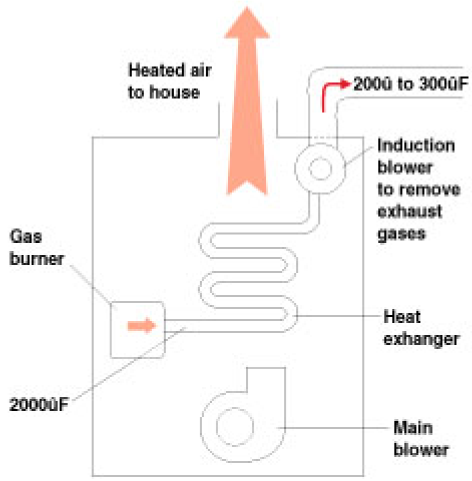
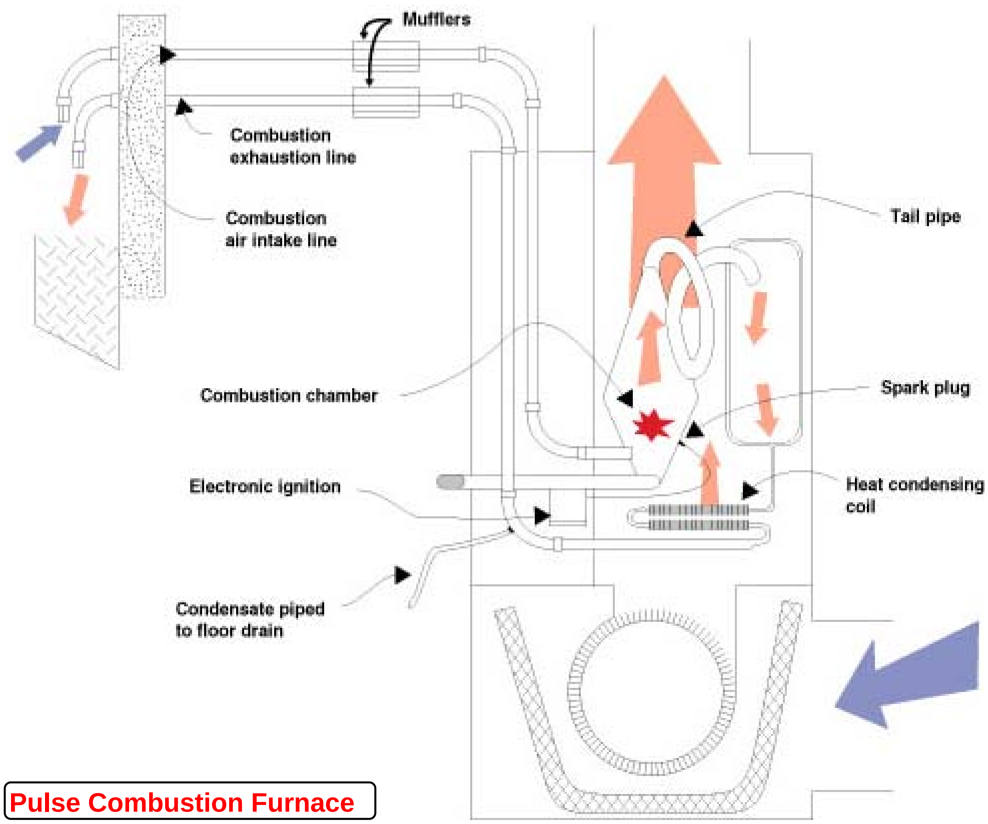
Furnace Types

Gas furnaces

Gas furnace technology has progressed by leaps and bounds during the past decade. Efficiencies have jumped from about 65% to as high as 95%. Most gas furnaces have the same basic components: A gas burner where fuel is burned, an ignition device to start the fire, one or more heat exchangers where the heat from combustion gases is transferred to the house air, a circulation blower to circulate air to and from the house, and a small second induction blower to draw flue gases through the furnace. As the hot exhaust gases from the gas burner pass through the heat exchanger, they are cooled by the circulating house air which carries the heat throughout the house.



The road to high efficiency: To achieve high efficiency, manufacturers designed special heat exchangers which squeeze as much heat as possible from the hot combustion gases before venting them out of the house. For example, in "mid-efficiency" furnaces (78% to 83%), the exhaust gases are cooled to about 250½F before exiting the furnace. To attain even higher efficiency, manufacturers install a second heat exchanger which further cools the exhaust gases to as low as 110½F. At that temperature, the gases are so cool that water vapor (one of the products of



Pulse Combustion Furnace

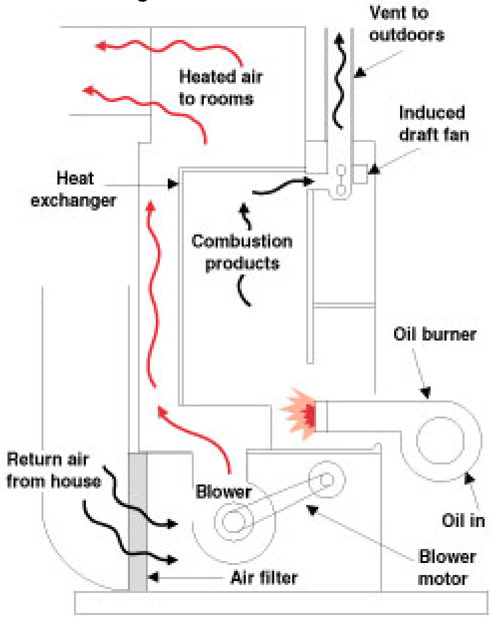
combustion) condenses out of the flue gases and is drained through a plastic tube to the sewer or floor drain. These ultra-high efficiency furnaces, called "condensing furnaces", have efficiencies ranging from 90% to 95%.

Other completely different approach to high-efficiency gas furnace design uses a technology called "pulse combustion." The gas is burned in a series of rapid tiny explosions, rather than in a continuous flame. A spark plug initiates combustion which then continues on its own in a specially shaped combustion chamber. The efficiency of a pulse combustion furnace is around 93%.

One advantage of pulse furnaces over conventional gas furnaces is that they need no auxiliary electricity except to operate the main circulation blower.

Oil furnaces

Oil furnaces are similar to gas furnaces and share many of the same high efficiency features. The most important difference is in the firing apparatus. Oil furnaces have power burners that atomize the fuel oil, mix it with combustion air, and force it through the combustion chamber.



Condensing oil furnaces, with efficiencies above 90%, are available but are not as common as condensing gas furnaces.

Electric Furnaces

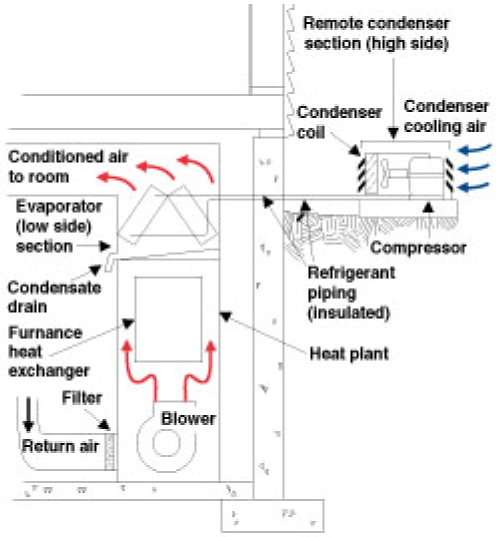
Electric furnaces contain an electric resistance heating coil that simply converts electricity directly into heat. The coil is mounted in a cabinet with a circulation blower. Except for a small amount of heat loss through the cabinet, nearly all the heat from the coil is transferred to the circulating house air. The efficiency of an electric furnace is close to 100%.

Electric heat pumps

Heat pumps work on a completely different principle than electric furnaces. Instead of just converting electricity into heat, a heat pump uses an electric compressor that "pumps" heat from one place to another.

A heat pump makes much better use of electricity than an electric resistance furnace. By pumping heat from outdoor air, soil or groundwater into the house, a heat pump can produce two to three times more heat per kWh than an electric furnace.

All heat pumps have the same basic components: a compressor which does the actual "pumping", an indoor coil which heats or cools circulating house air, an outdoor heat source which supplies heat to the system, and copper tubing that circulates refrigerant fluid between the indoor and outdoor units.



The outdoor heat source for a heat pump does not have to be "warm" in the common sense. The beauty of a heat pump is its ability to take heat from a relatively cool source and concentrate it to a higher temperature. A refrigerator is an example of a heat pump. It takes heat from inside the cold food storage box and pumps it out the back or bottom at a higher temperature.

Residential heat pumps can utilize heat sources down to about 30½F to heat indoor air up to about 100½F.

The most common type of residential heat pump is an "air-to-air" heat pump which uses outdoor air as the heat source. Heat is extracted from the air by an outdoor unit that contains a heat exchanger and fan.

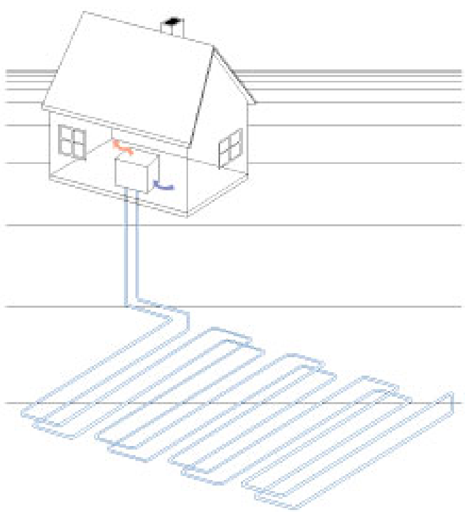
The only disadvantage of air-to-air heat pumps is that they lose efficiency and output at cold (less than 35½F) outdoor air temperature. While this is a troublesome problem in colder regions of the country, it is not a severe problem in the mild Virginia climate.

Geothermal" Or "Ground Source" Heat Pumps

Geothermal" or "ground source" heat pumps use the ground as the heat source. Heat is extracted from the ground either by water circulating in a closed-loop pipe or by well water pumped through the system.

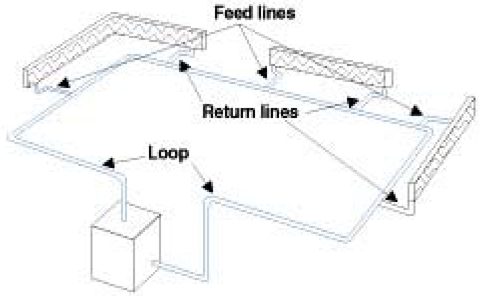
Ground source heat pumps are generally more efficient than air-to-air heat pumps because the deep-ground temperature stays constant all year round.

One prime advantage of any type of heat pump is that its cycle can be reversed in summer to supply air conditioning to the house. In the cooling mode, the indoor and outdoor elements switch functions. The house now becomes the heat source and the outdoor element -- air heat exchanger, ground loop or water well -- becomes the heat sink.



Hydronic Heating Systems

A hydronic heating system uses heated water to distribute heat from a central boiler to each part of the house. The distribution system may include any combination of baseboard heaters, radiators or sub-floor "radiant" heaters.



As with furnaces, boiler technology has advanced during the past decade although few boilers attain the impressive efficiency of condensing gas furnaces. Several gas- and oil-fired boilers are available with efficiencies up to 87% and a few condensing gas boilers are available with efficiency over 90%.

Hydronic heating systems are not very common in Virginia. One reason is that most new homes have central air conditioning which requires a ducted distribution system. It's hard to justify a second distribution system when you could just as easily use the cooling ducts for forced air heating.

Reference:

http://www.mme.state.va.us/de/hbchap5.html