

# Condensing Furnaces

## *Wring Out the Water to Save Energy*

by Harvey M. Sachs

While conventional natural gas furnaces have efficiencies (AFUE, the "Annual Fuel Utilization Efficiency") that top out at about 80 percent, condensing furnaces start at 90 percent and go up to 96 percent or better. The difference is simple: burning natural gas (or propane) forms water vapor, CO<sub>2</sub>, and minor amounts of contaminants. Conventional furnaces waste energy to keep the water vapor formed in combustion as steam, and prevent contaminants from corroding the furnace (or boiler). Condensing furnaces are designed to capture the latent heat that is released when the steam condenses. The small amount that condenses drains to a sanitary sewer.

Condensing furnaces use a corrosion-resistant secondary heat exchanger where the condensation takes place. After leaving this heat exchanger, the remaining exhaust gases are cool enough to vent with common PVC pipe through a side wall of the building. No chimney or metal atmospheric vent is needed. Indeed, many condensing furnaces feature sealed combustion systems. In these, air for combustion is drawn from outside the building, and then exhausted outside with fan pressure. This is a significant safety feature: In "tight" houses, conventional systems may draw enough air from the house to increase the likelihood of backdrafting other appliances, particularly the water heater. Backdrafting means that make-up air is actually drawn into the house through the chimney, and dangerous combustion gases from the water heater burner can be carried into the house.

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### **Combustion Chamber**

Sealed combustion is unique to 90+ percent furnaces.

### **Primary Heat Exchanger**

This is where heat is transferred to circulate air in the home.

### **Secondary Heat Exchanger**

Unique to 90+ percent furnaces, this re-circulates flue products and removes heat which results in condensation.

### **Blower Motor**

Circulates air in the home, some are variable speed.



Photo courtesy of Trane

Nationally, over one million condensing furnaces were sold in 2003, almost one-third of all furnace sales that year, but market share in Colorado was only 10 percent in 2000. Despite their somewhat higher first cost, condensing furnaces should be the universal choice in Colorado.

Condensing furnaces come with a variety of options. From bare-bones 90 percent AFUE models to higher efficiency models with other premium features that are attractive for many consumers. Variable speed fans help match the furnace (and air conditioner) to the duct system, promise quieter operation, and save substantial amounts of electricity. Two-stage (or modulating) gas valves allow the furnace to run on low-fire for longer periods of time unless it is very cold, when high-fire kicks in. Longer firing times at low speed yield more comfort (less temperature fluctuation) and higher efficiency, and tend to compensate for the substantial over-sizing that is always found.