

# Installing a Minisplit

What you need to know about choosing a minisplit heat pump and ensuring that it's set up correctly

BY PATRICK McCOMBE

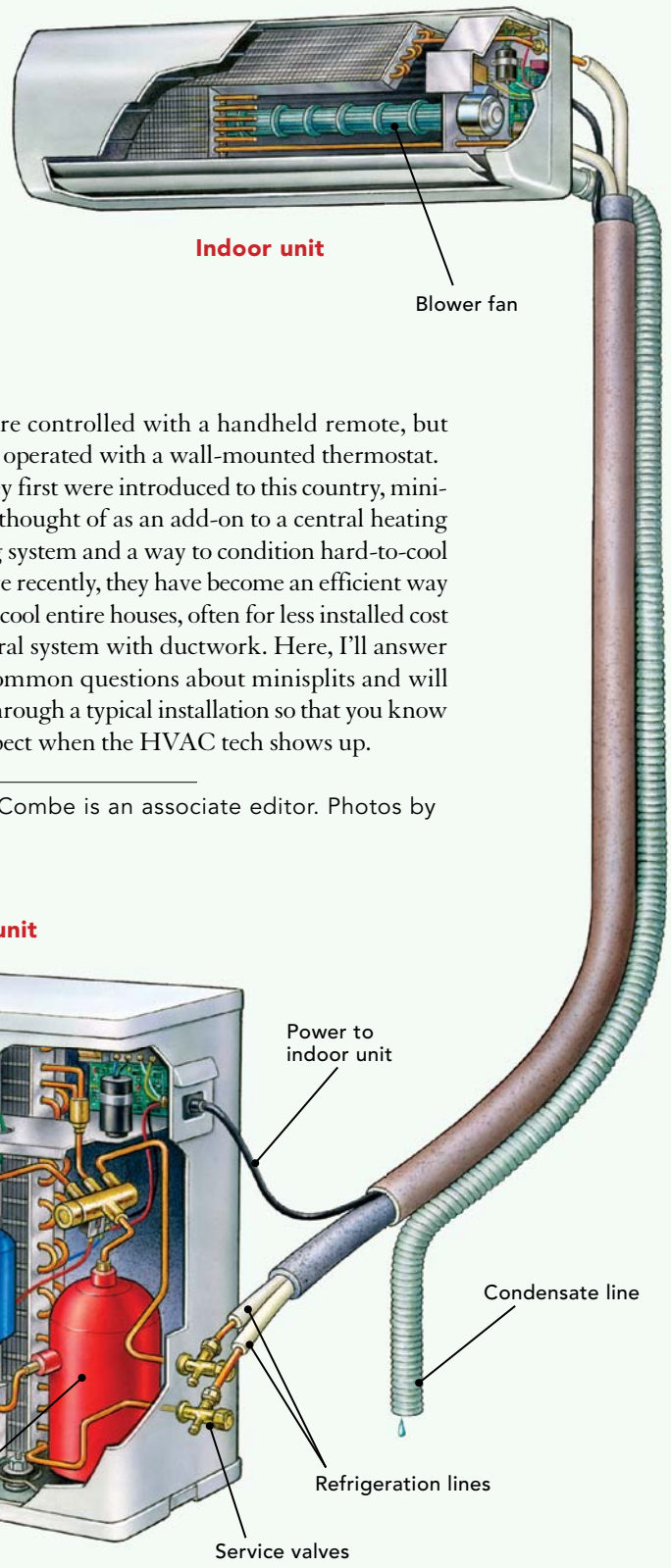
**A**lthough they've been around for a couple of decades and are common in Asia and Europe, minisplit heat pumps only recently have started to get traction in the United States. A minisplit heat pump uses a refrigeration cycle to warm or cool the air inside a building. In cooling mode, it extracts heat from within the building and moves it outside. In heating mode, it works in reverse, extracting heat from the outdoor air (even in very low temperatures) and moving it to the building's interior.

There are exceptions, but minisplits generally don't have ductwork. Instead, a minisplit has an air handler and a refrigeration coil in a self-contained wall-mounted or ceiling-mounted unit. Temperature and fan speed

generally are controlled with a handheld remote, but they can be operated with a wall-mounted thermostat.

When they first were introduced to this country, minisplits were thought of as an add-on to a central heating and cooling system and a way to condition hard-to-cool spaces. More recently, they have become an efficient way to heat and cool entire houses, often for less installed cost than a central system with ductwork. Here, I'll answer the most common questions about minisplits and will walk you through a typical installation so that you know what to expect when the HVAC tech shows up.

Patrick McCombe is an associate editor. Photos by the author.



A minisplit is a split refrigeration system, with an indoor air handler and an outdoor unit that houses the compressor. These systems are mini because they are much smaller than typical central air conditioners or heat pumps (9,000 to 15,000 Btu for a single minisplit vs. 30,000 to 60,000 Btu for a central air conditioner or heat pump).

## INSTALLATION STARTS WITH THE INDOOR UNIT

The indoor unit hangs from a metal bracket that's attached to wall framing with screws. The unit's refrigeration and condensate lines run through a 3-in.-dia. hole adjacent to the bracket. The bracket must be hung level for aesthetics and so that the condensate drains properly.

### Extras add to the cost.

Beyond what's supplied by the manufacturer, the installer needs enough refrigeration line and 14-ga. four-conductor cable for connecting the indoor units to the outdoor unit. Every indoor unit also needs enough condensate tubing to reach outside or to an interior drain. Every outdoor unit needs a wall bracket or pad for mounting.



**Made for easy mounting.** Using the instructions to determine the right location, the installer drills a 3-in. hole for running the refrigeration lines, electrical cable, and condensate tubing to the outside. The bracket is then leveled and mounted the specified distance from the hole. The bracket should be attached to two studs.



**Connections require access.** The indoor unit's short lengths of refrigeration tubing and condensate line must be extended to reach the outdoor unit. If the unit is on an outside wall, the extended lines are run on the outside of the building. If the unit is on an interior wall, either the lines need to be roughed in before the drywall is hung, or a hole needs to be cut to extend them.



## Q&A

**Is a minisplit less expensive than a furnace or a boiler?**

**Maybe.** The smallest 9000-Btu system can be found for under \$1000. Installation runs several hundred dollars more. A whole-house turnkey system with normal installation conditions costs anywhere from \$2000 to \$10,000 and depends on the number of indoor and outdoor units, the complexity of the installation, and local labor rates.

**Is installation complicated?**

**No.** Retrofit installations take about a day. The installer drills a 3-in. hole through the wall near the indoor unit for the two refrigeration lines, the condensate line, and the electrical cable. After mounting and connecting the indoor and outdoor units, the installer clears the refrigeration lines of air, tests for leaks, and charges the lines with refrigerant.

**Can I install a minisplit myself?**

**No.** At a minimum, clearing the refrigeration lines of air and water vapor requires a vacuum pump (\$200) and a refrigeration manifold gauge set (\$150). Depending on the distance between the indoor and the outdoor units, you also may need to add refrigerant, which requires a precision scale to measure accurately. Finally, to buy and handle the refrigerant, you need training and EPA certification.

**Can a minisplit heat and cool my entire house?**

**Yes.** Multiple minisplits can heat and cool a home of any size in all but the country's very coldest regions. Comfort with a single unit assumes a small, superefficient home with a compact footprint. Some homeowners with a single minisplit have complained that the upstairs sometimes

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## CABLES AND TUBING ARE ROUTED OUTSIDE

The indoor unit is connected to the outdoor unit with a pair of refrigeration lines and an electrical cable. The lines and the cable can be hidden within walls or inside a plastic covering called line-set ducting. The lines also can be left exposed on the building's exterior.



**Line sets should take a direct path.** Pairs of insulated soft copper tubing make up the refrigeration line set. In this installation, the line set, four-conductor cable, and condensate tubing run from the indoor unit toward the outdoors through an attic crawlspace. The bundle of tubes and wire requires a 3-in. hole that will be sealed later with duct-sealing compound for weathertightness.

**Reflare the fittings.** The copper refrigeration lines have flare connections. The line sets come preflared and with their own flare nuts, but manufacturers recommend removing these nuts and reflaring to accommodate the flare nuts that come with the indoor and outdoor units.



**Condensate line runs downhill.** Condensation produced during cooling mode is drained to the outside or to an interior drain through a  $\frac{3}{8}$ -in. flexible hose. The hose should slope a minimum of  $\frac{1}{4}$  in. per ft. for its entire length. When there's no way to drain the water via gravity, a condensate pump within the indoor unit or mounted externally can pump the condensate outside or to a drain.

**Power comes from the outdoor unit.** The indoor unit is powered by the outdoor unit through a 14-ga. four-conductor cable. The stranded cable is as flexible as an extension cord, so it's easy to run it and to make the connections. Some versions have reinforced UV-stabilized jackets, so they can be left exposed without a protective conduit.

## MOUNTING THE OUTDOOR UNIT

The outdoor unit, which houses the compressor and the control circuitry, requires 220v AC power for operation. By code, the power supply must include a “service disconnect” with a 110v receptacle so that HVAC technicians can power their service equipment or turn off the power during repairs.

**Secure the outdoor unit.** The outdoor unit either is screwed to a small concrete or plastic slab on the ground, or is attached to wall-mounted brackets. In both cases, the outdoor unit should be installed above the anticipated snow level. If it gets buried in snow, the unit will freeze up and stop operating.



**Plan for noise.** A minisplit’s outdoor unit is surprisingly quiet, but it should be located so that it’s far from bedroom walls, bedroom windows, and outdoor living spaces. The wall brackets shown have rubber mounts for reducing vibration and noise that can travel through the house’s framing.



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gets too hot in the summer. For more even temperature distribution, it’s best to have one unit upstairs and one unit downstairs. In this scenario, the upstairs minisplit does most of the cooling, and the downstairs unit does most of the heating.

### **Are minisplits one size fits all?**

**No.** The unit size depends on the size of the space you’re planning to heat and cool, the space’s insulation and airtightness levels, and your climate. Code requires the HVAC technician to perform a Manual J to account for all of these factors.

### **Are minisplits reliable?**

**Yes.** Unlike a conventional central heating and cooling system, which is comprised of dozens or even hundreds of parts from multiple manufacturers that are then assembled on-site, a minisplit has matched components that require very little on-site assembly. Also, there’s no fine-tuning of the components (a process known as commissioning) as there is with a conventional central air-conditioning or heating system.

### **Will a minisplit work on the coldest days?**

**Maybe.** Conventional heat pumps typically employ backup electric-resistance heating around 40°F to make up for the lack of available heat in the outdoor air. A cold-climate minisplit model such as the Mitsubishi HyperHeat can deliver 100% of its rated output down to 5°F. At -4°F, the heating capacity drops to 82% of the rated heating capacity. At -13°F, the heating capacity drops to 62%.

### **Will a minisplit improve the comfort of my home?**

**Maybe.** Minisplits are great for heating and cooling spaces that are

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tough to make comfortable, such as bonus rooms over garages. They offer more-even heating and cooling because of their variable-speed compressors and multispeed blowers. But they're unlikely to solve comfort complaints related to drafts and air leakage, and they won't reliably heat or cool spaces far from where they are located.

### **Do I have to remove my existing heating system?**

**No.** In fact, it's generally a good idea to preserve your existing system as a backup for especially hot or cold spells or if something goes wrong with the minisplit. If you are replacing a failed conventional system that has ductwork, it makes sense to remove or seal off any ductwork running through unconditioned attics or crawlspaces. After you've done that, plug any holes that connect conditioned and unconditioned spaces.

### **Will a minisplit save me money?**

**Maybe.** Minisplits can certainly heat more affordably than electric-resistance heaters. At an outdoor temperature of 30°F, a minisplit provides three times the amount of heat as an electric-resistance system for the same amount of money. Also, if you're cooling your entire house with conventional central air, multiple minisplits likely will be cheaper to run because of their more-efficient variable-speed compressors and more-nuanced zone control. The payback in energy savings for a whole-house system, however, could take so long that it's not worth making the switch until you need a system replaced.



## CONNECTING THE OUTDOOR UNIT

The copper refrigeration lines are attached to the service valves on the outdoor unit with flare connections that are the same size as those found on the indoor unit. The 220v AC power and the cable that powers the indoor unit also must be connected.



**Outdoor connections look like indoor connections.** The copper refrigeration lines running from the indoor unit are connected to the outdoor unit with flare fittings. As before, the flare nuts installed on the line set are removed and replaced with the nuts provided by the minisplit manufacturer.



**Checking for leaks.** After the copper lines are connected, they're pressurized to about 300 psi with nitrogen to test for leaks. A manifold gauge should show steady pressure. The fittings are then coated with a refrigeration-specific soap solution. Any bubbles around the fitting indicate a leak.



### **Power requirements are reasonable.**

Powered by a 20A or 30A circuit, depending on its Btu output, the outdoor unit gets its energy from the disconnect switch through conductors run within a flexible, watertight conduit called a whip.



### **Evacuating the line set to prevent problems.**

Before the service valves are opened and the 410a refrigerant in the outdoor unit is released, the refrigeration lines must be evacuated of air and water vapor with a vacuum pump.