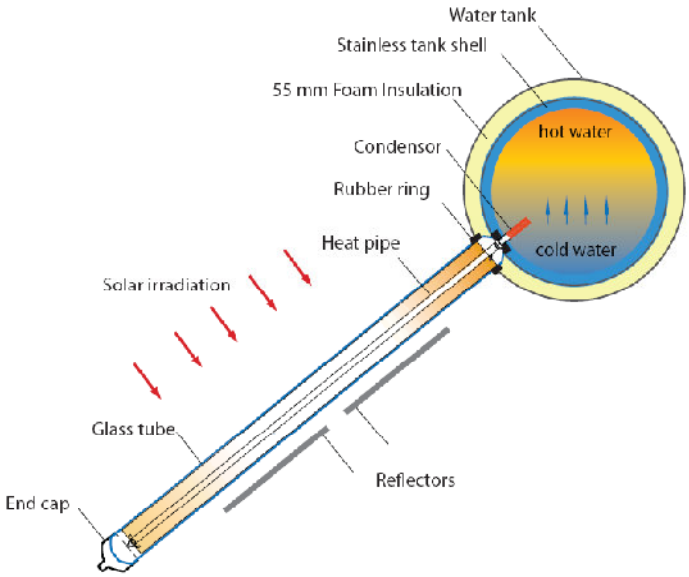
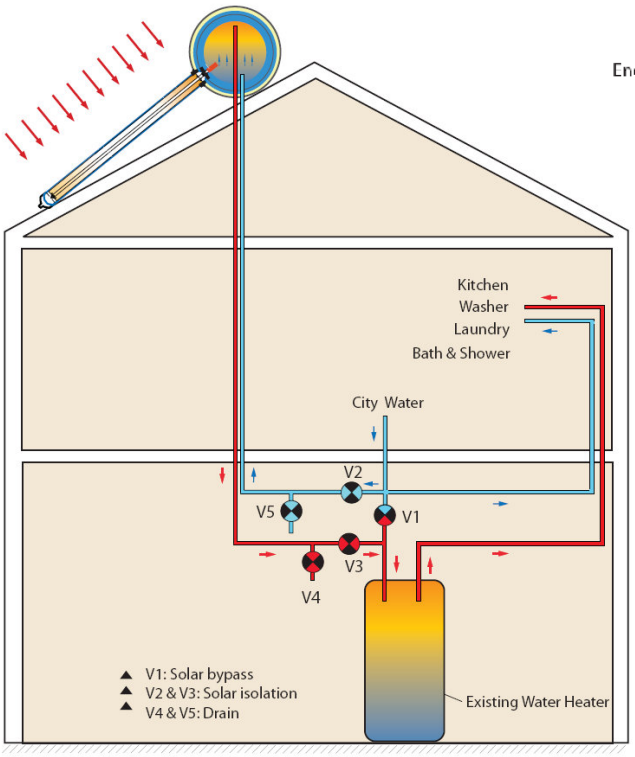
THE AFFORDABLE SOLAR SOLUTION

Performance Fact Sheet for IP-195 Solar Water Heater

24 solar evacuated tubes collect and convert solar energy into thermal energy to heat water for domestic use. The generated thermal energy (heat) is transferred to heat pipes located inside the evacuated tubes. This is done by conduction through aluminum fins (not shown in diagram) which bridge each tubes inner surface with the heat pipe. The vacuum in the glass tube (hence evacuated tube) acts as an insulation layer and prevents the generated heat from being lost. Each heat pipe inside the evacuated tube is made of copper, is completely sealed and contains tiny amounts of purified water at depressurized condition. When heated, the purified water inside the heat pip vaporizes at low temperatures (about 30˚C). The vapour rises to the pipe tips which are directly inserted into the solar water tank. Energy is transferred into the water, cooling the vapour which then condenses and falls back to the bottom of the heat pipe. By continuously circulating this way, the transfer of solar energy to the water inside the tank is enhanced. Please note that potable water (in the tank) is not in circulation through the evacuated tubes.

The Vacuum Tube and
Water Tank Cross-cut View





IP-195 solar water heater integrated with an existing gas or electric water heating system.

A solar hot water heater acts as pre-heater for your current hot water tank and is compatible with both: an on-demand (instantaneous or tankless system) or a conventional system using a hot water tank. When domestic hot water is required, preheated water from the solar unit flows into your existing hot water system. If the water temperature in the solar tank is not sufficient enough for your needs such as on overcast days, your hot water system continues to heat this water to the desired temperature. Cold city water then displaces the water from your solar unit and is preheated again through the available solar radiation.

Winter Performance of the IP-195 System

No one doubts the potential to use solar energy to heat hot water during sunny summer days. In fact, the IP-195 system can heat 95% of your hot water needs in the summer months. On average, about 60% of your hot water costs can be saved annually. However, most people in Toronto are sceptical that a solar unit can deliver significant amounts of hot water during the winter months. A flow meter with two heat probes [ISTEC 4400 meter] was installed at a private residence. The following data shows results from Jan. and Feb. of 2008.This data reflects the tank temperature after showers at 7am; please note that the incoming city water temperature in winter is about 5C° to 7C°, and hot water should not exceed 55C° otherwise it would cause scalding.

- Average January/08 solar tank outlet temperature: **31.8°C** [range 20.4°C– 45.3°C]
- Average February/08 solar tank outlet temperature: **35.4°C** [range 16.5°C – 46.1°C]
- The test results at the National Solar Testing Facility (test #:06-08-9141) show that overnight the IP-195 unit loses 1°C for every 6.43 degrees difference between the tank and outdoor temperature.
- At -30°C outside temperature and a tank temperature of 40°C, the tank loses ~ 10.1°C overnight.
- At -30°C outside temperature and a tank temperature of 20°C, the tank loses ~ 7.77°C overnight.

The data above demonstrates that the solar tank itself will never freeze because:

1. The tank receives heat daily even during overcast conditions.
2. Tank heat losses overnight (16 hour period) are about 10°C by a ΔT of 70°C.
3. Water at 0°C doesn't freeze instantly because the latent heat in the water has to be removed first in order for the water to change its state from fluid to solid. For 150 litres of water at 0°C the amount of latent heat that needs to be removed before it freezes solid is about 335,000 kJ (or 31,753 BtU). This is approximately the same amount of energy a furnace with a capacity of 60,000 BtU/h can produce in ½ hour.

The yellow portion of the bars in the diagrams below demonstrate the daily measured solar contribution of the system. This specific household would be considered a conserver household in hot water use: 3 showers a day, occasional dishwasher use, occasional hot bath and weekly warm water laundry. On average, they used 200 litres of hot water per day.