

# ELECTRIC IDEAS

## HEAT PUMPS



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# A GUIDE TO HEAT PUMPS

This guide has been designed to help you better understand heat pumps. It is divided into the following sections:

- **What is a Heat Pump?**
- **Heat Pump Advantages and Disadvantages**
- **Retrofit Systems**
- **Manufactured Housing**
- **Types of Heat Pumps**
- **Heat Pump Options**
- **Evaluating Contractors and Bids**
- **Definitions**

For additional information, contact our office.

**SAMPLE**

# HEAT PUMP DEFINITION

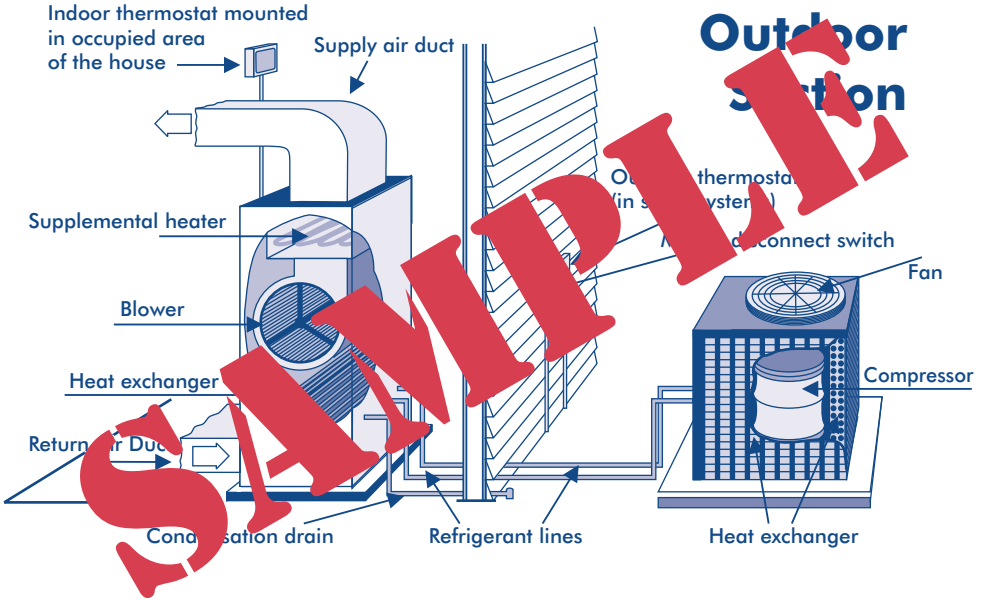
A heat pump is a ducted forced air heating and cooling system. It is called a "heat pump" because it moves or "pumps" heat from one place to another. Using a compressor and a circulating system of liquid/gas refrigerant, heat is extracted from outside sources and pumped indoors. The advantage of pumping heat is that it uses less electrical energy than converting electricity into heat. In the summer the cycle is reversed and the unit operates like an air conditioner. Heat is extracted from inside your home and pumped outdoors.



Heat pumps are the most efficient choice for heating and cooling systems. A heat pump supplies more heating and cooling capacity than the amount of electrical energy used to run it. The efficiency rating of heat pumps can be as high as 300%.

# BASIC COMPONENTS OF AN AIR SOURCE HEAT PUMP SYSTEM

## Indoor Section



# ADVANTAGES/DISADVANTAGES

## ADVANTAGES

- Generally costs less to operate than all other types of heating systems.
- Operates at a high-efficiency with no flames, fumes or chimneys.
- Filters are available to remove mold and mildew, which is helpful for those with allergies.
- Provides a more constant, even temperature, without the swings common to other heating systems.
- Maintains comfortable temperatures year-round.
- Heats and cools the home.
- Transfers heat already in the environment.
- Can provide both hot and cold water heating.

## DISADVANTAGES

- Larger initial investment than an electric furnace.
- May cost more to service and repair than other electric heating systems.
- Some outdoor units may be noisy.

# RETROFIT SYSTEMS

When converting from forced-air systems (electric, gas, or oil) to a heat pump, proper design is still important. The existing ductwork is probably adequate for the existing system, but may be undersized for a heat pump. In some situations it's best to remove the old system, including ductwork, then a properly designed heat pump, including ductwork, can be installed.

If the existing ductwork is adequate for a properly-sized heat pump, then duct sealing using a blower door pressure test and mastic sealant to seal the leaks is recommended.

To allow your heat pump to operate at its maximum efficiency, your home should be adequately weatherized prior to the design of the heat pump system. Contact your electric utility for information on home weatherization including:

- **Ceiling Insulation**
- **Floor Insulation**
- **Wall Insulation**
- **Window Replacements**
- **Duct Sealing**
- **Attic Sealing (caulking, weatherstripping)**



# MANUFACTURED HOUSING

Manufactured homes are built with supply ductwork running the length of the home with registers installed through the floor. The furnace is usually located in a closet in the home without a ducted return air system.

Manufactured homes (new and older models) usually have a forced air heating system (electric or gas). A heat pump can be a significant efficiency improvement and they are easy to install. Some manufactured homes may be uncomfortable in the summer without air conditioning. A heat pump provides comfortable cooling in the summer as well as efficient heating in the winter.

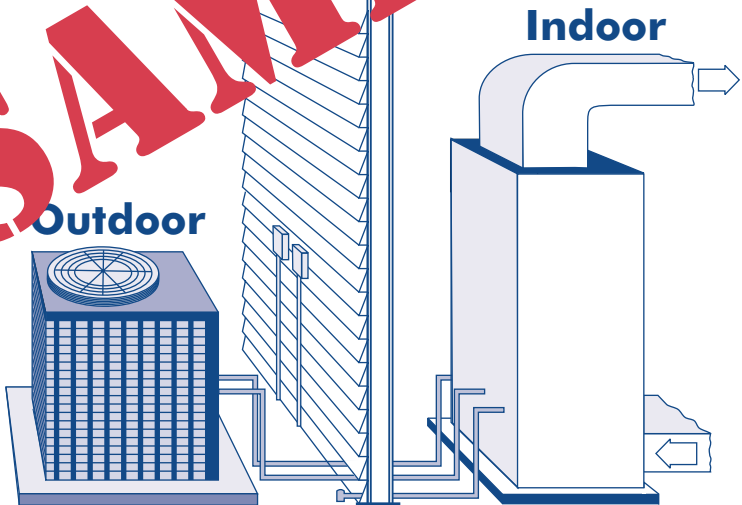
Packaged heat pumps have a condenser coil, compressor, and fan in one unit. They can be installed in manufactured housing as an alternative to the split system. Most packaged units are sized to fit the home, but a recent development in heat pumps is a self-contained floor heating and cooling unit. All of the components for heating and cooling are in a single unit occupying the same space as the more standard furnaces.

**A WORD OF WARNING:** If you have crawlspace skirting is not animal-proof, stray cats or other animals can rip open the "cross-over duct" that connects the heating system between the two sides of a double-wide home, allowing them to escape underneath your home. The flexible duct is commonly just a coil of wire with two thin layers of plastic and a bit of insulation wrapped around it, so it is very vulnerable to animals looking for warmth.

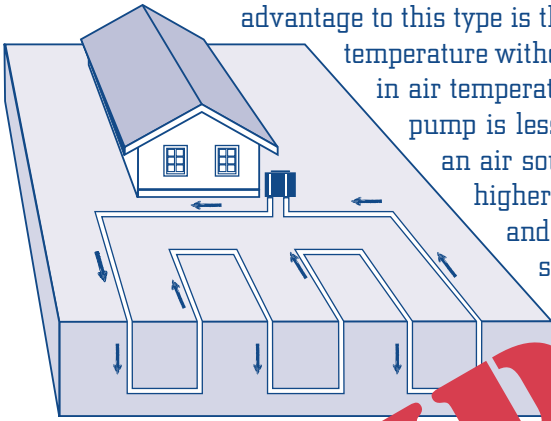
# TYPES OF HEAT PUMPS

Most heat pumps have two main parts: the outdoor unit and the indoor unit. The outdoor unit includes a heat exchanger, compressor, and a fan. This is where heat from the outside air is transferred inside during the heating season, and where heat from inside the home is transferred out during the cooling season. The indoor unit contains a heat exchanger and a fan that distributes heated or cooled air through the duct system into the home.

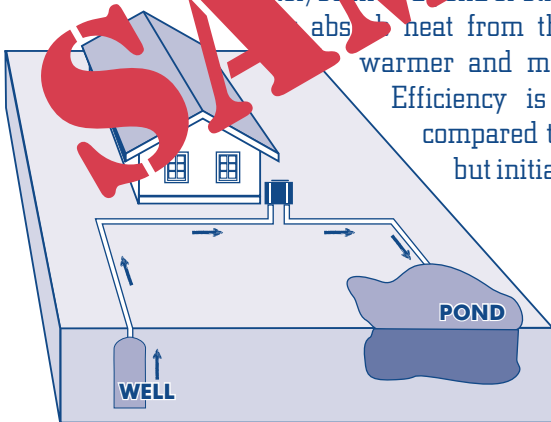
**AIR SOURCE:** An air source heat pump (the most common type) gets heat from the outdoor air and usually consists of an outdoor unit connected to an indoor unit. Ductwork is connected to the indoor unit to supply the heated or cooled air to the rooms in the home.



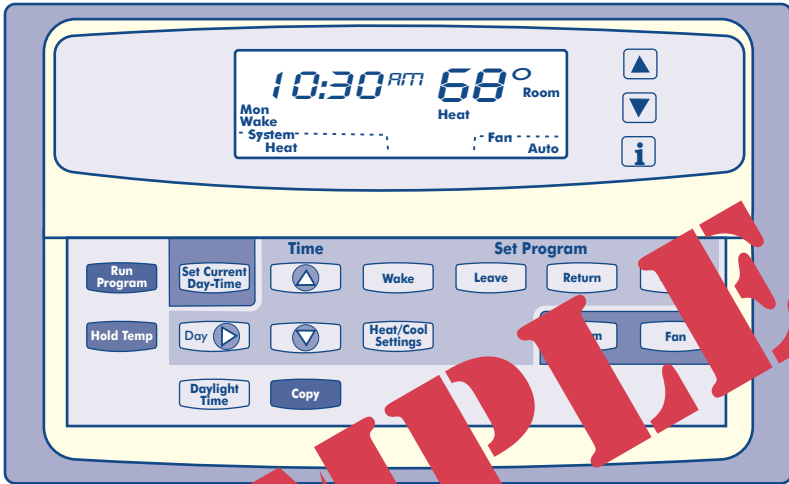
**GROUND SOURCE:** Ground source heat pumps use heat from the ground rather than from outdoor air. An advantage to this type is that the ground is a constant temperature without the common fluctuations in air temperatures. A ground source heat pump is less expensive to operate than an air source. These systems have a higher initial cost than an air source and the installation requires some excavation to install pipes in the ground.



**WATER SOURCE:** Water source heat pumps use a body of water, such as a pond or stream, for their source of heat. They absorb heat from the water, which is usually warmer and more stable than winter air. Efficiency is higher with this system compared to the air source heat pump, but initial investment is also higher.



# HEAT PUMP OPTIONS



**PROGRAMMABLE THERMOSTAT:** If adjusting the temperature during the day or night is important to you, use a programmable thermostat that is required for heat pumps. These thermostats gradually increase the temperature, or decrease it in the cooling mode, and prohibit the supplemental heat from activating.

**EMERGENCY HEAT INDICATOR:** Many thermostats come with a light that turns ON when the emergency heat is activated (indicating the heat pump isn't working when it should). This is a desirable feature because it will let you know immediately when your heat pump needs repair. NOTE: The terms "emergency heat," "supplemental heat," and "auxiliary heat" are often used somewhat interchangeably since they all refer to the heating unit that adds to, or takes over for, the heat pump when needed.

**SUPPLEMENTAL HEAT INDICATOR:** This lets you know when the supplemental heat is ON. Unlike emergency heat, supplemental heat is a normal occurrence.

**SUPPLEMENTAL HEAT LOCKOUT:** If you want to keep your heating costs low, it's important that your supplemental heat does not come on when it's not needed. There are two ways to prevent unneeded use of supplemental heat: 1) Outdoor thermostats sense the outdoor temperature and lock out the supplemental heat unless the temperature drops below a preset point. 2) Certain microprocessor-controlled thermostats allow the heat pump to "ramp-up" to the desired temperature but won't turn on the supplemental heat unless the heat pump alone is unable to keep the home up to the desired temperature.

**STAGING SUPPLEMENTAL HEAT:** Staging refers to turning the supplemental heat on in two or more phases. Important benefits of this are: it's more comfortable and staging may reduce the on/off cycles of the heat pump, which can increase the longevity of the heat pump compressor.

**DEFROST CONTROLS:** There are many types of defrost controls, but they can be grouped into two major categories: time and temperature controls activate the defrost cycle at specified intervals whenever the outdoor temperature reaches a preset minimum point (unfortunately, there may not actually be frosting during the times specified). Demand controls actually detect the presence of frost on the outdoor coil before activating.

**HIGH PRESSURE AND LOW PRESSURE SWITCHES:** A heat pump should have refrigerant pressure sensors to prevent compressor damage.

**AIR FILTERS:** Two popular options are to use an "electrostatic" or an "electronic" air cleaner. These types of filters can remove small particles from the air, including pollens. A High Efficiency Particulate Air (HEPA) filter is a replaceable filter that also removes very small particles. HEPA filters have a greater resistance to air flow than other filters, which needs to be accounted for in the system design.

**VARIABLE SPEED HEAT PUMPS:** Variable speed heat pumps adjust heating or cooling output to match the requirements of the home.

**SCROLL COMPRESSOR:** The scroll compressor uses a rotary motion that reduces noise and has higher efficiencies at lower outside temperatures.

# EVALUATING CONTRACTORS AND BIDS

High quality heat pumps built by different manufacturers may have almost identical performance and durability. However, a system's performance can be greatly affected by the quality of the installation (proper sizing, the duct system, and attention to detail). The low bid may not necessarily be the best one.

**HEAT PUMP SIZING:** There are three major reasons that the pump should be properly sized for your home.

- **Cost:** Larger equipment is more expensive than smaller equipment; if your system is too large you'll have to pay for it. If your heat pump is undersized for heating, your furnace will operate too often, increasing your electric bill.
- **Durability:** Most heat pump wear occurs when it starts up. Oversized equipment cycles on and off more frequently than properly sized equipment.
- **Efficiency:** Oversized equipment has shorter ON times, which means more time is spent getting started—the part of the heat pump where efficiencies are relatively low.

**DUCT DESIGN:** One of the most important parts of proper installation is insuring that the ductwork can deliver adequate air flow to maintain comfort in the house, and also meet manufacturers' specifications.

**DAMPERS:** After the system is installed, the contractor should use dampers to "balance" the system.

**DUCT SEALING:** Air leakage from ducts can be one of the largest sources of heat loss in the home. Ducts need to be sealed where sections are joined—along the seams in individual duct sections and where the duct penetrates from unheated to heated locations. It is recommended that contractors use a blower door to test duct tightness and mastic to seal in the duct work.

**DUCT INSULATION:** Metal ducts passing through unheated areas (garages, crawl spaces, and attics) should be insulated with a minimum of R-11 insulation.

**FLEX DUCT:** If flex duct is used, it should be installed with the following considerations:

- Use R-8 or higher insulated flex duct.
- Make all bends gradual so that airflow is not restricted.
- Seal connections (aluminum duct tape) between flex and sheet metal ducts. Secure joints with sheet metal screws and seal with mastic.
- Support flex duct so air flow is not restricted due to sagging.
- Stretch the duct to its full length so that air passages are as smooth as possible.

**OUTDOOR UNIT INSTALLATION:** The outdoor unit should be installed on a concrete pad. If possible, install the unit so it is sheltered from prevailing winter winds and where the noise it produces won't bother you or your neighbors.

**SERVICE CONTRACT:** Regular annual maintenance is critical for heat pump reliability.

# DEFINITIONS

**COP (Coefficient Of Performance):** A heat pump may use only one third as much energy as electric resistance heat. COP is the ratio of heat output to electrical energy input. The higher the COP, the more efficient the system. When the temperature is 40 degrees Fahrenheit, the COP may be 3.0; when the temperature is 20 degrees Fahrenheit, the COP will be closer to 2.0.

**HSPF (Heating Season Performance Factor):** The test for overall heating efficiency provides a rating known as the HSPF. This laboratory test attempts to take into account the reductions in efficiency caused by defrosting, temperature fluctuation, supplemental heat, fans, and on/off cycling. The higher the tested HSPF, the better the heating efficiency for the heat pump. Most heat pumps now have at least a 7.2 HSPF rating, with some rated over 9.0 HSPF.

**SEER (Seasonal Energy Efficiency Ratio):** Cooling performance is rated using the SEER. The higher the SEER, the more efficiently the heat pump cools. The SEER is the ratio of total energy removed from the home compared to the energy to run the heat pump (including fans). The SEER is usually noticeably higher than the HSPF since defrosting isn't needed and there is no need for supplemental heat during air conditioning weather.

**SUPPLEMENTAL HEAT:** As it gets colder outside, the heat pump provides less heat, yet the home needs more heat to remain comfortable. To make up the difference, heat pumps have a supplemental heating system, usually electric resistance coils. Since resistance heat doesn't operate with the same efficiency (the COP of electric resistance heat is 1.0), the total heat pump COP will be lower when the supplemental heat is on.

**DEFROST:** When temperatures get below 40 degrees Fahrenheit, ice may form on the coils and air-source heat pumps may need to defrost periodically. To melt the ice, the heat pump automatically takes heat from the home to heat up the outdoor coils.



## USE ENERGY WISELY!

This publication was compiled from information provided by the Northwest Regional Group, a group of electric utilities in the Northwest. For additional information contact your local utility.

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