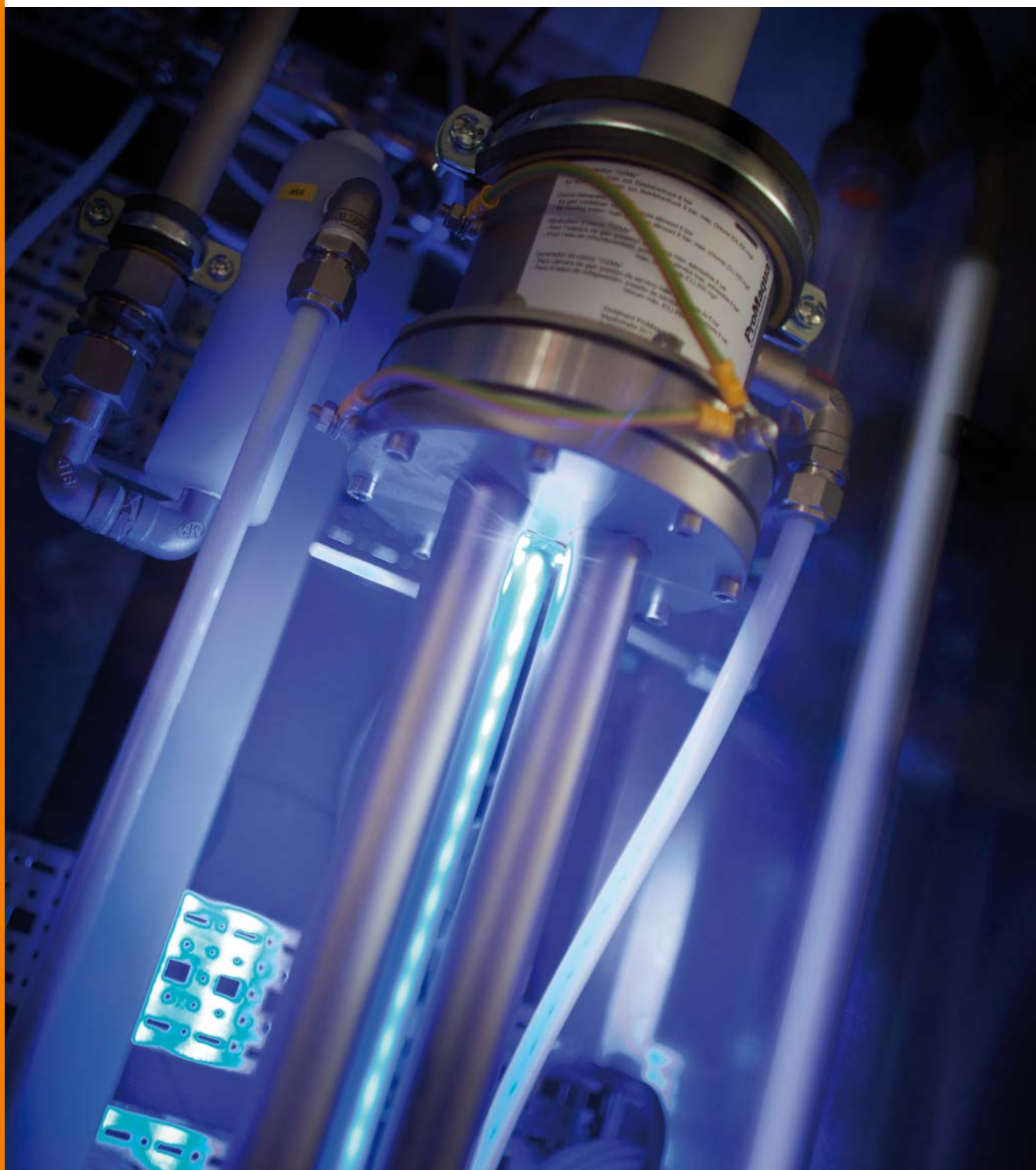


Water treatment and water disinfection



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Heidelberg, January 2013

Your Application, Our Solution. Welcome to ProMinent.



Quick orientation

We offer a compact product overview that provides a summary of our entire range so that you can quickly and easily find the product information that is relevant to you and your application. Four separate product catalogues provide you with comprehensive and detailed information on our individual product ranges:

- Volume 1: Metering pumps, components and metering systems
- Volume 2: Measuring, control and sensor technology
- Volume 3: Motor-driven and process metering pumps
- **Volume 4: Water treatment and water disinfection**

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The challenge of our times - hygienically clean water

Our range of ProMaqua® products and systems is the result of our research and development work on all standard technologies used in the preparation of hygienically pure water. Combined with our many years of practical experience, the results are application-orientated solutions for different industries, characterised by their optimum sustainability, minimal operating costs and maximum efficiency.

Select the solution that most closely suits your application from the wide ProMaqua® range

- UV systems for gentle and chemical-free water disinfection - an ideal process for applications, such as the treatment of potable water or swimming pool water, as well as in the beverage industry
- Chlorine dioxide systems - the economical and ecological

- sensible alternative to disinfectants, such as chlorine.
- Electrolysis systems - the particularly environmentally-friendly alternative to the use of chlorine gas.
- Systems that use membrane filtration technology for the reliable removal of particles and salts.
- Ozone systems for the effective removal of undesirable organic and inorganic substances or for efficient disinfection in the preparation of cooling and process water.

First-class products, for a first-class performance

Absolute process safety is always at the very heart of all our development, irrespective of whether custom-made individual products or complex, large-scale projects. You will benefit from over 50 years of experience and the comprehensive knowledge and expertise of our experts across the globe. Our modular program, comprising individual products and system solutions, offers maximum flexibility and cost-effectiveness whenever and wherever required.

Our product range - the benefits for you:

- Global sales and service presence.
- Personal project care and application-specific consultancy.
- Optimum quality and reliability.
- Absolute problem-solving approach and optimisation of potential cost-savings.
- Complete range of innovative, effective, efficient products and systems solutions.



Bello Zon® CDLb chlorine dioxide system



P_PMA_BEZ_0122_SW

- Production of chlorine-free chlorine dioxide solution from sodium chlorite solution and hydrochloric acid in a batch process
- The chlorine dioxide solution produced has outstanding long-term stability and a high output of over 90% with chlorine dioxide solutions
- Exceptional reaction efficiency without loss of chlorine dioxide from the gas phase (closed gas phase), ensuring environmentally-friendly operation with minimal use of chemicals
- Temporary storage in an integral or separate storage module (up to 60 g chlorine dioxide), hence cost-effective design of systems based on average consumption rather than on peak load
- Operation of several points of injection via the internal or external storage module
- All control versions from the ProMinent metering pump range can be selected for chlorine dioxide metering
- Excellent operating safety: Production of up to 120 g chlorine dioxide per hour dependent on system type, thanks to an innovative reactor design and step-wise process control
- Meets the high standards stipulated in the W 224 and W 624 German Association for Gas and Water (DVGW) data sheets
- Applications: Prevention of Legionella plus disinfection in the food and beverage industries; treatment of cooling water and potable water; filter disinfection in swimming pools

For more information see page → 3-5

Bello Zon® CDKc chlorine dioxide system



CDKc

- Increased safety due to pre-dilution
- Efficient operation, thanks to production, metering, and monitoring of ClO_2 using just one system
- Perfect quality management, thanks to integrated storage of all operating parameters and measured values
- Automatic monitoring of operating parameters and maintenance dates

For more information see page → 3-12

New Products Water Treatment and Water Disinfection



P_PMA_EL_0007_SW

CHLORINSITU® III compact electrolysis system

- Thanks to robust technology and space-saving design, it is particularly suitable for use with smaller swimming pools in residential properties and hotels (indoor pools of up to 2,000 m³).
- When Operated at full disinfection performance, it represents a particularly cost-effective investment
- Economical production of a chlorine-based disinfection solution using inexpensive sodium chloride (salt) as a raw material
- Digital display of the current output and all operating and error messages, as well as monitoring of all important functions with integrated microprocessor control
- Control of the output can be undertaken manually, automatically (with the controller option) or externally
- Additional pH value control (with the controller option) by activation of an external metering pump

For more information see page → 4-6



CHLORINSITU III

CHLORINSITU® III electrolysis system

- Minimised acid consumption for pH correction
- Safe system control with remote diagnosis by modem
- Cost-effective operation thanks to the use of sodium chloride as an inexpensive raw material and lower chemical consumption for pH correction
- Robust, simple technology

For more information see page → 4-5

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1 Dulcodes UV Systems

1.1 General Notes on UV Treatment

Disinfection is a fundamental step in modern water treatment. UV disinfection is used to an ever increasing extent, as a safe, chemical-free and reliable disinfection process. Extensive research projects and numerous trouble-free operational systems prove the safety and reliability of UV disinfection.

With UV disinfection, the water to be disinfected is irradiated with ultraviolet light, which involves a purely physical, chemical-free process for water disinfection.

UV-C radiation in particular, with a wavelength in the 240 to 280 nm range, attacks the vital DNA of the bacteria directly. The radiation initiates a photochemical reaction and destroys the genetic information contained in the DNA. The bacteria lose their reproduction capability and are destroyed. Even parasites, such as Cryptosporidia or Giardia, which are extremely resistant to chemical disinfectants, are efficiently reduced.

Initiation of photochemical reactions is utilised in other applications too. The undesirable combined chlorine in swimming pool water is reduced by UV radiation, as a result of which enormous fresh water savings are achieved. Oxidants such as ozone, chlorine or chlorine dioxide are reliably reduced in the production water used in the food and beverages industry, avoiding the need for costly activated charcoal filters.

Special systems with special lamps and special composition of the radiation chamber can be used for reduction of TOC (Total Organic Carbon) in the treatment of ultra-pure water.

UV disinfection has many advantages:

- Immediate and safe destruction of the bacteria without addition of chemicals
- Photochemical reduction of undesirable substances
- No THM or AOX formation, no formation of other undesirable substances
- No impairment of the odour or taste of the water
- No storage and handling of chemicals required
- Effect is independent of pH
- No reaction vessel or reaction tank required
- Minimal space requirement
- Low investment and operating costs with excellent reliability and efficiency

1.1.1 Applications of Dulcodes UV Systems

A large number of UV disinfection systems have been supplied worldwide, for the most diverse of applications:

- **Private source water and municipal water works**
for disinfection of potable water
- **Food and beverage industry**
to destroy the bacteria in the water needed for food and beverage production and for disinfection of service water
to reduce the chlorine dioxide in the production water
- **Pharmaceutical and cosmetics industry**
to maintain the high microbiological requirements of the production water
to destroy residual ozone in the production water without use of activated charcoal filters
- **Reverse osmosis plants**
for permeate disinfection
- **Municipal sewage plants**
for reduction of the bacterial count in the sewage plant outflow
for reduction of the bacterial count in industrial water extracted from the sewage plant outflow
- **Horticulture**
for disinfection of irrigation water
- **Spa pools and swimming pools**
for disinfection of pool water
for chloramine reduction in pool water
- **Semiconductor industry**
for reduction of TOC and to maintain the high microbiological requirements of the production water

1 Dulcodes UV Systems

1.1.2

Description of Dulcodes UV Systems

Basically, Dulcodes UV disinfection systems consist of:

- High-quality radiation chambers made of stainless steel (DIN 1.4404 or 1.4571) or UV-resistant plastic
- Lamp protection tubes made of high-quality quartz, easily removable for cleaning purposes
- Lamps with a particularly high UV output in the 254 nm range, ensuring outstanding disinfection
- Highly selective UV sensors with good long-term and temperature stability
- UV system controllers and modern electronic ballasts fitted in a control cabinet

The special features of our Dulcodes UV disinfection systems are:

- Even irradiation of the entire water flow through optimised system hydraulics, so ensuring effective disinfection results
- Flow-optimised inlet zone
- Longitudinal flow against UV lamps with high turbulence
- Use of UV lamps with long lamp life time and high UV-C output
- Automatic cleaning system for the sleeve of medium-pressure lamps
- Manual cleaning system for the sleeve of Dulcodes R or Dulcodes S systems
- System controller with comprehensive monitoring and reporting functions
- Display of all important operating parameters and reporting of faults in plain text
- Trend display of the variation in the UV sensor signal over time
- Analogue output sensor signal and alarm relay
- Use of modern electronic ballasts with bus technology for lamp-friendly ignition and operation
- Individual lamp monitoring
- Direct control of automatic isolation and flushing valves

Dulcodes UV Lamps

Standard low-pressure lamp

Robust low-pressure mercury lamp with a life expectancy of approx. 14,000 operating hours. The operating temperature of the lamp is 30-50 °C. This is why its use is limited to water temperatures between 5 and 40 °C. The output is approx. 100 W per metre arc length.

High-Flux low-pressure lamp

Low-pressure amalgam lamp with a life expectancy of approx. 10,000 operating hours. The operating temperature of the lamp is 100-130 °C. This is why its use is limited to water temperatures of up to 70 °C. The output is independent of the water temperature and is approx. 200 W per metre arc length.

Opti-Flux low-pressure lamp

Doped, high-performance low-pressure amalgam lamp with a life expectancy of approx. 14,000 operating hours. The operating temperature of the lamp is 100-130 °C. This is why its use is limited to water temperatures of up to 70 °C. The output is independent of the water temperature and is approx. 300 W per metre arc length.

Powerline medium-pressure lamp

Medium-pressure mercury lamp with a life expectancy of approx. 6,000 to 10,000 operating hours, depending on lamp size. The high output of these lamps (up to 10,000 W per metre arc length) permits the treatment of very large flows. Thanks to their broad range spectrum, these lamps are specifically suitable for photochemical processes. The operating temperature of the lamp is 650-850 °C. Powerline medium pressure lamps are typically operated with a mechanical wiper system. This is why their use is limited to water temperatures of up to 40 °C.

1 Dulcodes UV Systems

Dulcodes UV Controllers

Compact controller

Compact unit for control of all basic functions of the UV system. The large graphic display shows the current UV-C output, the operating hours and the number of lamp switch-ons. With fixed-setting warning and safety threshold levels, a warning signal is generated and a relay output (230 V / 0.2 A) for operation of a shut-off valve is actuated if the UV output is too low. Alternatively, this output can also be used as a common alarm relay (230 V / 2.5 A).

Deluxe control

The Dulcodes deluxe control includes a large, graphical display for viewing the UVC sensor signal. Shown as a trend display, lamp ageing, deposit formation on the lamp protection tube or a change in water quality can be seen in a time window. The freely programmable safety and alarm thresholds are also shown, as well as the number and times of lamp activations. All operating and error messages are shown in plain text. Setting of the operating parameters is facilitated by the clear menu layout. The control offers a selection of 9 different languages.

The control is connected to the ballasts via a bus system so that each individual lamp can be monitored. This also makes it possible to position the control at long distances from the radiation chamber, lamps and ballasts.

Various auxiliary functions, such as the automatic flushing of the system over a freely programmable flushing time, control of a shut-off valve and a circulating pump are integrated as standard. 2 voltage outputs 230 V / 0.2 A and a switching output 230 V / 2.5 A are provided for this purpose.

The UVC sensor signal can be monitored online via a standard signal output 0/4-20 mA. If the warning and safety thresholds are undershot, two relay outputs (230 V / 2.5 A) send a corresponding signal. All other faults are signalled via a combined alarm relay (230 V / 2.5 A).

3 potential-free control inputs make it possible to connect external information to the control: The error input can, for example, be used for external temperature monitoring, the pause input can be used to interrupt operation of the system at scheduled intervals, the flow control can be of help in connection with flushing procedures.

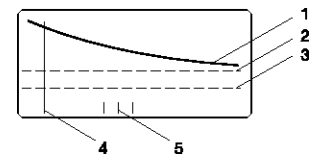
Powerline deluxe control

This control additionally includes the option of external power control via a standard signal 0/4-20 mA (not for Dulcodes M 2 kW, 3 kW and Dulcodes S). The systems can thus, for example, be controlled according to the flow or the lamp output and can be automatically adjusted to a defined UVC sensor signal. This saves energy costs and extends the lamp service life.

The control is also equipped with a display and monitor for the radiation chamber temperature, together with a freely programmable control for the mechanical wiper system used in automatic cleaning of the lamp protection tube.

Dulcodes A deluxe control

A Siemens S7-1200 control with a KP 300 Basic operating unit is used for operation and control of Dulcodes A systems. In addition to the functions of the Powerline deluxe control, it also has a digital input. The digital input can be used to set one of two freely programmable power levels (e.g. night reduction for pool water).



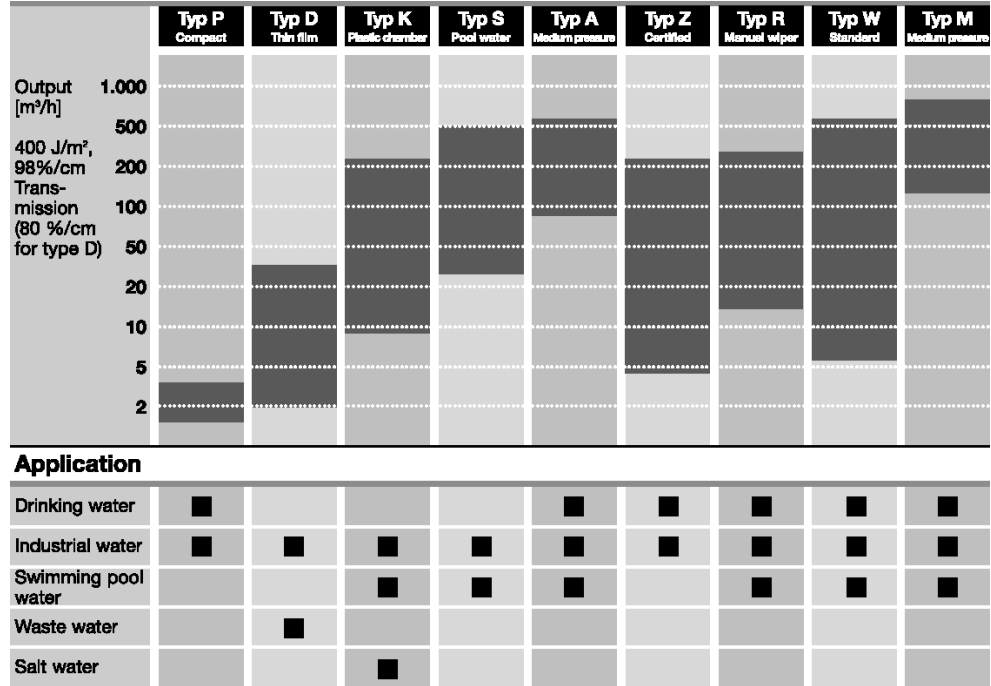
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- 1 UV sensor signal
- 2 Warning threshold
- 3 Safety threshold
- 4 Calibration
- 5 On/off contacts

1 Dulcodes UV Systems

1.2 Performance Overview of Dulcodes UV Systems

ProMaqua offers a wide range of UV systems for the most diverse applications. The following overview shows the output and main applications of our standard systems:



P_PMA_DS_0026_SW

We offer a full advisory service covering everything required for the safe use of a Dulcodes UV system:

- Assessment of the situation on site by trained, competent field engineers.
- All water parameters needed for optimum system design can be measured in our water laboratory.
- Design and planning of the system.
- Commissioning and system maintenance by our trained service technicians.

1

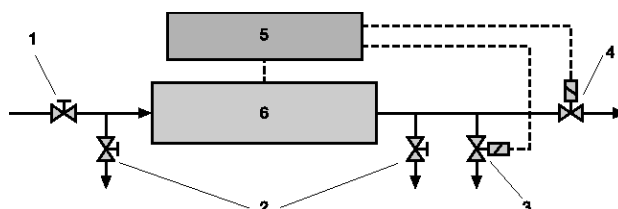
1 Dulcodes UV Systems

1.2.1

Notes on Planning and Designing a UV System

- The system should always be designed for the maximum water flow.
- The system should always be designed for the worst anticipated UV transmission.
- Fireproof sampling cocks for microbiological tests should be provided upstream and downstream of UV disinfection systems.
- A manual shut-off valve must be provided before the UV system to isolate the system for maintenance work.
- With potable water disinfection and similar applications, an electrically-controlled shut-off valve should be provided downstream of the UV disinfection system, which also closes automatically on mains failure (solenoid valve, automatic closing flap valve or similar).
- With service water disinfection, it is normally sufficient to provide a manual valve to isolate the system for maintenance work, instead of the electrically-controlled valve.
- With potable water disinfection and similar applications, a flushing valve should be provided downstream of the UV disinfection.
- It should be ensured that there is sufficient space available for removing the lamp protection tube and lamp replacement.
- Modern electronic ballasts only allow a limited cable length between ballast and lamp, so that the control box with the ballasts should be positioned close to the lamp. On the other hand, the controller can be fitted in a control area, for example. **However, the maximum cable lengths we have specified should not be exceeded in this case.**

- 1 Shut-off valve
- 2 Sampling cock
- 3 Flushing valve
- 4 Shut-off valve
- 5 Controller/ballast
- 6 Radiation chamber



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Typical installation diagram of a UV disinfection system

The following details are required for design of a UV system:

- Application of the system
- Maximum water flow
- Minimum UV transmission of the water

The UV transmission should be determined by means of a laboratory measurement of the absorption at 254 nm.

A full water analysis gives important conclusions on the operating conditions of the system. The following questionnaire provides our project engineers with the information needed to design an appropriate system.

1 Dulcodes UV Systems

1.3 Questionnaire for Designing a UV System

Application of the UV system:

- for disinfection of
 - drinking water
 - production water in the food industry, cosmetics or pharmaceuticals
 - utility water
 - wastewater
 - salt water or brackish water
 - _____
- for photochemical reduction of
 - ____ ppm ozone
 - ____ ppm chlorine dioxide
 - ____ ppm chlorine
 - ____ ppm chloramine

Water data:

Maximum water flow _____ m³/h Maximum water pressure _____ bar

Minimum UV transmission at 254 nm _____ %/1 cm _____ %/10 cm _____ SAC 254 nm

Turbidity _____ FNU _____ NTU

Suspended particles content _____ mg/l

Water quality constant fluctuating

Total hardness _____ mmol/l _____ °dH

Carbonate hardness _____ mmol/l _____ °dH

Chloride _____ mg/l

Manganese _____ mg/l

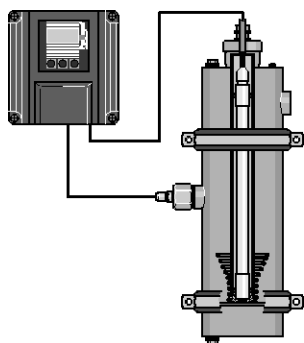
Iron _____ mg/l

Water temperature _____ °C

Other requirements:

1 Dulcodes UV Systems

1.4 Dulcodes P UV Systems



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Dulcodes P UV systems are used for disinfection of potable water and service water and – depending on transmission – can be used with flows up to 4 m³/h.

Features

- Flow: up to 4 m³/h (depending on transmission)
- Control with switching output, to which a shut-off valve or fault indicating device can be connected
- High-quality, factory-calibrated UV sensor
- Graphic display with indication of UV intensity, total number of operating hours and number of lamp switching cycles
- Standard low-pressure lamp with a service life of approximately 10,000 – 14,000 operating hours
- Radiation chambers made from high-grade stainless steel 1.4404
- Control and ballast in compact plastic housing

Main applications

Potable water	Industrial water	Swimming pool water	Waste water	Salt water
✓	✓			

Technical Data

Type	Max. flow m ³ /h	Lamp power W	Connected load W	Radiation chamber length mm	Minimum clearance for maintenance work mm	Ø mm	Empty weight/ Operating weight kg	Connection nominal diameter
16P	1.5*	16	30	382	350	114	6/10	G 3/4"
45P	3.8*	45	60	940	900	114	10/20	G 1 1/4"

Lamp type	Standard low-pressure lamp (see p. → 1-2)
Controller type	Compact controller (see p. → 1-3)
Permissible operating pressure	10 bar
Permissible ambient temperature	5–45 °C
Permissible water temperature	5–40 °C

* 98 %/cm transmission; 400 J/m² UV dose

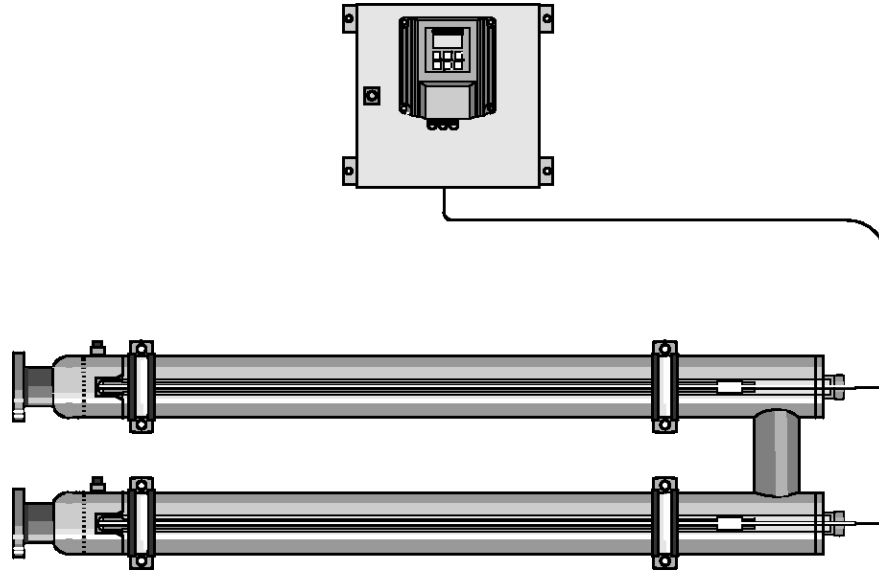
Spare parts for Dulcodes P UV systems

	Order no.
UV lamp 16 W	1002472
UV lamp 45 W	1002473
O-ring for fixing the lamp in the lamp protection tube	481016
Lamp protection tube for Dulcodes 16 P	1004450
Lamp protection tube for Dulcodes 45 P, 45 D and 130 D, 130 W	1002468
O-ring lamp protection tube/lamp cover	1004920
UVC sensor P/D/W/R G 3/4 1.4539 for systems delivered from Sept. 2006; U sensor	1004734
O-ring for UVC sensor	1002175
Sensor connection cable, 2 m long for systems supplied since September 2006	1029262
Screwed plug G 1/4"	1002752
O-ring for G 1/4" screwed plug	741256

1 Dulcodes UV Systems

1.5 Dulcodes D UV Systems for High-Turbidity Water

Dulcodes D thin-film type UV systems with High-Flux lamps are used for disinfection of high-turbidity or discoloured service water or waste water and – depending on transmission – can be used with flows up to 33 m³/h.



pk_7_050

Features

- Flow: up to 33 m³/h (depending on transmission)
- Standard chambers made up of one or more longitudinal flow radiation chambers arranged one after the other, each with its own lamp
- High-efficiency, low-pressure High-Flux lamp with special amalgam technology, increased UV output, largely independent of temperature
- Lamp service life approximately 10,000 h
- Ballasts with BUS interface for ignition and monitoring of each individual lamp
- Variable lamp current, hence lamp-friendly ignition process and precise adjustment of the optimum lamp operating current
- Long-term stable UVC sensor for monitoring the disinfection capacity and transmission (UV transmission factor) of the water, factory-calibrated
- Large, graphic display for viewing the sensor signal
- Monitoring of lamp ageing, lamp protection tube fouling and changes in water quality
- Freely programmable control, e.g. for different flushing, warning and shut-down procedures
- Radiation chambers made of high-grade stainless steel 1.4404
- Control cabinets made of painted steel
- Complete cleaning system available as an accessory and consisting of acid tank, circulating pump, valves and hoses for rapid chemical cleaning of the lamp sleeve and radiation chamber

Main applications

Potable water	Process water	Swimming pool water	Waste water	Salt water
—	✓	—	✓	—

1 Dulcodes UV Systems

Technical Data

Type	Max. flow	Lamp power	Connected load	Radiation chamber length	Minimum clearance for maintenance work	Ø	Empty weight/ Operating weight	Connection nominal diameter
	m ³ /h	W	W	mm	mm	mm	kg	
1x45 D**	2.0*	1x45	60	940	900	89	10/15	1"
1x130 D	4.6*	1x130	150	940	900	89	10/15	1"
1x230 D	8.2*	1x230	250	1,500	1,400	89	18/25	DN 65
2x230 D	16.0*	2x230	500	1,500	1,400	89	36/50	DN 65
3x230 D	25.0*	3x230	750	1,500	1,400	89	54/75	DN 65
4x230 D	33.0*	4x230	1,000	1,500	1,400	89	72/100	DN 65

* 80 %/cm transmission; 400 J/m² UV dose

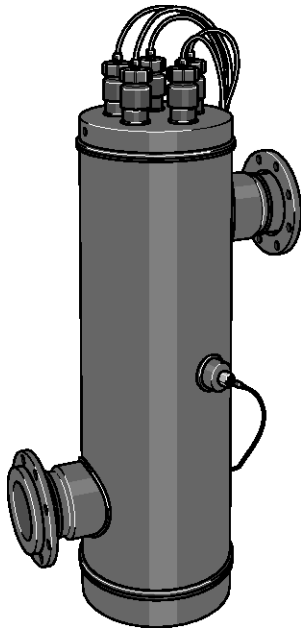
Lamp type	Standard low pressure lamp with 1x45 D High-Flux low pressure lamp with 1x130 D - 4x230 D (see p. → 1-2)
Controller type	Compact controller with 1x45 D De luxe controller with 1x130 D - 4x230 D (see p. → 1-3)
Permissible operating pressure	10 bar
Permissible ambient temperature	5–40 °C
Permissible water temperature	5-70 °C **5-40 °C

Spare parts for Dulcodes D UV systems

	Order no.
UV lamp 45 W	1002473
High-Flux UV lamp 130 W	1002486
High-Flux UV lamp 230 W	1002487
Lamp protection tube for Dulcodes 45 P, 45 D and 130 D, 130 W	1002468
Lamp protection tube for Dulcodes 1-6x230 D, 230 W	1002469
O-ring lamp protection tube/lamp cover	1004920
UVC sensor P/D/W/R G 3/4 1.4539 for systems delivered from Sept. 2006; U sensor	1004734
O-ring for UVC sensor	1002175
Sensor connection cable, 5 m long for systems supplied since September 2006	1021041
Screwed plug G 1/4"	1002752
O-ring for G 1/4" screwed plug	741256
Replacement filter mats for control cabinet ventilation (2 off required per control cabinet)	1004212
Sickle spanner (special tool required to change the lamp protection tube)	1002764

1 Dulcodes UV Systems

1.6 Dulcodes K UV Systems with PE-HD Radiation Chamber



pk_7_047

The Dulcodes K range of UV systems with High-Flux lamps can be used for the disinfection of saline water (thermal spring water, sea water). The radiation chambers are made of high-grade plastic and through the use of special welding procedures have an optimised pressure rating (can be used up to an operating pressure of 4 bar). Depending on transmission, the product range can be used with flows of up to 250 m³.

Features

- Flow: up to 250 m³/h (depending on transmission)
- High-efficiency low-pressure High-Flux lamp (130 W) or Opti-Flux (290 W) with special amalgam technology, increased UV output, largely independent of temperature
- Lamp service life: approximately 10,000 – 14,000 h
- Ballasts with BUS interface for ignition and monitoring of each individual lamp
- Variable lamp current, hence lamp-friendly ignition process and precise adjustment of the optimal lamp operating current
- Long-term stable salt water-resistant PTFE UVC sensor for monitoring the disinfection capacity and transmission (UV transmission factor) of the water, factory calibrated
- Large graphic display for output of the sensor signal
- Monitoring of lamp ageing, lamp protection tube fouling and changes in water quality
- Freely programmable control, e.g. for different flushing, warning and shutdown procedures
- Radiation chambers made of UV-stabilised PE-HD
- Control cabinets of painted steel

Main applications

Potable water	Process water	Swimming pool water	Waste water	Salt water
✓	✓	✓	—	✓

Technical Data

Type	Max. flow m ³ /h	Lamp power	Connected load	Radiation chamber length mm	Minimum clearance for maintenance work mm	Ø mm	Connection nominal diameter
		W	W				
1x130K	8.7*	1x130	150	1,371	1,400	125	DN 50
1x290K	26.6*	1x290	310	1,530	1,710	138	DN 80
2x290K	93.5*	2x290	600	1,535	1,710	188	DN 125
3x290K	192.7*	3x290	910	1,535	1,710	268	DN 200
4x290K	250.0*	4x290	1,200	1,535	1,710	268	DN 200

* 98 %/cm transmission; 400 J/m² UV dose

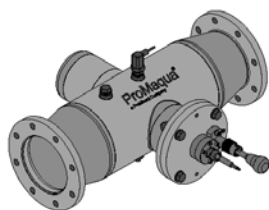
Lamp type	High-Flux low-pressure lamp 130 W Opti Flux low-pressure UV lamp, 290 W (see page → 1-2)
Controller type	De luxe controller (see p. → 1-3)
Permissible operating pressure	4 bar
Permissible ambient temperature	5–40 °C
Permissible water temperature	5–30 °C

Spare parts for Dulcodes K UV systems

	Order no.
High-Flux UV lamp 130 W	1002486
Opti Flux UV lamp 290 W	1040082
Lamp protection tube for Dulcodes 130 K	1006385
Lamp protection tube for Dulcodes 290 K and 290 W	1002471
O-ring lamp protection tube/lamp cover	1006332
UVC sensor K, red brass for systems supplied up to Nov. 2011	1006329
UVC-Sensor K, PTFE for systems supplied since Dec. 2011	1035201
O-ring for UVC sensor	1002175
O-ring for UVC sensor K, PTFE	1041049
Replacement filter mats for control cabinet ventilation (2 off required per control cabinet)	1004212

1 Dulcodes UV Systems

1.7 Dulcodes S UV Systems for Chloramine Control in Pool Water



P_PMA_DS_0018_SW1

Dulcodes S UV treatment systems are suitable for the photochemical degradation of combined chlorine (chloramine) in swimming pool water treatment. Special medium-pressure UV lamps generate intensive polychromatic UV radiation to reduce the odour-intensive and eye-irritating substances. The result is an improved water quality for healthy and pleasant bathing.

Features

- Flow: up to 500 m³/h (depending on transmission).
- Extremely compact inline system with small footprint.
- Simple installation due to a minimum of fitting work, quick retrofitting.
- A free choice of fitting position ensures maximum installation flexibility.
- Can be directly installed in a plastic circulation pipe because no UV radiation escapes from the radiation chamber.
- Unbeatable simple and quick maintenance: All maintenance work can be carried out quickly and conveniently from one side.
- Powerline S medium-pressure lamps with high power input of up to 3 kW.
- Special UV medium-pressure lamp with intense polychromatic UV radiation.
- Lamp service life: approximately 8,000 h.
- Long-term stable UVC sensor for monitoring the lamp output, lamp protection tube fouling and changes in water quality.
- Integral temperature sensor for monitoring the water temperature in the radiation chamber.
- Large graphic display for displaying the time dependency of the UV sensor signal with a trend indication line.
- Manual power control to optimally adapt the system to the relevant capacity needed (not for Dulcodes 1 x 0.65 and 1S).
- Automatic switching on and off based on the chloramine value, for example used in conjunction with the DULCOMARIN® II.
- Optional manual or automatic wiper system for efficient removal of deposits on the lamp protection tube. The wiper system can be easily retrofitted.
- Radiation chambers made of high-grade stainless steel 1.4404.
- Control cabinet made of painted steel.
- Optimised use of energy, thanks to large radiation chamber and uniform irradiation of the entire water flow due to optimised system hydraulics.

Application focuses

Potable water	Industrial water	Swimming pool water	Waste water	Salt water
-	✓	✓	-	-

1 Dulcodes UV Systems

Technical Data

Type	Max. flow m ³ /h	Lamp power kW	Connected load kW	Radiation chamber length mm	Minimum clearance for maintenance work mm	Min. distance from wall mm	Empty weight/ Operating weight kg	Connection nominal diameter can be selected mm
1x0,65S	17.0*	0.65	0.75	500	335	160	21/31	65/80
1x1S	51.0*	1.00	1.10	700	400	450	31/47	100/125
1x2S	89.0*	2.00	2.10	700	500	550	38/65	125/150
1x3S	177.0*	3.00	3.20	800	600	650	52/118	200/250
2x2S	240.0*	4.00	4.20	900	1,000	670	78/166	200/250
2x3S	330.0*	6.00	6.20	900	1,000	670	78/166	200/250
3x3S	500.0*	9.00	9.20	900	1,000	670	78/166	250/300

* 98 %/cm transmission; 600 J/m² UV dose

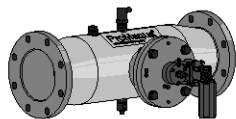
Lamp type	Powerline S medium-pressure lamp (see p. → 1-2)
Controller type	Powerline S comfort control (see p. → 1-3)
Permissible operating pressure	6 bar
Permissible ambient temperature	5–40 °C
Permissible water temperature	5–40 °C

Spare parts for Dulcodes S UV systems

	Order no.
Powerline UV lamp 1 kW	1035179
Powerline UV lamp 2 kW	1035057
UV lamp Powerline 3 kW	1035180
Lamp protection tube for Dulcodes 1 A and 0.6 S	1035218
Lamp protection tube for Dulcodes 1 S	1035166
Lamp protection tube for Dulcodes 2 S	1035041
Lamp protection tube for Dulcodes 3 S	1035193
Wiper element (2 required per UV lamp)	1027879
Spare part set for UV S 1-3 kW motorised wiper	1037735
Spare part set for UV S 2x2 kW and 2x3 kW motorised wiper	1037756
Spare part set for UV S 3x3 kW motorised wiper	1037757
O-ring lamp protection tube/lamp cover	790410
UVC-U sensor M 1.4539	1034147
O-ring for UVC sensor	1002175
Sensor connection cable, 5 m long for systems supplied since September 2006	1021041
Replacement filter mats for control cabinet ventilation (2 off required per control cabinet)	1004212

1 Dulcodes UV Systems

1.8 Dulcodes A Inline UV Systems with Medium-Pressure Lamps



P_PMA_DS_0024_SW1

Dulcodes A UV treatment systems are ideal for the photochemical decomposition of combined chlorine (chloramines) in the treatment of swimming pool water. Chlorine-resistant germs, especially cryptosporidia are reliably killed. Special medium-pressure UV lamps generate intense polychromatic UV radiation to reduce strong substances that produce odours and irritate the eyes. The result is an improved quality of water for healthy and pleasant swimming.

Features

- Flow: up to 569 m³/h (depending on transmission and radiation intensity).
- Extremely compact inline system with small footprint.
- Simple installation due to a minimum of fitting work, quick retrofitting.
- A free choice of fitting position ensures maximum installation flexibility.
- Powerline A medium-pressure lamps with high power input of up to 3 kW.
- Can be directly installed in a plastic circulation pipe because no UV radiation escapes from the radiation chamber.
- Unbeatable simple and quick maintenance: All maintenance work can be carried out quickly and conveniently from one side.
- Lamp service life: approximately 8,000 h.
- Long-term stable UVC sensor for monitoring the lamp output, lamp protection tube fouling and changes in water quality.
- Integral temperature sensor for monitoring the water temperature in the radiation chamber.
- Large graphic display for displaying the time dependency of the UV sensor signal with a trend indication line.
- External power control via 0/4 - 20 mA standard signal for optimum adaptation of the system to changing operating conditions, such as flow fluctuations.
- Automatic adjustment of lamp output to a defined UV-C sensor signal saves energy and extends the lamp service life.
- Freely programmable control (Dulcodes A deluxe control).
- Automatic motor-driven wiper for efficient removal of deposits on the lamp protection tube.
- Automatic chloramine value-dependent control, for example used in conjunction with the DULCOMARIN® II. Power increase to an adjustable value set via the digital input.
- Radiation chambers made of high-grade stainless steel 1.4404.
- Control cabinet made of painted steel.
- Optimised use of energy, thanks to large radiation chamber and uniform irradiation of the entire water flow due to optimised system hydraulics.

Key applications

Potable water	Process water	Swimming pool water	Waste water	Salt water
✓	✓	✓	-	-

1 Dulcodes UV Systems

Technical Data

Type	Max. flow m ³ /h	Lamp power kW	Connected load kW	Radiation chamber length mm	Minimum clearance for maintenance work mm	Min. distance from wall mm	Empty weight/ Operating weight kg	Connector width DIN/ ANSI
1 x 1A	58.0* / 88.0**	1.00	1.10	700	400	450	31/47	DN 100/4"
1 x 2A	102.0* / 153.0**	2.00	2.10	700	500	550	38/65	DN 150/6"
1 x 3A	205.0* / 307.0**	3.00	3.20	800	600	650	52/118	DN 200/8"
2 x 2A	278.0* / 417.0**	4.00	4.20	900	1,000	670	78/166	DN 200/8"
2 x 3A	379.0* / 569.0**	6.00	6.20	900	1,000	670	78/166	DN 250/10"
3 x 3A	569.0* / 853.0**	9.00	9.20	900	1,000	670	78/166	DN 300/12"

* 98 %/cm transmission; 600 J/m² UV dose for the breaking down of combined chlorine

** 98 %/cm transmission; 400 J/m² UV dose for disinfection applications

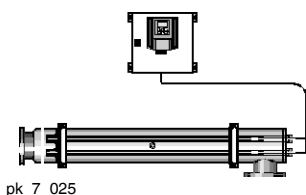
Lamp type	Powerline A medium-pressure lamp (see page → 1-2)
Permissible operating pressure	10 bar (for systems 1 x 1A - 1 x 3A) 6 bar (for systems 2 x 2A - 3 x 3A)
Permissible ambient temperature	5–40 °C
Permissible water temperature	5–40 °C

Spare parts for Dulcodes A UV systems

	Order no.
Powerline UV lamp 1 kW	1035179
Powerline UV lamp 2 kW	1041450
Powerline UV lamp 3 kW	1041451
Lamp protection tube for Dulcodes 1 A and 0.6 S	1035218
Lamp protection tube for Dulcodes 2 A	1041723
Lamp protection tube for Dulcodes 3 A	1041485
Wiper element (2 required per UV lamp)	1027879
Spare parts set for UV A 1-3 kW motor wiper	1042860
Spare part set for UV S 2x2 kW and 2x3 kW motorised wiper	1037756
Spare part set for UV S 3x3 kW motorised wiper	1037757
O-ring lamp protection tube/lamp cover	1023569
UVC-U sensor M -1, 4-20 mA	1041449
O-ring for UVC sensor	1002175
Replacement filter mats for control cabinet ventilation (2 off required per control cabinet)	1004212

1 Dulcodes UV Systems

1.9 Dulcodes Z UV Systems with Certified Performance



Dulcodes Z UV disinfection systems serve the disinfection of potable and industrial water and can be used - depending on transmission - for flows of between 2 and 230 m³/h.

All Dulcodes Z systems are DVGW-certified and meet the requirements of the DVGW Test Regulation W 294. This test regulation requires comprehensive biosimetric measurements as a proof of the required effectiveness of the disinfection.

The list of treatment substances and disinfection processes according to section 11 German Drinking Water Ordinance 2001 specifies that in Germany only UV systems may be used for potable water disinfection that meet the requirements according to the DVGW Test Regulation W 294.

Features

- Flow: up to 230 m³/h (depending on transmission)
- High-efficiency, low-pressure Opti-Flux lamp with special amalgam technology, increased UV output, largely independent of temperature
- Lamp service life: 14,000 h
- Low maintenance costs as a result of higher output per lamp and longer lamp service life
- Electronic ballasts with BUS interface for ignition and monitoring of each individual lamp
- Variable lamp current, hence lamp-friendly ignition process and precise adjustment of the optimal lamp operating current
- DVGW (German Gas and Water Association) certified UVC sensor for monitoring the disinfection capacity and transmission (UV transmission factor) of water
- Sensor calibration function according to DVGW guideline
- Large graphical display for output of the sensor signal and operating messages in plain text
- Monitoring of lamp ageing, lamp protection tube fouling and changes in water quality
- Freely programmable control, e.g. for different flushing, warning and shutdown procedures
- Radiation chambers made of high-grade stainless steel 1.4404
- Radiation chamber hydraulics optimised by computer simulation
- Control cabinets of painted steel

Main applications

Potable water	Process water	Swimming pool water	Waste water	Salt water
✓	✓	—	—	—

Technical Data

Type	Max. flow m ³ /h	Lamp power W	Connected load W	Radiation chamber length mm	Minimum clearance for maintenance work mm	Ø mm	Empty weight/ Operating weight kg	Connection nominal diameter
75Z***	4.5*	1x75	90	1,115	910	140	12/27	G 1 1/4"
200Z	10.0*	1x200	220	1,040	785	140	16/30	DN 50
300Z	20.0*	1x300	320	1,540	1,285	140	25/47	DN 80
2x300Z	60.0*	2x300	650	1,590	1,560	219	39/97	DN 100
3x300Z	110.0*	3x300	1,000	1,625	1,695	219	39/97	DN 150
4x300Z	165.0*	4x300	1,300	1,630	1,563	273	56/143	DN 150
5x300Z	230.0*	5x300	1,600	1,630	1,590	273	56/144	DN 200
7x300Z	230.0**	7x300	2,200	1,630	1,590	324	73/201	DN 200

* 98 %/cm transmission; 400 J/m² UV dose

** 94 %/cm transmission; 400 J/m² UV dose

Lamp type

Standard low pressure lamp with Type 75 Z
Opti-Flux low pressure lamp with Types 200 Z to 7x300 Z
(see p. → 1-2)

Controller type

Deluxe controller
UVC sensor signal in W/m² which can be calibrated with the help of a reference radiometer
(see p. → 1-3, Reference radiometer RRM see p. → 1-26)

Permissible operating pressure

10 bar

Permissible ambient temperature

5–40 °C

Permissible water temperature

5 - 70 °C ***5-30 °C

1 Dulcodes UV Systems

Spare parts for Dulcodes Z UV systems

	Order no.
Opti-Flux UV lamp 75 W	1020911
Opti-Flux UV lamp 200 W	1021008
Opti-Flux UV lamp 300 W	1020929
Lamp protection tube for Dulcodes 75 W and 75 Z	1020845
Lamp protection tube for Dulcodes 200 Z	1021010
Lamp protection tube for Dulcodes 1-7x300 Z, Dulcodes R	1020846
O-ring lamp protection tube/lamp cover	1023569
UVC sensor Z 1.4404 DVGW	1022347
Sensor window G 1x20 for Dulcodes 75, 200, 2x300Z	1021113
Sensor window G 1x30 for Dulcodes 300, 3x300Z	1022377
Sensor window G 1x47.5 for Dulcodes 4-7x300Z	1023884
O-ring for sensor window	1023570
Lamp cable, 3.5 m long	1017867
Lamp cable, 7.5 m long	1024826
Sensor connection cable, 5 m long for systems supplied since September 2006	1021041
Extension for sensor cable, 5 m long	1024825
Screwed plug G 1/4"	1002752
O-ring for G 1/4" screwed plug	741256
Replacement filter mats for control cabinet ventilation (2 off required per control cabinet)	1004212

1 Dulcodes UV Systems

1.10 Dulcodes R UV Systems with Wiper

Dulcodes R UV systems are used in disinfecting potable water and process water, as well as in the photochemical decomposition of chloramines in swimming pool water. They are particularly suitable for water that has a tendency to form deposits on the protection tube. These deposits can be easily removed using the wiper mechanism even at maximum operating pressure without any need to interrupt operation. The wiping process can be carried out manually or at adjustable intervals using a motorised automatic wiper.

Thanks to the Opti-Flux high performance UV lamps with a power output of 300 W, maximum flow rates are achieved with a minimum number of lamps. Combined with the long service life of the UV lamps of up to 14,000 operating hours, lamps need to be replaced less frequently when compared with conventional systems, resulting in reduced costs.

Features

- Flow: up to 274 m³/h (depending on transmission).
- Auto-adjusting wiper elements made of food-safe PTFE.
- Cleaning possible without interrupting operation: The manual or automatic wiper is easy to use even at maximum system operating pressure. Thanks to their self-sharpening function, the wiper elements provide optimum cleaning and have a long service life.
- High-efficiency, low-pressure High-Flux lamp with special amalgam technology, increased UV output, largely independent of temperature.
- Lamp service life up to 14,000 h.
- Increased output with fewer lamps: a lamp power output of 300 W ensures a higher flow rate per lamp with longer service cycles and lower operating costs.
- Electronic ballasts with BUS interface for ignition and monitoring of each individual lamp.
- Variable lamp current enables gentle ignition and exact matching to optimum lamp operation.
- Factory calibrated UV-C sensitive sensor.
- Large graphical display for output of sensor signal and operating messages in plain text.
- Freely programmable control, e.g. for different flushing, warning and shut-down procedures.
- Hydraulically optimised radiation chambers made of high-grade stainless steel 1.4404.
- Control cabinets made of painted steel.

Main applications

Potable water	Industrial water	Swimming pool water	Waste water	Salt water
✓	✓	✓	—	—

Technical Data

Type	Max. flow m ³ /h	Lamp power W	Connected load W	Radiation chamber length mm	Minimum clearance for maintenance work mm	Ø mm	Empty weight/ Operating weight kg	Connection nominal diameter
1x300R	30.0*	1x300	320	1,562	1,438	140	45/67	DN 80
2x300R	95.0*	2x300	650	1,633	1,438	220	75/134	DN 150
3x300R	179.0*	3x300	1,000	1,638	1,438	273	90/182	DN 200
4x300R	274.0*	4x300	1,300	1,652	1,438	330	120/253	DN 250

* * 98 %/cm transmission; 400 J/m² UV dose

Lamp type	Opti-Flux low-pressure UV lamp (see p. → 1-2)
Controller type	Deluxe controller (see p. → 1-3)
Permissible operating pressure	10 bar
Permissible ambient temperature	5–40 °C
Permissible water temperature	5–70 °C

1 Dulcodes UV Systems

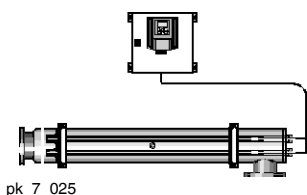
Spare parts for Dulcodes R UV systems

	Order no.
Opti-Flux UV lamp 300 W	1020929
Lamp protection tube for Dulcodes 1-7x300 Z, Dulcodes R	1020846
O-ring lamp protection tube/lamp cover	1023569
Wiper element (2 required per UV lamp)	1027879
UVC-U sensor P/D/W/R 1.4539 from Sep. 2006	1028115
O-ring for UVC sensor	1002175
Lamp cable, 3.5 m long	1017867
Lamp cable, 7.5 m long	1024826
Sensor connection cable, 5 m long for systems supplied since September 2006	1021041
Extension for sensor cable, 5 m long	1024825
O-ring for screw plug G 1/4"	792872
Replacement filter mats for control cabinet ventilation (2 off required per control cabinet)	1004212

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1 Dulcodes UV Systems

1.11 Dulcodes W UV Systems



Dulcodes W UV systems with High-Flux lamps are used for irradiation of a very wide range of water types and – depending on transmission – can be used with flows up to 600 m³/h.

Features

- Flow: up to 600 m³/h (depending on transmission)
- High-efficiency, low-pressure High-Flux lamp with special amalgam technology, increased UV output, largely independent of temperature
- Lamp service life approximately 10,000 h
- Ballasts with BUS interface for ignition and monitoring of each individual lamp
- Variable lamp current, hence lamp-friendly ignition process and precise adjustment of the optimum lamp operating current
- Long-term stable UVC sensor for monitoring the disinfection capacity and transmission (UV transmission factor) of the water, factory calibrated
- Large, graphic display for viewing the sensor signal
- Monitoring of lamp ageing, lamp protection tube fouling and changes in water quality
- Freely programmable control, e.g. for different flushing, warning and shut-down procedures
- Radiation chambers made of high-grade stainless steel 1.4404
- Control cabinets made of painted steel

Main applications

Potable water	Industrial water	Swimming pool water	Waste water	Salt water
✓	✓	✓	—	—

Technical Data

Type	Max. flow m ³ /h	Lamp power W	Connected load W	Radiation chamber length mm	Minimum clearance for maintenance work mm	Ø mm	Empty weight/ Operating weight kg	Connection nominal diameter
1x75W**	5.7*	75	90	1,115	910	140	12/27	G 1 1/4"
1x80W**	5.4*	80	100	630	600	114	8/14	G 1 1/4"
1x130W	8.7*	130	150	940	900	114	10/20	G 2
1x230W	20.0*	230	250	1,468	1,400	140	24/46	DN 65
2x230W	64.0*	2x230	500	1,640	1,500	220	41/96	DN 125
3x230W	117.0*	3x230	750	1,665	1,500	273	53/138	DN 150
4x230W	184.0*	4x230	1,000	1,690	1,600	324	65/150	DN 200
5x230W	228.0*	5x230	1,200	1,690	1,600	324	70/190	DN 200
6x230W	273.0*	6x230	1,400	1,790	1,600	406	75/200	DN 250
7x230W	369.0*	7x230	1,700	1,920	1,600	406	115/310	DN 250
8x230W	418.0*	8x230	1,900	1,920	1,600	406	115/310	DN 250
9x230W	467.0*	9x230	2,100	1,920	1,600	406	130/320	DN 250
10x230W	514.0*	10x230	2,400	1,920	1,600	406	130/320	DN 250
11x230W	561.0*	11x230	2,600	1,920	1,600	406	130/320	DN 250
12x230W	600.0*	12x230	2,800	1,920	1,600	406	130/320	DN 250

* 98 %/cm transmission; 400 J/m² UV dose

Lamp type	High-Flux low pressure lamp (see p. → 1-2)
Controller type	Deluxe controller (see p. → 1-3)
Permissible operating pressure	10 bar
Permissible ambient temperature	5–40 °C
Permissible water temperature	5–70 °C **5–30 °C

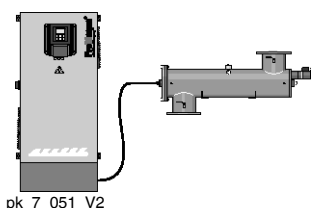
1 Dulcodes UV Systems

Spare parts for Dulcodes W UV systems

	Order no.
Opti-Flux UV lamp 75 W	1020911
High-Flux UV lamp 80 W	1002485
High-Flux UV lamp 130 W	1002486
High-Flux UV lamp 230 W	1002487
Lamp protection tube for Dulcodes 75 W and 75 Z	1020845
Lamp protection tube for Dulcodes 80 W	1002467
Lamp protection tube for Dulcodes 45 P, 45 D and 130 D, 130 W	1002468
Lamp protection tube for Dulcodes 1-6x230 D, 230 W	1002469
Lamp protection tube for Dulcodes 2-5x230 W	1002470
Lamp protection tube for Dulcodes 290 K and 290 W	1002471
O-ring lamp protection tube/lamp cover	1004920
UVC-U sensor P/D/W/R 1.4539 from Sep. 2006	1028115
O-ring for UVC sensor	1002175
Screwed plug G 1/4"	1002752
O-ring for G 1/4" screwed plug	741256
Replacement filter mats for control cabinet ventilation (2 off required per control cabinet)	1004212
Sickle spanner (special tool required to change the lamp protection tube)	1002764

1 Dulcodes UV Systems

1.12 Dulcodes M UV Systems with Powerline Medium-Pressure Lamps



pk_7_051_V2

Dulcodes M UV systems with Powerline medium-pressure lamps are used for treatment of large water quantities and – depending on transmission – can be used with flows up to 800 m³/h. Their special lamp makes these systems particularly suitable for photochemical reduction of chloramine in swimming pool water, chlorine dioxide in the beverages industry, or chlorine and ozone in other applications.

Features

- Flow: up to 800 m³/h (depending on transmission)
- Powerline medium-pressure lamp with a mercury vapour pressure of greater than one bar, hence high connected loads of up to 10 kW per metre arc length
- High gas pressure and relatively high lamp operating temperature of 600 to 800 °C, hence broad emission spectrum
- Particularly suitable for the chemical photochemical degradation of chloramine in swimming pool water, chlorine dioxide in the beverage industry, or chlorine and ozone in other production water, for example, due to the broad emission spectrum of the lamps
- Lamp service life approximately 10,000 h
- Ballasts with BUS interface for ignition and monitoring of the lamp
- Variable lamp current, hence lamp-friendly ignition process and precise adjustment of the optimum lamp operating current
- Long-term stable UVC sensor for monitoring the disinfection capacity and transmission (UV transmission factor) of the water
- Integral temperature sensor for monitoring the water temperature in the radiation chamber
- Large, graphical display for viewing the sensor signal
- Monitoring of lamp ageing, lamp protection tube fouling and changes in water quality
- External power control via 0/4-20 mA standard signal for optimum adaptation of the system to changing operating conditions, such as flow fluctuations (from Dulcodes 4ML)
- Automatic adjustment of the lamp output to a defined UV-C sensor signal saves energy and extends the lamp service life (from Dulcodes 4ML)
- Freely programmable control, e.g. for different flushing, warning and shut-down procedures
- Automatic motor-driven wiper for efficient removal of deposits on the lamp protection tube
- Radiation chambers made of high-grade stainless steel 1.4404
- Control cabinets made of painted steel

Main applications

Potable water	Industrial water	Swimming pool water	Waste water	Salt water
✓	✓	✓	—	—

Technical Data

Type	Max. flow m ³ /h	Lamp power kW	Connected load kW	Radiation chamber length mm	Minimum clearance for maintenance work mm	Ø mm	Empty weight/ Operating weight kg	Connection nominal diameter
1x2ML	88.0*	2	2.3	850	1,750	220	146	DN 100
1x3ML	158.0*	3	3.2	850	1,750	220	156	DN 150
1x4ML	229.0*	4	4.2	1,200	2,450	270	190	DN 200
1x6ML	406.0*	6	6.2	1,200	2,450	320	230	DN 250
1x8ML	541.0*	8	8.2	1,500	3,050	320	240	DN 250
1x10ML	600.0*	10	10.2	1,500	3,050	320	240	DN 250
1x10ML	800.0*	10	10.2	1,500	3,050	400	283	DN 300

* 98 %/cm transmission; 600 J/m² UV dose

Lamp type	Powerline medium pressure lamp (see p. → 1-2)
Controller type	Powerline deluxe controller (see p. → 1-3)
Permissible operating pressure	10 bar
Permissible ambient temperature	5–40 °C
Permissible water temperature	5–40 °C

1 Dulcodes UV Systems

Spare parts for Dulcodes M UV systems

	Order no.
Powerline UV lamp 3 kW	1009385
Powerline UV lamp 4 kW	1009386
Powerline UV lamp 6 kW	1009387
Powerline UV lamp 8 / 10 kW	1009388
Lamp protection tube for Dulcodes 2 ML / 3 ML	1009214
Lamp protection tube for Dulcodes 4/6 ML	1009215
Lamp protection tube for Dulcodes 8/10 ML	1009216
O-ring lamp protection tube/lamp cover	1027553
UVC sensor M 1.4539	1025685
UVC-U sensor M 1.4539	1034147
O-ring for UVC sensor	1002175
Sensor connection cable, 5 m long for systems supplied since September 2006	1021041
Replacement filter mat for control cabinet ventilation (2 No. required per control cabinet)	791038
Wiper complete	1009976

1 Dulcodes UV Systems

1.13

Accessories for Dulcodes UV Systems

Transmission Photometer TMX 02

Photometer for measuring the UV transmission at 254 nm in accordance with DIN 38404.

Supplied in sturdy aluminium case complete with 40 mm quartz cuvette, 4 x NiMH rechargeable batteries and charger.

Technical Data

Dimensions L x W x H (mm)	370 x 330 x 150
Weight	3.0 kg
Voltage supply	4 x 1,500 mAh NiMH batteries
UV-C lamp	Mercury medium pressure lamp
Measuring resolution	Transmission in 0.1 %
Measuring accuracy	Transmission in ± 0.5 %

Order no.

Transmission Photometer TMX 02	1027956
---------------------------------------	---------

Reference radiometer RRM

Reference radiometer for checking and recalibrating DVGW-certified Dulcodes Z UV systems. The portable instrument complies with DVGW technical standard W 294/Part 3/2003 and is fitted with an insertion sensor inserted directly in the radiation chamber of the Dulcodes Z UV system in place of the sensor to be calibrated, so that the radiation intensity can be measured without interrupting operation. Suitable UV protective glasses should be worn as UV radiation escapes from the radiation chamber during this procedure.

Technical Data

Measuring range	20/200/2,000/20,000 W/m ² (switchable)
Display	3-digit
Voltage supply	Battery, 9 V Type 6F22 or equivalent
Wavelength range	220 ... 290 nm, spectral adjustment in accordance with W 294
Angular field of view	40° in accordance with W 294, Item 7.2

Order no.

Reference radiometer RRM	1025094
---------------------------------	---------

UV protective glasses

Protective glasses to protect against UV radiation that can be harmful to the eyes when working on open UV systems.

Order no.

UV protective glasses	1025243
------------------------------	---------

Protective gloves

Protective gloves made of white cotton to avoid fingerprints on UV lamps and lamp sleeves. 1 pair universal size.

Order no.

Protective gloves	1032815
--------------------------	---------

Sampling cock

Fireproof sampling cock made of stainless steel.

Order no.

Sampling cock	on request
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1 Dulcodes UV Systems

Cleaning system

Cleaning system for flushing the radiation chamber with a cleaning solution to remove deposits on the lamp tubes and internal surfaces of the UV system. Consists of chemical tanks, booster and metering pumps, valves and complete automatic or manual controller. Design and technical equipment are matched to the particular UV system and its application.

	Order no.
Cleaning system	on request

Clip-on thermostat

A thermostat is fitted to the outside of the radiation chamber. The thermostat monitors the water temperature of the water and can be connected to the control. The flushing valve opens when the pre-set limit temperature is exceeded. IP30 degree of protection. Switching on temperature range 0-90° C.

	Order no.
Clip-on thermostat	1043944
Universal mounting tape suitable for all sizes	1044851

Fittings

Fittings provided for quick and easy wall mounting of the UV radiation chamber. Fitting parts comprise 2 screw-in pipe clips of high alloy steel (V2A), 2 base plates with M12 nut, 2 set screws and 4 M12 hexagon nuts.

Two-part clip with increased material cross-section to ensure high bearing strength and breaking resistance. A soundproofing layer ensures marked resistance in the sound level.

	For type	Order no.
Fittings A2	1x45D, 1x130D, 4x230D	1039826
	16P, 45P, 1x80W, 1x130W, 1x0,65S	1039827
	1x75W, 1x230W, 1x75Z, 1x200Z, 1x300Z, 1x300R	1039828
	2x230W, 2x300Z, 3x300Z, 2x300R, 1x2S	1039829
	3x230W, 4x300Z, 5x300Z, 3x300R	1039830

Overvoltage protection

Overvoltage protection for Dulcodes UV systems, operated at 230 V 50-60 Hz.

The external overvoltage protection is intended for operations when the device's internal protection is not sufficient for surge voltages of 1 kV between the conductors and 2 kV to earth. An overvoltage trip can be fitted as a low protection surge arrester to significantly increase the stability of the Dulcodes systems.

It can only be determined by thorough investigation of the voltage behaviour on site.

	Order no.
Fine protection PT 2-DE IS 230 IAC	733010

Replacement plug-in insert after tripping

	Order no.
Replacement plug-in insert PT 2-DE / S 230 / AC - ST	733011

2 OZONFILT® and Bono Zon® Ozone Plants

2.1 Ozone in Water Treatment

As the most powerful oxidant that can be used in water treatment, ozone permits a broad spectrum of possible applications:

Outstanding disinfection efficiency against

- Bacteria and viruses
- Fungi and parasites

Oxidation of undesirable inorganic substances in the water

- Iron and manganese
- Arsenic
- Nitrite and sulfide

Oxidation of undesirable organic substances in the water

- Strong-smelling and strong-tasting compounds
- Humic substances and other compounds which affect the colour of the water
- Cyclic hydrocarbons
- Trihalomethanes, chloramines and other chlorine compounds

Microflocculating action

- After oxidation with ozone, substances and colloids dissolved in the water become insoluble and can be filtered

Significantly less environmentally-harmful by-products occur in the production and use of ozone, than with other comparable oxidants and disinfectants. As a highly reactive gas, ozone is produced on site, and introduced to the water directly, without interim storage. Because of its high reactivity, ozone decomposes into oxygen again in the water, with a half-life of several minutes. All components of an ozone handling system should be perfectly coordinated to each other and the planned application, to achieve an optimum relationship between ozone production and its effect.

With every new project, our engineers can draw on experience that we have accumulated since 1971, in the following applications:

Potable water supply

- Oxidation of iron, manganese or arsenic
- Improvement in appearance and taste
- Disinfection

Food and beverage industry

- Disinfection of mineral water
- Disinfection of rinsers in the beverage industry
- Disinfection of production water

Swimming pools

- Reduction of chloramines and trihalomethanes, avoiding typical swimming pool odours
- Crystal-clear water thanks to micro-flocculating action
- Reliable microbiological barriers in therapy pools
- Reduction of investment and operating costs by the possibility of reducing the circulating power and throttling the fresh water inlet

Industry

- Cooling water treatment
- Combating legionella in cooling water circuits
- Disinfection of process water
- Removal of odorous substances in air scrubbers

2 OZONFILT® and Bono Zon® Ozone Plants

2.2 Performance Overview of Ozone Plants

ProMaqua® ozone plants function according to the proven principle of dielectric barrier discharge. By applying a high voltage of several thousands of Volts, ozone is produced from oxygen between two electrodes separated by an insulating dielectric. Depending on the plant type, either dried ambient air or concentrated oxygen is used as oxygen source. ProMaqua® ozone plants are optimised to ensure maximum profitability and operating safety. They meet the German standard for ozone generation plants DIN 19627 and are characterised by low energy and cooling water consumption.

Medium-frequency pressure systems

With the OZONFILT® OZVa and OZMa range, the operating gas air or oxygen is fed to the ozone generator under pressure. Ozone is generated using medium-frequency high voltage.

The use of an integrated variable pressure swing dryer and a dielectric with optimum thermal conductivity results in the extraordinarily compact design of the plant.

Thanks to operation under pressure, the ozone generated can be directly fed to water systems with a backpressure of up to 2 bar. Additional pressure-boosting pumps and injectors thus become superfluous in many applications.

Vacuum systems

With the Bono Zon® BONa range, the operating gas air is suctioned through the air dryer and the ozone generator with the help of a pressure-boosting pump and an injector system. The ozone itself is generated under mains frequency and is controlled by changing the high voltage. Operation in a vacuum ensures very safe operation.

ProMaqua® offers a number of ozone plants for diverse applications. The overview below shows the capacity ranges of our series types:

	OZVa 1-4	OZVa 5-7	OZMa 1-6 A	OZMa 1-6 O	BONa
Output [g ozone/h]					
1.000					
500					
200					
100					
50					
20					
10					
5					
2					
Operating gas	Air	Oxygen	Air	Oxygen	Air
Ozone concentration	20 g/Nm³	100 g/Nm³	20 g/Nm³	100 g/Nm³	20 g/Nm³

P_PMA_OF_0011

larger systems available on request

ProMaqua provides all the advice needed for the safe operation of an ozone plant:

- Evaluation of the situation on site by trained, expert field sales staff.
- In our water laboratory, we can measure all of the key water parameters required for an optimum plant design.
- Planning of the plant.
- Commissioning and plant service by our trained service technicians.

2 OZONFILT® and Bono Zon® Ozone Plants

2.3 Questionnaire on the Design of an Ozone Plant

Use of the ozone system:

- for treatment of
 - Drinking water
 - Product water in the food and beverages industry, cosmetics or pharmaceutical industry
 - Industrial water
 - Cooling water
 - Swimming pool water
 - Zoo
 - _____
- for oxidation of
 - Iron, manganese, nitrite, sulphide etc.
 - Organic matter
 - Discolouration
 - _____
- _____

Water values:

- | | | | |
|----------------------|-----------------------------------|---|--|
| Max. water flow rate | _____ m ³ /h | Maximum water pressure | _____ bar |
| Water flow rate | <input type="checkbox"/> constant | <input type="checkbox"/> fluctuating from | _____ m ³ /h to _____ m ³ /h |
| pH value | _____ | Iron (Fe ²⁺) | _____ mg/l |
| Temperature | _____ °C | Manganese (Mn ²⁺) | _____ mg/l |
| Solid fraction | _____ mg/l | Nitrite (NO ₂ ⁻) | _____ mg/l |
| | | Sulphide (S ²⁻) | _____ mg/l |
| | | TOC (total organic carbon) | _____ mg/l |

Response time to application:

_____ m³ volume reaction tank or _____ minutes residence time in entire system.

Type of metering:

- constant
- flow-proportional
- depending on measured value

Desired amount of metering: _____ mg/l

Other requirements:

2 OZONFILT® and Bono Zon® Ozone Plants

2.4

OZONFILT® OZVa

OZONFILT® OZVa ozone plants have been designed as pressurised plants, in which the operating gas – air or oxygen – is fed into the ozone generator under pressure. The ozone is generated using medium-frequency high voltage and is primary current controlled. The introduction of PCC (primary current controlled) technology, specially developed in-house by ProMaqua, provides complete protection for the electrical components (high-voltage transformer and power stage) and also permits the correct digital display of the ozone feed rate in “grams/hour”. As a result, any required ozone volume between 3 and 100 % of the nominal capacity can be set reproducibly, and largely independently of voltage and pressure fluctuations.

The use of an integrated pressure swing dryer and a dielectric with optimum thermal conductivity makes the plant extremely compact. The unique design of the generator ensures outstanding cooling performance with low cooling water consumption and removes the heat produced quickly before the ozone produced can decompose due to excessive heat.

Operation under pressure means that the ozone generated can be introduced directly into water systems with back pressures of up to 2 bar. Additional booster pumps and injectors can therefore be dispensed with in many applications.

Combined with DULCOMETER® measuring and control technology and DULCOTEST® OZE ozone sensors, these systems are especially suitable for use where the operation is dependent on, and is controlled, by the measured data.

Features

- Simple operation
- Fully equipped
- High efficiency
- Low consumption of energy and cooling water
- High ozone concentration thanks to operation with oxygen
- PCC technology ensures complete protection of electrical components
- Correct digital display of ozone output in g/h
- Reproducible setting of the desired ozone quantity between 3 and 100 % of nominal capacity

2 OZONFILT® and Bono Zon® Ozone Plants

2.4.1

OZONFILT® Ozone Production Plants OZVa 1-4 (Operating Gas - Air)

Under nominal conditions, the OZVa 1-4 range produces up to 40 g/h of ozone from oxygen in the surrounding air at a concentration of 20 g/Nm³. Using the designated mixing devices, ozone concentrations of between 3 and 12 ppm can be achieved in the water to be treated, depending on the temperature (theoretical value at 30 or 0 °C).

OZVa 1 and 2 are installed in a control cabinet for wall mounting; OZVa 3 and 4 are installed in a free-standing cabinet.

An adequate supply of compressed air and a mixing device designed for the operating conditions should be provided for operation of the ozone plant.

Compressed air requirements

- Oil- and dust-free, non-corrosive
- Constant upstream pressure of 6 - 10 bar
- Required air quantities:
 OZVa 1: 6.2l/min
 OZVa 2: 17 l/min
 OZVa 3: 38 l/min
 OZVa 4: 42 l/min

Mixing device

OZVa 1 can be ordered in the following versions:

- Transparent mixing system with flow monitor mounted at the side of the plant (see fig. pk_7_001_1_V2)
- Static helical mixer mounted directly below the plant, made of PVC, with 4 helical blades (pressure drop approx. 0.4 bar at maximum throughput) (see fig. pk_7_042_V2)
- Without mixing system for connection of 12/10 mm stainless steel pipes or 12/9 mm PTFE pipes

OZVa 2 can be ordered in the following versions:

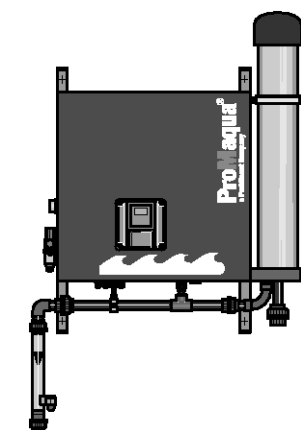
- Static helical mixer mounted directly below the plant, made of PVC, with 4 helical blades (pressure drop approx. 0.4 bar at maximum throughput) (see fig. pk_7_042_V2)
- Without mixing system for connection of 12/10 mm stainless steel pipes or 12/9 mm PTFE pipes

OZVa 3 and 4 are in principle delivered without mixing system; a suitable mixing system should be ordered separately (see Fig. pk_07_043_V2).

Static Helical Mixer Made of PVC or Stainless Steel see p. → 2-26

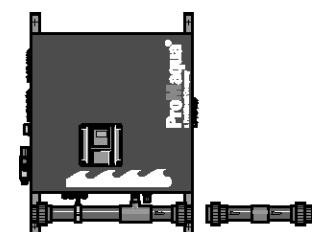
Notes

- The length of ozone gas-transporting pipes and the number of joints should be kept to a minimum. All rooms with a removable joint are to be monitored with a gas detector according to applicable German accident prevention regulations. All OZONFILT® plants are equipped for fitting a gas detector, such as a GMA 36 Ozon (see Accessories).
- The ozone generator must be interlocked with the water flow into the metering on all installations.
- A non-return valve should be installed upstream of the OZVa.



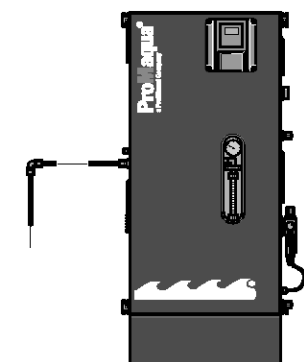
pk_7_001_1_V2

OZONFILT® OZVa 1; capacity: 5 g/h



pk_7_042_V2

OZONFILT® OZVa 2; capacity: 15 g/h



pk_7_043_V2

OZONFILT® OZVa 3; capacity: 35 g/h

2 OZONFILT® and Bono Zon® Ozone Plants

Technical Data

OZONFILT® OZVa 1-4 Ozone production plants (operating gas - air)

Environmental parameters

Max. humidity of the surrounding air 85 %, non-condensing, non-corrosive, dust-free,
 max. ambient temperature: 40 °C

		OZVa 1	OZVa 2	OZVa 3	OZVa 4
Number of generator modules		1	1	2	2
Ozone capacity, measured in accordance with DIN with air at 20 °C, cooling water at 15 °C	g/h	5	15	35	40
Air consumption (only ozone generation)	Nm ³ /h	0.25	0.75	1.75	2.00
Ozone concentration in the gas phase referenced to nominal conditions	g/Nm ³ *	20	20	20	20
Specific energy requirement at nominal capacity	Wh/g	30	30	21	20
Power factor at full capacity	cos φ	0.70	0.98	0.98	0.98
Ozone connection		integrated in mixing device or G 1/4" internal	integrated in mixing device or G 1/4" internal	G 1/4" internal	G 1/4" internal

* with air at 20 °C, cooling water at 15 °C

** Nm³ = m³ under standard conditions (p = 1.013x10⁵ Pa, T = 273 K)

Electrical connection

		OZVa 1	OZVa 2	OZVa 3	OZVa 4
Connected load	V/Hz/A	230/50;60/1,2	230/50;60/3	230/50;60/6	230/50;60/6
Enclosure rating		IP 43	IP 43	IP 43	IP 43

Overall dimensions (without mixer)

		OZVa 1	OZVa 2	OZVa 3	OZVa 4
Width	mm	840	840	710	710
Height	mm	840	805	1,400	1,400
Depth	mm	310	310	310	310

Weight

		OZVa 1	OZVa 2	OZVa 3	OZVa 4
Weight	kg	70	75	121	121

Ozone mixing

		OZVa 1	OZVa 2	OZVa 3	OZVa 4
Max. raw water temperature	°C	35	35	35	35
Permissible pressure at ozone outlet	bar	0.8–2.0	0.8–2.0	0.8–2.0	0.8–1.5

Air supply

		OZVa 1	OZVa 2	OZVa 3	OZVa 4
Required air volume	Nl/min	6.2	17	38	42

Air quality oil and dust-free, non-corrosive, constant upstream pressure of 6-10 bar

Cooling water

		OZVa 1	OZVa 2	OZVa 3	OZVa 4
Cooling water requirement	l/h	10–60	20–60	50–100	70–100
Cooling water inlet pressure	bar	1–5	1–5	1–5	1–5
Cooling water inlet, PE pressure hose	mm	6 x 4	6 x 4	6 x 4	6 x 4
Cooling water outlet, open discharge	mm	6 x 4	6 x 4	6 x 4	6 x 4
Cooling water temperature at ambient temp. max. 35 °C	°C	<30	<30	<30	<30
Cooling water temperature at ambient temp. 35–40 °C	°C	<25	<25	<25	<25

Cooling water quality No tendency to form lime scale; Removable substances: < 0.1 ml/l ; Iron: < 0.2 mg/l; Manganese: < 0.05 mg/l; no corrosive components; Conductivity: > 100 µS/cm

2 OZONFILT® and Bono Zon® Ozone Plants

2.4.2 OZONFILT® OZVa 5-7 (Operating Gas - Oxygen)

The OZONFILT® OZVa 5-7 range is a new development based on proven PSG technology producing ozone concentrations of up to 150 g/Nm³ by the use of oxygen as operating gas. Using the designated mixing devices, ozone concentrations in the water to be treated of up to 90 ppm can be achieved (theoretical value at 0 °C).

Depending on the plant type, ozone is produced in 1-3 generators from oxygen provided from special oxygen generators or bottles. The rated output of the individual generators is 30 g/h at 100 g/Nm³.

Type 5 is installed in a wall cabinet similar to OZVa 2; types 6 and 7 are installed in a free-standing cabinet similar to OZVa 4. In all three plants, ozone is transported to the mixing device through a separate 12/10 mm stainless steel pipe or 12/9 mm PTFE pipe.

Operating gas specification

- Oxygen
- Concentration: > 90 vol%
- Dew point: < -50 °C
- Pressure: 3-6 bar

Mixing device

Because of the high ozone concentrations, we recommend mixing systems made of stainless steel. PVC mixing systems may have a reduced service life, depending on the operating conditions.

Notes

- Keep the length of ozone gas transporting pipes and the number of joints to a minimum. Monitor all adjoining rooms with a gas detector in line with the applicable valid German accident prevention regulations. All OZONFILT® plants are equipped for fitting a gas detector such as GMA 36 Ozon.
- Depending on the operating and installation conditions, it might also be necessary to monitor the room air for excessive oxygen content. The GMA 36 Oxygen gas detector can be used for this purpose.
- The ozone generator should be interlocked with the water flow into the metering point on all installations.
- A non-return valve is to be installed upstream of the OZVa to prevent any return of ozonised water into the ozone-transporting pipe.
- All gas-transporting accessories must be resistant to ozone and oxygen (e.g. fat-free).
- Because of the high ozone concentrations, only catalytic residual ozone destructors can be used. Active carbon-based residual ozone destructors ignite spontaneously if subjected to increased ozone concentrations.

Room Air Monitoring see p. → 2-31

2 OZONFILT® and Bono Zon® Ozone Plants

Technical Data

OZONFILT® OZVa 5-7 (operating gas - oxygen)

		OZVa 5	OZVa 6	OZVa 7
Number of generator modules		1	2	3
Nominal ozone capacity at 100 g/Nm ³ ** and cooling water at 15 °C	g/h	30	60	90
Ozone capacity at 150 g/Nm ³ *	g/h	17.5	35.0	52.0
Ozone capacity at 80 g/Nm ³	g/h	35	70	105
Specific energy requirement at nominal capacity	Wh/g	10	10	10
Power factor at full capacity	cos φ	0.98	0.98	0.98
Ozone connection		G 1/4" internal	G 1/4" internal	G 1/4" internal

Electrical connection

		OZVa 5	OZVa 6	OZVa 7
Connected load	V/Hz/A	230/50;60/3	230/50;60/6	230/50;60/10
Enclosure rating		IP 43	IP 43	IP 43

Overall dimensions (without mixer)

		OZVa 5	OZVa 6	OZVa 7
Width	mm	865	705	705
Height	mm	804	1,400	1,400
Depth	mm	310	345	345

Weight

		OZVa 5	OZVa 6	OZVa 7
Weight	kg	75	109	114

Ozone mixing

		OZVa 5	OZVa 6	OZVa 7
Max. raw water temperature	°C	35	35	35
Permissible pressure at ozone outlet	bar	0.8–2.0	0.8–2.0	0.8–2.0

Specification of operating gas: oxygen

		OZVa 5	OZVa 6	OZVa 7
Gas volume at nominal capacity 100 g/Nm ³	NI/h	300	600	900
Gas volume at capacity 150 g/Nm ³	NI/h	117*	234*	347*
Gas volume at capacity 80 g/Nm ³	NI/h	438	875	1,313
Concentration min.	vol%	90	90	90
Dew point max.	°C	-50	-50	-50
Pressure	bar	3 – 6	3 – 6	3 – 6
Max. particles	µm	5	5	5
Max. hydrocarbons	ppm	20	20	20
Max. temperature	°C	30	30	30

Cooling water

		OZVa 5	OZVa 6	OZVa 7
Cooling water requirement	l/h	30	70	100
Cooling water inlet pressure	bar	1–5	1–5	1–5
Cooling water inlet, PE pressure hose	mm	6 x 4	6 x 4	6 x 4
Cooling water outlet, open discharge	mm	6 x 4	6 x 4	6 x 4
Cooling water temperature at ambient temp. max. 35 °C	°C	<30	<30	<30
Cooling water temperature at ambient temp. 35–40 °C	°C	<25	<25	<25

Cooling water quality No tendency to form lime scale. ; Removable substances: < 0.1 ml/l; Iron: < 0.2 mg/l; Manganese: < 0.05 mg/l; no corrosive components; Conductivity: > 100 µS/cm

* Capacity 150 g/Nm³ must be factory set as a special version

** Nm³ = m³ under standard conditions (p = 1.013x10⁵ Pa, T = 273 K)

2 OZONFILT® and Bono Zon® Ozone Plants

2.4.3

Ordering Information for OZONFILT® OZVa Plants

OZONFILT® OZVa 1 capacity 5 g/h

Type	Control cabinet connection	Order no.
without mixing system	blue painted	1004239
without mixing system	stainless steel	1026124
with transparent mixing system with flow monitoring 0.5–3 m ³ /h	blue painted	1026118
with transparent mixing system with flow monitoring 0.5–3 m ³ /h	stainless steel	1026125
with transparent mixing system with flow monitor, 3-5 m ³ /h	blue painted	1004235
with transparent mixing system with flow monitor, 3-5 m ³ /h	stainless steel	1026126
with PVCstatic mixer, DN 40, 5–10 m ³ /h	blue painted	1026120
with PVCstatic mixer, DN 40, 5–10 m ³ /h	stainless steel	1026127
with PVCstatic mixer, DN 50, 10–15 m ³ /h	blue painted	1026121
with PVCstatic mixer, DN 50, 10–15 m ³ /h	stainless steel	1026128
with PVCstatic mixer, DN 32, 0.5–2.8 m ³ /h	blue painted	1026122
with PVCstatic mixer, DN 32, 0.5–2.8 m ³ /h	stainless steel	1026129
with PVCstatic mixer, DN 32, 2.8–5 m ³ /h	blue painted	1026123
with PVCstatic mixer, DN 32, 2.8–5 m ³ /h	stainless steel	1026130

OZONFILT® OZVa 2 capacity 15 g/h

Type	Control cabinet connection	Order no.
without mixing system	blue painted	1005129
without mixing system	stainless steel	1026133
with PVC static mixer, DN 40, 5–10 m ³ /h	blue painted	1005127
with PVC static mixer, DN 40, 5–10 m ³ /h	stainless steel	1026134
with PVC static mixer, DN 50, 10–15 m ³ /h	blue painted	1005806
with PVC static mixer, DN 50, 10–15 m ³ /h	stainless steel	1026135
with PVC static mixer, DN 32, 0.5–2.8 m ³ /h	blue painted	1026132
with PVC static mixer, DN 32, 0.5–2.8 m ³ /h	stainless steel	1026144
with PVC static mixer, DN 32, 2.8–5 m ³ /h	blue painted	1005125
with PVC static mixer, DN 32, 2.8–5 m ³ /h	stainless steel	1026145

OZONFILT® OZVa 3 capacity 35 g/h

Type	Control cabinet connection	Order no.
without mixing system	blue painted	1009083
without mixing system	stainless steel	1026146

OZONFILT® OZVa 4 capacity 40 g/h

Type	Control cabinet connection	Order no.
without mixing system	blue painted	1009105
without mixing system	stainless steel	1026147

2 OZONFILT® and Bono Zon® Ozone Plants

OZONFILT® OZVa 5 capacity 30 g/h operating gas oxygen

Type	Control cabinet connection	Order no.
without mixing system	blue painted	1026148
without mixing system	stainless steel	1026149

OZONFILT® OZVa 6 capacity 60 g/h operating gas oxygen

Type	Control cabinet connection	Order no.
without mixing system	blue painted	1023452
without mixing system	stainless steel	1026150

OZONFILT® OZVa 7 capacity 90 g/h operating gas oxygen

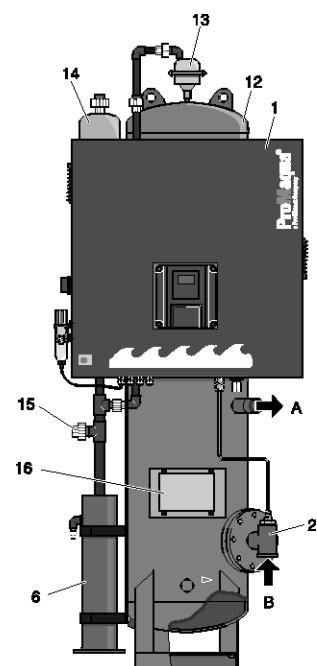
Type	Control cabinet connection	Order no.
without mixing system	blue painted	1026151
without mixing system	stainless steel	1026152

2

2 OZONFILT® and Bono Zon® Ozone Plants

2.4.4 OZONFILT® Compact OMVa

The OZONFILT® Compact OMVa is a complete, fully-assembled, ready for use ozone stage for the treatment of potable water, service water or swimming pool water in the capacity range from 5...40 g ozone/h, and consists of the following modules:



pk_7_024_V2

A to filtration
B Raw water

Ozone generation module (1), built in accordance with DIN 19627:

The ozone is produced with an OZONFILT® OZVa in a pressure-resistant ozone generator using an electronically produced and controlled medium-frequency voltage.

Ozone mixing module (2):

This module consists of an ozone metering point and a downstream mixing section made of stainless steel, with a series of static mixing elements for intensive mixing of the ozone/air mix with the water to be treated. The pipelines carrying the ozone, and the pipeline from the raw water connection to the entry to the reaction tank are fabricated totally in stainless steel and have been factory pressure tested.

With back pressures of up to max. 1.8 bar, no injector is required to suck out the ozone, as the ozone production takes place at positive pressure.

Reaction tank module (12):

The stainless steel reaction tank incorporates all the necessary fittings for water distribution and an automatic bleed valve (13). The ozone generation module (1), the residual ozone gas destructor (14) and room air monitoring (16) are mounted on this tank (12).

Residual ozone gas destruction module (14):

The residual ozone gas destruction module (14) incorporates an integrated water separator, (6) to remove traces of ozone gas in the exhaust air coming from the reaction tank (12). A connection is also available for the exhaust air from any downstream filter plant (15) that may be fitted.

Room air monitoring module (16):

The room air is monitored for traces of ozone gas by a calibrated gas warning device with an electrochemical sensor with good long-term stability.

If the alarm threshold is exceeded, ozone production is stopped and an alarm emitted. A buzzer is activated at the same time.

Technical Data

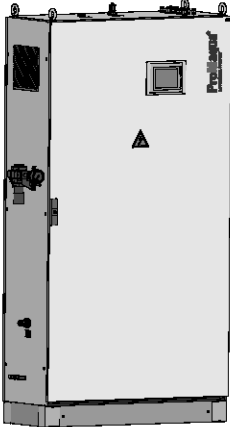
Type		OMVa 5-200	OMVa 15-500	OMVa 35-1,000
Ozone capacity	g/h	5	15	35
Reaction tank volume	l	205	460	1,080
Typical flow rate	m ³ /h	5 – 10	10 – 15	25 – 35
Operating pressure	bar	0.6 – 1.8	0.6 – 1.8	0.6 – 1.8
Reaction tank connection size		DN 40	DN 50	DN 80
Dimensions H x W x D	mm	2,000 x 850 x 760	2,200 x 850 x 760	2,600 x 1,100 x 1,160
Weight	kg	200	250	350
Connected load	V/Hz/A	230/50;60/2	230/50;60/3	230/50;60/6

All features of the three standard versions can be adapted to specific project-related customer requirements.

2 OZONFILT® and Bono Zon® Ozone Plants

2.5

OZONFILT® OZMa



P_PMA_OF_0010_SW

OZMa® ozone systems are designed as pressure systems which generate ozone using compressed air or oxygen through the use of medium-frequency high voltage. The electronic power unit offers complete protection for the electrical components (high-voltage transformer and power stage) and also permits the correct digital display of the ozone output in "gram/hour". As a result, any required ozone volume between 3 and 100 % of the nominal capacity can be set reproducibly and largely independently of voltage and pressure fluctuations.

The use of an integrated, self optimising (dynamic) variable pressure swing dryer ensures minimum compressed air consumption of the air systems. The use of a dielectric with optimum thermal conductivity results in an exceptionally compact system design and minimum energy consumption. The unique construction of the generator ensures outstanding cooling performance with low cooling water consumption whilst quickly removing the heat produced before the ozone produced can decompose due to excessive heat.

Simple and safe operation is ensured by the industry standard programmable logic controller (PLC) and clearly arranged touch panel with data logger and screen recorder. A PROFIBUS® DP communication interface ensures ease of integration into industrial control systems. Remote diagnostics and communication are optionally available via a LAN communication interface.

The automatic control of the gas flow ensures the concentration of the ozone in the gas flow is maintained constant, independently of ozone volume transported. This reduces the quantity of operating gas to a minimum and ensures constant ozone solubility.

An ozone sensor can be directly connected to the ozone measuring and control device integrated in the PLC. Thus, the ozone fed to the water can be monitored and the ozone output directly controlled.

Operation under pressure means that the ozone generated can be introduced directly into water systems with back pressures of up to 2 bar. Additional booster pumps and injectors can therefore be dispensed with in many applications.

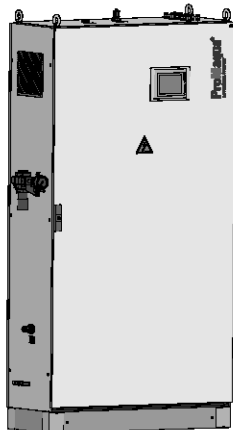
Features

- Simple installation thanks to compact design and single-phase power supply
- Low compressed air consumption thanks to a dynamic pressure swing dryer with low priming pressure (air systems) and demand-dependent regeneration matched to the individual conditions in-situ
- Minimum power and cooling water consumption thanks to new, maintenance-free generator concept
- Electronic power unit with automatic ozone generation largely independent of voltage and pressure fluctuations. Thus maximum error tolerance with regard to influences from installation environment
- Infinitely variable adjustment of any desired ozone quantity between 3 and 100 % of rated output
- PLC with integrated ozone measurement and control
- 5.7" touch panel with data logger and screen recorder
- PROFIBUS® DP communications interface (optionally LAN)
- Easy integration of customer-specific control requirements
- Automatic control of the gas volume flow ensures minimum process gas consumption at constant ozone concentration

2 OZONFILT® and Bono Zon® Ozone Plants

2.5.1

OZONFILT® OZMa 1-6 A Ozone Generation Plants (Operating Gas - Air)



P_PMA_OF_0010_SW

Under nominal conditions, the OZMa 1-6 A range produces up to 420 g/h of ozone from compressed air at a concentration of 20 g/Nm³. Using the designated mixing devices, ozone concentrations of between 3 and 12 ppm can be achieved in the water to be treated, depending on the temperature (theoretical value at 30 or 0 °C).

Different feature options can be achieved by combining different Identcode characteristics.

The plants are pre-mounted ready for connection in a painted steel cabinet (optional stainless steel control cabinet) and need only be connected to a single-phase voltage supply, compressed air, cooling water/waste water and ozone metering point on the customer's site.

An adequate compressed air supply and a mixing device designed for the operating conditions should be integrated.

Order Information For OZONFILT® OZMa Plants see p. → 2-20,
Static Helical Mixer Made Of PVC Or Stainless Steel see p. → 2-26

Requirements relating to the compressed air supply

- Oil and dust-free, non-corrosive, constant upstream pressure of 4.5 - 10 bar
- Required air quantity:
 - OZMa 1 A: 73 l/min
 - OZMa 2 A: 110 l/min
 - OZMa 3 A: 147 l/min
 - OZMa 4 A: 220 l/min
 - OZMa 5 A: 293 l/min
 - OZMa 6 A: 440 l/min

Mixing device

All OZMa plants are in principle delivered without mixing device and a suitable mixing system should be ordered separately. When selecting a suitable mixing device, please note that the mixing of ozone is more efficient the higher the water flow in the mixing system. The mixing system should therefore be designed so that the flow of the water to be treated is at the upper range of the flow specification.

Static Helical Mixer Made From PVC Or Stainless Steel see p. → 2-26

Notes on installation

Keep the length of ozone gas transporting pipes and the number of joints to a minimum. All rooms with a removable joint should be monitored with a gas detector in line with the applicable German accident prevention regulations. All OZONFILT® plants are equipped for fitting a gas detector such as GMA 36 Ozon.

Ozonisation adds a large amount of gas to the water of which only a small percentage can dissolve. Adequate bleeding should therefore be integrated. Because the gases discharged in this way have a considerable residual ozone concentration, appropriate residual ozone destructors should be installed.

The ozone generator should be interlocked with the water flow into the metering point for all installations.

A non-return valve should be installed between OZMa and the ozone metering point.

Room Air Monitoring see p. → 2-31, Residual Ozone Gas Destructor see p. → 2-30

2 OZONFILT® and Bono Zon® Ozone Plants

Technical Data

OZONFILT® OZMa 1-3 A ozone generation plants (process gas - air)

Ambient parameters

max. 85 % relative humidity of ambient air, non-condensing, non-corrosive, dust-free, max. ambient temperature: 40 °C

		OZMa 1A	OZMa 2A	OZMa 3A
Number of generator modules		1	1	1
Ozone capacity, measured in accordance with DIN with air at 20 °C, cooling water at 15 °C	g/h	70	105	140
Air consumption (only ozone generation)	Nm ³ /h	3.50	5.25	7.00
Ozone concentration in the gas phase referenced to nominal conditions	g/Nm ³ *	20	20	20
Specific energy requirement at nominal capacity	Wh/g	16.5	16.5	16.5
Power factor at full capacity	cos φ	0.95	0.95	0.95
Ozone connection		G 3/8" internal	G 3/8" internal	G 3/8" internal

* Nm³= m³at standard conditions (P = 1.013x10⁵Pa, T = 273 K)

Electrical connection

		OZMa 1A	OZMa 2A	OZMa 3A
Connected load	V/Hz/A	230/50;60/10	230/50;60/16	230/50;60/16
Enclosure rating		IP 43	IP 43	IP 43

Overall dimensions (without mixer)

		OZMa 1A	OZMa 2A	OZMa 3A
Width	mm	1,114	1,114	1,114
Height	mm	1,961	1,961	1,961
Depth	mm	405	405	405

Weight

		OZMa 1A	OZMa 2A	OZMa 3A
Weight	kg	270	280	300

Ozone mixing

		OZMa 1A	OZMa 2A	OZMa 3A
Max. raw water temperature	°C	35	35	35
Permissible pressure at ozone outlet	bar	0.8–2.0	0.8–2.0	0.8–2.0

Air supply

		OZMa 1A	OZMa 2A	OZMa 3A
Required air quantity	NI/min	73	110	147

Air quality

Oil- and dust-free, Non-corrosive, Constant upstream pressure of 4.5 - 10 bar

Cooling water

		OZMa 1A	OZMa 2A	OZMa 3A
Cooling water consumption (15 °C)	l/h	90	135	180
Cooling water consumption (30 °C)	l/h	200	300	400
Cooling water inlet pressure	bar	2–5	2–5	2–5
Cooling water inlet, PE pressure hose	mm	8 x 5	8 x 5	12 x 9
Cooling water outlet, open discharge	mm	8 x 5	8 x 5	12 x 9

Cooling water quality

No tendency to form lime scale; Removable substances: < 0.1 ml/l ; Iron: < 0.2 mg/l; Manganese: < 0.05 mg/l; no corrosive components; Conductivity: > 100 µS/cm

2 OZONFILT® and Bono Zon® Ozone Plants

OZONFILT® OZMa 4-6 A ozone generation plants (process gas - air)

Ambient parameters

max. 85 % relative humidity of ambient air, non-condensing, non-corrosive, dust-free,
 max. ambient temperature: 40 °C

		OZMa 4A	OZMa 5A	OZMa 6A
Number of generator modules		2	2	3
Ozone capacity, measured in accordance with DIN with air at 20 °C, cooling water at 15 °C	g/h	210	280	420
Air consumption (only ozone generation)	Nm ³ /h	10.50	14.00	21.00
Ozone concentration in the gas phase referenced to nominal conditions	g/Nm ³ *	20	20	20
Specific energy requirement at nominal capacity	Wh/g	16.5	16.5	16.5
Power factor at full capacity	cos φ	0.95	0.95	0.95
Ozone connection		G 3/8" internal	G 3/8" internal	G 3/8" internal

* Nm³= m³at standard conditions (P = 1.013x10⁵Pa, T = 273 K)

Electrical connection

		OZMa 4A	OZMa 5A	OZMa 6A
Connected load	V/Hz/A	400/50;60/16	400/50;60/16	400/50;60/16
Enclosure rating		IP 43	IP 43	IP 43

Overall dimensions (without mixer)

		OZMa 4A	OZMa 5A	OZMa 6A
Width	mm	1,320	1,320	1,606
Height	mm	1,961	1,961	1,961
Depth	mm	605	605	605

Weight

		OZMa 4A	OZMa 5A	OZMa 6A
Weight	kg	420	445	589

Ozone mixing

		OZMa 4A	OZMa 5A	OZMa 6A
Max. raw water temperature	°C	35	35	35
Permissible pressure at ozone outlet	bar	0.8–2.0	0.8–2.0	0.8–2.0

Air supply

		OZMa 4A	OZMa 5A	OZMa 6A
Required air quantity	NI/min	220	293	440

Air quality

Oil- and dust-free, Non-corrosive, Constant upstream pressure of 4.5 - 10 bar

Cooling water

		OZMa 4A	OZMa 5A	OZMa 6A
Cooling water consumption (15 °C)	l/h	270	360	540
Cooling water consumption (30 °C)	l/h	600	800	1,200
Cooling water inlet pressure	bar	2–5	2–5	2–5
Cooling water inlet, PE pressure hose	mm	12 x 9	12 x 9	12 x 9
Cooling water outlet, open discharge	mm	12 x 9	12 x 9	12 x 9

Cooling water quality

No tendency to form lime scale; Removable substances: < 0.1 ml/l ; Iron: < 0.2 mg/l; Manganese: < 0.05 mg/l; no corrosive components; Conductivity: > 100 µS/cm

2 OZONFILT® and Bono Zon® Ozone Plants

2.5.2

OZONFILT® OZMa 1-6 O Ozone Generation Plants (Operating Gas - Oxygen)

Under nominal conditions, the OZMa 1-6 O range produces up to 735 g/h of ozone from oxygen at a concentration of up to 150 g/Nm³. Using the designated mixing devices, ozone concentrations in the water to be treated of up to 90 ppm can be achieved (theoretical value at 0 °C). Ozone concentration in g/Nm³ and system feed rate in g/h can be varied depending on the operating conditions and can thus be individually matched to the application conditions. Examples for various combinations are listed in the technical data table.

Different feature options can be achieved by combining different Identcode characteristics.

The plants are pre-mounted ready for connection in a painted steel cabinet (optional stainless steel control cabinet) and should only be connected to a single-phase voltage supply, oxygen, cooling water/waste water and ozone metering point on the customer's site.

Order Information For OZONFILT® OZMa Plants see p. → 2-20

Requirements relating to the oxygen supply

- See technical data
- Required gas quantities: see technical data

Mixing device

All OZMa plants are in principle delivered without a mixing device, a suitable mixing system should be ordered separately. When selecting a suitable mixing device, please note that the mixing of ozone is more efficient the higher the water flow in the mixing system. The mixing system should thus be designed so that the flow of water to be treated is at the upper range of the flow specification.

We recommend mixing systems made of stainless steel because of the high ozone concentrations.. Mixing systems made of PVC may have a reduced service life, depending on the operating conditions.

Static Helical Mixer Made From PVC Or Stainless Steel see p. → 2-26

Notes on installation

The length of ozone gas transporting pipes and the number of joints to a minimum. All rooms with a removable joint should be monitored with a gas detector in line with the applicable German accident prevention regulations. All OZONFILT® plants are equipped for fitting a gas detector such as GMA 36 Ozon.

Depending on the operating and installation conditions, it might be necessary to also monitor the room air for excessive oxygen content. The gas detector GMA 36 Oxygen can be used.

All gas-transporting accessories should be resistant to ozone and oxygen (e.g. fat-free).

Ozonisation adds a large amount of gas to the water of which only a small percentage can dissolve. Adequate bleeding should therefore be integrated. Because the gases discharged this way have a considerable residual ozone concentration, appropriate residual ozone destructors should be installed. Because of the high ozone concentrations, only catalytic residual ozone destructors can be used. Active carbon-based residual ozone destructors ignite spontaneously if subjected to increased ozone concentrations.

The ozone generator must be interlocked with the water flow into the metering point for all installation..

A non-return valve should be installed between OZMa and ozone metering point to prevent any return of ozonised water into the ozone-transporting pipe..

Room Air Monitoring see p. → 2-31, Residual Ozone Gas Destructor see p. → 2-30

2 OZONFILT® and Bono Zon® Ozone Plants

Technical Data

OZONFILT® OZMa 1-3 O ozone generation plants (process gas - oxygen)

		OZMa 1 O	OZMa 2 O	OZMa 3 O
Number of generator modules		1	1	1
Nominal ozone capacity at 100 g/Nm ³ ** and cooling water at 15 °C	g/h	105	158	210
Ozone capacity at 150 g/Nm ³ *	g/h	60	90	120
Ozone capacity at 80 g/Nm ³	g/h	123	184	245
Specific energy requirement at nominal capacity	Wh/g	9	9	9
Power factor at full capacity	cos φ	0.95	0.95	0.95
Ozone connection		G 3/8" internal	G 3/8" internal	G 3/8" internal

Electrical connection

		OZMa 1 O	OZMa 2 O	OZMa 3 O
Connected load	V/Hz/A	230/50;60/10	230/50;60/16	230/50;60/16
Enclosure rating		IP 43	IP 43	IP 43

Overall dimensions

		OZMa 1 O	OZMa 2 O	OZMa 3 O
Width	mm	1,114	1,114	1,114
Height	mm	1,961	1,961	1,961
Depth	mm	400	400	400

Weight

		OZMa 1 O	OZMa 2 O	OZMa 3 O
Weight	kg	220	230	250

Ozone mixing

		OZMa 1 O	OZMa 2 O	OZMa 3 O
Raw water temperature max.	°C	35	35	35
Permissible pressure at ozone outlet	bar	0.8–2.0	0.8–2.0	0.8–2.0

Specification of operating gas: oxygen

		OZMa 1 O	OZMa 2 O	OZMa 3 O
Gas volume at nominal capacity 100 g/Nm ³	NI/h	1,050	1,580	2,100
Gas volume at capacity 150 g/Nm ³	NI/h	400*	600*	800*
Gas volume at capacity 80 g/Nm ³	NI/h	1,540	2,300	3,100
Concentration min.	vol%	90	90	90
Dew point max.	°C	-50	-50	-50
Pressure	bar	3 – 6	3 – 6	3 – 6
Max. particles	µm	5	5	5
Max. hydrocarbons	ppm	20	20	20
Max. temperature	°C	30	30	30

Cooling water

		OZMa 1 O	OZMa 2 O	OZMa 3 O
Cooling water consumption (15 °C)	l/h	120	180	240
Cooling water consumption (30 °C)	l/h	200	300	400
Cooling water inlet pressure	bar	1–5	1–5	1–5
Cooling water inlet, PE pressure hose	mm	8 x 5	8 x 5	12 x 9
Cooling water outlet, open discharge	mm	8 x 5	8 x 5	12 x 9

Cooling water quality No tendency to form lime scale, no corrosive components; Sedimentable substances: < 0.1 ml/l; Iron: < 0.2mg/l; Manganese: < 0.05 mg/l; Conductivity: > 100 µS/cm; Chloride: < 250 mg/l

* Output 150 g/Nm³ as special version must be factory-set

** Nm³ = m³ at standard conditions (P = 1.013x10⁵Pa, T = 273 K)

2 OZONFILT® and Bono Zon® Ozone Plants

OZONFILT® OZMa 4-6 O ozone generation plants (operating gas - oxygen)

		OZMa 4 O	OZMa 5 O	OZMa 6 O
Number of generator modules		2	2	3
Nominal ozone capacity at 100 g/Nm ³ ** and cooling water at 15 °C	g/h	320	420	630
Ozone capacity at 150 g/Nm ³ *	g/h	180	240	360
Ozone capacity at 80 g/Nm ³	g/h	370	490	735
Specific energy requirement at nominal capacity	Wh/g	9	9	9
Power factor at full capacity	cos φ	0.95	0.95	0.95
Ozone connection		G 3/8" internal	G 3/8" internal	G 3/8" internal

Electrical connection

		OZMa 4 O	OZMa 5 O	OZMa 6 O
Connected load	V/Hz/A	400/50;60/16	400/50;60/16	400/50;60/16
Enclosure rating		IP 43	IP 43	IP 43

Overall dimensions

		OZMa 4 O	OZMa 5 O	OZMa 6 O
Width	mm	1,320	1,320	1,320
Height	mm	1,961	1,961	1,961
Depth	mm	605	605	605

Weight

		OZMa 4 O	OZMa 5 O	OZMa 6 O
Weight	kg	320	345	415

Ozone mixing

		OZMa 4 O	OZMa 5 O	OZMa 6 O
Max. raw water temperature	°C	35	35	35
Permissible pressure at ozone outlet	bar	0.8–2.0	0.8–2.0	0.8–2.0

Specification of operating gas: oxygen

		OZMa 4 O	OZMa 5 O	OZMa 6 O
Gas volume at nominal capacity 100 g/Nm ³	NI/h	3,200	4,200	6,300
Gas volume at capacity 150 g/Nm ³	NI/h	1,200*	1,600*	2,400*
Gas volume at capacity 80 g/Nm ³	NI/h	4,630	6,130	9,190
Concentration min.	vol%	90	90	90
Dew point max.	°C	-50	-50	-50
Pressure	bar	3 – 6	3 – 6	3 – 6
Max. particles	µm	5	5	5
Max. hydrocarbons	ppm	20	20	20
Max. temperature	°C	30	30	30

Cooling water

		OZMa 4 O	OZMa 5 O	OZMa 6 O
Cooling water consumption (15 °C)	l/h	200	280	420
Cooling water consumption (30 °C)	l/h	330	470	700
Cooling water inlet pressure	bar	1–5	1–5	1–5
Cooling water inlet, PE pressure hose	mm	12 x 9	12 x 9	12 x 9
Cooling water outlet, open discharge	mm	12 x 9	12 x 9	12 x 9

Cooling water quality No tendency to form lime scale, no corrosive components; Sedimentable substances: < 0.1 ml/l; Iron: < 0.2mg/l; Manganese: < 0.05 mg/l; Conductivity: > 100 µS/cm; Chloride: < 250 mg/l

* Output 150 g/Nm³ as special version must be factory-set

** Nm³ = m³ at standard conditions (P = 1.013x10⁵ Pa, T = 273 K)

2 OZONFILT® and Bono Zon® Ozone Plants

2.5.3 Order Information for OZONFILT® OZMa Plants

OZMa		Type ozone generator	
		Air operation	Oxygen operation
		g/h	g/h
01		70	105
02		105	158
03		140	210
04		210	320
05		280	420
06		420	630
Operating gas			
A		Operating gas - air	
O		Operating gas - oxygen	
Type			
P		ProMaqua	
S		Special version	
Mechanical design			
0		Standard (packaging for transport by HGV)	
1		Standard (packaging for sea/air freight)	
2		In stainless steel cabinet (packaging for transport by HGV)	
3		In stainless steel cabinet (packaging for sea/air freight)	
M		Modified	
Operating voltage			
A		Single-phase 230 V ±10 %, 50/60 Hz (only types 01-03)	
S		Three-phase 230/400 V ±10 %, 50/60 Hz (only types 04-06)	
Gas treatment			
0		Gas treatment not integrated (design operating gas - oxygen)	
1		Gas treatment integrated without filter package (design operating gas - air)	
2		Gas treatment integrated with filter package (design operating gas - air)	
3		Gas treatment not integrated (oxygen operating gas version), including gas control valve	
4		Gas treatment integrated without filter package (air operating gas version), including gas control valve	
5		Gas treatment integrated with filter package (air operating gas version), including gas control valve	
Preset language			
DE		German	
EN		English	
FR		French	
IT		Italian	
ES		Spanish	
Control			
0		Basic version with digital input to control two power stages	
1		External power control via 0/4-20 mA input, data logger	
2		External power control, ozone measurement and visualisation via screen recorder, 2 freely configurable 0/4-20 mA inputs, 1 freely configurable 0/4-20 mA output	
3		As 2 with additionally integrated PID controller for control of the ozone concentration independent of measured value and flow	
Communication interfaces			
0		None	
4		PROFIBUS® DP interface	
Additional options			
0		None	
1		Dew point sensor	
Approvals			
01		CE-mark	
Hardware			
0		Standard	
Software			
0		Standard	

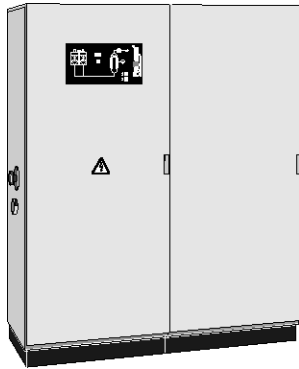
Explanations on the Identcode:

- Mechanical design: In design 0 and 1, the plant is installed in a standard control cabinet made of powder-coated steel.
- Gas treatment: Without filter package for oil-free generated or de-oiled compressed air.
With filter package for compressed air with residual oil content.

2 OZONFILT® and Bono Zon® Ozone Plants

2.6 Bono Zon® Ozone Plants

BONa range: capacity range 80-720 g/h



pk_7_002_V2
BONa 2A, capacity 160 g/h

BONa systems are designed as vacuum systems and so comply with the highest safety measures. A clear, easy to read display panel provides information on air flow, voltage, power consumption and the air treatment status.

The ozone capacity can be continuously adjusted over the entire capacity range. The entire process control and monitoring of safety-related parameters is done with the aid of the integrated PLC.

Minimal operating costs are achieved through load-dependent regeneration of the air treatment system and a significant reduction in the cooling water requirement.

Bono Zon® systems comply with the German standard for ozone generation systems, DIN 19 627.

Bono Zon® systems are fitted with a reliable and economic adsorber drier. The load-dependent control of adsorber regeneration ends the heating phase when the breakdown temperature is reached. The required dew point is continually ensured and operating costs are simultaneously minimised. This ensures optimum operational safety of the ozone system.

The control for the booster pump and the protection device are integrated in the electrical cabinet of the BONa system.

Features

- Ozone generation modules made of stainless steel
- Automatic electronic overload detection linked to safety disconnection, even during partial load operation
- The Siemens® Simatic S7 PLC controls all process sequences and issues fault messages if anomalies occur.
- Clear, easy to understand display and operating panel: the ozone generation sequence is displayed on the flow diagram. LED displays inform the operator of the current operating status and the set values, e.g. volume flow (process gas), primary voltage and primary current are displayed.
- Ozone generators that have been optimised for minimum power consumption. Power requirement 18.7 Wh/g.
- Continuous adjustment of ozone generation to demand through use of a regulating transformer that can be fitted with an electric actuator if required.
- Direct connection of our DULCOTEST® OZE ozone measuring sensor is possible.
- The booster pump control and fuse are already integrated in the electrical cabinet.
- Clear, easy to read display area with operating and fault lamps and digital measuring instruments integrated in a display panel.
- Vacuum operation ensures the highest possible protection against ozone leaks.
- Air treatment using cost-effective adsorber drier. An optimum dew point is ensured by means of thermostatically-controlled regeneration.
- Bono Zon® systems comply with the German standard for ozone generation systems, DIN 19627.

Nominal ozone concentration

20 g/m³ (based on standard conditions, p=1.013x10⁵ Pa, T=273 K), measured with a cooling water temperature of 15 °C max., at an ambient air temperature of 20 °C max.

Design conditions in accordance with DIN 19627

Max. 30 °C; 60 % rel. humidity, dust-free installation, no aggressive gases, supply and extract air ventilation of the installation room.

An air conditioning system may be required with elevated ambient temperature and/or humidity at the installation position of the plant. Please specify separately at time of ordering! Suitable measures (e.g. air conditioning of the installation room) should be taken to prevent condensation forming, even when the plant is shut down.

Standard values for cooling water quality:

- Temperature < 25 °C
- Replaceable substances < 0.1 ml/l
- Iron < 0.2 mg/l
- Manganese < 0.05 mg/l
- Chloride < 250 mg/l (BONa D und E)
- No tendency to form lime deposits
- No corrosive components

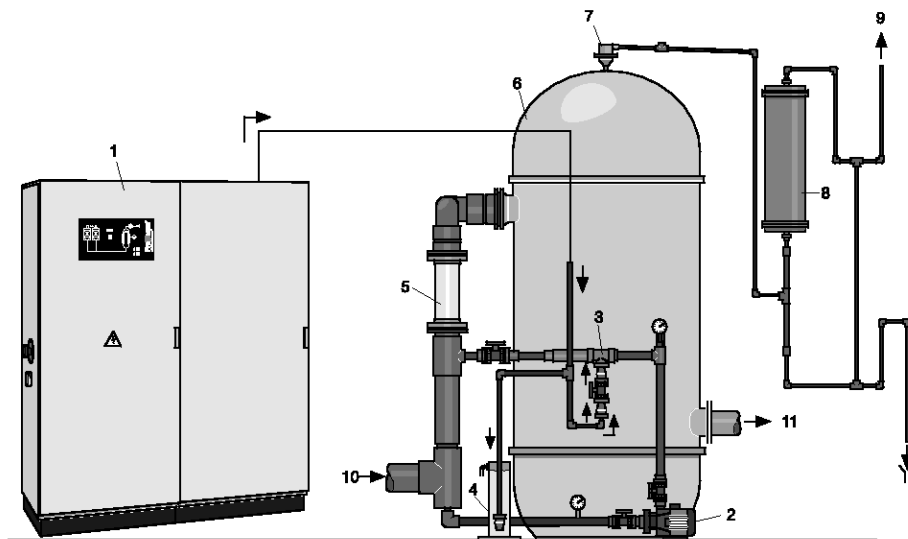
2 OZONFILT® and Bono Zon® Ozone Plants

Design

For optimum operation of a water treatment system using ozone, it is essential that all components are carefully matched with each other:

- **Ozone generation:**
Selection of a suitable ozone plant is not just determined by the required quantity of ozone/hour but also by other limiting conditions such as the nature and temperature of the cooling water and the environmental conditions, etc.
- **Mixing:**
First and foremost, the parameters of the water to be treated, such as flow rate, back pressure, etc. are required for design of the mixing system.
- **Reaction tank:**
Whether a reaction tank is required, and if so, what size and equipment is required, depends primarily on the requirements of the particular application.
- **Residual ozone destruction:**
Similarly, the choice of the suitable ozone destructor is determined by the ozonisation application. As an example, no catalytic residual ozone destructors can be used in the swimming pool, because of their sensitivity to chlorine.

The diagram below shows a typical arrangement of an ozone treatment system. For each ozone project, our project engineers combine all the right components to meet specific customer requirements.



pk_7_003_1

- 1 Ozone plant type BONA
- 2 Booster pump
- 3 Injector system
- 4 Water trap
- 5 Mixer
- 6 Reaction tank
- 7 Bleed valve
- 8 Residual ozone destructor
- 9 Ozone-free exhaust air
- 10 Raw water
- 11 Ozonised water

BONA ozone production plant with mixing device, reaction tank and residual ozone destruction

2 OZONFILT® and Bono Zon® Ozone Plants

2.6.1 Bono Zon® Ozone Plant with Stainless Steel Ozone Generator

Depending on capacity, the ozone plants in this range are equipped with 1 – 9 ozone generators made from stainless steel. Indirect cooling of the dielectrics eliminates the possibility of cooling water ingress. Individual electrodes can be easily replaced without the need to empty the entire reactor. This ensures a high level of reliability and makes the plant very service-friendly.

The operating pressure of the ozone generator is –0.08 to 0 bar and should be produced with an injector system matched to the particular application.

Ozone generators made of PVC are optionally available for use with corrosive cooling water.

Technical Data

Bono Zon® ozone plant with Stainless Steel Ozone Generator

Type		1D	2E	2D	3D	4D	5D	6D	7D	8D	9D
Number of generator modules		1	2	2	3	4	5	6	7	8	9
Ozone capacity, measured in accordance with DIN, with air 20°C, cooling water 15°C	g/h	80	120	160	240	320	400	480	560	640	720
Air flow for ozone production max.	m³/h	4	6	8	12	16	20	24	28	32	36
Ozone generation power consumption (without air treatment)	kW	1.5	2.2	3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5
Ozone connection		DN 15	DN 20	DN 20	DN 32	DN 32	DN 32	DN 40	DN 40	DN 40	DN 50

Cooling water

Type		1D	2E	2D	3D	4D	5D	6D	7D	8D	9D
Cooling water requirement cooling water temperature 15°C and air temperature < 25 °C	m³/h	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Cooling water requirement cooling water temperature 25°C and air temperature < 30 °C	m³/h	0.3	0.6	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7
Cooling water inlet pressure (before pressure reducer)	bar	1.5–6	1.5–6	1.5–6	1.5–6	1.5–6	1.5–6	1.5–6	1.5–6	1.5–6	1.5–6
Cooling water inlet	G..i	3/8"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"
Cooling water outlet, open discharge		1/2	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4

Electrical connection

Type		1D	2E	2D	3D	4D	5D	6D	7D	8D	9D
Mains supply, incl. booster pump	kVA	5.5	7.0	10.0	14.5	20.0	22.5	27.5	34.0	36.0	38.0
Infeed	3x A	25	50	50	63	50	63	80	80	80	80
Enclosure rating		IP 23	IP 23	IP 23	IP 23	IP 23	IP 23	IP 23	IP 23	IP 23	IP 23

Ozone conveying device interface

Type		1D	2E	2D	3D	4D	5D	6D	7D	8D	9D
Connection for booster pump	A	2.5–4	4–6.3	4–6.3	6–10	6–10	6–10	9–14	13–18	13–18	13–18
Motor circuit breaker (standard value)	kW	1.1	2.2	2.2	3.0	4.0	4.0	5.5	7.5	7.5	7.5

Overall dimensions

Type		1D	2E	2D	3D	4D	5D	6D	7D	8D	9D
Width	mm	800	1,600	1,600	2,000	2,400	2,400	2,800	3,200	3,400	3,400
Height	mm	1,950	1,950	1,950	1,950	2,200	2,200	2,200	2,200	2,200	2,200
Depth	mm	500	500	500	500	600	600	600	600	600	600

Weight

Type		1D	2E	2D	3D	4D	5D	6D	7D	8D	9D
Weight	kg	360	700	720	820	1,200	1,280	1,360	1,920	1,980	2,000

2 OZONFILT® and Bono Zon® Ozone Plants

2.7 Accessories for Ozone Plants

2.7.1 Compressors for OZONFILT® OZVa 1-4

Atlas Copco LFX compressors

The outstanding feature of this range of compressors is their outstanding value for money. They are equipped with active start unloading and automatic condensate discharge by solenoid valve. The compressors are not suitable for continuous operation and should only be used in less harsh operating conditions.

Technical Data

Type		LFX 0,7	LFX 1,5
Free air delivery rate at 7 bar	l/min	61	124
Power consumption at 7 bar	W	530	970
Number of cylinders		1	1
Sound pressure level	dB(A)	62	64
Air receiver capacity	l	20	20
Weight	kg	44	48
Suitable for OZVa Type		1 + 2	3 + 4

Type	Type	Order no.
LFX 0,7	230 V / 50 Hz	1004458
LFX 0,7	230 V / 60 Hz	1010719
LFX 1,5	230 V / 50 Hz	1006343
LFX 1,5	230 V / 60 Hz	1009638

Air filter kit

	Order no.
Air filter kit for Atlas Copco LFX compressors	1005789

Dürr ABK compressors

The outstanding feature of this continuously rated range of compressors is their extremely robust construction, making them ideally suitable for industrial use. They are equipped with active start unloading, automatic condensate discharge by solenoid valve and an hours-run meter. PTFE coated special aluminium pistons lead to the long service life and reliability of these compressor units.

Technical Data

Type		TA-080	HA-234
Free air delivery rate at 7 bar	l/min	62	152
Supply max.	VAC	230	230
Supply frequency	Hz	50 / 60	50
Power consumption at 7 bar	W	800	1,900
Number of cylinders		1	3
Sound pressure level	dB(A)	68	78
Air receiver capacity	l	25	55
Weight	kg	49	70
Suitable for OZVa Type		1 + 2	3 + 4

Type	Order no.
TA-080	1025398
HA-234	1025399

2 OZONFILT® and Bono Zon® Ozone Plants

Air filter kit

	Order no.
Air filter kit for Dürr ABK compressors*	1025400

* 1 filter kit is required per cylinder.

Compressors with refrigeration drying for operation in conditions of high humidity, and high-capacity screw compressors for connection to several ozone plants are available on request.

2.7.2

Oxygen Generator for OZONFILT® OZVa 5-7

OXYMAT 020

This compact oxygen generator works on the principle of pressure swing filtration of the surrounding air via a molecular sieve. When supplied with suitably dried compressed air, oxygen is generated with a purity of up to 95 % and a dew point of -70 °C. The plant develops a pressure of 4 bar at the oxygen outlet and can be directly connected to the OZVa 5-7.

Technical Data

(at 90 % oxygen yield):

Type		Version 1	Version 2
Capacity	Nm ³ /h	0.9	1.2
Air requirement (min. 6 bar)	Nm ³ /min	0.17	0.24
Power consumption incl. compressor	kW	1.5	2.5
Specific energy requirement	kWh/Nm ³	1.7	2.1

Required components for version 1

	Order no.
OXYMAT 020 eco, 110-240 V / 50-60 Hz	1044799
Pressure tank O ₂ for Oxyamat O 020 eco, 90 l, 11 bar, PED with revision opening	1044986
Reciprocating compressor (oil-lubricated) Atlas Copco LE 2-10 E/100, with 100 l air receiver, 400 V / 50 Hz	1025384
Refrigeration dryer FD 5, 230 V / 50 Hz	1025385
Filter set 006, for LE 2-10 and GX 2-10 FF	1025387
Hose set with quick-release couplings, LE 2-10 to OXYMAT 020 LE 2-10 to OXYMAT 020	1025388
Connecting set with connections for 6x4 mm PTFE hose, between OXYMAT and OZVa	1025395

Required components for version 2

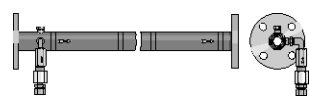
	Order no.
OXYMAT 020 eco, 110-240 V / 50-60 Hz	1044799
Pressure tank O ₂ for Oxyamat O 020 eco, 90 l, 11 bar, PED with revision opening	1044986
Atlas Copco Aircenter GX 2-10 FF/200, with screw compressor (oil injection), integrated refrigeration drying and 200 l air receiver, 400 V / 50 Hz	1025386
Filter set 006, for LE 2-10 and GX 2-10 FF	1025387
Hose set with quick-release couplings, for connection of air treatment GX 2-10 FF with OXYMAT 020	1025389
Connecting set with connections for 6x4 mm PTFE hose, between OXYMAT and OZVa	1025395

2 OZONFILT® and Bono Zon® Ozone Plants

Accessories

	Order no.
PTFE hose 6x4 mm, Admissible operating pressure 15 bar, sold in metres	037426
Service kit for Atlas Copco LE 2-10, (recommended after 8000 running hours)	1025390
Service kit for Atlas Copco GX 2-10 FF, (recommended after 8000 running hours)	1025391
Service kit 006, for Atlas Copco LE 2-10 and GX 2-10 FF	1025392

2.7.3



pk_7_072
Static Helical Mixer

PVC or Stainless Steel Static Helical Mixer

Designed for intensive mixing of gas with liquid flows. 4 helical blades ensure optimum mixing of the ozone with minimal pressure drop (0.1 bar per blade at maximum flow). The specified flow range of the static helical mixer should be complied with for optimum mixing results.

Version with loose flanges to DIN 2501 and integrated injection point made from stainless steel with couplings for 12 mm diam. stainless steel tube, or 12/9 mm PTFE hose, using stainless steel support inserts. In addition, the injection point is fitted with a non-return valve to protect the ozone plant from reverse flowing water. The mixers are manufactured as grease-free, so they are also suitable for Types OZVa 5-7. The stainless steel version has a G 1/4" pressure gauge tapping at the ozone mixing point.

Flow m ³ /h	Material	Overall length mm	Connector	Order no.
5 – 10	PVC-U	718	DN 40	1024324
10 – 15	PVC-U	718	DN 50	1024325
15 – 25	PVC-U	718	DN 65	1024326
25 – 35	PVC-U	1,100	DN 80	1024327
35 – 50	PVC-U	1,100	DN 100	1024328
50 – 90	PVC-U	1,300	DN 125	1034641
95 – 160	PVC-U	1,700	DN 150	1034640
5 – 10	1.4404	718	DN 40	1022503
10 – 15	1.4404	718	DN 50	1022514
15 – 25	1.4404	718	DN 65	1022515
25 – 35	1.4404	1,100	DN 80	1022516
35 – 50	1.4404	1,100	DN 100	1024154

Other sizes on request

Connecting parts for the gas pipeline

	Order no.
Stainless steel pipe 12/10 mm, sold by the metre	015743
Stainless steel pipe 12/10 mm, grease-less, 1.4 m	1022463
PTFE hose 12/9 mm, grease-less, sold by the metre	037428
Stainless steel support inserts, 2 No. for 12/9 mm PTFE hose, grease-less	1025397
Stainless steel coupling 12 mm - R 1/4, grease-less	1025755
Stainless steel fitting 12 mm - R 3/8, grease-less	1034642
Stainless steel 90° elbow D 12 - D 12, grease-less	1022462
Stainless steel pressure relief valve, adjustable pressure range 0.07 – 2 bar, Connection size: 1/4" NPT, 2 additional inputs for connecting 2 pressure gauges.	1029032
Stainless steel back pressure valve for OZMa 1-3 A and OZMa 4-6 O, adjustable pressure range 0.5-10 bar, connector G 3/4" - DN 10, grease-free	1039408
Spare parts kit for back pressure valve order no. 1039408	1039410
Stainless steel back pressure valve for OZMa 4-6 A, adjustable pressure range 0.5-10 bar, connector G 1 1/4" - DN 20, grease-free	1039409
Spare parts kit for back pressure valve order no. 1039409	1039411

2 OZONFILT® and Bono Zon® Ozone Plants

2.7.4 Accessories for OZONFILT® OZMa

The remote control module for OZMa systems enables bidirectional communication with the system control. Communication takes place optionally via a LAN, MPI or USB communications interface.

	Order no.
Remote control module for OZMa systems	on request

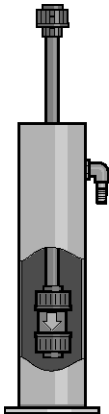
2.7.5 Accessories for Bono Zon® Ozone Plants

Water trap

Water trap as a vacuum breaker to prevent backflow of water into the ozone generator.

Pre-assembled unit consisting of PVC loss vessel including overflow with DN 10 hose spigot, and a non-return valve with DN 20 PVC coupling.

	Order no.
Water trap	1008781



pk_7_071
Water trap

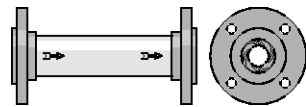
Ozone mixing

Static mixer designed for intensive mixing of gas with liquid flows. Made from PVC-U with two built-in helical mixers and a mixing section matched to the throughput.

The size depends only on the quantity of water to be ozonised.

Pressure rating: PN 4, other pressure ratings available on request.

Connection DN 65-200: loose flanges PN 10.



pk_7_044
Static mixer

Recommended flow m ³ /h	Flange connection DN mm	Length mm	Order no.
15-25	65	350	1007841
25-35	80	450	1007842
35-50	100	550	1007843
50-90	125	650	1007864
90-160	150	800	1007865
160-250	200	1,000	1007866
250-350	200	1,000	1007867

Higher flows on request.

Stainless steel version: on request

Ozone pumping devices

Complete ozone pumping devices consist of booster pump, injector and mixer and are assembled to suit specific project requirements. Design and technical details on request.

2 OZONFILT® and Bono Zon® Ozone Plants

Bleed valves

Bleed valves made of stainless steel 1.4571 in ozone-resistant version for mounting on reaction tanks.

Suitable for BONA types	Connector	Pressure bar	Order no.
1B	R 3/4" internal x R 1/2" external	0 – 6.0	302525
1A, 1D	R 1" internal x R 1/2" external	0 – 2.0	302526
to 3A, 3D	R 1" internal x R 3/4" external	0 – 2.0	303845

2.7.6

Residual Ozone Gas Destructor

Residual ozone gas destruction is used to remove traces of ozone gas from the exhaust air coming from the reaction tank. Because the exhaust air from the reaction tank still contains water, the pipework should be suitably routed so as to ensure that the water is drained off at the inlet side.

A suitable drainage connection should be provided here too as the exhaust air after the residual ozone gas destructor is still up to 100 % saturated with water vapour, and because small temperature fluctuations, even on the outlet side, can lead to flowback of condensate.

The exhaust air from any downstream filter plant that may be fitted can also be routed via this ozone gas destruction unit.

PVC version

Residual ozone destructor based on active carbon granules in a PVC housing.

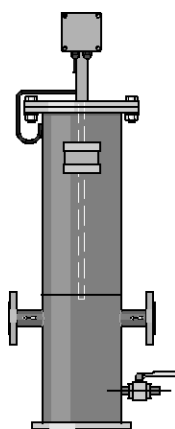
	Type	Ozone quantity g/h	Order no.
Residual ozone destructor 3 L	10	10	879022
Residual ozone destructor 14 L	40	40	1004267
Residual ozone destructor 30 L	100	100	879019
Residual ozone destructor 60 L	200	200	879018

Note:

The stated ozone quantities refer to quantities added to the raw water. The residual ozone destructor is designed for the normal residual ozone concentration found in swimming pool applications. It may only be used in plants with air as operating gas and a maximum added quantity of 1.5 g of ozone/m³ treated water.

Stainless steel version

Residual ozone destructor based on a maintenance-free MnO catalytic converter with integrated heating, 230 V, 50-60 Hz. Connections Rp 1/2" or flanges to DIN 2642, PN10. Types 18 to 110 m³/h also fitted with Rp 1/2" ball valve as condensate drain.



pk_7_073
Residual ozone destructor

Max. gas flow m ³ /h	Heating power W	Dimensions H x W x D mm	Connector	Order no.
1.5	100	700 x 110 x 180	Rp 1/2"	1018440
8.0	100	735 x 110 x 235	Rp 1/2"	1018406
18.0	140	1,154 x 275 x 240	DN 25	1019155
28.0	140	1,154 x 300 x 259	DN 25	1021037
40.0	500	1,156 x 330 x 264	DN 25	1026335
73.0	500	1,158 x 400 x 320	DN 32	1019971
110.0	500	1,160 x 450 x 375	DN 40	1027238

Note:

The catalytic residual ozone destructor must only be used in chlorine-free gas flows. The PVC version must therefore be used for swimming pool applications.

2 OZONFILT® and Bono Zon® Ozone Plants

2.7.7

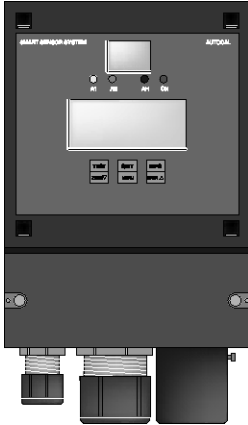
Room Air Monitor

Gas warning device GMA 36 – ozone and oxygen

Calibratable gas warning devices with digital display of the detected gas concentration. 2 relay outputs for issue of infringements of warning and alarm thresholds, to switch external alarm sounder and for interlocking with the ozone plant. The warning message relay is self resetting, the alarm relay is a latching type and should be acknowledged at the device. 1 self-resetting relay for connection to an alarm horn is switched in the event of fault conditions and when the alarm limit is exceeded.

The ozone sensor responds to all strongly oxidising gases, hence it responds to chlorine gas or chlorine dioxide too.

The GMA 36 oxygen warning device is intended for installations where an unacceptably high oxygen enrichment of the ambient air is possible.



pk_7_004_1
Gas warning devices GMA 36

Technical Data

Type	Ozone	Oxygen
Warning at approx.	ppm/vol% 0.3	23.0
Alarm at approx.	ppm/vol% 0.5	25.0
Permissible ambient temperature	°C -15...45	-15...45
Protection class housing	IP 54	IP 54
Dimensions (without PGs, without sensor) H x W x D	mm 247 x 135 x 95	247 x 135 x 95
Supply	V/Hz 85 – 264/50 – 60	85 – 264/50 – 60
Power consumption	W 5	5
Warm-up phase max.	s 150	20
"Warning" relay contact, self-resetting	V/A 230/1	230/1
"Alarm" relay contact, latching	V/A 230/1	230/1
"Horn" relay contact, latching, can be acknowledged	V/A 230/1	230/1
Sensor measuring principle	electrochemical	electrochemical
Sensor service life (depending on environmental cond.)	Years 2–3	2–3

	Type	Order no.
Gas warning device GMA 36	Ozone	1023155
Gas warning device GMA 36	Oxygen	1023971

Spare parts

	Order no.
Replacement sensor for chlorine, chlorine dioxide, ozone	1023314
Replacement sensor for oxygen	1023851
Replacement sensor for gas warning devices in the Life CGM range	1003009

Mounting kit

	Order no.
Mounting kit for direct mounting of the CGM 1060 and GMA 36 ozone warning devices on the housing of the OZVa plants	1004248
Support bracket for mounting kit for all types of OZVa except OZVa 1/2 with transparent mixing system	1005854

2 OZONFILT® and Bono Zon® Ozone Plants

Warning light and horn

Combined horn and red warning lamp. IP 33 enclosure made of impact-resistant ABS. Dome made of clear polycarbonate. Connected load: 230 V AC, 50 mA. Supplied complete with B 15 d / 7 watt bulb.

	Order no.
Warning light and horn	1010508

Gas tracing pump

Hand operated, non-continuously working test tube pump for fast and accurate measurement of ozone gas. Complete with 10 no. ozone gas test tubes 0.05-5 ppm in carrying case.

	Order no.
Gas tracing pump	1025533

Potassium iodide starch paper

Roll with 4.8 m test strip for leak detection on pipelines carrying ozone gas.

	Order no.
Potassium iodide starch paper	1025575

2.7.8

Cooling water heat exchanger

A heat exchanger can be used as an alternative to the use of fresh water as cooling water. The cooling water is fed through the heat exchanger and ozone system in a circuit. The cooling water heat exchanger discharges the heat to the surroundings.

Technical Data

- Single circuit system with tank open to the atmosphere
- Air-cooled refrigeration unit
- Integral evaporator
- Plastic tank with water level display and level switch with alarm contact
- Microprocessor-controlled temperature controller with digital display
- Integral pump
- Manometer
- Powder-coated exterior housing

Part no.		1043847	1043848	1043849	1043850
Refrigerant	CFC-free	R404a	R404a	R134a	R134a
Useful cooling power at 20 °C	kW	2.5	3.6	4.9	6.0
Working range	°C	+10 / +25	+10 / +25	+5 / +25	+5 / +25
Pump	Type	P16-YA62D	P16-YA62D	P3-BR11B	P3-BR11B
Pump output	l/min	5.0	5.0	16.7	18.3
Pump pressure	bar	3.0	3.0	2.2	2.1
Contents	l	13	13	30	30
Water connectors	Inch	< 1/2 " internal thread >		< 3/4 " internal thread >	
Power consumption 230 V/400 V	kW	1.6 / -	2.2 / -	- / 2.2	- / 1.8
Mains connection	V/Hz/Ph	230/50-60/1	230/50-60/1	400/50/3	400/50/3
Weight	kg	35	47	123	125
Outside dimensions (WxDxH)	mm	480x745x445	480x745x445	580x650x920	580x650x920

	Suitable for type	Order no.
Cooling water heat exchanger	OZVa 1-7, OZMa 1-2 A, OZMa 1-2 O	1043847
	OZMa 3 A, OZMa 3 O, OZMa 4 O	1043848
	OZMa 4 A, OZMa 5 A, OZMa 5 O	1043849
	OZMa 6 A, OZMa 6 O	1043850

2 OZONFILT® and Bono Zon® Ozone Plants

2.7.9 Personal Protection Needs

Gas mask

Ozone-resistant, full-face respiratory protective mask with panoramic window shield to EN 136 Class 3. Medium size with EN 148-1 threaded pipe connection. Complete with combination filter NO-P3 and carrying case.

	Order no.
Gas mask	1025574

Warning label

Warning label in accordance with the "Guidelines for the use of ozone for water treatment" ZH 1/474, issued by the central office of the industrial safety associations. Version supplied as a combined adhesive label with markings as follows: warning sign, ozone plant room indication and prohibited activity signs.

	Order no.
Warning label	740921

Emergency stop switch

For installation near the door of the ozone plant room. IP 65 PVC enclosure.

	Order no.
Emergency stop switch	700560

2.7.10 Overvoltage Protection

Overvoltage protection for OZONFILT® systems operated at 230 V 50-60 Hz.

The external overvoltage protection is intended for the operating case where the device internal protection is insufficient for surge voltages of 1 kV between the conductors and of 2 kV to earth. To protect the system when the supply mains is prone to power transients an overvoltage trip can be fitted as a low protection surge arrester to significantly increase the stability of the ozone systems.

Whether the low protection surge arrester requires further measures such as medium and main protection can only be determined by thorough investigation of the voltage behaviour on site.

	Order no.
Fine protection PT 2-DE IS 230 IAC	733010

2.7.11 Replacement Plug-in Insert after Tripping

	Order no.
Replacement plug-in insert PT 2-DE / S 230 / AC - ST	733011

3 Bello Zon® Chlorine Dioxide Plants

3.1 Chlorine Dioxide in Water Treatment

Chlorine dioxide is an extremely reactive gas, which – because of its instability – cannot be stored, and should only be produced in the required quantities in special plants on the site where it is to be used.

Chlorine dioxide offers a number of advantages for water disinfection compared with chlorine, the disinfectant mainly used. The disinfecting power of chlorine dioxide actually increases slightly with increasing pH, whereas with chlorine the disinfecting power reduces. Chlorine dioxide remains stable in the pipeline system over a long period and ensures microbiological protection of the water for many hours, or even several days. Ammonia and ammonium, which cause significant chlorine depletion, are not attacked by chlorine dioxide, so that the metered chlorine dioxide is fully available for bactericidal action. Chlorophenols, compounds with intense odours, which can be produced during water chlorination in some circumstances, are not formed when chlorine dioxide is used. Trihalomethanes (THMs), a group of substances, which, like their best known example, chloroform, are suspected of being carcinogenic, are produced when chlorine reacts with natural water components (humic acids, fulvic acids, etc.). Measured THM concentrations, if present at all, are drastically reduced when chlorine dioxide is used as an alternative disinfectant.

Advantages of chlorine dioxide:

- Disinfection power is independent of pH.
- High residual effect thanks to long-term stability in the pipeline system.
- Reduction of the biofilm in pipelines and tanks, hence reliable protection of entire water systems against legionella contamination.
- No reaction with ammonia or ammonium.
- No formation of chlorophenols and other intense odour compounds which can be produced in water chlorination.
- No formation of THMs and other chlorinated hydrocarbons, no increase in the AOX value.

3.1.1 Chlorine Dioxide Applications

For every new project, our engineers can draw on the experience that we have continually accumulated since 1976, in the following applications:

Municipal potable water and waste water plants

- Disinfection of potable water
- Disinfection of waste water

Hotels, hospitals, retirement homes, sports facilities, etc.

- Combating legionella in cold and hot water systems
- Water disinfection in air conditioning system cooling towers

Food and beverages industry

- Disinfection of product and industrial water
- Bottle cleaning, rinser and pasteuriser
- Cold sterile bottling
- Disinfectant in CIP systems
- Condensate water treatment in the milk industry
- Washing water treatment for fruit, vegetables, seafood, fish, and poultry

Horticulture

- Disinfection of irrigation water in plant growing

Industry

- Cooling water treatment
- Combating legionella in cooling circuits
- Disinfection of process water
- Removal of odorous substances in air scrubbers
- Combating slime in the paper industry

3 Bello Zon® Chlorine Dioxide Plants

3.1.2

Bello Zon® Plant Technology

Bello Zon® chlorine dioxide generation and metering systems use the chlorite/acid process. These systems generate a chlorine-free chlorine dioxide solution through the reaction of sodium chlorite solution with hydrochloric acid.

Decades of experience with Bello Zon® chlorine dioxide systems have shown that using the selected process parameters, an excellent output of 90 - 95 % (relative to the stoichiometric ratio) can be achieved.

In most applications, metering is proportional to the flow, i.e. the flow depends on the signal from an inductive or contact flow meter or is parallel to a feed pump.

In circulation systems, such as bottle washing machines, cooling circuits, etc., where a chlorine dioxide loss has only to be made up, the addition can also be controlled based on a chlorine dioxide measurement.

Features

- Precise and reproducible chlorine dioxide production, thanks to use of calibratable metering pumps for the input chemicals.
- Convenient easy operation, thanks to microprocessor control with display of all relevant operating parameters and error messages in plain text.
- Display of the current production quantity as well as the flow rate of the connected flow meter for CDV and CDK systems.
- Integrated measurement of ClO₂ and chlorite plus control of ClO₂.
- Highest safety level provided as standard, thanks to construction and operation in accordance with DVGW specifications W 224 and W 624.

Bello Zon® CDL

Ideal for small water quantities and for both continuous and discontinuous treatment: the specialist in combating Legionella and other germs supplying up to 10 g/h. The complete system with integral metering pump can be easily and safely used thanks to the chlorine dioxide concentration of 2 g/l. A clearly laid out user interface with intuitive menu navigation ensures simple operation.

Bello Zon® CDV

The ideal system for medium to large water quantities - for the production of 15 to 2,000 g/h of chlorine dioxide. Continuous treatment is safe and simple thanks to the use of diluted chemicals.

Bello Zon® CDK

The system produces 170 to 12,000 g/h chlorine dioxide for large water quantities. Continuous water treatment is particularly economical thanks to the use of concentrated chemicals.

ProMaqua provides all the advice needed for the safe operation of a chlorine dioxide system:

- Evaluation of the situation on site by trained, expert field sales staff.
- In our water laboratory, we can measure all of the key water parameters required for optimum system design.
- Planning the system.
- Commissioning and system service by our trained service technicians.

3 Bello Zon® Chlorine Dioxide Plants

3.2 Performance Overview of Chlorine Dioxide Plants

Type [g/h]	CDLb	CDVc	CDKc
15.000			
10.000			8 – 12.000
5.000			
1.000		1 – 2.000	
500			
100	0 – 120		
50			
10			
5			

Manufacturing method

	Chlorite-Acid (depleted) 7,5 % NaClO ₂ + 9 % HCl	Chlorite-Acid (depleted) 7,5 % NaClO ₂ + 9 % HCl	Chlorite-Acid (concentrated) 24,5 % NaClO ₂ + 25-37 % HCl
--	--	--	---

Application

Legionella combating	■		
Food and beverages industry	■	■	
Municipal drinking and waste water treatment	■	■	■
Industry (cooling tower, waste/ process water, etc.)	■	■	■

P_PMA_BEZ_0121_SW

Chlorine dioxide is establishing itself more and more as a universal disinfectant in applications such as the disinfection of potable water and industrial water, washing food or in the treatment of cooling water and waste water. Its effect independent of the pH value of the water ensures systems remain free of biofilms.

- Efficient disinfection in connection with excellent eco-compatibility
- Safe and reliable plant technology
- World wide availability of know-how and service

3 Bello Zon® Chlorine Dioxide Plants

3.3 Questionnaire on the Design of a Chlorine Dioxide Plant

Use of the chlorine dioxide plant:

- for disinfection of
 - Drinking water
 - Industrial water
 - Process water in the food industry
 - Waste water
 - Cooling water
 - _____
- for oxidation of
 - Iron, manganese, nitrite, sulphide etc.
 - Swimming pool water
 - Odour
 - _____
- _____

Water values:

- | | | | |
|------------------------------|-----------------------------------|---|--|
| Max. water flow rate | _____ m ³ /h | Maximum water pressure | _____ bar |
| Water flow rate | <input type="checkbox"/> constant | <input type="checkbox"/> fluctuating from | _____ m ³ /h to _____ m ³ /h |
| pH value | _____ | Iron (Fe ²⁺) | _____ mg/l |
| Temperature | _____ °C | Manganese (Mn ²⁺) | _____ mg/l |
| Solid fraction | _____ mg/l | Nitrite (NO ₂ ⁻) | _____ mg/l |
| Alkalinity K _{SA,3} | _____ mmol/l | Sulphide (S ²⁻) | _____ mg/l |
| | | TOC (total organic carbon) | _____ mg/l |

Response time to application:

_____ m³ volume reaction tank or _____ minutes residence time in entire system.

Type of metering:

- constant
- flow-proportional
- depending on measured value

Desired amount of metering: _____ mg/l

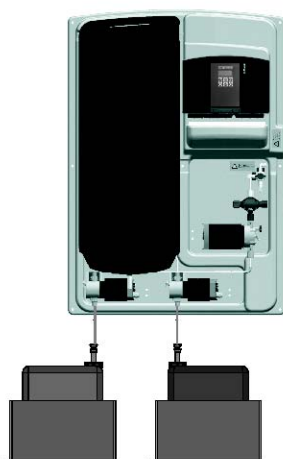
Desired concentration after chlorine dioxide metering: _____ mg/l

Other requirements:

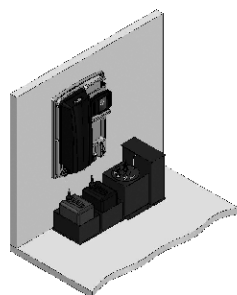
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3 Bello Zon® Chlorine Dioxide Plants

3.4 Bello Zon® CDLb Chlorine Dioxide Plant



P_PMA_BEZ_0077_SW



P_PMA_BEZ_0122_SW

The Bello Zon® CDLb chlorine dioxide system uses the chlorite/acid process. A chlorine-free chlorine dioxide solution is generated from a sodium chlorite solution using hydrochloric acid in a batch process. Thanks to the innovative reactor design and stepwise process flow, the production of chlorine dioxide in this manner is exceptionally safe. Depending on type, the system can produce up to 120 g chlorine dioxide per hour. This is then buffered in an integral or separate receiver module at a concentration of 1,000 or 2,000 mg/l. Thanks to the 60 g of chlorine dioxide buffered in the separate receiver module, these systems need not be dimensioned according to their peak load but rather based on their mean consumption. This drastically reduces investment costs compared with conventional systems. The ProMinent® product range includes a wide range of metering pumps and control versions from which to choose when operating several injection points using chlorine dioxide from a receiver module.

The innovative process produces a chlorine dioxide solution of exceptional long-term stability and achieves excellent efficiency of over 90% in the chlorine dioxide reaction. No chlorine dioxide can escape from the system due to the closed gas transport system, thereby guaranteeing economical, environmentally-friendly operation with minimal use of chemicals.

The modular construction of the system means it is suitable for a range of different applications. Possible applications of the Bello Zon® CDLb chlorine dioxide system are primarily in the prevention of Legionella and in disinfection in the food and beverage industries. Other applications are in cooling and potable water treatment, and in swimming pool filter disinfection. Meets the high standards stipulated in the W 224 and W 624 German Association for Gas and Water (DVGW) data sheets.

Advantages

- Safe process control
- No loss of chlorine dioxide due to closed gas transport system
- High stability of the chlorine dioxide solution
- Low investment costs
- Operation of several points of injection
- Filter disinfection
- Prevention of Legionella in hotels, hospitals, etc.
- Disinfection in the food and beverage industries (bottle rinsers, CIP, bottle washing machine, washing of fruit and vegetables)
- Market gardening (irrigation water and sprinkler irrigation water)
- Treatment of cooling water and potable water
- Swimming pools (filter backwashing and prevention of Legionella)

Technical Data

Type	Generation capacity	Solution concentration	Capacity	Dimensions (approx.) H x W x D (mm)	
	g/h	mg/l	l/h	mm	
CDLb 6	6*	1,000	8	1,236 x 878 x 306	
CDLb 12	12*	2,000	8	1,236 x 878 x 306	
CDLb 22	22*	2,000	13	1,236 x 878 x 306	
CDLb 55	55*	2,000	30	1,550 x 800 x 345	
CDLb 120	120**	2,000	**	1,300 x 880 x 425	

* Option: Integrated receiver tank and integrated metering pump with suitable capacity up to 7 bar back pressure.

** with external receiver module and separate metering pump

- Voltage supply** 100-230 V, 50/60 Hz
- Inputs** 2 freely configurable digital inputs for the functions Pause, High metering, Intermittent metering or Manual metering, as well as an external collective malfunction signal
4 digital inputs for monitoring (warning / empty message) the chemical supply
1 digital input for contact water meter 0.25-20 Hz
1 frequency input for water meter 10-10,000 Hz
- Outputs** 1 operating signal relay
1 alarm signal relay
1 warning signal relay
1 voltage output +5 V as supply voltage for a water meter with Hall sensor
- Operating fluids** Sodium chlorite 7.5 %, purity according to EN 938
Hydrochloric acid 9% purity according to EN 939
Potable water

3 Bello Zon® Chlorine Dioxide Plants

Identity code ordering system for Bello Zon® CDLb chlorine dioxide plants

CDLb	ClO ₂ production capacity
02	CDLb 06 = 6 g/h
04	CDLb 12 = 12 g/h
06	CDLb 22 = 22 g/h
08	CDLb 55 = 55 g/h
10	CDLb 120 = 120 g/h
Equipment	
0	With receiver tank, pump and multifunctional valve
1	With receiver tank and pump
2	With receiver tank, without pump
3	With 30 l receiver module, without pump
Design	
P	ProMinent®
S	Switzerland
Operating voltage	
0	230 V, 50/60 Hz
1	115 V, 50/60 Hz
Suction lance, suction assembly	
0	None
1	With suction lance
2	With suction lance and collecting pan
Pre-set language	
DE	German
EN	English
ES	Spanish
FR	French
IT	Italian

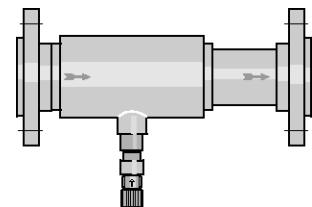
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3 Bello Zon® Chlorine Dioxide Plants

3.4.1

Accessories and Maintenance Sets for Legio Zon® CDLa and Bello Zon® CDLb

Metering station



pk_7_066

Corrosion-resistant metering station made of PVC-U or PVC-C for warm water applications with integrated mixer elements and maintenance-free PVDF metering valve.

	Material	installation length mm	Order no.
Metering station CDL DN 50	PVC-U	450	1027611
Metering station CDL DN 65	PVC-U	400	1026490
Metering station CDL DN 80	PVC-U	400	1027612
Metering station CDL DN 100	PVC-U	470	1034693
Metering station CDL DN 65	PVC-C	400	1029326
Metering station CDL DN 80	PVC-C	400	1029327

Temperature/pressure resistance – metering station CDL

Water temperature (°C)	maximum permissible operating pressure (bar)	
	PVC-U	PVC-C
40	12	12
50	7	9.5
60	4.5	7.5
70	–	5
80	–	3

Pressure relief valve

Type MFV pressure relief valve with wall mounting bracket and 6x4 mm hose connection for installation in chlorine dioxide metering line.

	Order no.
MFV pressure relief valve with wall mounting bracket	1027652

Safety collecting pan for chemical containers

Collecting pan with two separate compartments for 1 No. 25 l Bello Zon® acid and 1 No. 10 l Bello Zon® chlorite chemical container.

Dimensions (HxWxD): 290 x 700 x 350 mm

	Order no.
Safety collecting pan for CDL chemical	1026744

Service kits for Legio Zon® CDLa

The kits contain all parts subject to wear and tear that need to be replaced at regular service intervals. The 1-year kit should be used every year and the 3-year kit in addition every 3 years.

	Order no.
1-year service kit for pressure relief valve	1029442

For CDLa with ClO₂ pump

	Order no.
1-year service kit for Legio Zon®CDL5	1027263
3-year service kit for Legio Zon®CDL5	1027417
1-year service kit for Legio Zon®CDL10	1031549
3-year service kit for Legio Zon®CDL10	1031550

3 Bello Zon® Chlorine Dioxide Plants

For CDLa without ClO₂ pump

	Order no.
1-year service kit for Legio Zon®CDL5	1042829
3-year service kit for Legio Zon®CDL5	1042831
1-year service kit for Legio Zon®CDL10	1042830
3-year service kit for Legio Zon®CDL10	1042832

Maintenance sets for Bello Zon® CDLb

For CDLb with receiver tank, pump and multifunctional valve

	Type	Order no.
Annual maintenance kit	CDLb 06, CDLb 12	1044484
Annual maintenance kit	CDLb 22	1044501
Annual maintenance kit	CDLb 55	1044509
3-yearly maintenance kit	CDLb 06, CDLb 12	1044494
3-yearly maintenance kit	CDLb 22	1044502
3-yearly maintenance kit	CDLb 55	1044510

For CDLb with receiver tank and pump

	Type	Order no.
Annual maintenance kit	CDLb 06, CDLb 12	1044495
Annual maintenance kit	CDLb 22	1044503
Annual maintenance kit	CDLb 55	1044511
3-yearly maintenance kit	CDLb 06, CDLb 12	1044496
3-yearly maintenance kit	CDLb 22	1044504
3-yearly maintenance kit	CDLb 55	1044512

For CDLb with receiver tank without pump

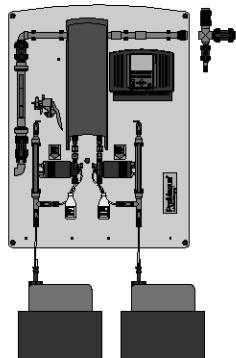
	Type	Order no.
Annual maintenance kit	CDLb 06, CDLb 12	1044497
Annual maintenance kit	CDLb 22	1044505
Annual maintenance kit	CDLb 55	1044513
3-yearly maintenance kit	CDLb 06, CDLb 12	1044498
3-yearly maintenance kit	CDLb 22	1044506
3-yearly maintenance kit	CDLb 55	1044514

For CDLb with 30 l receiver module without pump

	Type	Order no.
Annual maintenance kit	CDLb 06, CDLb 12	1044499
Annual maintenance kit	CDLb 22	1044507
Annual maintenance kit	CDLb 55	1044515
Annual maintenance kit	CDLb 120	1044517
3-yearly maintenance kit	CDLb 06, CDLb 12	1044500
3-yearly maintenance kit	CDLb 22	1044508
3-yearly maintenance kit	CDLb 55	1044516
3-yearly maintenance kit	CDLb 120	1044519

3 Bello Zon® Chlorine Dioxide Plants

3.5 Bello Zon® Chlorine Dioxide Plants Type CDVc



P_PMA_BEZ_0009_SW
CDVc 20-120 (figure shows optional configuration)

Connection-ready, Bello Zon® CDVc chlorine dioxide systems are used in the production, metering and monitoring of 20 to 2,000 g/h of chlorine dioxide made from dilute base chemicals. A completely newly developed reactor concept ensures the innovative production and metering of chlorine dioxide. PVDF is used for the first time instead of the PVC used hitherto in the industry. This results in improved operating safety and higher purity of the generated chlorine dioxide. The stroke lengths of the latest generation of ProMinent® metering pumps are continuously monitored. Impermissible operating statuses arising from incorrect pump stroke length adjustments can thus be ruled out.

The central system control manages the precise production of chlorine dioxide. DULCOTEST® chlorine dioxide, chlorite, pH or ORP sensors can be directly connected via the twin mA inputs. The chlorine dioxide in the treated water, as well as its main by-product chlorite, can thus be monitored and documented online. The chlorine dioxide concentrations in the water can be adjusted automatically depending on the measurement using the integrated PID controller. All status messages and measured values are documented in the integrated data logger and visualised in the clear colour display via the screen plotter.

The systems meet all the requirements of the DVGW specifications W 224 and W 624 with regard to design and operation and are designed for operation using the pre-diluted chemicals Bello Zon® chlorite (7.5 % NaClO₂) and acid (9 % HCl).

Advantages

- Efficient operation, thanks to production, metering, and monitoring of ClO₂ using just one system
- Maximum operating safety and purity of the ClO₂ produced by the use of PVDF reactors
- Highest operating safety, thanks to stroke length-monitored pumps
- Perfect quality management, thanks to integrated storage of all operating parameters and measured values
- Automatic monitoring of operating parameters and maintenance dates
- Easy and safe operation thanks to clearly laid-out menu navigation in plain text

Features

- Capacity range: 20-2,000 g/h ClO₂
- PVDF reactor
- Stroke length monitoring for metering pumps
- Control with large colour display, integrated data logger and screen plotter
- Measurement, documentation, and visualisation of ClO₂ and chlorite or ORP

Technical Data

Type	Chlorine dioxide dosing capacity*		Max. operating pressure**	Operating temp. °C	Hose connection dimensions of metering pumps	Dimensions*** H x W x D (mm)	Weight*** kg	Power consumption (max.) ****	
	min./hour g/h	min./day g/d						230 V A	115 V A
CDVc 20	1–20	6.4	8	10–40	6x4	1,344 x 1,002 x 200	26	2.7	0.9
CDVc 45	2–45	16.0	8	10–40	6x4	1,344 x 1,002 x 200	27	2.7	0.9
CDVc 120	6–120	40.0	8	10–40	6x4	1,344 x 1,002 x 200	28	2.7	0.9
CDVc 240	12–240	80.0	8	10–40	8x5	1,342 x 1,000 x 248	45	2.7	1.2
CDVc 600	30–600	140.0	8	15–40	8x5	1,711 x 1,200 x 273	75	2.8	1.4
CDVc 2000	100–2,000	468.0	5	15–40	DN 10	1,900 x 1,400 x 370	120	4.1	3.2

* The metering figures relate to 5 bar back pressure and an ambient temperature of 20 °C. The minimum capacity/per hour is based on the fact that when the system is operating at below 5 % of the nominal power, continuous metering is no longer possible because of the correspondingly low pumping frequency of the metering pumps. When systems are not operating continuously, the reactor contents should be changed at least twice daily. The system should not, therefore, be operated below the stated minimum capacity/day.

** at 35 °C ambient temperature

*** without bypass pump, flushing valve and water supply line

**** 230 V values with bypass pump, 115 V values without bypass pump

3 Bello Zon® Chlorine Dioxide Plants

3.5.1 Identcode Ordering System for CDVc Plants

CDVc	System type, metering output ClO₂	
02	CDVc 20=	20 g/h
04	CDVc 45=	45 g/h
06	CDVc 120=	120 g/h
08	CDVc 240=	240 g/h
10	CDVc 600=	600 g/h
14	CDVc 2000=	2,000 g/h
	Type	
P	ProMaqua	
	Power supply	
U	100-230 V ± 10 %, 50/60 Hz	
A	230 V ± 10 %, 50/60 Hz	
B	100-115 V ± 10 %, 50/60 Hz (not available for version with „bypass“ 04 or 06)	
	Bypass version	
02	Bypass PVC-U with float flow meter	
04	Bypass PVC-U with float flow meter and bypass pump (not CDVc 2000)	
	Calibrating device	
0	Without calibration device, but with measuring cylinder	
1	With calibration device	
	Suction lance, suction fitting, chemicals	
0	none	
1	Suction lance for 5-60 l container (only CDV 20-600)	
2	Suction lance for 200 l container (only CDV 20-600)	
3	Flexible suction fitting up to 5m with two-phase level switch (only CDV 20-600 g/h)	
4	Suction lance for 25 l tank with 2 drip pans 40 l without leakage sensor (only CDV 20-600 g/h)	
	Mechanical design	
0	Standard	
	Preset language	
DE	German	
EN	English	
FR	French	
IT	Italian	
ES	Spanish	
	Control	
0	Basic version	
1	With measuring and control properties (only in connection with version inputs and outputs 1 or 3)	
2	With measuring and control properties, data logger and screen recorder (only in connection with version inputs and outputs 1 or 3)	
	Extended in- and outputs	
0	none	
1	2 analogue inputs, freely configurable for controller output and flow rate	
2	1 analogue output, freely configurable	
3	2 analogue inputs and 1 analogue output, freely configurable	
	Communication interfaces	
0	Standard	
	Approvals	
01	CE-mark	
	Temperature monitoring	
0	without temperature monitoring	
	Hardware	
0	Standard	
	Software	
0	Standard	

3

3 Bello Zon® Chlorine Dioxide Plants

3.5.2 Spare Parts Kits for Bello Zon® Chlorine Dioxide Plants Type CDV

The spare parts kits include all parts subject to wear, which need to be replaced in the course of regular maintenance.

Spare parts kit for CDVc plants

	Order no.
Spare parts kit complete for CDVc 20	1034758
Spare parts kit complete for CDVc 45	1034759
Spare parts kit complete for CDVc 120	1034760
Spare parts kit complete for CDVc 240	1034761
Spare parts kit complete for CDVc 600	1034762
Spare parts kit complete for CDVc 2000	1034763

Spare parts kits for CDVb plants

	Order no.
Spare parts kit complete for CDVb 15	1022252
Spare parts kit complete for CDVb 35	1022253
Spare parts kit complete for CDVb 60	1022264
Spare parts kit complete for CDVb 120	1022265
Spare parts kit complete for CDVb 220	1024614

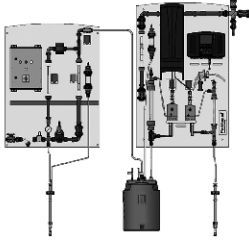
Spare parts kits for CDVa plants

	Order no.
Spare parts kit complete for 230 V CDVa 35	791842
Spare parts kit complete for 230 V CDVa 60	791913
Spare parts kit complete for 230 V CDVa 120	791915
Spare parts kit complete for 230 V CDVa 220	740824
Spare parts kit complete for 230 V CDVa 400	740765
Spare parts kit complete for 230 V CDVa 600	740826
Spare parts kit complete for 230 V CDVa 2000	1005333
Spare parts kit complete for 115 V CDVa 35	791860
Spare parts kit complete for 115 V CDVa 60	791914
Spare parts kit complete for 115 V CDVa 120	791916
Spare parts kit complete for 115 V CDVa 220	740825
Spare parts kit complete for 115 V CDVa 400	740819
Spare parts kit complete for 115 V CDVa 600	740827
Spare parts kit complete for 115 V CDVa 2000	1005344

Additional spare parts are listed in the operation instructions for the plants.

3 Bello Zon® Chlorine Dioxide Plants

3.6 Bello Zon® Chlorine Dioxide Plants Type CDKc



P_PMA_BEZ_0096_SW
CDKc 420 (figure shows optional configuration) ¹⁾

Connection-ready, complete Bello Zon® CDKc chlorine dioxide systems are used in the production, metering and monitoring of up to 12,000 g/h of chlorine dioxide made from concentrated base chemicals. A completely newly developed reactor concept ensures the innovative production and metering of chlorine dioxide. PVDF is used for the first time instead of the PVC used hitherto in the industry. This results in improved operating safety and higher purity of the generated chlorine dioxide. The stroke lengths of the latest generation of ProMinent® metering pumps are continuously monitored. Impermissible operating statuses arising from incorrect pump stroke length adjustments can thus be ruled out.

The central system control manages the precise production of chlorine dioxide. DULCOTEST® chlorine dioxide, chlorite, pH or ORP sensors can be directly connected via the twin mA inputs. The chlorine dioxide in the treated water, as well as its main by-product chlorite, can thus be monitored and documented online. The chlorine dioxide concentrations in the water can be adjusted automatically depending on the measurement using the integrated PID controller. All status messages and measured values are documented in the integrated data logger and visualised in the clear colour display via the screen plotter.

Thanks to the system's pre-dilution module it is just as safe to operate as the CDVc, but with the more economical use of concentrated chemicals.

The systems meet all the requirements of the DVGW specifications W 224 and W 624 with regard to design and operation and are designed for operation with 24.5 % sodium chlorite in accordance with DIN EN 938 and 25 to 36 % hydrochloric acid in accordance with DIN EN 939.

Advantages

- Selectable initial concentration of acid components
- Increased safety due to pre-dilution
- Efficient operation, thanks to production, metering, and monitoring of ClO₂ using just one system
- Maximum purity of the generated ClO₂ achieved through use of PVDF reactors
- Pumps with stroke-length monitoring to avoid incorrect operation
- Perfect quality management, thanks to integrated storage of all operating parameters and measured values
- Automatic monitoring of operating parameters and maintenance dates
- Easy and safe operation thanks to clearly laid-out menu navigation in plain text

Features

- Capacity range: 150-12,000 g/h ClO₂
- PVDF reactor
- Stroke length monitoring for metering pumps
- Control with large colour display, integrated data logger and screen plotter
- Measurement, documentation, and visualisation of ClO₂, chlorite or ORP

Technical Data

Type ¹⁾	Chlorine dioxide dosing capacity* ¹⁾		Max. operating pressure** bar	Connection dimensions of chlorite and acid metering pumps	Operating temp. °C	Dimensions*** H x W x D (mm) mm	Weight*** kg	Power consumption (max.)****	
	min.-max./hour g/h	min./day g/d						230 V A	115 V A
CDKc 150	8-150	56	6	6x4	10-40	1,384 x 1,080 x 325	55	2.7	1.2
CDKc 400	20-400	140	6	8x5	10-40	1,700 x 1,100 x 450	80	2.8	1.5
CDKc 900	45-900	300	8	8x5	10-40	2,000 x 1,130 x 510	95	2.9	2.5
CDKc 2000	100-2,000	700	5	8x5	10-40	2,000 x 1,320 x 550	160	2.2	3.5
CDKc 2800	140-2,800	700	5	8x5	15-40	2,000 x 1,320 x 550	160	2.2	3.5
CDKc 7300	365-7,300	1,750	3	DN 10	15-40	2,300 x 1,500 x 560	175	2.6	4.5
CDKc 12000	600-12,000	1,750	2	DN 10	18-40	2,300 x 1,500 x 560	180	2.6	4.5

* The metering figures relate to 5 or 2 bar back pressure and an ambient temperature of 20 °C. The minimum capacity/per hour is based on the fact that when the system is operating at below 5 % of the nominal power, continuous metering is no longer possible, due to the correspondingly low pumping frequency of the metering pumps. When systems are not operating continuously, the reactor contents must be changed at least twice daily. The system should not, therefore, be operated below the stated minimum capacity/day.

** at 35 °C ambient temperature

*** without bypass pump, flushing valve and water supply line

**** 230 V figure with bypass pump (CDKc 150-900), 115 V figures without bypass pump

¹⁾ **Technical and design changes reserved.**

3 Bello Zon® Chlorine Dioxide Plants

3.6.2 Spare Parts Kits for Bello Zon® Chlorine Dioxide Systems Type CDK

The spare parts kits include all wearing parts that need replacing in the course of regular maintenance.

	Order no.
Spare parts kit complete for 230 V CDKa 150	740740
Spare parts kit complete for 230 V CDKa 420	740743
Spare parts kit complete for 230 V CDKa 750	1000172
Spare parts kit complete for 230 V CDKa 1500	1000856
Spare parts kit complete for 230 V CDKa 6000	1004814
Spare parts kit complete for 230 V CDKa 10000	1006647
Spare parts kit complete for 115 V CDKa 150	740741
Spare parts kit complete for 115 V CDKa 420	740744
Spare parts kit complete for 115 V CDKa 750	1000173
Spare parts kit complete for 115 V CDKa 1500	1000855
Spare parts kit complete for 115 V CDKa 6000	1004815
Spare parts kit complete for CDKc 150 (type 20)	1043841
Spare parts kit complete for CDKc 170 (type 02)	1036454
Spare parts kit complete for CDKc 400 (type 21)	1043842
Spare parts kit complete for CDKc 420 (type 04)	1036455
Spare parts kit complete for CDKc 900 (type 06)	1036456
Spare parts kit complete for CDKc 900 (type 22)	1043843
Spare parts kit complete for CDKc 2000 (type 23)	1043864
Spare parts kit complete for CDKc 2100 (type 08)	1036457
Spare parts kit complete for CDKc 2800 (type 24)	1043865
Spare parts kit complete for CDKc 3000 (type 10)	1036458
Spare parts kit complete for CDKc 7500 (type 12)	1036459
Spare parts kit complete for CDKc 7500 (type 25)	1043866
Spare parts kit complete for CDKc 12000 (type 14)	1040079
Spare parts kit complete for CDKc 12000 (type 26)	1043867

Additional spare parts are listed in the operation instructions for the systems.

3 Bello Zon® Chlorine Dioxide Plants

3.7 Bypass Line Accessories

Premixers made of PVC

CDVb 15-120 premixers are fully integrated in the plant, provided they are ordered with the Identity Code. The premixer on the CDVb 220 can also be ordered by Identity Code but is supplied loose with the plant. On all other plants, the premixer can be ordered partly by Identity Code or partly as a separate order. The standard delivery package of the premixer includes all PVC couplings, screw hose clips and other fixing materials. On the CDVa 2000 and CDKa 1500–10000, the pre-mixer is in two parts.

Plant	Volume	Length	Connection nominal diameter	Order no.
	l	mm		
CDVb 220, CDKa 150	1.5	594	DN 25	740649
CDVa 400, CDKa 420	4.5	756	DN 25	740650
CDVa 600, CDKa 750	7.0	1,306	DN 32	740832
CDVa 2000, CDKa 1500	13.4	2x1,316	DN 40	1001000
CDKa 6000/10000	13.4	2x1,330	DN 50	1003121

Bypass pump

Booster pumps made of cast iron (GG) or stainless steel (SS) for operation in the bypass line. Electrical version 220-230 V, 50 Hz, with integrated overload protection.

The required bypass flow should be considered when selecting a suitable bypass pump. The following flow data is recommended for the different plants:

Plant type	Bypass line	Diameter (mm)	Flow rate (m ³ /h)
CDV 15 – 600	DN 25	32	0.5 - 2
CDV 2,000	DN 40	50	2 - 10
CDKa 150 – 420	DN 25	32	0.5 - 2
CDKa 750	DN 32	40	1 - 3.5
CDKa 1,500	DN 40	50	1.5 - 10
CDKa 6,000 – 10,000	DN 50	63	6 - 10
CDKc 150 - 900	DN 25	32	0.5 - 2
CDKc 2,000 - 2,800	DN 40	50	2 - 10
CDKc 7,300	DN 40	50	6 - 10
CDKc 12,000	DN 40	50	10 - 15

PVC should be used as the material for the bypass. The thickness should at least correspond to the pressure range PN 10, or even better PN 16 (bar).

Technical Data

Type	Material	Connection suction/ discharge side inch	Pump capacity at 2 bar m ³ /h	Nominal rating W	Nominal current A	Order no.
ZHM 3	SS	RP 1¼" / 1"	1.2	500	2.3	1038925

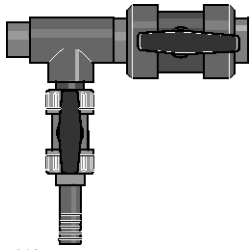
Accessories

	Order no.
Bracket for bypass pump	791474
Angle-seat valve PVC DN 25 for throttling the bypass pump	1001877

3 Bello Zon® Chlorine Dioxide Plants

Flushing assembly

To allow the reactor and premixer to be flushed clear for maintenance purposes or after a long shutdown period, a flushing valve should be installed downstream of the chlorine dioxide plant. The complete flushing equipment kit comprises a DN 25 PVC stopcock and a DN 20 PVC flushing valve with a hose nozzle and a DN 25 vacuum relief valve. It is already included in the scope of delivery of all new plants as standard.



pk_7_013
Flushing assembly

	Order no.
Flushing assembly PVC-U, EPDM, DN 25	1033405

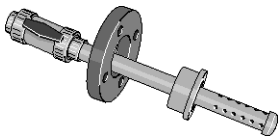
Ball-check valve

A back pressure-resistant ball-check valve should be fitted on installations with long bypass lines, especially if the pipe slopes downwards and the point of injection is below the Bello Zon® plant, as well as on installations with fluctuating back pressure.

Type	Nominal diameter	Connector	Material	Order no.
DHV-U	DN 15	G 1"	PVDF	1037766

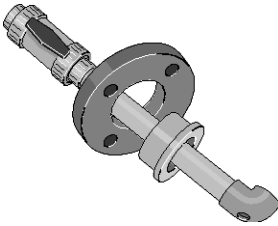
PVC-U chlorine dioxide point of injection

For uniform distribution of the chlorine-enriched bypass water in the main water pipeline, an injection pipe should be used to optimise the mixing and distribution of the chlorine dioxide. The injection pipes should be shortened to the required length on site. The standard delivery package includes a DN 25 ball valve as a shut-off valve. The injection pipe is fitted in a DN 50 DIN flange installed by a third party.



pk_7_011_2
Injection pipe from DN 100

	Order no.
Injection pipe for pipe diameters up to DN 80	1018754
Injection pipe for pipe diameters from DN 100	1018753



pk_7_012_2
Injection pipe to DN 80

Contact water meter

For direct connection to the Legio Zon® and Bello Zon® systems.

Nominal diameter	Rated flow m³/h	Max. flow rate m³/h	Pulse rate I	Order no.
DN 40	10	20	0.3	1041357
DN 50	15	30	1	1041358
DN 80	40	110	1	1041359

Inductive magnetic flow meters

The flow meter with transducer MAG 5100 W is especially suitable for water flow measurement in the fields of ground water, potable water, waste water and sludge.

	Connection nominal diameter	Order no.
Inductive magnetic flow meter	DN 50	1034685
	DN 65	1034686
	DN 80	1034687
	DN 100	1034688

3 Bello Zon® Chlorine Dioxide Plants

3.8 Chemical Supply Accessories

Suction lances and accessories

Suction lances have a rigid construction that can be precisely matched to the chemical tank. Suction assemblies consist of flexible suction pipes. All suction lances and suction assemblies are made of PVC with FPM seals and are fitted with foot valves and two-stage level switches including cable and round plug. Relevant parts must be selected from the ProMinent motor-driven pump accessories range for system types not listed here.

	suitable for system types	Order no.
Suction lance for connection to 5-60 litre non-reusable tank with 2 m long suction hose (6/4 mm)	CDVc 20-120	802077
Suction lance for connection to 5-60 litre non-reusable tank with 2 m long suction hose (8/5 mm)	CDVc 240-600	802078
Suction lance for connection to 200 litre drums with 3 m long suction hose (6/4 mm)	CDVc 20-120	802079
Suction lance for connection to 200 litre drums with 3 m long suction hose (8/5 mm)	CDVc 240-600	802080
Flexible suction fitting with D55 screw cap and 5 m suction hose (6/4mm)	CDVc 20-120	1034602
Flexible suction fitting with D55 screw cap and 5 m suction hose (8/5 mm)	CDVc 240-600	1034644
Gas-tight suction lance for 200 litre drums with bleed valve, connection for 6/4 and 8/5 mm suction lines and connector for 6/4 mm return line.	CDKc 150-2800	1036171
Flexible suction assembly with 5 m suction hose (6/4 mm) and gas-tight D55 screw cap with opening for a return line	CDKc 150-2800	1036174
Flexible suction assembly with 5 m suction hose (8/5 mm) and gas-tight D55 screw cap with opening for a return line	CDKc 150-2800	1036175

Vacuum cylinder chamber for CDVa and CDVb plants

To prevent gas bubbles in the suction line for the chemicals.

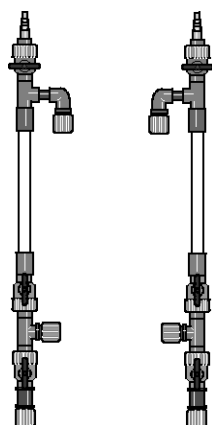
The CDVc plants in the version "with calibration device" already include the function "Suction aid".

	Order no.
Acid side: vacuum cylinder accumulator with fixings	1001820
Chlorite side: vacuum cylinder accumulator with fixings	1001821

Heating system for chemical lines

to preheat the chemical suction lines at low temperature

	Order no.
Diameter of suction hose 6/4 mm	1001636
Diameter of suction hose 8/5 mm	1001637
Diameter of suction hose 12/9 mm	1001638
Diameter of suction hose 19/16 mm	1001639



pk_7_010

3 Bello Zon® Chlorine Dioxide Plants

Safety collecting pans for chemical tank

Usable capacity l	Type	Order no.
40	without leakage monitor	791726
40	with leakage monitor	791728
70	without leakage monitor	740309
70	with leakage monitor	740308
140	without leakage monitor	740723
140	with leakage monitor	1003190

Scope of delivery:

- without leakage monitor: one pan
- with leakage monitor: two pans + level switch + electronics card for Bello Zon® control (CDVa, CDVb, CDKa)

Leakage monitor for CDVc and CDKc plants

Name of the item	Order no.
Level switch with litz wire 5 m	1003191

consisting of 1 level switch to be fitted in the 40, 70 or 140 l safety drip pans without leakage monitor and connected to the control of the Bello Zon® CDVc and CDKc.

Drip pan with grating to install two 200 l barrels

Material	Weight kg	External dimension WxDxH mm	Effective area WxD mm	Collecting volume l
Polyethylene	ca. 22	1,230 x 820 x 435	1,160 x 750	220

Meets the requirements of the German Water Resources Act (WHG) and possesses a general building supervision approval of DIBt, Berlin.

Name of the item	Order no.
Drip pan with grating	1027211

Bello Zon® Acid

Component 1 for Bello Zon® chlorine dioxide production plants.

Name of the item	Order no.
Bello Zon® Acid 25 l	1027594
Bello Zon® Acid 200 l	950131

* loan container

Bello Zon® Chlorite

Component 2 for Bello Zon® chlorine dioxide production plants.

Name of the item	Order no.
Bello Zon® Chlorite 10 l	1026422
Bello Zon® Chlorite 25 l	1027595
Bello Zon® Chlorite 200 l	950136

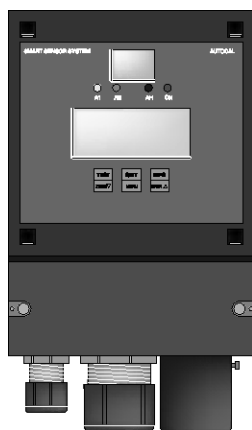
* loan container

3 Bello Zon® Chlorine Dioxide Plants

3.9 Safety Accessories and Analysis

Gas warning device GMA 36 – chlorine dioxide

The gas warning device GMA 36 for chlorine dioxide is designed as a compact measuring and switching unit for monitoring the surrounding air for dangerous concentrations of chlorine dioxide.



pk_7_004_1
Gas warning devices GMA 36

Technical Data

Type	Chlorine dioxide
Warning at approx.	0.1 ppm/vol%
Alarm at approx.	0.3 ppm/vol%
Permissible ambient temperature	-15...45°C
Protection class housing	IP 54
Dimensions (without PGs, without sensor) H x W x D	247 x 135 x 95 mm
Supply	85 – 264 / 50 – 60 V/Hz
Power consumption	5 W
Warm-up phase max.	150 s
"Warning" relay contact, self-resetting	230 / 1 V/A
"Alarm" relay contact, latching	230 / 1 V/A
"Horn" relay contact, latching, can be acknowledged	230 / 1 V/A
Sensor measuring principle	electrochemical
Sensor service life (depending on environmental cond.)	2–3 years

Note: The sensor responds to all oxidising gases

	Order no.
Gas warning device GMA 36 – chlorine dioxide	1023156

Spare parts

		Order no.
Replacement sensor	for chlorine, chlorine dioxide, ozone	1023314
Replacement sensor	for gas warning devices in the Life CGM range	1003009

Warning label for chlorine dioxide system

Soft PVC film, yellow/black, 300 x 200 mm, self-adhesive.

Text	Language	Order no.
"Behälter und Geräte nicht wechselweise benutzen"	german	607320
"Never mix up chemical containers"	english	607318
"Non usare serbatoi e apparecchi alternativamente"	italian	791886

Warning label for chlorine dioxide room

PVC film yellow/black, 200 x 80 mm

Text	Language	Order no.
"Zutritt nur für unterwiesene Personen"	german	607322
"Entry for authorised persons only"	english	607319
"Vietato l'accesso ai non addetti ai lavori"	italian	791885

3 Bello Zon® Chlorine Dioxide Plants

Acid fume separator

Acid fume separator SDA-90 filled with 0.7 l of acid-absorbing granules for absorption of hydrochloric acid fumes. Connection: DN 25 PP coupling with G 1 1/2" union nut.

	Order no.
Acid fume separator	1009987
Replacement pack of absorbent material 0.7 l	1010500

Reactor chamber bleed valve

Bleed valve for reactor space, adjustable, instead of bleed line, which is led to open air (already included in standard delivery package on CDVb).

	Order no.
Reactor chamber bleed valve	791801

Safety collecting pans for the chemicals containers, see Chap. 3.6

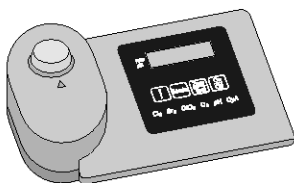
Photometers DT1, DT2 and DT4

- portable, compact photometer
- simple operation with text support
- safe, simple measurement of chlorine, chlorine dioxide, fluoride, chlorite, H₂O₂, bromine, ozone, pH and cyanuric acid
- calibratable

Technical Data

ranges DT1	0.05 ... 6.0 mg/l free chlorine (DPD1) +total chlorine (DPD1+3) 0.1 ... 13.0 mg/l bromine (DPD1) 0.05 ... 11 mg/l chlorine dioxide (DPD1) 0.03 ... 4.0 mg/l ozone (DPD4) 6.5 ... 8.4 pH (phenol red) 1 ... 80 mg/l cyanuric acid
ranges DT2B	0.05 ... 2.0 mg/l fluoride 0.05 ... 6.0 mg/l free chlorine and total chlorine 0.05 ... 11.0 mg/l chlorine dioxide
ranges DT4	0.03 ... 2.5 mg/l chlorite 0.05 ... 11 mg/l chlorine dioxide 0.05 ... 6 mg/l chlorine
Measuring tolerance	Dependant upon measured value and measuring method
Battery	4-off batteries AA/LR6
Permissible ambient temperature	5...40 °C
Relative humidity	30 ... 90 % (non-condensing)
Material	Housing material: ABS Keypad: Polycarbonate
Dimensions L x W x H (mm)	190 x 110 x 55
Weight	0.4 kg

		Order no.
Photometer DT1B	complete with carrying case	1039315
Photometer DT2C	complete with carrying case	1039316
Photometer DT4B	complete with carrying case	1039318



P_DT_0074_SW
Photometer

The standard delivery package for the photometers includes accessories, cuvettes and reagents

3 Bello Zon® Chlorine Dioxide Plants

Consumables for analysis

	Order no.
DPD 1 buffer, 15 ml	1002857
DPD 1 reagent, 15 ml	1002858
DPD 3 solution, 15 ml	1002859
Phenol red tablets R 175 (100 in each)	305532
Cyanuric acid tablets (100 in each)	1039744
SPADNS reagent, 250 ml for fluoride detection	1010381
Calibration standard fluoride 1 mg/l for calibration of photometer (fluoride detection)	1010382
3 spare cells: round cells with covers for DPD phenol red and cyanuric acid detection (DT1 and DT2B)	1007566
3 spare cells for fluoride detection (DT2A and B)	1010396
DPD reagents set, 15 ml each: 3 x DPD 1 buffer, 1 x DPD 1 reagent, 2 x DPD 3 solution	1007567
Chlorine dioxide tablets no. 1	1039732
Chlorine dioxide tablets no. 2	1039733
Chlorine HR tablets (100 off)	Chhlorine_tablets
ACiDiTYiNG tablets (100 off)	AC_tablets

DPD reagents for measurement of excess chlorine, ozone or chlorine dioxide in the water, in conjunction with a Lovibond comparator.

	Amount	Order no.
DPD tablets no. 1	100	501319
DPD tablets no. 2	100	501320
DPD tablets no. 3	100	501321
DPD tablets no. 4	100	501322

4 CHLORINSITU® and Dulco®Lyse Electrolysis Systems

4.1

CHLORINSITU® Electrolysis Systems

Chlorine and sodium hydroxide are produced in electrolysis in-situ by passing an electric current through salt water.

In **tubular cell electrolysis** (CHLORINSITU® II versions), the electrochemical reaction takes place in one chamber, so that the chlorine gas produced immediately reacts with sodium hydroxide to form sodium hypochlorite. Saturated brine is used as a salt solution which is produced in a separate salt-dissolving tank from salt of defined quality. The advantage of tubular cell electrolysis is the simple design of the equipment. The disadvantage is the relatively poor yield which leads to a high entrainment of chloride in the water to be treated and the relatively low chlorine concentrations in the reaction mixture.

In **membrane electrolysis**, the electrochemical reaction takes place in two electrode chambers separated by a membrane, so that the formation of the chlorine and sodium hydroxide is physically separated. CHLORINSITU® III type systems bring the reaction mixtures of both electrode chambers together again after the electrochemical reaction to produce a stock solution of sodium hypochlorite which can be stored temporarily and metered as needed. In compact CHLORINSITU® IV and CHLORINSITU® IV type systems, the chlorine is directly added to the water to be treated where it dissolves as hypochlorous acid. In CHLORINSITU® IV plus type systems, any excess chlorine gas produced is combined with the sodium hydroxide, as in the CHLORINSITU® III system, to form system hypochlorite and then stored temporarily. Hence the systems should thus only be designed for medium chlorine demand because capacity peaks are compensated for the temporary storage. In all CHLORINSITU® IV type systems the sodium hydroxide is stored temporarily and metered for pH value correction as required.

The **Dulco®Lyse** is a membrane electrolysis system for the production of ECA water (electrochemically activated water). The use of this systems engineering has been specially developed for processes in which the chloride content needs to be minimised to avoid corrosion of the system parts, e.g. in the food and beverage industry.

The advantage of membrane systems is the high efficiency and prevention of entrainment of chloride from the electrolysis cell into the water to be treated. In systems for the production of sodium hypochlorite, the high yield results in solutions which have a significantly higher chlorine content than when produced by tubular cell electrolysis.

- Disinfection based on cooking salt
- No handling of hazardous chemicals
- Economical method thanks to low salt and energy consumption
- Ultra-pure chlorine thanks to production in-situ and short temporary storage periods
- Water disinfection and pH correction using one system (CHLORINSITU® IV)
- Maximum operating safety thanks to design as a vacuum systems
- Improved working conditions for operating personnel
- No risk confusing dangerous chemical tanks

4 CHLORINSITU® and Dulco®Lyse Electrolysis Systems

4.2 Performance Overview

		CHLORINSITU® II	CHLORINSITU® III	CHLORINSITU® IV	CHLORINSITU® IV plus
Output [g/h]	4.000				
	3.000				
	2.000				
	1.000				
Production of HOCl				■	■
Production of NaOCl		■	■		■
Application					
Drinking water		■	■	■	■
Process water		■	■	■	■
Swimming pool water		■	■		■

P_PMA_EL_0008_SW

		DULCOLYSE	CHLORINSITU® III & IV compact
Output [g/h]	200		
	150		
	100		
	50		
Application			
ECA		■	
Swimming pool			■

P_PMA_EL_0034_SW

Note: larger systems available on request

4

4 CHLORINSITU[®] and Dulco[®]Lyse Electrolysis Systems

4.3 Questionnaire on the Design of a CHLORINSITU[®] Electrolysis System

Use of the electrolysis plant:

- for disinfection of
 - Drinking water
 - Industrial water
 - Cooling water
 - Swimming pool water
 - _____

Water values:

- | | | | |
|---------------------------------|-----------------------------------|---|--|
| Max. water flow rate | _____ m ³ /h | Maximum water pressure | _____ bar |
| Water flow rate | <input type="checkbox"/> constant | <input type="checkbox"/> fluctuating from | _____ m ³ /h to _____ m ³ /h |
| pH value | _____ | Iron (Fe ²⁺) | _____ mg/l |
| Temperature | _____ °C | Manganese (Mn ²⁺) | _____ mg/l |
| Solid fraction | _____ mg/l | Nitrite (NO ₂ ⁻) | _____ mg/l |
| Acid capacity K _{34,3} | _____ mmol/l | Sulphide (S ²⁻) | _____ mg/l |
| Total hardness | _____ mmol/l | TOC (total organic carbon) | _____ mg/l |
| Total hardness | _____ °dH | Ammonia | _____ mg/l |

Response time to application:

_____ m³ volume reaction tank or _____ minutes residence time in entire system.

Type of metering:

- constant
- flow-proportional
- depending on measured value

Desired dosing rate: _____ mg/l

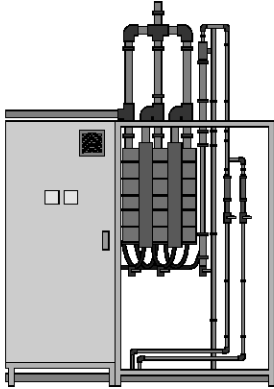
Disinfection method used up to now:

Consumption of disinfectant up to now: _____ kg/week

Other requirements:

4 CHLORINSITU® and Dulco®Lyse Electrolysis Systems

4.4 CHLORINSITU® II Tubular Cell Electrolysis Systems



P_PMA_EL_0003_SW

CHLORINSITU® II electrolysis systems generate sodium-calcium hypochlorite with a concentration of 5 g/l. A saturated solution of sodium chloride is produced in a salt dissolving tank (included in the scope of supply), which, after appropriate dilution, is electrolysed in an open cell. The resulting solution is collected in a storage container and, from there, metered according to requirements using separate metering pumps. Due to its moderate pH value of 8.5 - 9, it affects the pH of the treated water significantly less than if conventional sodium-calcium hypochlorite with a pH of 12 - 13.5 were to be used. The hydrogen produced is diluted with fresh air through an ATEX-approved ventilator and discharged safely. Both the salt-dissolving and diluting water comes from a softener integrated in the system, thereby preventing the formation of limescale and ensuring the long service life of the electrolytic cell.

The systems are controlled using a modern PLC with large, illuminated display and integrated modem for remote diagnosis and troubleshooting.

CHLORINSITU® II electrolysis systems are especially suitable for applications where a robust and clearly laid-out technology is required and where the carry-over of some sodium chloride into the water being treated is not a problem.

- Robust, simple technology
- Safe system control with remote diagnosis by modem
- Cost-effective operation thanks to the use of sodium chloride as an inexpensive raw material and lower chemical consumption for pH correction
- Compact, space-saving design
- Improved working conditions for the operating personnel
- No risk of confusing dangerous chemical tanks

Technical Data

Type/output	Voltage supply	Power Uptake	Salt consumption	Process water consumption	Cooling water consumption	Dimensions L x W x H (mm)	Brine tank	Recommended capacity storage tank
g/h		kW	kg/h	l/h	l/h		l	l
50	230 V	0.78	0.2	11.0	–	1,050 x 600 x 1,550	130	300
100	230 V	1.15	0.4	22.0	–	1,050 x 600 x 1,550	130	500
150	3 x 400 V	1.53	0.6	32.0	–	1,050 x 600 x 1,550	200	700
200	3 x 400 V	1.90	0.8	43.0	–	1,050 x 600 x 1,550	200	1,000
300	3 x 400 V	2.65	1.1	65.0	–	1,050 x 600 x 1,550	200	1,500
400	3 x 400 V	3.40	1.5	86.0	–	1,250 x 600 x 2,000	380	2,000
500	3 x 400 V	4.15	1.9	108.0	–	1,250 x 600 x 2,000	380	2,500
600	3 x 400 V	4.90	2.3	129.0	–	1,250 x 600 x 2,000	380	3,000
800	3 x 400 V	6.40	3.0	172.0	–	1,250 x 600 x 2,000	520	3,500
1000	3 x 400 V	7.90	3.8	215.0	–	1,250 x 600 x 2,000	520	4,500
1200	3 x 400 V	9.40	4.6	258.0	–	1,250 x 600 x 2,000	520	5,500
1400	3 x 400 V	10.90	5.3	301.0	–	1,250 x 600 x 2,000	520	6,000
1600	3 x 400 V	12.40	6.1	344.0	–	1,250 x 600 x 2,000	760	7,000
1800	3 x 400 V	13.90	6.9	387.0	–	1,650 x 600 x 2,000	760	8,000
2000	3 x 400 V	15.40	7.7	430.0	–	1,650 x 600 x 2,000	760	9,000
2200	3 x 400 V	16.90	8.4	473.0	–	1,650 x 600 x 2,000	760	10,000
2400	3 x 400 V	18.40	9.2	516.0	–	1,650 x 600 x 2,000	760	11,000

Scope of supply:

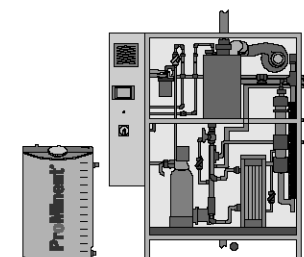
Connection-ready electrolysis system mounted on a powder-coated stainless steel frame with programmable logic controller (PLC) in a control cabinet, integrated softening system, electrolysis cell, ATEX-certified bleeding system and salt-dissolving tank supplied with level monitor. Level sensors to monitor the sodium-calcium hypochlorite storage tanks that are to be provided by the customer. Automatic monitoring of the water hardness downstream of the softening system for systems from 750 g/h.

Remarks:

CHLORINSITU® II, III, IV and IV plus electrolysis systems are offered and planned according to customer specifications. This is true both for the system documentation and the subsequent spare parts supply and maintenance.

4 CHLORINSITU® and Dulco®Lyse Electrolysis Systems

4.5 CHLORINSITU® III Membrane Electrolysis Systems



P_PMA_EL_0004_SW

CHLORINSITU® III membrane electrolysis systems generate sodium hypochlorite with a concentration of approximately 20-25 g/l without major transfer of sodium chloride from the electrolytic cell into the finished product. A saturated solution of sodium chloride is produced in a salt-dissolving tank (included in the scope of supply) for this purpose, which is then electrolysed in a membrane cell. Sodium hydroxide and hydrogen are produced in the cathode chamber, while chlorine gas and dilute residual brine are produced in the anode chamber, which is separated by the membrane from the cathode chamber. The chlorine gas produced binds to the sodium hydroxide solution and is collected in a storage container as sodium-calcium hypochlorite and from there metered according to requirements using separate metering pumps. Due to its moderate pH value of 9 - 9.5, it affects the pH of the treated water significantly less than if conventional sodium-calcium hypochlorite with a pH of 12 -13.5 were to be used. The hydrogen produced is diluted with fresh air through an ATEX-approved ventilator and discharged safely. The salt-dissolving water comes from a softener integrated in the system, thereby preventing the formation of limescale and ensuring the long service life of the electrolytic cell. The efficiency of the electrolysis system is monitored by an integral pH value measurement of the sodium hydroxide solution production.

The systems are controlled using a modern PLC with large, illuminated display and integrated modem for remote diagnosis and troubleshooting.

CHLORINSITU® III electrolysis systems are especially suitable for applications in which sodium-calcium hypochlorite solution low in chloride and chlorate is required.

- Sodium-calcium hypochlorite low in chloride and chlorate with a high chlorine concentration
- Minimised acid consumption for pH correction
- Safe system control with remote diagnosis by modem
- Electrolytic cells are extremely durable
- Cost-effective operation thanks to the use of sodium chloride as an inexpensive raw material and lower chemical consumption for pH correction
- Robust, simple technology
- Compact, space-saving design

Technical Data

Type/ output	Voltage supply	Power Uptake	Salt con- sumption	Process water con- sumption	Cooling water con- sumption	Dimensions L x W x H (mm)	Brine tank	Recommended capacity storage tank
g/h		kW	kg/h	l/h	l/h		l	l
50	3 x 400 V	0.90	0.1	2.4	–	1,250 x 600 x 1,550	130	100
75	3 x 400 V	1.00	0.2	3.6	–	1,250 x 600 x 1,550	130	100
100	3 x 400 V	1.10	0.2	4.8	–	1,250 x 600 x 1,550	130	200
200	3 x 400 V	1.50	0.4	9.7	–	1,250 x 600 x 1,550	130	300
300	3 x 400 V	1.90	0.6	15.0	100	1,250 x 600 x 1,550	200	400
400	3 x 400 V	2.30	0.8	19.0	100	1,250 x 600 x 1,550	200	500
500	3 x 400 V	2.70	1.1	24.0	100	1,250 x 600 x 1,550	200	600
600	3 x 400 V	3.10	1.3	29.0	100	1,650 x 600 x 1,550	200	700
1000	3 x 400 V	4.70	2.1	48.0	100	1,650 x 600 x 2,000	380	1,200
1500	3 x 400 V	6.70	3.2	73.0	100	1,650 x 600 x 2,000	380	1,800
2000	3 x 400 V	8.70	4.2	97.0	200	1,650 x 600 x 2,000	520	2,500
2500	3 x 400 V	10.70	5.3	121.0	200	1,750 x 1,200 x 2,000	520	3,000
3000	3 x 400 V	12.70	6.3	145.0	200	1,750 x 1,200 x 2,000	520	3,300
3500	3 x 400 V	14.70	7.4	169.0	200	1,750 x 1,200 x 2,000	520	4,000

Scope of delivery:

Electrolysis plant mounted ready for operation on a powder-coated stainless steel frame with programmable logic controller (PLC) in control cabinet, integrated softener, electrolytic cell, pH value monitoring, ATEX-certified bleeding system and side salt-dissolving tank with level monitor. Level sensors to monitor the storage tanks for sodium hypochlorite to be provided by the customer. Automatic monitoring of the water hardness downstream of the softener and chlorine gas detector for plants from 750 g/h.

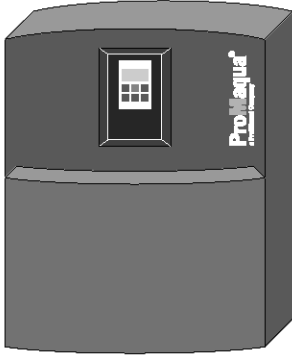
Remarks:

CHLORINSITU® II, III, IV and IV plus electrolysis systems are offered and planned according to customer specifications. This is true both for the system documentation and the subsequent spare parts supply and maintenance.

4 CHLORINSITU® and Dulco®Lyse Electrolysis Systems

4.6 CHLORINSITU® III compact and CHLORINSITU® IV compact Membrane Electrolysis Systems

4.6.1 CHLORINSITU® III compact



P_PMA_EL_0007_SW

CHLORINSITU® III compact electrolysis systems produce a chlorine-based disinfectant. A saturated solution of sodium chloride is produced in a salt-dissolving tank (included in the scope of supply) for this purpose, which is then electrolysed in a membrane cell. Sodium hydroxide and hydrogen are produced in the cathode chamber while ultra-pure chlorine gas and dilute residual brine are produced in the anode chamber, separated by the membrane from the cathode chamber. The chlorine gas produced reacts in the reactor with the sodium hydroxide produced to form a disinfection solution. The hydrogen generated is discharged through a bleed line. The salt-dissolving water comes from a softener integrated in the system, thereby preventing the formation of limescale and ensuring the long service life of the electrolytic cell.

The microprocessor controller integrated in the system digitally indicates the current output and monitors all key functions. All operating and error messages are shown in plain text on the clear display. The output can be controlled manually, automatically (controller option) or externally.

CHLORINSITU® III compact electrolysis systems are especially suitable for use with smaller swimming pools in residential properties and hotels (indoor pools of up to 2,000 m³).

Advantages

- Water disinfection and pH correction with one system
- Cost-effective operation, thanks to the use of sodium chloride as an inexpensive raw material and lower chemical consumption
- Optional integrated chlorine and pH control
- Robust, simple technology
- Compact, space-saving design

Technical Data

Type/ output g/h	Voltage supply	Power Uptake kW	Salt consumption g/h	Process water consumption l/h	Dimensions L x W x H (mm)	Brine tank l
25	230 V / 50 Hz	0.11	65	1.5	590 x 355 x 650	130
50	230 V / 50 Hz	0.22	131	3	590 x 355 x 650	130

Scope of supply:

Wall plate-mounted, connection-ready chlorine electrolysis system with integrated microprocessor control and softener system.

Electrolytic cell, separate salt-dissolving tank with level monitor.

Additionally a product tank is required and a metering pump for each point of injection (not part of the scope of supply)

	Order no.
CHLORINSITU® III compact 25	1041399
CHLORINSITU® III compact 50	1041401
CHLORINSITU® III compact 25 with integral pH and chlorine controller	1041400
CHLORINSITU® III compact 50 with integral pH and chlorine controller	1041402

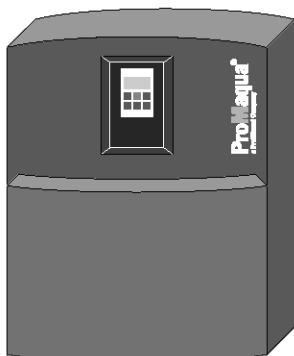
Spare parts and maintenance kits

	Type	Order no.
Annual maintenance kit	CHLORINSITU® III compact 25	1041407
Annual maintenance kit	CHLORINSITU® III compact 50	1041409
3-yearly maintenance kit	CHLORINSITU® III compact 25	1041408
3-yearly maintenance kit	CHLORINSITU® III compact 50	1041410

4 CHLORINSITU® and Dulco®Lyse Electrolysis Systems

4.6.2

CHLORINSITU® IV compact



P_PMA_EL_0007_SW

CHLORINSITU® IV compact electrolysis systems generate ultra-pure chlorine gas in a vacuum process. A saturated solution of sodium chloride is produced in a salt dissolving tank (included in the scope of supply) for this purpose, which is then electrolysed in a membrane cell. Sodium hydroxide and hydrogen are produced in the cathode chamber while ultra-pure chlorine gas and dilute residual brine are produced in the anode chamber, separated by the membrane from the cathode chamber. The resulting chlorine gas is suctioned off through an injector integrated in the system and dissolved as hypochlorous acid in the water being treated. The hydrogen generated is discharged through a bleed line. The sodium hydroxide is disposed of or optionally used with a metering pump integrated in the system to correct the pH of the water being treated. The salt-dissolving water comes from a softener integrated in the system, thereby preventing the formation of limescale and ensuring the long service life of the electrolytic cell.

The microprocessor controller integrated in the system digitally indicates the current output and monitors all key functions. All operating and error messages are shown in full text on the clear display. The output can be controlled manually or externally.

CHLORINSITU® IV compact electrolysis systems are especially suitable for use with smaller swimming pools in residential properties and hotels (indoor pools of up to 2,000 m³).

- Production and metering of ultra-pure hypochlorous acid
- Cost-effective operation thanks to the use of sodium chloride as an inexpensive raw material and lower chemical consumption for pH correction
- Water disinfection and pH correction with one system
- Safe vacuum system technology
- Optional integrated chlorine and pH control
- Robust, simple technology
- Compact, space-saving design

Technical Data

Type/ output g/h	Voltage supply	Power Uptake kW	Salt consumption g/h	Process water consumption l/h	Dimensions L x W x H (mm)	Brine tank l
25	230 V/50 Hz	0.11	65	1.5	590 x 355 x 650	130
50	230 V/50 Hz	0.22	131	3	590 x 355 x 650	130

Scope of delivery:

Chlorine electrolysis plant mounted on a wall plate, wired ready for connection, with integrated microprocessor control and softener system. Electrolytic cell with vacuum monitor, separate salt dissolving tank with level monitor. Fitted injector and metering equipment for sodium hydroxide (optional).

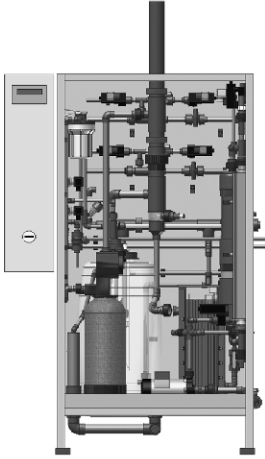
	Order no.
CHLORINSITU® IV compact 25	1036461
CHLORINSITU® IV compact 25 with pH correction	1036462
CHLORINSITU® IV compact 50	1036463
CHLORINSITU® IV compact 50 with pH correction	1036464
CHLORINSITU® IV compact 25 with integral pH and chlorine controller	1041405
CHLORINSITU® IV compact 25 with integral pH and chlorine controller plus pH correction	1041403
CHLORINSITU® IV compact 50 with integral pH and chlorine controller	1041406
CHLORINSITU® IV compact 50 with integral pH and chlorine controller plus pH correction	1041404

Spare parts and maintenance kits

	Type	Order no.
Annual maintenance kit	CHLORINSITU® IV compact 25	1041415
Annual maintenance kit	CHLORINSITU® IV compact 50	1041417
3-yearly maintenance kit	CHLORINSITU® IV compact 25	1041416
3-yearly maintenance kit	CHLORINSITU® IV compact 50	1041418
Membrane cell	CHLORINSITU® IV compact 25	1041419
Membrane cell	CHLORINSITU® IV compact 50	1041420
Membrane	CHLORINSITU® IV compact 25	1041421
Membrane	CHLORINSITU® IV compact 50	1041422

4 CHLORINSITU® and Dulco®Lyse Electrolysis Systems

4.7 CHLORINSITU® IV Membrane Electrolysis Systems



P_PMA_EL_0005_SW

CHLORINSITU® IV electrolysis systems generate ultra-pure chlorine gas in a vacuum process. A saturated solution of sodium chloride is produced in a salt dissolving tank (included in the scope of supply) for this purpose, which is then electrolysed in a membrane cell. Chloride-free sodium hydroxide and hydrogen are produced in the cathode chamber, while ultra-pure chlorine gas and dilute residual brine are produced in the anode chamber, separated by the membrane from the cathode chamber. The chlorine gas produced is suctioned off through an injector (contained in the scope of supply) and dissolved as hypochlorous acid in the water being treated. The chloride-free sodium hydroxide is stored temporarily and can be transferred into the water through the same injector to adjust the pH value. To achieve this, an external pH value controller is directly connected to the system's control. The generated hydrogen is diluted with fresh air through an ATEX-certified ventilator and discharged safely and the diluted residual brine is disposed of. The salt-dissolving water comes from a softener integrated in the system, thereby preventing the formation of limescale and ensuring the long service life of the electrolytic cell.

The systems are controlled using a modern PLC with large, illuminated display and integrated modem for remote diagnosis and troubleshooting. The chlorine metering and the pH value correction are controlled as standard via contact inputs.

Options:

- Analog input
- MOD-bus or PROFIBUS®
- Several points of injection

CHLORINSITU® IV electrolysis systems are suitable for all applications that require simultaneous hypochlorous acid metering and pH value correction.

- Production and metering of ultra-pure hypochlorous acid without temporary storage
- Chlorination and pH correction using a single system
- Cost-effective operation thanks to the use of sodium chloride as an inexpensive raw material and lower chemical consumption for pH correction
- Safe vacuum system technology
- Robust technology
- Compact, space-saving design

Technical Data

Type/ output	Voltage supply	Power Uptake	Salt consumption	Process water consumption	Cooling water consumption	Dimensions L x W x H (mm)	Brine tank	Recommended capacity storage tank
g/h		kW	kg/h	l/h	l/h		l	l
100	230 V	1.10	0.2	0.8	–	1,150 x 600 x 1,550	130	–
150	3 x 400 V	1.30	0.3	1.3	–	1,150 x 600 x 1,550	130	–
200	3 x 400 V	1.50	0.4	1.7	–	1,150 x 600 x 1,550	200	–
300	3 x 400 V	1.90	0.6	2.5	–	1,150 x 600 x 1,550	200	–
400	3 x 400 V	2.30	0.8	3.4	–	1,150 x 600 x 1,550	200	–
500	3 x 400 V	2.70	1.1	4.2	–	1,150 x 600 x 1,550	200	–
600	3 x 400 V	3.10	1.3	5.0	–	2,900 x 600 x 2,000	200	–
750	3 x 400 V	3.70	1.6	6.3	–	2,900 x 600 x 2,000	380	–
1000	3 x 400 V	4.70	2.1	8.4	–	2,900 x 600 x 2,000	380	–
1250	3 x 400 V	5.70	2.6	11.0	–	2,900 x 600 x 2,000	380	–
1500	3 x 400 V	6.70	3.2	13.0	–	2,900 x 600 x 2,000	380	–
1750	3 x 400 V	7.70	3.7	15.0	–	3,300 x 600 x 2,000	380	–
2000	3 x 400 V	8.70	4.2	17.0	200	3,300 x 600 x 2,000	520	–
2500	3 x 400 V	10.70	5.3	21.0	200	3,300 x 600 x 2,000	520	–
3000	3 x 400 V	12.70	6.3	25.0	200	3,300 x 600 x 2,000	520	–
3500	3 x 400 V	14.70	7.4	29.0	200	3,300 x 600 x 2,000	520	–

Scope of supply:

Electrolysis system mounted ready for operation on a powder coated stainless steel frame with programmable logic controller (PLC) in control cabinet, integrated softening system, electrolysis cell, pH value monitoring of the electrolysis, ATEX-certified bleeding system and salt-dissolving tank supplied with level monitor. The scope of supply also includes a central injector system matched to the system to meter chlorine gas and sodium hydroxide, inclusive of a booster pump. Automatic monitoring of the water hardness downstream of the softening system and chlorine gas detector for systems from 750 g/h.

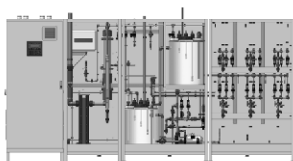
Remarks:

CHLORINSITU® II, III, IV and IV plus electrolysis systems are offered and planned according to customer specifications. This is true both for the system documentation and the subsequent spare parts supply and maintenance.

4 CHLORINSITU® and Dulco®Lyse Electrolysis Systems

4.8

CHLORINSITU® IV plus Membrane Electrolysis Systems



P_PMA_EL_0006_SW

CHLORINSITU® IV plus electrolysis systems generate ultra-pure chlorine gas in a vacuum process. A saturated solution of sodium chloride is produced in a salt dissolving tank (included in the scope of supply) for this purpose, which is then electrolysed in a membrane cell. Chloride-free sodium hydroxide and hydrogen are produced in the cathode chamber, while ultra-pure chlorine gas and dilute residual brine are produced in the anode chamber, separated by the membrane from the cathode chamber. The resulting chlorine gas is further processed in two ways. Firstly, as with CHLORINSITU® IV systems, the gas is suctioned off through an injector that forms part of the scope of supply and dissolved as hypochlorous acid in the water being treated. If the complete production output is not needed, excess chlorine gas can also be combined with the sodium hydroxide produced and then temporarily stored as sodium hypochlorite, as is the case with CHLORINSITU® III systems. The system thus does not have to be dimensioned according to the maximum chlorine gas demand rather according to the average daily demand. Peaks in demand are met by the additional metering of sodium-calcium hypochlorite from the temporary storage. As with chlorine gas, metering is done through a central injector system.

The chloride-free sodium hydroxide is likewise stored temporarily and can be transferred into the water being treated through the central injector system to adjust the pH value. To achieve this, an external pH value controller is directly connected to the system's control. The generated hydrogen is diluted with fresh air through an ATEX-certified ventilator and discharged safely and the diluted residual brine is disposed of. The salt-dissolving water comes from a softener integrated in the system, thereby preventing the formation of limescale and ensuring the long service life of the electrolytic cell.

The systems are controlled using a modern PLC with large, illuminated display and integrated modem for remote diagnosis and troubleshooting. The chlorine metering and the pH value correction are controlled as standard via contact inputs; analog inputs are likewise available.

CHLORINSITU® IV plus electrolysis systems are a particularly economical alternative for all applications that require simultaneous hypochlorous acid metering and pH value correction.

- Simultaneous production and metering of ultra-pure hypochlorous acid and sodium-calcium hypochlorite
- Chlorination and pH correction using a single system
- Cost-effective operation thanks to the use of sodium chloride as an inexpensive raw material and lower chemical consumption for pH correction
- Safe vacuum system technology
- Robust technology
- Compact, space-saving design

4 CHLORINSITU® and Dulco®Lyse Electrolysis Systems

Technical Data

Type/ output	Voltage supply	Power Uptake	Salt consumption	Process water consumption *	Cooling water consumption	Dimensions L x W x H (mm)	Brine tank	Recommended capacity storage tank
g/h		kW	kg/h	l/h	l/h		l	l
100	230 V	1.10	0.2	11	–	1,950 x 600 x 1,550	130	150
150	3 x 400 V	1.30	0.3	16	–	1,950 x 600 x 1,550	130	200
200	3 x 400 V	1.50	0.4	22	–	1,950 x 600 x 1,550	200	250
300	3 x 400 V	1.90	0.6	33	–	1,950 x 600 x 1,550	200	400
400	3 x 400 V	2.30	0.8	43	–	1,950 x 600 x 1,550	200	500
500	3 x 400 V	2.70	1.1	54	–	3,700 x 600 x 2,000	200	600
600	3 x 400 V	3.10	1.3	65	–	3,700 x 600 x 2,000	200	700
750	3 x 400 V	3.70	1.6	81	–	3,700 x 600 x 2,000	380	850
1000	3 x 400 V	4.70	2.1	108	–	3,700 x 600 x 2,000	380	1,100
1250	3 x 400 V	5.70	2.6	136	–	3,700 x 600 x 2,000	380	1,400
1500	3 x 400 V	6.70	3.2	163	–	3,700 x 600 x 2,000	380	1,700
1750	3 x 400 V	7.70	3.7	190	–	3,700 x 600 x 2,000	380	2,000
2000	3 x 400 V	8.70	4.2	217	200	4,100 x 600 x 2,000	520	2,200
2500	3 x 400 V	10.70	5.3	271	200	4,100 x 600 x 2,000	520	2,800
3000	3 x 400 V	12.70	6.3	325	200	4,100 x 600 x 2,000	520	3,300
3500	3 x 400 V	14.70	7.4	379	200	4,100 x 600 x 2,000	520	3,900

* The process water consumption depends on the ratio between chlorine gas and stock production. Here, the value for a ratio 50 % : 50 % is given.

Capacities > 3,500 g/h upon request

Scope of supply:

Electrolysis system mounted ready for operation on a powder coated stainless steel frame with programmable logic controller (PLC) in a control cabinet, integrated softening system, electrolysis cell, pH value monitoring of the electrolysis, ATEX-certified bleeding system and supplied salt-dissolving tank with level monitor. Level sensors to monitor the sodium-calcium hypochlorite storage tanks that are to be provided by the customer. The scope of supply also includes a central injector system matched to the system to meter chlorine gas, sodium-calcium hypochlorite and sodium hydroxide, inclusive of a booster pump. Automatic monitoring of the water hardness downstream of the softening system and chlorine gas detector for systems from 750 g/h.

Remarks:

CHLORINSITU® II, III, IV and IV plus electrolysis systems are offered and planned according to customer specifications. This is true both for the system documentation and the subsequent spare parts supply and maintenance.

4 CHLORINSITU[®] and Dulco[®]Lyse Electrolysis Systems

4.9 Questionnaire on the Design of an ECA Water System

Application

- Bottler flushing
- CIP
- Other _____

Applicational details

Number of bottlers: _____

Flushing duration: _____

Required volume to be added to bottler: _____ Recommendation with material SS 316 L 2-4 ppm

Number of CIP points of injection: _____

Duration of CIP: _____

Required volume to be added for CIP: _____ Recommendation 10-15 ppm

Water data:

Max. volume of water to be treated _____ m³/h maximum water pressure _____ bar

Water flow constant fluctuating from _____ m³/h to _____ m³/h

pH value _____ (iron (Fe²⁺) _____ mg/l)

Temperature _____ °C (manganese (Mn²⁺) _____ mg/l)

Proportion of solids _____ mg/l (nitrite (NO₂⁻) _____ mg/l)

Acid capacity K_{S4,3} _____ mmol/l (sulphide (S²⁻) _____ mg/l)

Total hardness _____ mmol/l (TOC (total organic carbon) _____ mg/l)

Total hardness _____ °dH (ammonium _____ mg/l)

Reaction time to application:

_____ m³ volume of reaction tank or _____ minutes dwell time in the total system.

Disinfection method used to date:

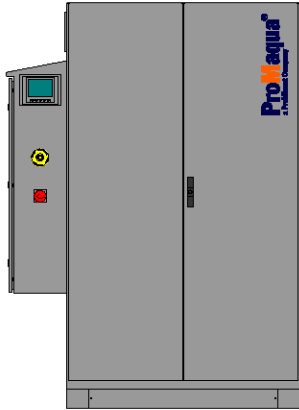
Disinfectant consumed to date: _____ kg/week

Other requirements:

P_PMA_ECA_0001_SW

4 CHLORINSITU® and Dulco®Lyse Electrolysis Systems

4.10 Dulco® Lyse ECA Water System



Dulcolyse_100-300gram_SW1

ECA water (electrochemically activated water) from the Dulco®Lyse is used wherever safe disinfection is required combined with simultaneous protection of the system components against corrosion.

Dulco®Lyse electrolysis systems generate ultra-pure chlorine gas in a vacuum process. A saturated salt solution is produced in the supplied salt dissolving tank for this purpose, which is then electrolysed in a membrane cell. Sodium hydroxide and hydrogen are produced in the cathode chamber while ultra-pure chlorine gas and dilute residual brine are produced in the anode chamber from which it is separated by the membrane. The resulting chlorine gas is immediately separated from the residual brine and dissolved in hypochlorous acid. The sodium hydroxide is temporarily stored and added to hypochlorous acid using a metering pump. The result is a neutral, highly-effective and extremely low-chlorine disinfection solution, which is temporarily stored in the product tank up until metering via separate metering stations. The hydrogen generated is diluted with fresh air through an ATEX-certified ventilator and discharged safely. The salt-dissolving water comes from a softening system integrated in the Dulco®Lyse system, thereby preventing the formation of lime deposits and ensuring the long service life of the electrolysis cell.

The systems are controlled by a modern PLC with a large, illuminated display and integrated modem for remote diagnosis and troubleshooting.

Advantages of the Dulco®Lyse system for the production and provision of pure, low-chlorine ECA water:

- Handling of chemicals is reduced (only sodium chloride is required)
- Compact, space-saving design
- Economic operation thanks to use of inexpensive sodium chloride as a raw material
- Control of the system with an integrated modem for remote diagnostics

Technical Data

Type/ Output *	ECA production at 400 ppm	No. of cells	Voltage supply	Power uptake	Dimensions H x W x D *	Salt solution tank volume	
g/h	l/h			kW	mm	l	
Dulco®Lyse 100	100	250	4	230 V / 50 Hz	1.95	2,100 x 1,500 x 355	130

* Greater outputs upon request, dimensions applicable up to 300 g/h

Scope of supply:

Dulco®Lyse electrolysis systems are assembled connection-ready in a stainless steel housing

- PLC (programmable logic controller) in attached control cabinet
- Integrated softening system
- Electrolysis cell(s)
- ATEX-certified bleeding system
- Integrated salt tank with level monitoring
- Automatic monitoring of the water hardness downstream of the softening system

	Order no.
Dulco®Lyse 100	1041424

Spare parts and maintenance kits

	Type	Order no.
Annual maintenance kit	Dulco®Lyse 100	1041427
3-yearly maintenance kit	Dulco®Lyse 100	1041430
Membrane cell	Dulco®Lyse 100	1041433
Membrane	Dulco®Lyse 100	1041436

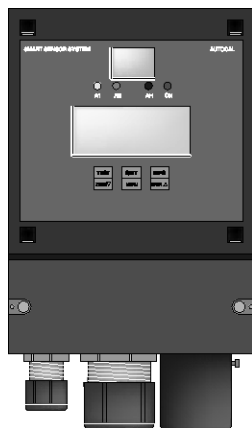
4 CHLORINSITU® and Dulco®Lyse Electrolysis Systems

4.11 Gas Warning Device for Monitoring for Chlorine Gas

The GMA 36 chlorine gas warning device is a compact measuring and switching unit designed for monitoring the surrounding air for dangerous concentrations of chlorine gas.

Gas warning device GMA 36

for monitoring chlorine gas



pk_7_004_1
Gas warning devices GMA 36

Type	Chlorine
Warning at approx.	2.0 ppm/vol%
Alarm at approx.	4.0 ppm/vol%
Permissible ambient temperature	-15...45°C
Protection class housing	IP 54
Dimensions (without PGs, without sensor) H x W x D	247 x 135 x 95 mm
Supply	85 – 264 / 50 – 60 V/Hz
Power consumption	5 W
Warm-up phase max.	150 s
"Warning" relay contact, self-resetting	230 / 1 V/A
"Alarm" relay contact, latching	230 / 1 V/A
"Horn" relay contact, latching, can be acknowledged	230 / 1 V/A
Sensor measuring principle	electrochemical
Sensor service life (depending on environmental cond.)	2–3 years

Note: The sensor reacts to all oxidising gases.

	Order no.
GMA 36 chlorine gas detector	1023157

Spare parts

		Order no.
Replacement sensor	for chlorine, chlorine dioxide, ozone	1023314
Replacement sensor	for gas warning devices in the Life CGM range	1003009

4.12 Accessories

Water hardness measuring kit

for manual determination of the overall hardness

	Order no.
Water hardness measuring kit for overall hardness	505505

5 ProCal Calcium Hypochlorite System

5.1 ProCal Calcium Hypochlorite System

When dissolved in water, calcium hypochlorite provides a highly effective disinfectant solution. The resulting solution not only contains the freely acting chlorine but also the lime deposits of the dissolving water and the non-soluble fractions of the calcium hypochlorite salt. After dilution, the solution is very stable and can be metered directly for disinfection purposes.

Calcium hypochlorite is very widely available and, in contrast to sodium hypochlorite, calcium hypochlorite can be stored as a salt. It is only dissolved when required.

Advantages of calcium hypochlorite:

- Very easy to handle.
- Excellent disinfection effect.
- Low proportion of side-products (dependent on the granulate used).

5.1.1 General Applications of Calcium Hypochlorite

Municipal water companies

- Emergency chlorination systems for disinfecting potable water

Industry

- Cooling water treatment
- Bleaching agent for use in the paper, cellulose and textile industries
- Disinfection of process water

Swimming pools (public and private)

- Disinfection of swimming pool water The ProCal has been specially developed for these uses.

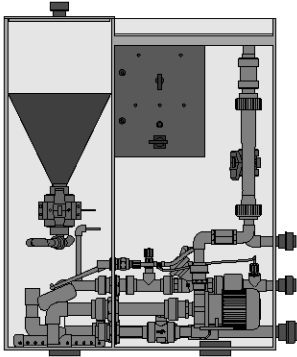
5.1.2 ProCal Systems Engineering

The ProCal system is incorporated in a constant flow bypass in the pool circuit. Dependent on requirements, calcium hypochlorite is metered as a granulate into a mixing chamber to form a solution and then added to the pool circuit by means of a booster pump. The calcium hypochlorite itself is kept in a storage tank above the mixing chamber. To avoid lime deposits in the system and the bypass lines, a time-controlled acid rinse can be integrated.

The control signal for the correct chlorine concentration in the pool comes from a swimming pool controller (D1C, D2C, DSR or DULCOMARIN® II) as a pulse-pause signal. This signal controls the adding of granulate to the mixing chamber.

5 ProCal Calcium Hypochlorite System

5.1.3 ProCal Calcium Hypochlorite System



ProCal_3240A_SW1

The ProCal disinfection system is used for the simple and economic disinfection of swimming pool water using calcium hypochlorite.

At low cost and with simple handling the ProCal granulate metering device can be used to produce calcium hypochlorite solution from dry calcium hypochlorite. The effective, low-chlorine disinfectant solution is used, ready prepared, with the integral, fully automated metering unit and added to the swimming pool water via a bypass line.

Measuring and control units from the DULCOMETER® D1C, D2C product range or the DULCOMARIN® II multi-channel unit can be used to provide controlled metering. Hence the swimming pool water of small to medium-sized pool systems can be reliably and economically disinfected in accordance with DIN 19643-1.

Application	Private and public swimming pools with circulating capacities of up to 2,000 m ³ /h (2,000 m ³ /h for inside pools, 400 m ³ /h for outside pools)
Disinfectant	Calcium hypochlorite
Electrical connection	230 V, 50 Hz
Process integration	Bypass input and output DN 25 for 3 m ³ /h Drain outlet/overflow DN 32
Option	Point of injection for acid cleaning
Signal outputs	Operating/Fault
Control inputs	Control input, potential-free contact for start/stop operation Pause input, potential-free contact for remote release
Dimensions H x W x D	1,100 x 900 x 500

	Order no.
ProCal calcium hypochlorite system	1040728
ProCal calcium hypochlorite system with acid rinse	1041481

Spare parts and maintenance kits

	Order no.
Annual maintenance kit (without acid rinse)	1041482
3-yearly maintenance kit (without acid rinse)	1041483
Annual maintenance kit (with acid rinse)	1041494
3-yearly maintenance kit (with acid rinse)	1041495

6 Membrane Technology

6.1

Overview of Membrane Technology

Systems for membrane filtration

In water treatment, membrane filtration is the process for removing particles and salts in the water ensuring the lowest operating costs. ProMaqua offers versatile and high-quality system technology in this field. This is complemented by the extensive ProMaqua[®] product range to produce customer-specific complete solutions.

Membrane filtration is a physical process to separate substances with the help of semi-permeable membranes. There are four types of processes, depending on the size of the particles/molecules to be removed:

- Microfiltration
- Ultrafiltration
- Nanofiltration
- Reverse osmosis

The following table shows the separation limits of the individual processes:

	Microfiltration	Ultrafiltration	Nanofiltration	Reverse osmosis
Particle size	> 0.1 µm	0.1 – 0.01 µm	0.01 – 0.001 µm	< 0.001 µm
Particle type	Suspended particles, colloidal turbidity, oil emulsions	Macromolecules, bacteria, cells, viruses, proteins	Low-molecular organic compounds, ions	Ions

The ProMaqua experts, with their detailed industry knowledge, are not only able to put together the optimum system for the relevant application but also deliver complete water treatment solutions from one source, supported by the extensive ProMinent product range.

6 Membrane Technology

6.2 Performance Overview of Ultrafiltration

Ultrafiltration is a membrane process which is increasingly used in water treatment to separate undesired water components. Parasites, bacteria, viruses and high-molecular organic substances as well as other particles are retained.

The applications of ultrafiltration are widespread and may include different types of water.

Typical applications include potable water, river water, process water, swimming pool water, salt water and waste water.

The tasks range from potable water purification to meet physical and microbiological limit values in accordance with the German Drinking Water Ordinance up to the pre-treatment of salt water for desalination by reverse osmosis.

The systems are matched to a specific task by individually selecting the membrane type and the operating mode. ProMaqua® uses extremely robust and resistant UF membranes and the dead-end principle to ensure optimisation with regard to investment costs, required space and operating costs. With this selection, all raw waters with the exception of waste water can be filtered largely without using chemicals.

The dead-end operation represents the standard operating mode. The raw water flows into the capillaries. The pure water (filtrate) passes through the membrane while the other constituents are retained on the surface of the membrane.

The constituents form a layer on the membrane. The membrane is backwashed fully automatically in regular intervals to remove the filter cake.

Ultrafiltration systems basically consist of:

- Stainless steel or high-grade coated steel rack
- Pre-filter to protect the membranes, if required. This filter can optionally be designed as a backwashing filter.
- UF membrane modules
- Pneumatically controlled valves made of high-quality materials
- Electronic pressure measurement
- Filtration pump and backwash pump with frequency converter made of suitable high-quality materials
- Magnetically inductive flow metering to control the flow rates for filtration and backwashing.
- Integrated filling system for the backwash water tank. The backwash water tank is also integral to small systems. With larger systems, tanks from our product range can be integrated or an application-specific solution found depending on the customer's requirements.
- PLC control with touch screen panel or microprocessor control unit.
The PLC control simultaneously monitors all important parameters, such as pressure, pressure difference and flow rates. This ensures that the membranes are optimally protected. The control of pre- and post-treatment processes can be integrated, if required.

Advantages of ultrafiltration systems

- Filtrate values smaller than 0.1 NTU independent of the raw water turbidity.
- Molecular weight cut-off of the membranes (MWCO, Molecular Weight Cut Off) approx. 100 kDa (kilodalton).
- Excellent retention rates for bacteria (99.9999 %) and viruses (99.99 % based on MS2 phages).
- Very easy to use and simple to combine with other systems thanks to PLC control with touch screen.
- Optimum operating processes thanks to modern measuring and control technology.
- Complete solutions with perfectly coordinated pre- and post-treatment are available on request.

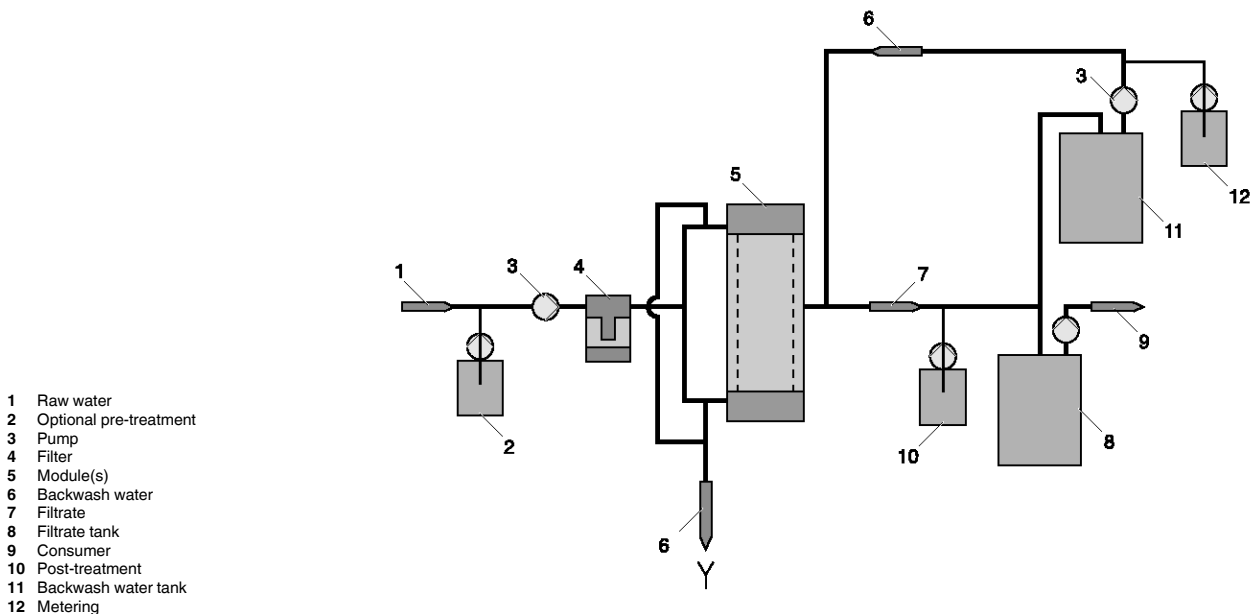
Ultrafiltration systems are available with a filtration capacity ranging from 1 to 80 m³/h with a water yield of > 96 %.

6 Membrane Technology

Areas of application of ultrafiltration systems

Typical areas of application include the removal of particles, turbidity and pathogens in public or private potable water supplies. Ultrafiltration is predominantly used for the treatment of fresh water, in particular surface water, spring water or well water. In principle, brackish water and salt water can also be treated, e.g. as pre-treatment for subsequent desalination by nanofiltration or reverse osmosis. Further areas of application include the treatment of swimming pool water, process water from the food and beverage industry.

A typical general system layout is shown below:



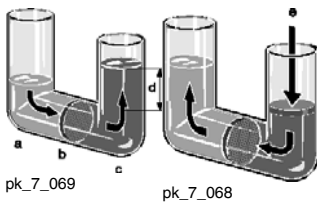
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Our engineers use their wide experience in water treatment to determine the ultrafiltration system to meet the specific raw water requirements. If desired and/or required, the best-suited pre- and post-treatment is also defined. Numerous further ProMinent® and ProMaqua® products are available. Thus, customers are offered a complete package of solutions from one single source.

The filtration capacity of ultrafiltration systems ranges from 1 to 80 m³/h. Other capacities are available on request. Please contact us, we will be glad to assist you.

6 Membrane Technology

6.3 Performance Overview of Nanofiltration



pk_7_069 pk_7_068

a diluted solution (permeate)
b semi-permeable membrane
c concentrated solution (concentrate)
d hydrostatic head corresponding to the osmotic product
e pressure

Osmosis Nanofiltration

Nanofiltration is based on the same principle as reverse osmosis. The difference: is that the cut-off limit is slightly lower. Although ions are still held back by this type of membrane filtration, this takes place at a distinctly reduced extent compared to reverse osmosis. Ultimately, operating costs are reduced.

Typical salt retention rates are at 80 – 90 %. Polyvalent ions (e.g. Ca, Mg) are retained more effectively than monovalent ions (e.g. Na, K) so that nanofiltration systems are often used as an alternative to classic water softening.

If a lower salt retention rate is acceptable, nanofiltration systems offer an inexpensively priced alternative to reverse osmosis facilities, as nanofiltration systems can be operated at lower operating pressures. This means a smaller booster pump can be used. The benefits include lower investment costs and, above all, lower energy costs! The operating costs are drastically reduced compared to conventional water softening as intricate and expensive routine regeneration with large quantities of salt is rendered completely unnecessary.

ProMaqua offers virtually all nanofiltration systems.

In principle, the untreated water to be desalinated by way of nanofiltration is pumped into a chamber which is closed off by a semi-permeable membrane. The membrane is permeable to pure water and smaller ions. All other water constituents are held back. Partially desalinated water (permeate) and a concentrated solution (concentrate) are produced. ProMaqua uses high-quality nano filtration membranes for this process.

Dulcosmose® nanofiltration systems basically consist of:

- Frame made from stainless steel, high-grade double layer coated steel or PP
- 5 µm pre-filter
- Inlet valve made from suitable, high-grade materials depending on the salt content of the raw water
- Pressure switch to protect the high-pressure pump
- High-pressure pump made from suitable, high-grade materials depending on the salt content of the raw water
- Low-pressure membranes designed as spiral-wound modules and fitted in GRP pressure vessels
- Variable-area flow meter or electronic and pressure gauge
- Stainless steel control and regulating valves for pressure and concentrate control
- ProMaqua in-house conductivity measuring cell and control system with versatile programming options also for the control of external pre- and post-treatment components
- A semi-automatic chemical cleaning system can be integrated as required

Advantages of Dulcosmose® nanofiltration systems

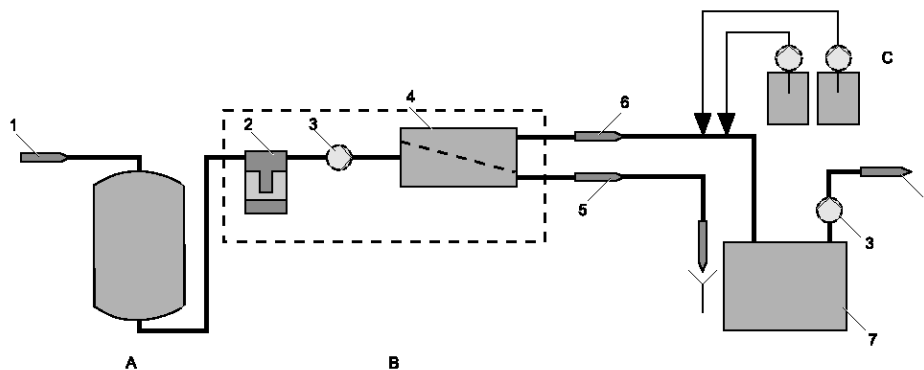
- Easy and safe operation ensured by ultra-modern microprocessor control with integrated conductivity measurement and plain text display of operating status
- Efficient operation with a permeate yield of up to 80 % and up to 90 % separation of dissolved ions
- Low energy requirements through the use of low energy nanofiltration membranes
- Long service life of membranes thanks to integrated cleaning concept
- Well-designed, service-friendly system structure on stainless steel, high-grade double coated steel or PP racks
- Low investment and operating costs as optimised components specifically matching the individual application are used
- On request, complete solutions with precisely matching pre-treatment and post-treatment facilities such as ProMinent® metering, measurement and control technology, i.e. simple networking, perfect function and overall monitoring of various system components

6 Membrane Technology

Applications of Dulcosmose® Nanofiltration systems

Typical applications include desalination installations in public or private potable water supply systems, in the chemical and pharmaceuticals industry, food and beverage industry, metal-processing industry, electroplating as well as in boiler feed water treatment. A typical system layout is shown in the following:

- 1 Raw water
- 2 Filter
- 3 Pump
- 4 Module(s)
- 5 Concentrate
- 6 Permeate
- 7 Permeate tank
- 8 Consumer
- A Pre-treatment
- B Nanofiltration
- C Post-treatment



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Nanofiltration is predominantly used for the treatment of fresh water.

However, the system can also be used to treat brackish water and salt water, e.g. as a pre-treatment stage for further desalination in a reverse osmosis system.

Our engineers use their wide experience in water treatment to determine the nanofiltration system to meet the specific raw water requirements. If required and/or necessary, the most suitable pre-treatment and post-treatment facilities are also selected from a comprehensive range of suitable ProMinent® and ProMaqua® products. In this way, a complete package is assembled for the customer with all components from under one roof. ProMaqua's extensive experience gained in the construction of specialised systems and complete solutions ranges from rack-mounted systems through to systems installed in standard transport containers.

The permeate capacity of Dulcosmose® standard nanofiltration systems ranges from 1 to 50 m³/h. Other capacity ratings are available on request.

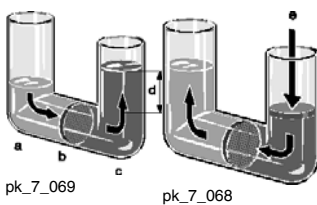
6 Membrane Technology

6.4 Performance Overview of Reverse Osmosis

Reverse osmosis is the part of membrane filtration with the highest separation performance. It is the reverse of the natural process of osmosis and hence is used as a method for desalination of aqueous solutions. Today, using suitable high-performance membranes, over 99 % of all salts can be removed from an aqueous solution.

The raw water to be desalinated is introduced into a chamber which is sealed by a semi-permeable membrane. Artificial pressure is created in the chamber, opposing the osmotic pressure gradient. The membrane is only permeable to pure water, and not to the ions and other particles dissolved in it, so part of the raw water becomes pure desalinated water (permeate) and part becomes even higher concentrated solution (concentrate). ProMaqua uses high-grade, low-pressure membranes in its Dulcosmose® reverse osmosis plants for this process.

Basically, Dulcosmose® reverse osmosis plants consist of:



pk_7_069
pk_7_068

a diluted solution (permeate)
b semi-permeable membrane
c concentrated solution (concentrate)
d hydrostatic head corresponding to the osmotic product
e pressure

Osmosis Reverse Osmosis

- Frame made from stainless steel, high-grade double layer coated steel, or PP
- 5 µm pre-filter
- inlet valve made of suitable, high-grade materials depending on the salt content of the raw water
- Pressure switch to protect the high-pressure pump
- High-pressure pump made of suitable, high-grade materials depending on the salt content of the raw water
- Low-pressure membranes designed as spiral-wound modules and fitted in GRP pressure pipes
- Variable-area flow meter or electronic and pressure gauge
- Stainless steel control and regulating valves for pressure and concentrate control
- ProMaqua in-house conductivity measuring cell and control system with versatile programming options also for the control of external pre- and post-treatment components
- Semi-automatic system for chemical cleaning

Advantages of Dulcosmose® reverse osmosis plants

- Simple, safe operation using modern microprocessor control with integrated conductivity measurement and real text display of operating status
- Efficient operation with pure water recovery of up to 80 % and rejection of over 99 % of dissolved ions
- Reduced energy consumption through use of "low-energy" reverse osmosis membranes and energy recovery from the concentrate stream by using state of the art pressure exchanger technology (with salt water desalination)
- Long service life of membranes thanks to integrated cleaning concept and permeate and raw water flushing option
- Well-designed, service-friendly system structure on stainless steel, high-grade double coated steel or PP racks
- Low investment and operating costs as optimised components specifically matching the individual application are used
- On request, complete solutions with precisely matching pre-treatment and post-treatment facilities such as ProMinent® metering, measurement and control technology, i.e. simple networking, perfect function and overall monitoring of various system components

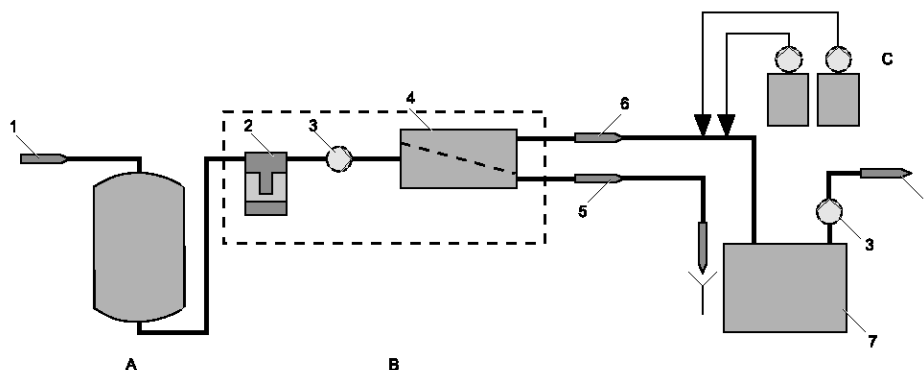
6 Membrane Technology

Applications of Dulcosmose® reverse osmosis plants

Typical applications are desalination duties in municipal or private potable water supply, in the chemical and pharmaceutical industries, food and beverages industry, metal processing industry, electroplating, in boiler feed water treatment and in power stations, for example.

A typical general plant diagram is shown below:

- 1 Raw water
- 2 Filter
- 3 Pump
- 4 Module(s)
- 5 Concentrate
- 6 Permeate
- 7 Permeate tank
- 8 User
- A Pre-treatment
- B Reverse osmosis
- C Post-treatment



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Basically, three types of raw water with different salt contents can be considered for desalination:

- potable water (typically up to 1,000 mg/l)
- brackish water (typically up to 2,000 - 5,000 mg/l)
- sea water (typically higher than 35,000 mg/l)

Our engineers use their years of experience in the treatment of this raw water to determine - based on the particular raw water analysis - the optimum version of reverse osmosis plant for the customer. At the same time, the most suitable pre-treatment and post-treatment stages are selected using other ProMinent® products. So a complete package is put together for the customer, from a single source. One of our specialities here is the supply of complete plants installed in a standard transport container.

ProMaqua also has wide experience in building other special plants, e.g. two-pass plants for higher permeate quality requirements. Please contact us - we'll be happy to advise you.

Type	ecoPRO	TW	BW	SW
Permeat-output [m³/h]	50			
	25			
	10			
	5			
	2,5			
	1			
	0,5			
	0,25			
0,1				
Salinity Drinking water	< 1.000 mg/l	< 1.000 mg/l	< 5.000 mg/l	< 40.000 mg/l

P_PMA_MT_0002_SW

6 Membrane Technology

6.5 Questionnaire

6.5.1 Questionnaire on the Design of a UF System

Application:

Drinking water production

Process water for food/beverage industry

Circulation water for swimming pools

Flushing water for swimming pools

Other: _____

Type of raw water

Drinking water

Surface water (lake, river water)

Source water

Ground water

Brackish water, sea water

Design principles: (please state maximum (peak), minimum and average values)

Clear water requirement: _____ m ³ /h	Chloride: _____ ppm
Clear water requirement: _____ m ³ /day	Iron in solution: _____ ppm
Temperature: _____ °C	Particular iron: _____ ppm
Turbidity: _____ NTU	Manganese in solution: _____ ppm
COD: _____ ppm	Particular manganese: _____ ppm
TOC/DOC: _____ ppm	Fluctuations? Yes <input type="checkbox"/> No <input type="checkbox"/>
Total hardness: _____ °dH	

Remarks (current pre-treatment, special requirements)

P_PMA_MT_0001_SW

6

6 Membrane Technology

6.5.2 Questionnaire on the Design of an RO System

Clean water requirement: _____ m³/h

Available space HxWxD: _____ m

Clean water requirement: _____ m³/day

Location of the system: _____ Floor

Operating hours: _____ h/day

Location of the users: _____ Floor

Required clean water pressure: _____ bar

Existing clean water tank: _____ m³

Raw water temperature, min./max.: _____ °C

Existing clean water pump: _____ m³/h
_____ bar

Lift yes
no

Required quality of clean water:

H x W x D: _____ mm

Conductivity: _____ µS/cm

Door dimensions

pH value: _____

H x W _____ mm

Bacteriological quality:

Crane on site: yes
no

Drinking Water Directive
Germ-free and sterile

Lifting capacity: _____ t

Intended use of clean water:

Raw water pressure: _____ bar

Raw water connection: _____ "

Type of raw water:

Clean water pipes available yes
no

Drinking water
Well water
Brackish water
Lake water
or _____

Material: _____ Ø
_____ "

Fluctuations: yes
no

Mains voltage: _____ V/Hz

State fluctuations:

Conductivity: _____ µS/cm

HCO₃: _____ mg/l

pH value: _____

SO₄: _____ mg/l

Ca: _____ mg/l

Cl: _____ mg/l

Mg: _____ mg/l

NO₃: _____ mg/l

K: _____ mg/l

F: _____ mg/l

Na: _____ mg/l

PO₄: _____ mg/l

Ba: _____ mg/l

CO₂ (free): _____ mg/l

Sr: _____ mg/l

SiO₂: _____ mg/l

Fe: _____ mg/l

COD*: _____ mg/l

Mn: _____ mg/l

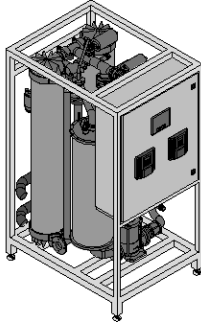
*COD = chemical oxygen demand

Al: _____ mg/l

6 Membrane Technology

6.6 Dulcoclean® Ultrafiltration Systems

6.6.1 Dulcoclean® UF Ultrafiltration Systems



P_PMA_MT_0003_SW

Dulcoclean® UF systems are ideal for removing turbidity, particles and microbiological contaminants (bacteria, viruses, parasites), delivering consistent filtrate quality, even with temporary clouding or microbiological contamination following precipitation - without turbidity and free from pathogens (retention rate for bacteria of 99.999 % and for viruses of 99.99 %). Equipped with exceptionally tough ultrafiltration membranes, these systems are operated using the economical dead-end process. Compared with the cross-flow mode, this requires considerably less water and energy. To prevent module blockages, backwashing is carried out in regular cycles. Matched to the prevailing raw water quality, cleaning is supported by the addition of chemicals where necessary. A PLC is used to control the system. Thanks to a multiplicity of

different control options, the system offers a high level of flexibility and operating safety. Fluctuations and changes in the raw water quality can therefore be easily met. All relevant events are electronically recorded.

The Dulcoclean® UF product range is suitable for the following water characteristics in the feed:

pH range	3.0 ... 12.0
Free chlorine	max. 1.2 mg/l
Turbidity	0.5 ... 30 NTU
DOC	0.5 ... 12 mg/l
Suspended solids	50 mg/l

Deviating values influence the performance data and require a separate design of the system. Please contact our experts.

Dulcoclean® type	Filtration capacity* at 15 °C m³/h	Approx. backwash water per rinse m³	Raw/rinsing water connector [Rp / DN]	Approx. dimensions LxWxH [mm]
UF 2	8 - 15	0.34	1 1/2 " / 2 "	1,200 x 920 x 2,100
UF 3	12 - 22.5	0.51	2 " / DN 65	1,600 x 920 x 2,100
UF 4	16 - 30	0.68	2 " / DN 80	1,600 x 920 x 2,100
UF 6	24 - 45	1.02	DN 65 / DN 80	2,000 x 920 x 2,100
UF 8	32 - 60	1.36	DN 80 / DN 100	2,400 x 920 x 2,100
UF 10	40 - 75	1.70	DN 100 / DN 125	2,800 x 920 x 2,100

* Filtrate performance depends on the water quality

Systems with filtration capacity of more than 18 m³/h are designed on a project basis. Offers are available on request. Please contact us.

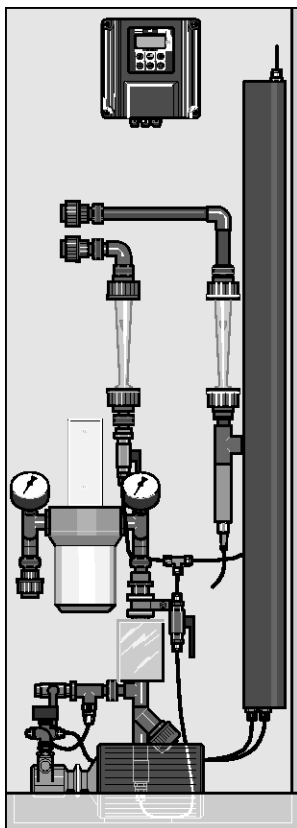
Optionally available are a fully automatic neutralisation system for the treatment of acid and alkaline backwash water, an integrity test as well as customised data logging.

6 Membrane Technology

6.7 Dulcosmose® Reverse Osmosis Plants

6.7.1 Dulcosmose® ecoPRO Reverse Osmosis Plants

Dulcosmose® ecoPRO reverse osmosis systems on PP rack; capacity range 100-1,500 l/h



This range is the cost-effective standard system for modern potable water desalination. Equipped with the latest generation of “ultra low-pressure” membranes, these systems achieve maximum permeate capacity at low operating pressures, thereby ensuring reduced investment and running costs. The low operating pressures enable the systems to be fitted cost-effectively with PVC pipes or pipes with pressure hoses throughout.

The ecoPRO 600-1500 models are additionally available with an integrated semi-automatic cleaning system and raw water flushing option. The semi-automatic cleaning system can also be simply retrofitted.

The ecoPRO 100-1500 range was designed for the following values in feed water:

pH range	3.0 ... 10.0
silt density index max.	3
free chlorine max.	0.1 mg/l
total Fe, Mn max.	0.2 mg/l
total hardness max.	0.1 °dH
bacteria count max.	100 KBE/ml
turbidity max.	0.5 NTU
COD max.	5 mg/l**

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Plants with 2.5" and 4" membranes, salt rejection of the plants 90-95 %

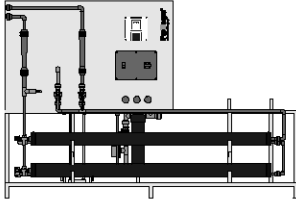
Plant	Permeate capacity at 15 °C water temperature l/h	Number of 2.5" and 4" membranes No.	Connected load kW	Dimensions H x W x D mm	Max. salt content * mg/l*	Weight kg
ecoPRO 100	100	1	0.37	1,400 x 500 x 320	650	47
ecoPRO 200	200	2	0.55	1,400 x 500 x 320	650	63
ecoPRO 300	300	1	1.10	1,500 x 600 x 400	650	88
ecoPRO 550	550	2	1.10	1,500 x 600 x 400	650	112
ecoPRO 600	600	2	1.50	1,850 x 800 x 800	1,000	167
ecoPRO 900	900	3	1.50	1,850 x 800 x 800	1,000	192
ecoPRO 1200	1,200	4	1.50	1,850 x 800 x 800	1,000	217
ecoPRO 1500	1,500	5	2.20	1,850 x 800 x 800	1,000	243

* differing salinities affect the performance data accordingly

** as O₂

6 Membrane Technology

Dulcosmose® ecoPRO reverse osmosis systems on powder-coated steel rack; capacity range 1,800-2,700 l/h



P_PMA_UO_0020_SW1

This range is the standard model for modern potable water desalination. Equipped with the latest generation of „ultra low-pressure“ membranes, these systems guarantee maximum permeate output at low operating pressures and thus low investment and operating costs. The low operating pressures enable cost-effective PVC pipes to be used. These systems are also available with an integrated semi-automatic cleaning system and with raw water flushing option.

The ecoPRO 1800-2700 range was designed for the following values in feed water:

salt content max.	1,000 mg/l*
pH range	3.0 ... 10.0
silt density index max.	3
free chlorine max.	0.1 mg/l
total Fe, Mn max.	0.2 mg/l
total hardness max.	0.1 °dH
bacteria count max.	100 KBE/ml
turbidity max.	0.5 NTU
COD max.	5 mg/l**

* differing salinities affect the performance data accordingly

** as O₂

Plants with 4" membranes, salt rejection of the plants 90-95 %

Plant	Permeate capacity at 15 °C water temperature l/h	Number of 4" membranes No.	Connected load kW	Dimensions	Weight kg
				H x W x D mm	
ecoPRO 1800	1,800	6	2.2	1,750 x 2,500 x 750	260
ecoPRO 2400	2,400	8	2.2	1,750 x 2,600 x 750	299
ecoPRO 2700	2,700	9	2.2	1,800 x 3,500 x 750	315

6 Membrane Technology

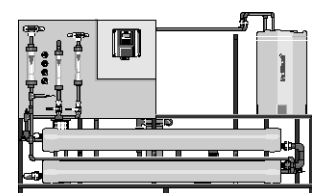
6.7.2

Dulcosmose® TW Reverse Osmosis Plants

This range represents the universal model for modern potable water desalination. Equipped with the latest generation of "ultra-low-pressure" membranes, these plants achieve maximum permeate capacity at low operating pressures, ensuring reduced investment and running costs. The low operating pressures allow the use of cost-effective PVC pipes on these systems. In addition these plants are available with integrated semi-automated cleaning system and a permeate and raw water flushing option.

Special customised versions are possible with the TW range. Different pipework materials and different membrane types can be implemented, for increased salt rejection, for example. Measurement and control equipment, e.g. conductivity, ORP or pH measurement, and metering equipment (in pretreatment and post-treatment) can easily be integrated in these plants.

The TW range was designed for the following values in the feed water:



pk_7_064

salt content max.	1,000 mg/l*
pH range	3.0 ... 10.0
silt density index max.	3
free chlorine max.	0.1 mg/l
total Fe, Mn max.	0.2 mg/l
total hardness max.	0.1 °dH
bacteria count max.	100 KBE/ml
turbidity max.	0.5 NTU
COD max.	5 mg/l**

* differing salinities affect the performance data accordingly

** as O₂

Plants with 8" membranes, salt rejection of the plants 90-95 %

Plant	Permeate capacity at 15 °C water temperature l/h	Number of 8" membranes No.	Connected load kW	Dimensions H x W x D mm
PRO 0300TW	3,000	3	3.0	1,800 x 4,000 x 1,000
PRO 0400TW	4,000	4	3.0	1,800 x 3,000 x 1,000
PRO 0500TW	5,000	5	4.0	1,800 x 4,000 x 1,000
PRO 0600TW	6,000	6	4.0	1,800 x 4,000 x 1,000
PRO 0700TW	7,000	6	7.5	1,800 x 4,000 x 1,000
PRO 0800TW	8,000	7	7.5	1,800 x 4,000 x 1,000
PRO 0900TW	9,000	7	7.5	1,800 x 4,000 x 1,000
PRO 1000TW	10,000	8	7.5	1,800 x 3,000 x 1,000
PRO 1100TW	11,000	9	11.0	1,800 x 4,000 x 1,000
PRO 1200TW	12,000	10	11.0	1,800 x 4,000 x 1,000
PRO 1300TW	13,000	11	11.0	1,800 x 4,000 x 1,000
PRO 1400TW	14,000	12	11.0	1,800 x 4,000 x 1,000
PRO 1500TW	15,000	12	11.0	1,800 x 4,000 x 1,000
PRO 2000TW	20,000	18	11.0	1,800 x 7,000 x 1,200
PRO 2500TW	25,000	24	15.0	1,800 x 7,000 x 1,200*
PRO 3000TW	30,000	28	18.5	1,800 x 7,000 x 1,200*
PRO 4000TW	40,000	34	22.0	1,800 x 7,000 x 1,200*
PRO 5000TW	50,000	48	22.0	1,800 x 7,000 x 1,200*

* separate cleaning tank

On request, these plants can also be supplied with different membrane types for further salt rejection, and with measuring and control equipment (conductivity, ORP, pH measurement) and metering equipment (in pre-treatment and post-treatment).

6 Membrane Technology

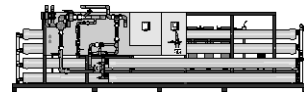
6.7.3

Dulcosmose® BW Reverse Osmosis Plants

This range represents the standard model for modern brackish water desalination. Equipped with the latest generation of “high rejection low-pressure” membranes, these plants achieve maximum permeate capacity at moderate operating pressures, ensuring reduced investment and running costs. The ProMaqua® BW range of reverse osmosis plants is piped in PVC on the low-pressure side. The system pipework on the high-pressure side is fabricated in high-grade stainless steel, type DIN 1.4571. ProMaqua® stainless steel pipework systems are welded under shielding gas and root gas atmospheres (TIG) and then passivated in our own pickling bath.

In addition these plants are equipped with an integrated semi-automated cleaning system and all permeate and raw water flushing options as standard.

The BW range was designed for the following values in the feed water:



pk_7_065

salt content max.	5,000 mg/l*
pH range	3.0 ... 10.0
silt density index max.	3
free chlorine max.	0.1 mg/l
total Fe, Mn max.	0.2 mg/l
total hardness max.	water must be chemically stabilised
bacteria count max.	100 KBE/ml
turbidity max.	0.5 NTU
COD max.	5 mg/l**

* Deviating salt contents have a corresponding influence on the performance data.

** as O₂

Plants with 8" membranes, salt rejection of the plants 95-98 %

Plant	Permeate capacity at 25 °C water temperature l/h	Number of 4" and 8" membranes No.	Connected load kW	Dimensions
				H x W x D mm
PRO 0200BW	2,000	9	4.0	1,800 x 3,500 x 750
PRO 0300BW	3,000	3	5.5	1,800 x 4,000 x 1,000
PRO 0400BW	4,000	4	5.5	1,800 x 3,000 x 1,000
PRO 0500BW	5,000	5	5.5	1,800 x 4,000 x 1,000
PRO 0600BW	6,000	6	7.5	1,800 x 4,000 x 1,000
PRO 0700BW	7,000	7	7.5	1,800 x 4,000 x 1,000
PRO 0800BW	8,000	8	11.0	1,800 x 4,000 x 1,000
PRO 0900BW	9,000	9	15.0	1,800 x 4,000 x 1,000
PRO 1000BW	10,000	10	15.0	1,800 x 4,000 x 1,000
PRO 1100BW	11,000	11	15.0	1,800 x 4,000 x 1,000
PRO 1200BW	12,000	12	15.0	1,800 x 5,000 x 1,000
PRO 1300BW	13,000	13	15.0	1,800 x 6,000 x 1,000
PRO 1400BW	14,000	14	15.0	1,800 x 5,000 x 1,000
PRO 1500BW	15,000	15	18.5	1,800 x 5,000 x 1,000
PRO 2000BW	20,000	21	18.5	1,800 x 6,000 x 1,200
PRO 2500BW	25,000	26	30.0	1,800 x 6,000 x 1,200*
PRO 3000BW	30,000	29	30.0	1,800 x 6,000 x 1,200*
PRO 4000BW	40,000	42	45.0	1,800 x 7,000 x 1,200*
PRO 5000BW	50,000	51	60.0	1,800 x 7,000 x 1,200*

* separate cleaning tank

On request, these plants can also be supplied with different membrane types for other salt rejection, and with measurement and control equipment (conductivity, redox potential, pH measurement) and dosing equipment (in pretreatment and post-treatment).

6 Membrane Technology

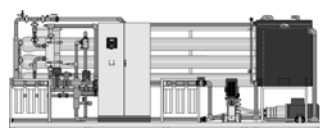
6.7.4

Dulcosmose® SW Reverse Osmosis Plants

This range is the standard model for modern sea water desalination. Equipped with the latest generation of “high rejection low-pressure” membranes, these plants achieve maximum permeate capacity at moderate operating pressures, ensuring reduced investment and running costs. The SW range of reverse osmosis plants is piped in PVC on the low-pressure side. Because of the high NaCl content, the system pipework on the high-pressure side is fabricated from extra high-grade, corrosion-resistant stainless steel, type DIN 1.4539. Stainless steel pipework systems are welded under shielding gas and root gas atmospheres (TIG) and then passivated in our own pickling bath.

In addition these plants are equipped with an integrated semi-automated cleaning system and all permeate and raw water flushing options as standard. As an option, the plants can be equipped with a system for energy recovery from the concentrate stream, where the latest generation of pressure exchangers are used.

The SW range was designed for the following values in the feed water:



salt content max.	40,000 mg/l*
pH range	3.0 ... 10.0
silt density index max.	3
free chlorine max.	0.1 mg/l
total Fe, Mn max.	0.2 mg/l
total hardness max.	water must be chemically stabilised
bacteria count max.	100 KBE/ml
turbidity max.	0.5 NTU
COD max.	5 mg/l**

* differing salinities affect the performance data accordingly

** as O₂

Plants with 4" and 8" membranes, salt rejection of the plants 99 %

Plant	Permeate capacity at 25 °C water temperature l/h	Number of 4" and 8" membranes No.	Connected load	Connected load	Dimensions H x W x D mm
			without energy recovery kW	with energy recovery kW	
PRO 0078SW	780	6	5.5		1,800 x 3,500 x 1,000
PRO 0185SW	1,850	3	15.0		1,800 x 4,000 x 1,000
PRO 0240SW	2,400	4	15.0		1,800 x 4,000 x 1,000
PRO 0300SW	3,000	5	18.5	11.2*	1,800 x 4,000 x 1,000
PRO 0360SW	3,600	6	18.5	14.7*	1,800 x 4,000 x 1,000
PRO 0490SW	4,900	8	30.0	18.7*	1,800 x 5,000 x 1,200
PRO 0610SW	6,100	10	37.0	18.7*	1,800 x 6,000 x 1,200
PRO 0730SW	7,300	12	41.0	22.2*	1,800 x 5,000 x 1,400
PRO 0920SW	9,200	15	75.0	26.2*	1,800 x 6,000 x 1,500
PRO 0980SW	9,800	16	75.0	27.7*	1,800 x 5,000 x 1,500
PRO 1230SW	12,300	20	75.0	41.2*	1,800 x 6,000 x 1,500**
PRO 1470SW	14,700	24	90.0	48.2*	1,800 x 7,000 x 1,500**
PRO 1840SW	18,400	30	110.0	66.2*	1,800 x 7,000 x 1,500**
PRO 2210SW	22,100	36	132.0	90.0*	1,800 x 7,000 x 1,500**
PRO 2580SW	25,800	42	150.0	105.0*	1,800 x 7,000 x 1,500**
PRO 2900SW	29,000	48	180.0	105.0*	1,800 x 7,000 x 1,500**

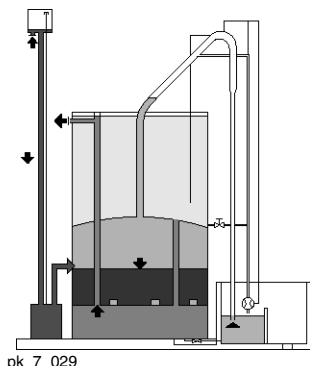
* Energy recovery by pressure exchanger technology

** Separate cleaning tank

On request, these plants can also be supplied with different membrane types for other salt rejection, and with measuring and control equipment (conductivity, ORP, pH measurement) and metering equipment (in pretreatment and post-treatment).

7 Gravity Filters

7.1 INTERFILT® SK



Filtration is one of the most important basic technical processes in water treatment. It is a mechanical separation process in which suspended particles in water are retained in a filter layer (e.g. a layer of sand) through which water is passed.

Raw water is generally filtered through the filtration plant using sand as the filter layer.

During the filtration process the pores in the filter layer become blocked by the contaminants removed from the raw water passing through it. This leads to a gradual drop in pressure.

The “back washing phase” begins once the minimum permitted pressure level is reached in the “operating phase”. Here impurities are flushed out of the filter layer. During the operating phase, water passes down through the filter and during the back-washing phase it travels back up through the filter layer.

The layer of sludge which has built up on the surface of the filter layer, is broken up at the start of the back washing process. This creates a fluidized bed.

The rotating motion of the grains of sand removes dirt particles that have become attached to the surface of the granules. These are carried away from the filter with the rising flow of water.

ProMaqua has built up particular expertise in the field of filtration technology.

Open sand filters with differential pressure-controlled back washing and integrated back washing water storage tank offer significant advantages:

- No control equipment
The filter uses no valves, flow meters, controllers or display equipment for filtration and back washing or final-rinse functions; in other words, no moving parts.
- No pump
The volume of water required for back washing is held in the storage area inside the filter which means there is no need for a back washing pump.
- No compressed air, pressurised water or electrical power
All processes are controlled and driven by the filter itself.
- No parts to maintain
No moving parts means no wear.
- No operating personnel
The filter works fully automatically and requires no external intervention.

Design

The filtration plant consists of the following key elements:

- Cylindrical tank
- Internal fittings
- Automatic back washing system with injector
- Raw water inlet and feed tank
- Filter nozzles
- Filter material

Material: polyethylene PE-HD

Filter material: filter sand EN 12904, other filter materials on request

Applications

The (SK) Gravity Filter is suitable for practically all filtration tasks and its uses include, for example, partial flow cooling water filtration, river, industrial and potable water treatment, iron removal from well water, waste water purification to reduce suspended solids, COD - BOD₅ and phosphate content (4th purification stage) etc.

Optional additional equipment:

- Cover for the cylindrical tank
- Frost protection insulation with associated electric heating
- Combined air/water backwash
- Backwash water sump made from plastic PE-HD
- Other options on request

7 Gravity Filters

Technical Data

Type list and capacity data

Type	Filter diameter mm	Filter capacity m ³ /h	Back wash Water ~ m ³	Weight empty ~ t	Weight in operation ~ t
SK- 9	900	6.5	1.4	1.2	4.5
SK- 12	1,200	11.5	2.5	1.5	7.1
SK- 15	1,500	18.0	4.5	1.9	10.5
SK- 18	1,800	26.0	5.5	2.3	15.0
SK- 21	2,100	35.0	8.5	2.8	19.5
SK- 24	2,400	46.0	10.0	3.0	25.0
SK- 28	2,800	62.0	14.0	3.5	30.0

Flow rate:	3 ... 10 m/h
Backwash intervals: (depending on type and amount of pollutants)	approx. 8 ... 36 h
Head loss:	120 ... 150 mbar
Clean water solids figure: (depending on raw water and filter material)	0 ... 3 mg/l
Backwash flow rate::	
at the start	44 m/h
in the middle	37 m/h
at the end	30 m/h
Cylinder height: (same for all types)	4,500 mm
Overall height: depending on filter diameter	6,500 mm
Backwash and refilling time:	13 ... 15 min.
Filter sand in accordance with EN 12904	
– Height of bed	600 mm
– Grain size range	0.71 ... 1.25 mm
Filter nozzles:	
– Type	Lamellar nozzle
– Material	PPN
– Slot width	0.2 mm
As system components are produced individually according to application, we will inform you of prices on request.	
We reserve the right to change components and their construction, as long as these do not affect their performance or function.	

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