dioxide
PACIFIC

Electricide® HG
Electrochemical
Chlorine Generators

electricide
Cl_2

Chemical Reactions – Electrochemical Cl_2 Production:
① Anode (oxidation): $2Cl^- \rightarrow Cl_2 + 2e^-$
② Cathode (reduction): $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$
① + ② (combined) $2Cl^- + 2H_2O \rightarrow Cl_2 + H_2 + 2OH^-$

Sodium Hypochlorite from Chlorine Gas
$Cl_2 + 2NaOH \rightarrow NaCl + NaOCl$

WHAT IS ELECTROCHEMICAL GENERATION?

Chlorine is available in a variety of forms:

- Chlorine gas in 70kg or 920 kg drums
- Sodium hypochlorite (bleach) solution
- Calcium hypochlorite granules

There are safety concerns with the storage and handling of chlorine gas. Commercial high strength (12.5%) sodium hypochlorite degrades quickly in storage to form chlorate and oxygen. Calcium hypochlorite requires specialized equipment for metering the solid product to obtain accurate dosing control and contains up to 35% impurities. The Electricide® electrochemical chlorine generators use only one precursor chemical: Salt (NaCl) and electrical energy to create chlorine. The Electricide® generator includes an electrochemical cell which has an anode (+) and cathode (-) side. Electrical current is applied to the cell electrodes where oxidation and reduction reactions occur. Oxidation at the anode electrode converts chloride ion (Cl^-) to chlorine (Cl_2). Reduction at the cathode converts water to caustic (OH^-) and hydrogen (H_2). If chlorine gas dosing is desired, this is dosed directly from the generator. If sodium hypochlorite solution is desired, caustic catholyte and chlorine gas are mixed in solution to form sodium hypochlorite. Hydrogen is diluted with air and vented to atmosphere.

GAS (G TYPE) OR SOLUTION (S TYPE)

Chlorine produced in the recirculating anolyte loop of the Electricide® generator is extracted using a gas separator column with a small quantity of air. Many sites store chlorine gas in cylinders or drums but have concerns about the risk of storing large quantities of liquified gas and the consequences of an uncontrolled leak. The Department of Homeland Security has onerous regulations governing the use and management of chlorine gas storage. The Electricide® type G generator has been designed for replacement of liquified chlorine gas storage. For dosing into water systems, injection of chlorine gas is via a booster pump and ejector. If the Electricide® generator is replacing a gas chlorine storage system, the existing booster pump and ejector can be re-used. For applications which require liquid dosing, the Electricide® S type generator is ideally suited. In the generator, pure chlorine gas is extracted and dissolved into caustic (NaOH) catholyte in a solution tank at nominally 2-30 g/L (as NaOCl). The generator is equipped with a control system for automatic actuation of up to three (3) dosing pumps. It is possible to use the Electricide® generator as a central depot for sodium hypochlorite to distribute it accurately under PID Residual, Flow Paced, Flow Paced Residual Trim or Manual control.

HIGH PURITY AND LONG STORAGE LIFE

Potable water, food and beverage applications require the highest level of chlorine purity. The Electricide® generators produce pure chlorine gas. No other impurities such as chlorate, chloride or sodium are included with the gas.

Other electrolytic chlorine generators produce sodium hypochlorite without gas separation and at less than 80% conversion. The resultant hypochlorite mixture contains unreacted sodium and chloride with high concentration of chlorate ion. Degradation of the stored hypochlorite solution is fast. The Electricide® generator separates chlorine gas from the anolyte mixture to subsequently dissolve into caustic catholyte. Chemical conversion to chlorine is greater than 85% and chlorate concentration in the sodium hypochlorite is extremely low. Since sodium hypochlorite purity is high, degradation in storage is very slow.

EVERYTHING INBUILT

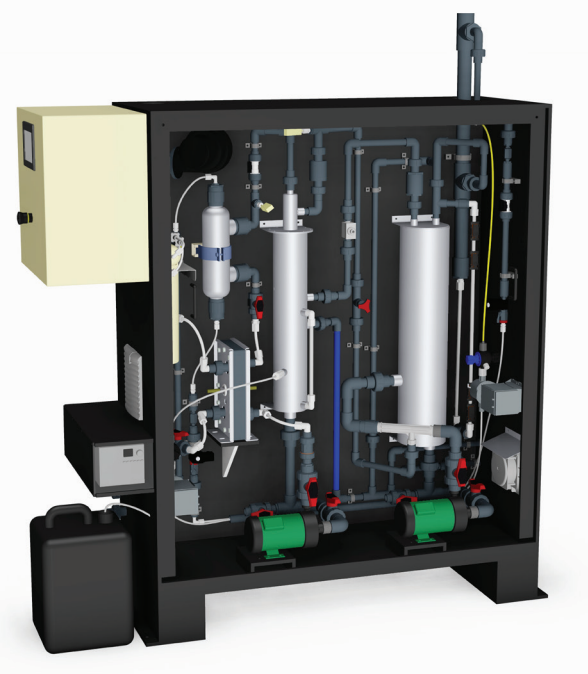
The Electricide® generator is modular with all components mounted in a cabinet. The system is fully wired and piped and arrives ready for connection to site utilities. Operation is controlled via PLC and HMI and remote internet access is standard.

HGB GENERATOR FOR SMALL CAPACITY GENERATION

The Electricide® HGB-2.5 generator has a capacity of 47 g/hr = 2.5 lb/day (as Cl_2). This model was developed to meet the requirements of food and beverage production, small cooling towers and water disinfection circuits. All internal components are mounted on a floor standing HDPE frame with splash shield, central electrical control panel, PLC, HMI and level controlled solution tank. Sodium hypochlorite solution is produced at 2 g/L to be dosed to one or multiple dosing points. Dosing control is added as required by ident code selection.

SYSTEM IDENT CODE SELECTION

Base model and options are selected via an ident code for the HG and HGB generators. Selection can be done interactively at our website: http://www.dioxide.com/products/chlorine/
Press on the button OBTAIN TECHNICAL INFO & QUOTATION. If you follow the prompts, you will immediately be emailed a specification for the chosen generator and a quote.



HGB-2.5 GENERATOR

Generator Models Available

Model	Description	Capacity (as Cl_2)
HGB-2.5	• HDPE cabinet. • All components mounted inside enclosure. • 12 L = 3.2 Gal solution tank. • Polycarbonate splash shield. • Control panel with 7 inch color touchscreen. • Optional control of three NaOCl solution dosing pumps. PID, Flow Paced, FPRT, Manual control selection. • Remote internet access standard via 4G router. • Type G or Type S	47.2 g/hr = 2.5 lb/day
HG-10 HG-25 HG-50 HG-100 HG-200 HG-300 HG-400 HG-500 HG-600 HG-700 HG-800 HG-900 HG-1000	• HDPE cabinet, 27 L = 7.1 Gal solution tank. • All components mounted inside skid frame • Titanium or PE solution tank. • PVC drip tray with drain. • PVC side and top covers. • Control panel with 7 inch color touchscreen. • Standard control of three NaOCl solution dosing pumps. PID, Flow Paced, FPRT, Manual control selection. • Remote internet access standard via 4G router. • Web camera. • Type G or Type S	189 g/hr = 10 lb/day 472 g/hr = 25 lb/day 945 g/hr = 50 lb/day 1,890 g/hr = 100 lb/day 3,780 g/hr = 200 lb/day 5,682 g/hr = 300 lb/day 7,576 g/hr = 400 lb/day 9,470 g/hr = 500 lb/day 11,364 g/hr = 600 lb/day 13,258 g/hr = 700 lb/day 15,151 g/hr = 800 lb/day 17,046 g/hr = 900 lb/day 18,900 g/hr = 1000 lb/day

Dioxide Pacific Electricide® HG Electrochemical Chlorine Generator

FEATURES AND BENEFITS

FEATURE	BENEFIT	WHAT THIS MEANS FOR YOU
High purity chlorine production. Sodium hypochlorite solution produced contains lowest concentration of sodium, chloride and chlorate.	Other electrolytic chlorine generators produce hypochlorite solution with unreacted sodium chloride and high chlorate. Chlorate is not desired in potable water and chloride is a contributor to corrosion of stainless steel. The Electricide® HG generator produces no additional chloride, chlorate, sodium to cause contamination to your product or process. Low chloride means low risk of stainless steel corrosion.	You can safely use chlorine generated from the HG generator in your food or potable water process with no fear of contamination or addition of unwanted chemicals or by-products. Risk of corrosion to stainless steel will be reduced.
Low chlorate concentration in sodium hypochlorite	Commercial bleach (120 g/L NaOCl) can contain 1.5 g/L chlorate ion. Hypochlorite degrades quickly with respect to pH, temperature, hypochlorite concentration and contamination with impurities. The HG generator produces sodium hypochlorite at 2-30 g/L with very low chlorate and no other impurities. Degradation in storage is very slow.	You can be confident that addition of chlorate to your potable water process will be minimized with the HG generator.
Only one precursor chemical required: Salt (NaCl)	You only need to handle one non-hazardous chemical. No chlorine gas storage. No bleach storage.These storage and handling risks are removed.	You will have the lowest possible safety risk related to chemical storage and handling.
High precursor conversion to chlorine.	The HG generator chemical efficiency is is greater than 80%. High conversion is related to the efficient HG cell design using membrane separation of anolyte and catholyte.	You can expect low running cost.

FEATURE	BENEFIT	WHAT THIS MEANS FOR YOU
Production of caustic is part of the HG type G generator process.	When producing chlorine gas, 10-15% sodium hydroxide is produced as a by-product. This can be dosed into your process for pH control, used for cleaning or disposed to sewer.	You get pure sodium hydroxide free of charge from the HG process.
Inbuilt safety interlocks to maximize safety.	Flow, pressure, temperature, current monitoring of critical processes with high and low alarms will shut down the generator	The HG generator has been looked at from a risk assessment and HAZOP perspective and engineering controls put in place to minimize risk.
The HG generator comes complete "cabinet mount". All components are mounted, plumbed and wired in an enclosure, ready to ship, install and operate.	Transportation to site and installation is easy. Just connect water, power, salt (NaCl) and control signals in; chlorine gas/sodium hypochlorite solution out and you are ready to run.	With relatively small involvement from mechanical and electrical trades, the HG generator can be installed and running in a short time. Your process can be disinfected and ready to use quickly.
All mounting components used are chemically resistant to chlorine. Materials include UPVC, Vinylester, PVDF, PTFE, Viton and Kynar.	Unlike other systems which use steel cabinets and fasteners (which are subject to corrosion), the HG generator uses more expensive components which are 100% chemical resistant. The frame, fasteners and pipe clamps are all from chemically resistant materials.	The HG generator will look new and operate reliably (without corrosion failure) many years after installation. The value for money will be realized as you see the low lifetime cost of ownership.
PLC controlled system with touchscreen HMI.	All items are controlled from a central PLC and the touchscreen provides an operator friendly way to view plant operation and status. Fault finding is simple.	It is easy to train operators and they will feel comfortable operating the plant. All the information you need and configuration capability is available at the HMI.
Inbuilt calibration cylinder for salt dosing pump.	The Electricide-B1 Dosing pump can be properly calibrated so that dosing is accurate and consumption of salt minimized.	You can view and accurately control the chlorine concentration produced and the amount of chlorine generated.
Inbuilt control modes: Flow Pacing; PID Residual Control; Flow Paced with Residual Trim; Manual Dosing.	Flexibility of control for whatever your process requires. For make-up to a cooling tower or to a water tank you can use flow pacing and dose into the make-up line. For a recirculating tank, you can use PID Residual Control. For potable water disinfection, you can use Flow Paced with Residual Trim.	Your process control scenario can be handled within the HG generator and the HMI will provide you with the necessary feedback signals for verification.
Three dosing pumps can be independently controlled from the HG generator.	The hardware and software control for three dosing points is built into the HG generator.	You can quickly realize payback on your investment by using chlorine in many applications on site. Just add dosing pumps and you can get going. No need to have your own PLC control system, the HG generator has it built in.

Electricide® Chlorine

SYSTEM SALES

Please contact us regarding your needs. Our staff of experienced engineers will assist you to correctly select a generator to suit your application.

INTEGRATION AND INSTALLATION

Having the correct unit is only half the equation.
The other half is correctly integrating the unit into your process. General Arrangement (GA) drawings, electrical wiring schematics, operation and maintenance manuals are provided to enable correct installation and operation of the generator.

In most cases, you can commission the generator using the information provided. If you need assistance, our technicians can provide remote or site support.

SUPPORT

Dioxide Pacific personnel and distributors will provide support throughout the lifetime of the unit. From the initial inquiry and unit selection through to operating questions over the phone, remote internet monitoring (with email alarms), scheduled preventative maintenance and precursor chemical supply, Dioxide Pacific is your partner in the disinfection process.

dioxide PACIFIC

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