

**Date: July 25, 2008****Bulletin Number: HP602****Subject: Commissioning and Integrating Multiple Boiler Staging Controls**

A multiple boiler staging control is a device that provides a central electronic processing area that receives inputs from supply water sensors, outdoor air sensors, relays and other related equipment. The processor calculates this feedback information and sends a signal or output that results in the proper supply water temperature to the load it is incurring. There are many benefits of a multiple boiler staging control. Many would agree, the top three are:

- Staging of boiler modules to meet load demand (outdoor reset or set point)
- Automatic rotation of boiler modules to ensure equal run time
- PID control logic for precise control of supply water temperature

Using these controls to obtain optimum performance from the boilers requires some key knowledge and overall understanding of how the staging control and the individual boiler aquastats will interface to produce a desirable sequence of operation that will meet the system design criteria.

It is important to understand that once a boiler staging control is introduced into the control scheme, it becomes the operating control for the system and the boiler mounted aquastat control simply becomes another limit. Whether commissioning a new multiple boiler system or restarting an existing multiple boiler system, consideration should be given to the relationship between all control set points in order for the staging control to operate as intended. Attention to the following recommendations during the commissioning process can result in significant improvements in system operation and energy efficiency:

1. Verify all sensor locations. The boiler staging control relies on input from the various temperature sensors in order to achieve the desired system operation. Improperly placed sensors will result in erratic system operation.
2. Verify all sensor calibration. Most control manufacturers provide resistance charts to check temperature versus resistance. If the measured value from any sensor is incorrect, the system will not respond as intended.
3. Verify the maximum supply water temperature the boiler staging control will require at design conditions. Ensure all boiler limit set points are set higher than this design temperature set point. If the boiler limits are set lower than the maximum set point temperature required by the staging control, additional boilers will be staged on even though there is no load on the system, wasting a significant amount of energy and causing short cycling.

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4. Verify burner operation. If a boiler staging control is used on multiple low high low or modulating burners where the boiler is equipped with a firing rate control, verify that the firing rate control mounted on the boiler is also set higher than what the boiler staging control is set for to avoid premature burner shut down. Ideally, a boiler staging control should be chosen based on firing mode. For example, if the burners are fully modulating, a boiler staging control that has a modulating output is desirable over just a simple on off contact closure. This application eliminates the need for the firing rate control that would otherwise be mounted on the boiler.
5. Verify that the reset parameters are optimized for the system - make sure the reset curve is set properly. In addition, ensure the reset control strategy does not result in a return water temperature from the building loads, which can cause the flue gasses to condense in non-condensing boiler systems.

Boiler staging controls will provide proper operation and precise regulation of the system temperature when properly adjusted, provided thought is given to the boiler aquastat control set points. Keep this in mind on your next multiple boiler installation.