

Make mine a mini!

Ductless air systems deliver, don't leak

A key obstacle in the design of any comfortable and efficient home is how to cost-effectively heat and cool the interior.

Traditionally, we solve this problem by installing a centrally located heating and cooling air handler system, which delivers conditioned air via ductwork and large blower fans to each room. As residential building science has evolved and provided tools to measure and accurately predict heating- and cooling-efficiency losses, we see this traditional system can cause as many problems as it solves.

The problems

Ducted delivery systems are installed either at the ceiling or under the floor. Installing ductwork under a slab requires additional engineering and, if not done correctly, can lead to cracking of the slab. Ductwork under the slab can also be impacted by ground moisture and can become a source of mold contamination.

Ductwork at the ceiling is usually routed within the attic space. The typical attic is a harsh environment. Temperatures in the summer linger above 130 degrees and drop well below freezing on winter nights. The attic is also full of other things, such as trusses to hold up the roof. Ductwork is twisted and kinked in spaghetti-like fashion through the trusses to reach registers at all room areas. Fiberglass insulation, dust (and dust mites), rodents and various other contaminants often share the attic with the ductwork.

Conventional flexible, hardboard and sheet metal ductwork is difficult to install as an airtight or sealed system. This is a key reason duct-leakage testing has become so important in the residential energy-efficiency field. According to industry statistics, the average new home built to code leaks 20 to 30 percent of its heated or cooled air to the exterior. Older homes tend to be even worse with 25 to 50 percent of the total flow leaking to the outside.

Conditioned air that is not leaked is directed through ducts in the attic (with minimal insulation value) where energy is lost by conduction to the worse-than-ambient temperatures. Since most ductwork is not airtight, contaminants from the attic space are transported to the air we breathe in the home.

The mini solution

One heating and cooling system resolves these energy losses and air quality issues. High efficiency, ductless split-system heat pumps, are also known as "mini splits." Mini split heat pump systems combine small, quiet, cassette air handlers at each large interior room with shared, exterior mounted, smaller footprint, condenser coils.

Mini split technology is novel in our area, but this type of system was first developed in the mid-1960s. Refrigerated air conditioning was introduced in Japan during U.S. reconstruction efforts after World War II.

The first conventional split and window mounted air conditioning units installed were very expensive to operate (postwar utilities ran as much as five times higher in Japan than in the U.S.). Cooling units tended to be a nuisance due to the limited space available for residences and the high noise level of the equipment. These issues, combined with generally high population density, led to the development of the ductless mini split systems.

Even though now widely used in Europe and in Pacific Rim countries, mini split heat pump air conditioning and heating units have most often been installed locally as solutions to comfort problems in isolated living or work spaces. Improved pricing, ever-increasing efficiency ratings (as high as 26 Seasonal Energy Efficiency Rating for some new Fujitsu equipment), industry installer acceptance and a wide variety of off the shelf configurations make mini splits a great option for whole house air conditioning and heating in retro-fit or new home applications.

I recently walked a Build Green New Mexico program home under construction by DAWCO Builders in Anthony, N.M. This home will utilize Sanyo mini split ceiling-mounted indoor air handler cassettes and outdoor heat pump condenser units for all of the air conditioning and heating.

There is zero ductwork in the home and very limited air loss or exchange to the attic space from rooms in the home. Walter Lujan, owner of DAWCO builders in El Paso, is installing four air handler ceiling mounted cassettes and two exterior compressors in this 2,600-square-foot home.

Conditioned air is moved to smaller rooms, such as bathrooms and utility areas, using low wattage fans. After taking advantage of

available tax credits and deducting the cost of duct and sheet metal fabrication and installation, overall equipment and installation costs are less than a comparable capacity standard efficiency system. Walter explained that even though this style of heat pump system installation carries a very respectable 17 SEER cooling efficiency rating, the true efficacy comes from a different design aspect.

A traditional ducted system has one or two large air handlers to move warm or cool air to the rooms in the home. It is all or nothing. When the thermostat is activated, conditioned air is supplied to every room in the house, regardless of the temperature in areas remote from the thermostat. Mini splits have room-by-room controls.

When the afternoon sun is baking the bedroom on the west side of the house and the kitchen on the east side is cool in the shade, cooling capacity is concentrated where the heat load is located in the home. A conventional system may be rated at 5 tons (60,000 BTU cooling capacity), and the full capacity, including the all the required electricity to support that capacity, kicks on to cool the home. Since the workload is divided for a mini split system, the condenser coil can supply fractional capacity to satisfy air conditioning demand to only the areas that require it. The result is lower overall tonnage or capacity needed and much less electricity used.

Higher-end mini split units have sensors to find hot or cold spots within individual rooms and then automatically concentrate air flow to those areas via motorized dampers.

Mini split heating and cooling systems are technologically advanced systems that deliver cost-effective proven comfort, indoor air quality and energy efficiency in existing or new home applications. Most mini splits also qualify for Federal Energy Efficiency tax credits and our local El Paso Electric EPE Savers rebate program.

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Miles Dyson

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