

**PRODUCT INFORMATION AND FEATURES (180 – 1,100 Kg/Day)**  
**Microclor™ On-Site Hypochlorite Generation System**

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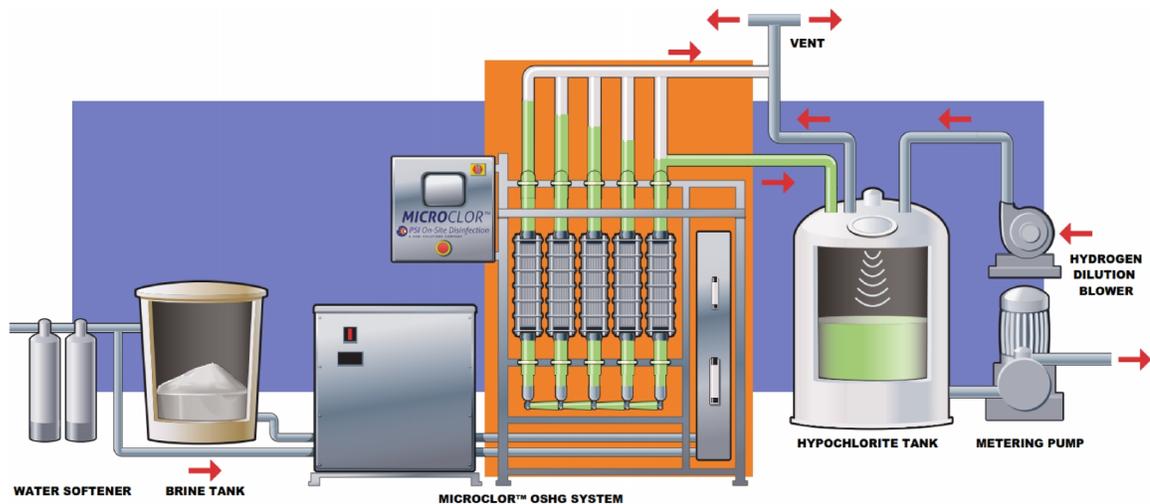
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## A. PROCESS DESCRIPTION

A packaged on-site generation system will be provided that will manufacture a  $0.8\% \pm 0.05\%$  solution of sodium hypochlorite ( $\text{NaOCl}$ ) to be used as a disinfectant using salt, water and DC current. Equipment required for on-site hypochlorite generation includes consist the following major components (Fig. 1):

- One (1) Microclor™ OSHG system including a programmable logic controller (PLC), rectifier, cells, brine pump, and hydraulic control equipment
- Water softener
- Brinemaker with makeup water solenoid valve, brine liquid level pressure transducer or switch, and remote display for both sensors
- Hypochlorite storage vessel(s) with ultrasonic level controls
- Chemical metering pump(s)
- Cast aluminum blower(s) with current and air flow switches



**Figure 1.** Diagram of the Microclor™ process showing the placement of the ancillary equipment relative to the Microclor™ system process skid.

The patented Microclor™ system works by feeding softened water into the brine tank to form a saturated salt solution. This brine solution is pumped via a gear pump to a stream of softened water and diluted to approximately 3% salt concentration (a 10:1 ratio of softened water to concentrated brine). This 3% brine solution is fed into the electrolytic cells. DC current from the rectifier is applied to the electrolytic cell, and the brine solution is converted to a 0.8% concentration of sodium hypochlorite. During this conversion, a small amount of hydrogen is produced by the electrolytic process. This hydrogen is released safely through a vent pipe at the top of the electrolytic cell. The small amounts of hydrogen gas are further diluted at a minimum ratio of 100:1 using a dilution air blower which reduces the hydrogen concentration to less than 25% of the Lower Explosive Limit (LEL) of hydrogen gas.

The Microclor™ system under normal operation is designed to automatically start and stop sodium hypochlorite production based upon the storage tank level. The PLC will function to monitor the hypochlorite level sensor. When the level reaches a preset low level point, a signal is sent to the OSHG controller to turn the generator on. Generation will continue while the OSHG controller continually monitors the storage tank level sensor. When the tank is full, and the high level point is reached, the Microclor™ system will cease generation. The system will then remain in standby mode, continuously monitoring the tank level until a low level is reached.

A variable speed pump alters cell feed rate of the brine, or electrolyte, solution, based on signals from the PLC and a current transducer. This operational strategy allows the Microclor™ system to vary the electrolyte solution conductivity so as to indirectly provide constant current. This philosophy eliminates expensive electronics that would otherwise be necessary to operate in a less reliable fashion.

Instrumentation is included to continuously monitor operational permissives during generator operation (airflow, current draw, water flow, flooded cells, and temperature). If any permissive times out, generator operation is interrupted. If the fault clears, generator operation is again called to run. If the fault reoccurs three additional times, the generation system is shut down and an alarm condition is sent to plant SCADA.

## **B. MAJOR SYSTEM COMPONENTS**

The Microclor™ On-Site Hypochlorite Generation System is pre-assembled, piped, wired, and factory-tested prior to shipping to the job site. Following are the major system components. **Additional details are provided in our equipment specifications.**

### **1. Electrolytic Cells**

The transparent acrylic design of the electrolytic cells provides quick visual indication of operation and condition. Each cell shall include Viton flexible couplings for quick disconnect an optical level switch, and a temperature switch or sensor. A cell spool is provided for installation should a cell need to be removed for maintenance or replacement. On systems using five electrolytic cells in series, 80% of the total generation capacity can be achieved when one cell is removed.

### **2. Rectifier**

The transformer rectifier uses an innovative design that eliminates the need for the outdated and unreliable switching rectifier or phase angle fired SCR voltage correction technology.

### 3. Brine Pump

The brine pump supplies a saturated salt solution to a stream of softened water for further dilution. Reliable brine feed is required for precise control of solution concentration. The pump flow rate is controlled automatically via an analog output.

Parameter	Value
Type	Gear
Material (Housing/Gears/Seals)	316SS/PPS/PTFE
Drive Type	Electromagnetic

### 4. Hydrogen Dilution Blower

A critical component of the enhanced safety system, the blower is provided to dilute the hydrogen gas byproduct. The blower is shipped loose for installation adjacent to the hypochlorite storage tank and arranged such that the tank will be under positive pressure. All air from the blower and any fumes from the hypochlorite will be vented outside the building.

Parameter	Value
Fan Type	Pressure Blower
Wheel Type	Radial
Material	Cast Aluminum
Drive Type	Direct
Motor Type	TEFC

### 5. Water Softener

A dual-tank automatically-regenerating water softener treats the water supply prior to entering either the brine tank or the electrolytic cells. An adjustable water meter will monitor the processed volume and initiate system regeneration. A flow-based hydraulic control valve operates all functions of the softener, eliminating the need for any electrical connections.

Parameter	Value
Material (Media Vessel)	Fiberglass-Wrapped Polyethylene
Media	Non-solvent Cationic Resin
Regeneration Type	Countercurrent
Outlet Hardness as CaCO <sub>3</sub> (Max.), gpg	0.5

## 6. Brine Tank

A tank is used for salt storage and brine production. Both manually- and pneumatically-filled tanks are available. Brine tank water makeup is controlled by a level sensor or switch. Pneumatically-filled tanks use a stainless steel salt fill tube, dust collection assembly, and salt level indicator. Depending on the tank dimensions, top and/or side access manways and a ladder with safety cage may be necessary to facilitate inspection.

## 7. Hypochlorite Tank

Hypochlorite storage tanks are sized for a specific amount of hypochlorite based on the peak generator capacity and project requirements. An ultrasonic level transmitter or pressure transducer continuously monitors the liquid level, initiating and ending operation of the generator. Hypochlorite fill, supply, drain, overflow, dilution air, and vent piping connections are typically included in the tank design. Depending on the tank dimensions, top and/or side access manways and a ladder with safety cage may be necessary to facilitate inspection.

## 8. Hypochlorite Metering Pump

A metering pump supplies disinfectant to the process from the hypochlorite storage tank. Reliable hypochlorite feed is required for precise control of chlorine residual. The pump flow rate is controlled automatically via 4-20 mA input signal sent to a variable frequency drive. Typical pump accessories are a calibration column, back pressure valve, pressure relief valve, pulsation dampener, wye strainer, and pressure gauge.

## 9. Electrical Control Panel

The Microclor™ On-Site Hypochlorite Generation Feed System includes a complete, pre-wired, PLC system. If the controls are remote mounted, a local junction box is provided on the generator system equipment skid.

The control system is designed to function using the power supply available at the installation site.

The PLC system, as a minimum, shall have the following interfaces and features:

- Programmable logic controller with color touchscreen HMI
- Ethernet communication
- “Water Solenoid Status” display
- “Brine Solenoid Status” display
- “Blower Status” display
- “Rectifier Status” display
- “Cell Level Alarm Status” display
- “Blower Differential Pressure Alarm Status” display
- “Blower Current Switch Status” display



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- “Cell Temperature Alarm Status” display
- “Hypochlorite Tank Level” display
- “Cell Amperage” display
- “Cell Temperature” display
- “Cell Flowrate” display
- “Brine Pump Manual-Auto” selection
- “Brine Pump Speed” display and manual adjustment
- “Emergency Stop” pushbutton

## 10. Instrumentation and Miscellaneous Accessories

The on-site hypochlorite generation system shall include the following instrumentation and accessories:

- Water and brine rotameters
- Water and brine makeup solenoid valves
- Water flow sensor
- Cell Temperature Sensor and Switches
- Blower current sensor
- Blower differential pressure switch (shipped loose)
- Stainless steel open frame equipment skid

Depending on project constraints or customer requests, the following optional instrumentation and accessories, all of which will ship loose, may be available or required:

- Heat exchanger
- Water chiller
- Hypochlorite dilution panel with a magnetically-driven pump, rotameters, flow control valves, and venturi eductor
- Acid cleaning system
- Hydrogen detector
- Water hardness monitor
- Chlorine analyzer

## **C. SYSTEM FEATURES & ADVANTAGES**

The Microclor™ On-Site Hypochlorite Generation System offers maximum value measured by performance and reliability as well as capital, installation, maintenance, and operating costs. This is illustrated by the following system advantages:

### **1. Passive Hydrogen Removal for Superior Safety**

Cells are configured in a vertical format with a recirculation loop for each cell that allows for optimized brine utilization and passive release of the hydrogen gas from each cell. Hydrogen gas is not allowed to pass from cell to cell. This design radically increases operator safety and substantially reduces the possibility of hydrogen gas build-up in the cell and the potential of catastrophic failure. Removing the hydrogen immediately from each cell eliminates the blinding of the electrodes by gas bubbles.

### **2. Brine Conductivity Control Optimizes Salt Efficiency**

Constant current is achieved via a current feedback loop where the brine pump speed is controlled by the system programmable logic controller. This feedback loop accounts for variations in temperature, conductivity, and water flow. The titanium, Teflon impregnated gear pump is attached to a variable speed drive that continually provides a consistent blended electrolyte flow to the cells maximizing salt efficiency.

### **3. Indirect Constant Current**

An active feedback loop which very slightly adjusts the brine flow rate achieves constant current in an indirect fashion. This innovative operational strategy eliminates the excessively high failure rate seen with forty year old switching rectifier or phase angle fired SCR voltage correction technology.

### **4. No Cell Internal Baffles or Gaskets**

The electrolytic cells consist of thirteen internal bipolar electrodes. All anodic surfaces are coated with DSA catalytic coating. The design of the cell precludes the need for wet D.C. cable connections. There are no internal cell baffles, gaskets, or fasteners found inside the cell. The cells are built with clear acrylic guides that support the internal bi-polar plates and allow for direct visual inspection of the plates.

### **5. Easy Access for Maintenance**

The Microclor™ On-Site Hypochlorite Generation System is skid-mounted. The stainless steel skid construction provides superior structural strength while electrolytic polishing ensures ultimate passivation, chemical compatibility, and corrosion resistance. Use of an open frame design for the skid and a simple

equipment layout facilitates access to each system component from multiple sides for easy inspection and maintenance. The vertical cell design allows for the cell to easily be removed from the cell carrier piping by simply breaking two coupled connections. This makes for simple cell maintenance and/or replacement. Custom-designed skid configurations and equipment layouts are available.

**6. Reliable Performance and Robust Construction**

The robust construction of the Microclor™ On-Site Hypochlorite Generation System allows the electrolyte feed, cells, power supply, controls, and monitoring components to be subjected to minimum stress, lowering maintenance requirements.

**7. Factory-Tested**

Each system is pre-assembled, piped, and wired at the factory, allowing for thorough factory-testing of not just each component, but of the entire system prior to shipment. At a minimum, a factory quality control technician shall operate and calibrate the brine feed pump, verify calibrations for the instrumentation, and test the complete control system prior to running the unit in automatic mode for a minimum of four hours.

**8. Minimum Installation Cost and Time**

Most parts for the Microclor™ On-Site Hypochlorite Generation System are inventoried at the factory, reducing lead times. By skid-mounting the system, installation is quick and straightforward, with minimum time and cost. Water line, brine feed, hypochlorite solution, and electrical connections are all predetermined and are clearly indicated.

**9. Proven Track Record**

The Microclor™ On-Site Hypochlorite Generation System has been in production for over ten years. This system is a fully-developed, mature product supported by an extensive list of successful installations.