

BY GEOFF FERRELL

## Ventilation That Works

**I'm the chief technology officer** for Mandalay Homes in Prescott, Ariz. We're a production home builder focusing on high-performance homes. One of the things that sets our homes apart is the airtight construction; we routinely achieve blower-door test results of around 0.6 ACH50 by sealing every house with AeroBarrier, the aerosol acrylic air-sealing system.

In a house that tight, we naturally need to provide mechanical ventilation. In fact, you don't need to build that tight before you'll need to ventilate the home. Ask any expert on healthy homes or ventilation, and they'll tell you that every house should have mechanical ventilation, whether that means a supply-only system, an exhaust-only system, or a balanced system like the setup we install in our homes.

Experts will also tell you that a house with three air changes per hour or less is a tight house. And in tight houses, balanced ventilation is the best choice. You can't count on natural air leakage to provide the fresh air you need. In the first place, it won't be enough fresh air; but beyond that, you need to control the source of the air that you're bringing in and filter the air. If you don't, the incoming air could bring in dust, smoke, and pollutants.

Mandalay Homes has been a fan of balanced ventilation for six years now. We accomplish our goals by installing an energy recovery ventilator (ERV). We use an ERV instead of a heat recovery ventilator (HRV) because ERVs exchange moisture as well as heat between the incoming and outgoing airstreams. In Arizona, we actually have a problem with the air being too dry. So an ERV helps us recover some of the humidity from the outgoing airstream to keep conditions inside the home comfortable for the homeowners.

In years past, we used to install single-stage heat pumps in our houses. If the system came on, it was blowing on the order of 800 cfm, or whatever the cfm rating was for that fan. It was either on or off. In those days, we didn't integrate the ERV with the heating and air conditioning system. The reason has to do with the way we run the ERVs: We like to keep the system operating 24/7, with the fan on a low speed. We figured that if we dumped 50 cfm of air into the cooling system's return when there wasn't a call for heating or cooling, it would tend to stay in the ductwork rather than being distributed equally around the house. Instead, we used a dedicated ERV with its own ductwork. We would distribute the incoming fresh air to the four corners of the house and then draw it back to a centrally located return.

Now, however, we've upgraded our heating and cooling systems to multi-stage equipment. Our current heat pump of choice is a Trane XR17 dual-stage unit, which has a SEER rating of 17 and



The Broan ERV shown above runs continuously, providing fresh air to the home. In the most recent generation of Mandalay Homes houses, the ERV is integrated with the ductwork serving the home's heating and cooling system, which continuously distributes air through the house.

Photos by Geoff Ferrell/Mandalay Homes



The home's HVAC duct system delivers conditioned fresh air to every room in the house. A centrally located return pulls stale air from the living space and exhausts it to the outdoors.

pairs with a variable-speed air handler. We program the air handler to run intermittently at a low speed, around the clock. Since we have that fan working all the time, we decided to take advantage of its power to distribute the incoming fresh air to every register in the home.

The ERV we use is the Broan ERV140TE, one of Broan's newer models that has been sold in Canada for a while and was recently introduced in the United States. It has intelligent controls and an ECM motor that allows fine-tuned control of the fan speed and operating time. We can dial in the amount of airflow that we are looking for, based on the square footage of the home, so that we're meeting ASHRAE requirements but we're not overventilating or underventilating. This way, we don't have to use a different ERV in every home; we can just program the Broan to precisely meet the requirements of any size home that we build.

We pair the Broan with the Trane by connecting the supply duct from the ERV to the return plenum for the heat-pump air handler. We dump the filtered incoming air to the return plenum, and then the Trane's fan moves it through the supply ductwork to every room in the house. We have a dedicated, centrally located return for the ERV that draws in stale air from the house and sends it out of the building.

Running the ERV continuously as we do enables us to control the air pressure in the house relative to the outdoors. When commissioning one of these ERVs, the pressures in the system must be

balanced. We do this by measuring indoor and outdoor pressures with a manometer, and then we set up the system so it creates just a very small positive pressure in the house compared with the outdoors. It's a tiny difference—just one or two pascals—but it's enough to keep air from seeping in through any leak points. This helps the homeowners avoid pollutants from outside, like smoke, dust, and pollen. Indeed, our homeowners report that they see less dust and fewer pollutants in their houses.

Our homes do have ordinary exhaust vent fans in the bathrooms and the laundry room, and they have range hoods that exhaust to the outdoors too. For the range hoods, we provide makeup air: Our HVAC contractor installs a simple duct to the outdoors, equipped with a gravity damper that opens up any time the range-hood fan creates a negative pressure in the house. This ensures that the range hood can pull enough cfm to clear cooking odors and combustion products out of the house, without having to fight a vacuum.

Balanced mechanical ventilation using a combination of an ERV plus point exhaust fans with makeup air at particular locations is the best way we have found to provide fresh, healthy, filtered air continuously to a home and create the best environment for the homeowners.

*Geoff Ferrell is the chief technology officer for Mandalay Homes in Prescott, Ariz.*