

# Reverse Osmosis - 4 Series

## The Basics

Reverse osmosis is a process that is used to remove a wide range of salts to give water of a high purity. 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 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 through the membrane is the same head pressure as the diluted 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. This means that water containing a high level of natural salts can be purified without the need for chemical regenerants such as the acid and alkali used in demin plants.

Reverse osmosis is therefore considered a much safer route of producing pure water for many commercial and industrial applications, and additionally the plant doesn't need to be taken out of service for regeneration as a demin plant does.

Rejection rates of salts from water is generally in the region of 95-99.5% dependant upon the membrane type used and the raw water feed quality. RO systems can be designed to utilise the wide range of membranes available, which will give different permeate water qualities. Standard designed RO's are manufactured using the low energy membranes which will give a permeate water quality of approx 10 microsiemens from an input water of between 500-700 microsiemens.

Reverse osmosis systems, in their most basic form, consist of a pressure pump, housing and membrane. Water is forced into the housing under pressure and the pure water (or permeate) is collected and passed to service. Reject water (or concentrate) is collected from another outlet and routed to drain, with a portion of the concentrate water recycled back to the inlet of the pump. This means that the portion of water sent to drain is kept to a minimum, allowing a recovery ratio of approx 75% to be achieved without significant fouling of the membrane. The recirculation allows a higher flow of water through the pump, reducing the load on it's bearings and keeping the pump running cooler. The recirculation on all units is adjustable.

The controller used on the RO system constantly monitors the quality of the permeate water and is also linked with safety controls on the system, to ensure the unit cuts out on low & high pressure, high & low conductivity, and full permeate tank signal. It will also run various pre and post flush cycles to maximise the life of the membranes. The constant monitoring is automatic and the programming is all pre-set to ensure protection of the system at all times and to maximise the quality of the pure water.

## Pre-treatment

RO plants must be supplied with softened and de-chlorinated water. A duplex softener is recommended for continuous operation. Utilising softened water for the feed to the RO will reduce the scaling potential on the membrane and therefore lengthen it's working life. De-chlorination of the feed will reduce oxidation damage to the surface of the membrane. Membranes can also be fouled by Iron, Manganese, organics and micro-organisms. For boreholes and other private supplies a full water analysis is advised before installing an RO so that a pre-treatment system can be specified.



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## Technical Table

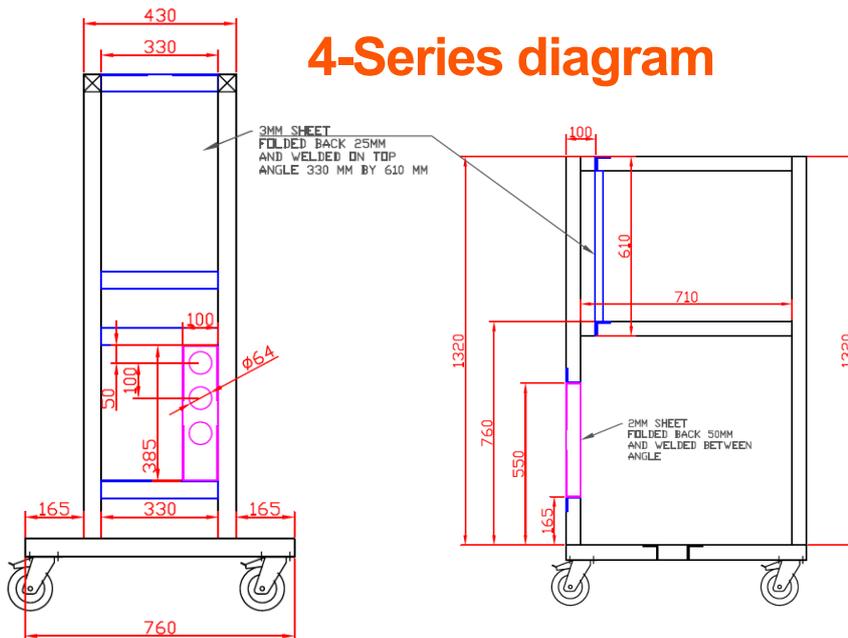
Model	ROPRO4-2	ROPRO4-3	ROPRO4-4	ROPRO4-5	ROPRO4-6	ROPRO4-7
Output (lph)	2300	3300	4400	5500	6500	7500
Input (lph)	3067	4400	5867	7333	8667	10000
Flush volume required for start up (lph)	4877	6200	7667	10933	12267	12933
Membrane type	OROM4040-1	OROM4040-1	OROM4040-1	OROM4040-1	OROM4040-1	OROM4040-1
Membrane number	6	10	12	16	18	20
Booster pump power (kw)	2.2	3	4	5.5	5.5	7.5
Power supply	Three phase	Three phase	Three phase	Three phase	Three phase	Three phase
Inlet connection	3/4" union	1" union	1.5" union	1.5" union	1.5" union	1.5" union
Permeate connection	3/4" union	1" union	1.5" union	1.5" union	1.5" union	1.5" union
Drain	3/4" union	3/4" BSP M	1" union	1.5" union	1.5" union	1.5" union
Suggested softener	75L duplex	120L duplex	150L duplex	200L duplex	250L duplex	250L duplex
Delivered weight	250kg	300kg	350kg	400kg	450kg	500kg
Included pre-treatment	Particulate	Particulate	Particulate	Particulate	Particulate	Particulate
Width x depth x height (mm)	760 x 1140 x 1625	760 x 1140 x 1625	760 x 1140 x 1625	1100 x 1140 x 1850	1100 x 1140 x 1850	1100 x 1140 x 1850

## Site Requirements

The site requirements of an RO on site are vital for its successful operation. Apart from the RO requiring a certain quality of water, free from potential foulants, the system must be fed with sufficient volume and pressure. The flush phase of an RO requires more water than during normal service. The flush phase flow rates can be found in the table to the left. If the RO is starved of water during the rinse phase it will shut down under low pressure in order to protect the pump

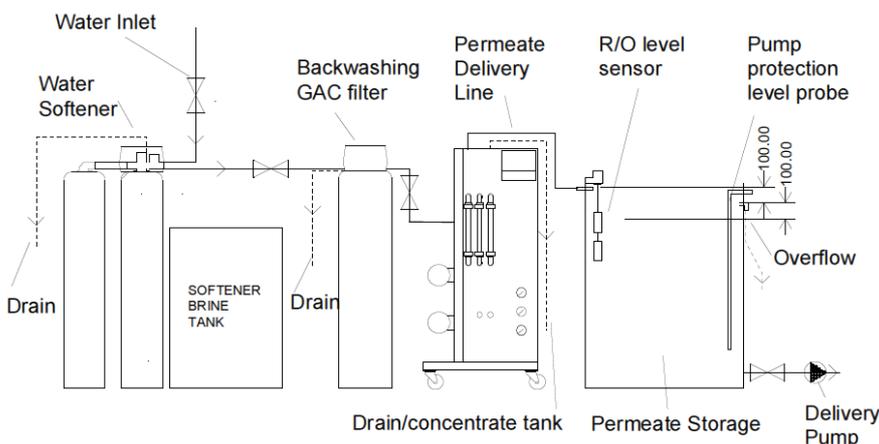
The site should also have sufficient space to allow siting, installation and ongoing maintenance.

## 4-Series diagram



## Overview

The 4-series RO uses a larger stainless steel skid and 4" membranes housed within stainless steel vessels to provide higher flow rates than the standard compact range. They come complete with a skid mounted particulate filter. A separate Carbon filter will be required if using mains water to provide Chlorine free water for the membranes. There are a number of different models available with flow rates ranging from 2.3m<sup>3</sup>/hr to 7.5m<sup>3</sup>/hr.



The diagram to the left shows a typical plumbing layout involving a reverse osmosis system. The softened water is fed to a backwashable Carbon filter before entering the 4-series RO. Water is then forced at high pressure through the membranes and the resulting permeate can then be collected in the permeate storage tank. Level probes (which are included in the RO system) control the operation of the RO. A delivery pump (suitable for use with RO water) may be used to boost the treated water to service.