Quench Pumps

Background

A client requested assistance in performing an energy walk through to identify some means of reducing energy consumption in an industrial manufacturing facility.

Initial Condition

It was found that a series of 16 quench pumps was operating at full speed on a 24/7 basis even though the actual quench cycle was of only short duration. Even though the pumps were only small in size, the quantity of pumps and the operating cycle made them a good opportunity for energy savings.

Analysis

Induspec obtains baseline data which showed that the actual quench cycle was only a few seconds in duration while the bypass portion of the cycle, which only served to circulate and temperature control the quenching medium, was the vast majority of the cycle. Induspec performed thermal analysis and pump flow analysis to show that there was a significant opportunity to utilize a variable frequency drive (VFD) along with a modified cycle sequence resulting in energy savings. The client installed a VFD and modified the cycle to a configuration which seemed appropriate to the client, however, only limited energy savings materialized.

Identified Cause

The baseline energy cost of the quench system was calculated to be almost \$ 140 k in energy. An initial attempt to utilize a VFD reduced that energy cost to just over \$ 90k; a savings of \$ 50k.

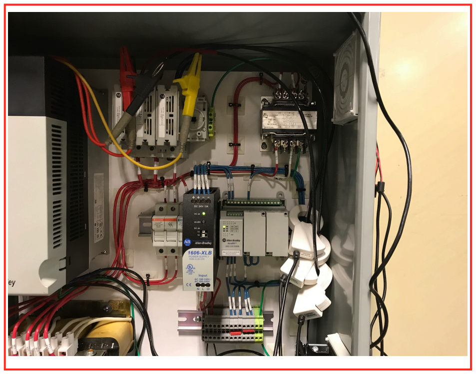
Recommendations

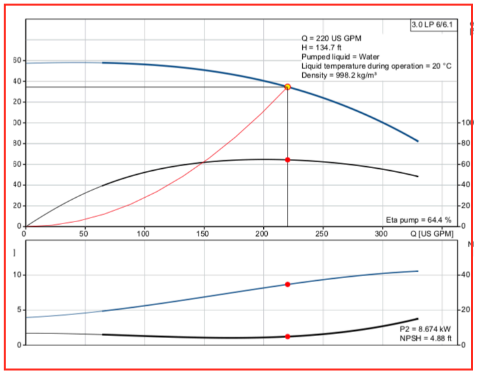
Induspec performed a follow-up inspection and noticed a missed opportunity in the control configuration. With just a few key strokes in the control system, the energy cost was further reduced to \$ 40k.

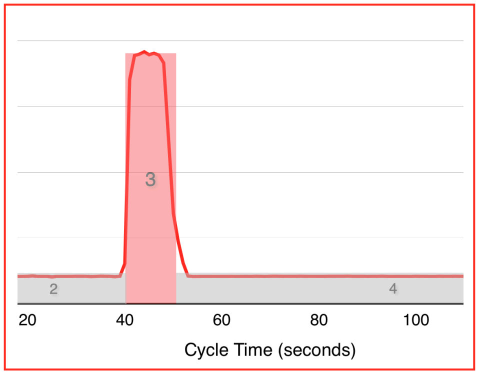
Implementation

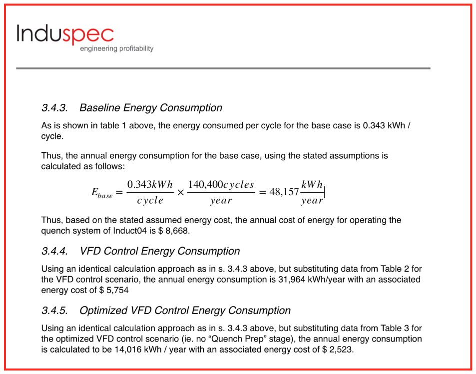
Induspec gathered follow-up data to confirm all numbers. The client performed standard quality testing of components quenched with the new control scheme and found no change in quench quality or final part performance. The final savings were calculated to be \$ 100k or a reduction of 71% of the cost. In addition, because incentives are available based on the amount of energy conserved, the client was eligible for a much larger energy rebate.

Gallery









Induspec engineering profitability

3.4.3. Baseline Energy Consumption

As is shown in table 1 above, the energy consumed per cycle for the base case is 0.343 kWh / cycle.

Thus, the annual energy consumption for the base case, using the stated assumptions is calculated as follows:

$$E_{base} = \frac{0.343kWh}{cycle} \times \frac{140{,}400cycles}{year} = 48{,}157\frac{kWh}{year}$$

Thus, based on the stated assumed energy cost, the annual cost of energy for operating the quench system of Induct04 is \$ 8,668.

3.4.4. VFD Control Energy Consumption

Using an identical calculation approach as in s. 3.4.3 above, but substituting data from Table 2 for the VFD control scenario, the annual energy consumption is 31,964 kWh/year with an associated energy cost of \$ 5,754

3.4.5. Optimized VFD Control Energy Consumption

Using an identical calculation approach as in s. 3.4.3 above, but substituting data from Table 3 for the optimized VFD control scenario (ie. no “Quench Prep” stage), the annual energy consumption is calculated to be 14,016 kWh / year with an associated energy cost of \$ 2,523.