MIDWEST ASHP
COLLABORATIVE

Heat Pump Glossary of Terms

Equipment

This glossary of terms is a valuable resource tailored for professionals working with residential heat pumps, aiming to clarify the complex terminology often encountered within the industry.

Whether you are a program administrator navigating the intricacies of heat pump systems, or an experienced contractor looking to expand your knowledge, this resource will equip you with the foundational knowledge needed to understand the terminology you may encounter.

Each entry is carefully selected to offer clarity and understanding, ensuring that you are thoroughly prepared to grasp the terminology encountered in your work.

Contents

Heat Pump Types

A heat pump is a heating and cooling system that moves heat from one place to another (similar to an air conditioner or refrigerator) instead of generating heat directly. During cold weather, it pulls heat from the outdoor air, ground, or nearby water sources such as lakes or ponds, and pumps it inside to warm a building. During hot weather, it reverses the process - it takes heat from inside a building and pumps it outside to provide cooling.

There are several different kinds of heat pump systems used in residential settings. The main differences are where they source their heat from, and how they distribute the heated or cooled air throughout a building. In this section, we will explore the terms used to describe the most frequently encountered types of residential heat pump systems.

Heat Exchange Medium

Air-source Heat Pump (ASHP)

An air-source heat pump is the most common type of heat pump. The heat pump absorbs heat from the outside air and transfers the heat to the space to be heated in the heating mode. In the cooling mode, the heat pump absorbs heat from the space to be cooled and rejects the heat to the outside air. The term "air-source heat pump" is a broad term used to describe a variety of heat pump system configurations that utilize air as the primary medium for heat transfer. These systems include both air-to-air and air-to-water heat pumps (see definitions below). Additionally, distinct distribution methods are employed, such as hydronic systems for air-to-water heat pumps, ductwork for ducted air source heat pumps, and individual blower heads (wall, ceiling, or floor mounted) for ductless air-source heat pumps.

- **Air-to-air Heat Pump**

An air-to-air heat pump is a type of air source heat pump system that uses forced air distribution. It operates by transferring heat between the indoor air and outdoor air directly using refrigerant.

- **Air-to-water Heat Pump**

  Air-to-water heat pumps exchange heat with the outdoor air but distribute the heat indoors through a hydronic system. All air-to-water heat pumps provide heating, and some can also provide cooling. To provide heating, air-to-water heat pumps extract heat from the outdoor air, transfer the heat to water, and circulate the water through radiators or in-floor loops. Air-to-water heat pumps have the potential of also heating domestic hot water, unlike typical air-source heat pumps. They can provide cooling if they are connected to a cooling system that can use chilled water, like a hydronic fan coil.

- **Cold-climate Air-source Heat Pump (ccASHPs)**

  Cold climate air source heat pumps are an iteration of traditional heat pump technology, engineered to efficiently heat homes in extremely cold conditions, typically at or below 5°F, while also providing cooling during warmer seasons. These heat pumps utilize advanced technology and enhanced components, such as variable-speed, inverter-driven compressors to maintain comfort and energy efficiency in challenging climates. They offer a sustainable alternative to traditional heating systems by leveraging electric power and renewable energy sources, reducing reliance on fossil fuels and lowering greenhouse gas emissions.

  Note: To promote the adoption of cold climate heat pump technologies and address the challenges of heating in colder climates, the U.S. Department of Energy launched the Cold Climate Heat Pump Technology Challenge. This initiative aims to accelerate the development and deployment of high-performance cold climate heat pump systems. Additionally, NEEP maintains a list of cold climate air source heat pumps that meet specific performance criteria. The list includes heat pump models that are well-suited for efficient heating in IECC climate zone 4 and higher, which encompasses regions with extended periods of cold temperatures.

Geothermal Heat Pump (also referred to as "Ground source, Water-source, Water-to-water, Water-to-air, GeoExchange, and Earth-coupled heat pumps")

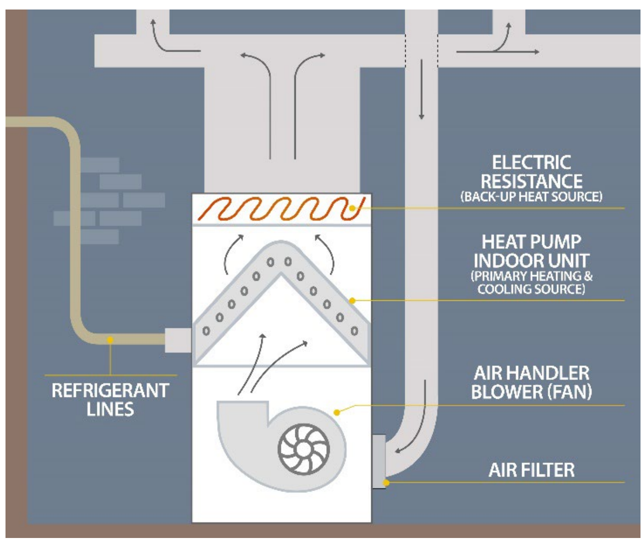
Geothermal heat pumps are similar to air-source heat pumps, but instead of using heat found in outside air, they rely on the relatively constant heat of the earth (thermal energy) to provide space heating, air conditioning and, in many cases, domestic hot water. In winter, geothermal heat pump systems collect the Earth's natural heat through a series of pipes made of copper or plastic, called a loop, installed below the surface of the ground or submersed in a body of water. Fluid circulating in the loop carries this heat to the home. There, an electric compressor and a heat exchanger concentrate the Earth's energy and release it inside the home at a higher temperature. In summer, the process is reversed in order to cool the home. Excess heat is drawn from the home, expelled to the loop, and absorbed by the Earth.

Note: There are four basic types of [geothermal heat pump] ground loop systems. Three of these—horizontal, vertical, and pond/lake—are closed-loop systems. The fourth type of system is the open-loop option. Several factors such as climate, soil conditions, available land, and local installation costs determine which is best for the site.

System Fuel Type

All-electric Centrally Ducted Heat Pump System

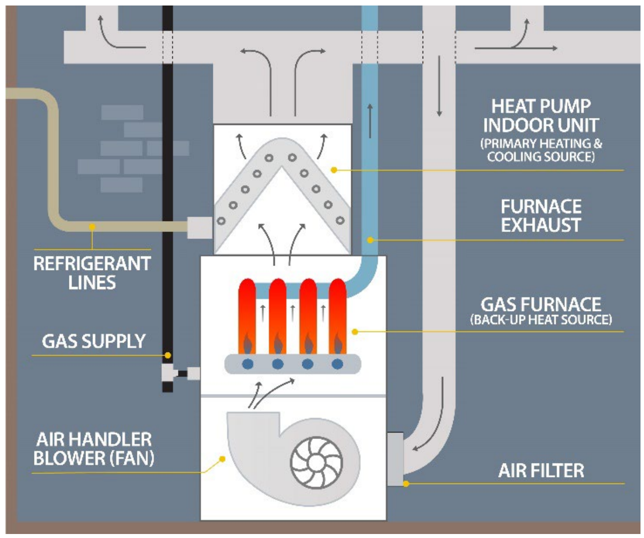
An all-electric centrally ducted heat pump system can either rely solely on the heat pump for heating or can merge the capabilities of an electric air-source heat pump with auxiliary electric heat. No gas-powered heating system is involved in either scenario. If the heat pump has auxiliary electric heat, when outdoor temperatures reach a certain low point, the auxiliary electric heat turns on to supplement the heating from the heat pump. All-electric heat pumps offer the most potential for lowering greenhouse gas emissions over time, depending on how quickly the local electric grid is decarbonizing.



Note: Ductless heat pumps may be integrated with a variety of other heating systems. All-electric ductless heat pump systems may be integrated with electric baseboard heating or boilers as a "multi-system" application.

Hybrid Heat Pump System (also referred to as "Dual-fuel heat pump system")

A hybrid heat pump system merges the capabilities of a centrally ducted electric air-source heat pump with a secondary fossil-fuel-fired furnace. As outdoor temperatures change, the system alternates between the two fuel sources, maximizing comfort, economics, and efficiency – offering the homeowner the key benefits of both fuel sources. In moderate winter weather, the heat pump efficiently draws warmth from the outdoor air to heat the home, while in summer, it reverses its operation to provide cooling. There are different methods used to control when the hybrid system switches from the electric air-source heat pump to the fossil-fuel-fired secondary heating source. The most common method is based on outdoor air temperature. When outdoor temperatures dip below a pre-set switchover point defined by the homeowner, the system seamlessly shifts to the secondary heating source, like a gas furnace, ensuring consistent comfort levels. This adaptability empowers homeowners to tailor energy usage and operational expenses to their preferences.



Note: In addition to the commonly used outdoor air temperature control method, other control methods for hybrid heat pump switchover include indoor air temperature “droop” and more sophisticated algorithm-based controls. In the indoor air “droop” control method, the system continuously monitors the indoor air temperature for variations. If the indoor temperature begins to "droop" or fall below the desired setpoint, the system recognizes that the heat pump alone is not sufficient to maintain the desired comfort level. As the temperature continues to drop, the system engages the fossil-fuel-fired secondary heating source to provide the necessary warmth. There are also more advanced algorithm-based control methods, which use a combination of data inputs and predictive models to optimize hybrid heat pump system performance, such as minimizing operational costs.

Absorption Heat Pump System (also referred to as “Gas-fired heat pump system”)

Absorption heat pumps are essentially air-source heat pumps driven not by electricity, but by a heat source such as natural gas, propane, solar-heated water, or geothermal-heated water. Because natural gas is the most common heat source for absorption heat pumps, they are also referred to as gas-fired heat pumps. There are also absorption (or gas-fired) coolers available that work on the same principle. Residential absorption heat pumps use an ammonia-water absorption cycle to provide heating and cooling. As in a standard heat pump, the refrigerant (in this case, ammonia) is condensed in one coil to release its heat; its pressure is then reduced, and the refrigerant is evaporated to absorb heat. If the system absorbs heat from the interior of your home, it provides cooling; if it releases heat to the interior of your home, it provides heating.

Heat Pump System Configurations

Residential heat pumps are available in a wide array of configurations that offer versatility to accommodate individual preferences, building designs, and spatial constraints. There are multiple indoor/outdoor unit types, sizes, mounting styles, and design options available. In this section, we will explore the definitions of terms used to describe the various configurations of residential heat pump systems.

Location of Heat Pump Components: Split system vs. Packaged system

Split-system Heat Pump

Most heat pumps are split-systems—that is, they have one refrigerant coil inside and one outside. Supply and return ducts connect to the indoor blower fan in ducted, central systems. In ductless heat pumps, air is distributed via one or more indoor units mounted to the wall, ceiling, or floor.

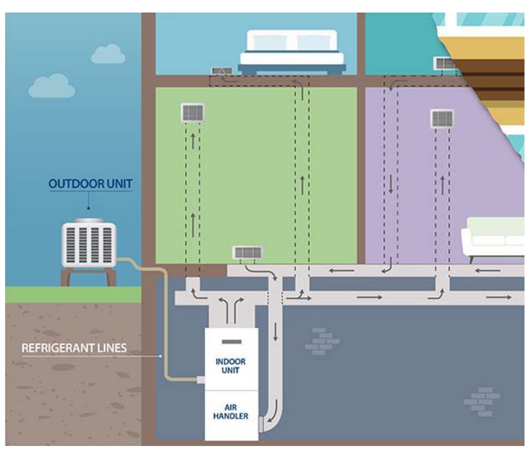
Packaged Heat Pump

Packaged systems usually have both coils and the blower fan located outdoors. Heated or cooled air is delivered to the interior from ductwork that is connected to the packaged heat pump and passes through a wall or roof.

Type of Distribution System: Ducted vs. Ductless vs. Short-run Ducted vs. Hydronic

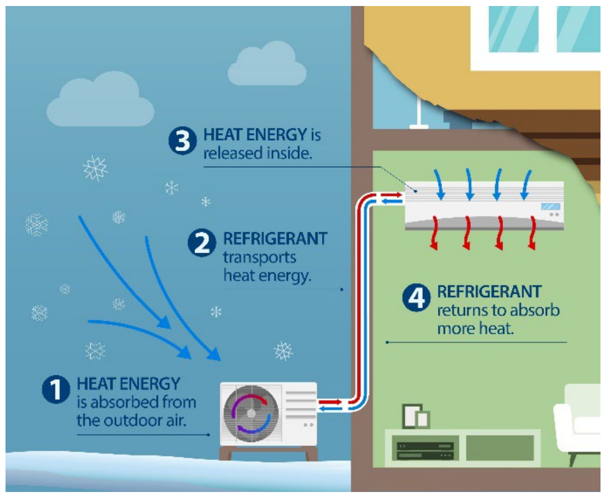
Ducted Systems (also referred to as "Central systems")

Ducted systems, also known as central heat pumps, use a network of ducts to distribute heated or cooled air throughout the home. They can integrate with existing ductwork or be installed with planned ductwork as part of new construction. Several types of heat pumps can have ducted configurations, including air-source heat pumps, geothermal heat pumps, and hybrid heat pumps.



Ductless Systems

Whereas traditional heat pumps and central air conditioning systems force cooled and heated air through ducts, ductless heat pumps deliver air directly into different zones. The term “ductless” refers to a type of distribution system where air is delivered through individual indoor units, or “heads,” that are mounted to the wall, ceiling, or floor of the room that they condition. A head or several heads (see single-zone vs. multi-zone definitions below) can be connected to a single outdoor unit to create zones. Several types of heat pumps can have ductless configurations, including air-source heat pumps and geothermal heat pumps.



Note: Ductless systems are a cost-effective way to replace inefficient window air conditioning units and replace or displace space heaters and electric baseboard heaters. They can be installed in home additions, new construction, condominiums, and apartments, or to improve temperature control in specific rooms. Ductless systems can even be fit for buildings that currently use ducted forced-air systems.

Short-run Ducted Systems (also referred to as Compact-ducted systems”)

Short-run ducted heat pumps have an indoor unit located above the ceiling or below the floor that is connected by short runs of ductwork to one or more registers. One advantage is that the indoor unit is out of sight and the registers are inconspicuous. Because one indoor unit can be ducted to multiple registers, they can also be well suited to heating several small rooms like bathrooms and bedrooms. A common configuration is an indoor unit installed in an insulated attic connected to a grill in a hallway ceiling below. Hallway air is returned to the unit, heated or cooled, then supplied to multiple adjacent rooms via ceiling vents. Alternatively, they can be installed beneath the floor (typically in the basement ceiling below). Super-insulated homes with very small heating demands may be good candidates for a small mini-duct indoor unit with ducts throughout the house.

Hydronic

Hydronic distribution systems for heat pumps use water as a medium to transfer heat to and from a home through a closed-loop system of pipes. For both heating and cooling, the water circulates through various types of indoor emitters, such as radiators, radiant panels, baseboards, or fan coil units. These emitters release heat from the water into the living spaces for warmth or absorb heat from the living spaces into the water for cooling. Radiators and radiant flooring provide radiant space conditioning, while fan coil units use forced air circulation. The hydronic system efficiently moves heat by taking advantage of water's high thermal capacity.

Zoning: Single-zone vs. Multi-zone

Single-zone Heat Pump

A single-zone heat pump is a ductless heat pump that consists of one indoor air-handler unit (or 'head') and one outdoor compressor unit. This type of system is designed to provide air conditioning in one specific area or 'zone' within a space, providing individualized control over temperature settings in that area. Single-zone systems are often used in scenarios where there is only a need for additional heating or cooling in a specific room, or to bring air conditioning to a section of a home that doesn't receive heating and cooling through its original HVAC system, like a garage, a newly finished basement, or a home addition.

Multi-zone Heat Pump (also referred to as "Multi-split heat pump")

A multi-zone heat pump is designed to provide air conditioning to multiple rooms or areas in a space. The system features a single outdoor unit (or sometimes more depending on the size of the home) that connects to multiple indoor units. Unlike single-zone systems, multi-zone systems allow for individualized temperature control in different zones. While the entire system must be in heating or cooling mode, each zone in a multi-zone system can be controlled independently for optimal individual comfort. Multi-zone heat pumps often utilize ductless distribution systems, though some models combine both ductless and ducted distribution.

Heat Pump Components

Heat pump systems are composed of various components that work together to provide heating and cooling. Each component plays a crucial role in the system's functionality and efficiency. In this section, we will explore the definitions of key terms used to describe the components of residential heat pump systems.

Air Handling Unit (AHU)

The air handling unit (AHU) plays a vital role in the heat pump system by conditioning and circulating air within the building or space. Tailored for heat pump operations, the AHU incorporates essential components like a blower or fan for air circulation, air filters to eliminate particulates, and a coil serving as a heat exchanger. During operation, the air handler directs air across the coil, where heat is added or removed, depending on the heating or cooling requirements, ensuring optimal indoor comfort.

Note: For ducted central heat pump systems, the AHU houses the coil, blower, and filters within its casing. The coil inside the AHU allows heat transfer between the refrigerant piped from the outdoor unit and the air being circulated by the blower. The conditioned air is then distributed throughout the building via the duct network.

For ductless heat pump systems, the AHU is an indoor unit, or head, often mounted on the wall, ceiling, or floor. Each individual unit houses a coil, fan, and filter to condition the air in that particular zone or room.

For packaged heat pump systems, the AHU is located outdoors and consolidates all the necessary air handling components like the coil, blower, and filters into a single enclosed casing.

Compressor

A heat pump compressor is a crucial component that circulates refrigerant through the system, enabling the transfer of heat for both heating and cooling. It works by compressing the refrigerant, raising its temperature and pressure, which facilitates heat exchange with the surrounding environment. The type of compressor significantly impacts the heat pump's efficiency and performance. The compressor's efficiency directly affects the overall energy consumption and operating costs of the heat pump system, making it a key factor in system selection and performance optimization. Residential heat pump systems use compressors with various designs (scroll, rotary, or reciprocating) and speed configurations.

- **Single-stage Compressor**

  Single-stage, or single-speed, compressors are the most basic compressors for heat pumps. They have two settings: on or off, meaning they operate at full capacity or not at all. These systems work at full speed to reach the desired temperature and then shut off completely once the indoor temperature is reached. Because of the frequent switch from on to off, and because they can only operate at 100% max speed, heat pumps with single-stage compressors are usually the most expensive to operate.

- **Two-stage Compressor**

  Two-stage, or two-speed, compressors take heat pumps with single-stage systems up a notch and control temperature more accurately. While single-stage systems must operate at either 0 percent or 100 percent capacity, two-stage systems add more variety by offering a high and low setting. In most cases, the low stage operates at around 65 percent capacity, while the high stage operates at 100 percent capacity. Compared to single-stage systems, the two-stage system provides improved efficiency and temperature control.

- **Variable-speed Compressor** (also referred to as "Inverter-driven compressor")

  Variable speed compressors use inverter technology to adjust the compressor's speed continuously to match the exact heating or cooling demand, offering the highest efficiency and most precise temperature control. When the temperature is set on the thermostat, a variable speed system takes into account the indoor and outdoor temperatures, the indoor and outdoor humidity levels, and the run time needed to reach your desired temperature, in order to determine the appropriate output. Variable speed systems can operate anywhere from 25 percent capacity to 100 percent capacity to meet temperature needs. Because they can operate at lower speeds, they consume less power, which makes them the least expensive to operate over time. You will often hear efficient heat pumps with variable-speed compressors referred to as variable-speed heat pumps, variable-capacity heat pumps, or inverter-driven heat pumps. Cold climate heat pumps are a subtype of variable-speed heat pumps.

Coils (also referred to as "Heat exchangers")

The evaporator and condenser coils inside a heat pump make it possible for these systems to complete the heat exchange process, which is the basis of refrigerated cooling and heating. The coils form a loop and, even though they are continuous, each has a different function. The ability of the condenser and evaporator coils to reverse their roles is a fundamental feature of heat pumps, enabling efficient heating and cooling by reversing the direction of the refrigerant flow through a reversing valve.

- **Condenser Coil**

  In a heat pump, the condenser coil's role varies depending on whether the system is in heating or cooling mode. It is responsible for rejecting the heat from the refrigerant to the surrounding environment.

  Cooling Mode: In cooling mode, the outdoor unit's coil serves as the condenser coil. The high-pressure, high-temperature refrigerant gas flows into the condenser coil, where it releases heat to the outdoor air, condensing into a high-pressure liquid.

Heating Mode: In heating mode, the indoor unit’s coil serves as the condenser coil. The high-pressure refrigerant gas releases heat to the indoor air, warming the space, and condenses into a high-pressure liquid in the process.

- **Evaporator Coil**

The Evaporator Coil is responsible for absorbing heat from the air and transferring it to the refrigerant. The evaporator coil’s function changes based on the system's mode of operation.

Cooling Mode: In cooling mode, the indoor unit’s coil serves as the evaporator coil. The low-pressure, low-temperature refrigerant vapor/liquid enters the evaporator coil, where it absorbs heat from the indoor air and evaporates into a low-pressure gas, cooling the indoor space.

Heating Mode: In heating mode, the outdoor unit’s coil serves as the evaporator coil. The low-pressure refrigerant liquid absorbs heat from the outdoor air and evaporates into a low-pressure gas, even in cold temperatures, to provide heating indoors.

Note: In packaged heat pump systems, both the condenser and evaporator coils are housed in the same outdoor unit.

Reversing Valve

The reversing valve is a crucial component in a heat pump system, allowing it to provide both heating and cooling functions by reversing the flow of refrigerant. The reversing valve has four ports that connect to different parts of the system: the compressor, the indoor coil, the outdoor coil, and the expansion valve. When the heat pump is in heating mode, the reversing valve directs the flow of refrigerant through the outdoor coil, absorbing heat from the surrounding air. Refrigerant then flows to the indoor coil where it releases the absorbed heat to the indoor air, providing warmth. In cooling mode, the reversing valve changes the flow of refrigerant through the indoor coil, absorbing heat from the indoor air. Refrigerant then flows to the outdoor coil where it releases the absorbed heat to the outdoor air, providing a cooling effect inside the home or building.

Expansion Valve

The expansion valve drops the refrigerant pressure and expands the refrigerant as it passes from the condenser coil into the evaporator coil. The expansion valve’s control of refrigerant pressure helps the evaporator coil to transfer heat most efficiently over its entire surface area while still guaranteeing the refrigerant fully evaporates before entering the compressor.

Blower Motor

The blower motor is the component of a heat pump that turns the system's fan that circulates the hot or cold air through the air handling unit and into a home. The exact HVAC blower motor location will vary slightly depending on the system type and model. For central heat pumps, it will be located inside the air handler (i.e., the indoor unit). For a ductless system, each indoor unit will have its own blower motor that is typically located behind the air handler casing and between the control panel and the fan blade. The efficiency and performance of a heat pump are heavily influenced by the type of blower motor employed. Single-speed motors operate at a fixed speed, while two-speed motors offer high and low settings for better efficiency and comfort. Variable-speed motors adjust their speed precisely to meet heating or cooling demands, maximizing energy efficiency and comfort. The choice of blower motor impacts energy use, noise levels, and overall comfort in the home.

Refrigerant

Refrigerants are the working fluids used in heat pump systems. They are chemical compounds that change temperature as they transition between liquid and gas form – cooling as they vaporize and heating up as they condense. It is this property that gives heat pumps their ability to heat and cool. Refrigerants are circulated throughout the heat pump system during the refrigeration cycle to effectively transfer heat between the indoor and outdoor environments (see below definition of refrigeration cycle).

Line Set (also referred to as "Refrigerant lines")

A pair of copper tubes that connect a condenser to an evaporator so refrigerant can move between the two. The smaller tube is called a liquid or discharge line and carries the liquid refrigerant to the evaporator. The larger tube is called a suction line, and it moves refrigerant in its gaseous form back to the condenser.

Heat Strips (also referred to as "Electric resistance heating elements or Plenum heaters")

Heat strips, also known as electric resistance heating elements, are commonly integrated into the air handler unit of a heat pump system. Depending on the specific design of the system, they are strategically placed either downstream of the heat pump's refrigerant coil or in parallel with it. In colder climates or during periods of extreme cold, heat pumps may experience reduced efficiency as they struggle to extract heat from the air. To maintain consistent heating performance, heat strips automatically activate to provide additional warmth. This ensures that occupants remain comfortable and the desired temperature is maintained throughout the home or building, regardless of external conditions impacting the heat pump's efficiency.

Note: Heat strip activation can be linked to outdoor air temperature and/or supply air temperature, depending on the controls. Utilizing supply air temperature as the control can help maintain occupant comfort.

Thermostat

A heat pump thermostat is a specialized device that controls the operation of a heat pump system. It regulates indoor temperature by activating the heat pump based on predefined settings, typically triggered by temperature thresholds. Additionally, thermostats may offer programmable scheduling options, allowing users to automate temperature adjustments throughout the day or week. Advanced models, such as smart thermostats, connect to the internet for remote access and may incorporate adaptive learning algorithms to optimize comfort and energy efficiency. Heat pump thermostats can also activate supplementary heating elements when necessary to maintain indoor comfort levels.

Mounting System

The primary goal of a mounting system is to keep the outdoor unit above the snow. There are several options available for mounting outdoor units. Foundation brackets (mounted to the homes foundation) do the best job at minimizing noise and staying out of the way of rakes, shovels, and lawn mowers. Ground stands minimize noise but can be susceptible to frost heaves if installed with inadequate drainage. Wall mounts keep units away from rakes, shovels, and mowers, but can transmit a low hum inside.

System Features and Functions

Heat pumps offer a range of modern features and functions, many of which differ from traditional residential HVAC systems. These capabilities are necessary for efficient heating and cooling, as well as for ensuring comfortable indoor temperatures throughout the year. Familiarity with diverse features and functions is essential for understanding how heat pumps operate in residential settings. In this section, we will explore key terms related to heat pump features and functions.

Auxiliary Heat (also referred to as “Supplemental heat”)

Auxiliary heat is a feature on some heat pump systems that is used when the outside temperature is too cold for the heat pump to efficiently heat the home on its own. Auxiliary heat supplements the heat pump by providing extra heat using a secondary source, such as electric heat strips, to ensure that the desired indoor temperature is reached. When the auxiliary heat setting is activated, the heat pump will continue to pull in as much heat as it can from the outside, but it will also use the secondary heat source to maintain the desired indoor temperature. If the outdoor temperature increases and the heat pump is able to efficiently heat the home on its own, the auxiliary heat setting will automatically turn off.

Note: The terms “auxiliary,” “supplemental,” or “secondary” heat is also often used to refer to a fossil fuel-fired system in hybrid heat pump systems. The distinction lies in how the heat pump system operates: instead of augmenting the heat pump's heat with electric heating elements, it switches off the heat pump entirely and transitions to the fossil fuel system.

Emergency Heat

Emergency heat is a setting on a heat pump system that is used in emergency situations, such as when the heat pump is not functioning properly. This setting is activated manually and bypasses the heat pump, using an alternate heating source, such as a fossil-fuel-fired furnace or electric resistance, to heat the home. The emergency heat setting is meant to be used as a temporary solution when there is not enough time to call a technician for repairs or when the heat pump is not working. It serves as the secondary heat source for the system, allowing the home to continue to be heated while the heat pump is being repaired or replaced.

Defrost Cycle (also referred to as “Defrost mode”)

In heating mode, a heat pump pulls heat from the outside air and transfers it inside to warm it. Under certain ambient temperature and humidity conditions (more common when outdoor temperatures are around freezing and outdoor humidity is relatively high), the moisture in the air freezes on the outdoor unit’s heat exchanger as the fan blows the air across it, and frost can form on the outdoor coil. This layer of frost will ultimately make the heat pump operate inefficiently, so it needs to be removed. During the defrost cycle, the heat pump is operated in reverse (switches to cooling mode). A defrost control tells the reversing valve when to send hot refrigerant outdoors to thaw the outdoor coil, turn the outdoor fan off, and the internal heater on. When the heat pump switches over, the outdoor fan is prevented from turning on and the temperature increase of the coil is accelerated. The time it takes to thaw the outdoor coil will vary, but heat pumps will typically be in defrost cycle until the coil reaches around 58 degrees. Once the unit is free of frost, the internal heater will stop, the valve will reverse, the outdoor fan will turn on, and the unit will resume the heating cycle.

Note: During the defrost cycle of a heat pump, an occupant might hear a noise similar to a tire losing pressure, which is normal for single-stage systems. Additionally, it may appear as though smoke is coming from the unit, but this is actually steam generated during the defrost process. Both of these phenomena are typical and indicate that the defrost cycle is operating correctly.

Dehumidification

Dehumidification is the process of reducing the moisture or humidity levels in the indoor air, typically by condensing water vapor into liquid form and removing it from the air. Similar to air conditioning, one feature of heat pump systems is their ability to provide dehumidification of indoor air by removing moisture while operating in cooling mode. During the cooling mode, warm, humid air from the home is drawn into the system by the indoor fan. Inside the unit, this air passes over the evaporator coil, which is maintained at a colder temperature. The temperature difference between the warm indoor air and the cold evaporator coil causes moisture (water vapor) in the air to condense. This condensed moisture collects on the surface of the evaporator coil and drips down into a drain pan or drainage system.

Note: Some heat pump models include a specialized "dry mode" setting. In dry mode, the unit operates at a lower fan speed, allowing the evaporator coil to stay colder for longer periods. This extended exposure helps the coil remove more moisture from the air without significantly lowering the room temperature. Additionally, variable-speed heat pumps tend to be more proficient at dehumidification than other types of systems.

Grid-connectivity

A grid-connected heat pump has built-in communication capabilities allowing it to receive signals and commands from the utility company over the electrical grid. This two-way communication link allows the utility to remotely control or curtail the heat pump's operation during periods of peak energy demand as part of demand response programs. In exchange for this control, utilities often provide incentives like rebates or lower electricity rates to customers with connected heat pumps enrolled in demand response programs. However, many variable-speed heat pump units are currently incompatible with utility demand response programs.

Zoning

Zoning is a feature of some heat pump systems that allow them to divide a home into different areas, or zones, to provide separate heating and cooling. Instead of having one thermostat or controller for the entire building’s air conditioning, each zone could have its own thermostat or controller to adjust the temperature according to occupant preferences, making it possible to meet different temperature requirements in different zones.

Note: Zoning can be done using both ducted and ductless heat pump systems. In the case of ducted systems it requires dampers, which are movable vents that channel the air that circulates through the ducts by fully or partially opening and closing them. Modern systems have automatic dampers that move according to the comfort required in each zone and are controlled by the thermostat or controller. Ductless heat pump systems can be zoned using multi-split systems. Depending on the system, each interior unit can have its own remote control to adjust temperature to different zones' requirements. There is also the option of having a centralized controller that gives the operator full visibility of a zoned heat pump system's operation.