Superheat Attemperator Spray

Application Discussion
AD108
June 15, 2003

With varying load requirements in many power plants, varying steam temperatures are inevitable. In drum style and once through designs, this is caused by such things as burner orientation and fuel to air ratios. In combined cycle plants, varying gas turbine exhaust temperatures and in the inclusion of duct firing can dramatically affect steam temperatures. In order to ensure the optimum operating heat rate and to protect the steam turbine, the steam temperature in the superheat and reheat sections of the boiler must be controlled.

The superheater section of a boiler typically includes what are commonly referred to as primary and secondary superheaters. These constitute two separate banks of boiler tubes used to heat the steam to the desired temperature. Once the steam passes through the superheater sections, it then proceeds to pass through the high pressure turbine.

Optimum efficiency and protection of the turbine elements are directly related to the temperature of the steam and must be properly controlled. Temperature control is usually achieved by admitting a fine spray of water into the steam line through what is called an attemperator or desuperheater, which is typically located between the primary and secondary superheaters. The attemperator utilizes water from a separate control valve and incorporates a nozzle that creates a mist that mixes with the process steam, thus lowering the steam temperature. This process, however, reduces thermal efficiency as it takes heat away from the process steam.

The superheater outlet temperature via a feedback control loop controls the attemperator spray water flow. While requiring additional piping, this design ensures that the average steam temperature will not exceed the final steam temperature desired. In order for proper control the valve must be able to react quickly to variations in downstream temperature and provide the rangeability to handle multiple operating loads.

With the spray water being pulled from the main boiler feedwater line (See Figure 1) high inlet pressures (2500 – 4000 psig) will be seen at the control valve. The main steam operating pressures vary between 1800 and 3850 psig. This means that a minimal pressure drop (100 – 300 psid) occurs across the valve eliminating the need for cavitation protection. However, the proper valve must possess the rangeablity to control low spray water flows at normal operating loads while providing higher spray water flows during low load demands.

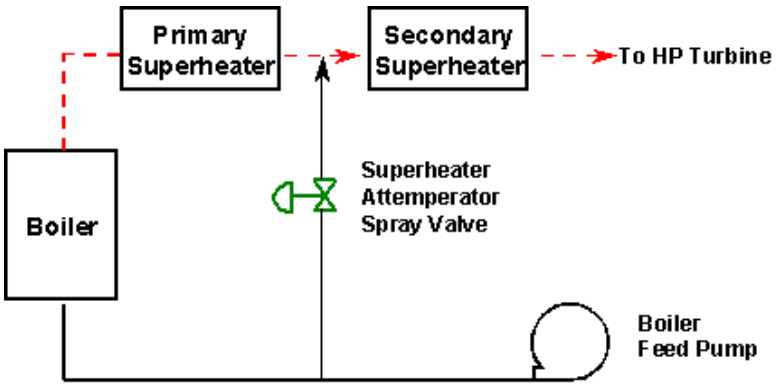

Figure 1: Superheat Spray Valve Orientation

Fisher recommends the use of a HP or EH design in conjunction with the MicroForm trim package. The MicroForm trim provides turndowns greater than 50:1 and incorporates tight shutoff to protect the trim from the damaging effects of wire draw and steam cuts during maximum unit load operation when the valve is closed. Additional solutions coupling the Fisher MicroFlat and MicroForm trim solutions are

available if necessary that can provide turndown of 200:1.