Cooling Tower Water pH and Conductivity Control

**Background**
Since many manufacturing, processing and utilities use cooling water, there is an ever-present demand for water. With rising water costs comes an increased emphasis for cost savings through re-use of cooling water. Cooling is achieved by evaporation of a small amount of water and heat exchange from air passing through the cooling tower. Problems with cooling towers are usually due to the cooling water quality. As water evaporates and dissolved solids in the water begin to concentrate, there is a huge potential for scaling and corrosion of the heat exchange equipment. Control of water quality to reduce scaling is imperative.

**Process**
Although there are many variations in cooling tower design, a common feature is the control of water quality using pH and conductivity to maintain a given set of conditions. The conductivity level will rise due to evaporative water loss during continuous recirculation of the cooling water. This causes an increase in concentration of impurities. These impurities can cause corrosion and scaling that results in loss of cooling tower efficiency. Maximum conductivity level is maintained using a conductivity sensor and controller. When the maximum conductivity is exceeded, the control system opens the blow down valve. This causes a demand for make-up water, less concentrated in impurities, and thus lowers the conductivity.

Most cooling tower water impurities are alkaline in nature. The impurities, especially calcium carbonate (CaCO₃), are less soluble at high pH. Therefore, a small quantity of acid (usually sulfuric) is added to the recirculating water to lower pH and thus prevent scaling. Corrosion and scaling are further minimized by the addition of scale and corrosion inhibitors. Inhibitor feed is based upon one of three methods:

1) On acid demand
2) On opening the blowdown valve
3) On operating the make-up water valve

To avoid frequent conductivity sensor cleaning, a toroidal conductivity sensor is suggested.
**Process (cont.)**

Warm water and air in cooling towers can become a breeding ground for biological growth. Slime and algae are examples of this growth that needs to be controlled. Biocides such as chlorine or bromine are the most commonly used biocides and are fed into the water on a timed basis or in a similar manner to the scaling inhibitors. Chlorine monitoring is possible via ORP (redox) or direct amperometric measurements. Sensorex offers both types of sensors.

Ozone is another example of treatment agent/biocide and can also be monitored via ORP or amperometric sensors.

**Products for Cooling Tower Monitoring**

- **Toroidal Conductivity Sensor:**
  
  Model TCS-1000 offers no maintenance control of water TDS for blowdown control.

- **In-line pH Sensors, Flat-Surface Self-Cleaning:**
  
  Models are available for 3/4", 1" or 2" in-line mounting. Sensors require no tools to install and can be changed in seconds. Mounting hardware with integral temperature sensor for ATC saves money!

- **In-line ORP Sensors Flat-Surface Self-Cleaning:**
  
  Models are available for 3/4", 1" or 2" in-line mounting. Sensors require no tools to install and can be changed in seconds.

- **Free Chlorine Sensors:**
  
  Sensors are available with 4-20mA output for range of 0-1ppm, 0-2ppm and 0-10ppm and should be used with flow cell FC70C for optimum performance.