Duplex Softeners

The Problems

The need to reduce the hardness of water is the most common form of water treatment. Hard water is created when naturally soft rain water percolates through subterranean rock strata and dissolves many solids including, in particular, Calcium and Mangnesium. There are many areas therefore where the supply water contains a significant level of these salts. It is called hard water because of the hard deposits created when this type of water is used in many applications.

The deposits are often called scale. However it is actually more like concrete, forming a thick coating on heat exchange elements and the insides of boilers, tanks and pipes. In addition, the hard minerals left in solution significantly detract from the performance of soaps and detergents which then have to be used in greater quantities to achieve the necessary cleaning performance. This not only adds to the level of deposits occurring inside systems and equipment, it also adds significantly to the chemical waste discharged into our sewer systems.

The other main problem created by scale build up is the reduction in efficiency of all heat exchange systems due to the insulating effect of the deposit. This will increase the energy costs and, in addition, can create overheating on the surfaces of the heat source, thereby causing premature failure.

Duplex softeners can be specified with a number of different valve options depending on size and manufacturer preference. The one above is a Fleck 9000 SE digital valve in a "slave / master" configuration. On larger systems there may be two complete valves with a seperate control box.

The Solutions

A cost effective way to solve these problems is to remove the dissolved hard mineral salts from the water and exchanging them with "soft salts" which are more soluble and therefore do not form hard scale. This is achieved by using one of our wide range of fully automatic water softeners.

They work by a process know as ion exchange. The hard water passes through a high quality exchange resin column inside a pressure vessel. The resin removes the Calcium and Magnesium ions from solution and exchanges them for Sodium ions . When the resin is about to become exhausted the softener commences the regeneration phase which is initiated by timer or volume control. The actual regeneration is achieved when the softener draws a solution of common salt water (brine) through the column of resin which displaces the captured Calcium and Magnesium ions and replaces them with the Sodium ions in the brine. Throughout the regeneration period, the unwanted ions and the subsequent rinse water is flushed to drain and does not enter the service line. The regeneration period takes between 60 and 120 minutes depending upon the size of the softener and can be repeated as necessary over many years without significant loss of performance.

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Duplex softeners function similar to simplex units, except that they consist of two resin columns where one is in service and the second is in standby. The flow of water to service is metered and when the first column reaches exhaustion the control valve automatically switches the service flow to the second column and then regenerates the first column. It is then put on standby until required again for service.

In this way a duplex softener is capable of giving a continuous 24 hour supply of softened water. Duplex softeners are therefore ideal for sites with large variations in water demand and for applications where a continuous and uninterrupted suppy of soft water is essential.

Duplexes are usually sized so that each vessel regenerates once per day but more frequent regens are possible as long as there is enough time in between for the salt to saturate the water (The minimum period is 4 hours). Paralell run systems are also available on larger systems where both vessels can be online at the same time with a staggered regen.

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Specifying & Sizing

Fundamentally, the size of a water softener is governed by the amount of exchange capacity that is required by the application. The capacity of ion exchange resin is a function of the volume of the water that passes through it, the hardness of the incoming water, and the regeneration brine setting. On the chart below we show the capacity of each size of softener assuming the feed water has a hardness of 300mg/litre (21 degrees Clarke) and a brining rate of 140g NaCl per litre of resin. The volume can be adjusted for different levels of hardness. Another important criteria to consider is the continuous flow rate required. This affects the size of valve that can be used and sometimes the size of the resin column, since the water needs to have a minimum contact time with the resin to achieve full softening. Short time higher peak flows can be tolerated, but this sometimes results in a low level of hardness passing through into service and can increase the pressure drop across the softener. At design flow rates you can expect a pressure drop of between 3/4—1 bar. The minimum pressure required is 2 bar and the maximum is 8 bar.

All softeners require an electrical supply of 240v. Transformers are supplied (12V for Clack and 24V for Fleck).

Valve Specification

Softener control valves are sized and specified according to the flow rate of the application. The inlet and outlet connection ports generally range between 3/4" and 3" for standard control valves with flow rates up to 50m3 per hour.

Steady demand applications are suitable for either timer control or volume control via in-built metering.

Consumables & Maintainence

Automatic water softeners need a supply of appropriate salt to make the required brine for regeneration purposes. Salt is most commonly supplied in 25kg bags of either granular or pellet type. This type of salt is manufactured specifically for water softening purposes and has a very high purity level. Other types of salt should not be used due to the levels of impurity or additives. The only attention required from the user is to check on a regular basis that the level of salt in the brine tank is kept topped up to ensure a saturated brine solution is available for regeneration. Although softeners are very reliable, as with any other piece of essential plant, routine servicing is strongly recommended. This will ensure many years of reliable service from the plant.

Softener Sizing Table

Resin Volume (Litres)	25	50	75	100	150	250	350	500	750	1000	1250	1500 (multi valve)	2000 (multi valve)
Service Flow m3/hr 1"	1.0	2.0	3.0	4.0	6.0	10	11.6	20	24	40	50	60	80
1.5"							14.0						
2"													
3"													
Vessel Type	935	1054	1354	1465	1665	2162	2472	3072	3672	4272	4872	6367	6386
Brine Tank Volume (Litres)	120	160	300	300	500	750	1000	1000	1000	1500	1750	1000 (measuring tank)	1500 (measuring tank)
Salt Used Per Regen (Kg)	3.5	7.0	10.50	14.0	21.0	35.0	49.0	70.0	105	140	175	210	280

Capacity Table

Resin Volume (Litres)	25	50	75	100	150	250	350	500	750	1000	1250	1500	2000
Capacity at 100ppm (m3)	12.5	25.0	37.50	50.00	75.00	125.00	175.00	250.00	375.00	500.00	625.00	750.00	1000.00
Capacity at 150ppm (m3)	8.37	16.75	25.125	33.50	50.25	83.75	117.25	167.50	251.25	335.00	418.75	502.50	670.00
Capacity at 200ppm (m3)	6.25	12.50	18.750	25.00	37.50	62.50	87.50	125.00	187.50	250.00	312.50	375.00	500.00
Capacity at 250ppm (m3)	5.00	10.0	15.00	20.00	30.00	50.00	70.00	100.00	150.00	200.00	250.00	300.00	400.00
Capacity at 300ppm (m3)	4.175	8.30	12.525	16.70	25.05	41.75	58.45	83.50	125.25	167.00	208.75	250.50	334.00
Capacity at 350ppm (m3)	3.575	7.10	10.75	14.30	21.50	35.75	50.05	71.50	107.25	143.00	178.75	214.50	286.00
Capacity at 400ppm (m3)	3.125	6.25	9.375	12.50	18.75	31.25	43.75	62.50	93.75	1250.00	156.25	187.50	250.00