

## GENERATOR SYSTEM SPECIFICATIONS CONTINUED

The chlorine dioxide generation equipment shall be capable of automatic shut down and alarm due to the following failures: 1) Hi or Lo flow of chlorine gas; 2) Hi or Lo flow of sodium chlorite; 3) No ejector water flow; 4) Low level in sodium chlorite day tank (Input from user provided switch); 5) Chlorine Dioxide production Rate/Set Point Deviation.

A control panel shall be furnished with the chlorine dioxide system which shall indicate failures as noted above. The system will not shut down unless the failure is present for a preset delay period, thereby preventing an inadvertent shut down due to a momentary out of parameter situation. The Control Panel shall produce a common failure alarm for connection to a PLC.

The electrical control module enclosure shall be of NEMA-4X construction. Generator system shall operate on a 120VAC, 60Hz power source.

The major generator components shall be:

- Visual flow meters for precursor chemicals
- Vacuum producing ejector
- Patented<sup>1</sup> Tuned reaction column
- Inlet water flow meter
- Chlorine dioxide sampling port
- Chlorine dioxide sight glass
- Process controller
- Chlorine proportioning valve
- Sodium chlorite proportioning valve
- Sodium chlorite magnetic flow meter

The chlorine dioxide generator will be of single block construction to minimize connections and leaks associated with unnecessary and excessive connections and fittings as manufactured by Sabre Oxidation Technologies, Inc., of Odessa, TX.

All materials in contact with chlorine dioxide, chlorine gas and sodium chlorite solution shall be constructed of Schedule 80 PVC, Teflon, polyethylene, or acceptable non-corroding metals.

Piping shall be furnished with sufficient unions to permit easy assembly and disassembly. All shut-off valves shall be true-union ball valves. Chlorine dioxide generator control components shall be contained on a corrosion resistant panel that shall be wall mounted. All components shall be fully accessible from the front.

The chlorine dioxide generator will provide a minimum yield of 95% based on the conversion of sodium chlorite with no more than 5% excess chlorine in the generation process. The yield will be determined by amperometric titration, which is capable of differentiating between chlorine dioxide, chlorine, chlorite, and chlorate. The analysis procedure shall be the method published in *Standard Methods For The Treatment Of Water And Wastewater*, APHA, AWWA, WEF, 19<sup>th</sup> (and later) Edition. Chlorine Dioxide. 4500-ClO<sub>2</sub> E. pg 4-80 to 83. Published APHA, Washington, DC.

Efficiency will be based on the theoretical stoichiometry optimized to produce ClO<sub>2</sub> from chemical feed rates of the reactants, according to:



### ACCESSORIES:

- On-Line ClO<sub>2</sub> ppm Analyzer
- Amperometric Titrator
- Booster Pumps
- Electrical Control Panel
- ORP Controls
- Generator Chemical Flushing System

### CUSTOMER APPLICATION INFORMATION:

- Generator Size or Dosing Information
- Motive Water Pressure and Flow Rate Available
- Back Pressure at Application Point
- Electrical Requirements

# SABRE

## A-SERIES AUTOMATIC CHLORINE DIOXIDE GENERATOR

Sabre Oxidation Technologies, Inc. has developed the next generation of vacuum driven chlorine dioxide generation systems, which utilizes both two and three chemical precursor chemical processes. This design was made to eliminate many of the problems associated with previous methods of chlorine dioxide generation. The two chemical process uses 25% aqueous sodium chlorite solution and chlorine gas. Sabre's automatic generators are among the most advanced and accurate chemical metering and control systems available on the market today.

The Sabre System patented<sup>1</sup> *Tuned Reaction Column* is designed to eliminate the build-up of material in the reaction column that can lead to frequent flushing, disassembly and manual cleaning. The *Integral Component Block Mounted* designed generator is built from a block of chemically resistant Schedule 80 PVC plastic with most of the pipe connections, chemical feed lines, and reaction column bored into the block. This process avoids the need for most of the external tubing, fittings, and connections common to other generators which are a source of pressure and vacuum leaks resulting in poor performance and efficiencies.

### METHOD OF OPERATION

The generator operates by water flow over an ejector that creates a vacuum and drives the entire system. This

vacuum draws the precursor chemicals from their storage points through the generator's ten inch precision glass meters and into the patented<sup>1</sup> *Tuned Reaction Column* where the chlorine dioxide reaction takes place. In milliseconds the chlorine dioxide is educted from the reaction column and into the water stream where it is immediately diluted and flows to the point of application. There are no dangerous concentrations of precursor chemicals in the Sabre generation process.

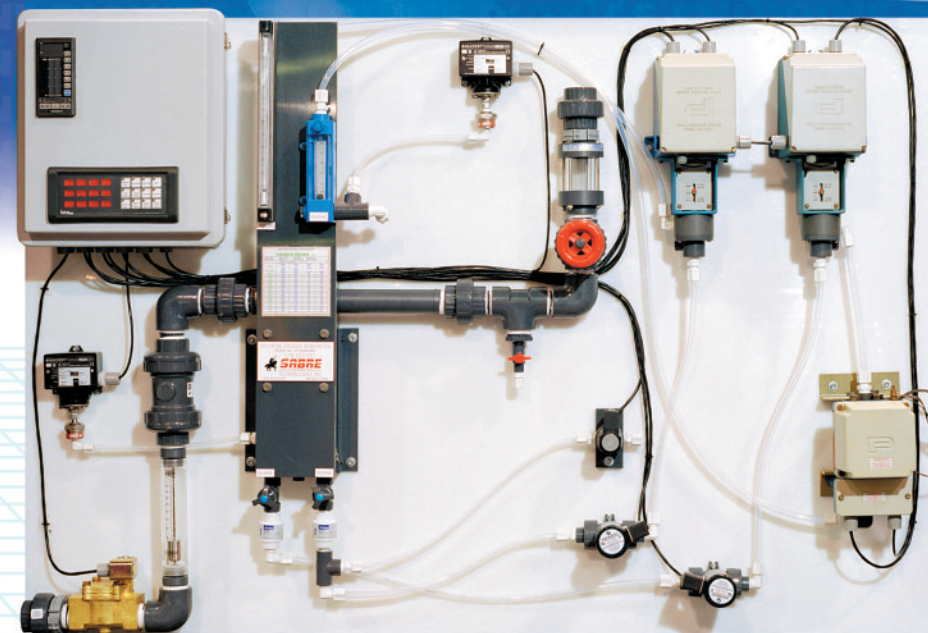
The process controller of the Automatic System can be controlled locally or remotely by inputting the desired production rate of chlorine dioxide in pounds per day. Another feature allows this system to flow pace itself based on plant production via a 4-20 mA signal which represents the plant flow.

The process controller then measures the precursor chemical through a mass flow meter and adjusts this flow through a 4-20 mA flow proportioning valve. This loop is continuously monitored and adjusted based on the set point. This insures the exact amount of chemical is fed, as determined by either the rate input into the controller or the amount calculated from plant production.

The process controller and flow measuring and control equipment are housed in separate NEMA 4X enclosures to isolate and eliminate corrosion and facilitate troubleshooting and repairs. The enclosures and the generator are attractively mounted on a compact backboard which requires little space for mounting. The components can also be mounted independently.

Continued Inside

## AUTOMATIC - TWO CHEMICAL



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Compact Systems -  
72" w x 48" h x 12" d

\* Many other custom configurations available

Typical Systems -  
10 to 3,000 lbs. ClO<sub>2</sub>/day

Other System Designs -  
Up to 100,000 lbs. ClO<sub>2</sub>/day

ClO<sub>2</sub> is generated at minimum of 95% efficiency with <5% excess chlorine.

[www.sabretechnologies.com](http://www.sabretechnologies.com)

<sup>1</sup>US Patent No 6,468,479. International & Other Patents Pending

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## GENERATOR SYSTEM SPECIFICATIONS

A microprocessor monitors the systems operation. When an alarm condition is detected, the system notifies plant personnel and shuts down, if desired. Automatic operations can be bypassed and the generator can be run manually if a loss of power is experienced. Contacts for other inputs/outputs and alarms can be added. There are many additional options and design features which can be incorporated into the Sabre System.

### ANALYTICAL ANALYSIS

With the included inlet water flow meter and the feed rate chart, a sample port is provided to quickly and easily obtain a sample of the generator product stream for analysis. This sample conveniently provides all the information needed to perform generator efficiencies and mass balances as may be required by government agencies, depending on your application, using Standard Methods. A sight glass for a visual indication of chlorine dioxide production is also provided.

### ADVANTAGES

**Flow Paced** - No batch tanks required. Chlorine dioxide is produced on demand as needed.

**Vacuum Operated** - No costly troublesome chemical feed pumps are required. A leak in the Sabre chemical feed lines results in air being educted into the system.

**Not pH Dependent** - Sabre generators are also not pH dependent and operate at near the true stoichiometric range required for efficient generation of chlorine dioxide. pH dependent systems require excess chlorine to be fed to significantly depress the pH to enhance the conversion of sodium chlorite which results in a more corrosive product stream and contains excess chlorine which enhances chlorate formation. Sabre System chlorine dioxide generators achieve 95% plus efficiencies with no more than 5% excess chlorine.

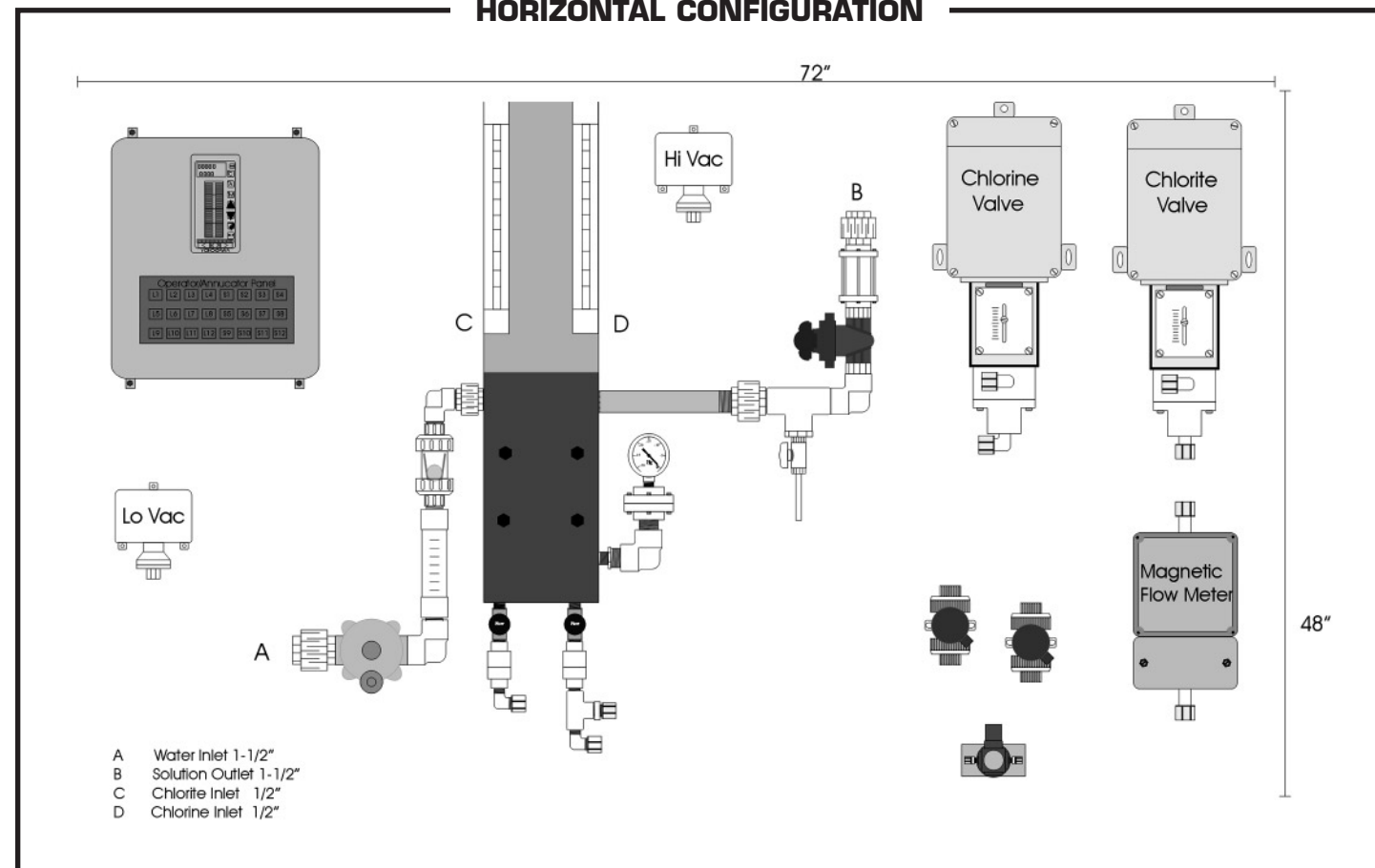
**Chemical Handling** - Sabre generators operate on 25% sodium chlorite solution that is easily shipped in drums, totes or bulk truckload shipments. 25% sodium chlorite is listed as a corrosive material and is not an oxidizer as is dry sodium chlorite. Once delivered there is no handling required by plant personnel.

The chlorine dioxide system shall operate based on the reaction, under vacuum, of chlorine gas and 25% sodium chlorite in solution. The vacuum will be created by a water ejector system. The chlorine dioxide generation equipment to be furnished shall be controlled by a process controller which will accept an input signal from either the front panel of the controller (local), or from a remote source (a PLC connected to the site SCADA computer system). The remote signal shall be a 4-20 mA signal which will represent plant water flow. The chlorine dioxide system controller shall also accept a dosage set point furnished by either a local set point or another 4-20 mA DC signal from the Control Room computer or from a residual analyzer. The controller will combine these signals and maintain the required chlorine dioxide production rate. The controller shall be mounted on the generator panel or may be mounted remotely. Start-stop controls shall be furnished for local or remote operation of the generator system. The process controller shall be furnished with a bar graph readout device that indicates the current set point and system production of chlorine dioxide.

Chlorine gas flow shall be controlled electrically by a flow control valve which receives a signal from the controller based on the production set point of chlorine dioxide desired. Sodium chlorite flow shall be metered through a flow measuring device which receives a signal from the controller based on the production set point of chlorine dioxide desired and controlled electrically through a flow control valve. An algorithm in the controller shall determine the pounds per day of chlorite and chlorine required and send a 4-20 mA signal to the chlorite and chlorine proportioning valve. For a visual representation a glass chlorine meter will be provided with a display calibrated in pounds per day of chlorine gas along with a glass sodium chlorite meter. The chlorine supply shall be dedicated to the chlorine dioxide system. The sodium chlorite meter will be calibrated from 0-100% and the system will be provided with a feed rate chart to show the appropriate setting for the desired chlorine dioxide dosage. The generator will be capable of a 10:1 control

range. The glass meters will have an accuracy of +/- 4% of the full flow meter range, the electronic sodium chlorite magnetic metering, proportioning and display equipment will have an accuracy of +/- 1% of the full flow meter range. The chlorine dioxide formation reaction will be completed within the reaction zone of the chlorine dioxide generator prior to entry into the ejector water stream. The water used to create the vacuum shall also dissolve the chlorine dioxide gas ordered for delivery at concentrations between 200 and 3300 mg/l.

### HORIZONTAL CONFIGURATION



### VERTICAL CONFIGURATION

