

SERIES 85-250

CHLORINE DIOXIDE SYSTEM

FEATURES

- Highest efficiency available, converts 96 to 98% of sodium chlorite to chlorine dioxide.
- Requires no acid or excess chlorine.
- Simple automatic-batch control.
- Automatic monitoring and control of input variables maintains proper chlorine, sodium chlorite, and water mixing ratios.
- Chlorine dioxide will not form THM's, is immune to ammonia and pH.
- Choice of capacities: 80 or 240 lb of chlorine dioxide per day.
- Shipped assembled and wired, easy to install.

CHLORINE DIOXIDE

Chlorine dioxide is a powerful disinfectant and oxidizing agent. It is recognized by the EPA as a primary disinfectant; but it is unstable and must be generated on-site. It does not react with ammonia to form less-active chloramines; it will not form trihalomethanes or other chlorinated organic compounds; nor will it react with many impurities that normally consume chlorine.

Chlorine dioxide has proved economical and effective treating waters high in ammonia or organic nitrogen and in the destruction of phenol-based taste-and-odor-causing compounds. Unlike chlorine, it is essentially unaffected by pH, thus is cost effective as a means of treatment when high pH is present.



A TWO-CHEMICAL PROCESS

In the Wallace & Tiernan system, the chemicals used in the preparation of chlorine dioxide are sodium chlorite (NaClO₂) and chlorine (Cl₂). A commercial solution of 25% sodium chlorite is generally used to react with a 3.9 g/L chlorine solution to form chlorine dioxide solution. The chemical equation of this reaction is:



At the appropriate ratio of sodium chlorite to chlorine and at a high reaction concentration, nearly pure chlorine dioxide solution can be produced. For the treatment of drinking water or industrial process water, it is usually desirable to generate chlorine-free chlorine dioxide solutions.

FEATURES

EFFICIENT, CONVERTS 96% to 98% OF SODIUM CHLORITE

The Wallace & Tiernan Products system is a batching system and generates solution at a fixed rate. This design simplifies the system control and assures the optimum mixing ratio-at any delivery rate within the system capacity. Thus, the system converts a high 96 to 98% of available sodium chlorite over its entire operating range and fully utilizes this expensive chemical.

NO ACID OR EXCESS CHLORINE

For efficient conversion of sodium chlorite to chlorine dioxide, a high concentration/low pH chlorine solution is required. At lower concentrations, some processes must add hydrochloric acid or use excess chlorine. The Wallace & Tiernan Products system utilizes continuous batching and optimum hydraulic conditions to maintain the pH at a low level and provide the acidity necessary to produce high-concentration chlorine dioxide solution rapidly and efficiently without acid or excess chlorine.

AUTOMATIC-BATCH CONTROL, SIMPLE TO OPERATE

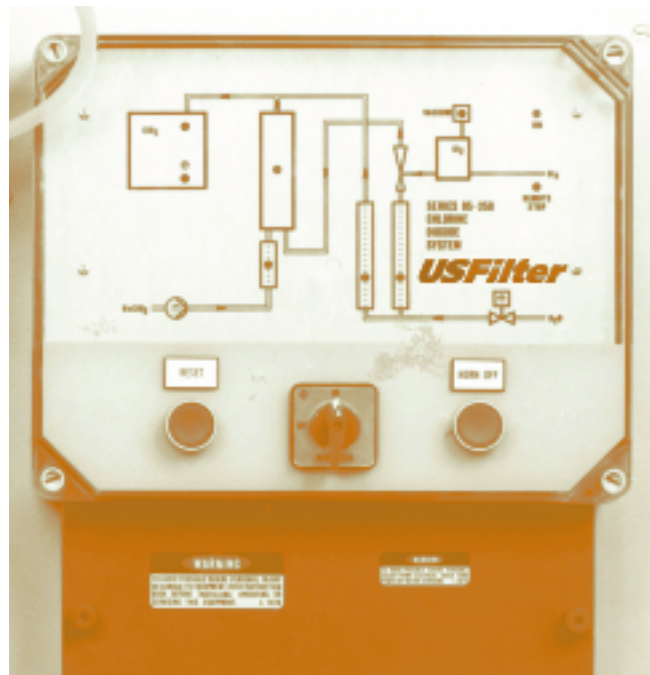
The Wallace & Tiernan Products system has a control panel for the operator's convenience. It shows the status of each process in the system at a glance. It has only one operator control: an on-off switch. Level probes in the chlorine dioxide holding tank monitor the stored solution level and start and stop the batch cycles. Chemical feed rates are fixed.

EFFICIENCY NOT TIED TO DEMAND

By design, most chlorine dioxide systems have their chemical feed rates tied to demand. Due to varying reactant concentrations, their efficiency drops when demand drops. But in the Wallace & Tiernan batch method, hydraulic and chemical-addition systems are fixed. Efficiency is maintained over the full range of operation.

SHIPPED ASSEMBLED, EASY TO INSTALL

The Wallace & Tiernan Chlorine Dioxide System is delivered assembled, wired, and pre-tested for easy start-up. It is mounted in a sturdy metal framework designed for convenient maintenance. Installation requires only placing the system on-site, making simple plumbing-type and electrical connections, and installing a metering pump to discharge chlorine dioxide solution to the point of application.



Close-up of control panel showing mimic diagram

OPERATION

The low solution level switch in the chlorine dioxide solution holding tank initiates system operation by opening the operating water solenoid valves. The chlorine gas is metered by the chlorinator (5), mixed with water in the chlorinator injector (4) to produce a high concentration chlorine solution for the reaction tower (18). The chlorine gas feedrate is manually set at the chlorinator (5) and indicated on a flowmeter. Another flowmeter (10) indicates the quantity of operating water going to the injector (4). Operating water pressure is set at the pressure reducing valve/strainer assembly (8). In cases where the water supply pressure is lower than required, a booster pump (7) must be installed. At the same time, sodium chlorite solution is taken from the customer storage tank by means of a metering pump (16) and injected into the reaction tower (18). The sodium chlorite feed rate is set at the metering pump and indicated on a flowmeter (17). A pulsation dampener smoothes flow to the meter. Chlorine dioxide solution is produced in the reaction tower, which contains ceramic mixing rings. The rings cause turbulence and thorough mixing as the solution rises to the top. A solution containing either pure chlorine dioxide or chlorine and chlorine dioxide, depending on the specific requirements, is obtained. After the reagents have fully reacted, dilution water is added to the chlorine

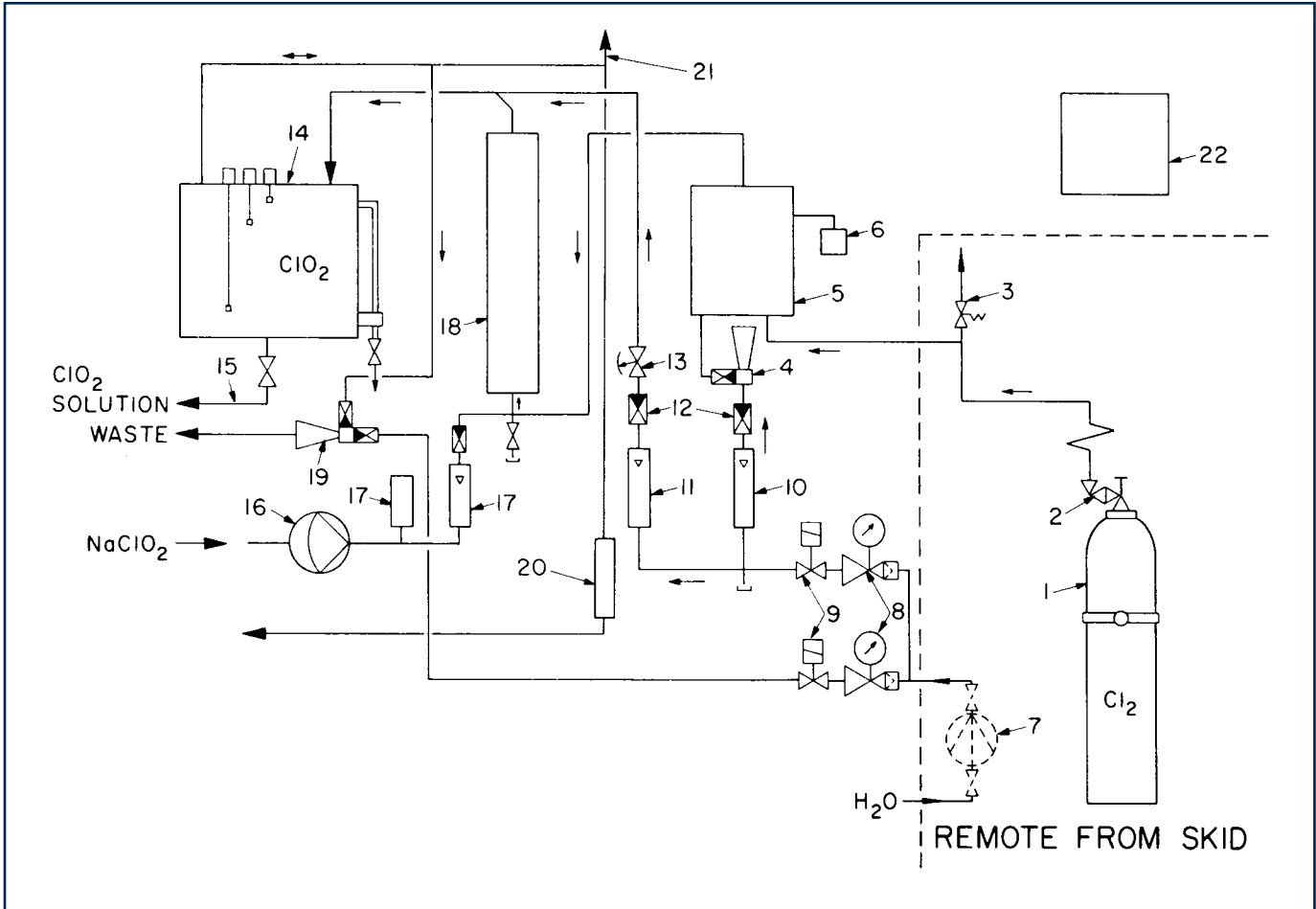
dioxide solution at the outlet of the reaction tower before it is passed into the storage tank (14). The quantity of dilution water is regulated by a ball control valve (13) and indicated on a flowmeter (11). The quantity depends on the specific solution strength required (between 2g/L and 4g/L). Chlorine dioxide solution is drawn from the storage tank outlet (15) and passed to the point of application using a metering pump such as the Wallace & Tiernan Chemtube®2000 Tubular Diaphragm Pump or Encore®700 Diaphragm Pump, both described in the section on options. The storage tank for chlorine dioxide solution is fitted with level probes for control of the batch cycle. The high level probe stops the generating cycle by closing the solenoid valve (9) and stopping the metering pump (16), and the low level probe restarts them. The storage tank is open to atmosphere through the vent line (21) to prevent pressurization. An integral overflow relief valve (20) in this line provides for the relief of an overflow condition in the storage tank. Associated with the chlorine dioxide storage tank is an injector (19) connected with the vent line from the tank. Chlorine dioxide vapors resulting from partial degassing of the solution during the generating process are evacuated by the injector. The water passing through this vent injector is injected into the water to be treated or is taken directly to

drain. When this injector is turned off, tank fumes are relieved through the vent line (21).

The chlorine dioxide generating system is equipped with appropriate monitoring controls to ensure that the mixing ratio is maintained and that no unreacted sodium chlorite is passed into the water being treated.

Adjustable alarm switches installed on the flowmeters for injector operating water (10), dilution water (11) and sodium chlorite (17), monitor the pre-set flow rates. A vacuum switch (6) situated in the chlorinator vacuum line monitors the chlorine gas supply.

All electrical function and controls are grouped at the control panel (22) in such a way that any electrical or hydraulic malfunction will actuate an alarm and shut the system off. The monitoring components and alarm interlocks make incorrect operation of the generating system due to malfunction virtually impossible.



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|----------------------------|-----------------------------------|--|
| 1. Chlorine cylinder | 9. Solenoid valve | 17. Sodium chlorite flowmeter and pulsation dampener |
| 2. Vacuum regulator | 10. Injector-water flowmeter | 18. Reaction tower |
| 3. Pressure-relief valve | 11. Dilution-water flowmeter | 19. Fume-evacuation injector |
| 4. Injector | 12. Backpressure-check valve | 20. Overflow relief valve |
| 5. Chlorinator | 13. Ball valve | 21. Vent line |
| 6. Vacuum switch | 14. Chlorine dioxide storage tank | 22. Control panel |
| 7. Booster pump (optional) | 15. Storage tank outlet | |
| 8. Pressure-reducing valve | 16. Sodium chlorite metering pump | |

DESIGN AND CONSTRUCTION

The Wallace & Tiernan Products Chlorine Dioxide System is an automatic-batching system. Its main components are a chlorinator, vacuum switch, sodium chlorite pump and supply tank (user furnished), reaction tower, control panel, water-pressure regulator, solenoid valve, flowmeters and a holding tank. Also included are piping, hardware and the sensors and controls which monitor system operation. Alarm interlocks monitor the water, chlorine gas, and sodium chlorite inputs as well as the holding tank.

Water is used to operate the chlorinator's injector and to dilute the chlorine dioxide solution generated. A water-

pressure regulator and a solenoid valve maintain the proper flow. Rotameters indicate flow; float-level alarms assure proper operation. Chlorine-gas supply is monitored by a vacuum switch at the chlorinator. The vacuum switch shuts down the system and activates an alarm on high or low chlorine supply vacuum. The chlorinator meters gas flow. Flow rate is manually set and indicated on a rotameter. The chlorine supply to and from the chlorinator is always under vacuum.

In the reaction tower, the sodium chlorite and chlorine solutions produce chlorine dioxide at a concentration of about 7g/L. Dilution water, added at the reac-

tion tower outlet, brings the concentration down to between 2g/L and 4g/L. High-and low-level probes in the holding tank start and stop operation to maintain solution level. An alarm switch warns of a high level.

There is a fume-evacuation injector in the vent line from the holding tank to control off-gassing during generation. Chlorine dioxide solution can be delivered from the holding tank to the point of application by a manual or automatic metering pump.

The control panel enclosure is rated NEMA 12. The automatic control and monitoring functions are accomplished by a relay-diode control system arranged on a printed circuit board. A remote, normally closed switch can be used to start and stop system operation.

Included on the panel are: the system on-off switch; a reset button which restarts the system after an alarm condition; a horn-off button which cancels local and remote alarms without restarting the system. A mimic diagram shows the main system components and monitors each one's operation by means of a lighted alarm LED.



SERIES 85-250

CHLORINE DIOXIDE SYSTEM

TECHNICAL DATA

Accuracy

Batch repeatability is within 3%.

Capacities

Two maximum capacities available: 240 lb and 80 lb of chlorine dioxide per 24 hours.

Control

Automatic start-stop batching.

Temperature Limits

Ambient, 35° to 104° F.

Electrical Requirements

115 VAC ± 10%; 50/60 Hz; single phase; 3 amps peak current.

Chlorinator

To 100 lb Cl₂/day (low capacity system); 250 lb Cl₂/day (high capacity system)

Chlorite Metering Pump

To 2 gph (low capacity system); 10 gph (high capacity system)

System-Operating Water

To 20 gpm at 75 to 130 psi.

Tank Capacities

Reaction tower, 18.5 gallons; chlorine dioxide holding tank, 40 gallons.

Flowmeter Capacities

For high- and low-capacity systems: injector-operating water, 500 and 200 gph; dilution water, 300 and 100 gph; sodium chlorite, 10 gph.

Chemical Requirements

Commercial-grade chlorine gas and sodium chlorite solution, minimum 25% by weight.

Solution Concentration

Dilution water flow is factory-set to produce 4 g/L chlorine dioxide solution, but can be adjusted for lower concentration.

Chlorine Dioxide Metering Pump Requirements

For the 80 lb/day system, 100 gph at 4% concentration (4 g/L); for the 240 lb/day system, 300 gph at 4% concentration. Higher dilution rates will increase metering pump requirements.

Control Panel

Panel enclosure rated NEMA 12 contains: system on-off switch; reset button (initiates a batch cycle); a horn-off button (cancels local and remote alarms without re-starting the system); green LED indicates the system is operating; yellow LED's indicate the supply-water solenoid and the sodium chlorite pump are energized and that the solution level in the holding tank is low; red LED's indicate remote stop; high or low chlorine-supply vacuum; high or low sodium chlorite feedrate; low injector-water and dilution-water flows; overflow level in the holding tank.

Optional Accessories

Wallace & Tiernan Two-cylinder Scale (dial or digital); automatic switchover (from empty to full cylinder) valves. Also optional are Wallace & Tiernan Metering Pumps for delivering chlorine dioxide solution to the point of application: Encore®700 Diaphragm Metering Pump in single- or dual-head models, capacity 317 gph per head, constant- or variable speed motor, backpressure to 175 psi. Chemtube® 2000 Pump is hydraulically actuated tubular diaphragm metering pump available with constant or variable-speed motor with single or double simplex heads. Capacity is 528 gph per head, backpressure to 200 psi.

Dimensions

75" H, 56" W, 24" D.

Weight and Shipping Weight

330 and 750 lb.



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