



De Nora SEACLOR[®] Seawater Electrochlorination System

Reliable, Safe, Easy Operation

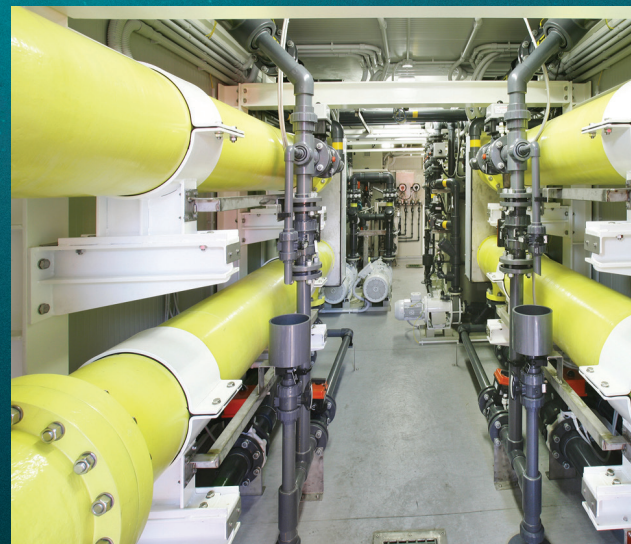


A Marine Biofouling Control Solution
for Coastal Installations



As the world leader for seawater electrochlorination technology for 40+ years, De Nora has more than 1200 installations in 60 countries, producing over 1.3 million kilograms per day of sodium hypochlorite from seawater, equaling 60-70% of the world capacity.

De Nora SEACLOR seawater electrochlorination systems use a simple and straightforward process, combining two common consumables – seawater and electricity to produce sodium hypochlorite to address the marine biological growth challenges of water intakes for coastal installations. Along with electrolytic cell assemblies of modular construction combined in an electrical and hydraulic series, SEACLOR systems are edged with electrodes coated with De Nora's patented DSA formulas for varying water temperatures and chloride concentrations from seawater.



WHY SEACLOR SYSTEMS

1

Unique Design / Advanced Engineering

- Electrolytic cell assemblies of modular construction combined in electrical and hydraulic series
- Capacity up to 28,800 kg/day and above
- Customized layout to meet site-specific requirement

2

Reliability / Equipment Longevity

- De Nora's patented DSA electrodes for varying water temperatures and chloride concentrations
- Long cell operating life of at least 5 years with minimal downtime
- Safe hydrogen removal process

3

Easy to Operate and Maintain

- Simple proven process with two common consumables seawater and electricity to eliminate the purchase, handling and storage of hazardous chemicals
- Designed and assembled for continuous and unattended operation requiring minimal monitoring

4

Superior Biofouling Control

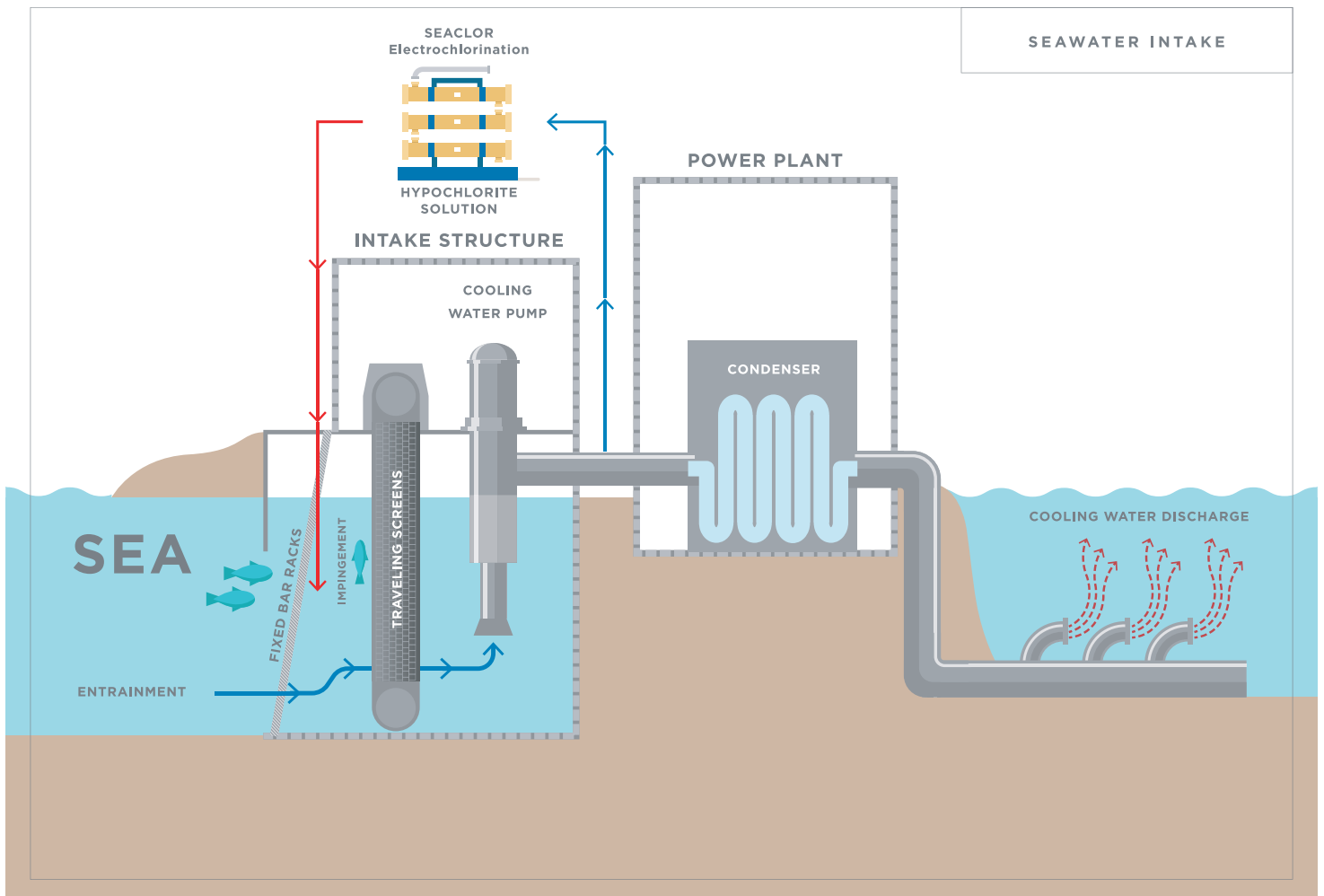
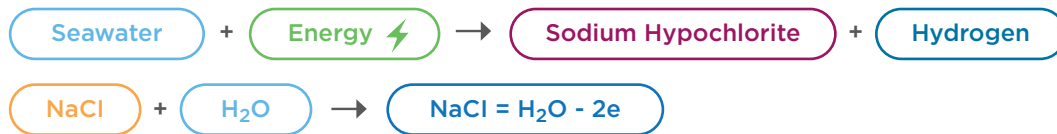
- Preferred electrochlorination system for biofouling control
- Effective and reliable treatment in hazardous marine/corrosive environments
- Up to 2000 mg/L of chlorine concentration depending on project conditions



HOW SEACLOR® SYSTEMS WORK

Pressurized seawater is delivered to the SEACLOR system where it is strained to remove suspended solids larger than 0.5mm. The seawater passes through a flow control assembly, then the electrolyzer cells and exits as sodium hypochlorite solution. This two-phase solution is piped to a tank or hydrocyclone where hydrogen gas is removed. Finally, the sodium hypochlorite solution is injected at the required continuous and/or shock-dose rates. The whole process is based on the electrolysis of seawater as it flows through an unseparated electrolytic cell.

Chemical Reaction



ELECTROLYZERS TO FIT DIVERSE APPLICATIONS

SEACLOR electrolyzers consist of electrolytic cells of modular construction. They are combined electrically and hydraulically in series and fastened together to form an electrode assembly, placed in a cylindrical electrolyzer body.

The electrode package can be inserted or removed from the electrolyzer body in short time for easy replacement without any special tool or specialized mechanics. The electrolyzers operate under constant seawater flow rate while the D.C. current is adjusted so that the generation of hypochlorite matches the water treatment demand.

SEACLOR Benefits

- Simple vessel-electrode connections for easy maintenance/replacements
- Operate under constant seawater flow rate
- Bipolar anode/cathode design
- DSA anode with Titanium-base material from in-house automated spray coating



SEACLOR Model Examples:

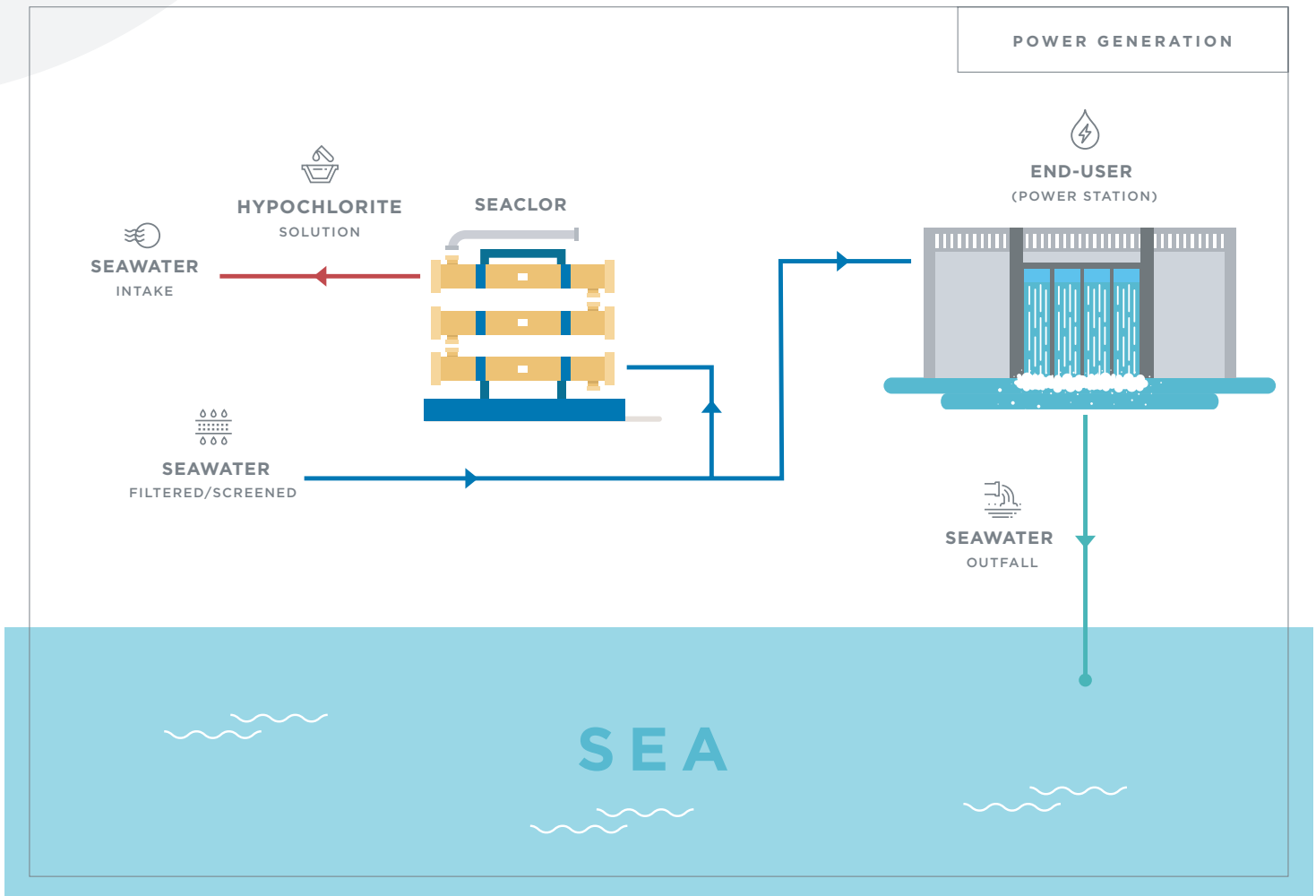
Seaclor® Model	Production Capacity (kg FAC/h)	Amount of Seawater to be treated at 2000ppm (m³/h)	Output FAC Concentration (ppm)	Required Seawater Flowrate (m³/h)	AC KVA*
4H6.100	20	10,000	1,500	13.3	125
3HX.100	50	25,000	2,000	25	310
3HX.200	75	37,000	2,000	37.5	460
4HX.375**	250	50,000	2,000	50	615

All values based on seawater temperature of 25°C and a concentration of 18.980 ppm of chloride.

*Values may vary depending on the rectifier efficiency.

**This list is not exhaustive. Please contact De Nora for your desired capacity.

TYPICAL APPLICATIONS & MARKETS

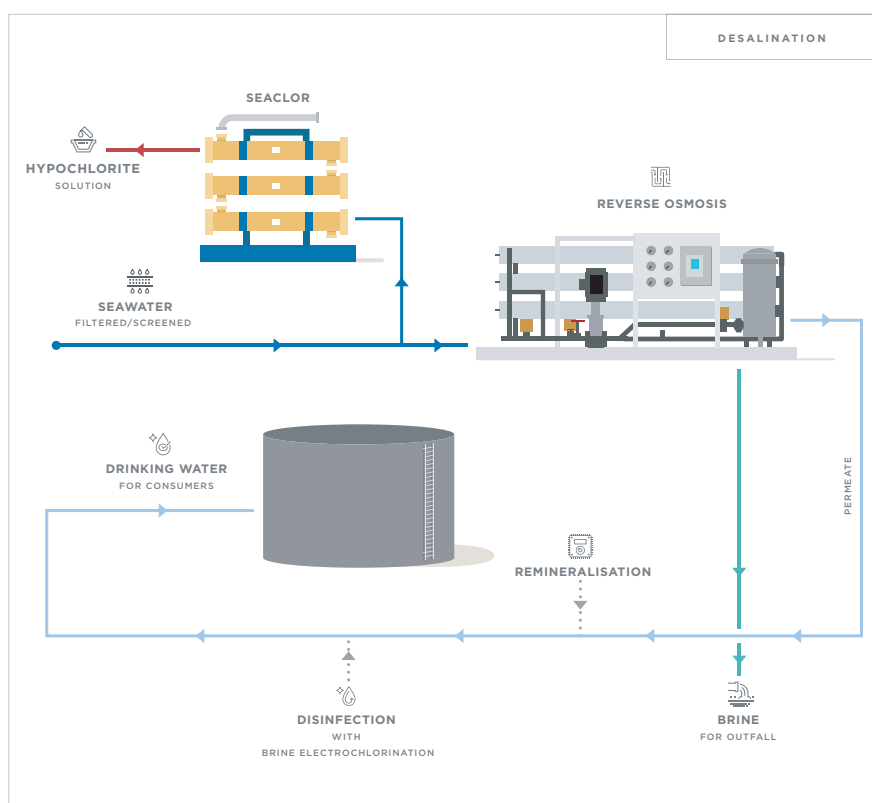
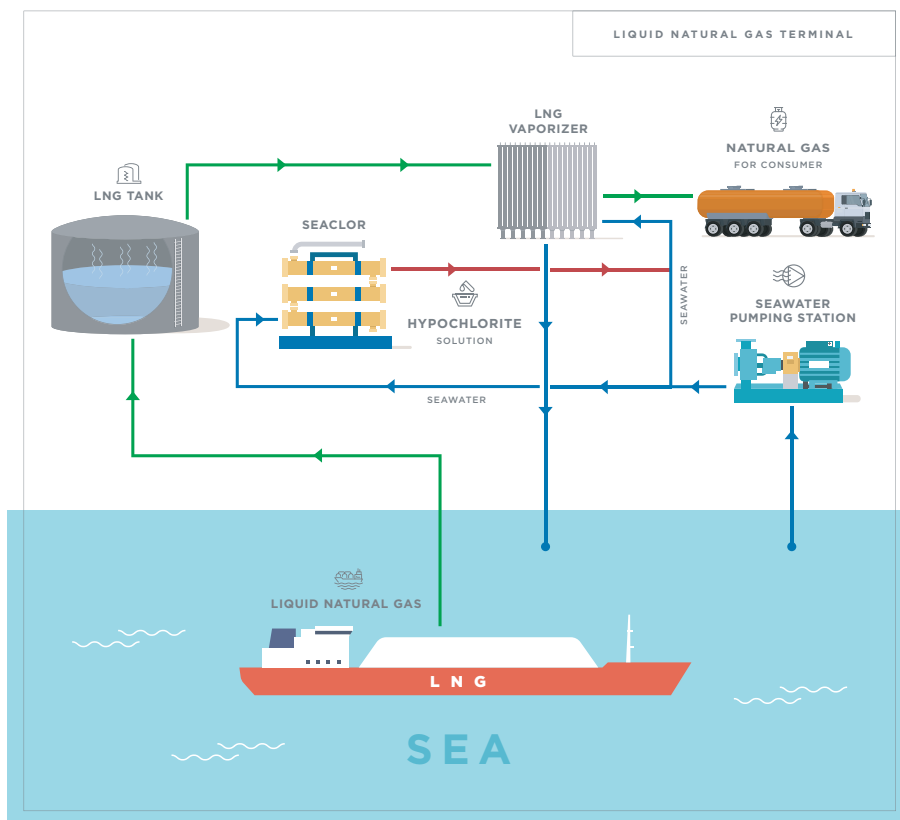


Power Generation, Oil & Gas and Petrochemical installations

Thermal power plants powered by either fossil fuel or nuclear energy, Oil & Gas and Petrochemical installations located along a seacoast normally use seawater as the coolant in their processes of cooling water systems. Sodium hypochlorite generated by seawater electrochlorination systems is generally injected at the intake structure and basin to control biological growth and fouling to keep the high efficiency of their operations.

Liquid Natural Gas (LNG) Terminals

The most common means of transportation of LNG is by ship. LNG must go through a liquefaction process prior to loading where chlorinated seawater is used as the cooling media. After unloading, seawater needs to be chlorinated and used for the heating process for regasification.



Desalination Plants

For a typical desalination plant, sodium hypochlorite generated from seawater is injected in the intake structure and protects the equipment from organic fouling. After the desalination plant, sodium hypochlorite generated from brine is injected to achieve the desired chlorine residual. Additional brine-based electrochlorination plants are added at each pumping station to maintain the residual chlorine as the drinking water moves through its distribution system.

AFTERSALES AND SERVICES DELIVER EXCELLENCE TO YOUR SEACLOR EQUIPMENT

At De Nora, we are strongly committed to providing aftersales and service support for our SEACLOR equipment and similar competitive equipment.

A variety of aftersales solutions are offered to reduce maintenance requirements and extend the life of your De Nora equipment.

Commissioning and start-up

Emergency repairs

On-site supervision

De Nora VIA remote service support

Long-term maintenance agreements (OPEX or CAPEX)

Spare/obsolete parts support

Proactive & preventive system health check

Automation and performance upgrades

Onsite & offsite equipment & maintenance training

Asset management

Performance audit / Retrofit planning / Quarterly partnership review

