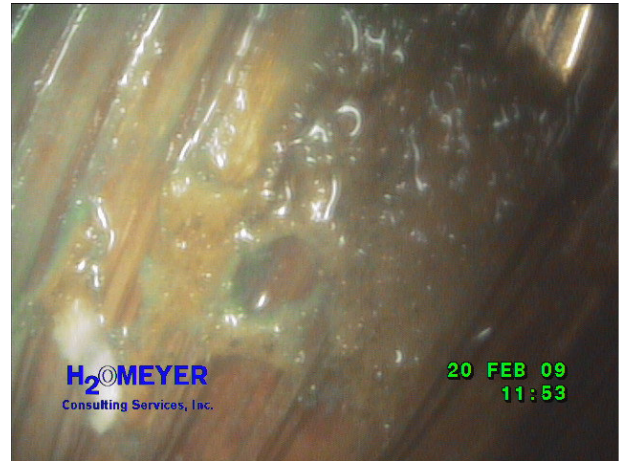


Figure 2: Enhanced tube filled with microbial slime reducing heat transfer efficiency and creating potential underdeposit corrosion.

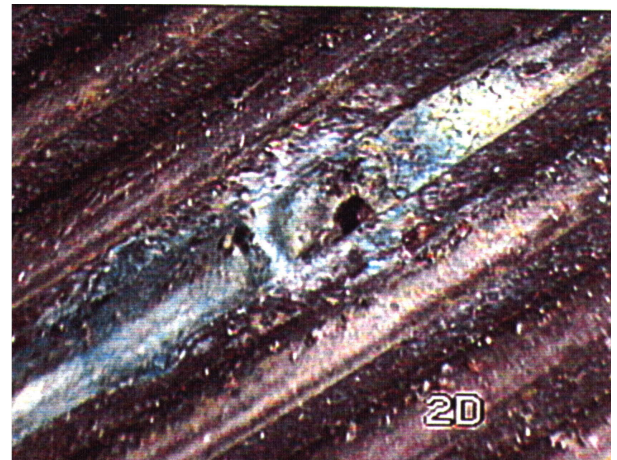


Figure 3: Underdeposit corrosion cell that lead to copper tube failure.