

## SEA WATER DESALINATION

Bkg Uprava vody was initially established to design, manufacture and operate reverse osmosis system for various applications, however mostly for treatment of drinking and brackish water. Over the years the scope of products has been widened to diverse pre- and post treatment solutions and to desalination projects of seawater for hotels, resorts, island developments, industrial needs and marine applications.

Desalination is a process that removes dissolved minerals and salts from seawater, brackish water, or treated wastewater. A number of technologies have been developed for desalination, including reverse osmosis (RO), distillation, electro dialysis, and vacuum freezing; however the reverse osmosis systems and distillation have proved to offer best quality compared to its investment- and operational costs.

Desalination plants for seawater are typically fed directly from the ocean through offshore intakes and pipelines, from wells located close to the shore, brackish groundwater or reclaimed water. Brackish water has generally lower salt concentration and the initial cost of desalination is less than feeding the system directly from the ocean.

Our plants are completely fitted on a stainless steel frame including the pre- and the post-treatment. This allows us to speed up the installation and the initial placing into operation since the plant is delivered with all piping ready to start up.

Multimedia filter filled up with sand of different grain size in order to remove the impurities from the incoming water. Activated carbon filter is supposed to remove the organic substances.

Followed by ultra-violet plant which eliminates the amount of bacteria contained in each water source.

Metering station of antiscaling to prevent the precipitation of hardness on the reverse osmosis membranes.

Reverse osmosis plants work with membranes which let water through their pores but prevent passing through of dissolved solids. They are semi permeable. By separating a saline solution and pure water by such a membrane, clean water flows without force through the membrane into the saline solution and dilutes it. This process is reversed by exerting a pressure upon the higher concentrated solution,



on, pure water flows after surmounting the osmotic pressure through the membrane.

After exceeding the pre-programmed time in the control electronics the system will run recirculation through the UV plant in order to prevent the reproduction of bacteria in the storage tank. The RO system is rinsed using the permeate.

## Pre-treatment

Pre-treatment is necessary to remove suspended solids and other substances that would interfere with the desalination process. The feed is typically pre-treated in filtration plants and/or coagulation. One of the characteristics of seawater is high content of biological substances which are to be reduced by proper filtration system and metering sodium hypochlorite and sulphuric acid to reduce the typical alkalinity of sea water. Furthermore biocide may be required to limit the growth of algae and bacteria inside the membranes (in some countries forbidden if producing drinking water). UV and ozone light are also widely used techniques, metering chlorine solutions may be an option as well, however chlorine should be removed before entering the reverse osmosis system so activated carbon filtration has to be implemented in such cases. Metals widely present in sea water are rejected along with the salts by the membranes and are discharged in the brine. With normal concentrations for metals in seawater, the metals present in the brine discharge, though concentrated by the RO process, would not exceed discharge limits.



## Piping

All internal process low-pressure piping is Schedule 80 PVC and 3-part solvent welded. All piping is properly supported and bracketed with SS bolts and nuts. The high-pressure is 317 Schedule 80 stainless steel (standard design but others available upon request). All high pressure piping welds are argon backed TIG welded. The high pressure fittings are flanged, Victaulic or ferrule compression type. High pressure sensors and gauges are connected with non-metallic thermoplastic tubing. This space age tubing eliminates the corrosion and pitting failures associated with traditional stainless sensor tubing.



## Membranes

BKG Wassertechnik utilizes thin film, high rejection spiral wound membrane elements. We use Toray or equivalent seawater membrane elements. The membrane materials of construction are not subject to bacterial attack of hydrolysis at high or low pH conditions. The thin film spiral wound membrane selected offers high productivity and superior salt rejection, while being quite resistant to particulate fouling. Individual membranes are rated for 99.7% salt rejection under standardized operating conditions.



## Reverse osmosis

The typical recovery relative to input water flow is 50% maximum for most seawater plants. However, the percentage varies, in part because the particulars of plant operations depend on site-specifics. Typically thin film, high rejection spiral wound membrane elements are used together with corrosion resistant filament wound fiberglass pressure vessels.

Desalination plant components must be cleaned to reduce scaling -a condition where salts deposit on plant surfaces, such as pipes, tubing or membranes. Scaling is caused by the high salt concentration of seawater and can result in reduced plant efficiency and corrosion of the pipes. In general, scaling increases as temperature increases; thus scaling is of greater concern for distillation plants, since RO plants require lower temperatures to operate. Scaling can be reduced by introducing additives to inhibit crystal growth, reducing temperature and/or salt concentrations, removing scale-forming constituents, or seeding to form particles. Once scales have formed, they can be removed with chemical or mechanical means.



Advantages of RO plants over distillation include: RO plant feed water generally does not require heating, so the thermal impacts of discharges are lower; RO plants have fewer problems with corrosion; RO plants usually have lower energy requirements; RO plants tend to have higher recovery rates-about 45% for seawater; the RO process can remove unwanted contaminants, such as trihalomethane-precursors, pesticides, and bacteria; and RO plants take up less surface area than distillation plants for the same amount of water production.

BKG Uprava vody build systems comprised of the finest components which result in the most reliable, efficient and cost effective machines available. Our customer satisfaction is a proof of our foregoing claim.



## Safety devices

Monitoring devices are provided to prevent damage of components due to improper operation and/or equipment as follows:

- The high-pressure pump is protected from low suction pressure conditions by a pressure switch in the suction line. The pump will not start until the pressure is sufficient to satisfy the required suction condition. At low pressure conditions the unit will shut down, an alarm will sound and visual indication of the fault will illuminate on the control panel.
- The high-pressure pump and the rest of the system are also protected from excessive high pressure by a high-pressure switch. In the case of excessive high pressure on the discharge side of the pump the unit will shut down, an alarm will sound and visual indication is provided on the control panel.
- The product water quality is monitored and controlled by a conductivity instrument. If the conductivity rises above the pre-set point indicating excessive TDS in the product, the product diversion valve will divert product to waste and the panel indicates "High Product Conductivity" only. If this condition exists for a pre-set time, the system will shut down and an alarm will sound. Continuous product quality is indicated on the control panel.
- A rupture disc is provided on the product line to prevent possible damage to the membranes due to excessive back pressure.
- A rupture disc is also provided on the feed water supply line to protect the low pressure equipment from pressure surges or over pressurization

## Control electronics

A centralized control center is provided which controls the operation of:

- Supply pump
- Pre-treatment chemical injection pump
- Reverse osmosis high pressure pump
- Ancillary Components
- Post-treatment chemical injection pumps
- Levels of the permeate storage tank
- Permeate pump station
- 2 conductivity meters
- pH controller to adjust and control dosing pump for permeate

As standard, all motor controls, transformers, alarms, indicators, fuses, etc., are housed in a VDE approved switch board panel. Local controls are rated NEMA 4X. All motors are TEFC and epoxy coated for tropical (high humidity) applications. The RO system's control circuit will be based on conventional relay logic in lieu of a PLC system because of its greater reliability in the high humidity conditions normally encountered at a seawater facility in the tropics. All control circuit wiring is tinned copper stranded conductors. All electrical components meet or exceed NEMA and NEC code requirements. The power supply to the Control Center is to be 400 V/3 Phase /50 Hertz.

We will provide 1 3kVA 400/24V transformer for control power.

Motor of sea water high pressure pump start will be with drive to protect membranes against pump hammers and telescoping.

