USER'S MANUAL

Reverse Osmosis System

ROTEK

Purification For Life

RA Series

MODELS

RA800

RA1500

RA2000

RA3000

RA4500

RA6000

Table of Contents

Introduction

Your compact commercial Rotek reverse osmosis system is a durable piece of equipment which, with proper care and maintenance will last for many years. These systems are part of a family of reverse osmosis units designed for operation with fresh feedwaters having TDS values below 1,500ppm. Models are available with permeate outputs of between 150 and 1,000 litres/hour as shown in the specification tables.

Common features to these systems include:

- ≈ High pressure stainless steel braided flexible hose lines
- ≈ Flow meters for permeate (treated product) and reject (waste) streams
- ≈ Liquid filled pressure gauges for feedwater pressure and membrane discharge pressure
- ≈ Automatic membrane flush (with feedwater) at start-up and every 24 hours continuous operation
- ≈ 304 grade stainless steel perimeter frame with rubber isolation feet
- ≈ Integrated microprocessor-based controller with display for TDS and system status
- ≈ Feedwater inlet cartridge filter
- ≈ Feedwater inlet solenoid valve
- ≈ Low feedwater pressure sensor with automatic shutdown
- ≈ High pressure SS membrane pressure vessels
- ≈ High performance, low pressure membranes
- ≈ Adjustable pressure regulating valve

Options are available for:

- ≈ Reject recirculation to recirculate some of the waste stream and improve recovery rates
- ≈ CIP provision for semi-automated membrane cleaning
- ≈ CIP station to simplify membrane cleaning
- ≈ Chemical dosing systems for automation of pre-treatment
- ≈ Automatic backwash sediment removal filters
- ≈ Automatic backwash carbon and de-chlorination systems
- ≈ Automatic water softeners for mineral hardness reduction.
- ≈ 415VAC 3 phase power operation

This User's Manual outlines installation, operating, maintenance, and troubleshooting details vital to the reliable performance of your system.

The systems are designed to operate at pressures between 760 and 1520 kPa (110-220psig) unless otherwise stated. The expected recovery rate with fresh feedwater below 1,500ppm TDS is between 15%-75%. Lower TDS feedwaters will allow higher recovery rates without a significant deterioration in membrane performance of operating life. A reject recirculation facility is available to improve system, recovery rates should feedwater quality permit this.

A current and comprehensive feedwater analysis is essential and should be obtained prior to system commissioning. This will assist in selecting the correct pre-treatment, chemical dosing and RO membrane selection. A typical water analysis of what is required is shown in the Appendix.

If your system is re-adjusted on-site after commissioning, or if the feed water quality changes, please contact your local dealer or distributor to determine the revised operating conditions and recommendations for conversion efficiencies to best suit these new conditions.

NOTE: In order to maintain any warranty, an operating log must be maintained as per the included sample sheet. Copies must be sent to your local dealer or distributor for review.

NOTE: Prior to operating or servicing this system, this User's Manual must be read and fully understood. Keep this manual and other associated information for future reference and for new operators or qualified personnel who may use the system at a future date.

Safety

The Safety section of this User's Manual outlines the various safety headings used throughout this manual as shown below:

NOTE: Indicates statements that provide further information and clarification.

CAUTION: Indicates statements that are used to identify conditions or practices that could result in equipment or other property damage.

WARNING: Indicates statements that are used to identify conditions or practices that could result in injury or loss of life. **FAILURE TO FOLLOW WARNINGS COULD RESULT IN SERIOUS INJURY OR EVEN DEATH.**

All electrical works should be performed by a licensed electrician and conform to all relevant electrical safety regulations

All plumbing works should be performed by a licensed plumber and conform to relevant plumbing codes.

Labelling

Do not under any circumstances remove any Caution, Warning, or other descriptive label from the system.

Feed Water Specifications

General Feed Water Requirements

Feedwater quality, pressures and flow rates have a significant impact on the performance of any reverse osmosis system. To ensure reliable and consistent long-term performance, it is important to supply feed water having the minimum specifications detailed below. If your feedwater supply is marginal, you should consider using a feedwater break tank and booster pump to supply the system.

FEED WATER SPECIFICATIONS (minimum)			
Hardness	<1 ppm	**Hydrogen Sulphide**	0 ppm
Free Chlorine	0 ppm	**Manganese**	<0.05 ppm
Total Dissolved Solids	<1,500 ppm	**Organics**	<1 ppm
Turbidity (SDI)	<5	**Temperature**	+5 to +40°C
pH	3-11	**Silica**	<1.0 ppm
Iron	<0.01 ppm	**Pressure**	>300 kPa

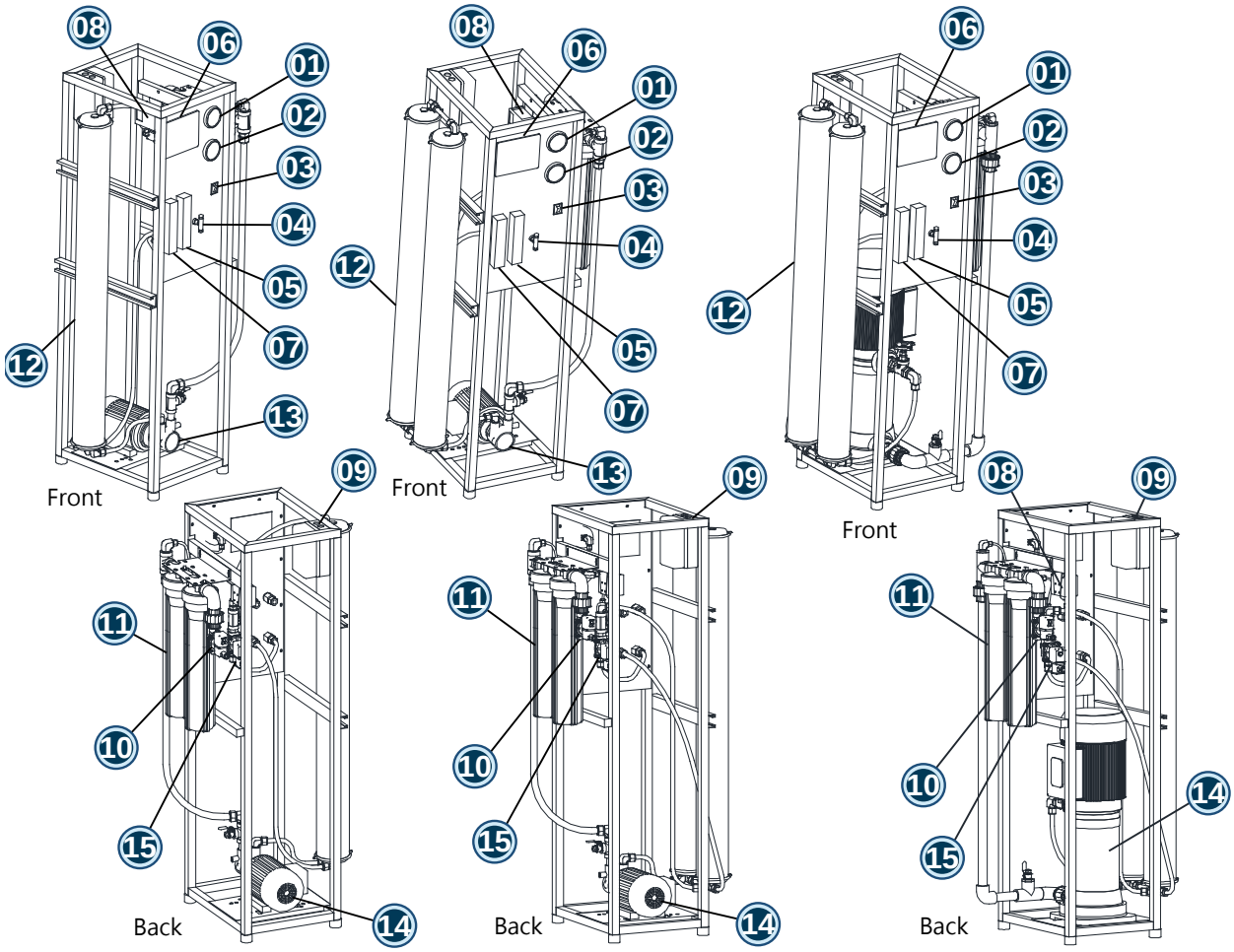
These specifications should be met in order to have the reverse osmosis system perform optimally. All operation specifications are based on the test conditions listed below.

RO OPERATION SPECIFICATIONS			
Min. Working Pressure	240kPa (35 psi)	**Max. Pressure**	1700 kPa (250 psi)
Min. NaCl % Rejection	96%	**Max. NaCl % Rejection**	99%
Min. Feed (lpm)	5	**Max. Feed (lpm)**	50
Max. Hardness	1.0 ppm	**pH Range**	3 – 11
Max. TDS	10,000 ppm	**Max. Temperature**	40°C (105°F)
TEST CONDITIONS: Permeate flow and salt rejection based on 1500 ppm NaCl, 1034kPa (150psi), 77°F (25°C), pH 6.5-7.0, and recovery of 15%.			
NOTE: Higher TDS and/or lower temperatures will reduce the system's production			

System Specifications

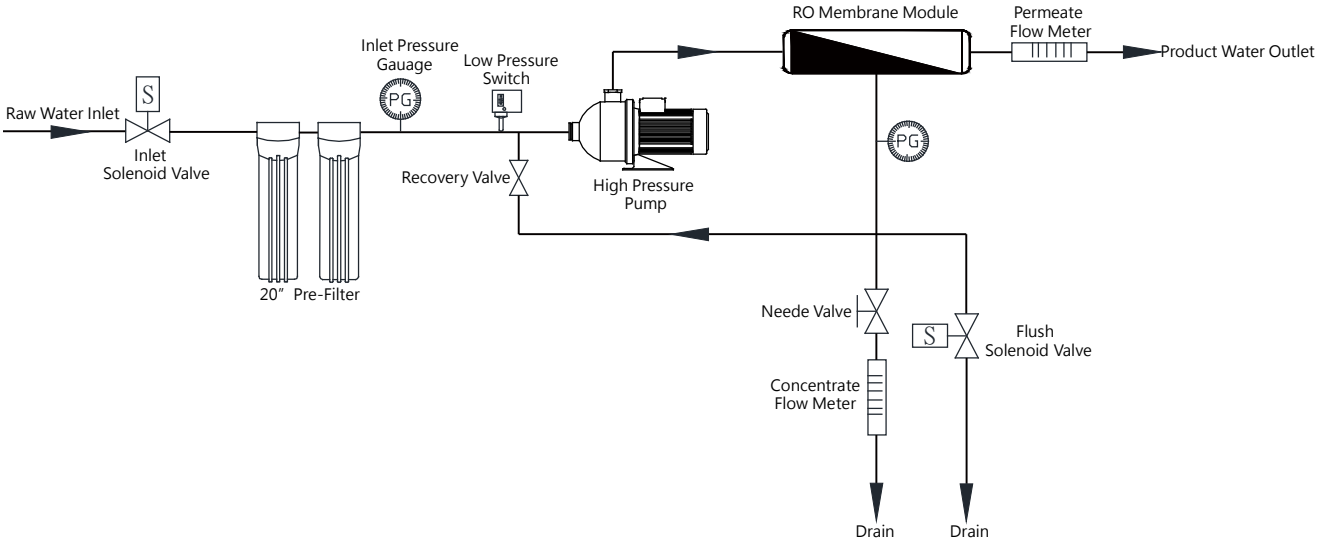
Systems for raw water TDS value below 1,500 ppm						
Model	**RA800**	**RA1500**	**RA2000**	**RA3000**	**RA4500**	**RA6000**
Permeate Flow [GPD/LPH]	800 / 150	1500 / 250	2000 / 350	3000/500	4500 / 750	6000 / 1000
Dimensions (LWH) [cm]	60*48*155	60*48*155	60*48*155	69*63*147	69*63*147	69*63*147
Weight (approx.) [kg]	35	62	70	88	94	100
Element Size [in.]	4” x 21” TFC	4” x 40” TFC	4” x 40” TFC	4” x 40” TFC	4” x 40” TFC	4” x 40” TFC
Elements [qty.]	1	1	1	2	3	4
High Pressure Pump	Procon Pump	LPE2-11 Multistage Pump	LPE2-11 Multistage Pump	LPE2-11 Multistage Pump	LPE2-11 Multistage Pump	LPE2-11 Multistage Pump
Voltage	110V~410V	220V~410V	220V~410V	220V~410V	220V~410V	220V~410V
Hertz	50/60					
Operating pressure [kPa]	760-1520 (adjustable)					
Pre-filtration (standard)	20" filter housings x 3pcs, 5μm & 1μm PP elements and carbon cartridge					
RO Membrane Vessel	High pressure SS304 end port type, 2100 kPa (300 PSI) rating					
Flow Meters	RO permeate and Reject streams (optional for recirculation)					
Pressure Gauges	Feedwater, membrane discharge (optional for pump discharge)					
Electrical controls	Micro-processor based, overload breakers, LED indicators, TDS monitor					
System Protection	Low feedwater pressure sensor, Automatic membrane flush, Inlet feedwater solenoid valve					
Power	220-240VAC 50hZ single phase (optional 415VAC 3 phase)					
Frame	AISI 304 grade stainless steel, electro polished					

System Component Identification



No.	Component	Part Number
1	Inlet Pressure Gauge	ON/OFF
2	RO Outlet Pressure Gauge	CBMC3T220VHS
3	Power Switch	GP35B25
4	Needle Valve (Concentrate Water Regulator)	GP07B25
5	Permeate Water Flow Meter	SMNV12F
6	Computer Programmed T.D.S. Controller	CMSNPS203
7	Concentrate Water Flow Meter	CSVNC04
8	Low Pressure Protection Switch	P02507
9	Electromagnetic Protection Switch	GF-CRI/CRN
10	Solenoid Valve	CSWHNO
11	Pre-Filters	FRP4040-300
12	RO Membrane + Vessel	GFMDLZB05-CH
13	Rotary Van Pump	GFMDLZB02-CH
14	1HP Motor	HFET2034BL+F0CHO5-20
15	Auto Flush Valve	NC04

System Flow Schematic



Optional features not shown here include:

- Reject (concentrate) recirculation valve
- Reject recirculation flow meter
- CIP connections
- Chemical dosing connections

Unpacking and Installation

Packing List

1 Reverse Osmosis System
2 ½" Flexible PE Tubing (5 m)
3 Filter Housing Spanner
4 Operating Manual

Check that all components are present and in an undamaged condition. If anything is missing or appears damaged, notify your supplier immediately.

Installation Notes

1 Before installation, check that the power supply available matches the power requirements of the system. Most units are supplied as standard for 220-240VAC 50Hz single phase operation. Options are available for 415V AC 3 phase power.

2 Ensure that all plumbing connections for the feed water inlet, permeate, concentrate and membrane flush outlets are secure and conform to relevant plumbing regulations.

3 Ensure that power lead is rated to carry the current draw of the system. A minimum electrical wire diameter of 3.5mm is recommended.

4 The external storage tank level contact switch should be connected to the blue wires labelled for tank connection and located inside the electrical cabinet. Do not apply power to these wires as the connection is designed for a simple non-powered contact type closure switch only.

5 Use an external pressure booster pump if the feedwater pressure is below 150kPa.

6 If your feedwater supply is marginal, use a feedwater storage tank and booster pump to supply the RO system and prevent system cycling.

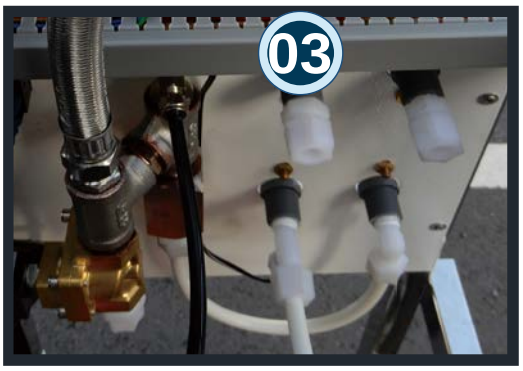
Installation Procedure

Step 1

Connect the pre-treated feedwater source to the inlet solenoid valve using a ¾" male thread coupling. Use Teflon tape and leak sealant as necessary to ensure a leak-proof connection.

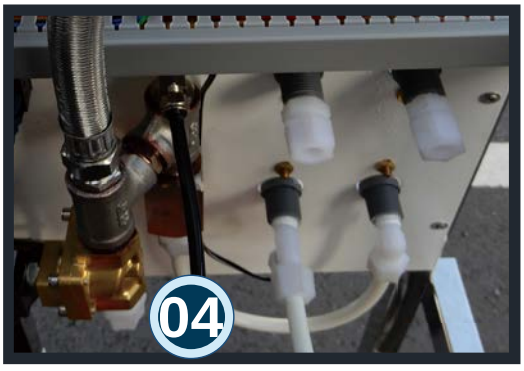
Step 2

Connect a length of ½" flexible PE tubing to the fitting on the rear of the front panel labelled '**Concentrate**'**.** Run this tubing to a nearby tundish to drain. There must be an air gap between the open end of the tubing and the tundish to prevent suck-back. The discharge point must be below the level of the outlet connection and within 2 metres of the installation.



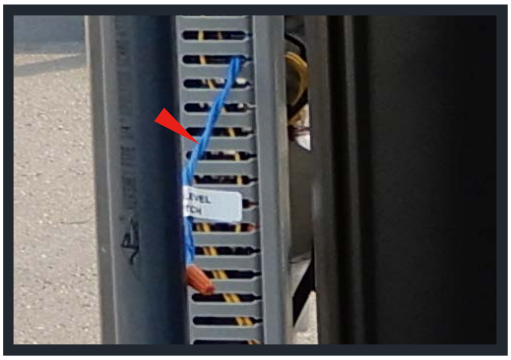
Step 3

Connect a length of ½" flexible PE tubing to the fitting at the rear of the front panel labelled '**Permeate**'. Run this tubing into the treated water (permeate) storage tank.



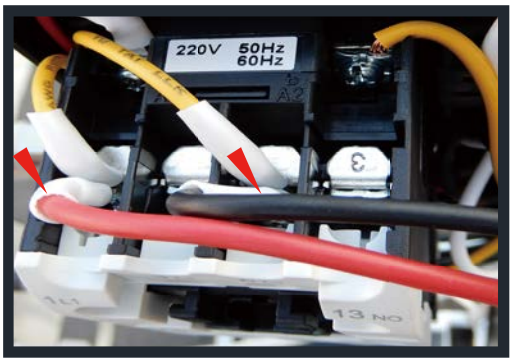
Step 4

Connect a length of ½" flexible PE tubing to the outlet of the membrane flush solenoid valve and run this to drain via a tundish as described in step 2. The tundish may be shared with the '**Concentrate**' stream.



Step 5

Take the blue wire from the wiring loom inside the electrical box and connect this to the float level sensor in the permeate storage tank. This allows the RO to turn on and off automatically according to the treated water storage tank level. Note that this connection is a contact closure only. Do not apply any power at any time to these connections.



Step 6

Connect the power supply to the contact breaker inside the electrical box. Ensure that the available power matches the power requirements of the system and that the power cables are rated to carry the current load of the system.

Start Up and Operation

System Operation Notes

1. Ensure that feedwater pressure is a minimum of 140kPa (20psi).
2. Check that your feedwater supply flow rate is sufficient for your particular model
3. Check that the available power supply matches your unit requirements.
4. Re-check all installation instructions and that all plumbing and electrical connections have been made correctly and are secure.

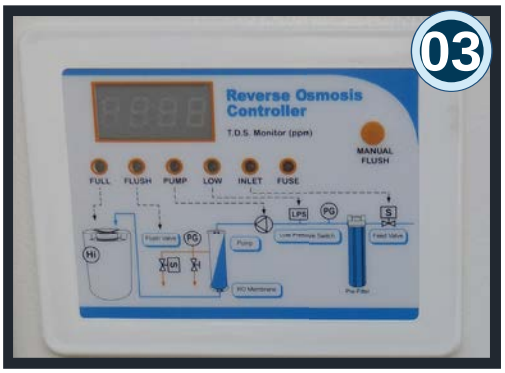
System Operation

Step 1

Loosen the breather valve(s) on top of the filter housing(s) to release any air pressure that may build-up when the system is started up.
This step will generally only have to be performed at initial start-up or where air may have entered the feedwater supply line.

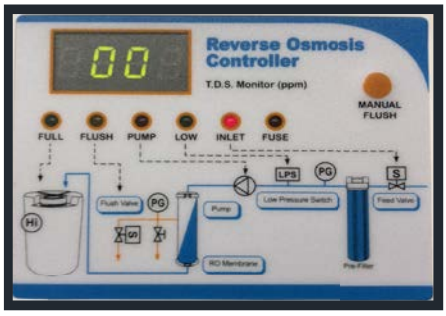
Step 2

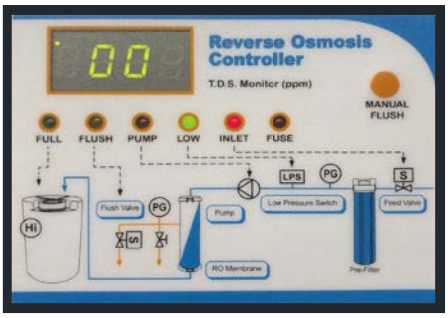
Turn the power switch on the front panel ON. This will open the inlet solenoid valve and allow pressurised feedwater to enter the filter housing(s). Once any trapped air has been vented from the filter housings, close the breather valve(s) on the filter housings.

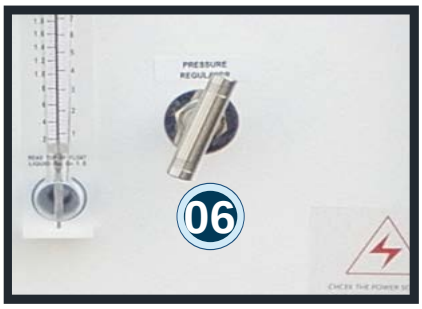


Step 3

Once the unit is switched ON, it will go into an automatic membrane flush cycle for 40 seconds. During this time the feedwater inlet solenoid valve will remain open, the membrane flush solenoid valve will open and the RO pressure pump will run. While the membrane flush cycle is operating, the LCD will show a countdown from 60 to 0 seconds and all indicator lights will flash.







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Step 4

After the membrane flush cycle is complete, the unit will close the membrane flush solenoid, check that sufficient feedwater pressure is available and go into normal operating mode

Step 5

If the system detects no error condition, normal operation will continue. If an error is detected, the system will shut down until the error condition is rectified. See "Troubleshooting" section for more information.

Step 6

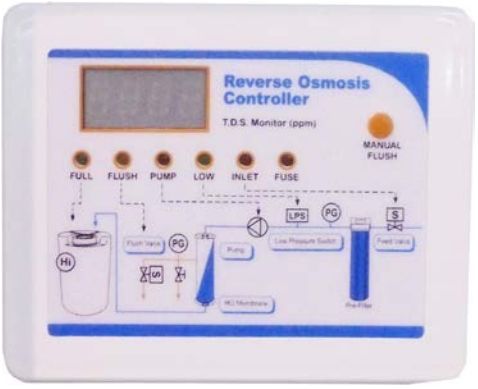
Open the pressure regulator valve by fully turning anticlockwise. When the system starts up, check flow rates and operating pressures for permeate and reject streams. Close the pressure regulator valve slowly until the RO outlet pressure gauge reads 700kPa. Check system flow rates. Adjust the operating pressure gradually until specified system permeate flow rate is reached. Use the minimum pressure possible for desired performance. Ensure that the operating pressure on the RO outlet pressure gauge does not exceed the maximum specified for the system (generally 1400kPa).

Membrane pressure and flow rates may also be altered by opening or closing the RO pump outlet valve. This valve is located on the discharge side of the pump. Close the valve slowly to reduce the overall system output and membrane pressure.

Under most operating conditions the ratio [illegible] and 1:3 and this ratio will vary according to [illegible] the system is around 1050kPa.

NOTE: The system will automatically enter a membrane flush mode for 60 seconds after continuous operation for 24 hours. This is to remove any sediment build-up that may have occurred on the membrane surface. The system will continue to operate normally after this process has finished.

Microprocessor Controller and TDS Readout



Display Description

Status Lamps

Full Alerts operator when the permeate storage tank is full. The light will turn green and the RO system will stop automatically.

Flush This lamp is red while the system is going through an automatic membrane flush cycle

Purify This lamp is green while the system is operating normally and treating feedwater.

Inlet This lamp is green whenever the power is on. If there is insufficient feedwater pressure, this lamp will turn on and off every second to alert the operator to a fault.

Manual Whenever the **Flush** button is pressed, this light will appear red and remain red until the membrane flush cycle is complete.

Control Switch Functions

Switch This button switches the display between operation time (1=10 minutes, 99-990 minutes) and permeate TDS value.

Flush This button may be pressed to initiate a membrane flush cycle while the system is in normal operation. After the 60 second membrane-flush cycle normal system operation will resume.

Reset This button may be used to reset the operating time to zero.

Troubleshooting

RO TROUBLE SHOOTING GUIDE						
SYMPTOMS			Location	Possible Causes	Verification	Corrective Action
Salt Passage	Permeate Flow	Pressure				
Normal to increased	Decreased	Normal to increased	Predominantly first stage.	Metal oxide scaling.	Analysis of metal ions in the feedwater. Check suitability of chemical dosing solution	Improved pretreatment to remove metals. Membrane cleaning with acidic cleaners.
Normal to increased	Decreased	Normal to increased	Predominantly first stage.	Colloidal fouling.	Feedwater SDI and/or X-ray diffraction analysis of cleaning solution residue.	Optimize pre-treatment system for colloidal removal. Clean with high pH, anionic detergent formulation.
Increased	Decreased	Increased	Predominantly last stage.	Scaling due to chemical precipitation ($CaSO_4$, $CaSO_3$, $BaSO_4$, SiO_2).	Analysis of metal ions in cleaning solution. Check LSI of reject stream. Calculate max solubility for $CaSO_4$, $BaSO_4$, and SiO2 in reject analysis.	Increase acid addition and scale inhibitor for $CaSO_3$ and $CaSO_4$. Reduce recovery. Clean with an acidic solution 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 streams. Slime build-up in pipework and pressure vessels.	Shock dosage with Sodium bisulphite. Continuous feed of low concentration of bisulfate at reduced pH. Clean with alkaline anionic surfactant. Consider upstream Chlorine dosage and pre-RO dechlorination. Replace cartridge filters.
Decreased or moderately increased	Decreased	Normal	All stages.	Organic fouling.	Destructive testing of membrane, e.g. IR reflection analysis.	Optimization of pretreatment system (e.g. flocculation or coagulation stage). Resin/activated carbon treatment. Clean with high pH detergent
Increased	Increased	Decreased	Most severe in the first stage.	Chlorine based oxidant attack.	Chlorine analysis of feedwater. Destructive element test.	Check chlorine feed equipment and efficiency of dechlorination steps.
Increased	Increased	Decreased	Most severe in the first stage.	Abrasion of membrane by crystalline material.	Microscopic solids analysis of feedwater. Destructive element test.	Improved pre-treatment stages Check all filters for media leakage.
Increased	Normal to increased	Decreased	At random.	O-ring leaks in pressure vessel. End or side seal glue leaks.	Probe test of pressure vessel and membranes. 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.

Appendix I

Membrane Cleaning

Periodic cleaning of the membrane(s) can improve system performance. In normal operation, mineral scale, biological matter, colloidal particles, and organic substances can foul the membranes and reduce performance. The best prevention is to use a well-designed pre-treatment system incorporating efficient sediment removal, de-chlorination (if chlorine-based sanitisers are present), and softening or chemical dosing for the removal of scale forming minerals.

WARNING: Cleaning chemicals are dangerous and can cause injury and damage to the environment. It is the user's responsibility to comply with all applicable federal, state, and local regulations.

General Safety Precautions

1. When using any chemical indicated here in subsequent sections, follow accepted safety practices. Consult the chemical manufacturer for detailed information about safety, handling and disposal.

2. When preparing cleaning solutions, ensure that all chemicals are dissolved and well mixed before circulating the solutions through the membrane elements.

3. It is recommended the membrane elements be flushed with good-quality chlorine-free water after cleaning. Permeate water is recommended; but a de-chlorinated potable supply or pre-filtered feedwater may be used, provided that there are no corrosion problems in the piping system. Operate initially at reduced flow and pressure to flush the bulk of the cleaning solution from the elements before resuming normal operating pressures and flows. Despite this precaution, cleaning chemicals will be present on the permeate side following cleaning so divert the permeate stream to drain for at least 10 minutes or until the water is clear when starting up after cleaning.

4. During recirculation of cleaning solutions, the temperatures must not exceed 50°C at pH 2-10, 35°C at pH 1-11, and 30°C at pH 1-12.

Organic Foulant Cleaning

The following cleaning procedures are designed specifically for membranes that have been fouled with organic matter. Review the general cleaning instructions for information that is common to all types of cleaning such as suggested equipment, pH and temperature limits, and recommended flow rates.

Cleaning Procedures for organic fouling

1. Prepare the cleaning solution as listed below.

Organic Fouling Cleaning Solution
* Preferred 0.1% (wt) Soda Ash pH 12, 30°C maximum
* Alternative solution 0.1% (wt) NaOH 0.025% (wt) pH 12, 30°C maximum
Notes:
1 (wt) Denotes weight percent of active ingredient.
2 Cleaning chemical symbols in order used: NaOH is sodium hydroxide.

2. Low-flow rate pumping. Pump mixed, preheated cleaning solution into the vessel at a low flow rate of 5-10 litres per minute at low pressure (<120kPa) to displace the process water. Use only enough pressure to compensate for the pressure drop from feed to concentrate. The pressure should be low enough so that little to no permeate is produced. A low pressure minimizes re-deposition of dirt on the membrane. Dump the concentrate, as necessary, to prevent dilution of the cleaning solution.

3. Re-circulate. After the process water is displaced, cleaning solution will be present in the concentrate stream and this can be recycled to the cleaning solution tank. Recycle the cleaning solution for 15 minutes or until there is no visible colour change. If a colour change occurs, dispose of the cleaning solution and prepare a new solution as described in step 2.

4. Soak. Turn the recirculation pump off and allow the elements to soak for 1-15 hours (soaking overnight will give best results). To maintain temperature during an extended soak period, use a slow recirculation rate (2-5 litres per minute). Soak time will vary depending on the severity of the fouling. For lightly fouled systems, a soak time of 1-2 hours is sufficient.

5. High-flow pumping. Recirculate the cleaning solution through the membranes at 15-20 litres per minute for 45 minutes. This high flow rate flushes out the foulants removed from the membrane surface by the cleaning. If the elements are heavily fouled, using a higher flow rate is possible up to the maximum pressure drop across the membrane permissible (check with membrane manufacturer's data sheets). With higher flow rates, excessive pressure drop may be a problem. The maximum recommended pressure drops for most common membranes are 100kPa per element or 340 kPa per multi-element vessel, whichever value is more limiting.

6. Flush out. Clean RO permeate water is preferred for this stage. If clean RO permeate water is not available, pre-filtered raw water can be used for flushing out the cleaning solution unless there will be corrosion problems (e.g., stagnant seawater will corrode stainless steel piping). To prevent precipitation of any remaining contaminants, the minimum flush out temperature is 20°C. The system should be flushed for 1 hour.

7. Re-start the system. The RO elements and the system need to stabilize before taking any performance data. The stabilization or normalisation period will vary depending on the severity of the fouling. To regain optimum performance, it may take several cleaning and soak cycles.

Inorganic Foulant Cleaning

The following cleaning procedures are designed specifically for membranes that have been fouled with inorganic matter. Review the general cleaning instructions for information that is common to all types of cleaning such as suggested equipment, pH and temperature limits, and recommended flow rates.

Cleaning Procedures for inorganic material fouling

1. Make up the cleaning solution listed from Table 1.

Inorganic Cleaning Solution
* Preferred 2.0% (wt) Citric Acid PH 2, 45°C maximum
* Alternate Muriatic Acid
* Alternative 1.0% Na2S2O4
Notes:
1. (wt) denotes weight percent of active ingredient.
2. Cleaning chemical symbols in order used: HCl is hydrochloric acid (Muriatic Acid).

2. Low-flow rate pumping. Pump mixed, preheated cleaning solution into the vessel at a low flow rate of 5-10 litres per minute at low pressure (<120kPa) to displace the process water. Use only enough pressure to compensate for the pressure drop from feed to concentrate. The pressure should be low enough so that little to no permeate is produced. A low pressure minimizes re-deposition of dirt on the membrane. Dump the concentrate, as necessary, to prevent dilution of the cleaning solution.

3. Re-circulate. After the process water is displaced, cleaning solution will be present in the concentrate stream that can be recycled to the cleaning solution tank. Recycle the cleaning solution for 10 minutes or until there is no visible colour change. If at any time during the circulation process there is a change in pH or a colour change, dispose of the solution and prepare a new solution as described in step 2. A pH of 2 must be maintained for the cleaning to be effective.

4. Soak. Turn the pump off and allow the elements to soak. Soak the elements for 1-15 hours (soaking overnight will give best results). To maintain temperature during an extended soak period, use a slow recirculation rate (2-5 litres per minute). Soak time will vary depending on the severity of the scaling. For lightly scaled systems, a soak time of 1-2 hours is sufficient.

5. High-flow pumping. Feed the cleaning solution at 15-20 litres per minute for 45 minutes. The high flow rate flushes out the foulants removed from the membrane surface by the cleaning. If the elements are heavily fouled, using a higher flow rate is possible up to the maximum pressure drop across the membrane permissible (check with membrane manufacturer's data sheets). With higher flow rates, excessive pressure drop may be a problem. The maximum recommended pressure drops for most common membranes are 100kPa per element or 340 kPa per multi-element vessel, whichever value is more limiting.

6. Flush out. Clean RO permeate water is preferred for this stage. If clean RO permeate water is not available, pre-filtered raw water can be used for flushing out the cleaning solution unless there will be corrosion problems (e.g., stagnant seawater will corrode stainless steel piping). To prevent precipitation of any remaining contaminants, the minimum flush out temperature is 20°C. The system should be flushed for 1 hour

7. Re-start the system. The RO elements and the system need to stabilize before taking any performance data. The stabilization or normalisation period will vary depending on the severity of the fouling. To regain optimum performance, it may take several cleaning and soak cycles.

NOTE: These recommendations are specific for the ROTEK membrane elements used in these reverse osmosis systems and may not be compatible with other brands of membrane elements. It is your responsibility to ensure the suitability of these recommendations and procedures if they are applied to membrane elements other than those which come with your system.

Additional Information

Never recirculate the cleaning solution for longer than 20 minutes. With longer recirculation, the carbonate scale can re-precipitate and end up back on the membrane surface, making it more difficult to clean. Carbonate scale reacts with HCl releasing carbon dioxide gas. Depending on the severity of the fouling, it may take repeated cleanings to remove all the scale. Cleaning severe scale may not be economical and element replacement may be the best choice.

Citric acid was originally used as a cleaner for cellulose acetate membranes and is not as effective with thin film composite chemistry. Furthermore, it has a disadvantage of being a nutrient source for systems which have biological fouling. I t is, however, easier to handle than HCl and is included as an alternative cleaner for that reason.

Appendix 2

Sample Operation Log										
Operator						Start up date				
Site location						Cleaning date				
Model						Cleaning solution 1 type				
System serial number						Cleaning solution 2 type				
Observations	**Range**	**Date**	**Date**	**Date**	**Date**	**Date**	**Date**	**Date**	**Date**	**Date**
Hours of operation										
Feedwater pressure (kPa)	**140-650 kPa**									
Pre-filter inlet pressure (kPa)	**140-650 kPa**									
Pre-filter outlet pressure (kPa)	**140-650 kPa**									
Pre-filter differential pressure (kPa)	**70 kPa**									
Pump discharge pressure (kPa)	**700-1520 kPa**									
Membrane discharge pressure (kPa)	**700-1400**									
Permeate flow (lpm)	**3-5lpm/membrane**									
Reject flow (lpm)	**3-8lpm/membrane**									
Feedwater flow (lpm)	**6-20lpm/membrane**									
Recovery %	**30-60%**									
Feedwater conductivity or TDS										
Permeate conductivity or TDS										
Reject ratio %	**95-98%**									
Chemical dosing system										
Scale inhibitor feed setting										
Acid feed setting										
Feedwater										
Last feedwater analysis date										
Feedwater temperature										
Feedwater conductivity or TDS										
Feedwater hardness										

Appendix 3

Water Analysis Requirements (minimum recommended)

Recommended sampling procedure for bore waters

The purpose of this water sample is to correctly identify and quantify the contaminants that may be present in your feedwater. To do this with any accuracy, the sample must be representative of the source water and not water that has been standing in the Pipework for any period of time. It is also important to minimise any contact between the water and the atmosphere during sample collection.

- The bore should be operating for at least 2 hours prior to sample collection
- Make a note of any observations on the water exiting the bore and include these with your sample. Things of note include:
  - Is the water milky, cloudy or coloured in appearance?
  - Is there any obvious sediment present?
  - Does the water have any noticeable odour?
  - Does the water cause any staining after contact with any surfaces regularly wetted?
  - What does the water sample look like after standing for 24 hours?
- Use a clean 500ml plastic bottle with a well-fitting lid to take your sample.
- Write your name, contact details, date and sampling location on the bottle label
- Rinse the sample bottle with fresh bore water several times.
- Fill the rinsed bottle completely and seal immediately. Tape the lid to prevent leakage
- Complete this sample request form and attach to your sample. Package sample and request form securely and forward to your test laboratory for analysis.

Name			
Street address			
Suburb		**Post code**	
Contact phone		**Fax**	
Contact email			
Sample location			
Date			

Please test the accompanying sample for the following analyses

	pH		**Nitrate**
	EC (conductivity)		**Chloride**
	TDS (Total dissolved solids)		**Fluoride**
	Turbidity		**Sulphate**
	Total Hardness		**Strontium**
	Calcium		**Ammonium**
	Potassium		**Phosphate**
	Magnesium		**Carbonate**
	Sodium		**Bicarbonate**
	Iron (Total)		**Alkalinity**
	Silica		**Barium**
	Boron		

Warranty & Guarantee

The manufacturer of your reverse osmosis system guarantees that the product is free from defects in material or workmanship when operated in accordance with written instructions for a period of 6 months from start-up or 12 months from receipt, whichever is the shorter. Parts that are not manufactured directly by the manufacturer of your reverse osmosis system will be covered by their manufacturer's warranties.

For applications or water conditions other than those specified in the original purchase order for the reverse osmosis system, the User should consult with their local dealer or distributor to assess the suitability of the solution to be run in the membrane elements. Limitations on pH and temperature can vary with membrane element type and the application of the equipment. For special applications or for pH or temperature ranges outside the stated limits, the manufacturer may reduce the warranty period at their discretion.

A membrane element which fails to perform satisfactorily within the first 30 days after receipt that has not been mishandled, will be replaced free of charge except for freight and local labour on return to the factory. A new membrane element supplied under warranty terms will carry the standard 30-day new membrane element warranty. Any specified or implied warranties on membranes excludes but is not limited to scaling events, damage due to physical events such as water hammer or over-pressurisation, damage due to exposure to oxidising agents or pH outside the specified range limit, or incorrect placement in the pressure vessel.

If a membrane element is returned for warranty inspection, the User must obtain a Return Good Authorization (RGA) number from their dealer or distributor before returning the membrane elements. The returned goods must be accompanied by a Returned Goods Form and be returned freight prepaid to the manufacturer.

The manufacturer will return any warranty replacement membrane elements to the customer prepaid. Membrane elements must be kept damp at all times and must be clean and sealed in a watertight bag before returning. Only the manufactured approved cleaners, biocides, dispersants or other chemicals may be used with the membrane elements. Use of other chemicals may void the warranty. The User is responsible for being aware of the membrane element material and for ensuring that chemicals harmful to the membrane element are never in contact with the membrane elements.

It is the obligation of the User to maintain frequent operating data records. The manufacturer may request these records to substantiate any warranty evaluation. The User must notify their dealer or distributor at the very first sign of changes in operation of the system or membrane elements. Such notification should be in writing and should include all data requested on the operating log sheets.

To obtain a copy of the manufacturer’s warranty for their systems and terms and conditions, please contact your local dealer and distributor.

Notes: