TECHNICAL MEMORANDUM
(used in Website)

№ TM004 REV. № 00
TOPIC: Softener Sizing Example
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Example Problem Statement: Suppose we size a system for 350 gpm peak flow with 150 gpm continuous flow for 16 hours per day and 8 grains per gallon hardness.
Rules: Meet flow with one unit out of service (except for simplex) / At max daily hardess loading, regnerate all units every 24 hours. So the n+1 rule applies to flow.

Simplex Sizing Solution:
Design Basis: Use a simplex system with 24 hours minimum time between regenerations.
Find required capacity: The required capacity is 150 x 60 x 16 x 8 = 1,152,000 grains per day of hardness to be removed.
Determine flow per unit: Assuming one units on line we would size each vessel at a peak flow of 350 gpm.
Determine Capacity per unit: Assuming 24 hours minimum time between regenerations. we supply the full capacity with one unit on a 12 hour regeneration cycle giving a minimum requirement of 1,152,000/(24/24) = 1.152,000 grains per unit.
Choose a system: The system required would be an MF 1200S-4. This system has 1,170,000 kilograins per unit of preset capacity and a continuous / peak flow of 398 / 546 gpm per unit.

Twin Alternating Sizing Solution:
Design Basis: Use a twin alternating system with 12 hours minimum time between regenerations.
Find required capacity: The required capacity is 150 x 60 x 16 x 8 = 1,152,000 grains per day of hardness to be removed.
Determine flow per unit: Assuming one units on line we would size each vessel at a peak flow of 350 gpm.
Determine Capacity per unit: Assuming 12 hours minimum time between regenerations, we supply the full capacity with two units on a 12 hour regeneration cycle giving a minimum requirement of 1,152,000/(24/12) = 576,000 grains per

unit.
Choose a system: The calculation indicates a model 600 but the 20 cubic feet of resin in a 600 has a maximum flow rating of 20 x 15 gpm/ cubic foot = 300 gpm. At peak flow, a single model 600 is overloaded. To achieve 350 gpm requires a system with 4" piping and more resin. The smallest standard system with 4" piping is an MF-900S-4"-TA with a continuous/peak flow per vessel of 300 / 450 gpm.

Twin Parallel Sizing Solution:
Design Basis: Use a twin parallel system with 12 hours minimum time between regenerations.
Find required capacity: The required capacity is 150 x 60 x 16 x 8 = 1,152,000 grains per day of hardness to be removed.
Determine flow per unit: Assuming two units on line we would size each vessel at a peak flow of 350/2 = 175 gpm.
Determine Capacity per unit: Assuming 12 hours minimum time between regenerations, we supply the full capacity with two units on a 12 hour regeneration cycle giving a minimum requirement of 1,152,000/(24/12) = 576,000 grains per unit.
Choose a system: The system required would be an MF 600S-3 Twin Parallel. This system has 594,000 kilograins per unit of preset capacity and a continuous / peak flow of 200 / 300 gpm per unit. With two model 600 units on line they would both regenerate every 24 hours. (Note a 2 1/2" system would also work with 176 gpm continuous and 236 gpm peak. A 2" system would not work since the peak flow rating is only 156 gpm.) We should note that if one unit is out of service, the remaining unit will not produce the required 350 gpm peak capacity. With a twin unit, if one is out of service (for maintenance) and the remaining unit on line goes into regeneration, the system cannot produce soft water.

Triplex Sizing Solution:
Design Basis: Use a triplex system with N+1 sparing. Use 8 hours minimum time between regenerations.
Find required capacity: The required capacity is 150 x 60 x 16 x 8 = 1,152,000 grains per day of hardness to be removed.
Determine flow per unit: Assuming two units on line and one out of service (N+1) we would size each vessel at a peak flow of 350/2 = 175 gpm.
Determine Capacity per unit: Assuming 8 hours minimum time

between regenerations and using N+1 sparing, we supply the full capacity with two units on a 8 hour regeneration cycle giving a minimum requirement of 1,152,000/(24/8) = 384,000 grains per unit.
Choose a system: The system required would be an MF 450S-3 Triplex Parallel or Triplex Sequential. This system has 432,000 kilograins per unit of preset capacity and a continuous / peak flow of 150 / 225 gpm per unit. With two 450 units on line they would both regenerate every 18 hours. With all three units operational all three vessels would regenerate every 27 hours. (Note a 2 1/2" system would also work with 176 gpm continuous and 236 gpm peak. A 2" system would not work since the peak flow rating is only 156 gpm.)

Quad Sizing Solution:
Design Basis: Use a quad system with N+1 sparing. Use 6 hours minimum time between regenerations.
Find required capacity: The required capacity is 150 x 60 x 16 x 8 = 1,152,000 grains per day of hardness to be removed.
Determine flow per unit: Assuming three units on line and one out of service (N+1) we would size each vessel at a peak flow of 350/3 = 117 gpm.
Determine Capacity per unit: Assuming 6 hours minimum time between regenerations and using N+1 sparing, we supply the full capacity with three units on a 6 hour regeneration cycle giving a minimum requirement of 1,152,000/(24/6) = 288,000 grains per unit.
Choose a system: The system required would be an MF 300S-2 Quad. This system has 293,000 kilograins per unit of preset capacity and a continuous / peak flow of 100 / 150 gpm per unit. With three model 300 units on line they would all regenerate every 18 hours. With all four units operational all four vessels would regenerate every 24 hours.

Price comparison						
Problem: 350 gpm peak flow with 150 gpm continuous flow for 16 hours per day and 8 grains per gallon hardness						
Type	Model	Vessels	Pipe Size (inches)	Resin Per Vessel (ft^3)	Total Resin (ft^3)	Price ($)
Simplex	MF 1200	1	4	40	40	$ 22,350
Twin Alternating	MF 900	2	4	30	60	$ 36,400
Twin Parallel	MF 600	2	3	20	60	$ 27,500
Triplex	MF 450	3	3	15	45	$ 35,450
Quad	MF 300	4	2	10	40	$ 39,600