

ASK THE

# INSPECTOR

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**I have recently noticed that there are a variety of different domestic water heating systems available on the market as alternatives to conventional water heaters. What are the available types of water heaters, how do they work, and what are the advantages/disadvantages of the different systems?**



Other than the conventional tank style water heaters that are found in most homes, there are tankless (or instantaneous) water heaters and solar water heaters. Most Canadians have a conventional tank style water heater

that is in the form of a tall cylinder with several water pipes attached to it. Both tank-style and tankless water heaters can be electric or fuelled by oil, natural gas, propane and even wood. Solar water heaters are fuelled by the sun's energy, but are typically used to supplement standard fuel-fired or electric water heaters since it is difficult to obtain sufficient energy from the sun to heat water to necessary temperatures on an ongoing basis. Water heaters fuelled by wood are very inefficient and very rare.

Tank style water heaters not only heat the water, they also store the water once it has been heated, which is why they are so large. The capacity of a tank usually ranges from 150 Litres to 230 Litres, depending on the hot water requirements of a household. Non – electric fuel-fired water heaters are equipped with a burner situated at the bottom of the tank to allow the exhaust gases to travel through either the middle of the tank or around the

outside of the tank to the exterior of the home. The exhaust gases may be vented through a chimney out the roof or through a plastic or metal pipe out the side of the home. This style of water heater is not very efficient when both operating and off-cycle losses (heat loss that occurs through the walls of the tank) are taken into consideration.

Most oil and gas or propane fired units are only 50-60% efficient! Many people think that a typical side wall vented water heater is "high efficient" given that the side venting characteristics are similar to those of a high efficiency furnace (90% plus efficient); however this is not the case. Although some side vented water heaters are high efficient, the majority have similar efficiencies as conventional chimney vented water heaters. The advantage of a side vented water heater is that a chimney is not required to vent the exhaust gases generated from the water heater and therefore initial installation costs are reduced.



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New technologies have increased the efficiency of gas and propane-fired tank style water heaters significantly. For example, condensing or high efficient units pre-heat the incoming cold water using the heat from the exhaust gases generated from the burning of the fuel, extracting so much heat that the exhaust gases condense and turn to liquid. Condensing or high efficiency water heaters are still rare to find in Canadian homes, and typically look the same as conventional side vented water heaters. The difference is that a condensing water heater has a condensate drain pipe that provides a discharge location for the condensate that is generated during the removal of heat from the exhaust gases.

The off-cycle losses for both oil and gas-fired units can be reduced by insulating the tank and hot water pipes. Before installing insulation on a tank, however, consult with a qualified heating contractor to determine the required clearance around the burners, exhaust vents and water pipes to ensure safety. Tank style electric water heaters have heating elements in the water that heat the water directly. Since there is no heat lost through the generation and venting of exhaust gases, tank style electric water heaters are 80-90% efficient.

The recommended temperature of the water in a tank-style water heater varies depending on who is making the recommendation. Safe Kids Canada recommends a temperature of 49°C (120°F), which will reduce the potential for scalding of small children. The Canadian Journal of Infectious Diseases, however recommends a temperature of 60°C (140°F) to prevent the growth of the Legionella bacteria, which is responsible for Legionnaire's disease. Both Union Energy (Ontario) and Enbridge recommend a set temperature of 54°C as a compromise. Since electric water heaters are more susceptible to the growth of Legionella

bacteria, the temperature should be set at 60°C and mixing valves (which will allow a small amount of cold water to mix with the hot water) installed outside of the water heater to lower the temperatures at the taps to a safe level.

All tank-style water heaters have a temperature-pressure relief valve installed to prevent the build-up of excessive pressure within the tank. When the pressure in the tank reaches a certain critical level, the valve trips and the water is expelled through the valve and out an extension pipe that should be extended approximately 6 inches from the floor to prevent scalding due to the temperature of the water. All gas or liquid fuelled water heaters should also have a gas shut off valve and cold water shut off valve to ensure safety and convenience when servicing the equipment.

Tankless (or instantaneous) water heaters heat water for a home as it is needed, rather than heating large amounts of water to be stored until required. The energy savings from eliminating the off-cycle costs (i.e. keeping an entire tank of water heated overnight) can be as much as 10-15%. As well, the water does not need to be heated to as high a temperature, since there will be minimal cooling of the water between the heater and the source and there is no risk of bacteria growth since there is no tank in which the bacteria can grow. Tankless water heaters can be powered by electricity or natural gas or propane-fired. The supply of hot water depends on the size of the electric element or burner. When a hot water tap is turned on, the water heater senses the demand and ignites the burner or energizes the element. A larger element or burner will supply more hot water, which is convenient if two or more appliances require hot water simultaneously. Tankless water heaters are relatively small and are usually wall-mounted units that take up little space. They are, however, significantly

more expensive to purchase and install than traditional tank-style units. It may also be difficult to locate contractors who will install and can service these types of systems, since they are not yet popular.

Solar water heaters use the energy from the sun to heat (or usually pre-heat) water for use in the home. These systems require the installation of solar panels on a (preferably) south-facing roof or on the ground to collect the sun's energy and a heat exchanger to transfer the heat from the sun to the water. Solar water heaters are characterized either as open loop (also called "direct") or closed loop systems (also called "indirect"). An open-loop system circulates household (potable) water through the solar panel where the water is heated directly by the sun. A closed-loop system uses a heat-transfer fluid (water or diluted antifreeze, for example) to collect heat from the sun and a heat exchanger to transfer the heat from the heat-transfer fluid to household water. In most cases, insufficient amounts of heat can be collected and transferred to meet the hot water needs in Canadian homes so the solar heating system is typically used in conjunction with a fuel fired or electric tank or tankless water heating system. The cost of installing solar panels for water heaters is high, however the maintenance requirements and fuel usage requirements are very low, once installed. In addition, the use of solar water heating is very beneficial to the environment because less fossil fuels are used and therefore less greenhouse gas emissions are produced.

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