Packaged and Split System Heat Pumps FAQs

First introduced in the 1950s, heat pump installations have increased in North America, in both residential and commercial projects. In fact, the U.S. Climate Alliance, a coalition of 25 states, recently agreed to quadruple the number of heat pumps in the US by 2030.[1] These climate commitments, incentives and advancing heat pump technologies, are paving the way for the decarbonization of commercial buildings.

1. How can heat pumps help with decarbonization goals?

As more renewable energy is added to the power grid, emissions from electric power use may decline.[2] This means transitioning from fossil fuel-based heat to electric heat pumps helps to reduce indirect carbon emissions if the power generated comes from a cleaner source such as wind, solar, hydroelectric, or nuclear.[3]

The electrification of heat is an important step toward decarbonizing building operations and heat pumps offer an energy-efficient alternative to traditional gas-fired boilers. Widespread adoption of heat pumps will significantly help the reduction of carbon emissions, contribute to a cleaner power grid, and help to aid in accomplishing net-zero goals.

2. How does heat pump efficiency compare to gas or cooling-only units?

Heat pump solutions do not generate heat. Rather, they move heat from areas with excess heat to areas that need more heat. Due to the laws of thermodynamics, it takes less energy to transfer heat than to generate it, which results in significant energy and cost savings.

The ratio of heat provided to energy consumed in a heat pump is a non-dimensional metric known as the Coefficient of Performance (COP). Depending on the conditions under which the heat pump is operating, the COP of heat pumps can range from 2 to 4, meaning that 2 to 4 times the energy used is pumped into the space. When compared to the 1 to 1 heat-to-energy ratio of electric heat, or efficiency less than 100% of gas heat, heat pumps offer an obvious energy advantage.

3. Can heat pumps work in colder temperatures?

Technological advancements allow heat pumps to work well below freezing outdoor temperatures. Dual fuel units provide a hybrid approach, using the electric heat pump as the primary heating method with an auxiliary natural gas heater activated only on the coldest days. The changeover temperature from heat pump to natural gas can be adjusted to occur between 15°F and 45°F depending on the customer's goals for balancing comfort, payback, and emissions reduction. Hybrid dual fuel units are especially attractive for replacements where buildings have existing gas lines and carbon reduction is a priority.

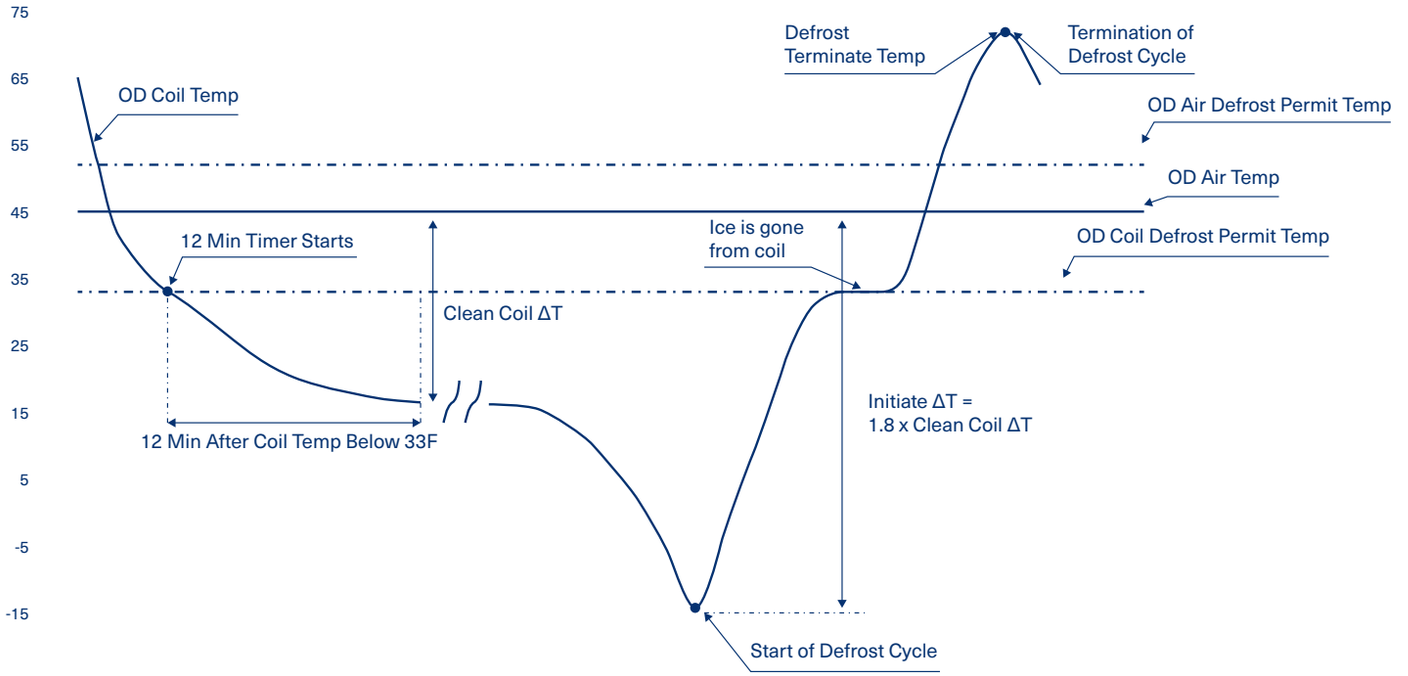
Some customers, particularly those in colder climates, may be hesitant to go all-in on electric heating. Similar to hybrid cars, hybrid dual fuel units provide the reassurance of a combustion-engine "plan B". In many cases, the biggest benefit to the customer is peace of mind. Building operators are often surprised by how infrequently gas heating is used.

1. https://usclimatealliance.org/press-releases/decarbonizing-americas-buildings-sep-2023/
2. The impact depends on the carbon intensity of the local grid (https://www.epa.gov/egrid/data-explorer), as there is a range of coefficient of performance values (COPs) you can achieve with heat pumps.
3. https://www.reuters.com/article/sponsored/the-important-role-of-heat-pumps-in-a-sustainable-future

4. How do you handle defrost cycles on heat pumps?

For Trane rooftop and split system equipment, after a power cycle, a first defrost will occur automatically when unit conditions are such that defrost is permitted. Defrost is accomplished by reversing the refrigeration cycle and rejecting heat to the outdoor coil melting the frost that has been accumulated.

When the first defrost cycle has terminated, the controller will track the difference between the outdoor air temperature and the refrigerant temperature within the outdoor coil. When the difference between these two temperatures indicates that sufficient frost has accumulated to require defrost, a defrost cycle is initiated.



As soon as the temperature of the outdoor coil indicates that the frost has been removed from the surface, defrost is terminated. For rooftops and split systems with two separate refrigerant circuits, independent defrost is conducted based on the temperature of the outdoor coil in each circuit.

5. How is a water source heat pump different than an air-to-air heat pump?

A water source heat pump (WSHP) operates like a standard air-to-air heat pump except that heat is removed and dissipated by water rather than air. The key to the system is the water loop, a water pipe system that is connected to the WSHP. The water loop is connected to a heat rejecter, such as a cooling tower, fluid cooler, or ground heat exchanger that is used to cool a space, as well as to a heat adder, such as a hot-water boiler or ground heat exchanger that is used to heat a space. The final element connected to the water loop is water-circulating pumps.

Water source heat pumps are fully compatible with geothermal technology and offer high efficiency levels. While WSHPs are used in many building types, they are ideal for multiple-occupant buildings such as office buildings, schools, hotels, apartment buildings, extended care facilities, and large malls.

Heat pumps are a practical, efficient solution and will play an important role in reducing carbon emissions now and in the future. To learn more about Trane's packaged and split system heat pumps, visit **trane.com** or contact your **Trane Account Manager.**

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