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REVERSE OSMOSIS PROCESS

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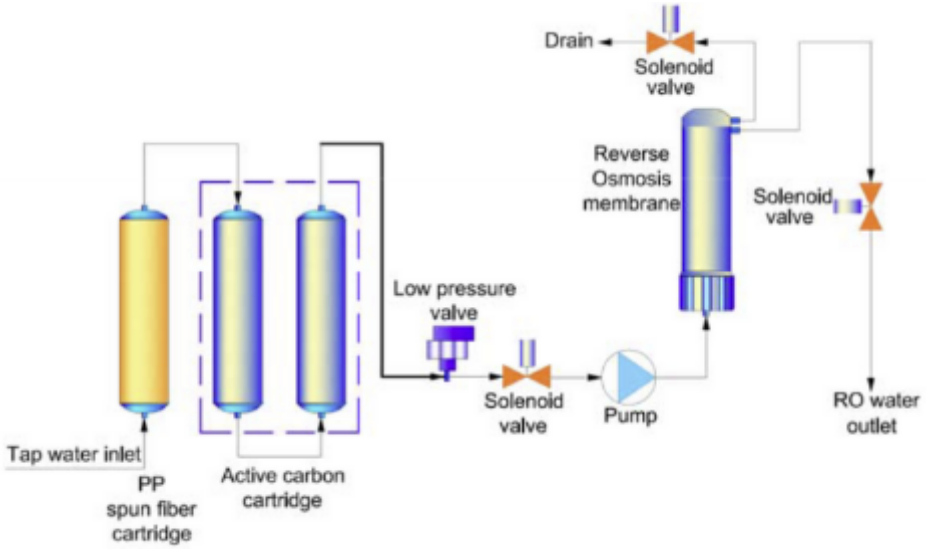
Product Category	• **RO Water** • **Design, Build, Install, Operate**
Application	• **High quality water for process** • **Removal strict impurities to meet specific water specifications**
Key Function(s)	• **Remove or minimize hardness from process water** • **Reduce consequent problem from hard water such as deposit** • **Adjust raw water quality to meet better quality for process requirement**

Reverse Osmosis (RO) is a water purification process that removes contaminants and impurities from water by using a semipermeable membrane to separate clean water from dissolved salts, minerals, and other impurities. This process is the opposite of osmosis, a natural process where water moves from an area of low solute concentration to an area of high solute concentration through a semipermeable membrane. In reverse osmosis, water is forced through the membrane in the opposite direction, leaving impurities behind. Processes are;



1. **Pre-Treatment:**
   - Filtration: Before water enters the RO membrane, it is often pre-filtered to remove larger particles, sediments, chlorine, and other debris that could damage the membrane or interfere with the process. Common pre-treatment steps include the use of sediment filters and carbon filters.
2. **Application of Pressure:**
   - Pressure Pump: In reverse osmosis, a pressure pump applies pressure to the feed water. This pressure is required to overcome the natural osmotic pressure and force water through the semipermeable membrane.
   - The pressure must be greater than the osmotic pressure of the feedwater to push water through the membrane, leaving contaminants behind.

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3. **Semipermeable Membrane:**
    - The core of the reverse osmosis process is the semipermeable membrane, which allows only water molecules to pass through, while blocking larger particles such as salts, bacteria, viruses, and other contaminants.
    - Pore Size: The pores in the membrane are typically between 0.0001 to 0.001 microns, which are small enough to filter out most dissolved substances.
4. **Separation of Water and Contaminants:**
    - As pressure is applied, clean water passes through the membrane into a clean water stream (the permeate or product water), while the contaminants (concentrate or brine) are left behind and are typically flushed away.
    - This process effectively removes dissolved salts, heavy metals, organics, and microorganisms from the water.
5. **Post-Treatment (Optional):**
    - After passing through the membrane, the water may undergo additional post-treatment steps, such as mineralization (adding essential minerals back to the water) or UV disinfection (to ensure the water is free from pathogens).
    - For some applications, the water is stored in a storage tank before being distributed for use.

Key Components of a Reverse Osmosis System:

1. Feed Water: The source water that needs to be treated.
2. Pre-Filters: Sediment filters and carbon filters that remove large particles, chlorine, and other chemicals.
3. RO Membrane: The semipermeable membrane that removes contaminants.
4. High-Pressure Pump: Provides the necessary pressure to push water through the membrane.
5. Post-Filters: These can be used to further purify the water (such as through activated carbon or UV treatment).
6. Storage Tank: Collects the treated water for later use.
7. Drain: Disposes of the brine (concentrated contaminants) left behind after the RO process.

Stages of Reverse Osmosis:

1. Pre-Treatment (Sediment and Carbon Filtration)
2. Reverse Osmosis Process (Membrane Filtration)
3. Post-Treatment (Mineralization, UV disinfection, or further filtration)

Challenges and Considerations:

- Water Wastage: RO systems typically waste water in the form of brine (concentrated wastewater), with a typical recovery rate of 50-75%. This means for every 1 liter of purified water produced, several liters may be rejected as waste.
- Energy Use: The pressure required to push water through the RO membrane can be energy-intensive, especially in large-scale industrial applications. However, energy recovery systems can help reduce this consumption.
- Membrane Fouling: Over time, the RO membrane can become clogged or fouled with organic material, salts, and minerals. Regular cleaning and maintenance are required to ensure optimal performance.
- Mineral Removal: While RO removes harmful contaminants, it also removes beneficial minerals from the water, which is why some systems add minerals back to the purified water after treatment.

At Stellar Unity, being a **good service provider** for **water processing** involves more than just delivering functional systems or technologies; it requires a focus on customer satisfaction, environmental responsibility, and technical expertise.

Consult or reach out our sales representative for more details.