Challenge

Water tanks are often heated with a steam sparger to provide hot water for production, cleaning, and a variety of other industrial uses. While steam spargers have a low initial cost, they are prone to noise, vibration, relatively short operating life, and limited heating rates. What’s more, high steam flow rates can result in incomplete condensation, energy loss from steam escaping to the atmosphere, and damage to tank linings from steam hammer or condensation shocks in the holding tank.

Another common method of tank heating is to utilize a shell and tube heat exchanger and a pump to circulate water from the tank through the heater. Tube bundles, however, are prone to fouling and require periodic cleaning to maintain heat transfer capacity. A system to return condensate must be maintained as well.

Solution

An alternative solution is to use a direct steam injection heater.

Results

Steam is injected into a recirculating loop. This steam not only supplies the thermal energy to heat the water, but also the pumping power to circulate the water in the loop. Because the steam condenses in the heater, no condensate return is required. In addition, condensation occurs rapidly inside the heater body in the turbulence created by the steam jet. Noise and vibration levels are substantially lower with a direct injection heater than with a steam sparger and the heating rates can be much higher.

Typical piping schematic of a direct injection tank heater. A PID controller automatically modulates the opening of the steam nozzle in the direct steam injection heater to control the water temperature in the discharge line from the tank.

Highlights

- Direct steam injection heaters can be used in place of steam spargers and shell and tube heat exchangers.
- With direct steam injection heaters, 100% of thermal energy is transferred to heated water.
- Direct steam injection heaters reduce noise and vibration levels.
- Direct steam injection heaters require up to 25% less steam.
- No condensate return required with direct steam injection heaters.