

Installation, Operation and Maintenance Manual

Heavy Commercial Reverse Osmosis Systems

Models: HC-4040-01-1, HC-4040-02-1, HC-4040-03-1, HC-4040-04-1,
HC-4040-05-1, HC-4040-06-1, HC-4040-08-1, HC-4040-10-1,
HC-4040-12-1



HC-4040-12-1

THANK YOU

Congratulations on your purchase of this Watts® HC-40 heavy commercial reverse osmosis system. You've made an excellent choice for delivering high-quality water while reducing contaminants that can impact your equipment and water quality. This system has been designed for reliable performance and built using premium components to ensure efficiency and durability. With user-friendly operation, corrosion-resistant materials, and a service-friendly design, your system is engineered for long-term, hassle-free maintenance.

Thank You!

The Watts Team

Reverse osmosis filtration offers a wide range of benefits, including reducing dissolved solids, reducing scale buildup in critical equipment, and providing clean, quality water. By protecting your plumbing and appliances from mineral deposits and other impurities, this system helps minimize maintenance costs and downtime while ensuring consistent water quality for your commercial applications.

⚠ WARNING



Please read carefully before proceeding with installation. Your failure to follow any attached instructions or operating parameters may lead to the product's failure.

Keep this Manual for future reference.



⚠ WARNING

If you are unsure about installing your Watts reverse osmosis system contact a Watts representative or consult a professional water treatment dealer or plumber.

You are required to thoroughly read all installation instructions and product safety information before beginning the installation of this product. FAILURE TO COMPLY WITH PROPER INSTALLATION AND MAINTENANCE INSTRUCTIONS COULD RESULT IN PRODUCT FAILURE WHICH CAN CAUSE PROPERTY DAMAGE, PERSONAL INJURY AND/OR DEATH. Watts is not responsible for damages resulting from improper installation and/or maintenance. Local building or plumbing codes may require modifications to the information provided. You are required to consult the local building and plumbing codes prior to installation. If this information is not consistent with local building or plumbing codes, the local codes should be followed.

Save manual for future reference.

Refer to the enclosed for operating parameters to ensure proper use with your water supply.

- As with all plumbing projects, it is recommended that a trained professional water treatment dealer or contractor install the water treatment system. Please follow all local plumbing codes for installing this water treatment system.
- Inspect the water treatment system for carrier shortage or shipping damage before beginning installation. Replace any damaged component immediately, before beginning installation.
- Use caution when installing soldered metal piping near the water treatment system. Heat can adversely affect the system's components.
- Use only lead-free solder and flux for sweat-solder connections, as required by state, province and federal codes.
- Handle all components of the system with care. Do not drop, drag or turn components upside down.
- Be sure the floor under the system is clean, level and strong enough to support the system while in operation.
- Install the system in a protected area.
- Do not attempt to treat water over 85°F (29°C) or under 40°F (4°C) with the system.
- Do not install in direct sunlight as overheating of electronics may occur and ultraviolet rays from the sun may cause damage. Exterior protection equipment is required for outdoor operation. Failure to follow outdoor installation requirements will void the warranty. Please consult Watts technicians before installing the system outside.
- Operating ambient temperature: 40° to 120°F (4° to 49°C).
- Operating water pressure range : 45 to 200 psi (3.1 bar to 13.8 bar)

- All plumbing connections to the system should be made using industry accepted best practices. Plumbing tape or paste may be used on metal inlet and outlet plumbing connections. Do not use paste type pipe thread sealants on the system's plastic plumbing connections.
- All electrical connections must be completed according to local codes.
- The power outlet must be grounded.
- For installations where plastic plumbing is used, install an appropriate grounding strap across the inlet and outlet piping of the building's metal plumbing to ensure that a proper ground is maintained.
- Always turn off the unit, shut off the feed water, and disconnect the electrical power when working on the unit.
- Observe drain line requirements.
- Support the full weight of the plumbing system with pipe hangers or other means.
- Do not allow this water treatment system to freeze. Damage from freezing will void this water treatment system's warranty.
- Periodic cleaning and maintenance is required for system to function properly.
- Observe all warnings that appear in this manual.

How To Use This Manual

This installation manual is designed to guide the installer through the process of installing and starting up this commercial reverse osmosis system.

This manual is a reference and will not include every system installation situation. The person installing this equipment should have:

- Training on the control panel with all control parameters.
- Knowledge of reverse osmosis systems and how to determine proper control settings.
- Adequate plumbing skills.

⚠ WARNING

Do not use with water that is microbiologically unsafe or of unknown quality without adequate disinfection before or after the system.

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I. Introduction

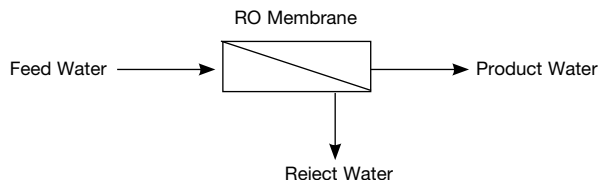
The separation of dissolved solids and water using RO membranes is a pressure driven temperature dependent process. The membrane material is designed to be as permeable to water as possible, while maintaining the ability to reduce dissolved solids.

The main system design parameters require the following:

- Internal flows across the membrane surface must be high enough to prevent the accumulation of fine suspended solids, fouling, and scaling, which could reduce membrane efficiency and damage the membrane.
- The concentration of each dissolved ionic species must not exceed the limits of solubility anywhere in the system.
- Pre-treatment must be sufficient to eliminate chemicals that would attack the membrane materials, particulates, organics, and chemicals that could attack or degrade the membrane material.

A. Reverse Osmosis Overview

Reverse osmosis systems utilize semipermeable membrane elements to separate the feed water into two streams. The pressurized feed water is separated into permeate (product) water and concentrate (reject) water. The impurities contained in the feed water are carried to the drain by the reject water. It is critical to maintain adequate reject flow in order to prevent membrane scaling and/or fouling.



NOTICE

Changes in operating variables are beyond the control of Watts. The end user is responsible for the safe operation of this equipment. The suitability of the product water for any specific application is the responsibility of the end user.

Successful long-term performance of an RO system depends on proper operation and maintenance of the system. This includes the initial system startup and operational startups and shutdowns. Prevention of fouling or scaling of the membranes is not only a matter of system design, but also a matter of proper operation. Record keeping and data normalization are required in order to know the actual system performance and to enable corrective measures when necessary. Complete and accurate records are also required in case of a system performance warranty claim.

Changes in the operating parameters of an RO system can be caused by changes in the feed water or can be a sign of trouble. Maintaining an operation and maintenance log is crucial in diagnosing and preventing system problems. For your reference, a typical log sheet is included in this manual

B. Specifications

Call customer support if you need assistance with technical details.

	HC-4040-01-1	HC-4040-02-1	HC-4040-03-1	HC-4040-04-1	HC-4040-05-1	HC-4040-06-1	HC-4040-08-1	HC-4040-10-1	HC-4040-12-1
Order code	68111213	68111214	68111215	68111216	68111217	68111218	68111219	68111220	68111221
Maximum Productivity (gallons per day)	2000	4000	6000	8000	10K	12K	16K	20K	24K
Quality (average membrane rejection)	98% (min. 96%)								
Recovery (user adjustable)	up to 75%								
Membrane Size	4" x 40"								
Number Of Membranes	1	2	3	4	5	6	8	10	12
Vessel Array	1	1:1	1:1:1	1:1:1:1	1:1:1:1:1	2:2:2	2:2:2:2	2:2:2:2:2	2:2:2:2:2:2
Prefilter (system ships with one 5 micron cartridge)	20"								
Feed Water Connection	1" FNPT								
Product Water Connection	3/4" FNPT			1" FNPT					
Reject Water Connection	3/4" FNPT			1" FNPT					
Permeate Water (maximum)	1.4 gpm	2.8 gpm	4.2 gpm	5.6 gpm	7.0 gpm	8.4 gpm	11.2 gpm	14 gpm	16.8 gpm
Minimum Concentrate Flow	3 gpm					6 gpm			
Feed Water Pressure (minimum)	45 psi								
Electrical Requirement	220V, 60Hz, 1pH, 8.8A				220V, 60Hz, 1pH, 16A				
Motor Horse Power	1.5				3				
Dimensions W x D x H (approximate inches)	26 x 26 x 60			32 x 26 x 60			32 x 50 x 60		
Shipping Weight (estimated pounds)	250	290	330	370	430	470	540	620	700

NOTICE

- Maximum production based on a feed water of 77°F, SDI < 1, 550 ppm TDS, and pH 7. Individual membrane productivity may vary (± 15%). May be operated on other feed waters with reduced capacity.
- Percent rejection is based on membrane manufacturer's specifications; overall system percent rejection may be less.

C. Operating Limits

PARAMETER	MAX	MIN
Design Temperature	77°F	
Feed Water Temperature†	85°F	40°F
Ambient Temperature	120°F	40°F†
Feed Pressure	85 psi	45 psi
Operating Pressure††	200 psi	150 psi
Turbidity	1 NTU	
SDI Rating	<3	
Free Chlorine	0 ppm	
TDS*	2,000 ppm	
Hardness	0 gpg	
pH (continuous)	10	4
pH (cleaning 30 minutes)	12	2

† Low temperatures and feedwater quality, such as high TDS levels will significantly affect the systems production capabilities and performance. Computer projections must be run for individual applications which do not meet or exceed minimum and maximum operating limits for such conditions.

†† System Operating Pressure is based on 60 psi feed pressure, minimum concentrate flow as stated and an average of 2000 gpd flow per membrane at 77°F.

*If any of the feed water parameters are not within the limits given, consult your local dealer or distributor for assistance.

⚠ CAUTION

Higher TDS and/or lower temperatures will reduce the system's production.

⚠ WARNING

Do not exceed the maximum operating pressure.

D. Pretreatment

The RO feed water must be pretreated in order to prevent membrane damage and/or fouling. Proper pretreatment is essential for reliable operation of any RO system.

Pretreatment requirements vary depending on the nature of the feed water. Pretreatment equipment is sold separately. The most common forms of pretreatment are described below.

Media Filter - Used to reduce large suspended solids (sediment) from the feed water. Backwashing the media removes the trapped particles. Backwash can be initiated by time or differential pressure. A backwash interlock is necessary to ensure proper system operation and prevent disruptions.

Water Softener - Used to remove calcium and magnesium from the feed water in order to prevent hardness scaling. The potential for hardness scaling is predicted by the Langelier Saturation Index (LSI). The LSI should be zero or negative throughout the unit unless approved antiscalants are used. Softening is the preferred method of controlling hardness scale. Under certain condition, softener can be eliminated with proper antiscalant dosing. Consult a Watts technician for accurate sizing and dosage projection.

Carbon Filter - Used to reduce chlorine and organics from the feed water. Free chlorine will cause rapid irreversible damage to the membranes. Organics (TOC) can lead to fouling, reducing system efficiency and membrane lifespan.

The residual free chlorine present in most municipal water supplies will damage the thin film composite structure of the membranes used in this unit. Carbon filtration or sodium bisulfite injection should be used to completely remove the free chlorine residual.

Chemical Injection - Typically used to feed antiscalant, coagulant, or bisulfite into the feed water or to adjust the feed water pH.

Prefilter Cartridge - Used to trap smaller suspended solids and any particles that may be generated by the other pretreatment. The cartridge(s) should be replaced when the pressure drop across the housing increases 5 - 10 psig over the clean cartridge pressure drop. The effect of suspended solids is measured by the silt density index (SDI) test. An SDI of five (5) or less is specified by most membrane manufacturers and three (3) or less is recommended.

Iron and Manganese - These foulants should be removed. Special media filters and/or chemical treatment is commonly used.

pH - The pH is often lowered to reduce the scaling potential. If the feed water has zero hardness, the pH can be raised to eliminate CO₂.

Silica: Reported on the analysis as SiO₂. Silica forms a coating on membrane surfaces when the concentration exceeds its solubility. Additionally, the solubility is highly pH and temperature dependent. Silica fouling can be prevented with chemical injection and/or reduction in recovery.

II. Controls, Indicators, and Components



Figure 1

ITEM NO.	PART NAME	DESCRIPTION
1	Feed Water Inlet Isolation Valve	Connect to the water source, allow pre-treatment interlock control
2	Prefilter Housing	Contains the RO prefilter
3	Reject Recycle Control Valve with Flow Indicator	Controls the amount of recycle flow
4	RO controller	RO on/off control with backlit display. Standard features include pressure switch control, monitor contactor, TDS/ Conductivity monitor with programmable setpoints, pre-treatment lockout, tank level switch control etc.
5	Pump Discharge Pressure Gauge	Indicates the membrane feed pressure
6	Concentrate Pressure Gauge	Indicates the pressure of the concentrate water as it exits the last membrane of the system
7	Prefilter Inlet/Outlet Pressure Gauge	Indicates the feedwater pressure when it enters and exits the pre-filter
8	Reject Control Valve with Flow Indicator	Controls the amount of reject flow
9	Product Flow Meter	Indicates the product flow rate in gallons per minute (gpm)
10	Product check valve	Prevent backflow to RO unit
11	Pump discharge globe valve	Throttle pump discharge, adjust flow and pressure
12	RO Membrane Housing(s)	Contains the RO membrane(s)
13	Low Pressure Switch	Protect the feed pump from low pressure condition
14	RO Feed Pump	Pressurizes the RO feed water

III. Operation

A. Installation

1. Proper pretreatment must be determined and installed prior to the RO system.
2. The water supply and pretreatment equipment should be sufficient to provide a minimum of 45-psig at the maximum feed flow.
3. An electrical disconnect switch located within 10 feet of the unit is recommended.
4. Responsibility for meeting local electrical and plumbing codes lies with the owner / operator.
5. Install indoors in an area protected from freezing and direct sunlight. Space allowances for the removal of the membranes from the pressure vessels should be provided.
6. Verify that a prefilter cartridge is installed in the housing. (See Figure #1, Item 2).
7. Select an area with enough head room to remove the membranes and easily access components and connections. Make sure there is enough room for service to be performed on the system

B. Plumbing Connections

Note: It is the responsibility of the end user to ensure that the installation is done according to local codes and regulations.

1. Locate the 1" feed water valve connection, connect the pre-treated feed water line to the prefilter inlet (Figure # 1 Item 1).
2. Locate the ¾" FNPT (HC-4040-01-1 to HC-4040-03-1) or 1" FNPT (HC-4040-04-1 thru HC-4040-12-1) on the outlet of the permeate flow meter labeled "PERMEATE", and run plumbing to a storage tank (During startup period, temporarily connect the product water outlet to a drain). The product outlet is located behind the panel at the top of the product flow meter. The product water line should never be restricted. Membrane and/or system damage may occur if the product line is blocked. An inline check valve is located at the product line to prevent the backflow.
3. Locate the ¾" FNPT (HC-4040-01-1 to HC-4040-03-1) or 1" FNPT (HC-4040-04-1 thru HC-4040-12-1) on the outlet of the concentrate flow meter labeled "CONCENTRATE", and run plumbing to a drain. The reject outlet is located behind the panel at the top of the reject flow meter. The reject drain line should never be restricted. Membrane and/or system damage may occur if the reject drain line is blocked. An air gap must be located between the end of the drain line and the drain. The use of a standpipe or other open drain satisfies most state and local codes and allows for visual inspection and sampling.

C. Electrical

Watts HC-40 series systems come pre-wired, ready to plug and play. HC-40 Series systems are available in 220V/60HZ/1PH. Available other power option: 220VAC 3PH 50Hz, 380VAC 3PH 50Hz, 460VAC 3PH 60Hz.

It is best that the HC-40 Series system be wired to a dedicated electrical circuit. Ensure that the electrical circuit supplying the system is compatible with the requirements of the specific HC-40 Series model you are installing.

For systems equipped with a chemical feed system, a chemical injection electrical plug is provided. The outlet allows the equipment to be plugged in for coordinated control. Please do not use the plug for anything other than its intended purpose.

HC-40 series systems are typically controlled with a liquid level (FLOAT) switch in a storage tank. The liquid level switch turns the system on when the water level in the tank drops, and off when the tank is full. Liquid level switches can be obtained by your local dealer or distributor. If a liquid level switch is to be used, install it at this time.

⚠ WARNING

To reduce the risk of electrical shock, the incoming power supply must include a protective earth ground.

It is recommended that a licensed electrician wire your system in accordance with local and national electrical codes (NEC).

D. Startup

1. Verify that the pretreatment equipment is installed and working properly. Verify that no free chlorine is present in the feed water.
2. Verify that the RO is off and the pump is not running.
3. Verify that a filter cartridge is installed in the prefilter housing
4. Direct the permeate water to drain during startup.
5. Open the reject control valve completely (Figure # 1 item 8).
6. Close the reject recycle control valve (Figure # 1 item 3) completely.
7. Open the pump discharge globe valve completely (Figure #1 item 11) and the feed water shutoff valve (Figure # 1 item 1).
8. Activate the system purge feature by pressing and holding the red Alarm Silence/Reset button on the RO Controller for 5 seconds. The inlet valve will open and the system will flush for 2 minutes.

NOTICE

If the system is equipped with a Permeate Flush option, you will have to unlock the "WRITE PROTECT" next to "CPU ACTIVE" and remove the jumper from "ON" and reinsert it to the "OFF" position. Then go to "Flush Mode" on the controller and change the setting to "1" before purging the system. Once the system has been purged, go back to the "Flush Mode" and revert back the setting to "0".

9. Allow the unit to run for 15 – 30 minutes to flush the preservative from the membrane(s). Let the system purge until no bubbles appear in concentrate flow meter. It may be necessary to flush the system more than one cycle.
10. When the RO system has been purged of air, turn it on. Adjust the pump discharge globe valve (Figure #1 item 11) and the reject control valves (Figure # 1 items 3 and 8) until the desired flows are achieved. Closing the reject valve increases the product flow and decreases the reject flow. Opening the reject recycle valve decreases both the reject and product flow. Closing the feed globe valve increases the operating pressure and reduces the feed flow. See the flow rate guidelines and temperature correction table on page 23 to determine the flow rates for different operating temperatures.
11. Allow the product water to flow to drain for 30 minutes.
12. Turn off the system and connect the product water line to the point of use.
13. Restart the system and record the initial operating data using the log sheet.

E. Flushing the System

As time progresses, the efficiency of the membrane will be reduced. In general, the salt rejection does not change significantly until two or three years after installation when operated on properly pretreated feed water. The permeate flow rate will begin to decline slightly after one year of operation, but can be extended with diligent flushing and cleaning of the membranes. The system should be flushed regularly to remove sediment from the surface of the membranes. HC-40 series systems are preprogrammed to flush for 60 seconds on shut down, 2 minutes for permeate flush and 5 minutes for manual flush.

F. Preparing Unit for Storage

If the system is to be shut down for an extended period, a membrane preservative should be used to preserve the membranes.

NOTICE

Prior to storing your system, the system should be cleaned with membrane cleaners, flushed with permeate water and preservative solution for membranes to protect it from biological attack.

NOTICE

The pressure vessels and plumbing lines of the system must be completely drained or filled with 20-40% polyglycol mix (to prevent freezing). Any water remaining in the plumbing of a system may freeze, causing serious damage.

1. Completely immerse the elements in the membrane housings using 2% preservative solution. For cold weather/winter storage add 20 - 40% by weight Polyglycol to the 2% preservative solution. Add Polyglycol AFTER the 2% preservative solution has been mixed.
2. Separate the preservative solution from the air outside by closing all valves. Any contact with oxygen will oxidize the preservative solution.
3. Check the pH once a week. When the pH becomes 3 or lower, change the preservation solution.
4. Repeat this process at least once a month.

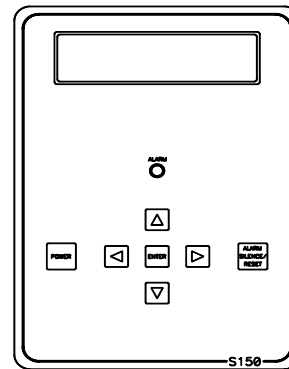
IV. Controller Specifications and Instructions



A. Controller Specifications

Power:	85 – 265VAC 50/60Hz, 25Watts
Environment:	–22°F to 140°F, 0 – 95% RH, noncondensing
Enclosure:	NEMA 4X
Display:	2 line x 20 character, alphanumeric backlit LCD
Front Panel:	Overlay with LCD window, alarm lamp, 7 key membrane switch Switch Inputs, Dry Contact: - Pressure fault - Pretreat lockout - Tank full high - Tank full low
Relay Outputs:	RO pump relay 120/240VAC, 1HP Inlet valve relay 120/240VAC, 5A Flush valve relay 120/240VAC, 5A
Cell:	TDS / Conductivity cell with digital display, permeate standard range, 0 – 250 PPM or µS.
Other ranges available:	Permeate: 50; 100; 500; 1,000; 2,500; 5,000.
Optional Feed:	50; 100; 500; 1,000; 2,500; 5,000; 10,000. Wetted parts ABS and 316SS, 3/4" NPT, maximum 300 psi
Optional I/O expander:	Auxiliary/divert/boost relay 120/240VAC, 1HP Divert/alarm relay 120/240VAC, 5A Tank low switch input, dry contact

B. Front Panel Controls and Indicators



DISPLAY:	Shows status of system.
ALARM LAMP:	Flashes when fault causes the RO system to shut down. On steady when a Setpoint is exceeded that does not cause the RO system to 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 shutdown has occurred.

Sample Wiring

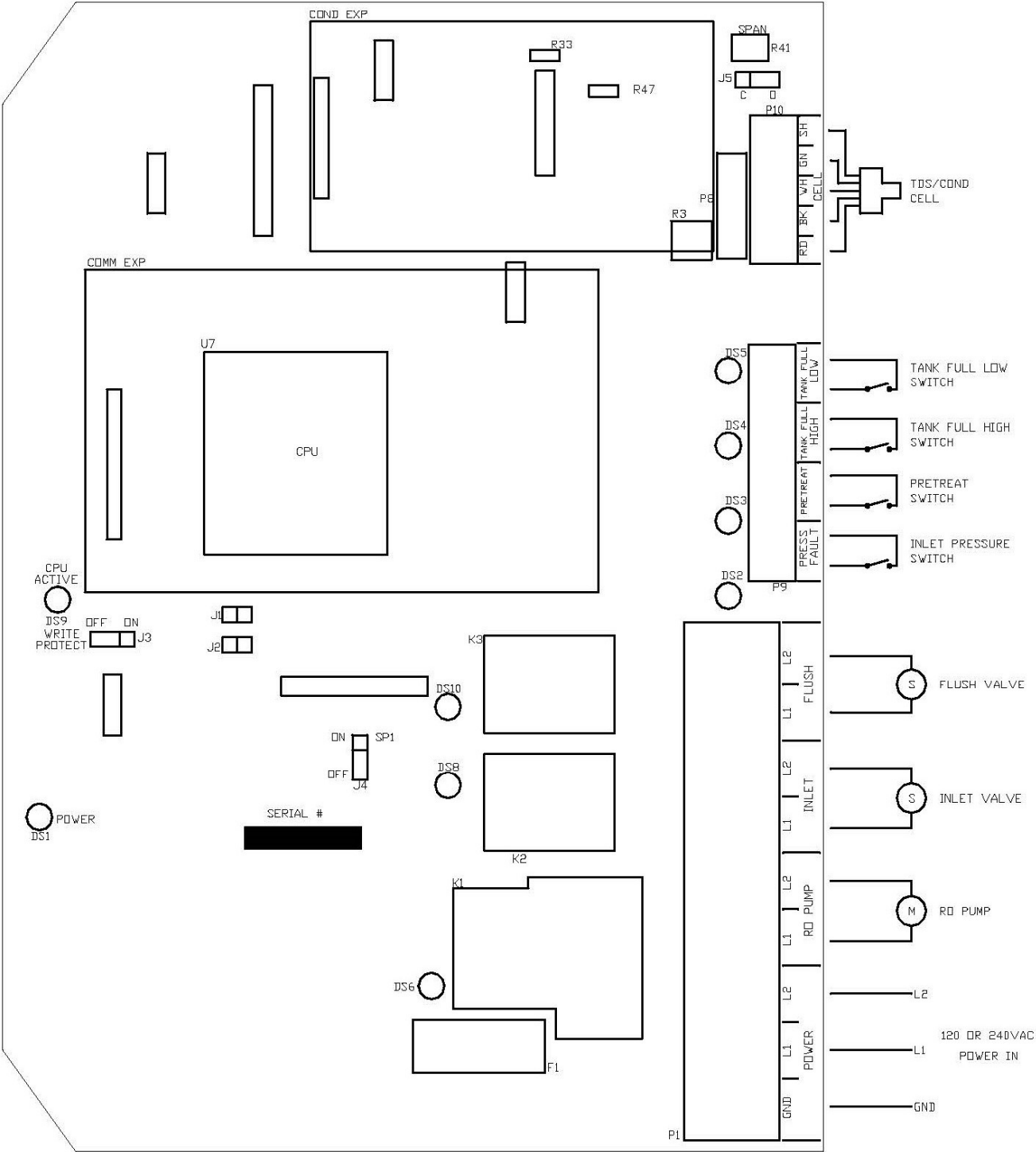


Figure 2

STANDARD SETPOINTS			
SETPPOINT	DESCRIPTION	RANGE	DEFAULT
TDS / Conductivity Limit	When this value is met or exceeded, the alarm lamp will light and high TDS / Conductivity will show on the display. To disable, set to zero.	0 – 999 µS or ppm	100
TDS / Conductivity Delay	When the limit Setpoint is exceeded, no alarm will be given until this time has expired.	0 – 999 seconds	30
TDS / Conductivity Shutdown	Once a TDS / Conductivity alarm is active, if the time in this exceeded, a TDS / Conductivity shutdown will occur. To disable, set to zero.	0 – 99 minutes	0
RO Start Delay	The amount of time between the inlet valve opening and the RO pump start.	0 – 99 seconds	5
Press Fault Delay	The time a pressure fault must be active before a pressure fault shutdown occurs.	0 – 99 seconds	5
Auto Reset	When a pressure fault shutdown is active, the system will attempt to restart after this delay. If set to zero, system must be manually reset.	0 – 99 minutes	5
Alarm Silence	If the audible alarm is silenced after this delay, the alarm will resound. If set to zero minutes the alarm will remain silenced.	0 – 99 minutes	0
TF Restart Delay	When a tank full condition clears, the system will restart after this delay.	0 – 99 seconds/ minute	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	5
Tank Lo Restart	When a tank low condition clears, the auxiliary pump will restart after this delay.	0 – 99 minutes	15
Flush Type	Selects the type of flush. Set to zero to disable flush.	0–8	1
Flush Time	The length of time a membrane flush cycle will last when flush is active.	0 – 99 minutes	2
Flush Interval	The interval between flush cycles. Only valid with op hour, elapsed time or off flush types.	0 – 99 hours	24
Flush Mode	Selects if the inlet and RO pump relays operate during flush.	0–3	1
Maximum Hours	If the current operating hours exceed this limit, the operating hours warning will occur. To disable, set to zero.	0 – 65000 hours	0
Current Hours	Current number of hours of RO system operation.	0 – 65000	0
Expander Mode	Selects how the relays on the I/O expander board operate.	0–4	0
Temp Offset	Allows adjustment of temperature reading by +–5 degrees.	–5 – +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	7
TDS / Conductivity UOM	Selects display of water quality in µS or PPM. NOTE: If this Setpoint is changed, the unit must be recalibrated.	0–1	0
TDS / Conductivity 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 may require some components be changed.	0–6	2
TF Delay	Selects delay time for Tank Full	0–5 seconds	5

To Display Or Change Setpoints

1. Refer to Figure 1 for the location of the keys used to display or change the Setpoints and Figure 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 off position (center and left pins).
2. NOTE: Setpoints cannot be changed if the write protect jumper is in the ON position.
3. 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.
4. The Up and Down arrow keys are used to increment or decrement the Setpoint value. The value will change by one count each time a key is pressed. If the key is pressed and held for less than one 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 Setpoint value to zero.
5. Pressing the Alarm Silence / Reset key at any time will cancel the operation and return the display to the main screen.
6. To accept the new Setpoint value, press the Enter key.
7. 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.
8. When finished changing Setpoints, the write protect jumper should be placed in the on position (center and right pins).

C. System Operation

General Operation

The unit has two modes of operation, a standby mode and an operating mode. 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. Setpoint information is also 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

TDS / Conductivity

The TDS / Conductivity is shown on the top line after the unit operating status. When the unit is offline because of a shutdown condition, the reading is replaced with '——'. If the reading is over range, the reading is shown as '^ ^ ^ ^'.

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. When the unit is offline because of a shutdown 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 TDS / Conductivity:	The TDS / Conductivity reading has exceeded the programmed limit.
TANK LOW:	The tank low input is active.
TANK LOW 99:	The tank low input has cleared, but the tank low restart delay is active.
OP HOURS EXCEEDED:	The current operating hours have 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 five 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 clear, the RO unit will run. The RO unit will continue to run when the water level rises and the lower switch becomes active. When the upper switch becomes active, after the five 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. When the lower level switch clears, 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 RO 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 three 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 shutdown condition.

Pressure Fault

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

Alarm Silence

When a shutdown 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 if the Alarm Silence Setpoint is programmed to zero. If the Alarm Silence Setpoint is programmed to a value greater than zero, 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 and stays active for two 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.

Membrane Flush

If the Flush Type Setpoint is programmed to zero, flush is disabled. If membrane flush is desired, several types of flush are available. When the unit enters a flush cycle, the flush relay will activate. The flush cycle will last for the time programmed in the Flush Time Setpoint. Table below shows the value that must be programmed in the Flush Type Setpoint for each type of flush.

FLUSH TYPE	DESCRIPTION
0	NO FLUSH
1	TANK FULL
2	OPERATING HOURS
3	OPERATING HOURS AND TANK FULL
4	ELAPSED TIME
5	ELAPSED TIME AND TANK FULL
6	OFF HOURS
7	OFF HOURS AND TANK FULL
8	RO START/STOP

TANK FULL:	The RO unit will flush each time a tank full condition occurs.
OPERATING HOURS:	A flush will occur when the RO pump has operated for the number of hours programmed in the Flush Interval Setpoint.
ELAPSED TIME:	A flush will occur after the number of hours programmed in the Flush Interval Setpoint has passed.
OFF HOURS:	A flush will occur when the RO has been shut down due to a tank full condition for the number of hours programmed in the Flush Interval Setpoint.
RO START/STOP:	A flush will occur each time the RO starts or stops. The tank full flush can be combined with any of the three interval flush types. A manual flush can be initiated by pressing the Alarm Silence/Reset key for three seconds.

Flush Mode

The Flush Mode Setpoint can be used to control the operation of the inlet valve and RO pump during flush. Each can be independently programmed to operate during flush. Table below shows the values to program into the Flush Mode Setpoint to control the operation of the inlet and RO outputs during flush.

FLUSH MODE	RO PUMP	INLET VALVE
0	OFF	CLOSED
1	OFF	OPEN
2	ON	CLOSED
3	ON	OPEN

High TDS / Conductivity Warning / Alarm

If the TDS / Conductivity reading exceeds the limit programmed the TDS / Conductivity Limit Setpoint for the delay programmed in the TDS / Conductivity Delay Setpoint, the alarm lamp will light and the HI TDS / Conductivity warning message will show on the display. This warning will clear when the TDS / Conductivity drops below the Setpoint. If the TDS / Conductivity Shutdown Setpoint is programmed to zero, the unit will continue to operate.

Otherwise, once a high TDS / Conductivity warning occurs, after the time programmed in this Setpoint, the RO unit will shut down and the alarm will sound. The alarm can be cleared by pressing the Alarm Silence/Reset key twice.

NOTE: The auto reset function is not active for this shut down.

Operating Hours Exceeded

If the current hours exceed the limit programmed in the Maximum Hours Setpoint, the alarm lamp will light and the OP HOURS EXCEEDED warning message will be shown. This warning can be cleared by programming the current hours to zero or by increasing the maximum hours limit.

I/O Expander

The I/O Expander board adds 2 relays and 1 switch input. The operation and programming of the 2 relays is described in the installation section.

Auxiliary Output

Relay 1 can be used to control a repressurization pump when Relay 1 of the expander board is configured to operate an aux relay. In this mode, this relay will be energized as long as the tank low input is not active. When energized, the relay supplies power to the repressurization pump.

Tank Low

When the tank low input has been active for five seconds, the auxiliary output will turn off. The alarm lamp will light and the TANK LOW warning message will show on the display. When the tank low condition clears, the TANK LOW 99 warning message is displayed. The number is the delay in minutes before the auxiliary relay will energize.

For boost pump operation, when the tank low input has been active for five seconds, the boost pump output will turn off, the RO unit will shut down, the alarm lamp will flash and the audible alarm will sound. TANK LOW shutdown message will show on the display. When the tank low condition clears, the TANK LOW 99 shutdown message is displayed. The number is the delay before the RO unit will restart. The shutdown can be manually reset by pressing the Alarm Silence/Reset button twice.

Boost Pump Output

Relay 1 can be used to control a boost pump when the expander board is configured to operate Relay 1 as a boost pump relay. This relay will operate the same as the inlet solenoid relay. This option is used to directly operate a boost pump up to 1HP.

Divert Output

When Relay 1 or Relay 2 has been programmed to operate as a divert relay, the relay will energize when the TDS / Conductivity exceeds the TDS / Conductivity Limit Setpoint. This will occur as soon as the reading exceeds the limit, there is no delay. When the reading drops below the limit and stays below the limit continuously for five seconds, the divert relay will turn off.

Alarm Output

When 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.

B. Adjustments

TDS / Conductivity Calibration

Refer to Figure 2 for adjustment location. To calibrate the 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 permeate water and testing it with a known, good meter. Adjust the span control until the reading matches the meter.

NOTE: If the TDS / Conductivity range is changed, the unit must be recalibrated and some components may need to be changed.

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.

C. Troubleshooting

⚠ 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 turned off at the disconnect.

Verify the programming of all Setpoints, Check the display and check the status of all lights and indicators. The more information available, the easier it will be to determine the source of the problem.

System Inoperative

Is the yellow CPU active LED blinking? If no, is the green power LED, DS1 Lit? If no, is the fuse OK? If no, replace the fuse. If yes, with a voltmeter, verify power is applied to the power terminals L1 and L2. If power is applied to the power terminals and the above checks are OK, the board is probably defective and should be replaced. If no power is applied to the board, check the power wiring to the system.

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 shutdown 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.

RO Pump Will Not Operate

Is the system in standby? If no, are any shutdown 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.

Unit Not Flushing or Not Flushing Correctly

Verify that flush is enabled and what type of flush is selected. Is flush enabled? If no, enable flush. If yes, press the Alarm Silence /Reset key for 3 seconds. Does the unit show flush on the display? If no, replace the board. If yes, is the flush LED, DS10 lit. If no, replace the board. If yes, with a voltmeter, verify if there is power on the flush terminals. Is there power? If no, replace the board. If yes, check the valve and wiring.

No or Incorrect TDS / Conductivity Reading

Is sensor wired correctly? If no, correct wiring. If yes, is sensor installed as described in the installation section? If no, install correctly. If yes, verify correct TDS / 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 pins of cell together. Does reading show '^^^'? If no, replace board.

D. TDS / Conductivity Expander

Installation / Wiring

The TDS / Conductivity expander board allows a 2nd TDS / Conductivity to be monitored and displayed by the Series controller. The expander board is mounted on the main board to the left of the connector for the first cell. Figure 3 shows the wiring and adjustment information for the expander.

TDS / Conductivity Expander

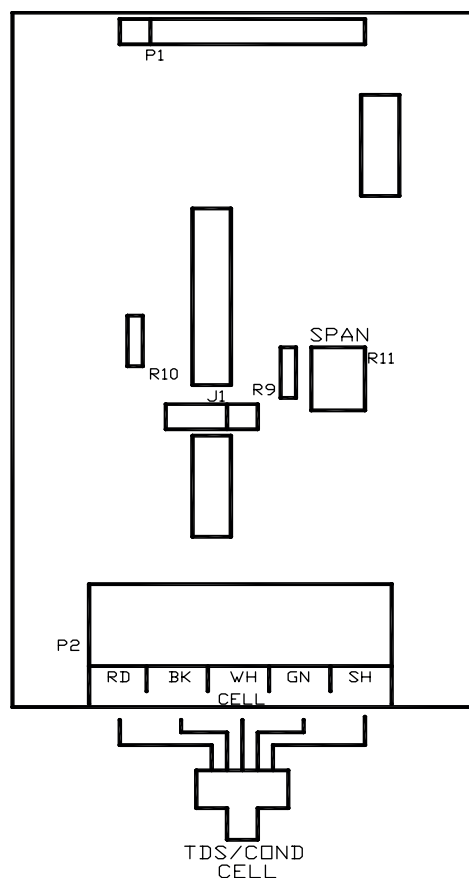


Figure 3

Setpoints

When the expander is installed, 3 additional Setpoints are provided to allow features of the expander to be changed. Refer to the Displaying or Changing Setpoints section of the manual on page 11 for information on changing the Setpoints. The additional Setpoints are listed below.

SETPOINT	DESCRIPTION	RANGE	DEFAULT
C2 Range	Selects range of TDS / Conductivity monitor 0 – 50, 1 – 100, 2 – 250, 3 – 500, 4 – 1,000, 5 – 2,500, 6 – 5,000, 7 – 10,000 NOTE: If this Setpoint is changed, the unit must be recalibrated and range components may need to be changed.	0–7	2
C2 Limit	When this value is met or exceeded, the alarm lamp will light and high TDS / Conductivity will show on the display. To disable, set to zero.	0 – 9999 µS or ppm	0
% Rejection	If the second TDS / Conductivity is used to monitor feedwater, programming this Setpoint to one allows the percentage of rejection to be displayed.	0–1	0

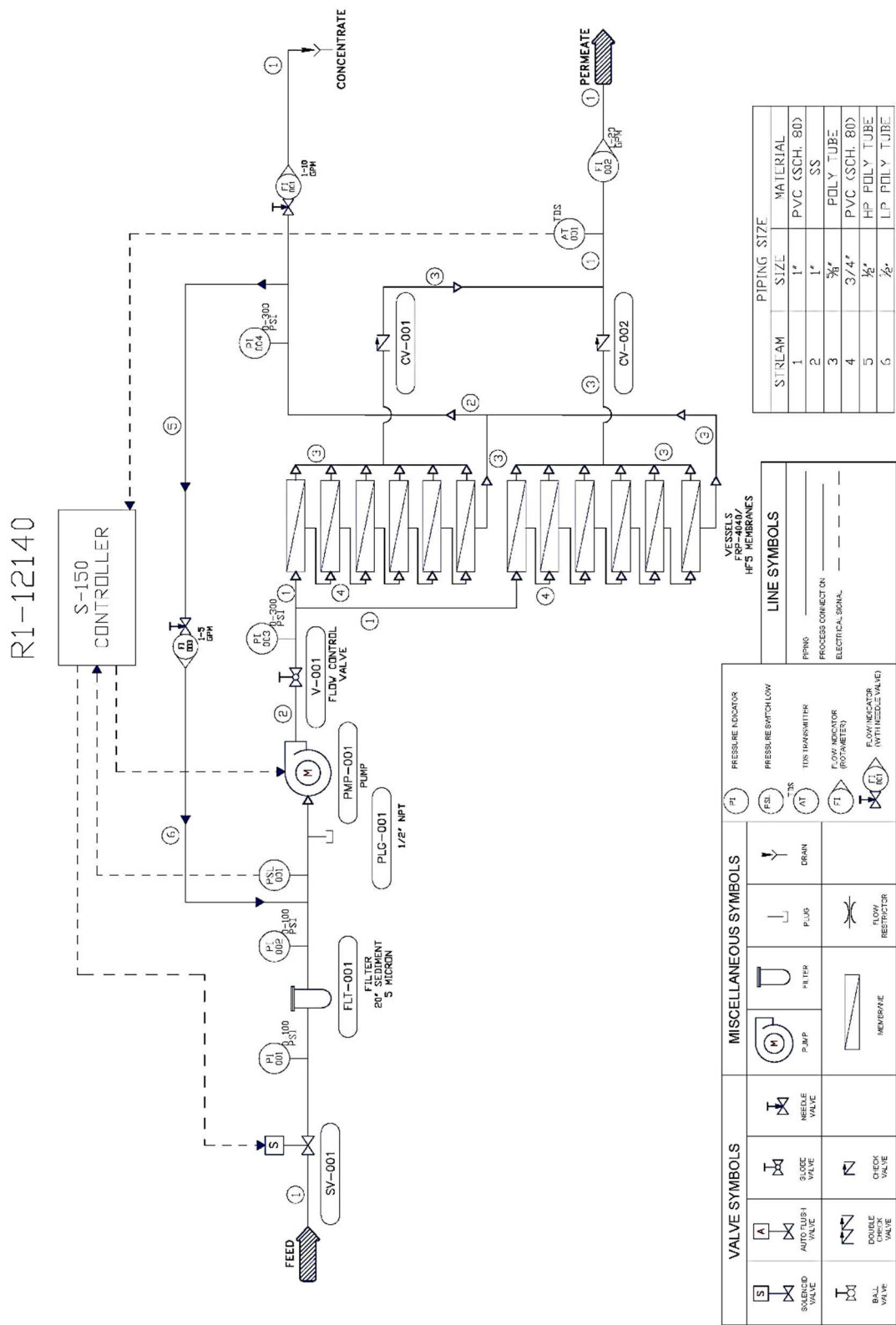
Operation

When the TDS / Conductivity expander is installed, the reading will be shown on line two and will alternate every three to four seconds with the hours and temperature. If the percentage of rejection display is enabled, it will be shown on line two with the second TDS / Conductivity reading.

If the C2 limit is enabled, and the second TDS / Conductivity reading exceeds the limit programmed the C2 Limit Setpoint for the delay programmed in the TDS / Conductivity Delay Setpoint, the alarm lamp will light and the HI TDS / Conductivity 2 warning message will show on the display. This warning will clear when the second TDS / Conductivity drops below the Setpoint.

Calibration

Refer to Figure 3 for adjustment location. To calibrate the second 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.



F. Troubleshooting

RO Membrane Troubleshooting Guide

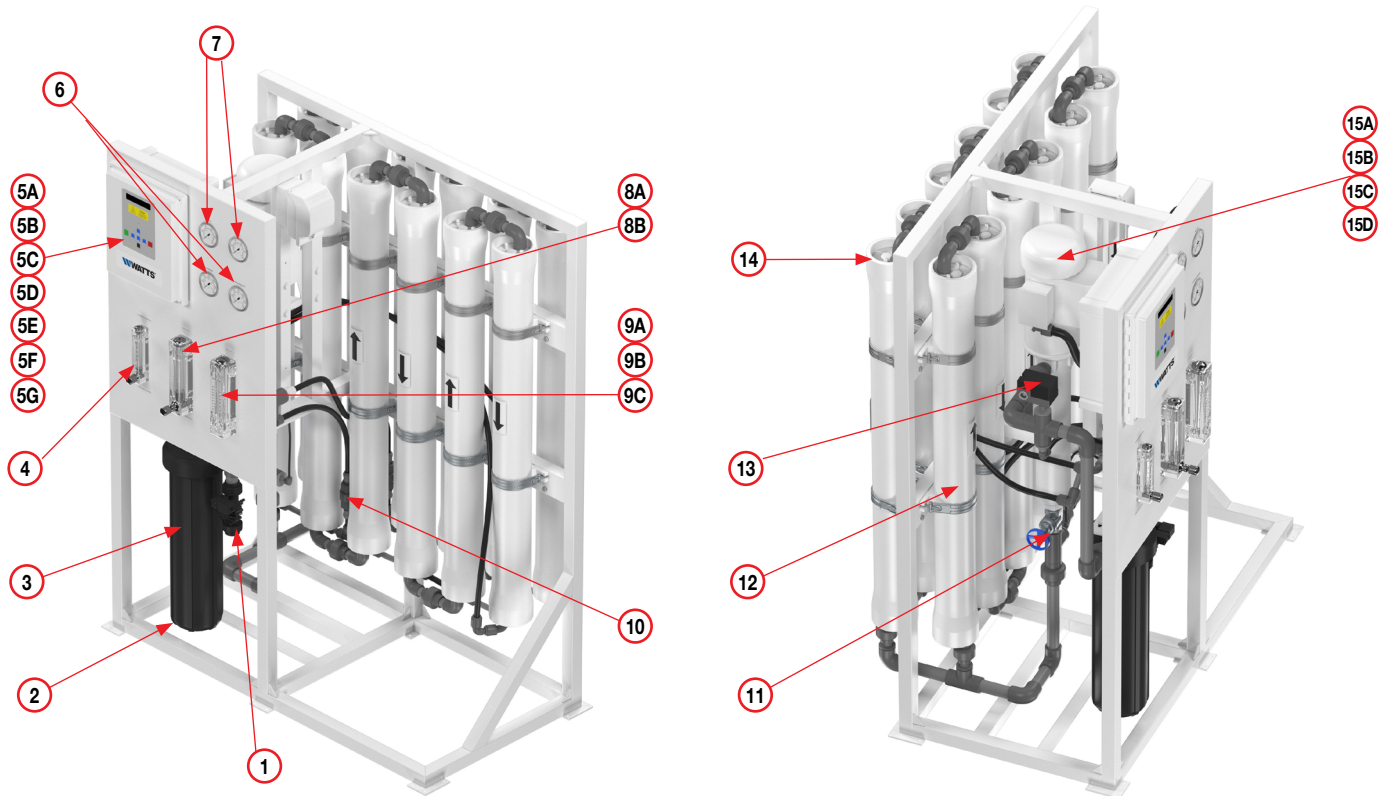
SYMPTOMS			LOCATION	POSSIBLE CAUSES	VERIFICATION	CORRECTIVE ACTION
SALT PASSAGE	PERMEATE FLOW	PRESSURE DROP				
Normal to increased	Decreased	Normal to increased	Predominantly first stage	Metal oxide	Analysis of metal ions in cleaning solution.	Improved pretreatment to remove metals. Cleaning with acid cleaners.
Normal to increased	Decreased	Normal to increased	Predominantly first stage	Colloidal fouling	SDI measurement of feed/ X-ray diffraction analysis of cleaning sol. residue.	Optimize pretreatment system for colloid removal. Clean with high pH, anionic detergent formulation.
Increased	Decreased	Increased	Predominantly last stage	Scaling (CaSO ₄ , CaSO ₃ , BaSO ₄ , SiO ₂)	Analysis of metal ions in cleaning sol. Check LSI of reject. Calculate maximum solubility for CaSO ₄ , BaSO ₄ , SiO ₂ in reject analysis.	Increase acid addition and scale inhibitor for CaSO ₃ and CaSO ₄ . Reduce recovery. Clean with an acid formulation for CaCO ₃ , CaSO ₄ and BaSO ₄ .
Normal to moderate increase	Decreased	Normal to moderate increase	Can occur in any stage	Biological fouling	Bacteria count in permeate and reject. Slime in pipes and vessels.	Shock dosage of sodium bisulfite. Continuous feed of low conc. bisulfite at reduced pH. Peracetic acid cleaning. Clean with alkaline anionic surfactant. Chlorine dosage upstream with dechlorination. Replace cartridge filters.
Decreased or moderately increased	Decreased	Normal	All stages	Organic fouling	Destructive testing, e.g. IR reflection analysis.	Optimization of pretreatment system (e.g. coagulation process.) Resin/ activated carbon treatment. Clean with high pH detergent.
Increased	Increased	Decreased	Most severe in the first stage	Chlorine oxidant attack	Chlorine analysis of feed. Destructive element test.	Check chlorine feed equipment and dechlorination equipment.
Increased	Increased	Decreased	Most severe in the first stage	Abrasion of membrane by crystalline material	Microscopic solids analysis of feed. Destructive element test.	Improved pretreatment. Check all filters for media leakage.
Increased	Normal to increased	Decreased	At random	O-ring leaks, End or side seal glue leaks.	Probe test. Vacuum test. Colloidal material passage.	Replace O-rings. Repair or replace elements.
Increased	Normal to low	Decreased	All stages	Conversion too high.	Check flows and pressures against design guidelines	Reduce conversion rate. Calibrate sensors. Increase analysis and data collection.

RO System Troubleshooting

SYMPTOMS	POSSIBLE CAUSES	CORRECTIVE ACTION
Low Inlet Pressure	Low supply pressure	Increase inlet pressure
	Cartridge filters plugged	Change filters
	Solenoid valve malfunction	Replace solenoid valve and/or coil
	Leaks	Fix any visible leaks
Low Permeate Flow	Low inlet flow	Adjust concentrate valve
	Cold feedwater	See temperature correction sheet
	Low operating pressure	See low inlet pressure
	Defective membrane brine seal	Inspect and/or replace brine seal
	Fouled or scaled membrane	Clean membranes
High Permeate Flow	Damaged product tube o-rings	Inspect and/or replace
	Damaged or oxidized membrane	Replace membrane
	Exceeding maximum feedwater temperature	See temperature correction sheet
Poor Permeate Quality	Low operating pressure	See low inlet pressure
	Damage product tube o-rings	Inspect and/or replace
	Damaged or oxidized membrane	Replace membrane
Membrane Fouling	Metal oxide fouling	Improve pretreatment to remove metals. Clean with acid cleaners
	Colloidal fouling	Optimize pretreatment for colloid removal. Clean with high pH anionic cleaners
	Scaling (CaSO ₄ , CaSO ₃ , BaSO ₄ , SiO ₂)	Increase acid addition and antiscalant dosage for CaCO ₃ and CaCO ₄ . Reduce recovery. Clean with acid cleaners
	Biological fouling	Shock dosage of sodium bi-sulfate. Continuous feed of sodium bi-sulfate at reduced pH. Chlorination and de-chlorination. Replace cartridge filters.
	Organic fouling	Activated carbon or another pretreatment. Clean with high pH cleaner
	Abrasion of membrane by crystalline material	Improve pretreatment. Check all filters for media leakage

V. Replacement Parts List

A list of common replacement parts is provided below. Contact your Watts representative for replacement parts assistance.



*10B is located behind the front panel attached to the permeate flow meter for R1 models 1140-5140.

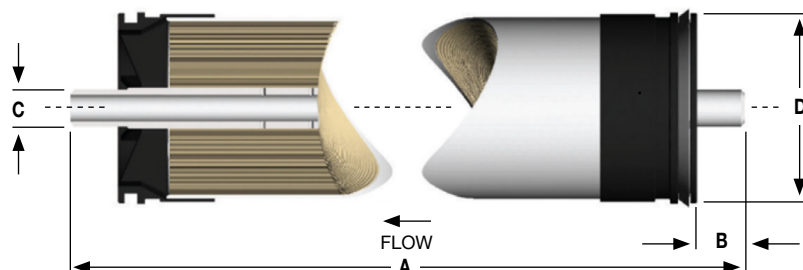
ITEM NO.	ORDER CODE	DESCRIPTION
1	5000000283	VALVE, SOLENOID, 2-WAY, COMPOSITE, 220V, 1" FNPT
2	5000000270	CARTRIDGE, SEDIMENT, POLYPRO, 4.5" X 20", 5 MIC
3	5000000271	HOUSING, FILTER, BLK/GRY, 4.5" X 20", SGL O-RING, NPR, 1" FNPT
4	5000000095	METER, FLOW, PM, 1-5 GPM, 1/2" MNPT x 1/2" MNPT
5A	5000000286	CONTROLLER, COMPUTER, 220V, 1PH, 12X10 BOX
5B	5000000287	CONTROLLER, COMPUTER, 220V, 3PH, 1.5HP, 12X10 BOX
5C	5000000288	CONTROLLER, COMPUTER, 380V, 3PH, 3HP, 12X10 BOX
5D	5000000296	CONTROLLER, COMPUTER, 460V, 3PH, 1.5HP, 12X10 BOX
5E	5000000297	CONTROLLER, COMPUTER, 220V, 3PH, 3HP, 12X10 BOX
5F	5000000298	CONTROLLER, COMPUTER, 380V, 3PH, 1.5HP, 12X10 BOX
5G	5000000299	CONTROLLER, COMPUTER, 460V, 3PH, 3HP, 12X10 BOX
6	5000000111	GAUGE, PM, GLY FILL, 0-300 PSI/BAR, 2.5" DIA, 1/4" MNPT
7	5000000110	GAUGE, PM, GLY FILL, 0-100 PSI/BAR, 2.5" DIA, 1/4" MNPT
8A	5000000095	METER, FLOW, PM, 1-5 GPM, SS VALVE, 1/2" MNPT X 1/2" MNPT
8B	5000000269	METER, FLOW, PM, 1-10 GPM, SS VALVE, 1" MNPT X 1" MNPT
9A	5000000276	METER, FLOW, PM, 1-10 GPM, 1" MNPT x 1" MNPT
9B	5000000277	METER, FLOW, PM, 2-20 GPM, 1" MNPT x 1" MNPT
9C	5000000275	METER, FLOW, PM, 1-5 GPM, 1/2" MNPT x 1/2" MNPT
10A	5000000289	VALVE, CHECK, PVC, 3/4" FNPT X 3/4" FNPT
10B	5000000098	VALVE, CHECK, PVC, 1/2" FNPT X 1/2" FNPT
11	5000000281	VALVE, GLOBE, SS, 1" FNPT
12	68112306	MEMBRANE, WM5, 4040, DRY, WATTS
13	5000000097	SWITCH, PRESSURE, LOW, 1/4" FNPT
14	5000000102	HOUSING, MEMBRANE, FRP-300E, 4040, 1/2" P X 1/2" C FNPT
15A	5000000292	PUMP, MULTI-STAGE, 1.5 HP, 110/220V 1 PH, 10GBS1514Q4, GOULDS
15B	5000000293	PUMP, MULTI-STAGE, 3 HP, 220V 1 PH, 25GBS3014P4, GOULDS
15C	5000000294	PUMP, MULTI-STAGE, 3 HP, 220/460V 3 PH, 25GBS3017P4, GOULDS
15D	5000000295	PUMP, MULTI-STAGE, 1.5 HP, 220/460V 3 PH, 10GBS1517Q4, GOULDS

VI. Membrane Element Specifications

HC-40 Series reverse osmosis systems come standard with WM5-4040-ULE Low Energy membranes. General membrane element performance characteristics are listed on the following membrane specification chart.

WM5-4040-ULE Ultra Low Energy Membranes (Standard)

Membrane Type: Polyamide Thin – Film Composite pH Range, Short Term Cleaning (30 Min.): 1 – 13
 Maximum Operating Temperature: 113°F (45°C) Maximum Feed Silt Density Index (SDI): 5
 Maximum Operating Pressure: 600 psi (4.14 MPa) Chlorine Tolerance: 0 ppm
 pH Range, Continuous Operation*: 2 – 11 Maximum Feed Flow Rate (gpm): 15
 *Maximum temperature for continuous operations above pH 10 is 95°F (35°C).



PRODUCT SPECIFICATIONS				DIMENSION INCH / MM			
PART NUMBER	DESCRIPTION	APPLIED PRESSURE PSI / BAR	PERMEATE FLOW RATE GPD / LPD	A	B	C	D
68112306	WM5-4040-ULE	100 / 6.9	3500 / 13249	40 / 1016.00	1.04 / 26.50	0.75 / 19.05	3.90 / 99.20

Warranty Evaluation Test Conditions: Permeate flow and salt rejection based on the following test conditions – 550 ppm, filtered and dechlorinated municipal tap water, 77°F / 25°C, 15% recovery and the specified operating pressure. Minimum salt rejection is 96%. Permeate flows for warranty evaluation may vary +/-20%. Maximum pressure drop at 15 psig / 0.9 bar.

All 4040 elements fit nominal 4.00" I.D. membrane housings.

Proper start-up of reverse osmosis water treatment systems is essential to prepare the membranes for operating service and to prevent membrane damage due to overfeeding or hydraulic shock. Before initiating system start-up procedures, membrane pretreatment, loading of the membrane elements, instrument calibration and other system checks should be completed.

Avoid any abrupt pressure or crossflow variations on the spiral elements during start-up, shutdown, cleaning or other sequences to prevent possible membrane damage. During start-up, a gradual change from a standstill to operating state is recommended as follows:

- Feed pressure should be increased gradually over a 30 – 60 second time frame.
- Cross – flow velocity at set operating point should be achieved gradually over 15 – 20 seconds.
- Permeate obtained from first hour of operation should be discarded.
- Maximum pressure drop across an entire single membrane pressure vessel (housing) can be up to 15 psi / 1.03 bar.
- Avoid static permeate – side backpressure at all times.

Under certain conditions, the presence of free chlorine, chloramines and other oxidizing agents will cause premature membrane failure. Since oxidation damage is not covered under warranty, the manufacturer recommends removing all oxidizing agents by pretreatment prior to membrane exposure. Please contact the manufacturer or your supplier for more information.

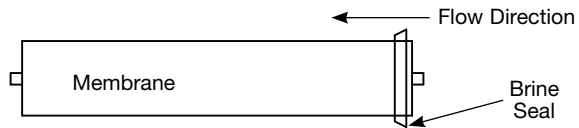
Do not use this initial permeate for drinking water or food preparation. Keep elements moist at all times after initial wetting. To prevent fouling during prolonged system shutdowns, it is recommended that membrane elements be immersed in a preservative solution. Rinse out the preservative before use. For membrane warranty details, please contact the manufacturer or your supplier for more information.

If operating limits and guidelines given in this product specification sheet are not strictly followed, the warranty will be null and void. The customer is fully responsible for the effects of incompatible chemicals and lubricants on elements. Use of any such chemicals or lubricants will void the warranty. These membranes may be subject to drinking water application restrictions in some countries; please check the application status before use and sale. The use of this product in and of itself does not necessarily guarantee the removal of cysts and pathogens from water.

No freedom from infringement of any patent owned by the manufacturer or others is to be inferred. Because use conditions and applicable laws may differ from one location to another and may change with time, customer is responsible for determining whether products and the information in this document are appropriate for customer's use and for ensuring that customer's workplace and disposal practices are in compliance with applicable laws and other governmental enactments. The claims made may not have been approved for use in all countries. The manufacturer assumes no obligation or liability for the information in this document. NO WARRANTIES ARE GIVEN; ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED.

VI. Membrane Installation and Replacement

1. Turn off the system and close the feed water shutoff valve.
2. Unplug the unit.
3. Disconnect the tubing from the top of the membrane housing(s).

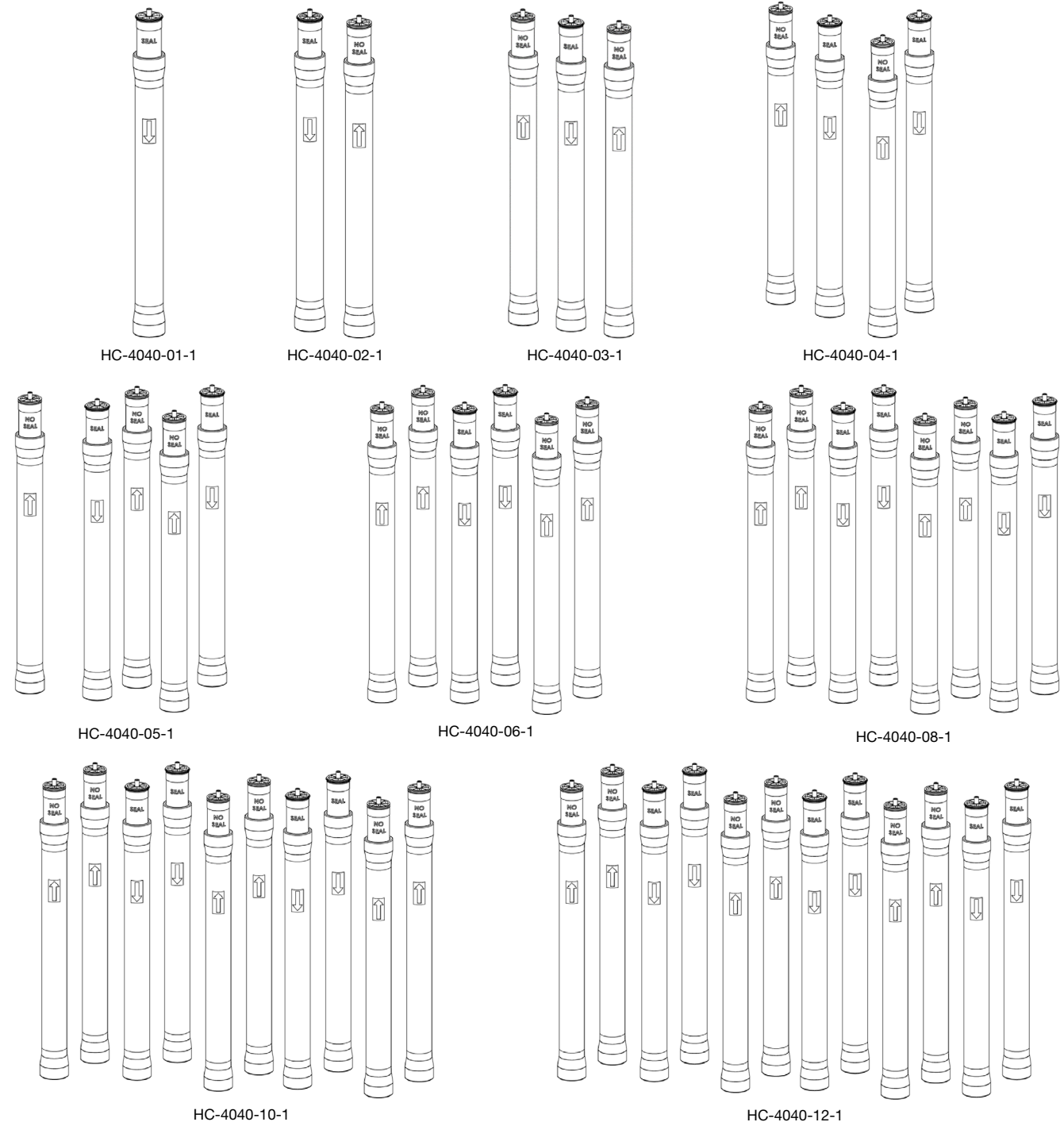


All pressure gauges must read zero before beginning this procedure. Turn the system off, disconnect the power, and bleed all water pressure from the system.

⚠ CAUTION

The brine seal must be in the correct position for each membrane housing in order for the membrane to function correctly.

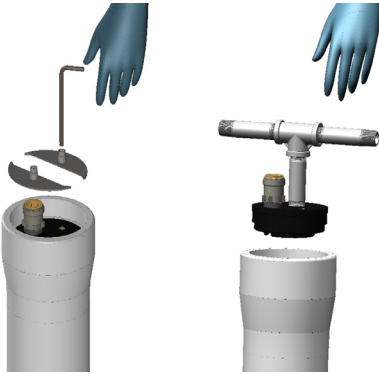
Pay close attention to the flow direction arrows on the membrane housings when installing new membranes. Refer to the following chart:



NOTICE

Wear gloves for the following steps in order not to contaminate the membrane.

4. Unscrew and remove the two locking crescents using a #5 Hex wrench. Use a ½" x 6" PVC nipple (or similar material) and thread it into the end plug permeate port to hand tightness. Pull the pipe outward to remove the end plug. If the pressure vessel has been in operation for an extended time, a slight rocking motion or forceful tug may be required. Set the end plug aside in a clean area where the O-ring will not pick up dirt or debris.



5. Remove the membrane bag containing the membrane element from the shipping box.
6. Cut the bag open as close as possible to the seal at the end of the bag, so the bag may be re-used if necessary.
7. Make sure that all parts are clean and free from dirt. Examine the brine seal and permeate tube for nicks or cuts. Replace the O-rings or brine seal if damaged.
8. Remove the old membranes from the pressure vessels. Use long nose pliers to pull the old membrane out of the pressure vessel.
9. Lubricate the brine seal and O-rings on the new membranes with a non-petroleum based lubricant. Do not use a petroleum-based lubricant.
10. Apply the same lubricant to the inside of the pressure vessel below the groove for the locking crescents, where the membrane brine seal will make contact when inserted.
11. Install membranes with brine seal location depicted in the membrane flow chart on the previous page.
12. When loading a membrane brine seal first, insert the membrane at a slight angle while gently rotating, being careful not to tear or flip the brine seal. With a smooth and constant motion, carefully push the membrane into the pressure vessel. A slow twisting motion should be used while inserting the membrane to ensure the brine seal stays in place. If there is considerable resistance when attempting to insert the membrane remove it and re-lube the brine seal and pressure vessel entrance as necessary. Pushing the membrane into the pressure vessel forcefully will cause the brine seal to flip at which point the membrane will no longer operate properly.
13. The membrane should stop when fully seated on the bottom end plug.

NOTICE

Make sure the O-rings and end plugs are free from dirt and debris before re-installing. Dirt and other foreign materials left on the end plugs can cause leaks and/or damage the membranes and cause contamination.

14. Reassemble the top end plugs.
15. Re-install the end plugs by gently and evenly pushing them onto the pressure vessel. Ensure that you do not pinch or fatigue any O-rings while re-installing the end plug. Push the end plug in until it is seated just below the groove for the locking crescents.
16. Reinstall the locking crescents and securely tighten the screws.
17. Reconnect any fittings that may have been disconnected when the pressure vessels were disassembled.
18. To start-up the system, please refer to the Start-Up section of this User's Manual.

NOTICE

The membranes must be flushed for at least 1 hour to remove the preservative from the membrane. Discard all of the permeate produced during the flush period.

VII. Appendix

Temperature Correction Factors

TEMPERATURE °F (°C)	TEMPERATURE CORRECTION FACTOR	TEMPERATURE °F (°C)	TEMPERATURE CORRECTION FACTOR	TEMPERATURE °F (°C)	TEMPERATURE CORRECTION FACTOR	TEMPERATURE °F (°C)	TEMPERATURE CORRECTION FACTOR	TEMPERATURE °F (°C)	TEMPERATURE CORRECTION FACTOR
50.0 (10.0)	1.711	57.2 (14.0)	1.475	64.4 (18.0)	1.276	71.6 (22.0)	1.109	78.8 (26.0)	0.971
50.2 (10.1)	1.705	57.4 (14.1)	1.469	64.6 (18.1)	1.272	71.8 (22.1)	1.105	79.0 (26.1)	0.968
50.4 (10.2)	1.698	57.6 (14.2)	1.464	64.8 (18.2)	1.267	72.0 (22.2)	1.101	79.2 (26.2)	0.965
50.5 (10.3)	1.692	57.7 (14.3)	1.459	64.9 (18.3)	1.262	72.1 (22.3)	1.097	79.3 (26.3)	0.962
50.7 (10.4)	1.686	57.9 (14.4)	1.453	65.1 (18.4)	1.258	72.3 (22.4)	1.093	79.5 (26.4)	0.959
50.9 (10.5)	1.679	58.1 (14.5)	1.448	65.3 (18.5)	1.254	72.5 (22.5)	1.090	79.7 (26.5)	0.957
51.1 (10.6)	1.673	58.3 (14.6)	1.443	65.5 (18.6)	1.249	72.7 (22.6)	1.086	79.9 (26.6)	0.954
51.3 (10.7)	1.667	58.5 (14.7)	1.437	65.7 (18.7)	1.245	72.9 (22.7)	1.082	80.1 (26.7)	0.951
51.4 (10.8)	1.660	58.6 (14.8)	1.432	65.8 (18.8)	1.240	73.0 (22.8)	1.078	80.2 (26.8)	0.948
51.6 (10.9)	1.654	58.8 (14.9)	1.427	66.0 (18.9)	1.236	73.2 (22.9)	1.075	80.4 (26.9)	0.945
51.8 (11.0)	1.648	59.0 (15.0)	1.422	66.2 (19.0)	1.232	73.4 (23.0)	1.071	80.6 (27.0)	0.943
52.0 (11.1)	1.642	59.2 (15.1)	1.417	66.4 (19.1)	1.227	73.6 (23.1)	1.067	80.8 (27.1)	0.940
52.2 (11.2)	1.636	59.4 (15.2)	1.411	66.6 (19.2)	1.223	73.8 (23.2)	1.064	81.0 (27.2)	0.937
52.3 (11.3)	1.630	59.5 (15.3)	1.406	66.7 (19.3)	1.219	73.9 (23.3)	1.060	81.1 (27.3)	0.934
52.5 (11.4)	1.624	59.7 (15.4)	1.401	66.9 (19.4)	1.214	74.1 (23.4)	1.056	81.3 (27.4)	0.932
52.7 (11.5)	1.618	59.9 (15.5)	1.396	67.1 (19.5)	1.210	74.3 (23.5)	1.053	81.5 (27.5)	0.929
52.9 (11.6)	1.611	60.1 (15.6)	1.391	67.3 (19.6)	1.206	74.5 (23.6)	1.049	81.7 (27.6)	0.926
53.1 (11.7)	1.605	60.3 (15.7)	1.386	67.5 (19.7)	1.201	74.7 (23.7)	1.045	81.9 (27.7)	0.924
53.2 (11.8)	1.600	60.4 (15.8)	1.381	67.6 (19.8)	1.197	74.8 (23.8)	1.042	82.0 (27.8)	0.921
53.4 (11.9)	1.594	60.6 (15.9)	1.376	67.8 (19.9)	1.193	75.0 (23.9)	1.038	82.2 (27.9)	0.918
53.6 (12.0)	1.588	60.8 (16.0)	1.371	68.0 (20.0)	1.189	75.2 (24.0)	1.035	82.4 (28.0)	0.915
53.8 (12.1)	1.582	61.0 (16.1)	1.366	68.2 (20.1)	1.185	75.4 (24.1)	1.031	82.6 (28.1)	0.913
54.0 (12.2)	1.576	61.2 (16.2)	1.361	68.4 (20.2)	1.180	75.6 (24.2)	1.028	82.8 (28.2)	0.910
54.1 (12.3)	1.570	61.3 (16.3)	1.356	68.5 (20.3)	1.176	75.7 (24.3)	1.024	82.9 (28.3)	0.908
54.3 (12.4)	1.564	61.5 (16.4)	1.351	68.7 (20.4)	1.172	75.9 (24.4)	1.021	83.1 (28.4)	0.905
54.5 (12.5)	1.558	61.7 (16.5)	1.347	68.9 (20.5)	1.168	76.1 (24.5)	1.017	83.3 (28.5)	0.902
54.7 (12.6)	1.553	61.9 (16.6)	1.342	69.1 (20.6)	1.164	76.3 (24.6)	1.014	83.5 (28.6)	0.900
54.9 (12.7)	1.547	62.1 (16.7)	1.337	69.3 (20.7)	1.160	76.5 (24.7)	1.010	83.7 (28.7)	0.897
55.0 (12.8)	1.541	62.2 (16.8)	1.332	69.4 (20.8)	1.156	76.6 (24.8)	1.007	83.8 (28.8)	0.894
55.2 (12.9)	1.536	62.4 (16.9)	1.327	69.6 (20.9)	1.152	76.8 (24.9)	1.003	84.0 (28.9)	0.892
55.4 (13.0)	1.530	62.6 (17.0)	1.323	69.8 (21.0)	1.148	77.0 (25.0)	1.000	84.2 (29.0)	0.889
55.6 (13.1)	1.524	62.8 (17.1)	1.318	70.0 (21.1)	1.144	77.2 (25.1)	0.997	84.4 (29.1)	0.887
55.8 (13.2)	1.519	63.0 (17.2)	1.313	70.2 (21.2)	1.140	77.4 (25.2)	0.994	84.6 (29.2)	0.884
55.9 (13.3)	1.513	63.1 (17.3)	1.308	70.3 (21.3)	1.136	77.5 (25.3)	0.991	84.7 (29.3)	0.882
56.1 (13.4)	1.508	63.3 (17.4)	1.304	70.5 (21.4)	1.132	77.7 (25.4)	0.988	84.9 (29.4)	0.879
56.3 (13.5)	1.502	63.5 (17.5)	1.299	70.7 (21.5)	1.128	77.9 (25.5)	0.985	85.1 (29.5)	0.877
56.5 (13.6)	1.496	63.7 (17.6)	1.294	70.9 (21.6)	1.124	78.1 (25.6)	0.982	85.3 (29.6)	0.874
56.7 (13.7)	1.491	63.9 (17.7)	1.290	71.1 (21.7)	1.120	78.3 (25.7)	0.979	85.5 (29.7)	0.871
56.8 (13.8)	1.486	64.0 (17.8)	1.285	71.2 (21.8)	1.116	78.4 (25.8)	0.977	85.6 (29.8)	0.869
57.0 (13.9)	1.480	64.2 (17.9)	1.281	71.4 (21.9)	1.112	78.6 (25.9)	0.974	85.8 (29.9)	0.866

°F=(°C x 9/5) + 32

Corrected Flow Rate= (Measured Flow Rate) * (TCF @ Feed Water Temp.)

Watts Commercial RO System

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