

Electric furnace: A squirrel-cage blower blows air over 2 to 6 electric resistance coils and down into the plenum below the floor.

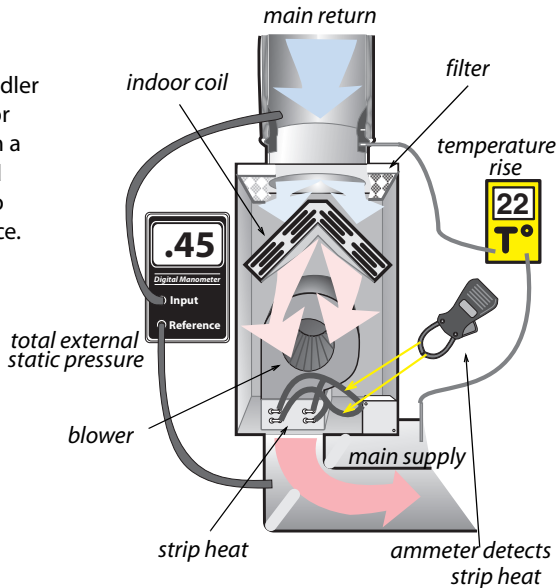
8.21.3 Heat-Pump Energy Efficiency

SWS Details: 5.0108.1 Air-to-Air Split System; 5.0108.2 Air-to-Air Package Unit; 5.0108.3 Mini-Split System; 5.0109 Clean and Tune; 5.0109.2 Air Handler; 5.0109.1 Condensers; 5.0109.3 Evaporators; 5.0101.1 Thermostat Replacement; 5.8801 Equipment Removal

An air-source heat pump is almost identical to an air conditioner, except for a reversing valve that allows refrigerant to follow two different paths, one for heating and one for cooling. Heat pumps move heat with refrigeration rather than converting it from the chemical energy of a fuel.

Like air conditioners, air-source heat pumps are available as centralized units with ducts or as room units. Heat pumps are 1.5 to 3 times more efficient than electric furnaces. Heat pumps can provide competitive comfort and value with combustion furnaces, but they must be installed with great care and planning.

Heat pump: The air handler contains a blower, indoor coil, strip heat, and often a filter. Static pressure and temperature rise are two indicators of performance.



Heat pumps are also equipped with auxiliary electric resistance heat, called strip heat. The energy efficiency of a heat pump depends on how much of the heating load the compressor provides without using the strip heat.

Evaluating Heat Pumps During the Heating Season

Heat pumps should have two-stage thermostats designed for use with heat pumps. The first stage is compressor heating and the second stage is the inefficient strip heat. Evaluating heat pumps in the winter is more difficult than a summer evaluation.

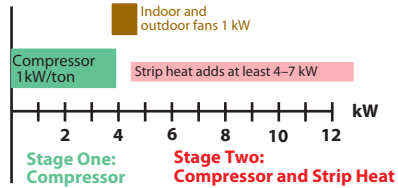
Although we can generally evaluate the heat pumps refrigerant charge in the winter, it may be necessary to return in warm weather to more accurately charge the system. This summer verification is required with new heat-pump installations.

Consider these steps to evaluate heat pumps during the winter.

- ✓ Measure the airflow of the air handler by temperature rise method, flow plate or flow hood. Heat pumps must have 400-450 CFM per ton.

- ✓ Look for a temperature rise of 20°F when the outdoor temperature is 32°F. Add or subtract 1° of temperature rise for every 3° it is over or under 32°F outdoor.
- ✓ Check for operation of strip heat by measuring amperage. Then use the chart shown here to find out if strip heat is operating.

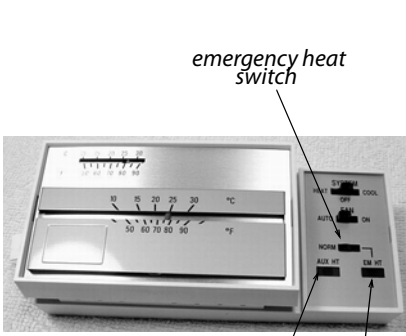
Is strip heat activated? Using an ammeter and the nameplate data on the heat pump, a technician can know when and if the strip heat is activated.



- ✓ External static pressure should be 0.5 IWC (125 pascals) or less for older, fixed-speed blowers and less than 0.8 IWC (200 pascals) for variable-speed blowers. Lower external static pressure promotes higher airflow.
- ✓ Seal supply and return ducts and insulate them after you've verified the airflow as adequate. Measure airflow again after duct sealing.

Most residential central heat pumps are split systems with the indoor coil and air handler indoors and outdoor coil and compressor outdoors. Individual room heat pumps are more efficient because they don't have ducts, and are factory-charged with refrigerant. The illustrations show features of an energy-efficient heat pump installation.

In the summer, use the same procedures to evaluate central heat pumps as to evaluate central air conditioners, described on [page 398](#).

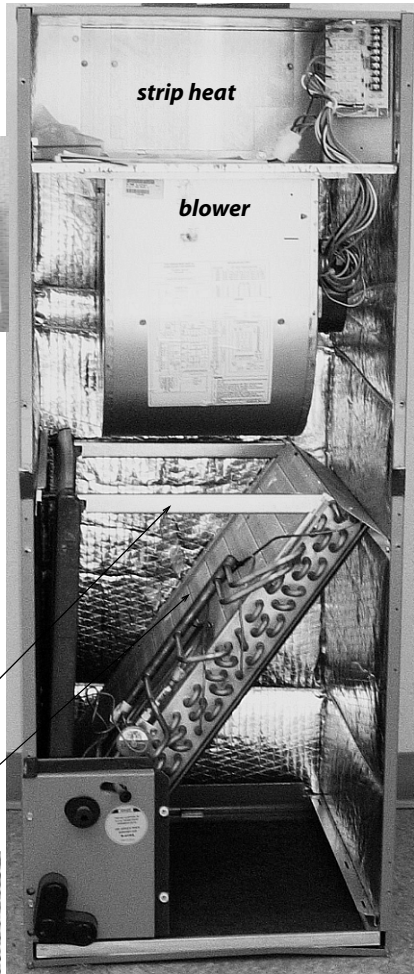


emergency heat switch

auxiliary heat indicator light

emergency heat indicator light

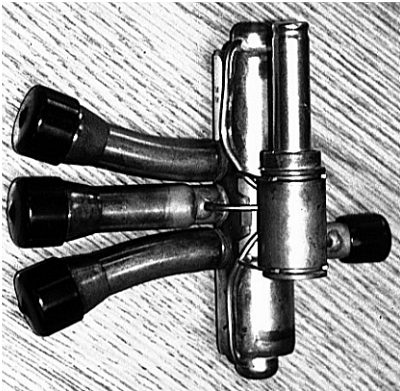
Heat pump thermostat: These should have two indicator lights, one for auxiliary heat and one for emergency heat.



filter bracket

indoor coil

Heat pump: This upflow indoor air handler contains a blower, indoor coil, strip heat, and filter bracket.

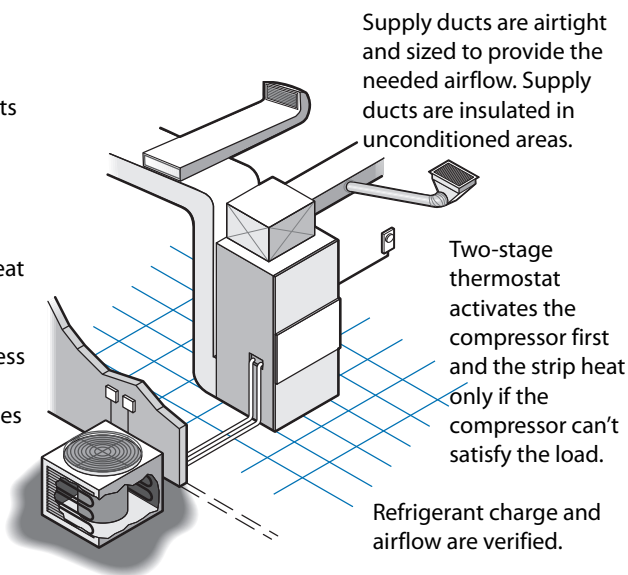


Reversing valve: The outdoor unit contains a reversing valve installed near the compressor.

The illustration shows features of an energy-efficient heat pump installation.

Multiple returns ensure good airflow to all parts of the home.

Outdoor thermostat prevents strip heat from operating until outdoor temperature is less than 40°F. Thermostat stages elements as needed.



Coil is cleaned every year. Weeds, grass and shrubs shouldn't grow within 3 feet. Verify that no airflow restrictions exist above the outdoor unit.

8.21.4 Room or Unitary Heat Pumps

SWS Details: 5.0301.1 Through-Wall and Window Units; 5.0108.2 Air-to-Air Package Unit; 5.8801 Equipment Removal

Room heat pumps can provide all or part of the heating and cooling needs for small homes. These one-piece room systems (also known as terminal systems) look like a room air conditioner, but provide both heating and cooling. They can also provide ventilation air when neither heating nor cooling are required. They mount in a window or through a framed opening in a wall.

Room (or unitary) heat pumps can be a good choice for replacing existing unvented gas space heaters. Their fuel costs may be somewhat higher than gas furnaces. However, they are safer than combustion appliances.

Room heat pumps are more efficient than ducted units because they heat a single zone and don't have duct losses. If they replace electric resistance heat, they consume only one-half to one-third the electricity to produce the same amount of heat.

Selection

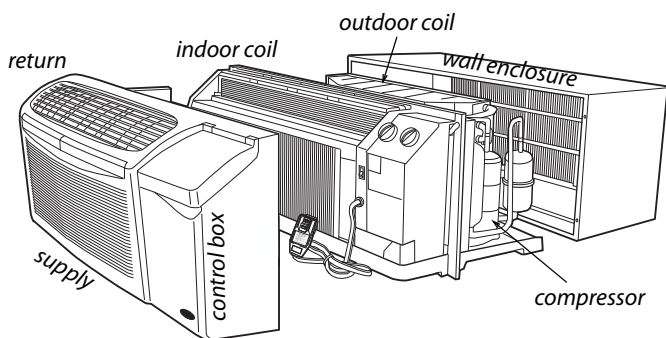
Room heat pumps draw a substantial electrical load, and may require 240-volt wiring.

- ✓ Select an ENERGY STAR® qualified model with Energy-Saver Mode or better.
- ✓ Size the new unit according to Manual J, assuming design temperatures of 75 degrees for cooling and 70 degrees for heating.
- ✓ Select a room heat pump, that's input matches available voltage and doesn't exceed the dedicated circuit's ampacity.

Installation

- ✓ Before installing through-wall unit, seal all adjacent framing and provide a sealed opening.
- ✓ Pipe condensate away from the building or to a sanitary drain.
- ✓ Insulate condensate drain to a minimum of R-3 if the possibility of freezing or condensation exists.
- ✓ Remove old room heat pump or air conditioner from job site and recycle or dispose of it, according to local and federal law.
- ✓ Provide occupants with a user's manual, warranty information, installation instructions, and installer contact information

Caution: Don't operate room heat pumps with extension cords or plug adapters.



Unitary heat pumps: These unitary ductless heat pumps sit inside an exterior wall. They are a very efficient kind of electric heating and cooling.



- ✓ Insufficient wiring capacity can result in dangerous overheating, tripped circuit breakers, blown fuses, or motor-damaging voltage drops.

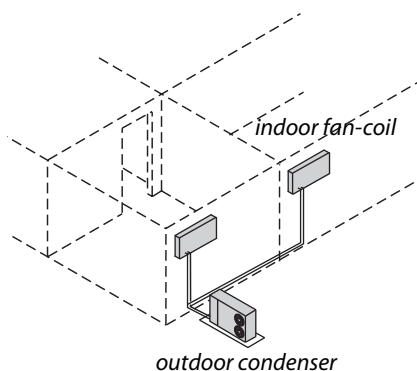
8.21.5 Ductless Minisplit Heat Pumps

SWS Details: 5.0108.3 Mini-Split System; 5.0101.1 Thermostat Replacement; 5.8801 Equipment Removal

Ductless minisplit heat pumps contain an outdoor condenser and one or more indoor fan-coil units that heat or cool the rooms. Mini-split heat pumps are among the most efficient heating and cooling systems available, providing 2-to-4 watt hours of heating or cooling for each watt hour of electricity they use.

Select a system that is ENERGY STAR® certified or equivalent.

Specify minisplits heat pumps as replacement HVAC solutions when they are appropriate, for example.



Ductless mini-split heat pumps:

These systems have very high efficiency: 200% to 400%.

- Homes currently having no ducts.
- Homes with poorly designed or deteriorating ducts outside the thermal boundary or located in inaccessible areas, such as floor cavities.
- Isolated part of a building such as an addition or a bonus room.
- Very well-insulated, airtight, and shaded homes.
- Bedrooms needing cooling in homes with no central air conditioning.
- Masonry buildings being retrofitted to replace obsolete central space-conditioning systems (often steam).

8.22 EVALUATING DUCTED CENTRAL AIR-CONDITIONING SYSTEMS

SWS Details: 5.0108.1 Air-to-Air Split System; 5.0108.2 Air-to-Air Package Unit; 5.0108.3 Mini-Split System; 5.0109 Clean and Tune; 5.0101.1 Thermostat Replacement; 5.8801 Equipment Removal