



# Utility Boiler Attemperator Controls

## Background

Effective control of main steam temperature on a coal fired utility boiler provides a difficult challenge. Feedback only control is not adequate due to significant dead time between the interstage attemperator (control element) and the superheater outlet temperature (process variable). Several variables affect the superheater outlet temperature such as boiler load, boiler pressure, excess air, gas recirculation, pulveriser biasing or burner tilt and sootblowing. Additionally the attemperator spray causes variances in the boiler main steam flow, which can have unwanted affects on boiler master and unit master control. Another problem is that attemperator spray nozzles and control valves are normally significantly oversized to handle a wide specification of fuels and extreme upset conditions.

## Design Approach

The design approach for attemperator control is based on the understanding that for a given fuel energy input to the boiler there is a fixed steam energy output. Attemperation can then be considered a function of the saturated steam generated at that boiler load.

*Main Steam Flow = Saturated Steam Generated + Attemperator Spray Flow*

Knowing the affects that variables such as boiler load, boiler pressure, excess air, gas recirculation, and pulveriser biasing have on saturated steam generation; feedforward signals can be developed that will predict the required attemperation. The feedforward signals are then tuned with lag or dead time to match the dynamic response of the system. If the control system is not capable of supporting the coordination of the attemperator and boiler master controls, then the feedforward signals can be tuned to reduce the affect of attemperator spray on the boiler master during load swings.

To ensure successful implementation, all aspects of the attemperation system are considered including the physical condition of the attemperator, nozzle and control valve sizing and current and historical operating data.

## Scope of Supply

- Review of current and historical boiler operating data to determine actual required attemperator spray flows.
- Internal (videoprobe) inspection of attemperator to assess physical condition.
- Review of attemperator nozzle and spray valve sizing.
- Development of control strategy using feedforward signals.
- Complete DCS graphic and control configuration
- Commissioning and startup services
- Control system tuning

## Summary

The implementation of the modified attemperator control strategy in conjunction with resizing of attemperator nozzle and spray control valve has proven to be successful in improving main steam temperature control during load swings on a coal fired utility boiler. Additionally, the attemperator controls have been tuned to reduce unwanted effects of the attemperator spray on the boiler master. The overall result is a significantly improved response of the boiler to unit load demand changes.

