Heat Pumps 101

The descriptions and pictures below are designed to foster a basic understanding of the parts of your ***heat pump*** system. This page will focus on ducted split systems such as the Carrier, Mitsubishi, and Daikin systems that have an outside heat pump and an inside fan coil / air handler connected to ductwork that delivers heating and cooling. For wall units and slim ducts that have minimal or no ductwork, see our Mini-split 101 page.

When you call for service, we hope they will help you to identify those parts of your system that may need service. When you receive an invoice from us, we hope the information below will help clarify which parts and systems we worked on during our service visit.

The "air source" heat pump – the type we install, service, and rescue – is truly a solar energy machine. The heat from the Sun heats the outside air all winter long and through the magic of the heat pump we are able to amplify this to heat your home.

Because we are using the outside air that is heated by the Sun, we need to somehow connect our heat pump to the outside air. This is accomplished with our **outside heat pump**.

The outside part of the heat pump system is usually powered by a **double pole circuit breaker** in the inside breaker box. An extremely common cause of no heating or cooling is a circuit breaker in the off position.

The **outside disconnect** is the switch used outside to turn on and off power to the outside heat pump. An extremely common cause of no heating or cooling is having this switch in the off position.

The outside unit uses a **condenser fan and motor** to pull outside air through the coil to extract heat in winter and reject heat in the summer.

The refrigerant flows through the outside coil and into the house. It is continuously filtered and dried by a **filter dryer** in the outside unit.

The compressor in the outside unit is started with the help of outside capacitors. Here we see the **capacitors** necessary for an typical inverter driven compressor found in a modern heat pump.

Power to the compressor is switched on and off by a **contactor** which is just a large relay that can handle a lot of current. The contact points in these contactors wear out over the years and are a common point of failure.

The refrigerant flow is controlled in modern heat pumps in the outside unit with an **electronic expansion valve**. This unit makes sure that refrigerant flow is optimized at all times. When the outside unit is first started up, these electronic expansion valves will tick for a few minutes as they re-index themselves.

To changeover from heating mode to cooling mode, the direction of the refrigerant must by reversed so that the outside unit gets hot and the inside unit gets cold in summer for cooling and vice versa in heating. This is accomplished in the outside unit with a **reversing valve**.

Modern heat pumps are highly sophisticated units that depend on computer programs to operate efficiently and reliably. The **outside control board** performs this task. Unfortunately, this is also the point of greatest vulnerability to the inadequate Vineyard power grid.

The refrigerant pipes are connected to the outside unit at the **service valves** – this is also the point where we can connect our gauges to measure the refrigerant pressures in the system.

The copper pipes that carry the refrigerant into the house and back out are called the "**line set**" and are usually brazed because of the high pressures. Both lines are insulated because a heat pump moves heat into the house in the winter and out of the house in the summer.

During the winter, the outside heat pump unit is removing heat from the cold winter air. This works for about 30 minutes and then frost starts to build up on the outside coil. The heat pump recognizes this and uses the warm refrigerant to melt, or **defrost**, the ice and frost on the coil. This results in a puddle of water under the unit. This is why it is critical to keep the outside unit clear off the snow and ice so that the melted water has a place to go and does not build up and freeze inside the unit. On a Daikin system, the thermostat will say "Standby" when the system is defrosting. Defrost time varies depending on how the computer system understands how much frost is present and how cold it is outside.

The refrigerant pipes (the "**line set**") carry the refrigerant from the outside heat pump into the unit in the house.

The inside unit is an **air handler** if it has a heat pump coil and a blower if it has no combustion.

Sometimes a **heat pump coil** is mounted on a furnace to provide backup heating if there is a service issue with the heat pump.

Inside the furnace or air handler is a **blower motor** that sends air through ductwork throughout the home. This blower motor is connected to a "squirrel cage" wheel with