Outline

Softening efficiency

Overview of settings
- Salt dosage
- Grain capacity
- Reserve capacity
- Hardness setting

Control head examples

Optimizing settings
- Truing up hardness setting
- Lowering salt dosage
- Truing up reserve capacity

Practice scenarios

Level 2: Achieving softening efficiency

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Learning objectives

- Understand softening efficiency and the factors that affect it
- Apply the relationship between softener efficiency factors to calculate efficiency and settings
- Be able to perform a simple optimization
- Use the Salt Savers app to perform and document an optimization

Softener efficiency

$$\frac{\text{Grain capacity (grains)}}{\text{Salt dosage (pounds)}} = \text{Softener efficiency}$$ (grains per pound)

$$\frac{\text{Grains of hardness removed per regeneration}}{\text{Pounds of salt per regeneration}} = \text{Softener efficiency}$$

Similar to miles per gallon

Target efficiency

Goal: highest salt efficiency possible

MMSD service area target: 4000 grains per pound

Example: Softener rated for 32,000 grains @ 8 lbs. of salt

32,000 grains ÷ 8 pounds = 4000 grains per pound

Settings that affect softener efficiency

Hardness setting: The programmed concentration of hardness **assumed** to be coming through the softener

Salt dosage: The amount of salt that recharges the softener with each regeneration

Grain capacity: The total amount of hardness (grains) that can be removed by the softener with one salt dosage

Dosage and grain capacity grouped together because they are related

Reserve capacity: Buffer subtracted from total capacity to prevent hard water from coming through

Efficiency varies between models

1 pound of salt

← Softens less water

Softeners more water →

1 gallon of gas

← Goes fewer miles

Goes more miles →

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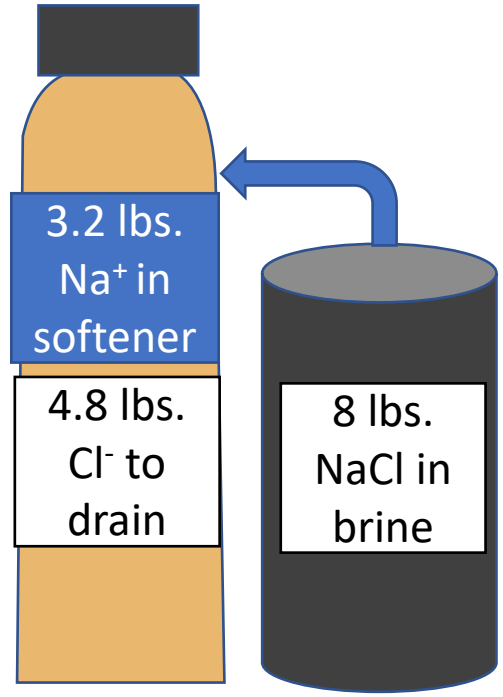
Salt dosage

- Definition: Amount of salt needed to replenish the softener with sodium per regeneration
- Measured in pounds of salt per cubic feet of resin
- High, medium, low settings

Salt dosage of 8 lbs. per cubic foot regenerating 1 cubic foot of resin



Grain capacity

- **What:** The number of grains of hardness that the softener can remove from water before needed to regenerate
- NOT fixed – grain capacity depends on the salt dosage
- In home softeners, you'll typically see grain capacities expressed around 24,000 – 32,000 grains; some may be lower or higher

Poll Question 1

Examples in softener descriptions

Waterboss

22,000-Grain Capacity Water Softener System

★★★★☆ (259) Write a Review Questions & Answers (54)

Whirlpool WHES30E 30,000 Grain Softener | Salt & Water Saving Technology | NSF Certified | Automatic Whole House Soft Water Regeneration, 0.75 inches, Off-White

Grain capacity variation

- Less salt in the softener provides less sodium for ion exchange, so the grain capacity is lower at lower salt dosages
- If you have access to softener user manual, rated grain capacities at different dosages can be found there

Different salt dosages

Resin Cu. Ft.	Rated Capacity Low Salt Grains @ Lbs.	Rated Capacity Medium Salt Grains @ Lbs.
.50	9,800 @ 3.0	14,100 @ 5.0
.75	14,700 @ 4.5	21,200 @ 7.5
1.00	19,600 @ 6.0	28,200 @ 10.0
1.50	29,400 @ 9.0	42,300 @ 15.0
2.00	39,200 @ 12.0	56,400 @ 20.0
3.00	58,800 @ 18.0	84,600 @ 30.0

Different amounts of resin

Same unit; different capacities

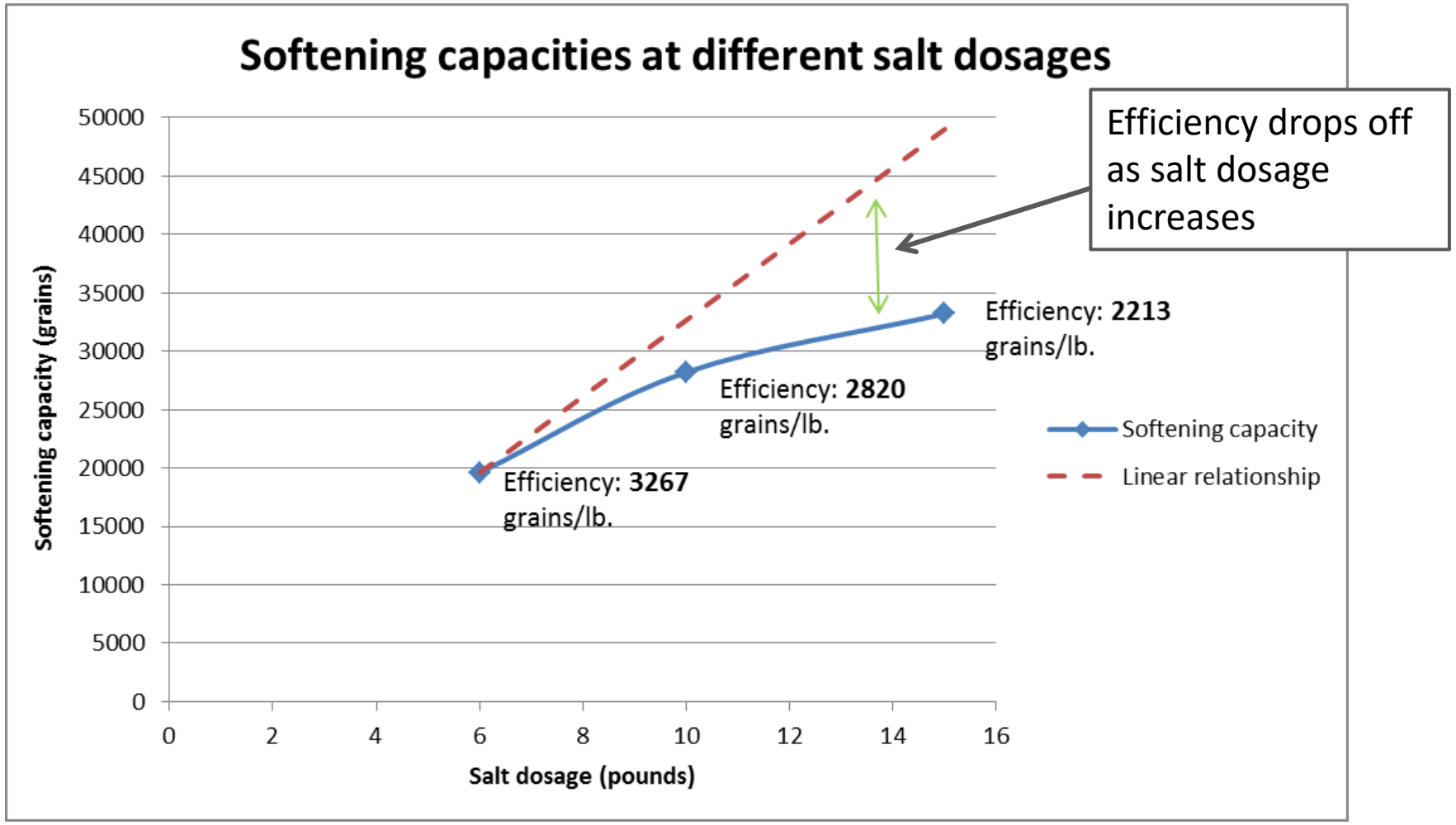
CAPACITY CHART

Resin Cu. Ft.	Rated Capacity Low Salt Grains @ Lbs.	Rated Capacity Medium Salt Grains @ Lbs.	Rated Capacity High Salt Grains @ Lbs.	Flow Rate Cont.
.50	9,800 @ 3.0	14,100 @ 5.0	16,600 @ 7.5	6.1
.75	14,700 @ 4.5	21,200 @ 7.5	24,900 @ 11.3	8.0
1.00	19,600 @ 6.0	28,200 @ 10.0	33,200 @ 15.0	10.0
1.50	29,400 @ 9.0	42,300 @ 15.0	49,800 @ 22.5	10.0
2.00	39,200 @ 12.0	56,400 @ 20.0	66,400 @ 30.0	10.7
3.00	58,800 @ 18.0	84,600 @ 30.0	99,600 @ 45.0	11.5

Efficiency at low salt:
19,600 grains ÷ 6 lbs.
3267 grains/lb.

Efficiency at high salt:
33,200 grains ÷ 15 lbs.
2213 grains/lb.

Same unit; different capacities



Grain capacity and gallon capacity

Gallon capacity is another way of expressing softening capacity

Definition: Gallon capacity is the number of gallons of water softened between regenerations

$$\text{Gallon capacity} = \frac{\text{Grain capacity}}{\text{Hardness setting}}$$

Grain capacity and gallon capacity

Gallon capacity often seen on control heads with a dial

← This softener will go 975 gallons between regenerations

Grain capacity and gallon capacity

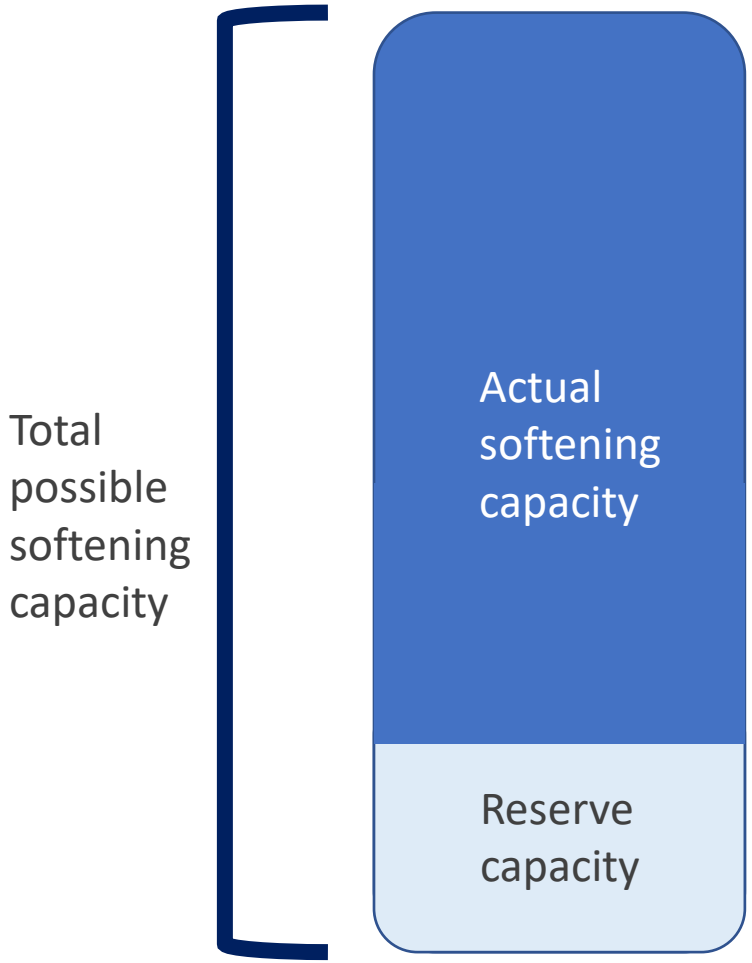
Example: What is the gallon capacity of a softener with a 24,000 grain capacity and a hardness setting of 21?

$$\frac{24{,}000 \text{ grains}}{21 \text{ grains per gallon}} = 1143 \text{ gallons}$$

Reserve capacity

Definition: Buffer programmed into softeners that prevents soft water from running out before regeneration

- Causes a softener to regenerate before it is due to run out of total softening capacity
- Subtracted from total possible softening capacity



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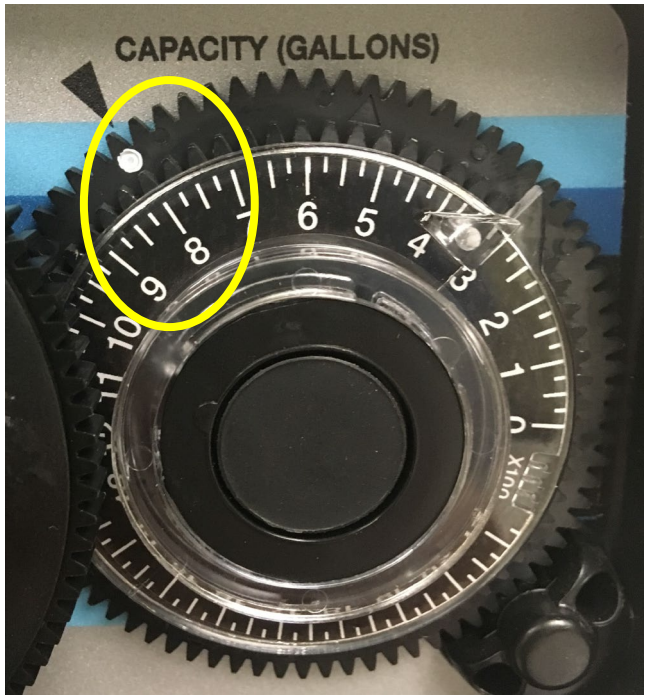
Reserve capacity example

Rated grain capacity: 22,000 grains at 6 pounds

Hardness setting: 20 grains per gal.

Assumed soft water use per day: 300 gal.

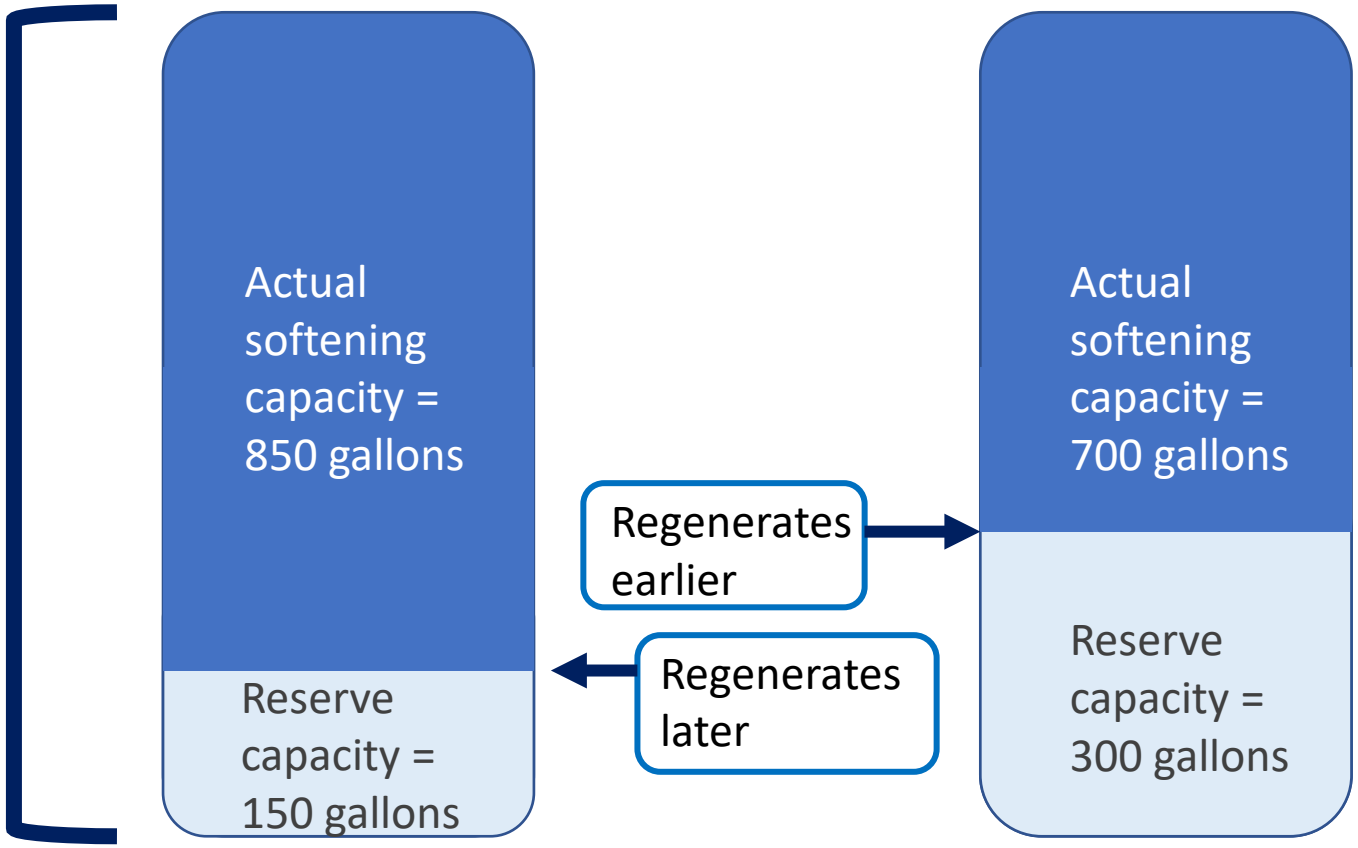
1) Total gallon capacity = 22,000 ÷ 20 = 1100 gallons per regeneration



2) Gallon capacity *adjusted for reserve* = 1100 - 300 = 800 gallons per regeneration

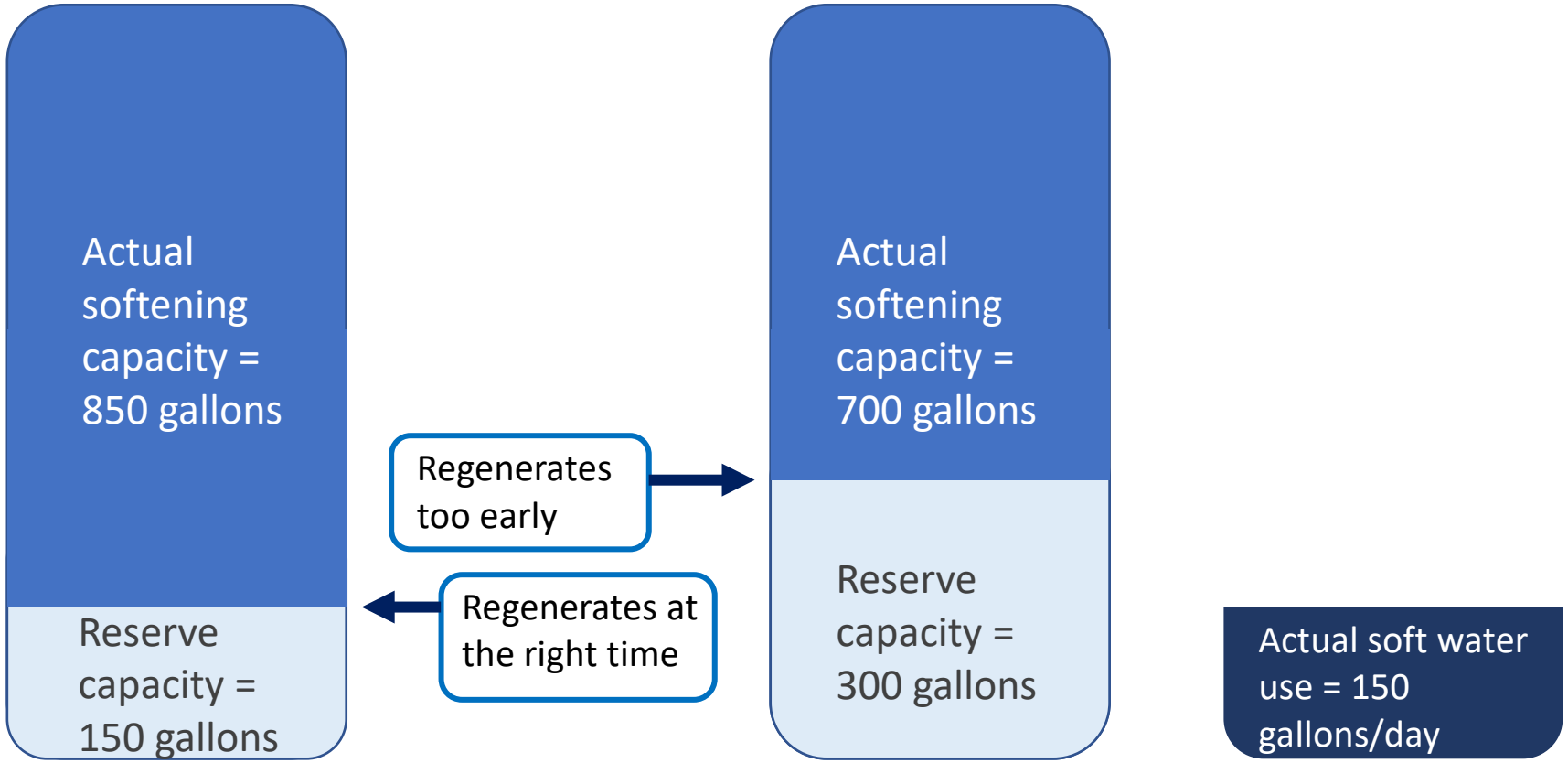
Reserve capacity effect on regenerations

Example:
Total softening capacity = 1000 gallons

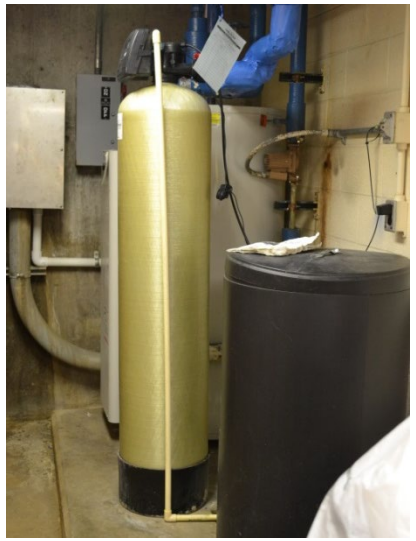


Optimized reserve capacity

Reserve capacity, if set manually, should reflect the actual soft water use of the home per day (not an overestimate)



Tank configurations



Single tank

- Requires reserve capacity

Multiple tank

- Does not require reserve capacity

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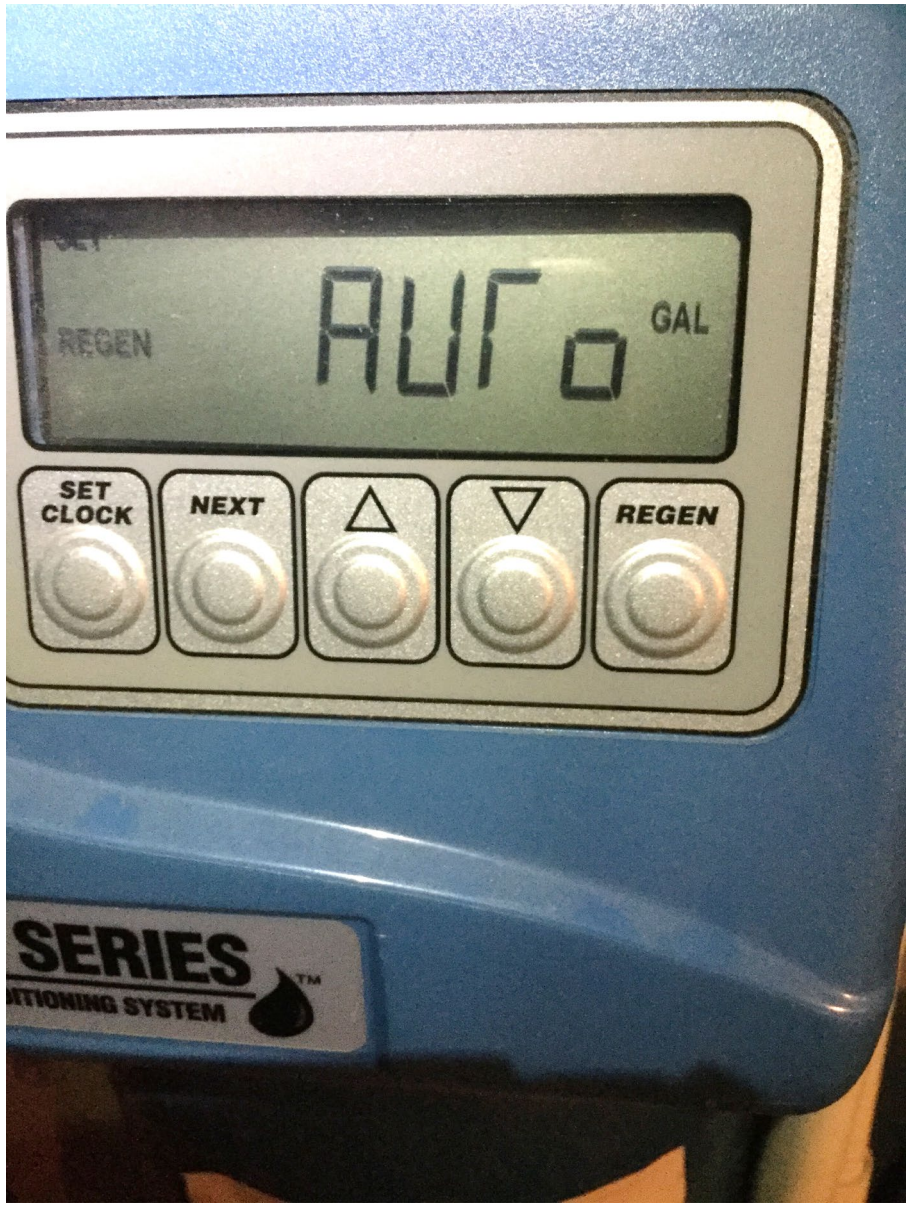
Practice scenarios

Manual or auto reserve capacity



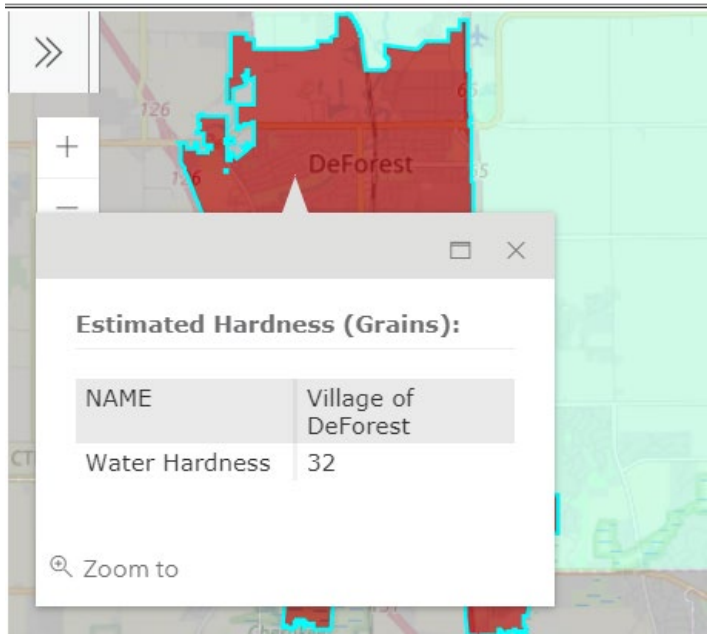
- Many newer softeners calculate reserve capacity automatically based on actual soft water use of home.
- More efficient than fixed

Hardness setting affects salt use

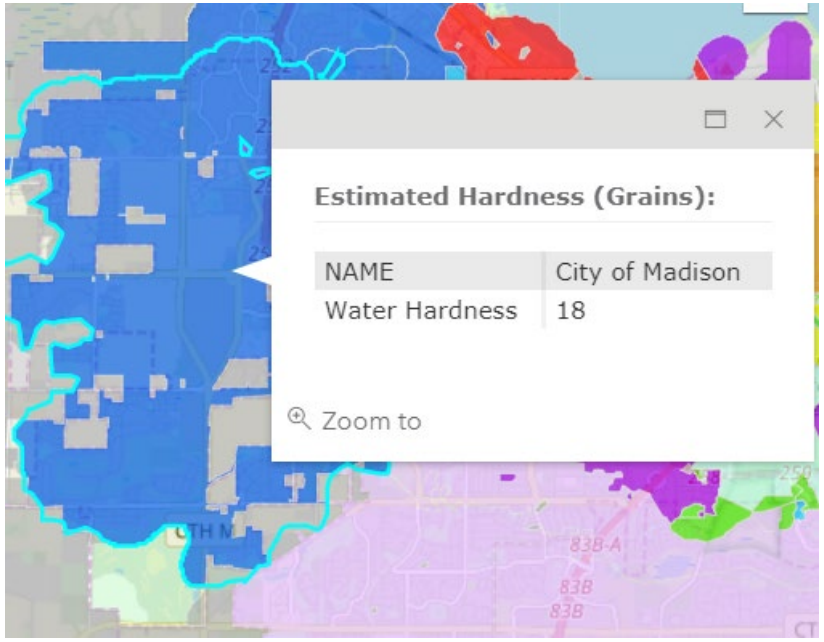
4WD a good idea for tough conditions…

…but wastes gas if in use when unnecessary

Hardness setting affects salt use



Using a high hardness setting is a good idea when the source water is very hard…



…but wastes salt if the hardness setting is higher than the source water hardness

Same unit, different hardness settings

Example: 20,000 grains @ 6 pounds (Same efficiency of 3333 grains/lb.

Hardness setting = 32 grains/gallon

20,000 ÷ 32 = **625** gallons between regenerations

Hardness setting = 18 grains/gallon

20,000 ÷ 18 = **1111** gallons between regenerations

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Same unit, different hardness settings

Example: Home uses 150 gallons of soft water per day

625 gallons between regenerations

625 ÷ 150 ~ **4 days**

6 pounds of salt used every **4** days

45 pounds of salt used every **30** days

1111 gallons between regenerations

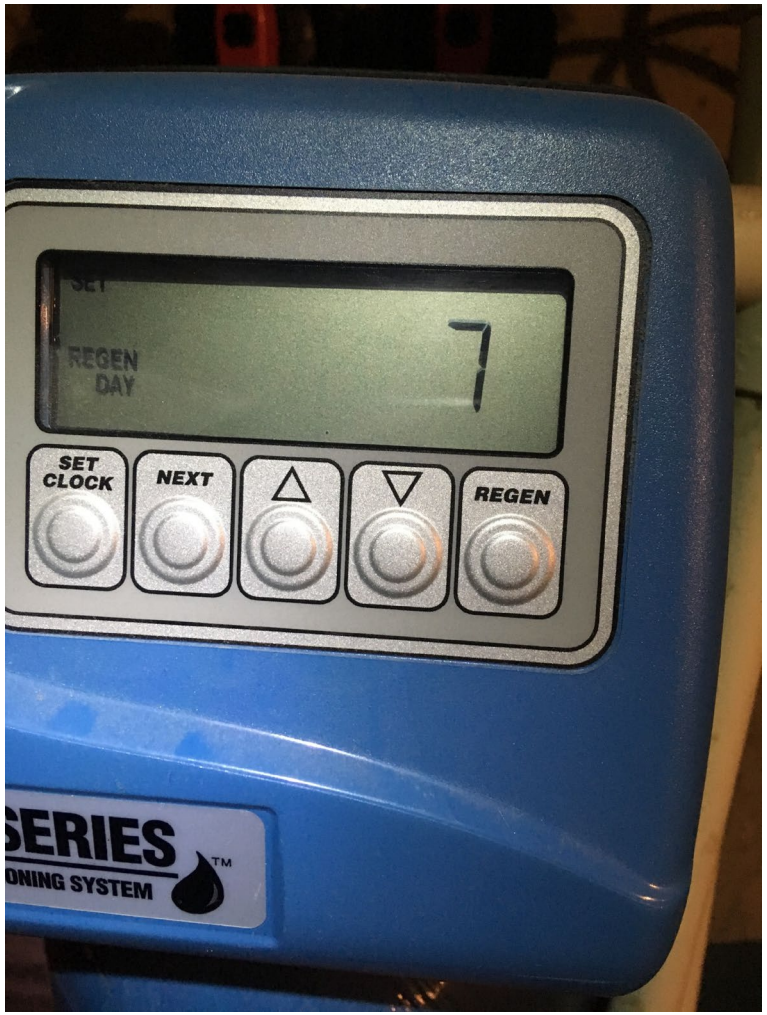
1111 ÷ 150 ~ **7 days**

6 pounds of salt used every **7** days

25 pounds of salt used every **30** days

Other settings to look for

- Time-clock override – may cause softener to regenerate too soon
- Salt efficiency mode – found on some softeners



Recap of settings

- Lower salt dosage → lower salt use
- Lower hardness setting → lower salt use
- Lower reserve capacity → lower salt use
- Time-clock override off → lower salt use
- Salt efficiency mode on → lower salt use

Exercise 1

- Calculating softener settings
- P. 8 in guidebook

Exercise 1

a. A softener has a grain capacity of 32,000 grains and a gallon capacity of 1280 gallons. What is the hardness setting of this softener?

32,000 grains ÷ 1280 gallons = 25 grains per gallon

b. A softener has a gallon capacity of 1500 gallons and a hardness setting of 20. How many grains of hardness will be removed by the softener between regenerations?

1500 gallons * 20 grains per gallon = 30,000 grains

Exercise 1

c. A softener has a grain capacity of 24,000 grains, a hardness setting of 18 grains per gallon, and a fixed gallon capacity of 1000 gallons per regeneration. What is the reserve capacity?

1. Determine total possible gallon capacity: 24,000 ÷ 18 = 1333 gallons
2. Subtract actual gallon capacity to determine reserve:

   1333 – 1000 = 333 gallons

What should the gallon capacity be for a 24,000-grain, single-tank softener with a source water hardness of 18 grains/gallon and an average home water use of 200 gallons per day?

1. Determine total possible gallon capacity: 24,000 ÷ 18 = 1333 gallons
2. Use average water use/day as reserve capacity.
3. Subtract reserve from total: 1333 - 200 = 1133 gallons

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Control head example – Fleck 5600

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Control head example – WS 1

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Practice scenarios

Break

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