VERTEX
Water Products

PureWaterMachine™

REVERSE OSMOSIS UNDERSINK WATER FILTRATION SYSTEM

OWNERS INSTALLATION MANUAL

Model 3C

VERTEX WATER PRODUCTS

The VERTEX PURE WATER MACHINE is made with quality components to provide clean, safe drinking water. No chemicals are added or used in this system. To preserve the filter capability, it is a *must* that the filter replacement be made at the intervals and with replacement elements as specified in section 4.0 of this manual.

All filter elements are made in the USA and are NSF approved, including the flow tubing and fittings.

Applicable Product Models
3C-4.0 (Standard model)
3C-4.0/P (With booster pump)
3C-4.0/UV (With Ultraviolet stage)
3C-14/P (With booster pump and 14 gallon tank)

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i NOTICE

This instruction manual was written to guide a professional plumber to make an easy installation of the VERTEX Pure Water Machine. The installation shall conform to local plumbing codes.
It is imperitive to install a pressure regulator in front of the unit or at water point of entry to prevent this system from experiencing pressure spikes above 90 psig.

This filter system can be installed by the homeowner who has sufficient tools and skills. Be cautioned that an extra faucet for purified water will be installed . This requires a 7/8-inch diameter hole in the sink top. If there is not an extra hole existing, a new one must be drilled. For a porcelain sink, this requires a special drill (7/8" Relton cutter) which costs about $100 and requires skill to use.

ii PARTS LIST

PARTS CONTAINED IN THE PURE WATER MACHINE CARTON

1-Box containing storage tank

1-Box with filter assemblies

1-Set of 1/4" plastic tubes, orange, black, 3/8” tubes, yellow, and white

1-clean water faucet and fittings

1-set of hardware consisting of:
- Inlet water 1/4" ball valve and 1/2" feed line adapter
- 3/8" plastic ball valve for tank shutoff
- Drain saddle clamp

1.0 INTRODUCTION

The VERTEX Pure Water Machine is a 4-stage water cleansing system. The principal cleansing of the water of its dissolved solids is by the Reverse Osmosis membrane filter (stage 3).

Stage One is a sediment filter which removes particles of rust, sand and other trash in the water line down to 5-microns in size.

Stage Two is an activated carbon block filter which removes odors, chlorine and foreign tastes.

Stage Three is an advanced reverse osmosis membrane for removal of dissolved solids. This is the heart of the system. The reverse osmosis technology removes 95% of the dissolved solids on average. Dissolved solids are not removed by municipal water treatment. That is why the Vertex Pure Water Machine is an important safety factor for the water you drink and use in your cooking. Chemical contaminants such as mercury, lead, nitrates, pesticides and others not yet identified which seep into municipal water systems are removed. Bacteria such as cryptosporidium and giardia lamblia and others yet unknown are removed. The RO system works differently than standard mechanical filters, such as the two pre-filters in this system. The RO splits the incoming water into two streams-clean water and brine water. The brine water carries away the contaminants. The water pressure against the reverse osmosis membrane forces the water molecules through the membrane, but the larger contaminant molecules and bacteria are kept behind and are flushed to the sewer. The clean water goes to the storage tank and is held there ready to use. When the faucet is opened, clean water from the storage tank flows through the final polishing filter (Stage Four) of activated carbon and into the faucet for your use. The tank is prepressurized with a bladder which pushes the water out through Stage Four.

On your sink, a special faucet is installed which is your safe, good tasting drinking water, and especially good for coffee, tea and drinks. By extending a line to your refrigerator, it can be used to make ice cubes.

LIFE. The filter life is specified by the number of gallons of water flowing through the system. Normal household will use two to three gallons of purified water daily. The filters are good for 1500 to 3000 gallons total usage. Therefore, to be safe, the filters, that is, Stage 1, 2, and 4, should be changed once per year. The reverse osmosis membrane has a 5-year shelf life and a 3 to 4-year working life. It is recommended this membrane be changed once each four years. See section 4.0

2.0 INSTALLATION

Before starting the installation, you should measure the water pressure that is available under the sink to power the Pure Water machine RO. If the pressure is less than 40-PSIG, it is too low; and if it is 90-PSIG, it may be too high. The solution if the pressure is too low is to use a model with a booster pump. The solution for high water pressure, is to put a pressure regulator in the inlet water line to the house. A pressure of 60-75 PSIG is normal.

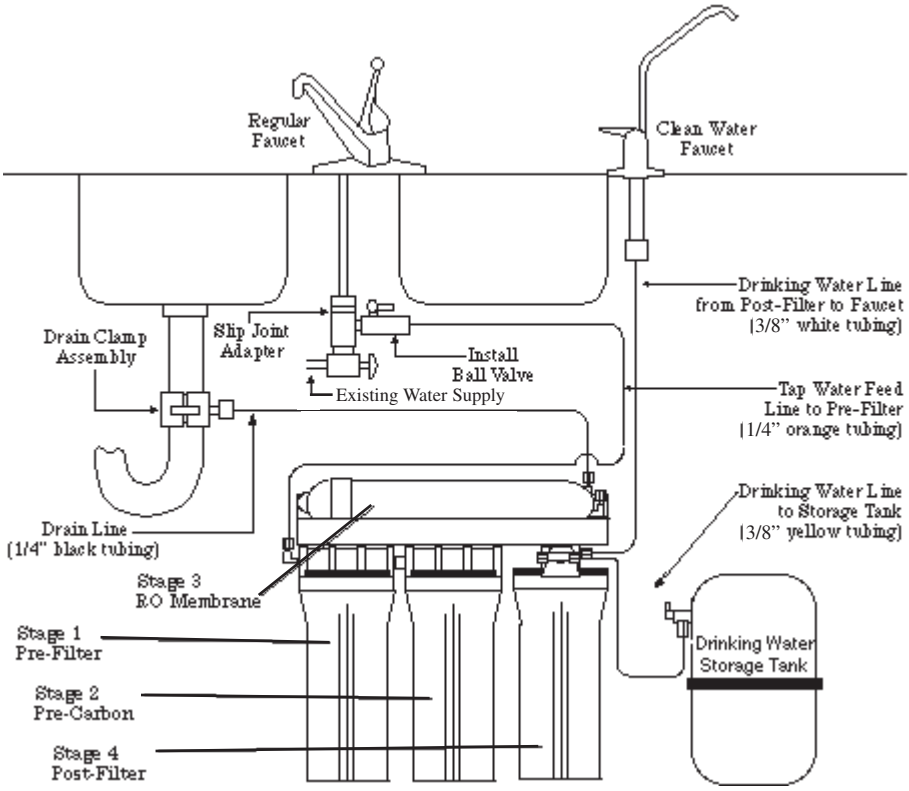
2.1 Location of RO unit

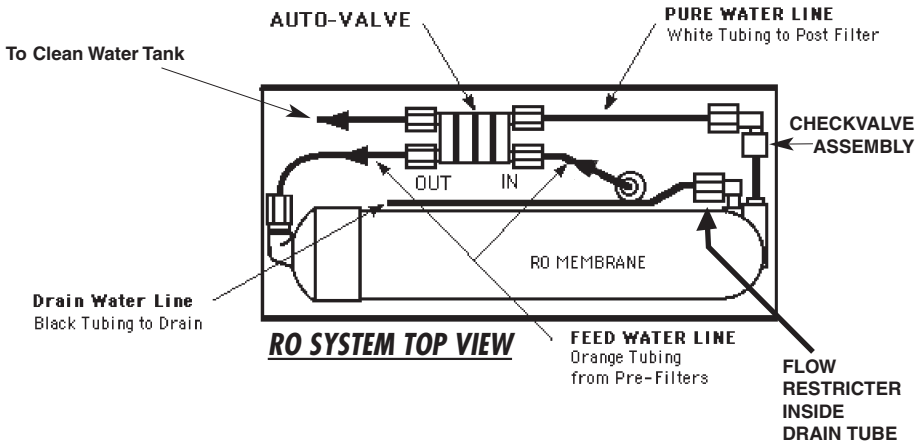
The RO unit may be located under the kitchen sink or in the basement. A cold water supply line must be close by. When locating the system under a sink make sure there is adequate room for the filter module assembly as well as the storage tank. For best performance the tank should be located as close to the clean water faucet (supplied) as possible (within 20 feet).

2.2 Mounting the RO filter unit under a sink (Fig. 1.)

Mount the unit to the wall of the sink cabinet. Pre-fit the unit by positioning the bottom of the pre-filter cartridges 2 inches off the floor of the cabinet. This clearance is necessary to make room to remove the housings when replacing the filter cartridges. Mark the location of the 2 mounting holes in the mounting bracket. Install 2 mounting screws leaving 1/8 inch clearance under the screw head. Check fit the mounting of the RO filter unit but don't install yet.

Figure 1





RO SYSTEM TOP VIEW

2.3 RO Stage

Note that the RO housing on the bracket in Figure 1 (horizontal element on top of the bracket) already contains a pre-installed 75 GPD (gallon per day) membrane. There is no need to install the membrane, and when it is time to replace the membrane, the whole element including the housing is discarded. Note that the fittings are the "push-type" (John Guest type) to seal, and are easily disconnected from the tubing.

The tubing is color coded. Orange for feed water through the 2-pre-filters to the auto-valve "IN" connection and from auto-valve "OUT" connection to the inlet of the membrane housing. Then the clean water from the from the RO is a white line to the auto-valve and from the auto-valve to the tank (yellow tubing is provided). The reject or brine line from the RO is colored black and connects to the sewer line under the sink.

2.4 Connecting the feed water supply (Fig. 2)

The feed water assembly consists of 1/2" brass slip joint adapter, a black washer, and a 1/4" x 1/4" ball valve. Locate these parts in the installation kit.

Locate the cold water shut off valve under the sink and turn it off. Open the cold water faucet to release the pressure. On single handled faucets, the hot water may have to be turned off to prevent any hot water cross-over. If water continues to come out of the faucet with the under-sink valves turned off, the house main valve will have to be turned off.

Now that the water has been turned off, disconnect the cold water riser tube (flex line) from the valve. Install the slip joint connector with the black washer. Loosen the nut and separate the cold riser tube from the faucet shank. Gently bend the riser tube so that the slip joint adapter fits onto the faucet shank. Reinstall the cold riser tube on the slip joint connector using the existing cone washer. For Solid copper tube the procedure is the same except you must cut a piece of the riser tube about 3/4" to 1" so the slip joint adapter can fit between the valve and the riser tube. Wrap several turns of teflon tape on the ball valve and install on the slip joint connector.

In some cases the Pure Water Machine is supplied with a saddle Valve which can clamp over a copper pipe and make the hole and seal at once. (See figure 3).

Figure 2

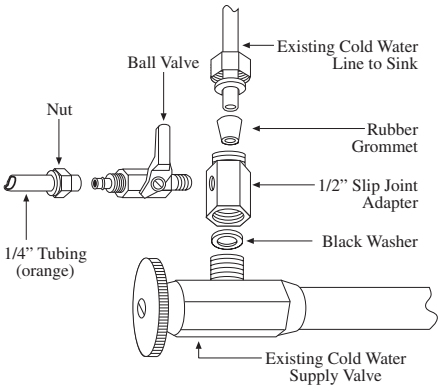
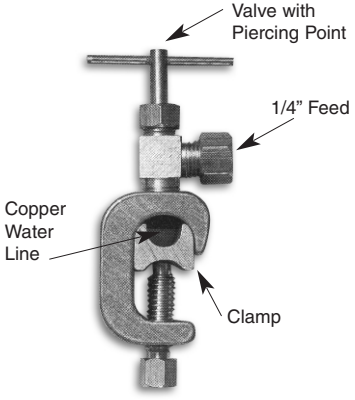


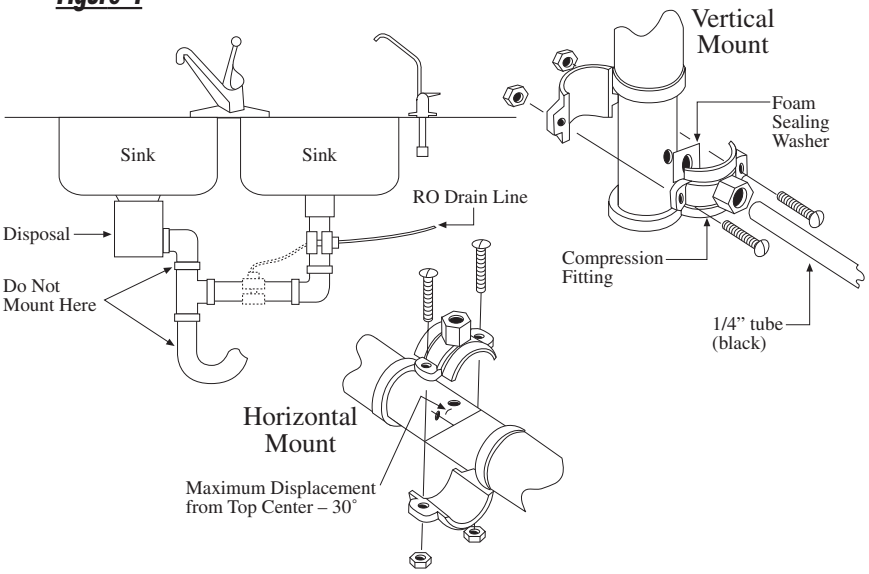
Figure 3



2.5 Installation of drain connection (Fig. 4)

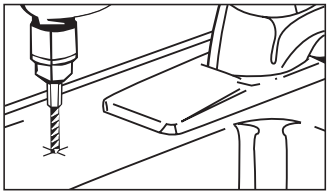
Place the drain outlet saddle on the drain pipe. Allow proper space for the drilling operation. Tighten the saddle bolts evenly on both sides. Using the opening in the drain outlet saddle as a guide, drill a 1/4" hole in the drain pipe. Clean any debris out of the drain saddle connection.

Figure 4



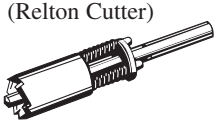
2.6 Installation of clean water faucet (Fig. 5.)

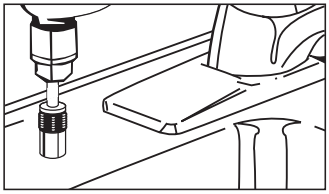
Step 1.
Pilot Drill



The faucet should be positioned with aesthetics, function, and convenience in mind. An ample flat area is required for the faucet base so that it can be drawn down tight. The space under the sink below where the faucet will be mounted must be clear of any obstructions.

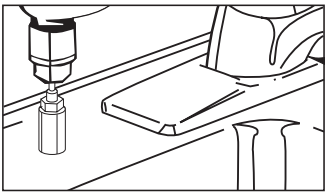
Step 2.
Spring Loaded
Porcelain Saw
(Relton Cutter)





Some conditions may eliminate the need to drill a hole in the sink such as a faucet previously installed in the sink, a hole covered by a chrome hole cover, or an unused spray handle. If any of these situations are present, you may mount the faucet in one of these holes. *continued...*

Step 3.
Finish Hole Saw



The sink drilling process is not complicated, but requires a certain amount of caution and forethought. Porcelain sinks can be chipped if care is not exercised when drilling the hole for the faucet.

[NOTE: This procedure is for the non air gap faucet provided.]

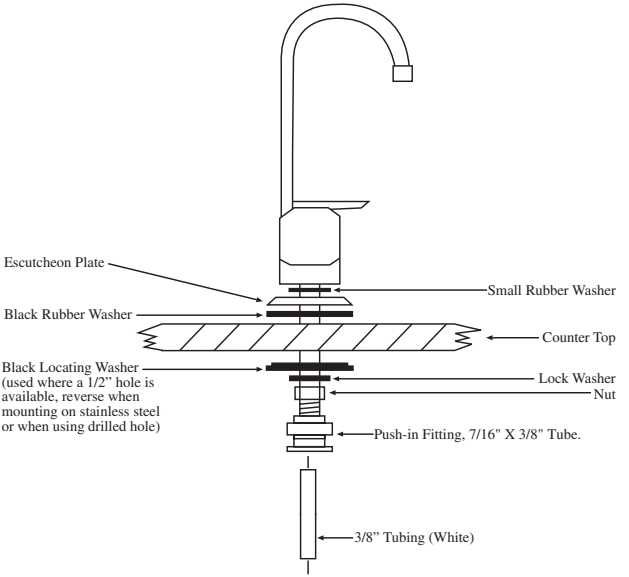
2.7 Porcelain/Enamel over Steel or Cast Iron Sinks

Using a small diameter carbide tipped drill, drill a pilot hole completely through the porcelain and the material underneath. Remove any metal chips that fall into the sink to prevent rust stains. Place the spring-loaded porcelain cutter bit in to the drill chuck. Make sure the pilot guide is inserted tightly. Insert the pilot guide onto the pilot hole. Push down gently on the drill motor to apply light pressure to the porcelain surface. Start the drill motor, turning as slowly as possible. After the initial cut has started, motor speed may be gradually increased. The cut may require three to four minutes to complete. Going faster could result in excessive chipping. Be sure a complete ring has been cut through the porcelain to the metal underneath.

Place the finish hole saw into the drill chuck. Make sure the pilot guide is inserted tightly. Insert the pilot guide into the pilot hole. Begin cut using a slow speed and light pressure until the porcelain has been penetrated to the material underneath. Remove the saw from the hole and clean all debris from the porcelain surface. Reinsert saw into the hole and cut through the remaining material.

2.8 Install Faucet (Fig. 6)

Figure 6



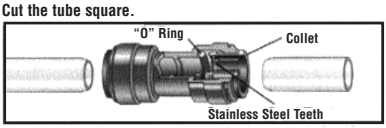
Disassemble the hardware from the threaded stud except for the top base plate and sealing gasket. Install the faucet in the sink hole. From below the sink assemble the mounting hardware. Use a deep socket to tighten the nut.

2.9 Tubing Connections

a. The model 3C-4.0 has the quick-connect "push-in" fittings. These fittings have a collet to grip the tube and an "o" ring to provide the seal to the tubing. The collet has steel teeth in it to grasp the tubing to prevent it from backing out.

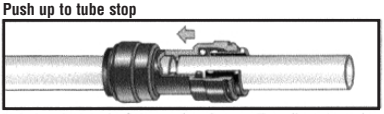
b. **Making a connection.** To make a connection, first cut the tubing so it has a square end. The tube must be clean and the surface smooth. Push the tube into the collet as far as it will go. See the diagrams below

Cut the tube square.



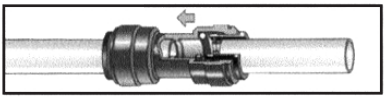
Cut the tube square. It is essential that the outside diameter is free of score marks and that burrs and sharp edges be removed before inserting into fitting

Push up to tube stop



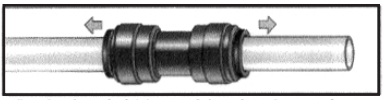
Push the tube into the fitting, to the tube stop. The collet (gripper) has stainless steel teeth which hold the tube firmly in position while the "O" ring provides a permanent leak proof seal

Insert tube



Fitting grips before it seals. Ensure tube is pushed into the tube stop

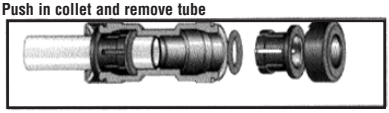
Pull to check secure



Pull on the tube to check it is secure. It is good practice to test the system prior to leaving site and/or before use.

c. Disconnecting

Push in collet and remove tube



To disconnect ensure the system is depressurized before removing fitting. Push in collet squarely against face of fitting. With the collect held in this position, the tube can be removed. The fitting can then be re-used.

d. Feed Water Line

Connect the orange colored 1/4" inlet tubing to the ball valve installed in step 2.4 above. To connect, remove compression nut and ferrule and slide on to tube. Insert tube over the ball valve tube as shown in Fig. 2. Slide nut over threads and tighten.

e. Drain Line

Find the black colored 1/4" tubing. Connect the tube to the drain saddle clamp from step 2.5. Push tube into fitting about 1/2 inch. Tighten plastic nut.

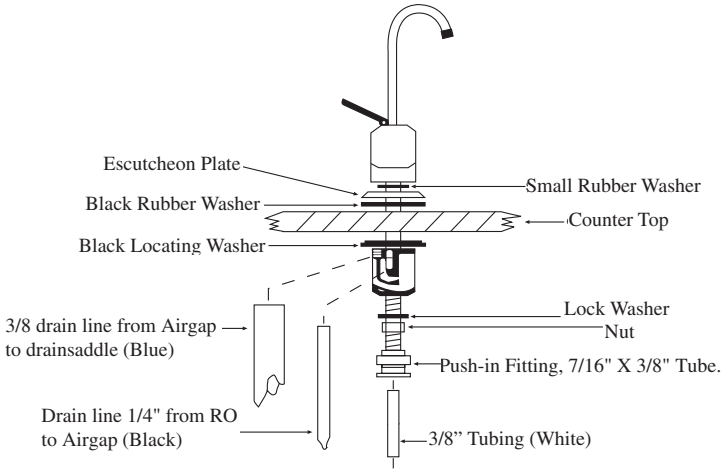
f. Faucet Line

Find the push-on fitting that screws on the faucet. Thread onto the faucet stem. Find the white colored 3/8" tubing and push the tube into the fitting until it stops.

g. Tank Line

Install the plastic ball valve on the storage tank. Find the yellow colored 3/8" tubing. Connect the tube to the plastic ball valve on the tank. Push tube into fitting until it stops. Turn the valve to the on position. The tank comes pre-charged from the factory at 5-7 psi. Double check the pressure with a tire gage (the air fitting is on the opposite end of the tank from the ball valve). If it is less than 5 psi add 2psi with a compressor or bicycle pump. Note: Putting more pressure than 7 psi does not help to increase water flow through the faucet.

Figure 9



2.10 Air-Gap Faucet Installation (Fig. 9)

Air-Gap Faucets are sometimes required by municipal code. The faucet is designed to take the waste water from the membrane to the top of the sink and then let it flow by gravity to the drain saddle. The objective is to prevent possible backup of drain water from the sink to the membrane in the event of a sink clog. A drain saddle with 3/8" instead of 1/4" is used. An extra section of 3/8" tubing (black) is used from the faucet to the drain.

Sink Preparation
Drill the appropriate size hole in the kitchen sink to accommodate the air-gap faucet.

Drain Connection
Follow instructions of section 2.5 except drill a 3/8" hole in the drain pipe.

Tubing Connections
Find the black colored 1/4" drain line from the membrane. Remove from membrane housing. Connect this tube to the 1/4" barbed fitting on the air-gap faucet. Find the 3/8" black tubing in the parts kit. Connect this tube to the 3/8" barbed fitting on the air-gap faucet. Install the faucet assembly (with tubes attached) into the sink hole. Secure the faucet per instructions in section 2.8. Re-attach the 1/4" black tubing to the drain side of the RO membrane housing. Be sure to tighten the fitting nut securely. Attach the 3/8" tube to the drain connector. Tighten the fitting nut securely. Attach the pure water line to the faucet per the instructions in section 2.9-f.

3.0 System Start Up

3.1 Start-Up

Start the system by opening the feed water ball valve. Make sure the ball valve on the storage tank is in the closed position. Check for leaks for at least 10 minutes. If water leaks from a fitting, retighten the fitting nut. Open the product water faucet and let the water flow until all the air has been expelled from the system. This will take about 30 minutes. Close the product water faucet. Make sure drain water has stopped flowing within one minute.

Open the tank ball valve and let the system run about 2-hours to get a complete tankful. Then open the clean water faucet on the sink and empty the tank. This is to flush the system and remove the preservative from the RO membrane, as well as flush carbon "fines" from the post filter

If the waste continues to run after the tank is full, it may mean there is air binding the autovalve. Empty the tank again by opening the faucet. This will help to clear more air from the system. If the waste water running persists, remove the connection and the stainless steel checkvalve at the outlet of the RO stage (fig. 1). Clean the check valve, reassemble and start the system again.

3.2 Air Purge

The water moves slowly through the PureWaterMachine™. Small amounts of air therefore tend to hang up in corners and accumulate over a period of time. This can cause the autovalve to malfunction (not close properly), letting water run continuously to the drain. The instructions in 3.1 “startup” should be rigidly followed.

4.0 Recommended Filter Changes

4.1 Filter Replacement, Pure Water Machine

Filter element replacements of Stage 1, Stage 2, and Stage 4 are mandatory once a year to maintain water purity.

The recommended replacement frequency is listed below:

	Part Number	Replacement Frequency
Sediment Filter Element, Stage 1	SF-4001	6-12 Months
Pre-Carbon Filter Element, Stage 2	CF-4000	6-12 Months
RO Membrane Assembly, Stage 3	MH-4206	3-5 Years
Post Carbon Filter Element, Stage 4	CF-4008	6-12 Months

These filter replacement elements are available from your dealer. When you buy or install your Pure Water Machine, we recommend that you buy the first year filter replacement kit. This includes Stage 1, 2 and 4 filter elements.

This kit comes in a plastic satchel which can be attached to the installed Pure

Water Machine under your sink. There is a space to write in the date of replacement, which is one year from date of installation. In this way you will have your reminder date for replacement and the parts to do it at hand. Kit part number is FK-102

In the replacement kit are instructions for replacement and cleaning, and a handy wrench to unscrew the Stage 1 and Stage 2 filter bodies. A post card order form for the next replacement kit is included, ready for you to send in for the new replacement kit for the next year.

At year 4 (or sooner if you have severe water problems),we recommend that the Stage 3 reverse osmosis assembly be changed also. When you order your fourth year kit from your Vertex dealer, this will be included, along with the other three elements. Kit part number is FK-102/75

4.2 Standard Filter Elements

The Stage 1, 2 and 4 elements are standard and are available in many large hardware stores. The descriptions below may be used to get comparable elements for the Vertex model 3C-4.0 Pure Water Machine.

Stage 1 Sediment filter, standard size, 2-3/4" dia. by 9-3/4" long, polyspun fiber, 5 micron, made by Osmonics, "Purtrex". Vertex P/N S-4001

Stage 2 Activated Carbon block filter, 2-3/4" dia. by 9-3/4" long (10" nominal), 10 micron, made by KX, "CTO"/2. Vertex P/N CB-4000

Stage 4 Activated carbon post-filter, 2 3/4" dia by 9 3/4" long, granulated carbon fill. Vertex P/N P/N CF-4008

Stage 3 This is the reverse osmosis element. It may be obtained from your dealer

5.0 Filter Replacement Procedure

Turn off the feed water at the feed water ball valve. Empty at least 2.0 gallons from the storage tank to take any back pressure off the system. Put a shallow pan under the RO system to catch any water that may spill during the operation.

Unscrew the filter housing and carefully lift it to the sink to drain or empty the water remaining in it. Remove the spent filter cartridge. Sanitize by adding 4 tablespoons of chlorine bleach to the empty housing and then filling with tap water. Let stand for 10 minutes. Empty the solution and rinse with clear water and dry. Install new cartridge in housing. Reinstall housing being careful to make sure o-ring is properly seated. Tighten housing securely. Re-start the system by opening the feed water ball valve.

The filter canisters, sediment and carbon, including the the caps must be replaced every 5 years. Order Vertex part number FH-1000 to obtain original equipment replacement part.

6.0 Installation Troubleshooting

Problem	Possible Cause	Solution
• No or low water production.	• Feed water shut off. • Tank valve closed or partially closed. • Low feed pressure. Feed pressure must by at least 40 PSI.	• Turn on feed water. • Open tank valve. • Increase inlet water pressure or install booster pump if feed water pressure is less than 40 PSI.
• Leak at filter housing.	• Defective or misaligned O-ring.	• Shut off feed valve and tank valve. Turn on faucet. Change or realign O-ring.
• Leak at threaded connection.	• Not properly tightened.	• Tighten compression fitting.
• Bad-tasting water.	• Post-filter cartridge not flushed completely.	• Flush one or two tanks of pure water through system.
• Water runs to drain all the time.	• Auto-valve not closing properly.	• Purge the system again. Lock the clean water valve open and turn the inlet water on for thirty minutes
• RO Production good at first but falls off in months or weeks.	• High TDS and/or Iron and Manganese.	• Consult your dealer or Factory and provide water analysis.

7.0 Conditions Of Use

Water must be microbiologically safe. System pressure, 40 to 100 PSIG. Temperature, 40 to 100 degrees F. PH Range, 3 to 10. Maximum TDS, 1500 PPM. Turbidity, less than 1.0 NTU. Max iron content, 0.3 ppm

8.0 Product Warranty

The VERTEX Pure Water Machine components, specifically the bracket, the filter housings, the filter elements, tank and valves are warranted to be free of defects. Any defect arising in these items within one year from date of purchase will be replaced at no cost. Example - if the filter housing is cracked and leaks during the warranty period, we will replace it at no cost. Procedures in the manual must be followed during installation and maintenance.

There is no liability assumed by the company for damage due to water leakage or other secondary effects from the component defects. Labor for installation is not covered in this warranty.

9.0 Other Models

9.1 Pure Water Machine with booster pump; Configuration and operation Model 3C 4.0/P

The 4 stage RO system with pump is used when the city water pressure is below 40 psi. The booster pump allows the RO system to run at peak efficiency by providing a pressure of about 80 psi to the RO membrane.

The model 3C-4.0/P, 4 stage RO system with booster pump includes these additional components: A 24 volt DC diaphragm pump powered by a step down transformer, (115 VAC/24 VDC 60 hz) a high pressure switch to monitor the pressure in the storage tank and turn the pump off when the tank is full.

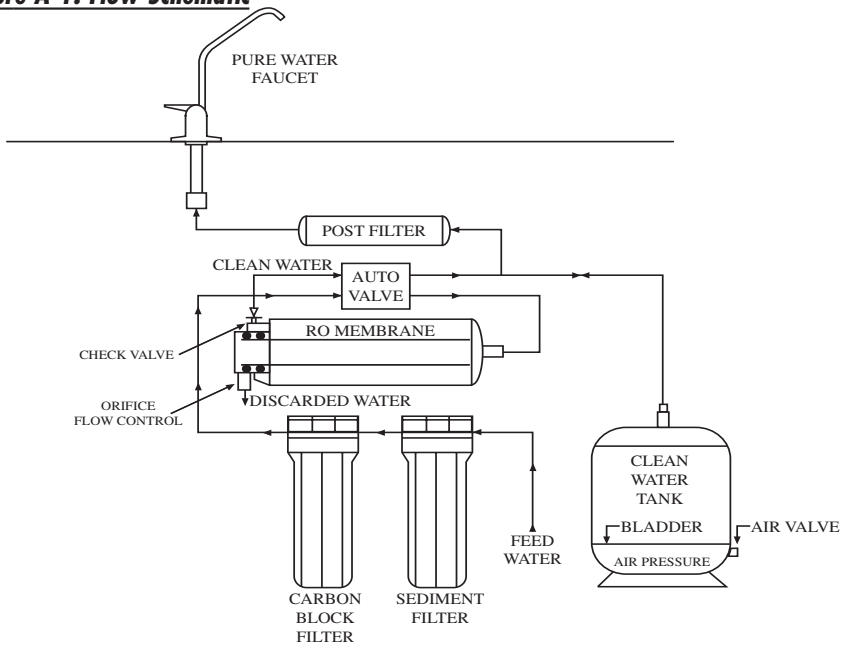
Installation and Operation

Install the RO system per the instructions in the previous section of this manual.

To start the RO system operating, turn on the water supply. But before plugging in pump transformer, perform the air-purge procedure outlined in section 3.1. After airpurge has been completed plug in pump transformer to an electrical outlet. The pump will start running. From this point on follow the rest of the start-up procedure. The pump will now operate automatically. The pump will start running. From this point on follow the normal start up procedure for the RO system. The pump will now operate automatically.

Appendix A: Theory of Operation

Figure A-1: Flow Schematic



A.1 Pre-Filters:

The pre-filters have two purposes, one is to clean the water for better consumption, and the second is to prevent the RO membrane from being fouled. The RO membrane is at the heart of this system, taking out dissolved materials from the water. The first stage filter removes sediment, that is materials such sand, rust, pipe scale, and dirt. This is accomplished with spun polypropylene material that will take out particles down to 5 -microns.

The water then goes to the carbon block filter, which is there for two reasons; first to take out 90% of the chlorine in the water- this protects the RO membrane which would be damaged by prolonged presence of chlorine. The carbon block also takes out the taste of chlorine, and other tastes and odors too, which affect the drinking water, and changes the flavor of tea, coffee or other mixed drinks. The carbon accomplishes this by adsorption on its surface. This is a chemical/mechanical process unique to carbon that is activated, that is, made to have high surface area.

The second reason is the carbon block also takes out VOC's (volatile organic chemicals) which are contaminants from industrial pollution.

A.2 The Reverse Osmosis Membrane:

This is the heart of the Machine, and is the great protector. The membrane is a replication of human or animal stomach tissue, which permits the water molecule to pass through, and holds dissolved molecules back. This is done naturally by osmotic pressure developed because of the content of dissolved solids. To make this happen with the RO membrane, we apply pressure to the water (reversing the process of generating pressure) and this pushes the water molecules through, keeping most of the dissolved solid molecules behind. "Most" means about 70% of nitrates are kept behind, and 99% of Copper and Lead, and high molecular weight material. The reverse osmosis technology will, on average, reject 95% of the total dissolved solids in the incoming water. Over time, the RO membrane will foul with a very thin layer of materials, and the efficiency drops, so that the TDS content of the clean water will rise. When it rises from 10% of the inlet TDS value, it is an indicator that the RO membrane should be replaced. In large units, the RO can be cleaned periodically by back wash, but for home units, the cost of replacement is low and usually only needs to be made every 3 years. About 4 gallons of water is discarded for every gallon of pure water made. In Figure A-1, the discard is shown with a flow control orifice at the outlet of the RO stage. This is designed to hold back the discard water to the above ratio, and maintain pressure on the water in the membrane. For a 75-gallon per day membrane, approximately 788 milliliters per minute of water are discarded. Note there is a check valve on the clean water outlet from the RO. The purpose is to prevent backflow of water to the membrane from the tank or faucet or because of autovalve failure. In the average household, 3 gallons of drinking water are used a day.

A.3 Auto Control:

As water is produced , the pressure in the storage tank increases. To stop production of water when the tank is full, an auto control valve is used in the system, as shown in Figure A-1. The pressure in the tank is set nominally at 2/3 of the incoming line pressure. Normal U.S. city water pressure is 60-psi, therefore the tank pressure when full and when water flow stops is at a tank pressure of 40-psi.

The purified water goes to the tank where it is stored at pressure as described above. The tank has a bladder in it, and on one side is air at 6-psi, initially. The initial volume of the storage tank is 4.0 gallons. As the water fills the tank, it pushes against the bladder, and raises the pressure as it takes space in the tank. When the pressure increases to 40-psi, water flow stops. The net amount of water in the tank when full, less the space taken by the air at 40-psi is approximately 2.5 gallons. When water is drawn by opening the clean water faucet on the sink, water flows through the final post filter, another activated carbon filter, which polishes, or take out staleness of the water which has set in the tank, and the last few molecules of taste or odor. When water is supplied to the refrigerator, the line should be therefore taken after the post filter.

When the raw water pressure available is 40-psi or less, the RO membrane will not operate efficiently or produce water at a reasonable rate. This is overcome by using a booster pump which raises the water pressure to 80-psi.

Notes

Water Disinfection

with chlorine bleach (5.25%)

Quantity	Clean Water	Cloudy Water
1 quart	2 drops	4 drops
1 gallon	8 drops	16 drops
5 gallons	1/2 tsp.	1 tsp.

VERTEX WATER PRODUCTS, Montclair, Calif.

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