Automaker Trades Three-Pass Boilers for Modulating Units, Saves Thousands

Annual fuel savings at least 40 percent since late 2005

At Mitsubishi Motors Corp.'s manufacturing plant in Normal, Ill., two large, 20-year-old, 300-hp, three-pass boilers had met their match, unable to perform consistently without rigorous maintenance. Each boiler had burner capacities of 12,562 MBH and consumed fuel at an alarming rate. Making matters worse, they were oversized to accommodate additional plant needs that never materialized.

"Water was circulating through both of the ... boilers when just one of the systems was activated," Staff Engineer Don Jones said. "This was great for planned redundancy—each of the boilers met heat needs at capacity—but not ideal in terms of energy efficiency."

Additionally, Jones said, "We had to acknowledge the fact that the old, non-modulating systems were running at full tilt all the time ... with the added challenge of inefficient short-cycling."

Jones obtained estimates for the cost of re-tubing the boilers.

"That came to $90,000," Jones said. "But when we compared that with the cost of a complete replacement, with us doing all of the replacement work ourselves, and with the huge advantage of being able to size the system more accurately to the load, it was a foregone conclusion."

The cost of replacing the systems with new equipment was $120,000. Knowing that several lead-lagged boilers would provide greater flexibility and overall efficiency, Mitsubishi chose three 2.4 million-Btu boilers and two 2 million-Btu boilers, reducing a 12.5 million-Btu draw to no more than 8.8 million Btu, although, Jones said, more than 6 million Btu rarely is needed.

A Rheos boiler.

Rheos condensing boilers from Laars Heating Systems Co. were chosen. The fully modulating systems offer up to 87-percent combustion efficiency and variability of modulation between 100 percent and 25 percent of the input rate to precisely meet heating loads from 1.2 million to 2.4 million Btu.

"The boilers are perfectly suited for the job because their controls monitor the demand for hot water and automatically adjust each boiler's capacity ...," Jones said. "They're an environmental win, too, ... with NOx levels of less than 10 ppm and low CO greenhouse-gas emissions."

Another advantage, Jones said, was the units' footprint.

"The new boilers' compact size allowed us to install five new units in place of the two older ones ...," Jones said. "We were able to open significantly more floor space in the mechanical room. The ... boilers have also reduced the amount of natural gas required for process heat."

Mechanical-room piping was redesigned to optimize recovery from the boilers and storage tanks.

"The primary/secondary piping system was designed with total serviceability in mind, incorporating bypass piping so that any piece of equipment within the system can be isolated for maintenance without disrupting the supply of hot water," Jones said.

When hot-water temperature drops below set point, boiler pumps switch on, drawing water from the secondary piping header. The water is heated and injected back into the secondary piping loop. When the water reaches the desired temperature, the boiler pumps switch off and wait in standby mode.

"The hot water continues to circulate through the secondary piping and the storage tanks without passing through the boilers ...," Jones said. Thus, "There's no heat loss to the atmosphere through the vent stack/heat exchanger .... The water instead flows through the two tees that were installed in the secondary piping."

Because each boiler has its own circulation pump, water flow through the heat exchangers, as well as inlet- and outlet-water design temperature, is maintained optimally.

Since the boilers were installed in late 2005, Mitsubishi has saved at least 40 percent on fuel each year.

Information and photograph courtesy of Laars Heating Systems Co.

Circle 101