Locating Water Losses in Closed Systems

Technical Bulletin 3-003
Closed Systems

The Problem
Closed heating and cooling water systems typically require little makeup water and minimal treatment chemical additions following the initial system charge. However, when leaks occur, it can be both costly and difficult to maintain the treatment levels necessary for corrosion and deposit control. The source(s) of significant water loss should be identified and eliminated. This will help improve treatment program effectiveness, lower operating costs, and reduce the potential for unexpected system failure.

Verifying Water Loss
Routine testing of the conductivity, pH or alkalinity, and inhibitor level is used to determine if there has been a water loss. If these parameters decrease simultaneously, water has been lost. If the water loss is significant (>1 gpm), a ¾” water meter installed on the makeup line (on a bypass) can help quantify the rate of water loss.

Possible Causes
The following check list may help identify why a closed system is losing water

1. Check all circulating pumps for leaks around the seals or packing. Replace and/or tighten if necessary.
2. Check the expansion tank to ensure it is not full of water. If the expansion tank does not have sufficient air space for expansion when the system water heats up, the relief valve will lift to relieve the excess pressure. If the tank is full of water, manually drain it so it is only about a third full when the system is cold.
3. Check all pressure relief valves. Closed systems can intermittently relieve excess system pressure due to temperature changes and an improperly functioning pressure regulator (located on makeup line). If the regulator fails, the system pressure can slowly increase to the point where the pressure relief valve momentarily opens. Water will then be expelled until the pressure returns to normal. Check for a defective pressure regulator by installing a pressure gauge before and after the regulator. The pressure reading after the pressure regulator should not exceed the preset pressure setting on the regulator. If it does, the pressure regulator is defective and should be replaced. The pressure setting (fixed regulator) or the pressure range (adjustable regulator) will be indicated on a metal tag attached to the regulator and the regulator should be set at two psig above the highest head in the system. Since the system pressure can change with the temperature, make sure the temperature is stable when checking the pressure regulator. For example, a hot water system at room temperature with the circulating pumps off may have a pressure of only 12 psig. With the pumps on and the water heated to 160ºF, the pressure may increase to as high as 28 psig.
4. Check all automatic air vents to see if they are leaking water. Pay particular attention to vents that are piped directly into a drain. Replace all air vents that are leaking water.
5. Check the back flow preventer. If the makeup line does not have a properly installed and functioning back flow preventer and if the system pressure is greater than the makeup line pressure, system water can be lost into the makeup line. Swing type check valves are unacceptable as they will not function properly under a vacuum: as water rushes from the closed system (higher pressure) to the makeup line (lower pressure), a vacuum can occur. A common cause of system pressure being greater than the makeup line pressure is shutting off the main water supply outside a building or down the street. All new buildings have back flow preventers on the main potable water supply line. Each closed system should have its own back flow preventers.
6. Where fan coil units are used with a chilled water system, check the conductivity, pH, inhibitor level, hardness, or color (if a colored treatment product or a dye is used) of the water in the condensate drain pans. If a fan coil unit is leaking, you will detect the presence of treatment chemicals and/or hardness in the drain pan water. Otherwise, the drain pan water should be more or less distilled water (<25 umhos).
7. Where steam is used to heat a hot water system (via a heat exchanger), check for contamination in the various boiler system waters. If there is a leak in the heat exchanger, water from the hot water loop will generally leak into the boiler system via the condensate return. This contamination may be reflected in the conductivity, color, hardness, or sulfite level (lowered) of the condensate, feedwater, or boiler water.