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On the Spot

A mini-split ductless heat pump provides spot heating and cooling for a Pennsylvania home

BY JOHN VASTYAN

▲ **Installed unobtrusively on the wall of the Thomases' media room, the ductless mini-split system provides allergen-free heating and cooling.**

The Thomas family of Lancaster, Pa., recently had a comfort conundrum. The family's residence sits on a large, nicely landscaped rural lot near farm fields and horse meadows. When the Thomases built the home six years ago, they decided that a bonus room over the three-bay garage would be used only for storage. But eventually they changed their minds and decided to use the space as a media room. However, they were uncertain of how to heat and cool the space.

When in doubt, call in the experts. The Thomases contacted Dave Yates, a master plumber, president of F.W. Behler Inc. and contributor to *Smart HomeOwner*, and asked for his opinion. After evaluating the space and calculating the costs of making changes to the home's existing comfort system, Yates suggested a different approach: Install a separate mini-split ductless heat pump system.

Spot Heating and Cooling

The Thomases' two-story, 3,000-square-foot home has two central HVAC systems — one for the first floor and a separate one for the upper floor. Yates determined that the new media room — because of its size, location over a non-conditioned garage and exposure to western wind and sun — was a larger load than the existing equipment could handle without major changes, including the installation of a zoned damper system and the routing of new ductwork through restrictive attic spaces.

An easier and no more expensive approach, Yates suggested, would be to install a new, separate ductless mini-split heating and cooling system. "Financially, the options were almost a coin-toss apart," says Yates. "But there were many unique advantages to the use of a new mini-split."

For instance, with a ductless mini-split system there would be no need for ceiling registers, which could cause cold drafts in winter and the likelihood, in summer, of ducted hot air blasts following an off cycle. Another consideration: Altering the ducts could affect airflow

What Is a Ductless Mini-Split?

As the name suggests, a ductless mini-split is a small air conditioner or heat pump that uses no ductwork. It's different than a "window rattler" air conditioner because it needs no window, and it is much quieter and more efficient to operate.

The system is divided, or "split," into two components: an indoor air handler (or evaporator) and an outdoor condensing unit. Small-diameter copper tubing that carries refrigerant connects the two components. Typically, a remote control is used to operate the unit.

Room conditioning is carefully controlled and allergen-free. Many systems have built-in filters to further clean the air. In addition, an economy, high-dehumidification setting improves comfort.

Multi-zone systems with a single, variable-speed outdoor condensing unit can accommodate multiple indoor units, which can be mounted on the wall, floor or ceiling. Each indoor unit can be turned on or off at will, and each indoor unit's thermostat can be set at any level.

Mini-splits come in sizes as low as 9,000 BTUs and up to 42,000 BTUs. That's a lot of comfort in a small package.

▶ **A ductless mini-split system consists of two components. First, installer Dave Yates sets up and connects the outdoor condensing unit, which contains a compressor. The 12,000-BTU system will heat and cool a 12-by-30-foot media room at efficiency ratings that are almost off the chart.**

throughout the house and possibly throw the system out of balance. Also, there would be no need to poke holes in the home's R-45 attic insulation (typical attic ductwork insulation values are R-8), which could result in energy loss.

In the parlance of pros in the HVAC industry, ductless technology is typically applied for "spot" cooling and heating — in other words, conditioning interior spaces right where you want it, and *only* where you want it. Other, lesser-used areas of the home aren't cooled or heated unnecessarily, which saves energy.

Mini-splits are ideally suited for home improvement projects, whether an existing central air system is installed in the home or not. This approach can be less expensive and less disruptive than retrofitting an existing HVAC system. However, mini-splits are not commonly used for new construction because today's central air systems are, for the most part, effective and invisible.

Punch the Gas or Feather It?

Sleek new mini-splits with variable speed, or "inverter," technology have been in use for several decades in European countries but are just now catching on in the U.S. as energy costs rise, and as homeowners begin to realize that it's simply not necessary to condition every room in a home to the same temperature all the time.

"Old-school on/off technology for any type of HVAC equipment is rapidly losing its appeal here," says Yates, who notes that many older HVAC systems run at one speed only — full tilt. "With this old-style technology, it's like driving your car with the gas pedal glued to the floor and controlling it purely by turning the ignition key on or off."

A new approach — and one that made sense to the Thomas family — is to use equipment that continuously modulates (increases or

reduces) its energy production to match heat loss and gain. Sticking with Yates' car analogy, it's like feathering the gas pedal in your automobile to meet the speed you need. Toss in new "automatic modulation," and you get ultra-high-efficiency operation, complete with the chauffer to drive the car.

Before the Thomases agreed to have the system installed, Yates offered some details about the advantages of mini-splits, including the 1-ton (12,000-BTU) Fujitsu split system he proposed for the Thomas home.

- Installation would be simple, with an affordable installation cost.
- No ductwork would be required.
- The system would be easy to program and control using a wireless remote controller.
- Mini-splits are great at removing airborne humidity. The Thomases' new unit, for example, would offer a dry mode setting for dehumidification without altering room temperatures by more than one degree and operation with ambient (outdoor) temperatures as low as zero degrees Fahrenheit.
- The systems offer superb air filtration and — because they're ductless — there's no downstream concern about contaminated ducts.
- It would be a very energy efficient option.

The Thomases were satisfied with Yates' explanation and agreed to have him install the system. So on a muggy day last summer, Yates, his son Mike, and ace technician Bob Sieger went to work on the install. Three hours later, the job was complete and the system was operational.

◄ **Copper tubing will carry refrigerant between the outdoor unit and the indoor air handler, which is seen being installed here. The entire installation took about three hours. The system is ideal for the homeowners, who will use the media room only a few days a week, and only for three or four hours at a time.**

Stealth Conditioning

"The room was noticeably cooler within minutes, and water was streaming steadily through the outside condensate line," Yates says. "But when the homeowners checked on us toward the end of the job, they couldn't believe the system was running. Both the indoor fan coil and outside condensing unit operate so quietly that

you have to strain to hear them."

In fact, one member of the Thomas family had to get on his hands and knees to see the fan blade turning and feel the gentle movement of hot air from the condenser's coil as heat was transferred from the indoor air handler. He was amazed at the unit's stealthy operation, and was equally impressed by the quietness of the system inside.

Mini-split air conditioning is accomplished not by moving cooled, dehumidified air through a network of ducts, but by circulating a small amount of refrigerant through thin, insulated copper tubes that run from the outdoor unit to the air handler inside (see sidebar). As the refrigerant moves through coils in the indoor unit, a variable-speed fan moves air across the coils, cooling and dehumidifying the room. Condensate from the coils is drained away through a plastic line tethered to one of the refrigerant lines.

The Fujitsu heat pump unit Yates installed for the Thomases has an HSPF (Heating Seasonal Performance Factor) of 10.55 in the heating mode, and a 21 SEER (Seasonal Energy Efficiency Rating) rating for cooling. "Those ratings are almost off the charts for air-sourced heating and cooling equipment," says Yates, noting that today, central heat pump systems typically have HSPFs of 5 or 6, and SEER ratings of 13 to 18. Each rise of 1 SEER represents roughly a 10-percent improvement in energy consumption.

"While the newly established U.S. [air conditioner] standard dictates a minimum of 13 SEER, those manufacturers that chose to develop inverter technology managed to leave that efficiency rating in the dust," Yates adds. What's more, he notes, the unit offers energy efficiency that's equal to or higher than that of many geothermal systems.

Another facet of this advanced equipment is that all key components run at variable speeds, enhancing efficiency and extending the life of the unit — and all at a reasonable cost. The homeowners' price for the equipment ran about $1,800 for the 12,000 BTU heat pump; larger units cost more, but not dramatically so. Additional materials, including the 1/4-inch and 3/8-inch copper line sets, insulation for the tubing, the plastic condensate line and 3-phase electric wire, cost another $250 to $400.

Total for the homeowner, installed, might be in the $2,200 to $4,500 range, depending on the size of the unit. Installed cost depends chiefly on the ease of running the refrigerant lines and condensate drain from the indoor air handler to the condensing unit outside, and the level of difficulty in completing the wiring from the home's main breaker panel to the outdoor unit.

Ultimately, the homeowner is rewarded with a whisper-quiet comfort system that gingerly sips electrical current, is better for the environment and installs quickly. Professionals like it for the same reasons. That's truly a win-win home improvement project.

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▲ Ductless mini-split systems are easy to install, since there's no ductwork involved, and easy to maintain. And they operate so quietly you'll barely know they're running.