

Thermostats

Overview

As you know, a thermostat allows you to control the heating and/or cooling system in your home. What you might not know is that there are quite a few different types that vary from a simple temperature range dial, to one that can be programmed with a customized schedule, to newer super high-tech “smart” thermostats that include occupancy sensors, remote control, learning algorithms, and even voice control! Regardless of the bells and whistles, *most* thermostats and heating/cooling systems are truly capable of only two modes; on or off. That said, be aware that some systems, such as gas furnaces and heat pumps, may be capable of a low and a high stage, and therefore the thermostat should be compatible with system capabilities.

Definitions

Set point - *The preferred target temperature on a heating and cooling system's thermostat.*

Setback - *A strategy where the temperature set point is temporarily expanded outside the typical temperature setting, for example, at night or during the work day.*

Electric heat lock out - *A heat pump thermostat feature where electric heat (also called strip heat, auxiliary heat, or emergency heat) is temporarily locked out to allow the compressor to run longer in very cold weather. When heat pumps use electric strip heat, their efficiency plummets so it is advantageous to prevent the strip heat from being necessary.*

Deadband - *A programmed temperature buffer that prevents inefficient or overlapping system operation between heating and cooling needs.*

When is This Applicable?

This is a simple and inexpensive change that can save you money. For new construction and mechanical system replacements, the 2012 Washington State Energy Code (R403.1.1) requires that any forced-air furnace have a programmable thermostat capable of a weekday program and a weekend program. It also requires a minimum 5°F deadband between heating and cooling set points, a vacation setback mode, auto start with intelligent recovery, and heat pump electric heat lockout capabilities. For existing systems, now is the best time to start operating your system optimally, or considering whether a new thermostat is beneficial to you and your home.

What Makes it Green?

Learning to optimally use your existing thermostat or purchasing a new thermostat may improve the energy efficiency of your home and help reduce utility costs. Optimally controlling your heating and cooling equipment can also help prolong the life of your equipment which is good for your pocketbook and the environment.

Best Practices

Whether you are looking to make the most of what you already have, exploring options for replacement, or building new, consider the following best practice opportunities.



Using the thermostat you have now:

- First, ensure your thermostat is best matched with your system type. Look at the user's manual for your furnace or heating system, and confirm whether you have a single-stage or dual-stage system. Ensure your thermostat enables compatible features. If you have questions, call a qualified, licensed mechanical contractor.
- Next, ensure you are using your thermostat optimally.
 - For manual thermostats – only turn the system to your desired set point when you are present; otherwise, adjust the set point to save energy while you are away.
 - For programmable thermostats – confirm the programmed schedule matches your current lifestyle including reducing the thermostat at night (68 degrees in winter and 78 degrees in summer).
- Learn to use the features of your thermostat in conjunction with the heating and/or cooling system, especially setting back. Many thermostat user manuals are easily found by searching for the make/model online.
- Consider that programmable thermostats do not necessarily save energy automatically. In a recent study, only 50 percent of homes used their

programmable thermostat correctly/optimally. To improve efficiency, ensure you use your according to your schedule.

- If using a heat pump, make sure it has an outdoor thermostat – this ensures the system does not run in the less efficient auxiliary or emergency heat mode. This feature is also called electric heat lock out.

Choosing a new thermostat:

All of the tips for existing thermostats apply to choosing and using new thermostats as well. Consider the following when choosing among the numerous options for new thermostats.

- If replacing an old, mercury switch style thermostat, the thermostat must be treated as hazardous waste and disposed of properly (see resources).
- Consider a smart or learning thermostat, one that gathers information about your temperature preferences and automatically adjusts hourly and weekly programming to fit. There is rapid development in this industry. Some smart thermostats even provide troubleshooting data about your heating and cooling system to alert you of problems.
- Pick the thermostat that best fits your desired level of interaction with it.



NEW THERMOSTAT CONSIDERATIONS

Manual Thermostats are the simplest type of thermostat. Some only have the current set point while others may display the current temperature, the current set point, and have buttons for higher or lower temperature. These may be digital or simple dials.



Source: O'Brien & Company

Programmable thermostats provide added features for occupants who want to have heating and cooling based upon a regular schedule. These allow for multiple, pre-determined set-back periods and temperature set points. Most allow for 2-4 programs per weekday and on the weekend. For example, a Monday to Friday schedule may mimic the schedule of a workday, whereas the weekends reflect more time at home. This is the most common pre-programmed schedule for these thermostats. They are geared for people who work outside the home during the week and spend time at home on the weekend. These programs can be changed and also have manual override features.



Source: O'Brien & Company

Smart, or Learning thermostats have all the same functionality of a programmable thermostat with added capability to track manual changes to programming and adjust accordingly. Since this type of thermostat adjusts to occupant patterns, it minimizes the need to manually refine programming over time, as it is done automatically.

Smart thermostats that are integrated with your phone or computer typically send your information, system control patterns and set points to an information gathering database. This information is used in aggregate for customer research and product improvement, and for some may be a privacy issue.



The Nest Thermostat
[Source](#)



NEW THERMOSTAT CONSIDERATIONS *continued*

Remote access thermostats can be controlled with an internet connected device such as a computer, tablet or smart phone. If you leave home in a hurry and forget to turn off your system, you can shut it off remotely. Or, if you're returning home earlier than normal and want to start the system before your arrival, a remote access thermostat can do this. Adding to the interactivity, some remote access thermostats will alert you by e-mail or text message if the temperature unexpectedly changes dramatically, when a filter needs to be changed, or if there is a problem with a part of the system. Some are capable of generating reports and providing usage information.



Example remote access thermostat enables control from various wireless devices. [Source](#)

Is a “smart” or “learning” thermostat right for you?

Do you:

- Prefer to have one main program run automatically and adapt to your manual adjustments?
- Have a budget that allows for additional initial cost of an upgrade?
- Have an interest in remote access or control?
- Have an interest in cutting edge technology?

If you answered “yes” to at least one of the above, then you might consider a smart thermostat. However, you may want to research compatibility with your equipment type and lifestyle or consult with a mechanical contractor first. The benefits and estimated savings of these thermostats may not be applicable to all systems.

Fun Fact: You can operate some thermostats from your smart phone!

Applicable References/ Standards

King County’s [“What Do I Do With...”](#) website provides a searchable database for where you can take your mercury-containing thermostats.

The [2012 Washington State Energy Code](#) (Section 403 in particular) describes thermostats if you want to dig into the specifics.



Resources

For the complete King County Green Building Handbook and individual Green Sheet PDF files, please visit our website at: <http://kingcounty.gov/property/permits/publications/greenbuild.aspx>. For additional information, please email dperwebinquiries@kingcounty.gov or call 206-296-6600.

See these related DPER Green Sheets (GS):

- Air Sealing Your Home, GS Number 10
- Alternative Heating Systems, GS Number 19
- Duct Sealing, GS Number 11
- Fresh Air Ventilation, GS Number 14
- Furnace Replacement, GS Number 18
- Right Sizing Heating/Cooling Systems, GS Number 17
- Routine Maintenance, GS Number 5

Thermostat Center: Helpful resources, including a “Buying Guide.”

Washington State University Extensions:
Electric Heat Lock Out on Heat Pumps:

Guidance on electric heat pump lockouts for new and existing systems.

Puget Sound Energy; Home heating rebates:

Current offers for new and existing systems, including Heat Pump Sizing and Lock-out Control for your heat pump.

EPA’s Proper Use Guidelines for Programmable Thermostats:

This Guide claims that proper use of a programmable thermostat (using the four pre-programmed settings) can save about \$180* every year in energy costs.

Smart Residential Thermostats: Capabilities, Operability, and Potential Energy Savings:

If you really want to geek out on smart thermostats, this 2012 study by WSU Extension Energy Program provides a helpful comparison table of features at the very end of the document.

Permit Tips

If submitting a permit for new construction, include a note on your plans to indicate the type of thermostat that will be installed.

