

# NATURAL GAS HOME HEATING SYSTEMS



## AFUE – Annual Fuel Utilization Efficiency

The Federal Energy Agency requires all furnaces be given an Annual Fuel Utilization Efficiency (AFUE) rating. 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 percent AFUE.

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



Your heating system is one of the largest energy users in your home, so choosing an energy efficient unit is especially important. When shopping for a new natural gas heating system, compare efficiencies and installation costs of various models. Most homes have central heating systems which generate heat at a central point and distribute it by air to each room in the house. Furnaces, or warm air heating systems, supply heat to an air transfer system.

## How a furnace works: the basics

### 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.

### Tips on ducts

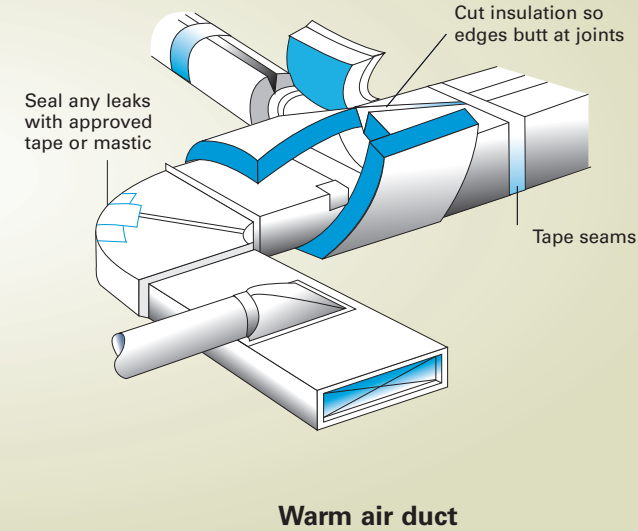
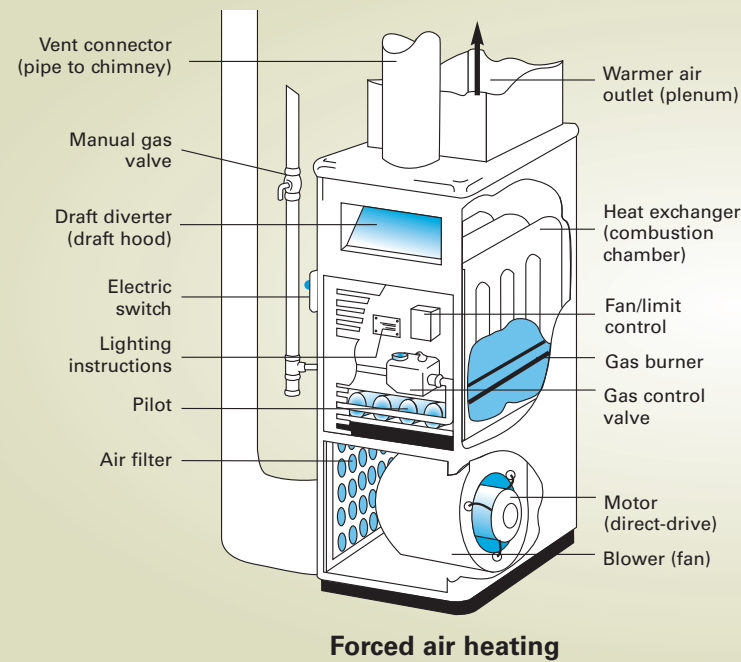
Warm air ducts and cold air returns that pass through cold areas (such as an unheated basement, crawl space, attic, garage or unheated areas of your home) must be insulated. Before you insulate ducts, use duct tape to repair any holes or cracks in seams.

*See illustrations inside.*



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## Types of natural gas heating systems

### Atmospherically vented furnaces

This type of furnace has atmospheric gas burners and a gravity venting system. Some also use a vent damper, which closes when the furnace shuts off so less heat escapes up the chimney.

### Condensing furnaces

An enlarged heat exchanger surface lowers the temperature of the exhaust gases, making this 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 release 970 Btus per 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 96 percent.

### Recuperative or partially condensing furnace

A recuperative heat exchanger section is added to the conventional heat exchanger and the exhaust gases are vented to the outdoors by a small fan. A conventional chimney is not necessary. Some units require a vertical vent; others can be vented through a sidewall. Formerly lost heat is captured

in the recuperative heat exchanger. Some water vapor in flue gases is condensed, allowing additional heat to be released for use. 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. This type of system 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 to push (forced draft) or pull (induced draft) air into the combustion chamber. Some forced draft and induced draft furnaces allow for a Type B vent or metal-lined chimney and can be from 80 to 83 percent efficient (see illustration).

## Care of your heating system

- Home heating systems need periodic care to extend operating life, save energy and increase efficiency. Follow manufacturer's recommendations.
- Cleaning or adjusting natural gas burners should be done by a qualified service person. If your heating system is not working properly, contact a professional.

The following conditions indicate the system could be operating inefficiently or unsafely:

- 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 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.
- Nose or eye irritation, headaches or listlessness.
- Visually inspect chimney and vent connector (the pipe between the furnace or boiler and the chimney) for rust holes or corrosion which may allow hazardous flue products to enter your home. Replace any defective vent connector or chimney.
- Maintain blowers, motors and filters. Before working on your heating system, turn off the electric power to the furnace. Some pump and fan motors require periodic oiling but some are permanently lubricated. See manufacturer's instructions on oiling. If instructions are unavailable, look for a tube or hole on both ends of the

motor, directly above the motor shaft. Oil 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.

- Blower blades require occasional cleaning; dust and dirt reduce their air capacity, causing overheating of fan motor and heat exchanger, and fuel waste. To do this, remove the blower assembly from the furnace and use a brush to clean the blades. Be careful not to bend the blades or remove small clips attached to them. These clips are balance weights that ensure vibration-free operation.
- If you have a belt-driven forced air furnace, 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 limit control keeps your heating unit from overheating.

## Using energy wisely

- Check registers. Look for and correct the following:
  - 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 the bottom of baseboard registers.
  - Piles of clothes, towels, etc., that block heat or air flow.

- Lower your thermostat 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.
- 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 be approved by CSA America or Underwriters Laboratories.

## Safety

- Keep furnace area clear of flammable liquids (gasoline, paint products, solvents or cleaners) and all combustible materials (newspaper, cardboard boxes or rags).
- Furnaces run longer during very cold weather to maintain the thermostat setting, so duct and register surfaces may be hot. Keep children away.
- 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 or adequate combustion air is not supplied.
- Provide sufficient ventilation to your home when using an open-hearth fireplace by opening a nearby window or adding a fresh air intake to the fireplace.



## Common furnace terms

**Automatic vent damper:** A device attached in the venting system after the draft hood. Automatically closes the vent when the furnace or boiler is off, keeping 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 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.