Tankless Water Heater
A Primer for Contractors, Installers, Builders and Homeowners

AHRI
Air-Conditioning, Heating, and Refrigeration Institute
Where Can It Be Installed?

Tankless water heaters have gained popularity in the North American market for the past 25 years. They come in a variety of capacities to meet different needs such as supplying water for a whole house, a hot tub, a remote bathroom or a single sink. Compact in size, tankless water heaters can be mounted on a wall, allowing them to be installed in a wide variety of spaces.

Some examples of where tankless water heaters are installed include:

- **House/apartment hot water supply**
  Tankless water heaters today are most commonly used to provide an entire home with hot water. They come in many sizes to meet the needs of different sized homes with varying hot water requirements.

- **Vacation property hot water supply**
  Because tankless water heaters are “off” until a hot water tap is opened, they are often utilized for vacation properties to reduce energy costs. In addition, the water in them is easy to drain, which make a tankless water heater a good solution for a property that is not occupied during the winter.

- **Barn or remote structure hot water supply**
  Tankless water heaters can be utilized in barns and other remote structures because of their ability to provide a continuous flow of hot water.

- **Remote or private office bathroom**
  Many businesses have a remote sink that does not need large quantities of heated water. For example, a service station needs a sink with hot water in the bathroom, but it never needs large volumes of hot water. Tankless water heaters can be used in these situations to provide hot water at the sink without incurring standby losses.

**GAS TANKLESS WATER HEATER**

1. A hot water tap is turned on.
2. Water enters the heater.
3. The flow sensor detects the water flow.
4. When the required flow rate is reached the control ignites the burner.
5. Water circulates through the heat exchanger.
6. The heat exchanger heats the water to the designated temperature.
7. When the tap is turned off, the unit shuts off.
- **Pool shower or deck bar.** These uses are another example of when hot water is only required periodically, and a tankless water heater can provide it without incurring standby losses.

- **Commercial Uses.** Tankless water heaters also are used in a wide variety of commercial spaces such as restaurants, hotels, apartment complexes, salons and office buildings.

**How It Works**

A tankless water heater, sometimes called an instantaneous water heater, heats water as it flows through the unit. What this means is that a tankless water heater does not have standby heat loss because it does not store hot water.

To provide hot water efficiently, many tankless water heaters today use various design enhancements that regulate temperature and water flow to help save money on monthly hot water bills.

A tankless water heater has a flow-sensing device that is activated when a hot water tap is opened and the necessary flow rate to activate the unit is achieved. Once activated, the water flowing through the appliance is heated to deliver a constant supply of hot water.

The heating element in a tankless water heater can be electric resistance heating coils or a gas fired burner using natural gas or propane fuel. When the hot water tap is closed, the tankless water heater senses that the flow of the water has stopped and it shuts down the gas burner or electrical elements.

To further save energy, many tankless water heaters now incorporate electronic ignition of the gas-fired burner to eliminate standby losses from the pilot.

A tankless water heater's overall energy efficiency is measured using an energy factor (EF) rating. The EF rating is based on test procedures developed by the U.S. Department of Energy and certified by the Air-Conditioning, Heating, and Refrigeration Institute. Certified water heaters and their performance ratings are listed online in the AHRI Directory of Certified Product Performance at www.ahridirectory.org.

**Electric Tankless Water Heater** (inside view from front)

- Heating elements
- Compact design mounts on wall or cabinet
- Electric controls
- Hot water out
- Cold water in
Today, tankless water heater energy factors range between .64 and .91 for gas-fired models and up to .99 for electric models. The higher the energy factor, the more efficient the water heater. When selecting a water heater it is important to not base your decision just on the energy factor, but also on fuel type, size and gallons per minute.

What Size Do I Need?
Correctly sizing a water heater is important for comfort and efficiency. An oversized water heater can increase costs with no added benefit. An undersized water heater that cannot meet the peak demand results in the dreaded cold shower or customers complaining of a lack of hot water in the restroom.

Choosing the proper size is a simple matter of selecting a model based on the amount of hot water that will be needed during peak demand, when a high volume of hot water is used. The peak demand period usually occurs in the morning when most people shower.

To determine the amount of hot water needed during peak demand, make a list of how many hot water taps are expected to be open at one time and add up their flow rates. The following estimates can be used to help determine the peak hot water demand:

- **Showerheads** (pre-1992) 3–5 gallons per minute
- **Showerheads** Low Flow (post-1992) 1.5–2.5 gallons per minute
- **Bathtubs** 2.5–4.0 gallons per minute
- **Faucets** 1–2.5 gallons per minute
- **Clothes Washers and Dishwashers** 1–2 gallons per minute

For example, if one person in a home begins his day with a shower, and at the same time another person is using a hot water faucet to prepare food, they may need up to 6 gallons per minute (GPM) of heated water. A tankless water heater that is rated to supply 6 GPM may be the appropriate choice for this household. Alternatively, a business with a sink in the women’s restroom and another in the men’s restroom may only need a tankless water heater rated to supply 3 GPM.

Once you’ve determined the maximum amount of hot water used in one hour during your peak usage period, you can find a model with a GPM matching your peak demand. Each model has a “flow rate,” which is measured in GPM. It is important to note that the flow rate must be based on the desired outgoing water temperature supplied by the water heater.

You can determine the incoming water temperature by asking your local plumber. For example, let’s assume that the incoming ground water temperature is 55 degrees Fahrenheit (10 degrees Celsius), which is the average for the United States, and the resident wants his shower of hot water to be 106 degrees Fahrenheit. To determine the temperature rise needed, subtract the incoming water temperature from the desired output temperature. Assuming a target temperature of 106 degrees Fahrenheit, in this example the needed temperature rise is 51 degrees Fahrenheit.

Keep in mind, hotter temperatures are commonly needed for dishwashers and clothes washers, and even at shower and faucets where hot water is mixed with the cold water. Once you figure out your peak demand, incoming ground water temperature and desired outgoing temperature, choose a model that meets your peak flow rate and temperature rise need. Manufacturers calculate flow rates based on different temperature rise requirements, so make sure you get the proper GPM for your temperature rise need.
Installation Considerations

Installing a gas tankless water heater in new construction is similar to installing a storage tank water heater. It has a cold water pipe, a hot water pipe, a gas line and a vent pipe. If a gas tankless water heater is replacing a storage water heater, the installer may face challenges because of differences in pipe dimensions and the materials used.

For example, many gas tankless water heaters require stainless steel vent pipes that are 3 inches to 4 inches in diameter. In addition, the required gas line size is usually larger for a tankless water heater because of the higher BTU input capacities, and most require an electrical connection. Therefore, if a homeowner is considering replacing a storage tank with a tankless water heater, it is important to consider the changes to the vent pipe, the gas line and electrical connection that may be necessary.

Similarly, before purchasing and installing an electric tankless water heater, it is important to understand the power requirements of the specific model being considered to ensure that the home can provide sufficient power.

Find More Information on Tankless Water Heaters

Visit the Homeowner Section of AHRI’s Web site at www.ahrinet.org or find performance certified water heaters online in the AHRI Directory of Certified Product Performance at www.ahridirectory.org.


GLOSSARY

**BTU** – Abbreviation for British Thermal Unit. The amount of heat required to raise the temperature of a pound of water one degree Fahrenheit.

**Electronic Ignition** – An electrical system for igniting the gas burner. The electricity can be provided by the building’s electric supply or a battery.

**Energy Factor (EF)** – A measure of a water heater’s overall energy efficiency based on the amount of hot water produced per unit of fuel consumed over a typical day. The EF is measured based on the U.S. Department of Energy test procedures.

**Energy Input Rating** – The maximum amount of input energy delivered at the burner and measured in British thermal units (Btus) per hour.

**Flow Rate** – The volume of water that is flowing through a water heater during a specific time.

**GPM** – Gallons Per Minute. For tankless water heaters, GPM is measured using the amount of heated water that can be delivered by the appliance at a specific temperature.

**Minimum Flow Rate** – Tankless water heaters require a minimum flow rate threshold to start heating water.

**Instantaneous Water Heater** – Another term for a tankless water heater.

**Pilot** – A small gas flame used to ignite gas at a main burner.

**Retrofit** – The act of replacing one type of water heater with a different type, such as replacing a storage tank water heater with a tankless model.

**Standby Heat Loss** – A measure of how much energy is consumed to replace heat lost between heating cycles.

**Storage Capacity** – The volume of water stored within the water heater.

**Storage Tank Water Heater** – A water heater that heats and stores water at a thermostatically controlled temperature.

**Tankless Water Heaters** – A water heater that uses gas or electricity to heat water as it flows through the appliance.

**Tankless Water Heater Capacity** – The maximum flow rate the water heater can produce at a given temperature rise specified as Gallons Per Minute (GPM).

**Temperature Rise** – The temperature difference between the incoming cold water and the outgoing heated water delivered by the water heater.