Water Softener Sizing and Run Length

Resin volume and salt per regeneration for a water softener from flow, hardness, run time and resin capacity, and the run length of an installed resin volume.

Method: Ion-exchange mass balance (hardness load / operating capacity)

Input parameters

Unit system: SI

Parameter	Value	Unit
Water flow	10.000	m³/h
Total hardness of the raw water, as $CaCO_3$	200.00	mg/L
Run time between regenerations	12.000	h
Operating capacity of the resin, as $CaCO_3$ From the resin maker's curve at your salt dose and water quality.	50.000	g/L
Salt dose per litre of resin	160.00	g/L
Installed resin volume (for its run length)	0.50000	m³

Calculated results

Parameter	Value	Unit
Resin volume needed	480.00	L
Salt per regeneration	76.800	kg
Hardness removed per run, as $CaCO_3$	24.000	kg
Run length of the installed resin	12.500	h

Formula and method

$$L_h = \dot{V} t_r H \qquad V_r = \frac{L_h}{C_r} \qquad m_s = V_r s \qquad t_i = \frac{V_i C_r}{\dot{V} H}$$

Variables

$\dot{V}$	water flow	m³/s
H	total hardness as $CaCO_3$	kg/m³
t_r	run time between regenerations	s
C_r	resin operating capacity as $CaCO_3$	kg/m³
s	salt dose per volume of resin	kg/m³
V_i	installed resin volume	m³
V_r	resin volume needed	m³
m_s	salt per regeneration	kg
L_h	hardness removed per run	kg
t_i	run length of the installed resin	s

Method and standards

Mass balance of an ion-exchange bed: the hardness load per run equals the resin volume times its operating capacity. Capacity and salt dose are the resin maker's data.

Assumptions and limits

- Constant flow and hardness; no hardness leakage; capacity at your salt dose.
- No design margin, minimum bed depth or regeneration downtime is included: add a margin on the resin, check the bed depth with the maker, and provide a second unit or storage for the regeneration time.

References

- Ion-exchange mass balance (hardness load / operating capacity)

Report details

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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/boilers-power-plant/water-treatment/softener-sizing

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.