

Installation and Operations Manual

**WMS-550, WMSQ-550, WMS-1000, WMSQ-1000, WMS-1400,
WMSQ-1400, WMS-1700, WMSQ-1700, WMS-2200, WMSQ-2200,
WMSQ-3000**

The Fresh Connection!™

Model # _____
Serial # _____

Rev. 04/11/22

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1. General Information

About Watermakers, Inc.

Founded in 1984 by Joe Hoher, Watermakers, Inc. soon became one of the leading manufacturers of marine reverse osmosis desalinization systems in the U.S. As owner and proprietor of the Staniel Cay Yacht Club in the Bahamas, Joe's experience with early R.O. systems and their shortfalls inspired him to build the highest quality, easy to install and maintain systems available. We have since expanded to include land based systems providing drinking water to homes, hotels and islands worldwide.

Our commitment to customer service is unparalleled in the industry. Located in Fort Lauderdale, Florida (the yachting capital of the world), and dealing factory direct gives us the unique opportunity to meet most of our customers face to face. Whether you call or visit our manufacturing facility you will be talking to a technician who actually builds and tests watermakers. The same goes for our field techs, each started out on the production floor building our machines. Our on-site testing lab not only tests each machine prior to leaving the plant but can also troubleshoot and repair all major brands of R.O. equipment. Our Parts Department maintains an on-site warehouse fully stocked with every part used in our watermakers ensuring that *when you need it we have it*.

We invite all of our customers to come by our showroom anytime you are in the Ft. Lauderdale area.

What is Reverse Osmosis?

Figure 1 below is an illustration of the process used to extract fresh water from seawater.

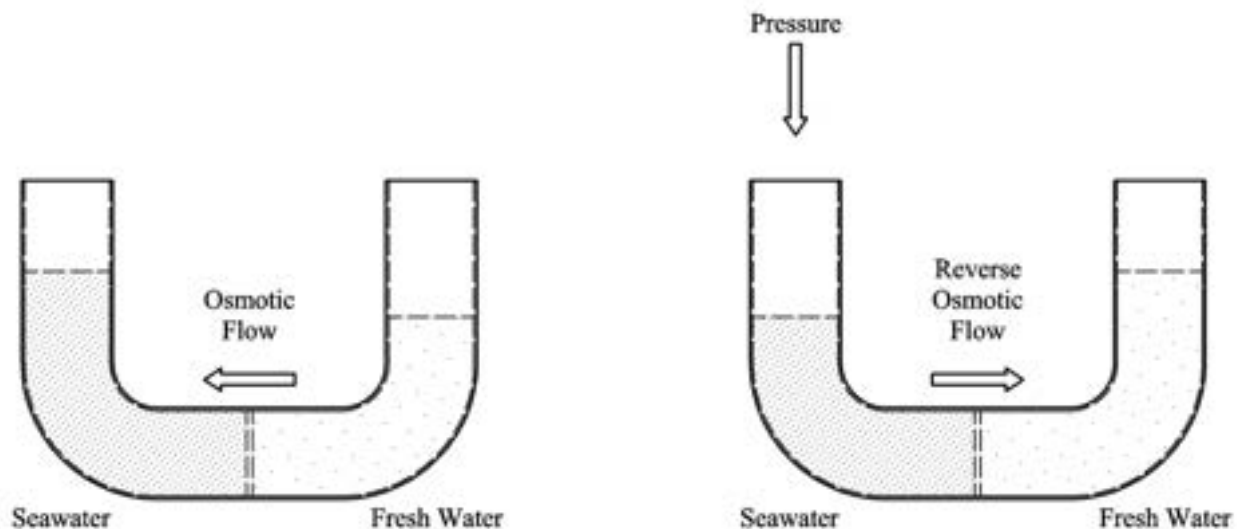


Figure 1

Osmosis is a naturally occurring process whereby placing solutions of differing densities on opposite sides of a semi-permeable membrane the less dense solution (fresh water) will pass through the membrane to the side of greater density (seawater). In a closed loop this process will continue until pressure on the seawater side of the membrane reaches approximately 385 PSI this is called Osmotic Pressure and will vary depending on the densities of the two solutions.

During reverse osmosis the osmotic pressure is overcome by applying higher pressure to the seawater side of the membrane forcing the fresh water through the membrane and leaving behind highly concentrated saltwater.

The salt particles removed by the reverse osmosis process are smaller than the smallest bacteria, so this process does remove bacteria as well as salt and other impurities. The membrane will “reject” approximately 99.6% of the salt contained in the seawater. The resulting product water will contain less than 500ppm/TDS. This is excellent quality drinking water and meets World Health Organization standards for potable water.

System Overview

This manual covers the entire WMS/WMSQ Series of watermakers. All of the machines in this series are made up of the same ten (10) basic components. The size and configuration of each component will vary but the function and name will remain the same throughout this manual.

Figure 2 below shows a typical installation of a WMS system (WMS-550 system shown). The major components are:

- 1) Seawater Booster Pump
- 2) Pre Filter Assembly
- 3) Valve Panel
- 4) R.O. Pump and Motor Assembly
- 5) Membrane Skid Assembly
- 6) Flow Panel
- 7) Electric Control Panel and Salinity Probe
- 8) Automatic Product Diverter (PKG) and Reject Manifold
- 9) Charcoal Filter Assembly
- 10) Contactor Box

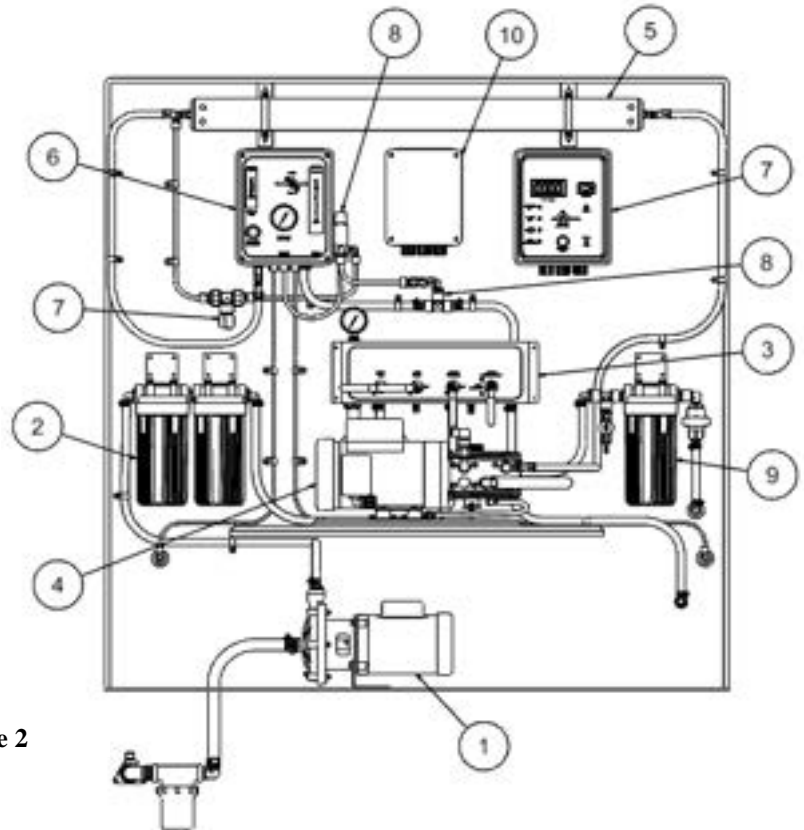


Figure 2

Seawater typically enters the system via a thru-hull fitting and sea strainer and into the booster pump. The booster pump is required to force the seawater through the primary seawater filters. It supplies feed water to the R.O. Pump via the Seawater Filters and Valve Panel at a flow rate of at least 1 gpm more than required by the system and at least 10psi (normally approx. 20-40 psi). This is to avoid damage to the R.O. Pump due to cavitation. The Booster Pump is constructed of all non-ferrous metals or plastic to resist corrosion. Iron compounds or fittings must never be used.

The Pre Filters are designed to prevent sediment and other particles from entering the system. This protects the R.O. Pump from excess wear and the membranes from fouling. This is done in two (2) stages, the seawater first passes through a 30 micron filter element to remove plankton and larger particles then through a 5 micron element to remove smaller particles and sediment. This combination is recommended for normal seawater applications, however, if it is suspected that finer silt or sediment is present in the feed supply, the 5 micron element may be replaced with a 1 one micron element. The filter elements should be replaced before the feed pressure drops to approximately 10 psi.

The Valve Panel allows the operator to direct the incoming seawater and brine overboard through a manifold for the normal operation and maintenance procedures. A feed pressure gauge and low pressure cutoff switch are located on the feed inlet manifold to monitor the condition of the primary filters and shut the watermaker down if the feed pressure drops below 10 psi.

The Charcoal Filter element is also connected to the valve panel. This is used only during fresh water rinse of the system. The charcoal filter removes chlorine and other chemicals that can damage the membranes. A sample port is provided on the outlet of the charcoal filter to test for chlorine. During a fresh water rinse the fresh water passes through the charcoal filter and via the valve panel into the R.O. Pump and then to the Membranes.

The R.O. Pump (high pressure pump) raises the seawater pressure to a level that makes reverse osmosis possible (800-900 psi). The pump is a diaphragm type positive displacement pump which uses a balanced hydraulic system with a minimum of moving parts. A high pressure switch connected to the outlet of the pump will turn the unit off in the event of system over pressurization. On larger models there is also a nitrogen filled accumulator designed to absorb pulsation caused by the high pressure pump. The motor is a totally enclosed fan cooled type to withstand the marine environment.

The Membrane Skid Assembly contains the reverse osmosis membranes which extract fresh water from the feed water when the inlet pressure is raised to the desired level. The pressure vessels are made of wound fiberglass for strength and to prevent corrosion. The high strength plastic end caps are held in place with stainless steel retaining pins.

The Flow Panel houses all of the mechanical controls to operate the unit, Flow meters to monitor fresh water production and reject flow, a manual product diverter valve to direct product to the holding tanks, overboard or sample, and the pressure regulator and high pressure gauge to monitor and maintain seawater (R.O.) pressure.

The Automatic Product Diverter (PKG) gets a signal from the salinity controller via the PLC located in the electric panel and diverts the product water to either the ship's holding tanks or overboard via the reject manifold depending on the quality of the product water.

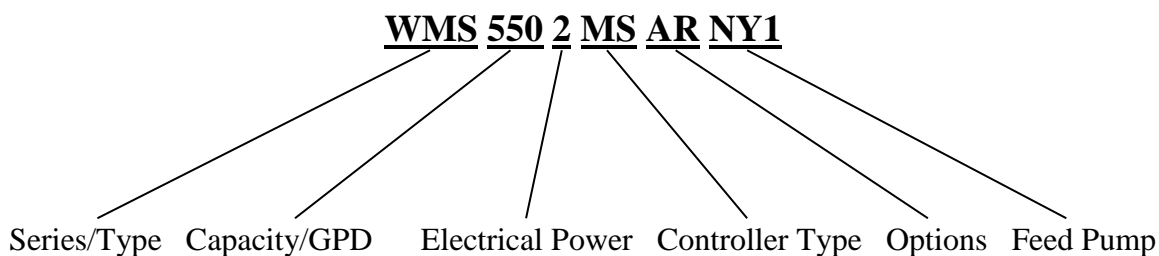
The Electric Panel contains all of the electrical controls for operating the system. The operator can start and stop the pumps for normal operation and for performing maintenance on or troubleshooting the system. Terminals are provided for connecting the high and low pressure switches which protect the system from abnormal pressures as well as other system and optional connections. A PLC contains all of the programming for operating the system and optional upgrades. A digital salinity meter constantly monitors the quality of the product water. The meter is factory calibrated and the PLC is programmed to divert water greater than 550 parts per million overboard.

The Contactor Box houses the motor starters and overload protection devices for the R.O. and Feed Pumps.

Model/Serial Number Designation

Each Watermakers Inc, system is given a unique model/serial number. This is so that if you ever need to call us for any reason we can look up your specific records to determine not only your watermakers date of manufacture and configuration, but also any factory service or upgrades/modifications that have been made. The "serial number stickers" are located on the front of the Valve Panel and on the side of the Electric Panel. These numbers should also be listed on the front cover of this manual, if they are not please take the time to record them in the space provided for easy reference when talking to a technician.

The model number provides the technician with the following information:



System Specifications

<u>Model Number</u>	<u>Production* gpd/gph/lph</u>	<u>Power Usage** volts/amps/kw</u>	<u>Weight lbs/kg</u>	<u>Membranes Qty/Model#</u>
WMS-550	649/27.0/102.3	230/10.9/2.5	202/91.8	1/SW30-2540
WMSQ-550	660/27.5/104.1	230/14.5/3.3	304/138.2	1/SW30-2540
WMS-1000	1068/44.8/168.5	230/10.9/2.5	211/95.9	2/SW30-2540
WMSQ-1000	1044/43.5/164.7	230/14.5/3.3	313/142.3	2/SW30-2540
WMS-1400	1472/61.3/232.2	230/19.4/4.6	318/144.6	3/SW30-2540
WMSQ-1400	1405/58.5/221.6	230/18.7/4.3	371/168.6	3/SW30-2540
WMS-1700	1746/72.8/275.4	230/27.7/6.3	345/156.8	3/SW30-2540
WMSQ-1700	1825/76.0/287.8	230/26.0/5.9	418/190.0	3/SW30-2540
WMS-2200	2395/99.8/377.8	230/27.7/6.3	376/170.9	2/SW30-4040
WMSQ-2200	2360/98.3/372.3	230/26.0/5.9	449/204.1	2/SW30-4040
WMSQ-3000	3217/134/507.4	230/26.0/5.9	496/225.5	3/SW30-4040

*Standard Test Conditions:

Pressure: 900 psi

Water: 35,000 ppm, pH 7, Temp 77F/25C

Product Flow: +/- 15%

Operating Pressures:

High Pressure Pump: 900 psi

Booster Pump: 10 psi min. 20-60 psi max.

Product water: < 15 psi

**@ 230VAC Single Phase

2. Installation

Before You Begin

The WMS/WMSQ Series are modular systems designed to use less space and provide ease of operation and maintenance. Although every installation is unique, this section contains the typical sequence of steps required to complete the installation of your watermaker. The installation of this unit must be carried out carefully in order to ensure its long life and safe operation and to avoid damage to your vessel. The installation kit provided includes all materials needed for a typical installation with the exception of electrical wire (marine type boat cable recommended), thru hull fittings and suction strainers. Other fittings may be required to adapt plumbing connections on some vessels.

The inlet thru hull should be located as deep in the hull as possible and not shared with other equipment. To avoid air intake and turbulence which could cause damage to the booster pump and loss of feed pressure (a forward facing scoop is recommended). A cleanable strainer should be installed between the thru hull and the feed pump suction.

Due to the many different vessel configurations some additional hardware may be required.

Note: If you have purchased any optional upgrades for your watermaker, it is a good idea to become familiar with the installation and operating instructions provided with those options prior to beginning the installation of your watermaker.

Unpack and Inspect your Watermaker

If you are reading this manual then you have received your watermaker. Now is the time to inspect the components and report any damaged or missing parts. You should have received the following:

<u>Qty</u>	<u>Part #</u>	<u>Description</u>
1	EP-2016	Electric Control Panel
1	CB-2000-XX	Contactor Box
1	PA-XGPM/XHP-XPH #	R.O. Pump and Motor Assembly
1	FA-SEA-XXX #	Pre Filter Assembly
1	MS-XXXXXXFG #	Membrane Skid Assembly
1	4024-XXX-3450 #	Feed Booster Pump
1	FA-CHAR-XXX #	Charcoal Filter
1	FP-XXXX #	Flow Panel
1	PKG-XXXX #	Product Diverter Assembly(PKG)
1	VP-XXXX #	Valve Panel
1	INSTL-KIT-XXX #	Installation Kit

varies with model purchased.

Planning Your Installation

In order to save time and avoid problems during the installation of your watermaker, it is a good idea to pre-plan the layout of the system including hose and wire runs. The following are points to consider prior to beginning the actual installation of your watermaker:

The use of any ferrous (iron) materials including fasteners must be strictly avoided in the installation of the watermaker as they will cause damage to the membranes and VOID ANY WARRANTY.

Location and type of inlet thru-hull: The thru-hull fitting and sea strainer must be at least 1” and made of non-ferrous material, and not shared with other equipment, a forward facing scoop is recommended. Ideally it should be located as close to the feed pump as possible.

Location and Type of Overboard Thru-Hull: Above the waterline and not shared with other systems.

Electrical Connections: The main power feed should be rated to carry the full load current of the unit with the proper size circuit breaker (see system specifications in Section 1. to determine your watermakers power consumption).

Component Layout: Keep in mind that components are all connected by hoses, wires or both, leave sufficient room for routing and making the necessary connections. Some components require routine maintenance i.e. filter and oil changes so mount these in areas that are easily accessed.

Water Spillage: During routine maintenance or repairs some saltwater spillage will occur. Avoid mounting components above or near any equipment that is susceptible to water damage.

Operation and Maintenance: Plan ahead and place components in areas that are easily accessible.

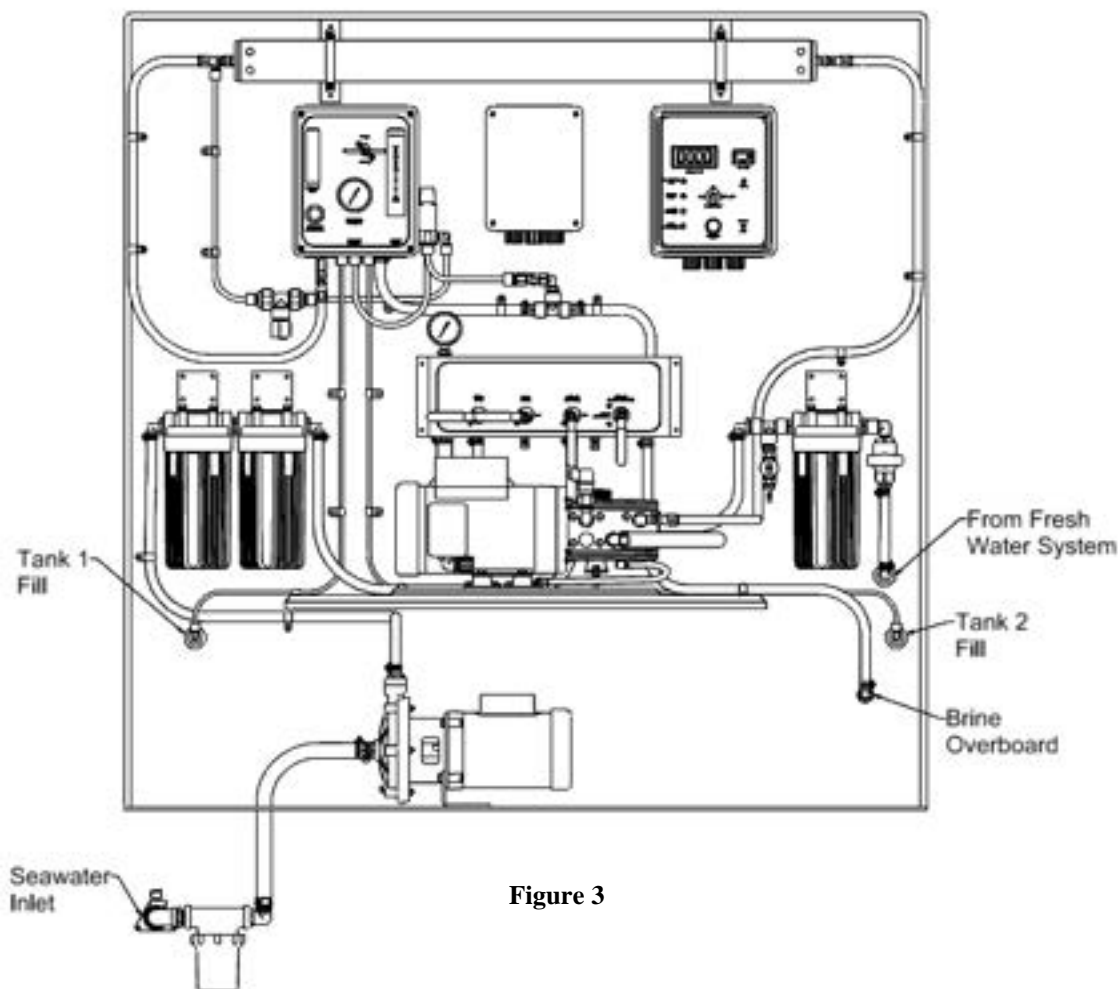


Figure 3

Installation

Now that you have a watermaker and a plan, you are ready to begin. The following instructions are broken down into the major steps required to complete the installation. All of the watermakers covered by this manual are made up of the same basic components the only difference is the physical size of each component. Figure 3 shows a typical installation of a WMS-550 with hose runs.

1. Mounting the Components:

A. Seawater Booster Pump:

1. Select a flat, horizontal surface **below the waterline** as close to the inlet sea strainer as possible. Mount the booster pump using four (4) ¼"x1" lag screws provided.

Note: The Booster Pump must be mounted below the waterline in order to maintain a flooded suction. Failure to do so will result in damage to the pump. If necessary, the feed pump mounting bracket may be rotated to allow bulkhead mounting. The discharge fitting must always be on the top of the pump.

B. Primary Seawater Filters:

Note: When removing the filter canisters, they will be full of salt water and some spillage will undoubtedly occur. Avoid mounting filters above or near equipment that may be susceptible to damage from salt water.

1. Using eight (8) tapping/lag screws provided mount the filter assembly to the bulkhead. Allow 3-4" of clearance beneath the canisters for removal during filter changes.

C. Charcoal Filters:

Note: When removing the filter canisters, they will be full of water and some spillage will undoubtedly occur. Avoid mounting filters above or near equipment that may be susceptible to damage from contact with water.

1. Using four (4) tapping/lag screws provided mount the filter assembly to the bulkhead. Allow 3-4" of clearance beneath the canisters for removal during filter changes. Be sure to provide easy access to the sample port.

F. Contactor Box:

1. Using four (4) tapping screws provided mount the contactor box to the bulkhead in an easily accessible location away from areas where water could drip onto it. Allow clearance for opening the front cover for wiring connections and room for the wiring runs into the bottom of the panel.

D. Membrane Skid:

1. Mount the membrane skid assembly to any convenient surface (bulkhead, overhead or deck) using four (4) ¼"x1-¼" lag screws provided. If mounting the membrane skid vertically the product outlet must be on top. To reduce noise, insulating the membrane from the mounting surface is recommended.

Note: When removing the end caps, the vessels will be full of salt water and some spillage will undoubtedly occur. Avoid mounting vessels above or near equipment that may be susceptible to damage from salt water.

Note: For ease of operation the electric panel, flow panel and valve panel should be mounted so that all three are within arm's reach of the operator. All flow meters, pressure gauges and indicators should be visible from the operator's position.

E. Electric Panel:

1. Using four (4) tapping screws provided mount the electric panel to the bulkhead in an easily accessible location away from areas where water could drip onto it. Allow clearance for opening the front cover for wiring connections and room for the wiring runs into the bottom of the panel.

G. Flow Panel:

1. Using four (4) tapping screws provided mount the flow panel to the bulkhead in an easily accessible location. Allow 6-8" clearance for the hose runs into the bottom of the panel.

H. Valve Panel:

1. Using four (4) tapping screws provided mount the valve panel to the bulkhead in an easily accessible location. Allow 6-8" clearance for the hose runs into the bottom of the panel.

I. R.O. Pump:

1. R.O. Pump. Using four (4) lag screws provided mount the R.O. Pump to a convenient flat, level surface in a well ventilated area. Remember the R.O. Pump oil must be changed for routine maintenance so try to place it in an area you will be able to access later.

J. Salinity Probe:

1. Using two (2) clamps and tapping screws provided mount the salinity probe to the bulkhead in a location along the planned tubing run between the product outlet fitting on the membrane skid and the product inlet fitting on the flow panel. The tee must be mounted horizontally so that the probe is on the bottom as shown in Figure 4.

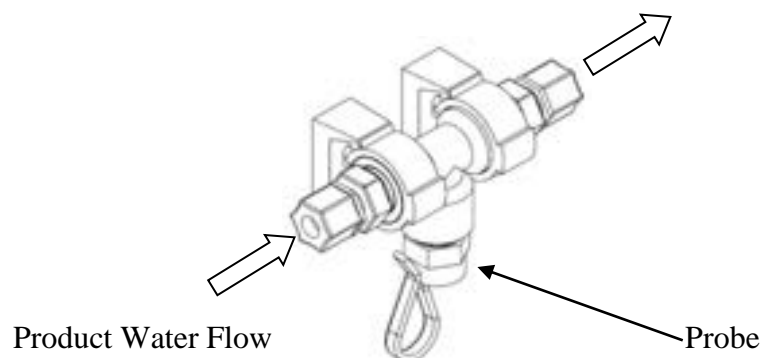


Figure 4

K. Product Diverter (PKG):

1. On WMS 550-1000 watermakers the PKG is already mounted to the side of the flow panel. For WMS 1400-3000 machines use the four (4) tapping screws provided to mount the PKG valve assembly to the bulkhead in a location along the planned tubing run between the salinity probe and the product inlet fitting on the flow panel.

2. Plumbing Connections:

Note: When laying out hose runs try to choose the shortest most level path possible. Securely clamp all connections, check for and eliminate any kinks, and securely fasten hose to avoid chafing. Figure 5 is a Piping and Instrumentation diagram of a typical watermaker; the plumbing is labeled to match the steps in the installation instructions

A. Seawater Feed Plumbing:

1. Connect the thru-hull/strainer to booster pump inlet using the following;

WMS-550-1000 $\frac{3}{4}$ " wire reinforced hose and double clamp with four (4) clamps # 50-R-28 provided.

WMS-1400-3000 1" wire reinforced hose and double clamp with four (4) clamps # 50-R-32 provided.

2. Connect the booster pump outlet to the seawater filter inlet using the following;

WMS-550-1000 $\frac{1}{2}$ " polybraid hose and clamp with two (2) clamps # 50-R-20 provided.

WMS-1400-3000 $\frac{3}{4}$ " polybraid hose and clamp with two (2) clamps # 50-R-28 provided.

3. Connect the seawater filter outlet fitting to the valve panel seawater inlet fitting using the following;

WMS-550-1000 $\frac{1}{2}$ " polybraid hose and clamp with two (2) clamps # 50-R-20 provided.

WMS-1400-3000 $\frac{3}{4}$ " polybraid hose and clamp with two (2) clamps # 50-R-28 provided.

4. Connect the valve panel seawater outlet fitting to the high pressure pump inlet fitting using the following;

WMS-550-3000 $\frac{3}{4}$ " polybraid hose and clamp with two (2) clamps # 50-R-28 provided.

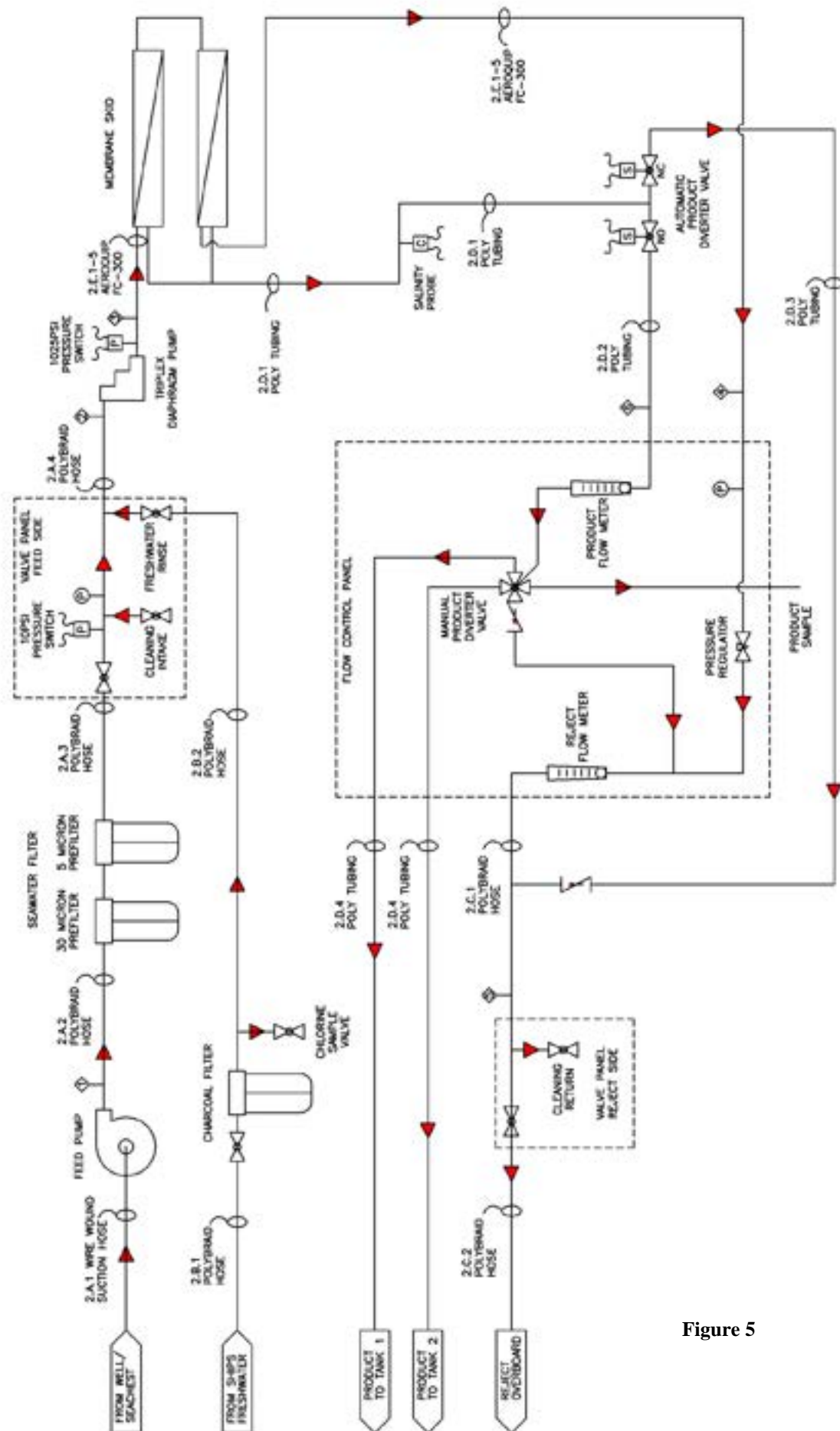


Figure 5

B. Freshwater Rinse Plumbing:

1. Connect the charcoal filter inlet fitting to the fresh water system using the following;

WMS-550-1000 ½" polybraid hose and clamp with two (2) clamps # 50-R-20 provided.

WMS-1400-3000 ¾" polybraid hose and clamp with two (2) clamps # 50-R-28 provided.

2. Connect the charcoal filter outlet fitting to the valve panel freshwater inlet fitting using the following;

WMS-550-1000 ½" polybraid hose and clamp with two (2) clamps # 50-R-20 provided.

WMS-1400-3000 ¾" polybraid hose and clamp with two (2) clamps # 50-R-28 provided.

C. Reject Overboard Plumbing:

1. Connect the reject outlet fitting on the flow panel to one side of the PKG tee assembly. Connect the other side of the tee to the top fitting on the reject overboard valve on the valve panel using the following;

WMS-550-1000 ½" polybraid hose and clamp with two (2) clamps # 50-R-20 provided.

WMS-1400-3000 ¾" polybraid hose and clamp with two (2) clamps # 50-R-28 provided.

2. Connect the reject outlet fitting on the valve panel to the overboard thru-hull using the following;

WMS-550-1000 ½" polybraid hose and clamp with two (2) clamps # 50-R-20 provided.

WMS-1400-3000 ¾" polybraid hose and clamp with two (2) clamps # 50-R-28 provided.

D. Product Plumbing:

Note: Depending on the size of your watermaker there are two different styles of PKG, both perform the same function. Refer to Figures 6 & 7 for the correct configuration for your watermaker.

1. Connect the product outlet fitting on the membranes to one side of the salinity probe tee assembly. Connect the other side of the salinity probe tee assembly to the center port of the PKG valve using the following;

WMS-550-1000 ⅜" poly tubing provided.

WMS-1400-3000 ½" poly tubing provided.

2. Connect the fitting on the Normally Open port on the PKG to the Product Inlet fitting on the Flow Panel using the following;

WMS-550-1000 ⅜" poly tubing provided.

WMS-1400-3000 ½" poly tubing provided.

3. Connect the fitting on the Normally Closed port on the PKG to the Reject overboard tee assembly which should already have been plumbed into the reject overboard line, using the following;

WMS-550-1000 ⅜" poly tubing provided.

WMS-1400-3000 ½" poly tubing provided.

4. Connect the product outlet fitting(s) on the flow panel to fresh water storage tank(s) using the following;

WMS-550-1000 3/8" poly tubing provided.

WMS-1400-3000 1/2" poly tubing provided.

WMS/WMSQ-550 thru 1000

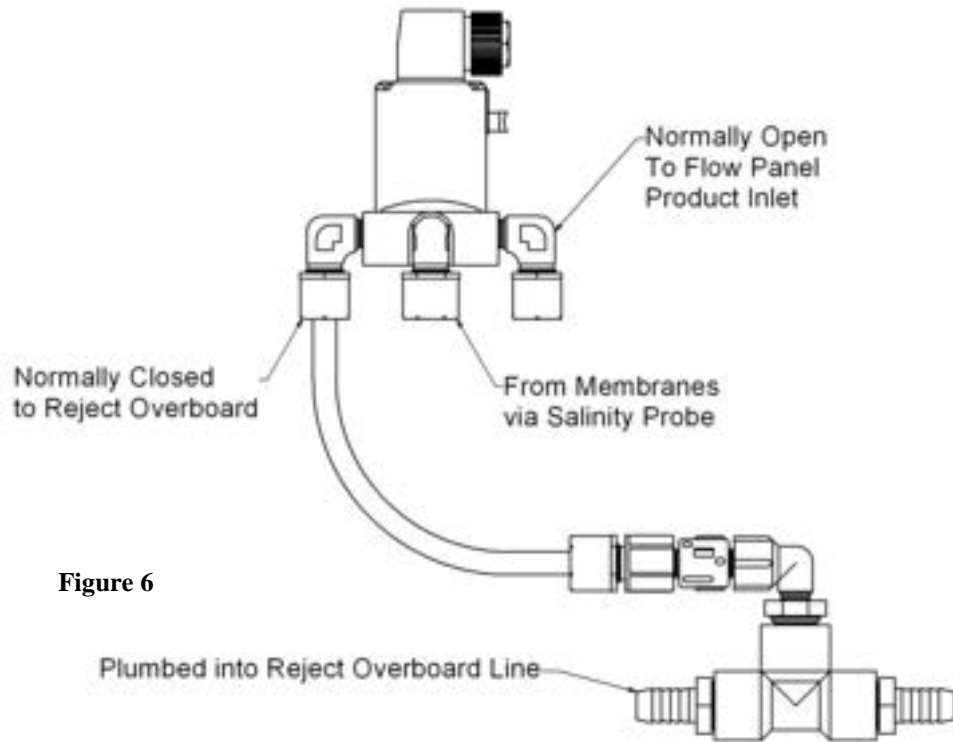


Figure 6

WMS/WMSQ-1400 thru 3000

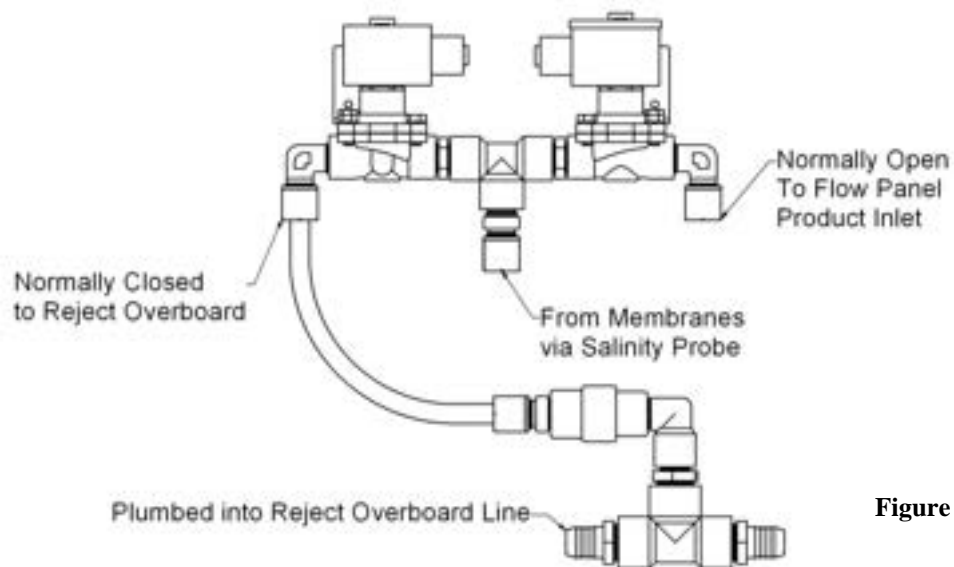


Figure 7

E. High Pressure Hose Connections:

1. Assemble one end fitting onto the high pressure hose. Refer to Fig 8.
 - a. Clamp the socket portion of the hose end fitting in a vise.
 - b. Thread hose counterclockwise until the hose bottoms in the fitting, back hose out $\frac{1}{4}$ turn clockwise.
 - c. Apply a small amount of silicone grease to the threads of the swivel portion of the fitting.
 - d. Thread the swivel portion of the fitting into the socket until the hex shoulders against the socket. It may be necessary to hold the hose with one hand to prevent it from turning.
2. Thread assembled fitting onto R.O. Pump discharge fitting hand tight. Place hose in position so that it meets the high pressure inlet fitting on the membrane skid. Mark hose $\frac{3}{4}$ " back from the end of the fitting and cut.
3. Assemble second end fitting on hose as in step E.1, Thread onto membrane skid inlet fitting.
4. Repeat steps E.1.-E.3 for hose from the membrane skid outlet fitting to the flow panel.

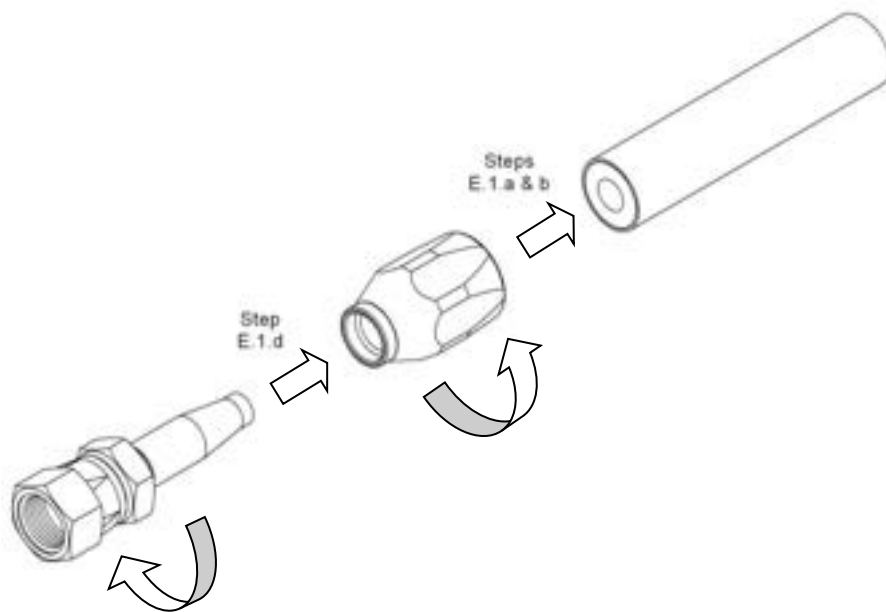


Figure 8

5. Tighten all fittings.

3. Electrical Connections:

USE EXTREME CAUTION! : While making connections to and while servicing the electrical parts of your watermaker. Disconnect all electrical power before attempting to wire the panel or when the panel is open for any reason.

CAUTION! : Depending on the electrical configuration some units may be powered from two separate sources, always double check with a meter before working on or around open electrical control panels.

Note: The watermaker must be wired to a circuit breaker in the electrical system with a load rating sufficient to handle the full load of the unit (refer to specification sheet in Section 1). For motor wire size guidance refer to the motor label plate information and local electric codes. **It is recommended that connections to the electrical system be performed by qualified personnel.**

Note: For your safety and the proper operation of the watermaker, grounding terminals are provided in all electric panels and on all electrical components. Be sure to make all connections including grounds in accordance with local electric codes.

Due to the variety of electrical configurations around the world there may be some slight differences in the size and layout of the contactor box and its components. The drawings shown at the end of this section are for the most common configuration and are for reference only. Each unit is shipped from the factory with electrical connection drawings specific to that watermaker and the power configuration it was designed for. Refer to the drawings that came with your watermaker for making electrical connections.

When making wire runs make sure to securely clamp all wires and cables to prevent chafing.

A. R.O. Pump

1. Connect the ground terminal in the contactor box to the R.O. Pump motor.
2. Connect the load side of the R.O. Pump Contactor in the contactor box to the R.O. Pump motor. Refer to the drawings provided and the connection information on the motor label plate.

B. Feed Pump

1. Connect the ground terminal in the contactor box to the Feed Pump motor.
2. Connect the load side of the Feed Pump Contactor in the contactor box to the Feed Pump motor. Refer to the drawing provided and the connection information on the motor label plate.

C. Electric Panel

Note: All of the connections in the Electric Panel will be made to the terminal board located at the inside bottom of the panel as shown on the drawing in page 23.

1. Connect the Five (5) conductor cable coming from the Contactor Box as follows:
 - a. Connect the GREEN wire to the ground bundle in the Electric Panel.
 - b. Connect the BLACK wire to terminal #1.

- c. Connect the WHITE wire to terminal #2.
 - d. Connect the BROWN wire to terminal #13.
 - e. Connect the RED wire to terminal #14.
- 2. Connect the Three (3) conductor cable coming from the PKG as follows:
 - a. Connect the GREEN wire to the ground bundle in the Electric Panel.
 - b. Connect the BLACK wire to terminal #7.
 - c. Connect the WHITE wire to terminal #6.
- 3. Connect the Two (2) conductor cable coming from the High Pressure Switch as follows:
 - a. Connect the RED wire to terminal #8.
 - b. Connect the BLACK wire to terminal #9.
- 4. Connect the Two (2) conductor cable coming from the Low Pressure Switch as follows:
 - a. Connect the BLACK wire to terminal #9.
 - b. Connect the WHITE wire to terminal #10.

D. Main Power

- 1. Connect the Main Power in from the circuit breaker in the ships main panel to the terminals provided in the contactor box. Refer to the drawings provided with your watermaker for the correct voltage configuration.

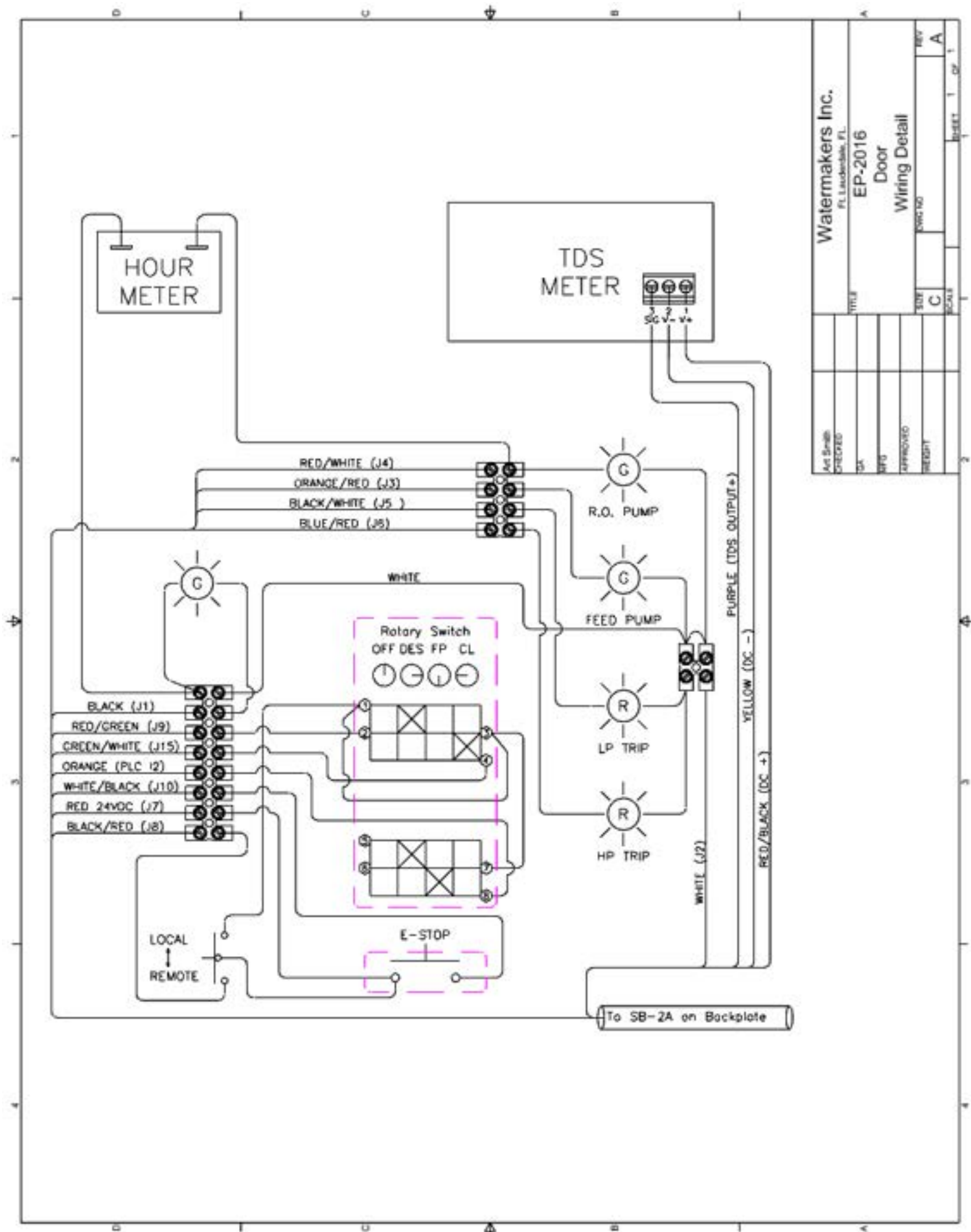
E. Control Power

Regardless of the incoming main power configuration, the watermaker requires a small amount of 115VAC power in order to operate.

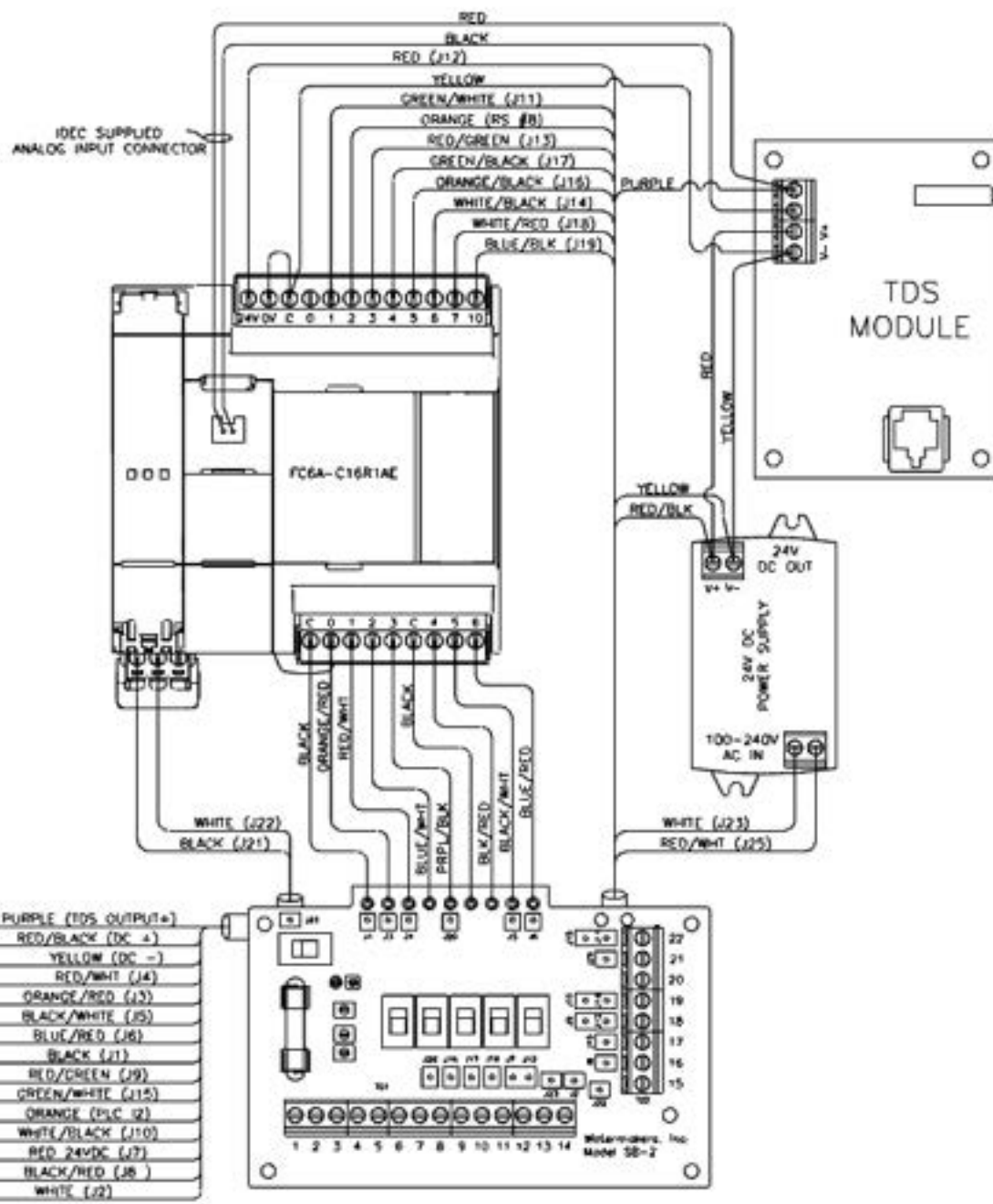
If 115VAC power is available make the connections in the contactor box as shown in the drawings that came with your watermaker.

If 115VAC power is not available, a transformer box such as those available from Watermakers Inc. must be installed and connected in accordance with the manufacturer's instructions.

- 1. Connect the Control Power from the main panel/transformer box to the terminals provided in the contactor box. Refer to the drawings provided with your watermaker/transformer box for the correct wiring connections.



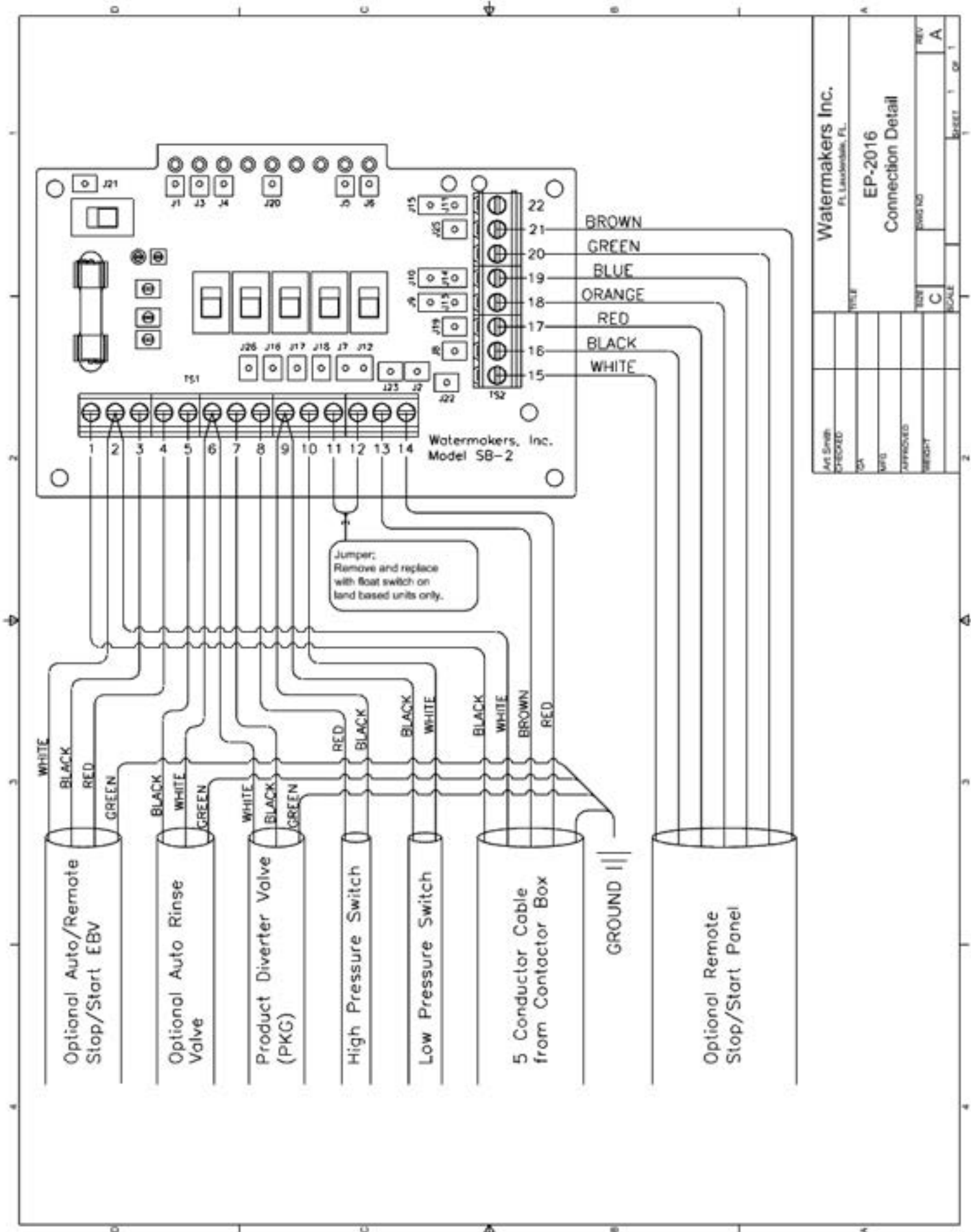
Watermakers Inc.		EP-2016		Door		Wiring Detail		REV		A	
FL Lauderdale, FL		TITLE		DATE		C		SCALE		SHEET 1 OF 1	
Art Smith		DESIGNED		DATE		APPROVED		REVISION			

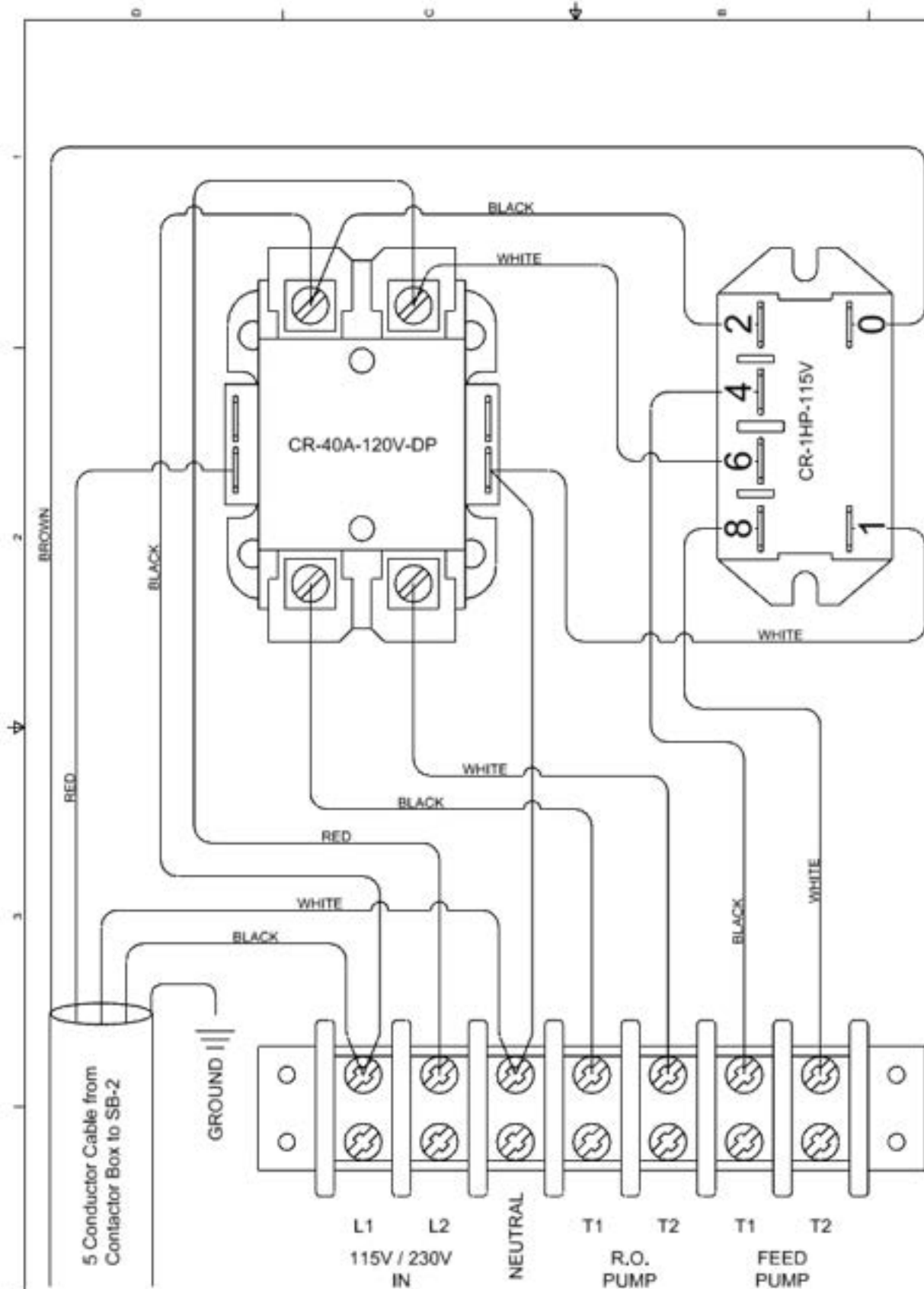


Watermakers Inc.		EP-2016		REV	
FL, Lakeland, FL		Backplate		A	
FILE		Wiring Detail		REV	
Art Smith		DESIGNED		SCALE	
C.A.		DTS		SHEET 1 OF 1	
APPROVED		REIGHT			

CAUTION: All bypass switches must be in the OFF (down), and the PLC power switch in the ON position for the unit to operate properly. In case of PLC failure contact watermakers Inc. for emergency use instructions. Failure to operate the unit with the switches in the correct position will cause damage to the watermaker and void any warranty.

[illegible]





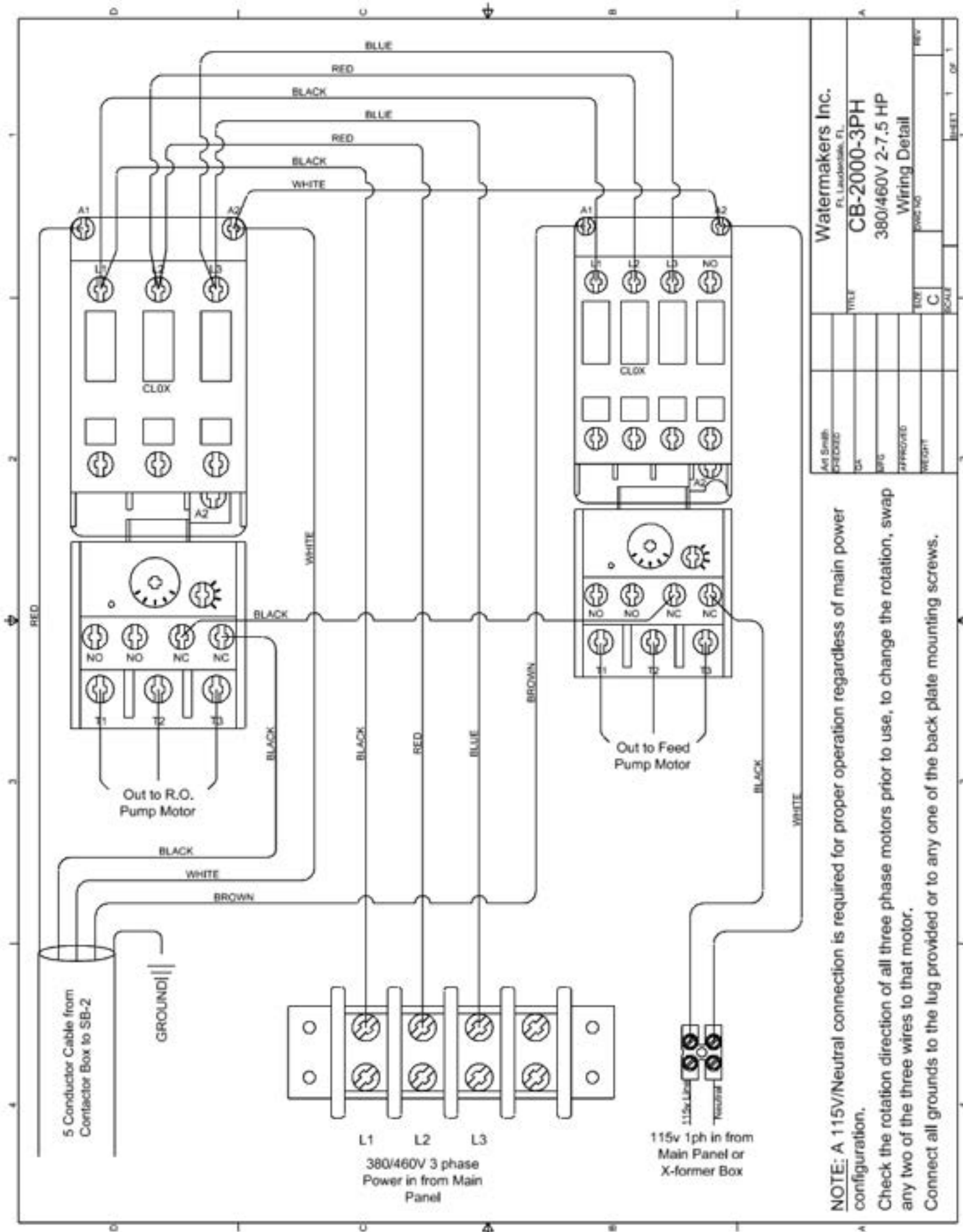
NOTE: A 115V/Neutral connection is required for proper operation regardless of main power configuration.

For 115VAC operation place a jumper between terminal L2 and Neutral. Connect the incoming 115V line to L1 and the incoming neutral to L2.

For 230VAC operation connect the two incoming hot lines to L1 and L2 and a separate neutral to the neutral terminal.

Connect all grounds to the lug provided or to any one of the back plate mounting screws.

Art Smith DESIGNED	Watermakers Inc. FL, Lakeland, FL
DATE	TITLE
DATE	CB-2000-1PH-A
DATE	Wiring Detail
DATE	REV
DATE	SCALE
DATE	SHEET 1 OF 1



NOTE: A 115V/Neutral connection is required for proper operation regardless of main power configuration.

Check the rotation direction of all three phase motors prior to use, to change the rotation, swap any two of the three wires to that motor.

Connect all grounds to the lug provided or to any one of the back plate mounting screws.

3. Operating Instructions

Operating Your Watermaker

The following procedures will guide you through the normal operation, start-up, shut-down and rinsing of your watermaker. The following drawings and descriptions should help to familiarize you with the location and names of the controls (valves and switches etc.) required for the operation of the watermaker. If you have purchased any optional upgrades take some time and review the instructions that came with them as they may affect the operation of your watermaker.

NOTE: If you have purchased and installed the Remote Start/Stop or Auto Start/Stop upgrade for your watermaker please use the operating instructions and procedures that came with the upgrade kit or severe damage could occur.

Use the following procedures only if your watermaker is **NOT** equipped with the Remote Start/Stop or Auto Start/Stop option.

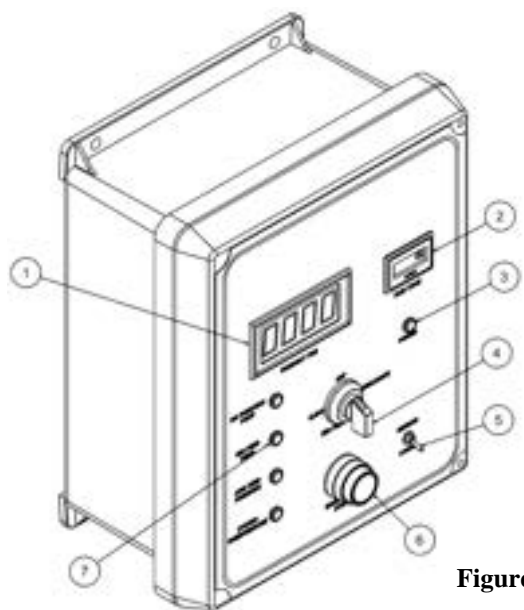


Figure 9

EP-2016 Electric Panel

1. TDS Meter
2. Hour Meter
3. Power Available Indicator
4. Rotary Switch
5. Operate/Remote Selector Switch (Optional)
6. Emergency Stop Pushbutton
7. Status/Alarm Indicators

Flow Panel

1. Manual Product Diverter
2. Product Flow Meter
3. R.O. Pressure Gauge
4. Pressure Regulator Valve
5. Reject Flow Meter

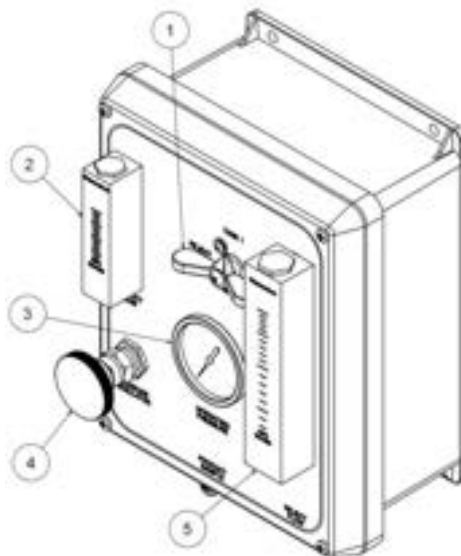


Figure 10

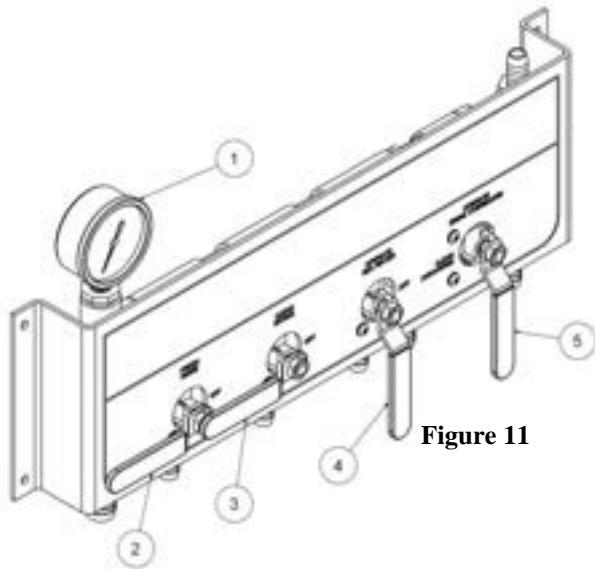


Figure 11

VP-050 Valve Panel
WMS/Q-550 thru 1400

1. Feed Pressure Gauge
2. Freshwater Rinse
3. Clean Intake
4. Operate Seawater
5. Brine Overboard/Clean Discharge

VP-1000 Valve Panel
WMS/Q-1700 thru 3000

1. Feed Pressure Gauge
2. Clean Feed
3. Freshwater Feed
4. Seawater Feed
5. Overboard Discharge
6. Clean Discharge

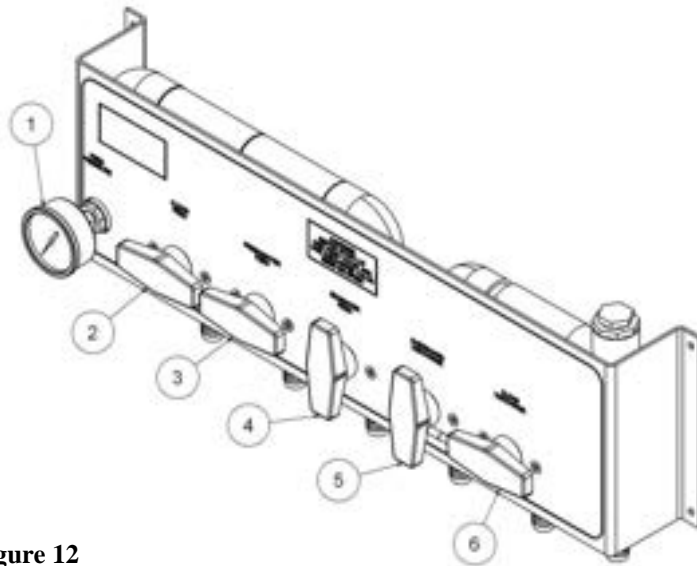


Figure 12

Prior to start up of the unit the following prestart-up checks should be performed:

1. Check the high pressure pump oil level.
2. Check the pressure regulator is full open (Counter Clockwise).
3. Check that the suction seacock is open.
4. Check the main and control power circuit breakers in the main panel closed/on.
5. Check that the operation/remote switch is in the operation position.
6. Check that the fresh water feed, clean feed, and clean return valves are closed.
7. Check that the inlet valve to the charcoal filter is open.
8. Check the seawater feed valve on the valve panel is open.
9. Check the reject valve on the valve panel is in the overboard position.

Once you have verified that the initial conditions have been met, you are ready to proceed.

CAUTION: This watermaker utilizes a positive displacement High Pressure Pump. It is imperative that a clear flow path be maintained through the system while the High Pressure Pump is running. This manual only refers to those valves included with or recommended for installation in the system. If other valves have been installed, it is the operator's responsibility to verify their positions prior to starting the watermaker.

WARNING! Severe damage will result if the watermaker is started with suction or discharge valves closed.

1. Initial Start-Up:

The following initial start-up procedure should be performed when the unit is being started for the first time following installation, service or filter changes. It allows the user to purge air from the system and to check for leaks prior to actually running the system at full pressure.

- A. Open the Seawater Feed valve on the Valve Panel.
- B. Divert reject to overboard on WMS-550-1400 place the Reject Valve in the Brine Overboard position on the VP-050 or on WMS1700-3200 open the Overboard Discharge and close the Clean Discharge on the VP-1000.
- C. Place the rotary switch in the FEED PUMP position.
- D. Observe the reject flow meter on the flow panel and the feed pressure gauge on the valve panel. Allow 1-2 minutes for all air to be purged from the system.
- E. Depress the red vent button on the top of the pre-filter canister to purge any air from the canister.
- F. Turn the rotary switch to the OFF position.

If you wish to run the watermaker at this time proceed to the normal start-up procedure.

If the watermaker is not going to be run in the next 24 hours, a manual rinse should be performed as outlined later in this section.

2. Normal (Manual) Start-Up:

Note: Be sure to perform the prestart-up checks prior to starting the unit.

- A. Place the manual product diverter in the desired tank fill position.
- B. Turn the rotary switch to the DESALINATE position.
- C. The feed pump should start as indicated by the Feed Pump light on the electric panel and after a few seconds seawater flow should be seen in the reject flow meter.
- D. After a time delay of 30 seconds (1 minute on land based units) the R.O. pump should start as indicated by the R.O. Pump light on the electric panel.
- E. Allow 30 second for the system to stabilize.
- F. Adjust the seawater pressure by slowly turning the pressure regulator in the clockwise direction until the R.O. Pressure gauge indicates 900 psi.
- G. Flow should be seen in the product flow meter. Once the product water TDS falls below 550ppm it will be diverted to the selected tank automatically.

3. Normal (Manual) Shutdown:

- A. Turn the pressure regulator slowly counter clockwise until fully open.
- B. Place the rotary switch in the OFF position.
- C. The R.O. Pump should stop as indicated by the R.O. Pump light on the electric panel.
- D. After a time delay of 10 seconds the Feed Pump should stop as indicated by the Feed Pump light on the electric panel.

Note: If you have purchased and installed the auto rinse upgrade for your watermaker, the unit will now rinse itself for the factory preset time then return to a normal shutdown condition. If you have not installed the auto rinse option proceed to the next section to perform a manual rinse of the watermaker.

4. Manual Rinse:

Note: The watermaker must be rinsed with fresh water after each use and every 7-10 days of non use to avoid fouling the membranes. Failure to do so will void any warranty.

Note: The following procedure assumes that the unit is in a normal shutdown condition and that the freshwater distribution system is in operation.

- A. Test the freshwater supply for residual chlorine, using the sample port on the charcoal filter and a chlorine test kit (Watermakers, Inc. Part # CL-1A).
- B. Close the Seawater Feed Valve on the valve panel.
- C. Open the Freshwater Rinse Valve on the valve panel.
- D. Allow freshwater to rinse the machine for 3-5 minutes.
- E. Close the Freshwater Rinse Valve.
- F. Open the Seawater Feed Valve on the Valve Panel.

5. Operating in Areas of Varying Salinity or Temperature:

As the salinity (amount of dissolved salt) or the temperature of the feed water varies, the amount of product water the unit produces at a given pressure will vary. In general, the machine will produce more water in areas of lower salinity or higher temperature and less in areas of high salinity and lower temperature. In most cases the changes are so slight they would not be noticed. For example you cruise off the coast of Maine in the summer and in the Bahamas in the winter, you may notice some changes in fresh water production. If this is the case and the variation cannot be traced to some other cause i.e., membrane fouling, chlorine damage etc. then use the following procedures to increase or decrease the product flow as necessary to for your operating conditions.

CAUTION: At no time should the maximum designed flow rate (refer to specification sheet in Section 1) or the maximum operating pressure of 900 psi be exceeded.

CAUTION: Extreme caution should be taken when using the following procedure, especially when operating in areas such as the Gulf Stream where temperature changes of as much as 20 degrees can occur in just a few minutes.

- A. Monitor the product flow rate as indicated by the flow meter.
- B. If over time the product flow rate increases to an amount greater than the unit was designed to produce, adjust the pressure regulator counter clockwise until the product flow drops to the designed level.
- C. If the product flow rate decreases to an amount less than the unit was designed to produce, adjust the pressure regulator clockwise until either the designed product flow or the maximum operating pressure of 900 psi is achieved, whichever comes first.

6. Operator's Log Sheet:

On the next page is an example operating log sheet, make a copy or incorporate the data into your engineering logs. This will help to identify trends and the need for maintenance (membrane cleanings, oil changes etc.).

Watermaker Performance Log

Model Number: _____

Serial Number: _____

[illegible]

4. Maintenance Instructions

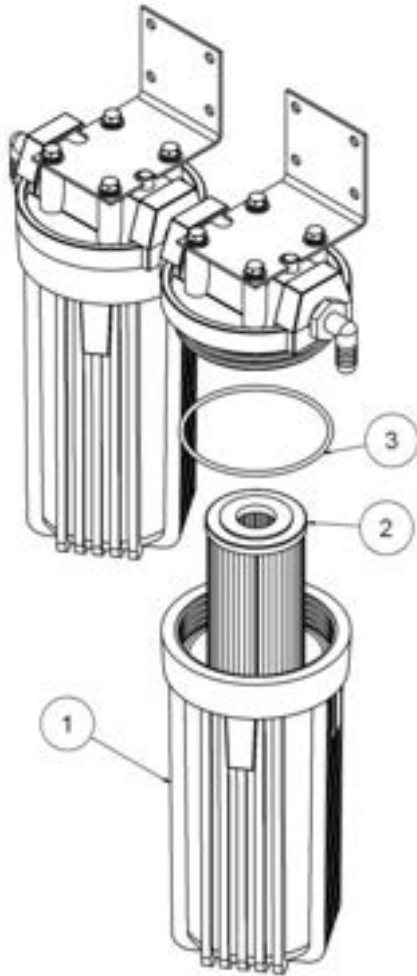
Maintaining Your Watermaker

1. Filter Replacement:

A. Pre-Filters.

The Pre-Filters must be replaced periodically in order to provide clean feed water to the watermaker. All of the Pre-Filters should be replaced before the feed pressure as indicated on the Feed Inlet gauge drops to 10 psi.

There are 2 different sizes of prefilter elements used in the WMS series of watermakers, 2-1/2" and 4" diameter. The housings for both sizes while different in size consist of the same basic parts and are assembled the same. The 2-1/2" version is shown below.



CAUTION: The watermaker must be in the normal shutdown condition prior to servicing the Pre-Filters.

Note: DO NOT attempt to rinse or wash and reuse the filter elements, this may cause serious damage to the watermaker and void any warranty.

CAUTION: When removing the filter canisters they will be full of salt water and as a result quite heavy. Take care to cover any equipment that may be damaged by exposure to or contact with salt water.

1. Remove the sump (1) by unscrewing in a Clockwise direction (looking down on the lid).
2. Pour out any water left in sump.
3. Remove and discard old filter element (2). Wipe sump clean.
4. Insert new filter element into sump.
5. Check O-Ring (3) for damage and replace if necessary.
6. Thread sump onto lid Counter Clockwise until hand tight.
7. Repeat for any additional canisters.

Figure 13

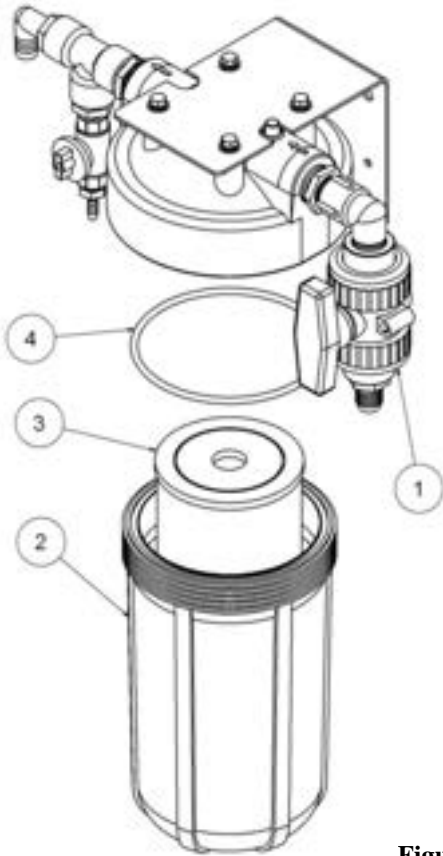
B. Charcoal Filters.

The charcoal filters are designed to remove chlorine from the freshwater used to rinse the watermaker after use. If even the smallest amount of chlorine were to come into contact with the R.O. membranes, irreparable damage would occur and the membrane warranty would be voided.

The sample port on the outlet of the filters allows the operator to test for any residual chlorine prior to rinsing the unit. If after testing it is determined that chlorine is present the charcoal filter elements must be replaced.

There are 2 different sizes of prefilter elements used in the WMS series of watermakers, 2-1/2" and 4" diameter. The housings for both sizes while different in size consist of the same basic parts and are assembled the same. The 4" version is shown below.

Note: DO NOT attempt to rinse or wash and reuse the filter elements, this may cause serious damage to the watermaker and void any warranty.



CAUTION: When removing the filter canisters they will be full of water and as a result quite heavy. Take care to cover any equipment that may be damaged by exposure to or contact with water.

1. Close the inlet valve (1) to the charcoal filters.
2. Remove the sump (2) by unscrewing from lid in a Clockwise Direction (looking down on the lid).
3. Pour out any water left in sump.
4. Remove and discard the old filter element(s) (3).
5. Insert new filter element into sump. If you have a 20" long canister insert the cartridge coupler and a second filter element.
6. Check O-Ring (4) for damage and replace if necessary.
7. Thread sump onto lid Counter Clockwise until hand tight.
8. Repeat for any additional canisters.

Figure 14

2. Membrane Cleaning:

The membranes process a large quantity of seawater to produce fresh product water. It is, therefore easy to understand the need for occasional maintenance.

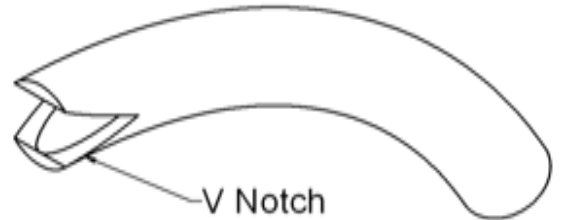
Cleaning must be performed whenever the fresh water production decreases or product salinity increases by 10 to 15% or if there is a noticeable taste or odor present in the product water. Foulants are generally classified as either organic or inorganic. The organic foulants include sea life, plants, bacteria, etc. and produce a sulfur-like odor in the product as well as a blackish growth inside the hoses. RO1 Alkaline Cleaner is used in the case of organic fouling. The inorganic foulants consist of mineral deposits left behind by the feed water and will cause a decrease in fresh water production and in some cases an increase in product salinity as well. An indication of iron fouling is the appearance of a reddish discoloration in the hoses and flow meters. RO2 Acid Cleaner is used for inorganic fouling.

CAUTION: Never mix cleaning chemicals. If both cleaners are to be used to clean the system, use RO1 first then rinse the machine. Thoroughly rinse the cleaning bucket and mixing utensils before using RO2.

Note: The following procedure assumes that the unit is in a normal shutdown state and that the fresh water rinse procedure has been performed.

- A. Close Seawater Feed/Operate Valve on the Valve Panel.
- B. Open the Clean Feed Valve on the Valve Panel.
- C. Align discharge valve(s) to CLEAN DISCHARGE.
- D. Turn the manual product diverter on the Flow Panel to REJECT.
- E. Place a clean, non-corrosive bucket on the deck in front of the Valve Panel.

F. Connect a piece of polybraid hose long enough to reach the bottom of the bucket to the Clean Intake fitting on the Valve Panel and secure with a hose clamp. Using a sharp razor knife cut a V notch in the free end of the hose.



G. Connect a piece of polybraid hose long enough to reach the bottom of the bucket to the Clean Return fitting on the Valve Panel and secure with a hose clamp.

H. Place the free ends of the hoses in the bucket.

I. Fill the bucket with approximately five Gallons of fresh water by slowly opening the Freshwater Rinse Valve on the Valve Panel. When the bucket is full, close the Freshwater Rinse Valve.

J. Empty one (1 lb.) bottle of cleaner into the bucket and mix using a non corrosive utensil until the chemical is completely dissolved. AVOID SKIN CONTACT.

K. Place the rotary switch in the CLEAN/RINSE Position.

L. The R.O. Pump should start as indicated by the R.O. Pump light on the electric panel.

M. Allow the pump to run for the length of time indicated on the bottles label.

N. Once the pump has run for the allotted time, turn the rotary switch to OFF.

O. Empty the bucket by, WMS-550-1400 placing the Reject Valve in the Brine Overboard position on the VP-050. On WMS-1700-3200 open the Overboard Discharge and close the Clean Discharge on the VP-1000. Turn the rotary switch to the ON position.

P. When the bucket is almost empty, place the Rotary Switch in the OFF position.

Q. Close the Clean Feed Valve.

R. Discard the remaining chemical. Thoroughly rinse the bucket and utensils. The hoses may be removed or coiled up and stored in place.

S. Rinse the unit in accordance with the fresh water rinse procedure in the previous section.

T. Repeat steps H thru R if needed for additional chemical.

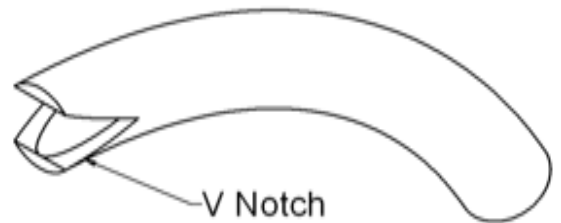
3. Long Term Storage:

The watermaker must be rinsed weekly or sanitized if it is to be left unused for more than one week. This will prevent the growth of biological foulants and keep the membranes moist. If the unit can be rinsed once a week, the sanitizing procedure need not be used. If, however the machine will be idle for more than one week it should be laid up by using the following procedure.

The RO3 preservative is a special blend of liquids that removes the oxygen supply in the water to eliminate biological growth and lubricates the membranes and other internal components.

Note: Use only Watermakers, Inc. approved sanitizing solution. The chemical is premixed in the exact amounts required for maximum protection. Using other types could result in damage to membranes and other internal equipment.

- A. Close Seawater Feed/Operate Valve on the Valve Panel.
- B. Open the Clean Feed Valve on the Valve Panel.
- C. Open the Clean Discharge Valve on the Valve Panel.
- D. Turn the manual product diverter on the Flow Panel to REJECT.
- E. Place a clean, non-corrosive bucket on the deck in front of the Valve Panel.
- F. Connect a piece of polybraid hose long enough to reach the bottom of the bucket to the Clean Intake fitting on the Valve Panel and secure with a hose clamp. Using a sharp razor knife cut a V notch in the free end of the hose.
- G. Connect a piece of polybraid hose long enough to reach the bottom of the bucket to the Clean Return fitting on the Valve Panel and secure with a hose clamp.
- H. Place the free ends of the hoses in the bucket.
- I. Fill the bucket with approximately five Gallons of fresh water by slowly opening the Freshwater Rinse Valve on the Valve Panel. When the bucket is full, close the Freshwater Rinse Valve.
- J. Empty one bottle of preservative into the bucket and mix using a non corrosive utensil until the chemical is completely dissolved. AVOID SKIN CONTACT.
- K. Place the rotary switch in the CLEAN/RINSE Position.
- L. The R.O. Pump should start as indicated by the R.O. Pump light on the electric panel.
- M. Allow the pump to run for the length of time indicated on the bottles label.
- N. Once the pump has run for the allotted time turn the rotary switch to OFF.



- O. Empty the bucket by, WMS-550-1400 placing the Reject Valve in the Brine Overboard position on the VP-050 or on WMS1700-3200 open the Overboard Discharge and close the Clean Discharge on the VP-1000. Turn the rotary switch to the ON position.
- P. When the bucket is almost empty, place the Rotary Switch in the OFF position.
- Q. Close all inlet valves on the valve panel.
- R. Close the Pressure Regulator.
- S. Discard the rest of chemical. Thoroughly rinse the bucket and utensils. The hoses may be removed or coiled up and stored in place.
- T. Remove and discard the prefilter elements.
- U. When restarting the watermaker discard any product for the first hour by manually diverting it overboard.

Note: Repeat the Long Term Storage Procedure every 3 months until the watermaker is returned to normal service.

4. Winter Storage:

Note: If the watermaker is going to be stored for the winter in areas that are prone to sub freezing temperatures the following procedures should be followed.

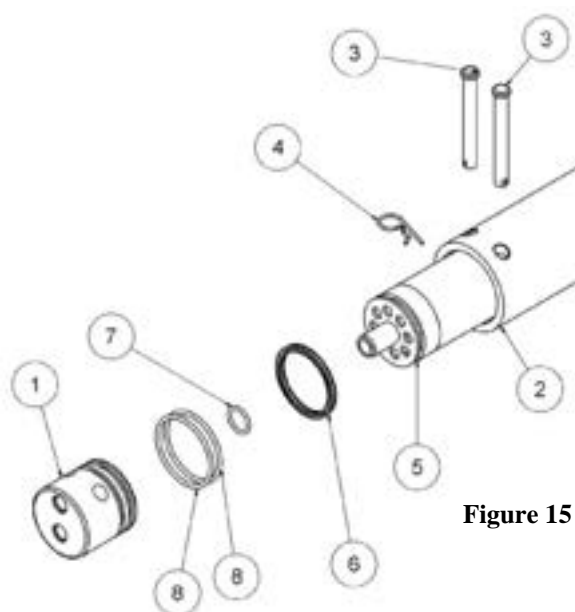
- A. Perform the cleaning and storage procedures as outlined in the previous section.
- B. Remove the membranes from the vessels as shown in sections 5, A & B.
- C. Allow the membranes to “drip out” then seal tightly in plastic bags.
- D. It is recommended that the membranes be stored in an area not subject to freezing conditions. If this is not possible be sure to thaw the membranes completely prior to reuse.
- E. Drain as much water from the system lines and components as possible.

Note: When restarting the watermaker be sure to perform the prestart-up checks and follow the initial start-up procedure in section 1 of the operating instructions. Divert all product water overboard for the first 30 minutes after restarting.

5. Membrane Inspection/Replacement:

At some point over the life of your watermaker it will become necessary to inspect or replace the membranes. Refer to the following figures and procedures.

Note: When removing the end cap some saltwater spillage will occur. Take whatever precautions you feel necessary to prevent damage or injury to yourself and your vessel.



1. End Cap (VC-107B)
2. Pressure Vessel (PV-FBGL-2540)
3. Retaining Pin (RP-107)
4. Retaining Clip (4109)
5. Membrane Element (SW30-2540)
6. Brine Seal (80042)
7. Product Port O-Ring (4005)
8. End Cap O-ring (4004)

Figure 15

1. Membrane Removal.

Note: Whenever possible the membrane should be removed and reinstalled from the inlet end of the pressure vessel.

- a. Remove retaining clip (4) and the retaining pins (3).
- b. Using the fittings pull firmly to remove the end cap (1).

Note: Be careful not to damage the outer surface of the product tube when removing the membrane.

- c. Using long nosed pliers, grasp the exposed product tube of the membrane (5) and firmly pull from the pressure vessel (2).
- d. Inspect all o-rings (7 & 8) and brine seals (6) for nicks, cuts or stretching and replace as needed.

2. Membrane Installation.

- a. Lubricate all o-rings (7 & 8) and brine seals (6) with a water soluble food grade lubricant (i.e. Dow #7 Silicone mold release compound).
- b. Insert the membrane (5) into the pressure vessel (2) making sure that the brine seal (6) is facing the inlet end. Push firmly until the product port seats into the opposite end cap.
- c. Insert the end cap (1) into the pressure vessel (2) be sure check the orientation of high pressure fittings. Push firmly until retaining pin holes align.
- d. Insert the retaining pins (3) and reinstall the retaining clip (4).

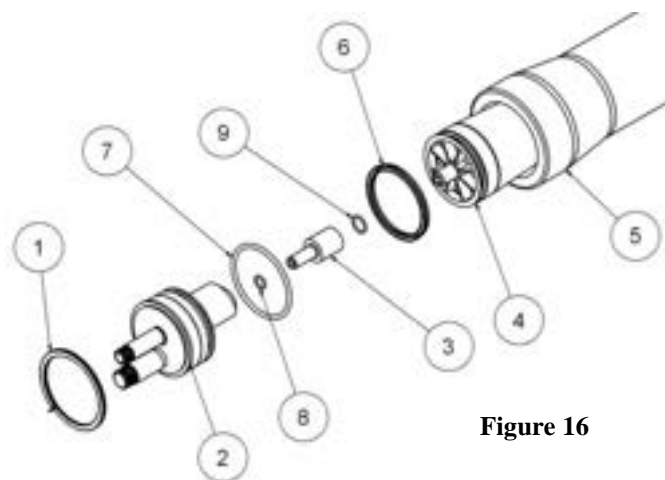


Figure 16

1. Retaining Ring (45260)
2. End Plug Assy (47476)
3. Product Port Adptr (104075)
4. Membrane Element (SW30-4040)
5. Pressure Vessel (PV-GLASS-4040)
6. Brine Seal (80050)
7. End Plug O-ring (A-342-EP)
8. Product Port O-Ring (A-114-EP)
9. Prod Port Adptr O-Ring (A-116-EP)

1. Membrane Removal.

Note: Whenever possible the membrane should be removed and reinstalled from the inlet end of the pressure vessel.

- a. Remove retaining ring (1) by pulling firmly on the tab.
- b. Using the high pressure fittings as a handle pull firmly to remove the end plug assy (2) use caution the center PVC product port is very fragile.

Note: Be careful not to damage the outer surface of the product tube when removing the membrane.

- c. If it did not come out with the end plug, grasp the product port adapter (3) and firmly pull from the pressure vessel (5).
- d. Using long nosed pliers, grasp the exposed product tube of the membrane (4) and firmly pull from the pressure vessel (5).
- e. Inspect all o-rings (7, 8 & 9) and brine seals (6) for nicks, cuts or stretching and replace as needed.

2. Membrane Installation.

- a. Lubricate all o-rings (7, 8 & 9) and brine seals (6) with a water soluble food grade lubricant (i.e. Dow #7 Silicone mold release compound).
- b. Insert the membrane (4) into the pressure vessel (5) making sure that the brine seal (6) is facing the inlet end. Push firmly until the product port seats into the opposite end plug.
- c. Reinstall the product port adapter (3) onto the membrane product port.
- d. Insert the end plug (2) into the pressure vessel (5) be sure to check the orientation of high pressure fittings. Push firmly until the product port seats onto the membrane.
- e. Reinstall the retaining Ring (1).

6. High Pressure Pump:

The High Pressure Pump oil needs to be changed on a regular basis. The frequency of the oil change depends on the type and configuration of the pump. Below is the recommended schedule for all of the pumps covered in this manual.

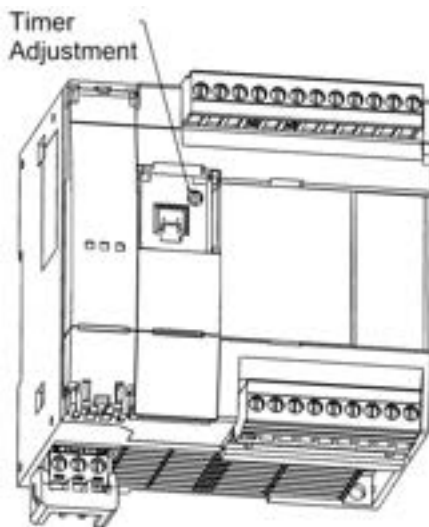
New installations break in period	50 hours
All Wanner Pumps	300 hours

Note: Do not leave the oil reservoir empty for more than a few minutes.

CAUTION: Never rotate the pump crankshaft while the oil reservoir is empty.

- A. Open the watermaker circuit breaker(s) in the main power panel.
- B. Remove oil fill cap.
- C. Remove oil drain plug.
- D. Drain oil into suitable container of at least one (1) U.S. quart capacity.
- E. Check oil for water, metal or other contaminants as this could be a sign of larger problems.
- F. Replace oil drain plug.
- G. Immediately refill pump with one (1) U.S. quart of Hydra-Oil (watermakers part# 4233).
- H. Replace the oil fill cap.
- I. Dispose of used oil in accordance with all local ordinances.

7. Electric Panel Settings and Adjustments:



The EP-2016 is a PLC based control panel and is programmed at the factory based on information provided when the order was placed.

The only field adjustments to the PLC controller are for installation type (Marine or Land based) and Fresh water rinse duration timer. Both of these functions are set using the potentiometer located under the access door on the left side of the PLC as shown in fig 17.

It is recommended that you contact Watermakers Inc. prior to making adjustments as incorrect settings may cause damage to the equipment.

Figure 17

A. Installation Type (Start Up Timers):

Due to the extreme differences between land based and vessel installation conditions i.e. length of plumbing runs and elevation changes, two different sets of startup timers are preprogrammed into the PLC. These internal timers determine the delay between the time the feed pump starts and when the high pressure pump starts. And if the remote or auto start/stop option is installed the delay between the high pressure pump start and when the high pressure ball valve closes.

1. For Land based applications turn the dial to the left of center. This will set the pump delay to 1 minute and the ball valve close delay to 1 minute.
2. For Marine applications turn the dial to the right of center. This will set the pump delay to 10 seconds and the ball valve close delay to 30.

B. Rinse Timer Settings:

Adjusting the dial all the way to the left for Land Based or all the way to the right for Marine applications will also set the rinse timer to 3 minutes. Turning the dial back towards the center will increase the rinse time to a maximum of 10 minutes at 10 degrees on either side of center. **REMEMBER** if you turn the dial past the center point you will also change the start up timers.

Dial is shown in Marine Based application, 3 Min rinse time position.

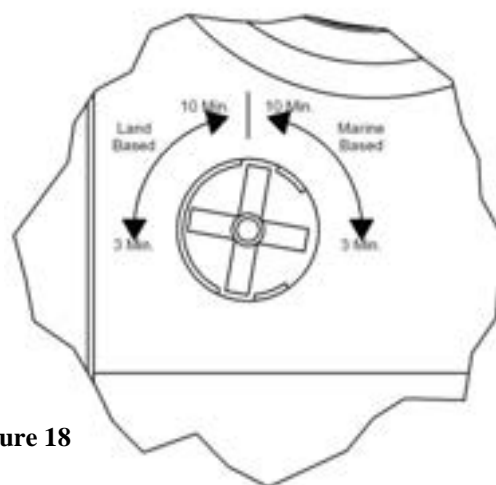


Figure 18

C. Salinity Controller Calibration:

The TDS control module is located on the right hand side of the EP-2016. The readout and alarm setpoints are set and tested at the factory and under normal circumstances further adjustment should not be required. However should the need arise the following procedures should be used.

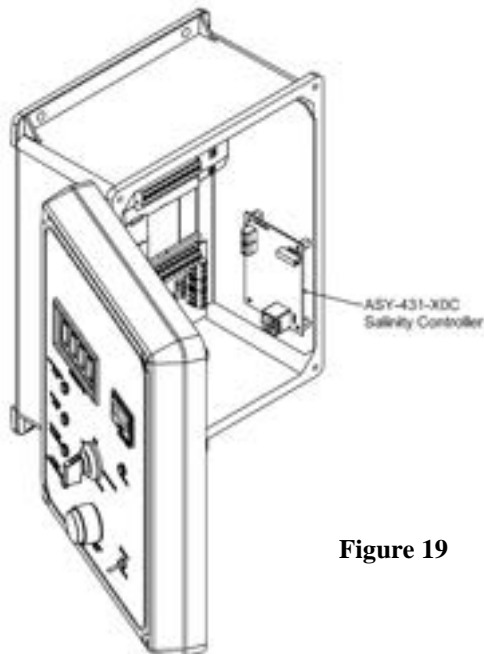


Figure 19

USE EXTREME CAUTION! : The following procedures require working in the energized electric panel. Use extreme caution while working on or around exposed electrical circuits. Take all necessary precautions to protect yourself and the equipment.

There are two methods for calibrating the sensor input, either one will work on any Watermakers Inc machine using the EP-2016. Read the following procedures carefully and determine which one is best for you.

Watermakers Inc. recommends you contact the factory prior to making any changes to the salinity controller settings.

1. Method 1 (using calibration solution):

- a. Remove the sensor probe from the product line tee fitting.
- b. Rinse the probe surface with fresh water and wipe with a clean cloth.
- c. Suspend the probe by the cable so that the surface of the probe is just submerged in the calibration solution (Watermakers Inc. part# 300).
- d. Start the watermaker by performing steps A-D of the normal start up procedure in section 3 of this manual. **DO NOT CLOSE THE PRESSURE REGULATOR.**
- e. Wait for the TDS display reading to stabilize.

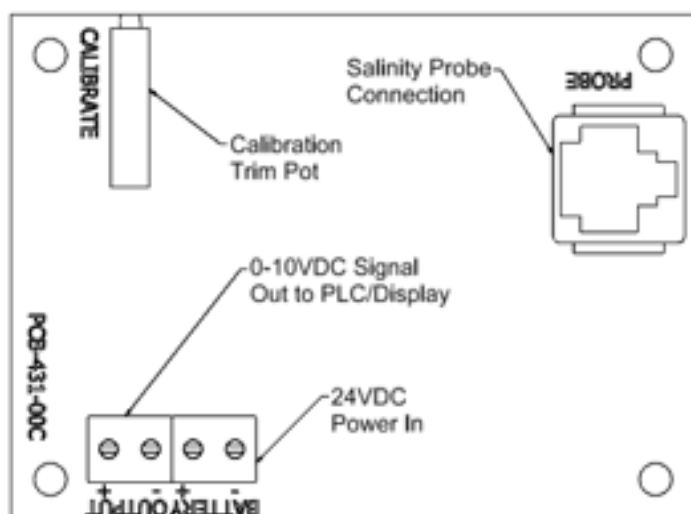


Figure 20

f. Using a small screwdriver slowly turn calibration adjustment pot, as shown in figure 20 until the display reading matches the calibration solution value.

g. Stop the watermaker by using the normal shutdown procedure in section 3 of this manual.

h. Replace the sensor probe.

i. Perform a fresh water rinse of the unit as outlined in section 3 of this manual.

2. Method 2 (using handheld meter):

- a. Start the watermaker in accordance with the normal start-up procedure in section 3 of this manual.
- b. Wait for the TDS display to stabilize.
- c. Using the manual product diverter valve, draw and test a sample of the product water.
- d. Using a small screwdriver slowly turn calibration adjustment pot, as shown in figure 20 until the display reading matches the reading obtained from your hand held meter (Watermakers Inc. part # TDS-1).
- e. Shutdown the watermaker using the normal shutdown procedure outlined in section 3 of this manual.
- f. Perform a fresh water rinse of the unit as outlined in section 3 of this manual.

8. Spare Parts Quick Reference:

The following is a list of part numbers for the most commonly used spare/replacement parts for the WMS/WMSQ Series machines. Our Parts Department and Service Technicians will be glad to advise you on what to keep on hand for your particular needs.

<u>Description</u>	<u>Watermakers Part #</u>
5m Prefilter 2-1/2"x10"	CP-5
5m Prefilter 4"x10"	CP-5BB
30m Prefilter 2-1/2"x10"	R-30
30m Prefilter 4"x10"	PP30-BB
Charcoal Filter 2-1/2"x10"	RFC-93
Charcoal Filter 4"x10"	RFC-BB
Charcoal Filter 4"x10"	GAC-BB
Filter Cartridge Coupler	144229
H. P. Pump Oil Quart	4233
Membrane Cleaner (organic)	RO1
Membrane Cleaner (scale)	RO2
Membrane Preservative	RO3

5. Troubleshooting

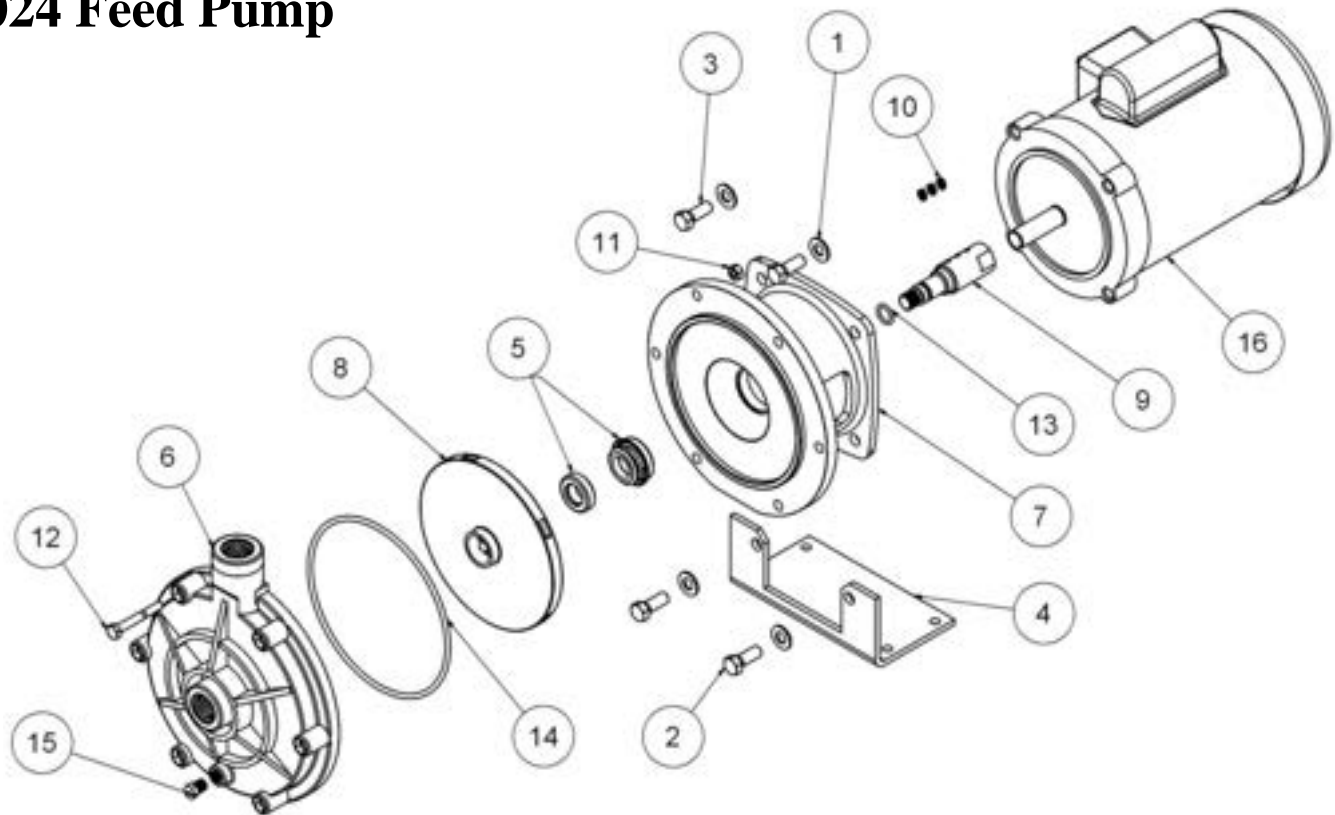
Troubleshooting Guide

<u>Problem</u>	<u>Possible Cause</u>	<u>Corrective Action</u>
Unit will not start	No power	Check main power source. Check main breaker closed. Blown control power fuse on circuit board in EP
	Incorrect or low voltage	Meter main power source.
	Loose or incorrect electrical connections.	Check and tighten all electrical connections.
	Insufficient power	Check generator settings turn off non essential loads.
	Overload tripped on motor	Reset using push button on side of motor connection box.
	Thermal tripped on motor starter.	Check motor starter in contactor box if set for manual, push reset button on thermal overload. If set for automatic wait for circuit to cool and reset.
Unit starts but will Not stay running	Low pressure trip	Replace seawater filters and restart.
	No feed pressure	Check all valves are open and there are no obstructions or kinks in feed lines. Turn the rotary switch on the electric panel to “feed pump” and and verify feed pump is running.
	Faulty low pressure switch	Place rotary switch in “feed pump” position if feed pressure is above 10 psi and the low pressure light is on the low pressure switch is bad.
	High pressure trip	Check pressure regulator is fully open then restart machine.
Unit starts then trips Thermal overload.	Improper incoming power.	Meter incoming power.
	Motor wired incorrectly.	Check all motor connections with connection diagrams inside motor junction box and wiring diagrams in this manual.
	Thermal set incorrectly.	Verify thermal setting and compare to FLA rating on motor label plate.set thermal at least 1 amp higher than FLA rating of motor.
	Incorrect wire size.	Check all motor leads are sized in accordance with NEC and local codes.

<u>Problem</u>	<u>Possible Cause</u>	<u>Corrective Action</u>
Excessive vibration.	Broken/stuck valve or plunger in high pressure pump.	Refer to high pressure pump repair section in manual.
	Dirty pump oil.	Change pump oil. If problem persists contact Watermakers Inc. for Diesel flush instructions.
	Air in feed lines.	Check all feedwater lines for loose connections and broken fittings. If problem persists do not run watermaker or severe damage may occur.
Oil leak in high pressure pump.	Worn oil seal or o-ring.	Refer to pump repair section in appendicies section.
	Overfilled crankcase.	Drain oil to proper level.
Unusual taste or odor in product water.	Bacterial growth on membrane.	Clean with RO1 as outlined in section 3.
Severe reduction in product water flow.	Scale buildup on membrane	Clean with RO2 as outlined in section 3.
Salt taste in product water.	Membrane damage	Have membrane tested at a qualified RO testing facility.
	Damaged or leaking product port o-ring	Replace damaged o-rings.
Watermaker is dumping good water.	Dirty salinity probe.	Wipe surface of probe with a soft cloth.
	Salinity controller out of calibration.	Calibrate in accordance with the procedures in the maintenance section of this manual. If problem persists disconnect the PKG from inside the electric panel and use manual product diverter until problem is resolved. Contact Watermakers Inc. for service.

6. Appendices

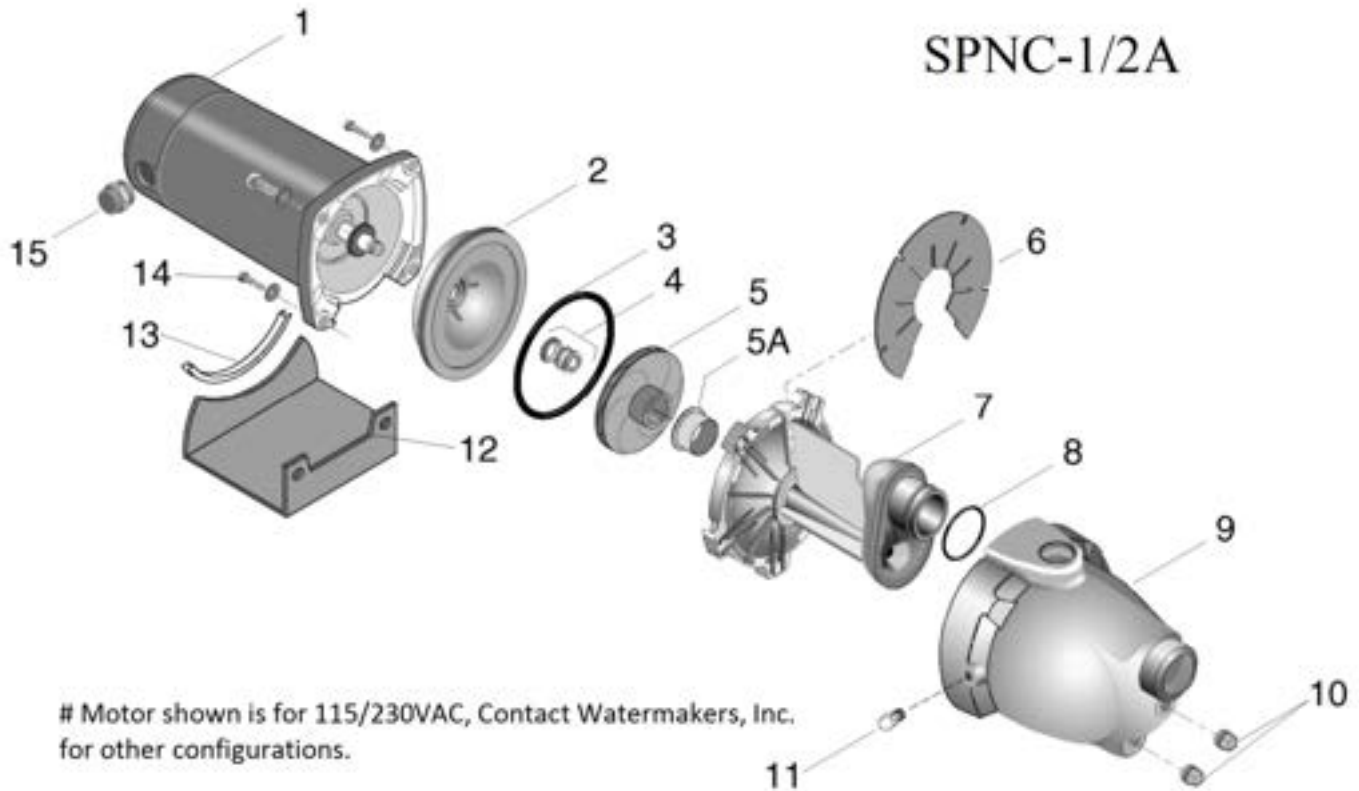
4024 Feed Pump



* Motor part # varies with watermaker model.
Contact watermakers, Inc. for correct part number.

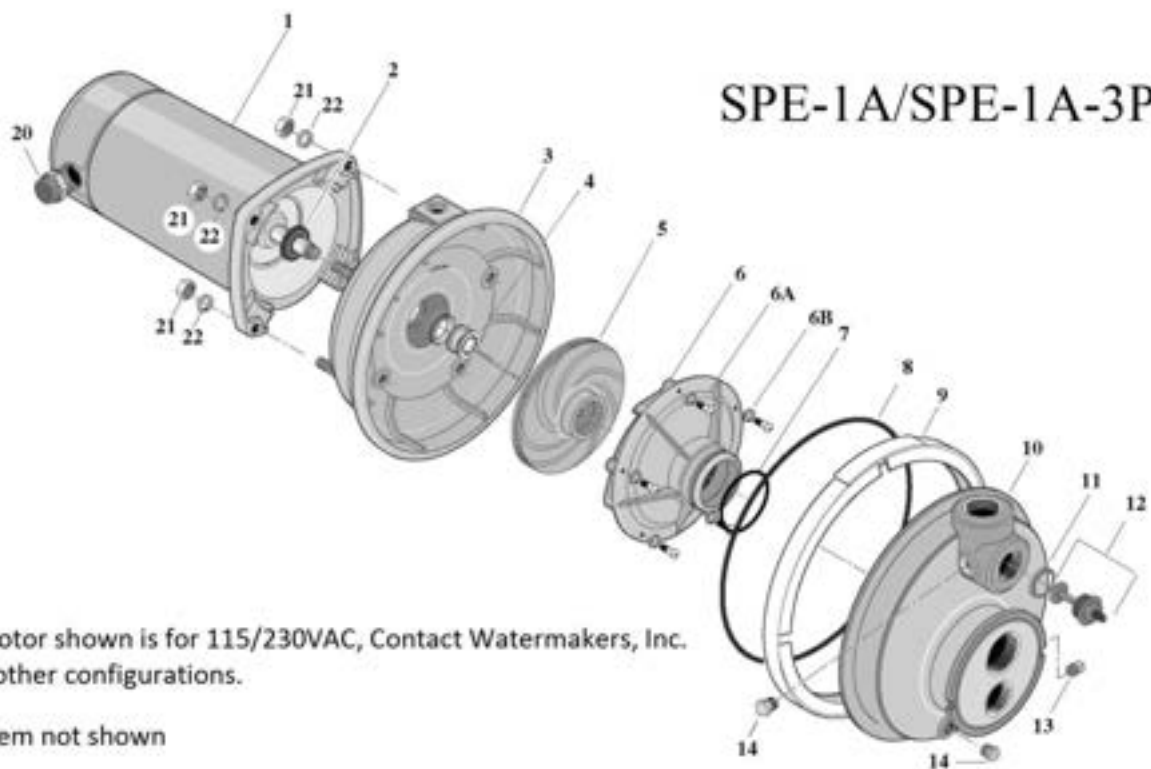
Key No.	Part Description	Qty.	Watermakers Inc. Part No.
1	Flat Washer	4	3/8FW
2	Lower Mounting Bolt	2	3/8X1HHCS
3	Upper Mounting Bolt	2	3/8X3/4HHCS
4	4024 Mount	1	4045
5	Shaft Seal	1	4069
6	4024 Volute	1	4114
7	4024 Seal Bracket	1	4114B
8	4024 Impeller (3/4HP) 4024 Impeller (1/3HP)	1	4115 4115A
9	4024 Shaft Extension	1	4116
10	4024 Shaft Set Screw	3	4117
11	Hex Nut, Volute	6	5/16HN
12	Bolt, Volute	6	5/16X2HHCS
13	4024 Shaft O-Ring	1	A-112
14	Volute O-Ring	1	A-258-EP
15	Pipe Plug 1/8"	1	TPS-1
16	Motor	1	*

SPNC-1/2A



Motor shown is for 115/230VAC, Contact Watermakers, Inc. for other configurations.

Key No.	Part Description	Qty.	Watermakers Inc. Part No.
1	Motor	1	SR-J218-582APKG #
2	Seal Plate	1	SR-N3-15P
3	O-Ring	1	SR-U9-390
4	Shaft Seal	1	4129
5	Impeller	1	SR-J105-40PNB
5A	Floating Wear Ring	1	SR-N23-12SS
6	Priming Baffle	1	SR-U97-153P
7	Nozzle/Venturi/Diffuser Assy	1	SR-N101-30PA
8	Nozzle O-Ring	1	SR-U9-449
9	Pump Body	1	SR-76-46P
10	Pipe Plug 1/4"	1	TPS-1
11	Pipe Plug 1/8"	1	TPS-2
12	Base	1	SR-J104-9F
13	Rubber Pad	1	SR-C35-5
14	3/8" x 2" HHCS	4	3/8" x 2" HHCS
15	Wire Restrainer	1	4046A



Motor shown is for 115/230VAC, Contact Watermakers, Inc. for other configurations.

* Item not shown

Key No.	Part Description	Qty.	Watermakers Inc. Part No.
1	Motor	1	EM-1HP-56Y-208 #
2	Water Slinger	1	SR-17351-0009
3	Seal Plate	1	SR-L176-47P
4	Shaft Seal	1	4129
5	Impeller	1	SR-J105-8PAN
6	Diffuser	1	SR-J1-40P
6a	Diffuser Screws	5	SR-U30-542SS
6b	Washer, #8	5	SR-U43-21SS
7	Diffuser O-Ring	1	SR-U9-199
8	O-Ring, V-Clamp Assembly	1	SR-U9-399
9	V-Clamp Assembly	1	SR-C19-54SS
10	Pump Body	1	SR-L76-37P
11	Control Valve Gasket	1	SR-L20-40
12	Pressure Control Valve	1	SR-J198-20
13	Pipe Plug 1/8"	1	TPS-1
14	Pipe Plug 1/4"	2	TPS-2
20	Wire Restrainer	1	4046A
21	Hex Nut, 5/16"-18	4	5/16HN
22	Washer, 5/16"	4	5/16FW
*	Base	1	SR-BRACKET

REPAIR PARTS FOR STA-RITE SHALLOW WELL KITS SPE-1A (1HP) AND SR-PLF SIERIES (1.5HP) PUMPS



NOTE: FOR COMPLETE JET, ORDER BY PACKAGE NUMBER WHICH INCLUDES KEY NUMBERS 1 THRU 12.
EXAMPLE: JET 21N - ORDER PKG. 1-21N, ETC.

REPAIR PARTS LIST

Key No.	Part Description	No. Used	PLE 1 HP	PLF 1-1/2 HP
•	Jet Assembly Complete - 1 HP	1	Pkg. 1-23N	-
•	Jet Assembly Complete - 1-1/2 HP	1	-	Pkg. 1-24N
1	O-Ring	1	U9-202	U9-202
2	Clamp	1	J19-6	J19-6
3	O-Ring	1	U9-201	U9-201
4	Venturi	1	N32P-64	N32P-65
5	Nozzle	1	J34P-44	J34P-41
6	Insert - Jet Body	1	N40-39P	N40-39P
7	Gasket	1	J20-18	J20-18
8	Jet Body	1	N40-38P	N40-38P
9	O-Ring - Check Valve	1	U9-226	U9-226
10	Check Valve (Complete)	1	N166-5P	N166-5P
11	Pipe Plug - 1/8" NPT	1	WC78-41T	WC78-41T
12	Screw - #10 - 16 x 1-1/8" Lg.	4	U30-742SS	U30-742SS

• Not Illustrated

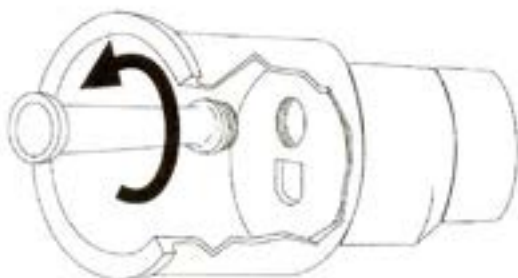


Figure 1

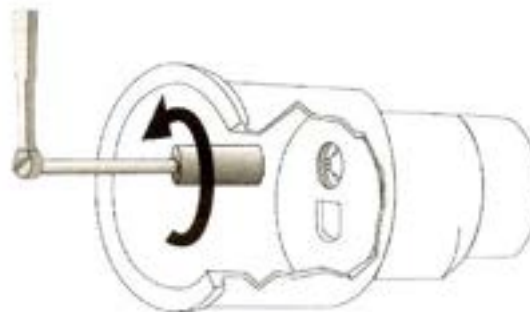


Figure 2

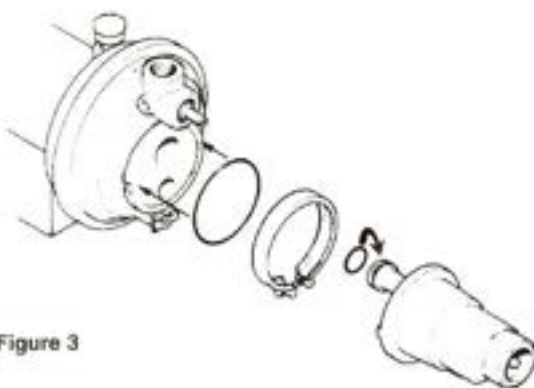


Figure 3

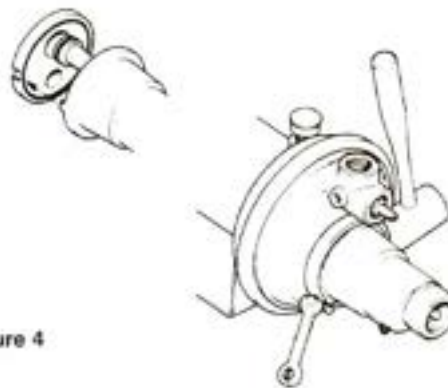


Figure 4

Cleaning/Replacing the Shallow Well Ejector

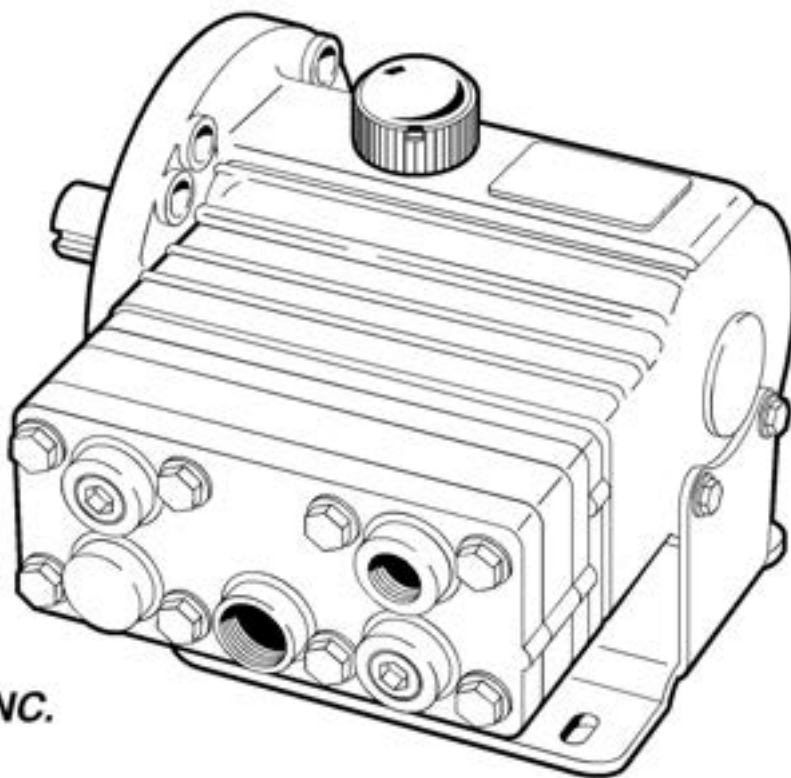
1. **Disconnect power and release all pressure on system before proceeding.**
2. If tank has an air volume control (for standard tank applications), unscrew compression nut from fitting under ejector. Remove tube from fitting.
3. Remove suction piping from pump.
4. Remove clamp and O-Ring holding shallow well ejector to pump body.
5. Remove ejector from pump body. Be careful not to damage O-Ring.
6. Remove venturi by unscrewing it (turn counter-clockwise; see Figure 1).
7. Remove nozzle (if necessary) by unscrewing it with a 5/8" deep well socket wrench (see Figure 2).
8. Clean venturi and nozzle by carefully inserting an ice pick or other small diameter pointed tool or wire, and dislodging foreign material.
9. Replace nozzle and venturi by turning in clockwise until snug. **Do not overtighten.**
10. **BE SURE** O-Rings, O-Ring grooves and clamp are clean.
11. Place O-Rings in grooves on venturi and pump flange (see Figure 3).
12. Insert venturi into upper pump port; be sure tabs and slots align (see Figure 4).
13. Install clamp and snug up; alternately tighten clamp screw and tap clamp with mallet to seat O-Ring (see Figure 4).
14. Prime pump. See pump owner's manual for instructions.

SYMPTOM	POSSIBLE CAUSE(S)	CORRECTIVE ACTION
Motor will not run	<p>Disconnect switch is off Fuse is blown or circuit breaker tripped Starting switch is defective Wires at motor are loose, disconnected, or wired incorrectly</p> <p>Pressure switch contacts are dirty</p>	<p>Be sure switch is on. Replace fuse or reset circuit breaker. DISCONNECT POWER; Replace starting switch. Refer to instructions on wiring (Page 7). DISCONNECT POWER; check and tighten all wiring.</p> <p>⚠WARNING Capacitor voltage may be hazardous. To discharge capacitor, hold insulated handle screwdriver BY THE HANDLE and short capacitor terminals together. Do not touch metal screwdriver blade or capacitor terminals. If in doubt, consult a qualified electrician. DISCONNECT POWER and file contacts with emery board or nail file.</p>
Motor runs hot and overload kicks off	<p>Motor is wired incorrectly Voltage is too low</p> <p>Pump cycles too frequently</p>	<p>Refer to instructions on wiring. Check with power company. Install heavier wiring if wire size is too small (See Electrical / Wiring Chart). See section below on too frequent cycling.</p>
<p>Motor runs but no water is delivered*</p> <p>* (Note: Stop pump; then check prime before looking for other causes. Unscrew priming plug and see if water is in priming hole).</p>	<p>Pump in new installation did not pick up prime through:</p> <ol style="list-style-type: none"> 1. Improper priming 2. Air leaks <p>Pump has lost prime through:</p> <ol style="list-style-type: none"> 1. Air leaks 2. Water level below suction pipe inlet <p>Foot valve or strainer is plugged Ejector or impeller is plugged Check valve or foot valve is stuck shut Pipes are frozen Foot valve and/or strainer are buried in sand or mud Water level is too low for shallow well setup to deliver water</p>	<p>In new installation:</p> <ol style="list-style-type: none"> 1. Re-prime according to instructions. 2. Check all connections on suction line, AVC, and ejector with soapy water or shaving cream. 3. Replace foot valve or check valve. <p>In installation already in use:</p> <ol style="list-style-type: none"> 1. Check all connections on suction line and shaft seal. 2. Lower suction line into water and re-prime. If receding water level in well exceeds 25' (7.6M), a deep well pump is needed. <p>Clean foot valve or strainer. Clean ejector or impeller. Replace check valve or foot valve. Thaw pipes. Bury pipes below frost line. Heat pit or pump house. Raise foot valve and/or strainer above bottom of water source. Clean foot valve and strainer. A deep well jet package may be needed (over 25 ft. to water) to deliver water.</p>
Pump does not deliver water to full capacity	<p>Water level in well is lower than estimated Steel piping (if used) is corroded or lined, causing excess friction Piping is too small in size Packed well point</p>	<p>A deep well jet will be needed if your well is more than 25' (7.6M) depth to water. Replace with plastic pipe where possible, otherwise with new steel pipe.</p> <p>Use larger piping. Backflush well point or sink new point.</p>

Parts & Service

Hydra-Cell[®] INDUSTRIAL PUMPS

Models: M-03
Kel-Cell and Standard Versions

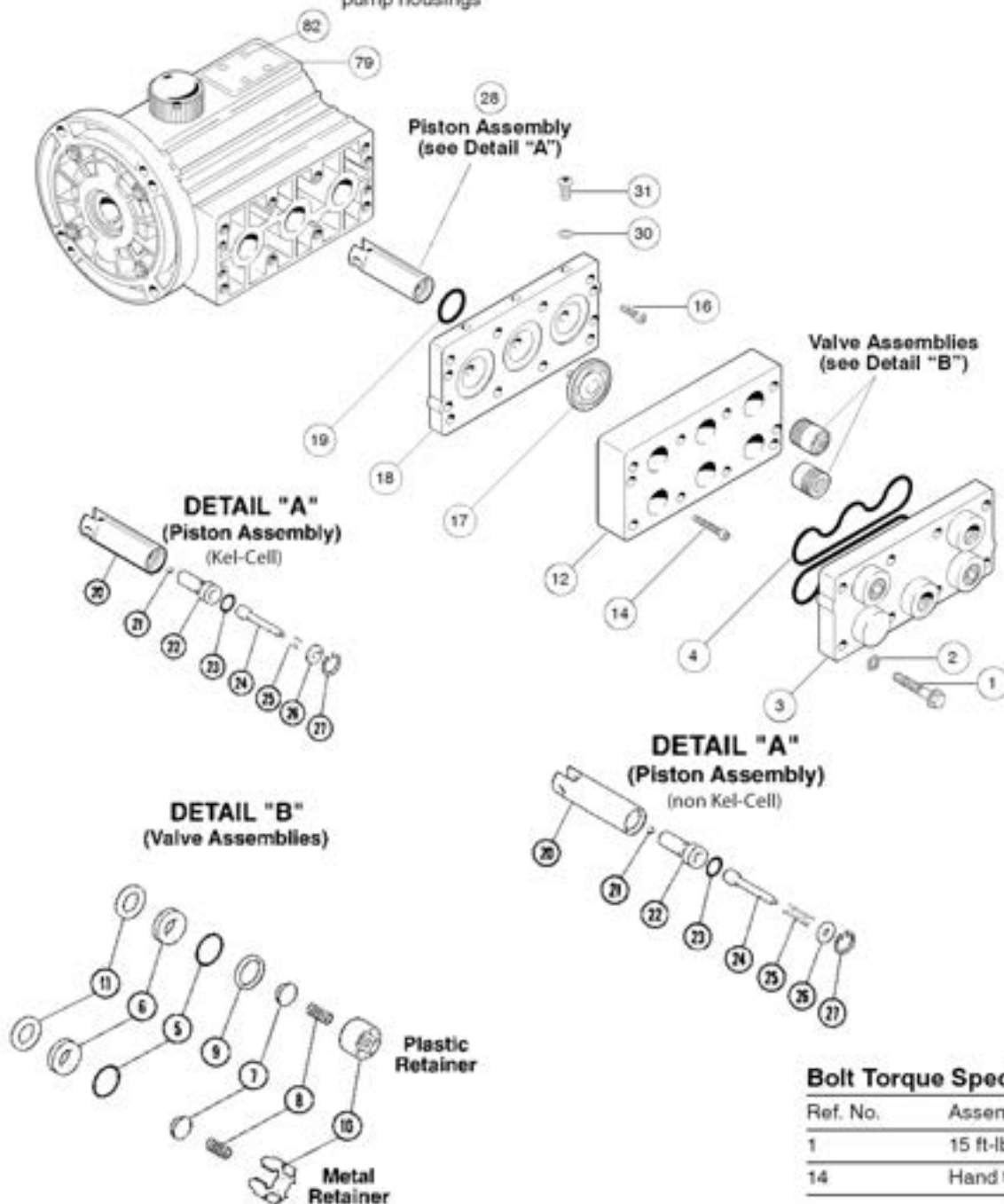


WANNER ENGINEERING, INC.

M-03 Fluid End Parts

Pump with Metallic Head
(Kel-Cell version shown)

See Hydraulic End for
pump housings



M-03 Fluid End Parts

Ref. No.	Part Number	Description	Quantity/ Pump	Ref. No.	Part Number	Description	Quantity/ Pump
1	D03-024-2010	Bolt, hex-head, 3" (for use with metallic head models).....	8	10	D03-023-1010	Retainer, valve spring, 17-7 SST.....	6
	D03-024-2017	Bolt, hex-head, 4" (for use with non-metallic head models).....	8		D03-023-1017	Retainer, valve spring, Hastelloy C.....	6
	G03-024-2010	Cap Screw, socket head, M8 x 1.25 x 80 mm (for metallic head models).....	8		D03-023-2310	Retainer, valve spring, Celcon.....	6
	G03-024-2011	Cap Screw, socket head, M8 x 1.25 x 90 mm (for non-metallic head models).....	8		D03-023-2316	Retainer, valve spring, Nylon.....	6
					D03-023-2317	Retainer, valve spring, polypropylene.....	6
					D03-023-2318	Retainer, valve spring, Kynar.....	6
2	C22-014-2000	Washer, 5/16" (metallic head only).....	8	11	D03-125-1011	Washer, dampening, 316 SST.....	6
3	D03-004-1010	Manifold, brass.....	1		D03-125-2310	Washer, dampening, Celcon.....	6
	D03-004-1012	Manifold, 316 SST.....	1		D03-125-2316	Washer, dampening, Nylon.....	6
	D03-004-1017	Manifold, nickel alloy (Hastelloy CW12MW).....	1		D03-125-2317	Washer, dampening, polypropylene.....	6
	D03-004-1050	Manifold, polypropylene.....	1		D03-125-2318	Washer, dampening, Kynar.....	6
	D03-004-1053	Manifold, Kynar.....	1	12	D03-003-1010	Valve Plate, brass.....	1
	G13-004-1010	Manifold, brass.....	1		D03-003-1012	Valve Plate, 316 SST.....	1
	G13-004-1012	Manifold, 316 SST.....	1		D03-003-1017	Valve Plate, nickel alloy (Hastelloy CW12MW).....	1
	G13-004-1017	Manifold, nickel alloy (Hastelloy CW12MW).....	1		D03-003-1050	Valve Plate, polypropylene.....	1
	G13-004-1050	Manifold, polypropylene.....	1		D03-003-1053	Valve Plate, Kynar.....	1
	G13-004-1053	Manifold, Kynar.....	1		K03-003-1022	Valve Plate, brass, Kel-Cell.....	1
4	D25-073-2110	O-ring, manifold, Buna.....	2		K03-003-1021	Valve Plate, 316 SST, Kel-Cell.....	1
	D25-073-2111	O-ring, manifold, Viton.....	2		K03-003-1023	Valve Plate, Hastelloy C, Kel-Cell.....	1
	D25-073-2112	O-ring, manifold, Neoprene.....	2		K03-003-1050	Valve Plate, polypropylene, Kel-Cell.....	1
	D25-073-2113	O-ring, manifold, EPDM.....	2		K03-003-1053	Valve Plate, Kynar PVDF, Kel-Cell.....	1
	D25-073-2118	O-ring, manifold, PTFE.....	2	14	D03-029-2010	Cap Screw, socket-head, 1".....	2
5	D25-046-2110	O-ring, valve seat, Buna.....	6		G03-029-2010	Cap Screw, socket-head, M6 x 1 x 25 mm.....	2
	D25-046-2111	O-ring, valve seat, Viton.....	6	16	D03-088-2010	Cap Screw, socket-head, 3/4".....	2
	D03-035-2112	O-ring, valve seat Neoprene.....	6		G03-088-2010	Cap Screw, socket-head, M6 x 1 x 20 mm.....	2
	D03-035-2113	O-ring, valve seat, EPDM.....	6	17	D03-018-1212	Diaphragm, Neoprene.....	3
	D03-035-2118	O-ring, valve seat, PTFE.....	6		D03-018-1213	Diaphragm, EPDM.....	3
6*	D03-020-1001	Valve Seat, 316 SST.....	6		D03-018-1215	Diaphragm, Viton-Xt.....	3
	D03-020-1002	Valve Seat, 17-4 SST.....	6		D03-018-1220	Diaphragm, Buna-N-XS.....	3
	D03-020-1017	Valve Seat, Hastelloy C.....	6		D03-018-1218	Diaphragm, PTFE.....	3
	D03-020-3300	Valve Seat, ceramic.....	6		K03-018-1240	Diaphragm, Buna-N-XS, Kel-Cell.....	3
	D15-020-2016	Valve Seat, tungsten carbide*.....	6		K03-018-1242	Diaphragm, Neoprene, Kel-Cell.....	3
7	D03-021-1001	Valve, 316 SST, stamped.....	6		K03-018-1243	Diaphragm, EPDM, Kel-Cell.....	3
	D03-021-1002	Valve, 17-7 SST, stamped.....	6		K03-018-1245	Diaphragm, Viton-Xt, Kel-Cell.....	3
	D03-021-1011	Valve, Nitronic 50.....	6	18	D03-002-1000	Diaphragm Plate.....	1
	D03-021-1015	Valve, 17-4 SST, machined.....	6		K03-002-1022	Diaphragm Plate, Kel-Cell.....	1
	D03-021-1016	Valve, tungsten carbide.....	6	19	D03-075-2110	O-ring, diaphragm plate, Buna.....	3
	D03-021-1017	Valve, Hastelloy C.....	6	20	D03-014-1004	Piston.....	3
	D03-021-3300	Valve, ceramic.....	6		K03-014-1004	Piston, Kel-Cell.....	3
8	D03-022-3113	Valve Spring, Hastelloy C.....	6	21	D10-015-3010	Ball.....	3
	D03-022-3114	Valve Spring, Elgiloy.....	6	22	D03-043-1000	Valve Cylinder.....	3
	D03-022-3118	Valve Spring, 17-7 SST.....	6		K03-043-1010	Valve Cylinder, Kel-Cell.....	3
9	D03-092-2110	Tetra Seal, Buna.....	6	23	D03-034-2110	O-ring, valve cylinder, Buna.....	3
	D03-092-2111	Tetra Seal, Viton.....	6		C23-009-2110	O-ring, valve cylinder, Buna, Kel-Cell.....	3
	D03-092-2112	Tetra Seal, Neoprene.....	6	24	D03-044-1000	Valve Plunger.....	3
	D03-092-2113	Tetra Seal, EPDM.....	6		K03-044-1010	Valve Plunger, Kel-Cell.....	3
	D03-035-2118	O-ring, PTFE.....	6				

* Tungsten carbide seat valve (6) does not require dampening washers.

M-03 Fluid End Parts

Ref. No.	Part Number	Description	Quantity/ Pump
25	D03-045-3110	Spring, sleeve valve.....	3
	D03-045-3111	Spring, sleeve valve for PTFE diaphragms.....	3
	K03-045-3110	Spring, sleeve valve, Kel-Cell.....	3
26	D03-049-1000	Washer.....	3
	K03-049-1000	Washer, Kel-Cell.....	3
27	D03-048-2210	Snap Ring.....	3
28	D03-014-1210	Piston Assembly.....	3
	K03-014-1210	Piston Assembly, Kel-Cell.....	3
29	D03-100-1010	Manifold Support Plate.....	1
	D03-100-1011	Manifold Support Plate, painted.....	1
30	102-210	O-ring, Viton.....	3
	D10-047-2110	O-ring, Buna N.....	3
31	D10-030-2010	Screw, Flat-head, SST.....	3
73*	D03-087-2011	Screw, Mach, HH slf tp (D-03 only)....	2
79	D10-040-2400	Nameplate.....	1
82	D10-112-2200	Rivet.....	4

M-03 Fluid End Service (All versions)

This section explains how to disassemble and inspect all easily-serviceable parts of the pump. Repair procedures for the hydraulic end (oil reservoir) of the pump are included in a later section of the manual.

Note: The numbers in parentheses are the Ref. Nos. on the illustrations in the Parts Manual.

Caution: Do not disassemble the Hydraulic End unless you are a skilled mechanic. For assistance, contact Wanner Engineering (Tel 612-332-5681 or Fax 612-332-6937) or the distributor in your area.

Important: Fluid End Service is different for Kel-Cell and non Kel-Cell versions. Before performing Fluid End Service, determine if the pump is a Kel-Cell or non Kel-Cell version as follows:

Kel-Cell versions are indicated by a "K" in digit 5 of the pump model number.

Non Kel-Cell versions are indicated by an "A" or "D" in digit 5 of the pump model number.

1. Remove Manifold (3), Valve Plate (12) (All versions)

- Remove all eight bolts (1) around the manifold.
- Remove the manifold (3).
- Inspect the manifold for warping or wear around the inlet and outlet ports. If wear is excessive, replace the manifold.
To check if the manifold is warped, remove the O-rings (4) and place a straightedge across it. A warped manifold should be replaced.
- Remove the two socket-head capscrews (14).
- Inspect the valve plate in the same manner as the manifold.

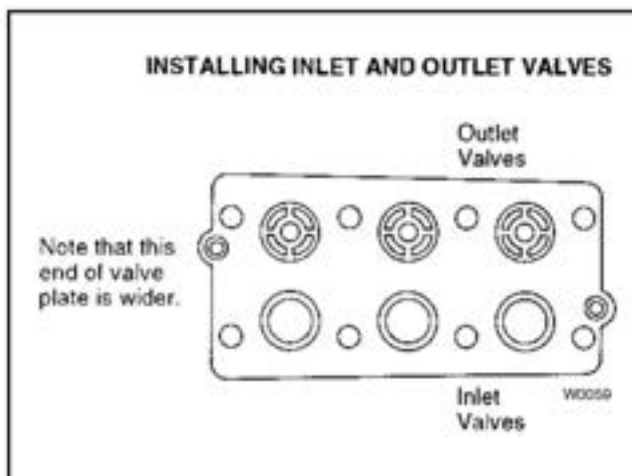
2. Inspect Valves (5-11) (All versions)

The three inlet and three outlet valve assemblies are identical (but face in opposite directions). Inspect each valve as follows:

- Check the spring retainer (10), and replace if worn.
- Check the valve spring (8). If it is shorter than a new spring, replace it (don't just stretch the old spring).
- Check the valve poppet (7). If worn excessively, replace it.
- Remove the valve seat (6). A seat puller is included in the Wanner Tool Kit.
Inspect the valve seat for wear, and replace it if necessary. A new O-ring (5) should be installed.
- Check the dampening washer (11), and replace if worn.
- Reinstall the valve assemblies:
 - Clean the valve ports and shoulders with emery cloth, and lubricate them with lubricating gel or petroleum jelly.
 - Install the O-ring (5) on the valve seat (6).
 - Inlet (3 lower valves in the illustration below).** Insert the spring retainer (10) into the valve plate, then insert the spring, valve, tetra seal, valve seat with O-ring, and dampening washer (8,7,9,6,11). A flat O-ring [tetra seal] (5) goes between the plastic spring retainer and seat.
 - Outlet (3 upper valves in the illustration).** Install the 3 outlet valve assembly components in reverse order as inlet valves.

For Kel-Cell versions continue with Step 3 on page 13

For non Kel-Cell versions continue with Step 3 on page 14.



M-03 Fluid End Service (Kel-Cell only)

3. Inspect and Replace Diaphragms (17) (Kel-Cell only)

- a. Lift a diaphragm by one edge, and turn the pump shaft until the diaphragm moves up to "top dead center". This will expose machined cross holes in the plunger shaft behind the diaphragm.

Note: If the pump has a hollow shaft, use the shaft rotator from the Wanner Tool Kit to turn the shaft.

- b. Remove the three flat-head screws (31) and O-rings (30) from the edge access holes in the diaphragm plate (18). Insert a 3/32" hex wrench (A03-163-2200) into one of the holes in the diaphragm plate (18). Turn and pull the diaphragm (17) until the front cross hole in the valve plunger spool (24) lines up and allows the hex wrench to pass through. (Don't remove the hex wrench until the new diaphragm is installed in step "g" below.)

- c. Unscrew the diaphragm. Use a 5/16 in. (8 mm) open-end wrench, and turn counterclockwise.

- d. Inspect the diaphragm carefully. A ruptured diaphragm generally indicates a pumping system problem, and replacing only the diaphragm will not solve the larger problem. Inspect the diaphragm for the following:

- **Small puncture.** Usually caused by a sharp foreign object in the fluid, or by an ice particle.

- **Diaphragm pulled away from the sides.** Usually caused by fluid being frozen in the pump, or by over pressurization of the pump.

- **Diaphragm becoming stiff and losing flexibility.** Usually caused by pumping a fluid that is incompatible with the diaphragm material.

- **Diaphragm edge chewed away.** Usually caused by over pressurizing the system.

Caution: If a diaphragm has ruptured and foreign material or water has entered the oil reservoir, do not operate the pump. Check all diaphragms, then flush the reservoir completely (as outlined below) and refill it with fresh oil. Never let the pump stand with foreign material or water in the reservoir, or with the reservoir empty.

- e. Clean away any spilled oil. Apply Loctite No. 242 Threadlocker to the screw of the new diaphragm (or the old one, as appropriate).
- f. Install the diaphragm and tighten to 10 in-lbs (110 N-cm).
- g. Repeat the above inspection procedure (and replacement, if necessary) with the other two diaphragms.

4. Flush Contaminant from Hydraulic End (Kel-Cell only)

(Only if a diaphragm has ruptured)

- a. With the valve plate and manifold still removed (see above), remove the oil drain cap (60) and allow all oil and contaminant to drain out.

Caution: If you have EPDM diaphragms, or if food grade oil is in the reservoir, flush with the same lubricant that is in the reservoir. Pumps with EPDM diaphragms have an "E" as the 7th digit of the Model No.

- b. Fill the reservoir with fresh oil, manually turn the pump shaft to circulate the oil, and drain once again.
- c. Refill the reservoir. If the oil appears milky, there is still contaminant in the reservoir. Repeat the flushing procedure until the oil appears clean.

5. Reinstall Valve Plate (12), Manifold (3) (Kel-Cell only)

- a. Reinstall the valve plate (12), with the valve assemblies installed as outlined above, onto the diaphragm plate (18).
- b. Reinstall the O-rings (4) on the rear side of the manifold. Use petroleum jelly or lubricating gel to hold them in place.
- c. Reinstall the manifold onto the valve plate.
- d. Insert all bolts (1), with washers (2), around the edge of the manifold, and alternately tighten opposite bolts until all are secure. Torque to 15 ft-lbs (20 N-m).
- e. Recheck all bolts for tightness.

6. Prime the Hydraulic Cells (Kel-Cell only)

- a. With the pump **horizontal**, fill the reservoir with the appropriate Hydra oil for the application.
- b. All air in the oil within the hydraulic cell (behind the diaphragms) must be forced out by turning the shaft (and thus pumping the piston). A shaft rotator is included in the Wanner Tool Kit.

Turn or jog the shaft until a **blubble-free** flow of oil comes out of each access hole in the diaphragm plate (18). Watch the oil level in the reservoir; if it gets too low during priming, air will be drawn into the pistons (inside the hydraulic end). This will cause the pump to run rough, and you will have to start over again with priming the hydraulic cells.

Reinstall the flat-head screw (31) and O-ring (30) for each access hole as they are primed.

M-03 Fluid End Service (non Kel-Cell only)

3. Inspect and Replace Diaphragms (17) (non Kel-Cell)

- a. Lift a diaphragm by one edge, and turn the pump shaft until the diaphragm moves up to "top dead center". This will expose machined cross holes in the plunger shaft behind the diaphragm.

Note: If the pump has a hollow shaft, use the shaft rotator from the Wanner Tool Kit.

- b. Insert a 3/32 in. hex wrench through one of the machined cross holes, to hold the diaphragm up. The proper size tool is included in the Wanner Tool Kit. (Don't remove the tool until the new diaphragm is installed in step "g" below.)
- c. Unscrew the diaphragm. Use a 5/16 in. (8 mm) open-end wrench, and turn counterclockwise.
- d. Inspect the diaphragm carefully. A ruptured diaphragm generally indicates a pumping system problem, and replacing only the diaphragm will not solve the larger problem. Inspect the diaphragm for the following:
 - **Small puncture.** Usually caused by a sharp foreign object in the fluid, or by an ice particle.
 - **Diaphragm pulled away** from the sides. Usually caused by fluid being frozen in the pump, or by overpressurization of the pump.
 - **Diaphragm becoming stiff** and losing flexibility. Usually caused by pumping a fluid that is incompatible with the diaphragm material.
 - **Diaphragm edge chewed away.** Usually caused by over pressurizing the system.

Caution: If a diaphragm has ruptured and foreign material or water has entered the oil reservoir, do not operate the pump. Check all diaphragms, then flush the reservoir completely (as outlined below) and refill it with fresh oil. Never let the pump stand with foreign material or water in the reservoir, or with the reservoir empty.

- e. Clean away any spilled oil. Apply Loctite No. 242 Threadlocker to the screw of the new diaphragm (or the old one, as appropriate).
- f. Install the diaphragm and tighten to 10 in.-lbs (110 N-cm).
- g. Repeat the above inspection procedure (and replacement, if necessary) with the other two diaphragms.

4. Flush Contaminant from Hydraulic End (non Kel-Cell)

(Only if a diaphragm has ruptured)

- a. With the valve plate and manifold still removed (see above), remove the oil drain cap (60) and allow all oil and contaminant to drain out.

Caution: If you have EPDM diaphragms, or if food grade oil is in the reservoir, flush with the same lubricant that is in the reservoir. Pumps with EPDM diaphragms have an "E" as the 7th digit of the Model No.
- b. Fill the reservoir with fresh oil, manually turn the pump shaft to circulate the oil, and drain once again.
- c. Refill the reservoir. If the oil appears milky, there is still contaminant in the reservoir. Repeat the flushing procedure until the oil appears clean.

5. Prime the Hydraulic Cells (non Kel-Cell)

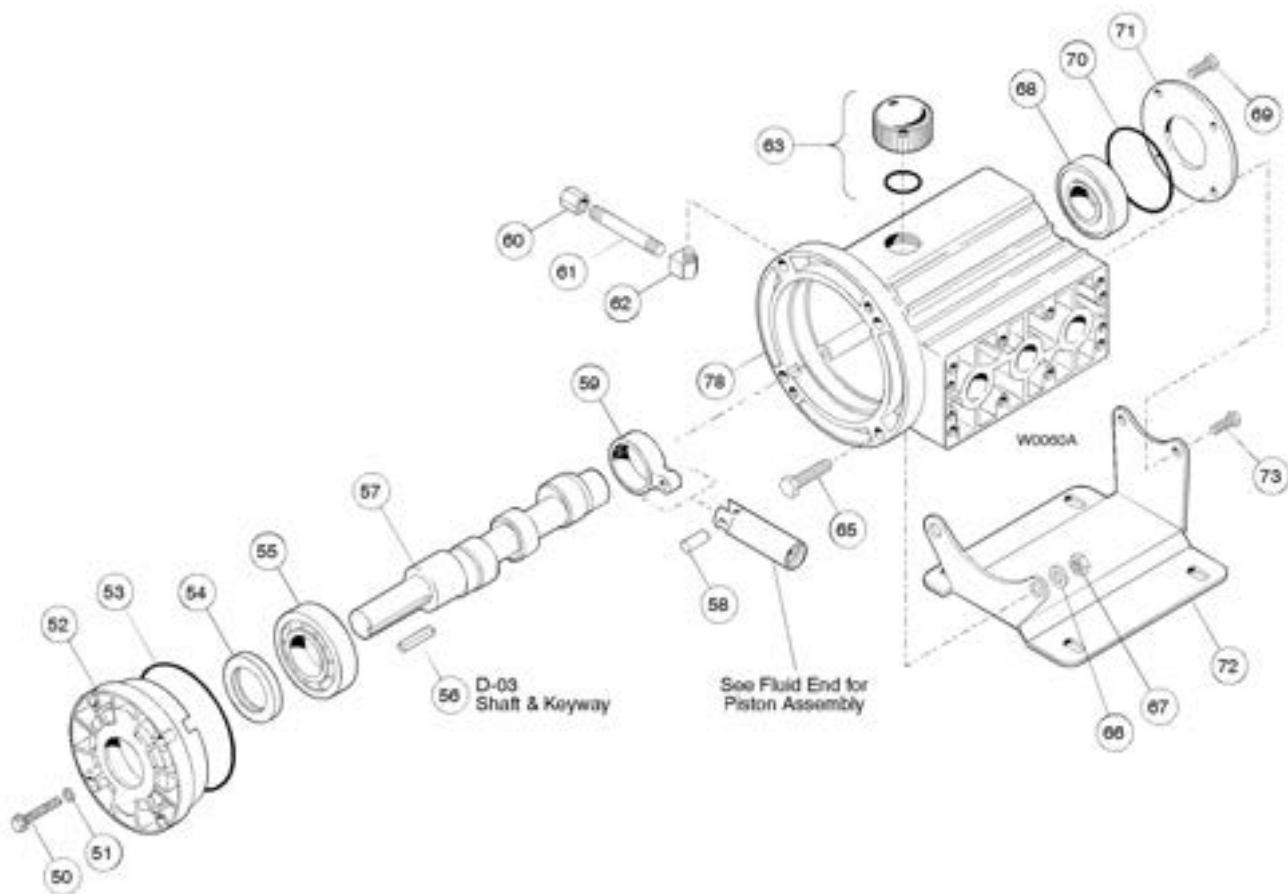
- a. With the pump **horizontal**, fill the reservoir with the appropriate Hydra oil for the application.
- b. All air in the oil within the hydraulic cell (behind the diaphragms) must be forced out by turning the shaft (and thus pumping the piston). A shaft rotator is included in the Wanner Tool Kit.

Turn the shaft until a **bubble-free** flow of oil comes from behind all the diaphragms. Watch the oil level in the reservoir; if it gets too low during priming, air will be drawn into the pistons (inside the hydraulic end). This will cause the pump to run rough, and you will have to start over again with priming the hydraulic cells.

6. Reinstall Valve Plate (12), Manifold (3) (non Kel-Cell)

- a. Reinstall the valve plate (12), with the valve assemblies installed as outlined above, onto the diaphragm plate (18).
- b. Reinstall the O-rings (4) on the rear side of the manifold. Use petroleum jelly or lubricating gel to hold them in place.
- c. Reinstall the manifold onto the valve plate.
- d. Insert all bolts (1), with washers (2), around the edge of the manifold, and alternately tighten opposite bolts until all are secure. Torque to 15 ft-lbs (20 N-m).
- e. Recheck all bolts for tightness.

M-03 Hydraulic End Parts



M-03 Hydraulic End Parts

Ref. No.	Part Number	Description	Quantity/ Pump
50	D03-086-2010	Cap Screw, hex-head, with washer4	
	G03-086-2010	Cap Screw, hex-head, with washer4	
51	D25-047-2110	O-ring, back cover screws, Buna.....4	
52	D03-131-1000	Back Cover.....1	
53	D03-037-2110	O-ring, back cover, Buna.....1	
54	D03-031-2110	Seal, Buna.....1	
55	D03-011-2910	Back Bearing.....1	
56	D10-085-2210	Key, shaft.....1	
57	D03-009-1002	(E) Crank Shaft, shaft-driven, 7/8" O.D., 2.2 GPM @ 1750 RPM.....1	
	D03-009-1003	(X) Crank Shaft, shaft-driven, 7/8" O.D., 3.0 GPM @ 1750 RPM.....1	
	D03-009-1011	(B) Crank Shaft, shaft-driven, 7/8" O.D., 1.1 GPM @ 1750 RPM.....1	
	D03-009-1018	(S) Crank Shaft, shaft-driven, 7/8" O.D., 1.8 GPM @ 1750 RPM.....1	
	D03-009-1067	(G) Crank Shaft, shaft-driven, 7/8" O.D., 0.5 GPM @ 1750 RPM.....1	
	M03-009-1002	(E) Hollow Shaft, 56C direct drive, 5/8" I.D. (close-coupled), 2.2 GPM @1750 RPM.....1	
	M03-009-1003	(X) Hollow Shaft, 56C direct drive, 5/8" I.D. (close-coupled), 3.0 GPM @1750 RPM.....1	
	M03-009-1011	(B) Hollow Shaft, 56C direct drive, 5/8" I.D. (close-coupled), 1.1 GPM @1750 RPM.....1	
	M03-009-1018	(S) Hollow Shaft, 56C direct drive, 5/8" I.D. (close-coupled), 1.8 GPM @1750 RPM.....1	
	M13-009-1002	(E) Hollow Shaft, IEC 90 direct drive, 24 mm I.D. (closed-coupled), 7.1 l/min @1450 RPM.....1	
	M13-009-1003	(X) Hollow Shaft, IEC 90 direct drive, 24 mm I.D. (closed-coupled), 9.9 l/min @1450 RPM.....1	
	M13-009-1011	(B) Hollow Shaft, IEC 90 direct drive, 24 mm I.D. (closed-coupled), 3.5 l/min @1450 RPM.....1	
	M13-009-1018	(S) Hollow Shaft, IEC 90 direct drive, 24 mm I.D. (closed-coupled), 5.6 l/min @1450 RPM.....1	
	M13-009-1067	(G) Hollow Shaft, IEC 90 direct drive, .. 24 mm I.D. (closed-coupled), 1.6 l/min @1450 RPM.....1	
	M23-009-1004	(X) Hollow Shaft, 20 mm I.D. (for Honda Engine), 3.0 GPM @ 1750 RPM.....1	
58	D03-133-1000	Pin.....3	
59	D03-132-1000	Connecting Rod.....3	
60	D10-078-2210	Cap, brass, 1/8".....1	
61	D10-077-2210	Pipe, brass, 1/8".....1	
62	D10-076-2210	Elbow, brass, 1/8".....1	
63	D03-039-1030	Cap with O-ring, oil fill.....1	
64	D10-080-2111	O-ring, oil fill, Buna.....1	
65	*D03-068-2010	Cap Screw, socket-head, 1-1/2".....4	
	G03-068-2010	Cap Screw, socket-head, M10 x 1.5 x .. 40 mm (G-03 only).....2	
66*	D10-048-2010	Washer, 38".....4	
	G25-048-2010	Washer, M10 (G-03 only).....2	
67	D10-028-2010	Nut, hex, 3/8" (for D-03 models only) .2	
	G10-028-2010	Nut, hex, M10 (G-03 only).....2	
68	D03-010-2910	Front Bearing.....1	
69*	D03-087-2010	Cap Screw, hex-head, 1/2".....4	
70	D40-074-2110	O-ring, front cover, Buna.....1	
71	D03-130-1000	Front Cover.....1	
72	D03-025-1010	Base Plate (D-03/G-03/K-03 only).....1	
73	D03-089-2010	Cap Screw, hex-head, 3/4" (D-03/K-03 models only).....2	
75	M13-151-1000	Offset Bolt (G-13 only).....4	
76	G25-048-2010	Washer, lock, 10 mm (G-13 only).....8	
77	G10-028-2010	Nut, hex, 10 mm (G-13 only).....8	
78	D03-001-1001	Pump Housing.....1	
	G13-001-1001	Pump Housing.....1	
80	M23-085-2010	Cap Screw, hex-head, M8 x 16 mm....4	
81	M23-025-1010	Plate, adapter.....1	

* Quantity 2 on Model D-03.

M-03 Hydraulic End Service

Note: The numbers in parentheses are the Ref. Nos. on the illustrations in the Parts Manual.

This section explains how to disassemble and inspect the hydraulic end (oil reservoir) of the pump.

Caution: Do not disassemble the hydraulic end unless you are a skilled mechanic. For assistance, contact Wanner Engineering (Tel 612-332-5681 or Fax 612-332-6937) or the distributor in your area.

Depending on the repair you are attempting, you may or may not have to remove the motor from a direct-drive pump/motor unit.

Internal piston components (21 - 27) can be serviced without removing the motor or crankshaft. The motor and crankshaft must be removed to service the connecting rod (59), piston housing (20), crankshaft (57), front bearing (68), back bearing (55), or seal (54).

To Service Pistons Without Removing Motor or Crankshaft

1. Disassemble Pistons

With the manifold, valve plate, diaphragm plate, and diaphragm removed, and the oil drained from the pump (see the Fluid End Service Section):

- Remove the snap ring (27) from one of the pistons, using a standard snap-ring pliers.
- Pull out the valve plunger (24). This also removes the washer (26) and spring (25).
- Insert a hook through the center hole of the valve cylinder (22), and pull the cylinder out of the piston. Be careful not to damage the piston.
- Inspect all parts, and replace the O-ring and any other parts that are worn or may be damaged.
- Repeat steps "a" through "d" for the remaining pistons.

2. Reassemble Pistons

- Tip the pump so the pistons are vertical.
- Drop a ball (21) into the opening in the bottom of the piston.
- Insert a valve plunger (24) into a valve cylinder (22). Slide a spring (25) over the plunger, inside the valve cylinder.
- Slide the assembled valve cylinder, plunger, and spring (22 - 25) into the piston (20).
- Insert a washer (26) over the plunger.
- Insert a snap ring (27) into the piston. Use the snap-ring pliers.
- Repeat the above procedure for the other two pistons.

To Remove Motor from Direct-Coupled Unit

1. Disassemble Motor from Pump

- M-03.** Remove the four bolts (65) and washers (66) that secure the pump and motor together.
M-23. Remove the four bolts (65) and washers (66) that secure the pump and adapter plate (81) together.
G-13. Remove the four nuts (77) and washers (76) from the motor side of the offset stud (75).
- M-03, M-23.** Install two of the bolts into the threaded holes in the rear of the pump housing.
G-13. Install two M10 x 1.5 x 40 mm (65) or longer bolts into the threaded holes in the rear flange of the pump housing.
- Alternately turn the bolts clockwise until the pump and motor separate.

2. Reassemble Motor to Pump

- Thoroughly clean the motor shaft and the hollow pump shaft. Remove the tape from the key and keyway.
- Apply a **liberal** amount of Loctite® Nickel Anti-Seize No. 77164 to the pump shaft.
- Install the shaft key (56) into the keyway.
- Slide the motor shaft into the hollow pump shaft.

Caution: When assembling this pump to the direct-coupled motor, be careful that the shaft key remains in the motor shaft keyway and does not ride up the keyway and contact the shaft seals (which would cause premature seal failure). Incorrect key placement could also cause the hollow pump shaft to fail.

Use a screwdriver to move the shaft key back in the motor shaft keyway as the motor and pump are drawn together.

- M-03, M-23.** Reinstall the four bolts (65) and washers (66).
G-13. Reinstall the four washers (76) and nuts (77).

M-03 Hydraulic End Service

To Service the Remainder of the Hydraulic End

1. Remove Pump Housing

- Remove the manifold, valve plate, and diaphragms, as outlined in the Fluid End Service Section.
- Drain the oil from the pump housing by removing the drain plug (60).
- Stand the pump on end, with the drive shaft up.
- Remove the bolts (50) that secure the back cover (52) to the housing (78). Use a 3/8 in. socket wrench (10-mm on M-03/G-03 and G-13). Save the O-rings (51).
- Remove the cover and the cover O-ring (53).
- Remove the crankshaft (57) by pulling it through the connecting rods (59).

2. Remove and Replace Pistons

To remove the pistons (20), first remove the connecting rod (59) and pin (58) by pressing the pin through the connecting rod.

Reverse the process to reinstall the pistons.

Refer to Steps 5 and 6 below to replace the diaphragm and reassemble the pump.

3. Replace Shaft Seal

Note: Inspect the shaft seal (54) before continuing. If it looks damaged in any way, replace it.

- Press the back bearing (55) and seal (54) out of the back cover (52). Discard the seal.
- Apply a coating of Loctite® High-Performance Pipe Sealant With Teflon®, or a comparable product, to the outer surface of a new seal and the inside surface of the opening in the back cover (52) where the seal will rest.
- Press the new seal into the back cover.
- Inspect the bearing (55). If pitted or damaged, replace it.
- Apply a coating of Loctite Rc/609 Retaining Compound or comparable product to the outer surface of the bearing. Press the bearing into the back cover until it rests on the shoulder. The shield on the bearing must face away from the back cover.

4. Reassemble Housing and Back Cover

- Stand the pump on end.
- With the pistons and connecting rods in place, reinstall the crankshaft by threading it through the connecting rods.
- Reinstall the back cover (52), cover O-ring (53), and bolts (with their O-rings).

5. Reassemble Pump

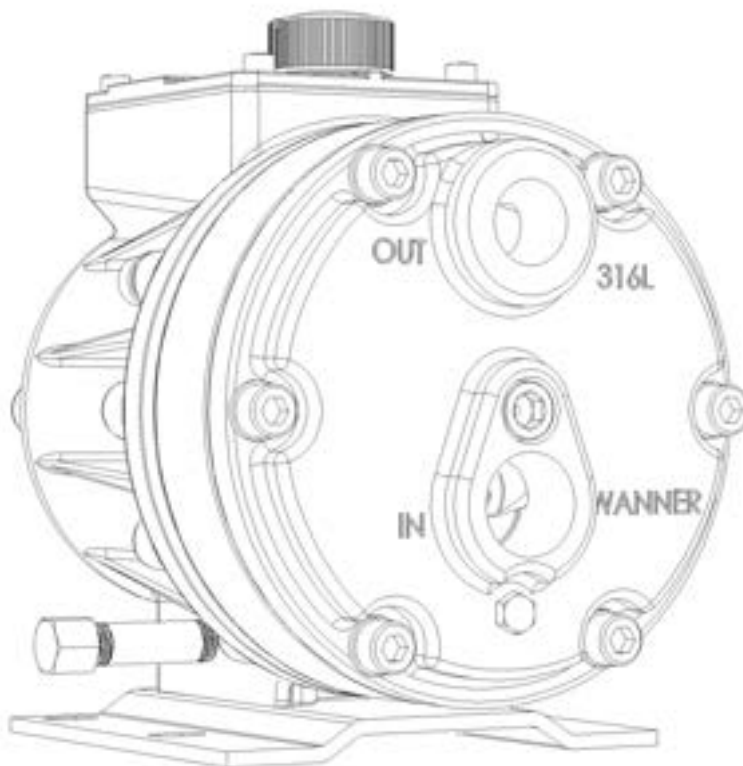
Reassemble the pump as outlined in the Fluid-End Service Section.

Parts & Service

Hydra-Cell[®] **INDUSTRIAL PUMPS**

Model: D-10

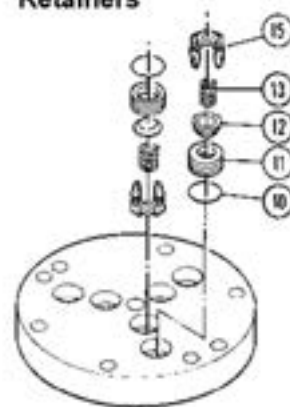
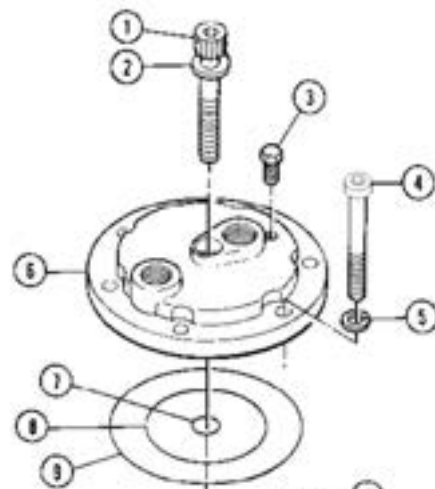
Kel-Cell and Standard Versions



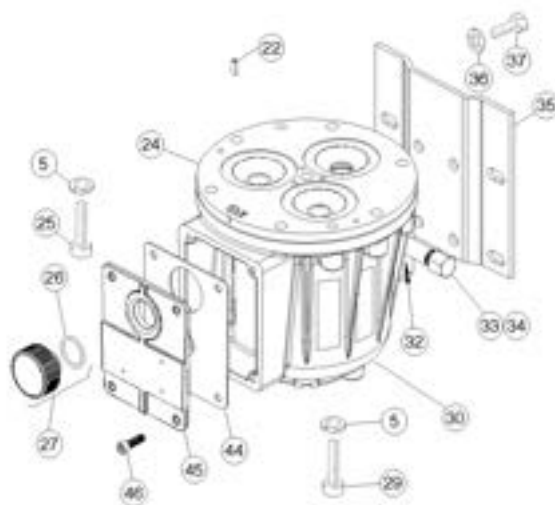
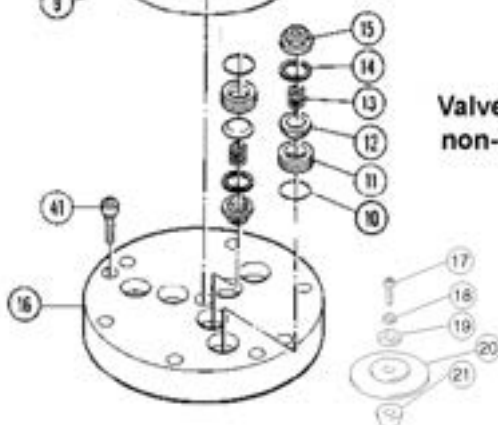
WANNER ENGINEERING, INC.

D-10 Fluid End

Valve Assemblies with Metal Retainers



Valve Assemblies with non-Metallic Retainers



D-10 Fluid End

Ref. No.	Part Number	Description	Quantity/ Pump
1	D10-081-2012	Screw, Cap, soc-hd, 2-3/4 in. ¹	1
	G10-081-2010	Screw, Cap, soc-hd, 70 mm ²	1
2	D10-084-2010	Washer, Flat ¹	1
	G10-084-1010	Washer, Flat ²	1
3	D10-038-2017	Plug, Hastelloy C	1
	D10-038-2210	Plug, Brass	1
	D10-038-2211	Plug, 316 sst	1
4	D10-024-2010	Bolt, Hex-hd, 3-1/2 in. ¹	6
	G10-024-2011	Screw, Cap, soc-hd, 80 mm ²	6
5	D10-048-2010	Washer, Split lock ¹	8
	G25-048-2010	Washer, Split lock ²	8
6	D10-004-1002	Manifold, 316 sst, NPT	1
	D10-004-1008	Manifold, Brass, NPT	1
	D10-004-1017	Manifold, Nickel alloy, Hastelloy	1
		CW12MW, NPT	1
	D10-004-1034	Manifold, Cast iron, NPT	1
7	D10-083-2110	O-ring, Center bolt, Buna	1
	D10-083-2111	O-ring, Center bolt, Viton	1
	D10-083-2112	O-ring, Center bolt, Neoprene	1
	D10-083-2113	O-ring, Center bolt, EPDM	1
	D10-083-2118	O-ring, Center bolt, PTFE	1
8	D10-073-2110	O-ring, Inner manifold, Buna	1
	D10-073-2111	O-ring, Inner manifold, Viton	1
	D10-073-2112	O-ring, Inner manifold, Neoprene	1
	D10-073-2113	O-ring, Inner manifold, EPDM	1
	D10-073-2118	O-ring, Inner manifold, PTFE	1
9	D10-074-2110	O-ring, Outer manifold, Buna	1
	D10-074-2111	O-ring, Outer manifold, Viton	1
	D10-074-2112	O-ring, Outer manifold Neoprene	1
	D10-074-2113	O-ring, Outer manifold EPDM	1
	D10-074-2118	O-ring, Outer manifold, PTFE	1
10	D10-035-2110	O-ring, Valve seat, Buna	6
	D10-035-2111	O-ring, Valve seat, Viton	6
	D10-035-2112	O-ring, Valve seat, Neoprene	6
	D10-035-2113	O-ring, Valve seat, EPDM	6
	D10-035-2118	O-ring Valve seat, PTFE	6
11	D10-020-1010	Valve seat, 17-4 sst, HT	6
	D10-020-1011	Valve seat, 316 sst	6
	D10-020-1016	Valve seat, Tungsten carbide	6
	D10-020-1017	Valve seat, Hastelloy C	6
	D10-020-3300	Valve seat, Ceramic	6
12	D10-021-1010	Valve, 17-7 sst, stamped, HT	6
	D10-021-1011	Valve, Nitronic	6
	D10-021-1015	Valve, 17-4 sst, machined, HT	6
	D10-021-1016	Valve, Tungsten carbide	6
	D10-021-1017	Valve, Hastelloy C	6
	D10-021-3300	Valve, Ceramic	6
13	D10-022-3116	Valve Spring, 17-7 sst, HT	6
	D10-022-3117	Valve Spring, Elgiloy	6
	D10-022-3123	Valve Spring, Hastelloy C	6
14	D10-092-2110	Tetra Seal, Buna	6
	D10-092-2111	Tetra Seal, Viton	6
	D10-092-2112	Tetra Seal, Neoprene	6
	D10-092-2113	Tetra Seal, EPDM	6
	D10-092-2118	Tetra Seal, PTFE	6
15	D10-023-1010	Retainer, Valve spring, 17-7 sst, HT	6
	D10-023-1017	Retainer, Valve spring, Hastelloy C	6
	D10-023-2310	Retainer, Valve spring, Celcon	6
	D10-023-2326	Retainer, Valve spring, Nylon	6
	D10-023-2327	Retainer, Valve spring, polypropylene	6
	D10-023-2328	Retainer, Valve spring, Kynar	6
16	D10-003-1011	Valve Plate, Brass	1
	D10-003-1012	Valve Plate, 316 sst	1
	D10-003-1019	Valve Plate, Cast iron	1
	D10-003-1027	Valve Plate, Nickel alloy, Hastelloy	1
		CW12MW	1
17	D10-030-2010	Screw, Flat-hd, sst, 3/8 in.	3
	D10-030-2011	Screw, Flat-hd, Hastelloy C, 3/8 in.	3
18	D10-047-2110	O-ring, Follower, Buna-N	3
	D10-047-2111	O-ring, Follower, Viton	3
	D10-047-2112	O-ring, Follower, Neoprene	3
	D10-047-2113	O-ring, Follower, EPDM	3
	D10-047-2118	O-ring, Follower, PTFE	3
19	D10-017-1010	Follower, 316 sst	3
	D10-017-1011	Follower, Hastelloy C	3
20	D10-018-2312	Diaphragm, Neoprene	3
	D10-018-2313	Diaphragm, EPDM	3
	D10-018-2315	Diaphragm, Viton XT	3
	D10-018-2318	Diaphragm, PTFE	3
	D10-018-2320	Diaphragm, Buna-N-XS	3
21	D10-016-1010	Plunger	3
22	G10-082-2010	Set Screw, 10 mm	3

¹ Used on D10 models prior to S/N 216283.

² Used on D10 models S/N 216283 and above.

D-10 Fluid End

Ref. No.	Part Number	Description	Quantity/ Pump
24	K10-002-1010	Cylinder Housing ¹	1
	K10-002-1020	Cylinder Housing, Metric ²	1
	K10-002-1210	Cylinder Housing Assembly ^{1,3}	1
	K10-002-1220	Cylinder Housing Assembly, Metric ^{2,3}	1
	K10-002-1232	Loaded Cylinder Housing, UNC, Neoprene ^{1,6}	1
	K10-002-1233	Loaded Cylinder Housing, UNC, EPDM ^{1,6}	1
	K10-002-1234	Loaded Cylinder Housing, UNC, Buna N-XS ^{1,6}	1
	K10-002-1235	Loaded Cylinder Housing, UNC, Viton XT ^{1,6}	1
	K10-002-1236	Loaded Cylinder Housing, UNC, PTFE ^{1,6}	1
	K10-002-1242	Loaded Cylinder Housing, Metric, Neoprene ^{2,6}	1
	K10-002-1243	Loaded Cylinder Housing, Metric, EPDM ^{2,6}	1
	K10-002-1244	Loaded Cylinder Housing, Metric, Buna N-XS ^{2,6}	1
	K10-002-1245	Loaded Cylinder Housing, Metric, Viton XT ^{2,6}	1
	K10-002-1246	Loaded Cylinder Housing, Metric, PTFE ^{2,6}	1
25	D10-029-2010	Screw, Cap, hex-hd, 1 in. ¹	1
	G10-089-2011	Screw, Cap, hex-hd, 38 mm ²	1
26	D10-080-2110	O-ring, Oil fill, Buna.....	1
27	D03-039-1030	Cap with O-ring, Oil fill	1

Ref. No.	Part Number	Description	Quantity/ Pump
29	D10-087-2010	Screw, Cap, hex-hd, 1-1/4 in. ¹	1
	G10-087-2011	Screw, Cap, hex-hd, 45 mm ²	1
30	G10-001-1050	Pump Housing, Metric ⁴	1
	G10-001-1215	Pump Housing Assembly, Metric ⁵	1
31	D10-028-2010	Nut, Hex, 3/8 in. ¹	6
32	D10-076-2210	Elbow, Brass, 1/8 in. ¹	1
	D10-076-2250	Plug, Soc-hd, 1/4 in. ²	2
33	D10-077-2210	Nipple, Brass, 3/8 in. ¹	1
	D10-077-2250	Nipple, Brass, 1/4 in. ²	1
34	D10-078-2210	Cap, Brass, 1/8 in. ¹	1
	D10-078-2250	Cap, Brass, 1/4 in. ²	1
35	D10-025-1010	Base	1
36	D10-054-2010	Washer, Shakeproof ¹	4
37	D10-029-2010	Screw, Cap, hex-hd, 1 in. ¹	4
	G10-029-2010	Screw, Cap, hex-hd, 25 mm ²	4
41	D10-088-2010	Screw, Cap, soc-hd ¹	2
	G10-088-2010	Screw, Cap, soc-hd, 30 mm ²	2
44	G10-106-2350	Gasket, Cover ²	1
45	G10-105-1050	Cover/Nameplate ²	1
46	G03-088-2010	Screw, 20 mm ²	4

¹ Used on D10 models prior to S/N 216283.

² Used on D10 models S/N 216283 and above.

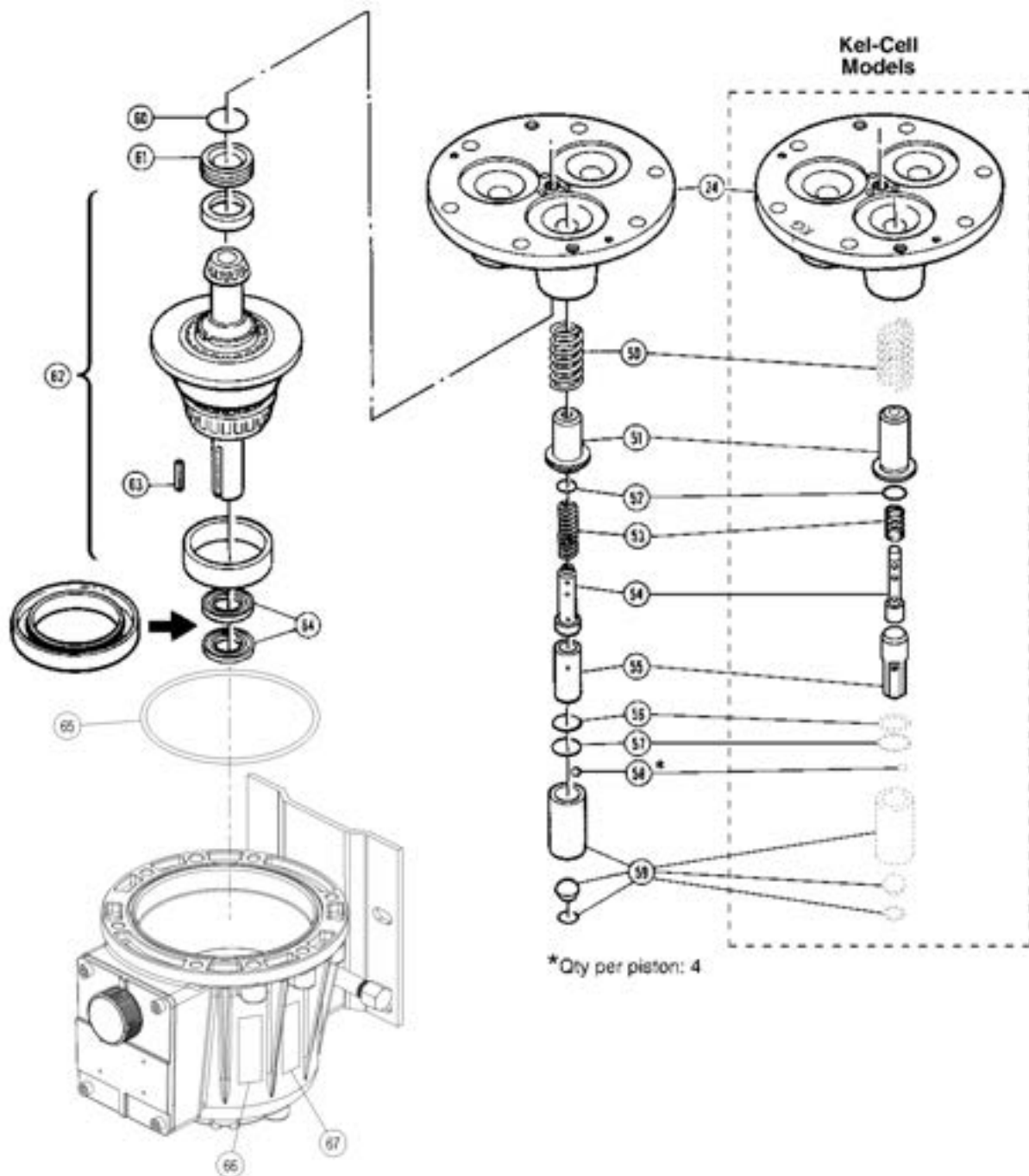
³ Cylinder Housing Assembly includes casting (24), bearing, adjusting plate (61), O-ring (60), and set screws (22).

⁴ Pump housing (metric) includes housing (30), cover (45), gasket (44), and screws (46). Requires new screws (4), washers (5), screws (25), and screw (29).

⁵ Pump Housing Assembly includes housing (30), oil drain/plugs (32, 33, 34), cover (45), gasket (44), and screws (46). Requires new screws (4), washers (5), screws (25), and screw (29).

⁶ Loaded Cylinder Housing includes Fluid End parts (17 - 22) and Hydraulic End parts (50 - 61).

D-10 Hydraulic End



D-10 Hydraulic End

Ref. No.	Part Number	Description	Quantity/ Pump
50	D10-019-3110	Spring, Piston return	3
51	D10-042-1010	Retainer, Spring	3
	K10-042-1010	Retainer, Spring, Kel-Cell ⁶	3
52	D10-046-2110	O-ring, Valve cylinder, Buna	3
	C23-009-2110	O-ring, Valve cylinder, Buna, Kel-Cell ⁶	3
53	D10-045-3110	Spring, Sleeve valve	3
	D10-045-3111	Spring, Sleeve valve, PTFE diaphragm	3
	K10-045-3110	Spring, Sleeve valve, Kel-Cell ⁶	3
54	D10-044-1010	Valve Plunger	3
	K10-044-1010	Valve Plunger, Kel-Cell ⁶	3
55	D10-043-1010	Cylinder, Valve	3
	K10-043-1010	Cylinder, Valve, Kel-Cell ⁶	3
56	D10-034-2110	O-ring, Buna	3
57	D10-041-1010	Washer, Ball retainer	3
58	D10-015-3010	Ball	12
59	D10-014-1209	Piston with foot and retainer	3
	D10-014-1210	Piston Assembly ⁷	—
	K10-014-1210	Piston Assembly, Kel-Cell ^{6,7}	—
60	D10-075-2110	O-ring, Bearing adjusting plate, Buna	1
61	D10-012-1010	Bearing Adjusting Plate	1
62	D10-007-1210	(X) Cam Assembly, 8 gpm @ 1450 rpm ⁸	—
	D10-007-1211	(I) Cam Assembly, 4 gpm @ 1750 rpm ⁸	—
	D10-007-1212	(S) Cam Assembly, 6 gpm @ 1750 rpm ⁸	—
	D10-007-1214	(E) Cam Assembly, 8 gpm @ 1750 rpm ⁸	—
63	D10-085-2210	Key, Shaft	1
64	D10-031-2110	Seal, Buna	2
65	D10-037-2110	O-ring, Pump housing, Buna	1
66	D10-111-2401	Label, Caution, freezing	1
67	D10-111-2402	Label, Caution, check oil	1

⁶ Parts used in Kel-Cell version pumps (Kel-Cell version pumps are indicated by a in.K in. in the 5th digit of the pump model number).

⁷ Piston Assembly includes cylinder, foot, valve plunger, O-rings, spring retainer, and springs (50-59).

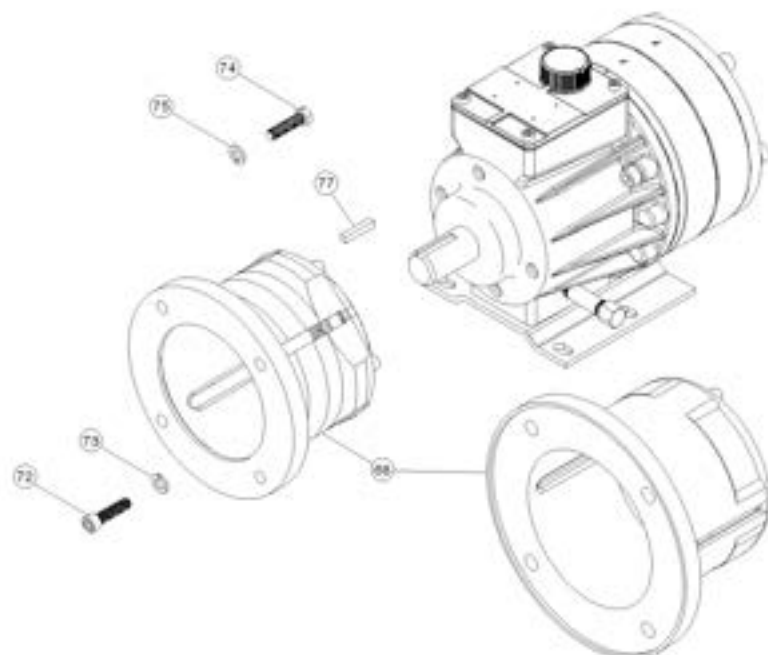
⁸ Cam Assembly includes cam, shaft, wobble plate, cups and bearings. It is only available as an assembly.

D-10 Adapter Kit

D-10 Pump/Motor Adapter Kit

For 56C-145TC NEMA C-Face Motors (Complete Kit Part No. A04-001-1200)

For 182-215TC NEMA C-Face Motors (Complete Kit Part No. A04-002-1200)



Ref	No.	Description	A04-001-1200	A04-002-1200	Qty/Kit
68		Pump/Motor Adapter	A04-031-1000 ¹	A04-030-1000 ¹	1
			A04-032-1050 ²	A04-033-1050 ²	1
69*		Adapter Baseplate	A04-025-1010 ¹	—	1
70*		Screw, Cap, Hex-hd	D10-029-2010 ¹	—	4
71*		Lockwasher, Internal tooth	D10-054-2010 ¹	—	4
72		Screw, Cap, Soc-hd	A04-041-2010 ¹	A04-041-2010 ¹	4
			G10-089-2010 ²	G10-089-2010 ²	4
73		Lockwasher, Split	D10-048-2010 ¹	D10-048-2010 ¹	4
			G25-048-2011 ²	G25-048-2011 ²	4
74		Screw, Cap, Hex-hd	D03-068-2010 3/8 in.	M10-110-2000 1/2 in.	4
75		Lockwasher, Split	D10-048-2010 3/8 in.	M10-111-2000 1/2 in.	4
77		Key, Short	A04-085-2210	A04-085-2210	1

¹ Used on D10 models prior to S/N 216283.

² Used on D10 models S/N 216283 and above.

* Not shown.

D-10 Service (Fluid End)

NOTE: The numbers in parentheses are the Reference Numbers on the exploded view illustrations found in this manual and also in the Parts Manual.

This section explains how to disassemble and inspect all easily-serviceable parts of the pump. Repair procedures for the hydraulic end (oil reservoir) of the pump are included in a later section of the manual.

CAUTION: Do not disassemble the hydraulic end unless you are a skilled mechanic.

CAUTION: The two bolts (29; 25 or 44) that screw through the back of the housing into the cylinder casting hold the casting over the hydraulic end of the pump. Do not remove them except when repairing the hydraulic end.

1. Remove Manifold (6), Valve Plate (16)

a. Remove all nuts (31) and bolts (4) around the manifold. Do not remove two bolts (29; 25 or 44) that are installed through back of pump housing.

b. Use 3/8-in. (10-mm) hex Allen wrench to remove center bolt (1) and its washer (2).

CAUTION: Do not turn the pump drive shaft while the manifold and valve plate are off the pump, except when removing diaphragms or repriming the hydraulic cells.

c. Remove manifold (6), and support plate (42) [non-metallic pump head only]. Valve plate (16) will remain on cylinder casting (24).

d. Inspect manifold for warping or wear around inlet and outlet ports. If wear is excessive, replace manifold.

To check if manifold is warped, remove O-rings and place straightedge across it. Warped manifold should be replaced.

2. Inspect Valves (10-15, 39)

The three inlet and three outlet valve assemblies are identical (but face in opposite directions). Inspect each valve as follows:

a. Check spring retainer (15), and replace if worn.

Note: if your pump has either abrasive duty valve assemblies or a non-metallic pump head there will be a plastic dampening washer (39) at the bottom of each seat. Inspect each one for wear or cracks and replace if necessary.

b. Check valve spring (13). If it is shorter than new spring, replace it (don't just stretch old spring).

c. Check valve poppet (12). If worn excessively, replace it.

NOTE: If your pump has plastic spring retainers, there is a tetra seal (flat O-ring, 14) between the retainer (15) and valve seat (11).

d. Remove valve seat (11). Seat remover is included in Wanner Tool Kit. Inspect valve seat for wear, and replace it if necessary.

e. Reinstall valve assemblies:

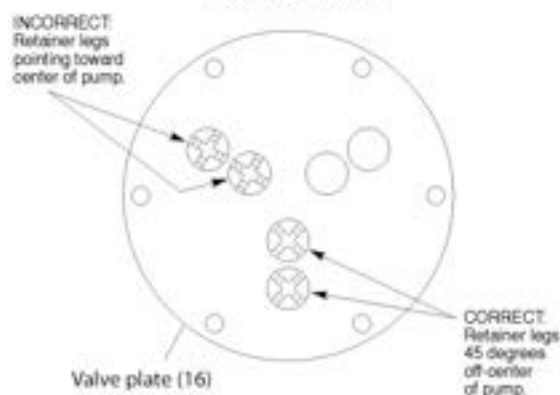
- Clean valve ports and shoulders with emery cloth, and lubricate them with lubricating gel or petroleum jelly.

- Install O-ring (10) on valve seat (11).

- **Inlet (3 center valves).** Insert spring retainer (15) into valve plate, then insert spring (13), valve (12), and valve seat (11). If pump has plastic spring retainers, flat O-ring (14) goes between retainer and seat. Insert dampening washer (39) if included in valve assembly.

- **Outlet (3 outer valves).** Insert dampening washer (39) if included in valve assembly. Insert valve seat, valve, and spring, then retainer. If pump has **plastic** retainers, install flat O-ring between retainer and seat. If pump has **metal** spring retainers in outlet valves, position them so leg does not point toward center of pump (refer to illustration below).

Valve Retainer Orientation In Valve Plate



D-10 Service (Fluid End)

3. Inspect and Replace Diaphragms (20)

If necessary to service the diaphragms, remove the two socket-head cap screws (41) that secure the valve plate (16) to the cylinder casting (24). Inspect the valve plate in the same manner as you did the manifold.

- Lift diaphragm by one edge, and turn pump shaft until diaphragm pulls up. This will expose machined cross-holes in plunger shaft behind diaphragm.
- Insert Allen wrench through one of holes, to hold diaphragm up. Proper size tool is included in Wanner Tool Kit.
- Remove screw (17), O-ring (18), and follower (19) in center of diaphragm.
- Remove diaphragm, and inspect it carefully. Ruptured diaphragm generally indicates pumping system problem, and replacing only diaphragm will not solve larger problem. Inspect diaphragm for following:

- Half-moon marks.** Usually caused by cavitation of pump (refer to "Troubleshooting" section).
- Concentric circular marks.** Usually caused by cavitation of pump (refer to "Troubleshooting" section).
- Small puncture.** Usually caused by sharp foreign object in fluid, or by ice particle.
- Diaphragm pulled away** from center screw or from cylinder sides. Usually caused by fluid being frozen in pump, or by over pressurization of pump.
- Diaphragm becoming stiff** and losing flexibility. Usually caused by pumping fluid that is incompatible with diaphragm material.
- Slice in ridge of diaphragm.** Occurs when Viton diaphragm is operated at cold temperatures.
- Diaphragm edge chewed away.** Usually caused by over pressurizing system.

- Inspect plunger (21) for any rough surfaces or edges. **Do not** remove plunger from plunger shaft. Smooth surfaces and edges as necessary with emery cloth or fine file.

CAUTION: If a diaphragm has ruptured and foreign material or water has entered the oil reservoir, do not operate the pump. Check all diaphragms, then flush the reservoir completely (as outlined below) and refill it with fresh oil. Never let the pump stand with foreign material or water in the reservoir, or with the reservoir empty.

- Install new diaphragm (or reinstall old one, as appropriate), ridge side out.
- Clean screw (17) and remove any oil from it. Apply medium-strength threadlocker to screw. Reinstall screw and follower (19), and a new O-ring (18). Tighten to 18 in.-lbs (2.0 N-m).
- Repeat above inspection procedure (and replacement, if necessary) with other two diaphragms.

4. Flush Contaminant from Hydraulic End

(only if diaphragm has ruptured)

- Remove oil drain cap (34) and allow all oil and contaminate to drain out.
- Fill reservoir with kerosene or solvent, manually turn pump shaft to circulate kerosene, and drain.
CAUTION: If you have EPDM diaphragms, or if food grade oil is in the reservoir, do not use kerosene or solvents. Instead, flush with the same lubricant that is in the reservoir. Pumps with EPDM diaphragms have an "E" as the 7th digit of the Model No.
- Repeat flushing procedure (step b).
- Fill reservoir with fresh oil, manually turn pump shaft to circulate oil, and drain once again.
- Refill reservoir. If oil appears milky, there is still contaminate in reservoir. Repeat flushing procedure until oil appears clean.

5A. Prime Hydraulic Cells on Standard Pumps

- With pump horizontal, and fluid-end head removed, fill reservoir with correct Hydra-oil for application. Have catch basin for oil that leaks from behind diaphragms when priming. Catch oil and dispose of it properly; **do not reuse it.**
- All air in oil within hydraulic cell (behind diaphragms) must be forced out by turning shaft (which pumps piston). Shaft rotator is included in Wanner Tool Kit. Turn shaft until bubble-free flow of oil comes from behind all diaphragms. Watch oil level in reservoir; if it gets too low during priming, air will be drawn into pistons (inside hydraulic end) and will cause pump to run rough.
- Wipe excess oil from cylinder casting (24) and diaphragms (20).
- Ensure that oil is 1 inch (25 mm) from top of fill port.
- Replace oil fill cap (27).

D-10 Service (Fluid End)

5B. Priming Hydraulic Cells for Kel-Cell Pumps

NOTE: Providing oil prime to Kel-Cell fitted pumps requires pressure be applied to the diaphragms. This can be done manually, with the system head pressure, or with pressurized air if available. Review all methods below to determine the procedure most suitable.

Method #1 (system head pressure *less* than 2 psi)

- Install valve plate (16) but without outlet valves installed (or else remove outlet valves; leave seats installed) on cylinder housing. Tighten two socket-head screws (41).
- Fill reservoir with correct Hydra-oil to fill port.
- With blunt pointer (eraser end of pencil), reach in through each outlet valve port and push follower-diaphragm backwards. Note air bubbles coming out at oil fill port. Now turn shaft about 1/2 turn.
- Repeat depressing diaphragms and rotating shaft (approximately 4-6 times) until no more air bubbles escape and oil has dropped about 1 inch (25 mm) from top of fill port. Hydraulic cells are now primed. Replace oil fill cap.
- Install outlet valve assemblies in each outlet valve port. See Parts Manual for correct assembly order. You may have to tip pump (head upward) in order to keep valve centered on seat and allow retainer to fit all way into port flush.
- Install manifold (6) and complete installation.

Alternative Method #1:

With pump horizontal, and fluid-end head removed, fill reservoir with correct Hydra-oil for application. Have catch basin for oil that leaks from behind diaphragms when priming. Catch oil and dispose of it properly; **do not reuse it.**

- All air in oil within hydraulic piston behind diaphragms must be forced out by turning shaft (which pumps piston). Shaft rotator is included in the Hydra-Cell Tool Kit. Keep pressure on diaphragms while turning shaft until bubble-free flow of oil comes from behind all diaphragms. Maintain oil level in reservoir. Do not allow oil level to be lower than reservoir.
- Quickly attach loaded valve plate (16) (before oil runs out past diaphragms) with socket head screws (41), but do not tighten completely. Leave gap between valve plate and cylinder housing. Turn shaft 2-3 turns to finish forcing out air behind diaphragms. Hydraulic cells are now primed. Now finish tightening valve plate with two socket head screws and add pump manifold.
- Wipe excess oil from around pump head.
- Check that oil level is 1 inch (25 mm) from top of fill port.
- Replace oil fill cap and complete installation.

Method #2 (head pressure *greater* than 2 psi)

This simple and clean method of priming Hydra-cells requires an inlet head pressure of at least 5 feet (1.5 m) or 2 psi (.14 bar). Pressure source is required to hold diaphragms back while piston moves to force out air.

Completely assemble pump and fill reservoir with correct Hydra-oil to fill port.

- When tank head pressure is being used to prime**, install pump back into system and connect tank supply line to pump inlet. Pump discharge line may be connected at this time, but end of line must be open to allow air to pass out.
- Slowly turn pump shaft by hand and watch for bubbles exiting oil reservoir fill opening. This will take several rotations; when no more bubbles come out and reservoir level has dropped about 1 in. (25 mm), hydraulic cells are primed.
- Replace oil fill cap and complete installation.
- When compressed air is being used to prime**, insert clean air hose to pump inlet and restrict pump outlet. Turn shaft quarter turn and then apply air pressure into manifold to put pressure on diaphragms. This will force air out from inside pistons and bubbles will appear at reservoir opening. Repeat for several rotations until no more air bubbles come out and reservoir level has dropped about 1 in. (25 mm). Hydraulic cells are now primed.
- Replace oil fill cap and complete installation.

6. Reinstall Pumping Head

MODEL D-10

NOTE: Use bolt (29) protruding through cylinder casting at 10 o'clock position to locate valve plate on cylinder casting. Place "blind hole" on valve plate over this bolt.

- Reinstall valve plate (16), with valve assemblies installed as outlined above, onto cylinder casting. Recheck that blind hole is over protruding bolt at 10 o'clock position. Install socket-head cap screws (41) and secure valve plate to cylinder casting.
- Reinstall O-rings (7,8,9) on rear side of manifold. Use petroleum jelly or lubricating gel to hold them in place.
- Reinstall manifold onto valve plate. Be sure drain plug (3) is at the bottom of manifold.
- Insert all bolts (4), washers (5), and nuts (31). Hand tighten.
- Reinstall center bolt (1) with its washer (2), and torque to 45 ft-lbs.
- Alternately tighten perimeter bolts (4) until all are secure. Torque to 45 ft-lbs.
- Recheck all bolts for tightness.

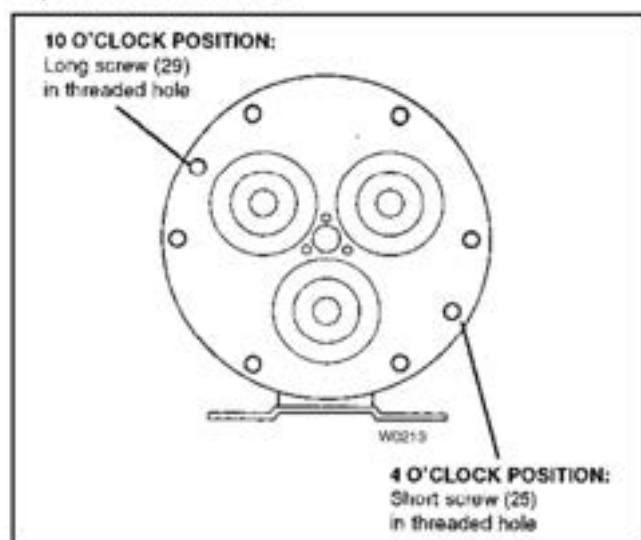
D-10 Service (Hydraulic End)

NOTE: The numbers in parentheses are the Reference Numbers on the exploded view illustrations found in this manual and also in the Parts Manual.

CAUTION: Do not disassemble the hydraulic end of the pump unless you are a skilled mechanic.

CAUTION: The two bolts (29; 25 or 44) that screw through the back of the housing into the cylinder housing (24) hold the housing to the pump housing. Do not remove them except when repairing the hydraulic end.

NOTE: The following service procedures refer several times to the Wanner Tool Kit (P/N A03-175-1101). We strongly urge you not to try to repair the hydraulic end of the pump without using the tools in this kit (available from Wanner or your local distributor).



1. Remove Pump Housing

- Remove head of pump, and diaphragms, as outlined in the Fluid-End Service Section.
- Drain oil from pump housing by removing drain plug (34).
- Set hydraulic end of pump face-down on cylinder housing (24), onto smooth, clean surface.
- Check shaft for sharp burrs. Smooth any burrs, to prevent scarring housing seals (64) when you disassemble pump.
- Remove bolts (29; 25 or 44) that secure housing to cylinder casting. Piston return springs (50) will force cylinder housing and housing apart.

NOTE: When reassembling later, note that one bolt (29) is 1/4 in. (5 mm) longer than the other (25 or 44). The longer bolt must be installed in the 10 o'clock position of the cylinder housing (24).

- Lift off housing (30).
- Inspect cam and bearings (62), and bearing race in rear of housing. If bearings are pitted or binding, or if housing race is worn, replace them both.

2. Disassemble Pistons

- With pump housing removed (see above), turn unit over and set it on flat surface, piston side down.
- With diaphragms removed (see Fluid-End Service Section), reinsert follower screw (17) into hole in one of valve plungers (54). Tap screw lightly with hammer and plunger (21) should slip off valve plunger (54).

Hydraulic piston assembly (50-59) can now be disassembled. Inspect all parts, and replace all O-rings and any other parts that are worn or damaged.

- Repeat step b. for remaining pistons.

NOTE: When you reassemble the hydraulic piston, use new plungers (21). They are press-fit onto the valve plungers (54) and are not reusable.

3. Reassemble Pistons

- Drop ball (58) into each opening in bottom of piston assembly (59).
- Insert retaining washer (57) and O-ring (56) to hold balls in place.
- Insert valve plunger (54) into valve cylinder (55). Slide spring (53) over plunger, inside valve cylinder.
- Insert O-ring (52) into spring retainer (51).
- Slide assembled valve cylinder, plunger, and spring (53-55) into spring retainer (51).
- Slide complete cylinder-and-retainer assembly (51-55) into piston assembly (59).
- Insert return spring (50) into piston assembly, wide end first. This is tight fit, and can best be done by turning spring in counterclockwise.
- Repeat above procedure for other two pistons.

4. Reassemble Pump Housing and Cylinder Housing

NOTE: Inspect the shaft seals (64) before continuing. If they look damaged in any way, replace them (remove by pounding them out from inside the pump housing). Both seals should be replaced at the same time. Clean the bore in the housing using emery cloth or ScotchBrite™.

- Place cylinder housing (24) face-down on flat surface.
- Insert assembled pistons (50-59) into cylinder housing. Holes on foot end of pistons should all point toward center of casting.
- Note location of outer ring of holes in cylinder housing and in pump housing flange (in particular, holes where bolts (29) and (25 or 44) will be installed).
- Stand camshaft assembly (62) on cylinder housing (24).

CAUTION: The pilot bearing **MUST** be properly nested in the bearing race during assembly. If misaligned, the bearing will be damaged and the pump will fail within the first hours of operation.

D-10 Service (Hydraulic End)

- e. Using petroleum jelly or grease to retain it, install O-ring (65) and slide housing (30) down over shaft. Be sure holes in housing and the cylinder housing are properly aligned.
- f. Install two assembly studs from Tool Kit, washers and nuts on threaded studs, but don't tighten yet. You may want to insert two or more bolts (4) into unthreaded holes of housing and cylinder housing to help align parts.
- g. Alternately tighten the nuts of assembly studs to evenly draw housing down to cylinder housing. Be sure O-ring (65) stays in place.
Also, as you tighten nuts keep checking shaft alignment by turning shaft (use rotator in Wanner Tool Kit). If shaft begins to bind and become difficult to turn, back off nuts and realign shaft. When housing is tight against cylinder housing, you should be able to turn shaft smoothly.
- h. After pump housing and cylinder housing are together, insert bolt (25) with lock washer (5) (at 4 o'clock position) through pump housing and into cylinder housing. Repeat with bolt (29) in 10 o'clock position. Tighten evenly and then remove assembly studs.
- i. Turn shaft again to check its alignment.

5. Replace Shaft Seals

- a. Apply thin film of grease on seal protector tool (part of Wanner Tool Kit). Slide both seals onto tool, with spring side of seals toward open end of tool.
Apply heavier coat of grease between seals and press together.
- b. Apply coating of Loctite® High-Performance Pipe Sealant with PTFE, or comparable product, to outer surface of both seals and inside surface of the opening in pump housing where seals will rest.
- c. Apply light film of grease to drive shaft. Slide seal protector tool (with two seals) over end of shaft.
- d. Slide seal inserter tool (from Wanner Tool Kit) over seal protector tool, and press seals completely into place. Tap tool with soft mallet to firmly seat seals.

6. Adjust Cam Shaft Endplay

- a. Remove three set screws (22) from cylinder casting (24), and clean them.
- b. Insert center bolt (1) into hole in center of cylinder casting. Turn it in to move bearing adjusting plate (61) and cup tight against bearing cone.
- c. Back out center bolt two full turns, then turn it back in again until it is tight against adjusting plate (61).
- d. Back out the center bolt exactly 1/4 of a turn.
- e. With plastic mallet (or regular mallet and wooden board) to prevent damage to shaft, rap end of shaft 3 or 4 times. This will provide about 0.006 in. (0.15 mm) endplay in shaft.
- f. Apply removable threadlocker to threads of three cleaned set screws (22).
Screw three set screws (22) into cylinder casting until they contact bearing adjusting plate (61).
- g. Remove center bolt (1).

7. Install Plungers

NOTE: If the plungers (21) have been removed from the valve plungers (54), do not reuse them. Install new ones instead.

- a. Rotate pump shaft so piston is at top-dead-center position.
- b. Place plunger on exposed screw end of plunger guide tool (from Wanner Tool Kit). Larger-diameter side of plunger should face tool.
- c. Screw guide (with plunger) into valve plunger (54) until tight.
- d. Hold single bottom handle of guide, and turn double top handle to force plunger to seat on valve plunger. This is press-fit. When installed, plunger should be tight against shoulder of valve plunger.

NOTE: Do not remove the plunger guide until the diaphragm is installed (see below).

- e. Install diaphragm as outlined below, then repeat procedure for other two plungers and diaphragms.

8. Reinstall Diaphragms

- a. With plunger guide tool still screwed into valve plunger (54), pull valve plunger up until cross-holes in valve plunger are exposed.
- b. Insert diaphragm Allen wrench (from Wanner Tool Kit), through top hole — to hold plunger (21) away from cylinder casting. This will also keep valve plunger from turning when diaphragm is being installed.
- c. Place diaphragm (20) onto plunger (21) ridge-side out.
- d. Center diaphragm follower (19) on diaphragm.
- e. Place O-ring (18) onto follower screw (17).
- f. Apply small amount of threadlocker to threads of follower screw.
- g. Insert follower screw (with O-ring) through diaphragm follower (19) and diaphragm (20), and screw it into valve plunger (54).
- h. Hold plunger holder, and torque follower screw to 18 in.-lbs (2.0 N-m).
- i. Repeat above procedure for plungers and diaphragms of other two cylinders.
- j. Fill reservoir with fresh oil and prime pump, as outlined in Fluid-End Service Section.

9. Reassemble Pump Head

Reassemble pump head as outlined in Fluid-End Service Section.

7. Warranty and Service

LIMITED WARRANTY

Watermakers, Inc. warrants that each Watermaker's Inc., system has been factory tested to perform in accordance with published specifications at the time of delivery. The Company further warrants that the Watermaker will continue to make potable water for a period of one year from the warranty effective date, provided that the user provides feed-water meeting minimum standards and adopts and implements the maintenance program as outlined in the Operating Manual. Expendable or consumable products such as but not limited to filters, oils, chemical, or UV lamps, which by nature have a life expectancy of less than twelve (12) months, will be replaced if their performance is less than normally attributed by industry standards to that product.

The Company's liability under this warranty is limited to the repair or replacement at the Company's discretion of the system or components found to be defective solely as to materials or workmanship during the warranty terms. The replacement will be on an exchange basis from the factory direct or arranged through a Watermaker dealer or distributor (no labor, transportation, duties or mileage charges will be reimbursed). If a complete Watermaker's Inc., system is returned to the factory (freight prepaid), Watermaker's Inc., will repair or replace all or part of the system at Watermaker's Inc., discretion, free of charge(except transportation) if the unit is determined to be defective under this warranty. Owner will be required to pay any labor charges incurred by a Watermaker's Inc., dealer if replacement takes place after three (3) Months of original purchase.

This warranty does not extend to any system or component which failed due to (1) Damage from mishandling, misuse, substandard feed-water, improper maintenance procedures or neglect, (2) Improper installation, or (3) Incorrect electrical supply. This warranty is void if serial numbers of components are mutilated or missing. The warranty period is established by the warranty card supplied with each unit, which is to be filled out by the purchaser or installer and returned to the factory for validation. If no warranty card is returned, the warranty is considered to be effective thirty (30) days from date of factory shipment.

There are no warranties express or implied which go beyond the foregoing statement.

Some states do not allow for the exclusion or limitation of incidental or consequential damages or limitations on how long an implied warranty lasts, so the above limitations or exclusions may not apply. This warranty gives you specific legal rights and you may have other rights that vary from state to state.

Warranty/Service Policy

In the event that a component breaks down on a system, whether or not the unit is under warranty, please follow the directions below so that we may resolve the problem quickly.

1. Any part of the system that has malfunctioned must be sent prepaid to the factory with a return authorization number. This number can be obtained by calling the factory and speaking to the service manager. A description of the problem and all necessary data from the Owners Performance Log must be included to assist the factory in identifying the problem.
2. Upon receipt of the item(s), an inspection and test will be made and a determination as to whether repair or replacement under warranty will be made. In cases of non-warranty repair, a cost estimate will be made and the customer will be notified before proceeding with the repair.
3. Normal service time required is approximately one to two weeks, depending on the part.

Important

If the unit is still within the warranty period, a copy of the warranty sheet must accompany the part(s).

For valid Warranty please observe the following conditions:

Upon factory shipment of the reverse osmosis system or parts, the original purchaser is responsible for acceptance testing within 45 days of invoice. On all systems shipped outside the continental United States, the purchaser has 60 days.

Unauthorized repair of the RO system in the field will void all warranties. Use of unauthorized filters, oils or chemical cleaners also will void all warranties.

ALL SYSTEMS MUST BE OPERATED WITHIN FACTORY INSTRUCTIONS AND WRITTEN DESIGN SPECIFICATIONS OF THE EQUIPMENT. UNAUTHORIZED ADJUSTMENT OR DISABELING OF ANY SAFETY DEVICE (PRESSURE SWITCHES, RELIEF VALVES, ETC) WILL VOID THE WARRANTY. MISUSE, MISAPPLICATION, ABUSE, NEGLECT, CHLORINE DAMAGE, UNAPPROVED CLEANING CHEMICALS, AND ACTS OF GOD WILL VOID THE WARRANTY.

Contact Information

To Order Parts visit www.watermakers.com and click on the Parts Tab to use the online order form.

For Sales, Service and Technical inquiries, e-mail info@watermakers.com

Or, contact us direct at the factory:

Watermakers, Inc.
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Fort Lauderdale, Florida 33316
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