

How Residential Self-Regenerating Water Softeners Work

Residential self-regenerating water softeners are an effective means for treating hard water. Hard water contributes to the buildup of limescale which can foul plumbing and shorten the lifespan of key appliances like hot water heaters and dish washers. Hard water is caused by an excess of minerals – primarily calcium and magnesium – in the water supplied to a home. Water hardness is measured in mineral grains per gallon, with water containing up to one grain per gallon considered as being “soft”. Water containing more than 10 grains per gallon is generally considered to be “hard”.

Self-regenerating water softeners (also known as automatic water softeners) are plumbed into the home’s water supply and work by removing dissolved minerals in the hard water through a process called ion exchange. Inside each water softener is a mineral tank that is filled with small plastic beads (also known as resin) that are negatively charged. To balance the charge, positively charged sodium ions are present on the beads. A separate brine tank holds a concentrated brine solution made up of sodium chloride (rock salt) or potassium chloride, which is used to regenerate the softener. Under normal operation, hard water is passed through the mineral tank. The calcium and magnesium ions in the hard water have a stronger positive charge than the sodium (or potassium if that is used) ions on the resin. As a result, the calcium and magnesium ions swap places and replace the sodium ions on the beads. The water that flows out of the softener is now considered “soft” because the majority of the calcium and magnesium in the water has been replaced with sodium ions.

Eventually, there will not be enough sodium left on the resin to effectively soften the water. Then the softener has to be regenerated. The process is usually done in the middle of the night or early in the morning because soft water is not available during the regeneration. To start the regeneration cycle, the concentrated salt water from the brine tank washes over the resin. The high levels of sodium in the brine replace the calcium and magnesium on the resin, while the chloride stays in solution.

After the regeneration is complete, the brine solution is flushed to the sewer. New rock salt or potassium chloride must be added to the brine tank on a regular basis for the water softener to continue to work. As a result, the regenerating process discharges significant quantities of salt

into the sewer line. On average, self-regenerating water softeners discharge about 30 pounds of salt per month to the sewer system.

Exchange tank water softeners work in a similar manner to self-regenerating water softeners, but feature a removable tank that can be replaced with a fresh one when the resin is depleted. The depleted tanks are removed by a professional service and discharge into the local brine line that sends the salt to a treatment plant that handles salty wastes. By using the brine line to properly dispose of this salt, recycled water and groundwater within IEUA's service area and the Santa Ana watershed are protected.

There are two basic types of water softeners: self-regenerating water softeners and exchange tank systems. Residential self-regenerating water softeners are plumbed into the home's water supply and work by eliminating dissolved minerals through a process called ion exchange. Inside each water softener is a tank that is filled with small plastic beads (also known as resin) that are negatively charged. To balance the charge, positively charged sodium ions are present on the beads. A separate brine tank holds a sodium chloride (salt) or potassium chloride solution, which is used to regenerate the softener. Under normal usage, hard water is passed through the mineral tank. The calcium and magnesium ions in the hard water have a stronger positive charge than the sodium or potassium ions on the resin. Therefore, the calcium and magnesium ions replace the sodium or potassium ions on the resin. The water flowing through the softener is now considered "soft" because the majority of the calcium and magnesium in the water has been replaced with sodium or potassium.

Eventually there will not be enough sodium left on the resin to effectively soften the water. Then the softener has to be regenerated. This process is usually done during the middle of the night because soft water is not available during the regeneration. To start the regeneration, salt water from the brine tank is sent to the mineral tank. The high levels of sodium or potassium in the brine force the calcium and magnesium off the resin, replacing it with sodium or potassium. The chloride present in the brine water simply stays in solution. After regenerating the mineral tank, the brine solution is flushed to the sewer. New salt or potassium chloride must be added to the brine tank on a regular basis to replace the salt or potassium chloride that is used to regenerate the mineral tank.

Exchange tank softeners work in a manner similar to automatic water softeners, but feature a removable resin tank that is replaced with a fresh resin tank when the sodium on the resin is depleted. The depleted tanks are regenerated by water conditioning services at off-site facilities that are permitted to treat and discharge salty wastes, and does not increase salt levels in the recycled water supply.

If you have any further questions about the self-regenerating water softener rebate program or want more information about recycled water, you may call the IEUA at 909-993-1550