

What Is HVAC and How Does it Work?

By Teresa Bitler

Feb 2, 2022



HVAC systems warm indoor spaces in the winter and cool them in the summer. In addition to your air conditioner and furnace, HVAC includes combined systems like heat pumps and indoor air-quality equipment like air purifiers. It also encompasses the control systems and smart thermostats that help everything work together.

Read on for an overview of how HVAC systems work. Then, learn about particular brands in our rating of the [Best HVAC Companies of 2022](#), and call a local HVAC contractor. After evaluating your home and needs, an HVAC technician will help you determine the system that is right for you.

What Does HVAC Stand For?

HVAC stands for heating, ventilation, and air conditioning. It refers to the systems that regulate and move heated and cooled air throughout residential and commercial buildings, from homes to offices to indoor stadiums. Although there are many options when it comes to HVAC systems, they all work similarly, taking in fresh air and using a mechanical ventilation system to heat or cool it to a desired temperature.

HVAC units also can control humidity levels and improve air quality through air cleaners that capture bacteria, spores, and virus-sized particles. The HVAC technician who comes to your home for a pre-installation evaluation will help you determine which system and options are best for you and your home.

What Does an HVAC System Do?

At the most basic level, an HVAC system takes in air, cools or heats that air, and blows it into an indoor space, according to the [American Society of Heating, Refrigerating and Air-Conditioning Engineers](#). That space could be a specific room or an entire building or structure, such as a house, office, school, airport, or even a submarine. An individual component of an HVAC system may serve dual purposes. For example, your home could have a separate air conditioner and furnace, or a heat pump for both cooling and heating.

At the most basic level, an HVAC system takes in air, cools or heats that air, and blows it into an indoor space.

In addition to moving air and making it comfortable inside, HVAC systems can improve the air by drawing it through filters that remove dust, particles, spores, bacteria, and viruses, says Rick Bohdel with [Ductz](#). Whole-home humidifiers and dehumidifiers can add or remove humidity to keep the dew point of your home at an ideal level. This can make your home feel cooler without having to run a cooling system.

All of these components link to a conventional or internet-connected (smart) thermostat. Depending on the sophistication of your control system, you may be able to program your HVAC equipment through an app to make small changes that help each component run at its peak. Smart thermostats can also reduce the overall costs of heating and cooling your home because they help maintain the temperature within a designated range.

How Does an HVAC System Work?

HVAC systems are designed to move air, heating or cooling an indoor space in the process. These systems generally have three major elements: a heating unit, cooling unit, and duct to move the air. [Bright Hub Engineering](#) explains that an HVAC system starts with the ventilation that brings fresh air into a building. Natural ventilation takes air from open windows, doors, or cracks and uses pressure differences to force the air through a building. With today's tightly sealed homes and offices, this requires the use of fans, blowers, filters, and ducts.

Air Conditioning Systems

To cool air, the fan in an air conditioning unit from [Frigidaire](#), [Coleman](#), and other HVAC companies draws the air in and forces it over the evaporator's coils. Filled with refrigerant, these coils draw heat from the air, cooling it. Next, the air moves into the air handler, where a blower sends it into the ducts. As the cool air moves through the ducts, any noxious gasses produced during the process are expelled through the flue.

When an air conditioner absorbs heat, the refrigerant vaporizes. To return to its natural state, the refrigerant travels into the compressor, which pressurizes it, and onto the condenser, where it condenses from a vapor back into a liquid. As it does, it expels heat that is blown out by a fan.

Heat Pumps

A heat pump works similarly to a central air conditioner and is based on the same idea that heat is always attracted to cold. To cool the air, heat is absorbed by the refrigerant and expelled out of the building. To produce warm air, a heat pump draws cold outside air over even colder refrigerant. Heat is then drawn

into the refrigerant, which heats the coils. The air is drawn over those heated coils, where it rises to the desired temperature and is blown into the home.

Furnaces

To heat a building using a gas furnace, an HVAC system draws air in through the ducts and forces it into the furnace, according to HVAC dealer [Ingram's Water & Air Equipment](#). When the furnace is running, the combustion chamber heats the heat exchanger to the designed temperature. Air is pushed through the exchanger, heated, and blown by the motor through the ducts and back into the house.

An oil furnace like those sold by [American Standard](#) works similarly. An oil furnace pumps oil from a reserve tank through a filter and into a chamber, where it's converted into a mist and sprayed on a burner. The burner ignites, and the flame heats the heat exchanger. Just as it is with a gas furnace, air is then forced into the exchanger, heated, and blown back into the house. Oil furnaces are rare; [Richmond's Air Heating & Air Conditioning](#) says that only 5% of all HVAC systems use them.

Some gas furnaces from [York](#), [Amana](#), and other companies can be modified to burn liquid propane instead of natural gas or oil. Propane furnaces are a good option for remote areas where other fuel sources might not be as reliable. Additionally, propane furnaces can fit in mechanical closets and other small spaces when square footage is scarce.

Each HVAC system varies depending on the heating and cooling needs of a home, where that home is located, its age, its existing ductwork, its heating and cooling needs, and other factors.

Air purifiers, humidifiers, dehumidifiers, and other indoor air quality products can be added to the air system to enhance the comfort of the home. These elements then deliver optimal thermal comfort through the control of either a conventional or smart thermostat. A Wi-Fi-enabled smart thermostat allows you to make small adjustments throughout the day that enhance energy efficiency.

Types of HVAC Systems

Each HVAC system varies depending on the heating and cooling needs of a home, where that home is located, its age, its existing ductwork, its heating and cooling needs, and other factors. As a result, an HVAC can take any number of forms. Your HVAC technician will help you determine which of the following best meets your needs.

Split System

Also referred to as a forced-air system, a split system has one unit inside the home and one outside. This setup can consist of a furnace and air conditioner, an air handler and heat pump, or a furnace and heat pump. Which configuration is best for your home will depend largely on where you live. For example, the furnace and heat pump setup works best in very cold climates.

Hybrid Heat Pump

In this scenario, the central heating system includes an electric heat pump that works in conjunction with a furnace. In milder times of the year like the spring and fall, the heat pump heats the home. During weather that's too cold for a heat pump to operate effectively, the furnace takes over. This hybrid system,

also known as a dual-fuel system, saves money because it costs less to heat the home with a heat pump than a furnace.

Ductless Mini-Split

A ductless mini-split system has an outdoor unit that contains the compressor and condenser, and an indoor air handler mounted in the room that blows the cooled air directly into the room, according to the [Air Conditioning, Heating & Refrigeration Institute](#). This type of ductless system is usually best for small spaces like garages and workshops that don't require a traditional split system. They aren't suited to whole-house applications. Typically, these systems are easy enough for homeowner to install themselves.

Ducted Mini-Split

A ducted mini-split system uses tubes instead of larger ducts to move air into a room from an outdoor compressor and condenser. This solution is best for homes where there isn't a lot of room for traditional ductwork. Compared to ductless mini-split systems, ducted mini-splits have the advantage of better air circulation.

Packaged System

A packaged system contains the traditional components of a split system. However, all units are housed outside. This solution works best for homes that don't have the space for a heating unit inside the home. Even if you have the space for a split system, you might consider a packaged system because they are quieter (everything is located outside the home) and have lower installation costs (there's only one unit to install).

What Does an HVAC System Include?

A basic HVAC system consists of a heating unit, a cooling unit, and a duct to move the heated or cooled air around. Generally, a furnace serves as the heating unit. Whether the furnace runs on natural gas, electricity, or propane, its efficiency is measured by its Annual Fuel Utilization Efficiency (AFUE) rating, which indicates how much fuel is converted into heat. A furnace with an AFUE rating of 95% converts 95% of the fuel supplied to it into heat. Today, the minimum acceptable AFUE rating is 80%. Particularly high-efficiency models like those from [Carrier](#), [Bryant](#), and [Goodman](#) have ratings of 95% to 98%.

HVAC and air conditioning are often used interchangeably. However, the terms actually refer to two different things.

HVAC systems also have a cooling unit, usually an AC unit. In some areas where it doesn't get cold enough for a furnace, a heat pump that can both cool and heat the air is a cheaper option. Either way, these units' cooling efficiency is measured by their Seasonal Energy Efficiency Ratio (SEER), and the cool air they produce is distributed into the house through the ductwork. For energy efficiency, you want to shop for a unit with a high SEER rating. The highest efficiency units will have SEER ratings of 20 or more, while the minimum rating is 13. To receive the U.S. government's [Energy Star](#) certification, an air conditioner must have a SEER rating of at least 14.

Some systems may also include ventilation systems that direct air out of the house, humidifiers (or dehumidifiers) that adjust the air's humidity, and air purifiers that filter out spores, bacteria, viruses, and other miniscule particles. An HVAC tech can help you determine which of these additional components, if any, make sense for your needs.

All of these are controlled by a conventional or smart thermostat like those sold by [Lennox](#), [Trane](#), and [Rheem](#). When the temperature or other criteria reach a set point, it triggers the necessary components to begin running. Some smart systems can even alert you to when there is a problem that needs attention, remind you to change the filters, and share diagnostics with your HVAC contractor.

How are HVAC and Air Conditioning Different?

HVAC and air conditioning are often used interchangeably. However, the terms actually refer to two different things. Where an HVAC system consists of several components that work together to regulate the temperature and ventilation in a building, air conditioners simply cool that building. Think of it this way: An HVAC system can include a furnace, ductwork, air cleaner, smart thermostat, and air conditioner while a central air conditioner is just an air conditioner. In other words, an air conditioner may fall under the HVAC umbrella, but not all HVAC systems will actually have an air conditioner.

Best HVAC Companies of 2022

Shopping for an HVAC system can be complicated. To help with your search, see our list of top-rated HVAC systems in our [Best HVAC Companies of 2022](#). For more about HVAC systems, see our guide [Central Air Cost & Ways to Save](#).

- [American Standard](#)
- [Amana](#)
- [Bryant](#)
- [Carrier](#)
- [Coleman](#)
- [Frigidaire](#)
- [Goodman](#)
- [Lennox](#)
- [Rheem](#)
- [Trane](#)
- [York](#)

Other Ratings From 360 Reviews

- [Best Refrigerators of 2022](#)
- [Best Dryers of 2022](#)
- [Best Washing Machines of 2022](#)
- [Best Moving Companies of 2022](#)

Why You Can Trust Us: 17 HVAC Companies Researched

At U.S. News & World Report, we rank the Best Hospitals, Best Colleges, and Best Cars to guide readers through some of life's most complicated decisions. Our 360 Reviews team draws on this same unbiased approach to rate the products that you use every day. To build our ratings, we researched more than 17 HVAC companies and analyzed 9 reviews. Our 360 Reviews team does not take samples, gifts, or loans of products or services we review. All sample products provided for review are donated after review. In addition, we maintain a separate business team that has no influence over our [methodology](#) or recommendations.