

How they work

Natural gas furnaces consist of five major components:

1. **Burner assembly** – Maintain a controlled natural gas flame within the heat exchanger.
2. **Heat exchanger** – Transfers heat from the combustion process to the air passing over the heat exchanger.
3. **Operating and safety controls** – Start and stop the furnace as necessary to maintain the desired temperature, or shut down the furnace for safety reasons.
4. **Fan assembly** – Transfers air over the heat exchanger to pick up heat; the heated supply air is distributed throughout the home via ductwork.
5. **Venting system** – Passes all of the products of combustion to the outdoors.

Furnace efficiency

Natural gas furnaces are rated by their Annual Fuel Utilization Efficiency (AFUE). The AFUE rating system was developed by the Government of Canada and the Heating, Refrigeration, and Air Conditioning Institute of Canada (HRAI).

The rating describes how efficient a furnace is over the entire heating season. For example, a high efficient furnace with an AFUE of 92 per cent will provide 92 per cent of the natural gas energy to the home over the heating season.

Furnaces with higher AFUE ratings are more efficient and result in lower heating bills. All new furnaces have an EnerGuide label listing the furnace's AFUE rating. The current minimum AFUE for new residential natural gas furnaces in the replacement market is 92 per cent and 94 per cent for new homes.



Replacing your existing standard efficiency natural gas furnace

A standard efficiency furnace (conventional furnace) has a standing pilot light that operates continuously and a natural draft venting system which allows heated house air to escape up and out of the chimney even when the furnace is off. The estimated AFUE rating for a conventional furnace is 60 per cent. These conventional units have not been available since 1995.

Mid-efficiency furnace

An electronic ignition system eliminates the need for a standing pilot light and an induced draft fan replaces the conventional furnace's natural draft venting system. The AFUE rating for mid-efficiency furnaces ranges from 78-84 per cent.

High-efficiency condensing furnace

One of the by-products of burning natural gas is water vapour, which contains approximately 10 per cent of the fuel's energy. However, in conventional and mid-efficient furnaces all of the energy contained in the water vapour escapes through the chimney.

A high efficiency furnace has a secondary heat exchanger that extracts most of the energy from the water vapour by condensing it to water. The water is then drained to a floor drain, via gravity or an optional condensate pump system. These units cannot use a conventional metal chimney. The lower temperature flue gases are vented outside using a special plastic venting system. Plastic pipe is used for its corrosion resistance properties. The AFUE ratings for high-efficiency, condensing furnaces is between 90-96 per cent. It is estimated that a high efficiency furnace can reduce your home's annual heating bill by up to 35 per cent compared to a conventional furnace.

Your existing natural gas water heater can be left alone on the existing chimney as long as it works properly and the chimney meets the requirements of the National Natural Gas Installation Code.

However, once the water heater is isolated on the existing chimney, it may not work properly. Problems such as flue gases condensing in the chimney, back-drafting or other venting problems can occur. The chimney may have to be modified to correct these problems. The most common modification is installing a smaller diameter chimney liner into the existing chimney.

Reduced home ventilation due to new furnace

In addition to providing heat, a conventional furnace provides uncontrolled ventilation for your house since it uses air from within your home for the combustion and venting process, and warm house air escapes up and out of the chimney even when the furnace is off. Air escaping up and out of the chimney induces cold, dry air to leak into the home through building openings such as cracks around the walls, windows, and doors. Usually conventional furnaces provide more ventilation than is needed. This wastes energy dollars and can make homes drier in winter than they need to be.

A high efficiency furnace works differently than a conventional furnace. They provide significant energy savings, due to reducing or eliminating the uncontrolled ventilation provided by the conventional furnace. This reduction in ventilation leads to a rise in humidity and changes where air leaks into and out of your home. In most homes this causes no problems. But it can cause problems in some homes such as frozen door locks, increased condensation and icing on windows and doors, and between panes of poorly sealed windows.

If humidity and/or icing become an issue, the following may help minimize or eliminate the problem:

- Improve weather stripping and caulking on doors and windows.
- Use seasonal window insulator kits (clear poly over inside windows and frames).
- Run an exhaust fan for a couple of hours each day.
- Install a better exhaust fan controlled by a dehumidistat or timer.
- Install a ventilation system.

Sizing

A contractor should perform a heat loss calculation to find out what size of furnace a particular home requires. This calculation is based on the home's construction and ensures that the heating system is large enough to maintain a temperature of 22°C (72°F) on the coldest design day. This calculation should be done according to CAN/CSA Standard F280, Determining the Required Capacity of Residential Space Heating and Cooling Appliances.

Over-sizing a furnace is not recommended since the increased size will generally reduce efficiency and comfort.

Furnace options

Two-stage furnace

A two-stage furnace has a low fire and high fire burner, which operate as required. A two-stage furnace that meets the design heat loss on high fire should operate most of the heating season on low fire. The burner will operate at high fire only in the coldest weather or while recovering from cooler setback temperatures. The major advantages of operating on low fire are comfort related. This is due to less air noise, and longer run times. It may also offer slightly higher efficiency than a single stage furnace which should be reflected in the AFUE rating.

Modulating furnace

A modulating furnace has a low and high fire burner just like the two stage furnace. However, it also modulates the burner input between the low and high fire burner settings to try to more closely meet the heating load of the home. The intention of this system is to provide an even greater level of comfort in the home.

Variable speed DC fan motor

Variable speed DC fan motors (also referred to as ECM motors), are more efficient than standard furnace fan motors. Someone who plans on operating the fan continuously should consider choosing a furnace with a variable speed DC motor for the energy and cost saving benefits (estimated between \$50-\$100/year). Estimated annual savings if the fan only operates when the furnace or air conditioner are on, is \$10-\$20 (based on an electrical rate of \$0.06/kWh and a natural gas rate of \$0.40/cubic meter).

Maintenance

- Clean or replace the air filter regularly.
- Ensure the return air grilles and supply air registers are clean and unobstructed.
- Keep the area around the furnace clean and unobstructed.
- Have the furnace serviced annually by a qualified service person.
- Modern furnaces have more operating and safety components than older standard efficiency furnaces and generally require more maintenance.
- If you suspect a problem with your natural gas service, contact Manitoba Hydro at 480-5900 (in Winnipeg) or toll free at 1-888-624-9376.

Installation considerations

All natural gas equipment installed in Manitoba must be:

1. Approved and labelled by a certification agency such as the Canadian Gas Association (CGA), Canadian Standards Association (CSA), Underwriters Laboratory of Canada (ULC), or any other agency approved by the Government of Manitoba, Mechanical and Engineering Branch.
2. Installed by a licensed gas fitter, who first obtains a permit from the Manitoba Department of Labour. This generates a Manitoba Hydro gas inspection to ensure the installation meets current provincial gas codes.

For information about Manitoba Hydro's Power Smart programs:

Telephone: 480-5900
Toll-free: 1 888 MB HYDRO (1-888-624-9376)
www.hydro.mb.ca

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