Electric Heat Lock Out on Heat Pumps

If you heat with a heat pump, it is time to cut your heating cost even more.

In most of the U.S., heat pump installations include electric strip back-up heat. The reason for this is that heat pump technology has a limitation: as the outside air gets colder, the heat pump loses capacity to heat. See Figure 1:

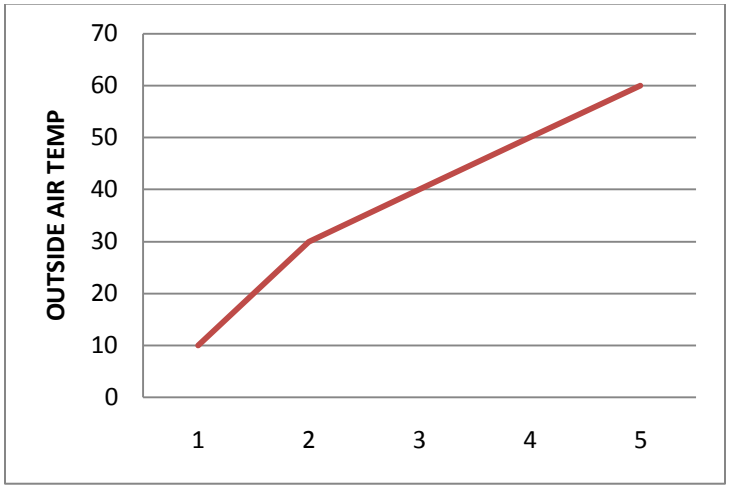

Figure 1: Generic Heat Pump Capacity Versus Outside Air Temperature

This figure shows that, as the outside air temperature decreases, the heat pump performance (Coefficient of Performance, COP) also decreases. A point is reached where the heat from the heat pump will not keep up with the heat loss of the building and supplemental heat is needed. Therefore, in cold climates we add electric strip heat to kick in and assist the compression heat from the heat pump so that our indoor space is still comfortable. Typically the strip heat is energized when the heat pump cannot keep up with the demand—when the space temperature is about two degrees colder than the requested temperature at the thermostat.

When it is too cold outside—below about 35 degrees F—we want the strip heat to assist the heat pump. But, does that strip heat come on even if the heat pump could meet the demand but just needs a little more time to get there?

During a typical heating day, a heat pump cycles on and off (or ramps up and down, depending on the brand) maintaining a comfortable indoor air temperature of about 70 degrees. But what happens if we turn the temperature down at night to 60 degrees? In the morning we set our heat pump to quickly raise the temperature ten degrees. Since we are more than two degrees from setpoint, the expensive electric strip heat comes on too.

What Can We Do Differently?

To save money and energy heating, we can add an electric heat lockout based on outside air temperature. We would also set the time at which we want the space temperature to be 70 degrees to about 30 minutes earlier, allowing more time for the heat pump to bring the space up to temperature. (It isn't that compression heat is slower than electric heat; both heat sources take time to bring the space up to temperature.)

Many newer heat pump installations have "smart thermostats." These thermostats have an outside air sensor that records about ten days of history/data. This data is then averaged to automatically determine how many minutes before the set time the heat pump needs to come on in order to heat the space to 70 degrees using only compression heat. However, if there is a sudden drop in night-time temperature, the averaging method may be inadequate, allowing the electric heat to come on during the morning warm-up cycle—even though the compression heat may have been able to meet the demand. Therefore, we could benefit financially by locking out the electric heat and allowing the compression heat to handle the load.

Older heat pumps would also benefit from adding the electric heat lockout based on outside air temperature, although equipment performance at the de-rated/colder operating condition needs to be considered.

Incentives and Standards for Electric Heat Lock Out

For existing installations, there are utilities that offer financial incentives for adding this electric heat lockout. Check with your local utility and the Database of State Incentives for Renewables & Efficiency (www.dsireusa.org) for participating utilities.

The International Energy Code, Section 503.2.4.1.1, states that, except during defrost mode, supplemental heat shall be locked out when compression heat can meet the load. This is typical of most states.

The 2009 Washington State Energy Code, section 503.8.3.5, goes one step further. It states that the control for the lockout temperature shall have a maximum setting of 40 degrees F, and set for 32 degrees or less at final inspection. This new requirement will allow us to rely on the more energy-efficient compression heat. It also means the equipment selection must consider the de-rated performance at 35 degrees.

To install an electric heat lockout, contact your local equipment distributor. Most HVAC equipment manufacturers offer this accessory. The manufacturer will also provide installation instructions. Schematically, the wiring would look something like that shown in Figure 2. **However, please consult with your manufacturer for actual wiring for their equipment**.

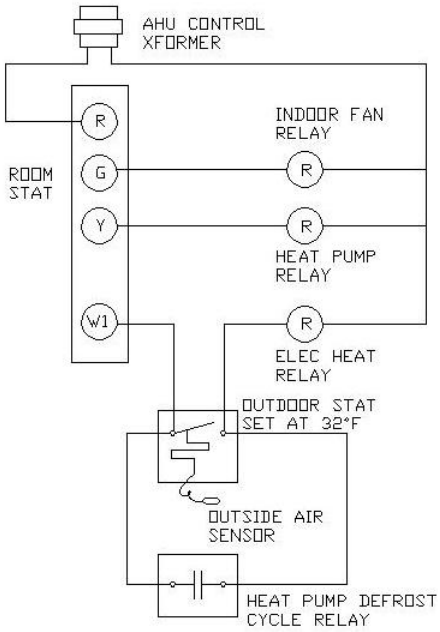

Figure 2: Sample Wiring Schematic for Electric Heat Lockout on Heat Pumps

If the heat pump is not maintaining a comfortable temperature when the outside air temperature is above about 40 degrees, a call to a technician should be made.

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