

INDIRECT-FIRED Water Heaters

For homes heated with a boiler, adding an indirect tank will provide efficient, reliable hot water



by John Vastyan and Rich McNally

Indirect water heaters may be the most important technology enhancement to enter the residential hot water industry in the past 30 years. Two key needs have driven demand for these useful and practical heating units: fuel efficiency and an ever increasing desire for more hot water. Hot tubs, large baths, multi-head showers, and bigger homes with more bathrooms have increased America's appetite for hot water, and indirect water heaters can satisfy the need faster than any other technology.

Water Heating Choices

Before the advent of indirects, the options for heating domestic potable water included conventional direct-fired units or boiler-integrated "tankless coils."

Direct-fired water heaters (electric-, gas-, or oil-fired) are by far the most common technology, primarily because they have the

lowest front-end cost. They have their disadvantages, however.

While electric water heaters are almost 100% efficient, operating costs can be high, especially given the demands of a large, modern custom home.

Fossil-fuel tank water heaters are typically inefficient, unless they're specifically designed for high efficiency, which means a substantially higher expense on the front end. Also, the difference in temperature between the combustion passages and the large tank of relatively cool water above or around them, depending on design, puts a lot of stress on metals and glass linings. That causes fatigue and shortens life span. This is especially true when they are harnessed for use as a heat source, because they really aren't designed for that much duty.

All tank-type water heaters collect precipitates. The incoming water slows suddenly, heats up, and gives up its mineral particulates, which fall to the bottom, insulating the tank from the heat source over time, adding to thermal stress, and decreasing efficiency.

Tankless coils. Although they're inexpensive, internal tankless coils, in either a gas or an oil boiler, are inefficient. As early as 1935, advertisements promised "free hot water" during the winter, but there was a cost penalty for having to fire the boiler all summer long to produce domestic hot water. Laboratory tests in the 1950s showed that tankless heaters with large-volume boilers were only about 18% efficient during the non-heating season.

Today's tankless units, like earlier models, rely on internal boiler convection and very high boiler temperatures. Because their gasketed attaching plates are made of metals dissimilar to the boiler's, over time they all leak at least a little, usually onto sensitive components. They're also notoriously troublesome because, as hard or otherwise untreated water passes through them, the super-heated coils collect mineral deposits that quickly diminish coil efficiency and then require costly acid bath cleanings.

Indirect-fired units, on the other hand, take advantage of the high efficiency and the inherent sturdiness of modern hydronic boilers by

becoming an attached "zone." This arrangement directs the boiler's power to heating potable water in a well-insulated tank but without the stress on the tank common in direct-fired units.

As an indication of their efficiency and their ability to produce hot water, many indirect-fired water heaters provide two to four times the recovery rate of gas-fired water heaters. They also offer two to three times the peak flow of a tankless coil, and three to six times the peak output of comparably sized electric water heaters.

With indirects, the simpler tank designs and lower temperature difference between the heating medium and heated potable water also allow for the use of potentially longer-lasting tank materials like plastics, cupronickel, and stainless steel, as well as high R-value insulations for optimal storage efficiency. Some indirect tanks have a glass or stone lining to protect the steel from corrosive electrolysis and natural oxidation. Most indirects do not require the use of a mixing valve, allowing better flow rates and fewer mechanical issues in the flow.

Sizing an Indirect-Fired Tank

The most common problem with indirect-fired units is undersizing. The indirect tank is typically the single largest zone attached to the heating plant and the most noticed if underpowered. It takes a tremendous amount of energy to heat water enough to raise its temperature 90 or 100 degrees at a flow rate sufficient to satisfy the modern family.

Proper sizing starts with the boiler. Most 30- to 40-gallon tanks with a 15- or 20-square-foot EDR (equivalent direct radiation) coil can absorb a boiler output of 120,000 to 130,000 Btu, generally lots more than the average home's heat load. Thus, sizing the boiler to match the heating load rather than hot water needs can obviously adversely affect the indirect's performance.

What may not be quite as obvious is how critical it is to properly size the circulator pump and piping, and to use controls that give priority to domestic hot water when necessary. If the pipe and pump are too small and there's no priority control, there won't be enough hot water, no matter how big the boiler is.

Shopping for an Indirect Water Heater

Indirects, like many other popular products, are available in a wide variety of configurations and sizes from a number of European and domestic manufacturers, each claiming superiority in some way or other. There are similarities and vast differences among them.

Most use a heat exchanger coil submersed in the potable water that's to be heated. There are a diversity of coil profiles and materials. Among the best — and most expensive — is cupronickel, a copper alloy with good heat-transfer ability as well as good resistance to metal fatigue.

The coils are often finned to add surface area for more efficient heat transfer in a shorter length of tube. Some manufacturers claim that the fins lead to premature accumulation of precipitates, so they use a smooth-surfaced tube. To boost efficiency and output, these makers must use a longer tube, replicating the effective area for heat transfer.

Little standby loss. All of the leading manufacturers of indirect units insulate their tanks very well. Most claim losses of 2 degrees or less per hour during standby; some measure heat loss at less than $1/4^{\circ}\text{F}$ per hour. No water heater connected to a flue and chimney can make that claim.

Among the many indirect manufacturers, tank sizes range from 20 to 120 gallons and more. Prices vary greatly, with a range at the 40-gallon size from \$500 to \$2,000, and from \$1,000 to \$4,200 for 120-gallon units. The wide variance in pricing is due to quality of craftsmanship, accommodation for faster heat recovery, ease of installation and maintenance, resistance to deterioration and mineral buildup, integration with boiler controls, efficiency, standby losses, and expected service life.

These price ranges do not reflect differences in installation labor, which can be substantial. It's always good to seek an opinion from two or three installing professionals. Just be sure that they specialize in hydronic work.

It's worth mentioning that some of these suppliers are chiefly boiler manufacturers; the indirect-fired lines — whether they manufacture these as well or

supply tanks made by others — are designed to complement their boiler systems.

Amtrol

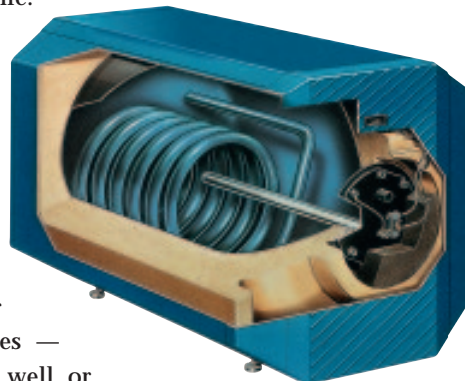
Amtrol's BoilerMate indirect unit uses a cold-water inlet that radially dispenses the water into the tank. According to the manufacturer, this reduces the mixing of stored hot water with the incoming cold water, allowing up to 87% percent of the tank's hot water storage volume to be used at temperature.

The BoilerMate's thermostat is positioned to activate the boiler and circulator after 20 gallons have been withdrawn. The heat exchanger is a finned copper material that permits high heat transfer. Amtrol claims that its vertical cylindrical coil creates a convective "chimney effect" that causes high flow rates around the coil, keeping it clear. The heat exchanger creates thermal layering that sends the hottest water to the top of the tank, where it's then drawn for domestic use.

Contact: Amtrol Inc., 800/736-1149, www.amtrol.com.

Buderus

Buderus's Thermoglaze tank capacities range from 36 to 251 gallons. The company states that its glass and steel tank coating provides safe protection against all forms of corrosion. Thick magnesium anode rods draw corrosion away from the tank wall; an optional electric anode is available. Among the best-insulated units available, Buderus tanks lose less than $1/4^{\circ}\text{F}$ per hour. Their large-diameter heat exchanger coil increases with tank volume. Buderus



offers both horizontal and vertical tanks (the vertical units provide the best recovery rates). All tanks have an easy-access cover with a reusable gasket for coil cleaning and interior tank cleaning. Tanks come with screw-in feet for leveling.

Contact: Buderus, 800/283-3787, www.buderus.net.

Burnham

Burnham Corporation's Alliance water heaters are well matched to its primary boiler line. The units are available in five sizes: 26, 40, 53, 79, and 119 gallons. A stainless-steel tank design ensures long service, and the smooth-surface, open-wound stainless coil offers excellent heat transfer to the domestic water in the tank. The tank's outer two shells sandwich an expanded polystyrene insulation. That changes with the largest unit, in which soft foam insulation is used. An inspection and cleanout opening is conveniently located. As with many indirects, these units can be installed in a modular or tandem arrangement to meet higher demands.

Contact: Burnham Corp., 877/567-4328, www.burnham.com.

Ergomax

Ergomax indirect-fired units — more accurately termed “external tankless coils” or “heat exchangers” — are unique in that the tank is filled with boiler water and domestic water flows through multiple coils. Boiler water is kept in turbulent motion. Domestic hot water is not stored but produced instantaneously when needed, as it passes through several 50-foot copper coils surrounded by boiler water. According to the manufacturer, laboratory tests show that this design bumps heat-transfer efficiency to an astounding 99%.

The tank that's heated by the boiler is a closed loop. So, except for a very small amount of make-up water, no new minerals or oxygen ever

enter it. This reduces the risk of scale buildup and, with no new oxygen in the water, avoids corrosion. The constant water turbulence prevents stratification and cold spots. Standby loss is less than 1/2°F per hour. There are five models to choose from: 20-gallon (with three coils), 30-gallon (four coils), 45-gallon (five coils), 65-gallon (five coils), and 100-gallon (nine coils).

Model E20 comes with an aquastat, an ASME temperature-pressure relief valve set at 30 pounds, and a drain cock. Larger Ergomax models come with an aquastat and pressure relief valve, plus a temperature-pressure gauge and ball drain valve. Higher-pressure relief valves may be installed.

Contact: Group Thermo, 908/281-1005, www.ergomax.com.

Heat Transfer Products

Heat Transfer Products manufactures the SuperStor, made of high-grade 316L stainless steel with cupronickel coils. Two-inch-thick polyurethane foam insulation and good heat transfer within the unit keep heat loss to less than 1/2°F per hour. The Superstor is so efficient that it has a first-hour rating (the amount of water produced in an hour) of 140 gallons for the 30-gallon model, which is greater than that of many 80- to 100-gallon direct-fired water heaters. The Superstor is available in 24 models. Easy maintenance is an HTP hallmark.

The company's newest product, the SSU-45, is a 45-gallon tank that contains a beefy 1 1/4-inch finned cupronickel coil, which provides low pressure drop at very high efficiency. Cold water entering the tank is directed at the coil to ensure a debris-free surface. Because the coil is so low in the tank, air stays out and good thermal layering is maintained.

Contact: Heat Transfer Products, 800/323-9651 (508/763-8071 in Mass.), www.htproducts.com.

Lochinvar

Lochinvar's Efficiency Mate heats domestic water when fluids pass through the internal heat exchanger, a double-wall highly conductive tube that surrounds the storage vessel. The Efficiency Mate features a heavy-gauge, glass-lined tank, a magnesium tank saver, factory-installed dielectric nipples, and a built-in



thermostat. The unit's ample insulation reduces standby loss to less than 1/2°F per hour. It's available in four sizes: 40, 50, 65, and 80 gallons.

Contact: Lochinvar, 615/889-8900, www.lochinvar.com.

Peerless

Peerless units transfer boiler-generated heat through the use of cupronickel, fin-tube heat exchangers. According to Peerless, the coil is highly resistant to scaling deposits and is positioned so that entering water provides a "scrubbing action," eliminating the need for chemical



cleanings. Domestic hot water is stored in a heavy-duty 316L stainless-steel tank. Two-inch foam insulation keeps the water hot with a standby loss of less than 1/2°F per hour. These units come equipped with an adjustable, well-type Honeywell control and a T&P relief valve as standard equipment. Peerless indirects are available in 37-, 57-, 77-, and 119-gallon sizes.

Contact: Peerless, 610/367-2153, www.peerless-heater.com.

TFI Everhot

TFI Everhot's Therma-Flow Advantage Series combines a durable stone lining with a removable copper, finned heat exchanger. Stone lining has proven itself over the years as an excellent safeguard for domestic hot water vessels. It's highly resistant to hard water, high temperatures, and additive chemicals. The removable copper heat exchanger is located

directly in front of the unit. TFI units are available in 30-, 40-, 65-, 80-, and 120-gallon single heat exchanger models and 80- and 120-gallon double heat exchanger models. A 40-gallon low-profile model is also available.

Contact: TFI Everhot, 800/654-8045, www.tfi-everhot.com.

Thermo2000

Like the Ergomax units, the Thermo2000's Turbomax indirect-fired tanks work opposite the way many other units work. Rather than being stored in the tank, domestic water circulates through giant copper coils surrounded by boiler water. Domestic hot water is produced instantaneously as it passes through the coils. Inside each end of the Turbomax is an injector with perforated walls. The top injector creates multiple swirling jets that bathe the copper coils, spreading boiler water evenly throughout the tank to enhance heat transfer.

The tank heated by the boiler is a closed loop, so, as with the Ergomax, the risk of scale buildup and corrosion is greatly reduced.

Contact: Thermo2000, 888/854-1111, www.thermo2000.com.

Triangle Tube

Triangle Tube's Phase III indirect-fired water heater solves lime buildup challenges by imposing a tank-in-a-tank water barrier between the source of heat and the domestic water. A corrugated stainless-steel inner tank eliminates the need for coils and ensures excellent heat transfer and rapid recovery. The Phase III is available in 40, 45, 60, 80, 90, and 100 gallons.

Contact: Triangle Tube, 856/228-8881, www.triangletube.com.



Vaughn

Vaughn states that its nonferrous, brass plumbing connections and seamless, 1/2-inch-thick "hydrastone" lining protect the steel tank

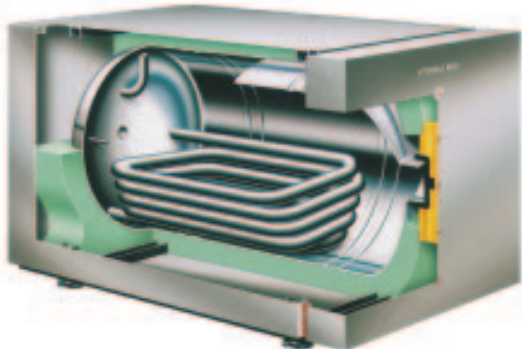
from electrolysis and oxidation. According to the manufacturer, as water enters the tank, it's absorbed into the finely porous stone lining. Initially, aggressive water saturates the stone, reaching the inner wall of the tank. But doing that uses all of the oxygen in the water, changing it to an inert film, now trapped in place to blanket the entire inner tank.

Vaughn introduces the cold domestic water into the base of the tank to reduce stirring of water within the reservoir. A top-mounted, eight-bolt flange permits easy removal of the coil for inspection or maintenance.

Contact: Vaughn Corp., 800/282-8446, www.vaughncorp.com.

Viessmann

Viessmann offers a wide variety of exceptionally well-crafted vertical and horizontal stainless-steel- and glass-lined tanks. The high-alloy stainless-steel tanks are impeccably engineered. Across the product line, sizes range from 42 to 120 gallons. Fast, even heat transfer takes place with the 1¹/₄-inch non-finned heat exchanger coil. The manufacturer's innovative Vitocell-B 300 series can be used for domestic



water heating applications that combine boiler and solar heat sources.

Contact: Viessmann, 800/288-0667, www.viessmann.com.

Weil-McLain

Weil-McLain's indirect-fired heater line offers four residential sizes (30 to 80 gallons) and two commercial sizes (100 and 120 gallons), all with no coil to maintain. The tank-in-a-tank design combines a corrugated stainless-steel inner tank for domestic water and a carbon-steel outer tank for boiler water with a "self-cleaning" design



that reduces calcification within the system. Weil-McLain also boasts the lowest pressure drop in the industry, with no high head pump required for residential applications. Two inches of rigid polyurethane insulation reduce standby loss to less than 1/2°F per hour.

All units come with an automatic air vent and adjustable aquastat. Some also include the drain valve assembly.

Contact: Weil-McLain, 219/879-6561, www.weil-mclain.com. 

John Vastyan is president of Common Ground, Uncommon Communications, based in Manheim, Pa., and specializing in communications for the hydronics, radiant heat, hvac, and home construction industries. Chesapeake, Va.-based Rich McNally has 23 years' experience in the hvac industry and is currently eastern regional sales manager for Watts Radiant, the largest American-owned radiant heat manufacturer.