

CHEMICAL MANUFACTURER IMPROVES REACTOR PERFORMANCE WITH SECONDARY THERMAL FLUID LOOP REDESIGN

A manufacturer of specialty chemicals operates an 8000 gal. reactor heated and cooled by thermal fluid. The original thermal fluid system consisted of a dedicated hot fluid loop and a dedicated cold fluid loop.

PROBLEM STATEMENT:

1. Temperature control of the reactor was accomplished by throttling the flow of 550°F heat transfer fluid. While batch temperature was controlled, the hot fluid entering the vessel jacket produced a “hot spot” on the interior wall, which caused degradation of certain temperature sensitive batches.
2. Cooling of batches constituted changing valves to admit cooled thermal fluid, which then went to a water-cooled tube & shell heat exchanger. Maintenance problems were encountered with the heat exchanger due to very hot fluid entering the heat exchanger causing the cooling water to boil on the tube walls, resulting in tube corrosion and failure.

CORRECTIVE ACTION

A project was undertaken to improve heating performance, cooling performance and to extend heat exchanger life.

1. The solution to the reactor heating problem addressed by installing a pump and a high-flow tempered oil loop. This arrangement allows the fluid being introduced to the reactor to be controlled to a temperature that allows a high flow rate to achieve the desired batch temperature without hot spots. A PLC control system optimizes the temperature of the loop to provide the required heat transfer at the optimum thermal fluid loop temperature.
2. The secondary loop was designed to allow for automatic, “bumpless” transfer between heating and cooling, which allows the reactor to react to exothermic reactions by changing to a modulated cooling mode automatically.
3. A tempered fluid pump was also installed at the heat exchanger which increased fluid velocity in the heat exchanger tubes, reducing the hot spot at the fluid inlet and improving Reynolds number through the heat exchanger.

IMPROVEMENTS NOTED

The reactor now operates more efficiently, with less degradation to product and the heat exchanger operates with no corrosion of the tubes.