

Why Add a Tank to a Tankless Water Heater?

Instant water heaters save energy and offer endless hot water, but not without some problems. A small tank and a big pump can fix the flaws.

BY MICHAEL CHANDLER

Mention tankless water heaters in a room full of plumbers, and the language can get heated pretty quickly—and that language isn't pretty.

Also known as demand water heaters, these compact units have long been used in Europe and in other parts of the world where energy costs are high. Here in the United States, we early adopters remember that in the 1980s, we installed units that roared like jet engines. The slower the hot water ran, the hotter it got, so adjusting the water temperature in the shower was often a challenge. Many of us installed tankless water heaters only to go back later to replace them with tank-type units.

Today's tankless heaters have better control circuitry and perform more efficiently than older models. My company installs a gas or propane tankless water heater in every house we build (electric models don't deliver the performance we need). We have many happy customers, but we've learned that it's not enough simply to replace a tank-type water heater with a tankless water heater.

Cold-water surprise effect

Picture this: The plumber has just finished hooking up a new high-efficiency gas-fired



No floor space required. Because the water-heating system is so compact, it can fit comfortably in a crawlspace.

tankless water heater. Dad jumps in the tub and enjoys his shower, hot to the last drop. Five minutes later, Mom hops in. The water in the pipes under the house is still warm because the pipes are insulated, but the heat exchanger inside the water heater is dead cold. When Mom turns on the hot water, the burners in the heater go to work making hot water, but the cold water is out of the gate and heading straight for

Mom. She is well into her shower when a slug of cold water hits. "Yow!" she cries. "This energy-efficient water heater isn't so great after all!"

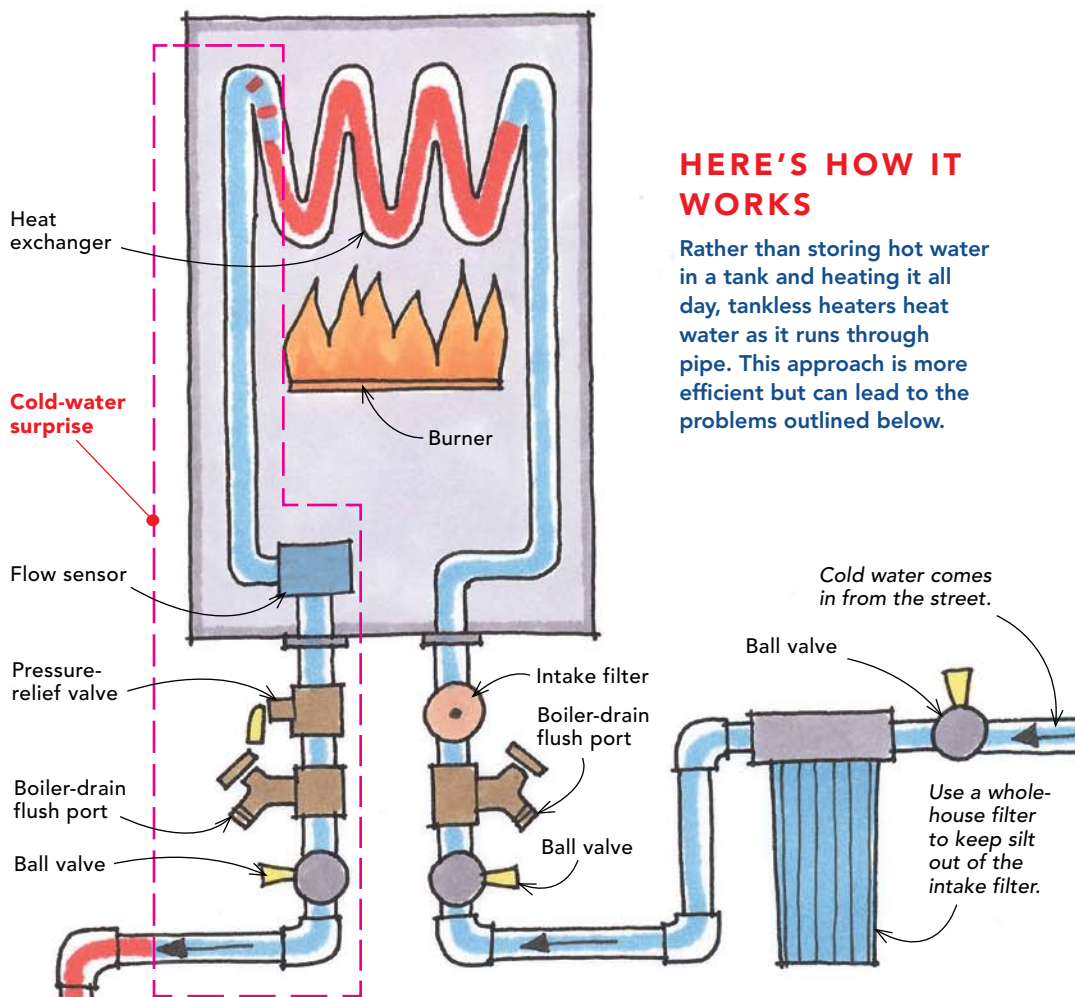
There's an easy solution to this problem: Place a small (10-gal.) electric water heater in line between the tankless water heater and the point of use. The heavy lifting of heating the cold water is done by the tankless water heater, giving you endless hot water. Before the slug of cold water from the tankless heater reaches the showerhead, it mixes with the hot water in the small tank, preventing the icy blast. By locating the small tank in a closet or under a vanity in a bathroom, you can enjoy the convenience of instant hot water with the efficiency of the tankless water heater.

Drooping-pressure effect

The small-tank solution above can solve one problem with tankless water heaters, but it doesn't solve another: the fact that a water heater's output is limited by its heating capacity, measured in Btus per hour.

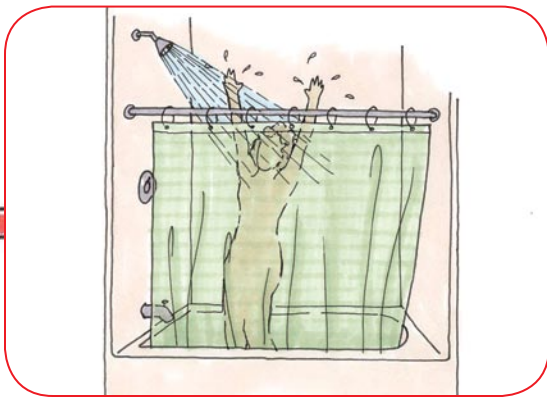
The warmer the water is as it enters the heater, the easier it is for the heater to keep up with demand. With incoming water at 45°F, a 195,000-Btu-per-hour heater produces approximately 5 gal. per minute (gpm). Even with warmer water coming in, the output is limited, though not as much. If two people want to use hot water at the same time, this

Tank versus tankless water heaters



HERE'S HOW IT WORKS

Rather than storing hot water in a tank and heating it all day, tankless heaters heat water as it runs through pipe. This approach is more efficient but can lead to the problems outlined below.



PROBLEM #1

Because the pipes typically are insulated but the heat exchanger isn't, the water inside the heater cools more quickly than the water in the pipes beyond the heater. This cold water making its way through the pipes is an unpleasant surprise to an unsuspecting shower-taker.



PROBLEM #2

Heaters can heat only so many gallons of water per minute. If a dishwasher is turned on during a shower, the hot water is split between the two uses, reducing hot-water pressure to each.

COST

- Tankless: \$300 to \$1500
- Tank: \$200 to \$900

INSTALLATION

- Tankless water heaters are much smaller and can fit almost anywhere. They're designed to be mounted on a wall. Gas-fired units require exhaust venting.
- Tank heaters require a closet or basement-floor area.
- If you replace a tank with a tankless heater, both the gas line and the venting usually need to be increased because the heating elements are much larger in tankless heaters than in tank-style units.

MAINTENANCE

- Upkeep on tank-type heaters is simpler, and it's easier to find people who can work on them.
- Parts for tankless heaters are more difficult to get.
- Tank heaters are more tolerant of hard water. Lime buildup in tankless heaters cuts efficiency; adding flush ports allow the heater to be cleaned with white vinegar.

DURABILITY

- A tankless heater generally outlasts an unmaintained tank type.

OTHER FACTORS

- Tank heaters are less likely to be damaged by freezing weather than tankless heaters are.
- Tankless heaters pose less risk in an earthquake (less weight to restrain).

For a detailed discussion of tank vs. tankless water heaters, see *FHB* #191 or visit www.finehomebuilding.com.

5 gpm will be diminished, dropping the pressure in the hot-water line, but not the cold.

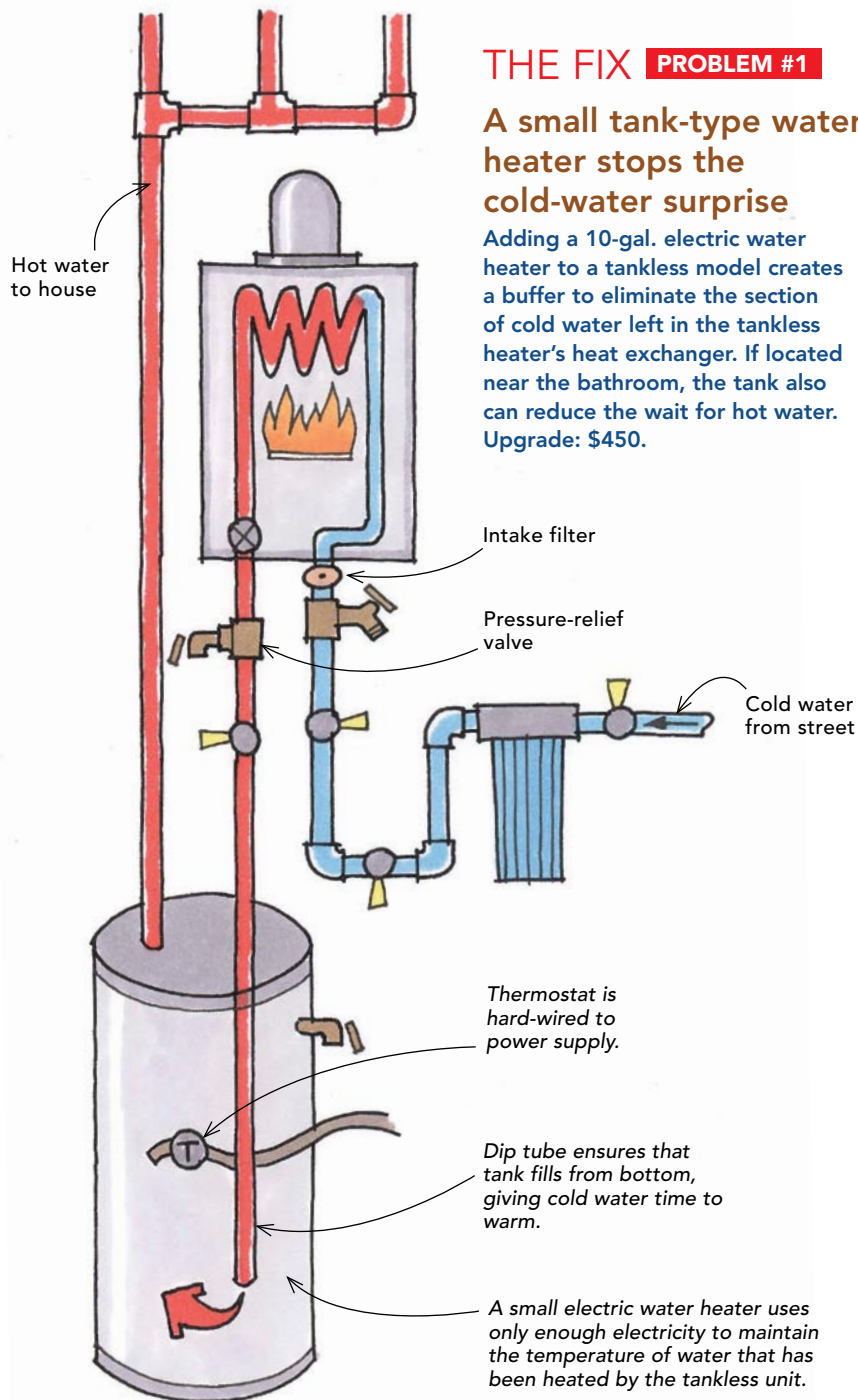
The hypothetical scenario plays out like this: Mom is in the shower, recovering from the cold-water surprise, when Dad turns on the dishwasher. Suddenly, the 5-gpm hot-water capacity is split between Mom's shower and Dad's well-intentioned dish-washing. With the supply of hot water cut in half, Mom's shower will either get noticeably colder or (if the shower has a pressure-balancing valve) diminish to a trickle as the cold-water supply is automatically reduced.

This problem is solved by adding a pump and a tank to the tankless water heater. I rewire the thermostat in a small electric water heater to be used as a switch to control a pump that circulates water from the tank, through the tankless water heater, and back to the tank. When the water in the tank becomes cold, the thermostat turns on the pump and refills the tank with hot water from the efficient gas tankless water heater.

Now hot water is being pushed out of the tank by cold water coming in from the well or the city without first having to go through the tankless water heater. This means that the hot-water pressure at the tap no longer relies on the capacity of the tankless water heater. Hot and cold are now available at the same pressure and flow rate. No more pressure lags, no cold-water surprise, and all the benefits of the energy-efficient endless hot water of the tankless system.

Fine-tune the system with a tempering valve

I use a big pump (a Taco 009 or the equivalent; see "Sources," facing page) because I want water to flow through the tankless water heater quickly to reheat the small tank in as short a time as possible so that the pump will shut down and the gas flame will go out quickly. To achieve this brief burn time, I turn the tankless water heater's thermostat up to about 140°F while leaving the tank thermostat set at 125°F. When the water in the tank drops below 125°F, the pump turns on and starts filling the tank with hot water. The quicker the tank gets back up to temperature, the shorter the flame burns, and the more efficiently the tankless water heater converts the energy in the propane to hot water. Now the pump and the tankless water heater will be activated infrequently, but because the tank temperature will fluctuate from 125°F to 140°F, I install a tempering



THE FIX **PROBLEM #1**

A small tank-type water heater stops the cold-water surprise

Adding a 10-gal. electric water heater to a tankless model creates a buffer to eliminate the section of cold water left in the tankless heater's heat exchanger. If located near the bathroom, the tank also can reduce the wait for hot water. Upgrade: \$450.

valve on the output to the house to keep the domestic hot water at a safe 125°F.

With a tank of reliably hot water, I can easily add a recirculating hot-water loop to keep Mom from having to wait for hot water at the master bath.

Will a tankless heater pay for itself?

Whether all this extra work pays for itself depends on your behavior. If you have a tank-type water heater, you're probably used to limiting the length of your showers so that you don't run out of hot water. With a tankless system such as this one, you'll never run

out of hot water—even with several teenagers in the house. Of course, this might prompt family members to take more and longer showers, negating some energy savings.

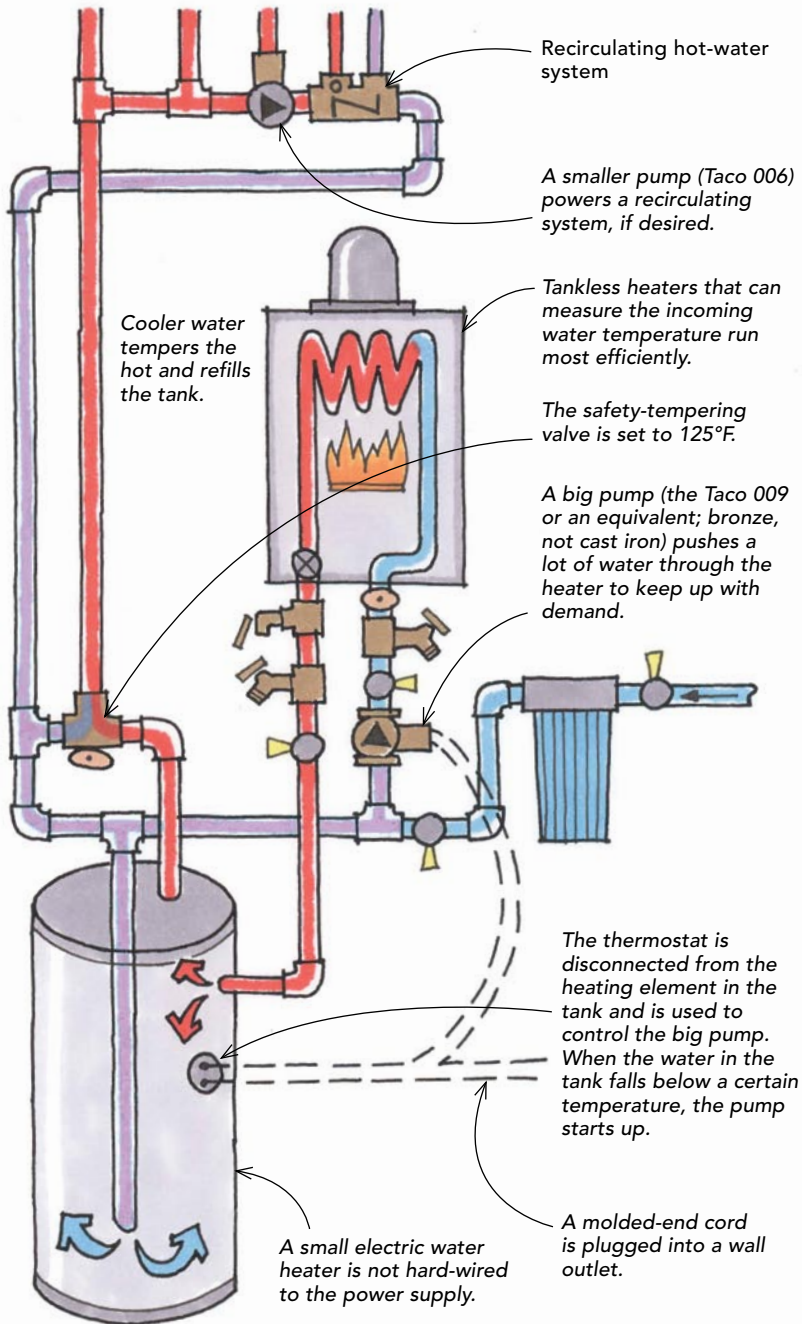
The best thing about a tankless water heater is probably the peace of mind it affords. Your supply of hot water is endless, but you're paying little or no money to heat water when it's not being used. Of course, a \$300 tax incentive is another bonus (www.tanklesstaxcredit.com). □

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THE FIX **PROBLEM #2**

A big pump provides all the hot-water pressure you need

When the dishwasher is turned on during a shower, the hot water is split between two uses, which reduces the pressure. This usually translates into a lukewarm shower. Adding a large pump to the system pushes enough water through the tankless heater and into the tank to satisfy the needs of multiple hot-water users simultaneously. Upgrade: \$650.



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To boost the value, Michael Chandler often adds a solar water heater and radiant-floor heat to tankless water-heater systems. To see how these elements fit together, visit our Web site.

RECIRCULATING LOOPS CAN SOLVE ONE LAST PROBLEM

A lot of cold water can go down the drain while you wait for endless hot water. You can save gallons and gallons of water by keeping that hot water handy with a recirculating loop. These loops are either automatic (timer- or temperature-activated) or switch-activated (motion sensor or manual). See *FHB* #183 or www.finehomebuilding.com for more.

Timer-controlled systems

The Grundfos and Laing systems keep water at a steady 90°F to 100°F between the water heater and the farthest hot-water outlet in the house. Both systems are designed to run for long periods, so they work well on timers targeting high-use periods. While they save a great deal of water, they use energy while you're away and double a family's water-heating cost if the hot-water pipes aren't well insulated. For this reason, neither LEED for Homes nor NAHB's green-building guidelines make these systems eligible for green points. Cost: about \$300.



Demand-activated systems

The more energy-efficient solution is a demand-activated system, which uses a motion sensor or push button to trigger a high-velocity pump that automatically moves hot water to the faucet. Metlund's D'mand system earns both LEED-H and NAHB green points for water as well as energy conservation. It uses a high-velocity pump to push hot water through dedicated 3/4-in. supply lines to the farthest tap. As soon as the water in the tap is warm, the pump shuts off. Cost: about \$500.



SOURCES

Grundfos
www.grundfos.com

Laing
www.lainginc.com

Metlund
www.gothotwater.com

Taco
www.taco-hvac.com

Uponor
www.uponor-usa.com