



MILLER  
LEAMAN

# ULTRA PURE

UF/RO MEMBRANE SYSTEMS

## Reverse Osmosis System



## Installation & Start-up

### **Miller-Leaman**

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# Introduction

Miller-Leaman, Inc. - Warrants that the water treatment equipment supplied will conform to the description stated, that when shipped all parts will be free from defects in material and/or workmanship. If the goods do not conform to the description, or if there are defects in material and/or workmanship, Miller-Leamans' responsibility and liability shall be limited solely and exclusively to the replacement of the repair of such goods when returned to Miller-Leaman. Miller-Leaman, Inc. shall not be liable for any other damages, whether direct or consequential, nor will be responsible for any labor charges and/or other cost resulting from the removal or installation of the repaired or replaced part. This warranty does not cover defects caused by accident, fire, flood, acts of God, misuse, misapplication or neglect.

## **LIMITED WARRANTY**

### **1. Water Softeners and Carbon Filters**

Miller-Leaman warrants to the original consumer/purchaser against defect in material and/or workmanship from the date of the original manufacture as follows:

- CONTROL VALVE
  - o Commercial Valve: 3 Years
- POLYGLASS and/or FIBERGLASS MINERAL TANKS
  - o Commercial Mineral Tank: 5 Years
- POLYETHYLENE BRINE TANK
  - o Commercial Brine Tank: 3 Years

### **2. Reverse Osmosis Systems**

Miller-Leaman warrants to the original consumer/purchaser against defects in material and/or workmanship from the date of original manufacture for 2 year.

### **3. Constant Pressure, Booster, and Repress Pumps**

Miller-Leaman warrants to the original consumer/purchaser against defects in material and/or workmanship from the date of original manufacture for 2 year.

### **4. Water Reclamation Systems**

Miller-Leaman warrants to the original consumer/purchaser against defects in material and/or workmanship from the date of original manufacture for 2 year.

## **WARRANTY TERMS & CONDITIONS**

- Improper installation, operation and/or maintenance voids warranty coverage.
- Warranty is void if component Failure or damage results from, but not limited to, misuse, misapplication (unacceptable water conditions), neglect (inadequate filter changes, failure to fill brine tank, use of poor-quality salt, etc), alteration of equipment design, accidents, and freezing.
- Warranty coverage assumes all necessary, preventative maintenance has been performed by consumer/operator. In order to receive warranty, proper maintenance documentation may be required.
- Warranty does not cover Consumable Products including R.O. membranes and 5 micron pre-filters
- All components assembled as part of Miller-Leaman equipment that are manufactured by others are warranted by those manufactures, and therefore covered by their warranty.

## **WARRANTY INVOICING & SHIPPING POLICY:**

Replacement parts are shipped to consumer/purchases via \*Fed-Ex Ground. Consumer/purchaser will be invoiced for replacement parts when the product is shipped. Normal terms will be applied to the invoice. When the returned product is confirmed to be covered under warranty, the consumer's account be credited for the cost of the replacement part.

## **WARRANTY CLAIM & RETURN PRODUCT PROCEDURE:**

Please refer to Returned Materials Authorization (RMA) form. Call (920) 423-7170 or e-mail





## WARNING

**DISCONNECT THE MAIN POWER SUPPLY AND DISSIPATE ALL POTENTIALLY HAZARDOUS ENERGY SOURCES PRIOR TO SERVICING OR MAINTAINING EQUIPMENT**



## WARNING

**THIS EQUIPMENT CONTAINS ITEMS THAT ARE EITHER PNEUMATICALLY CONTROLLED, OR IN SUPPORT OF AN AIR OPERATED CONTROL CURCUIT. DISCONNECT AND DISSIPATE STORED PRESSURE IN LINES PRIOR TO SERVICING, OR MAINTAINING EQUIPMENT**



## NOTICE

**CONSULT A TRAINED TECHNICIAN. ONLY A TRAINED OR AUTHORIZED INDIVIDUAL, KNOWLEDGEABLE IN THE RELATED PROCEDURES SHOULD INSTALL, INSPECT, MAINTAIN OR SERVICE THIS EQUIPMENT.**



## NOTICE

Note: Reference the OSHA standard for the Control of Hazardous Energy (Lockout/Tagout), Title 29 Code of Federal Regulations (CFR) Part 1910.147 and the example provided in 1910.147 Appendix A for practices and procedures necessary to disable machinery or equipment, thereby preventing the release of hazardous energy while employees perform servicing and maintenance activities. The standard outlines measures for controlling hazardous energies – electrical, mechanical, hydraulic, pneumatic, chemical, thermal, and other energy sources.



## NOTICE

OSHA standards can be found at the following website: <http://www.osha.gov/law-regs.html>. Browse to the General Industry tab under the Find an OSHA Standard heading, scroll down to the link of interest and click on it.



## NOTICE

Reference OSHA standard 29 CFR 1910.331 to 29 CFR 1910.335 for safe work practices to protect employees working on electrical circuits and equipment. This section requires workers to use safe work practices, including lockout and tagging procedures. These provisions apply when employees are exposed to electrical hazards while working on, near, or with conductors or systems that use electrical energy.

# Reverse Osmosis

## Introduction (R.O. System)

Miller-Leaman's R.O. System's electronic controller (ML-VROC) oversees the operation of the unit with cutting edge precision and monitoring. It will provide ongoing security, dependability to the operator, and application by providing the necessary information for a continued water quality, safety, and functionality.

The function of the Reverse Osmosis System is to produce superior quality Permeate Water. Permeate water, or water that has a low Total Dissolved Solids (TDS) content, is necessary for many industrial applications to keep equipment and systems running at their most efficient capacities.

## How Reverse Osmosis Works

Reverse Osmosis (R.O.) is a process in which water passes through a semi-permeable membrane when an external pressure is applied that is greater than the natural osmotic pressure. The R.O. System utilizes cross flow filtration to allow the water to pass through the membrane while carrying off the dissolved solids through the reject line. The **PRODUCT WATER** flowing through the permeate side of the membrane is low in dissolved solid and thereby Mineral Free. The **REJECT WATER** (drain, plus recirculation) carries the concentrated dissolved salts, minerals and suspended particles that were rejected by the membrane element to the drain, or storage tank for re-used in applications not needing the R.O. water.

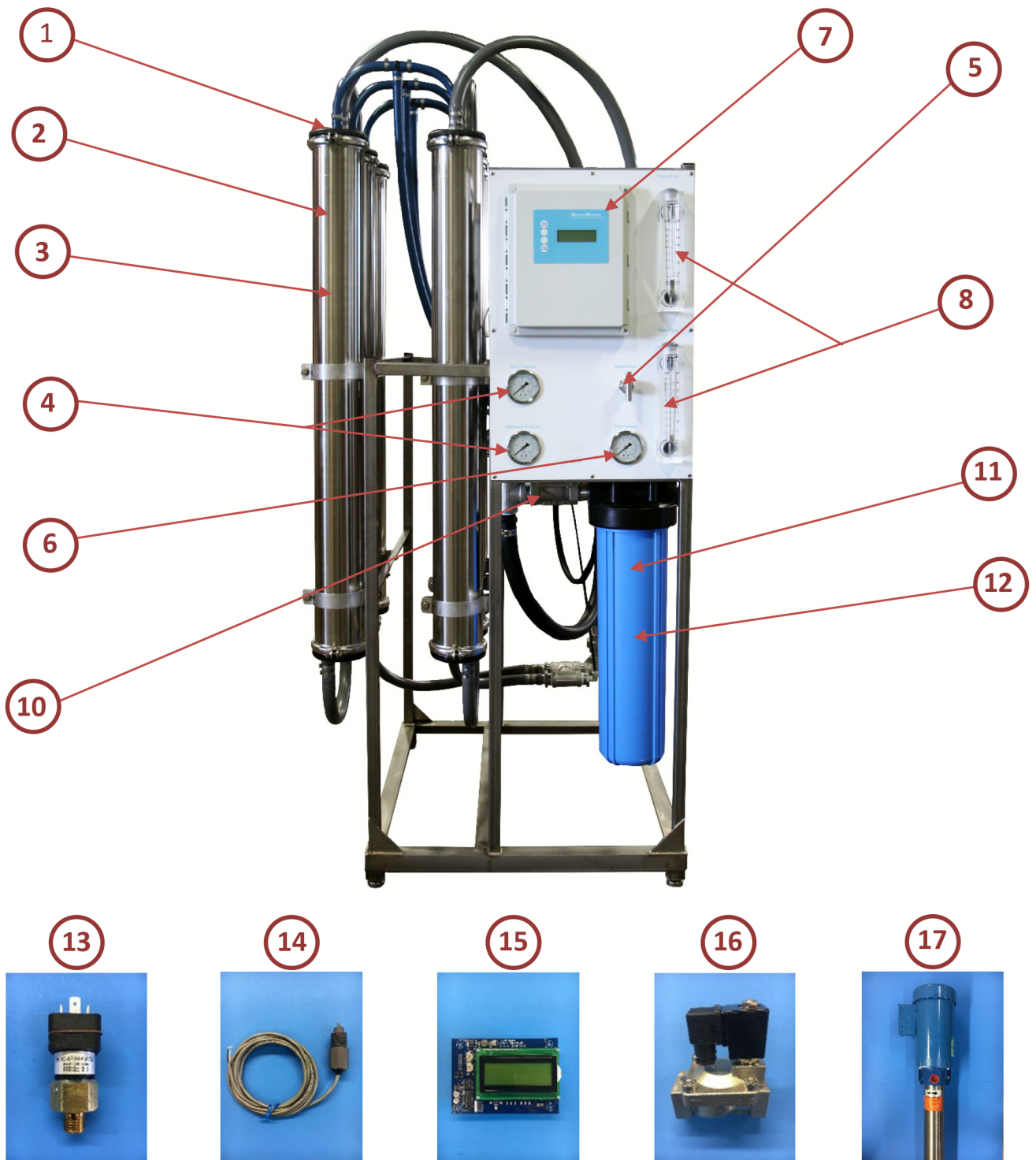
## Unpacking your R.O. System

Your R.O. system has been tested, inspected, and carefully packaged for shipment. It was shipped in proper working order, and in excellent condition. Remove the R.O. system and carbon filter from the crating and check it for signs of concealed damage which may have occurred during shipping. If damage has occurred, immediately contact the delivering carrier and file a claim for damages.



## NOTICE

Installation must be performed in compliance with local plumbing, electrical and sanitation codes.

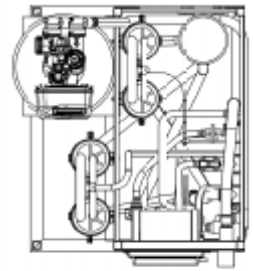
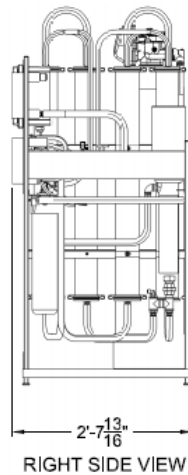
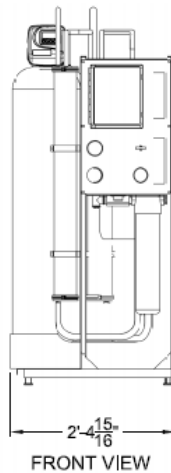
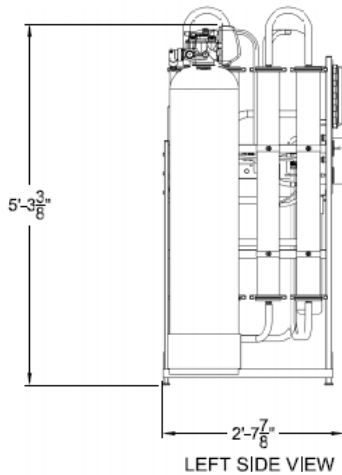


<i>Item #</i>	<i>Part #</i>	<i>Description</i>	<i>System Used With</i>
1	600-444-RP	Membrane Cap with Clamp	ALL
2	600-440-SS	Membrane Housing	ALL
3	230-440-FL	RO Membrane	ALL
4	600-300-RP	0-300psi Pressure Gauge	ALL
5	601-001-SS	Reject Valve	ALL
6	600-100-RP	0-100psi Pressure Gauge	ALL
7	610-200-RP	1 Phase RO Control Box	ALL 1 Phase
	610-303-RP	3 Phase RO Control Box	ALL 3 Phase
8	604-202-RP	.2 - 2 gpm Panel Mount Flow Meter	ML-VRO 1800
	604-505-RP	.5 - 5 gpm Panel Mount Flow Meter	ML-VRO 1 thru 4
	604-510-RP	.5 - 10 gpm Panel Mount Flow Meter	ML-VRO 3 thru 8
	604-216-RP	2 - 16 gpm Panel Mount Flow Meter	ML-VRO 5 thru 9
	604-220-RP	2 - 20 gpm Panel Mount Flow Meter	ML-VRO 8 thru 9
9	600-002-SS	Recycle Valve	ALL
10	601-072-SS	3/4" Inlet Solenoid	ML-VRO 1 thru 3
	601-102-SS	1" Inlet Solenoid	ML-VRO 4 thru 8
11	600-220-RP	2.5" x 20" Pre-Filter Housing	ML-VRO 1 thru 3
	600-420-RP	4.5" x 20" Pre-Filter Housing	ML-VRO 4 thru 8
12	230-001-FL	2.5" x 20" 5 Micron Pre-Filter	ML-VRO 1 thru 3
	230-002-FL	4.5" x 20" 5 Micron Pre-Filter	ML-VRO 4 thru 8
13	600-007-RP	Low Limit Pressure Switch	ALL
14	600-011-RP	TDS Probe	ALL
15	600-600-RP	Display Board	ALL
16	601-052-SS	1/2" Reject Solenoid	ML-VRO 1 thru 8
17	880-1071-SS	1 HP 7 gpm RO Production Pump 1 Ph	ML-VRO 1 thru 2
	880-1073-SS	1 HP 7 gpm RO Production Pump 3 Ph	
	880-2181-SS	2 HP 18 gpm RO Production Pump 1 Ph	ML-VRO 3 thru 4
	880-2183-SS	2 HP 18 gpm RO Production Pump 3 Ph	
	880-3251-SS	3 HP 25 gpm RO Production Pump 1 Ph	ML-VRO 5
	880-3253-SS	3 HP 25 gpm RO Production Pump 3 Ph	
	880-3331-SS	3 HP 33 gpm RO Production Pump 1 Ph	ML-VRO 6 thru 8
	880-3333-SS	3 HP 33 gpm RO Production Pump 3 Ph	

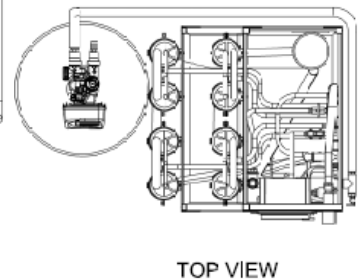
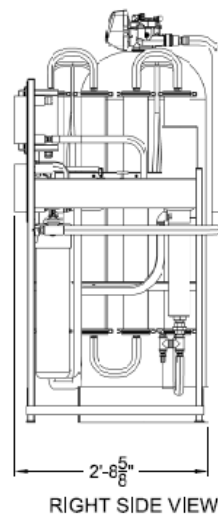
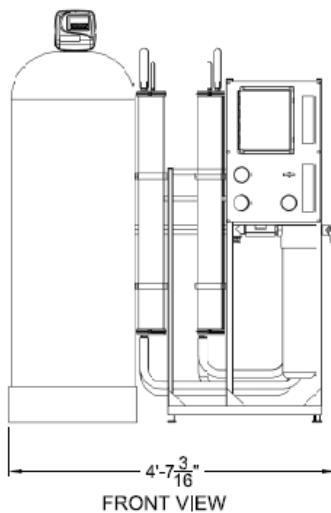
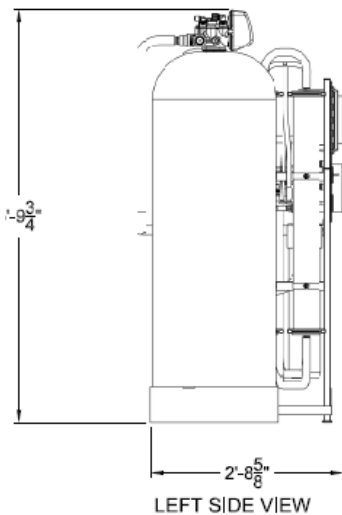
# Getting Started

# Working Envelope

## ML-VROF1 thru 4

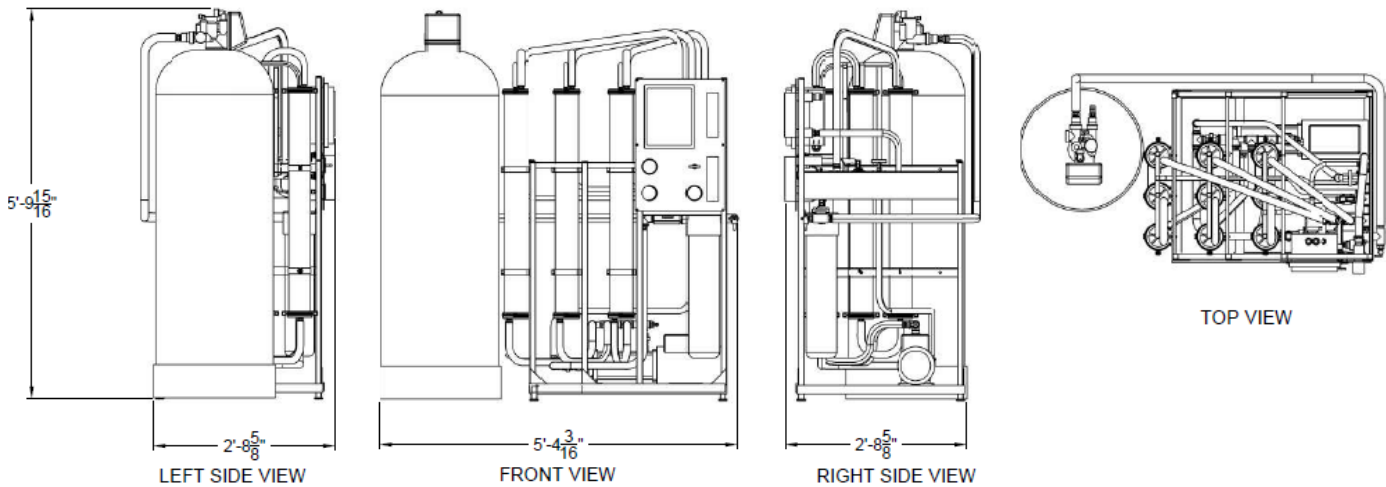


## ML-VROF6&8

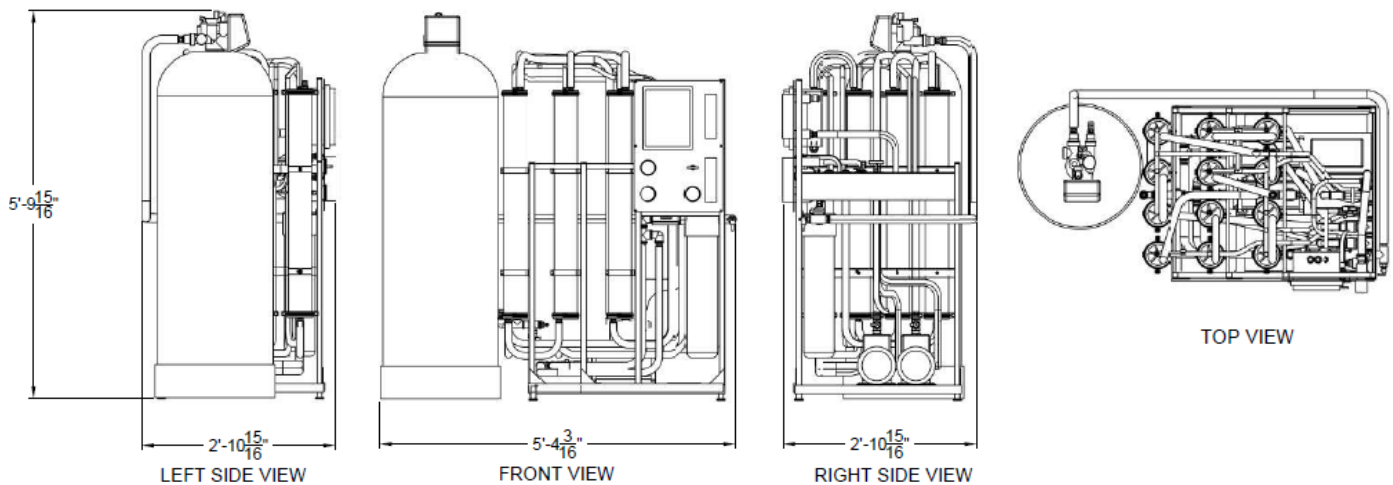


# Working Envelope

## ML-VROF9

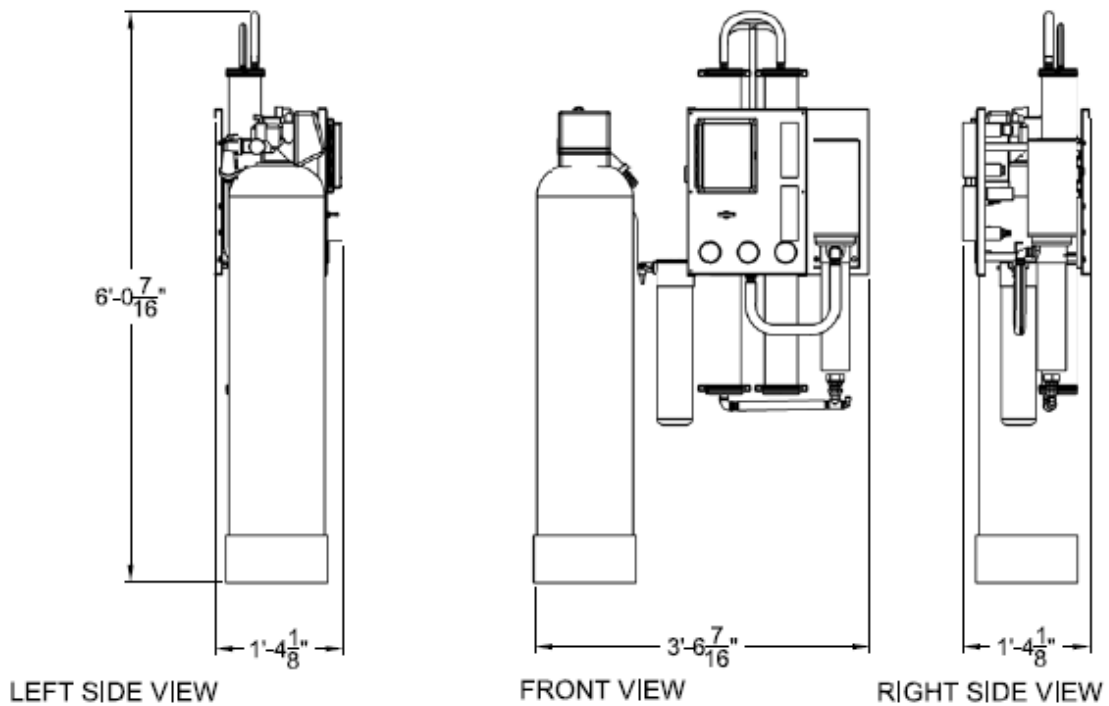


## ML-VROD12



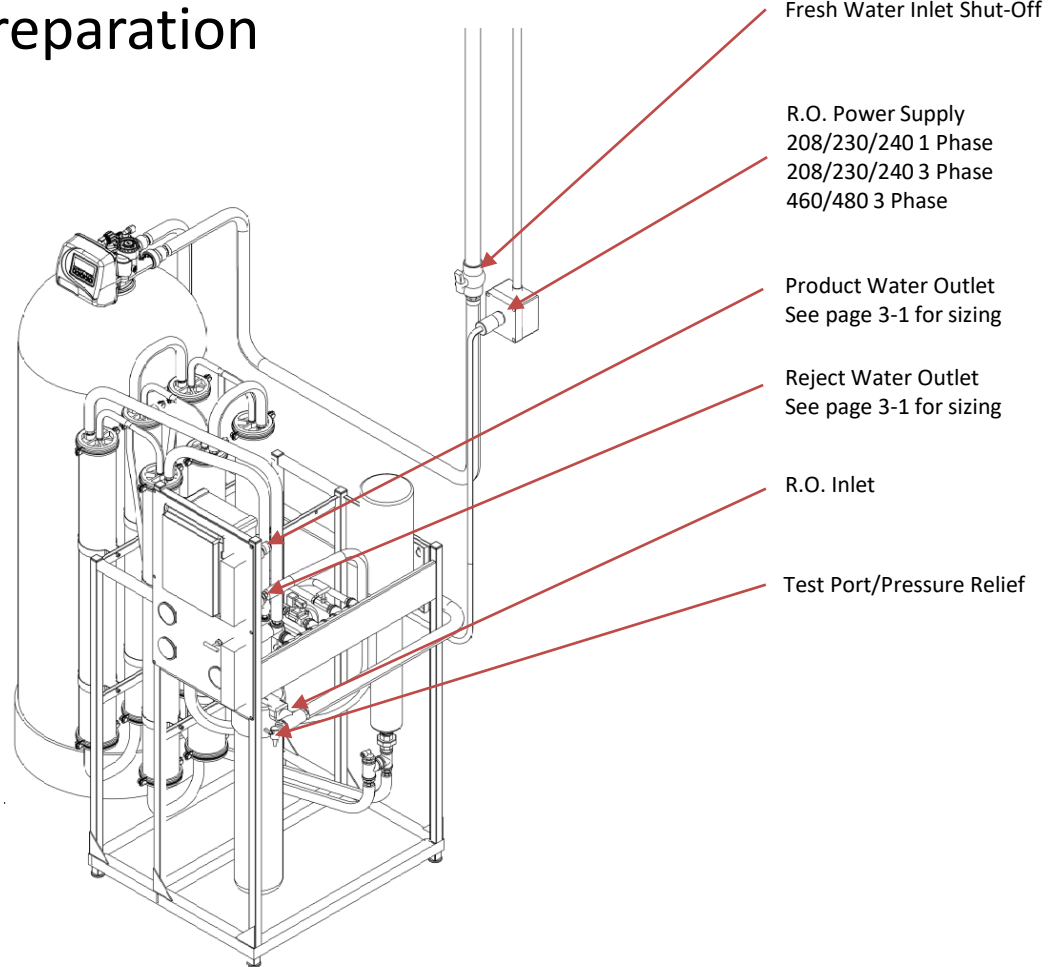
# Working Envelope

## ML-VROW1&2





# Site Preparation



- Single Phase Systems Shipped with L6-20 Plug on 15' Cord
- 3 Phase Systems Will Need to Be Hard Wired By a Licensed Electrician in Accordance With Local Code
  - 3 Phase Systems Require a 120V Outlet For the Control Board



## ML-VRO SERIES

<i>Model</i>	<i>Electrical Ratings</i>	<i>Pump hp</i>	<i>AMP Draw</i>	<i>Product Flow Rate</i>	<i>Reject Flow Rate</i>	<i>Minimum Flow Rate Required</i>	<i>Boost Pressure @ min flow rate</i>	<i>Pump Max GPM</i>
ML-VRO-1	220v 1ph	1 HP	8.3 amps	1.7 gpm	1.2 gpm	3.4 gpm	150 psi	8 gpm
	230v-3ph	1 HP	4.4 amps	1.7 gpm	1.2 gpm	3.4 gpm	150 psi	8 gpm
	460v-3ph	1 HP	2.1 amps	1.7 gpm	1.2 gpm	3.4 gpm	150 psi	8 gpm
ML-VRO-2	220v 1ph	1 HP	8.3 amps	3.4 gpm	1.5 gpm	6.8 gpm	150 psi	10 gpm
	230v-3ph	1 HP	4.4 amps	3.4 gpm	1.5 gpm	6.8 gpm	150 psi	10 gpm
	460v-3ph	1 HP	2.1 amps	3.4 gpm	1.5 gpm	6.8 gpm	150 psi	10 gpm
ML-VRO-3	220v 1ph	2 HP	11.4 amps	5.0 gpm	2.2 gpm	10.0 gpm	150 psi	18 gpm
	230v-3ph	2 HP	6.6 amps	5.0 gpm	2.2 gpm	10.0 gpm	150 psi	18 gpm
	460v-3ph	2 HP	3.1 amps	5.0 gpm	2.2 gpm	10.0 gpm	150 psi	18 gpm
ML-VRO-4	220v 1ph	2 HP	11.4 amps	6.7 gpm	2.9 gpm	13.4 gpm	150 psi	18 gpm
	230v-3ph	2 HP	6.6 amps	6.7 gpm	2.9 gpm	13.4 gpm	150 psi	18 gpm
	460v-3ph	2 HP	3.1 amps	6.7 gpm	2.9 gpm	13.4 gpm	150 psi	18 gpm
ML-VRO-5	220v 1ph	3 HP	16.0 amps	8.3 gpm	3.5 gpm	16.6 gpm	150 psi	33 gpm
	230v-3ph	3 HP	9.1 amps	8.3 gpm	3.5 gpm	16.6 gpm	150 psi	33 gpm
	460v-3ph	3 HP	4.2 amps	8.3 gpm	3.5 gpm	16.6 gpm	150 psi	33 gpm
ML-VRO-6	220v 1ph	3 HP	16.0 amps	10.0 gpm	4.3 gpm	20.0 gpm	150 psi	33 gpm
	230v-3ph	3 HP	9.1 amps	10.0 gpm	4.3 gpm	20.0 gpm	150 psi	33 gpm
	460v-3ph	3 HP	4.2 amps	10.0 gpm	4.3 gpm	20.0 gpm	150 psi	33 gpm
ML-VRO-8	220v 1ph	3 HP	16.0 amps	12.5 gpm	5.4 gpm	25.0 gpm	150 psi	43 gpm
	230v-3ph	3 HP	9.1 amps	12.5 gpm	5.4 gpm	25.0 gpm	150 psi	43 gpm
	460v-3ph	3 HP	4.2 amps	12.5 gpm	5.4 gpm	25.0 gpm	150 psi	43 gpm
ML-VRO-9	220v 1ph	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	230v-3ph	4 HP	11.3 amps	15.3 gpm	6.3 gpm	30.0 gpm	150 psi	42 gpm
	460v-3ph	4 HP	5.5 amps	15.3 gpm	6.3 gpm	30.0 gpm	150 psi	42 gpm
ML-VRO-12	220v 1ph	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	230v-3ph	7.5 HP	18.7 amps	20.4 gpm	8.8 gpm	40 gpm	150 psi	56 gpm
	460v-3ph	7.5 HP	8.9 amps	20.4 gpm	8.8 gpm	40 gpm	150 psi	56 gpm

\*Based upon 77° softened water

# Plumbing

# Plumbing

Table 2

<i>Model #</i>	<i>Number of Membranes</i>	<i>Pump HP</i>	<i>RO Inlet Size</i>	<i>Product Water Outlet Size</i>	<i>Reject Water Outlet Size</i>	<i>Feed Flow Required</i>	<i>Min psi</i>
ML-VRO-1800	1	1/2 HP	3/4"	1/2"	1/2"	2.5 gpm	20 psi
ML-VRO1	1	1 HP	3/4"	1/2"	1/2"	3.3 gpm	20 psi
ML-VRO2	2	1 HP	3/4"	1/2"	1/2"	6.5 gpm	20 psi
ML-VRO3	3	2 HP	3/4"	1/2"	1/2"	9.6 gpm	20 psi
ML-VRO4	4	2 HP	1"	1"	1/2"	12.7 gpm	20 psi
ML-VRO5	5	3 HP	1"	1"	1"	15.9 gpm	20 psi
ML-VRO6	6	3 HP	1"	1"	1"	19.0 gpm	20 psi
ML-VRO8	8	3 HP	1"	1"	1"	25.4 gpm	20 psi
ML-VRO9	9	4.5 HP	1-1/2"	1"	1"	28.8 gpm	20 psi
ML-VRO12	6/6	Dual 3 HP	1-1/2"	1"	1"	38.0 gpm	20 psi

## Plumbing

Feed water supply must maintain a pressure of 10 psi to 90 psi while supplying adequate flow required by R.O. (see table 2) and must not exceed 110°F

ML-VROF-1 through ML-VROF-4 systems come with the pre-treatment carbon filter mounted to the R.O. frame and will be plumbed to the inlet pre-filter housing, carbon filter drain will need to be plumbed. Systems larger than 4 membranes will have a separate carbon filter which will need to be filled, placed and plumbed.

Product water will need to be plumbed from outlet side of product flow meter (see figure 3-1) into R.O. product water storage tank using tubing with adequate flow rating (see table 2).

Reject water will need to be plumbed from outlet side of reject flow meter (see figure 3-1) into acceptable floor drain, stack or into reject water storage tank using tubing with adequate flow rating (see table 2).



## NOTICE

Use rigid plumbing materials for: Product and Reject Water lines. Restriction in plumbing or soft materials resulting in collapse may cause an unpredictable back pressure on R.O. System. The result may cause damage to R.O. Membranes, and possibly the R.O. production pump.



## WARNING

**NEVER RUN RO SYSTEM WITH REJECT VALVE CLOSED. THIS WILL CAUSE IRREVERSABLE DAMAGE TO RO SYSTEM**



## NOTICE

Product Water is corrosive. Use only PVC, CPVC, PEX or Stainless Steel materials for product water distribution.

# Plumbing

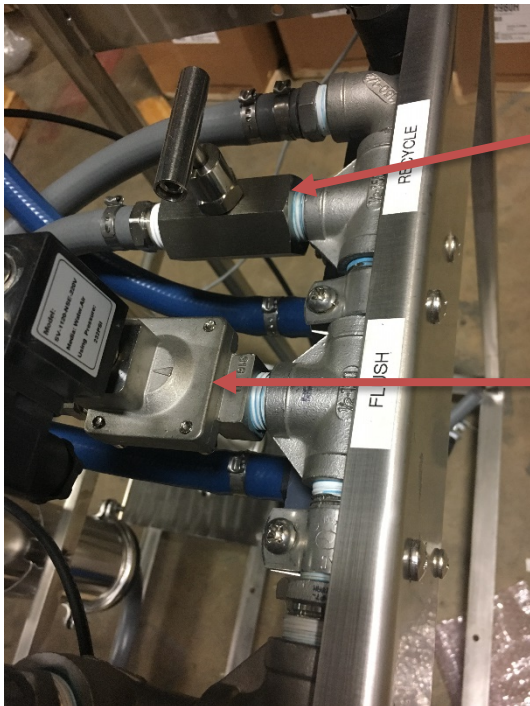
Figure 3-1



Product Water Outlet

Reject Water Outlet

Figure 3-2

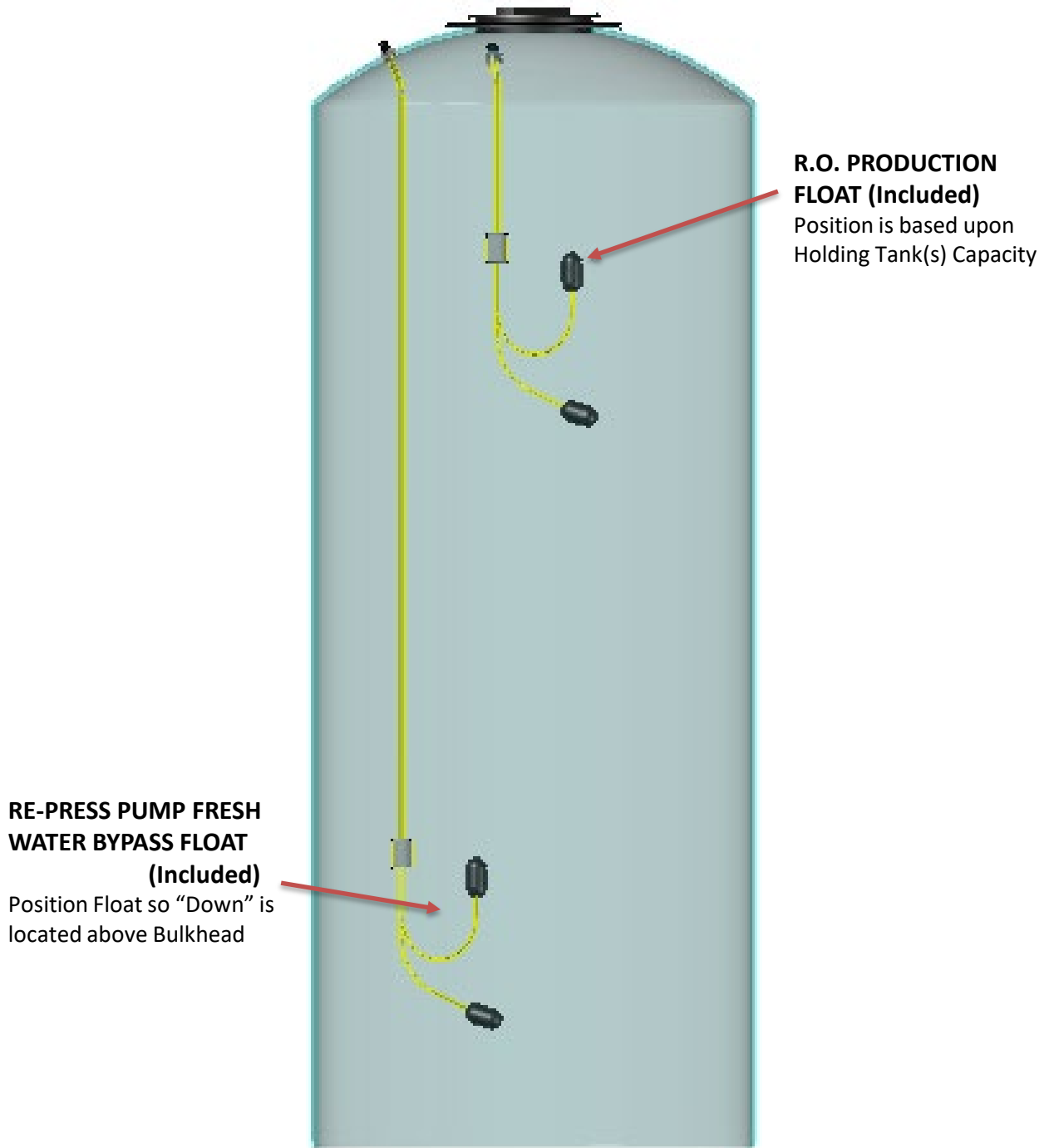


Recycle Valve

Flush Solenoid

# Plumbing

## RO Product Tank



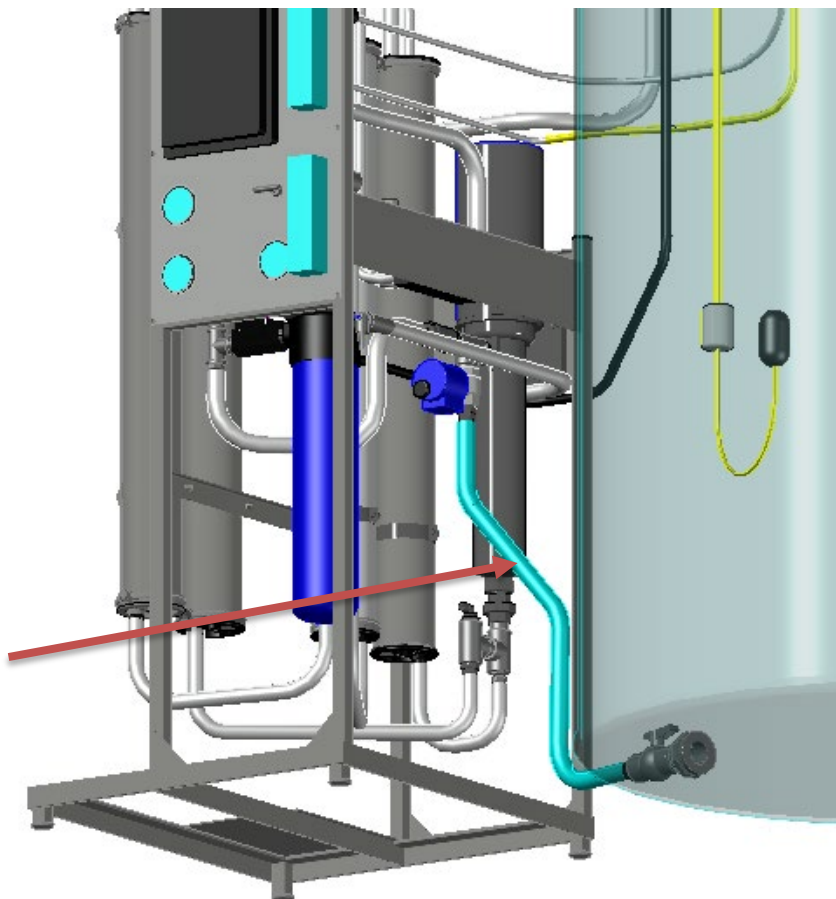
# Plumbing

## Permeate Flush (patent pending)

Permeate Flush is a patented process that uses the R.O. product (permeate) water to flush the membranes. The R.O. systems are designed to do an automatic membrane flush when a "Tank Full" condition is reached, at that time the system will open a valve that will be plumbed from the product water holding tank and flush the membranes with the product water leaving them with clean water during the resting period preventing scale build-up on the membranes.

<i><b>Model #</b></i>	<i><b>Number of Membranes</b></i>	<i><b>Permeate Flush Connection</b></i>
ML-VRO-1800	1	3/4"
ML-VRO1	1	3/4"
ML-VRO2	2	3/4"
ML-VRO3	3	3/4"
ML-VRO4	4	1"
ML-VRO5	5	1"
ML-VRO6	6	1"
ML-VRO8	8	1"

**PERMEATE  
FLUSH LINE**  
Run from R.O.  
holding tank to  
permeate flush  
valve



# Carbon Filter

**WARNING**

**PLEASE RINSE  
CARBON FILTER  
THOROUGHLY  
BEFORE  
INSTALLATION**

*Carbon Media must soak 24 hours for optimal performance*

## **Carbon Set-Up Instructions**

1. Thread filter valves on tanks to determine the front of the tank. Mark front with tape or marker.
2. Set tank in place with front, forward facing.
3. Level tank. Tank should be shimmed, or a level floor space should be chosen.
4. Remove filter valve.
5. Fill tank with 1/3 water to avoid damage to the laterals inside the tank while pouring media.
6. Make sure distributor is centered in the bottom of tank.
7. Cap distributor with PVC cap or duct tape so **NO** media gets into distributor.
8. Pour gravel into tank first.
9. Pour carbon into tank.
10. Fill tank with water up to 2" below threads in collar.
- 11. FOR BEST RESULTS LET CARBON SOAK FOR 24 HRS**
12. Thread filter valve onto tanks. a. Confirm O-ring is in place on bottom of valve to seal between valve and tank.
13. Be sure to install Bypass Valve onto main control valve before beginning plumbing.
14. Plumb inlet feed line to inlet of Filter Valve.
15. Plumb out of Carbon filter to inlet of R.O. system.
16. Plumb filter valve to drain.
17. After soaking carbon for 24 hrs open INLET valve only to Carbon Filter and initiate manual backwash cycle.
18. Repeat manual backwash cycle 3 times before turning water on to feed R.O. system



# Carbon Filter

## ***Auto-Backwashing Filter Valve***

### ***Set time of Day***

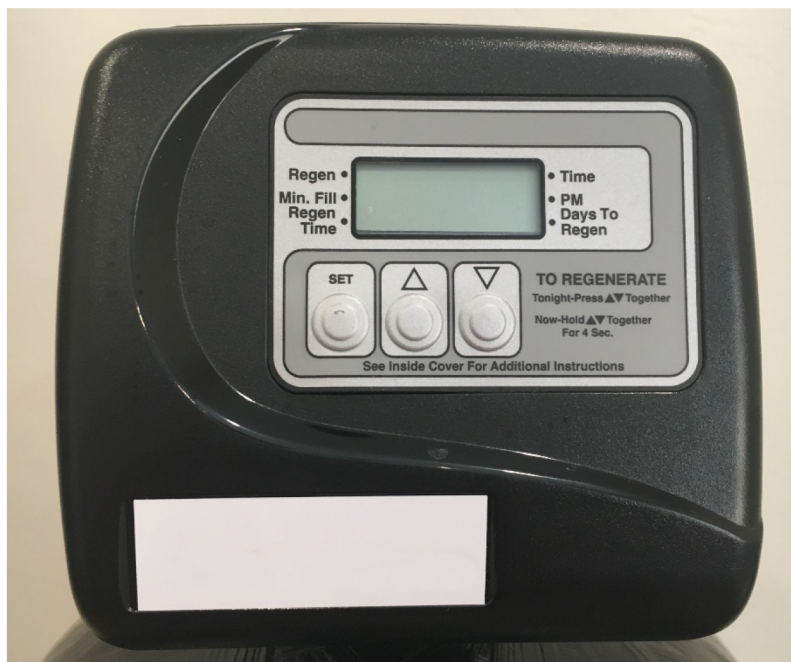
Time of day should only need to be set upon initial installation and after prolonged power outage. If prolonged power outage occurs, the time of day will flash on and off indicating that the time should be reset.

1. Press **SET HOUR**
2. **CURRENT HOUR:** Set the clock to the closest hour by using the **UP** and **DOWN** buttons. An arrow points tot the PM after 12.
3. Press **SET HOUR** to exit.

### ***Manual Backwash***

Sometimes there is a need to regenerate before the control valve calls for it or to troubleshoot problems.

- To initiate a manual regeneration *at the preset regeneration time*, press and release the **UP** and **DOWN** buttons. The arrow will point to the word Regen and the system will regenerate at the preset regeneration time (default at 2am)
- To initiate a manual regeneration *immediately*, press and hold the **UP** and **DOWN** buttons for three to five seconds. The system will begin to regenerate immediately. **This command cannot be cancelled.**



# Carbon Filter

## ***Auto Backwashing Filter Valve***

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# Carbon Filter

## R.O. Pre-Treat Switch

The Carbon Filter comes with a Pre-Treat Switch installed, this switch prevents the R.O. system from running while the Carbon Filter is backwashing. When the Carbon filter is pre-mounted to the RO frame the Pre-Treat Switch will come wired into the controller. If the Carbon Filter is separate, the Pre-Treat Switch will need to be wired into the RO control (see pages 4-2 through 4-4 for inputs)



## BYPASS VALVE OPERATION

Figure 1  
NORMAL OPERATION

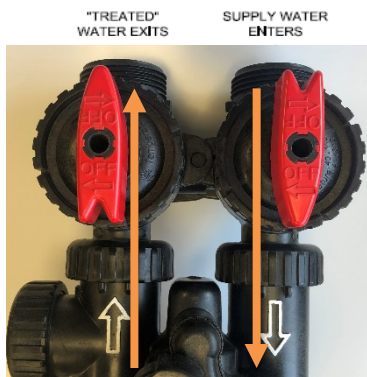


Figure 2  
BYPASS OPERATION

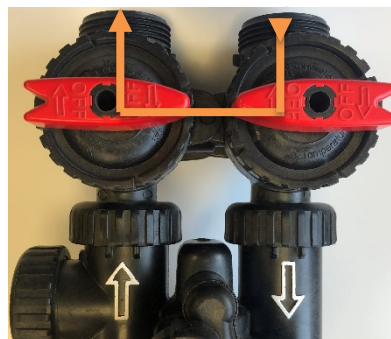


Figure 3  
DIAGNOSTIC MODE

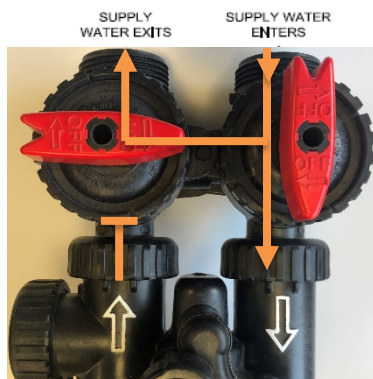
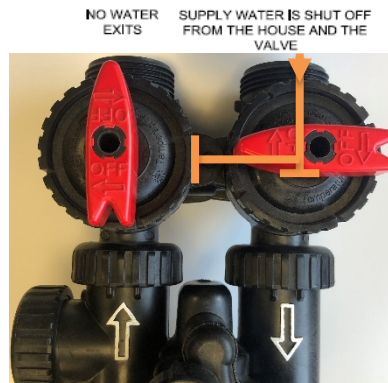


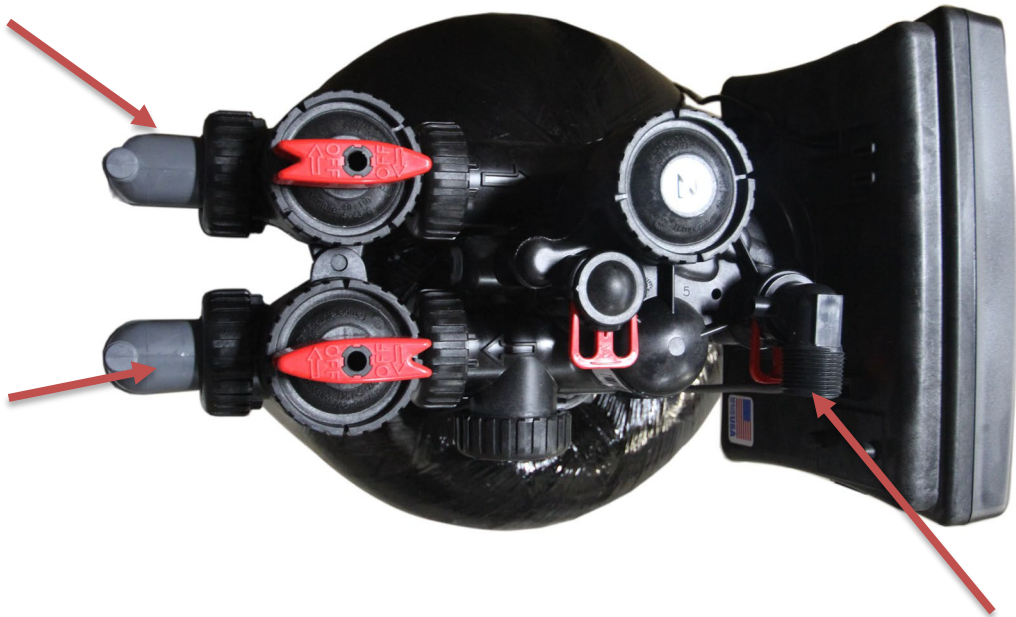
Figure 4  
SHUT OFF MODE



# Carbon Filter

Fresh  
Water  
Supply

Outlet  
to RO



**Drain** (5/8" OD Tubing or  
3/4" NPT)

## **Error Message**

If the "E1, E2, or E3" appears and flashes, record the ERROR number and contact your servicing dealer promptly. This indicates that the control valve was not able to function properly.

### **E1, 101, 1001 – Unable to recognize start of regeneration**

- Valve has just been serviced (*Unplug power from circuit board to reset*)
- Piston is obstructed (*Check Piston and Spacer Stack for obstruction*)

### **E2, 102, 1002 – Unexpected Stall**

- Piston is obstructed (*Check Piston and Spacer Stack for obstruction*)
- High drive forces on piston (*Replace piston and spacer stack assembly*)

### **E3, 103, 1003 – Motor ran too long**

- Piston not in home position (*Press SET HOUR and DOWN for 3 seconds to reset control board*)
- Motor not fully inserted (*Check that motor is inserted and engaged with pinion gear*)
- Center Drive gear reflector dirty or damaged (*Swap drive gears to have good reflector on center gear, replace drive gear*).
- Drive bracket incorrectly aligned on backplate (*Reseat drive bracket*)
- PC board not seated correctly on drive bracket (*Reinstall PC board*)

# Electrical

# Electrical

## General



Typically the electrical portion of the installation is the most substantial. Begin by referencing the supplied electrical drawings and reviewing our “Best Practice Methods” within this chapter. Understanding the electrical requirements for Miller-Leaman’s RO System, in addition to these Best Practice Methods will not only assist with a successful installation but will also ensure proper future system performance.

## Best Practice Methods



It is good practice to provide your Electrician with a “Scope of Work” prior to beginning the installation. If you do not have a scope of work outlined, you can contact your Miller-Leaman Representative for a sample scope of work for the electrical system requirements. **Refer to your supplied electrical prints for installation details.**

## Proper Grounding



It has been our experience that issues associated with improper electrical grounding can cause feedback conditions within the electrical panel that may cause un-predictable operation. We require that grounding to the service panel be done in a way that ensures that only one location common ground be connected and be in close proximity to a ground rod.



# Electrical

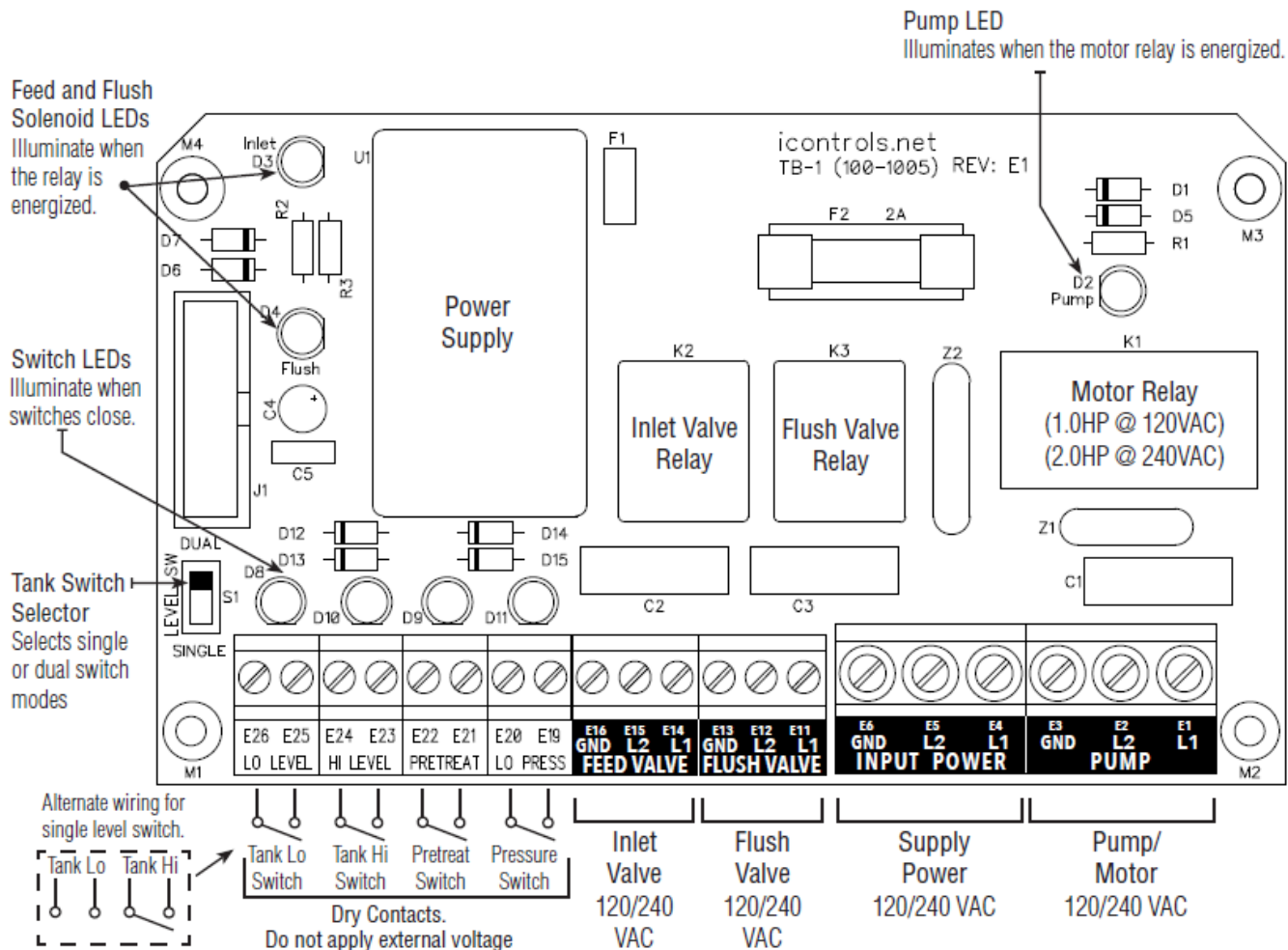
<b>MAIN POWER</b>	<b>1 HP</b>	<b>2 HP</b>	<b>3 HP</b>	<b>4.5 HP</b>
220V 1ph	8.3 amps	11.4 amps	16.0 amps	N/A
208/230V 3 ph	4.4 amps	6.6 amps	9.1 amps	11.3 amps
460/480V 3 ph	2.1 amps	3.1 amps	4.2 amps	5.5 amps

**\*\* 3 Phase Systems come with 10' 120V Cord for Display Board**

- Enclosure:
  - NEMA4X
- Display:
  - 3 Line Backlit Display
- Front Panel:
  - Overlay with LCD window, power/standby button, manual run/flush key
- Switch Inputs, Dry Contact:
  - Pressure Fault
  - Pre-Treat lockout
  - Tank Full High
  - Tank Low
- Relay Outputs:
  - R.O. Pump Relay
    - 1 Phase – 220VAC
    - 3 Phase – 110VAC
  - Inlet Valve Relay
    - 1 Phase – 220VAC
    - 3 Phase – 110VAC
  - Flush Valve Relay
    - 1 Phase – 220VAC
    - 3 Phase – 110VAC

# Electrical

## 1 Phase & Dual Pump System Controller

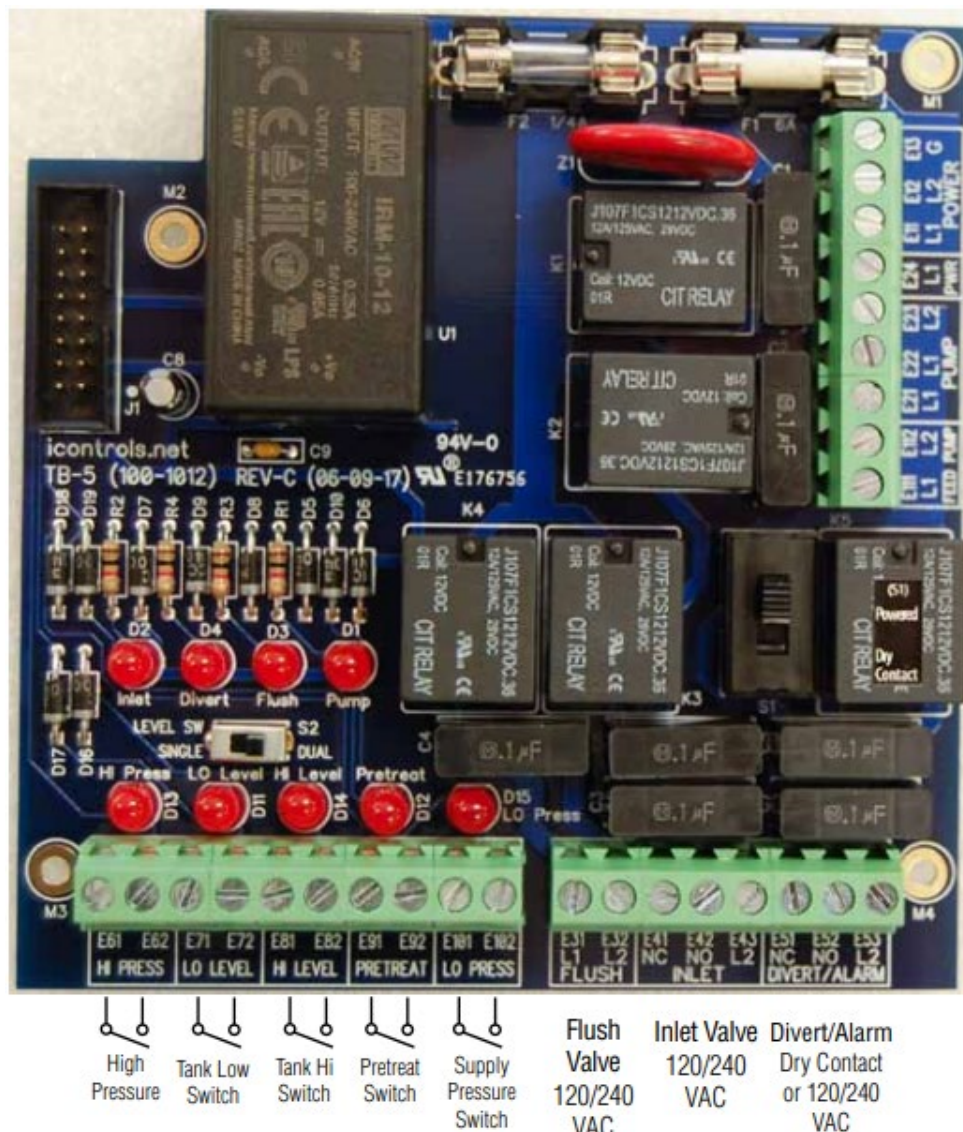






# Electrical

## 3 Phase Pump System Controller with Anti-Scalant Pump



Supply Power  
120/240 VAC

Aux Output, unswitched

RO Pump Contactor Coil  
120/240 VAC

Aux Output, Switched with pump

Feed/BW Pump Contactor  
Coil - 120/240 VAC

**S1**  
Divert/Alarm relay,  
Powered or Dry contact  
selector

**NOTE:** Switch only when  
not under load.

# Electrical

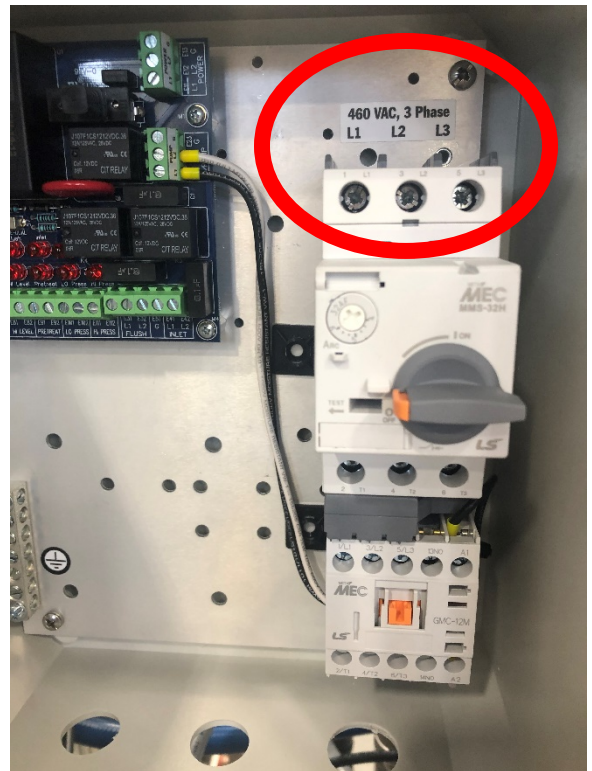
## ***RO Power***

- 208-230/240 Single Phase
  - Single Phase Systems come with a 15' cord with a L6-20 plug (see figure 4-5-1)
- 208-230/240 Three Phase
- 460/480 Three Phase
- 575 Three Phase
  - Three Phase Systems come ready to hard wire by a licensed electrician in accordance with local codes (see figure 4-5-2)

Figure 4-5-1



Figure 4-5-2



# Start-Up

# Start-Up



## **WARNING**

**CONSULT A TRAINED ELECTRICIAN. ONLY TRAINED OR AUTHORIZED INDIVIDUALS KNOWLEDGEABLE IN THE RELATED PROCEDURES SHOULD INSTALL, INSPECT, MAINTAIN OR SERVICE THIS EQUIPMENT**



## **WARNING**

**THIS EQUIPMENT CONTAINS ITEMS THAT ARE EITHER PNEUMATICALLY CONTROLLED, OR IN SUPPORT OF AN AIR OPERATED CONTROL CIRCUIT. DISCONNECT AND DISSIPATE STORED PRESSURE IN LINES PRIOR TO SERVICING, OR MAINTAINING EQUIPMENT**



## **NOTICE**

**CONSULT A TRAINED TECHNICIAN. ONLY A TRAINED OR AUTHORIZED INDIVIDUAL, KNOWLEDGEABLE IN THE RELATED PROCEDURES SHOULD INSTALL, INSPECT, MAINTAIN OR SERVICE THIS EQUIPMENT.**

### **Start-up Procedure**

#### **1. Service Confirmation**

- 1) Turn off all breakers in Control Panel
- 2) Turn on Main Power and Control Power at Circuit Breaker Panel
- 3) Confirm Voltage at Control Panel
  - a) Confirm that all three phases are present at the top of the Disconnect.
  - b) Confirm that three phase power is the same as is listed on the UL Label
  - c) Confirm that Control Power is present at the top of the auxiliary contact.



## **NOTICE**

**All three legs of Main Power should be balanced, and not have more than a 5VAC difference Phase to Phase. A differential greater than this may cause permanent damage to the system, and void warranties associated with the Variable Frequency Drive (VFD)**

# Start-Up

## Start-up Procedure 1 Phase Systems



1. **DO NOT BEGIN RO START UP PROCEDURE UNTIL CARBON FILTER START-UP PROCEDURE HAS BEEN COMPLETED.**
2. **ENSURE REJECT VALVE IS NOT CLOSED!**
3. **Plug in 220V L6-20 Power Cord**
4. **Close Recycle Valve**
5. **Push System On/Off Button to Turn R.O. System On**
6. **Let System Run Until Air Bubbles Have Purged Through the Rejet Flow Meter**
7. **Set reject flow rate using reject valve (1) , reading the top of the stainless steel float in flow control. Set reject water as specified in Table 5-2-1**
8. **Open Recycle Valve (3, 4 & 5) to adjust pump pressure, Miller-Leaman recommends pump pressure be set between 150-180 psi (max 210 psi).**

1. Inlet pressure above 50 psi will make it difficult to keep your pump pressure below 180, with 50 psi inlet and higher try to set pump pressure to 200 psi

NOTE: Recycle valve adjustment may affect flow rate, it may be necessary to make several adjustments to achieve proper settings

Wall Mount **3**



Floor Mount **4**



Small Frame **5**



Table 5-2-1

RO Size	ML-VRO-1800	ML-VRO1	ML-VRO2	ML-VRO3	ML-VRO4	ML-VRO5	ML-VRO6	ML-VRO8	ML-VRO9	ML-VRO12
Average Reject gpm	.75 gpm	.75 gpm	1.5 gpm	2.5 gpm	3.5 gpm	4.5 gpm	5 gpm	7 gpm	8 gpm	10 gpm
Minimum Reject gpm	.5 gpm	.5 gpm	1 gpm	1.75 gpm	2.5 gpm	3.5 gpm	4 gpm	5.5 gpm	6 gpm	8 gpm



# Start-Up

## Start-up Procedure 3 Phase Systems



**1. DO NOT BEGIN RO START UP PROCEDURE UNTIL CARBON FILTER START-UP PROCEDURE HAS BEEN COMPLETED.**

**2. ENSURE REJECT VALVE IS NOT CLOSED!**

**3. Plug in 110V Power Cord, turn disconnect to off position**

**4. Close Recycle Valve**

**5. Push System On/Off Button to Turn R.O. System On**

**6. Let System Run Until Air Bubbles Have Purged Through the Rejet Flow Meter**

**7. Turn Disconnect to On position**



**8. Set reject flow rate using reject valve (1) , reading the top of the stainless steel float in flow control. Set reject water as specified in Table 5-2-1**

**9. Open Recycle Valve (3, 4 & 5) to adjust pump pressure, Miller-Leaman recommends pump pressure be set between 150-180 psi (max 210 psi).**

1. Inlet pressure above 50 psi will make it difficult to keep your pump pressure below 180, with 50 psi inlet and higher try to set pump pressure to 200 psi

NOTE: Recycle valve adjustment may affect flow rate, it may be necessary to make several adjustments to achieve proper settings

**Wall Mount 3**



**Floor Mount 4**



**Small Frame 5**

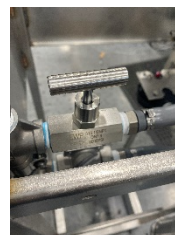


Table 5-2-1

RO Size	ML-VRO-1800	ML-VRO1	ML-VRO2	ML-VRO3	ML-VRO4	ML-VRO5	ML-VRO6	ML-VRO8	ML-VRO9	ML-VRO12
Average Reject gpm	.75 gpm	.75 gpm	1.5 gpm	2.5 gpm	3.5 gpm	4.5 gpm	5 gpm	7 gpm	8 gpm	10 gpm
Minimum Reject gpm	.5 gpm	.5 gpm	1 gpm	1.75 gpm	2.5 gpm	3.5 gpm	4 gpm	5.5 gpm	6 gpm	8 gpm

# Operation & Programming



# Operation

## Standard Set Points

**TDS / Cond Limit:** When the value is met or exceeded the display will show a High Cond. Alarm (Default = 100)

**TDS/Cond Delay:** When the limit set point is exceeded, no alarm will be given until this time has expired. (Default = 30)

**R.O. Run Delay:** The amount of time between the inlet valve opening and the R.O. pump start. (Default = 10)

**Press Fault Delay:** The time a pressure fault must be active before a pressure fault shutdown occurs. (Default = 10)

**Auto Reset:** When a pressure fault shut down is active, the system will attempt to restart after this delay. After 5 consecutive faults the system must be manually reset. (Default = 5 auto restarts)

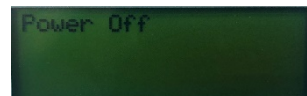
# Operation

## Display Screens

**Display:** The display is a 3-line X 20 character back-lit liquid crystal display. System operating status and sensor readings are shown on this display. Set point information is also shown on the display.

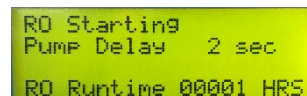
**Operating Status Messages:** The operating status of the unit is shown on the top line of the display. The following list describes the items shown for the operating status

**POWER OFF** – The unit is Powered Off.



Power Off

**RO START DELAY** – The unit is in R.O. start delay. The number of seconds remaining before the R.O. pump starts is displayed.



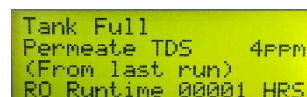
RO Starting  
Pump Delay 2 sec  
RO Runtime 00001 HRS

**RO RUNNING** – The R.O. unit is producing R.O. water.



RO Running  
Permeate Temp 71°F  
Permeate TDS 2ppm  
RO Runtime 00001 HRS

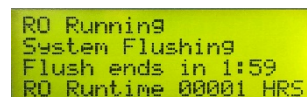
**TANK FULL** – The unit is shut down due to a tank full condition  
- Unit will run when float returns to down position



Tank Full  
Permeate TDS 4ppm  
(From last run)  
RO Runtime 00001 HRS

**RO FLUSHING** – Membrane Flush is occurring. The number of minutes remaining in the flush cycle is displayed.

\*R.O. Flush occurs when R.O. reaches Tank Full condition



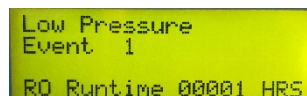
RO Running  
System Flushing  
Flush ends in 1:59  
RO Runtime 00001 HRS

**PRETREAT ALARM** – The unit is shutdown due to a pretreat lockout condition caused by the carbon filter backwashing.



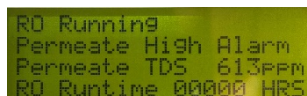
Service Fault  
Pretreat  
Check Pretreat Sys.  
RO Runtime 00000 HRS

**PRESS FAULT** – The unit is shutdown due to a low pressure condition.



Low Pressure  
Event 1  
RO Runtime 00001 HRS

**HIGH TDS/CONDUCTIVITY** – The unit is shut down due to a high TDS level in the product water, this level is field adjustable and is Indicated by on-screen message and audible alarm.



RO Running  
Permeate High Alarm  
Permeate TDS 613ppm  
RO Runtime 00000 HRS

### TDS/Conductivity

The TDS/Conductivity is shown on the top line after the operating status

### Operating Hours

The current operating hours are shown on the bottom line.

### Temperature

The current water temperature is shown on the bottom line after the operating hours

# Maintenance

# Pre-Filter Replacement

R.O. Pre-Filters are recommended to be changed monthly, follow steps below to change the R.O. Pre-Filter

## Monthly Pre-Filter Change Instructions

1. Turn off RO system by holding System ON/OFF button
2. Shut off water to R.O. System using the carbon filter bypass (see figure 7-1-1), if the carbon filter does not have a bypass pre-installed a shut-off must be installed between carbon filter and R.O.
3. Relieve pressure using pressure relief/sample port. (see figure 7-1-2)
  1. If your system does not have sample port use red pressure relief button
  2. **NOTE: IF YOU DO NOT RELIEVE PRESSURE YOU WILL NOT BE ABLE TO REMOVE HOUSING**
4. Using filter wrench remove filter housing.
5. Remove old filter
6. Rinse out filter housing.
7. Install new filter, making sure hole in the middle is lined up with nipple at bottom of housing.
8. Verify housing O-ring is in place.
9. **HAND TIGHTEN HOUSING BACK IN PLACE, DO NOT USE WRENCH TO TIGHTEN HOUSING.**
10. Turn water back on to R.O. system.
11. Turn R.O. system back ON.

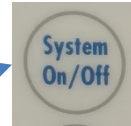


Figure 7-1-1

### SHUT OFF MODE

NO WATER EXITS  
SUPPLY WATER IS SHUT OFF FROM THE HOUSE AND THE VALVE

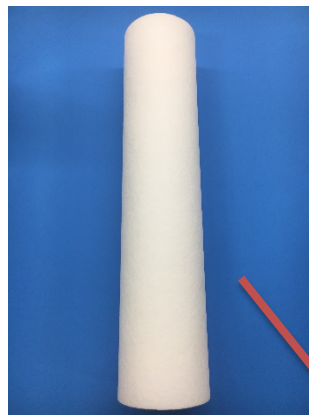
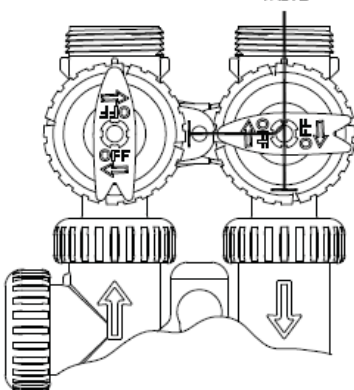


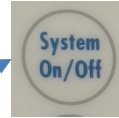
Figure 7-1-2



RO Model #	Pre-Filter Part #	Membrane Part #
ML-VRO1-3	230-001-FL	230-440-FL
ML-VRO4-12	230-002-FL	230-440-FL

# Membrane Replacement

R.O. membranes will need to be replaced periodically due to wear creating a high TDS condition or they may get fouled due to organics or bacteria. When one of these situation occurs follow the steps below to replace membranes.



1. Turn off R.O. system by holding System ON/OFF button.
2. Shut off water to R.O. System using the carbon filter bypass (see figure 7-1-1), if the carbon filter does not have a bypass pre-installed a shut-off must be installed between carbon filter and R.O.
3. Remove Clamps on membrane housing caps (see figure 7-2-1)
4. Using flathead screwdriver CAREFULLY pry caps out of housings (see figure 7-2-2)
5. Remove membrane from housing, NOTE DIRECTION OF ARROW ON MEMBRANE OR LOCATION OF SEAL ON MEMBRANE (see figure 7-2-3)
6. Remove new membrane from plastic.
7. Install new membrane in proper direction (see figure 7-2-4), spinning membrane as you insert it to ensure the brine seal does not fold over.

**NOTE: DO NOT USE SILICONE OR PETROLEUM BASED LUBRICANTS ON CAP O-RINGS OR MEMBRANE SEALS**

8. Replace membrane cap.
9. Replace membrane clamp.
10. Open Valve turn R.O. back ON



Figure 7-2-1



Figure 7-2-2

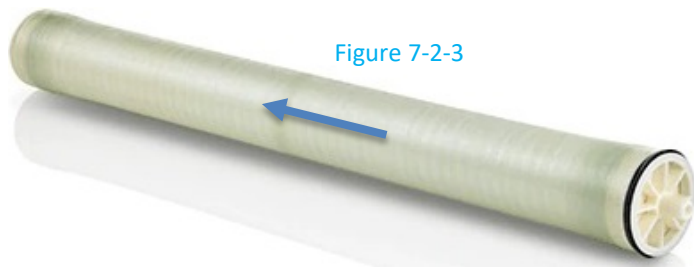


Figure 7-2-3



Figure 7-2-4

Membrane Part# 230-440-FL

## Performance Log

[illegible]

# Troubleshooting

Low Pressure  
Event 1

RO Runtime 00001 HRS

## RO Technical Protocol "Low Inlet Pressure"

<i>Fault</i>	<i>Possible Cause</i>	<i>Action</i>		<i>Resolution</i>
<b>Low Inlet Pressure</b>	<b>A. Pre-Filter</b>	<b>1A</b>	Check when last time filter was changed	Change Filter if over 1 month, run RO to verify issue is resolved
		<b>2A</b>	Check if filter looks dirty	Change Filter, run RO to verify issue is resolved
		<b>3A</b>	Remove filter and run RO for a minute or so to confirm if filter is causing restriction	Change Filter, run RO to verify issue is resolved
	<b>B. Carbon Filter</b>	<b>1B</b>	Bypass carbon filter and run RO to verify if carbon filter is causing restriction	Replace or Rebed Carbon Filter
		<b>2B</b>	Backwash carbon filter then run RO to see if problem is resolved	Increase backwash frequency
		<b>3B</b>	Verify carbon filter sizing and max flow rates will accommodate RO size	Replace Carbon Filter with correct size
	<b>C. Water Softener</b>	<b>1C</b>	Bypass water softener and run RO to verify if softener is causing restriction	Replace or Rebed Softener
		<b>2C</b>	Verify softener sizing and max flow rates will accommodate RO size	Replace softener with correct size
	<b>D. RO Pressure Switch</b>	<b>1D</b>	Verify there is sufficient Pressure feeding the RO system on front panel Inlet pressure gauge	Replace switch if pressure gauge reading over 10psi and RO shutting down
		<b>2D</b>	Check RO terminal board	Jump pressure switch on terminal board to verify terminal board is working
	<b>E. Feed Supply Volume and Pressure</b>	<b>1E</b>	Verify gpm feeding RO system	If water volume is not sufficient consult with our Technical team for options
		<b>2E</b>	Verify pressure feeding RO system	If sufficient volume is available but pressure is low install booster pump



# ***Fault Conditions***

***Pre-Treat Fault:*** Pre Treat fault works in conjunction with the carbon filter.

- Check if carbon filter is in backwash. If carbon filter is backwashing during operating hours check to see that time of day is set correctly on carbon filter, change if necessary.
- If carbon filter is not in backwash contact your distributor.
- Check wire connections on the Pre-Treat Micro Switch connected to the carbon filter.
- Check that micro switch is operating properly.

***Permeate Conductivity Fault:*** Permeate conductivity fault is a result of TDS level of the product water reading higher than R.O. control set point.

- Adjust reject valve higher to try to lower the TDS reading.
- Adjust recycle valve higher to try to lower the TDS reading.
- Check Conductivity Probe Wiring
- Contact distributor for replacement membranes.



# MILLER-LEAMAN

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