



# Chlorine **Dioxide**

Production System

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think  
innovate

**GRUNDFOS** 



## Preface

Chlorine dioxide ( $\text{ClO}_2$ ) is used in water treatment for domestic and industrial uses to reduce unpleasant odours, flavours and colours and remove mould and algae as well as to help remove iron and manganese from untreated water.

Specifically for water purification, chlorine dioxide has the major advantage of ensuring disinfected clean water from the tap where the action of other disinfectants such as ozone and ultraviolet light is only temporary.

This brochure presents the components that constitute a uniquely tailored chlorine dioxide underwater production system, noting the features and benefits of using an innovative chlorine dioxide generator from ISIA, a Grundfos-owned company fully integrated into Grundfos Water Treatment Solutions. ISIA is highly specialised in delivering chlorine dioxide in large-scale applications.

# Chlorine Dioxide production system

**Customised system for the generation of 1 kg to 200 kg ClO<sub>2</sub>/hour**

## General

The Grundfos chlorine dioxide production system is suitable for large water treatment applications. Based on a patented underwater production technology, it generates chlorine dioxide (ClO<sub>2</sub>) using concentrated solutions of sodium chlorite (NaClO<sub>2</sub> 25-31 %) and hydrochloric acid (HCl 31-33 %).

With their high precision, the integrated Grundfos dosing pumps assure a high performance level and yield.

The chlorine dioxide solution is produced in a very small reaction chamber which is installed in-line, and is injected directly into the water to treat. In this way, the chlorine dioxide is present only in the treated water, which provides high safety and very effective consumption of the chemical precursors.

## Features and benefits

- Very effective underwater production technology: chemical reaction yield of 95-98 % requiring less chemicals and generating less by-products
- Low consumption of chemicals and power: only 5.7 kg HCl per 1 kg of generated ClO<sub>2</sub>
- Reduced transportation and chemical storage costs: using concentrated sodium chlorite (NaClO<sub>2</sub> 25-31 %) and hydrochloric acid (HCl 31-33 %)
- Reduced investments and increased safety: no need for a storage tank or safety zone for the generated ClO<sub>2</sub> solution
- Lower risk due to low quantity: small volume of reaction chamber means lower ClO<sub>2</sub> quantity
- No risk of concentrated ClO<sub>2</sub> gas released into the atmosphere: highly concentrated ClO<sub>2</sub> is generated under water
- Few components
- Easy installation

## Applications

- Drinking water treatment in municipal waterworks
- Cooling towers
- Municipal wastewater treatment
- Industrial wastewater treatment



# Customised solutions

The Grundfos chlorine dioxide production system is suitable for all water treatment applications and can always be customised to meet the client's requirements.

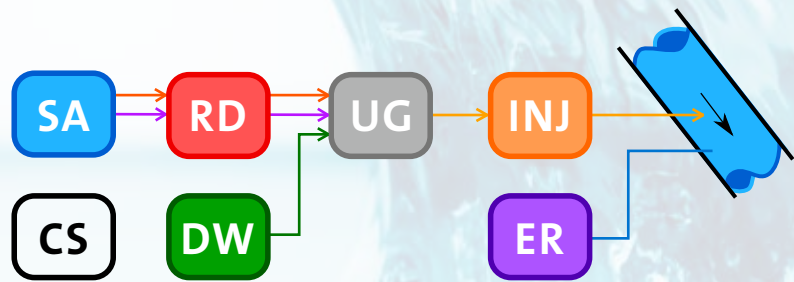
To produce  $\text{ClO}_2$ , the Grundfos system uses two different compounds:

SODIUM CHLORITE 25-31%

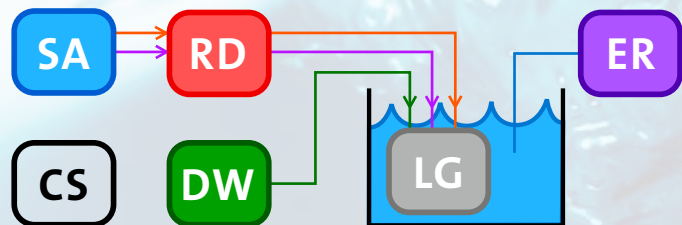
HYDROCHLORIC ACID 31-33%

Dilution water is required (seawater, fresh water, circulating water, etc.)

Depending on the injection, we offer customers the following two different solutions:



System dosing  $\text{ClO}_2$  IN A PIPE



System dosing  $\text{ClO}_2$  IN A BASIN

- SA - Storage Area
- RD - Reagents Dosing Area
- DW - Dilution Water Area
- UG - U-type Generator
- LG - L-type Generator
- INJ -  $\text{ClO}_2$  Injection Area
- CS - Control System
- ER - EasyReadox

THE SYSTEM CAN BE DESIGNED  
ACCORDING TO  
CUSTOMER STANDARDS

THE FOLLOWING PAGES  
DESCRIBE THE COMPONENTS  
AND GRUNDFOS SERVICES THAT  
CONSTITUTE A TURNKEY  
SOLUTION

## Storage area



For each of the two chemicals (HCl and NaClO<sub>2</sub>) we provide a different concrete basin for leakage containment.

The tanks are designed for approximately one month of usage.

This area is equipped with:

- One or more tanks for each reagent (horizontal or vertical)
- Loading section (pneumatic or electrical pumps)
- Instrumentation
- Acid vapors cut down (fume trap)
- Safety equipment (showers, eyewashers)
- Facilities (Civil basements Tanks ladders, piping, supports, cable trays etc.)

The piping material can be: U-PVS, C-PVS or fiberglass (GRP/FRP).



## Reagent dosing area

Depending on the  $\text{ClO}_2$  demand at the plant, we provide reagent dosing skids:

- Complete redundancy (2 skids for 1 dosing point)
- Partial redundancy (3 skids for 2 dosing points)
- Single (1 skid for each dosing point)

Our skid solution characteristics are:

- Pre installation in a container
- PP frame
- Painted steel support
- Normal or special pump type
- Instrumentation
- Leakage containment basin with detector (PP)
- Pipe material: C-PVC, U-PVC

The reagent dosing area and the related equipment are installed in a container to protect them and let the operator work in a safe and clean environment.

The container is configurable with lights, A/C or heater, service sockets, fan, service sink office and laboratory. Using the container solution we pre-install and test the equipment with the Control System (CS) in our workshop; in this way the time for commissioning at site and the related costs are reduced to a minimum.

This configuration does not decrease the operator safety because the chlorine dioxide has been generated outside the container.

# L-type generator

This configuration is the safest solution for the chlorine dioxide generation, because the two chemicals and the dilution water are carried from the dosage area up to the injection point separately and protected.

The generator is directly installed into the water basin and is the only place where the customer has a  $\text{ClO}_2$  presence.

The generator is protected by a fiberglass cover. This type of generator is provided with a diffusion system for the chlorine dioxide in order to distribute it in the water and increase the efficiency. With this technology there is no limit for  $\text{ClO}_2$  production.





## U-type generator

Where using the L-type generator is not possible, Grundfos offers the U-type generator, providing a chlorine dioxide solution for every kind of plant.

In this case, the chlorine dioxide is produced in the U-type generator and carried up to the injection point by using titanium injection pumps.

For example, this system can be applied to pressurised injection lines or closed tanks.



# Dilution water area

Dilution water is a must in this process from a safety point of view.

The dilution water line is designed to guarantee always no more than 1g/l concentration of chlorine dioxide during the re-action. For safety reasons, there is always at least double redundant instruments on this line (flow meter, flow switch) connected to the control system.

Depending on the plant design and water availability, the dilution water can be pumped, filtered or both.





## Injection area

Using U-type generators, the chlorine dioxide has to be carried from the reaction chamber up to the injection point, by using a pumping station.

In this way ISIA technology can satisfy any customer requirement (for example, we can inject the chlorine dioxide into a high pressurised lines).

This pumping station is commonly pre-installed in the container with the control system and dosing area.



# Control system

Grundfos offers several types of solutions for the electrical power and control system. Grundfos has experience from all over the world with different standards and specifications.

The entire plant can be managed by using PLC and human machine interface (HMI) that will be configured providing the best user-friendly interface and, at the same time, the safest program.

The control system is pre-installed in the container, together with the dosage area and it is tested at the Grundfos facility, reducing the costs for on-site installation.





# EasyaReadox

EasyaReadox consists of an online monitoring system of oxidant biocide treatment, which is capable of estimating, by an electrochemical probe the first bio fouling growth (biofilm) and the presence of oxidizing agents (chlorine dioxide).

This instrument will help to decide the number and duration of shots, and chlorine dioxide dosage rate in order to optimise the dosing strategy. The electrical signal is correlated to the biological micro-fouling growth upon the surface of the system (pipe lines, heat exchangers, etc.).

The electronic instrumentation of the system can be connected to the Control System so it is possible to check the instant and the historical trend of an electrical signal (mV) coming from the electrochemical probe.





## Grundfos and water treatment

Grundfos Water Treatment Solutions is a full-line supplier of tailored solutions for the entire water treatment process with the know-how and resources to handle any application in the field of dosing and disinfection technology.

As specialists in chemical dosing and chlorination, Grundfos offers large-scale, tailored applications of chlorine and chlorine dioxide in water treatment.

Grundfos has been a global leader in advanced pump solutions and a trendsetter in water technology for more than 60 years and turnover in 2013 was EUR 3.1 billion. Today 2.5 million Grundfos pumps in operation collect water for 800 million people and our pump solutions distribute water to more than 600 million people. Grundfos is raising the bar for sustainable product solutions within energy efficiency and water, focusing on the entire product life cycle.

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