A Review of Water Softening Technologies

Other Softening Considerations

There are some products or actions that can improve the efficiency and life of water softeners. Some of these are discussed below.

Salt type

Regardless of labelling, all softener salt products contain chloride. While there are many salt products available, the base of these products is either sodium chloride or potassium chloride. Sodium chloride is the most commonly used salt in water softener brine tanks. It is widely available and is sold at comparatively lower prices than other salt products. Potassium chloride is used when there are health concerns with sodium intake.

- Cost: Potassium chloride is 3- 5x more expensive than sodium chloride
- Salt Use: Potassium chloride is 15 to 30 % less efficient than sodium chloride
- Water treatment: Used in ion exchange water softeners to recharge resin
- Maintenance: Will need to add salt more frequently with potassium chloride

Filters

Filters may be needed to remove contaminants in water including iron, manganese, hydrogen sulfide and sediment from well water and chlorine from city and well water. It is important to have your water tested to determine if you need a filter.


Resins and other media

- Cost: $ additional capital cost, $ filter media replacement costs
- Salt Use: Reduces salt use. Removal of iron with a softener uses ~ 4x more sodium than used to remove hard ions.
- Water treatment: Removes iron, manganese, hydrogen sulfide, sediment or chlorine depending on filter type
- Maintenance: Filter media replacement
- Water use: Degraded resin decreases water softener efficiency, filter backwash uses water

Iron, Manganese and Hydrogen Sulfide

Iron and manganese stain laundry and plumbing fixtures, add a metallic taste to water, reduce the efficiency of water softeners, and potentially build up in pipelines, water heaters, and water softeners. In general, water softeners may remove up to 3 mg per liter of iron in the water. For higher levels or more efficient operation, iron filters are recommended. If iron or manganese is not thoroughly removed from the resin beads, oxygen in the water oxidizes them, reducing capacity and efficiency. Many municipalities remove iron and manganese before distribution.

Activated carbon filters

Activated carbon filters are recommended for municipal water supplies treated with chlorine and well water if chlorine is used for disinfecting. Chlorine degrades resin beads. A chlorine concentration of 2 parts per million can reduce by half the life of resin beads. Removing chlorine significantly improves taste. Carbon filters also remove many other contaminants such including carcinogenic disinfection by-products, VOCs, and many pesticides.

Resin Type

Water softeners include a resin tank containing resin beads. Resin beads are little porous, plastic spheres of polystyrene strings linked in a crisscross pattern. Resin with a higher % cross-linkage (10% vs. 8$) increases the resin beads durability and life-span. Over time resin beads break down or get clogged, reducing the capacity of the resin beads to trap hard minerals which results in more frequent regeneration, wasting water and salt. Quality resin can extend water softener life by 50 – 100%.

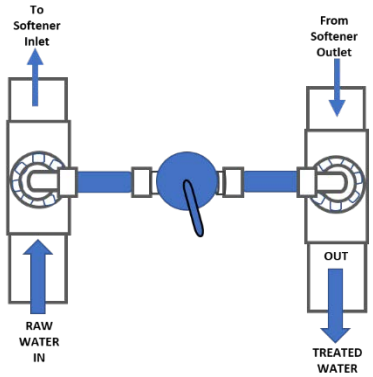
Resin beads

- Cost: $ Better resin will cost more up front
- Salt Use: Reduced due to less frequent regeneration needed for higher cross-link or newer resin
- Water treatment: Provides softened water
- Maintenance: Use resin bed cleaner every 3-12 months based on iron levels
- Water Use: Quality resin will reduce water use by requiring fewer regeneration cycles

Blending Valve

Some people don't like the slippery feeling of soft water. A blending valve is an accessory valve that mixes some hard water into the softened water to raise the hardness from 0 to usually about 2 grains per gallon.

- Cost: $ valves are very inexpensive, a plumber may need to install
- Salt use: Reduced only slightly
- Water treatment: Added to a water softener to reduce slippery feel of soft water
- Maintenance: Adjusted and tested periodically by a professional
- Water use: No extra water used



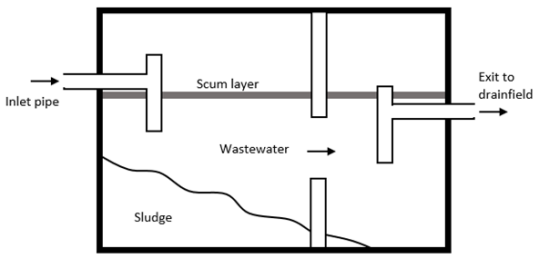
Blending valve diagram

Tank Size

A properly sized water softener tank will improve the efficiency of salt and water use, while achieving a satisfactory soft water supply. A water softener that is too small will run out of soft water and need to regenerate more frequently. This increases wear on the water softener and reduces its lifespan. A water softener that is too big may cause channeling, limiting softening capacity. In both cases, improperly sized water softeners have a greater potential for using salt inefficiently. Water softeners should be sized to work three to five days without regeneration and designed to treat water without significant pressure loss.

Water Softener and Iron Filter Discharge Effects on Septic Systems

Past studies showed a negative impact of water softener regeneration discharge on septic tanks. More recent research shows that discharge from more efficient water softeners do not have a negative impact on septic tanks and may have a positive impact. The key is "efficient" softeners. A water softener that has a timer-based regeneration controller or a softener that is not set correctly may have a negative impact on the septic tank. A set properly softener uses less salt and water. Studies have shown that the large volume of water used for regeneration of softeners, and especially for iron filters which use a lot of water for backflushing, may displace partially treated water in the septic tank and move it into the drainfield, potentially damaging the field. A septic system should be sized correctly to accommodate the water softener discharge and iron filter discharge (if needed) as well as other estimated household uses. Chloride in the softener discharge cannot be treated in the drainfield and will eventually end up in groundwater.



Typical septic system

If needed, softener discharge may be rerouted directly to the distribution box or discharge basin for a reasonable cost ($) to prevent agitation of the layers in the septic tank. Iron filters could potentially increase maintenance costs of septic systems. Iron filter backwash places a volume load on the septic system and dilutes working bacteria. Backwash water can often be diverted to the surface or to a pond to reduce maintenance of the septic system. Check with the local jurisdiction to see if either of these plumbing changes is encouraged.

Key to Costs: $= <$1500 $$= $1500 - $2500 $$$= $2500 - $5000 $$$$=>$5000

For more information and resources, refer to the University of Minnesota Water Resources Center web site: www.wrc.umn.edu/watersoftening.