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BOILER FEED • CONDENSATE • DEAERATOR • VACUUM

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Re: Modulating versus On/Off Feed Water Pump Control

Modulating the feed water to the boiler is the most important part of the boiler feed water system. Modulating the feed water flow to the boiler has so many advantages over on-off feed water addition that it is difficult to visualize any other system. Boilers with modulating firing controls are quite common. Why would you modulate the boiler-firing rate, but control the feed water with an on-off level switch?

Modulating feed water control offers several benefits:

- **ELIMINATES PUMP PROBLEMS.** Experience shows that a larger number of the systems with on-off pump controls have problems with the boiler feed pumps. It is easier for on-off pump operation to result in the pump running outside of the allowable NPSH range. This results in pump cavitations and increased pump maintenance costs.
- **INCREASES BOILER EFFICIENCY.** With on-off feed water addition, the pump is sized for two or three times the boiler evaporation rate. The pump must be oversized to allow it to catch up when the boiler calls for feed water. When the pump starts it literally overloads the boiler with “cooler” water. If your boiler had a window and you could actually see the effect of this surging quench, you would be amazed. What you would see is a boiler happily steaming away until the pump starts and this colder surge collapses the bubbles and disrupts the natural thermal circulation. The result is a slight loss in pressure which signals the firing control to add more fuel resulting in wasteful cyclical firing. When compared to the smooth operation of a modulating system, one can imagine the effect this constant cycling has on the fuel consumption. On-off pumping systems remind me of car trying to average 50 mph by going 100 mph for an hour then stopping for an hour,
- **STABILIZES DEAERATOR OPERATION ANDEFFLUENT QUALITY.** Did you ever stop to consider what on-off pump control does to deaerator performance. Suppose you have 400 horsepower boiler and a 400 horsepower deaerator. Your on-off pump selection would be roughly three times 400 horsepower or equivalent to 1200 horsepower. The deaerator is rated at only 400 horsepower so in effect your deaerator operates at 1200 horsepower one-third of the time and zero loads for two-thirds of the time. This unbalanced cyclical loading ruins the quality of the feed water because it drives your level and pressure controls crazy.
- **USES EFFICIENT, LOW WEAR CENTRIFUGAL PUMPS.** At this time, it might be well to compare turbine type pump to multi-stage centrifugal pump. The turbine type pump, which is generally the type of pump used for on-off systems, is considered to be a low-

capacity, high-head pump. These pumps rely on close tolerance and consequently have very high wear rates. They are inexpensive but inefficient. Their lower initial cost is rapidly overshadowed by high maintenance and repair cost, along with wasted energy.

On the other hand, the centrifugal pump is more efficient, has a longer life cycle and experiences fewer repairs.

The main difference in operation is the turbine type pump has a very steep performance curve making it unsuitable for modulating operation. The centrifugal pump has a fairly flat curve that offers a steady inlet pressure to the feed water regulating valve making it ideal for modulation.

- **PUMP SIZE CAN BE REDUCED.** With modulating feed water, it is not necessary to drastically oversize the boiler feed pumps since the boiler input matches boiler steam output. Modulating valves function as an engineered restriction in the feed line thus preventing the pump from overloading, and allowing the selection of smaller, more efficient, lower horsepower pumps. With a slight overcapacity for surge loads, a pump can be selected for 130%-150% of the boiler[s] rate output.
- **MANY SYSTEM VARIATIONS AVAILABLE.**
On multiple boilers, there are many variations available. One is where we furnish two P/E switches. The second switch is set to operate a second or lag pump should any one of the feed water valves go to a full open position. This allows the selection of a lead pump for light boiler loads and then automatically starts a second pump for heavy loads. Or perhaps using a pump more closely sized to actual operating conditions with built-in surge capacity.

Another variation is utilizing a pressure switch in the discharge manifold which signals a selected lag pump to pick up whenever the pressure drops signaling a pump has failed. This type of system is particularly useful on jobs that an automatic standby pump is desired. With this system three pumps are used in lieu of two larger pumps. With electrical horsepower figuring at \$300-\$400 per year per horsepower, using smaller pumps is very cost effective.

Using modulating feed water control is far superior to on-off pump control. Modulating feed water control: 1) doesn't slug the boiler, 2) allow the deaerator to operate within its capacity and 3) requires smaller pumps that use less electricity.

Sincerely,

Shipco® Marketing and Sales Department