RoPro 8

Installation Operation Maintenance Manual

RoPro 8 Standard M2X2 Platform
Reverse Osmosis Systems
OS3030 controller
With 8" membranes

Models

8-50
8-75
8-100
8-150

Rev8 **17/2/12**

CONTENTS

1.0 GENERAL NOTES

These instructions cover the RoPro 8" base platform range of commercial Reverse Osmosis Systems built on the M2X2 platform, which includes models with nominal outputs ranging from 60m3 to 180m3 per day.

It is recommended that these instructions are read throughout before commencing any work on the unit, particularly if you have no previous experience of installing and using a high pressure Reverse Osmosis System.

The instructions have been written in such a manner that the vast majority of the text applies to all the models in the range. However, in some cases, there are differences between different models, and when these result in a requirement to undertake a task in a different way, individual sections have been written to cover each case. These are clearly marked, and should be easy to identify.

2.0 THE REVERSE OSMOSIS PROCESS

2.1 Introduction

Osmosis is a natural process involving fluid flow across a semi-permeable membrane barrier. It is the process by which nutrients feed the cells in our bodies and how water gets to the leaves at the top of trees.

If you separate a solution of salts from pure water using a basic thin semi-permeable membrane like a sausage skin, the pure water passes through the membrane and tries to dilute the salt solution. If the salt solution is connected to a vertical pipe then the progressively diluted solution will fill the pipe until the 'osmotic pressure' drawing the pure water though the membrane is the same as the head of solution.

This process can be reversed - hence 'Reverse Osmosis' - by applying a higher pressure to the salt solution. Pure water will then pass the other way through the membrane in a process that is easy to visualise as 'filtration' where the filter will only let through the small water molecules and retain almost all of the other molecules.

The mechanism of water and salt separation by reverse osmosis is not fully understood at the 'atomic' level. Current scientific thinking suggests two transport models: porosity and diffusion. That is, transport of water through the membrane may be through physical pores present in the membrane (porosity), or by diffusion from one bonding site to another within the membrane. The theory suggests that the chemical nature of the membrane is such that it will absorb and pass water preferentially to dissolved salts at the solid/liquid interface. This may occur by weak chemical bonding of the water to the membrane surface or by dissolution of the water within the membrane structure. Either way, a salt concentration gradient is formed across the solid/liquid interface. The chemical and physical nature of the membrane determines its ability to allow for preferential transport of solvent (water) over solute (salt ions).

2.2 Membrane construction

The semi-permeable membrane for reverse osmosis applications consists of a thin film of polymeric material a fraction of a millimetre thick cast on a fabric support. Commercial grade membranes have high water permeability and a high degree of semi-permeability; that is, the rate of water transport is much higher than the rate of transport of dissolved ions.

The membranes are stable over a wide range of pH and temperature, and have good mechanical integrity. The stability of these properties over a period of time at field conditions defines the commercially useful membrane life, which is in the range of 3 to 5 years. There are a number of different materials used for membranes and several ways of constructing them. This system uses Composite polyamide spiral wound membranes.

In a spiral wound configuration two flat sheets of membrane are separated with a permeate collector channel material to form a leaf. This assembly is sealed on three sides with the fourth side left open for permeate to exit. A feed/brine spacer material sheet is added to the leaf assembly.

A number of these assemblies or leaves are wound around a central plastic permeate tube. This tube is perforated to collect the permeate from the multiple leaf assemblies. The feed/brine flow through the element is a straight axial path from the feed end to the opposite brine end, running parallel to the membrane surface. The feed channel spacer induces turbulence and reduces concentration polarisation.

The spiral membrane is then enclosed by wrapping with glass reinforced resin into which is bonded an adapter cap at each end. The membrane is then housed in reinforced pressure tube with seals at each end. Water under pressure is introduced into one end of the housing/membrane assembly so that it runs between the feed channel spacer and the concentrate and permeate output piped away at the other

2.3 Pressure pump

In order to develop sufficient water pressure to overcome the Osmotic Pressure of the feed water and produce an acceptable volume of permeate, a three phase vertical multistage pump is used to boost the supply pressure by approximately 150 - 200psi which results in the system running at 170-250 psi in normal service.

This type of pump is both quiet and reliable in continuous applications, requiring minimal maintenance with low energy costs.

2.4 Recirculation

Membranes will normally each 'recover' only 10-15% permeate from the raw water without fouling. However by returning a proportion of the concentrate exiting from the final membrane to the inlet of the pressure pump, the flow across the surface of the membrane is dramatically increased allowing a recovery ratio of up to 75% to be achieved without significant fouling. Recirculation also allows a higher flow of water through the pump, reducing the load on its bearings and helping the pump to run cooler. The recirculation rate on the RoPro Series is adjustable.

2.5 Recovery

The 'recovery' of a Reverse Osmosis System is a measure of the proportion of the total input water that is converted to high quality permeate. A recovery ratio of 10% means that only 1 part in ten of the input water is converted to permeate. At 50% recovery, half of the input water is converted. At 75% recovery, three quarters of the input water is converted to permeate.

The recovery ratio on the RoPro Series is adjustable, and its setting will affect the final water quality. At high recovery ratios, the amount of solids in the concentrate water as it exits the membrane will be high which will result in a higher level of solids in the permeate. However by reducing the recovery, the operating pressure in the system will also be reduced, which in turn can also result in a raised level of solids in the permeate since rejection rates are better at higher pressures.

A balance of the optimum water quality and volume is usually found at recovery ratios of 50%-65%.

2.6 Rejection

The rejection ratio is a measure of the amount of solids dissolved in the raw water that are 'rejected' by the membrane. A rejection rate of 99% means that that only 1% of the dissolved solids will pass through the membrane, and these are usually of low molecular weight.

At 99% rejection on a raw water supply of 400 ppm, you would therefore expect a permeate quality of 4 ppm. However by running single membranes at high recovery levels with considerable recirculation will mean that the membrane actually 'sees' a raw water of 1000-1500 ppm which could give a product water quality of 10-15 ppm. This is still a very pure water, but may need additional polishing through a mixed bed ion exchange resin or a ‘second pass’ RO system if ultra-low TDS water is needed for process.

2.7 Flush

In order to remove fouling that accumulates during service it is essential to periodically flush the membrane at a high water flow.

The controller fitted will automatically flush the membrane at the end of a production run and also flush it periodically during standby.

2.8 Pre-Treatment

For a Reverse Osmosis plant to function as efficiently as possible, the raw water feeding the system needs to have its hardness reduced by a water softener, or inhibited with special chemicals that are dosed in to the supply upsteam of the system. For small industrial R/O systems like the RoPro8 Base Series, duty/standby duplex softening is preferred since it is very cost effective and contributes to the longevity of the membranes.

The Composite Polyamide membranes used in high output Reverse Osmosis systems do not tolerate high levels of Chlorine. This should be removed with a backwashing filter filled with Granular Activated Carbon.

3.0 UNPACKING AND IDENTIFICATION

3.1 Basic Packages

The Reverse Osmosis unit will normally be delivered as a single item on a wheeled frame with locking castors. Additional items may also be supplied if ordered, such as a product water storage tank, pre-filter or water softener. If no additional items have been ordered, then a level probes assembly will also be supplied for installation in to the customer's treated water storage tank.

3.2 Unpacking notes

The unpacking of system is straightforward and there are no 'hidden' items. It is advisable to keep the system wrapped until ready to complete installation to prevent dust or water ingress.

Care must be taken if carton slitters or hobby knives are used to remove any external wrapping since there are control cable and pressure gauge flexible lines routed around the system frame.

3.3 Lifting

Caution: The R/O system will weigh between 300 and 600 kg depending on the model. The frame is fitted with lockable wheels so that the system can easily pushed into place.

If the system must be lifted clear of the ground, suitable lifting straps must be used which will lift the system by the base without stressing components on the frame.

Lifting eyes are not fitted to the frame unless ordered.

4.0 Temporary Storage

If installation is not to start immediately after delivery, the equipment should be stored in a clean dry area, where it will not be damaged, or be subjected to temperatures below freezing.

5.0 DESCRIPTION OF SYSTEM

Twin membrane length stainless steel frame with one or more twin or triple length pressure vessels fitted with ESPA membranes, electronic controller, flow meters, valves, sediment filter, vertical multistage pressure pump and all interconnecting pipe work.

The inlet connection point from the GAC filter is positioned on the stainless steel sediment filter housing. The filter housing contains three 5µ filter cartridges of 20”, 30” or 40” length depending on the system. The housing also has drain valves and pressure gauge line connection points on the raw and filtered side of the bank of cartridges. After the filter is the inlet solenoid and then pipework takes the supply water to a manifold on the inlet of the pressure pump. On this manifold is the low pressure switch, recirculation return and piping to the cleaning inlet port.

The control panel will not initiate service unless the water pressure is above the minimum set, currently 1.0 bar. This level is set low since the high pressure pump draws water at a very high rate during flushing with the effect that the monitored inlet pressure will drop.

From the pump, high pressure water is piped via a manifold to the inlet on the end of the first, lowest membrane housing. The manifold is also fitted with a high pressure cut out and pump pressure gauge line.

The permeate outlet from each housing is connected to the inlet of the permeate flow meter. The outlet of the permeate flow meter is terminated with a three way 1.1/2" 'L port' ball valve with a 1.1/2" socket ABS socket union on the service outlet. The other outlet port is joined to a tee from a similar valve on the concentrate line. The central take off point from the tee is a 1.1/2" ball valve with a 1.1/2" BSP male thread for use with a cleaning set.

The concentrate outlet from the membrane housing is connected to the inlet of the next membrane housing (if fitted). Subsequent membranes continue this sequence. On the 8-100 and 8-150 models the inter-housing pressure is also monitored.

The concentrate outlet from the final membrane is piped to a manifold with an adjustable recirculation flow controller, pressure gauge line, tee to the flush line and a pressure regulating/concentrate valve. The regulating valves are used to control the back pressure in the concentrate line and the recirculation flow.

The outlet of the concentrate flow meter is terminated with a three way 1.1/2" 'L port' ball valve with a 1.1/2" socket ABS socket union on the drain outlet. The other outlet port is joined to a tee from a similar valve on the permeate line. The central take off point from the tee is a 1.1/2" ball valve with a 1.1/2" BSP male thread for use with a cleaning set.

The recirculation valve directs a proportion of the concentrate water back to the inlet of the high pressure pump which maintains the water speed over the surface of the membrane. Water is recirculated to help give high recovery of permeate from the concentrate water, and also to keep up the flow across the surface of the membrane to prevent fouling

The flows have been factory tested under working conditions, but the concentrate valve has been opened prior to despatch in order to fill the membranes with preservative. The valve will need setting up on site to balance the outputs to the user's requirements depending on the incoming water pressure and quality.

Pressure gauges supplied are glycerine filled to minimise bounce and prolong the service life.

If a permeate storage tank has not been ordered, a tank 'full/restart'level sensor and flying lead has been included with the system to be installed in the permeate tank. Installation will require the tank cable to be connected via the tank connector/stuffing assembly the two core flex and two way connector to the Reverse Osmosis system.

6.0 PRE INSTALLATION CHECKS

6.1 MECHANICAL

6.1.1 Foundations/Drainage

The Reverse Osmosis unit and pre-filter will not require any special foundations, provided that a firm, level area which is capable of supporting the working weight (see Engineering Data, **Section 12.2)** is available.

Reject/concentrate water from the process must flow to drain, or to a storage tank where it can be utilised for other processes that do not require high quality water such as washdown or lavatories.

If the system is simply run to waste this must be to an open drain or gully, capable of passing the necessary flow is required (see Process and Operating Data, **Section 12.1**, for relevant flows). The total flow of water to drain depends on site conditions, but will typically be between 50-100% of the product water flow. The drain must not be at a level higher than the Reverse Osmosis unit and preferably should be installed with an air break at the same height as the drain outlet.

6.1.2 Operating Space

It is difficult to be precise with regard to the floor space which will be occupied by the assembled unit, since there will usually be associated pre-treatment and product water storage. However, an idea can be gained from reference to the Engineering Data (**Section 12.2**).

Access will be required to monitor the operating pressures, permeate & concentrate flows, and permeate conductivity. Access will also be needed to carry out adjustments or maintenance on the equipment. It is therefore recommended that a minimum of 500mm clearance be allowed around the base for this purpose.

Since the system is wheeled, it can be easily moved to allow replacement of membranes.

6.1.3 Incoming Water

The raw water to be fed to the Reverse Osmosis GAC pre-filter unit must comply with the following:

(a) Available at all times at a flow equal to the required maximum service flow or greater.
(b) At a pressure between 2.0 and 5.0 bar at the service flow required.
(c) Temperature between 10°C and 40°C.
(d) Iron less than 0.2 ppm, Manganese less than 0.1ppm.
(e) Free Chlorine less than 0.2 ppm
(f) Softened to no greater than 10ppm hardness as CaCO3 .

6.1.4 Pipework

Pipework to be connected to the Reverse Osmosis Unit should not have an excessive amount of Iron or hardness scale deposit. Piping that is heavily built up with scale or Iron deposits should be replaced.

Make sure that the pipework can be connected to the Reverse Osmosis Unit in such a way as to impose no stresses on the inlet connection, and that it is properly aligned and supported. Excessive vibration can cause erratic operation of the solenoid valves, so, if required, a suitable vibration damper should also be installed. Final connections to the Unit should be made where possible using flexible connections to avoid stresses during operational cycles.

6.1.5 Water Supply Company Requirements

It is essential that the equipment is connected to a pressurised water supply. If connected to a mains supply the local bye laws must be adhered to. These cover both plumbing and the prevention of back flow into the mains. If there is any doubt, the local water inspector should be consulted, but in general, the installation of a 'Double check valve assembly' conforming to BS.6282 part 2 will be required in the supply pipework to the system.

6.2 ELECTRICAL

The system requires a continuous three phase supply of 415v, 50 Hz with a rating as indicated in Section 12.3. A pump starter/overload switch, contactor and soft starter is fitted in the transformer enclosure on the frame. An isolating switch and MCB should be installed on an adjacent wall to supply the system.

A continuous three single phase supply of 24v, 50 Hz with a rating of 5 Amps is required by the Reverse Osmosis Unit controller. A 240/24v fused safety isolating transformer is fitted to the frame to provide power to the controller with its supply taken from supply phase one.

7.0 INSTALLATION

7.1 MECHANICAL

Flow diagrams showing the suggested overall layout of the system is included in Section 14 ,and should be referred to for guidance.

Check all the items against the parts list and shipping documents, and ensure you have them all before starting work. In addition to the components you will require basic tools, (i.e. spanners, screwdrivers etc., and P.T.F.E. tape).

7.1.1 Inlet Pipework

Pipework should be assembled incorporating the features shown in the Flow diagrams, Section 14. It is essential that an inlet isolating valve is provided, and that the water main is protected by a double check valve where appropriate (see Local Water Bye laws).

Pipework can be constructed from any normally acceptable material (Copper, Galvanised, Plastic), provided it is properly supported and aligned. Ensure that the pipe is sufficiently large to accommodate the flow of water required.

NOTE: IF BRAZED OR SOLDERED FITTINGS ARE TO BE USED, THE PIPEWORK MUST BE DISCONNECTED FROM THE SYSTEM CONNECTIONS DURING HEATING AND COOLING. EXCESS HEAT CAN CAUSE PERMANENT DAMAGE TO SOME OF THE SYSTEM COMPONENTS.

The inlet pipework should be connected to the inlet port on the filter housing (2" ABS socket unit)

7.1.2 Drain Connection

The R/O drain pipework should be connected to the 1.1/2" ABS socket union connected to the 'L' port ball valve on the outlet from the concentrate flow gauge There is also a 1.1/2" ball valve with a 1.1/2" BSPM outlet tee'd into a cross pipe between the concentrate and permeate 'L' port valves for use during membrane cleaning.

The concentrate should be run to a drain or concentrate storage tank capable of taking the maximum flow during flushing (see **Section 12.1**), using flexible tube it at all possible An air gap is necessary on the drain line from the system to prevent negative pressures acting on the membrane.

7.1.3 Permeate Connection

The permeate connection is made to the 1.1/2" 'L' port ball valve on the outlet from the permeate flow meter and should be made with piping of at least 1" nominal bore for the 8-50 and 8-75 models and 1.1/2" nominal bore for 8-100 and 8-150 models.

The permeate connection must be made with polymer or other non corrodible pipe material such as stainless steel. Copper or steel piping must **not** be used under any circumstances.

There is also a 1.1/2" ball valve with a 1.1/2"" BSP male fitting teed between permeate line and concentrate lines for use during membrane cleaning.

Install a suitable overflow in the permeate storage tank. This must be below the level of the permeate inlet and must also make allowance for permeate production during flushing **(see Section 7.2.3 & Drawing Section 14)**

The top of the permeate storage tank should be no higher than 500mm above the outlet fitting on the top of the membrane to prevent operating back pressure on the membrane during production or static pressure on the membrane during standby. Back pressure during production reduces the output of the system. Static pressure on the membrane from a column of water can de-laminate the membranes during standby.

The permeate inlet to the tank must be open with no restriction. Under no circumstances must a float shut off valve be used to close off the permeate delivery line.

The permeate inlet must be at least 100 mm above the overflow/high water level in the storage tank to prevent permeate being drawn back through the membrane by osmosis during standby.

Prior to making the permeate connection final, make a temporary pipe connection from the permeate outlet or cleaning port to drain so that the system can be fully flushed during commissioning.

7.2 ELECTRICAL

Electrical installation is very straightforward, but should still be carried out by a competent electrician, and must conform to the appropriate standards of safety.

7.2.1 Mains Supply

The mains supply connection should be made through separate, switched supply, fused and earthed in accordance with Institute of Electrical Engineers Regulations.

One power supply is required by the system. This should be 415v, 50 Hz three phase supply plus neutral and earth, with an isolator and MCB rated as detailed in the data sheet in Section 12.3.

The power supply for a pre-filter or softener is provided by the system control panel via terminals 1&2 in a plug in 6 way connector that mates to a socket on the side of the transformer enclosure.

7.2.2 Auxiliary closedown

There is a low voltage interlock between the R/O controller and the softener/filter valve. This ensure that the R/O shuts down while the filter is regenerating.

The feedback/shutdown cable between the softener or filter valve and the R/O controller is joined using the using same plug in connector that provides power to the valve. The feedback line used the cables on terminals 3&4

7.2.3 Level sensor installation

Install the level switch on the treated water storage tank. This may require the cabling to be disconnected at the 2 way plug on the end and the terminals re-made when the probes have been installed. The blue and brown wires run from terminals A and C in the sensor and are connected to the terminals L & N in the 2 way connector which plugs into the transformer enclosure on the back of the R/O unit.

The floats for the sensor will need to be tied to hook on the underside of the sensor using the rot proof string provided. When the second float is tied to the bottom of the first float, the R/O unit will switch off when the level reaches the middle of the upper float, and will turn on again when the level drops to the middle of the lower float. This mean that the highest practical treated water level in the storage tank is 150mm from the top and the minimum differential is 170mm

Important: When installing the level sensor in the permeate tank, the middle of the top float must be at least 100 mm below the overflow since permeate will flow to the tank during the post-service flush.

7.2.4 BMS/Alarm connection

The controller has an integral volt free alarm contact that can be utilised to connect in to a BMS system. See controller wiring diagram in Section 15

8.0 COMMISSIONING

The GAC filter will need to be filled with water and flushed prior to supplying dechorinated water to the R/O system. The R/O membrane(s) are shipped in preservative which will also need to be flushed prior to putting permeate water to service. Commissioning and flushing should take place immediately before the system is put into service

8.1 Pre Service Flush

8.1.1 GAC Filter (if used)

Do not turn on any power at this point

After connecting the water inlet, run a line to drain from the concentrate and permeate outlets. Ensure the drain line from the GAC filter is run to a suitable drain point.

Turn on the water supply to the system and check the inlet side for leaks up to the inlet solenoid.

Before opening the inlet water supply or switching on the power supply, remove the GAC filter valve cover. Swing 'open' the timer which is hinged on its left. Using the knob on the front of the timer, turn the program wheel to the backwash position (first bank of pins lift outer microswitch). Turn on the main power supply to the controller which will provide power for the GAC filter. Do not turn on the controller at this stage. This will activate the piston motor and the timer motor. When the piston motor has stopped, slowly open the inlet water supply. At first, air will be expelled from the drain line, followed by water once the vessel is full. When water is running from the drain line with minimal air, turn off the power and water and allow the media to soak for at least four hours. After soaking turn on water and allow water to run to drain by backwashing for 5-6 minutes in order to rinse the filter media and remove fines.

Turn on the power again. Next, turn the timer to the first gap in pins. Ensure the piston motor has stopped before indexing to the next position.

Then, turn the timer to the fast rinse position (second bank of pins). Water will run swiftly to drain. This is the 'fast rinse' cycle which lasts 6 minutes. Leave the water and power turned on to allow the valve to finish the cycle. When the fast rinse is over, the valve returns to the service position. However the timer will continue to run the program past the remaining pins on the program wheel. This will cause the drive motor to operate briefly twice as resets the piston motor to the standby position.

Set the time of day on the controller and the frequency of backwash. This is normally factory set to once every four days. A twelve day timer is fitted to the valve. The days programmed for backwash have the timer tags slid out from the centre. The tags remain in on days when backwash is not required.

The valve will backwash at 02:00 unless the timer is adjusted (see **Section 15**)

Backwash is automatic provided that the power supply to the Reverse Osmosis unit is connected and turned on.

8.1.2 Reverse Osmosis Unit

Ensure that the stop/start signal plug is connected.

Turn the mains isolator and pump isolator to off, open the transformer/pump control gear enclosure and ensure that the pump starter is set to 'Stop'. This will disable the pump contactor during flushing.

Close and lock the enclosure and turn on the main power supply.

Turn on the R/O controller with the rocker switch under the outer cover.

The controller should default to Service, but if it does not then press the service button.

The inlet solenoid will then open allowing water to flush through the system but the pump will not operate since its contactor is disabled.

Open the pressure regulator by unscrewing the valve handle knob five full turns. Leave the system like this for 5-10 minutes in order to prime the pump, fill up the membrane housings and start primary flushing. Open the pump priming port to expel air.

If the system cuts out at this point because of high permeate TDS, reset the maximum threshold or temporarily disable the cut-out (see OS3030 manual) and continue.

Check for leaks with low pressure running in the system.

8.2 Pressure flush

Prior to starting the pump, wind in the pressure regulator knob until it stops then back up to six turns.

Turn the mains isolator and pump isolator to off, open the transformer/pump control gear enclosure and ensure that the pump starter is set to 'Start'.

Close and lock the enclosure and turn on the main power supply and the external pump isolator

Ensure that the control panel is still indicating Service.

The inlet solenoid will open, then after a short delay the pump will power up and the system will run up to pressure. The system has a 'Soft Starter' installed to reduce the starting load on the power supply and water hammer in the system. The pump motor will start initially at low speed then over 1-3 seconds will run up to full power. **Ensure that the pump is running the correct way! If it is not, switch off the system and reverse two of the incoming phases to the isolator.**

Monitor the permeate and concentrate flows and balance with the pressure regulator so that the permeate flow is approximately the same as the concentrate flow (50% recovery) or as otherwise required.

This should give a back pressure on the pump (centre) pressure gauge of 170-250 psi depending on the raw water pressure.

Do not adjust the concentrate valve so that the pump pressure exceeds 270 psi.

Leave to run to drain for 30-60 minutes to flush the preservative out of the membranes. During the flush period, monitor the concentrate flow and fine tune to no more than 75% recovery (concentrate 1/3 of permeate) with appropriate recirculation flow as detailed in section 12.1.

If the permeate is then to the correct quality then the system can be put into service.

8.3 Service connections and checks

With the system switched off, connect the permeate tube to the storage tank. Turn the system on and leave to run to service.

Test the flush circuitry by lifting both tank switch floats. This will initiate a 'post service' flush. The pressure pump will cut out as the float switch is operated. Shortly afterwards the flush solenoid will open and then the pump will start up again. This will flush the membranes at a high flow rate for the time set in the controller. Lowering the floats will immediately switch the system back to service.

If the pump draws a massive amount of water during flushing it may be necessary to adjust down the low pressure threshold or adjust the flow control globe valve on the flush solenoid. Monitor the inlet pressure during flushing on the top pressure gauge

During normal production, there should be no more that 2.6 bar (40 psi) pressure difference between the feed pressure off the pump (centre gauge) and the back pressure on the membrane (bottom gauge).

The system is now commissioned.

9.0 Operation

The RoPro Reverse Osmosis systems are designed to run and flush automatically and should not be turned off at the mains after a production run of permeate.

For the first few days of use, the operating pressures, permeate and concentrate flows should be monitored every few hours and the system fine tuned as the membrane settles down to its working environment.

Thereafter the flows, pressure and permeate conductivity should be monitored daily at a regular time when production is taking place. These readings will vary slightly due to variations in incoming water temperature and pressure. An example data recording sheet can be found in section 9.3

If a variation of more than 15% is noted in the permeate flow at usual operating pressures then the system should be cleaned with an appropriate recirculating cleaner. This must be done by a service technician with a thorough understanding of reverse osmosis systems and their cleaning regimes

9.1 Routine maintenance.

Daily	Monitor permeate and concentrate flow, inlet, pump and back pressures, and product water conductivity.
Weekly	Monitor raw water temperature
Monthly	Inspect system for leaks and tighten fittings where necessary
3 Monthly	Replace inlet filter cartridge

Annually Clean membrane with a recirculating cleaner if normalised output has fallen by greater than 15%

Bi-Annually Service GAC filter valve and replace media

9.2 Temporary Shutdown

If permeate is not required for up to five days then the system should be left with the permeate tank empty, the level probes plug disconnected and the water and power supplies turned on. The controller will automatically flush the system every 24 hours and a small amount of permeate will flow to the tank.

If the permeate tank must remain empty, then disconnect the level probes plug and route the permeate production line to drain.

If the system needs to be powered down for more than 7 days, then the membrane housing should be filled with an appropriate preservative. The system should then be re-commissioned prior to putting back into service. See Section 8.0

9.3 Example Data Recording Sheet

Model ....

Date installed ....

Date	Inlet Pressure (IP)	Pump Pressure (PP)	Back Pressure (BP)	Conc Flow (CF)	Perm Flow (PF)	Total Flow (TF) = CF+PF	Recovery % (R) = (PF/TF) 100	Raw Water Temp °C (Weekly)	Operator initials

10.0 FAULT FINDING AND RECTIFICATION

Problem	Possible cause
No Power	Main fuse or supply cabling fault Pump power MCB or overload relay tripped
Power on controller motor does not run	High level probe jammed or failed
	Motor failure/short circuit (RED LIGHT ALERT) Power contactor/overload failure (RED LIGHT ALERT)
	Broken cable on contactor/overload Pump power turned off Permeate quality above limit (membrane failure)
Pump motor runs low/no production	Pump motor drive loose Concentrate valve fully open Inlet filter blocked Membrane fouled Concentrate valve fully closed
Pump cuts out during flush	Inlet filter blocked Low pressure threshold too high
Pump cuts out during service	Inlet filter blocked Water supply failure
Permeate quality reads 0	Conductivity probe disconnected/failed

11.0 WARRANTY AND SERVICE

11.1 SERVICE

Most important. **The unit must be checked and serviced by a competent professional every six months. The warranty will be invalidated if regular recorded servicing is not completed.**

11.2 AFTER SALE WARRANTY Your Reverse Osmosis unit is covered by a parts warranty for a period of one year from installation on all mechanical and electrical components. Filters cartridges and membranes are excluded from this warranty since they can deteriorate due to operational or site conditions.

Should you have any problems with your Reverse Osmosis unit or require routine service, please contact your supplier.

12 Data

12.1 PROCESS AND OPERATING DATA - R/O unit

MODEL		**8-50**	**8-75**	**8-100**	**8-150**
PARAMETER UNITS					
Max. Output Flow*	m3/hr	2.5	3.75	5.0	7.5
Min Input Flow* @ 75% recovery	m3/hr	3.3	5.1	6.7	10.0
Max. Input Flow* @ 50% recovery	m3/hr	5.0	7.5	10.0	15.0
Min Cont. Flow to drain* (during service @ 75% recovery)	m3/hr	0.8	1.35	1.7	2.5
Max. Cont. Flow to drain* (during service @ 50% recovery)	m3/hr	2.5	3.75	5.00	7.5
Maximum Flow to drain (during flush)	m3/hr	4.0	5.5	7.5	7.5
Recommended	@75% recovery	5.0	4.0	3.5	2.5
Minimum	@66% recovery	4.1	3.5	2.6	1.2
Recirculation flow	@50% recovery	3.0	1.7	0.5	Not required
Minimum salt % Rejection		99	99	99	99
Maximum Recovery	%	75	75	75	75
Recommended Recovery	%	66	66	66	66

IMPORTANT NOTES

The data quoted in the above table is affected by the inlet pressure, and so should be regarded as nominal only. * Total inlet flow and flow to drain will depend on the recovery settings chosen for the Reverse osmosis unit

12.2 ENGINEERING DATA

RoPro Series Reverse Osmosis Units

MODEL		**8-50**	**8-75**	**8-100**	**8-150**
PARAMETER	**UNITS**				
Width	mm	1100	1100	1100	1100
Depth	mm	3000	4100	3000	4100
Height inc. wheels	mm	1750	1750	1750	1750
Inlet Conn.	ins ABS S/U	2.0	2.0	2.0	2.0
Permeate Outlet Conn.	ins ABS S/U	1.1/2	1.1/2	1.1/2	1.1/2
Drain Conn. R/O	ins ABS S/U	1.1/2	1.1/2	1.1/2	1.1/2
Delivered Wt. Kg.		300	400	450	600
Working Wt. (approx.)	Kg.	350	500	550	800
Maximum Flow to drain	m3/hr	4.0	5.5	7.5	10.0
Electrical					
Pump Power	v	415	415	415	415
	Hz	50	50	50	50
	Ph	3	3	3	3
Rating	kW	5.5	5.5	5.5	11.0
FLC Run	Amp	11.5	11.5	11.5	22.00

MAXIMUM INLET PRESSURE 5.5 Bar MINIMUM INLET PRESSURE 2.0 Bar MAXIMUM OPERATING TEMPERATURE 40.0C.

HEADROOM - Allow 1000 mm greater than overall height.

12.3 PARTS DATA

Model	**8-50**	**8-75**	**8-100**	**8-150**
Frame	Box section BS304 Stainless steel			
Membrane no	Two	Three	Four	Six
Membrane type			ESPA	
Membrane ref.			ESPA1 (8040)	
Pump ref.	CRN10-14	CRN10-16	CRN10-16	CRN15-10
Controller			EWS3030	
Transformer			115 VA	
Voltage			240 - 24v	
Transformer MCB			6A & 3A	
Soft Starter	Telemecanique altistart			
Contactor	LC1D12	LC1D12	LC1D12	LC1D25
Overload	GV2ME16	GV2ME16	GV2ME16	GV2ME22
Overload setting	11.5	11.5	11.5	21.5
Perm flow meter	4	6.5	10	10
Conc flow meter	4	4	10	10
Recirc flow meter	6.5	6.5	6.5	4.0
Sediment filter 5µ	3x20”	3X20”	3X30”	3X40”

13.0 EWS OS303 CONTROLLER

13.1 Manufacturers Manual

The system has been built with an OS3030 controller and the controller manufacturers manual is enclosed with the system. Please refer to this for information operation and programming of the controller.

13.2 Factory programming notes

The controller has been set up with a typical operating program suitable for a reverse osmosis system of this size and type and this is detailed in 14.1

The programming includes a pre-service flush, post service flush, flush during service and flush during standby.

The RO system is programmed to shut down if the permeate conductivity exceeds 50µS

13.3 System with Permeate Divert valve

Systems built with motorised three way Pemeate Divert valves can be configured so that the valve opens to service during any production cycle provided that the divert conductivity threshold of 30µS is not exceeded. This is the default programming configuration as detailed in 14.1

An alternative permeate valve configuration is detailed in 14.2 which uses the 'Auxiliary Program' settings to control the permeate valve which will keep it closed unless the system is in the full high pressure production mode to enable a forced prolonged flush at start up. However this configuration will not close off the permeate outlet in the event of high permeate conductivity during service which will then only rely on the 50µS main high conductivity alarm threshold to shut the system down.

13.4 Flush after Power Failure

The standard controller configuration forces a system flush when power is restored after a power failure, even if there is no demand signal. This can give problems with feed water treatment capacity on duplexed systems. The configuration can be changed to 'No Rinse after power up' as follows:

Turn the controller off with the green power switch; While pressing the ‘Off’’ key, turn the power on; Release the ‘Off’ key and press the ‘i’ Info key to switch to OEM Mode 2; press the ‘Off’ key again.

14.0 Factory programming

14.1 Standard default program

Program Step	Display	Setting
1.1	Constant	0.10
1.2	Limit Min	Yes
1.3	Value Min	1.0
1.4	Switch Off	No
1.5	Limit Max	Yes
1.6	Value Max	50.0
1.7	Switch Off	Yes
1.8	Delay	60s
2.1	Temperature	25
3.1	Factor	1
4.1		LP
4.2		ST
4.3		EP
4.4		FU- EM- LP- STI EP-
5.1	Level Switch	1
5.5	Delay	10s
5.6	Switch On	4*
5.7	Delay	300s
5.8		PI R1I R2I R3I M- S1-
5.13		PI R1I R2I R3I M- S1-
5.14	Manual Start	No
5.15	Stop Power Failure	No
6.1		PV
6.2		MF
6.3		PUI IVI CVI PVI MFI
7.6	Limit CM	30.0
7.7	Delay Open	10s
7.8	Delay Close	30s
7.9		MII MAI EM- FU-

7.10		LPI ST- EP-
7.11		PSI PFI MT-
8.1		MII MAI EM- FU-
8.2		LPI ST- EP-
8.3		PSI PFI MT-
9.1	Production 1	30s
9.2		PU- IVI CVI PV-
9.3	Production 2	60s
9.4		PUI IVI CVI PVI
9.5	Production 3	0s
9.7		PUI IVI CV- PVI
10.1		IV- CV- PV-
10.2		IV- CV- PV-
11.1		IV- CV- PV-
12.1	Standby	0s
12.3		IV- CV- PV-
13.1	Rinse	Yes
13.2	Rinse 1	30s
13.3		PU- IVI CVI PV-
13.4	Rinse 2	180s
13.5		PUI IVI CVI PV-
13.6	Rinse 3	0s
14.1	Rinse Standby	Yes
14.2	Interval	24h
14.3	Rinse 1	30s
14.4		PU- IVI CVI PV-
14.5	Rinse 2	180s
14.6		PUI IVI CVI PV-
14.7	Rinse 3	0s
15.1	Rinse Production	Yes
15.2	Interval	8h
15.3	Rinse 1	60s
15.4		PUI IVI CVI PV-
15.5	Rinse 2	0s
15.7	Rinse 3	0s
16.1	Maintenence 1	0s
16.3	Maintenence 2	10m
16.4		PU- IV- CV- PV-
16.5	Interval	No
18.1	Code Number	No

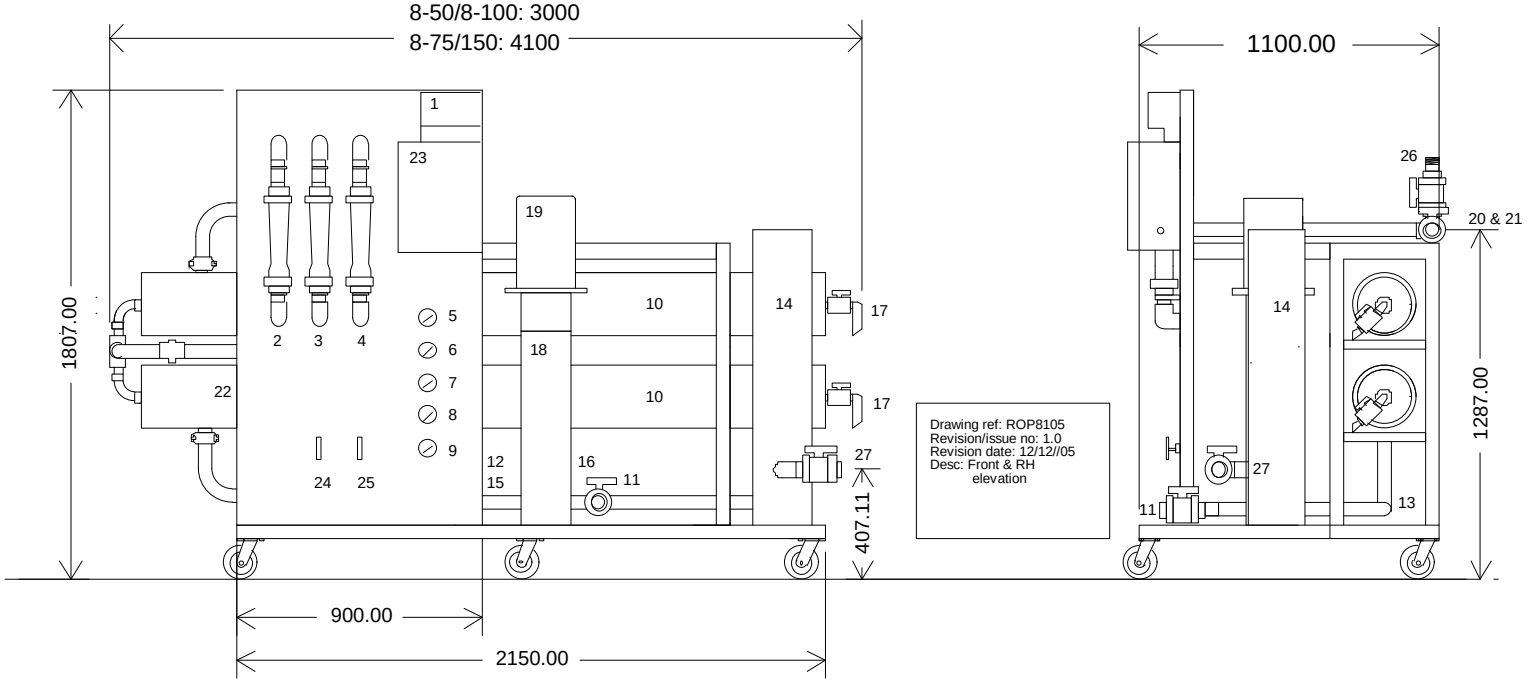
14.2 Alternative forced flush program

Program Step	Display	Setting	Function
1.1	Constant	0.10	Cell constant setting
1.2	Limit Min	Yes	Sets min. conductivity condition
1.3	Value Min	1.0	Sets minimum value
1.4	Switch Off	No	Not sw. off if min val. reached
1.5	Limit Max	Yes	Sets max. conductivity condition
1.6	Value Max	50.0	Set maximum value
1.7	Switch Off	Yes	Switch off is max.val. reached
1.8	Delay	60s	Delay before switching off
2.1	Temperature	25	Manual temperature comp. val.
3.1	Factor	1	Compensation correction factor
4.1		LP	Input 1 function
4.2		ST	Input 2 function
4.3		EP	Input 3 function
4.4		FU- EM- LP- STI EP-	Function activation condition
5.1	Level Switch	1	Single level switch
5.5	Delay	10s	Low water cutout delay
5.6	Switch On	4*	Number of restarts
5.7	Delay	300s	Delay between restart attempts
5.8		PI R1I R2I R3I M- S1-	Phases when pressure monitored
5.13		PI R1I R2I R3I M- S1-	Phases when stop signal monitored
5.14	Manual Start	No	Auto start after stop signal canx
5.15	Stop Power Failure	No	Auto start after Power Failure
6.1		AP	Output 1 function Permeate Valve
6.2		MF	Output 2 function Alarm Relay
6.3		PUI IVI CVI API MFI	Output activation state
7.4	Add Program	0m	Opens PV when activated
7.5	Delay add.pr	0s	No delay opening PV
7.9		MII MAI EM- FU-	Events triggering alarm relay
7.10		LPI ST- EPI	Events triggering alarm relay
7.11		PSI PFI MT-	Events triggering alarm relay
8.1		MII MAI EM- FU-	Events triggering alarm buzzer
8.2		LPI ST- EPI	Events triggering alarm buzzer
8.3		PSI PFI MT-	Events triggering alarm buzzer
9.1	Production 1	30s	Length of first production phase
9.2		PU- IVI CVI AP-	Functions active
9.3	Production 2	60s	Length of second production phase
9.4		PUI IVI CVI AP-	Functions active

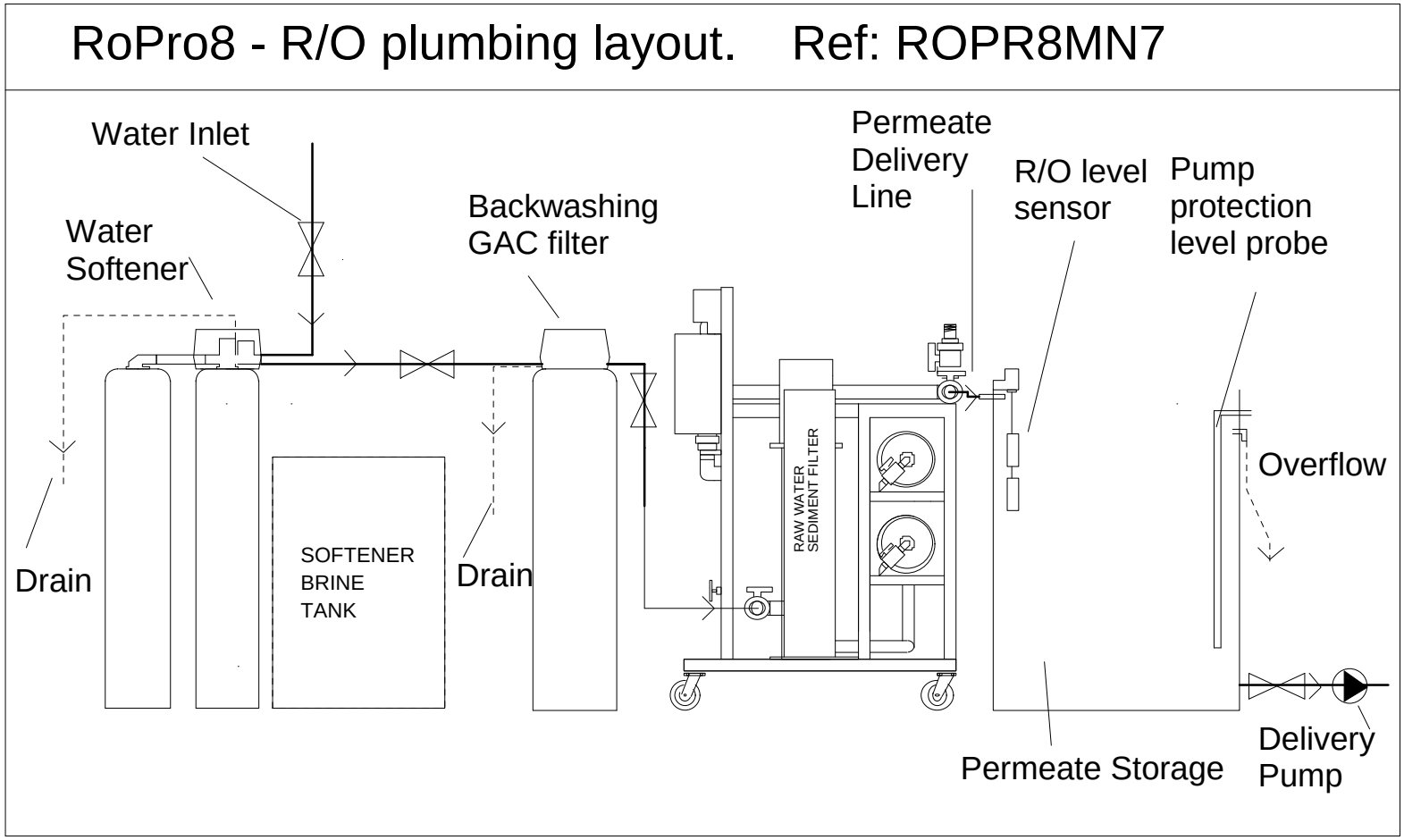
9.5	Production 3	0s	Production phase skipped
9.7		PUI IVI CV- API	Main production phases active
10.1		IV- CV- AP-	Stop in production functions
10.2		IV- CV- AP-	Stop in rinse functions
11.1		IV- CV- AP-	Stop in alarm functions
12.1	Standby	0s	Standby stage one skipped
12.3		IV- CV- AP-	Standby functions
13.1	Rinse	Yes	Rinse after production
13.2	Rinse 1	30s	Length of post production rinse 1
13.3		PU- IVI CVI AP-	PP rinse 1 functions
13.4	Rinse 2	180s	Length of post production rinse 2
13.5		PUI IVI CVI AP-	PP rinse 2 functions
13.6	Rinse 3	0s	Length of post production rinse 3
14.1	Rinse Standby	Yes	Rinse during standby
14.2	Interval	24h	Frequency of standby rinse
14.3	Rinse 1	30s	Length of standby rinse 1
14.4		PU- IVI CVI AP-	Standby rinse 1 functions
14.5	Rinse 2	180s	Length of standby rinse 2
14.6		PUI IVI CVI AP-	Standby rinse 2 functions
14.7	Rinse 3	0s	Length of standby rinse 3
15.1	Rinse Production	Yes	Rinse during production
15.2	Interval	8h	Frequency of production rinse
15.3	Rinse 1	60s	Length of production rinse 1
15.4		PUI IVI CVI AP-	Production rinse 1 functions
15.5	Rinse 2	0s	Length of production rinse 2
15.7	Rinse 3	0s	Length of production rinse 3
16.1	Maintenence 1	30s	Length of maintenance st. 1
16.2		PU- IVI CVI AP-	Maintenance st. 1 functions
16.3	Maintenence 2	500m	Length of maintenance st. 2
16.4		PUI IVI CVI AP-	Maintenance st. 2 functions
16.5	Interval	No	Maintenance interveal set
18.1	Code Number	No	Code number not required

15.1 Dimension & parts identification RoPro-8 (8" membrane) Series

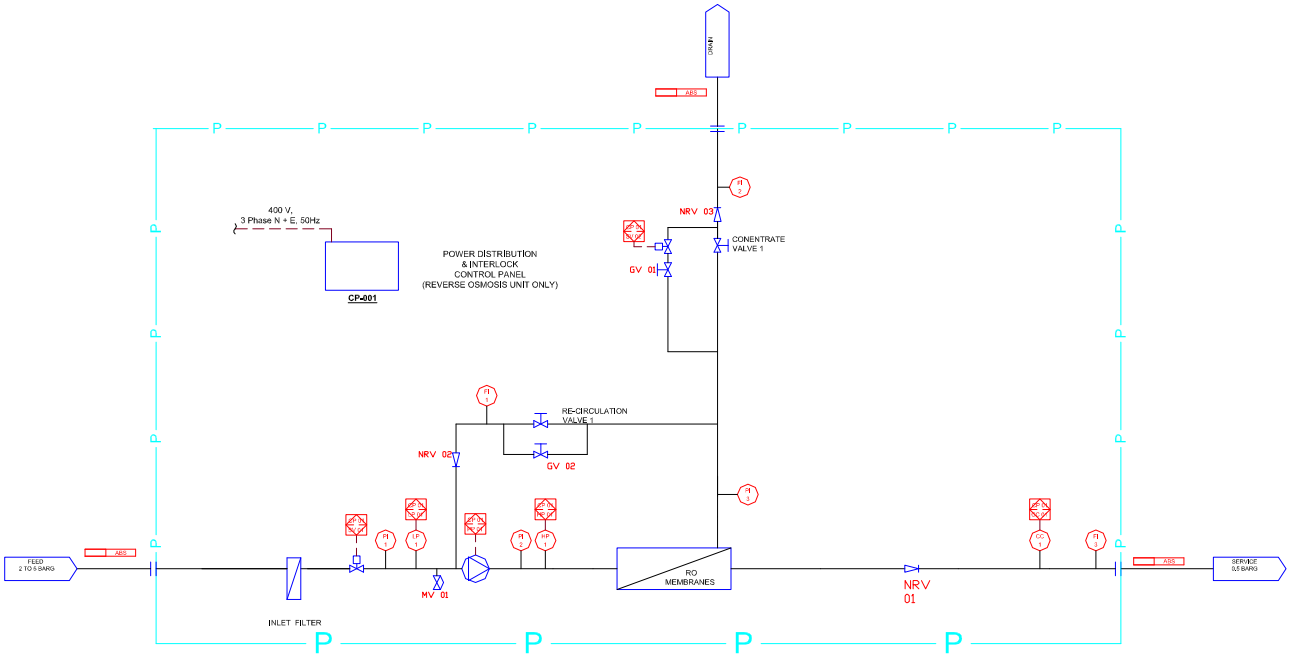
1 - Controller
2 - Permeate flow meter
3 - Concentrate flow meter
4 - Recirculation flow meter
5 - Raw inlet pressure gauge
6 - Filtered inlet pressure gauge
7 - Pump pressure gauge
8 - Inter-housing pressure gauge
9 - Back pressure gauge
10 - Membrane housing
11 - Cleaning inlet port
12 - Flush solenoid
13 - Inlet solenoid
14 - Sediment filter housing
15 - High pressure switch
16 - Low pressure switch
17 - Permeate sample port
18 - Pump
19 - Pump motor
20 - Permeate outlet
21 - Concentrate outlet
22 - Conductivity probe
23 - Pump control gear encl.
24 - Pressure control valve
25 - Recirculation control valve
26 - Cleaning port outlet
27 - Raw water inlet



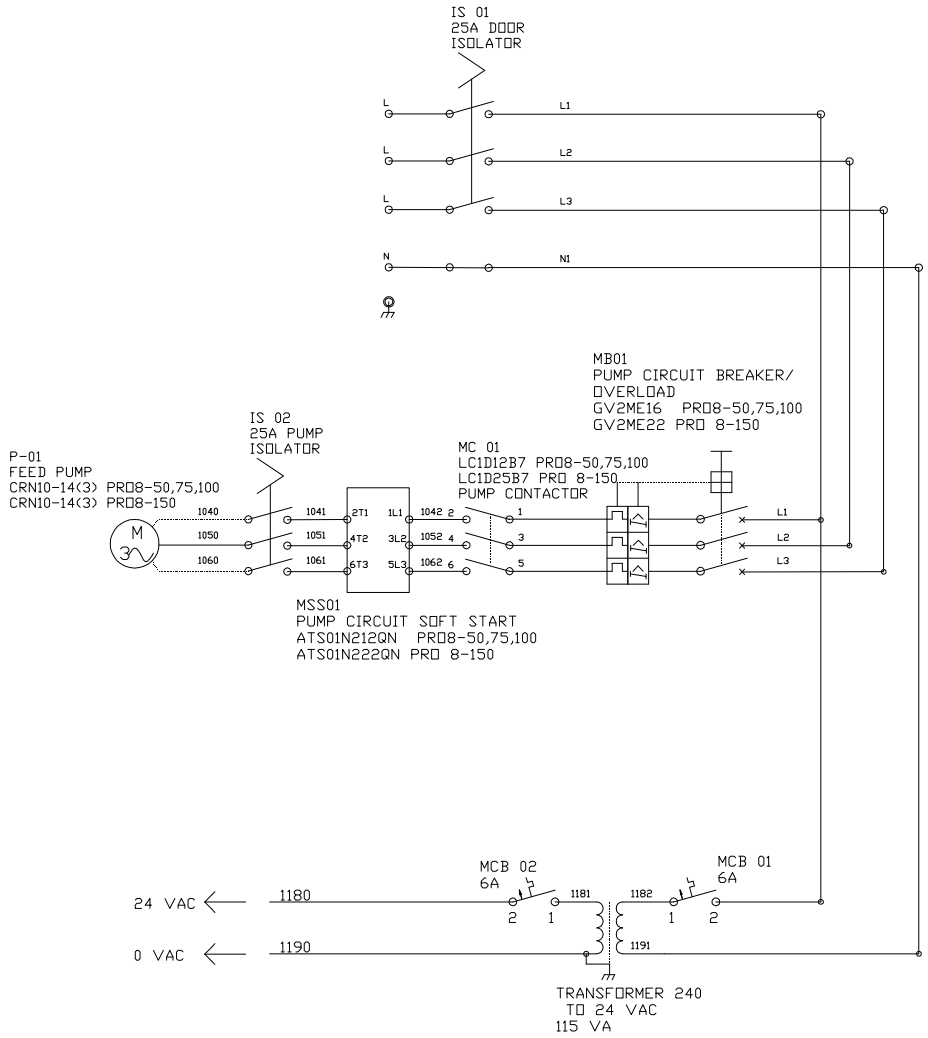
15.2 Plumbing layout



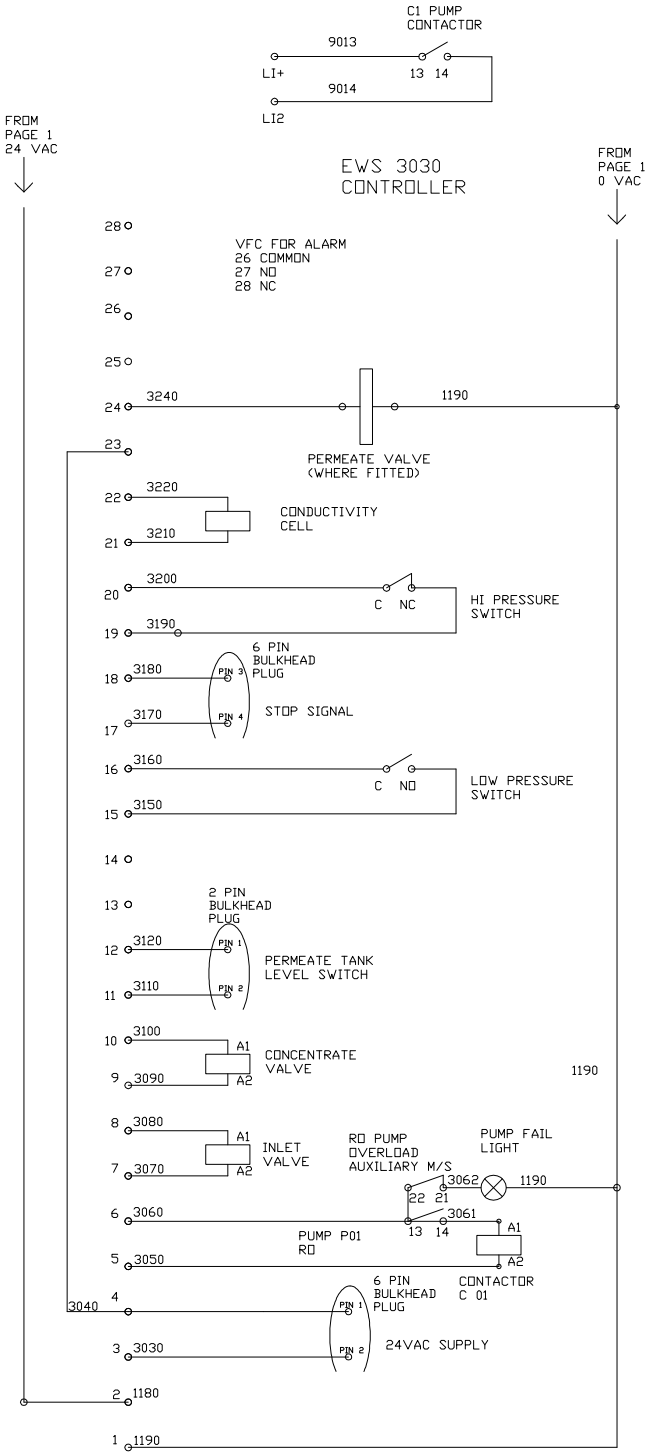
15.3 PID


400 V,
3 Phase N + E, 50Hz
CP-001
POWER DISTRIBUTION
& INTERLOCK
CONTROL PANEL
(REVERSE OSMOSIS UNIT ONLY)
NRV 03
CONENTRATE
VALVE 1
GV 01
RE-CIRCULATION
VALVE 1
NRV 02
GV 02
MV 01
INLET FILTER
RO
MEMBRANES
NRV
01
FEED
2 TO 5 BARG
SERVICE
0,5 BARG

15.4 3 Phase Electrical Schematic



15.5 Single Phase Electrical Schematic



16 CE Statement

Manufacturer's Declaration of Conformity

We the undersigned

EURAQUA UK, HITCHIN, ENGLAND

Certify that the product

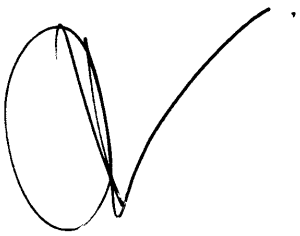
---

type: RoPro Series Reverse Osmosis Unit
Models 8-50, 8-75,8-100, 8-150

---

has been designed and manufactured in accordance with the specifications of the following:

Directive	**Standard**
Machinery Directive 89/392/EEC	EN 292-1, EN 292-2
Low Voltage Directive 73/23/EEC	EN 60 335-1
EMC-Directive 89/336/EEC	EN 55 014



RT Adam

Director

Hitchin, England 12/12/2005

Issue place & date