

UP Boiler Furnace Protection

Purpose

Provide owners and operators with additional instructions for start-up firing and cool-down rates for once-through UP boilers.

Problem

Severe furnace and convection pass enclosure tube wall damage has been observed on many once-through boilers. This is evidenced by tube failures, membrane splits, wall distortion and buckling.

This damage to furnace tube panels and other components is caused by excessive temperature differentials between water/steam cooled tubing and the attachments to the tubing. Excessive temperature imbalances between parallel fluid flow paths (i.e., adjacent panels) can also cause some damage. Excessive temperature differentials are most commonly caused by overfiring during start-ups and/or rapid cooling when shutting down the unit. **WARNING: NEVER FIRE BELOW MINIMUM FEEDWATER FLOW.**

Recommendations

Boiler operating procedures should be reviewed to include the following:

1. Limit the furnace first-pass outlet fluid temperature change (furnace outlet for single pass units) to not exceed 17°F for any five minute period (200°F/hr.) during either start-ups or forced cooling during shut-down.
2. Temperature differentials between adjacent wall panels in the furnace first pass should be monitored during start-up and cool-down periods. Fuel input rates or cooling flow rates should be controlled to limit the temperature differential between adjacent panels to a maximum of 100°F during cool-down and 50°F during start-up.
3. The rate of temperature change of the economizer inlet feedwater must also be limited during start-ups and shut-downs to protect the furnace. This limit varies from unit to unit. The economizer water temperature limit is especially critical after a unit trip, when fluid flow has been interrupted and is being re-established during a hot restart.
4. During unit shut-downs, the best cool-down method for minimizing temperature differentials is fanning the unit without fluid circulation.
5. To achieve satisfactory cool-down rates within recommended temperature limits, it may be necessary to regulate feedwater flow rates below the minimum rate for firing.
CAUTION IS REQUIRED — Fluid distribution problems may occur if the cooling feedwater flow rates are lowered too far, and may also result in excessive temperature differentials. Unit hardware (pump and valve limitations, etc.) and control system capability may limit or prohibit a feedwater flow rate for cooling, which is less than the minimum feedwater flow rate for firing.
6. As a general guideline, limit the start-up heat input rate to a maximum 1.15 times the steady state rate, corresponding to the steam flow.
7. Boiler testing over several start-ups and shut-downs should be conducted to determine actual limitations, and to develop the optimum operating procedures for individual boilers.

Support

If any questions arise or further assistance is required, contact Babcock & Wilcox Field Service Engineering.

For more information, contact your nearest B&W sales and service office. In the U.S.A., write: Dept. CIC, Power Generation Group, Babcock & Wilcox, P. O. Box 351, Barberton, Ohio 44203-0351. In Canada, write: Manager, Marketing and Sales, B&W Canada, Cambridge, Ontario, N1R 5V3.

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