Effective Disinfection For Healthy Water.

BE › THINK › INNOVATE ›

GRUNDFOS

Water is life –
The right disinfection is vital

Our disinfection systems ensure clean water worldwide

Over 70% of the Earth's surface is covered with water, about 60% of water makes up a human being. One single person consumes more than 30,000 gallons of fresh water a year on average. Clearly, water is our most important resource for sustaining life. However, environmental influences and the effects of civilization cause constant pollution, particularly in the form of infection from germs or contamination with toxic substances.

Ensuring there is always enough clean, drinkable water available for all people in the world requires a great deal of diligence and specially designed, highly advanced technologies to safeguard water purity. With its ongoing product and solution innovations, Grundfos is helping to secure our supply of clean, fresh water for the future.

PROCESS	CHLORINE	ELECTROLYSIS
APPLICATION	Drinking water Utility water Waste water Swimming pool water	Drinking water Utility water Waste water Swimming pool water

Effective disinfection systems sustain life and health

Complete disinfection from a single source – from Grundfos

High quality standards are extremely important, and not just for drinking water – to which particular attention needs to be paid – or swimming pool water. Stringent process technology and statutory standards for water quality also apply to industrial environments, for example when supplying water for production or using it as a process resource in the form of cooling or cleaning water.

The Grundfos product and solution spectrum comprehensively covers almost all areas of water chemistry, including more complex tasks. Regardless of the volumes of water involved, the nature of the contamination, and the purpose for which our customers are using the water, we offer completely effective, long-term, reliable disinfection and treatment to make the water suitable for use.

PROCESS	CHLORINE DIOXIDE
APPLICATION	Drinking water Utility water Waste water Drinks industry Food industry Horticulture/agriculture

Disinfection with chlorine: the No. 1 choice worldwide

Our disinfection systems ensure clean water worldwide

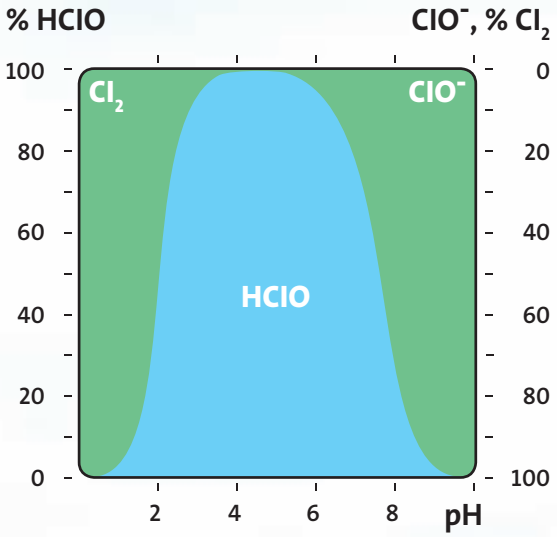
Chlorine has been used to treat drinking water for more than 75 years. Thanks to its high safety standards, it is the most widely used disinfectant worldwide. It is a highly effective oxidant and disinfectant. It sterilizes rapidly and efficiently, more or less completely destroying nearly all microorganisms, even at low concentrations which are harmless to humans.

Chlorine works as follows:
When dissolved in water, hypochlorous acid (HClO) is formed based on the following chemical equation:

$$Cl_2 + H_2O \rightleftharpoons HCl + HClO$$

The actual disinfectant is HClO which penetrates and degrades the cell membranes and disrupts the metabolism of the microorganisms.

Of particular benefit is chlorine's excellent sustained-release action. For instance, it continues to disinfect a pipeline system over a long period of time. Chlorine is used as a disinfectant in a wide range of applications which stretch far beyond drinking water treatment. It is essential for disinfecting swimming pools worldwide and is often a statutory requirement.



Dissociation of hypochlorous acid, dependant on pH value of water

Chlorine disinfection processes
Tried-and-tested for generations

Our disinfection systems ensure clean water worldwide

In practice, three processes are mainly used:

- Dosing of chlorine gas
- Dosing of liquid sodium or calcium hypochlorite solution
- Electrolytic chlorine generation

Disinfection with chlorine gas is the most widely used process. Liquid hypochlorite solution is primarily suited to cases where smaller quantities of water need to be treated. With electrolysis, chlorine is produced directly from a solution of common salt using electricity, with no significant by-products.

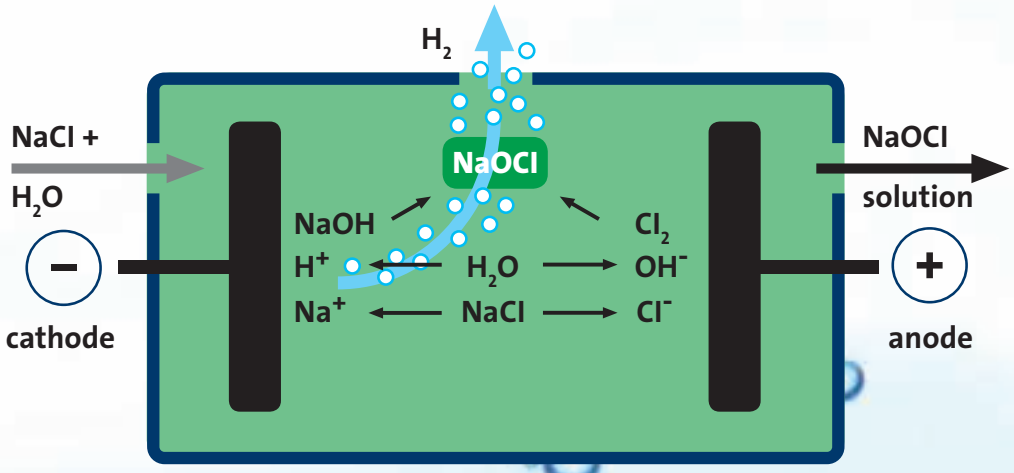
The following reactions take place in the electrolytic cell:

$$2\,NaCl + 2\,H_2O \rightleftharpoons 2\,NaOH + Cl_2 + H_2$$

The chlorine produced reacts immediately with the caustic soda solution also formed, resulting in a hypochlorite solution:

$$Cl_2 + 2\,NaOH \rightleftharpoons NaCl + NaClO + H_2O$$

The solution generated has a pH value between 8 and 8.5, and a chlorine concentration of less than 8 g/l. It has a very long half-life which makes it ideal for storage in a buffer tank.



Generation of hypochlorite solution in an electrolytic cell

VACCUPERM chlorine disinfection systems – safe, effective and economical

Measure & control your chlorine gas dosing with absolute dependability – our full vacuum systems ensure process reliability

VACCUPERM VGS-140
up to 200 kg/h (440 lb/h)

VACCUPERM gas dosing systems from Grundfos work according to the globally tried-and-tested full-vacuum principle, which can be used to regulate the addition of gaseous chlorine reliably and precisely. From the gas dosing device and vacuum regulator to the injectors and automatic container changeover, the perfect interplay of all components in our systems ensures a reliable, high-quality process.

VACCUPERM VGA-111
up to 4 kg/h (8.8 lb/h)

Our product spectrum is extensive:

- **Compact devices including injector** and installation material up to 4 kg/h (8.8 lb/h) for direct installation on chlorine gas cylinders or header lines.
- **Gas dosing systems up to 10 kg/h (22 lb/h)** including multiple dosing devices for up to four injection points (water circuits).
- **Fully automated high-performance systems with a PLC** controller and cutting-edge sensor technology for dosing quantities up to 200 kg/h (440 lb/h).

VACCUPERM VGA-117
up to 10 kg/h (22 lb/h)

SELCOPERM electrolysis systems generate chlorine directly on site with no critical by-products

Generate your hypochlorite solution – cost-effectively and without transport or storage of disinfectants

SELCOPERM SES
chlorine electrolysis system up to 2000 g/h (4.5 lb/h)

The particular advantage of on-site generation of chlorine with a **SELCOPERM system from Grundfos** is the fact that no significant unpleasant by-products are generated. The disinfectant – the hypochlorite solution – is produced cost-effectively and with high operating convenience.

With no expenditure required on safe transport and storage of chlorine gas and a system that is easy to handle and run, operating costs remain low.

SELCOPERM also effortlessly handles peaks in demand because the disinfectant generated can be very easily stored in buffer tanks for long periods of time.

The benefits at a glance:

- No transport, storage or handling of disinfectants.
- No formation of unwanted by-products.
- Cost-effective use of common salt as a base material.
- On-site generation precisely according to your requirements.

Chlorine dioxide – effective, lasting protection against all germs and biofilms

Chlorine dioxide for long-term control of dangerous germs and prevention of biofilm formation.

Chlorine dioxide (ClO_2) provides excellent, lasting disinfection for your water. Even if water is not flowing through the pipes, chlorine dioxide prevents germs from building up again thanks to its outstanding sustained-release action. The sterilization process with chlorine dioxide is also taste and odor-free.

Chlorine dioxide offers a wide range of other benefits

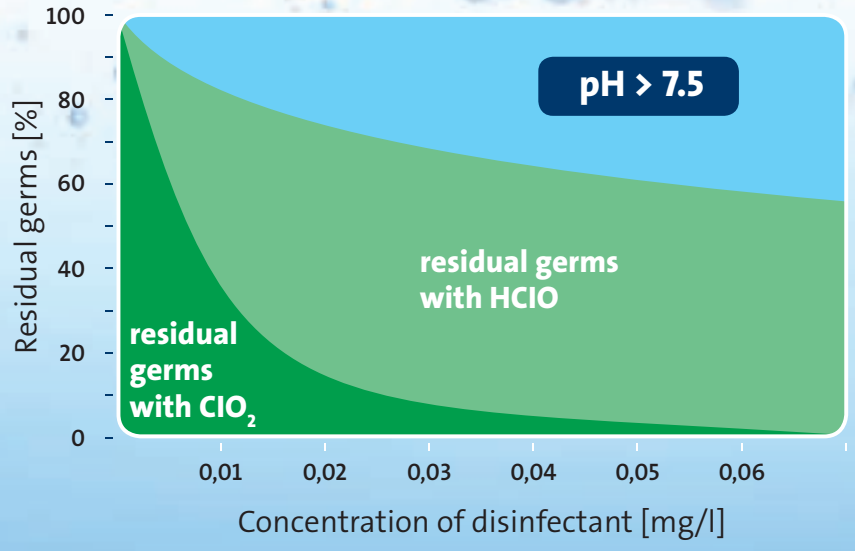
As a bactericide, sporicide, virucide and algicide, chlorine dioxide is in every respect highly effective against all critical and even chlorine-resistant germs.

Chlorine dioxide is particularly effective in fighting legionella and prevents biofilm formation and corrosion of water pipeline systems. It removes the nutrient source for these types of hazardous germs, which significantly prolongs the duration of the disinfectant effect.

Its disinfection capability is very high even in relatively small quantities and is more or less independent of the pH value. Chlorine dioxide can therefore also be used in an alkaline environment with no problem.

The formation of strong-smelling by-products such as trihalogeno-methyls (THM), chlorophenols or chloramines that cause irritation to mucous membranes is negligible. This makes chlorine dioxide the disinfectant of choice for processing food and drink.

Disinfection properties: the disinfectant effect of chlorine dioxide is very high even if only very small quantities are added.



Generate your chlorine dioxide directly on site – with maximum yield

Two methods have been tried and tested worldwide and conform to international standards

The disinfectant can be generated on site either from chlorite and hydrochloric acid or from chlorite and chlorine. With both these processes, Grundfos meets the stringent requirements for disinfection of drinking water.

The disinfectant yield is up to 95% with both methods. It is used as an aqueous solution containing 0.5 - 3 mg ClO_2/l, depending on the application.

Hydrochloric acid / sodium chlorite method:

With the acid/chlorite method, the chlorine dioxide can be generated from diluted or concentrated sodium chlorite and hydrochloric acid solutions depending on the user's requirements:

Diluted: HCl 9%, $NaClO_2$ 7.5%
Concentrated: HCl 33%, $NaClO_2$ 24.5%

The chemical formula:

$$5\ NaClO_2 + 4\ HCl \rightleftharpoons 4\ ClO_2 + 5\ NaCl + 2H_2O$$

Chlorine / sodium chlorite method:

With this particularly cost-effective preparation method, the chemical starting materials are concentrated sodium chlorite solution (24.5%) and chlorine gas (acidic chlorine solution) dissolved in water.

The chlorine dioxide is produced according to the chemical formula:

$$2\ NaClO_2 + Cl_2 \rightleftharpoons 2ClO_2 + 2\ NaCl$$

OXIPERM® chlorine dioxide generators – effective disinfection and reliable performance

Grundfos systems ensure optimum precision and immunity to interference

The brand name OXIPERM® stands for highly effective, compact chlorine dioxide preparation systems and user-friendly, ergonomic design. Smart electronics and sensor technology combined with unique calibration technology ensure optimum precision and process reliability.

No matter which type of system you choose, the precise dosing technology, optimum component mixing and complete chemical reaction in a minimum of time enable you to generate your chlorine dioxide both reliably and precisely while at the same time reducing your costs.

Compact in design and functionality, **OXIPERM** offers user-friendly operation, monitoring and maintenance: All control elements and all system components requiring regular maintenance are very easily accessible when required.

Plain text and flowchart with LEDs for dual monitoring – it doesn't get more reliable than that:

As a special feature on **OXIPERM OCD-164 and OCC-164** systems the whole process is visualized in two ways. LEDs, arranged in a clear flowchart, enable disruptions to be localized immediately and definitively and allow convenient monitoring of the operating state. All operating states and messages also appear on the plain-text display.

Remote communication is also optionally available with this system – by connecting the bus interface to primary integration and process control systems.

OXIPERM OCD-164 up to 2000 g/h (4.4 lb/h) HCl/ $NaClO_2$ method diluted components.

OXIPERM OCD-162 up to 60 g/h (0.13 lb/h) Especially for combating legionella HCl/ $NaClO_2$- method diluted components.

OXIPERM® OCD / OCC (hydrochloric acid / sodium chlorite method)

Concentrated or diluted chemicals – with **OXIPERM OCD / OCC,** individual requirements on site determine which type of system is the best choice.

OXIPERM OCC-164 up to 10,000 g/h (22 lb/h) Chlorine dioxide preparation and dosing system up to 10,000 g/h (22 lb/h) [HCl/ $NaClO_2$ method, concentrated components].

The **OXIPERM OCD-162** system is based on diluted starting solutions. With a capacity range up to 60 g/h (0.13 lb/h) it is specifically designed to combat and prevent legionella in hotels, hospitals, nursing homes and the shower facilities of swimming pools.

The larger **OXIPERM OCD-164** also uses diluted components and offers a capacity range up to 2000 g/h (4.4 lb/h). **OXIPERM OCC-164** uses concentrated chemicals. The capacity range of these systems can go up to 10 kg/h (22 lb/h).

OXIPERM® OCG-166 (chlorine gas / sodium chlorite method)

In addition to cutting-edge sensor technology, these liquid/gas systems also feature a precision programmable controller with interactive graphic display. Depending on the application, **OXIPERM OCG-166** allows you to select from 6 capacity levels of dosing quantities up to 10 kg/h (22 lb/h).

OXIPERM OCG-166 up to 10,000 g/h (22 lb/h) Cl/ $NaClO_2$ method

The disinfections methods of Grundfos,

CHLORINE

The advantages of chlorine

Globally tried-and-tested No 1 method

As a highly effective disinfection method, chlorine is the world's most widespread and prescribed process.

Cost-effective disinfection method

The costs of the agent used, the equipment required and the operating costs are relatively low.

Excellent sustained-release action

Chlorine continues to disinfect a pipeline system over a long period of time.

YOUR BENEFIT

How you benefit

High standard of know-how ensures reliability

Many years' experience and know-how accumulated worldwide – expertise you can rely on

You save on disinfectant costs

With the right system, you can keep your investments and running costs low.

Your disinfection is sustainable and cost-effective

Due to the sustainable disinfection you save on disinfectant and process costs.

CHLORINE DIOXIDE

The advantages of chlorine dioxide

Highly effective against germs, even in small quantities:

Chlorine dioxide provides excellent and lasting protection against all critical germs.

No formation of biofilms in pipes; breaks down existing biofilm

Chlorine dioxide prevents the formation of biofilms and corrosion in water pipeline systems.

Disinfection independent of pH value

The disinfection capability of chlorine dioxide is more or less independent of the pH value of the water to be sterilized.

No AOX / TMH formation

The formation of strong-smelling by-products that cause irritation to mucous membranes is negligible.

YOUR BENEFIT

How you benefit

No additional disinfection method required

You save on running and chemical costs.

Highly-effective disinfection without re-contamination

You simply remove the nutrient sources for hazardous germs such as legionella, significantly prolonging disinfection effects.

No additional pH correction required

You can also use chlorine dioxide in an alkaline environment with no problems. This saves you the cost of pH correction.

No adverse effects on odor and taste

Chlorine dioxide can also be used with no problem in sensitive applications such as the processing of food and drink.

their special features and the benefits for you

VACCUPERM & SELCOPERM

The features

Vaccuperm: reliable full-vacuum method with chlorine gas

Perfectly coordinated system components ensure reliable addition and precise regulation of gaseous chlorine – can even be fully automated if required.

Selcoperm: generation of chlorine directly on site

The disinfectant hypochlorite solution (sodium hypochlorite) is produced cost-effectively with no significant by-products.

Very straightforward handling and operation

Both systems feature reliable handling and a user-friendly design.

YOUR BENEFIT

How you benefit

Reliable disinfection process:

With precise regulation of chlorine addition depending on the water properties, you can ensure optimum disinfection effects at all times, giving you the best water quality.

You save on storage and transport costs:

You generate your disinfectant according to your requirements or produce it in advance safely – without costs for safe transport and storage.

You save time and therefore running costs:

In this respect, you also benefit from our many decades of know-how, giving you more time to concentrate on other tasks.

OXIPERM®

The features

Grundfos offers both worldwide approved processes

ClO_2 is generated on site from chlorite/hydrochloric acid or chlorite/chlorine gas

User-friendly ergonomic design and optimum process monitoring

All systems feature very straightforward operator guidance with optimum process control.

Innovative dosing and calibration technology

Cutting-edge dosing pumps mean even small quantities of concentrated components can be reliably dosed.

Complete chemical reaction in a minimum of time

Perfect interplay between precision dosing technology and cutting-edge control electronics.

YOUR BENEFIT

How you benefit

Always the optimum solution for your specific application

Our versatile Oxiperm systems suit any of your tasks

Convenient operation and monitoring help you to save costs

Thanks to the convenient operation you save precious time and thus operating costs.

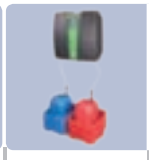
Optimum precision and process safety

You generate and dose your chlorine dioxide both reliably and precisely.

Low chemical consumption

Thanks to optimum component mixing you receive the maximum ClO_2 yield and reduce your chemical costs considerably.

No matter how demanding your applications, ... you can rely on the skill and versatility of our solutions

DISINFECTANT	CHLORINE GAS				CHLORINE DIOXIDE			
METHOD / COMPONENTS	chlorine gas dosing (HClO)			Salt (NaCl)	HCl / $NaClO_2$ diluted		concentrated	chlorine/ $NaClO_2$
PRODUCTS	Vaccuperm VGA-111	Vaccuperm VGA-117	Vaccuperm VGS-140	Selcoperm SES	Oxiperm OCD-162	Oxiperm OCD-164	Oxiperm OCC-164	Oxiperm OCG-166
CAPACITY	up to 4 kg/h (8.8 lb/h)	up to 10 kg/h (22 lb/h)	up to 200 kg/h (440 lb/h)	up to 2000 g/h (4.5 lb/h)	up to 60 g/h (0.13 lb/h)	up to 2000 g/h (4.4 lb/h)	up to 2500 g/h (5.5 lb/h)	up to 10 kg/h (22 lb/h)
SPECIAL FEATURES	full vacuum systems	full vacuum systems	automated full vacuum systems	electrolytic Cl_2 generator	on site ClO_2 generator	on site ClO_2 generator	on site ClO_2 generator	on site ClO_2 generator
IMAGES								

● ideally suited ○ well suited × limited suitability

Drinking water								
Independent water suppliers	●	●		●		○		
Municipal waterworks			●	●		●	●	
Reverse osmosis systems								
Hotel, hospital, retirement home								
Legionella protection				×	●	○		
Process and waste water								
Municipal sewage works						○	○	○
Industrial waste water		●		●		○	○	○
Swimming pool water								
Private jacuzzis/swimming pools								
Hotel pools/therapy pools				●	●	○		
Public swimming pools	●	●		●				
Shower facilities				×	●	○		
Food and drink industry								
Table water					○	○	○	
Brewing water					●	●	●	
Bottle washing systems						●	○	
Rinsers					●	●	○	
CIP systems					●	●		
Belt lubrication (filling area)					●	●		
Fruit & vegetable washing water					●	●	●	
Condenser vapor (dairy)					●	●	●	
Pasturization					●	●	●	●
Meat processing					○	●	●	
Industry in general								
Process water						○	○	○
Cooling water circuits								
Air washers								
Air conditioning systems				○		○		
Cooling circuit water				○		●	●	
Horticulture / agriculture								
Disinfection for propagation						○		
Irrigation water					○			

Measurement and control

A complete range of easy-to-use amplifiers for measurement and control in a wide range of disinfection applications. A full line of analyzers that can measure one or two different parameters; compensate for pH, temperature or flow variations and provide you with a PID controlled analog output.

DIA-1, DIA-2, DIA-2Q and DIP

The preassembled units from Grundfos Alldos is delivered with an amplifier and controller and your choice of measuring cell and cleaning method

Conex DIA-2Q

Dual measuring amplifier and multi-functional controller that allows for compound loop control with flow compensation

Monitoring and control parameters:

Parameter 1:	Chlorine, chlorine dioxide, ozone, hydrogen peroxide or peracetic acid
Parameter 2:	pH, redox or fluoride

Conex DIA-1

Universal measuring amplifier and controller

Monitoring and control parameters: Chlorine, chlorine dioxide, ozone, hydrogen peroxide, peracetic acid, pH, redox or fluoride

BE > THINK > INNOVATE >

Being responsible is our foundation
Thinking ahead makes it possible
Innovation is the essence

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U.S.A.
GRUNDFOS Pumps Corporation
17100 West 118th Terrace
Olathe, Kansas 66061
Telephone: 913.227.3400
Fax: 913.227.3500

Canada
GRUNDFOS Canada, Inc.
2941 Brighton Road
Oakville, Ontario L6H 6C9
Telephone: 905.829.9533
Fax: 905.829.9512

Mexico
Bombas GRUNDFOS de Mexico S.A. de C.V.
Boulevard TLC No. 15
Parque Industrial Stiva Aeropuerto
C.P. 66600 Apodaca, N.L. Mexico
Telephone: 011.52.81.8144 4000
Fax: 011.52.81.8144 4010

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www.grundfos.us/industry