

# PRODUCT SPECIFICATION & EVALUATION



**Product Name: Reverse Osmosis Systems**

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## DESCRIPTION & SPECIFICATIONS

Reverse Osmosis (RO) is the most economical method of removing 95% to 99% of all contaminants. The pore structure of R.O. Membranes is much tighter than that of UF membranes. RO membranes are capable of rejecting practically all particles, bacteria and organics >200 Dalton molecular weight (including pyrogens) at a rate close to 99%. Natural osmosis occurs when solutions with two different concentrations are separated by a semi-permeable membrane. Osmotic pressure drives water through the membrane; the water dilutes the more concentrated solution, and the end result is equilibrium.

In water purification systems, hydraulic pressure is applied to the concentrated solution to counteract the osmotic pressure. Pure water is driven from the concentrated solution at a flow rate proportional to applied pressure and collected downstream of the membrane.

RO also involves an ionic exclusion process. Only solvent (i.e. water molecules) is allowed to pass through the semi-permeable RO membrane, while virtually all ions and dissolved molecules are retained (including salts and organic molecules such as sugars). The semi-permeable membrane rejects salts (ions) by a charge phenomenon action: the greater the charge, the greater the rejection. Therefore, the membrane rejects nearly all (>99%) strongly ionized polyvalent ions but only 95% of the weakly ionized monovalent ions like sodium. Salt rejection increases significantly with applied pressure up to 5 bar.

*Fig.1 – Reverse Osmosis System in Operation*



## PROCESS

The Reverse osmosis, also known as hyper-filtration, is the finest filtration known. This process will allow the removal of particles as small as dissolved individual ions from a solution. Reverse osmosis is used to purify water and remove ions and dissolved organic molecules. It can be used to purify fluids such as the wastewater, which will pass through the reverse osmosis membrane, while rejecting other ions and contaminants from passing. The typical use for reverse osmosis is in purifying water. It is used to produce water that meets the most demanding specifications that are currently in place and set out by the EPA.

Reverse osmosis uses a membrane that is semi-permeable, allowing the fluid that is being purified to pass through it, while rejecting the contaminants that remain. Most reverse osmosis technology uses a process known as cross-flow to allow the membrane to continually clean itself. As some of the fluid passes through the membrane the rest continues downstream, sweeping the rejected species away from the membrane, in concentrated brine reject water that is returned to the Head works.

The process of reverse osmosis requires a driving force to push the fluid through the membrane, and the most common force is pressure from a pump. The higher the pressure, the larger the driving forces. As the concentration of the fluid being rejected increases, the driving force required to continue concentrating the fluid increases.

Reverse osmosis will reject bacteria, salts, sugars, proteins, particles, dyes, and other constituents that have a molecular weight of greater than 150-250 Daltons. The separation of ions with reverse osmosis is aided by charged particles. This means that dissolved ions that carry a charge, such as salts, are more likely to be rejected by the membrane than those that are not charged, such as organics. The larger the charge and the larger the particle, the more likely it will be rejected.

**STRENGTHS**

- The RO Filtration system removes Bacteria, viruses, metals, salts, etc. efficiently.
- It improves the taste of water by removing the excess salts.
- It is low maintenance.
- The RO system uses a technique called cross-flow to clean its membrane.

**RECOMMENDED DEPLOYMENT SCENARIOS:**

The product is designed to meet requirements for the following deployment scenarios and industry solutions:

- Volumes between 1m<sup>3</sup>/hr up to 10,000m<sup>3</sup>/hr are feasible with appropriate sizing of single skid or multiple units.
- Suited for all Water Purification
- Boiler Water feed
- Industrial processing
- Water recycling
- Other applications in conjunction with biological treatment and Ultrafiltration (UF).
- Applicable to Surface Water, the following industries: Food & Beverage, Brewing & Distillery, Dairy Products, Pharmaceutical, Bio-Technology, Chemical / Petro-Chemical, Commercial and Municipal.

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