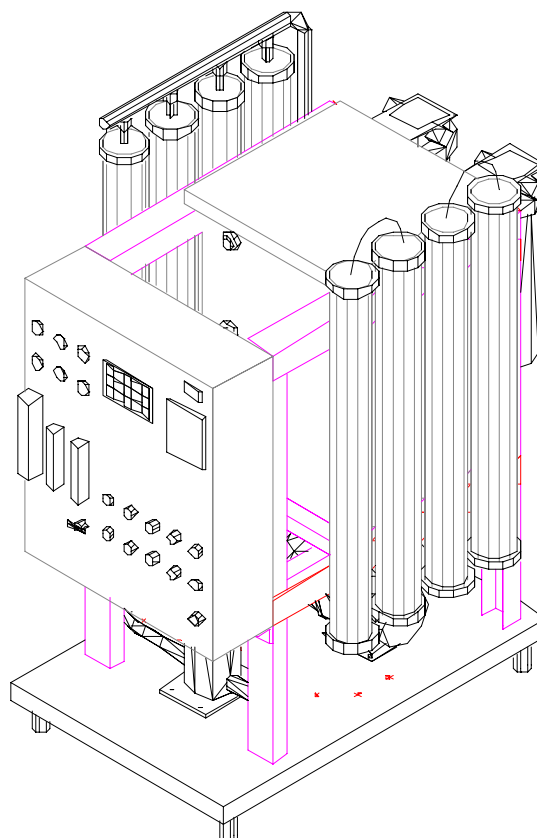

O & M Manual

IUR-1000

Puritron Engineering Co., Ltd.



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Overview

Read Me First

NOTE

PLEASE READ THROUGH THIS MANUAL BEFORE PROCEEDING TO INSTALLATION AND OPERATION OF THE SYSTEM.

WARNING

RINSE THE SYSTEM CLEAN OF ANY PRESERVATIVE AND DISCARD THE PRODUCT WATER. IT MAY TAKE FOUR TO SIX HOURS TO COMPLETELY RINSE DOWN THE SYSTEM.

CAUTION

KEEP SUFFICIENT CONSUMABLES AT HAND TO AVOID A SYSTEM DOWN TIME IF THE SYSTEM IS MEANT FOR CONTINUOUS RUNNING.

NOTIFY PURITRON OF ANY SYSTEM UPSET BY SENDING A BRIEF DESCRIPTION OF THE PROBLEM TO PURITRON ENGINEERING CO., LTD. VIA FAX AT 852-2-6826445. WE SHALL RESPONSE AS SOON AS POSSIBLE.

Introduction

HYPERPURE I is a series of industrial grade UF/RO water purification system having design capacity ranging from 500 to 1000 LPH

HYPERPURE IUR-1000

HYPERPURE I Series water purification systems employ the most advanced cross flow membrane separation technologies such as Ultrafiltration (UF) and Reverse Osmosis (RO) to purify water. Through a multiple steps of purification process, contaminants such as particles, colloids, organics, Total Dissolved Solids (TDS) and microorganisms can be removed from municipal water and well water, thus making the treated water suitable for drinking and industrial purposes.

Since there is no single water treatment process, that can do the purification job effectively alone. A complete water treatment system usually consists of a number of different purification processes. These different processes work together to improve the water quality further down stream with successive purification steps.

Pre-filtration and De-Chlorination

HYPERPURE I Series water purification systems utilize a 20-micron cartridge filter as a pre-filtration step and cartridge activated carbon filter for the removal of free chlorine and organics. Raw water first enters a 20-micron pre-filter, where sediments, suspended solids and large particulate matters are removed. Immediately after the pre-filter is a cartridge carbon filter. The carbon filter serves to remove free chlorine and some dissolved large molecular weight organics. Water exiting the carbon will be routed through a UF unit for the removal of fine particles with sizes down to 0.01 micron. The UF elements used are rated at 50,000 Molecular Weight Cut Off (MWCO), thus is capable of removing large molecular weight organics, colloidal silica as well as bacteria.

UF and RO units

The Ultrafiltration (UF) process is best known for its ability to achieve the greatest reduction of feed water Silt Density Index (SDI)₁₅. UF product water typically has a SDI value of 1, which is best suited for further treatment with Reverse Osmosis system (RO). RO is described as a demineralization process capable of removing Total Dissolved Solids (TDS). RO removes up to 98% of all mineral ions that are present in the feed water.

HYPERPURE I Series water purification systems use RO as a final step to improve water quality. UF product from the UF unit will be fed to a RO system where mineral ions, e.g. objectionable elements such as heavy metals and toxic chemicals can be removed.

Polishing

Product water of this system can be fed to an ion exchange resin bed for polishing, and multi-megohm water can be obtained for other demanding purposes. Water quality of over 18 megohm-cm can be achieved with a mixed bed deionizer down stream of this system.

*Puritron Engineering Co.,
Ltd. supplies a wide variety of
ion exchange systems to suit
your specific needs.*

Key Components

Components Details

RO BOOSTER PUMP	GRUNDFOS, CRN2-110
RAW WATER FEED PUMP	GRUNDFOS, CHI 2-40
PREFILTER	20 MICRON x 20"
ACTIVATED CARBON FILTER	4.25 DIA. x 20" HEIGHT
ULTRAFILTRATION ELEMENT	4040 x 4
REVERSE OSMOSIS ELEMENT	TW30 4040 x 4
STORAGE TANK FOR RO PRODUCT	150 LITERS
CONDUCTIVITY METER	MYRON-L, DIGITAL 0-2000 μ S/cm

Operating Conditions

Specifications

DIMENSION (L x W x H)	1.35 x 1 x 1.7m
FEED WATER	8.8 GPM (2000 LPH)
FEED WATER PRESSURE	1 - 3 KG/CM²
OPERATING TEMPERATURE	2 - 45 °C
FEED WATER SDI (15 MIN.)	< 6
LANGELIER SATURATION INDEX (RO REJECT)	NEGATIVE
FEED WATER CHLORINE CONCENTRATION	< 2 PPM
IRON	< 0.1PPM
ALUMINIUM	< 0.1PPM
MANGANESE	< 0.1PPM
TOTAL DISSOLVED SOLIDS (TDS)	< 1000 PPM
FEED WATER pH	2 -11

Projected Performance

Performance

Ultrafiltration Unit

FEED FLOW RATE	1680 LPH (7.4 GPM)
UF REJECT FLOW RATE	430 LPH (1.9 GPM)
UF RECOVERY RATE	75%
UF PRODUCT FLOW RATE	1250 LPH (5.5 GPM)
UF PRODUCT SDI	< 1 (PROJECTED)

Reverse Osmosis Unit

RO FEED FLOW RATE	1250 LPH (5.5 GPM)
RO REJECT FLOW RATE	250 LPH (1.1 GPM)
RO RECOVERY RATE	59%
RO PRODUCT FLOW RATE	1000 LPH (4.4 GPM)
RO SALT REJECTION	> 93% (MONOVALENT) > 96% (MULTIVALENT) > 99% (PARTICLES, BACTERIA, VIRUS)

PRODUCTION OF THE REVERSE OSMOSIS SYSTEM IS RATED AT 0 KG/CM² BACK PRESSURE AND AT 25 ° C WATER TEMPERATURE. FOR EVERY DEGREE C DROP IN WATER TEMPERATURE, PRODUCTION RATE WILL DECREASE BY APPROXIMATELY 3%.

RO Recovery

$$\text{RECOVERY RATE} = \frac{\text{PRODUCT FLOW RATE}}{\text{PRODUCT FLOW RATE} + \text{REJECT FLOW RATE}} \times 100\%$$

Recovery rate of the UF unit can be adjusted by regulating the UF reject throttling valve. Under no circumstances should the reject throttling valve be completely turned off.

Recovery rate of the RO system can be adjusted by regulating the RO reject throttling valve. Under no circumstances should the reject throttling valve be completely turned off.

Operating your UF/RO system at recovery rate higher than that specified in this manual will result in accelerated membrane fouling.

The system will shut down automatically when the raw water pressure is less than **1 kg/cm²** or when the RO feed pressure is less than **1 kg/cm²**.

System Description

Sequence of Operation

Raw Water Pump - P1

Raw water is pressurized by means of a raw water feed pump (**P1**) through a 20 micron filter and then an activated carbon filter for the removal of large particulate matters and chlorine.

Filtered raw water will go through a UF unit for the removal silt, colloids and large molecular weight organics. UF as a pretreatment step is very effective in reducing the Silt Density Index (SDI). Water leaving a UF unit usually has a SDI₁₅ of less than 1. Most RO membrane elements manufacturers strongly suggest that feed water for a RO system have a SDI₁₅ value of less than 5 lest the RO system will get fouled rapidly.

RO Booster Pump - P2

UF product is re-pressurized by means of a RO booster pump (**P2**). Pressurized water is fed to the RO system where ionic contaminants, particles, bacteria, pyrogen and organics are removed.

RO product water will go to a RO product storage tank. The RO product storage tank is equipped with high/low level switches for the automatic control of the system and membrane flush mode. The flush mode will be initiated when the liquid level reaches high; the system will restart when the liquid level reaches

Installation

Physical Requirements

Unpacking

This system has gone through a series of performance and hydraulic tests before leaving our manufacturing plant. Please inspect and report any damages or missing components immediately to the freight carrier and equipment supplier upon receipt of the system.

Locating

The system should be located as close as possible to the water source and on a level and rigid base, preferably on a concrete foundation. Leave sufficient space around the system to facilitate servicing. We suggest that at least 1-meter space on each side of the system be allowed.

Plumbing

Run a 1.5" PVC pipe from the water source to the system inlet. Install a manually operated shut off valve for isolation purpose. Install a drain pipe and direct all the waste water, i.e. UF reject and RO reject water to an open drain, make sure that the drain is capable of handling a flow rate of **8.8 GPM (2000 LPH)** to avoid over-spill. Avoid connecting the system drain pipe to other drainage system which is likely to create siphoning.

Wiring

Run a 3.5 mm² or larger lead wire from the power source to the control cabinet of the system. Finish the wiring by connecting the lead wires to the main breaker of the system.

System Operation

Electrical

Power - Main Power Supply Breaker

The main power supply breaker is located on the upper left corner inside the electrical cabinet.

System (SW1) - Two Way Selector Switch

1. **SW1** in “**ON**” - When **SW1** is switched to “**ON**”, the power indicator will light. The system is turned on and ready to start.
2. **SW1** in “**OFF**” – When **SW1** is switched to “**OFF**”, the system is turned off.

System Flush Mode (SW2) - Three Way Selector Switch

SW2 in “**MODE 1**” - The system is being controlled by the system programmable logic controller (**PLC**), and the system is operating automatically with **P1** and **P2** in the “**AUTO**” position, the system will start a forward fast flush cycle upon each RO product storage tank high level. The sequence of flushing is such that **P1** will be turned on, the respective RO membrane elements will receive an one minute forward fast flushing with UF product water. Then followed by UF modules, each will receive a one-minute forward fast flushing with filtered raw water.

SW2 in “**MODE 2**” - The system is being controlled by the system programmable logic controller (**PLC**), and the system is operating automatically with **P1** and **P2** in the “**AUTO**” position, the system will initiate a forward fast flushing after every hour of operation.

SW2 in “**MODE 3**” - The system is being controlled by the system programmable logic controller (**PLC**). With **P1** in “**AUTO**” and **P2** in “**OFF**”, the system will initiate a forward fast flushing at an interval of every eight hours. This mode is best suited for system that is being put off line for an extended period of time.

P1 (SW3) - Three Way Selector Switch

1. **SW3** in “**AUTO**” - **P1** is being controlled by the control logic. When the liquid level of the RO product storage tank drops to “**Low Water Level**”, the system inlet solenoid valve (**SV1**) will be energized (**open**) and **P1** will be turned on after a time delay of a few seconds.
2. **SW3** in “**OFF**” - **P1** will be turned off, and **SV1** will be de-energized (**close**) after a time delay of a few seconds.
3. **SW3** in “**HAND**” – the system inlet solenoid valve (**SV1**) will be energized (**open**) immediately and **P1** will be turned on after a 5 seconds time delay. **P1** is not being protected from dry run by the low feed pressure switch in this mode.

P2 (SW4) - Three Way Selector Switch

1. **SW4** in “**AUTO**” - **P2** is being controlled by the control logic. **P2** will be turned on **30** seconds after **P1** was turned on. **P2** will continue running provided that:
 - a. **P1** is not in “**OFF**” position.
 - b. RO product storage tank level is not high.
 - c. The system is not in the flushing mode.
 - d. The system is not shut down.
2. **SW4** in “**OFF**” - **P2** will be turned off immediately.
3. **SW4** in “**HAND**” - **P2** will be turned on immediately and is not under the protection of the control logic.

Note:

To start the system, turn **SW3** and **SW4** to “**AUTO**”, then turn **SW1** to “**ON**”, the system will start according to the pre-determined sequence. To shut down the system, simply switch **SW1** to “**OFF**”

Reset Button (PB1)

1. Push this button to restart the system after an alarm shut down.
2. Push this button to terminate the flush mode and restart the system when the system is in flushing cycle.

Alarm Silence Button (PB2)

Push this button to acknowledge an alarm and silence the buzzer.

Buzzer (BZ)

The buzzer will sound an audio alarm when anyone of the following system faults occur:

- A. Pressure switch (PS1) - low pressure alarm
- B. Pressure switch (PS2) - low pressure alarm
- C. Pump 1 overload (OVL1) - P1 overload alarm
- D. Pump 2 overload (OVL2) - P2 overload alarm

Hydraulics

Valves

1. **Valve V1** – Raw water pump (P1) discharge throttling valve, adjust this valve to obtain a UF feed pressure of around **3 to 4 kg/cm²**.
2. **Valve V2** - UF reject throttling valve, use this valve to get a minimal UF reject flow rate of **1.9 GPM**. Never completely shut off this valve or the UF unit will be fouled rapidly.
3. **Valve V3** – RO booster pump (P2) discharge throttling valve, adjust this valve to obtain a RO feed pressure of around **12 to 14 kg/cm²**.
4. **Valve V4** - RO reject throttling valve, use this valve to get a minimal RO reject flow rate of **1.1 GPM**.

NEVER COMPLETELY SHUT OFF THIS VALVE OR THE RO UNIT WILL BE PERMANENTLY DAMAGED.

5. **Valve V5** - Rinse valve for Activated Carbon Filter, open this valve to allow rinsing of the Activated Carbon Filter every time a new filter is installed. A **3 to 5** minutes rinse with filtered raw water may be sufficient to rinse most of the carbon fines off the new filter cartridge.
6. **Valve V6** - This valve is provided in case the UF needs chemical cleanings. Connect the outlet of the cleaning pump to this valve and open this valve to clean the UF when the cleaning chemicals is thoroughly mixed and ready for introduction into the UF unit.

Instrumentation

Indicators

Control Panel

There are a number of indicating lights on the control panel. The indicating lights provide a clear picture of the operating conditions of the system.

Status

Green lights represents components that are energized or operating. Red lights indicate system faults. When system faults do occur, the system will shut down and sound an alarm. Press the alarm silence button (**PB2**) to silence the buzzer, then check to locate the problem. Pressing the system-reset button (**PB1**) can restart the system.

Power Light

The power light indicates that power is “ON” and the system is ready to operate.

Operating Hour Meter

The operating hour meter records the elapsed hours of system operation.

Conductivity Meter

The conductivity meter with an inline probe continuously monitors the RO product water conductivity.

Service and Maintenance

Cartridge Replacement

Pre-Filter

The filter cartridge should be replaced on a regular basis. The change-out frequency is a function of the quality and quantity of water that has been treated. When the differential pressure across the pre-filter reaches **1 kg/cm²**, replace the filter cartridge with a new one.

Differential pressure of pre-filter = Pre-filter inlet pressure minus Pre-filter outlet pressure.

Activated Carbon Filter

As the activated carbon only has a finite chlorine removal capacity. To protect the polyamide thin film composite (TFC) RO membrane element from being oxidized by free residual chlorine, we recommend replacing the carbon cartridge periodically.

We recommend checking ACF outlet water for chlorine concentration to determine when to change ACF. Chlorine level should be zero.

Replacement of Filter Cartridge

Replace the filter cartridges when the differential pressure across the filter reaches **1 kg/cm²**.

- a. Switch off **SW1**, make sure that system pressure drops to **0 kg/cm²**. Remove the filter housing by turning the housing counter clockwise (as viewed from the filter head).
- b. Remove and discard the used filter cartridge, Rinse the filter housing with clean water, install the new cartridge.
- c. Replace the filter housing by turning the housing clockwise (as viewed from the filter head).

Membrane Cleaning

Chemical cleaning with 0.1 to 0.4 % NaOH solution is effective in removing most organic foulants from the UF membrane surface.

UF Membrane Elements

The UF membrane element needs either chemical cleaning or replacement when one of the following conditions occur:

- a. UF feed pressure increases by **20%** as compared with pressure logged at system start-up.
- b. Differential pressure of the UF unit (**UF feed pressure minus UF product pressure**) increases by **20%** as compared with differential pressure logged at system start-up.

RO Membrane Elements

Chemical cleaning with Hcl solution at a pH of above 2 is effective in removing most scalants from the RO membrane surface.

The RO membrane element needs either chemical cleaning or replacement when one of the following conditions occur:

- a. RO product flow rate drops by **20%**.
- b. RO feed pressure increases by **20%** as compared with pressure logged at system start-up.
- c. Salt rejection of the RO system drops to **90%**.

Note

Flow rate and pressure must be corrected for a constant feed water temperature. For a drop of every one degree c, there will be an approximate **3%** decrease in product flow rate.

Troubleshooting

Electrical

Power Supply

a. If there is no power supply when you switch **SW1** to “**ON**”, check and see if the breaker “**MCCB1**” is tripped.

b. Programmable logic controller (PLC)

With power on, the green “**POWER**” **LED** on the left of the PLC should be on, if not, please check for open contact or blown fuses.

c. Conductivity meter

If the conductivity meter is not functioning, check and see if the breaker “**MCCB4**” is tripped.

d. Solenoid valves

If the solenoid valves are not functioning, check fuse “**F1**” first, then check respective solenoid valves.

e. Raw water pump (**P1**)

If the raw water feed pump is not functioning, check and see if the breaker “**MC1**” is tripped.

f. RO booster water pump (**p2**)

if the RO booster pump is not functioning, check and see if the “**MC2**” is tripped.

Pressure

a. Low pressure alarm - **PS1**

Check the source of water supply, make sure that there is sufficient line pressure when the system is operating. Make sure that the inlet solenoid valve is functioning properly.

b. Low pressure alarm - **PS2**

Insufficient pre-treated water supply to the RO unit, usually caused by high differential pressure across equipment upstream of the RO unit.

Check the inlet/outlet pressure of the pre-filter and the UF unit, compare pressure readings with initial operating data logged at start-up.

Plugging Of Pre-Filter

If the outlet pressure of the pre-filter has declined as compared with the initial data and the differential pressure across the pre-filter has increased, the pre-filter is being plugged by particulate matters. If so, replace the pre-filter cartridge with new cartridge will solve the problem.

Plugging Of Activated Carbon Filter

If the outlet pressure of the activated carbon filter has declined as compared with the initial data, and the differential pressure across the carbon filter has increased, the activated carbon filter is plugged by the build up of contaminants. If so, replace the activated carbon filter cartridge with new cartridge will solve the problem.

Fouling of the UF Unit

If the product pressure of the UF unit has declined as compared with the initial data and the differential pressure across the UF unit has increased, the UF unit is being plugged by foulants deposited on the membrane surface. If so, the solution is either chemical cleaning or replacement with new membrane elements.

Scaling of the RO Unit

If the product pressure of the RO unit has declined as compared with the initial data and the differential pressure across the RO unit has increased, the RO unit is being plugged by scalants deposited on the membrane surface. If so, the solution is either chemical cleaning or replacement with new membrane elements.

Product Flow Rate

RO Product Flow Rate Decline

Insufficient UF product water supply to the RO unit - plugging of equipment upstream of the RO unit.

Incorrect RO recovery rate - regulate RO reject flow rate according to specification. RO feed pressure should be around **12 to 14 kg/cm²**.

Fouling or scaling of the RO membranes - chemical cleaning or replacement with new RO elements.

Programmable Logic Controller (PLC)

Input Signal

a. PS1

Pressure switch (**PS1**) is employed to prevent **P1** from dry run. **PS1** is a normally open contact. Under normal operation, the **#I01** input "**LED**" on the PLC should go out if water supply is turned on. If **#I01 "LED"** is lit after **P1** is on, the possible causes may be insufficient line pressure, poor electrical connection, or a defective pressure switch. Replace if the pressure switch is at fault.

b. **PS2**

Pressure switch (**PS2**) is employed to protect the RO unit from low-pressure damage. **PS2** is a normally open contact. Under normal operation, the #**I02** input “**LED**” on the upper right of the PLC should go out if there is sufficient UF product. If #**I02** “**LED**” is lit after **P1** is on, the possible causes may be insufficient RO feed pressure due to UF fouling, poor electrical connection, or a defective pressure switch. Replace if the pressure switch is at fault.

c. **Low Level Switch**

#**I04** “**LED**” on the PLC should be lit when the liquid level of the RO product storage tank becomes low. This is a normally closed contact. If #**I04** “**LED**” is not lit when the liquid level is low, the low level switch may be at fault.

d **High Level Switch**

#**I03** “**LED**” on the PLC should be lit when the liquid level of the RO product storage tank becomes high. This is a normally open contact. If #**I03** “**LED**” is not lit when the liquid level is high, the high level switch may be at fault.

f. For other input signals, please refer to relevant electrical diagram. Please check respective wiring and connections in case there are malfunctioning inputs.

Output Devices

Please refer to the electrical diagram and make sure that the output devices are energized when their corresponding “**LED**” on the PLC are lit. If not, measure the voltage between output pins on the PLC and terminals of the particular devices. If the voltage is abnormal then the problem lies in the wiring and the connections.

Status Lights

With the control power on, the “**POWER**” and “**RUN**” “**LED**” on the bottom left of the PLC will be lit. If the “**POWER**” “**LED**” is not lit, the circuit breaker for the PLC may be tripped. If the “**POWER**” “**LED**” is lit while the “**RUN**” led is not lit, the PLC is in the programming mode.

Notes

For system malfunctions other than those mentioned above or any unsolved problems, please notify **PURITRON ENGINEERING CO., LTD** for technical supports.

Endusers are required to record operating data and maintain a daily operating log for reference. Failure to produce a complete operating log shall void the warranty.

RO Membrane

CAUSES	PHENOMENA			AREAS TO CHECK	REMEDIES
	FLUX	REJECTION	PRESSURE DROP		
MEMBRANE DEGRADATION	INCREASE	DECREASE	STABLE	OPERATING TIME FEED WATER TEMP- ERATURE AND pH, CHLORINE CONCEN- TRATION	REPLACE ELEMENT
COMPACTION OF MEMBRANE	DECREASE	INCREASE	STABLE	TEMPERATURE AND PRESSURE OF FEED WATER, OPERATING TIME	REPLACE ELEMENT
LEAKAGE FROM O-RING	STABLE	DECREASE	STABLE	VIBRATION, SHOCK PRESSURE	REPLACE O-RING
IMPROPER BRINE SEAL	DECREASE	INCREASE	DECREASE	ELEMENT FITTING, MATERIAL AGEING WRONG DIRECTION	REPLACE BRINE-SEAL
INTERCONNECTOR DAMAGED	INCREASE	DECREASE	INCREASE	HIGH PRESSURE DROP HIGH TEMPERATURE	REPLACE INTER- CONNECTOR
PRODUCT TUBE DAMAGED	INCREASE	DECREASE	INCREASE	HIGH PRESSURE DROP HIGH TEMPERATURE	REPLACE ELEMENT
DEFORMATION OF ELEMENT	DECREASE	DECREASE	INCREASE	HIGH PRESSURE DROP HIGH TEMPERATURE	REPLACE ELEMENT
MEMBRANE FOULED BY SUSPENDED SOLIDS	DECREASE	DECREASE	INCREASE	INADEQUATE PRETREATMENT	CLEANING OR REPLACE ELEMENT
MEMBRANE FOULED BY SCALANTS	DECREASE	DECREASE	INCREASE	INADEQUATE PRETREATMENT	CLEANING OR REPLACE ELEMENT
MEMBRANE FOULED BY ORGANISMS OR OILY MATTERS	DECREASE	DECREASE	INCREASE	INADEQUATE PRETREATMENT	CLEANING OR REPLACE ELEMENT
HIGH WATER TEMPERATURE	INCREASE	DECREASE	STABLE	FEED TEMPERATURE	COOLING
LOW WATER TEMPERATURE	DECREASE	STABLE	STABLE	FEED TEMPERATURE	HEATING
HIGH FEED PRESSURE	INCREASE	INCREASE	STABLE	PUMP, VALVES	ADJUST PRESSURE
LOW FEED PRESSURE	DECREASE	DECREASE	STABLE	PUMP, VALVES, PLUGGED FILTER	ADJUST PRESSURE REPLACE FILTER
HIGH REJECT FLOW RATE	DECREASE	INCREASE	INCREASE	REJECT THROTTLING VALVE	ADJUST REJECT VALVE
LOW REJECT FLOW RATE	INCREASE	DECREASE	DECREASE	REJECT THROTTLING VALVE	ADJUST REJECT VALVE
HIGH FEED WATER TDS	DECREASE	DECREASE	STABLE	FEED WATER TDS	INCREASE PRESSURE
LOW FEED WATER TDS	INCREASE	INCREASE	STABLE	FEED WATE TDS	DECREASE PRESSURE

Reverse Osmosis

Theory

Reverse Osmosis

Osmosis is natural phenomenon - the passage of a dilute solution through a semi-permeable membrane into a more concentrated solution. The concentrated solution then becomes diluted. The membrane acts as a barrier, which keep the dissolved solids (salt) from passing through. The osmosis continues until the pressure created by the osmotic head equals the osmotic pressure of the concentrated solution. This is called osmotic equilibrium.

By applying external pressure greater than the osmotic pressure to the concentrated solution. The water flow across the membrane can be reversed. By reversing the flow from the concentrated solution to a dilute solution. Pure water is obtained from the more concentrated salt solution. This is called a reverse osmosis process.

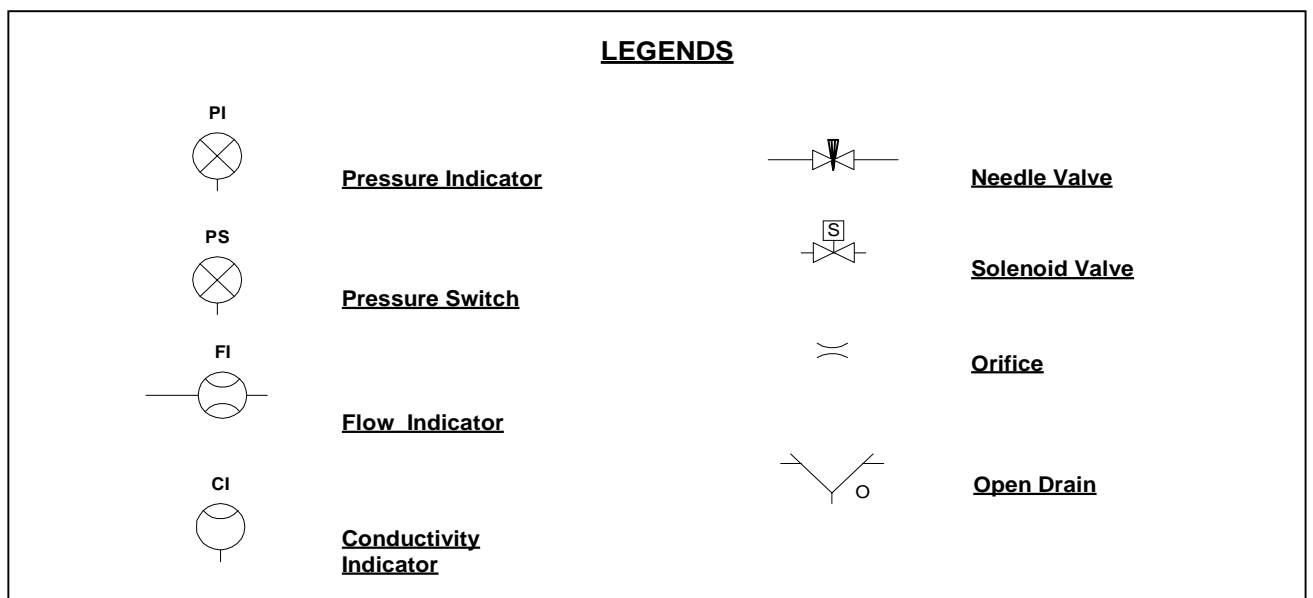
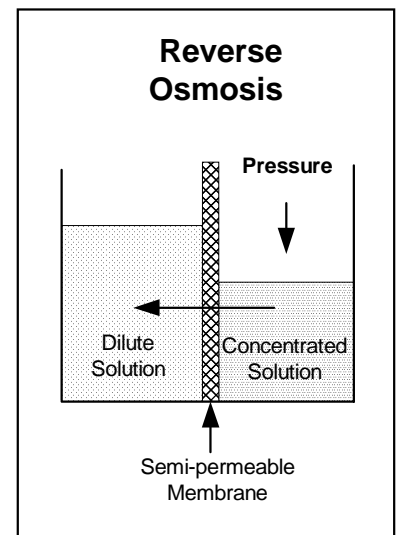
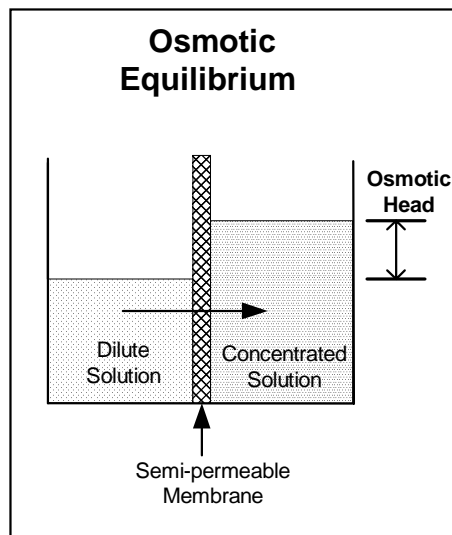
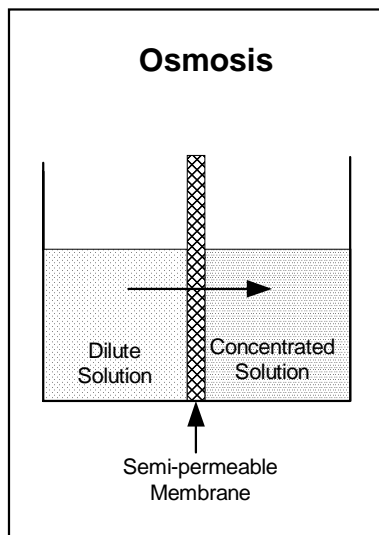
Salt Rejection

The liquid and dissolved solids rejected by the membrane is referred to as the “**Concentrate**” or “**Reject**”, while the liquid passing through membrane is called “**RO Product**” or “**RO Permeate**”. RO membrane typically reject over 98% of the feed water dissolved solids while recovering as much as 85% of the feed water provided that the feed water is softened UF product which becomes product water.

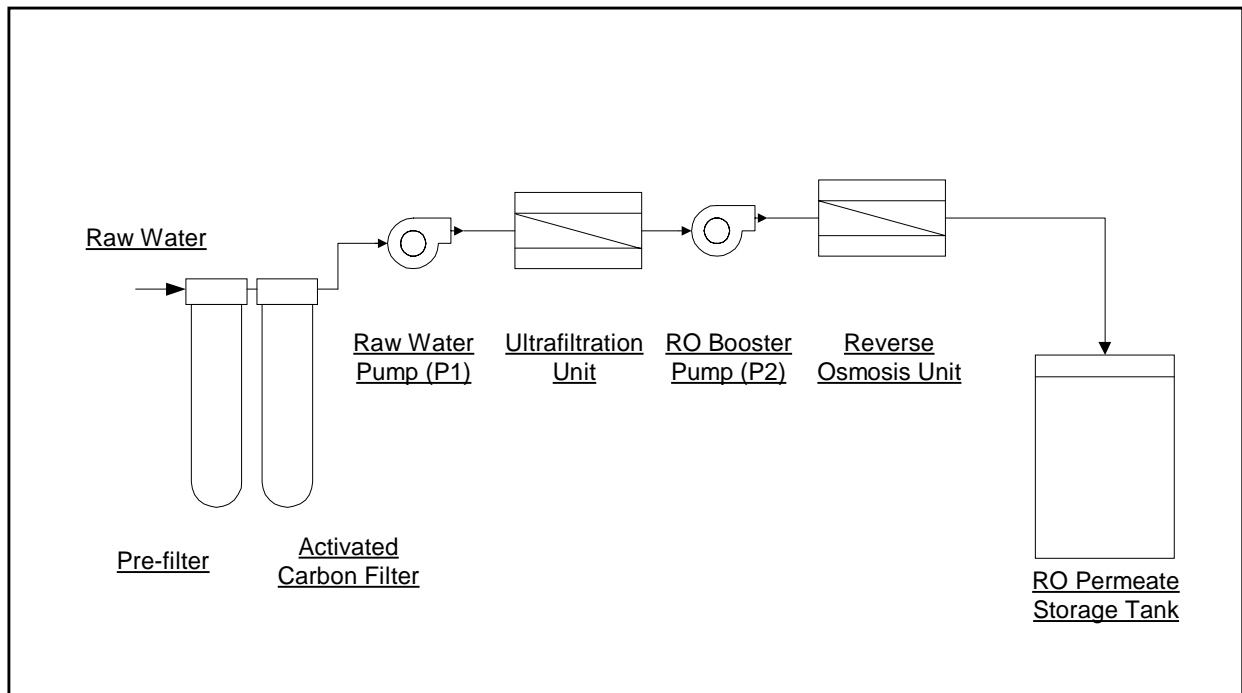
$$\text{SALT REJECTION} = \frac{\text{FEED TDS} - \text{RO PERMEATE TDS}}{\text{FEED TDS}} \times 100\%$$

Schematics

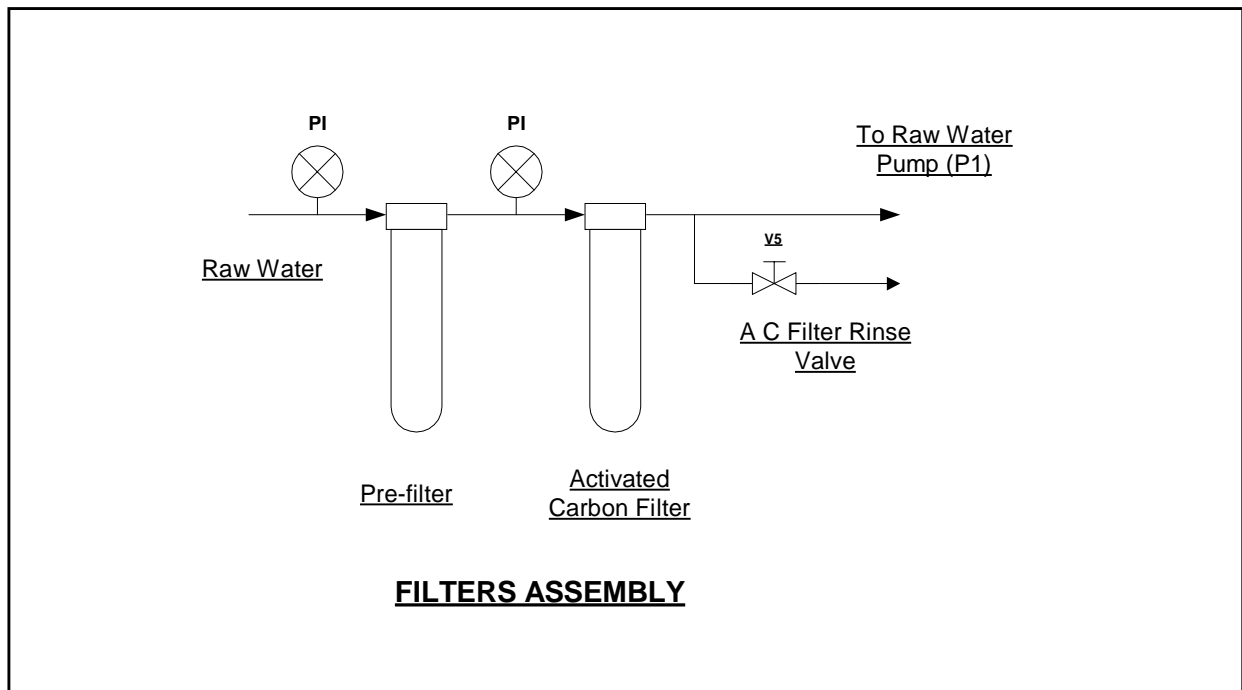
Reverse Osmosis



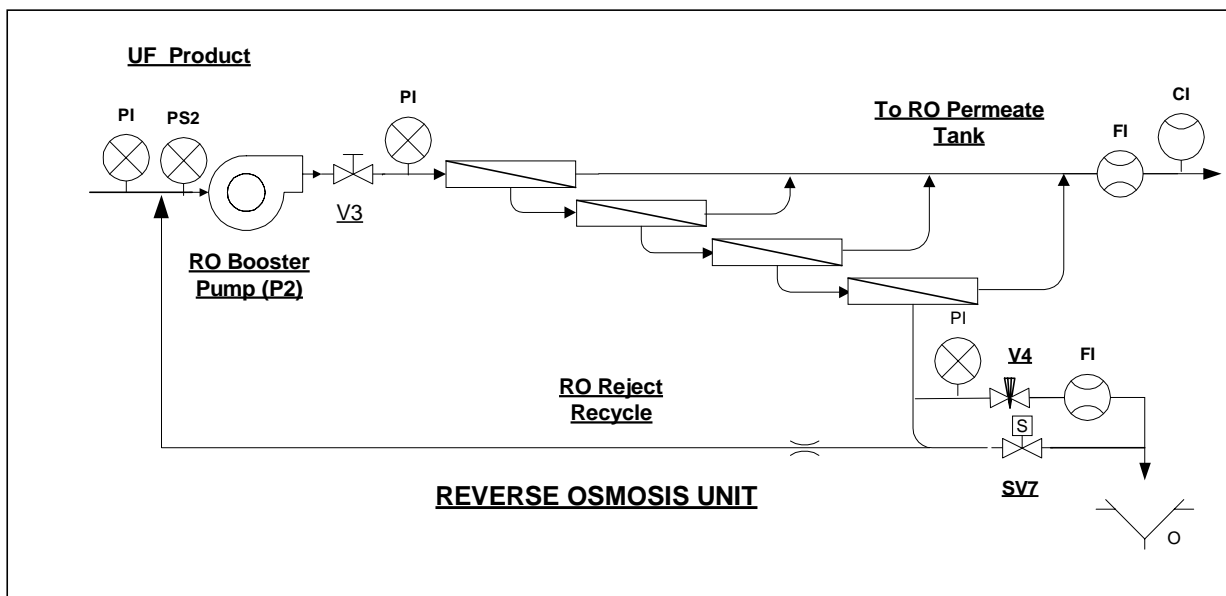
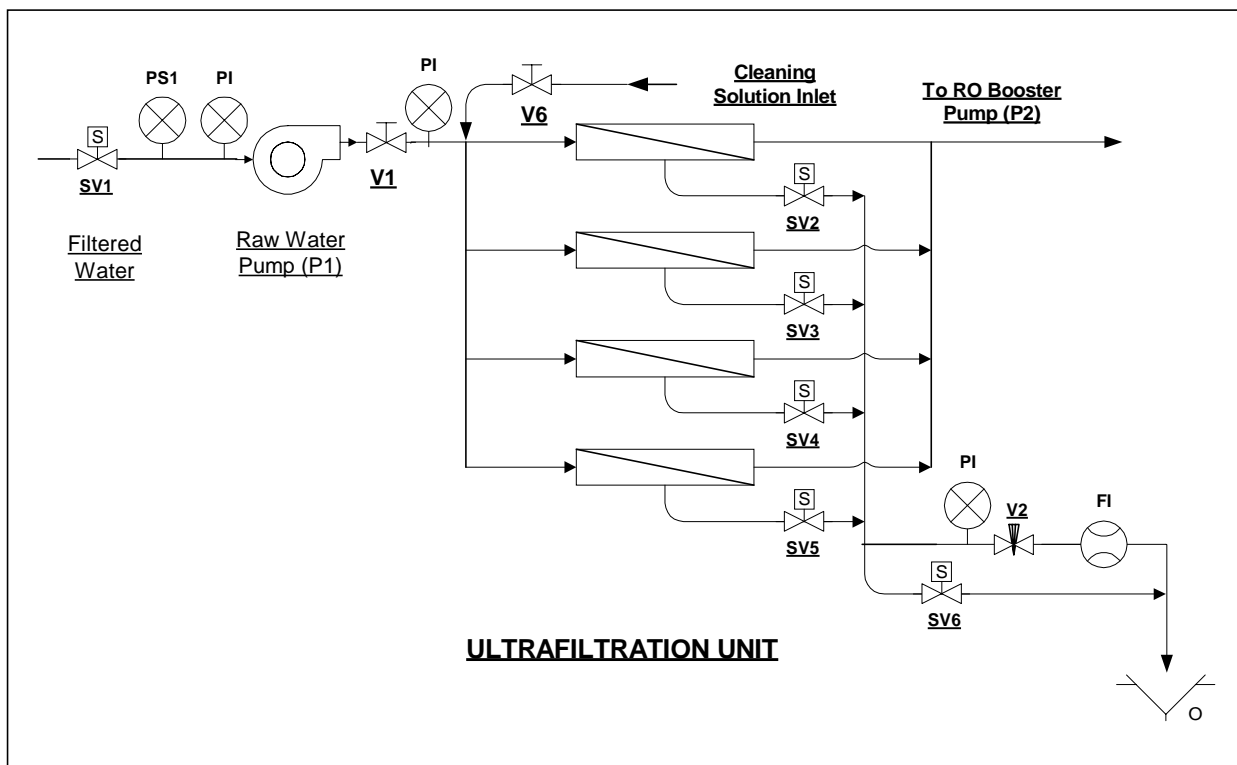
Process Flow Diagram



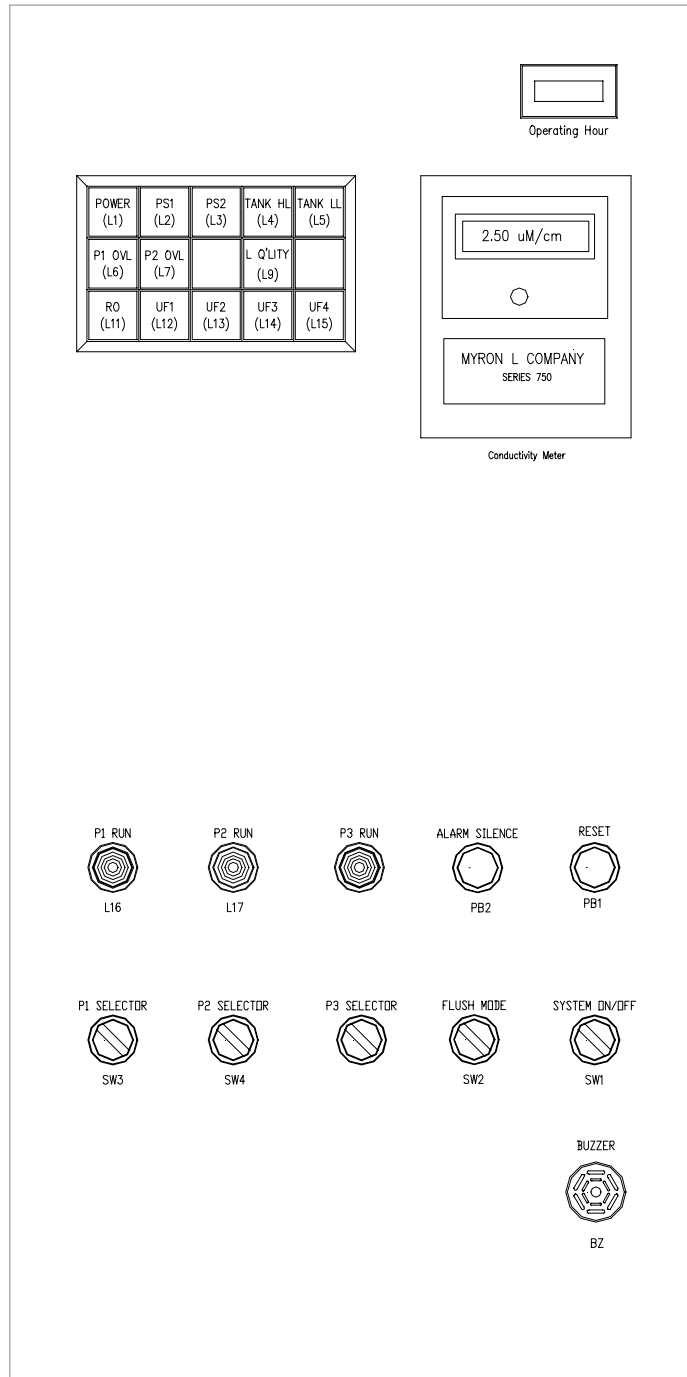
Process & Instrumentation Diagram



Process & Instrumentation Diagram



Control Panel



Warranty

Warranty

THIS SYSTEM CARRIES AN ONE YEAR WARRANTY UNDER THE FOLLOWING CONDITIONS:

1. THE WARRANTY PERIOD SHALL START FROM THE DATE OF START-UP OR FROM SIXTY DAYS AFTER SHIPMENT.
2. THE SYSTEM IS BEING INSTALLED AND OPERATED AS SPECIFIED.
3. FEED WATER MEETS REQUIREMENTS SPECIFIED IN THIS MANUAL.
4. FILTERING MEDIA AND FILTER CARTRIDGE REPLACED AS NEEDED.
5. OPERATING LOGS MAINTAINED.

Glossary of Terms

Colloids

A dispersion of finely divided and negatively charged particles (< 1 micrometer) suspended indefinitely in a fluid.

De-Chlorination

The removal of free residual chlorine in the feed stream through chemical reaction with reducing agents.

Flush Mode

In the flush mode water at high flow rate and high velocity is introduced to the membrane surface to dislodge and remove contaminants accumulated on the membrane surface during normal operation.

Foulant

The deposition of organic based contaminants on the membrane surface which impedes the transport of water through the membrane, thus decreasing the product flow rate.

Ion Exchange

Ion exchange is the reversible interchange of ions of similar electrical charge between a solution and a solid insoluble body in contact with the solution. The solid insoluble body is called an ion exchange resin.

Membrane Fouling

The formation of a layer of contaminants on the membrane surface as a result of the increased concentration of solutes in a thin boundary layer at the membrane surface on its high pressure side during ultrafiltration or reverse osmosis.

Microorganisms

An inclusive term for bacteria, virus, fungi, algae and mold, etc..

Mixed Bed Deionizer

Mixed bed means that two resins, cation and strong base anion exchange resins are thoroughly mixed in a certain ratio then added into a single column to effect the exchange of ions in a solution.

Molecular Weight Cut Off (MWCO)

UF are rated on their ability to remove certain sized molecules. The "size" of a molecule is roughly proportional to its weight, and therefore MWCO specified for an UF indicates the minimum size (weight) of molecules that will be removed by a particular UF device.

Multi-MEGOHM

The specific resistance of water is measurable in OHMs, the unit of electrical resistance. The less minerals dissolved in water, the higher its resistance to electricity. Natural waters have a specific resistance in the 1,000 to 5,000 OHMs range, while theoretically pure water have a specific resistance of 18.2 MEGOHM-cm.

Organics

An inclusive term for a large class of carbon based compounds found in the feed water, e.g., fulvic and humic acid formed from the decomposition of dead vegetable matter, Humic acids comprise a loosely bound association of compounds of above 2000 molecular weight. The fulvic acids, similar in structure to humic acids but possessing smaller molecular weight of 500 to 2000.

Polishing

Further treatment to improve the water quality after the RO process. Polishing is a continuous process with water circulating continuously through the polishing equipment on the polishing loop.

Pyrogen

Pyrogen is a lipopolysaccharide coming from the cell walls of bacteria. A small quantity (as low as 0.00000001 gram)When injected into the human blood would cause a series of adverse effects, from fever to shock and death.

Recovery Rate

Recovery Rate is the percentage of the feed water exiting a membrane process as the product water.

RO Reject

RO reject is the portion of the RO feed water remaining after the RO permeate is collected through the centre collecting tube. RO reject is usually directed to drain with all the retained salts.

Salt Rejection

The ability of a RO element to remove TDS in a solution during reverse osmosis is expressed as percentage salt rejection.

Scalants

The deposition of inorganic contaminants on the membrane surface when the solubility of certain sparingly soluble salts is exceeded. Scaling impedes the permeate of water molecules through the membrane surface, thus decreasing the product flow rate.

Silt Density Index (SDI)

The concentration of the colloids is determined by the SDI. The SDI is derived from the rate of plugging of a 0.45 micron Millipore filter when water is run through the filter at 30 psig applied pressure. Although the SDI measurement is not absolute, excellent correlation has been obtained between the SDI and the rate of colloidal deposits in RO elements.

Total Dissolved Solids (TDS)

Total Dissolved Solids refer to all inorganic minerals dissolved in the water in the form of ions.

UF Reject

UF reject is the portion of the UF feed water remaining after the product water is collected through the centre collecting tube. UF reject is usually directed to drain with all the retained solutes.

Ultrafiltration (UF)

Ultrafiltration is a pressure driven membrane separation process in which particulates, colloids, emulsified oils, and macromolecules are separated from a liquid feed stream. On the separation size spectrum, UF falls between nanofiltration (NF - membrane pore sizes below approximately 0.01 micrometer) and microfiltration (MF - pore sizes greater than 0.1 micrometer)