RC660-DI Reverse Osmosis-Deionisation Systems

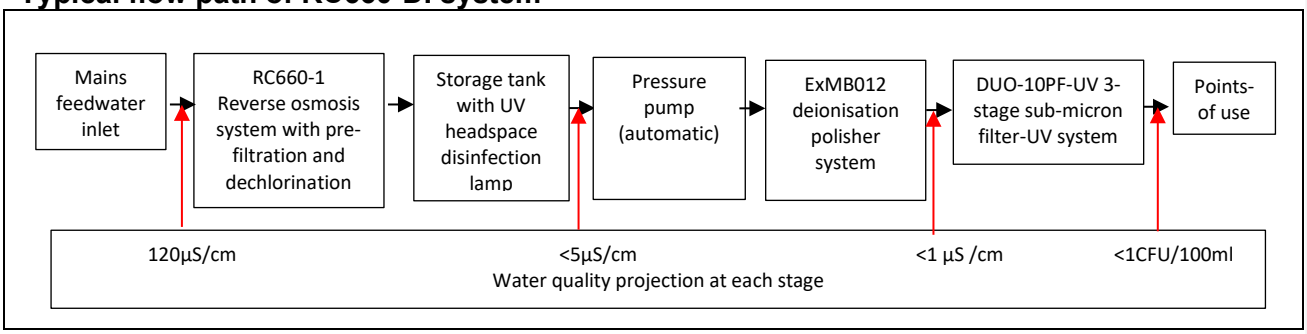
The RC660-DI series high flow reverse osmosis systems have found applications in medical, dental and veterinary laboratories for supply of high quality water to meet ASTM Type 2 and NCCLS Type 2 standards.

The modular design combines pre-treatment, reverse osmosis, storage, deionisation UV sanitation and sub-micron filtration in a compact floor mounted unit with minimal footprint. The standard systems will treat most potable feedwaters and are easily re-configured for poor-quality feedwater supplies or where higher outputs are required.

System configuration allows for changes to all stages to cater for applications where low endotoxin water is required (to meet AS/NZS 4187:2014 specification for re-useable medical device processing), or where higher purity water is required.

All systems include RO permeate water quality monitoring, polished deionised water quality monitoring, feedwater pressure monitoring, storage tank level sensors and low storage tank visual alarms. A manual bypass control is also included to allow pre-treated feedwater to pass directly to the deionisation stage should power be interrupted.

Typical flow path of RC660-DI system



Operational specifications:

Feedwater temperature range:	+15 to +35°C
Feedwater pressure range:	350-750kPa
Feedwater maximum TDS (ppm):	250ppm (up to 500ppm with lower performance)
Operating pressure (post boost pump):	600-700kPa
System flow rate (RO Permeate):	1,800 litres/24 hours (75 litres/hour)
System flow rate (Deionisation stage):	5,500 litres/24 hours (220 litres/hour)
System discharge pressure (from Deionisation stage):	250kPa (adjustable)
RO stage conversion efficiency (volumetric)	50-75%
RO stage rejection:	>98% of incoming contaminants
Final water quality:	Meets ASTM Type 2 and NCCLS Type 2 standards
Dimensions (with spill tray):	600mm wide x 800mm deep x 1620mm high
Dimensions (spill tray with DI tanks)	600mm wide x 300mm deep x 800mm high

Pure Water, Simple Solutions

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The pre-treatment stages for feedwater use industry standard filter cartridge housings with a 5-micron high flow sediment removal cartridge followed by a bacteriostatic carbon block cartridge to remove chlorine. This water is then fed into an automatic high-pressure pump on the reverse side of the pre-treatment/control face and then supplied to the reverse osmosis membrane where contaminants are removed from the pressurised feedwater and run to drain.

Purified (permeate) water is then passed into an integrated 150 litre all-plastic storage tank. The tank has a sloping base to allow for complete drainage and a level sensor to automate the RO system and keep the tank filled. Fluid filled stainless steel pressure gauges are fitted to the feedwater pre-filter inlet and outlet to monitor filter differential pressures. The discharge from the RO pump is also fitted with a pressure gauge. Adjustable flow rotameters are also fitted to control reject and recirculated water flow. A non-adjustable flow rotameter is used to monitor permeate flow. RO permeate quality is monitored continuously with an in-line TDS monitor.

The stored RO permeate water is drawn from the tank with an automatic multi-chamber pressure pump which is fitted with a pressure sensor. The sensor detects a drop in the outlet pressure of the system when water is drawn off and turns the pump on and off to maintain a constant pressure. This pressurised water is then polished through a dual tank mixed-bed deionisation resin system to remove trace levels of inorganic contaminants. Water quality exiting the deionisation polisher is monitored continuously by a simple conductivity sensor fitted with a red/green LED pre-set to change from green to red when water quality fails to meet specification (1µS/cm conductivity or 1MΩ/cm resistivity). This simple visual alarm is readily interpreted to alert operators when change of the resin bed is required. Options are available for a conductivity monitor with 3-digit LED display of water quality should this be required for QA purposes.

The standard ExDIMB012 mixed-bed deionisation resin beds have sufficient capacity to treat around 35,000 litres of RO permeate water (this will vary according to feedwater quality) prior to exhaustion and larger resin bed sizes are available for high volume users.

The final dual stage sub-micron filter/UV stage will remove suspended solids above a nominal 0.2µm diameter and the UV sanitation lamp achieves a 99.9% reduction in microbial contamination. RO permeate water flows through this stage on-demand at flow rates up to 4.0 litres/minute.

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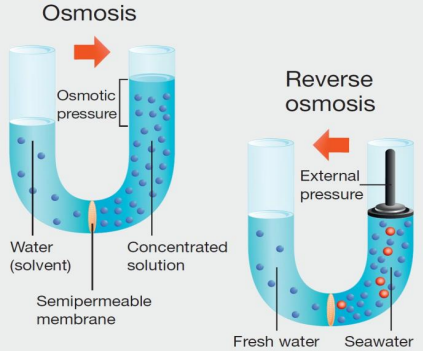
About Reverse Osmosis

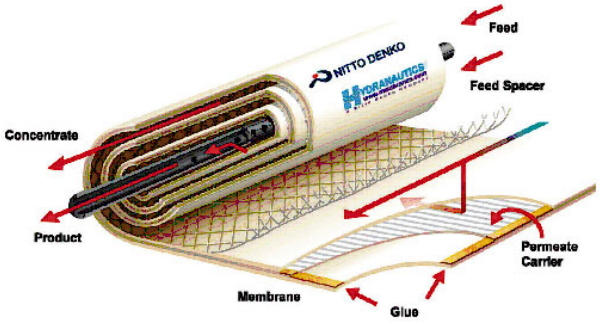
Reverse osmosis is a very mature, well developed technology whose performance is easily measured. It is the method of choice for many industrial, municipal and commercial works when a reduction in feedwater TDS/conductivity or similar contaminants is required.



Osmosis is a term used to describe the diffusion of fluid through a semipermeable membrane from a solution with a low solute concentration to a solution with a higher concentration. Osmosis can be reversed if sufficient pressure is applied to the concentrated side of the membrane. This reversal process is used for water purification and desalination as the membrane allows only the water to pass through, but not larger molecules or ions (like salt).

For the reverse osmosis system to operate effectively, the feedwater must be filtered to remove suspended solids (to around 5 microns and then de-chlorinated. An anti-scale process may be required to remove hardness minerals (calcium, magnesium and iron) which would otherwise increase in concentration on the waste side of the membrane to the point where they form scale and foul the membranes.

The pre-treated feedwater is pressurised and forced into a series of membrane and pressure vessel assemblies where the separation of pure water and contaminants occurs. Multiple membranes may be used for the higher flow rates and are housed in single or multi-place pressure vessels. RO membranes are available for a wide variety of feedwater types and all have a similar physical structure. They differ in membrane polymer type, membrane thickness, surface area, spacer thickness, outer membrane covering and physical size. Surface modified membranes are used in more specialised areas to yield maximum stable performance.



Permeate (purified) water exiting the reverse osmosis membrane may be used directly or may be polished to remove trace levels of remaining contaminants through:

- Mixed-bed Deionisation for scavenging trace levels of inorganic contaminants
- Organic scavenger resins or UV photo-oxidation to reduce TOC levels
- UV irradiation to sterilise the water
- Membrane degassing to remove any remaining dissolved gases.

Any or all of these technologies can be incorporated into a system design to ensure that final water quality is suitable for the intended purpose.

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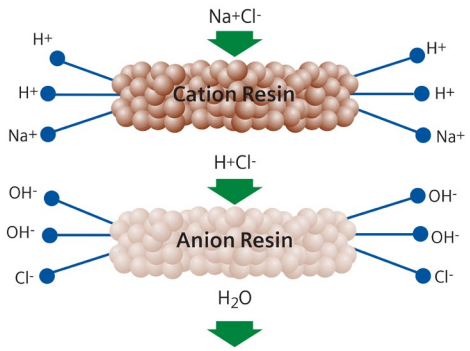
About Deionisation



Deionisation systems provide a simple means of producing low conductivity water either directly from a mains feedwater supply or as a polisher stage following reverse osmosis. A typical exchange mixed bed deionisation stage will scavenge trace levels of inorganic contaminants from the source water until exhausted. Deionisation stages incorporate a conductivity/resistivity or TDS monitor to indicate when cartridge performance falls below specification and change-out is required.

Deionisation will not remove organic contaminants, colour, taste of contributors to TOC content, nor will they remove bacteria or endotoxins. If microbial control is required, sub-micron filtration, ultra-filtration or UV sanitisation must be incorporated into the treatment process, typically immediately before the dispensing point.

About UV sanitation

Short wavelength ultra-violet radiation (254nm or in the UVC band) is an effective means of disrupting microbial DNA, removing their ability to reproduce or survive. UV light will kill bacteria, viruses, yeasts and moulds and is most effective when used downstream from a sediment filtration system.

UV sanitation lamps are available to suit a most flow rates and water qualities. Commercial systems generally have single or multi-lamp stainless-steel chambers with separate power supply. Selection criteria include water flow rate, lamp power and UV transmittance of the water stream being treated.

"Pure-Water" and Water Quality

To resolve the use of the term "pure water", several professional organisations have drawn up water quality standards graded according to the intended use for the water. These standards enable end users to define their needs more precisely and evaluate the myriad of purification technologies available without reliance on manufacturer's bias or non-specific brand names. Typical of the currently recognised standards are those of the American Society for Testing and Materials (ASTM), the College of American Pathologists (CAP), the American Chemical Society (ACS), the National Committee for Clinical Laboratory Standards (NCCLS) and the British Pharmacopoeia (BP), all of which are in the public domain.

The predominant measure used in classification systems and throughout most discussions of "purity" refers to the resistivity or conductivity of the water. Since minerals form ions in solution, they increase the electrical conductivity of that solution. To put this into perspective, the calculated conductivity of chemically pure water is 0.0548µS/cm @ 25°C. Typical municipal water supplies have a conductivity of <250µS/cm and permeate water exiting a small reverse osmosis system fed from this mains water will be <15µS/cm. Use of a post reverse osmosis deionisation polisher stages will yield <1.0µS/cm conductivity water.

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