



## The Pump Detective

By Doug Kriebel, P.E.

### The case of the unreliable boiler feed water pump.....

We were visiting an electric generating utility company on a matter, and we told of a pump issue they have experienced over several years.

The site is a 445 MW fossil steam power plant. This occurred 15 years ago, but the lesson is still valid.

The plant uses two 50% steam turbine driven boiler feed water pumps. Very high horse power pumps such as used here have a very high minimum flow requirement.

When the plant is operating at low loads or no load conditions, such as weekends or holidays, they only run one pump. But, the minimum flow for the pump is much higher than that required by the boiler. This means they are burning up a lot of energy to run the pump on a higher than needed minimum flow.

For this reason, they installed a motor driven "startup" boiler feed water pump to be used under low load conditions. This was sized as a 25% unit, and its minimum flow was below the minimum flow requirements for the boiler under low or no load conditions. This option would save enough energy to justify its installation.

The pump was bought, delivered, installed and started up. It seized on startup.

Everyone considered it a warranty issue and the pump OEM repaired the pump for no charge under warranty. The utility still had the cost of removal and reinstallation.

When the repaired pump was reinstalled, they started it up and it failed again within a few minutes.

It went back to the OEM for a second, no charge repair and returned to the station.

It failed again on the third start up.

Since the OEM would not do another no charge warranty repair, It was determined the pump design was no good, and a new pump from a different manufacturer was ordered and installed.

It too failed on start up.

It was repaired under warranty, reinstalled and started up. It failed again within a few minutes of startup.

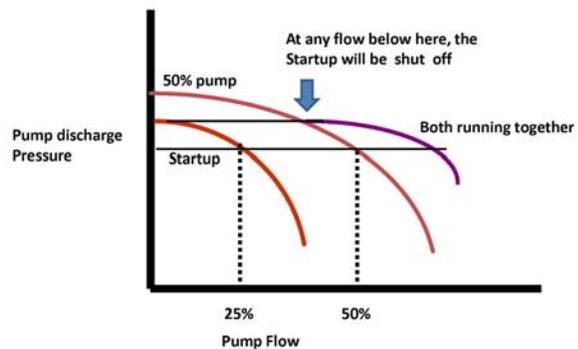
At this point, the utility abandoned its plan to utilize a startup pump.

After hearing this story, I asked to look at the system.

The plant procedure for reducing load is to have one 50% pump taken off line. Then bring the still running pump back to its lowest flow as they start the "startup" pump.

From the performance curves here, you can see that the startup pump and the 50% pump were not similar curves, obviously since the 50% is twice as big.

### One 50% Main and 25% Start up

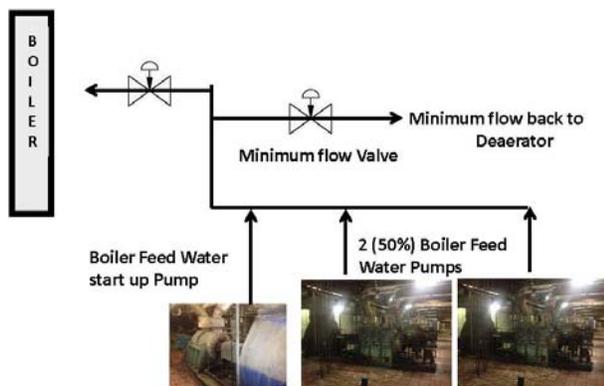


But you must use extreme care when applying two different size pumps in parallel. The flows are additive at the same pressure. But you can see the pressure of the larger pump is greater than the smaller pump. For this reason, the smaller pump, if started after the larger is running, could never get any flow. It would be running at shut off.

This would not have wrecked the pump, since it should have been protected by its minimum flow bypass.

BUT, looking at the piping sketch attached, you can see the minimum flow recirculation line from the start up pump manifolds into the minimum flow line for the main pumps. Since these are higher pressure, they prevented any flow from the start up!

### Boiler Feed Water Minimum Flow Line



Without flow, this large horsepower pump seized up, 5 times.

Someone "value engineered" the minimum flow piping design, by connecting it to the exiting recirculation line instead of running its own line to the deaerator

The lesson learned is to make sure your pumps ALWAYS have sufficient minimum flow under all operating conditions.