

# Softener Tank Size and Optimal Resin & Gravel Levels

## 1. Tank sizes and how much resin, carbon and gravel to use:

1. When adding gravel, white resin, carbon, or other media, you must reduce the softener resin to maintain the desired free board.
  - a. Freeboard refers to the empty space in the tank that is left above the media. It is required for the media bed to expand and be cleaned properly during regeneration.
  - b. Recommended freeboard for a softener is 50%, Minimal is 35%. If bed turnover is not required, and an upper basket is used, this is sometimes even less.
  - c. Resin volume should typically be reduced from the recommended freeboard percentage when using gravel under-bedding or other resin and media to maintain the desired freeboard.
  - d. Having more freeboard is beneficial with problematic water

Tank Size	Amount of Resin	Resin Weight (Est)	Gravel Under-bedding	Opt White Resin	Opt CAT Carbon
8" x 35"	0.64 cu. ft.	32 lbs.	Optional up to 10 lbs.	8 lbs.	8 lbs.
8" x 44"	0.75 cu. ft.	37.5 lbs.	Optional up to 10 lbs.	8 lbs.	8 lbs.
9" x 35"	0.75 cu. ft.	37.5 lbs.	Optional up to 10 lbs. (12 lbs max)	9 lbs.	9 lbs.
9" x 40"	0.90 cu. ft.	45 lbs.	Optional up to 11 lbs. (12 lbs max)	9 lbs.	9 lbs.
9" x 48"	1.00 cu. ft.	50 lbs.	Optional up to 12 lbs.	9 lbs.	9 lbs.
10" x 35"	1.00 cu. ft.	50 lbs.	Optional up to 13 lbs. (16 lbs max)	10 lbs.	10 lbs.
10" x 40"	1.00 cu. ft.	50 lbs.	Optional up to 14 lbs. (16 lbs max)	10 lbs.	10 lbs.
10" x 44"	1.25 cu. ft.	62.5 lbs.	Optional up to 15 lbs. (16 lbs max)	10 lbs.	10 lbs.
10" x 54"	1.50 cu. ft.	75 lbs.	Optional up to 16 lbs.	10 lbs.	10 lbs.
12" x 52"	2.00 cu. ft.	100 lbs.	Optional up to 24 lbs. (20 lbs min)	12 lbs.	12 lbs.
13" x 54"	2.50 cu. ft.	125 lbs.	Recommended: 35 lbs. (25 lbs min)	13 lbs.	13 lbs.
14" x 65"	3.00 cu. ft.	150 lbs.	Recommended: 40 lbs	14 lbs.	14 lbs.
16" x 65"	4.00 cu. ft.	200 lbs.	Recommended: 50 lbs.	16 lbs.	16 lbs.
18" x 65"	5.00 cu. ft.	250 lbs.	Recommended: 100 lbs.	18 lbs.	18 lbs.
20" x 62"	6.00 cu. ft.	300 lbs.	Recommended: 100 lbs. of 1/2 x 1/4 and then 50 lbs. of 1/4 x 1/8	20 lbs.	20 lbs.
21" x 62"	7.00 cu. ft.	350 lbs.	Recommended: 100 lbs. of 1/2 x 1/4 and then 50 lbs. of 1/4 x 1/8	21 lbs.	21 lbs.
24" x 60"	8.00 cu. ft.	400 lbs.	Recommended: 125 lbs. of 1/2 x 1/4 and then 100 lbs. of 1/4 x 1/8	24 lbs.	24 lbs.
24" x 72"	9.00 cu. ft.	450 lbs.	Recommended: 150 lbs. of 1/2 x 1/4 and then 100 lbs. of 1/4 x 1/8	24 lbs.	24 lbs.
24" x 72"	10.00 cu. ft.	500 lbs.	Recommended: 150 lbs. of 1/2 x 1/4 and then 100 lbs. of 1/4 x 1/8	24 lbs.	24 lbs.
30" x 72"	15.00 cu. ft.	750 lbs.	Recommended: 250 lbs. of 1/2 x 1/4 and then 100 lbs. of 1/4 x 1/8	30 lbs.	30 lbs.
36" x 72"	18.00 cu. ft.	900 lbs.	Recommended: 300 lbs. of 1/2 x 1/4 and then 125 lbs. of 1/4 x 1/8	36 lbs.	36 lbs.
36" x 72"	20.00 cu. ft.	1,000 lbs.	Recommended: 350 lbs. of 1/2 x 1/4 and then 150 lbs. of 1/4 x 1/8	36 lbs.	36 lbs.

## 2. Under-bedding:

- a. In smaller sized systems, under-bedding is optional, but recommended.
- b. Under-bedding is required on larger systems for proper regeneration.

3. **White Resin:** it is typical to add 1lb per inch of tank diameter, and then reduce the Softening Resin Volume accordingly to keep proper freeboard in the tank.
4. **Carbon:** it is not recommended to add carbon to a softener. It causes significantly different back-wash rates, a shorter life with an inability to be separated and replaced, and inefficiency after mixing due inadequate volumes and water channeling.
  - a. *If you don't have the option of installing a separate carbon tank* and want the benefits of carbon, add high quality, high ball pan hardness, Catalytic Carbon to the softener.
  - b. Carbon is typically added at 1 lb per inch of tank diameter; resin volume is reduced to maintain proper freeboard.
5. **ALWAYS use upper distributor baskets!** Saving \$1.50 is not worth the risk.

## 2. Salt Dosing and Resin Capacity Chart

1. Often you will hear of a softener referred to by its **capacity**. Many base the capacity on the amount of resin inside; However, although this is a factor, true capacity is based on the salt dosing-- due to the ion exchange resin performs. This is where **salt efficiency** and **hardness leakage** come into play.
  - a. The *lower* the salt setting, the *more efficient* the resin is, *but the more hardness leakage occurs*, and vice versa.

For the following examples, consider a 10" x 54" softener. It may typically have 1- 1.5 cubic feet of softening resin. 1.5 ft<sup>3</sup> is most common; however, with under-bedding, white resin, carbon, etc., the size may be reduced to keep the desired freeboard.

2. If this system is generated using *15 lbs. of salt*, it has a *45,000 grains capacity*; even though hardness leakage is typically less than 1ppm, the salt efficiency is reduced by 50%.
  - a. Some companies may advertise this type of softener as a 48,000 grains capacity unit since that is its *maximum capacity*. However, this would require the system to be regenerated at 20 lbs. of salt per cubic foot.
  - b. *Rarely* would you want to increase capacity to the maximum, because it is ***very inefficient to use a lot more salt for very little added capacity.***
3. If the same softener is regenerated using *8 lbs. of salt*, then it has a capacity of *approximately 36,000 grains of hardness*. This would increase the salt efficiency, but hardness leakage would be at 6ppm.
  - a. Some companies may advertise this type of softener as being *super-efficient*, perhaps only using half the salt of a "regular" softener. This could be achieved by using less salt per cubic foot to regenerate, but this would also increase the hardness leakage.
  - b. *Rarely* would you want a lot of hardness leakage, because the customer would ***still have the negative effects of hard water.***

Resin can be manufactured to meet a wide range of needs, and quality can vary, however, beware of advertisements that make claims of extraordinary capacity and efficiency.

Use the chart below to find the best setting for your application. Common salt settings are 9 or 14/15 lbs/ft<sup>3</sup>

Resin Volume ft <sup>3</sup>	Typical Media Tank	≈ grains @ 2lbs/ft <sup>3</sup>	≈ grains @ 4 lbs/ft <sup>3</sup>	≈ grains @ 6 lbs/ft <sup>3</sup>	≈ grains @ 8 lbs/ft <sup>3</sup>	≈ grains @ 10 lbs/ft <sup>3</sup>	≈ grains @ 15 lbs/ft <sup>3</sup>	≈ grains @ 20 lbs/ft <sup>3</sup>
1	9x48	10,000	17,000	21,000	24,000	26,000	30,000	32,000
1.5	10x54	15,000	25,500	31,500	36,000	39,000	45,000	48,000
2	12x52	20,000	34,000	42,000	48,000	52,000	60,000	64,000
2.5	13x54	25,000	42,500	52,500	60,000	65,000	75,000	80,000
3	14x65	30,000	51,000	63,000	72,000	78,000	90,000	96,000
4	16x65	40,000	68,000	84,000	96,000	104,000	120,000	128,000
5	18x65	50,000	85,000	105,000	120,000	130,000	150,000	160,000
6	21x62	60,000	102,000	126,000	144,000	156,000	180,000	192,000
7	24x60	70,000	119,000	147,000	168,000	182,000	210,000	224,000
8	24x60	80,000	136,000	168,000	192,000	208,000	240,000	256,000
9	24x72	90,000	153,000	189,000	216,000	234,000	270,000	288,000
10	24x72	100,000	170,000	210,000	240,000	260,000	300,000	320,000
14	30x72	140,000	238,000	294,000	336,000	364,000	420,000	448,000
15	30x72	150,000	255,000	315,000	360,000	390,000	450,000	480,000
18	36x72	180,000	306,000	378,000	432,000	468,000	540,000	576,000
20	36x72	200,000	340,000	420,000	480,000	520,000	600,000	640,000
25	42x72	250,000	425,000	525,000	600,000	650,000	750,000	800,000
30	48x72	300,000	510,000	630,000	720,000	780,000	900,000	960,000
35	63x86	350,000	595,000	735,000	840,000	910,000	1,050,000	1,120,000
40	63x86	400,000	680,000	840,000	960,000	1,040,000	1,200,000	1,280,000
50	63x86	500,000	850,000	1,050,000	1,200,000	1,300,000	1,500,000	1,600,000
60	63x116	600,000	1,020,000	1,260,000	1,440,000	1,560,000	1,800,000	1,920,000
100	63x144	1,000,000	1,700,000	2,100,000	2,400,000	2,600,000	3,000,000	3,200,000

Hardness Reduction Efficiency	≈ 5000 grains/ lb	≈ 4200 grains/ lb	≈ 3500 grains/ lb	≈ 3000 grains/ lb	≈ 2600 grains/ lb	≈ 2000 grains/ lb	≈ 1600 grains/ lb
Hardness Leakage	≈ 40 ppm	≈ 15 ppm	≈10 ppm	≈ 6 ppm	≈ 3 ppm	≈ 1 ppm	≈ 1 ppm
Water Quality	poor	fair	good	better	better	best	best
Salt Efficiency	best	better	better	better	fair	poor	poor

\*Estimated primarily calcium hardness capacity for 8% crosslinked cation softening resin at influent water temperature of >50F, TDS of <5000 ppm.

\* Calculations assume proper distribution, bed depth, and system design to mitigate channeling.

\*Data herein is provided as a courtesy and is subject to change without notice.