

# Home Heating Systems

Your heating system is usually the largest energy-user in your home, so choosing a new energy-efficient unit is especially important. When shopping for a new gas heating system it's important to compare efficiencies and installation costs of various models.

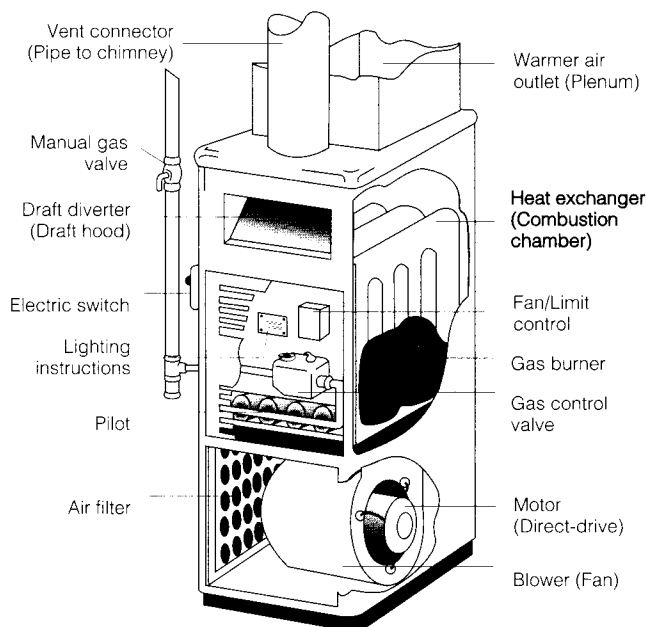
Look for models Design Certified by the American Gas Association to ensure safety, reliability and efficiency.

Most homes have central heating systems which generate heat at a central point and distribute it by air, water or steam to each room in the house. The appliance that supplies heat to an air transfer system is a "furnace"; the appliance used to heat water or furnish steam is a "boiler."

## WARM AIR HEATING SYSTEMS (FURNACES)

- **Gravity** - Heated air rises from the furnace through large supply ducts. Cool air returns to the furnace through cold air return ducts. The weight difference between warm and cool air keeps the air circulating.
- **Forced Air** - Warm air is forced through supply ducts by a blower; it enters a room through registers or diffusers, then returns via a cold air duct to the furnace where it is filtered of dust and dirt particles, reheated and recirculated.

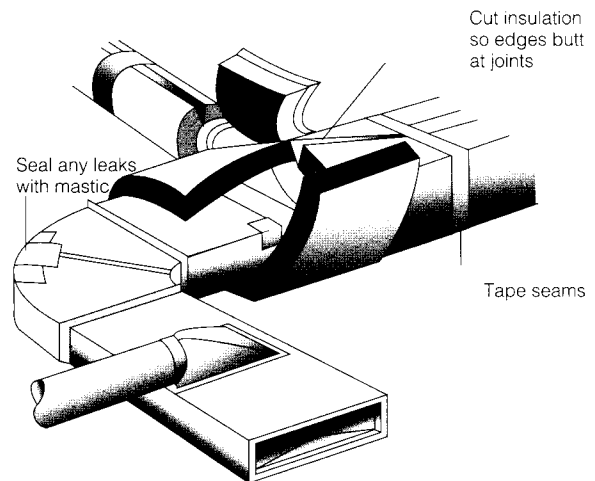
### Forced Air Heating



## DUCTS

Warm air ducts and cold air returns that pass through cold areas (such as an unheated basement, crawl space, garage or areas of your home that you do not wish to heat) should be insulated. Before you insulate ducts, use mastic tape to repair any holes or cracks in seams.

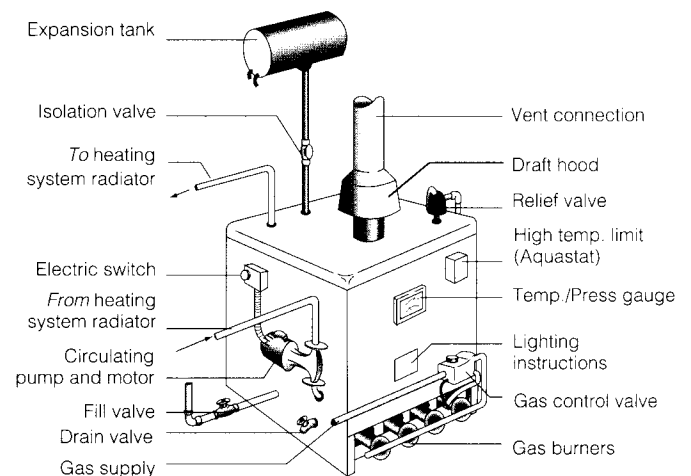
### Warm Air Duct



## HOT WATER HEATING SYSTEMS (BOILERS)

- **Gravity** - Operates on the principle that warm water rises. Hot water circulates from the boiler through large supply pipes, to the radiators. Cool water returns to the boiler due to the weight difference between warm and cool water. The lowest radiator must be located above the top of the boiler.
- **Forced** - Hot water is distributed by a pump. Pipes that carry the water to the boiler can be located above or below the boiler.

### Forced Hot Water Heating



Hot water heating systems include an expansion tank to provide a cushion of air for heated water to expand against so pressure doesn't become excessive in the system.

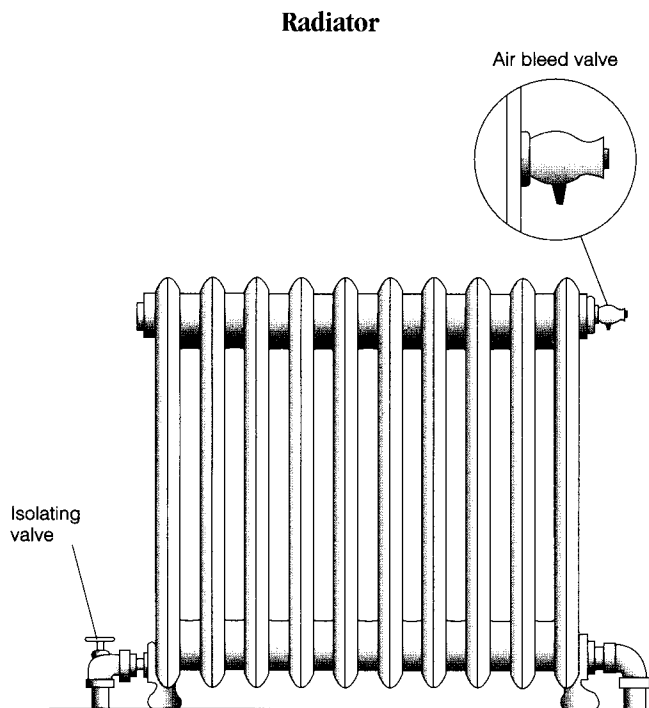
#### DISTRIBUTION PIPES

Distribution pipes carry hot water from the boiler to radiators throughout the house, and back to the boiler. Pipes should be insulated if they pass through unheated areas such as an unheated basement, crawl space or garage.

#### RADIATORS

Radiators should be full of water for maximum heat output; air in a radiator obstructs the water flow. If the radiator is warm at the bottom and cool at the top, or warm at the inlet side and cool at the outlet side, there may be air in the radiator. Keep radiators free of air by bleeding them when needed and adding water as required, according to manufacturer's instructions.

If manufacturer's instructions for bleeding radiators are not available, open the bleed valve to allow air to escape; close the valve when water begins to flow from it. Start with the radiator located at the highest level in the house and repeat on all the radiators, ending with the one at the lowest level. You may need to add water to the system after bleeding the radiators.



#### AFUE - ANNUAL FUEL UTILIZATION EFFICIENCY

The Federal Energy Agency requires all furnaces and boilers be given operating efficiency ratings -- the annual fuel utilization efficiency (AFUE). The AFUE tells how much heat the system

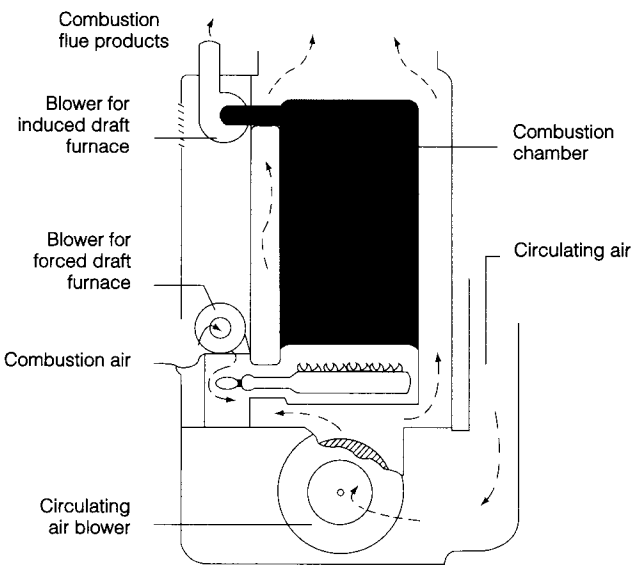
extracts from the fuel it burns during a single heating season. The higher the AFUE, the more efficient the equipment. The minimum efficiency standard for new furnaces is 78% AFUE.

A high efficiency furnace or boiler has special efficiency features which raise the AFUE. These features may include electronic ignition, power draft system, improved burner, vent damper, high efficiency heat exchangers, and secondary heat exchangers in the highest efficiency models.

#### TYPES OF HIGH EFFICIENCY HEATING SYSTEMS

- **Condensing Furnaces** In a condensing furnace or boiler, an enlarged heat exchanger surface lowers the temperature of the exhaust gases, making the furnace more efficient. The exhaust gas temperature drops to the dew point of the water vapor in the gas, causing the vapor to condense to water and give up 970 Btus for every pound of water condensed. Natural gas can yield more than 1 gallon (8 lbs) of water per 100,000 Btus (one therm) burned, giving up about 7,760 Btus. Condensing furnaces achieve AFUEs up to 94 percent.
- **Heat Transfer Module Boiler/Warm Air System (HTM)** The heat transfer module system uses a glycol/water solution that is heated and passed through a blower/coil unit which distributes heated air throughout your home. It does not require a conventional chimney, can be located outside, and can achieve an AFUE of 90 to 95 percent.
- **Recuperative or Partially Condensing Furnace/Boiler** A recuperative heat exchanger section is added to the conventional heat exchanger and the exhaust gases are vented to the atmosphere by a small fan. A conventional chimney is not necessary; flue gases can be vented directly outside. Some units require a vertical vent; others can be vented through a side wall. Formerly "lost" heat is captured in the recuperative heat exchanger section. Some water vapor in flue gases is condensed, allowing additional heat to be released for use in your home. The water is disposed of by a condensate drain. Loss of heated air when the furnace is not operating is reduced by restriction through the forced draft fan. Achieves an AFUE of 81 to 88 percent.
- **Power Draft Furnaces** While a conventional furnace draws air into the combustion chamber by natural draft, power draft furnaces use a motor-driven fan at the burner level to **push** (forced draft) or **pull** (induced draft) air into the combustion chamber. Some forced draft and induced draft furnaces allow for a normal chimney and can be from 80 to 83 percent efficient. (See illustration)

## Induced Draft or Forced Draft Furnace



### STANDARD FURNACE WITH VENT DAMPER

Standard design has atmospheric gas burners and a gravity venting system; an automatic vent damper closes when the furnace shuts off so less heat escapes up the chimney.

### CARE OF YOUR HEATING SYSTEM

- Home heating systems need periodic care. Proper maintenance will extend the operating life, save energy and increase efficiency. Follow manufacturer's recommendations in caring for your system.
- Cleaning or adjusting natural gas burners should be done by a qualified serviceperson. If your heating system is not working properly, contact a qualified heating contractor. The following conditions indicate the heating system could be operating inefficiently or unsafely:
  - odors and/or irritation to your nose or eyes
  - soot and carbon deposits on the burner, in the combustion chamber, on the floor near the furnace/boiler or below the draft hood opening
  - buildup of dust, dirt or scale on burners and/or burner unit components
  - a yellow flame rather than a blue flame
  - flame backing up and burning outside the combustion chamber
  - **excessive** humidity or frost on windows or walls
- Vents and Chimneys - Visually inspect the chimney and the vent connector (the pipe between the furnace or boiler and the chimney) for rust holes or corrosion. These conditions may allow hazardous flue products to enter your home. **Replace any defective vent connector or chimney.**
- Pumps, Blowers, Motors and Filters - Before working on your

heating system, **TURN OFF THE ELECTRIC POWER TO THE FURNACE OR BOILER.** Most pump and fan motors require periodic oiling. (Some newer motors are permanently lubricated.) Consult manufacturer's instructions on oiling. If they are unavailable, look for a tube or hole on both ends of the motor, directly above the motor shaft. Oil at least twice during the heating season, using non-detergent #20 oil, two or three drops per location. Do not over-lubricate; too much oil will soak into the motor's insulation and shorten its life. The blower (fan) may also be permanently lubricated. Look for cups at each end directly above the fan shaft. Fill oil cups with non-detergent #20 oil twice during the heating season.

- Blower blades require occasional cleaning; dust and dirt reduce their air capacity, causing overheating and fuel waste. To do this, remove the blower assembly from the furnace and use a brush, such as an old toothbrush, to clean the blades. Be careful not to bend the blades or remove small clips attached to them. These clips are balance weights installed to ensure vibration-free operation.
- Check the V-belt that connects the motor and blower pulley and replace if worn or cracked.
- Check filters monthly and replace or clean when dirty to prevent damage to blower or fan motor and maintain efficiency.

### Controls

- The main gas valve turns the burner on and off. It is electrically controlled by the room thermostat, pilot safety device and the maximum temperature limit control.
- The maximum limit control keeps your heating unit from overheating. On a furnace it is called a limit control; on a boiler it is called an aquastat.

### USING ENERGY WISELY

- Registers - Look for and correct the following conditions:
  - closed supply dampers
  - drapes, furniture or carpet obstructing the supply and/or return registers or grilles
  - leaks in warm air ducts and cold air returns
  - dust plugging the supply and/or return registers or grilles
  - high pile carpet blocking baseboard radiators at the bottom
- Lower your thermostat setting at night and when there will be no one home for at least 4 hours; a 10° setback can give you significant savings. Setback thermostats save energy by automatically turning the thermostat down and up on a preset schedule.
- If you turn off the pilot during summer to save energy, you should know how to safely relight it. It might not be economical to hire a serviceperson to relight the pilot.

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- In recent years, a number of “energy-saving devices” (retrofit devices) have been developed for heating systems. The cost effectiveness of a retrofit device depends primarily on the age and condition of your heating system. Generally, older systems have fewer operating years remaining, so retrofit devices will be less cost-effective. Before considering any retrofit device, check with your local building inspector to see if it complies with code. It should also be American Gas Association (A.G.A.) or Underwriters Laboratories (UL) approved.

#### SAFETY

- Keep furnace area clear of flammable liquids (gasoline, paint products, solvents or cleaners) and all combustible materials (newspaper, cardboard boxes or rags).
- The furnace runs longer during very cold weather to maintain the thermostat setting, so duct and register surfaces may be hot. Prevent children from touching or playing near hot surfaces.
- If the pilot goes out, look for relighting instructions printed on the furnace. If it goes out repeatedly, call a qualified heating contractor.
- All fuel-burning appliances need sufficient air for proper combustion. If a natural gas, oil, coal, kerosene or wood heating appliance does not receive adequate intake air, it will not burn the fuel completely and may operate inefficiently. Under certain conditions, carbon monoxide could be produced and enter the home if the chimney or vent connector is defective.
- Provide sufficient ventilation to your home when using a fireplace by opening a nearby window or adding a fresh air intake to the fireplace.

#### COMMON FURNACE/BOILER TERMS

- Automatic Vent Damper - A device attached in the venting system after the draft hood. It automatically closes the vent when the furnace or boiler is off, restricting heated air from going up the chimney.
- Intermittent Ignition Device (IID)/Electronic Ignition - Uses a spark or other heat source to ignite the pilot when the thermostat calls for heat. Replaces a continuously burning pilot flame.
- Heat Exchanger - A section of the furnace or boiler where heat generated by the combustion process is transferred to circulating air or water.
- Flue gases - The products of combustion (carbon dioxide and water vapor) which are vented to the outdoors.

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