


 KNOW-HOW



The New Downsizing

Mini-split technology is changing the way we heat and cool our homes. **By Mary Ellen Polson**

 Anyone who has lived with all-electric heat in a cold climate—and seen winter energy bills skyrocket—may be reluctant to consider an electric-powered mini-split system. That would be a shame, because this new generation of heating and cooling technology is more comfortable than ever, and can be less expensive to operate than HVAC systems burning fuel oil or natural gas.

While mini-split systems are a go-to energy choice for much new construction, they also can be adapted to existing homes, whether or not the house already has ductwork. And unlike earlier generations of heat pumps (common in climates dependent more on air conditioning than

heat), the new mini-split systems have working components rated for different climate ranges, even frigid ones. Bosch Thermotechnology, for example, offers a low-temperature series with an outdoor compressor rated for temperatures down to -22° F.

how it works To heat and cool the house, a mini-split system uses piped refrigerant delivered to compact indoor units. The refrigerant absorbs built-up heat indoors and transfers it to an outdoor unit, where the heat is expelled.

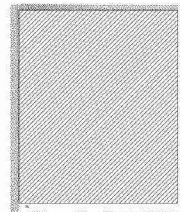
In cold weather, the process reverses at the touch of a button, switching the direction of the refrigerant so that it absorbs

heat from the outside and transfers it indoors to warm the house.

Unlike conventional units, however, mini-split systems are equipped with inverters that enable the compressor to quickly adjust the amount of power used, along with the amount of refrigerant transferred to and from the indoor units.

This means the compressor generates only what's needed to maintain a desired temperature, be it 60 degrees in a laundry room or 72 degrees in a living room. That's a significant difference from systems that run at full power until a set temperature is reached, then stop, only to turn on again as the temperature becomes uncomfortable.

COURTESY MITSUBISHI ELECTRIC (ABOVE & OPF)



AIR ON DELIVERY

Mini-split systems can be designed to cool a single room or an entire house, using a variety of discreet delivery components.



← **WALL-MOUNTED** Best for cooling/heating a single room, a ductless wall unit such as the **Climate 5000 from Bosch Thermotechnology** is quiet (as low as 20 dB) and easy to install. They are most efficient when located on the inside of an exterior wall, near an outdoor compressor.



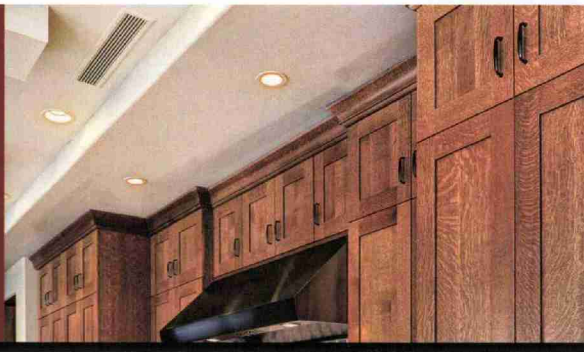
← **CEILING CASSETTE** Usually measuring about 23" x 23" inches—roughly the size of a tin ceiling plate—ceiling cassettes direct air in a circular motion. Some, like this **Rheem Classic cassette**, come with multiple fan speeds. While some units are louder than wall-mounted ones (up to 36 decibels), others operate as low as 23 dB. Most require 10" of clearance in a ceiling or soffit for installation.



← **CONCEALED DUCT** If there is existing ductwork (or space to design a ducted system), your home may be a candidate for a concealed system such as **Fujitsu's Slim Duct mini split**. Conditioned air is delivered through grille-covered ducts similar to those of forced-air systems, and the network can be set up for separate climate zones.

LEFT Compact cassettes that deliver warmed or cooled air in all four directions sit almost flush into the ceiling, where they're less visible than wall-mounted mini splits.

RIGHT A concealed mini-split duct looks no different from a forced-air vent, once installed. The trick is fitting the compact unit in voids in walls and ceilings.



the essentials

Mini-split systems are powered by a compressor, also known as a heat pump. Ducted systems require an air handler, similar to a furnace but about one-third smaller. The entire system can be controlled with a handheld device such as a smartphone, or by a wireless controller.

1. WIRELESS CONTROLLER Just introduced, the **Kumo Touch from Mitsubishi** is a wall-mounted, wireless remote controller with touchscreen controls.

2. DUCTED AIR HANDLER Calibrated for different climatic conditions, units such as **Mitsubishi's SVZ unit** make excellent replacements for aging forced-air furnaces when combined with other mini-split components. Some are capable of delivering heat in temperatures up to minus-20 degrees.

3. INVERTER-DRIVEN COMPRESSOR The compressor is the driver of any mini-split system, delivering heating and cooling to a single unit or an entire house. An inverter-driven compressor like the **Halcyon Flex from Fujitsu** automatically adjusts to maintain desired temperatures, eliminating the wasteful cycle of starting and stopping common to conventional heat pumps.



resources

- **Barn Light Electric** barnlightelectric.com *Belt-driven ceiling fans*
- **Big Ass Fans** bigassfans.com *Residential & industrial fans, evaporative coolers*
- **Bosch Thermotechnology** bosch-thermotechnology.us *Inverter mini-split systems*
- **Fujitsu General** fujitsugeneral.com *Mini-split heating/air conditioning*
- **Hi-Velocity Systems** hi-velocity.com *Small-duct, high-velocity HVAC*
- **Mitsubishi Electric** mitsubishi.comfort.com *Inverter-based mini-split heating & cooling*
- **Rheem** rheem.com *Mini-split heating/air conditioning*
- **SpacePak** spacepak.com *Original small-duct central HVAC*
- **Unico System** unicosystem.com *Small-duct air conditioning*
- **Woolen Mill Fan Co.** architecturalfans.com *Belt-driven, direct-drive & pulley ceiling fans*

ABOVE The belt-and-pulley Emu from Woolen Mill Fan Co. fits well in rooms with ceilings 9' or higher. All of the iron and bronze parts are sand casted, as they were in the 1880s.
TOP The Brewmaster short neck belt-and-pulley fan is a replica of an 1880s design.



Comeback of a Fan

Looking for an old-tech solution to cooling the house? Consider a belt-driven or direct-drive pulley fan. At least one company has been making close replicas of the two- or four-bladed cast-iron beauties once common in high-ceilinged emporiums, factories, and homes for more two decades, and others are picking up the trend.

Both types are usually based on period belt-and-pulley fans by companies such as Snediker & Carr, with ornate detailing on the suspension rod and floral or serpentine patterns on the motor housing and blade mounts. The difference is one of scale and motor placement. While the motor on a belt-and-pulley system can serve two or more long-bladed fans linked across a large span, a direct-drive motor serves a single fan. (The more fans in the set-up, the more powerful the motor should be.) Woolen Mill's fan motor mounts are always wall mounted, with the pulley at the same level as the pulley on the first fan. With direct-drive fans, the motor is concealed in a void in the ceiling directly over the fan.

Both fan types are ideal for moving high volumes of air, so they're best suited for rooms with ceilings that are 9' high, or higher. That said, Woolen Mill Fan Co. offers several models—the large and small Kiwis, and the Martin—that work in rooms with ceilings of a mere 8' height.

Use of an inverter eliminates the noisy, wasteful stop-and-start cycle—and therefore the accompanying cold spots and drafts—of typical forced-air heating and cooling. Like a beating heart, the system is always active, making subtle adjustments as temperatures rise and fall indoors. A mini-split system is “greener” and more sustainable than conventional heating units, and studies show that **Mitsubishi's** inverter-based system, for one, can reduce energy consumption by up to 40 percent.

Mini-split systems typically offer higher SEER (Seasonal Energy Efficiency Ratio) ratings than conventional systems, too. The Department of Energy requires minimum SEER ratings of 13 to 14 for new HVAC systems, depending on region. Mini splits typically start at 16 and range up to 27. Consider, too, that a 10-year-old forced-air system—even a good one—typically has a SEER rating of only 8 or 9. Eliminating a fuel-burning furnace cuts down on greenhouse gases, too.

retrofits So how does a retrofit in an existing house work? Mini splits are built on ductless and ducted products that include wall-, ceiling-, and floor-mounted units. Some require only a 3" opening in the wall; Mitsubishi's EZ FIT recessed ceiling cassette mounts easily between joists spaced a standard 16" apart.

If there is existing ductwork, an aging furnace can be replaced with a ducted air handler that's about one-third smaller than a conventional forced-air furnace. For maximum efficiency—though at greater upfront cost—the old ducts can be replaced with copper tubing. Energy savings can reach up to 24 percent of heating and cooling bills, all without the need to directly burn fossil fuels. As a bonus, mini-split air handlers are smaller and less noisy than other furnaces. A further financial incentive comes in the form of state and federal tax rebates, which range from a few hundred dollars to \$5,000 or more.