SKRO Reverse Osmosis Water Treatment Unit

Installation Instructions and User Manual

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Intertek

4011008

Foreword

Neptronic Company Overview

Founded in 1976, Neptronic is a private corporation that designs, manufactures and distributes products for the HVAC industry. Our product line includes intelligent controllers, electronic actuators, actuated valves, humidifiers and electric heaters.

Our products are designed and manufactured by over 250 dedicated employees in our 7,500 m^2 (80,000 ft^2) state-of-the-art facility located in Montreal, Canada. Our entire manufacturing chain is under one roof from software and hardware development to SMT circuit board assembly, to sheet metal fabrication, to product testing ensuring that our products are engineered to last using a vertical integration model.

We currently hold several national and international patents, and with our continued commitment to research and development, we provide innovative products and technologies for the ever-evolving challenges of the HVAC industry. Exporting over 75% of our sales, we have an exclusive distribution network around the globe that provides comprehensive solutions to our worldwide customers.

About the Manual

These installation and operation instructions have been developed to facilitate the installation of the SKRO Reverse Osmosis water treatment unit.

- The strict application of these instructions ensures conformity of your installation and operation as per the manufacturer's recommendations.
- The application of these instructions is one of the conditions for the application of the warranty.
- The application of these instructions does not ensure, at any time, conformity to procedures, regulation or local codes, regarding electric connections and installation to local water supply.

This product has been declared to conform to the applicable Canadian and American safety standards and directives and bear the ETL (c) & (us) mark. The Certificate of Conformity for ETL is available, upon request with the manufacturer.

Copyright Information

Health and Safety Instructions

General

This manual has been written to ensure correct, safe and sustainable operation of the SKRO Water Treatment unit and is intended for use by engineers and technical personnel trained by or their official agents. This manual must be read thoroughly before specifying, designing, installing or operating a SKRO Water Treatment unit. Please retain for reference and contact Neptronic should you have any questions.

The triangular symbol with the word **WARNING**: is used to designate danger of severe or lethal consequence.

The circular symbol with the word **CAUTION**: is used to designate danger of injury, or to warn of the hazardous operating condition, or other relevant information.

Electrical Warning Message

WARNING:

Risk of electric shock. Do not access. Disconnect SKRO Water Treatment unit before opening the electrical access door.

All work concerned with electrical installation MUST only be performed by skilled and qualified technical personnel (such as an electrician or a technician with appropriate training). The customer is always responsible for ensuring the suitability of the technical personnel.

Please observe the local regulations concerning the provision of electrical installations.

Health & Safety

Installation, maintenance, repair work or de-commissioning should only be carried out by appropriately qualified technical personnel. Any risks or hazards relating to the system, including during installation and maintenance, should be identified by a qualified Health & Safety representative who shall be responsible for introducing effective control measures, as necessary. The customer is responsible for ensuring that the installation of the equipment complies with all local regulations.

CAUTION: Maintenance personnel must be trained by Neptronic or their official agent, and it is the customer's responsibility to ensure their suitability. Failure to use qualified personnel may lead to a hazardous operating condition.

WARNING: Danger of Electrocution! Danger of contact with live parts when the unit is open. Always isolate all water and electrical supplies to the system before commencing any maintenance or repair. Isolate power and water immediately if there are any signs of water leaking from the unit.

General Warranty

This product is subject to the terms and conditions described at www.neptronic.com/sales-conditions.aspx.

Handling and Packaging

Lifting or Handling MUST be carried out by trained and qualified personnel. Ensure that the lifting operation has been properly planned, assessed for risk and that the equipment is checked by a qualified Health & Safety representative, and effective control measures are in place.

It is the customer's responsibility to ensure that the operators are trained in handling heavy goods and to enforce the relevant lifting regulations.

The SKRO Water Treatment unit MUST always be handled and lifted with care and should remain in its original packaging for as long as possible before installation.

The SKRO Water Treatment unit package may be carried using a forklift from the underside. Caution should be exercised to ensure balanced load before lifting.

Inspection

Upon receipt, and once packaging material is removed, carry out an inspection to ensure that no damage occurred during transit. Verify that all the components listed in the packing list are included. Report any damage or missing parts immediately to your Neptronic representative.

Unpacking

The SKRO unit is delivered in a crate.

Contents

Overview

The SKRO Water Treatment unit purifies water by filtering it with reverse osmosis membranes, creating highly purified water with almost no minerals or contaminants. The SKRO is a part of a water treatment system with the following units as the main components:

- Dechlorinator unit
- Water softener unit

The purified water is ideal for combining with Neptronic's high pressure humidifiers such as SKH4 and isothermal humidifiers.

Advantages

The following are the advantages of the SKRO Water Treatment unit:

- Calibration free unit, plug and run
- Simple plumbing layout
- Membranes easily accessible for replacement
- Sized to match Neptronic's humidifiers

Technical Specifications

The following are the technical specifications of the SKRO Water Treatment unit:

- **Capacity**: up to 13000 gallons per day
- **Feed Water Pressure**: 30 psi to 60 psi (207 kPa to 414 kPa)
- **Operating Temperature**: 40°F to 100°F (4°C to 38°C)

Features

The following are the features of the SKRO Water Treatment unit:

- Enclosed cabinet design with no external knobs or dials
- User-friendly, menu-driven LCD (128 x 64) display
- Numerical monitoring of the unit operation
- Pressure regulator to maintain osmotic pressure and maximize pure water output
- Digital sensors for:
  - Inlet pressure
  - Osmotic pressure
  - Pure water pressure
  - Pure water flow
  - Total Dissolved Salts (TDS)
- Wetted parts and fittings in stainless steel or brass
- Real-time clock and SD card or USB key for scheduling, trend monitoring, and data logging
- Firmware updates via SD card or USB key

Available Options

- Digital sensor for concentrate flow
- BACnet and Modbus communication

Sizing SKRO for Neptronic Humidifiers

The SKRO is designed to work with Neptronic humidifers for pure water supply. The key factors for sizing the SKRO include:

- Minimum ambient temperature
- Humidifier model and tank size
- Duty cycle

The following table shows the SKRO models that can be sized for Nepronic humidifers.

Table 1 - Sizing SKRO with Humidifiers

SKRO Models	SKRO Pure Water Capacity [rated at 50°F (10°C)]			SKE Model	SKG Model	SKH4 Model	SKH4 SS Model
	L/h	Lb/h	GPD [GPM]				
SKRON012	120	265	760 [0.5]	SKE4-S	-	-	-
				SKE4-M			
SKRON022	220	480	1460 [1]	SKE4-L	SKG4-1 Module	SKH4-N021B	
				SKE4-XL			
SKRON023	230	500	1470 [1]	-	SKG4-1 Module	SKH4-N021B	
SKRON046	460	1010	2900 [2]		SKG4-2 Modules	SKH4-N050B	SKH4-N062S
SKRON091	910	2000	5770 [4]		SKG4-3 Modules	SKH4-N100B	SKH4-N140S
SKRON137	1370	3010	8690 [6]		SKG4-4 Modules	SKH4-N185B	SKH4-N225S
SKRON205	2050	4510	13000 [9]		-	SKH4-N280B	SKH4-N280S

Reverse Osmosis Water Treatment

Principle of Operation

The SKRO Water Treatment unit purifies water through Reverse Osmosis (RO) membranes, producing highly purified water with minimal minerals or contaminants. The SKRO is part of a complete water treatment system that includes a dechlorinator unit and a water softener unit.

1. **Dechlorinator Unit**
   The dechlorinator unit uses Activared Carbon Filtration method to remove chlorine from the incoming water supply at the start of the water line. Water flows through the carbon filter, and chlorine molecules are trapped on the surface of the carbon particles. Chlorine can degrade the RO membranes quickly, so this step is crucial for preserving membrane life.
2. **Water Softener Unit**
   The water softener exchanges hardness minerals (like calcium and magnesium) for sodium or potassium ions, making it easier to filter out these minerals and reducing the potential for membrane scaling. This process helps extend the life of the membranes.

After filtration, the purified water is stored in a pressurized tank (as shown in the illustration) until required by the humidifier. The SKH4 model is shown here as an example.

Illustration 1 - Visual Overview of an SKRO

Water Treatment and Filtration Process

1. **Inlet and Circulation:** Water enters the SKRO unit through the inlet valve and circulates through the plumbing system.
2. **Pressurization and Filtration:** The pump pressurizes the feed water, forcing it through semi-permeable membranes. Contaminants are trapped on the pressurized side, while purified water passes through. The system maintains optimal differential pressure across the membranes to maximize filtration efficiency.
3. **Concentrate Management:** A pressure regulator controls the concentrate (waste stream) at 150 psi (1034 kPa), directing overflow to the drain. At the end of the cycle, the fast flush valve bypasses the regulator to clean the membranes. The software monitors the pressure on concentrate side using a digital manometer (PT4).
4. **Pure Water Distribution:** Purified water flows through a separate branch to the reservoir. A manifold with sensors monitors water quality (TDS), pressure, and flow rate. The pure water is stored in a pressurized tank (supplied by others) and distributed to the humidifier as required.

SKRO Unit

Visual Overview

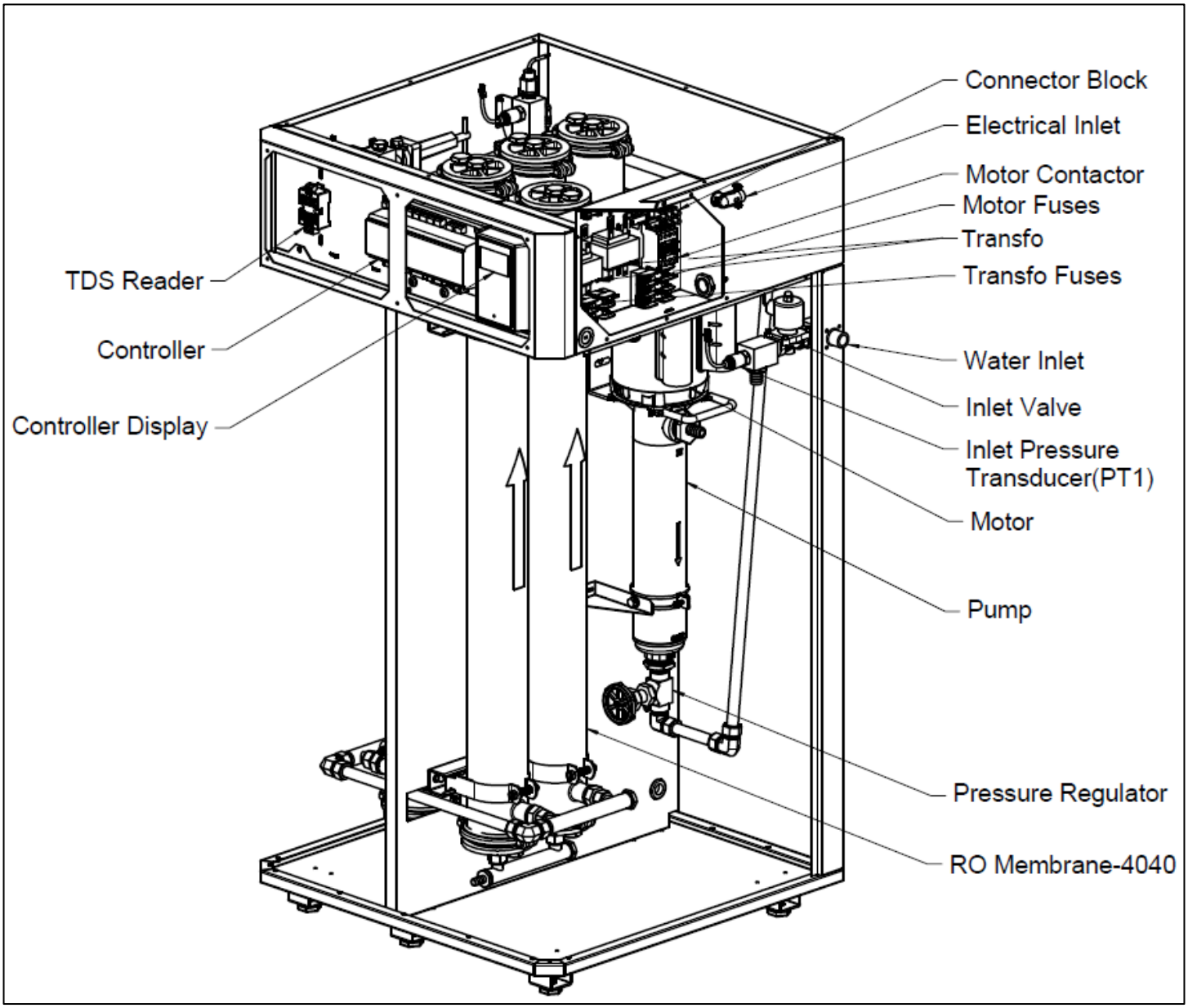


Illustration 2 - Visual Overview of the SKRO

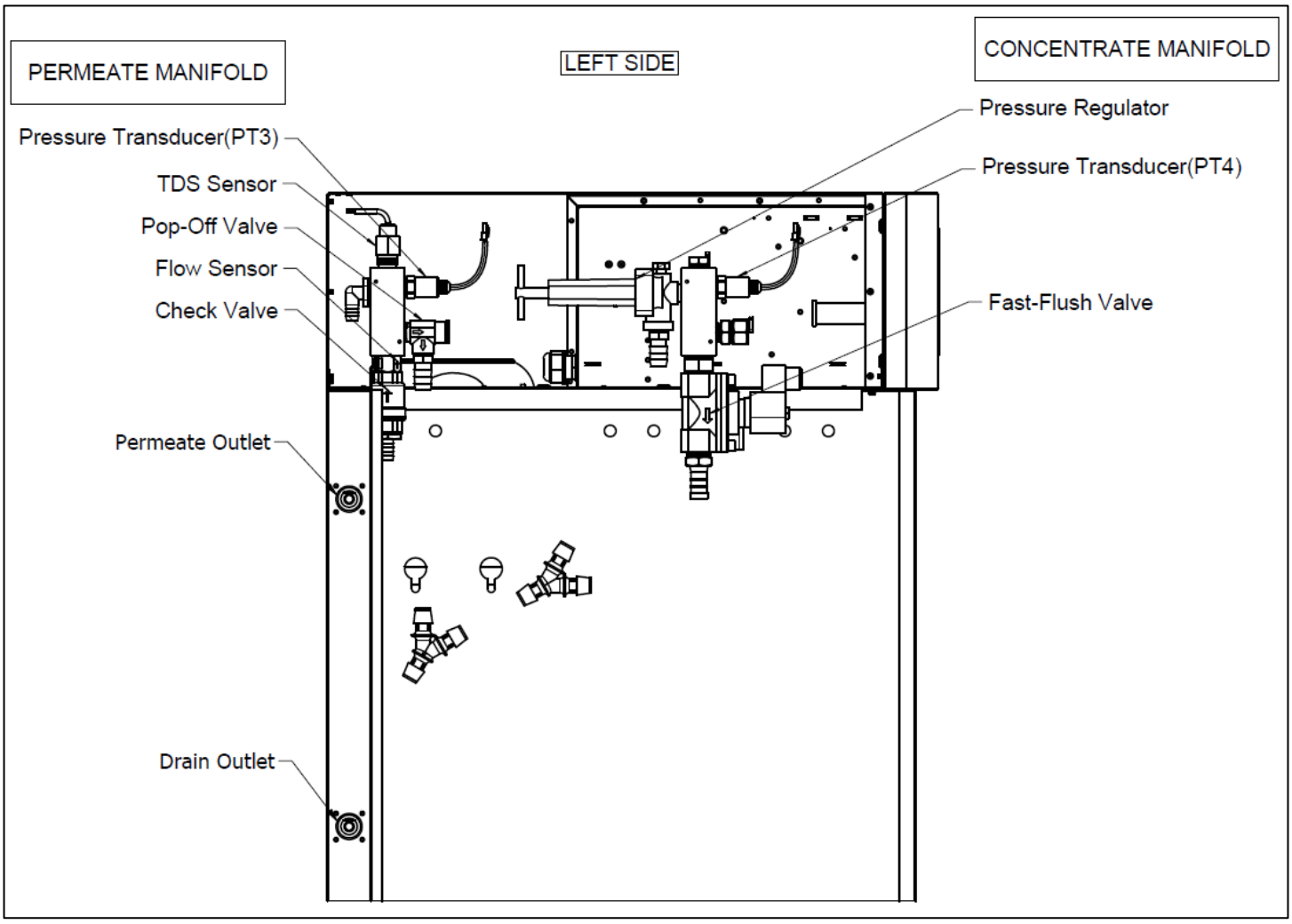


Illustration 3 - Components Overview

Nomenclature

Table 2 - SKRO Nomenclature

WF SKRO	N	046	B	E
		Pure Water Capacity	**Membrane Type**	**Voltage**
		012 = 120 L/h (0.5 GPM)	A – Low Energy	A = 120V/1ph
		022 = 220 L/h (1 GPM)	B – Extra Low Energy	B = 208V/1ph
		023 = 230 L/h (1 GPM)		C = 220-240V/1ph
	Frequency: N = 60Hz	046 = 460 L/h (2 GPM)		D = 208V/3ph
		091 = 910 L/h (4 GPM)		E = 220-240V/3ph
		137 = 1370 L/h (6 GPM)		
		205 = 2050 L/h (9 GPM)		G= 480V/3ph
				H= 600V/3ph

Capacities and Power Consumption

Table 3 - Capacities and Power Consumption with A Membranes

Model	Min output At 50°F (10°C)		MCA (A)							Cabinet
			A	B	C	D	E	G	H	
	L/h	gpd	120/1	208/1	240/1	208/3	240/3	480/3	600/3	
SKRO-N012x	120	760	20.0	11.5	10.0	-	-	-	-	Small
SKRO-N022x	220	1400	20.0	11.5	10.0	-	-	-	-	Small
SKRO-N023x	230	1460	-	18.5	16.1	10.3	8.9	4.5	2.3	Large
SKRO-N046x	460	2920	-	18.5	16.1	10.3	8.9	4.5	2.7	Large
SKRO-N091x	910	5770	-	25.4	22.1	11.4	9.9	4.9	3.9	Large
SKRO-N137x	1370	8690	-	-	35.3	15.3	13.2	6.6	5.4	Large
SKRO-N205x	2050	13000	-	-	-	22.9	19.9	10.0	8.0	Skid

Table 4 - Capacities and Power Consumption with B Membranes (Extra Low Energy)

Model	Min output At 50°F [10°C]		MCA (A)							Cabinet
			A	B	C	D	E	G	H	
	L/h	gpd	120/1	208/1	240/1	208/3	240/3	480/3	600/3	
SKRO-N012x	120	760	20.0	11.5	10.0	-	-	-	-	Small
SKRO-N022x	220	1400	20.0	11.5	10.0	-	-	-	-	Small
SKRO-N023x	230	1460	22.6	13.0	11.3	6.4	5.6	2.8	3.6	Large
SKRO-N046x	460	2920	-	15.8	13.7	7.8	6.8	3.4	3.6	Large
SKRO-N091x	910	5770	-	25.4	22.1	11.4	9.9	4.9	3.9	Large
SKRO-N137x	1370	8690	-	-	35.3	15.3	13.2	6.6	5.4	Large
SKRO-N205x	2050	13000	-	-	-	22.9	19.9	10.0	8.0	Skid

The system is rated at these conditions:

Table 5 - SKRO Membranes Rating

Rated Condition						
Membrane Type	TDS *(Sodium chloride)*	Water Recovery	Average Salt Rejection	AverageHardness Rejection	Regulator Pressure	Temperature rated
A – Low Energy	2000ppm	10-15%*	99%	99%	200 psi (1379 kPa)	25°C (77°F)
B – Extra Low Energy	500ppm	10-15%*	99%	99%	150 psi (1034 kPa)	

**Per membrane, units with multiples membranes multiply the overall recovery.*

Note: ***Perform a Physico Chemical analysis of the water before selecting the type of equipment.***

Dimensions and Weight

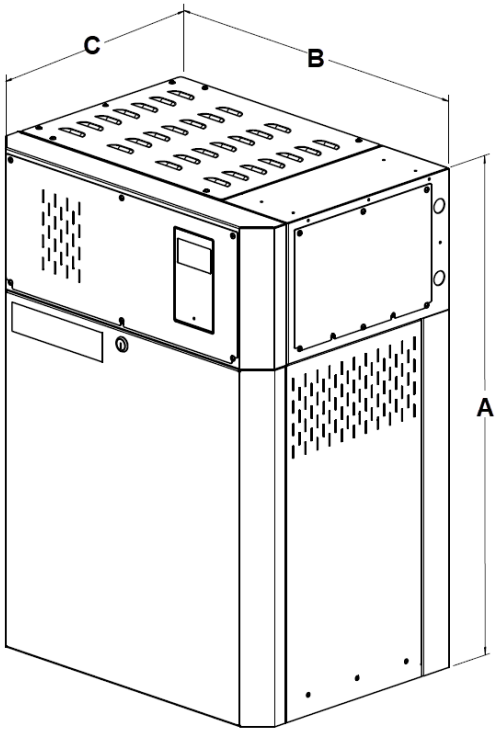
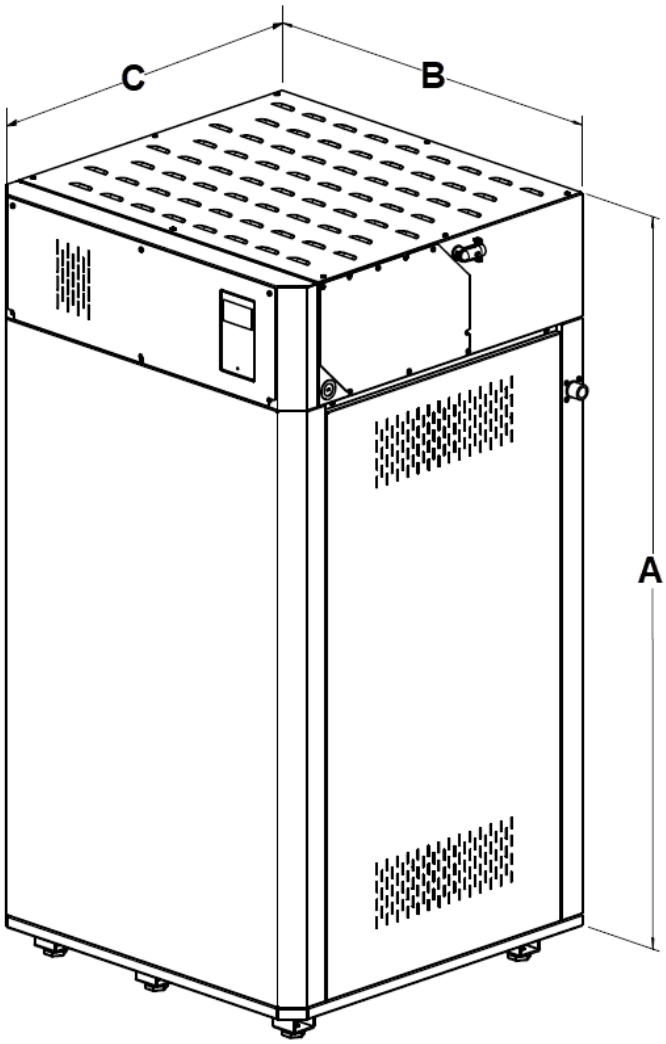
SKRO Small	SKRO Large
	

Illustration 4 - SKRO Dimensions

Table 6 - Unit Dimensions (North America)

Enclosure Type	Model	Dimensions (inch) [mm]			Weight (lb) [kg]	
		A	B	C	Dry	Full
Small Enclosure	SKRO-N012	31 [790]	22.3 [565]	16 [400]	65 [29]	79 [36]
	SKRO-N022					
Large Enclosure	SKRO-N023	55.0 [1400]	29 [740]	28 [710]	250 [114]	270 [123]
	SKRO-N046				280 [127]	320 [145]
	SKRO-N091				330 [150]	410 [186]
	SKRO-N137				390 [177]	510 [232]

Basic Installation Overview

WARNING: Failure to observe manufacturer's installation recommendations voids the manufacturer's warranty.

Installation Steps

Illustration 5 - Overview of a Typical System

Step 1 – SKRO Unit Installation

Step 2 – Membrane Insertion

Step 3 – Water Connections for the SKRO Unit

Step 4 – Power Supply Connections

Step 5 – Electrical Control Connections

Step 6 – Controller Installation and Configuration

Step 1 – SKRO Unit Installation

Safety Precautions

WARNING: Risk of electric shock. Disconnect the appliance from the electric supply before commencing installation.

CAUTION: Risk of injury. The SKRO unit is heavy; It MUST always be handled and lifted with care.

Location

Consider the following points before deciding the location for the unit:

- Plan a location that is easy to access to permit an easy inspection and servicing of the unit.
- Position the system near a water source and a drain.
- Do not install the unit where the failure of the appliance could cause damage to the building structure or other equipment.
- Ensure that the location is ventilated appropriately, and that the ambient temperature is less than 86°F (30°C).
- Ensure that the floor beneath the SKRO unit is waterproof to withstand any water spillage during servicing or if a problem occurs.

Positioning

- The pump unit can be floor mounted, either directly or with the use of a floor stand.
- Allow some space beneath the unit for the drain pan connection, located below the bottom plate.
- Respect the clearances around the unit as shown in this illustration to permit access to the connections and allow for servicing:

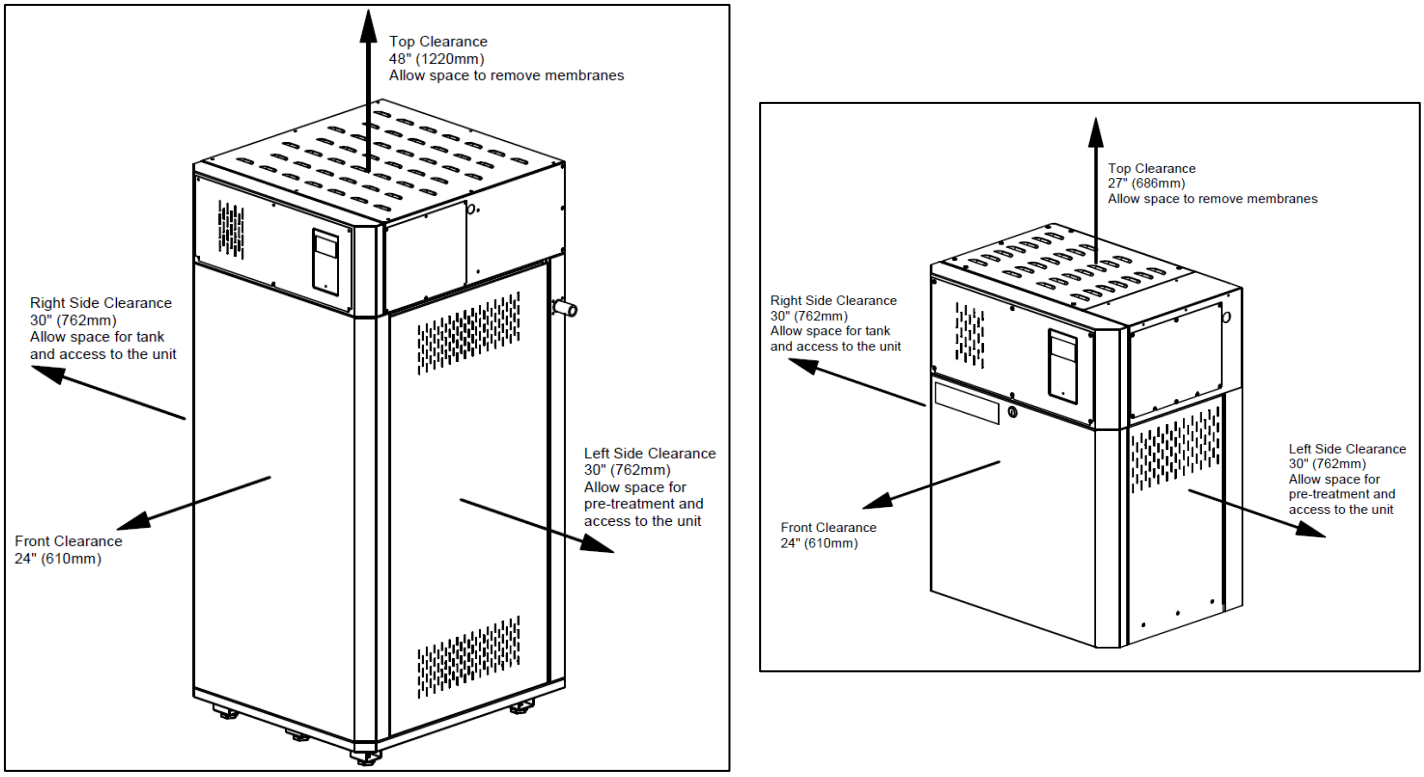


Illustration 6 - Clearances

Floor Mounting (Large Cabinet)

- Provide a level, solid foundation for the SKRO unit.
- Ensure that the SKRO unit is leveled with the provided adjustable legs.
- Allow some space beneath the unit for the drain pan connection, located below the bottom plate.
- Secure the system frame to the floor using appropriate anchors.

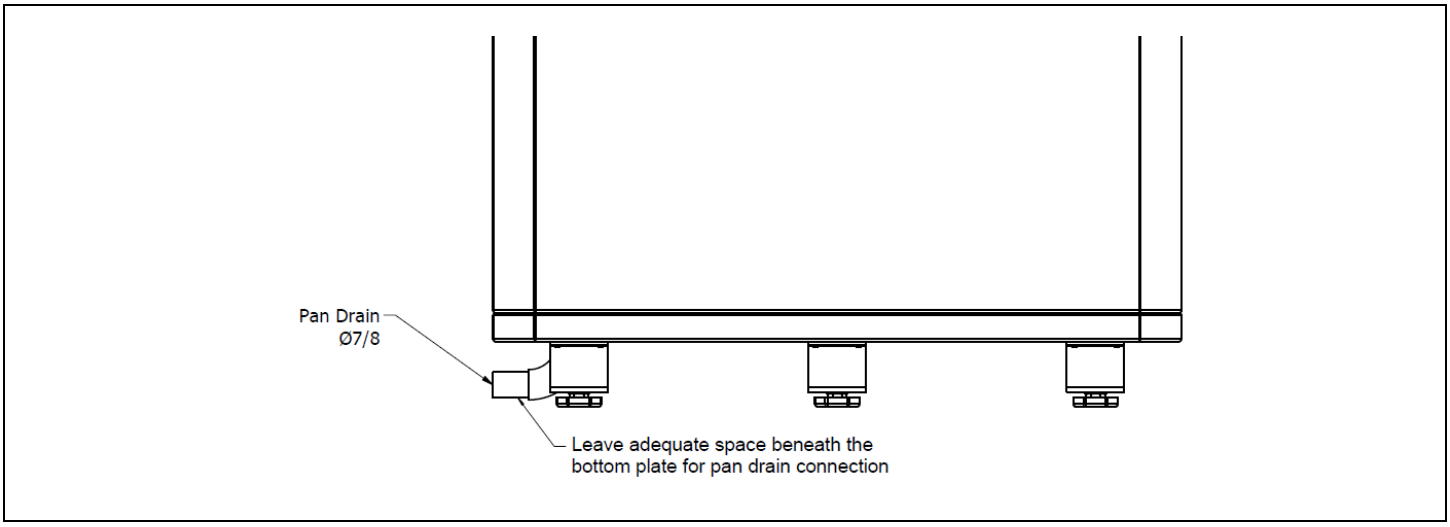


Illustration 7 - Floor Mounting and Clearances

Wall Mounting (Small Cabinet Only)

CAUTION: Risk of malfunction. The unit must be placed at an equal level.

Note: Only the small enclosure units can be mounted on the wall.

Before proceeding, check the strength of the chosen support or wall (brick, concrete, stud partition wall) on which the water treatment system will be mounted. See the Dimensions and Weight section to know the weight of the unit.

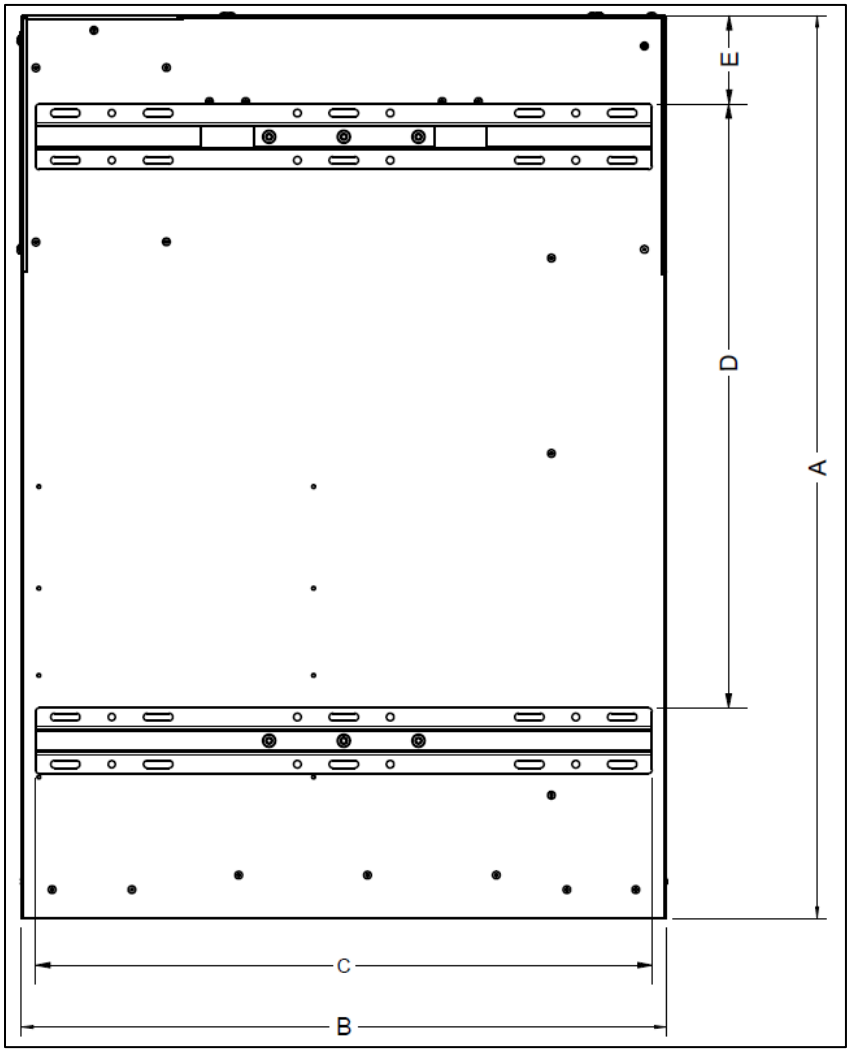


Illustration 8 - Mounting Bracket Positioning

Table 7 - Positioning Lines of Mounting Brackets

Dimensions (inch) [mm]				
A	**B**	**C**	**D**	**E**
31 [790]	22.3 [567]	21.25 [540]	20.79 [528]	3.04 [77]

To wall mount the water treatment system, perform the following steps:

1. Place the top bracket (supplied) on the support or wall as per the dimensions specified in Table 7 - Positioning Lines of Mounting Brackets.
2. Drill 6 screws with dimensions of 1/4” (6mm) (not supplied) into the slotted holes of the top bracket, to secure the bracket to the support or wall.
3. Place the bottom bracket (supplied) on the support or wall as per the dimensions specified in Table 7 - Positioning Lines of Mounting Brackets.
4. Drill 6 screws with dimensions of 1/4” (6mm) (not supplied) into the slotted holes of the bottom bracket, to secure the bracket to the support or wall.

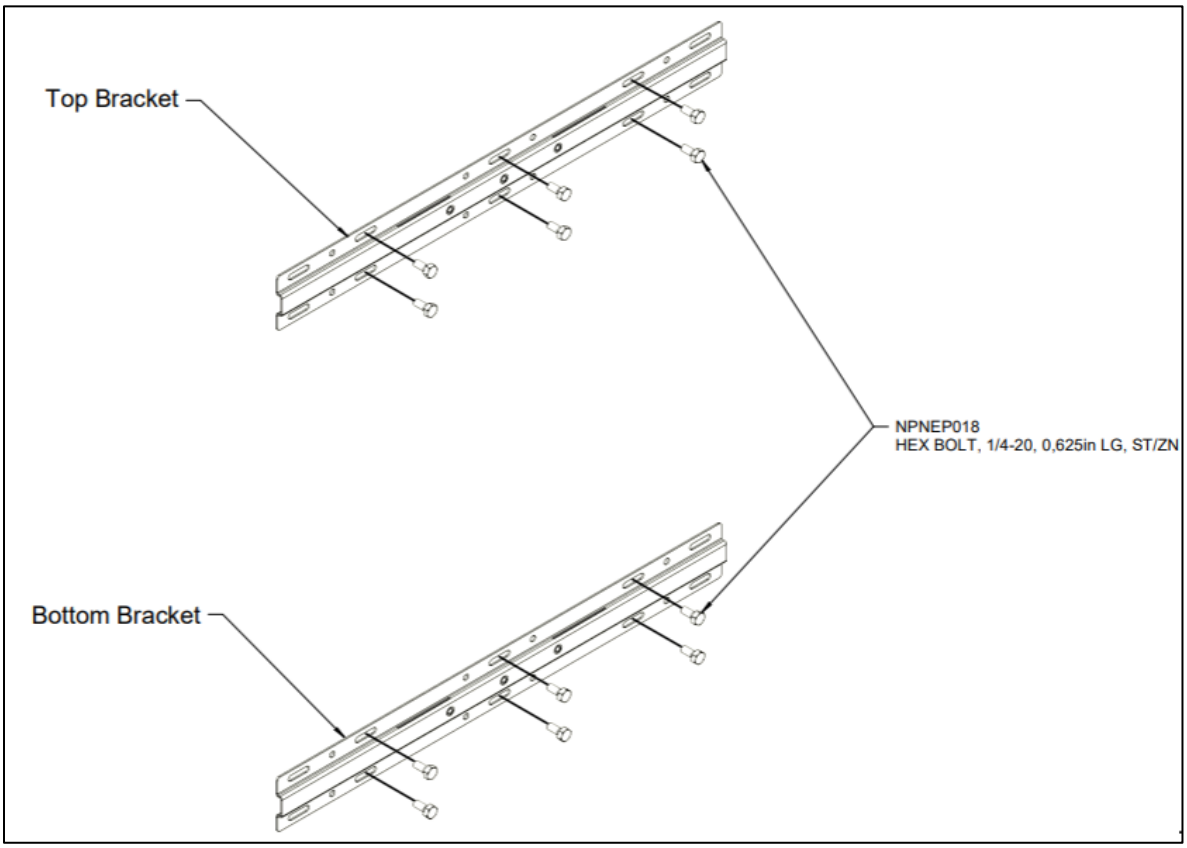


Illustration 9 - Mounting Bracket Attachment

5. Secure the water treatment system to the top bracket, by placing the back inserts into the open slots located on the edge of the center of the top bracket.

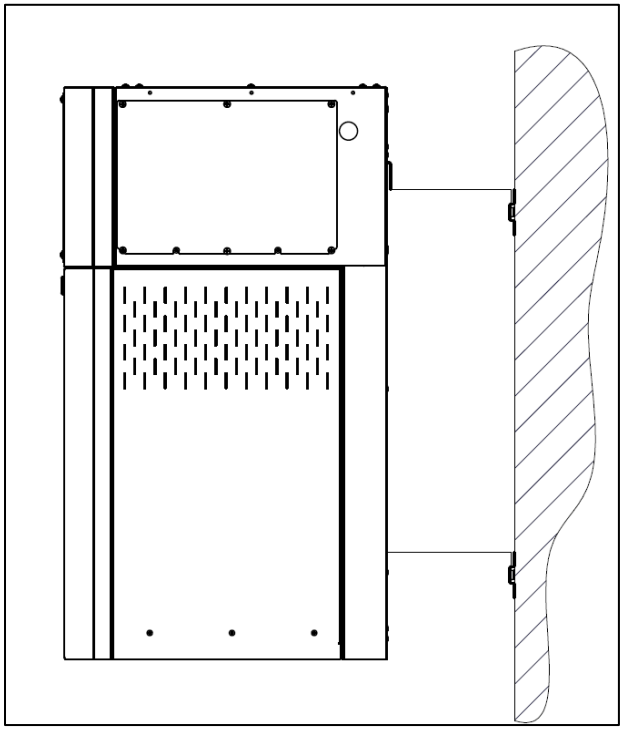


Illustration 10 - Top Mounting Bracket Connection

6. Open the front door of the humidifier to gain access to the slotted holes located in the back of the cabinet. Verify that the holes are aligned with the ones located in the center of the bottom bracket.
7. From inside the water treatment system, install 2 screws (supplied) into the center of the bottom bracket, in order to secure the water treatment system to the support or wall.

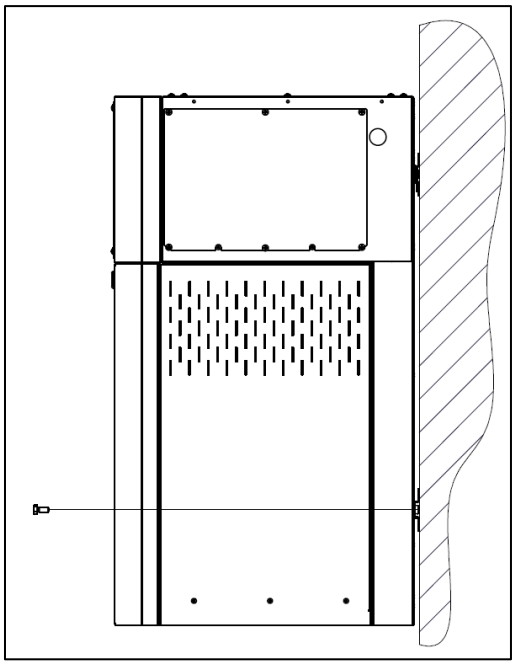


Illustration 11 - Bottom Mounting Bracket Connection

Step 2 – Membrane Insertion

The Membranes are shipped dry and sealed to allow for maximum shelf life before comissionning. After installation of the SKRO physical unit, install the membranes in the unit.

Note: For all lubrification, use food-grade silicone grease, non-petroleum based *(Order at Neptronic, Spare part #SPG9325-6)*.
Apply grease only as a thin layer on the sealing surfaces.
Do not apply grease on the wall of the membrane.

Procedure

1. Remove the top end cap by removing the bolts of the clamp.
2. Identify the direction of the flow on the metal housing.
3. Unwrap the protective plastic film on the membrane.
4. Locate the brine seal and feed flow arrow on the membrane.
5. Lubricate both the membrane ports and the membrane brine seal.
6. Insert the membrane straight in the housing. Match orientation of the flow (Pay attention to brine seal orientation as well, see Illustration 13). The Membrane port needs to insert in the spacer at the bottom, the alignment is important.
7. Insert spacer on the top membrane port.
8. Ensure that the lubricated spacer head and housing top lip and internal surface are hatched as shown in Illustration 13.
9. Close the membrane assembly back with top cap. Expect some resistance as several o-rings are being compressed but do not use excessive force. It is important to lubricate and align the top cap properly. If it is not aligned, re-grease and repeat the procedure. Cap should be flush to the housing lip.
10. Reassemble clamp around the top cap.

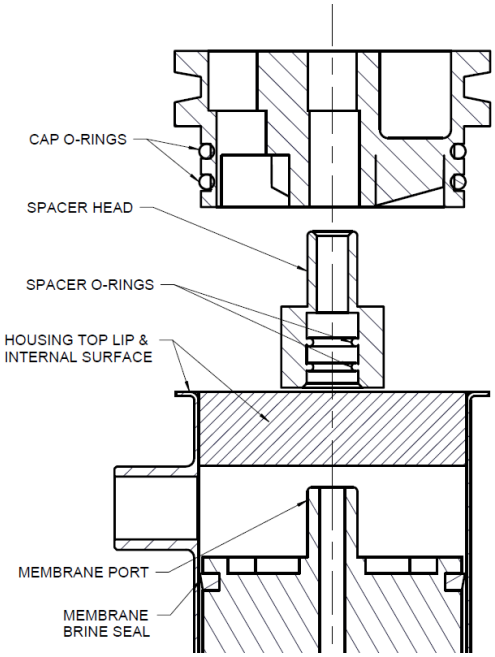


Illustration 12 - Membrane Cross-Section

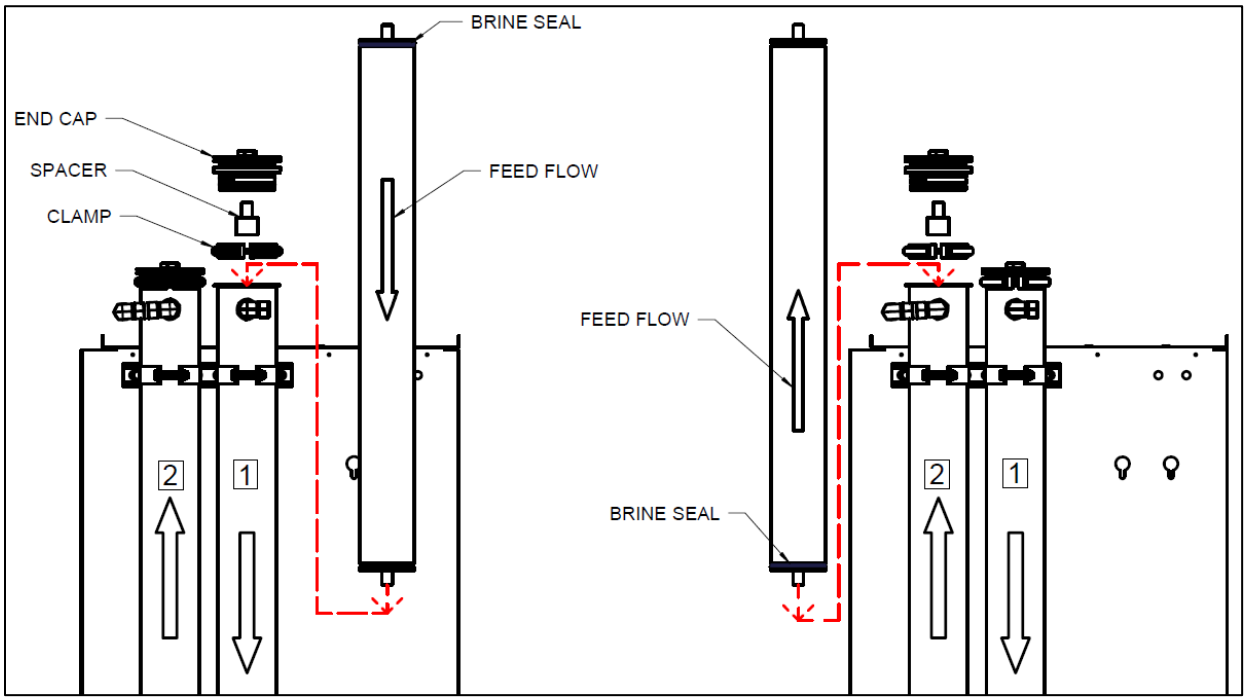


Illustration 13 - Membrane Insertion Procedure

Step 3 – Water Connections for the SKRO Unit

Water Source

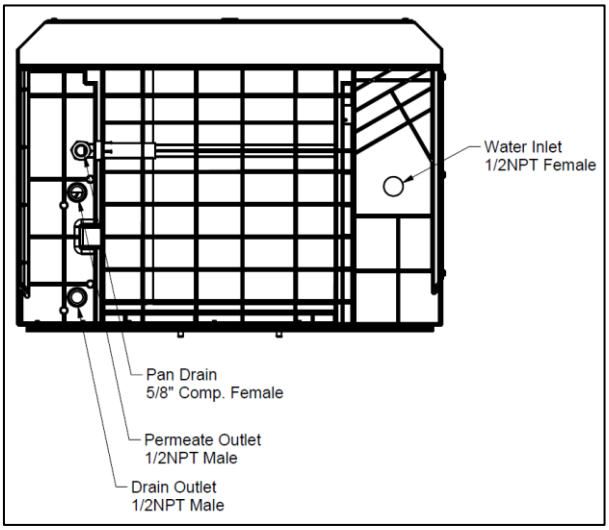
The pre-treatment equipment is connected to the water supply that shall meet the following requirements:

Table 8 - Water Conditions

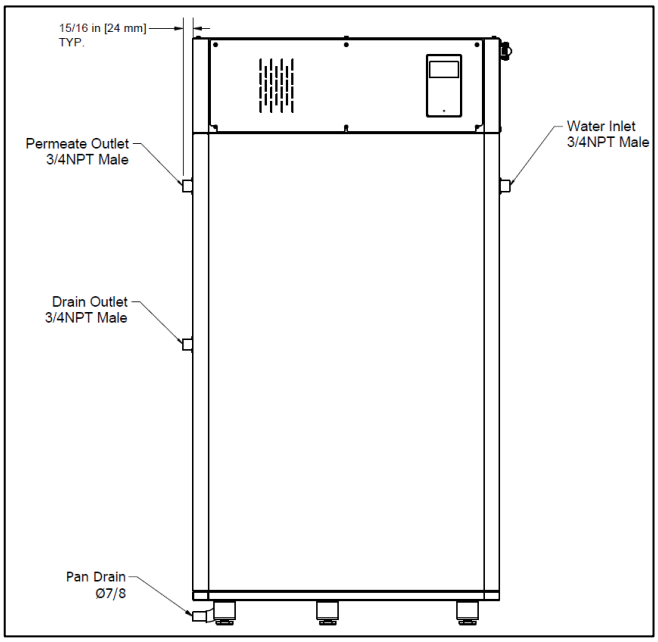
Conditions		Min	Max	*Note*
Inlet Water Temperature		41°F (5°C)	95°F (35°C)	*See water compensation table.* *Protect RO unit from freezing temperature.*
Inlet Water Pressure		30 psi (207 kPa)	60 psi (414 kPa)	
TDS *(Sodium chloride)*	*Membrane type*			
	A – Low Energy	-	2000 ppm	
	B – Extra Low Energy	-	500 ppm	
	C – Calcium Tolerant	-	2000 ppm	
	D – Chlorine Tolerant	-	2000 ppm	
Chlorine Tolerance	A, B & C		0 ppm	*Usage of a carbon filter is required.*
	D – Chlorine Tolerant		1 ppm	
pH (continuous)	All type	6	8	
pH (peak)	All type	4	10	*To select cleaning agent for ponctual use*
Turbidity		-	1NTU	
Silt Density Index		-	4	
Minerals:				
Iron (Fe)		-	0.1 ppm	
Manganese (Mn)		-	0.05 ppm	
Silica		-	1 ppm	
Hydrogen Sulfide		Not tolerated		
Oxidizer				*Such as bleach or hydrogen peroxide.*
Barium				
Heavy metals				
Strontium				
Sulfate (SO4)				
H2S (rotten egg smell)				

The water conditions vary highly from place to place but also from season to season. Be mindful of variations that will affect the output and lifespan of the membranes.

Water and Drain Connections Specifications



SKRO Small Cabinet



SKRO Large Cabinet

Illustration 14 - Water Connections for SKRO

Table 9 - Water Supply and Drain Connection Specifications

Specification		Small Models	Large Models
Water Supply	Water supply size	Female NPT 1/2" (13 mm)	Male NPT 3/4" (19 mm)
	Minimum water supply pressure	30 psi (207 kPa)	30 psi (207 kPa)
	Maximum water supply pressure	60 psi (414 kPa)	60 psi (414 kPa)
	Minimum water supply temperature	40°F (4°C)	40°F (4°C)
	Maximum water supply temperature	77°F (25°C)	77°F (25°C)
Outlets	Drain outlet size	Male NPT 1/2" (13 mm)	Male NPT 3/4" (19 mm)
	Permeate water outlet size	Male NPT 1/2" (13 mm)	Male NPT 3/4" (19 mm)
	Pan drain outlet size	Female Compression DIA. Ø 5/8" (16 mm)	Male DIA. Ø 7/8" (22 mm)

Connecting SKRO to Water and Drain Lines

Water Inlet Connection

- Connect the inlet NPT connection water supply.
- Install an isolation valve (not supplied) on the water line near the unit inlet for ease of maintenance and servicing.
- Flush the water line thoroughly before connecting the feed water pipework to the unit.

Water Drain Connections

- Connect the NPT drain outlet to an open drain outlet.
- The pan drain is located below the base of the SKRO unit and must be connected seperatly to an open drain.
- The open drain pipe must have a minimum diameter of Ø 1-1/2" (38mm) (DN40).

WARNING: Risk of flooding. Never connect the drains to a closed piping network.

Permeate Water Outlet Connection

- Connect the NPT permeate outlet to a holding reservoir, atmospheric or pressurized.
  Line should be rated for at least 75 psi (517 kPa).
- Holding tank should be equipped with a isolation valve from the RO water distribution network and a bleed valve, used to empty the tank and sampling the water.

Pressurized:

- Pressurized tank should have an initial pressure of 25 psi (172 kPa).

Atmospheric:

- Atmospheric tank need to be equipped with a level sensor with 2 or 3 levels of float :

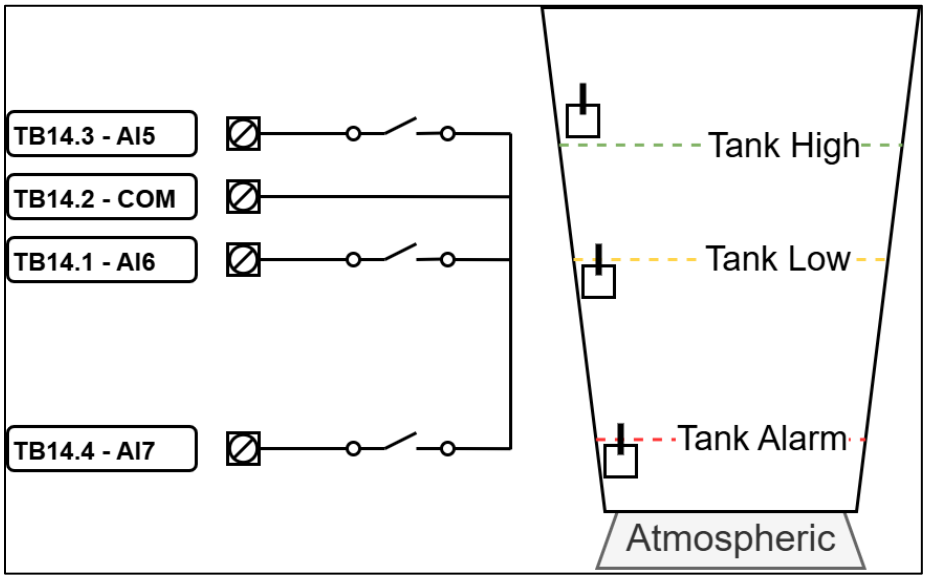


Illustration 15 - Atmospheric Tank Float Level

- If using only two floats, jump the COM and AI7 together. Low level alarm will be disabled.

Atmospheric tank should be connected to a booster pump to provide pressure for the humidifiers connected downstream of the water treatment system.

Step 4 – Power Supply Connections

WARNING: All work concerned with electrical installation MUST only be performed by skilled and qualified technical personnel, such as electricians or technicians with appropriate training. The customer is responsible for ensuring their suitability.

WARNING: Risk of electric shock. Isolate all power supplies before installation and maintenance of the SKRO Water Treatment unit.

You MUST externally fuse all incoming power supplies for over-current protection.

Observe local codes and regulations concerning the provision of electrical installations.

The installation technician must ensure the following:

- Use copper power conductors only.
- Ensure that the size of the power conductors is suitable for the maximum current supplied.
- Secure the incoming power cables using a suitably sized cable gland.
- Secure each terminal connection with a cable ferrule.
- Do not use the SKRO unit's frame to connect to ground. The SKRO unit cabinet has a provision for the electrical ground.

Power Supply Connections on SKRO unit

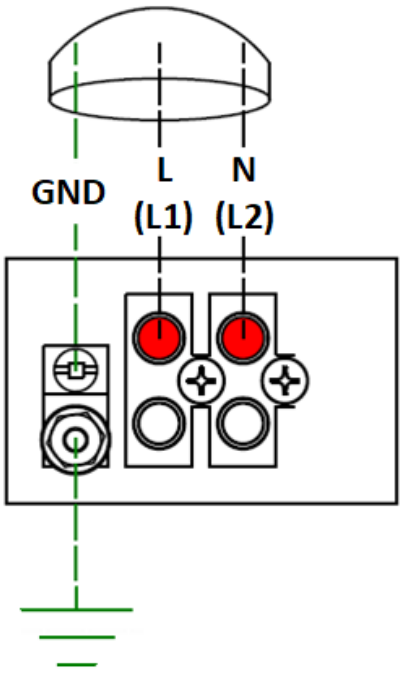
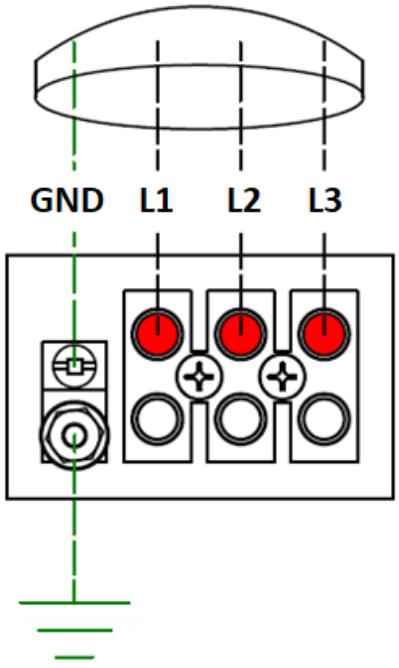
1 Phase (by others)	3 Phase (by others)
	

Illustration 16 - One and Three Phase Power Supply Connections

Power Supply Knockout Locations on SKRO unit

Connect high power cable through the knockout holes provided on the unit. Alternative points are given depending on the installation constraints.

WARNING: Do NOT create any cutout holes on the top of the cabinet.

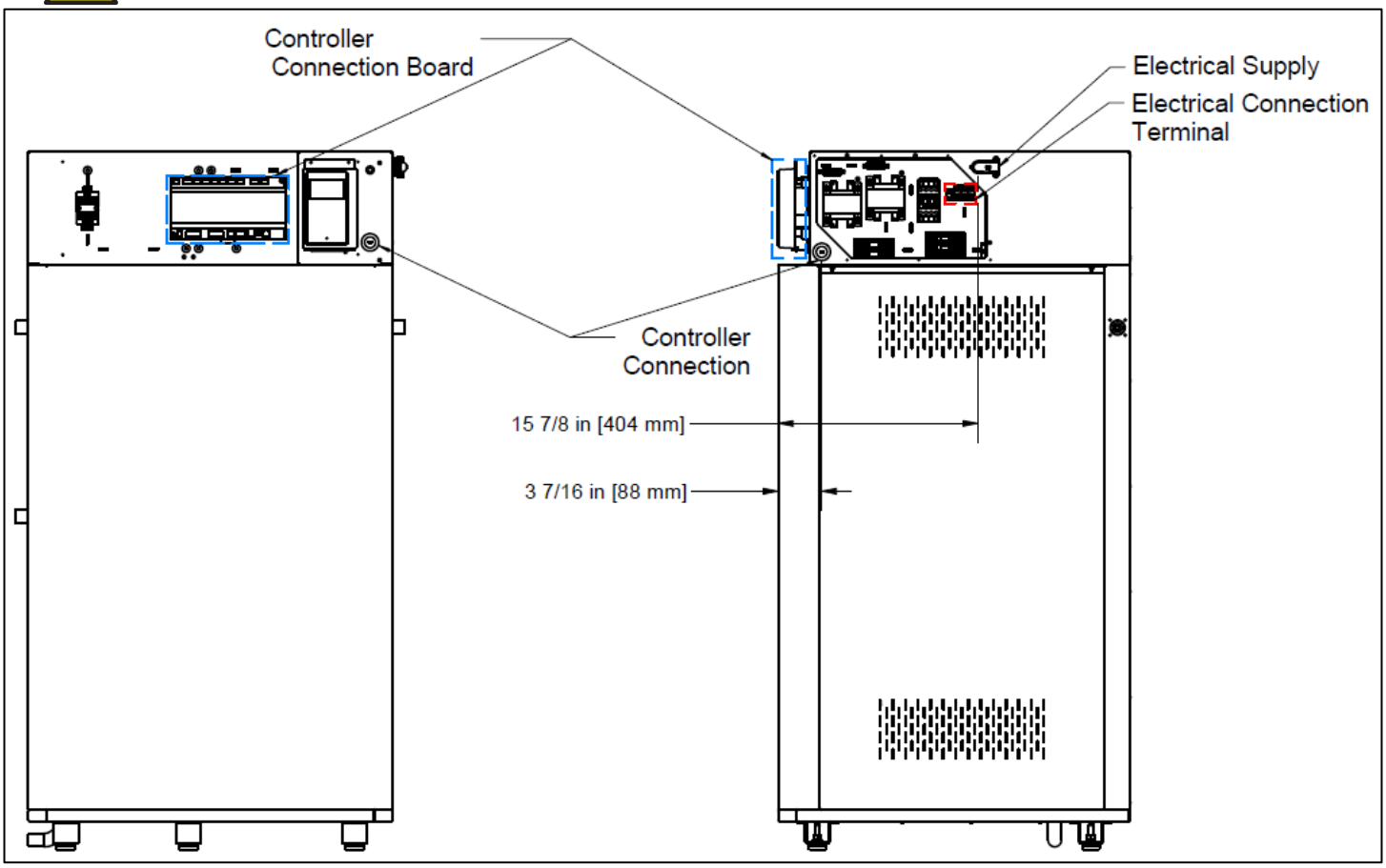


Illustration 17 - Power Supply Knockout Locations

Step 5 – Electrical Control Connections

WARNING: All work concerned with electrical installation MUST only be performed by skilled and qualified technical personnel, such as electricians or technicians with appropriate training. The customer is responsible for ensuring their suitability.

WARNING: Risk of electric shock. Isolate all power supplies before installation and maintenance of the SKRO.

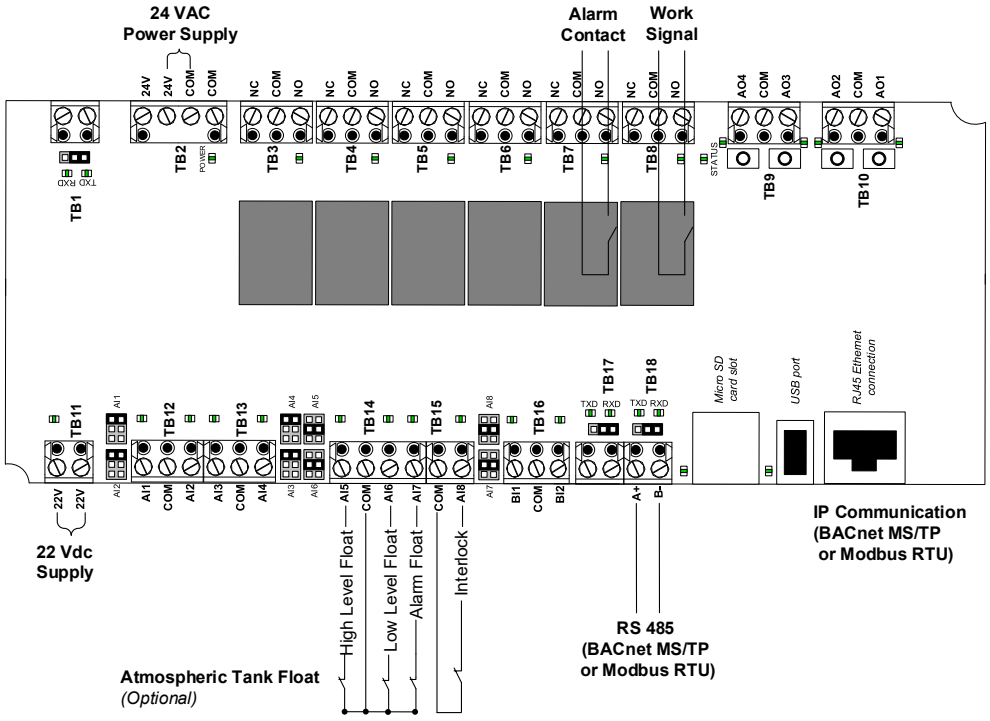


Illustration 18 - Electrical Connections

Safety Contact Connections

- *Interlock.* Wire the switch on the PCB between terminals TB15 2&3. If this contact opens, the operation of the SKRO unit stops and an Alarm will be displayed. If the interlock is not used, install a jumper between terminals TB15 2&3.

Work Signal

- Work signal is a dry contact on TB8 2&3 that will activate when the unit is filtering water, flushing the membranes or waiting idle for the reserve to go low so it will start again filling. This contact will be closed in normal operation, allowing to be connected to the interlock of humidifiers and prevent them from running without water.

Alarm contact

- Alarm dry contact on TB7 2&3 that will open when any alarm is activated or when the unit is without power.

Network Communication

Monitoring of the unit and changes in configuration can be done either with BACnet or Modbus communication protocol. The network control signal(s) must be selected by accessing the *Control* sub-menu located in the Menu - Installation (see page 30). To setup the communication parameters, access the Menu - Integration (see page 30). If using a BACnet MS/TP or Modbus RTU network, connect terminals TB18 1&2 to the RS485 network. BACnet and Modbus are also available on the IP port.

Note: BACnet MS/TP is configured by default. To change the communication interface to Modbus RTU, access the NtwrkOption setting located in the Network *sub-menu of the* Menu - Integration *(see page* 30*).*

Step 6 – Controller Installation and Configuration

User Interface

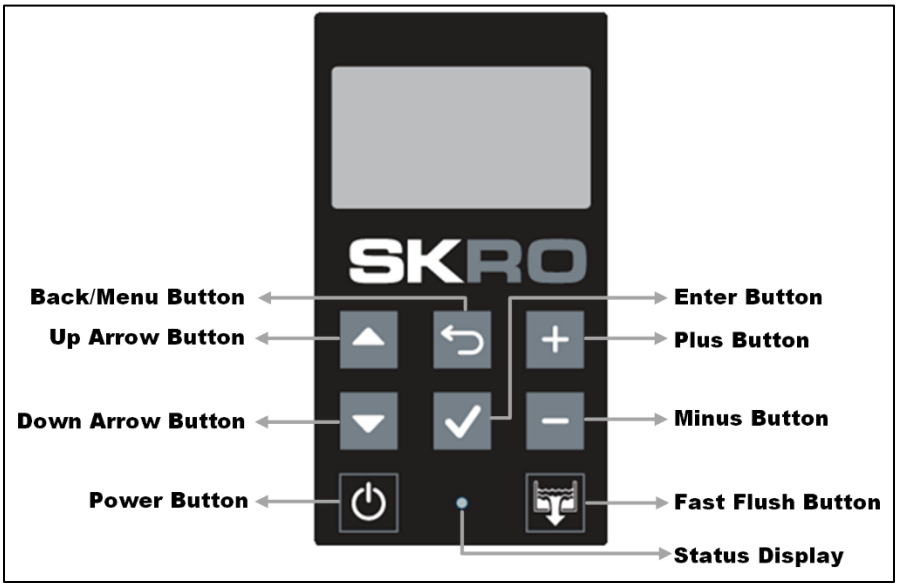


Illustration 19 - SKRO Controller

Controller Panel Features

The following are the features of the Control Panel and their description:

Table 10 - Water treatment system Control Panel Description

Feature		Description
Status Display	☼ (Blue)	Indicates that the water treatment system is turned on. The LED will begin blinking as the system is initializing.
	☼ (Red)	Indicates that the water treatment system is issuing an alarm or warning and that the system must be verified.
	O (Off)	Indicates that the water treatment system is turned off.
Power Button	⏻	The power button is used to turn the water treatment system on or off. Must be pressed and held for 3 seconds to perform the related action, to prevent accidental activation. Even when the water treatment system is powered off, the controller remains operational.
Fast Flush Button		The fast flush is used to manually activate the flushing cycle. Must be pressed and held for 3 seconds to perform the related action, to prevent accidental activation. Even when the unit is powered off, a manual flush cycle may be initiated. *Once the manual drain cycle is completed, the system will automatically be powered off. To turn the system back on, press and hold the power button.*
Up and Down Arrow Buttons	▲	The up arrow button is used to scroll to the next menu item or parameter.
	▼	The down arrow button is used to scroll to the previous menu item or parameter.
Plus and Minus Buttons	+	The plus button is used to increase the value of the displayed parameter.
	−	The minus button is used to decrease the value of the displayed parameter.
Back/Menu Button	⮌	The back/menu button is used to go to previous menu or to access the Main Menu page from the Idle Screen.
Enter Button	✓	The enter button is used to advance to the next sub-menu, to access selected option or to confirm set parameter value.

Idle Screen

When the controller is in operation, the unit displays the following information on the Idle Screen:

Table 11 - Idle Screen Display Description

Setting	Default	Range (* indicates no configuration; display only)	Description/Notes
State:	*Current value*	* (Off, Idle, Purifying, FastFlush, Alarm)	Displays the current state of operation of the unit.
TDS:	*Current value*	* (min: 0ppm, max 2000ppm)	Displays the water quality of the permeate.
InletPressure:	*Current value*	* (min: 0 psi, max 500 psi, [0 kPa to 3447 kPa)	Displays the pressure at the inlet of the unit.
PermeatePress:	*Current value*	* (min: 0 psi, max 500 psi) [0 kPa to 3447 kPa)	Displays the pressure of the permeate tank.
ConcentPress	*Current value*	* (min: 0 psi, max 500 psi) [0 kPa to 3447 kPa)	Displays the osmotic pressure on the concentrate side.

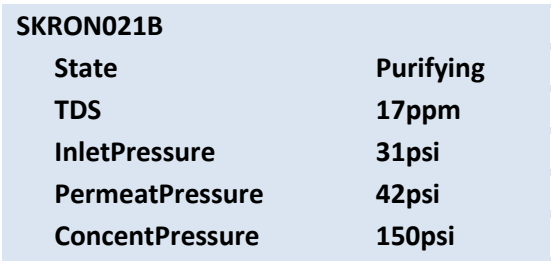


Illustration 20 - Idle Screen Display

Menu Access

- From the Idle Screen, the Main Menu can be accessed by pressing the **Back/Menu** ⮌ button, enabling access to the General menu.
- To view other menu options and perform configurations to the system, press **Enter** ☑ while on the Idle Screen to advance to the **Login** Screen, where a valid password must be entered.
- Four different passwords can be used, each granting access to an additional menu option depending on the access level assigned to the provided password.
- If a password of higher access is provided, all menu options accessible with the use of a lower-level password will also be unlocked.

Table 12 - Access Levels

Access Level	Password	Menu Unlocked	Description/Notes
1	None	General	Grants access to General menu.
2	2222	User	Grants access to General and User menus.
3	3322	Service	Grants access to General, User and Service menus.
4	4433	Installation	Grants access to General, User, Service and Installation menus.
5	5544	Integration	Grants access to General, User, Service, Installation and Integration menus.

Note: To modify or retrieve lost passwords, please contact factory.

Menu - General

This is a Level 1 menu and does not require a password to access. Press the Back/Menu ⮌ button from the Idle Screen to access the General menu.

Sub-Menu	Setting	Default	Range (** indicates no configuration; display only)*	Description/Notes
Status	SysPowerState:	On	* (Off, On)	Displays the status of the system power state.
	Interlock	Open	* (Open, Closed)	
Physical IO	PermeateFlow:	0 l/min	* (min: 0 l/min, max: 50 l/min)	Displays the flow of the permeate water in liter per minute.
	ConcentFlow (Concentrate):	0 l/min	* (min: 0 l/min, max: 50 l/min)	Displays the flow of the concentrate water in liter per minute. (*Optional equipment)*
	InletValve:	Closed	* (Closed, Open)	Displays the inlet valve status.
	Motor:	Off	* (Off, On)	Displays the motor status.
	FFValve (Fast Flush):	Closed	* (Closed, Open)	Display the fast flush (drain) valve status.
	WorkSignal:	Off	* (Off, On)	Display the status of the work signal contact.
System	Status:	Operational	* (Operational, Operational Read-Only, Download required, Download in progress, Non-operational, Backup in progress)	Displays the current system status.
	Vendor:	Neptronic	*	Displays the name of the vendor of the product. (Always Neptronic)
	Model:	-	*	Displays the water treatment system model name.
	AppVersion:	*Current value (1.00.20250327)*	*	Displays the current application software version.
	SerialNo:	RO20180000	*	Displays the serial number of the water treatment system.
	Profile:	SKH4 Controller	*SKH4 Controller	Displays a short profile for the configured device.
	MCULoad:	*Current value*	* (min: 0%, max: 100%)	Displays the current microcontroller load.
	MemoryLoad:	*Current value*	* (min: 0%, max: 100%)	Displays the current memory load.
	ResetReason:	None	* (None, BOR, Pin, POR, Soft, IWDG, WWDG, LPWR, Unknown)	Displays the reason for the previous system reset: *None = No Reset; BOR = Brownout Reset; Pin = Pin Reset (using PCB Reset Button); POR = Power-on Reset; Soft = Software Reset; IWDG = Independent Watchdog;* *WWDG = Windowed Watchdog; LPWR = Low Power Reset; Unknown = Unknown Cause*

Menu - User Settings

This is a Level 2 menu and requires a level 2 (or higher) password to access.

Sub-Menu	Setting	Default	Range	Description/Notes
System	UTCOffset:	-300min	min: -720min, max: 720min	Configure the value of the UTC offset.
	DaylightSavings:	No	No, Yes	Select whether to enable daylight savings or not.
	LocalDateTime:	YYYY-MM-DD 00:00:00		Configure the current date and time.
Interface	**LocalDisplay [4]**			
	BacklightLvl:	25%	min: 0%, max: 100%	Select the backlight level of the LCD screen.
	Contrast:	10%	min: 0%, max: 30%	Select the contrast level of the LCD screen.
	Language:	English	English, French, Spanish	Select the device language.
	Units:	Imperial	Metric, Imperial	Select whether to use a metric or imperial system of units for the local device.

Menu - Service

This is a Level 3 menu and requires a level 3 (or higher) password to access.

Sub-Menu	Setting	Default	Range (** indicates no configuration; display only*)	Description/Notes
Status	On Time:	0.00hr	*	Displays the total operating time of the unit.
Command	Request:	None	None, ResetAlarms, FastFlush, ResetServCnt	Perform one of the following actions for the water treatment system: reset warning alarms, initiate a fast flush drain cycle, reset service counters.

Menu - Installation

This is a Level 4 menu and requires a level 4(or higher) password to access.

Sub-Menu	Setting	Default	Range (* *indicates no configuration; display only*)	Description/Notes
System	ResetFactory:	No	No, Yes	Select *Yes* in order to reset the water treatment system back to its original factory configuration settings. **WARNING: There is no way to recover previous configurations once the device has been reset.**
Extended Config	Installed:	*Current Value*	-	Displays the installation date.
	RegPressure:	150 psi (1034 kPa)	min: 100 psi, max: 275 psi (689 kPa to 1896 kPa)	Parameter of the pressure of the regulator. Regulator can be adjusted by hand to set this nominal pressure.
	PmpOnFFDelay: (Pump On Fast Flush Delay)	120sec	min: 60sec, max: 300sec	Delay after which the pump is turned on during fast flush routine.
	IdleDrainTime:	8hr	min: 1hr, max: 24hr	Set the drain time interval.
Physical IO	PermeatPulse:	0	min: 0, max: 300	Raw pulse value of the flow meter for permeate.
	ConcentPulse:	0	min: 0, max: 300	Raw pulse value of the flow meter for concentrate.

Menu - Integration

This is a Level 5 menu and requires a level 5 (or higher) password to access.

Sub-Menu	Setting	Default	Range (* *indicates no configuration; display only*)	Description/Notes
Network	**Device [4]**			
	DeviceName:	-		Establish a name for the device.
	Location:	-		Establish a designated location for the unit.
	Description:	-		Establish a brief description for the unit.
	DeviceInstance:	152999 (0x000255a7)	min: 0, max: 4194302	Define the device instance value.
	NtwkTimout: (Network Timeout Delay)	60sec	min: 30sec, max: 600sec	Define the amount of time the water treatment system may attempt to connect to the BACnet or Modbus network before it stops operating due to a communication error.
	Network: (Network Timeout Failsafe)	Ok	Ok, Timeout	Displays the network value.
	HTTPServer [1]			
	HttpServerUnits:	Metric	Metric, Imperial	Select whether to use a metric or imperial system of units for the web server.
	BACnetServer [6]			**For models connected to the BACnet network.**
	Eth enable: (Ethernet enable)	Disable	Disable, Enable	Select whether to enable or disable the Ethernet option.

		ListMode:	Integrator	Integrator, Advanced, Factory	Select the category of BACnet objects to display.
		Units:	Metric	Metric, Imperial	Select whether to use a metric or imperial system of units for the BACnet server.
		CovMaxSubs:	15	min: 0, max: 255	Select the maximum number of BACnet COV subscriptions allowed.
		NtwkTimeout:	Off	Off, On	Define the amount of time the water treatment system may attempt to connect to the BACnet or Modbus network before it stops operating due to a communication error.
		TimeoutState:	Ok	Ok, Timeout	
	BACnetMSTP1 [6]				**Only appears if *NtwrkOption* is set to *BACnet*.**
		MaxMaster:	127	min: 1, max: 127	Configure MaxMaster value to increase network efficiency when there are less than 127 devices on the network. For optimal efficiency, set value to the highest MAC address in the MS/TP network.
		MaxInfoFrames:	1	min: 1, max: 100	Configure the maximum number of information messages the controller may transmit, before it must pass the token to the next controller.
		Network:	1	min: 1, max: 65534	Displays the network value.
		AutoBaud:	No	No, Yes	Enable or disable automatic baud rate detection.
		BaudRate:	19200	9600, 19200, 38400, 76800	Select the baud rate for data transfer.
		MSTP1MAC:	001		Set the MS/TP network MAC address.
	BACnetMSTP2 [6]				**Only appears if *NtwrkOption* is set to *BACnet*.**
		MaxMaster:	127	min: 1, max: 127	Configure MaxMaster value to increase network efficiency when there are less than 127 devices on the network. For optimal efficiency, set value to the highest MAC address in the MS/TP network.
		MaxInfoFrames:	1	min: 1, max: 100	Configure the maximum number of information messages the controller may transmit, before it must pass the token to the next controller.
		Network:	4	min: 1, max: 65534	Displays the network value.
Network		AutoBaud:	No	No, Yes	Enable or disable automatic baud rate detection.
		BaudRate:	19200	9600, 19200, 38400, 76800	Select the baud rate for data transfer.
		MSTP2MAC:	002		Set the MS/TP network MAC address.
	BACnetIP [2]				**For models connected to BACnet IP.**
		NtwkNumber:	2	min: 1, max: 65535	Set the local BACnet IP network number.
		BACnetIPPort:	47808	min: 0, max: 65535	Set the User Datagram Protocol (UDP) port number. BACnet port number is set by default.
	BACnetETH [1]				**For models connected to BACnet Ethernet.**
		NtwkNumber:	3	min: 0, max: 65535	Set the local BACnet Ethernet network number.
	ModbusServer [3]				**For models connected to Modbus.**

		Units:	Metric	Metric, Imperial	Select whether to use a metric or imperial system of units for the Modbus server.
		NtwkTimeout:	Off	Off, On	Define the amount of time the water treatment system may attempt to connect to the BACnet or Modbus network before it stops operating due to a communication error.
		TimeoutState:	Ok	Ok, Timeout	
	ModbusRTU1In [4]				**Only appears if *NtwrkOption* is set to *Modbus*.**
		MAC:	1	min: 1, max: 247	Set the Modbus MAC address.
		Autobaud:	No	No, Yes	Enable or disable automatic baud rate detection.
		PortConfig:	No Parity, 2 Stop Bits	No Parity, 2 Stop Bits Even Parity, 1 Stop bit Odd Parity, 1 Stop bit	Select the Modbus communication port configuration.
		BaudRate:	38400	9600, 14400, 19200, 38400, 57600	Select the baud rate for data transfer.
	ModbusTCPIP0In [2]				**For models connected to Modbus TCP/IP.**
		KeepAliveTimeOut:	5min	min: 1min, max: 1440min	Set the amount of time the communication stays open before connection is cut out, when no signal is received from the device.
		ListeningPort:	502	min: 0, max: 65535	Set the communication port number. Modbus TCP port number is set by default.
	SMTP [7]				
		SSL:	Off	Off, On	If turned to *On*, a secure socket layer will be used to encrypt the communication between the device and the email server (Port value must be set to *587* and *Username* and *Password* settings must be filled out). If turned to *Off*, the default socket will be used (use Port *25* to use server without login account or Port *587* if login details for email account have been entered).
		Port:	25	25, 587	If set to *25*, server to server email transfer is enabled (can only be used if SSL is set to *Off*). If set to *587*, client to server email transfer is enabled.
		ServerAddr:	192.168.100.100		Configure the server IP address for the email account.
		From:	*Current value*		Set the email address that will be sending the water treatment system notification messages.
		To:	*Current value*		Set the email address that will be receiving the water treatment system notification messages.
		Username:	*Current value*		Set the login username for the email account.
		Password:	*Current value*		Set the login password for the email account.
	Notify [3]				
Network		Alarm:	Off	Off, On	If turned to *On*, then the humidifier alarm messages will be sent to the email configured in the *SMTP* sub-menu.
		Warning:	Off	Off, On	If turned to *On*, then the water treatment system warning messages will be sent to the email configured in the *SMTP* sub-menu.

	AppMsg:	Off	Off, On	If turned to *On*, then the water treatment system event messages will be sent to the email configured in the *SMTP* sub-menu.
Communication	**IPSettings[10]**			
	DHCP:	Inactive	Inactive, Active	Select whether to enable Dynamic Host Configuration Protocol (DHCP) to automatically provide an IP address.
	RstIPSetting:	No	No, Yes	Select whether to restart the IP module, in order to allow recent parameter modifications to be effective.
	StaticAddress:	192.168.1.100		Configure the static IP address.
	StaticSubnetMask:	255.255.255.0		Configure the static subnet mask.
	StaticDefaultGateway:	192.168.1.1		Configure the static default gateway.
	StaticDnsServer:	192.168.1.1		Configure the static DNS server.
	ActualAddress:	*Current value*	*	Displays the actual IP address.
	ActualSubnetMask:	*Current value*	*	Displays the actual subnet mask.
	ActualDefaultGateway:	*Current value*	*	Displays the actual default gateway.
	ActualDnsServer:	*Current value*	*	Displays the actual DNS server.
	ETHSettings[1]			
	EthernetMacAdd:	*Current value*	*	Displays the MAC address of the Ethernet interface. **(Only applicable if using an Ethernet connection.)**
System	SysLogAlarm:	*Current value*	*	Displays the system log alarm file.
	USBSystemLogFile:	*Current value*	*	Displays the USB system log file.
	USBSysAlarmLogFile:	*Current value*	*	Displays the USB system alarm log file.
	SystemLogFile:	*Current value*	*	Displays the current log file being archived and is sent to the SD card when file is full and a new one is started.
Not Defined	**BACnetMSTP1 [5]**			
	RxValid	*0*	*min: 0, max: 999999999	Displays information on the received communication frames for troubleshooting purposes.
	RxInvalid	*0*	*min: 0, max: 999999999	
	RxLost	*0*	*min: 0, max: 999999999	
	Tx	*0*	*min: 0, max: 999999999	Displays information on the transmitted communication frames for troubleshooting purposes.
	TxLost	*0*	*min: 0, max: 999999999	
	BACnet IP [5]			**For models connected to BACnet IP.**
	RxValid	*0*	*min: 0, max: 999999999	Displays information on the received communication frames for troubleshooting purposes.
	RxInvalid	*0*	*min: 0, max: 999999999	
	RxLost	*0*	*min: 0, max: 999999999	
	Tx	*0*	*min: 0, max: 999999999	Displays information on the transmitted communication frames for troubleshooting purposes.
	TxLost	*0*	*min: 0, max: 999999999	
	BACnet Ethernet [5]			**For models connected to BACnet Ethernet.**
	RxValid	*0*	*min: 0, max: 999999999	

	RxInvalid	*0*	*min: 0, max: 999999999	Displays information on the received communication frames for troubleshooting purposes.
	RxLost	*0*	*min: 0, max: 999999999	
	Tx	*0*	*min: 0, max: 999999999	Displays information on the transmitted communication frames for troubleshooting purposes.
	TxLost	*0*	*min: 0, max: 999999999	
	BACnetMSTP2 [5]			
	RxValid	*0*	*min: 0, max: 999999999	Displays information on the received communication frames for troubleshooting purposes.
	RxInvalid	*0*	*min: 0, max: 999999999	
	RxLost	*0*	*min: 0, max: 999999999	
	Tx	*0*	*min: 0, max: 999999999	Displays information on the transmitted communication frames for troubleshooting purposes.
	TxLost	*0*	*min: 0, max: 999999999	

List of Alarms and Warnings

Table 13 - List of Alarms

Display	Description	Alarm Reset
LowInletPressure (Warning)	Indicates that the pressure is insufficient at the inlet to supply water for the pump. System will perform a flush and stop purifying until the water supply has reached the sufficient pressure. Make sure that the supply of water is free flowing and confirm that pre-filters are not clogged.	Automatic
HighInletPressure	Indicates that the pressure at the inlet is too high and will create overpressure in the concentrate plumbing. System will perform a flush and wait for the pressure to reduce.	Automatic
DamagedMembrane	Indicates that the membranes were compromised because the quality of permeate has degraded beyond the threshold. Change membranes.	Manual
InsufficientOsmosis* (Warning)	Warning indicating that the water is not being replenished in the holding tank. First level of warning indicating that the performance of the membranes is decreasing.. Consider replacing the membranes in the near future.	Manual
Service Due Warning* (CloggedMembrane) (Warning)	Warning indicating that the water in the tank is falling to a low level. Second level of warning indicating that the performance of the membranes is decreasing. Consider replacingthe membranes immediately.	Manual
BlockedMembrane*	Indicates that the membranes are not able to filter water anymore, and that the water reserve is empty. Purifying state will stop and it will go into the alarm state. Membranes need to be replaced.	Manual
TDSSensorFailed (Warning)	Indicates that the TDS sensor is not working. Operations are not stopped but the water quality will not be monitored any longer.	Automatic
ConcentrateOpen	Indicates that the concentrate manifold is not creating restriction and the pump is not able to pressurize the system. The fastflush valve may be stuck open or the pressure regulator may be broken and completely open.	Manual
LowPumpPressure	Indicates that the pump can no longer build pressure above the parametered regulating pressure (See Regulator Pressure in **Menu - Installation**) and therefore cannot evacuate the concentrate. Consider lowering the pressure regulator and adjusting the parameter after to have concentrate flush. Consider changing the pump to keep original performance of the unit.	Manual
InletValveOpen (Warning)	Warning that indicates that the inlet valve has failed open. While not preventing normal operation, it is preferrable for the membranes to be depressurized to rest. Consider replacing the valve.	Manual
FastFlushBlocked (Warning)	Warning that indicates that the fast flush valve has failed closed. Fast flush is used at the end of each fill to prolong the life of the membranes. Consider replacing the valve.	Manual
PressureSensor#	Indicates that a pressure sensor is defective. Pressure monitoring is essential for the monitoring and sequencing of the unit, replace the sensor immediately.	Manual

InletClogged	Indicates that the pressure at the inlet has dropped below the threshold for 3 times in 10 minutes. This means that something is clogged from the inlet, most likely a filter that creates too much restriction.	Manual
OverUsage (Warning)	Warning to indicate that the purifying state has been active for more than 6 hours continuously. Consider changing the membranes to regain original performance.	Automatic
PressureRegClosed	Indicates that the pressure regulator failed closed and does not regulate the pump pressure anymore. Replace the pressure regulator and inspect the membrane.	Manual
NoPureWater	Indicates that there is no flow detected on the permeate manifold.	Manual
TankClosed	Indicates that the pressurized tank is closed.	Manual

* Only active for pressurized tank

Start-Up Procedure

Once the installation is complete, follow this start-up procedure to ensure that the SKRO water treatment unit is ready for normal operation. We strictly recommend following this procedure in order to avoid any anomaly resulting from inaccurate installation of the components.

Initial verification and start-up must be carried out by suitably qualified personnel.

Initial Verification

Clearance	1. Ensure that the system is installed in a location where it can be serviced correctly with the recommended clearances.	☐
Mechanical	2. Ensure that the unit is installed in a temperature-controlled environment of less than 86°F (30°C). Verify that the unit is fixed securely to the ground and that it remains stable.	☐
	3. Check all membrane housing tops, ensure that the cap is sitting on the lip of the housing for each, and all clamps are properly fastened.	
Hydraulic	4. Verify that the unit water connections are installed properly:	
	a) Ensure that water is supplied to the unit and that an isolation valve is installed on the water line. With the water isolation valve turned on, verify that there are no apparent leaks.	☐
	b) Ensure that the main drain and pan drain outlets are properly connected to an open drain. Verify that the water drainage is not obstructed.	☐
	5. Check that pre-treatment filters and equipment are connected to the water inlet and operational.	☐
Tank	**If using a pressurized tank:** Ensure that the permeate outlet is connected to a pressurised tank with an initial **pressure adjusted to 25 psi** (172 kPa). The Tank should have an isolation valve.	☐
	If using an atmospheric tank: Ensure that the three float switches are wired to the control board. If only using high and low switch, jump the AI7 contact with COM.	☐
Electrical	6. Verify that the power supply (voltage) conforms to the appliance name plate on the side of the water treatment system.	☐
	7. Ensure that the Interlock is properly connected to the controller. If Interlock is not used, verify that a jumper is connected between terminals TB15-2&3.	☐

Start-Up

Maintain a purging period of 30 minutes when the unit is turned on for the first time. The purging period ensures that the permeate is flushed directly and provides high quality water.

Membranes	1. Remove the top cover. 2. Remove the top cap(s) by loosening the two bolts holding the semi-circular clamps at the top of the membrane holders.	☐
	3. Remove the transport wrapping plastic of the membrane and insert them in each housing with the centering ring and spacers.	☐
	4. Grease all o-ring seal with and insert the top cap back on top of the membrane in the housing. Cap should push in the membrane inside completely. Cap should be placed on the lip of the stainless-steel housing.	☐
	5. Clamp back the cap with the bolts at the base of the cap with the lip of the membrane housing.	☐
Flush	6. Proceed to start up the water treatment unit, as follows:	
	a) Turn on power.	☐
	b) Confirm that the inlet pressure is in the range of 30 psi (207 kPa) to 60 psi (414 kPa) on the main screen.	☐
	c) Press the Fast Flush button  . Verify that the concentrate pressure does not rise by 75 psi (517 kPa) higher than the inlet pressure.	☐
Start-up	Press the On button. The unit will go into purifying state.	☐
	Monitor the pressures of the system.	☐
	Inlet pressure should not be lower than at idle. Otherwise check pre-treatment equipment.	☐
	Permeate pressure should rise quickly to a minimum of 25 psi (172 kPa), then slowly increase while the tank is filling. At the commissioning or after changing the membrane, flush the produce of the first 30 minutes in the drain.	☐
	Concentrate pressure should be adjusted while the pump is running using the pressure regulator handle to be at:	

	Membranes A, C & D	Membranes B	
	200 psi (1379 kPa)	150 psi (1034 kPa)	☐

The regulating valve at the bottom of the pump can be adjusted to reduce the amount of concentrate water purged to the drain but at least 15% of water entering the unit should be evacuated while purifying.	☐
End 7. The SKRO is now ready for normal operation.	☐

Servicing and Maintenance

Replacing the RO Membranes

Note: For all lubrification, use food-grade silicone grease, non-petroleum based *(Order at Neptronic, Spare part #SPG9325-6)*.
Apply grease only as a thin layer on the sealing surfaces.
Do not apply grease on the wall of the membrane.

Procedure

1. Remove the top end cap by removing the bolts of the clamp.
2. Remove the spacer carefully from the top of the membrane.
3. Remove the membrane using pliers and discard according to the local regulations.

Follow steps of membrane insertion:

4. Identify the direction of the flow on the metal housing.
5. Unwrap the protective plastic film on the membranes'.
6. Locate the brine seal and feed flow arrow on the membrane.
7. Lubricate both the membrane ports and the membrane brine seal.
8. Insert the membrane straight in the housing. Match orientation of the flow (Pay attention to brine seal orientation as well, see Illustration 22). The Membrane port needs to insert in the spacer at the bottom, the alignment is important.
9. Insert spacer on the top membrane port.
10. Ensure that the lubricated spacer head and housing top lip and internal surface are hatched as shown in Illustration 22. Close the membrane assembly back with top cap. Expect some resistance as several o-rings are being compressed but do not use excessive force. It is important to lubricate and align the top cap properly. If it is not aligned, re-grease and repeat the procedure. Cap should be flush to the housing lip.
11. Reassemble clamp around the top cap.

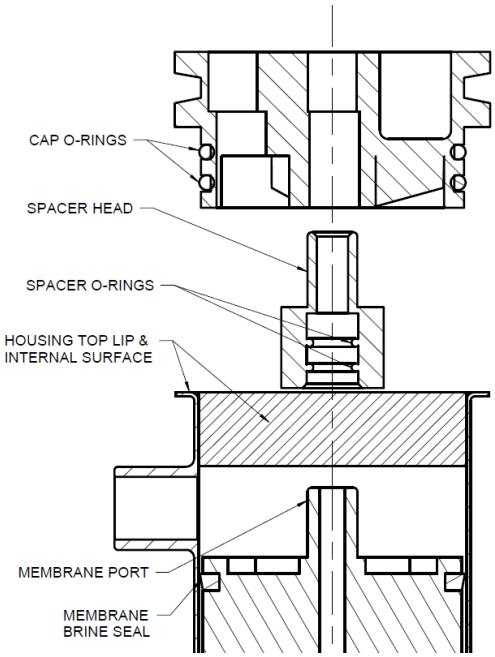


Illustration 21 - Membrane Cross-Section View

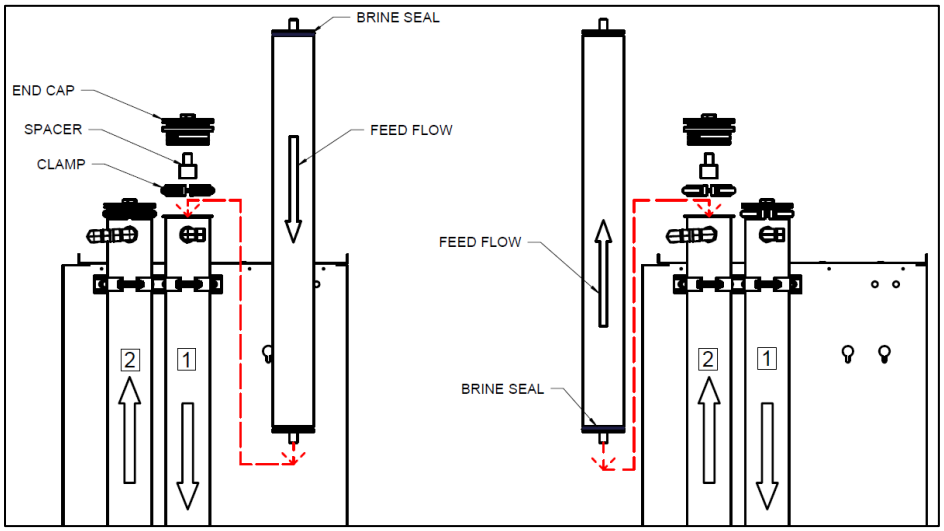


Illustration 22 - Inserting Membrane

Cleaning the Membranes

The regular cleaning of the membranes of the Reverse Osmosis (RO) system ensures a prolonged lifespan and efficient performance. The following instructions provide a detailed description for cleaning the membranes.

Schedule for Cleaning

The RO membranes should be cleaned in one or any of the following situations:

- **Scheduled Maintenance**: The membranes should be cleaned once every 6 to 12 months, depending on the feedwater quality and system usage.
- **Increase in Differential Pressure**: When there is an increase of 10 to 15% in pressure drop across the membrane.
- **Increase in Salt Passage**: When there is an increase of 10 to 15% in salt rejection or TDS (Total Dissolved Solids) in the permeate water.

Equipment

The following equipment *(Not supplied)* is required for the servicing and maintenance of the membranes:

- **RO Cleaning Tank**: A dedicated tank to prepare and circulate the cleaning solutions.
- **Cleaning Pump**: A low-pressure pump to circulate the cleaning solutions through the membranes.
- **Pressure Gauges and Flow Meters**: To monitor the cleaning process.
- **pH Meter**: To ensure the correct pH of the cleaning solutions.

Cleaning Solutions

The following cleaning solutions *(Not supplied)* are recommended for cleaning the membranes.

- **Acidic Cleaning Solution (for inorganic scale)**: A citric acid or phosphoric acid solution.
- **Alkaline Cleaning Solution (for organic fouling)**: A solution of Sodium hydroxide (caustic), possibly with an added detergent or surfactant for organic removal.

Cleaning the Membranes

Cleaning the membranes has the following steps:

Stage 1 - Shut Down the RO System
Stage 2 - Prepare the Cleaning Solution
Stage 3 - Set Up the Cleaning Equipment
Stage 4 - Recirculate the Cleaning Solution
Stage 5 - Monitor pH and Temperature
Stage 6 - Soak the Membranes
Stage 7 - Flush the Membranes
Stage 8 - Evaluate the Cleaning

Stage 1 - Shut Down the RO System

1. Turn off the RO system and disconnect the system from the feed water and the permeate line.
2. Isolate the RO system by closing the inlet and outlet valves.

Stage 2 - Prepare the Cleaning Solution

1. Prepare the appropriate cleaning solution in the cleaning tank:
   - **Acidic Solution**: Use a citric acid or similar descaler. Maintain a pH between 2 and 4.

- **Alkaline Solution**: Use sodium hydroxide with a detergent. Maintain a pH between 10 and 12.

2. Fill the cleaning tank with the solution, ensuring that it is thoroughly mixed and is at the correct concentration.

Stage 3 - Set Up the Cleaning Equipment

1. Connect the cleaning tank to the RO membrane system using the appropriate hoses.
2. Connect the cleaning pump to circulate the solution through the membrane housing at low pressure 30 psi to 60 psi ((207 kPa to 414 kPa).
3. Ensure that the cleaning setup includes valves to allow recirculation of the solution.

Stage 4 - Recirculate the Cleaning Solution

1. Start circulating the cleaning solution through the membrane. The cleaning solution should pass through the feedwater inlet and discharge back into the cleaning tank.
2. Maintain a flow rate and pressure according to the membrane manufacturer's recommendations (typically low-pressure recirculation at about 30 psi to 60 psi (207 kPa to 414 kPa).

Stage 5 - Monitor pH and Temperature

1. Check the pH and temperature of the cleaning solution, periodically. Adjust as necessary:

   - For acidic cleaning, maintain the pH between 2 and 4.
   - For alkaline cleaning, maintain the pH between 10 and 12.
   - Cleaning temperatures should not exceed 100°F (38°C) to avoid damaging the membranes.

Stage 6 - Soak the Membranes

1. After circulating the cleaning solution for 30 to 60 minutes, stop the pump and allow the membranes to soak.
   - The soaking time should be at least 1 hour for standard cleaning or up to several hours (or overnight) for more severe fouling.
2. Recirculate the solution for another 30-60 minutes after the soak.

Stage 7 - Flush the Membranes

1. After cleaning, flush the membranes with clean water to remove all traces of the cleaning chemicals.
2. Use the RO permeate water or softened water to prevent further fouling during flushing.
3. Continue flushing until the pH of the flushed water matches the feedwater (pH ~7).

Stage 8 - Evaluate the Cleaning

1. Check the flow and pressure of the permeate after cleaning to see if the performance has improved.
2. Compare the pre-cleaning and post-cleaning pressures, permeate flow, and TDS to ensure that the cleaning was effective.

Post-Cleaning System Startup

1. **Reconnect Feed Water** - Reconnect the system to the feed water supply.
2. **Gradual Startup** - Gradually increase the pressure back to the normal operating range.
3. **Monitor System Performance** - Monitor the system for leaks, pressure drops, or other abnormalities.
4. Check that the permeate flow and TDS to ensure that the system is performing within specifications.

Maintenance Tips

By following these steps, you can effectively clean and maintain your RO membranes, ensuring an optimal performance and a longer lifespan for your system.

1. Clean the membranes regularly, even if there are no significant performance drops, to prevent long-term damage.
2. Use RO-compatible cleaning chemicals only, as other chemicals may damage the membranes.
3. Consider adding a cleaning log to track the membrane performance before and after cleaning.

Types of Fouling and Cleaning Agents

Fouling	Cause	Cleaning Agent
Inorganic Scale	Commonly caused by calcium carbonate or silica buildup.	Acidic solutions such as citric acid or phosphoric acid (pH 2-4).
Organic Fouling	Caused by bacterial growth, biofilm, or organic materials.	Alkaline solution with sodium hydroxide and a detergent (pH 10-12).
Colloidal Fouling	Caused by clay, silt, or other suspended particles.	Low-pH solution with detergents or dispersants.
Iron and Manganese Scaling	These metals can precipitate on the membrane surface.	Use an acid solution, or specialized iron-removing cleaners.

Troubleshooting

Issues in a reverse osmosis system can arise from various sources, including feed water conditions, membrane fouling, mechanical failures, or improper operation. The following is a detailed troubleshooting guide to help diagnose and resolve common problems in a 3000 GPD RO system.

Table 14 – Troubleshooting Typical Problems

Problem	Possible Cause	Corrective Action
Low Permeate (Product Water) Flow	• Clogged pre-filters: Sediment or carbon filters may be fouled. • Fouled or scaled membranes: Membranes may be clogged with organic or inorganic matter. • Low feed water pressure: The system may not be receiving sufficient inlet pressure. • Damaged or worn-out multi-stage pump: The high-pressure multi-stage pump may not be providing adequate pressure. • Incorrect system settings: Flow restrictors, valves, or controls may be misadjusted. • Incorrect multi-stage pump motor correct rotation direction: Motor should be rotating in Clockwise (CW) position when viewing from the fan end. Reverse electrical motor wiring if it is rotating in the wrong direction.	• Replace or clean the pre-filters. • Perform a membrane cleaning procedure using the appropriate cleaning agents. • Check the inlet feed water pressure and increase it, if necessary (should be within 40 psi to 85 psi [276 kPa to 586 kPa]). • Inspect the multi-stage pump for wear or damage and repair or replace, if needed. • Adjust the system settings or check the flow restrictors for blockage. • Reverse the electrical motor wiring if it is rotating in the wrong direction. See List of Alarms and Warnings for more information.
High TDS (Total Dissolved Solids) in Product Water	• Damaged or degraded membranes: Membranes may be torn, or their performance may have degraded. • Inadequate rejection due to high feedwater TDS: Feedwater may have excessively dissolved solids. • Bypass flow issue: A bypass valve may be partially open or malfunctioning.	• Inspect the RO membranes for damage or fouling and replace, if necessary. • Ensure that the inlet feed meets system specifications (TDS below 2000 ppm). • Check all bypass valves for proper operation and ensure that they are fully closed.
High Pressure Differential Across Membrane	• Membrane fouling or scaling: High pressure differentials may indicate that the membrane is clogged. • Clogged pre-filters: These can cause resistance, increasing the differential pressure.	• Clean or replace the RO membranes. • Replace the pre-filters (sediment and carbon filters). • Check the system pressures and confirm that they are within the normal operating range.
System Shutting Down Frequently	• Low pressure switch activated: This could be due to insufficient inlet feed water pressure. • Overheating of the pump: Prolonged operation at high pressure or flow rate may cause the pump motor to overheat. • Electrical issues: Faulty wiring, circuit breakers, or system controls may cause the system to shut down.	• Check the inlet feed water pressure and ensure that it is within the required range (35 psi to 75 psi [241 kPa to 517 kPa]). • Inspect the multi-stage pump motor for signs of overheating and ensure adequate ventilation and cooling. • Check the wiring and electrical connections for loose or damaged components.

Problem	Possible Cause	Corrective Action
		• Reset any tripped circuit breakers or replace the faulty switches.
Pump Is Noisy or Vibrating	• Air trapped in the multi-stage pump or plumbing lines: Air bubbles can cause cavitation and noise. • Worn out multi-stage pump bearings or components: Over time, mechanical components may wear out. • Loose mounting or piping connections: Vibration may be due to improper securing of the pump or pipes.	• Bleed the air out of the system by opening a valve until the water flows smoothly. • Inspect the pump for worn or damaged parts and replace them, if necessary. • Tighten all mounting bolts and check for loose piping connections.
Low Feed Water Pressure	• Clogged feed water line or pre-filters: The feed water supply line or pre-filters or carbon block filter may be obstructed. • Inadequate water supply: The feed water source may not be delivering enough pressure. • Pre-water treatment issue: Check the Water softener or dechlorinator for any media issue that may be restricting the normal water flow.	• Check and replace pre-filters and carbon block filters, if necessary. • Inspect the feed water line for kinks, blockages, or leaks. • Ensure that the feed water source delivers the required pressure (minimum 40 psi [276 kPa]).
High Brine (Wastewater) Flow	• Malfunctioning flow restrictor: The flow restrictor/pressure regulator may be faulty, causing excessive brine flow. • Improperly adjusted flow restrictor: The flow restrictor/pressure regulator may need to be adjusted.	• Check the flow restrictor/pressure regulator for blockages or damage and replace, if necessary. • Verify that the flow restrictor/pressure regulator is properly adjusted.
High Feed Water TDS Causing Performance Issues	• Inadequate pre-treatment: The feed water may require additional treatment (for example, Iron, tannin.). • Overloaded membranes: High TDS feed water can overload the RO membranes and decrease the efficiency.	• Have a water sample tested in a Certified laboratory for water quality issue. • Consider adding pre-treatment such as modified media beds to improve feed water quality within specs. • Consider installing an additional pre-treatment system if the feed water's TDS consistently exceeds the recommended levels of 500 ppm.
Fouling of Membranes (Frequent Cleanings or replacement Required)	• Poor feed water quality: Excessive sediment, organics, or scale-forming substances in the feed water can foul the membranes quickly. • Inadequate pre-filtration: Sediment or carbon block filters may not be performing adequately. • Improper system operation: Operating at too high or too low pressures can contribute to fouling.	• Improve the feed water quality by adding or upgrading the pre-treatment systems. • Replace or upgrade the sediment and carbon pre-filters. • Ensure that the system operates within the manufacturer's recommended pressure range.

Notes

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