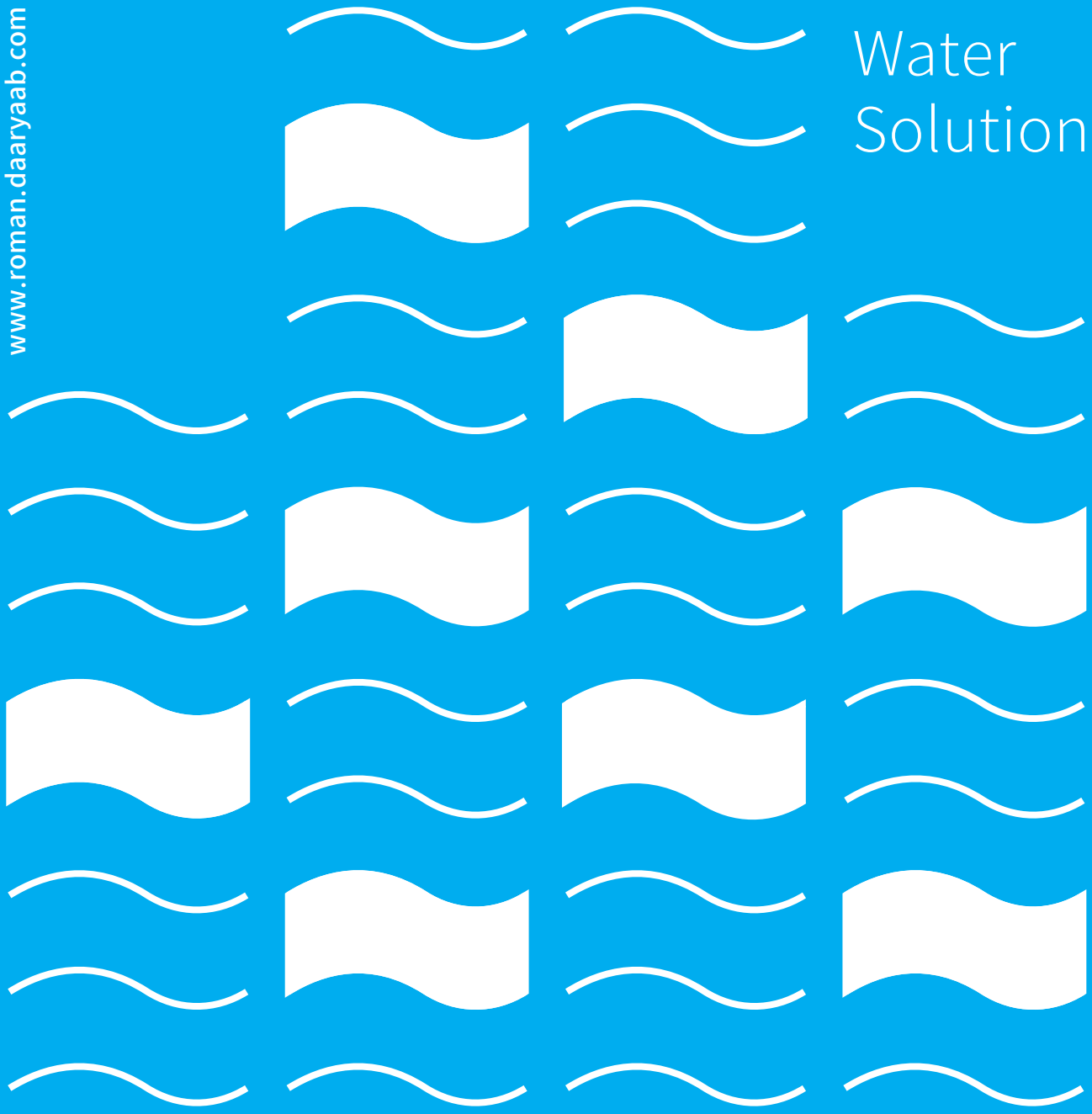
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Water
Solution



ROMAN
Water solution

Water Desalination Catalogue

powered by **PACKMAN** industrial group

ABOUT
ROMAN

PACKMAN industrial group has been operating since 1975. Supplying fresh water is one of long-term goals of this company for the independence of Iran in the water related industries.
In this regard, the Daaryaab project has been defined in Packman Company with the presence of more than a hundred experts, including engineers and university faculty members.
The ROMAN project is one Daaryaab's sub-projects. ROMAN's name is a combination of Packman's company name and the word RO (Reverse Osmosis) and is indicative of the field of work of this company in the direction of providing fresh water by reverse osmosis.
The working group of the ROMAN project consists of summa cum laude graduates of the country's universities with scientific degrees of doctorate, master's degree and bachelor's degree in chemical engineering, mechanical engineering and electrical engineering. This working group has made every effort to fully meet the needs of the country in this area by using the expert force inside the country and trusting the scientific connections with various scientific and industrial centers in the world.

The relevant areas are:

- Water and wastewater treatment using reverse osmosis desalination systems
- Demineralized water (DEMIN) production systems for special industries
- Ultrafiltration and combined RO-UF treatment systems
- Wastewater treatment system and water cycle of various industries
- Chemistry of the steam-to-water cycle

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The necessity of saline water treatment

Water treatment for mankind has a very long history. Historians believe that the history of water treatment reaches about two thousand years before Christ.

The need to sweeten available internal resources is critical in many regions of the world, communities grow rapidly with limited fresh water resources.

Increasing population growth, industry and agriculture development, reduction of extractable water resources, water pollution of existing fresh water sources and environmental effects, mismanagement of water resources, global warming and climate change are all factors that have recently led to the aggravation of water problems.

Considering the above-mentioned cases and since sea water makes up 79% of the world's water, water treatment is very important in solving the water crisis.

The need to plan and manage water supply on the one hand and the limitation of available fresh water sources on the other hand, makes it necessary to use existing non-conventional sources such as salty and brackish water sources.

In this way, the cities and regions that are facing a shortage of surface and underground fresh water resources and are mainly located next to the seas or on the salt water table or on the edge of the brackish water should make maximum use of these resources to provide the water they need. Therefore, for these areas, it is necessary to use new technologies and solutions to provide fresh water.

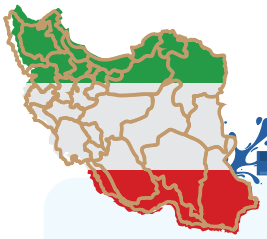
Iran is one of the countries that is mainly located in an arid and semi-arid region and faces many problems in the field of water supply. Membrane processes including reverse osmosis (RO) are among advanced water treatment methods that are widely used in arid and semi-arid regions.

It is estimated that by 2050, one in four people will live in a country with a permanent shortage of fresh water resources.

Water Treatment Methods

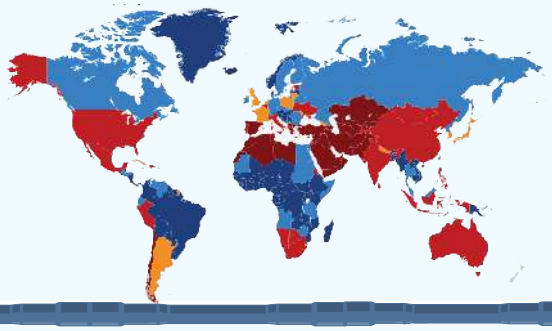
1-Desalination by reverse osmosis method
2-DEMIN production systems for special industries
3-UF and combined RO-UF treatment system
4-Wastewater treatment system and water cycle of various industries
5-Chemistry of the steam-to-water cycle

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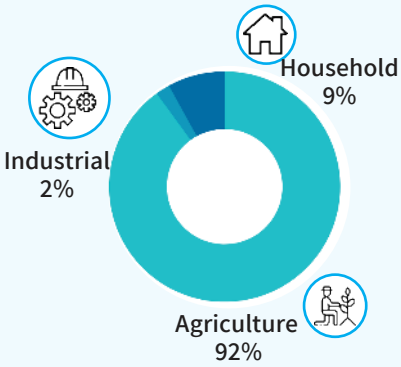
Iran as the fifth most consuming country in the world in2020

Forecasting the ratio of water use to water supply (water stress) in year 2040



92% of the total water resources

The amount of water consumed in Iran's agricultural sector Currently, Iran uses 83% of its total renewable freshwater resources, while international norms suggest a ceiling of 40% to ensure environmental sustainability and meet the increasing demand of a growing population.



The water consumption of each sector in the year2020



Arid and semi-arid areas make up nearly %60 of the country

260mm average annual rainfall of the country

70% of which evaporates directly

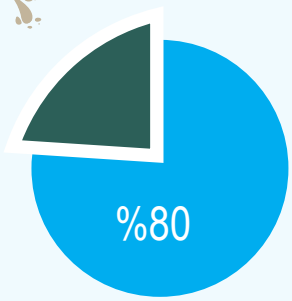
Water evaporation is three times the world in Iran

The total water evaporation capacity in the country is equivalent to 3 times the water consumption in the agri cultural sector

Average annual evaporation potential in Iran is 2100

Average rainfall in Iran is 1/3 of the world





The consumption of the whole country
96 billion cubic meters equal to
%80 of the country's water resources

Comparison with global statistics

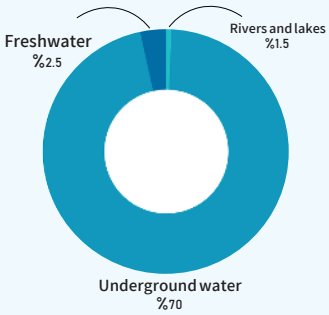
Water consumption per person in Iran is 2 times the world standard consumption

Consumption per Iranian
300 liters

~

Global standard
140 liters

×2



Water sources of deep wells and salt and fresh water in the world

is only 2.5% of the fresh water available

The necessity of desalination of existing saline water resources is more important than ever



Desalination By Reverse Osmosis Method

Reverse osmosis is a form of filtration under pressure and the filter of which is a semi-permeable membrane. The force required to overcome the osmotic pressure in reverse osmosis water desalination is created by using high pressure pumps. Therefore, water enters the dilute side from the thick side by passing through the semi-permeable membrane. This semi-permeablemembrane can remove many types of molecules and ions from water, therefore, it is used in both industrial processes and drinking water production.

The pressure required for the pump depends on the salt concentration in the water to overcome the osmotic pressure. This technology can remove viruses and chemical substances such as metal ions, lead, arsenic, fluoride, radium, etc. and radioactive substances such as plutonium, radioactive and strontium, which cause water pollution.

Desalination is the most important application of reverse osmosis process in today's world. It consists of several parts: 50% desalination of sea water and brackish water, 40% high purity water for use in (pharmaceutical, electrical and energy production industries) and 10% urban and industrial water disinfection system



Ultrapure Water Or Demin Water

Demin water is used in high-pressure boilers, electronic industries and industries that require ultra-pure water. Two methods can be used to produce demin water: The first method is to use the RO Double device. Two reverse osmosis devices are used in series in this method. The second method is to use a RO reverse osmosis device with a resin system. RO reverse osmosis treatment with a resin system is the best way to produce completely pure water that does not contain any salts. In this method, first, The TDS of the water reaches close to zero by using RO device in reverse osmosis method. Then, the remaining ionized salts in the water are removed using a resin system.

The ion exchange resin used in this method is Mix Bed. This resin is able to remove cations and anions in water. This method is more economical than the Double RO method in producing completely pure water.



UF And Combined UF-RO Treatment Systems

Ultrafiltration (UF) is a membrane filtration process similar to reverse osmosis which moves water through a semi-permeable membrane using hydrostatic pressure.

Ultrafiltration is used as an agent to separate bacteria, viruses and other harmful contaminants from water, but ions and small molecules are not removed in this method. UF membranes remove dissolved substances with a size of 0.03 micron and larger. Suspended particles that are too large to pass through the membrane stick to the outer surface of the membrane and only fresh water and dissolved minerals pass through it. Ultra filters have the ability to remove sand, mud, clay, algae, microbes, bacteria, viruses and humic substances. Ions and small molecules are not removed in this method.

Although ultrafiltration is used to treatment surface water with very low salinity and produce drinkable water, but its main role is in the desalination industry as a pre-treatment of nano-filtration& reverse osmosis methods



Wastewater Treatment System & Water Cycle Of Various Industries

In the wastewater treatment process, the natural treatment process is tried to be done with a faster speed to remove the pollutants.

Wastewater contains impurities such as suspended materials, floating particles, waste materials, etc. Physical and biological processes are used for wastewater treatment in the conventional treatment process.

Different wastewater treatment methods are divided into three main categories: 1) Primary treatment (physical process), 2) secondary treatment (biological), 3) advanced treatment (combination of physical, chemical and biological methods).

Each category of these treatment processes can include preliminary sedimentation units,disinfection and sludge management (sludge treatment & disposal).

It should be noted that, considering proper pre-treatment, the reverse osmosis process can be used in addition to sweetening salt water (such as sea water) to reuse polluted water during the production of industrial products such as steel, stone cutting factories and...

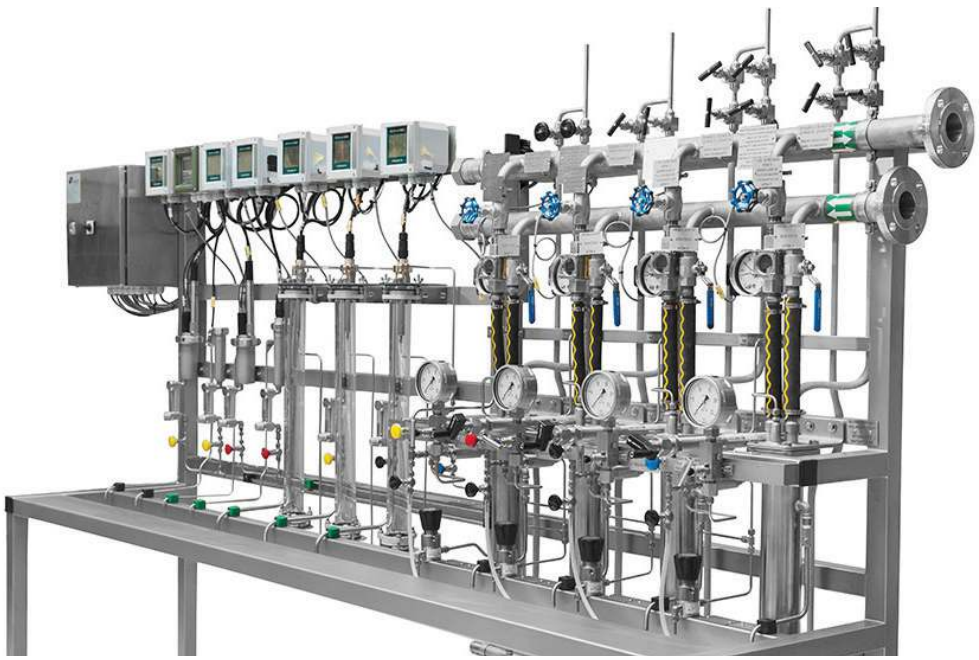


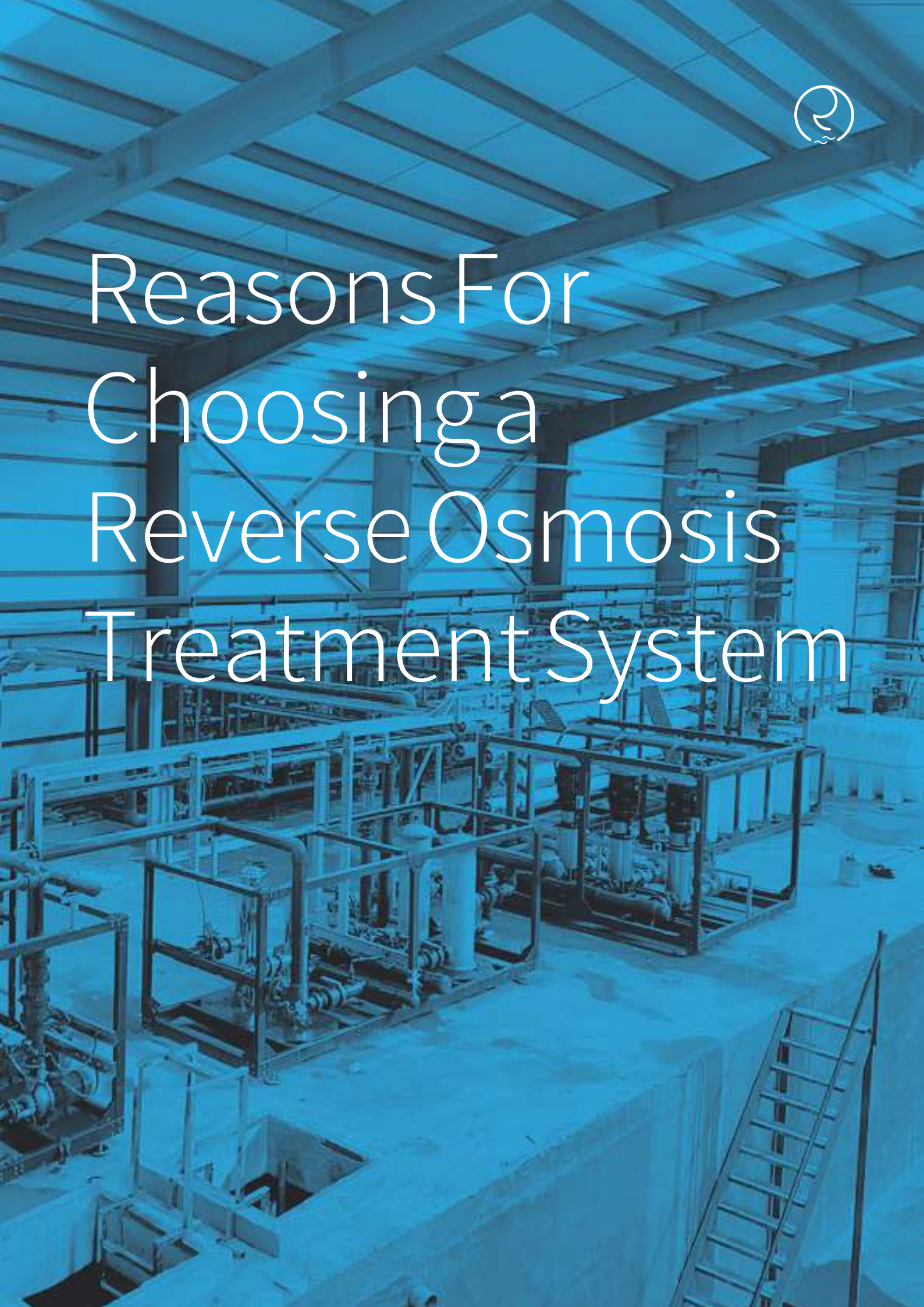
Chemistry Of Water Vapor Cycle

Steam production with good quality is required for active industrial boiler systems. Achieving this goal depends on the proper management of the water treatment process to control steam purity, deposits and corrosion. In addition, some impurities in boiler water, especially high alkalinity and organic matter, change the surface tension of water and allow small bubbles to collapse into larger bubbles. Larger bubbles create a larger foam layer, which results in higher heat transfer and lower vapor quality. As a result, it is very important to keep boiler water chemistry stable within the specified range. For this purpose, dosing systems are designed by the ROMAN group to release chemicals with a certain pressure and speed into the water.



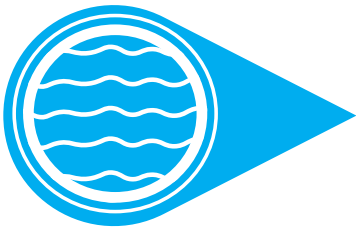






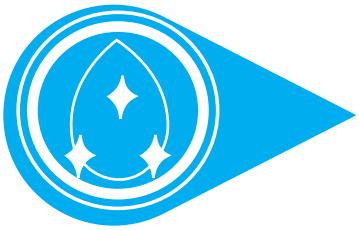
Reasons For Choosing a Reverse Osmosis Treatment System

Reverse Osmosis Advantages



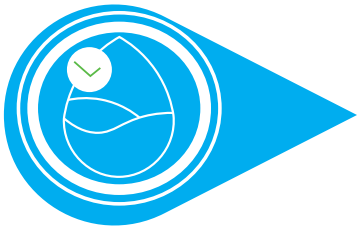
The Possibility of Using Infinite Resources of Sea Water& Underground Resources In This System

By using this system, fresh and potable water can be easily obtained in areas that are facing a shortage of fresh water or a water crisis and are close to the sea.



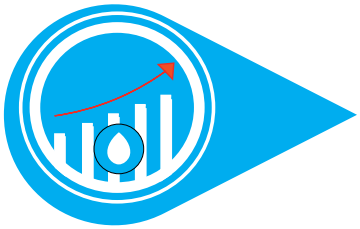
Improving The Water Color And Taste

The reverse osmosis system produces clear blue water by removing turbidity and dissolved ions (such as lead) that reduce the quality of water taste. As a result, water treated by reverse osmosis has a better taste compared to tap water.



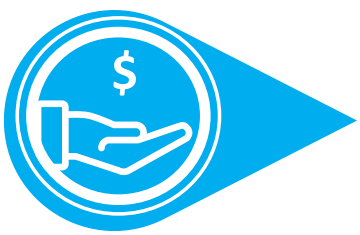
Remove All Unwanted Particles Including Ions And Heavy Metals

The reverse osmosis treatment method is able to remove ions soluble in water such as lead, iron, manganese, etc. In addition to damaging industrial equipment, these ions also cause damage to health.



High Efficiency

Compared to water treatment by distillation method, water wastage is much less in the water treatment process by reverse osmosis when TDS < 4500 ppm. Typically, recovery amount in the RO system is approximately between 50 and 58%.



Economical And Low Energy Consumption

Compared to thermal methods of water purification, reverse osmosis consumes less energy and if the water TDS is lower than 45000 ppm and it does not have the problems related to high temperature or sedimentation, clogging and corrosion.

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Reverse Osmosis Applications

Drinking Water Production

Pollutants such as lead, bacteria, viruses that can be transmitted by water, etc. in water have harmful effects on human health and body. Since the reverse osmosis system has the ability to remove these pollutants, it produces clear water without harmful pollutants.



Chemical Industry

In this context, it is possible to supply water with the desired quality needed for the production of cosmetics and health products, water needed for the electro-plating industry, water needed for the dyeing and printing industries, and water needed for laboratory washing using a reverse osmosis water purification system.



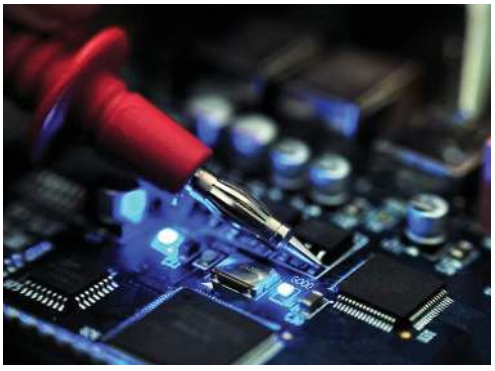
Food Industry

Preventing corrosion and sedimentation is one of the applications of water purification used in steam boilers. Because boilers are the most important part of the food production industry. In addition, the reverse osmosis system is also used in the food industry to concentrate liquids.



Electronics Industry

The reverse osmosis water treatment system in the electronics industry can be used to supply water needed for battery making, water needed for the production of microelectronics, and water used in the production of semiconductors, devices, and optical fiber.



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Agriculture Industry

Desalination of industrial water in this industry is very important to prevent damage to agricultural products. As a result, the water used in the irrigation department is desalinated using a reverse osmosis filtration system so as not to harm the plants.



Water Supply For Heating & Cooling Systems

Low quality water entering the boiler increases energy consumption, reduces the quality and purity of produced steam, and ultimately reduces production and quality. Application of reverse osmosis is in the water supply circuit of the boiler and increases the reliability of production and reduces the cost of operation



Pharmacology

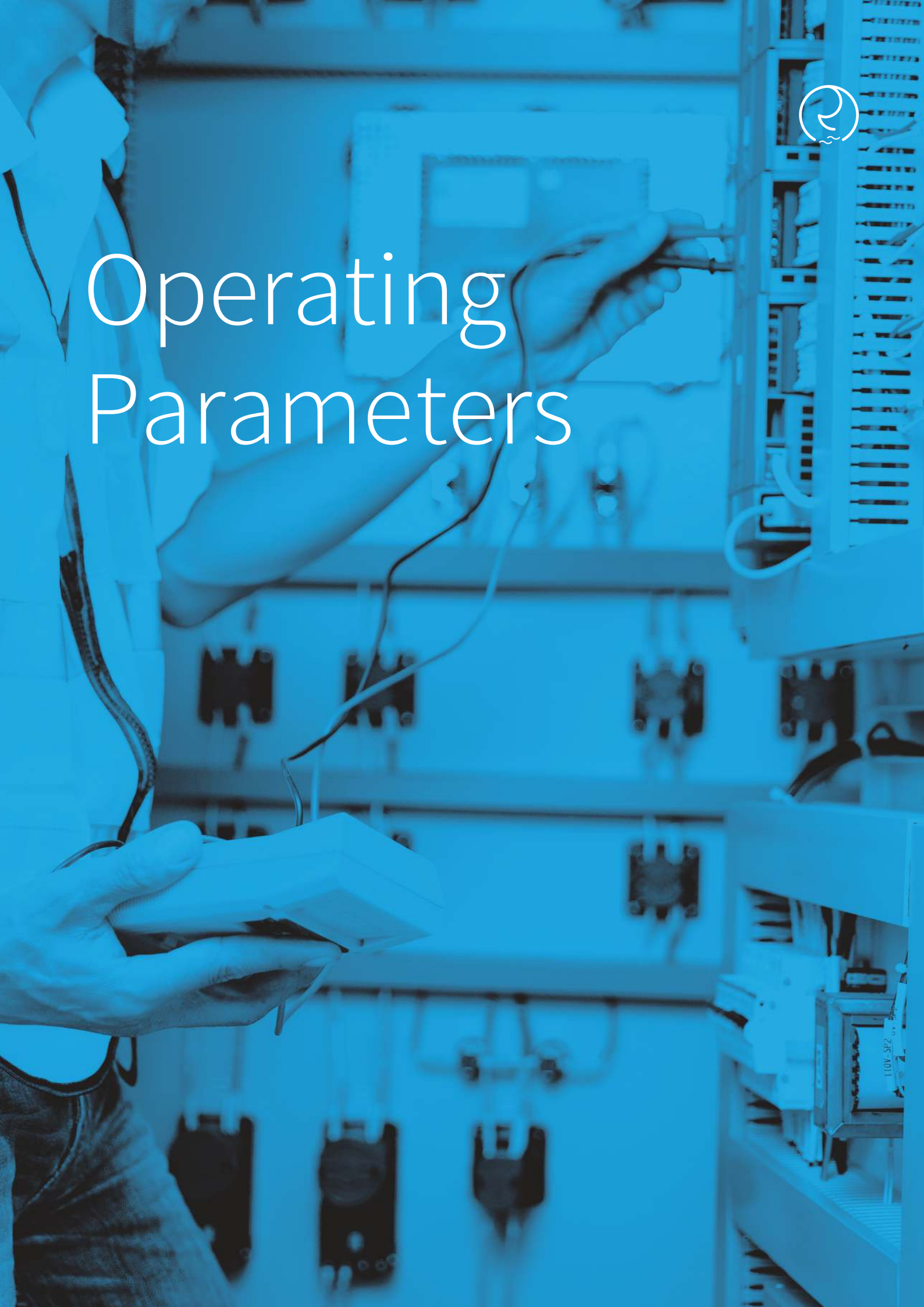
Due to the presence of salts and impurities in the drinking water of the urban water supply system, it sometimes makes it impossible to use this water in this industry. Reverse osmosis can be used to ensure the desired quality of this water, which can reduce impurities by 98%.



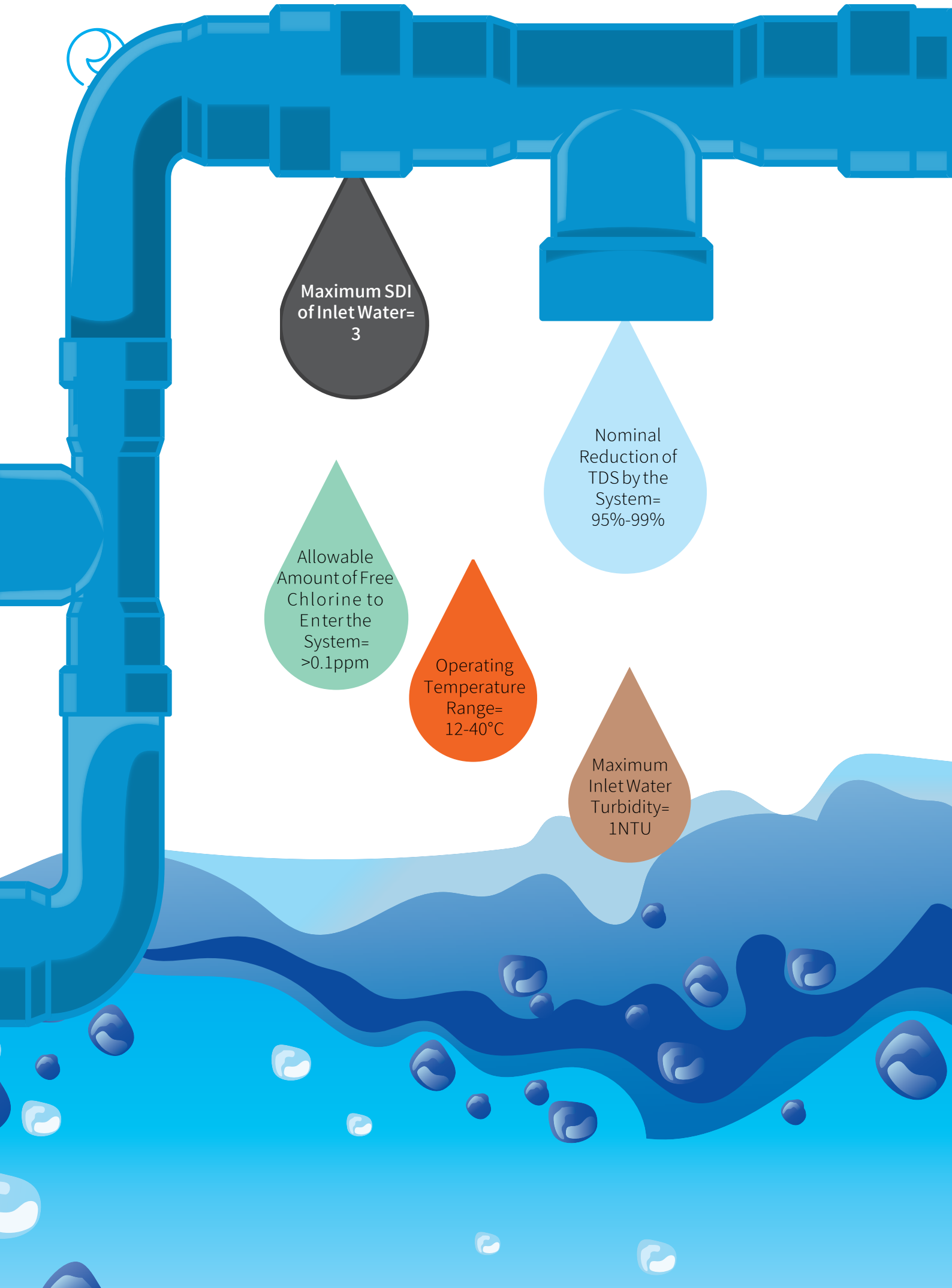
Power plant/Refinery/Petrochemical

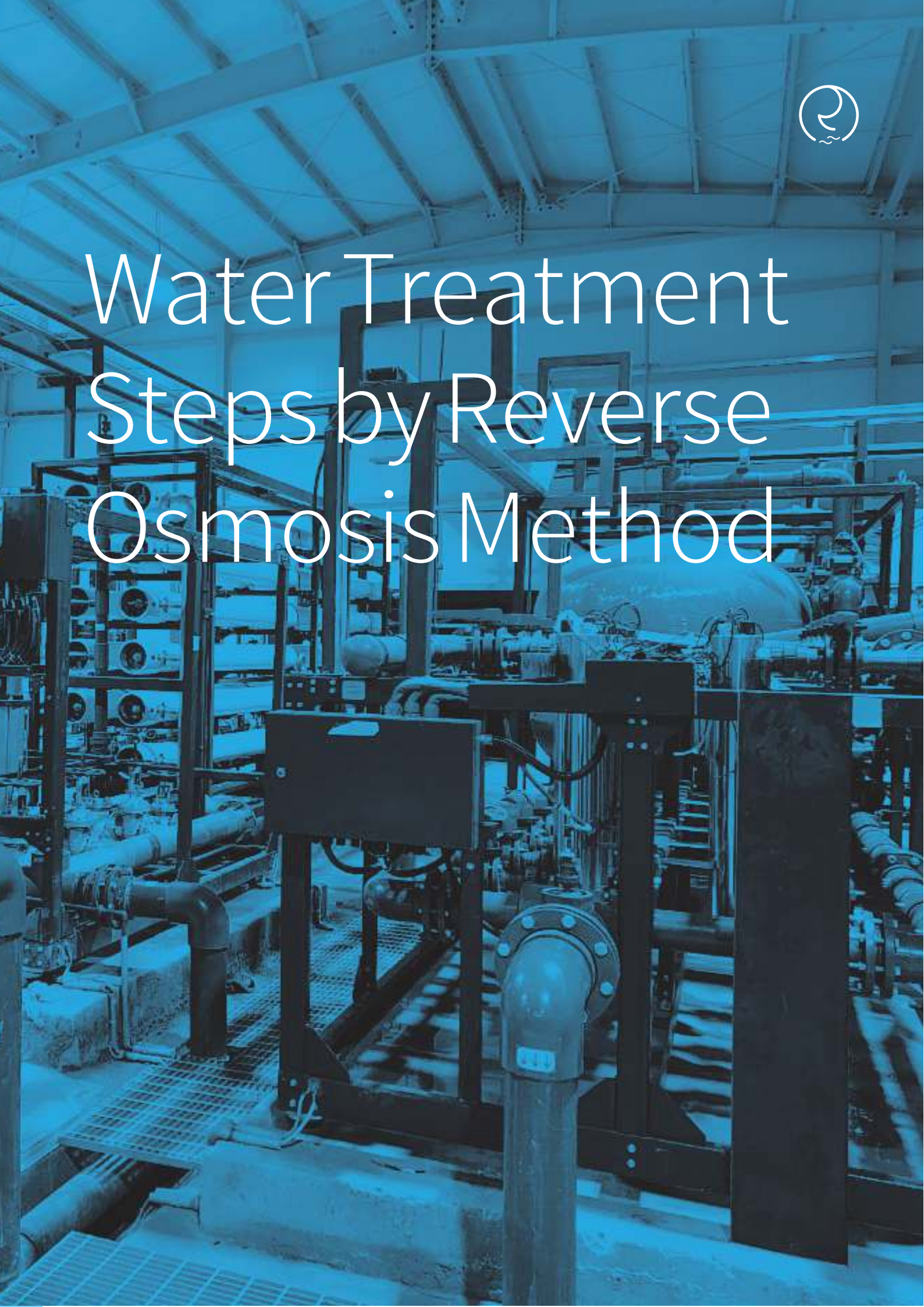
Purification of the water used in the steam boiler prevents the formation of deposits in the turbine blades and the loss of its balance, which ultimately disrupts the electricity production process. As a result, the use of reverse osmosis water purification system in the power plant helps a lot in electricity production.





Operating Parameters


Maximum SDI of Inlet Water= 3
Nominal Reduction of TDS by the System= 95%-99%
Allowable Amount of Free Chlorine to Enter the System= >0.1ppm
Operating Temperature Range= 12-40°C
Maximum Inlet Water Turbidity= 1NTU



Water Treatment Steps by Reverse Osmosis Method

Water Treatment Steps By Reverse Osmosis

03

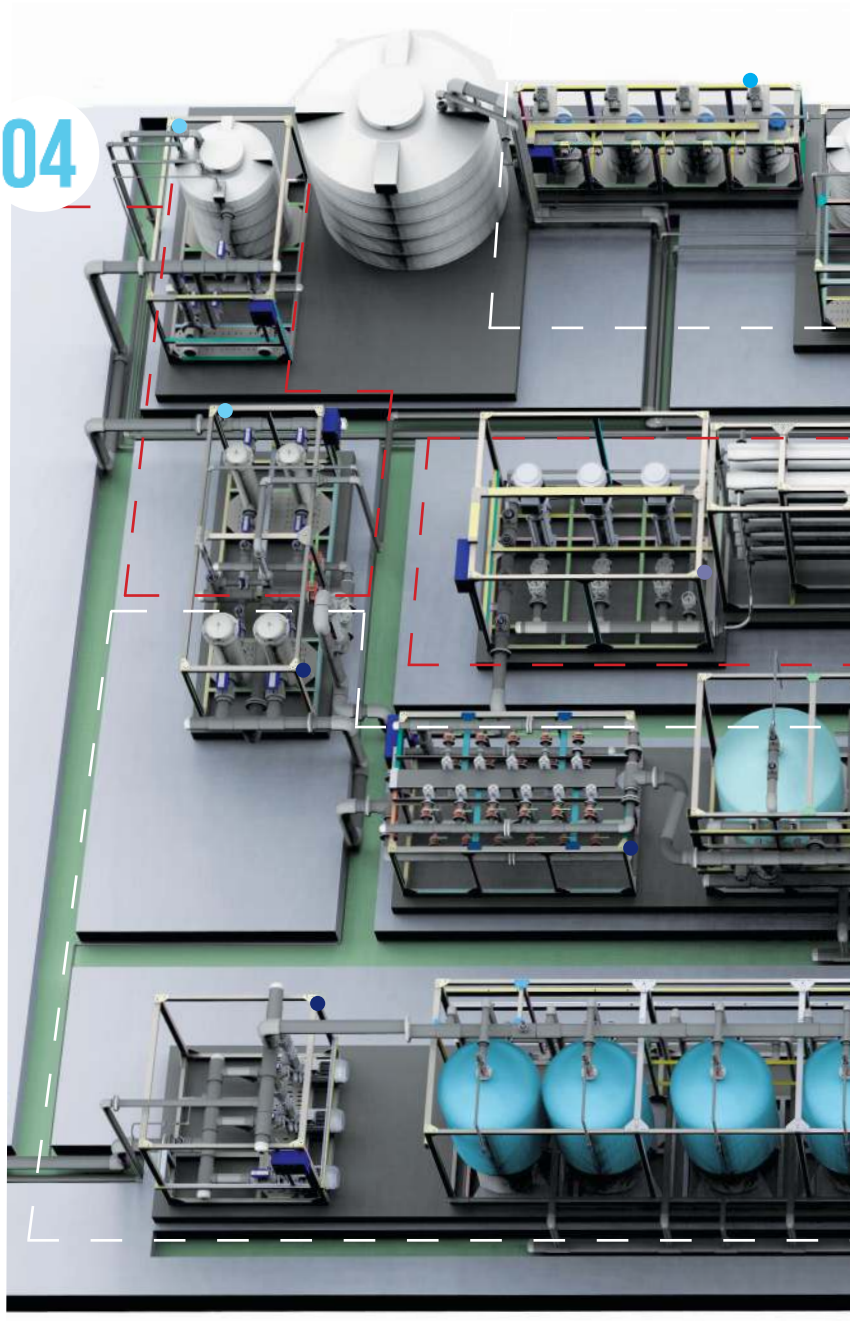
Post-Treatment Unit

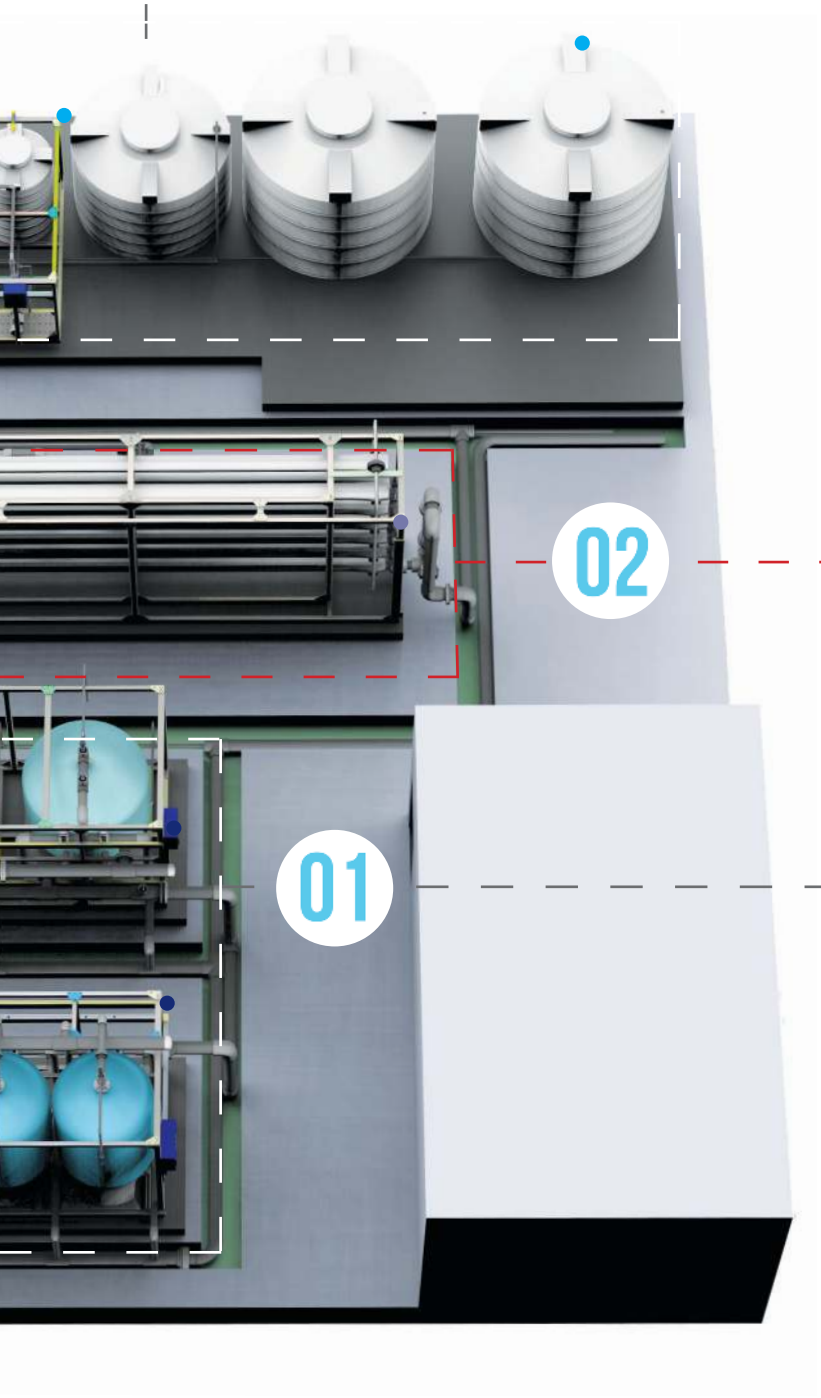
The available equipment is determined based on the sensitivity of the fresh water consumer unit. This section can includes disinfection system, TDS adjustment, PH adjustment, etc.

04

CIP & Flushing Unit

The chemical washing method is selected based on the type of clogging and the correct selection of this method has a significant impact on the performance and life of the membranes. Flushing: When the machine is stopped, the surface of the membranes must be washed with purified water to prevent the formation of deposits.





Treatment Unit

The water subjected to the pre-treatment process enters the pressure vessels by a high pressure pump that has a reverse osmosis membrane inside them.

Pre-Treatment Unit

Equipment such as sand filter, active carbon filter, cartridge filter, chemical dosing system (such as Antiscalant, sodium meta bisulfite, etc.), ultrafiltration, MBBR/MBR are selected according to the condition of raw water.

Pretreatment System Equipment

Sand Filters

This filter physically removes solid and suspended particles, mud & biological suspended particles up to 50 microns. In simpler words, sand filter reduces the turbidity of the water and, as a result, makes the water clearer.



Sand Filter

Carbon Filter

Activated carbon has an acceptable ability to remove color, odor, oil and grease, free water chlorine, with a very porous structure and a very high specific surface. It is also effective for reducing a wide range of minerals, chromate, sulfide, chlorine and chloramines.



Carbon Filter

Water Softener

In this method, the hard ions in the water (calcium and magnesium) are exchanged with the soft ions in the resins during the passage of the water through the resins. Water flow rate, desired water hardness and backwash time are effective factors in designing resin hardener with suitable capacity



Water Softener

Ultra Filtration

This system is used when BOD, SDI, COD and high turbidity indicators and TOC parameters should be in the range of 0-40 ppm, or for surface water treatment with very low salinity and water production. But its main role is in the desalination industry as a pre-treatment of nanofiltration and reverse osmosis methods.



Ultra Filtration

MBBR/MBR Filter

These filters will be used when inlet flow to reverse osmosis treatment system, is wastewater or the BOD/COD is very high and the TOC value is more than 40 ppm. Using ultrafiltration alone is not correct to purify this water, and in addition to RO, ultrafiltration is also harmful.


MBBR/ MBR Filter

PH Adjustment Dosing

Based on the analysis of the incoming water and the available ions, acidification will be used with a high saturation index to prevent the formation of sediment on membranes. Also, the permeate output from reverse osmosis has low pH and NaOH dosing can be used to balance the final


PH Adjustment Dosing

Dosing of Antiscalant Injection

It is used to minimize the deposits that form membranes in the RO process and dissolves.
the materials accumulated near the surface of the membrane and reduces the amount of deposits. Its selection depends on composition of the inlet water. Many of these materials are made with purpose of solving the problem of specific sediments.


Dosing of Antiscalant Injection

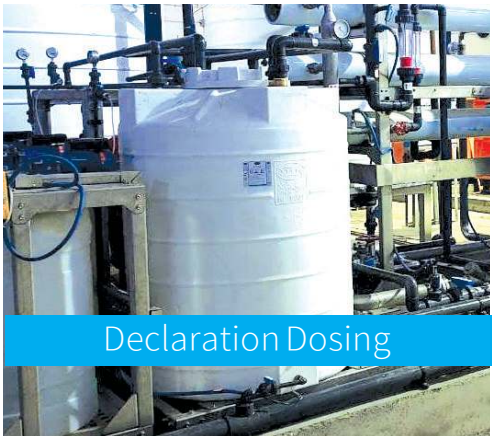
Chlorination Dosing

It is used in the pre-treatment of reverse osmosis and nanofiltration systems, with the aim of preventing biofouling, especially when surface water is used as a source of water supply. Chlorine must be removed before chlorine enters the membranes in order to prevent reverse osmosis membranes from oxidizing.


Chlorination Dosing

Declaration Dosing

Membranes will be oxidized by free chlorine, if the amount of free chlorine entering the reverse osmosis water is more than its allowed limit. Therefore, chemical dosages such as sodium bisulfite (SBS) or sodium metabisulfite (SMBS) will be used to remove this type of active chemical and prevent membrane damage.



Declaration Dosing

Ozone Generator

This system is used in pre-treatment to oxidize heavy metals such as iron, manganese, aluminum, etc., to reduce or eliminate organic, bacterial and microbial water pollution which will damage the membrane if it enters reverse osmosis with a high concentration



Ozon Generator

Heat Exchanger

The heat exchanger will be used to provide the optimal temperature for the reverse osmosis process when the temperature of the incoming water flow is variable in different seasons and is very low or very high compared to the designed state or the operating range of the membrane. It will change by changing this parameter.



Heat Exchanger

Cartridge Filter

In all reverse osmosis systems, Roman Group uses cartridge filters in the last part of the RO pre-treatment system just before the feed water enters the pressure pumps to protect these pumps and RO membranes from the dangers caused by the presence of suspended particles in drinking water.



Cartrige Filter

Treatment System Equipment (Reverse Osmosis)

Chassis

The chassis design of ROMAN group reverse osmosis system is done in a special way according to the placement of the equipment. It is made with steel or stainless steel sheet and its thickness is determined based on the weight of the equipment under construction.

The number of chassis connections and equipment installation locations are determined precisely based on their working weight, dimensions and piping. All parts of the chassis are made with stainless steel material and can be fully assembled, disassembled and replaced with rusted or damaged parts. Bending is used in the construction of ROMAN group chassis and welding is not used in any way. This has led to easy construction, simple repairs and relocation, and increased production speed.

Also, the chassis design is such that it is resistant to rust and splashing of chemicals and it is easy to access all equipment and cleaning.

The chassis is analyzed statically and dynamically after the design so that it does not suffer any problem or damage while working on the site.

The chassis is covered with three layers of epoxy paint if the chassis material is not stainless steel.



Chassis



Chassis

High Pressure Pumps

Floor pumps and in some cases piston pumps are used to create pressure in reverse osmosis desalination devices. The impeller material of these pumps must be selected in such a way that it does not get damaged or corroded during the water treatment process.



High Pressure Pump

Pressure Vessel

All reverse osmosis systems have a fiberglass or stainless steel housing which can withstand high pressure and is responsible for maintaining and protecting the membrane. The pressure vessel is made to the size of the membrane and its structure is proportional to the shape of the membrane.



Pressure Vessel

Membrane

Reverse osmosis membranes are thin film composite or TFC. These membranes are used in many purification processes such as desalination due to their excellent mechanical properties and extraordinary rejection ratio.



Membrane

Piping

1.Low pressure: all communication pipes are of U-PUC type from the pre-treatment section to the high pressure pump.
2.High pressure: all communication pipes, valves and connections are of stainless steel type, from the high pressure pump to the produced water and waste water.



Piping

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Instrumentation

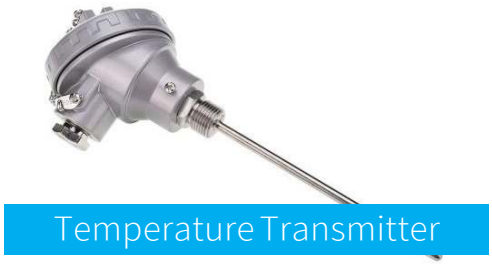
Reverse osmosis systems are usually pressure transmitters, rotametric flowmeters with temperature transmitters, pressure transmitters, free chlorine sensors, TDS controllers, PH controllers, ORP sensors, etc., and we have introduced some of these equipment.



Instrumentation

Temperature Transmitter

The temperature of the flow entering system is controlled by temperature transmitter, because change in temperature will causes change the quality of purified water and even causes damage to the membrane in some cases.


Temperature Transmitter

Pressure Transmitter

The pressure transmitter measures pressure of liquids, fluids and gases. This instrument receives a weak electrical signal and converts it into an electrical signal to be sent to controllers, electronic circuits and monitoring systems. The main purpose of controlling the flow pressure is to prevent problems such as cavitation, to inform about the clogging of filters, etc.



Pressure Transmitter

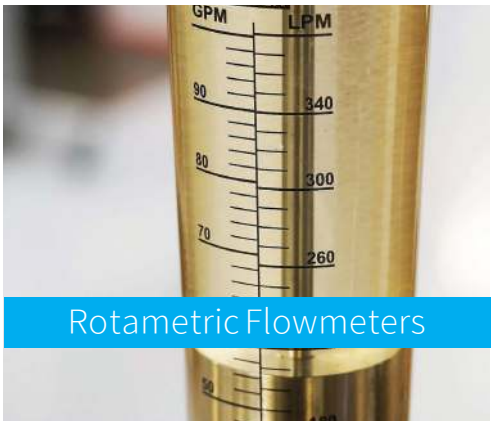
Free Chlorine Sensor

This device is used to know the amount of free chlorine in the water entering the reverse osmosis system and prevent damage to the membrane. Chlorine sensor is one of the most important sensors for various industries that use water.


Free Chlorine Sensor

Rotametric Flowmeters

They consist of a conical glass or plastic tube and a float. This tool is used to measure flow rate. Flow rate measurement is especially important to check process and project conditions when a fluid is passing through the facility.



Rotametric Flowmeters

ORP Sensor

The ORP oxidation reduction potential indicator is used to ensure the absence of free chlorine and the complete removal of this chemical. The Oxidation and Reduction Potential Index (ORP) controller is also used to ensure the absence of free chlorine and the complete removal of this chemical.


Orp Sensor

TDS

TDS meter is a device for measuring the amount of TDS or the concentration of dissolved solid particles. Due to the increase in electrical conductivity of the solution due to dissolved ionized solids such as salt or minerals, TDS meter measures the conductivity of the solution and based on that, it estimates amount of dissolved solids in the desired solution.



TDS

Control System

The ROMAN desalination control system is based on PLC control system with ability to send information and status of the device, which gives an accurate picture of the system.
The reference for precision instruments panel parts and standard layout is IEC.


Control System

Post- Treatment System Equipment

Deionization

Deionization system can be used for the secondary reduction of ions in purified water or to control a specific ion.ion exchange process takes place by removing the undesirable ions and replacing acceptable ions of solid resin.



Post-Treatment System Equipment Deionization

UV For Sterilization

This system is used in the post-treatment section to ensure the complete removal of microbial, viral and bacterial contamination in cases where the purified water is used for drinking.
Ultraviolet (UV) rays are effective against all microorganisms including bacteria, viruses, fungi, molds, yeasts and algae in the air and surfaces.



UV For Sterilization

Mineral Additives

Therefore, long-term use of this water is not useful for drinking because water treatment by reverse osmosis system has very few salts. For this reason, mineral additives are used to increase useful and essential ions needed by the human body.



Mineral Additives

NaOH Dosing

Due to the fact that pH of water treated by RO always decreases compared to the pH of the inlet flow to RO, according to the use of treated water, (for example, the pH of the water entering the boiler should be increased to 5.8).
Sodium hydroxide dosing is used to increase pH.



NaOH Dosing

CIP Unit Equipment

The CIP unit is an independent and basic unit for washing membranes. This unit is responsible for recovering the membranes with periodic acid and base washes and in some cases, do the daily drainage of the membranes with fresh water. The chemical washing method is selected based on the type of clogging and the correct selection of this method has a significant effect on the performance and life of the membranes.

A long delay in chemical washing after clogging of the membranes makes washing difficult and reduces the life and performance of the membranes after washing. It is also necessary to wash the system with purified water every time it stops, in cases where the water entering the membrane has the possibility of sedimentation.

CIP Tank

This tank is used to store washing solution during CIP operation. The material of this tank must have sufficient resistance against various acidic and alkaline chemical solutions. Also, an electric heater is used inside this tank to set the appropriate temperature during operation.



CIP Tank

CIP Pump

The CIP pump is selected according to the number of reverse osmosis filtration system membranes. The pump pressure is usually considered 5 bar. The pump material is also selected according to the chemical solutions used in the CIP operation so that it does not suffer from corrosion.



CIP Pump

Cartridge Filter

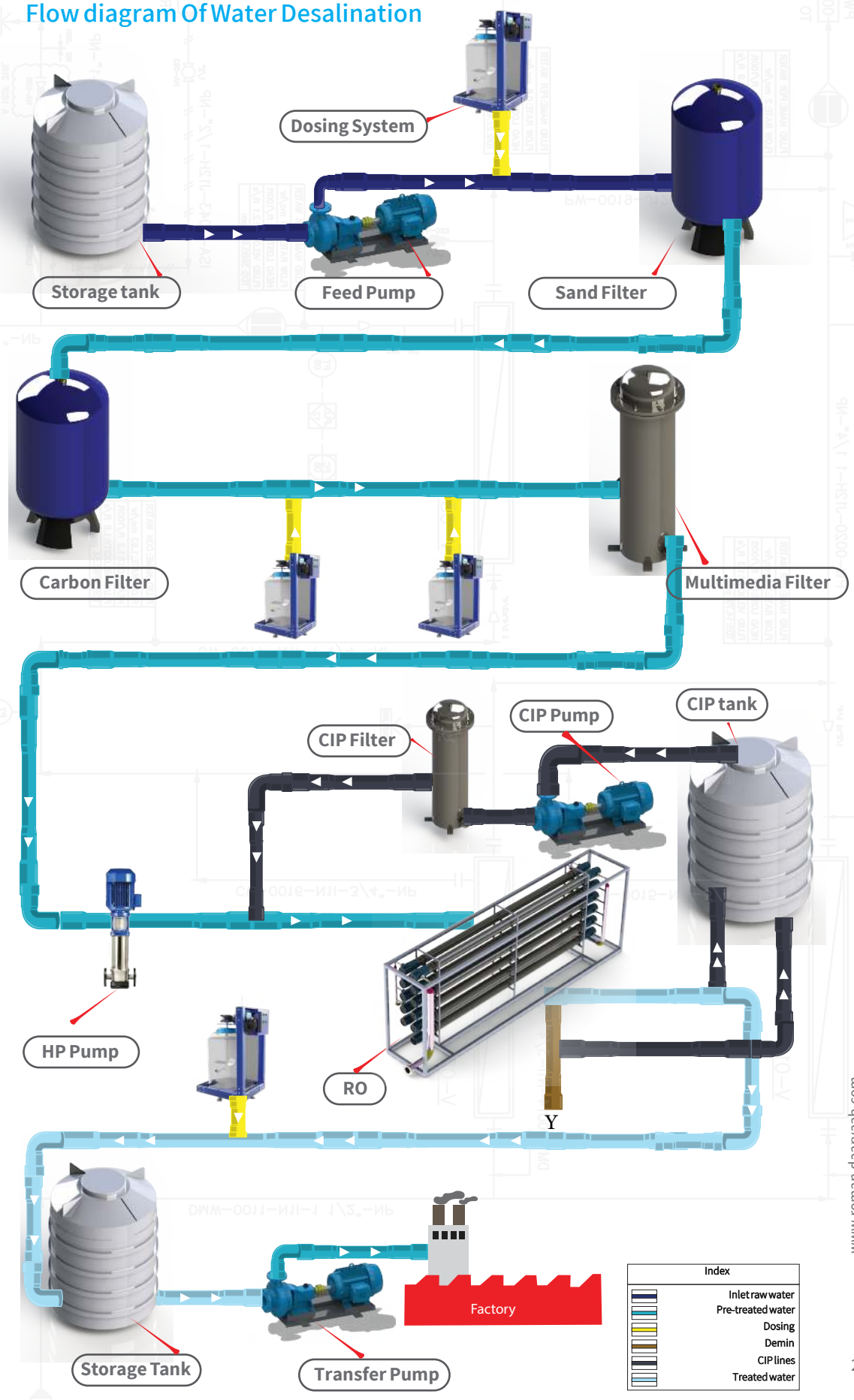
After passing through the membrane, washing solution returns to the tank. The return flow to tank can contain various contaminants such as mineral, biological or organic contamination. A cartridge filter is used to prevent these contaminations from re-contacting the membranes at the outlet of the CIP pump.



Cartridge Filter

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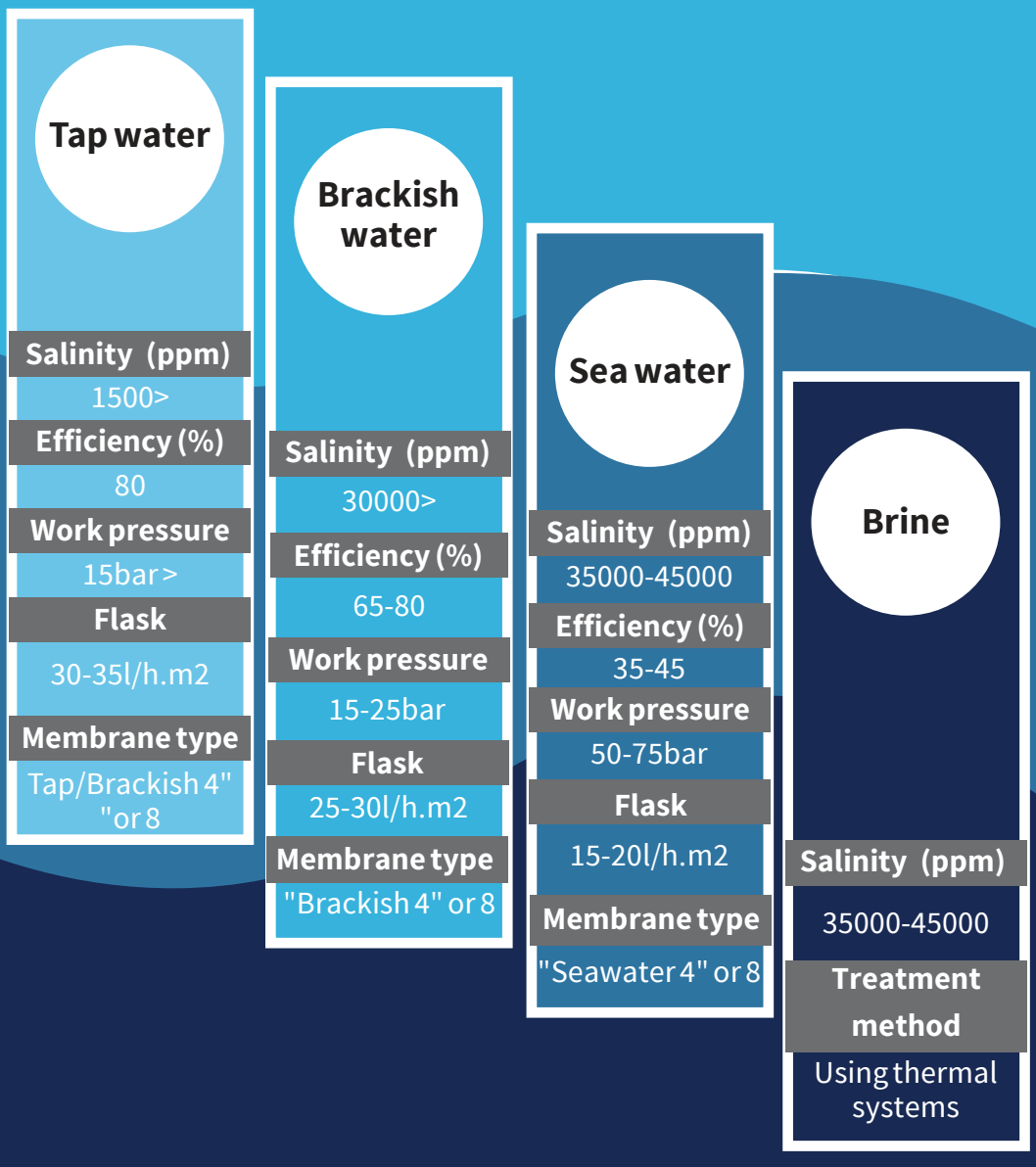
Flow diagram Of Water Desalination



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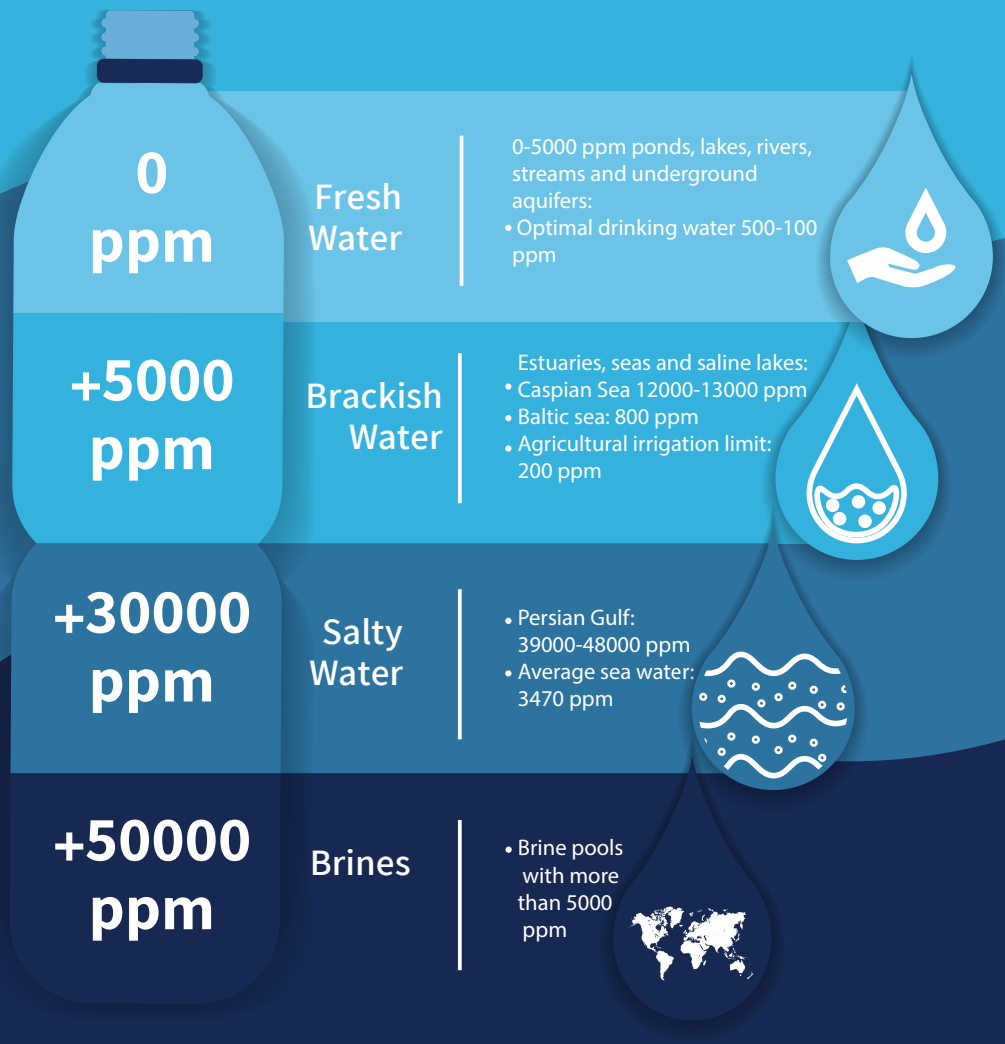
Choosing the Reverse Osmosis System Membrane According To The TDS Of Input Feed

Currently, reverse osmosis (RO) membrane desalination is the dominant technology for producing fresh water from brackish water sources (seawater, brackish water, wastewater, etc.). Proper treatment and reduction of dissolved salts in feed water mainly depends on the choice of membrane. For this purpose, different types of membranes have been designed for water treatment. In the following, it is described the type of selected membrane, the efficiency of the system and the required energy of the system, according to the source of water used.



Types Of Water Salinity

Conceptually, salinity is the amount of salt dissolved in water. Salts are water-soluble compounds such as sodium chloride, magnesium sulfate, potassium nitrate, and sodium bicarbonate. Operationally, a soluble substance is defined as a substance that can pass through a filter with very small pores (0.2 micrometers). Next, the type of water is specified according to salinity.



Flow Diagrams of Reverse Osmosis Based on Inlet Water Analysis

Water Without Special Chemical Compounds

Water does not need pre-treatment or special chemical dosing to improve the conditions of water entering RO if the water entering treatment system does not contain chemical or biological pollution and the ions dissolved in the water are chemically balanced. In this case, all undesirable water impurities will be removed or reduced by a simple pre-treatment and RO system. In this case, the pre-treatment system equipment is considered the simplest and will include sand filters, carbon filters, acid/sodium hydroxide dosing system, and cartridge filters. Water enters the main treatment system (RO) after going through the pre-treatment steps and creating suitable conditions to enter the RO device and thus impurities are removed from it.flow diagram of the reverse osmosis purification system is as follows:reverse osmosis treatment system flow diagram is as follows:



Water Containing a High Concentration Of Heavy Metal Ions

By designing a suitable pre-treatment system, it is possible to remove heavy metal ions if the water entering reverse osmosis system contains a high concentration of dissolved heavy metal ions (such as iron, manganese, aluminum, etc.) that can be oxidized. In this way, by preventing the entry of these types of ions, we will not witness the occurrence of sediments that interfere with the function of membrane. Pre-treatment system equipment can include chlorine injection system, ozone injection system, tank (to provide time for metals to oxidize), disk filter, sand filter, carbon filter, sodium meta bisulfite injection system, acid/sodium hydroxide injection system, dosing system antiscalant and finally cartridge filter if chlorine dosing and ozonation to water are used at the same time. The water enters the main treatment system (RO), after going through pre-treatment steps and creating suitable conditions for entering the RO device, and in this way, impurities are removed from it. The reverse osmosis treatment system flow diagram is as follows

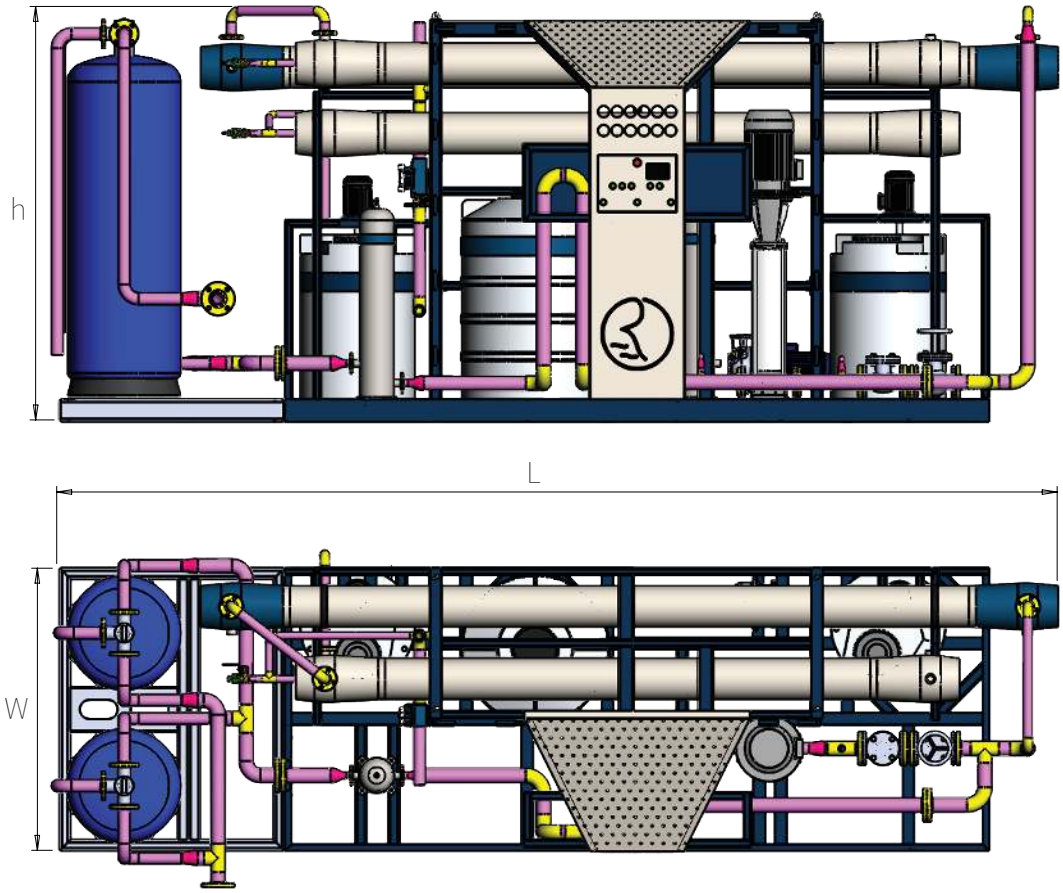


Water Containing Chemical/Biological Pollution

A suitable pre-treatment system should be considered which is effective in removing or reducing these parameters if the water entering the reverse osmosis treatment system contains chemical (COD/BOD), biological pollution and the concentration of heavy ions dissolved in should be optimal. This is done in order to reduce the chemical oxygen demand or biological oxygen demand of the water, and prevent damage to the RO membrane. Pre-treatment system equipment can include sand filter, carbon filter, and ultrafiltration system, water storage tank treated by ultrafiltration, acid/sodium hydroxide injection system, antiscalant injection system, and finally cartridge filter (it should be noted that in some circumstances, the chlorine injection system may also be added to this system). The water enters the main treatment system (RO), after going through pre-treatment steps and creating suitable conditions for entering the RO device, and in this way, impurities are removed from it. The reverse osmosis treatment system flow diagram is as follows.



Technical Specifications Of Reverse Osmosis Designed By ROMAN



Technical Data												
Flow Rate	m^3/h	2	5	10	15	20	25	30	35	40	45	50
TDS Input	ppm	500-3000	500-3000	500-3000	500-3000	500-3000	500-3000	500-3000	500-3000	500-3000	500-3000	500-3000
Recovery	%	60	60	75	75	75	75	75	75	75	75	75
Feed Pressure	bar	11-15	9-13	12-18	12-17	12-18	14-19	12-18	14-19	13-18	13-19	13-19
TDS Output	ppm	27	31.1	34	33.7	34	32.5	32	29	31	30.1	30.4
Length	m	4	4	6	6	6	7	5	6	5	6	6
Width	m	1.5	2	2	2	2	2	2	2	2	2	2
Height	m	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5

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PACKMAN GROUP
History

The Packman Company was founded in February 1975, and was soon afterwards registered in companies Registration Office. In early years the Packman construction and service branch focused on building installations. Different mega power plants were built by cooperating with Brown Boveri and Asseck companies in 1976.

The company started its official activities in construction of High-Pressure Vessels such as Hot-Water Boilers, Steam Boilers , Storage Tanks, Softeners and Heat Exchangers from 1984.

Packman Company is one of the first companies which supplied the high quality and standard hot water boilers to the customers.

Packman has exported its products to countries such as Uzbekistan, United Arab Emirates and other countries in the Middle East. It is one of the largest producers of hot-water and steam boilers in the Middle East.

Now we are proud to announce that the Packman industrial group has five major sub-brands that have product titles in all field of HVAC equipment and engineering services, and we do not know this success except with the help and support of our customers.

1. Construction Services Industry Association
2. Industry Association
3. Construction Companies' Syndicate
4. Technical Department Association
5. Mechanical Engineering Association
6. Engineering Standard Association

Departements:

Sales Deps:
- ∩ Power Plant & Petrochemical
- ∩ Industrial
- ∩ Hospitally Service
- ∩ Commercial & Residential
- ∩ Sport Complex & Pool

Technical Deps:
- ≡ Manufacturing R&D
- ≡ Innovation Center
- ≡ EPC Execute Unit
- ≡ Product Develop Unit
- ≡ Sales Engineering Dep.

Others:
- ≈ After Sales Service
- ≈ Project Control
- ≈ Financial Office
- ≈ Commercial Office
- ≈ Marketing Department



PACKMAN GROUP
Brands

PACKMAN
Industrial Group

Designer&manufacturer of Condensing, Hot Water, Steam, Hot Oil& Waste Heat Boilers, Heat Exchangers, Autoclave Pressure&Storage Vessels&etc

GREENMAN
Green mindset, green future

Engineering& Designing Commercial Greenhouse Plant, CO2 Dosing System, Flue gas Condenser& Special HVAC Systems, Sustainable Agriculture &etc

ROMAN
Water solution

Designer&manufacturer Reverse Osmosis Plant& Package, Water Treatment, Softener& Filters and Chemical Dosing Systems&etc

RAADMAN
a look to the future

Designer&manufacturer of Industrial Mono&Dual Block Gas, LPG, Light& Heavy Oil Burners, Premixed&Postmixed Burners, Watertube burners, Process burners, Special application burners&Combustion Solutions&etc

CHILLMAN
Coolest hvac around

Designer&manufacturer of Air&Water Cooled Chillers, Air Handling Units, Fancoil, HVAC Equipment, Cold Storage Room&etc




1. Isfahan Factory


2. Vilashahr Factory


3. Parand Factory


4. Parand (2) Factory


5. Bonyad Factory

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