

## Enhanced Tubes

– Company position paper –

### Definition

Enhanced tubes are the replacement for the old standard "smooth bore tubes," which had been used on condenser and evaporator bundles inside of chillers. The enhancements vary from mild to radical.

### Concern

As energy becomes a more important area of concentration, chiller manufacturers have opted to use more energy efficient condenser tubes. Along with altering the flow of water as it moves through the condenser bundle, enhanced tubes also have an increased surface area and appear to be thinner at the weakest point on the tube. The water treatment industry has failed to be proactive in its response to these new enhanced tubes. Under certain conditions, enhanced tubes have a much higher potential for deposition than smooth bore tubes. If deposited, the enhanced tubes will have dramatic reductions in heat exchange useful life.

Our company has seen numerous cases when enhanced tubes have pitted inside of the first year of operation, or when they have prematurely failed.

### Problem Areas

- Flow is a major contributor to the deposition in enhanced tubes.
  - : Many customers periodically lay-up condensers with high solids tower water. This may be due to reduced capacity needs, plate/plate free cooling availability, or seasonal lay-up. A lack of flow increases the deposition potential.
- Once deposited, the enhanced tubes may become subjected to biologically induced under-deposit corrosion conditions.
  - : Most customers open the condenser tubes on an annual basis, but often use incorrect brushes for the cleanings. They generally "clean blind," and have no way of determining the effectiveness of the cleaning.
- In general, the water treatment industry has made no allowances for the deposition potential of the enhanced tubes.
  - : The industry uses various forms of precipitation as a corrosion inhibitor for mild steel. One of the more common treatments involves Orthophosphate, or products which revert to Orthophosphate, as the mild steel corrosion inhibitor. However, with enhanced tube condensers, this could be disastrous.
- No allowances are being made to ensure that a good corrosion barrier exists on the enhanced tubes.
  - : The only product used to protect copper in a system is azole (usually in the form of Tolytriazole or Benzotriazole). The treatment suppliers are depending on stoichiometric balancing of the treatment program where the mild steel corrosion inhibitor (or tracer) is balanced against the Tolytriazole component of the chemical drum. Invariably, this does not work, as the Tolytriazole becomes decomposed or consumed at higher rates and often leaves the system unprotected from copper corrosion. As a check, the treatment supplier may utilize copper corrosion coupons, but this is after the fact and does not account for the heat load of the condenser tube. Chemical reactions generally occur faster as heat is added, and the condenser tube may be as much as 50 degrees F higher temperature than the corrosion coupon.