AmeriWater
The Water Purification Specialists

INDUSTRIAL RO

OPERATION & MAINTENANCE MANUAL

MODELS: IRO & HRO

Manufactured With Pride
In The USA

www.ameriwater.com • 800-535-5585

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98-0024F

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SECTION 1, GENERAL INFORMATION

1.1 THEORY OF OPERATION

Osmosis occurs when a semi-permeable membrane, one permeable to water but not to salts or organic molecules in solution, separates water or a dilute solution from a more concentrated solution. Water molecules have a stronger tendency to escape from water than from a solution. Water flows through a membrane by osmosis from the dilute to the concentrated side in an effort to equalize the osmotic pressures of the two solutions. If two solutions are placed side by side in two arms of a U-tube, with a semi-permeable barrier between them, the water will rise in the more concentrated side and diminish in the side containing the dilute solution (or pure water). The relative heights of the solutions at equilibrium are a measure of their osmotic pressure differences in “head height”.

The process of osmosis can be reversed by placing pressure upon the feed water side (concentrated solution side) of the membrane. Water will be forced through the membrane barrier to yield water that is purer on the lower pressure side of the membrane than on the more concentrated solution side (higher pressure side) of the membrane. The feed water will become more “concentrated,” and will be discharged through the reject port known as “reject water” or “concentrate”.

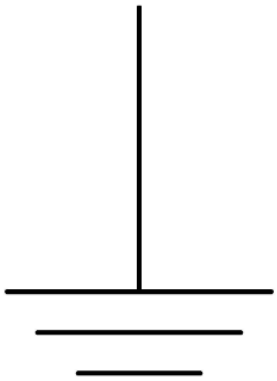
Hence, the liberation of purer water from its solutions is caused by the reversal of the osmotic pressure; the operation is termed “Reverse Osmosis”. Reverse Osmosis is commonly referred to as “RO”.

1.2 CAUTIONARY SYMBOLS

Caution, risk of electrical shock!
Attention, risque de choc électrique!

Open by qualified service personnel only!
Ouverture par le personnel qualifié seulement!

Refer to this Operation and Maintenance Manual for instructions and safety considerations. **Référez-vous au manuel des Opérations et Entretien pour instructions et mesures de sécurité.**



Earth Ground terminal
Borne de mise à la terre

SECTION 2, TECHNICAL INFORMATION

2.1 IRO SPECIFICATIONS

	IRO2	IRO3	IRO4	IRO5	IRO6	IRO8
PERFORMANCE:						
Projected Rejection	>96%					
Production (GPD)*	4000	6000	8000	10,000	12,000	16,000
Product Flow (GPM)*	2.8	4.2	5.5	7	8.3	11.1
Recovery:	50% - 75%					
ELECTRICAL:						
Single Phase	IRO21, IRO31, IRO41, IRO51, IRO61, & IRO81: 220V / 1-PH					
Three Phase	IRO22, IRO32, IRO42, IRO52, IRO62, & IRO82: 208V / 3-PH					
Three Phase	IRO23, IRO33, IRO43, IRO53, IRO63, & IRO83: 230V / 3-PH					
Three Phase	IRO24, IRO34, IRO44, IRO54, IRO64, & IRO84: 460V / 3-PH					
Three Phase	IRO63, & IRO84: 575V / 3-PH					
Horsepower	2 HP thru IRO5					
Horsepower	3 HP for IRO6, IRO8					
MEMBRANES:						
Size (in)	4” Dia. X 40” Long					
Quantity	2	3	4	5	6	
Type	Thin Film Composite					
FEED WATER REQUIREMENTS:						
Max Free Chlorine	<0.1					
Temperature	33-113°F (1-45°C)					
Operating pH Range	4-11					
Cleaning pH	2.0-11.5					
Pre-filtration	5 Micron					
Pressure Range (PSIG)	20-90					
Max. Fouling Index (SDI)	<3					
DIMENSIONAL DATA:						
Connections	1” Inlet - ¾” Product - ¾” Reject					
H x W x D	72”H X 35”W X 24”D					
Ship Weight	520#	550#	575#	600#	630#	700#

* Product flow rate varies with temperature, all models are rated at 77°F (25°C) with feed water of 1500 mg/L NaCl @ 200 PSI and pH of 7.5.

2.2 HRO SPECIFICATIONS

	HRO23	HRO24	HRO33	HRO34
PERFORMANCE:				
Projected Rejection	>96%			
Production (GPD)*	20,000	20,000	30,000	30,000
Product Flow (GPM)*	13.8	13.8	20.8	20.8
Recovery:	50% - 75%			
ELECTRICAL:				
Single Phase	N/A			
Three Phase	HRO23 & HRO33: 208-230V / 3-PH			
Three Phase	HRO24 & HRO34: 460V / 3-PH			
Horsepower	7.5 HP			
MEMBRANES:				
Size (in)	8” Dia. X 40” Long			
Quantity	2	2	3	3
Type	Thin Film Composite			
FEED WATER REQUIREMENTS:				
Max Free Chlorine	<0.1			
Temperature	33-113°F (1-45°C)			
Operating pH Range	4-11			
Cleaning pH	2.0-11.5			
Pre-filtration	5 Micron			
Pressure Range (PSIG)	20-90			
Max. Fouling Index (SDI)	<3			
DIMENSIONAL DATA:				
Connections	1.5” Inlet - 1” Product - 1” Reject			
H x W x D	80”H x 45”W x 26”D			
Ship Weight	500#	500#	600#	600#

- Product flow rate varies with temperature, all models are rated at 77°F (25°C) with feed water of 1500 mg/L NaCl @ 200 PSI and pH of 7.5.

2.3 FEED WATER REQUIREMENTS

The quality of the feed water to the reverse osmosis unit must meet the following requirements:

- Hardness, max..... . 0.5grains
- Free Chlorine, max ..... 0.01 ppm
- Turbidity, max .....1 NTU
- Silt Density Index (SDI), max 3

Hardness: If the feed water exceeds 0.5 grains, use a softener to reduce the hardness.

Free Chlorine: If the feed water exceeds the free chlorine limit, remove the chlorine with a carbon filter. Chlorine is destructive to RO membranes.

Particulates: The feed water should always be processed through an inlet filter of no greater than 5 microns to remove any particles or silt that may potentially clog the membranes.

2.4 TEMPERATURE CORRECTED RO+ PRODUCTION RATES

The Product Water Flow Rate and Output decreases as the temperature of the feed water decreases. The chart below provides both Total Product Output (in **G**allons **P**er **D**ay) and Product Flow Rate (in **G**allons **P**er **M**inute).

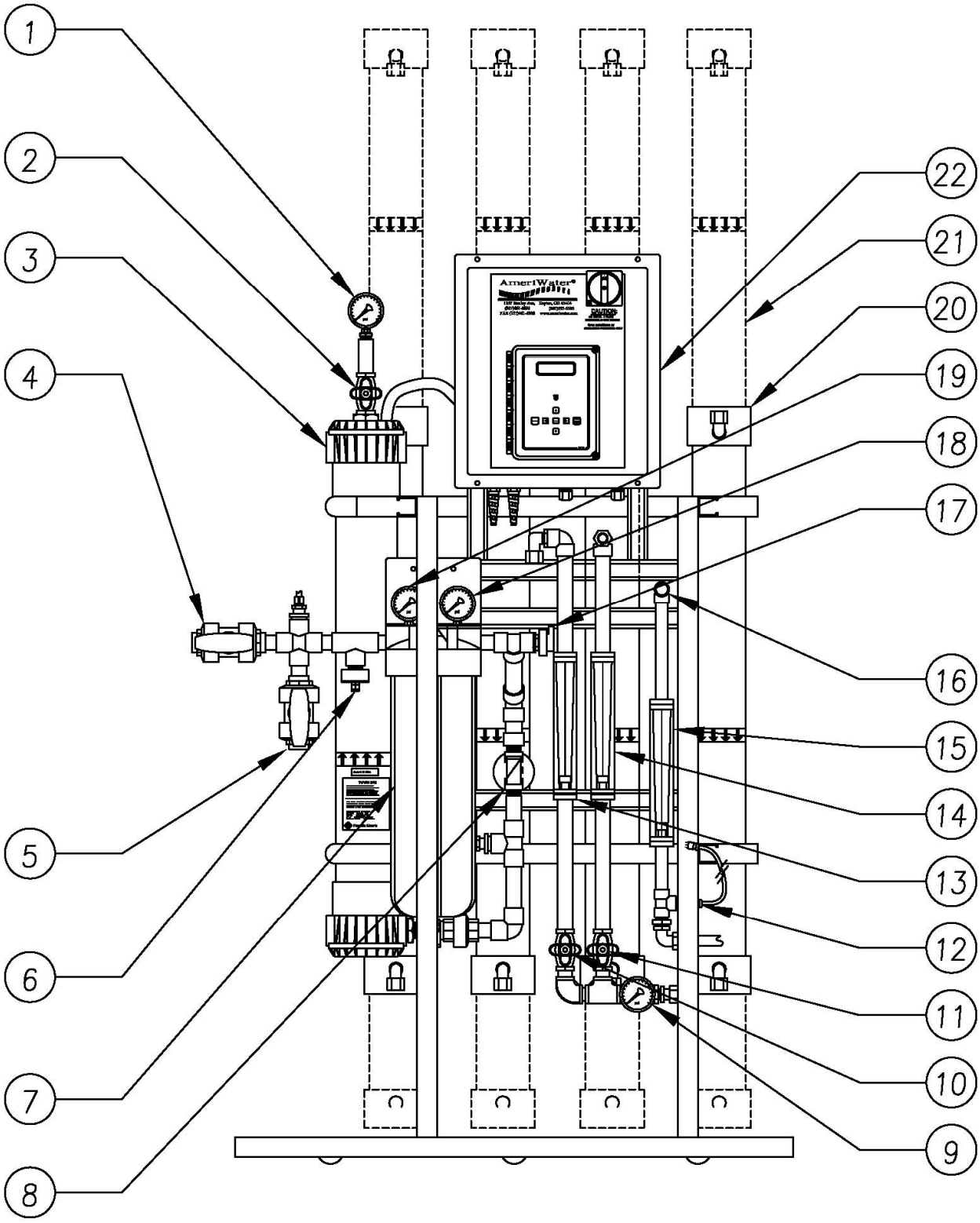
- Measure your Incoming Tap Water temperature by reading the temperature on the controller LCD display.

- Follow the chart across to find your Temperature Corrected Product Rates. On chart below 1.0 equals 100% as a multiplier.

Temperature °F	Temperature °C	Total Output %
40	4.45	.37
45	7.23	.42
50	10.01	.47
55	12.79	.51
60	15.57	.56
65	18.35	.61
70	21.13	.65
75	23.91	.70
77	25.00	1.0

SECTION 3, COMPONENTS AND SCHEMATICS

3.1 IRO COMPONENT IDENTIFICATION



1. **PUMP PSI GAUGE:** Gauge that measures the discharge of the pump in PSI.

2. **PUMP THROTTLE VALVE:** Valve that is used to throttle the output of the pump.

3. **PUMP:** Provides the driving pressure for the reverse osmosis system.

4. **INCOMING TAP WATER**: Connection point for the incoming tap water.

5. **CIP CONNECTION:** Connection for the optional membrane clean in place system.

6. **INCOMING CONDUCTIVITY SENSOR:** Cell that reads the quality of the feed water.

7. **SYSTEM PRE-FILTER:** Pre-filter for the system to remove particulate from the water prior to the RO system.

8. **INLET SOLENOID:** Opens when the RO system is on to allow water to feed through the system, closes when the system is OFF.

9. **REJECT PSI:** Gauge that measures the pressure of the water coming from reject side of the membranes in PSI.

10. **RECIRCULATION THROTTLE VALVE:** Valve that can be used to adjust the flow of water being re-circulated back to the pump.

11. **REJECT THROTTLE VALVE:** Valve that can be used to control the reject flow.

12. **PRODUCT CONDUCTIVITY SENSOR:** Cell that reads the quality of the product water.

13. **RECIRCULATION FLOW METER:** Measures the water being recirculated back before the pump, in gallons per minute (GPM).

14. **REJECT FLOW METER:** Measures the water being sent to the drain, in gallons per minute (GPM).

15. **PRODUCT FLOW METER:** Measures the flow of the Product Water in gallons per minute (GPM).

16. **PRODUCT WATER DISCHARGE:** Connection carrying Product Water.

17. **LOW PRESSURE SWITCH:** Switch to protect the pump if there is low feed pressure.

18. **PREFILTER GAUGE:** Gauge measuring the water pressure on the filter inlet in PSI.

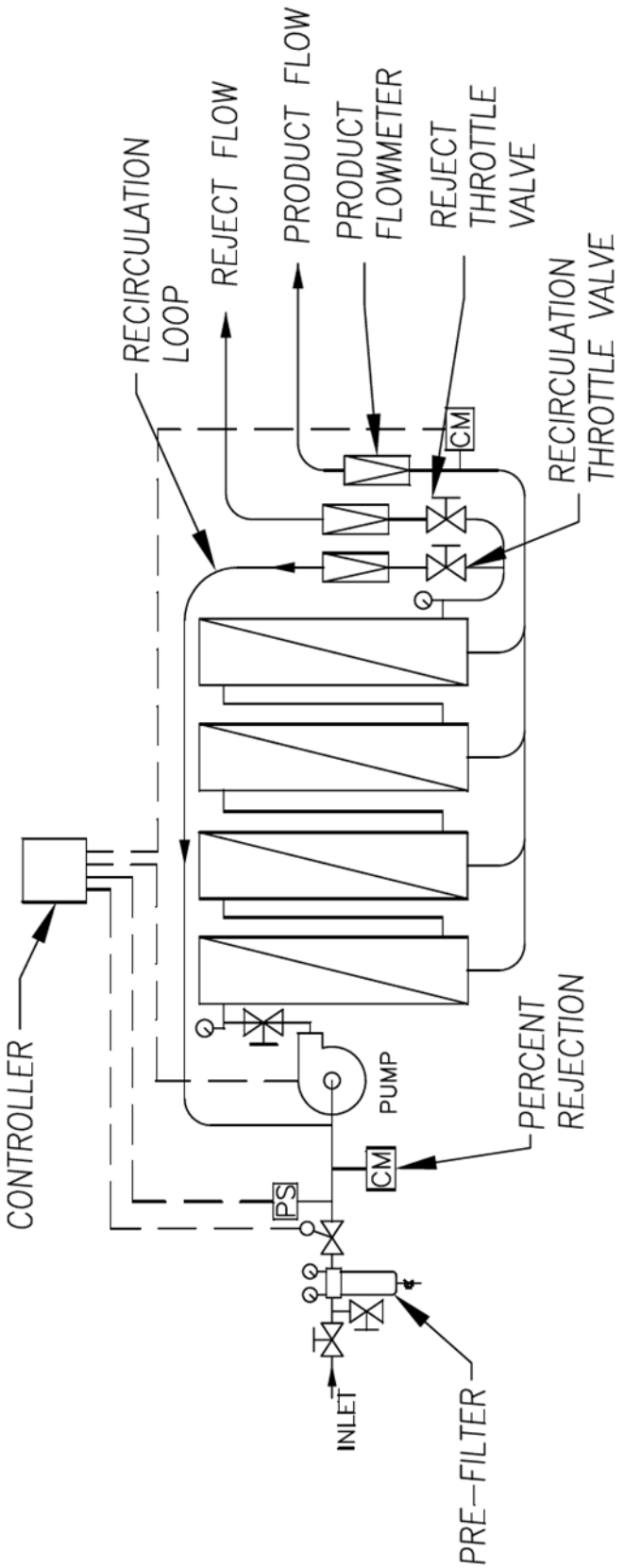
19. **POSTFILTER GAUGE:** Gauge measuring the water pressure on the filter outlet in PSI.

20. **MEMBRANE ASSEMBLY(IRO2-5):** Membrane for reverse osmosis.

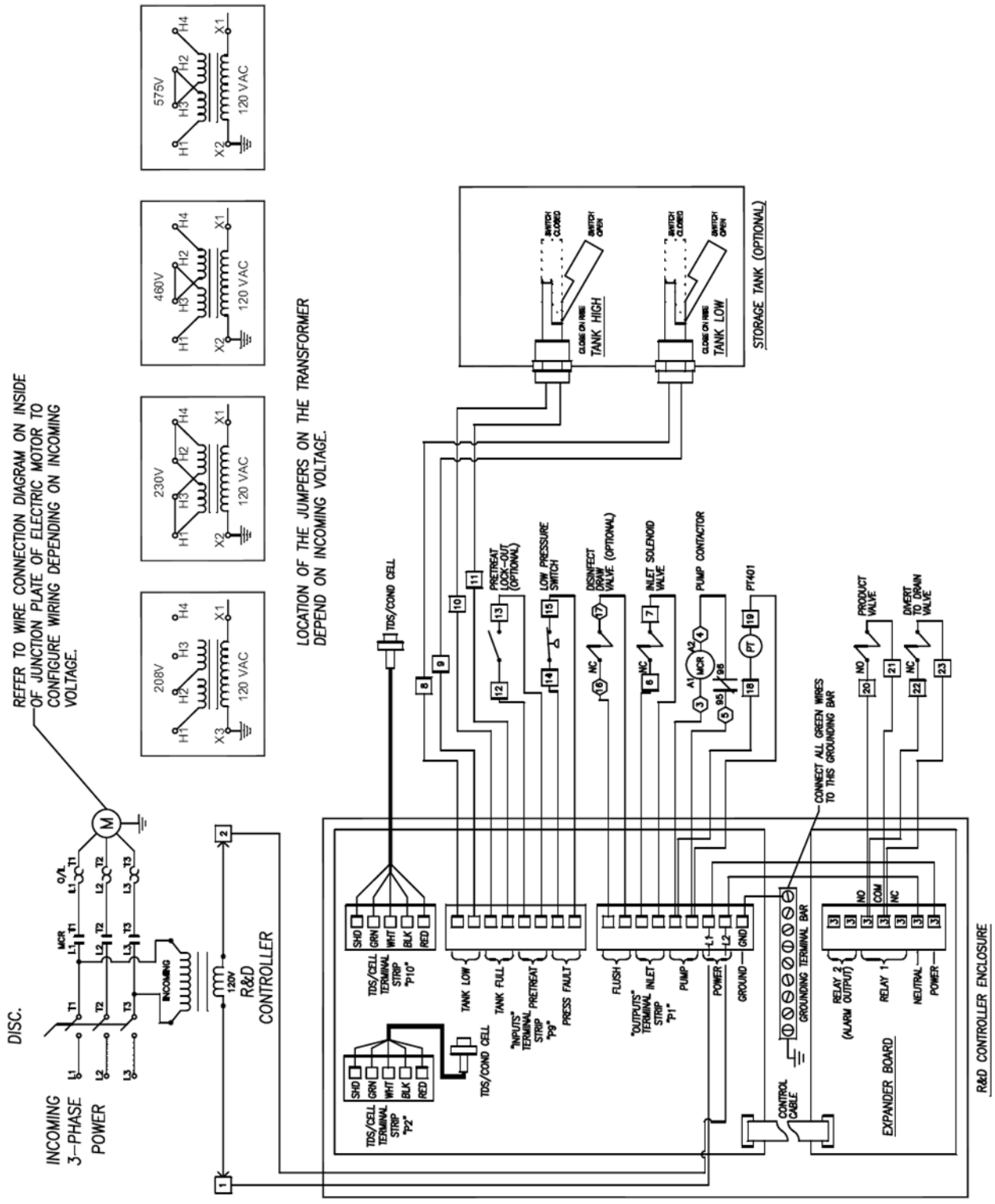
21. **MEMBRANE ASSEMBLY(IRO6-8):** Membrane for reverse osmosis, 2 per housing.

22. **CONTROLLER:** Control mechanism for the RO.

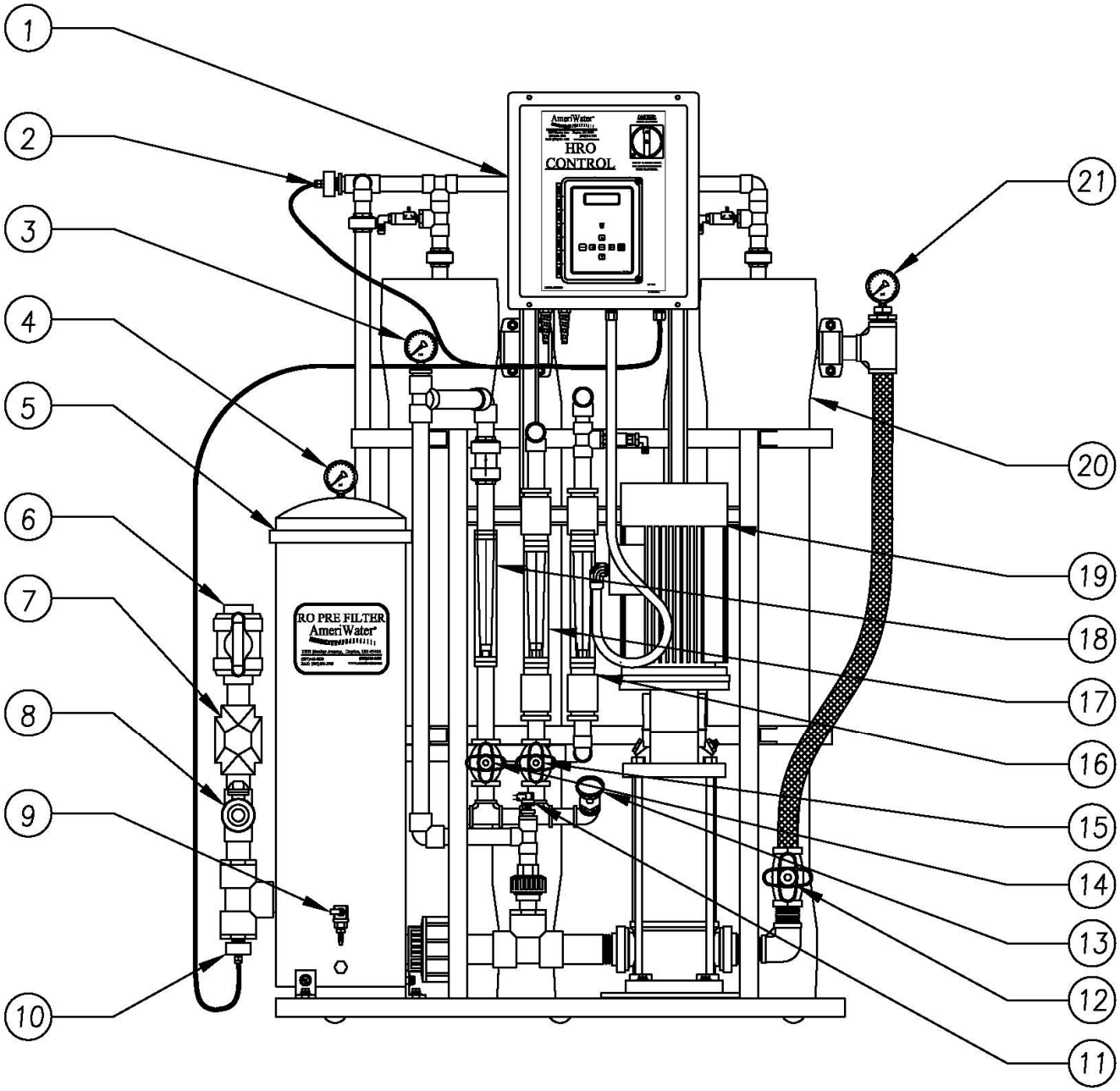
3.2 IRO FLOW DIAGRAM



3.3 IRO ELECTRICAL SCHEMATIC



3.4 HRO COMPONENT IDENTIFICATION



1. **CONTROLLER:** Control mechanism for the RO.

2. **PRODUCT CONDUCTIVITY SENSOR:** Cell that reads the quality of the product water.

3. **RECIRCULATION GAUGE:** Gauge that measures the pressure of the reject water coming back to the inlet of the pump in PSI.

4. **PREFILTER GAUGE:** Gauge measuring the water pressure on the filter inlet in PSI.

5. **SYSTEM PRE-FILTER:** Pre-filter for the system to remove particulate from the water prior to the RO system.

6. **INCOMING TAP WATER**: Connection point for the incoming tap water.

7. **INLET SOLENOID:** Opens when the RO system is on to allow water to feed through the system, closes when the system is OFF.

8. **CIP CONNECTION:** Connection for the optional membrane clean in place system.

9. **FILTER SAMPLE PORT:** Used to check the quality of water after the pre-filter.

10. **INCOMING CONDUCTIVITY SENSOR:** Cell that reads the quality of the feed water.

11. **LOW PRESSURE SWITCH:** Switch to protect the pump if there is low feed pressure.

12. **PUMP THROTTLE VALVE:** Valve that is used to throttle the output of the pump.

13. **REJECT PSI:** Gauge that measures the pressure of the water coming from reject side of the membranes in PSI.

14. **RECIRCULATION THROTTLE VALVE:** Valve that can be used to adjust the flow of water being re-circulated back to the pump.

15. **REJECT THROTTLE VALVE:** Valve that can be used to control the reject flow.

16. **PRODUCT FLOW METER:** Measures the flow of the Product Water in gallons per minute (GPM).

17. **REJECT FLOW METER:** Measures the water being sent to the drain, in gallons per minute (GPM).

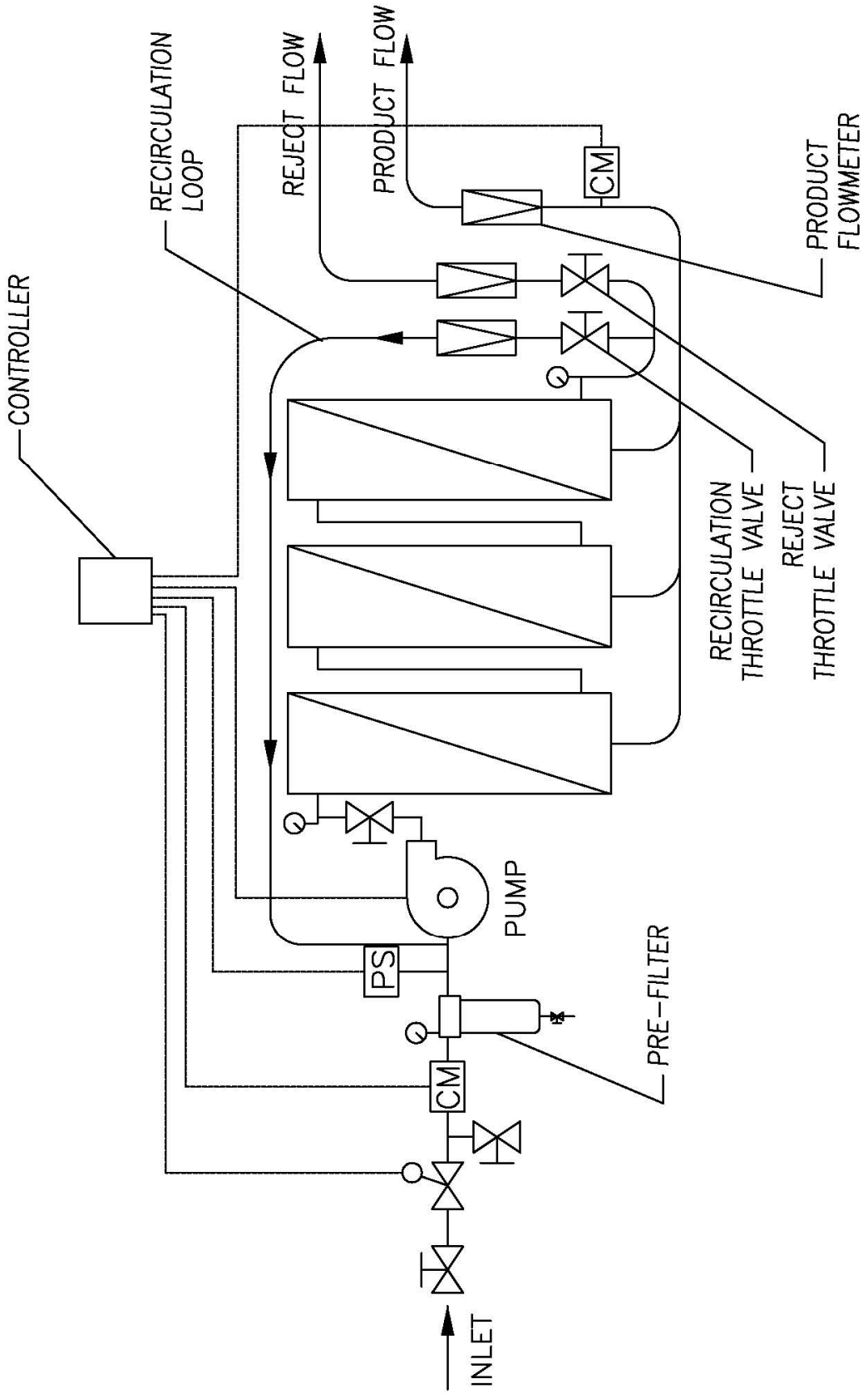
18. **RECIRCULATION FLOW METER:** Measures the water being recirculated back before the pump, in gallons per minute (GPM).

19. **PUMP:** Provides the driving pressure for the reverse osmosis system.

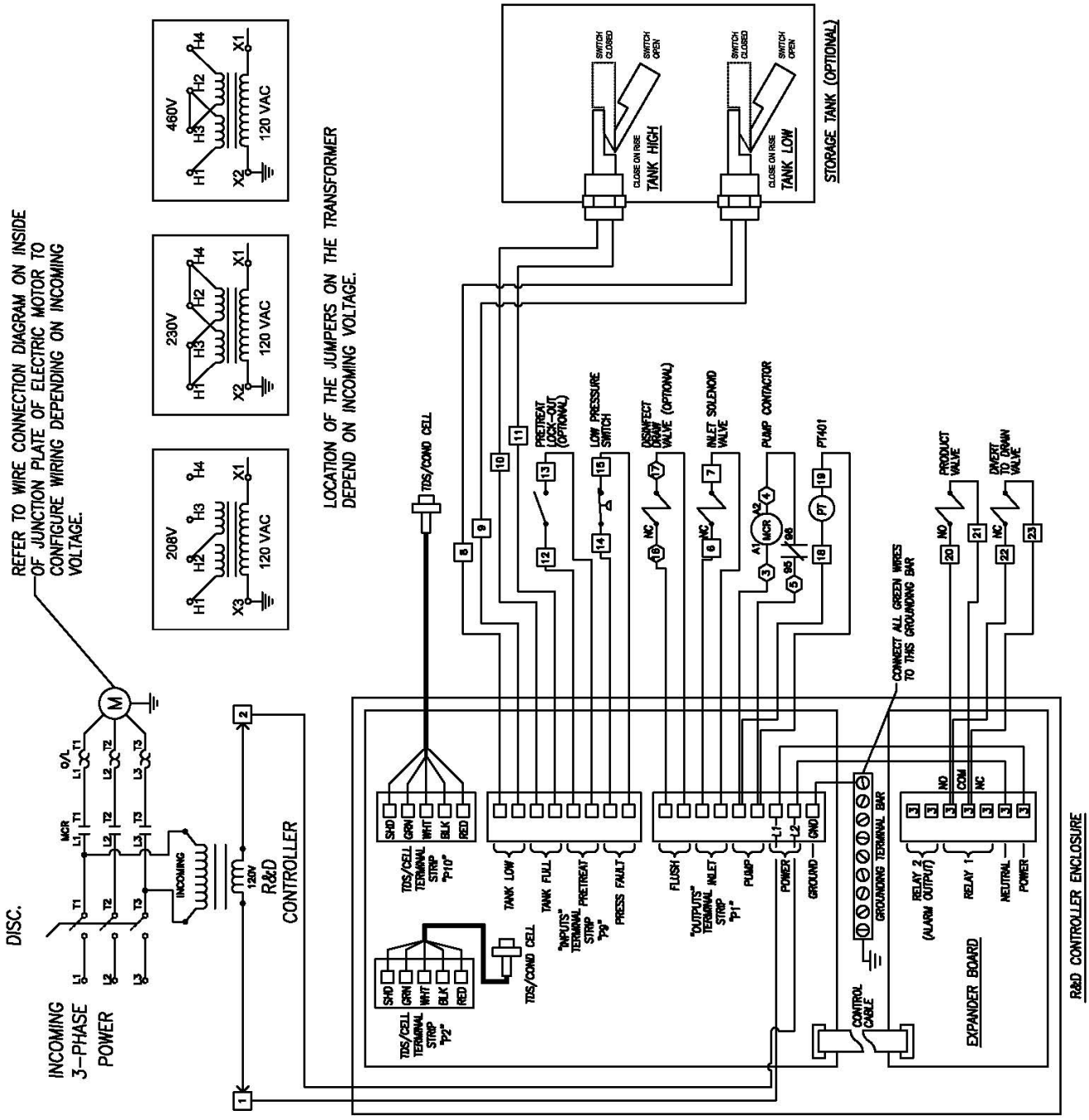
20. **MEMBRANE ASSEMBLY:** Membrane for reverse osmosis.

21. **PUMP PSI GAUGE:** Gauge that measures the discharge of the pump in PSI.

3.5 HRO FLOW DIAGRAM



3.6 HRO ELECTRICAL SCHEMATIC



SECTION 4, RO+ STARTUP & OPERATION

4.1 INSTALLATION

NOTE: This entire Operations Manual should be read before operating or servicing the RO. The Operations Manual should then be kept near the system and used as a reference and troubleshooting guide.

1. Feed water to RO must not contain chlorine, iron, manganese, oil, or large quantities of organic matter. Common waterworks water will normally meet these requirements.

2. Normally the water temperature must not exceed 80°F

3. The installation location must be dry and frost-free.

4. The pressure at the industrial RO inlet, when in operation, must be 20 PSI, minimum, and must not exceed 90 PSI. If the pressure exceeds the maximum stated pressure, or it fluctuates to pressures exceeding 90 PSI, install a pressure-reducing valve on the inlet.

5. The flow of inlet water supplied to the RO unit shall be an uninterrupted flow at 20 PSI, minimum, and at a minimum flow rate of twice the rated Product Water flow of the RO unit purchased.

6. A floor drain close to the unit is required that is capable of carrying away the reject water flow for the RO unit. The reject flow is approximately the same as the rated Product Water flow.

7. The piping, faucets, valves etc. for the Product Water outlet of the Reverse Osmosis unit must be made of PVC or corrosion resistant stainless steel.

8. The electrical power shall be provided to the RO through a 30 amp disconnect located near the unit. The voltage and phase must match and be verified to the RO unit that was purchased. Control voltage is provided within the RO unit controller via a transformer.

9. Local plumbing codes and electrical regulations must be observed and followed.

10. For the optional MQ3 Distribution Pump for IRO models, locate a dedicated 120V, 20amp outlet near the installation location of the RO.

4.2 START-UP

1. Connect the RO+ to your potable water supply using the Incoming Water hose and fittings supplied. If blending both warm and cold water to improve product flow rate, do not exceed 25C (77F).

2. Install the pre-filter cartridge(s) inside its housing (if not already factory installed).

3. The Reject To Drain hose coming out of the RO+ system is for reject water. The water from this hose will go down the drain. Leave at least a 1" to 2" of air gap between the hose, and the drain to prevent siphoning or reverse contamination.

4. Connect the storage tank float switch(es) into the appropriate terminal connector on the RO's controller board.

5. The Product Water hose should temporarily be placed near the drain to flush any initial impurities from the RO before connecting the Product Water hose to the point of use or storage tank.

6. Connect the RO to its electrical power supply through the disconnect switch on the main control enclosure. Refer to the electrical schematic for proper voltage connections.

7. Open the RO's feed water inlet valve located near the left side as facing the front of the unit.

8. Turn the RO control master switch to ON that is located at the upper right on the face of the electrical enclosure.

9. Press the RO controller switch to the ON position. A 5-10 second delay will occur before the pump starts.

10. Fully open the Reject and Recirculation throttle valves (Refer to the IRO or HRO Component Display drawings for the locations).

11. Once the pump has started, adjust the pump throttle valve located near the discharge of the pump to achieve a pressure at the inlet of the 1st membrane to about 200 PSI

12. Allow the RO to run for 30 minutes to allow components to fill with water, purge trapped air and to rinse the membranes.

13. After the flows and pressures have had time to stabilize close the recirculation throttle valve.

14. Begin to close the Reject throttle valve and adjust to a 50:50 ratio flow through the Reject flowmeter compared to the Product flowmeter.

15. Continually watch the pump pressure gauge located at the inlet of the 1st membrane and keep adjusted to around 200 PSI.

16. Adjust the Recirculation throttle valve to about 10-20% of the Reject flow, then re-adjust the Reject to be approximately equal to the Product flow (This is 50% recovery).

17. Once the RO has stabilized and all impurities have been flushed, the water will have stabilized, also. Set the water quality value at the desired limit (Refer to the controller adjustments in section 5).

18. When the RO is running stable and within desired water quality limits, Product hose can be connected to your process water system or storage tank.

19. Make copies of the log sheet in section 4.4. Record initial operating conditions on the Log Sheet, and then, periodically afterwards as determined by your Quality Department or Facilities Manager. The operating conditions should be recorded at least once each day the RO is operated.

4.3 SYSTEM SHUTDOWN

1. Before turning off the POWER key, it is recommended to fully open the reject throttle valve and allow the RO+ to flush for 5 minutes. This will flush the concentrate out of the system.

2. Press the POWER key (the display will show STANDBY).

3. Turn off the main power switch to the system.

4. Turn off the potable tap water supply to the RO.

4.4 STARTUP LOG

Reverse Osmosis System Log

Date	Softener Hardness Gr.	Chlorine ppm	RO Filter DP	RO Pump PSI	Conductivity µS	Reject GPM	Product GPM	D.I. (if app) Red/Green

SECTION 5, RO+ CONTROLLER

5.1 FRONT PANEL CONTROLS AND INDICATORS

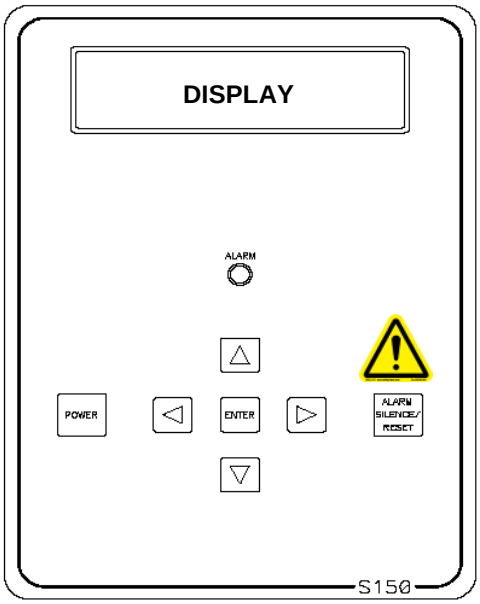


FIGURE 5.1

DISPLAY - Shows status of system.

ALARM LAMP - Flashes when fault causes an RO system shut down. On steady when a Setpoint is exceeded that does not cause an RO system shut down.

POWER KEY - Places controller in operating or standby mode.

LEFT ARROW KEY - Scrolls through Setpoints starting with first Setpoint.

RIGHT ARROW KEY - Scrolls through Setpoints starting with last Setpoint.

UP ARROW KEY - Increases value of Setpoint.

DOWN ARROW KEY - Decreases value of Setpoint

ENTER KEY - Confirms entry of new Setpoint value

ALARM SILENCE/RESET KEY - Push once for alarm silence and twice to reset system after a shut down has occurred.

ACCESSING DISINFECT MODE - Push and hold the left arrow key, and then push the right arrow key. (Not normally used)

NOTE: The J2 jumper must already be installed to make this an active mode.

DISINFECT - Push the ENTER key and hold until all of the solution is drawn into the MRO.

5.2 CONTROLLER OPERATION

General Operation

The unit has 2 modes of operation, a standby mode and an operating mode that are controlled by the POWER key. In the standby mode, the unit is effectively off. All outputs are turned off and the display shows STANDBY. In the operating mode, the unit operates automatically. All inputs are monitored and the outputs are controlled accordingly. Pressing the POWER key will toggle the unit from STANDBY to OPERATE or from OPERATE to STANDBY. If power is removed from the unit, when power is reapplied, the unit will restart in the mode it was in when power was removed.

Display

The display is a 2 line x 20-character backlit liquid crystal display. System operating status and sensor readings are shown on this display. Set point information can, also, be shown on this 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.

STANDBY - The unit is in the STANDBY mode.

DELAY 99 - The unit is in the RO start delay. The number is the seconds remaining before the RO pump starts.

OPERATING - The RO unit is operating.

TANK FULL - The unit is shut down due to a tank full condition.

TANK FULL 99 - The unit is shut down due to a tank full condition. If the number is blinking, the tank full high switch has cleared, but the tank full low switch is still active. If the number is on steady, both tank level switches have cleared and the delay is counting down.

PRETREAT - The unit is shut down due to a pretreat lockout condition.

PRESS FAULT - The unit is shut down due to a pressure fault condition.

MEMB FLUSH 99 – Membrane Flush is active. The number is the minutes remaining in the flush cycle.

CONDUCTIVITY

The Conductivity is shown on the top line after the unit operating status. When the unit is in STANDBY, because of a shut down condition, the reading is replaced with '----'. If the reading is over range, the reading is shown as '^^^^' when in the OPERATE mode.

Operating Hours

The current operating hours are shown on the bottom line.

Temperature

The current water temperature is shown on the bottom line to the right of operating hours. When the unit is in STANDBY due to a shut down condition, the reading is replaced with '---'.

Warning Messages

Warning messages are also shown on the second line. If any warnings are active, the active warnings will alternate with the normal displays for the bottom line. The following lists the warning messages.

HI COND - The Conductivity reading has exceeded the programmed limit.

Tank Full Operation

The unit can be operated with 1 or 2 level switches. With 1 level switch, the switch is connected to the tank full high input. When this switch has been active for 5 seconds, the unit will shut down on tank full. TANK FULL will show on the display. When the tank full condition clears, the display will show TANK FULL 99. The number is the tank full restart time and the unit will restart when this delay times out.

For 2 level switch operation, the upper switch is connected to the tank full high input and the lower switch is connected to the tank full low input. When both switches are "open", the RO unit will start. The RO unit will continue to run when the water level rises, and while the lower switch becomes active (closed). When the upper switch becomes active (closes), after the 5 second delay, the RO unit will shut down. TANK FULL will show on the display. When the tank level drops and the upper level switch clears, the display will show TANK FULL 99 and the RO unit will remain off. The number is the tank full restart time and the number will blink until the lower level switch clears (opens). When the lower level switch clears (opens), the number will remain steady and the RO will restart when the delay times out.

Tank Full Restart

The tank full restart is the delay before the unit starts when a tank full condition clears. This delay can be in minutes or in seconds. The TF Restart Setpoint selects seconds or minutes.

Tank Full Override

A timed tank full override can be initiated when the RO unit is shut down due to a tank full condition. Pressing the Alarm Silence/Reset key for 3 seconds during a tank full condition will enable the tank full override. The RO will start and TF OVERRIDE 9 will show on the display. The number is the minutes remaining in the override timer. When the override times out, the unit will return to the tank full shut down condition.

Pressure Fault

If the pressure fault input becomes active (closes) and stays active for the delay programmed in the PF Delay Setpoint, the unit will shut down for a pressure fault. The display will show PRESS FAULT, the alarm lamp will flash and the audible alarm will sound. The pressure fault can be cleared by pressing the Alarm Silence/Reset key twice.

Auto Reset

If a pressure fault shut down occurs and the Auto Reset Setpoint is programmed to 0, the unit will remain shut down until manually reset. If the Auto Reset Setpoint is programmed to a value greater than 0, the unit will automatically clear the pressure fault and attempt to restart after this delay times out.

Alarm Silence

When a shut down occurs that causes the audible alarm to sound, the alarm can be silenced by pressing the Alarm Silence/Reset key once. The alarm will remain silenced for 3 minutes. If the Alarm Silence Setpoint is programmed to a value other than 3, the alarm will resound after this delay times out. Pressing the Alarm Silence/Reset key will silence the alarm and reset this delay.

Pretreat

If the pretreat input becomes active (closes) and stays active for 2 seconds, the unit will shut down in a pretreat lockout condition. PRETREAT will show on the display and the unit will remain shut down as long as the pretreat input is active.

High Conductivity

If the Conductivity reading exceeds the limit programmed the Cond Limit Setpoint for the delay programmed in the Cond Delay Setpoint, the alarm lamp will light and the HI COND warning message will show on the display. This warning will clear when the Conductivity drops below the Setpoint.

When the High Conductivity warning message is active, the RO will alarm, until the Product water conductivity goes back into the acceptable quality range.

Alarm Output

The Expansion I/O relay 2 has been programmed to operate as an alarm relay. The relay will energize whenever a warning or alarm condition occurs. The relay will remain energized as long as the warning/alarm condition is active.

5.3 CONTROLLER ADJUSTMENTS

Your controller has been calibrated prior to shipment and the conductivity set point has been preset based on an analysis of your water provided at the time of sale. It may be necessary to periodically calibrate the Conductivity. If the controller should require calibration, follow the instructions below. Please contact AmeriWater at 800/535-5585 or 937/461-8833 if you have any questions regarding the procedure.

CONDUCTIVITY CALIBRATION

Refer to Figure 5.2 for adjustment location (SPAN). To calibrate the Conductivity, place the cell in a known standard solution. Adjust the span adjustment for the correct reading. If the cell is installed, the unit can be calibrated by taking a sample from the PRODUCT TEST PORT and testing it with a known, calibrated meter. Adjust the span control until the reading matches the meter.

Refer to figure 5.1 for adjustment location. To calibrate the 2nd TDS / Conductivity, place the cell in a known standard solution. Adjust the span adjustment for the correct reading. If the cell is installed, the unit can be calibrated by taking a sample of the water and testing it with a known, good meter. Adjust the span control until the reading matches the meter.

DISPLAY ADJUSTMENT

The display contrast can be adjusted for best viewing by adjusting control R3. This control is located toward the upper right corner of the board, just to the left of the cell connector.

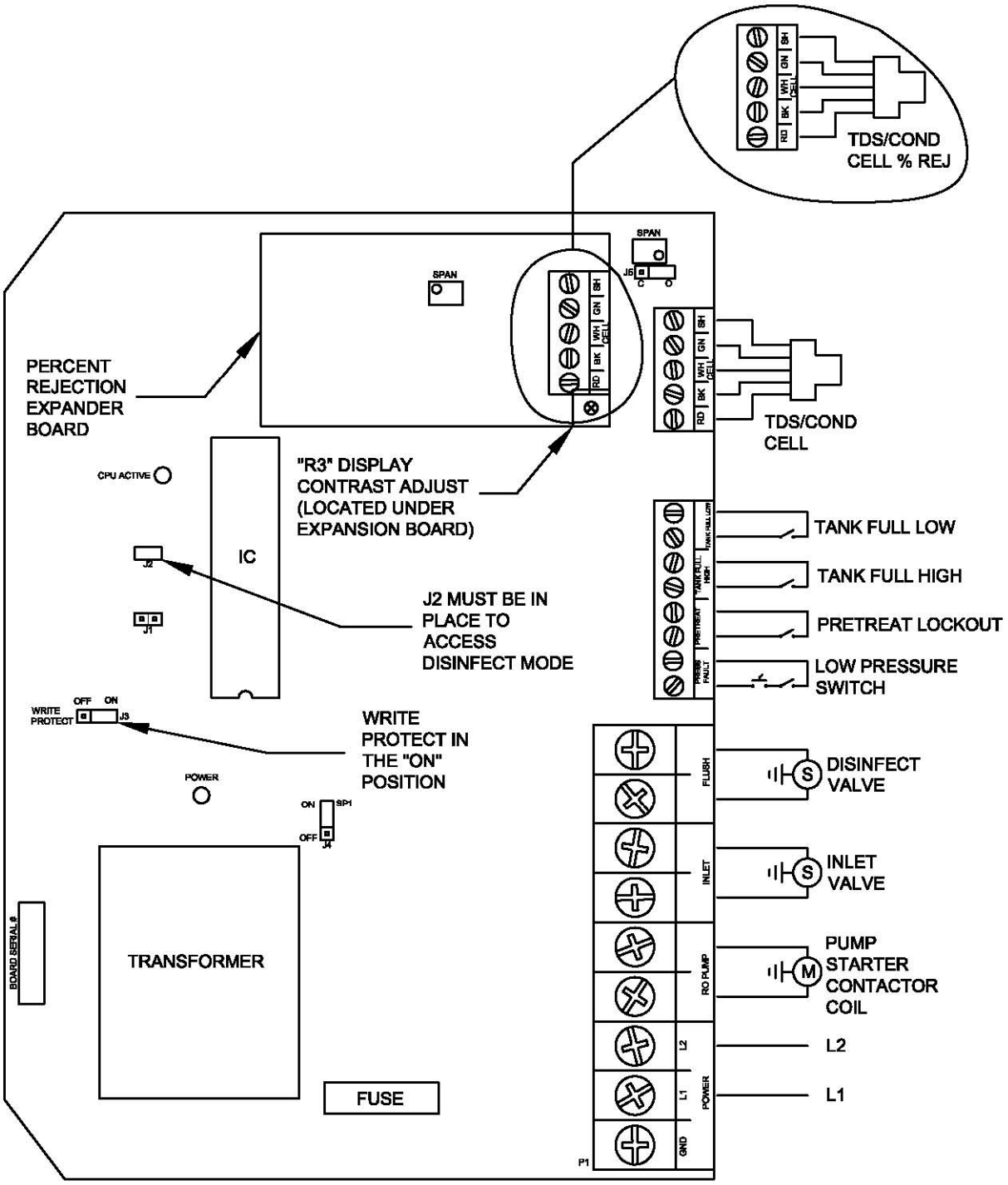

TDS/COND
CELL % REJ
SPAN
J6
PERCENT
REJECTION
EXPANDER
BOARD
TDS/COND
CELL
CPU ACTIVE
"R3" DISPLAY
CONTRAST ADJUST
(LOCATED UNDER
EXPANSION BOARD)
IC
J2
J1
J2 MUST BE IN
PLACE TO
ACCESS
DISINFECT MODE
TANK FULL LOW
TANK FULL HIGH
PRETREAT LOCKOUT
LOW PRESSURE
SWITCH
WRITE
PROTECT
OFF
ON
J3
WRITE
PROTECT IN
THE "ON"
POSITION
POWER
SP1
J4
TRANSFORMER
BOARD SERIAL #
FUSE
FLUSH
DISINFECT
VALVE
INLET
INLET
VALVE
RO PUMP
PUMP
STARTER
CONTACTOR
COIL
L2
L1
POWER
GND
P1

FIGURE 5.2

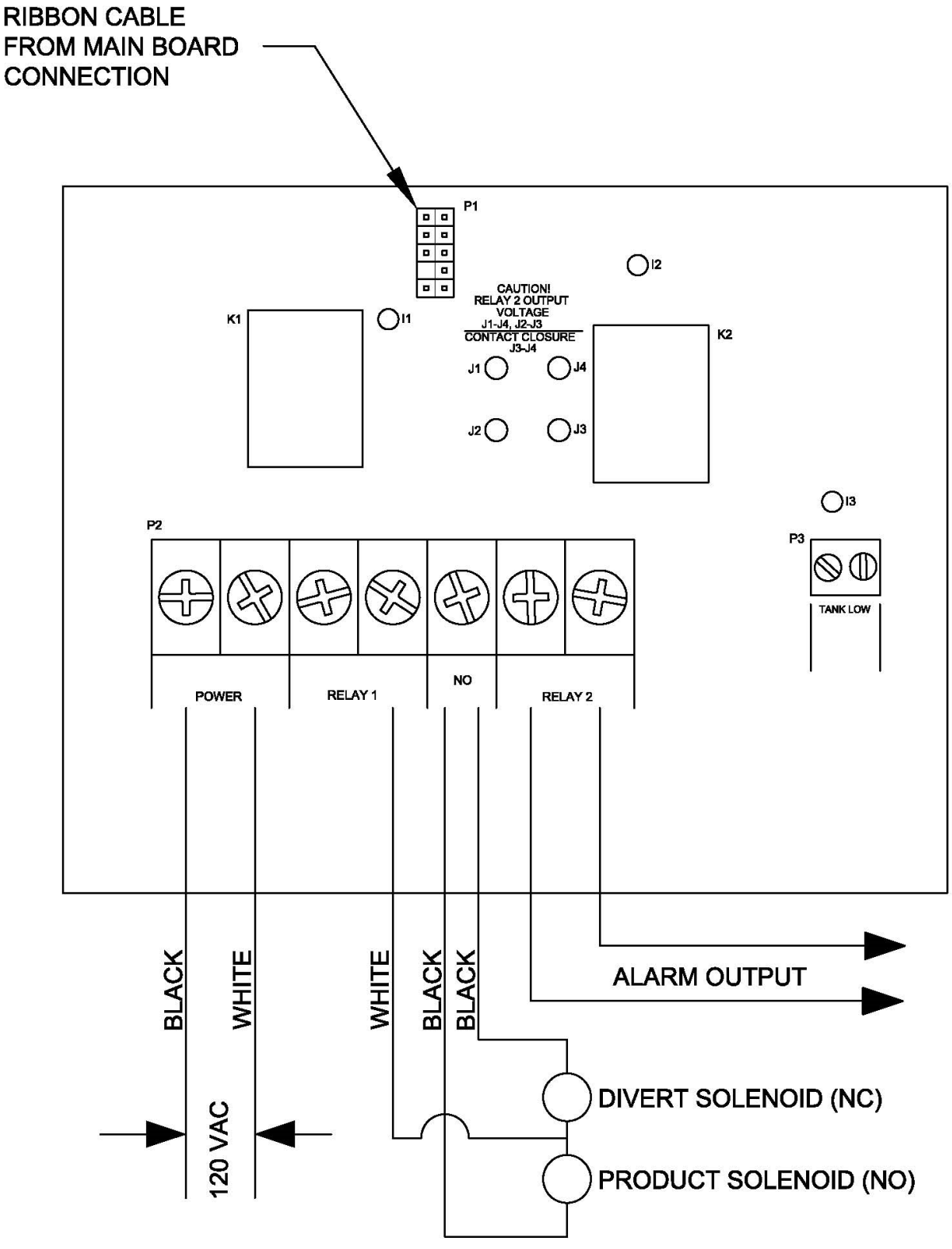

RIBBON CABLE
FROM MAIN BOARD
CONNECTION
P1
I2
CAUTION!
RELAY 2 OUTPUT
VOLTAGE
J1-J4, J2-J3
CONTACT CLOSURE
J3-J4
K1
I1
K2
J1
J4
J2
J3
I3
P2
P3
TANK LOW
POWER
RELAY 1
NO
RELAY 2
BLACK
WHITE
WHITE
BLACK
BLACK
ALARM OUTPUT
120 VAC
DIVERT SOLENOID (NC)
PRODUCT SOLENOID (NO)

FIGURE 5.3

5.4 STANDARD SETPOINTS

SETPOINT	DESCRIPTION	RANGE	FACTORY SETTING
TDS/Cond Limit	When this value is met or exceeded, the alarm lamp will light and high TDS/Cond will show on the display. To disable, set to 0.	0-999 µS or PPM*	Based on water analysis.
TDS/Cond Delay	When the limit Setpoint is exceeded, no alarm will be given until this time has expired.	0-999 seconds	10
RO Start Delay	The amount of time between the inlet valve opening and the RO pump start.	0-99 Seconds	10
Press Fault Delay	The time a pressure fault must be active before a pressure fault shut down occurs.	0-99 Seconds	10
Auto Reset	When a pressure fault shut down is active, the system will attempt to restart after this delay. If set to 0, system must be manually reset.	0-99 minutes	0
Alarm Silence	If the audible alarm is silenced, after this delay, the alarm will resound. If set to 0, the alarm will remain silenced.	0-99 minutes	3
TF Restart Delay	When a tank full condition clears, the system will restart after this delay.	0-99 sec/min	5
TF Restart	Selects whether the tank full restart delay is in seconds or minutes. 0=seconds, 1=minutes.	0-1	0
TFO Time	The amount of time that a tank full override lasts.	0-9 Minutes	3
Tank Lo Restart	Not Used		
Flush Type	Selects the type of flush. Set to 0 to disable.	0-8	0
Flush Time	The length of time a membrane flush cycle will last when flush is active.	0-99	0
Flush Interval	The interval between flush cycles. Only valid with operation hour, elapsed time or off flush types.	0-99 minutes	0

* µS = microsiemens; PPM = Parts Per Million

SETPOINT	DESCRIPTION	RANGE	FACTORY SETTING
Flush Mode	Selects if the inlet and RO pump relays operate during flush.	1-4	0
Maximum Hours	If the current operating hours exceed this limit, the operating hours warning will occur. To disable, set to 0.	0-65000 hours	0
Current Hours	Current number of hours of RO system operation.	0-65000 hours	0
Expander Mode	Not Used		
Temp Offset	Allows adjustment of temperature reading by +-5 degrees.	± 5	0
Temp UOM	Selects display of temperature in °F or °C	0-1	0
Switch Select	Selects if switch inputs are normally open or normally closed.	0-32	0
TDS/Cond UOM	Selects display of water quality in uS or PPM **NOTE: If this Setpoint is changed, the unit must be recalibrated.**	0-1	0
TDS/Cond Range	Selects range of TDS/Conductivity monitor 0-50, 1-100, 2-250, 3-500, 4-1000, 5-2500 6-5000 **NOTE: If this Setpoint is changed, the unit must be recalibrated.**	0-6	1
C2 Range	Selects range of TDS/Conductivity monitor 0-50, 1-100, 2-250, 3-500, 4-1000, 5-2500 6-5000 **NOTE: If this Setpoint is changed, the unit must be recalibrated and range components may need to be changed.**	0-6	4
C2 Limit	When this valve is met or exceeded, the alarm lamp will light and high TDS/Cond will show on the display. To disable,set to 0.		
%Rej	The 2nd TDS/Conductivity is used to monitor feed water,programming this setpoint to 1 allows the % rejection to be displayed.	0-1	1

5.5 TO DISPLAY OR CHANGE SETPOINTS

NOTE: Please contact your AmeriWater representative prior to changing set points.

1. Refer to Figure 5.1 for the location of the keys used to display or change the Setpoints and Figure 5.2 for the location of the write protect jumper, J3. For the unit to be able to accept a change in a Setpoint, the shorting jumper must be in the WRITE PROTECT OFF position (center and left pins).

NOTE: Setpoints cannot be changed if the write protect jumper is in the ON position.

2. Use the LEFT and RIGHT ARROW keys to display the Setpoints. Each press of an arrow key will advance the display to the next Setpoint. The Left arrow key starts with the beginning Setpoint and the Right arrow key starts with the last Setpoint.

3. The Up and Down arrow keys are used to increase or decrease the Setpoint value. The value will change by 1 count each time a key is pressed. If the key is pressed and held for >1 second, the Setpoint value will change at a fast rate. When the key is released, the fast rate will be reset. Pressing both the UP and DOWN ARROW keys together will reset the set point value to 0.

4. Pressing the ALARM SILENCE/RESET key at any time will cancel the operation and return the display to the main screen.

5. To accept the new set point value, press the ENTER key.

6. The unit will beep twice if the change is accepted. If the write protect jumper is on, the unit will show WRITE PROTECTED on the display and one long beep will sound.

7. When finished changing Setpoints, the write protect jumper should be placed in the ON position (center and right pins).

SECTION 6, MAINTENANCE

WARNING: If any component of the water treatment system is changed or replaced, the user should conduct appropriate tests to ensure that the revised system meets all standards to which it was initially tested.

WARNING: Always remove the RO+ from the power source and turn off the water prior to any maintenance activities!

6.1 MAINTAINING THE SYSTEM

1. A Startup Log for the RO+ system has been provided by AmeriWater in Section 4.4. This must be filled out completely each time the system is used.

2. The hardness of the inlet water should be checked daily. If this is above 0.5 grains, the membrane will foul.

3. The membranes and carbon or micron prefilter are non-durable components and will need to be exchanged periodically.

    a) The membranes will need to be cleaned or replaced when the flow of product water decreases more than 10% while the water temperature remains constant (see temperature correction table in section 2.4).

    b) If using the carbon filters, these will need to be replaced whenever there is a chlorine break-through detected after the filter to protect the membranes.

    c) If using a micron pre-filter, this will need to be replaced whenever the differential pressure on the outlet is 10 PSI or greater than the pressure on the inlet of the filter housing.

4. The accuracy of the Conductivity display should be verified with a calibrated, hand-held meter at least annually. If the conductivity display is not within 5% of the hand-held meter readings, the controller should be calibrated in accordance to the procedures in Section 5.

6.2 SYSTEM PREPERATION

1. Press the POWER key (the display will show STANDBY).

2. Turn off the main power switch to the system.

3. Switch the main fused disconnect to OFF.

4. Turn off the potable tap water supply to the RO.

5. Relieve the pressure from the system by opening the sample port on the filter as well as any sample ports on the product water lines.

6.3 IRO FILTER EXCHANGE

1. Prepare the system as per the instructions in section 6.2.

2. Use the filter wrench to unscrew the filter housing.

CAUTION: Even after relieving the pressure from the Sample Port, the filter bowls will be full of water. Use care to prevent spillage.

3. Remove and discard the used filter.

4. Partially unwrap the plastic from the new filter. Holding the end covered with plastic, place the new filter in the housing. Discard the remaining plastic after installation.

5. Screw the filter housing back on making sure the o-ring is in the groove, and not pinched. Hand-tighten, only.

6.4 HRO FILTER EXCHANGE

1. Prepare the system as per the instructions in section 6.2.

2. Depress the vent on top of the housing to ensure that all pressure is relieved.

3. Loosen the banding strap by turning the key counter-clockwise.

4. Remove the top from the filter housing and slide out and discard the exhausted cartridges.

5. Partially unwrap the plastic from the new filters. Holding the end covered with plastic, place the new filters into the housing. Discard the remaining plastic after installation

6. Replace the top on the filter housing and secure in place with the banding strap by turning the key clockwise.

6.5 CIP

An alternative to changing the membranes when their performance degrades would be to clean them using AmeriWater's optional clean-in-place (CIP) system. Doing so will extend the life of the membranes and reduce the frequency of membrane exchanges. The CIP system can also be used to draw PAA disinfectant into the RO is you have having bacteria issues. Contact AmeriWater for details.

1. Remove the prefilter(s).

2. To enter CIP mode on the controller, simultaneously press the POWER and RIGHT ARROW keys.

3. Follow the CIP instructions for connecting the drum to the RO+.

4. Follow the instructions provided in the manual with your CIP system to clean the membranes.

WARNING: DO NOT place the RO+ in service until all operational parameters are within specification. Consult the STARTUP LOG (See section 4.4) to verify that all specifications are met.

6.6 IRO MEMBRANE EXCHANGE

1. Prepare the system as per the instructions in section 6.2.

2. Note the orientation of the membrane housing as well as the connections to the tubing.

3. Remove the fittings for the water inlet, reject water and product water from the membrane to be exchanged. This will allow the water to drain from the membrane housing.

NOTE: The SS compression fitting will remain with the tubing on which it was connected

4. Loosen the clamps that hold the membrane assembly to the RO frame.

5. Remove the end caps from each end of the membrane by loosening the bolts that hold these in place.

6. Pull the membrane out of the housing.

NOTE: The IRO 6 and 8 models will have 2 membranes per housing, joined by an adapter. Ensure that this adapter is not misplaced.

7. Load the replacement membrane(s) into the housing ensuring that the brine seal is towards the water in side.

8. Replace the end caps and secure with the clamps.

9. Re-install the membrane onto the skid and secure with the clamps.

10. Connect all fittings back to their original positions.

11. Replace any additional membranes at this time by following steps 2-10.

12. Return the device to service and allow it to run for 30 minutes with the reject throttle valve completely open to flush the preservative out of the membrane.

6.7 HRO MEMBRANE EXCHANGE

1. Prepare the system as per the instructions in section 6.2.

2. Loosen the Victaulic fittings on the inlet and reject portions of the housing. This will allow the water to drain.

3. Loosen the union for the product water.

4. Remove the clamps that hold this membrane to the skid.

5. Pull the quick release spring on the cap to allow removal of the end caps.

6. Remove the existing membrane form the housing.

7. Load the replacement membrane into the housing ensuring that the brine seal is towards the inlet.

8. Replace the end caps and secure in place with the quick release spring. It may be necessary to use a rubber mallet to gently tap the second cap to get the spring to seat fully.

9. Replace the membrane on the skid and secure with the clamps.

10. Re-connect the product water union.

11. Replace any additional membranes at this time by following steps 2-10.

12. Re-connect all Victaulic fittings.

13. Return the device to service and allow it to run for 30 minutes with the reject throttle valve completely open to flush the preservative out of the membrane.

SECTION 7, TROUBLESHOOTING AND REPAIR

7.1 TROUBLESHOOTING CHART

WARNING: Only those persons who have read the complete operations manual or who have received authorization from the medical facility director should attempt to troubleshoot and/or repair the RO+ system.

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
RO+ will not start	RO+ not plugged in	Plug into electrical outlet.
	Circuit breaker blown	Reset the breaker.
	RO+ in a FAULT condition	Check RO+ controller display for FAULT condition and correct the FAULT.
System has power but no water flow	Feed source not open	Open Incoming Tap Water valve.
	Feed pressure < 20 PSI	Increase pressure to ≥ 20 PSI.
	Prefilter clogged	Check the prefilter gauges for pressure drop; replace the prefilter if the pressure drop is 10 PSI greater than intitially recorded.
	Feed solenoid is not operating	Test the solenoid (see Section 7.4). Replace the valve if it is defective.
Pump making excessive noise	Low pressure or flow rate feeding the RO+	Check the prefilter outlet gauge PSI (must be ≥ 20 PSI), and verify that the product flow (flowmeter) is within range (see Sections 2.1 & 2.2)
	Pump motor or impeller failing	Check PUMP PSI GAUGE to verify that it is within operating parameters. Replace the pump assembly if necessary (see Section 7.6).
	Pump loose in cabinet	Isolate pump from frame.

PROBLEM	**POSSIBLE CAUSE**	**CORRECTIVE ACTION**
Poor quality product water	High Chlorine levels	Replace the Carbon Filters.
	RO+ not rinsed thoroughly	Rinse membrane (see Section 4.2).
	Fouled membrane	a. Clean or replace membranes (Section 6).
	Conductivity cell out of calibration	Verify the conductivity cell accuracy with a known good meter. Follow the calibration procedures in Section5.3 or replace cell if necessary.
Low product flow rate	Low pressure feeding membrane	Verify that the incoming tap water supply is fully open.
	Low pump PSI	Pump should be operating at 200 PSI.
	Reject GPM flow rate too high	Turn reject flow to product flow with the throttle valve.
	Excessive PRODUCT line backpressure	Check for restrictions in the PRODUCT line.
	Low temperature incoming tap water	Consult temperature correction chart in Section 2.4 to determine if the flow rate is normal in relation to the feed water temperature.
	Prefilter clogged	Check the prefilter gauges for pressure drop. Replace the prefilter cartridge if the pressure drop is $\geq$ 10 PSI from the initial value.
	Fouled Membrane	Clean or replace membranes (Section 6).

7.2 CONTROLLER TROUBLESHOOTING CHART

CAUTION: Hazardous voltages are present when power is applied to the unit. Care should be taken when troubleshooting any of the input power or output circuits. When disconnecting or connecting any board or accessory, be sure power is unplugged.

Before contacting AmeriWater for technical help, verify the programming of all Setpoints, Check the display and the status of all lights and indicators. The more information available when you contact us, the easier it will be to determine the source of the problem.

PROBLEM	INVESTIGATION	CORRECTIVE ACTION
System Inoperative	Is the yellow CPU active LED blinking?	If power is applied to the power terminals and the other checks are OK, the pc board is defective and should be replaced.
	If no, is the green power LED, DS1 Lit?	
	If no, is the fuse OK?	If no power is applied to the board, check the power wiring to the system.
	If no, replace the fuse.	
	If yes, with a voltmeter, verify power is applied to the power terminals L1 and L2.	
Display Blank	Is the green power LED, DS1 lit?	If no, refer to the system inoperative section.
	If yes, is the CPU active LED, DS9 blinking?	If no, replace the board.
	If yes, adjust the display contrast adjustment, R3. Is the display still blank?	If yes, replace the board.
Inlet Valve Will Not Operate	Is the system in standby?	
	If no, are any shut down conditions active?	
	If no, is the inlet LED, DS8 lit?	If no, replace the board.
	If yes, with a voltmeter, verify if there is power on the inlet terminals. Is there power?	If no, replace the board. If yes, check the valve and wiring.

PROBLEM	INVESTIGATION	CORRECTIVE ACTION
RO Pump Will Not Operate (Cont.)	Is the system in standby?	
	If no, are any shut down conditions active?	
	If no, is the RO LED, DS6 lit?	If no, replace the board.
	If yes, with a voltmeter, verify if there is power on the RO pump terminals. Is there power?	If no, replace the board. If yes, check the pump and wiring.
No or incorrect conductivity reading	Is sensor wired correctly?	If no, correct wiring.
	If yes, is sensor installed inline as shown in the tubing diagram on page 14?	If no, install correctly.
	If yes, verify correct Conductivity range. Range correct?	If no, correct range. If yes, calibrate unit.
	Does unit calibrate OK?	
	If no, disconnect green and white wires of sensor. Does reading show 0?	If no, replace board.
	If yes, reconnect wires and remove sensor from piping and dry. Does reading show 0?	If no, replace cell.
	If yes, short terminals of cell together. Does reading show '^^^' ?	If no, replace board.

7.3 CONDUCTIVITY CELL REPLACEMENT

1. Prepare the RO per section 6.2.

2. Open the RO controller by loosening the screws on the face of the controller.

3. Loosen the screws on the terminal strip for the appropriate conductivity cell (the inlet goes to the expander board while the product goes to the main board. See Figure 5.2)

4. Disconnect the conductivity sensor wiring and remove from the controller.

5. Remove the appropriate conductivity cell by turning it counter clockwise.

6. Apply pipe thread sealant to the replacement cell and thread into the connection.

7. Route the new cells wiring back to the controller.

8. Secure the wiring into the terminal block ensuring that the colors of the wires match the listing on the terminal block.

9. Return the RO to service.

10. Check for leaks around the cell that was replaced.

11. Calibrate the conductivity cell per the instructions in Section 5.3.

7.4 INLET SOLENOID VALVE TEST / REPLACEMENT

1. With the RO+ Off, turn the incoming tap water supply on. If there is water flowing to the drain, the inlet solenoid may be bad. Proceed to Step 3.

2. Turn the RO+ On (with the incoming tap water supply on). If there is no flow to the drain, the inlet solenoid or wiring harness may be bad. Proceed to Step 3.

3. Prepare the RO per section 6.2.

4. Use a slotted screwdriver to remove the wire harness from the solenoid valve.

5. Note the orientation of the valve in regards to the flow direction.

6. Break the connections on the inlet and outlet side of the valve.

7. Remove all fittings from the current valve and clean for use in the replacement.

8. Install the fittings into the new valve.

9. Re-install the valve and fittings in-line and secure all connections.

10. Replace the wire harness onto the new valve and secure in place with the screw.

11. Return the RO to service.

12. Check for leaks around the solenoid valve that was replaced.

7.5 CONTROLLER REPLACEMENT

1. Prepare the RO per section 6.2.

2. Note the position of all of the wiring leading into the control box.

3. Remove the wires from their respective terminals.

4. Open the main panel to have access to the rear of the RO controller.

5. Loosen the strain reliefs on the controller to allow the wiring to be pulled through.

6. Completely remove the strain reliefs and set aside for re-use with the new controller.

7. Remove the screws that secure the bracket to the controller and main panel and set-aside.

8. Pull the defective controller out of the main panel.

9. Mark the locations for the strain reliefs on the new controller to match where they were located on the old controller.

10. Drill holes for the new strain reliefs using a stepped drill bit, being careful not to make these oversized.

11. Slide the new controller into the main panel and secure in place with the brackets and screws.

12. Install the strain reliefs and route the wires into the controller.

13. Secure the wires to their respective terminals.

14. Return the RO to service.

7.6 PUMP REPLACEMENT

1. Prepare the RO per section 6.2.
2. Open the controller and trace the existing pump power cord.
3. Note the position of the power cord in the terminals on the motor contactor.
4. Remove the existing pump power connections from the motor contactor.
5. Loosen the strain relief to allow the cord to be pulled free.
6. Remove all fittings from the current pump and clean for use in the replacement.
7. Loosen the securing clamps / screws (depending on model) and pull the pump free.
8. Install the fittings into the replacement pump.
9. Secure the pump in place with the clamps / screws.
10. Route the power cord back through the strain relief and into the motor contactor.
11. Secure to the terminals as initially noted.
12. Return the RO to service.

SECTION 8, WARRANTY

The buyer has a one year warranty on all equipment and parts, excluding non-durable components (e.g., RO membrane, PT401 solution, and micron prefilter); provided that the system is not subject to abuse, misuse, alteration, neglect, freezing, accident or negligence; and provided further that the system is not damaged as the result of any unusual force of nature such as, but not limited to, flood, hurricane, tornado lightning, or earthquake. The warranty covers the replacement of equipment and/or parts only. The warranty does not cover labor charges or travel expenses resulting from the service of equipment. The manufacturer is excused if failure to perform its warranty obligations is the result of strikes, government regulation, materials shortages, or other circumstances beyond its control.

To obtain warranty service, notice must be given to the manufacturer within 30 days of the discovery of the defect.

There are no warranties on the RO+ system beyond those specifically described above. All implied warranties, including any implied warranty of merchantability or of fitness for a particular purpose are disclaimed to the extent they might extend beyond the above periods. The sole obligation of the manufacturer under these warranties is to replace or repair the component or part which proves to be defective within the specified time period, and the manufacturer is not liable for consequential or incidental damages. No dealer, agent, representative, or other person is authorized to extend or expand the warranties expressly described above.

Some states do not allow limitations on how long an implied warranty lasts or exclusions or limitations of incidental or consequential damage, so the limitations and exclusions in the warranty may not apply to you. This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state.

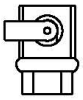
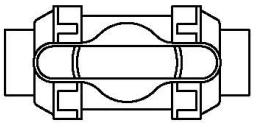
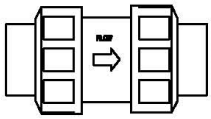
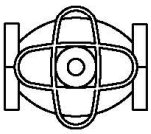
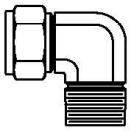
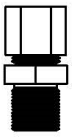
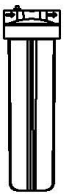
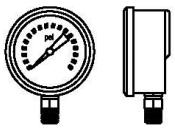
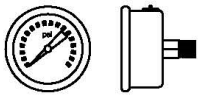
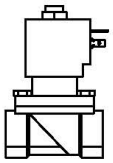
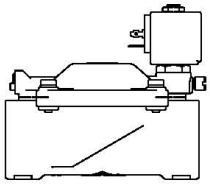
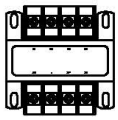
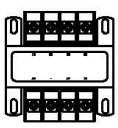
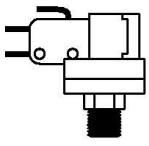
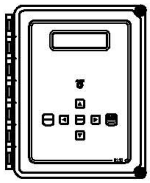
SECTION 9, REPLACEMENT PARTS

9.1 ROUTINE REPLACEMENT ITEMS (NON-DURABLE COMPONENTS)

PART #	DESCRIPTION
0013-0002	IRO Membrane Replacement O-Ring Kit
20-1016	IRO 1 Micron Sediment Replacement Filter
20-5101	IRO 10 Micron Carbon Block Replacement Filter
20-2510	HRO Replacement Filters (4 required)
R22-4040	IRO Replacement Membrane
22-8040	HRO Replacement Membrane
97RC22101	WaterCheck RC test strips for Measuring Residual Chlorine
97WS20301	WaterSoft Hardness test strips for measuring Hardness.

*Call AmeriWater or your AmeriWater distributor for pricing.

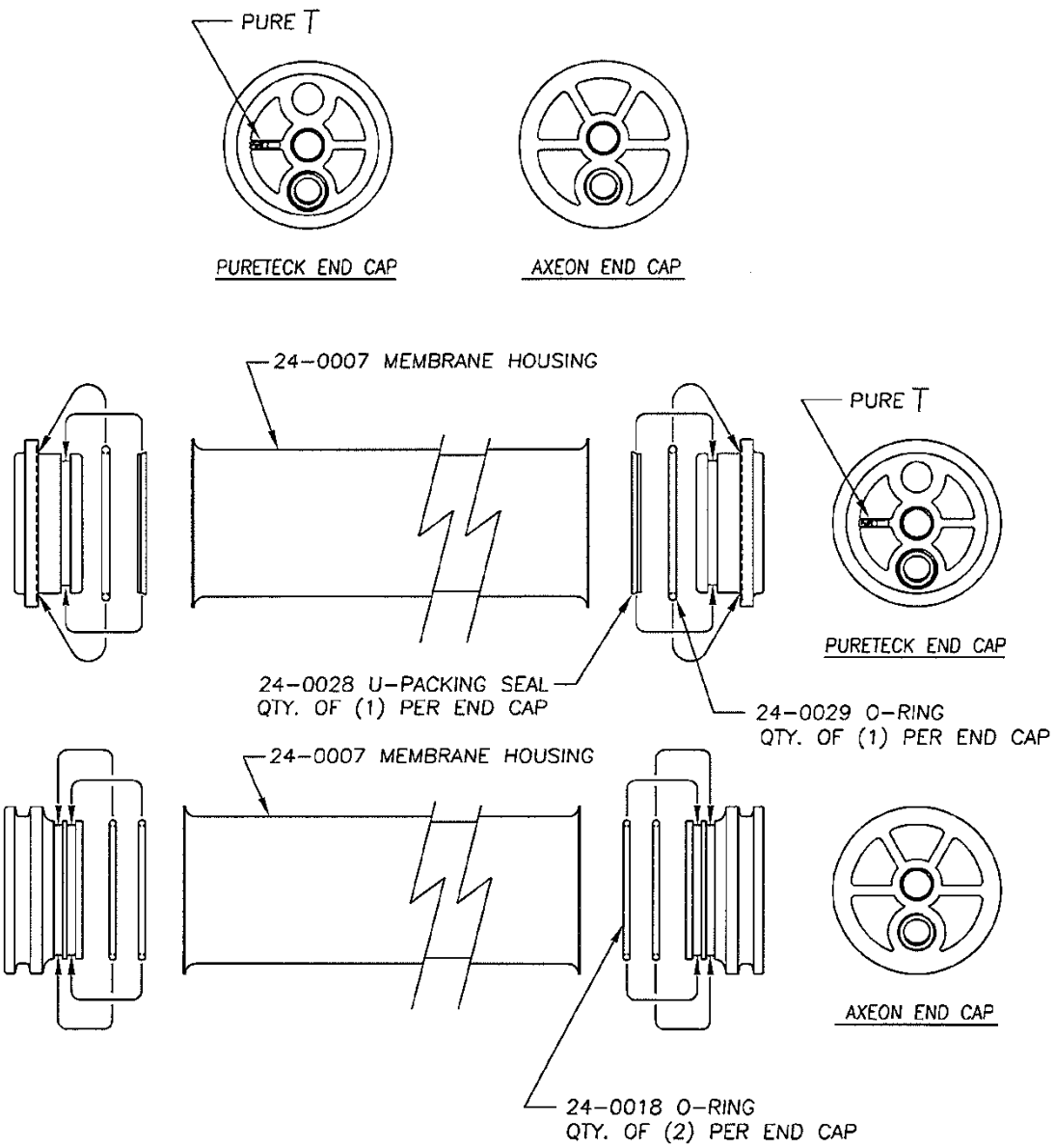
9.2 SPARE PARTS LIST

SAMPLE PORT BALL VALVE PN: 041002 (CON, 0.25" MPT X 0.25" FPT) PN: 041004 (ELBOW, 0.25" MPT X 0.25" FPT) 	BALL VALVE PN: 041530841 (.75" TU, PVC80) PN: 041531840 (1.5" TU, PVC80) PN: 041720169 (1" TU, PVC80) 	HRO CHECK VALVE PN: 041720168 
GLOBE VALVE PN: 045531878 (1" FPT), PN: 045-1000 (.5" FPT PN: 045-1001 (.75" FPT), PN: 045-1009 (1.5" FPT) 	ADAPTER, ELBOW 0.75MPT X 0.75T, SS PN: 10-8003 	ADAPTER, CONNECTOR 0.5MPT X 0.75T, SS PN: 10-8007 
IRO FILTER HOUSING PN: 21675175 	FLOW METER PN: 41530604 (0-10GPM, 3/4" FPT) PN: 41-0005 (5-25GPM, 1.5" MPT) PN: 41F41017LN-16 (1-17GPM, 1" FPT) 	GAUGE, BOTTOM MOUNT PN: 43530711 (0-100PSI) PN: 43730133 (0-160PSI) PN: 43730197 (0-300PSI) 
GAUGE, CENTER BACK MOUNT PN: 43530714 (0-300PSI) 	IRO INLET SOLENOID PN: 59-0015 	HRO INLET SOLENOID PN: 59740554 
IRO MOTOR CONTACTOR, 12 AMP PN: 61760226 	HRO MOTOR CONTACTOR, 37 AMP PN: 61760227 	TRANSFORMER, 208V - 120V PN: 62760097 
TRANSFORMER, 460/230V - 120V PN: 62760159 	PRESSURE SWITCH PN: 65511105 	CONTROLLER PN: 69446010 

9.3 EXPLANATION OF THE IRO MEMBRANE O-RING REPLACEMENT KIT

The 24-0007 membrane housing is purchased from (2) different vendors, Pureteck & Axeon.

To identify the correct housing being used with your product, see the pictures below that identify the membrane housing by the style of the end cap.



The 0013-0002 o-ring kit contains a quantity of (2) of the 24-0029 o-rings and a quantity of (2) of the 24-0028 u-packing seals that are used on the Pureteck membrane housing for the (2) end caps. Also included in the kit are a quantity of (4) of the 24-0018 o-rings used on the Axeon membrane housing for the (2) end caps.