

Today's Softener Systems

Common methods of initiating regeneration of water softeners are the following:

- The number of days since the last regeneration.
- The volume of water used.
- A sensor that detects conductivity changes.

A softener may be a prefill upflow, postfill upflow, prefill downflow or postfill downflow system.

A softener may be a single tank or twin tank design. Definition of a twin tank design is that there are two mineral tanks. When the ionic capacity to reduce hardness of one tank is used, the second tank comes on line and is consumed before switching back to the first tank. While the second tank is being used the first tank regenerates. In general twin tank systems are regenerated based on the volume of water used or a sensor that detects conductivity changes.

Demand initiated water softeners initiate regeneration based on the following criteria:

- sensors that detect conductivity changes
- volume of water used

Sensors that detect changes in conductivity in the bed are typically placed in the bed so that about 20% of the volumetric capacity of the bed is held in reserve. The height at which the sensor is placed may be set at a higher height if the water is significantly higher than 20 gpg. If the water is at a lower hardness it may be set at a slightly lower height. When the sensor detects that the softener has been exhausted at that bed height then the system may be set to regenerate immediately or at a delayed regeneration time. One of the advantages of a sensor style system is that it would account for fluctuating incoming hardness.

Incoming hardness may fluctuate due to changes in blending of different water sources. For example: In the winter a ground water source may be used and in the summer a surface water source may be used. The hardness is most likely different. Another example: A municipality has more than one well. The wells have different hardness concentrations. Depending on which well is supplying water the hardness in the source water delivered to the water softener will fluctuate.

If a softener regenerates based on the volume of water used, a meter is usually employed that counts the number of gallons treated. The volume of water that the softener will treat before breakthrough occurs is estimated by measuring the amount of hardness in the water and then doing one of the following:

- Manually calculating the volumetric capacity by dividing the ionic capacity by the water hardness measured.
- Electronically calculating the volumetric capacity by programming the ionic capacity (which is based on salt dosage and the amount of resin) and the water hardness into the water softener and dividing the two to arrive at the volumetric capacity.

Breakthrough in the United States is usually defined as 1 gpg. In Europe some countries require some amount of hardness in the treated water and so the volumetric capacity delivered before initiation of a regeneration is equal to the ionic capacity of the softener based on a salt dosage/(water hardness in – water hardness treated).

For metered softeners the volume of water that will be treated for a given influent hardness before initiating regeneration does not automatically fluctuate with fluctuating incoming hardness.

When a volume capacity is determined, how much of that volume is used before a regeneration occurs varies. Where water hardness is consistent:

- Twin tank systems can be set to use the entire volume capacity.
- Prefill upflow single tank systems can be set to proportionally add the needed amount of salt based upon remaining capacity. However after a few regenerations at the lower salt dosages systems may trigger a regeneration at full salt dosage.
- For many pre or post fill down flow or post fill upflow single tank systems, the volume capacity may not be fully consumed before regeneration occurs. The volume capacity trigger point may be derated to avoid having hard water which would trigger a service call. Common methods of derating include the following:
 - reducing the capacity by up to 75 gallons per day per person. It is estimated that each person would use about 75 gallons per day of hot and cold water.
 - Having some type of algorithm that automatically estimates how much water would be used the next day and then comparing it to the remaining capacity. The algorithm's typically adjust based on past water usage.

If a softener has the same injector, amount of the same resin, regenerated with the same amount of salt, with the same distributor design and regenerates solely on days between regenerations, that softener would have the same ionic capacity rating(s) as a demand initiated regeneration softener.

The reason for this is that the ionic capacity test is based on the pounds of salt used for regeneration for a given volume of resin and determining the gallons of water treated to a break through of 1 grain or hardness as calcium carbonate per gallon.

The efficiency rating of a softener typically is based upon the ionic capacity generated per pound of salt and the amount of water consumed during the regeneration. By regenerating at the lower end of the salt dosage/capacity curve, capacities of over 5000 grains/pound of salt can be achieved. However if a softener with this salt setting was installed on a water supply that was in the 20 gpg range it would generally not work very well over an extended period of time.

Efficiency ratings of softeners also do not take into account true brine reclaim systems. A brine reclaim system reuses a part of the waste brine stream. A brine reclaim system is not the same as a brine diversion system. A brine diversion system is where the waste stream during the brining cycle is diverted to a holding tank for later collection and disposal.

Portable exchange tanks are typically regenerated off site and do not have an efficiency rating.

Efficiency Rating Concerns

The method in NSF/ANSI 44 used to determine efficiency ratings do not take into account the following:

- Efficiencies for brine reclaim systems.
- Unused capacity used as a reserve for single tank DIR water softeners that are not proportional upflow brining systems.
- Incoming water supply hardness concentration fluctuation.
- Operation on water supplies above 8 to 10 gpg when companies certify by using very low salt dosages per cubic foot and then modify salt dosages based on incoming hardness, iron, etc.
- Proportional upflow brining systems.

Currently California requires an efficiency rating of 4000 grains/lb of salt. NSF/ANSI 44 requires a value of 3350 grains/lb of salt. The water consumption during regeneration must also be 5 gallons or less per 1000 grains removed.

California, Iowa and Wisconsin representatives have advised that they think it is okay to publish the efficiency rating at the lower salt setting and not at higher capacity salt settings.

If the efficiency at each salt setting is required to be specified this will increase testing costs.

Modifying how efficiency ratings are calculated or determined in a laboratory setting may not be the best way to move towards more green technology. Companies may be shipping out efficiency rated softeners at higher salt dosages than what the test was completed at, or giving the installer or end user instructions on how to set at a higher salt dosage.