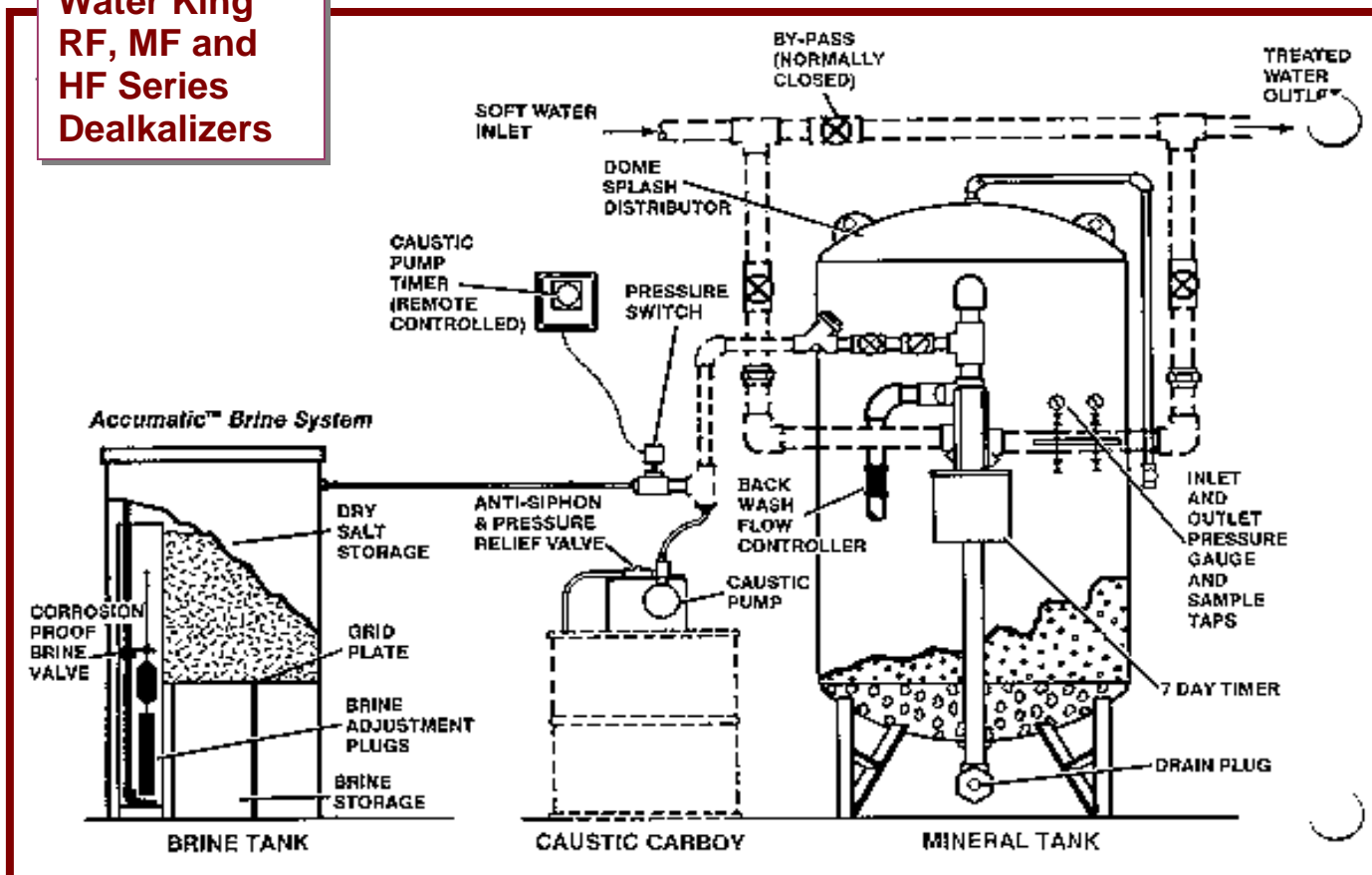


Dealkalizers

Water King
RF, MF and
HF Series
Dealkalizers



This brochure lists all of the Water King dealkalizers. The RF series uses fiberglass tanks and the Task Master II™ - 1 ½ inch five-cycle valve in a top-mount configuration. The MF series uses galvanized steel tanks and the Task Master II™ - 1 ½ inch five-cycle valve in a side-mount configuration. The HF series uses either galvanized or lined and primed steel tanks with a side mount Task Master™ - 2 or 2 ½ inch five-cycle valve.

ADVANTAGES OF DEALKALIZERS

- **Reduce blowdown** and save energy, water and chemicals
- **Boost Boiler Performance.** The amount of boiler blowdown is most often attributed to alkalinity. Concentrations of alkalinity beyond recommended operating limits cause problems of foaming and solids carryover to the steam. A dealkalizer will increase the number of times the make-up is concentrated in the boiler, reducing blowdown and boiler operating costs, foaming and carryover.
- **Reduce Condensate Line Corrosion.** Reducing the amount of carbonic acid which forms from carbon dioxide reacting with condensed steam reduces the amount of expensive chemicals necessary to neutralize the acid and reduces return line corrosion.

Water King
WATER CONDITIONING

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- **Reduce Chemical Treatment.** The reduction of blowdown by dealkalization keeps water treatment chemicals in the boiler longer, and thus minimizes the amount of chemicals required for efficient, non-corrosive operation.
- **Lower Fuel and Operating Costs.** Blowdown losses to the sewer are expensive because the lost water has been heated, softened, pumped, and chemically treated.

APPLICATIONS

- **Boilers operating below 300 psi** are the best application. Boilers at higher pressures generally require special water treatment, such as deionization or reverse osmosis, to reduce dissolved solids.
- Use of dealkalizers on **low-pressure boilers** pays off when the total exchangeable anion content is less than 400 ppm as CaCO₃ or if the total exchangeable anions are more than 50% of the total anions.
- Dealkalizing **cooling water** substantially reduces blowdown. Although acid feeding accomplishes the same thing, since acids are difficult to control and handle, a chloride anion dealkalizer is a simple, safe, economical way to handle cooling waters.

ANION EXCHANGE RESIN

The anion exchange resin used in Water King dealkalizers is Purolite™ A-300E. Purolite™ A-300 can also remove nitrates when regenerated with salt. In some dealkalization cases, small amounts of caustic is used in combination with salt during the regeneration in order to enhance the resin operation. This addition gives higher operating capacity and lower silica leakage. Purolite A-300E is a type 2 strong base anion devoid of taste and odor. A-300E meets the requirements of paragraph 121.1148 of the Food Additives Regulation of the FDA. The water treated by A-300E must not exceed 0.05 ppm of free chlorine, 5 A.P.H.A. turbidity units, 0.1 ppm of iron or 0.1 ppm heavy metals.

SODIUM HYDROXIDE FEED SYSTEM

Caustic feed systems are available for all Water King dealkalizers. The caustic feed system consists of an 18" diameter solution feed tank and an LMI Series "A" chemical feed pump. The pump is set to run during brine draw and operates automatically with the system. Since many customers supply their own caustic feed system, it is an adder on the Water King systems. Specify caustic feed system for dealkalizer with pressure switch and timer (part number 805098).

Notes for Dealkalizer Sizing Information

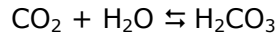
1. For twin units, capacities and flow rates will be doubled. For twin-alternating units, the flow rates are the same as a single unit with the capacity doubled. The twin and twin alternating systems include one brine tank and two mineral tanks.
2. Models 120 through 180 use 3/8-inch brine line. Models 200 through 800 use 1/2-inch brine line.
3. Caustic tanks are not included in the systems since caustic solution is usually delivered in a drum and can be fed directly.
4. Models DRF-45 through DRF-240 use fiberglass mineral tanks and do not use caustic.

DEALKALIZER SIZING INFORMATION												
Model ¹	Mineral Tank (In.)	Capacity at 4 lb salt / ft ³ of Resin		Sodium Hydroxide per Regeneration		Flow Rates		Back-wash Rate (gpm)	Anion Resin (ft ³)	Gravel (lbs)	Brine Tank	
		Grains	Salt Applied (lbs)	Gallons of 50% NaOH Solution	Pounds of 50% NaOH Solid	Continuous (gpm)	Peak (gpm)				Tank Size (In.)	Salt Storage (lbs)
DMF-120-1½	18 x 54	52,000	16	0.25	1.6	8	20	4.5	4	100	24 x 50	600
DMF-150-1½	20 x 54	65,000	20	0.31	2.0	10	25	6	5	100	24 x 50	600
DHF-150-2	20 x 54	65,000	20	0.31	2.0	10	25	6	5	100	24 x 50	600
DMF-180-1½	20 x 54	78,000	24	0.38	2.4	12	30	6	6	100	24 x 50	600
DHF-180-2	20 x 54	78,000	24	0.38	2.4	12	30	6	6	100	24 x 50	600
DMF-200-1½	24 x 54	86,600	26.6	0.42	2.7	13.3	33	8	6.67	150	24 x 50	525
DHF-200-2	24 x 54	86,600	26.6	0.42	2.7	13.3	33	8	6.67	150	24 x 50	525
DMF-225-1½	24 x 54	97,500	30	0.47	3.0	15	37.5	8	7.5	150	24 x 50	525
DHF-225-2	24 x 54	97,500	30	0.47	3.0	15	37.5	8	7.5	150	24 x 50	525
DMF-240-1½	24 x 54	104,000	32	0.50	3.2	16	40	8	8	150	24 x 50	525
DHF-240-2	24 x 54	104,000	32	0.50	3.2	16	40	8	8	150	24 x 50	525
DMF-300-1½	30 x 60	130,000	40	0.63	4.0	20	50	12	10	275	24 x 50	450
DHF-300-2	30 x 60	130,000	40	0.63	4.0	20	50	12	10	275	24 x 50	450
DHF-300-2½	30 x 60	130,000	40	0.63	4.0	20	50	12	10	275	24 x 50	450
DMF-450-1½	30 x 60	195,000	60	0.94	6.0	30	75	12	15	275	30 x 60	1000
DHF-450-2	30 x 60	195,000	60	0.94	6.0	30	75	12	15	275	30 x 60	1000
DHF-450-2½	30 x 60	195,000	60	0.94	6.0	30	75	12	15	275	30 x 60	1000
DMF-600-1½	36 x 60	260,000	80	1.26	8.0	40	100	15	20	425	38 x 60	1650
DHF-600-2	36 x 60	260,000	80	1.26	8.0	40	100	15	20	425	38 x 60	1650
DHF-600-2½	36 x 60	260,000	80	1.26	8.0	40	100	15	20	425	38 x 60	1650
DHF-600S-2½	36 x 60	260,000	80	1.26	8.0	40	100	15	20	425	38 x 60	1650
DMF-750-1½	36 x 72	325,000	100	1.57	10.0	50	125	15	25	425	38 x 60	1650
DHF-750-2	36 x 72	325,000	100	1.57	10.0	50	125	15	25	425	38 x 60	1650
DHF-750-2½	36 x 72	325,000	100	1.57	10.0	50	125	15	25	425	38 x 60	1650
DHF-750S-2½	36 x 72	325,000	100	1.57	10.0	50	125	15	25	425	38 x 60	1650
DHF-900-2	42 x 72	390,000	120	1.89	12.0	60	180	25	30	600	42 x 60	2000
DHF-900-2½	42 x 72	390,000	120	1.89	12.0	60	180	25	30	600	42 x 60	2000
DHF-900S-2½	42 x 72	390,000	120	1.89	12.0	60	180	25	30	600	42 x 60	2000
DHF-900S-3	42 x 72	390,000	120	1.89	12.0	60	180	25	30	600	42 x 60	2000
DHF-1200-2½	48 x 72	520,000	160	2.51	16.0	80	200	30	40	900	48 x 60	3900
DHF-1200-3	48 x 72	520,000	160	2.51	16.0	80	200	30	40	900	48 x 60	3900
DHF-1650-2½	54 x 72	715,000	220	3.46	22.0	110	275	40	55	1200	54 x 60	4900
DHF-1650-3	54 x 72	715,000	220	3.46	22.0	110	275	40	55	1200	54 x 60	4900
DHF-2100-2 ½	60 x 72	910,000	280	4.40	28.0	140	350	50	70	1500	60 x 60	6200
DHF-2100-3	60 x 72	910,000	280	4.40	28.0	140	350	50	70	1500	60 x 60	6200
DHF-2100-4F	60 x 72	910,000	280	4.40	28.0	140	350	50	70	1500	60 x 60	6200
DHF-2550-2½	66 x 72	1,105,000	340	5.34	34.0	170	425	60	85	2000	66 x 60	7500
DHF-2550-3	66 x 72	1,105,000	340	5.34	34.0	170	425	60	85	2000	66 x 60	7500
DHF-2550-4F	66 x 72	1,105,000	340	5.34	34.0	170	425	60	85	2000	66 x 60	7500
DHF-3000-3	72 x 72	1,300,000	400	6.29	40.0	200	500	70	100	2500	72 x 60	8900
DHF-3000-4F	72 x 72	1,300,000	400	6.29	40.0	200	500	70	100	2500	72 x 60	8900
DRF-45-1½ ⁴	10 x 54	16,900	5.2	--	--	2.6	5.2	1.5	1.3	15	18 x 40	250
DRF-70-1 ½ ⁴	13 x 54	29,250	9	--	--	5	10	2.5	2.25	30	24 x 40	400
DRF-100-1 ½ ⁴	14 x 65	42,250	13	--	--	6	12	3	3.25	40	24 x 40	400
DRF-120-1 ½ ⁴	16 x 65	52,000	16	--	--	8	20	4.5	14	95	24 x 40	525
DRF-150-1 ½ ⁴	21 x 62	65,000	20	--	--	10	25	6	5	140	24 x 40	525
DRF-240-1 ½ ⁴	24 x 71	104,000	32	--	--	16	40	8	8	200	24 x 50	600

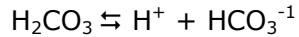
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Theory of Dealkalizer Operation

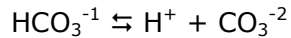
A dealkalizer removes the alkalinity from water. Alkalinity is the combination of carbonate (CO_3^{-2}) and bicarbonate (HCO_3^{-2}). These ions, along with carbon dioxide (CO_2) and carbonic acid (H_2CO_3) comprise the carbonate system. Carbon dioxide dissolves in water to form carbonic acid.



Carbonic acid disassociates into a hydrogen ion and bicarbonate.



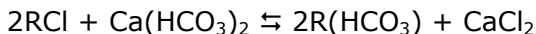
Bicarbonate disassociates into a hydrogen ion and carbonate.



The carbonate salts (calcium carbonate, magnesium carbonate, etc.) tend to precipitate and form scales in boilers. A softener reduces this problem by removing the calcium and magnesium from the water. A dealkalizer further improves boiler water quality by removing the carbonates and bicarbonates.

The carbonate system is the major buffer in natural waters. Buffering is the resistance of water to changes in pH when acids or bases are added to the water. In boiler water, the carbonate system reduces the effectiveness of chemicals applied to stabilize the water and reduce boiler water scaling.

Dealkalizers are anion exchangers regenerated with sodium chloride brine. Anions are negatively charged ions including sulfates (SO_4^{-2}), bicarbonates (HCO_3^{-2}), carbonates (CO_3^{-2}), and chlorides (Cl^-). A dealkalizer exchanges sulfates, carbonates and bicarbonates for chlorides. Chlorides do not cause the problems with boiler water that can be caused by the carbonate system. The following equation shows the chloride-cycle anion interchange reaction:



R=Anion Exchange Resin (with its fixed amine functional groups)

In practice, the chloride-cycle anion dealkalizer is regenerated with a 10 percent solution of sodium chloride brine at the rate of five pounds (2.3 kg) NaCl per cubic foot. By adding 0.25 pounds (113g) caustic soda (NaOH) to the five pounds (2.3 kg) of NaCl, overall operating capacity can be increased by an average of two kilograins per cubic foot of resin. This NaCl / NaOH combination also reduces alkalinity leakage and carbon dioxide production. The use of salt/caustic will also tend to stabilize the product water pH value throughout the run. Using more than five pounds (2.3 kg) NaCl per cubic foot does not increase anion capacity appreciably. In addition to alkalinity reduction, sulfate and nitrate content will be reduced. When NaCl / NaOH is used, it is necessary to presoften the water. Softening before dealkalization avoids precipitation of calcium and magnesium compounds such as CaCO_3 and $\text{Mg}(\text{OH})_2$.

The strong base anion dealkalizer is especially good for smaller installations and places where it is desirable to avoid the handling of acid. While this system initially may represent a larger capital investment than hydrogen cycle cation exchange systems, it is more easily handled by unskilled operators and can be easily converted into automatic operation with simple controls.

Reference: McGowan, Wes. **Residential Water Processing**, Water Quality Association, 1997.