AC39 Manual Water Softener
Operation and Recharging

Hard water is any water that contains minerals such as calcium, magnesium and iron. Approximately 3/4 of the United States has water that is considered hard. When heated, the minerals in hard water come out of solution and are deposited inside fittings, check valves, strainers, heat exchangers, valves, jets and hoses. These minerals build up and cause inefficiency in solution heating, cause component malfunction, premature wear and damage to equipment. Damages resulting from hard water deposits are considered abuse or neglect and such repairs are not covered under equipment warranties. These minerals can also make cleaning chemicals less effective, increasing chemical use and costs. Use of a water softener can save much more time and money than the cost of the water softener.

To remove these minerals, the Hydro Force water softeners operate on the principle of ion exchange. Ions are atoms or groups of atoms that have an electrical charge. During the ion exchange softening process, positively charged cations are attracted to the negatively charged resin beads in the water softener. The resin beads initially hold sodium ions (Na+) which are exchanged for the calcium ions (Ca+), magnesium ions (Mg+) and other cations in the hard water.

The ion exchange resin inside the softener tank consists of highly porous, amber colored polystyrene-divinylbenzene beads loaded with exchange sites. At the beginning of the softening cycle, sodium ions occupy the resin's exchange sites. As the water passes through the resin, the resins stronger attraction for the hardness ions (calcium and magnesium ions) causes it to take on the hardness ions and give up the sodium ions. Iron, lead or other metals in solution may also be removed by ion exchange; but only portions that exist in solution as cations (Positively charged ions). Non-ionic particulates or anions (Negatively charged ions) will not be removed. Ion exchange will not remove suspended matter or chemicals.

The sodium ions added to the softened water are added at an inconsequential rate. The amount of sodium contained in the discharged softened water will not affect the cleaning solution or residual content on the cleaned surface in any measurable or noticeable way.

As the hard water flows downward through the resin bed, the resin at the top of the bed is the first to exchange the sodium ions for the hardness ions. The exchange is not instantaneous and occurs in an area called the reaction zone. The depth of the reaction zone depends on the water hardness, water flow rate, and water temperature. As the resin takes on more hardness the reaction zone moves down in the tank. When the reaction zone reaches the bottom of the tank and hard water passes through the tank the resin has become exhausted and must be recharged.

The size of the tank, the amount of resin and the hardness of the water will affect the amount of water that can be softened before recharging is required. Our softener has a rated capacity of 32,000 grains. Hardness is rated in grains per gallon. The rated capacity divided by the grains per gallon of your water supply will give you the estimated amount of water that can be softened before recharging is required. For example, if your local water is rated at 15 grains per gallon the AC39 can soften approximately 2,100 gallons before recharging is required. Compaction and channeling of the resin bed or loss of resin can greatly reduce the softening capacity. Water hardness test strips can be used to test the water flow out of the water softener to determine if the softener needs to be recharged.

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The recharging or regeneration process should begin with a 10 minute back flush to loosen the resin bed and flush out suspended particles.
(This does not necessarily need to be performed before every recharging, but at least it should be done before every second recharging process.)

The regeneration occurs when a salt or brine solution is passed downward through the resin bed. When the salt (sodium chloride) is dissolved in water to make the brine solution, it splits into sodium (Na+) cations and chloride (Cl-) anions. When the brine solution flows through the softener, the resin beads are surrounded by overwhelming numbers of sodium ions, some of the sodium ions will attach to the resin bead exchange sites, thereby kicking off the hardness ions that previously occupied these sites. The hardness ions are then flushed from the tank along with the excess brine. The chloride ions merely pass through during the recharging process or bond with the hardness ions and are discharged as calcium chloride and magnesium chloride.

The negative electrical charge is permanently infused in the structural chemistry of the resin beads. This negative charge will always seek balance by attracting a counteracting positive charge of the cations in the hard water such as the calcium or magnesium ions or the sodium cations in the brine solution. The bead charge is permanent and cannot be destroyed. However the exchange sites of the resin beads can be fouled or blocked if the beads become coated with iron hydroxide or oil. Oxidants such as chlorine can destroy the structure of the polystyrene-divinylbenzene causing the beads to physically disintegrate. Even so, water softening resin beads typically have a life of 10 to 20 years.

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SECTION ONE – BACKFLUSH PROCEDURE

1. Shutoff incoming water supply to the water softener.
2. Remove the inlet water hose and outlet water hose from the softener head.
3. Connect a drain line to the inlet port of the water softener head. Connect the inlet water hose to the outlet port of the softener head. This will allow the water to flow in the opposite direction of its normal flow.
4. Place the end of the drain line in a bucket. This will allow you to catch any resin beads that are flushed out during the procedure. These resin beads can then be poured back into the softener tank.
5. Turn the water on and allow the water to flow through the softener at a rate of approximately 2-4 gallons per minute. Allow water to run for 10 minutes.
6. When the water supply is turned off, disconnect the incoming water supply hose from the outlet port. Disconnect the drain line and connect the drain line to the outlet port of the water softener. Reconnect the incoming water hose to the inlet port of the water softener. It is now ready for recharging.

SECTION TWO – SOFTENING PROCEDURE

If necessary perform back-flush procedure before continuing with softening procedure. (See section 1)

1. Shutoff incoming water supply to the water softener.
2. Remove the black fill plug from the top of the softener head
3. Pre-measure by weight 10 pounds or coarse rock salt.
4. Pour the 10 – 15 pounds of coarse rock salt through the hole into the softener tank. You may need to siphon some water (about 1 gallon) from the softener tank to make room for the salt. Do not allow siphon hose to touch the resin beads. You do not want to accidentally remove any resin beads. If any beads are removed during the siphoning they can be poured back into the tank with the salt.
5. Replace the black fill plug.
6. Remove the outlet hose from the softener head and replace with a drain line that can be run to a bucket or drain.
7. Turn on the incoming water supply to the water softener. Allow a small trickle of water to flow from the drain line. The flow stream should be about the size of a pencil, approximately 1/4 gallon per minute. Allow the water to run for 15 to 30 minutes. After the water has run a few minutes, you can taste the outlet flow of water. The flow will be very salty. After 15 minutes taste the water again. If the water still tastes salty, let the water continue to run for a few minutes more and retest. Once the salt taste is gone, you can turn off the water supply, the softening process is complete.
8. When the water supply is turned off, disconnect the drain line and reconnect the outlet hose to the softener. It is now ready for normal operation.

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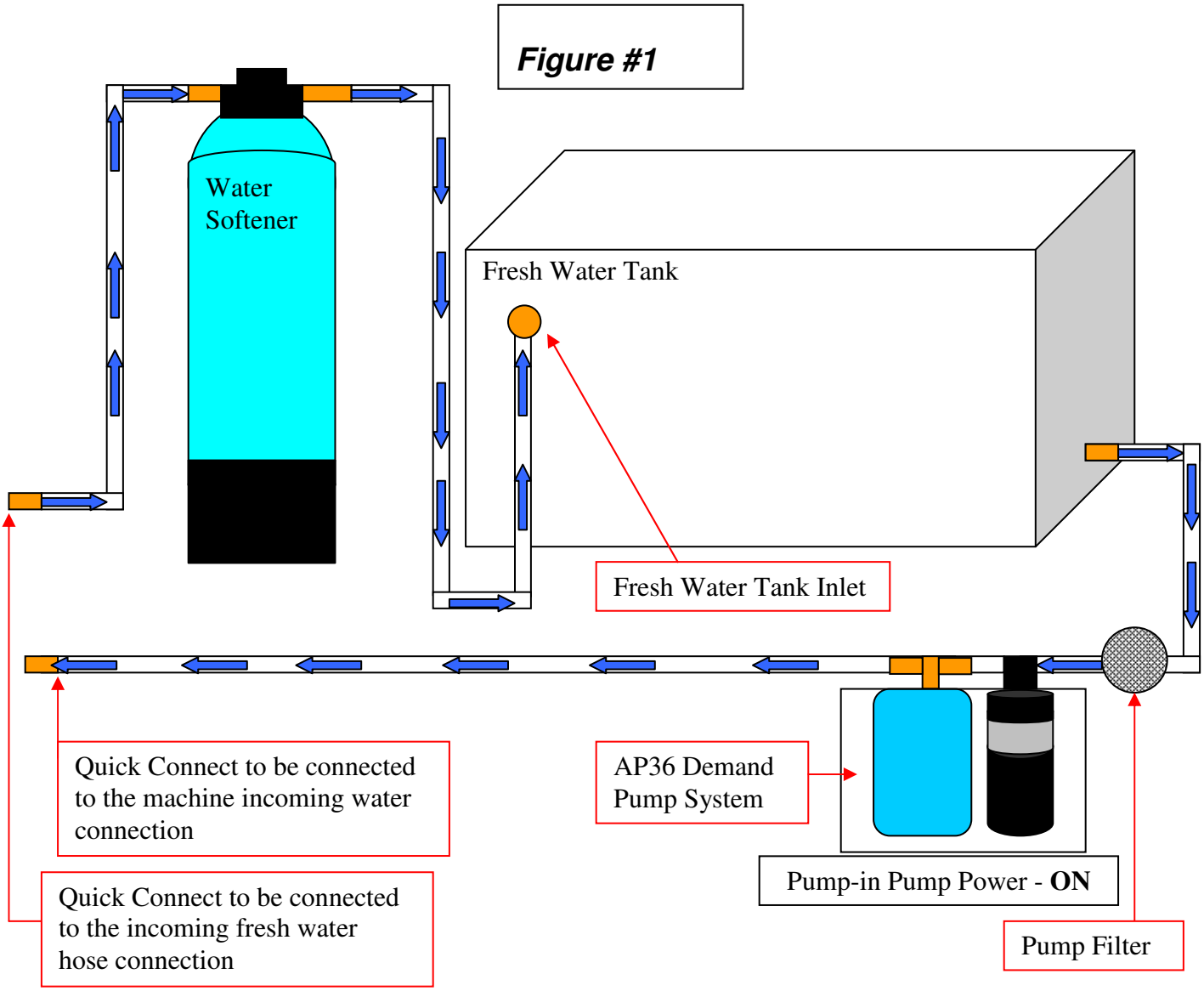

When installing a water softener with a fresh water tank, the water softener should be placed on the fill or incoming side of the fresh water tank and its water flow path. The softened water from the fresh water tank will flow to the Pump-in pump and be pumped to the incoming water connection on the front of the machine. **(See Figure #1)**

Quick connects are to be used on the inlet and outlet hoses of the water softener for connections to the incoming water hose and fresh water tank. Adapters may be needed to be able to reverse the water flow through the softener to back-flush the resin before recharging.

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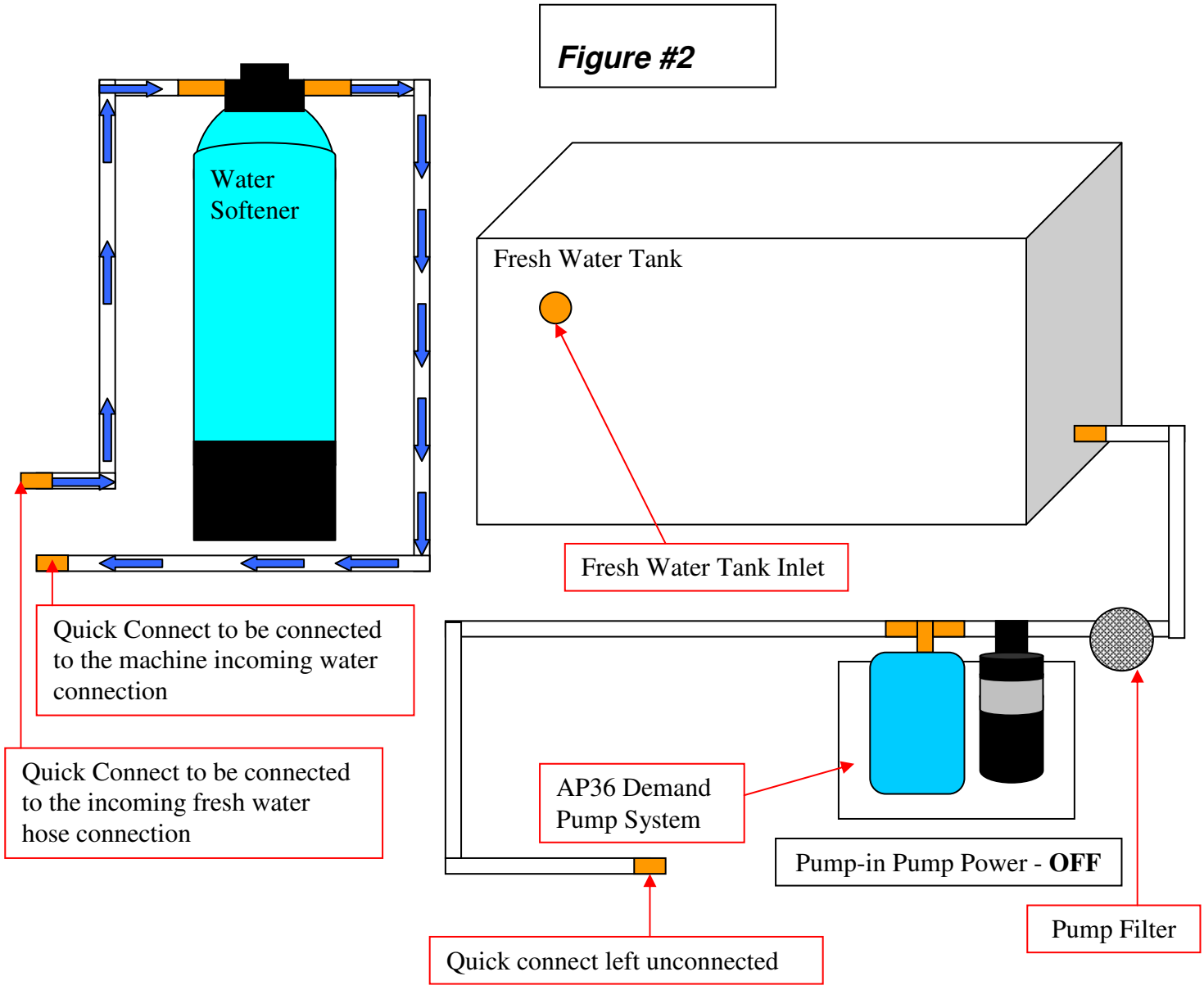
The same size and style quick connect used as the incoming water connection on the machine should also be used on the fresh water tank inlet. If the hose from the softener to the tank is made long enough it can be connected to the incoming water connection on the machine when the pump-in pump and fresh water tank are not needed or malfunctioning. This is the same water softener plumbing route used on machines without a fresh water tank or pump-in system. **(See Figure #2)**



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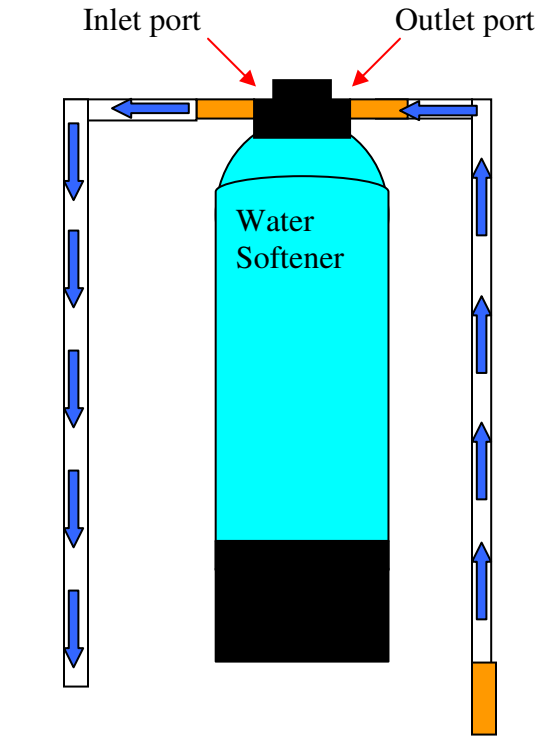
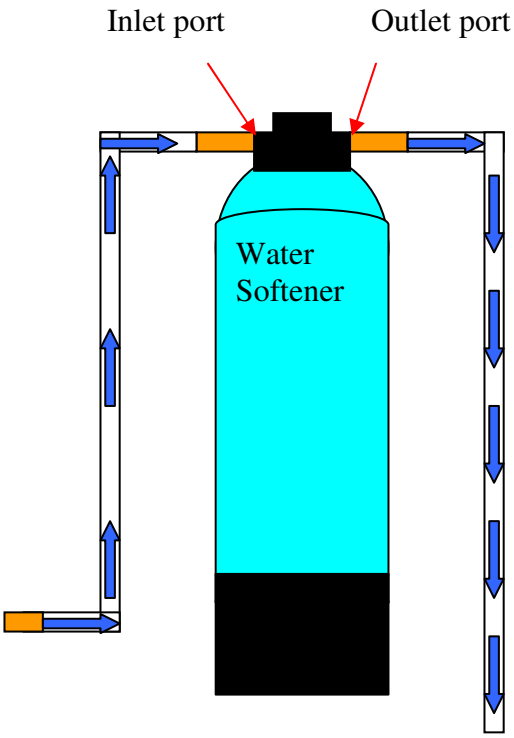


BACK-FLUSH

During back-flush, incoming water is connected to the Outlet port and water flows out the drain line connected to the inlet port.



RECHARGING

During recharging, incoming water is connected to the Inlet port and water flows out the drain line connected to the Outlet port.