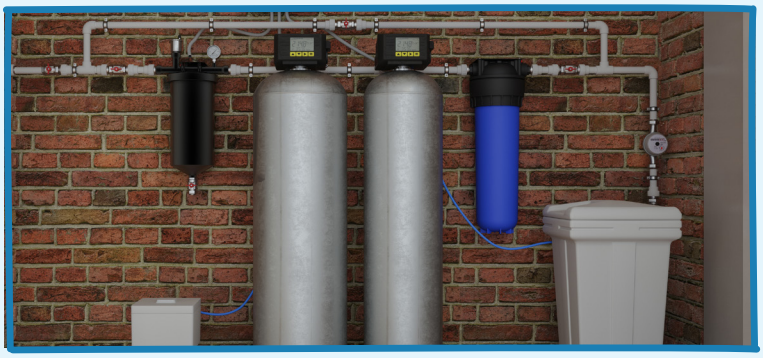
Soften Water Without Wasting It



Guide to Selecting and Maintaining a Water-Efficient Water Softener

EPA WaterSense

Installing a water softener can reduce the effects of hard water.

Many homes in the United States are located in regions with hard water. While hard water is not a health concern, it can allow scale buildup on plumbing fixtures and appliances and damage your home's plumbing system. Washing with hard water can also leave a residue on dishes and clothes and make it difficult to lather up soap. Home water softeners are an effective way to reduce hardness in water; however, these appliances can waste a fair amount of water in the process of treating it and create a salty brine that may pose problems for wastewater treatment and local water quality.

Proper selection and maintenance can ensure your water softener doesn't create more waste than necessary. The U.S. Environmental Protection Agency's (EPA's) WaterSense® program has developed this guide to provide basic information on water softener technology, operations, and maintenance. Selecting the right water softener for your needs and maintaining and operating it properly will ensure your system performs well while minimizing water waste.

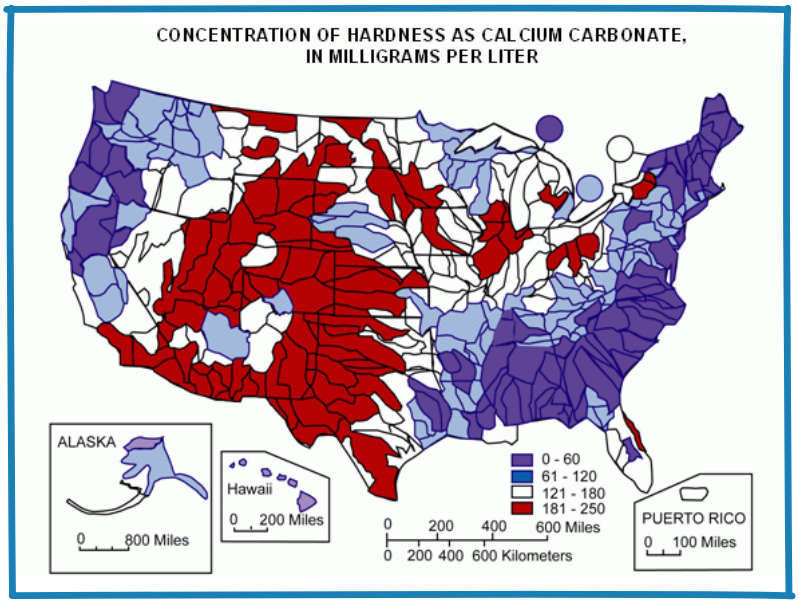
Water: The Hard Facts

In certain geographic areas, water picks up minerals as it flows through rocks, soil, and riverbeds before being collected for use in households or buildings. Hard water has a high concentration of minerals—mainly calcium and magnesium. These minerals make the water "hard" to work with, requiring more soap to lather, creating scaling on surfaces such as pipes, and drying out skin and hair. Hard water is most common in the Southwest and Midwest United States, as well as other areas that rely primarily on groundwater as a water source.

Not sure if you have a water softener? Check your basement; while models vary, a water softener typically consists of two tanks placed side-by-side, one tall cylindrical resin tank and a shorter brine container.

Water hardness is measured as the concentration of calcium and magnesium minerals in water, typically in grains per gallon (gpg), milligrams per liter (mg/L), or parts per million (ppm, which is equivalent to mg/L). Water with a hardness level greater than 120 mg/L (or 7 gpg) is generally considered hard and may benefit from softening. Water softeners are often recommended when hardness exceeds 180 mg/L or 10 gpg.

Hard water causes scale to form on water fixtures, pipes, water heaters, and other appliances. Scaling impedes the flow of water and decreases heat conductivity, meaning that water heaters operate less efficiently. Water heaters, appliances, plumbing valves, and fixtures with scale buildup require more frequent cleaning or replacement to operate properly. Hard water can reduce the life of water heaters, toilet components, washing machines, and other plumbing products and appliances. Hard water often leaves a slimy or sticky feeling on skin and contributes to greater soap scum buildup. In addition, hard water can deposit abrasive minerals on linens and clothing during washing, reducing their lifespan. Water softeners reduce hardness, scale formation, and other negative impacts.



Many regions in the United States experience hard water. This graphic illustrates the water hardness levels in different areas of the country. www.usgs.gov/water-science-school/science/hardness-water

Cation Exchange Water Softeners

Nearly all water softeners rely on ion exchange to remove hardness. Cation exchange is a chemical process that substitutes, or exchanges, sodium ions for the calcium and magnesium ions that cause hardness, softening the water in the process. See more information in the box on the next page.

While cation exchange water softeners are effective at removing the minerals that cause hard water, they can consume a significant amount of water in the process of regeneration. The regeneration process

Hard water can cause scale buildup on appliances such as clothes washers and water heaters, decreasing efficiency and reducing lifespan.

Other Water Treament Types

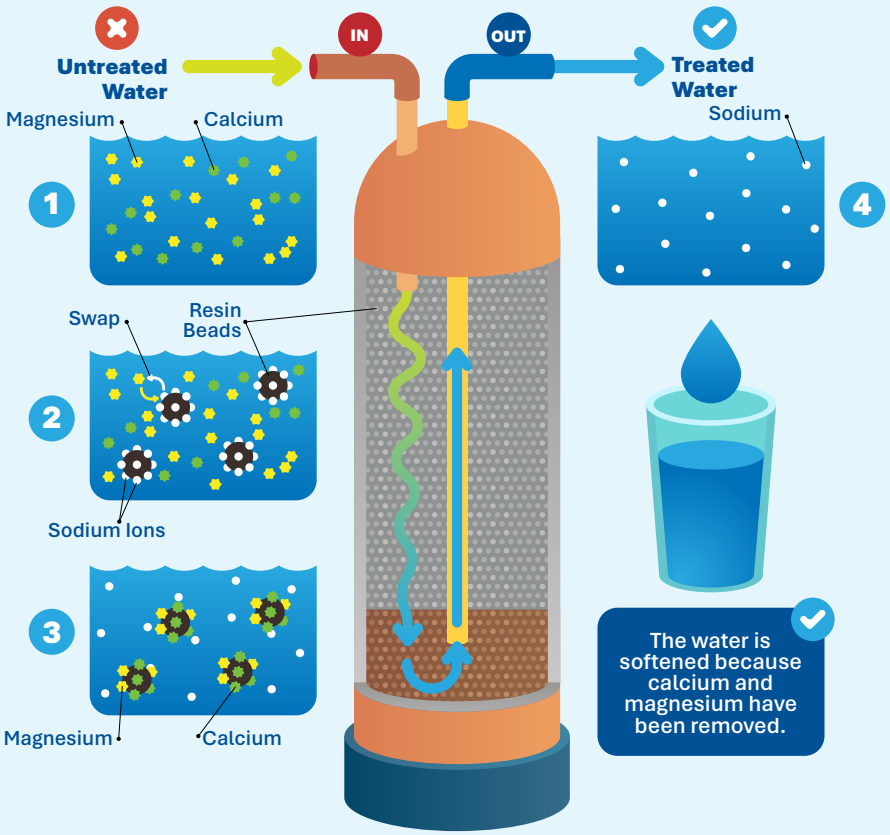
Looking to treat issues other than hardness for healthier and tastier drinking water? View the *WaterSense Guide to Selecting Water Treatment Systems*.

is needed to rinse the resin beads used in the softening process, purging them of hardness ions and replenishing the sodium or potassium ion supply in the resin beads for further softening.

A typical softener uses 20 to 70 gallons of water per regeneration cycle, although some larger systems can use up to 200 gallons. The frequency of regeneration—and therefore the amount of water used—is dependent on the hardness of the incoming water, the rate of water consumption, the hardness removal capacity of the softener, and the system's regeneration design. Efficient softeners can use 4 gallons of water or less per 1,000 grains of hardness removed.

Cation Exchange Technical Overview

In the cation exchange process, the hard water that enters the system contains positively charged calcium and magnesium cations (1). This water passes through a "media tank" filled with negatively charged resin beads with positively charged sodium or potassium ions attached to their binding sites (2). As the calcium and magnesium ions pass through the media tank, they knock the sodium or potassium ions out of place and bind to the resin beads in their place (3). By the time the water passes through all the resin beads, sodium has replaced the calcium and magnesium. The water then exits the media tank as softened water, to be distributed throughout the house or building (4).



Selecting a Water Softener

If your home has hard water, and softening is allowed/necessary, these are some steps you can take to ensure water isn't wasted in the softening process.

Determine whether a softener will address your needs: First, consider whether a water softener is the right treatment system to address your needs. Water softeners are not needed in all homes and do not typically treat for other water contaminants. Only install a water softener if you live in an area with substantial hardness or where a water professional, water utility, or local health and safety code recommends them. Some jurisdictions limit the use of water softeners or impose requirements to minimize water consumption, so be sure to check the water softener requirements in your area.

Where Water Softeners Don't Work

Because cation exchange water softeners discharge salt to the wastewater stream, they can impact local water quality or septic system efficacy. Therefore, some local jurisdictions prohibit the installation and use of these systems. Prior to purchasing an ion exchange water softener, check local restrictions. If your home uses an onsite septic system, check with the septic system manufacturer or a local service provider to ensure installation of the water softener will not overload the system, void the warranty, or otherwise negatively impact the system.

Select the right size for your needs: Water softeners are sized based on grain capacity, or the grains of hardness they can remove per cycle. For example, a 32,000-grain softener can remove 32,000 grains of hardness in a cycle before it needs to regenerate. Both the hardness of your water and your household water use will determine the size of water softener you need.

You can determine the hardness of your water by finding your local water quality report online or having a professional test your water. Review recent water bills to understand your typical household water consumption, and consider water uses that do not require softening (e.g., irrigation). It is important not to oversize your system, as this will lead to inefficient use of water.

Choose efficient technology: Softeners use different technologies to determine when the system initiates a regeneration cycle. Some softeners regenerate after a set period of time regardless of how much water has been treated. Others use demand-initiated regeneration (DIR), where a water meter or hardness sensor will trigger regeneration only after a certain amount of water is used or when a certain hardness level is detected. DIR ensures that the system regenerates only when necessary, which improves salt efficiency and minimizes the water consumed during backwashing. When selecting a softener, avoid time-initiated regeneration systems and choose DIR for a more efficient system.

Look for a certified model: When selecting a water softener, choose one that has been certified to meet the NSF/ANSI 44 Residential Cation Exchange Water Softeners standard, which sets minimum requirements for materials, design, construction, and performance of residential cation exchange water softeners. Selecting an NSF/ANSI 44 certified system assures that the product has been tested in a professional laboratory and meets industry standards.

Consider both water and salt efficiency: To ensure the most efficient system, look for models that:

- Consume 5 gallons (18.9 liters) of water or less per 1,000 grains of hardness removed.
- Have a salt efficiency greater than 3,350 grains of total hardness exchange per pound of salt.

These criteria can be easily verified by looking for models that have been certified to the voluntary efficiency rating under NSF/ANSI 44.

Salt-Free Water Softener Alternatives

Cation exchange softening is not always appropriate or desired by some individuals, such as those with certain medical conditions or who live in jurisdictions where softeners are prohibited. Salt-free water conditioners provide an alternative to traditional ion exchange treatment. Instead of removing the hardness ions, they condition them using electricity or another method that reduces scale buildup without added chemicals or water waste. If you opt for a salt-free water conditioner, look for models that meet the requirements of the IAPMO/ANSI Z601 *Standard for Scale Reduction Devices*.

Water Softener Use and Maintenance

Ensuring that your softener is properly installed and maintained according to manufacturer instructions will prevent damage and unnecessary water and salt use. Following are some softener installation and maintenance tips.

Installation: Make sure the softener is installed on the home's water supply line before water enters the water heater. If possible, avoid softening water used for outdoor purposes such as irrigation by installing the softener after the plumbing line branches off to the exterior hose bibb or irrigation line. If you have a whole house filter to treat water for other contaminants, it's generally recommended that you install your softener on the water line after water leaves the filter, so that any chemicals or sediment is filtered before softening.

Bypass valve: Softeners have a bypass valve that allows you to divert water away from the softener. This is particularly useful if the softener is treating water that may be used outdoors. Activate the bypass valve when watering the lawn, washing your car, filling a pool, or using water for something that does not require softening. Bypassing the softener will save salt, water, and energy, but be sure to return the valve to its previous position once you are done, so water is directed back through the softener.

When you start to see the water level above the salt pellets, it's time to add more salt to your brine tank.

Salt level: During regeneration, the softener draws brine from a tank that needs to be manually filled with salt pellets. As part of regular maintenance, you will need to refill the salt in the softener's brine tank; use sodium or potassium salt pellets specifically made for softeners and avoid rock salt, road salt, or table salt. Fill the tank about half full with salt pellets and check salt levels every 4 to 6 weeks; once the salt level falls below the water level, add more salt. Do not let the salt level go below one quarter full. If the tank runs out of salt, not only will the water not soften, but you will waste water and energy.

Check for salt bridging or clogging: Avoid filling the brine tank to the top with salt, as the excess weight can create salt bridging, which occurs when the salt pellets fuse together and interferes with the softening process. If you notice the salt level isn't going down over time, this could be due to salt bridging or clogging in the brine tank. Salt bridging forms a hard layer in the middle of the tank, preventing the pellets from falling to the bottom of the tank and preventing the suspended salt from properly mixing with the water below to form brine. You can use a broom handle or similar item to break up a salt bridge. Be sure to initiate a regeneration cycle after you successfully break up the salt bridge. Salt clogging occurs when salt hardens over the openings in the brine well, preventing water from moving between the brine tank and the media tank. If you have clogging along the brine well, pour a gallon of hot tap water into the brine tank and let it sit for about 10 minutes, then use a broom handle to break up the clogging. Run a regeneration cycle once the clogging has been cleared. Hot water can also be used to loosen a persistent salt bridge as well.

Regenerate only as necessary: If your water softener does not use demand-initiated regeneration, schedule regeneration only as often as needed to produce your desired level of water softening. When scheduling regeneration, make sure you know your softener's capacity, the level of hardness needing removal, and how much water is treated and used in your home. You probably don't need to schedule regeneration every day; regenerating too frequently will waste both salt and water. If there is a power outage, double check your softener after the power is restored to ensure it's still programmed correctly and to reset the clock. Also, if you are travelling and away from home for an extended period, be sure to set the softener to vacation mode, bypass or unplug the softener, or turn the water off in your house to ensure water and salt are not unnecessarily consumed.

Clean the resin beads: The resin beads in the media tank of a cation exchange system need to be cleaned annually to maintain efficiency. Review the owner's manual and follow

the manufacturer's instructions; cleaning the resin beads usually involves pouring a cleaner recommended by the manufacturer into the brine well and running a regeneration cycle.

Clean the brine tank: Clean out the brine tank as needed to remove any mold or dirt buildup, according to the manufacturer's instructions, at least every few years. Allow the salt level to run down completely, removing any excess salt and water until the tank is empty. You can use a warm soapy water mixture to clean the tank, sanitize it with a bleach solution, then rinse it clean.

Monitor for leaks: As with all water-using appliances, you should periodically check your water softener for leaks at water connection points, valves, and drains. For example, a continuous trickle or flow of water to the drain could indicate a broken valve or other malfunction.

WaterSense Labeled Products Can Reduce Household Water Demand

Before installing a water softener, consider replacing older plumbing fixtures with WaterSense labeled models to reduce household water consumption. WaterSense labeled products, such as toilets, showerheads, and faucets, are at least 20 percent more efficient than standard models. Selecting ENERGY STAR® certified appliances reduces the amount of water and energy used for washing clothes and dishes; hot water heaters can also earn the ENERGY STAR label. Reducing household water use will reduce the size capacity of your water softener, saving you money on the initial purchase and for ongoing operation.

Visit www.epa.gov/watersense/watersense-products for more information about WaterSense labeled products.

References and Additional Resources

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