Kitchen & Bath

Reverse-Osmosis Water Filtration

by John Vastyan

Do your clients trust their drinking water? If they're like a lot of Americans — who spend an estimated $10 billion a year on bottled water — they don't. And their concerns may be justified: According to a recent study by the Environmental Working Group (www.ewg.org), many dangerous contaminants from a wide range of sources can be found in tap water around the country.

So it's not particularly surprising that point-of-use (POU) water-filtration systems — which supply pure drinking water right at the kitchen sink — are becoming more popular. These systems provide water comparable in quality to bottled water, and they do it economically.

Since choosing the right home-filtration system depends on the kinds of pollutants in the water supply, the first step in the selection process should always be to have the water analyzed.

In a point-of-use reverse-osmosis water filtration system, a simple tap is installed at the sink (above), while the heart of the system — a multi-stage filter and a small storage tank — is installed under the sink (right).

Carbon-filtration systems, which are effective at absorbing chlorine and certain other contaminants, are generally the simplest and least expensive to install and operate. But reverse-osmosis (RO) systems — which rely on the technology used to process Coca-Cola's Dasani and Pepsi's Aquafina bottled waters — are widely considered the best solution for problematic water. Ranging in cost from $200 for a basic unit to more than $1,000 for a full-featured installed unit, RO systems are the fastest-growing form of in-home water treatment in the United States.

How RO Works

Reverse-osmosis systems filter out pollutants by using household water pressure (or sometimes pressure supplied by a small pump) to push water through a selective semipermeable membrane. Most residential RO systems contain polyamide thin-film-composite (TFC) membranes, which are pricier than cellulose triacetate membranes but also stronger, more durable, and more effective at blocking a wider range of compounds. TFC membranes usually last for two to five years and cost roughly $100 to replace.

Since RO membranes can be damaged by — or are ineffective against — certain contaminants, most RO systems incorporate other types of filtration as well. For example, in typical four- or five-stage point-of-use RO systems, water drawn from the sink's cold-water supply first flows through a polyester or polypropylene fiber sediment filter, which traps suspended dust, dirt, sand, rust particles, and other larger particles that would otherwise clog or tear the RO membrane (see illustration, next page). This filter needs to be replaced either semiannually or when it becomes clogged enough to reduce water pressure within the RO system.

Next, the water passes through either granular

activated carbon or a carbon block cartridge — or both, depending on the system. Chlorine and other oxidizing chemicals will damage TFC membranes, so activated carbon prefiltering is necessary when those chemicals are present in the water. Some systems have an additional carbon block cartridge; this helps remove high levels of organic chemicals, including some volatile organic chemicals (VOCs) and pesticides, as well as foreign tastes and odors. These filters also require periodic replacement.

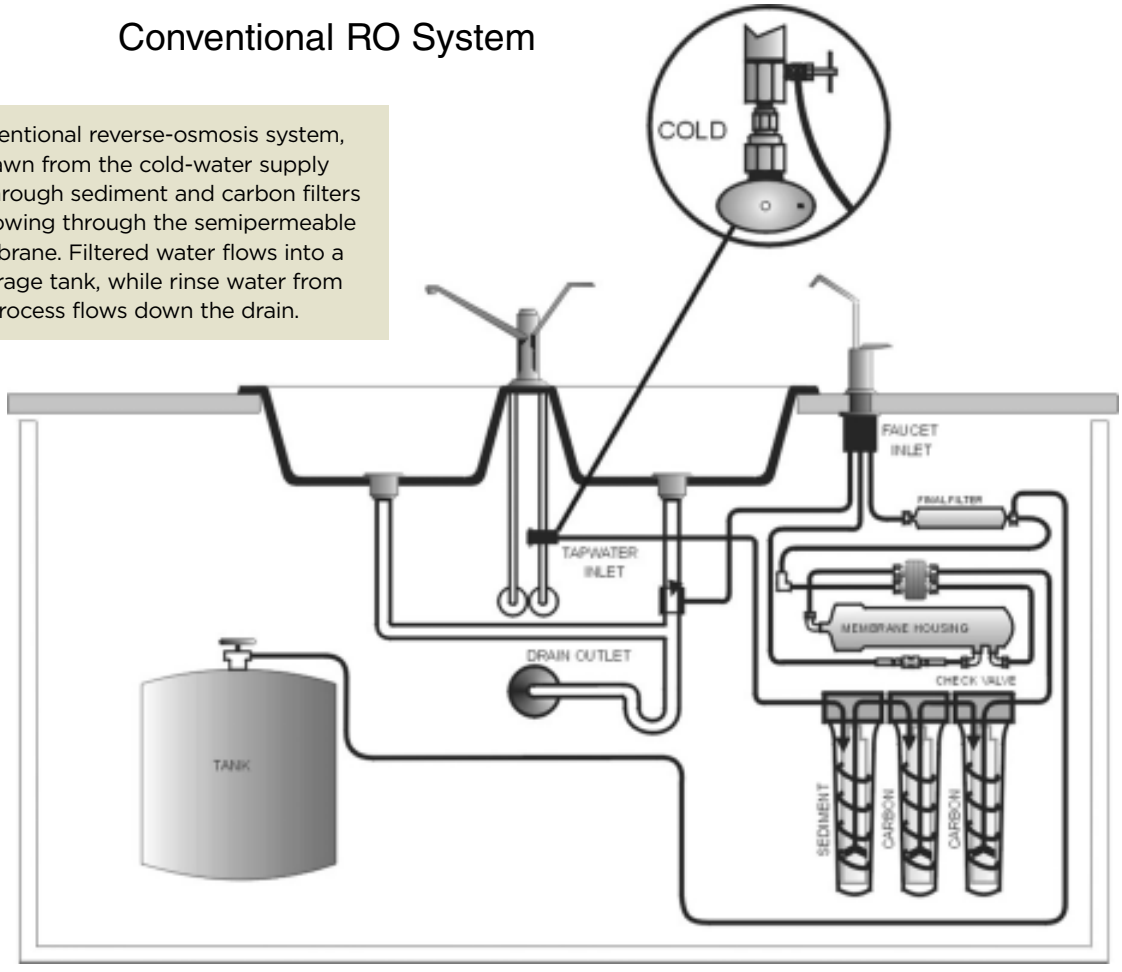
Water then flows through the RO membrane. Osmosis is the process by which two equally pressurized fluids containing unequal concentrations of a substance try to reach equilibrium through diffusion across a semipermeable membrane; in reverse osmosis, pressurized water is forced through a membrane that blocks up to 98 percent of the total dissolved solids, metals, salts, and other contaminants contained in it.

To prevent water from flowing around the membrane, a flow restrictor mounted on the drain line exiting the RO module creates back pressure. As a result, in addition to the small stream of purified water passing through the membrane, there is a a larger 'rinse' stream that carries the rejected contaminants — such as arsenic, copper, iron, lead, chromium, fluoride, radium, cyanide, nitrates, viruses, and

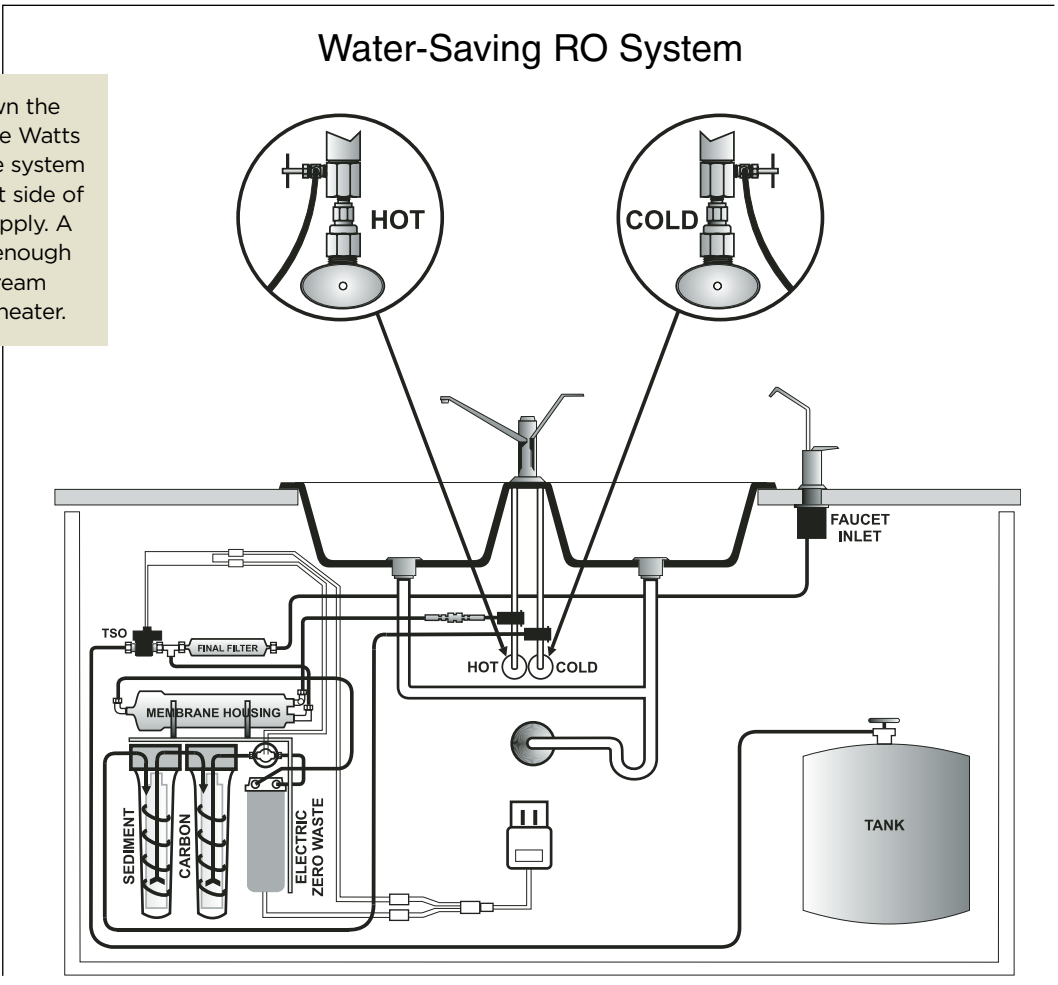
Installation of an RO system is straightforward. To supply water to the RO filter, an adapter with a 1/4-inch needle valve is added to the cold-water supply under the sink, while wastewater is routed to either the drain or — in a ZeroWaste System — the hot-water supply.

Conventional RO System

In a conventional reverse-osmosis system, water drawn from the cold-water supply passes through sediment and carbon filters before flowing through the semipermeable RO membrane. Filtered water flows into a small storage tank, while rinse water from the RO process flows down the drain.



Instead of flowing down the drain, rinse water in the Watts Pure Water ZeroWaste system is recycled into the hot side of the domestic water supply. A small pump provides enough pressure to push upstream toward the hot-water heater.



bacteria — down the drain.

Reverse osmosis is a gradual process; it takes as long as five hours to produce three gallons of purified water. To store the purified water until it can be used, the small stream from the RO module flows into a small plastic or stainless steel storage tank.

When water is called for at the RO tap, it passes from the storage tank through a final polishing carbon filter, which removes any residual taste or odors. An automatic shut-off valve (ASOV) stops the inlet water flow to the RO filtration system when the water storage tank is full. As water is drawn from the storage tank, this ASOV activates additional production of RO water.

Recycle the Rinse Water

Many RO systems use as many as 20 gallons to produce just one gallon of purified water; even the most efficient residential systems can require four to five gallons of water for every gallon produced. In most cases, this rinse water simply flows down the drain.

However, one product — Watts Pure Water's ZeroWaste System (888/774-7405, www.wattspurewater.com) — routes "wastewater" back into the home's plumbing for nondrinking uses like bathing, dishwashing, and laundry. This is a cost-effective solution for areas with severe water-use restrictions or very high water costs; it's also a good option for jurisdictions where water softener and RO wastewater is prohibited from being drained into an on-site septic system.

In Watts' system, water that has passed through the sediment and carbon prefilters moves through a solenoid valve and pump before going to the membrane inlet (see illustration, above). This pump, which is also used to drive water across the RO membrane, pushes the rinse water back into the hot-water supply via a needle valve installed at the sink's hot-water angle stop. From there, the rinse water flows back toward the hot-water tank as it's reintroduced into the domestic water supply.

To meet IAPMO (International Association of Plumbing and Mechanical Officials) approval, two check valves mounted

downstream from the flow restrictor outlet prevent hot water from reaching the RO membrane if there is a surge or back pressure in the hot-water system. (For backflow prevention, codes require air-gap faucets to be used on standard RO systems.)

A pressure switch coupled to the solenoid valve at the pump shuts off the incoming water supply when the tank is full and activates the system when the water is drawn from the RO tap.

Depending on RO system capacity and water-usage habits (consumption of RO drinking water in a typical household averages 1½ to 4 gallons per day), a ZeroWaste system may recycle 10 to 20 gallons or more of rinse water into the domestic water supply daily, rather than sending that amount down the drain.

When the system is in use, there may be a slight drop in the hot-water supply temperature. And if there is a check valve used on the hot-water heater, the system will not function properly.

Cautions

In all RO systems, performance depends on water pressure, water temperature, and incoming water quality. Membrane output ratings are calculated assuming a system pressure of 60 psi and a water temperature of 77°F, but cold well water or low pressure can reduce daily water output considerably, factors which must be considered when sizing an RO system.

Clogged filters can reduce system pressure and performance, too, which is one reason they require routine replacement.

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High-Temp Team.

Front-loading washers are quickly catching on for their convenience, superior cleaning capability, and conservation of water. *Duet Sport* washer-and-dryer pairs come in two versions, standard and "HT," a high-temperature sanitizing option. The units may be stacked or installed on optional 10- or 15 1/2-inch-high pedestals for improved access. Prices for the standard washer and dryer are $800 and $700, respectively. HT models cost $1,000 and $800.

Whirlpool, 800/253-3977, www.whirlpool.com. **Circle #1**

No Vent Required.

What beats stacking when space is at a premium? Compacting. The *WM3632HW Washer/Dryer Combo* merges a washer and a dryer in a single box containing a large 3.72-cubic-foot stainless steel drum and a direct-drive motor. With its ventless condensing drying system and 110-volt hookup requirement, this unit can be installed wherever you can run water lines and a drain. Its suggested retail price is $1,899.

LG Electronics, 800/243-0000, www.lgusa.com. **Circle #2**

Shut Out the Noise.

Though appliance makers are producing increasingly quiet machines, there is another option for homeowners reluctant to replace their loud but otherwise functional units. The *ProCore Quiet Door* is designed to muffle the sound of the washing machine chugging away in the next room; the manufacturer claims a sound-transmission class (STC) rating of 31, which is about 50 percent quieter than hollow-core interior doors. The molded doors come in two styles — Rockport (above) and Santa Fe (far right) — and cost $100 to $150 apiece.

Jeld-Wen, 800/877-9482, www.jeld-wen.com. **Circle #3**

Environmental Upgrade.

For your next comfort-seeking client, consider creating a self-contained shower enclosure equipped with a *Steam-Shower Generator.* Options include a retractable, aromatherapy-capable steam head; a stainless steel steam generator that can be installed up to 50 feet from the shower; and a remote or wall-mounted control unit. Steam systems are priced according to specific model and component selections.

ThermaSol, 800/776-0711, www.thermasol.com. **Circle #4**

Easy In, Easy Out.

Enhanced access and usability is what it's all about in universal design. Attributes like a low-threshold entry, a fold-down seat, and built-in grab bars make this one-piece *836561A-R/L* acrylic stall wheelchair-friendly. The unit comes with a textured floor, a self-caulking drain, and a curtain and rod; an integral anti-microbial agent in the wall material helps prevent mildew and bacterial growth. At 64 1/2 inches wide by 61 inches deep, the stall sells for $3,728.

Aqua Glass, 731/632-2501, www.aquaglass.com. **Circle #5**

Custom Components.

Adjustable interlocking corner posts allow for complicated angles in *Paragon* custom-designed showers. Homeowners can choose from a variety of frame finishes — oil-rubbed bronze is shown — and glass patterns. Deluxe details include through-glass handles and towel bars. Shower prices vary by configuration.

Coastal Industries, 800/874-8601, www.coastalind.com. **Circle #6**