Diagnosing & Repairing **Residential POE Systems**

By Jerry Horner

Overview of problem areas and how to overcome them systematically

Part II

In the May 2007 issue, we primarily examined how automatic water softeners operate and discussed many of the potential solutions to operational challenges. Observation, documentation and testing were noted as the most important starting points. In this issue, we will further discuss specific problem areas and how to overcome them systematically. We will continue where we left off, with brine concentration and contact issues.

Possible Clogging

Proper brine concentration is a function of many factors that include the injector size, motive flow pressure, brine concentration and injector efficiency. Watch out for a salt bridge where the salt sticks to the sides of the brine tank and prevents contact of the salt with the refill water. Check the brine concentration, preferably using a salinometer. We take a 26% full-strength brine solution, typically dilute it to about 10 to 12% with the injector and hopefully move this solution equally throughout the resin bed at an optimum rate. The draw rate can vary widely depending on salt dose and other factors, but in general, you should expect to remove the brine from the brine tank in approximately 10 to 15 minutes. All of this is good, but has little to do with hard water problems. Even an inefficient or poorly configured injection system will still produce soft water. The capacity will not be great, but if you achieve contact between the concentrated brine solution and resin, the ion exchange process will take place. Detailed brine injection efficiency is most important when targeting capacity or hardness leakage issues. For our purposes, we will concentrate on brine contact and concentration.

The injector incorporates one or more components that work to create a vacuum and draw the brine solution from the brine tank. The relatively small opening of the injector almost encourages clogging. Poor brine draw is often caused by simple clogging of the assembly. Cleaning or replacing the injector may be all that is needed. It is important to replace or thoroughly clean not only the injector, but also the related components and surrounding areas to make sure the cause of the clog is extracted. If you still have poor brine draw, check for a flow restriction in the drain line. A partially restricted drain line flow control will prevent proper suction.

A Poor Resin Bed

A more difficult symptom to diagnose is a deteriorated resin bed. You must physically core sample the resin to determine the condition. Inspecting the resin, you may find that the top section of the resin bed is soft or mushy. New resin is firm and flows through your fingers when squeezed. If the resin is not in good condition, back pressure from the broken down resin bed can prevent proper injector operation. This can also cause channeling of the regenerant and/or service flow resulting in poor brine contact. This, of course, causes lousy capacity and poor soft water results. A poor resin bed can leave salt pockets that fail to rinse adequately, resulting in intermittent salty water to service. Do not try to replace only the top portion of the resin that appears to be causing the problem. I can almost guarantee that you will regret this attempt to save a little time and money.

When in the brine and rinse cycle, there should be a strong suction at the brine pick up tube. If you have good suction strength at the injector, but are not drawing from the brine tank, then you need to inspect the brine pick up and float assemblies. Don't spend too much time on this inspection. These are good parts to replace as a matter of preventative maintenance. Brine draw is dependent on the valve sending water throughout the internal porting properly. Thus you may need to overhaul the controller's internal parts to fix the problem. Again, these parts are preventative maintenance items and should be replaced if in doubt. The last thing you need is to have to redo something you should have done properly the first time.

Ion exchange is wholly dependent on the brine solution contacting the resin. If the brine is drawn into the mineral tank but does not pass through the resin bed, you will still have hard water. Check this by first confirming you have a strong brine solution in the salt tank. Put the system into the brine and rinse cycle and confirm that the brine is being removed from the brine tank. Go to the drain line and taste the water coming from the drain line. In a

properly functioning system, you will expect to first taste relatively fresh water at the drain. This is the displaced water from the mineral tank.

Next, you should taste a strongly bitter solution. This signifies that the hardness minerals are being driven out of the system. Once the bulk of the hardness has been removed from the resin, you should notice a salty taste that occurs when the brine solution no longer has a significant amount of hardness to remove. If within about five minutes you find that the water to the drain line is salty, shut the system down and check the riser pipe connection. You will want to replace any related seals and the distributor assembly. If the connection between the bottom of the controller and the distributor pipe is not properly sealed, the brine water will enter the mineral tank and as always, follow the path of least resistance. This path will bypass the resin bed, leading directly back through the controller and to the drain line.

Resin-to-Service

Resin-to-service is usually discovered when strainers in the home begin to clog, or you may find resin beads in the toilet tank. If your system is losing media to service, check to see if they are whole beads or smaller particles. If the loss is of whole resin beads, you can count on finding a problem with the distributor assembly. It is important to transport loaded point-of-entry (POE) systems in a vertical position. Putting them into a horizontal position tends to place the weight of the media across the length of the distributor pipe. This can bend and pull the pipe out from the correct position in the bottom of the valve. When set back to vertical, the pipe may damage the seal on the bottom of the controller and may not sit back in the proper position at the bottom of the mineral tank. If there is a gravel base, the rock may slide under the screen of the bent distributor tube. When placed upright, the screen will rest higher than originally intended—on the gravel rather than the bottom of the tank. This essentially makes the pipe too long and can make it jam into the bottom of the controller. This can lead to a distributor failure from the constant pressure exerted on the pipe and screen caused by the shorter area available.

Want a migraine? Have a distributor failure that allows the resin to pass into a home. Not only do you have to repair the system, but the real entertainment is trying to get all the resin out of the house. The resin likes to settle in the water heater, but when you open the drain valve, the resin will stir up and only partially drain from the valve. You have to wait for the resin to settle again to the bottom and repeat the process until the resin is extracted. Transport the system in a vertical position or load the media on site to avoid a world of frustration. If you find that the resin beads to service are consistently very small, check for a system that is plumbed in backwards. Don't be a hard head and insist that it is plumbed correctly. Water flowing up flow to service will lift the resin fines up to and through the slots of the top screen and into the service flow.

Calculating Water Flow

Hard water is often intermittent. You may find soft water after a system regenerates, but hard water before the calculated regeneration takes place. Last time we covered how to make reasoned, realistic capacity calculations. If all your calculations make sense and everything checks out from an operational standpoint, take a look at another possibility. Hopefully we are no longer using time clock softener systems initiated by a set number of days; these are anathema except in a few specific applications. Most modern systems use a flow meter to count the volume of water used in order initiate the regeneration, at least in theory, just before exhaustion of the systems capacity occurs. Most residential systems can count water flows down to about 0.25 gal per minute (gpm). This seems perfectly adequate, as not many water flow demands fall under this parameter. However, a small leak in a toilet float, faucet or any of a number of other water devices can lead to a huge water flow disparity. A continuous leak of just 0.05 gpm will result in a loss of 72 gal per day of softened water. This is like adding an extra person to the family and not counting their water use. Put on your Johnny Dollar detective hat and correct any small leaks. If you don't take this extra step, the user will look to you for answers as to why the softener does not maintain soft water at the expected capacity.

Practice these troubleshooting steps and watch your return calls diminish, while your customer service satisfaction and profits increase. *wqp*

About the Author
Jerry Horner, CWS-VI, CI, is vice president of sales and technical support for Topway Global, Inc. He can be reached at 714.255.7999, or by e-mail at jerry@tgipure.com.

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