

## Boiler Controls and Heating Strategies

Closed hot water heating systems usually are controlled with simple control systems that the boilers come from the manufacturer with. These systems are designed to meet a minimum safety standard and are often left with the water temperature between 180F and 190F. This is a useful temperature because this is the design temperature necessary to satisfy the heat load when the outside air is at the coldest. The systems then run every day of the year at that high temperature.

Recently a number of control manufacturers developed economical microprocessor based boiler control devices. These controls offer a wide range of control options, all of which contribute to decreasing operating costs and increased economy. Each one of these control options is referred to as a strategy and each has a different application.

The most useful strategy is ***outdoor reset***. A temperature-sensing bulb is placed outside and another bulb is placed on the boiler water outlet. These bulbs then provide feedback to the controller, which matches the boiler water temperature to the outside air temperature. The controller will then move the boiler water temperature up and down to meet the temperature swings of the outside air. The net effect is that the boiler is only as hot as it needs to be and not a single degree more. There is no energy wasted in keeping water hotter than it needs to be and heat losses from hot water piping and the boiler itself are reduced as well. In a situation where the boilers also provide potable hot water heating a limit is set that is the minimum temperature where potable hot water can be provided.

***Warm weather shutdown*** is an extension of outdoor reset. When the outside temperature rises to a point where the boiler needs to do no work the control puts the boiler to sleep and shuts it off until it is needed again. This results in appreciable energy savings.

***Indoor reset*** is a strategy for two temperature systems where the temperature of the water supplied to the radiant zones is varied with the outdoor temperature. This saves energy, as like outdoor reset, the zone water is only as hot as it needs to be control indoor temperature. Personal comfort is enhanced as when the zone calls for heat the temperature of the supply water is in proportion to the heat loss of the room instead of a single temperature year round.

***Boiler protection*** is a function that sets a minimum temperature that the boiler is allowed to operate at. It also effectively the lowest temperature in the heating curve. It is an important temperature as it is the minimum at which the boiler can operate without the formation of destructive flue gas condensate. This enables protection of the boiler heat exchanger, cabinet and venting system. The boiler will come off the heating curve it follows in outdoor reset and stops cooling at the boiler protection. When the control decides to enter warm weather shutdown it simply shuts off at the protection temperature. For less sophisticated systems that include domestic hot water the minimum temperature can also be the lowest temperature necessary to provide DHW.

**Boiler staging** is a function where two boilers are installed to meet a maximum need but where one boiler can meet all of the need most of the time. The controller will shut off one boiler until it is unable to meet the heat demand and then restart it as required. This strategy is an extension of notion of using only the minimum amount of energy to keep the building population happy. Where the boilers also provide the potable hot water heating the lag boiler is allowed to enter warm weather shutdown.

**Boiler rotation** is a strategy where the controller cycles the boiler doing most of the work, that is to say, the lead boiler, with the off or lag boiler. Rotating lead and lag boilers spreads the mechanical wear evenly across the two appliances.

**Pump exercising** is a feature where the programmer will briefly run the boiler pumps when the boiler is in warm weather shutdown. This helps ensure the pump remains in good running order and is available when it is needed.

**Indoor temperature feedback** allows the system to measure heat gains or losses from activities indoors. Heat gains occur from such sources as to people, office and cooking equipment, entertainment systems and passive solar heating. Indoor feedback senses these sources and allows for them in heat curve calculation.

**Domestic hot water setback** sets a period where there will be no call for hot water when the building is unoccupied or the residents are asleep. During this period the boiler ignores calls for tank reheating. Energy is saved from lower tank standby losses and inefficient boiler operation during periods of low DHW demand.

**Priority DHW** is a function in which at a call for DHW heating the slab heating loop is shut off while the hot water tank heating is completed. This allows for smaller boiler size and rapid reheating of the DHW tank at no loss of comfort for the building occupants.

**Optimum start** is an intelligent control function that allows the control to constantly recalculate the time necessary to reheat the complete system before the setback period ends as outdoor temperature changes from day to day.

**Building unoccupied** is a strategy where a manual switch sets the programmer to follow a heating curve set back 10% from the occupied settings. This allows the building to cool slightly when occupant comfort is not required.

Some twenty five other strategies are available.