



Outdoor reset... Indoor reset... (is there a difference?)

One of the most popular subjects on everyone's mind is ENERGY! More specifically, the cost of it and how this escalation is impacting their lives. The rising cost of a barrel of oil is making it expensive to heat a home. The cost of gasoline at the pumps is continuing to climb, which is hurting people in their wallets.

As it relates to the heating industry, an opportunity exists to help soften the "financial blow" your customers are experiencing. Any customer that has a hot water heating system can take advantage of a concept called outdoor reset. Outdoor reset is when you increase or decrease the water temperature going out to the heating system based on the outdoor temperature. The system incorporates an outdoor sensor which informs the control of the outdoor temperature since this has the greatest impact on the building's heating load.

When you reduce the supply water temperature, you reduce the Btu/h output of the heating terminal unit (baseboard). This is because you are changing the difference between the air temperature surrounding the baseboard and the water temperature inside the baseboard. By lowering the supply water temperature, you can input the right amount of heat, offsetting the heat loss of the building. A lower water temperature eliminates the room temperature swings that occur with a more traditional "high temperature system," thus creating a more comfortable environment for the homeowner.

A typical heating system uses a thermostat, which is a switch that sends a signal to the boiler and a circulator saying it is cold. The circulator turns on and sends 180°F water out to the baseboard zone. And this happens

whether it is 10°F or 50°F.

Most of the time, the 180°F water heats up the zone quickly and the thermostat, sensing this temperature rise, shuts off the circulator. Remember, the heat loss from the building has not stopped. It continues as long as the outdoor temperature is below the desired indoor temperature. Therefore, the system continues to cycle on and off, becoming too cold and then too warm.

With a weather responsive reset control, however, when you change the temperature of the water to match the load, the circulators and/or zone valves stay on for longer periods. This will keep the radiation warm all the time instead of cycling on and off. This more constant supply of cooler, comfortable water also eliminates the creaking and groaning noises usually heard in systems that cycle 180°F water into a zone. The room temperature will not override due to the excessive water temperatures. And probably the best benefit of resetting a hydronic system is fuel savings. By lowering the water temperature in the boiler and piping system, the stand-by losses and stack losses are minimized.

The concept of changing the water temperature to match the load of the heating system is very logical and has been around for quite



some time. But reset control systems alone do have some limitations. Though a step in the right direction, outdoor reset cannot provide close enough water temperature control of the building. Remember, the modern home is very dynamic, with each zone having varying rates of heat gain and heat loss. The outdoor sensor simply cannot account for all of these changes, and may provide an inaccurate water temperature as a result. Too warm and the boiler is working harder than it needs to. If not warm enough, occupant comfort is compromised.

Recently however, control technology has advanced considerably. These newer controls take the benefits of outdoor reset one step further...they use thermostats that have the ability to communicate with each other as well as with the outdoor reset control which, by the way, is the zone controller as well. This ability to communicate provides the most comfortable, affordable and energy-efficient system available.

One of the many benefits of a hydronic system is the ability to zone or "cut-up" the heating system. People like to be able to control/zone individual areas of the house and sometimes even control/zone room by room. From the homeowner's perspective, this micro-zoning is viewed as a benefit; they can control the room temperature in all areas of their house.

But from an efficiency stand point, all of this micro-zoning can lead to significant short-cycling of the boiler. That is because the boiler operates best when it runs long enough to reach its steady-state efficiency.

Unfortunately, when one or two smaller zones are calling for heat, the boiler is grossly over-sized relative to the loads that are looking for heat. In that case, the boiler reaches its limit very quickly and shuts down. It short cycles, never reaching that steady state of higher efficiency. The result is an inefficient use of the fueloil for that cycle. Compound that over hundreds, if not thousands, of cycles during the course of a heating season and then, even worse, consider years of operating like this and the result is a very inefficient heating system that is wasting money for your customer.

What I have described is nothing new. A lot of systems have operated like this and many continue to do so. The issue is as energy costs continue to rise; consumers are looking for ways to REDUCE their fuel consumption.

One of the benefits of these new communicating thermostats is that they have the ability to offer zone synchronization to the system. Synchronization means all the thermostats line up (as in the beginning of a race) and start at the same time at the beginning of each heating cycle. Of course, the on-time of each thermostat can and will be different during each heating cycle. The on-time of each thermostat is controlled by the zone's load during that particular cycle. But the boiler benefits from this synchronization because all the zones are calling at the beginning of each cycle; therefore, it has a decent load (i.e. flow rate/gallons of water) to work against each time it fires. And this loading helps the boiler prevent short-cycling from occurring, thus increasing the efficiency of the customer's boiler. This is an important feature you gain by using communicating thermostats, because non-communicating thermostats operate independently of each other. In fact, they do not even know that each other

exists. This results in random calls for heat to the boiler. The boiler then "sees" significantly fluctuating flow rates which leads to severe short-cycling.

Communicating thermostats provide superior comfort to the zones they are controlling because they calculate a desired water temperature to maintain the space set point. They don't just make and break a switch, but rather calculate a specific water temperature and then request this temperature onto a communicating "bus" that is sent to the reset control. So in essence, these communicating thermostats take an already good system, i.e., an outdoor reset control and make it better! They do this by directly influencing the final water temperature that the control calculates and provides from the boiler out to the zones. Of course each zone may be experiencing a slightly different heat loss compared to the others and so the requested water temperatures will be different. The "brain" of the system takes all of these requests, determines the zone with the greatest demand and then fires the boiler up to this water temperature. The control broadcasts this temperature out to all the thermostats as well as the predicted length of the heating cycle. The thermostats then figure out how long they need to operate at this higher water temperature during the next heating cycle to maintain the zone's thermostat setting. This operation continually repeats itself for every heating cycle, constantly "tweaking" its water temperature and/or it's on times during the heating cycle.

And all of this happens "behind the scenes." The homeowner doesn't see any of this, only that they set their thermostat to a particular setting and the room constantly stays at that setting. The other nice feature of these new communicating thermostats is they only need two wires, which makes it very easy to upgrade the existing hot water heating systems. By simply upgrading the older thermostats to the new communicating thermostats and new communicating boiler reset control, you can provide your customer with an integrated heating control system that increases the efficiency of the boiler by reducing short cycling (thus saving money) and maintaining space temperatures by requesting the lowest water temperature needed to maintain the room's set temperature (thus keeping your customer very comfortable).

This "new" technology also allows the heating system to be viewed and communicated with through the Web. By adding a "gateway" to the control system, the heating system, in effect, has a web address that can be typed into any internet service and can be viewed from anywhere. Homeowners can see and adjust their heating system online; they also can receive email alerts if the system experiences a problem and they can send the alerts to their heating service provider. Sounds like an opportunity....

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