

Water treatment and water disinfection

ProMaqua[®]
a ProMinent Brand



Smart Disinfection

Low Impact | Less Cost | High Efficiency

2012



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Heidelberg, January 2012

Success comes in many sizes. Welcome to ProMinent.



Innovation

A visionary idea, inventive talent, the courage to take risks and even more commitment - these properties and the invention of magnetic diaphragm metering technology were, more than 50 years ago, the foundation stones for an unparalleled success story. Today ProMinent stands for total solutions in the complete process chain of fluid metering technology, water treatment and water disinfection.

Customer satisfaction

Then as now, our focus was and is on close interaction with our customers. Your individual requirements have top priority and form the basis for our activities. Regardless of whether customer-specific individual manufacturing or large-scale project - absolute process safety is always at the centre of our developments. Long-term experience combined with a high level of application know-how are essential success factors. A complete product portfolio means that the correct solution exists for every application. Including personal care and high availability.

A competitive edge with ProMaqua® Smart Disinfection

Water is life. The preparation of hygienic, safe water is one of the greatest challenges of our time. The fulfilment of this task is fulfilled perfectly by the ProMaqua product portfolio. The focus of our research and development work in all available technologies is, in this respect, the preparation of hygienically pure water. We have given this expertise a name: ProMaqua® Smart Disinfection. Low Impact. Less cost. High efficiency. These are the concepts that describe the technologies which stand for maximum sustainability, minimum operating costs and maximum effectiveness and efficiency. We share long years of practical know-how in the food & beverage, drinking water, swimming pool & wellness hotels & resorts sectors with whom we develop optimal application-oriented solutions. And our cross-sector complete systems for cooling water disinfection and combating legionella set new standards in hygiene and operating comfort.

Chemical-free water disinfection

We offer all processes for oxidation and disinfection for countless applications. Common to all these processes is the minimum influence on man and the environment. An example of a particularly sustainable process is use of a UV-system. In this case disinfection takes place without any chemicals. Ideal processes for many applications, e.g. in the drinking water, swimming pool water or water treatment and drinks industries.

Ecologically harmless alternatives

We have a future-orientated, sustainable solution for nearly every water treatment application. Our chlorine dioxide systems are an economic and ecologically sensible alternative to disinfectants such as chlorine. Electrolysis systems are an extremely environmentally friendly alternative to chlorine gas for example. Likewise our membrane filtration technology removes particles and salts more environmentally than ever. These are just a few examples of modern sustainable technology. And of responsibility for the future

Efficient oxidation and disinfection

Ozone's character as a strong oxidation agent makes possible the removal of undesirable inorganic substances such as iron and manganese. Moreover it displays outstanding disinfectant properties. Typical areas of application: cooling/process water treatment and combating legionella.

Top of the range: Solution-orientated products made by ProMinent

Developed to match customer requirements, our modular product portfolio provides you with a maximum of flexibility and economy. Depending on requirements, you can even specify individual components. Or opt for maximum performance, efficiency and safety with a total solution which interacts perfectly in every detail.

New products

Water treatment and water disinfection



Dulcodes A UV systems



This system was specifically developed for the treatment of drinking, pool and process water up to 750 m³/h. This product range is characterized by a low space requirement plus the use of special UV medium pressure lamps.

For more information see page → 1-14

Dulcodes R UV systems



These UV systems for drinking and process water disinfection are now available with an automatic wiper.

For more information see page → 1-18

Dulcodes K UV systems with stronger UV lamp



Dulcodes K is a new plastic system and due to its corrosion resistance is particularly suited for salt containing water. It is equipped with opti flux high-performance lamps, which offer a guaranteed service life of 14,000 h. Hence even for high power ranges with large flows only a small number of lamps are necessary. Typical applications are the disinfection of salt-containing waters such as thermal spring water or seawater or as used in fish farming.

For more information see page → 1-10

New products

Water treatment and water disinfection

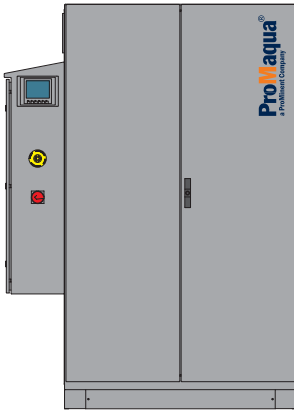
Ozone systems OZONFILT[®] OZMa 04 / 05 / 06



The new ozone generation systems extend the OZONFILT[®] OZMa product range. The OZMa systems now generate up to 420 g per hour ozone from air and up to 735 g per hour from oxygen.

For more information see page → 2-13

Dulco[®]Lyse electrolysis system for the production of ECA water



The Dulco[®]Lyse compact electrolysis systems are used for the efficient production of ECA water with an exceptionally low chloride content. The extremely low chloride fraction guarantees reliable protection of the plant against corrosion, even with stainless steel, and thus is extremely cost-effective.

This inexpensive disinfectant is produced from water, cooking salt and electricity directly where it is used. Dulco[®]Lyse systems provide extremely effective and environmentally friendly disinfection. Without any need for the transport, storage or handling of highly concentrated chemicals, they guarantee a long lasting sterile environment.

For more information see page → 4-12

ProCal – calcium hypochlorite preparation and metering system



When dissolved in water, calcium hypochlorite provides a highly effective disinfectant solution. Calcium hypochlorite is available globally and, in contrast to sodium-calcium hypochlorite, can be stored as a salt. It is only dissolved as necessary. Operation of the ProCal treatment and metering system is simple and represents a very effective disinfection solution which, dependent on the granulate used, only contains minimal undesirable by-products. This permits the sustainable, economic operation of the disinfection system. With the additional possible optimisation of the fresh water feed, the process also saves resources. Calcium hypochlorite is very widespread and aside from its application to swimming pool water it is also used for drinking water treatment and industrial processes.

For more information see page → 5-1

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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 being used to an ever increasing extent here, 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.

The 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 version 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 ultrapure 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 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
- Low space requirement
- Low investment and operating costs with high 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 applications:

- **Own source water suppliers and municipal water works**
for disinfection of drinking water
- **Food and beverages industry**
to destroy the bacteria in the water needed for food and beverages production and for disinfection of service water
to reduce the chlorine dioxide in the production water
- **Pharmaceuticals 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 the industrial water extracted from the sewage plant outflow
- **Horticulture**
for disinfection of the irrigation water
- **Spa pools and swimming pools**
for disinfection of the pool water
for chloramine reduction in the 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 from stainless steel (DIN 1.4404 or 1.4571) or UV-resistant plastic
- Lamp protection tubes made from high-quality quartz, easily removable for cleaning purposes
- Lamps with a particularly high UV output in the 254 nm range, ensuring an outstanding disinfection characteristic
- 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 outstanding 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 system type Dulcodes R or Dulcodes S
- 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 of the UV sensor signal with 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.

Low pressure lamp High-Flux

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.

Low pressure lamp Opti-Flux

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.

Medium pressure lamp Powerline

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 graphical display shows the current UV-C output, the operating hours and the number of lamp switch-ons. With the 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).

Comfort control

The Dulcodes comfort control includes a large, graphical display for viewing the UVC sensor signal. Shown as a trend display, the lamp ageing, any possible 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 the lamp activations. All operating and error messages are shown in full text. Setting the operating parameters is facilitated by the clear menu navigation. The control offers a selection of 9 different languages.

The control is connected to the ballasts via a bus system which permits monitoring of each individual lamp. This also facilitates a spatial separation of the control over long distances from the radiation chamber including lamps and ballasts.

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

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

3 potential-free control inputs facilitate linking of the control with external information: The error input can e.g. be used for an external temperature monitoring, the operation of the system can be normally interrupted using the pause input, the flow monitoring can be of help in connection with flushing processes.

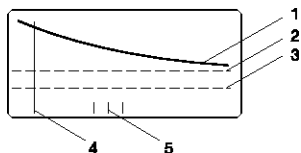
Comfort control Powerline

This control type in addition includes the option for an 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 e.g. be controlled independent of the flow or the lamp output can be automatically adapted to a defined UVC sensor signal. This saves energy costs and extends the lamp life time of the lamps.

The control also is equipped with a display and monitoring of the temperature of the radiation chamber as well as with a freely programmable control of the mechanical wiper system for an automatic cleaning of the lamp protection tube.

Dulcodes A comfort control

A Siemens S7-1200 control with a KP300 Basic operating unit is used for operation and control of Dulcodes A systems. The control unit is CE compliant and UL/CSA certificated. Alongside the functionality of the Powerline comfort control, a digital input is also provided using which it is possible to set one of two freely programmable power levels according to requirements (e. g. night reduction for pool water).



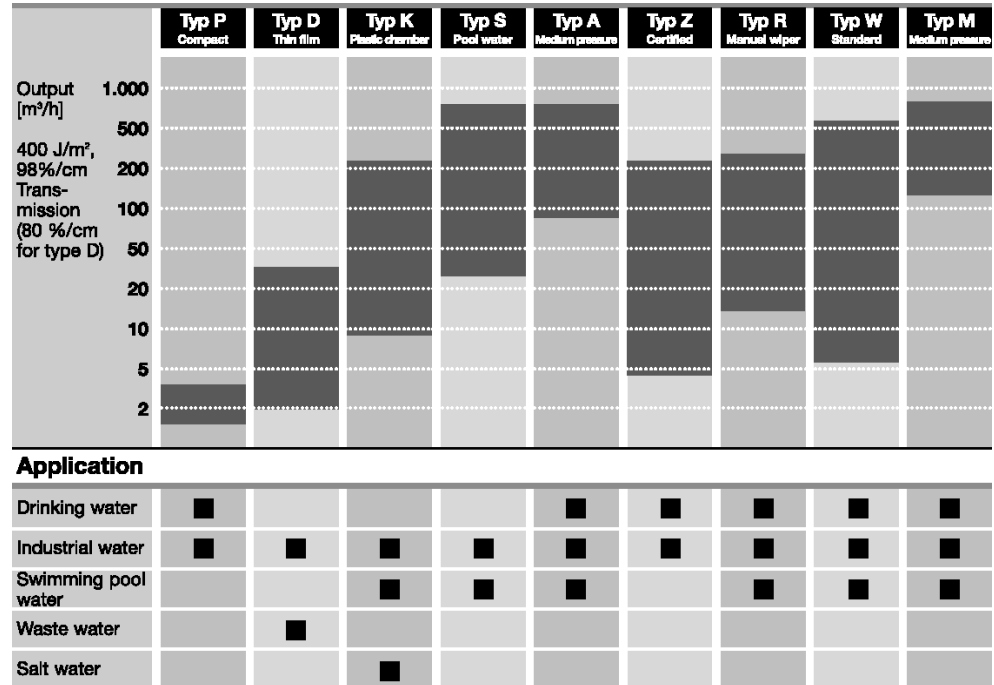
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- 1 UV sensor signal
- 2 Warning threshold
- 3 Safety threshold
- 4 Calibration
- 5 On/off contacts

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_0022_SW

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

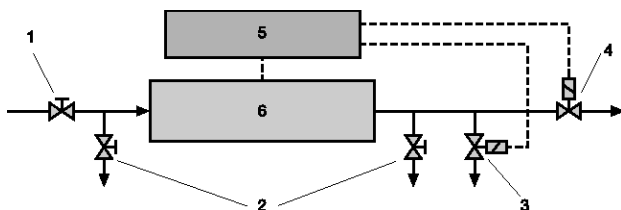
- Assessment of the situation on site by trained, competent field employees.
- All water parameters needed for an optimum system design can be measured in our water laboratory.
- Design and planning of the system.
- Commissioning and system maintenance by our trained service technicians.

1 Dulcodes UV systems

1.2.1 Notes On Planning And Designing An UV System

- The system must always be designed for the greatest water flow.
- The system must always be designed for the worst anticipated UV transmission.
- Fireproof sampling cocks for microbiological tests must be provided before and after UV disinfection systems.
- A manual shut-off valve must be provided before the UV system to isolate the system for maintenance work.
- With drinking water disinfection and similar applications, an electrically-controlled shut-off valve must be provided after 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 drinking water disinfection and similar applications, a flushing valve must be provided after the UV disinfection.
- It must 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 must 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 specified by us must 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



pk_7_059

Typical installation schematic 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 must 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

1

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 _____ FTU _____ 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

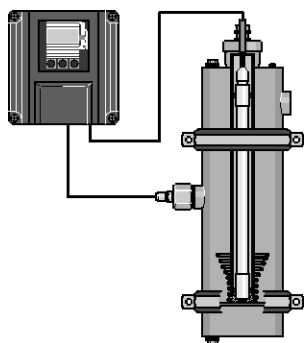
Iron _____ mg/l

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 drinking 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
- Graphical 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 from high-grade stainless steel 1.4571 or 1.4404
- Control and ballast in compact plastic housing

Main applications

Drinking water	Industrial water	Swimming pool water	Wastewater	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

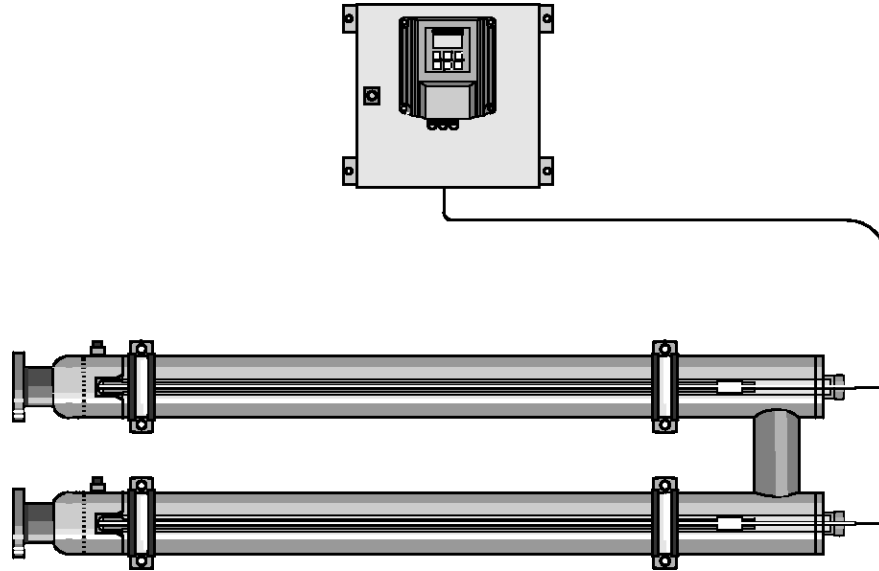
Spare Parts For Dulcodes P UV Systems

Name of the item	Order no.
UV lamp 16 W	1002472
UV lamp 45 W	1002473
O-ring for fixing the lamp in the lamp sleeve	481016
Lamp protection tube for 16 P	1004450
Lamp protection tube for 45 P	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 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 wastewater 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 radiation chambers, each with its own lamp, arranged sequentially so that the flow passes through them parallel to their longitudinal axis.
- 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 optimal lamp operating current
- Long-term stable UVC sensor for monitoring the disinfection capacity and transmission (UV transmission factor) of the water, factory calibrated
- Large graphical 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 from high-grade stainless steel 1.4571 or 1.4404
- Control cabinets of painted steel
- Complete cleaning system available as accessories comprising acid tank, circulating pump, valves and hoses for rapid chemical cleaning of lamp protection tube and radiation chamber.

Main applications

Drinking water	Process water	Swimming pool water	Wastewater	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

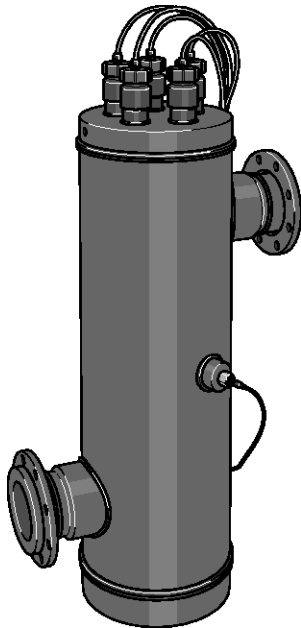
Lamp type	Standard low pressure lamp with 1x45 D High-Flux low pressure lamp with 1x130 D - 4x230 D (see p. → 1-2)
Controller type	Compact controller with 1x45 D De luxe controller with 1x130 D - 4x230 D (see p. → 1-3)
Permissible operating pressure	10 bar
Permissible ambient temperature	5–40 °C
Permissible 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 für Dulcodes 45 D und 130 D	1002468
Lamp protection tube for Dulcodes 1-6x230 D	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 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 control cabinet ventilation (2 mats required per control cabinet)	1004212
Hook spanner (special tool required for lamp replacement)	1002764

1 Dulcodes UV systems

1.6 Dulcodes K UV Systems With PE-HD Radiation Chamber



The Dulcodes K range of UV systems with High-Flux lamps can be used for disinfection of saline water (thermal spring water, sea water). The radiation chambers are made from 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
- Lam 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 graphical 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 from UV-stabilised PE-HD
- Control cabinets of painted steel

Main applications

pk_7_047

Drinking water	Process water	Swimming pool water	Wastewater	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	Connection nomi- nal diameter
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

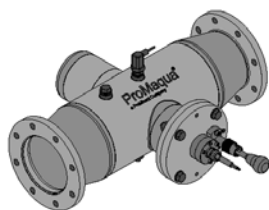
Lamp type	High-Flux low pressure lamp 130 W or low pressure Opti Flux 290 W lamp (dependent on system type) (see page → 1-2)
Controller type	De luxe controller (see p. → 1-3)
Permissible operating pressure	4 bar
Permissible ambient temperature	5–40 °C
Permissible water temperature	5–30 °C

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 K, 130 W lamp	1006385
Lamp protection tube for Dulcodes K, 290 W lamp	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 UVC sensor	1002175
O-ring UVC sensor K, PTFE	1041049
Replacement filter mats control cabinet ventilation	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 a photochemical degradation of combined chlorine (chloramine) in swimming pool water treatment. Special medium pressure UV lamps generate the 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 750 m³/h (depending on transmission rate and radiation intensity).
- Extremely compact inline system with minimum space requirement.
- Simple installation thanks to minimal installation and fast retrofitting.
- Ultra-flexible installation thanks to free choice of installation location.
- Powerline S type medium-pressure lamp with a high connected load of up to 3 kW per metre of arc length.
- High gas pressure and relatively high lamp operating temperature of 600 to 800 °C, hence broad emission spectrum.
- Lamp life time: approx. 6,000-8,000 h depending on lamp size.
- Long-time stable UVC sensor for monitoring the lamp output, the lamp protection tube contamination as well as changes in the water quality.
- Integral temperature sensor for monitoring the water temperature in the radiation chamber.
- Large graphical display to show the sensor signal with trend line of the variation of the UV sensor signal over time.
- Manual power control via manual step switch to perfectly adapt the system to the relevant capacity needed (not suitable for use with Dulcodes 1 x 0.65 and 1S).
- Automatic chloramine value-dependent on/off control, for instance when 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 is simple to retrofit.
- Radiation chambers made from high-grade stainless steel 1.4571 or 1.4404.
- Control cabinet made of coated steel.
- Optimum energy use thanks to large radiation chamber and even radiation of the entire water flow due to improved system hydraulics.

Application focuses

Drinking 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

Replacement parts for Dulcodes S UV systems

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

1 Dulcodes UV systems

1.8 Dulcodes A inline UV systems with medium pressure lamps



P_PMA_DS_0018_SW1a

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 the strong odour producing and eye irritating substances. The result is an improved quality of water for healthy and pleasant swimming.

Features

- Flow: up to 750 m³/h (depending on transmission and radiation intensity).
- Extremely compact in-line system with low space requirement.
- Simple installation due to minimal installation expense, quick retrofitting.
- Maximum installation flexibility due to free choice of fitting position.
- Powerline A medium pressure lamps with high power input of up to 3 kW.
- High gas pressure and relatively high lamp operating temperature of 600 to 800 °C, hence broad emission spectrum.
- 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 switch for monitoring the water temperature in the radiation chamber.
- Large graphical display for displaying the time dependency of the UV sensor signal with trend indication line.
- External power control via 0/4 - 20 mA standard signal for optimal matching of the system to changing operating conditions such as flow fluctuations.
- Automatic set point control to a defined UV-C sensor signal saves energy and extends lamp life time.
- Freely programmable control (comfort control Dulcodes A type, see chap. 1.1.2).
- Automatic, motor-driven wiper for efficient removal of deposits from the UV sleeve.
- Automatic switching on and off based on the chloramine value, for example used in conjunction with the DULCOMARIN® II. Power increase to an adjustable value set via the digital input.
- Radiation chambers from high-grade stainless steel 1.4571 or 1.4404.
- Control cabinets 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

Drinking 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	Connection width
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 Radiation intensity for the breaking down of combined chlorine

** 98 %/cm Transmission; 400 J/m² Radiation intensity for disinfection applications

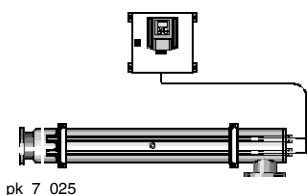
Lamp type	Powerline A medium pressure lamp (see page → 1-2)
Permissible operating pressure	10 bar (for systems 1 x 1A - 1 x 3A) 6 bar (for systems 2 x 2A - 3 x 3A)
Permissible ambient temperature	5–40 °C
Permissible water temperature	5–40 °C

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	1035218
Lamp protection tube for Dulcodes 2 A	1041723
Lamp protection tube for Dulcodes 3 A	1041485
Wiper element (2 required per UV lamp)	on request
Spare parts kit UV A 1-3 kW motor wiper	on request
Spare parts kit UV A 2x2 kW and 2x3 kW motor wiper	on request
Spare parts kit UV A 3x3 kW motor wiper	on request
O-ring lamp protection tube/lamp cover	on request
UVC-U sensor M 1.4539	on request
O-ring UVC sensor	on request
Sensor cable, 5 m long	on request
Replacement filter mat for control cabinet ventilation (2 mats required per control cabinet)	on request

1 Dulcodes UV systems

1.9 Dulcodes Z UV Systems With Certified Performance



Dulcodes Z UV disinfection systems serve the disinfection of drinking and industrial water and can be used - depending on transmission - for flows 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 the 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 drinking water disinfection which 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 from high-grade stainless steel 1.4404
- Radiation chamber hydraulics optimised by computer simulation
- Control cabinets of painted steel

Main applications

Drinking water	Process water	Swimming pool water	Wastewater	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	De luxe controller UVC sensor signal in W/m ² which can be calibrated with the help of a reference radiometer (see p. → 1-3, Reference radiometer RRM see p. → 1-23)
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.
OptiFlux 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 Z	1020845
Lamp protection tube for Dulcodes 200 Z	1021010
Lamp protection tube for Dulcodes 1-7x300 Z	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 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 control cabinet ventilation (2 mats required per control cabinet)	1004212

1 Dulcodes UV systems

1.10 Dulcodes R UV systems with wiper

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

Thanks to the OptiFlux high performance UV lamps with a power output of 300 W, maximum flow rates are achieved with a minimum number of lamps. Due to the long service life of the UV lamps of up to 14,000 operating hours, the lamps need to be replaced less frequently when compared to conventional systems hence reducing costs.

Depending on the transmission of the water and the desired irradiation dose, the product range can be used with flows of up to 438 m³.

Features

- Flow: up to 438 m³/h (depending on transmission)
- Auto-adjusting wiper elements made from food-grade 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 achieve maximum cleaning effect combined with a long service life
- High efficiency low pressure Opti-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 enables a higher flow rate per lamp, longer service cycles and lower operating costs
- Electronic ballasts with BUS interface for ignition and monitoring of each individual lamp
- Variable lamp current, hence lamp-friendly ignition process and exact adaptation of optimal lamp operation
- Factory calibrated UV-C sensitive sensor
- Large graphical display for output of the sensor signal and operating messages in plain text
- Freely programmable control, e.g. for different flushing, warning and shutdown procedures
- Hydraulically optimised radiation chambers made from high-grade stainless steel 1.4404
- Control cabinets of painted steel

- Now also available with motor-driven automatic wiper for the Dulcodes 2 - 4x300R

NEW

Main applications

Drinking water	Industrial water	Swimming pool water	Waste water	Saltwater
✓	✓	✓	—	—

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** De luxe controller (see p. → 1-3)
- Permissible operating pressure** 10 bar
- Permissible ambient temperature** 5–40 °C
- Permissible water temperature** 5–70 °C

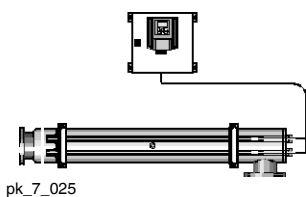
1 Dulcodes UV systems

Spare parts for Dulcodes R UV systems

	Order no.
Opti-Flux UV lamp 300 W	1020929
Lamp protection tube for Dulcodes 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 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 control cabinet ventilation (2 mats required per control cabinet)	1004212

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 optimal lamp operating current
- Long-term stable UVC sensor for monitoring the disinfection capacity and transmission (UV transmission factor) of the water, factory calibrated
- Large graphical 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 from high-grade stainless steel 1.4571 or 1.4404
- Control cabinets of painted steel

Main applications

Drinking water	Industrial water	Swimming pool water	Wastewater	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	De luxe 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

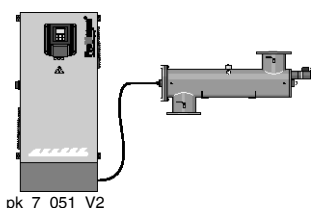
Spare Parts For Dulcodes W UV Systems

	Order no.
OptiFlux 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	1020845
Lamp protection tube für Dulcodes 80 W	1002467
Lamp protection tube für Dulcodes 130 W	1002468
Lamp protection tube for Dulcodes 230 W	1002469
Lamp protection tube für Dulcodes 2-5x230 W	1002470
Lamp protection tube für Dulcodes 6-12x230 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 UVC sensor	1002175
Screwed plug G 1/4"	1002752
O-ring for G 1/4" screwed plug	741256
Replacement filter mats control cabinet ventilation (2 mats required per control cabinet)	1004212
Hook spanner (special tool required for lamp replacement)	1002764

1

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 type medium pressure lamp with a mercury vapour pressure of greater than 1 bar, hence high power inputs of up to 10 kW per metre of arc length
- High gas pressure and relatively high lamp operating temperature of 600 to 800 °C, hence broad emission spectrum
- Particularly suitable for photochemical reduction, e.g. of chloramine in swimming pool water, chlorine dioxide in the beverages industry, or chlorine and ozone in other production water, due to the lamps' broad emission spectrum
- 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 optimal lamp operating current
- Long-term stable UVC sensor for monitoring the disinfection capacity and transmission (UV transmission factor) of the water
- Integral temperature switch for monitoring the water temperature in the radiation chamber
- Large graphical display for output of 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 optimal matching of the system to changing operating conditions such as flow fluctuations (from Dulcodes 4ML)
- Automatic matching of lamp output to a defined UV-C sensor signal saves energy and extends lamp service life (from Dulcodes 4ML)
- Freely programmable control, e.g. for different flushing, warning and shutdown procedures
- Automatic, motor-driven wiper for efficient removal of deposits from the radiation protection tube
- Radiation chambers from high-grade stainless steel 1.4571 or 1.4404
- Control cabinets of painted steel

Main applications

Drinking water	Industrial water	Swimming pool water	Wastewater	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 de luxe 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 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

1 Dulcodes UV systems

1.13 Accessories For Dulcodes UV Systems

Transmission Photometer TMX 02

Photometer for measurement of 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
Measurement resolution	Transmission in 0.1 %
Measurement 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 which is 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 must be worn as UV radiation escapes from the radiation chamber during this procedure.

Technical Data

Measurement 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 harmful to the eye UV radiation when working on open UV systems.

	Order no.
UV protective glasses	1025243

Protective gloves

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

	Order no.
Protective gloves	1032815

Sampling cock

Fireproof sampling cock made from stainless steel.

	Order no.
Sampling cock	on request

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 dosing 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. It monitors the temperature of the water and can be connected to the control. The flushing valve opens when the preset limit temperature is exceeded.

	Order no.
Clip-on thermostat	on request

Fittings

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

Two-part clip with increased material cross section to ensure high bearing strength and breaking resistance. A sound proofing layer ensures a 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, which are operated at 230 V 50-60 Hz.

The external overvoltage protection is intended for the operating case in which the device internal protection is not sufficient for surge voltages of 1 kV between the conductors and of 2 kV to earth. To protect the system when the supply mains are prone to power transients an overvoltage trip can be fitted as a low protection surge arrester to significantly increase the stability of the Dulcodes 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

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 enables 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
- Arsen
- 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 must be perfectly matched with each other and with the planned application, to achieve an optimum relationship between ozone production and effect.

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

Drinking water supply

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

Food and beverage industry

- Disinfection of mineral water
- Disinfection at the rinser in the beverage industry
- Disinfection of production water

Swimming pools

- Reduction of chloramines and trihalomethanes, so avoiding typical swimming pool smell
- Crystal-clear water thanks to microflocculating action
- Reliable microbiological barriers in therapy pools
- Reduction of investment and operating costs through 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

In case of the series OZONFILT® OZVa and OZMa, the operating gas air or oxygen is fed to the ozone generator under pressure. Ozone is generated using medium-frequency high voltages.

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

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

Vacuum systems

In case of the series Bono Zon® BONA, the operating gas air is suctioned through the air drying and the ozone generator with the help of a pressure-increasing pump and an injector system. The ozone itself is generated under mains frequency and is controlled by changing the high voltage. The vacuum operation ensures a very safe operation.

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

	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_0028

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

Ozone plants of the OZONFILT[®]OZVa range 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 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).

Types OZVa 1 and 2 are installed in a control cabinet for wall mounting; types 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 must be provided for the 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: 6.2 l/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:

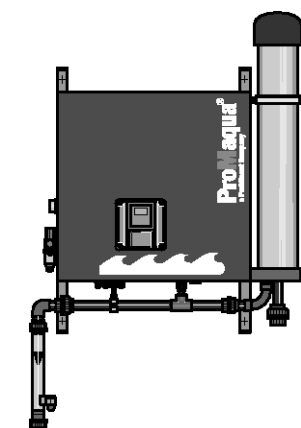
- Static helical mixer mounted directly below the plant, made of PVC, with 4 helical blades (pressure drop approx. 0.4 bar at maximum throughput) (see fig. pk_7_042_V2)
- Without mixing system for connection of 12/10 mm stainless steel pipes or 12/9 mm PTFE pipes

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

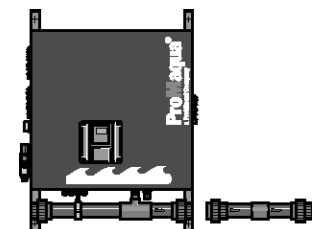
Static Helical Mixer Made From PVC Or Stainless Steel see p. → 2-25

Notes

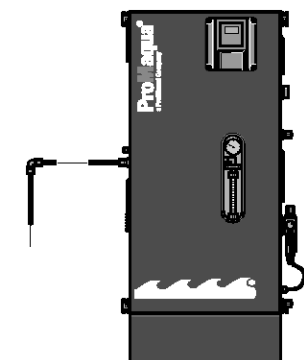
- The length of ozone gas transporting pipes and the number of joints should be kept to a minimum. All rooms with a removable joint are to be monitored with a gas detector according to the valid German accident prevention regulations. All OZONFILT® plants are equipped for fitting a gas detector such as e.g. type GMA 36 Ozon (see Accessories).
- For all installations the ozone generator must be interlocked with the water flow into the metering point.
- To prevent any return of ozonised water into the ozone-transporting pipe, a non-return valve is to 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® Ozone Production Plants OZVa 1-4 (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	2.0
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 mixing)

		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
Raw water temperature max.	°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 quantity	NI/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 which enables ozone concentrations of up to 150 g/Nm³ through 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 corresponding to OZVa 2; the types 6 and 7 are installed in a free-standing cabinet corresponding to OZVa 4. In all three plants, the 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. Mixing systems made of PVC may show a reduced service life, depending on the operating conditions.

Notes

- The length of ozone gas transporting pipes and the number of joints should be kept to a minimum. All rooms with a joint are to be monitored with a gas detector according to the valid German accident prevention regulations. All OZONFILT® plants are equipped for fitting a gas detector such as e.g. type GMA 36 Ozon.
- Depending on the operating and installation conditions, it might be necessary to also monitor the room air for excessive oxygen content. For this purpose, the gas detector GMA 36 Oxygen can be used.
- For all installations the ozone generator must be interlocked with the water flow into the metering point.
- To prevent any return of ozonised water into the ozone-transporting pipe, a non-return valve is to be installed upstream of the OVZa.
- 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. Residual ozone destructors on the basis of active carbon ignite spontaneously if subjected to increased ozone concentrations.

Room Air Monitoring see p. → 2-28

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 mixing)

		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
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

		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
Particles max.	µm	5	5	5
Hydrocarbons max.	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 static mixer PVC, DN 40, 5–10 m ³ /h	blue painted	1026120
with static mixer PVC, DN 40, 5–10 m ³ /h	stainless steel	1026127
with static mixer PVC, DN 50, 10–15 m ³ /h	blue painted	1026121
with static mixer PVC, DN 50, 10–15 m ³ /h	stainless steel	1026128
with static mixer PVC, DN 32, 0.5–2.8 m ³ /h	blue painted	1026122
with static mixer PVC, DN 32, 0.5–2.8 m ³ /h	stainless steel	1026129
with static mixer PVC, DN 32, 2.8–5 m ³ /h	blue painted	1026123
with static mixer PVC, 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 static mixer PVC, DN 40, 5–10 m ³ /h	blue painted	1005127
with static mixer PVC, DN 40, 5–10 m ³ /h	stainless steel	1026134
with static mixer PVC, DN 50, 10–15 m ³ /h	blue painted	1005806
with static mixer PVC, DN 50, 10–15 m ³ /h	stainless steel	1026135
with static mixer PVC, DN 32, 0.5–2.8 m ³ /h	blue painted	1026132
with static mixer PVC, DN 32, 0.5–2.8 m ³ /h	stainless steel	1026144
with static mixer PVC, DN 32, 2.8–5 m ³ /h	blue painted	1005125
with static mixer PVC, 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

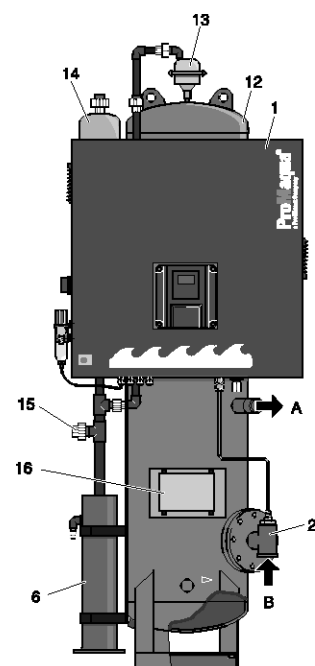
OZONFILT[®] OZVa 7 capacity 90 g/h operating gas oxygen

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

2 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 treatment of drinking 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 dosing point and a downstream mixing section made from 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 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 necessary fittings for water distribution and an automatic vent 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 (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 signalled. A buzzer is activated at the same time.

Technical Data

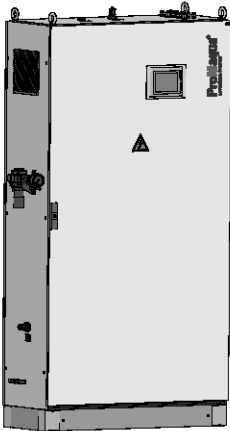
Type		OMVa 1	OMVa 2	OMVa 3
Ozone system type		OZVa 1	OZVa 2	OZVa 3
Ozone capacity	g/h	5	15	35
Reaction tank volume	l	205	460	1,080
Typical flow rate	m ³ /h	5 – 10	10 – 15	25 – 35
Operating pressure	bar	0.6 – 1.8	0.6 – 1.8	0.6 – 1.8
Reaction tank connection size		DN 40	DN 50	DN 80
Dimensions H x W x D	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

Ozone systems of the OZMa® series 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 a 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 the clearly laid out touch panel with data logger and screen recorder. A PROFIBUS® DP communication interface ensures easy integration into industrial control systems. Remote diagnostics and communication are optionally available over a LAN communication interface.

The automatic control of the gas flow ensures the concentration of the ozone in the gas flow is maintained constant, independent from the transported ozone quantity. 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 can be 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.

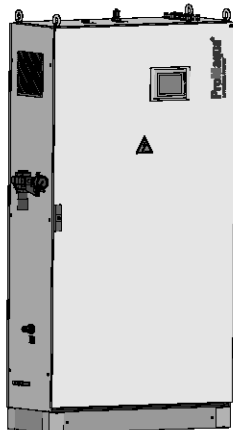
Features

- 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
- Communications interface PROFIBUS® DP (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® Ozone Generation Plants OZMa 1-6 A (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 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 compiled by combining different Identcode characteristics.

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

For the operation of the ozone plant, an adequate compressed air supply and a mixing device designed for the operating conditions are to be integrated.

Order Information For OZONFILT® OZMa Plants see p. → 2-19, Static Helical Mixer Made From PVC Or Stainless Steel see p. → 2-25

Requirements on 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, a suitable mixing system must be ordered separately. When selecting a suitable mixing device, please note that the mixing of ozone is the more efficient the higher the water flow in the mixing system is. The mixing system should thus be designed such 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. → 2-25

Notes on installation

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 the valid German accident prevention regulations. All OZONFILT® plants are equipped for fitting a gas detector such as e.g. type GMA 36 Ozon.

Ozonisation contributes a large amount of gas to the water of which only a small percentage can dissolve. An adequate bleeding is thus to be integrated. Because the gases discharged this way have a considerable residual ozone concentration, suitable residual ozone destructors must be installed.

For all installations the ozone generator must be interlocked with the water flow into the metering point.

To prevent any return of ozonised water into the ozone-transporting pipe, a non-return valve is to be installed between OZMa and ozone metering point.

Room Air Monitoring see p. → 2-28, Residual Ozone Gas Destructor see p. → 2-27

2 OZONFILT® And Bono Zon® Ozone Plants

Technical Data

OZONFILT® Ozone Generation Systems OZMa 1-3 A (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 mixing)

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

Weight

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

Ozone mixing

		OZMa 1A	OZMa 2A	OZMa 3A
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

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® Ozone Generation Systems OZMa 4-6 A (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 mixing)

		OZMa 4A	OZMa 5A	OZMa 6A
Width	mm	1,314	1,314	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	580

Ozone mixing

		OZMa 4A	OZMa 5A	OZMa 6A
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

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® Ozone Generation Plants OZMa 1-6 O (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 table of the technical data.

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

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

Order Information For OZONFILT® OZMa Plants see p. → 2-19

Requirements on the oxygen supply

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

Mixing device

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

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

Static Helical Mixer Made From PVC Or Stainless Steel see p. → 2-25

Notes on installation

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 the valid German accident prevention regulations. All OZONFILT® plants are equipped for fitting a gas detector such as e.g. type GMA 36 Ozon.

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

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

Ozonisation contributes a large amount of gas to the water of which only a small percentage can dissolve. An adequate bleeding is thus to be integrated. Because the gases discharged this way have a considerable residual ozone concentration, suitable residual ozone destructors must be installed. Because of the high ozone concentrations, only catalytic residual ozone destructors can be used. Residual ozone destructors on the basis of active carbon ignite spontaneously if subjected to increased ozone concentrations.

For all installations the ozone generator must be interlocked with the water flow into the metering point.

To prevent any return of ozonised water into the ozone-transporting pipe, a non-return valve is to be installed between OZMa and ozone metering point.

Room Air Monitoring see p. → 2-28, Residual Ozone Gas Destructor see p. → 2-27

2 OZONFILT® And Bono Zon® Ozone Plants

Technical Data

OZONFILT® Ozone Generation Systems OZMa 1-3 O (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
Particles max.	µm	5	5	5
Hydrocarbons max.	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® Ozone Generation Systems OZMa 4-6 O (Process 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	1,314	1,314	1,314
Height	mm	1,961	1,961	1,961
Depth	mm	600	600	600

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
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 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
Particles max.	µm	5	5	5
Hydrocarbons max.	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 = 1.013x10⁵Pa, 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	
2		Oxygen measuring cell (Oxygen operating gas version)	
3		Dewpoint sensor and oxygen measuring cell (Oxygen operating gas version)	
Approvals			
01		CE-mark	
Hardware			
0		Standard	
Software			
0		Standard	

Explanations on the Identcode:

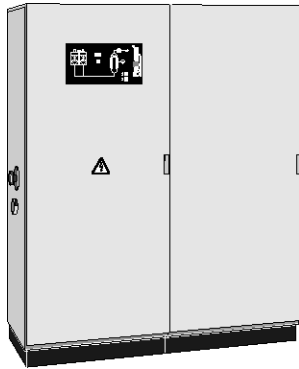
Mechanical design: In the design 0 and 1, the plant is installed in a standard control cabinet made of powder-coated steel.

Gas treatment: Without filter package for oil-free generated or already 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 plants are designed as vacuum plants 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 status of the air treatment.

The ozone capacity can be steplessly adjusted over the full capacity range. The entire process control and monitoring of safety-related parameters takes place with the aid of the integrated PLC.

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

Bono Zon® plants comply with the German standard for ozone production plants, DIN 19 627.

Bono Zon® plants are fitted with a reliable and economical adsorption drying system. The load-dependent control of the adsorption regeneration ends the heating phase when the breakdown temperature is reached. The required dew point is ensured at all times and the operating costs are minimised at the same time. This ensures optimum operational safety of the ozone plant.

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

Features

- Choice of stainless steel or PVC ozone generation modules
- Automatic electronic overload detection linked to safety disconnection, even with part load operation.
- PLC Siemens® Simatic S7 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 (take-off gas), primary voltage and primary current are displayed.
- Ozone generator(s) optimised for minimum power consumption. Power requirement 18.7 Wh/g.
- Stepless adjustment of ozone generation to demand by means of a regulating transformer, fitted with an electric actuator if required.
- Our DULCOTEST® OZE ozone sensor can be connected directly.
- The control for booster pump and the protection device are 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 highest possible protection against ozone escape.
- Air treatment using cost-effective adsorption drying plant. An optimum dew point is ensured by means of thermostatically-controlled regeneration.
- Bono Zon® plants comply with the German standard for ozone production plants, 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) must 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

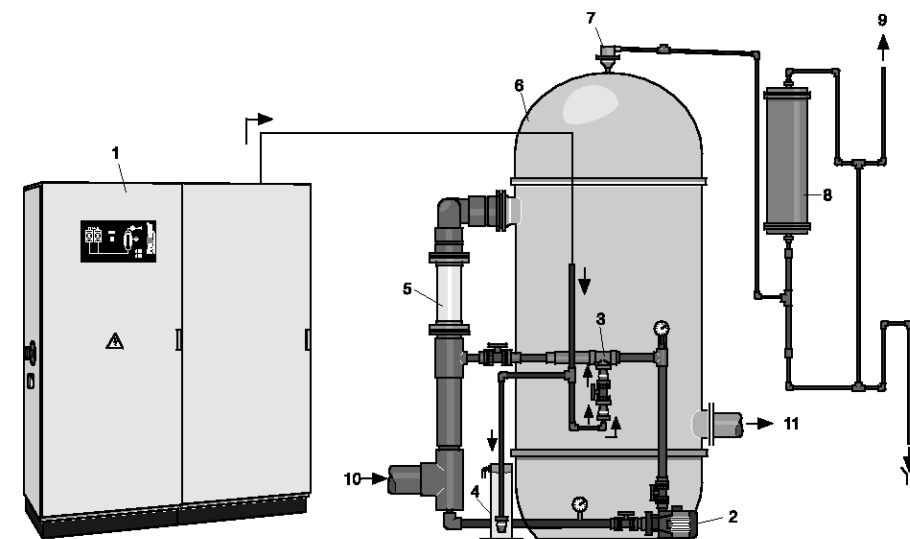
2 OZONFILT® And Bono Zon® Ozone Plants

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 the design 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 Vent 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 Ozone Generator Made Of Stainless Steel

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 any 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 must be produced with an injector system matched to the particular application.

Ozone generators made from PVC are optionally available for use in connection with corrosive cooling water.

Technical Data

Bono Zon® Ozone Plant With Ozone Generator Made Of Stainless Steel

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.	m ³ /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	m ³ /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	m ³ /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 especially favourable price/performance ratio. 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, 110-240 V / 50-60 Hz	1025383
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, 110-240 V / 50-60 Hz	1025383
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

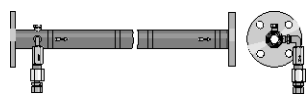
2 OZONFILT® And Bono Zon® Ozone Plants

Accessories

	Order no.
PTFE hose 6x4 mm, Admissible operating pressure 15 bar, sold in meters	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

Static Helical Mixer Made From PVC Or Stainless Steel



pk_7_072
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). For optimum mixing results, the specified flow range of the static helical mixer must be complied with.

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 meter	015743
Stainless steel pipe 12/10 mm, grease-less, 1.4 m	1022463
PTFE hose 12/9 mm, grease-less, sold in meters	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 pressure relief valve for OZMa 1-3, adjustable pressure range 0.5-10 bar, connector size G 3/4" - DN 10, grease-less	1039408
Spare parts kit for back pressure valve order no. 1039408	1039410
Stainless steel pressure relief valve for OZMa 4-6, adjustable pressure range 0.5-10 bar, connector size G 1 1/4" - DN 20, grease-less	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

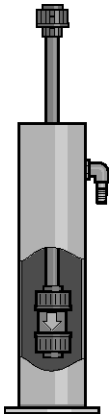
2.7.5 Accessories For Bono Zon® Ozone Plants

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.

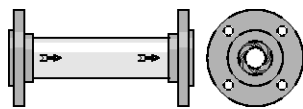
Recommended flow m ³ /h	Flange connection DN mm	Length mm	Order no.
15-25	65	350	1007841
25-35	80	450	1007842
35-50	100	550	1007843
50-90	125	650	1007864
90-160	150	800	1007865
160-250	200	1,000	1007866
250-350	200	1,000	1007867

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.



pk_7_044
Static mixer

2 OZONFILT® And Bono Zon® Ozone Plants

Vent valves

Vent valves made from 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.

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, a suitable drainage connection must be provided here too.

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.

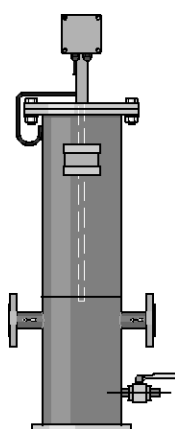
	Type	Ozone quantity g/h	Order no.
Residual ozone destructor 3 L	10	10	879022
Residual ozone destructor 14 L	40	40	1004267
Residual ozone destructor 30 L	100	100	879019
Residual ozone destructor 60 L	200	200	879018

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

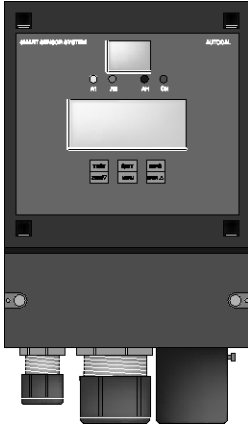
Room Air Monitoring

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 must be acknowledged at the device. 1 self-resetting relay for connection to an alarm horn is switched on 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
Relay contact "Warning", self-resetting	V/A	230/1	230/1
Relay contact "Alarm", latching	V/A	230/1	230/1
Relay contact "Horn", 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 Type GMA 36	Ozone	1023155
Gas warning device Type GMA 36	Oxygen	1023971

2 OZONFILT® And Bono Zon® Ozone Plants

Spareparts

	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

Warning light and horn

Combined horn and red warning lamp. IP 33 enclosure made from impact-resistant ABS. Dome made from 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

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

2 OZONFILT® And Bono Zon® Ozone Plants

Emergency stop switch

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

	Order no.
Emergency stop switch	700560

2.7.9

Overvoltage protection

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

The external overvoltage protection is intended for the operating case in which the device internal protection is not sufficient for surge voltages of 1 kV between the conductors and of 2 kV to earth. To protect the system when the supply mains are 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.
Low protection PT 2-DE IS 230 IAC	733010

2.7.10

Replacement plug-in insert after tripping

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

3 Chlorine Dioxide Plants Bello Zon®

3.1 Chlorine Dioxide In Water Treatment

Chlorine dioxide is an extremely reactive gas, which – because of its instability – cannot be stored, and must 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 dosed 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 drinking water and waste water plants

- Disinfection of drinking 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 Chlorine Dioxide Plants Bello Zon®

3.1.2

Bello Zon® Plant Technology

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

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

In most applications, the metering is proportional to the flow, i.e. flow dependent on the signal from an inductive or contact flow meter or 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 dependent on a chlorine dioxide measurement.

Features

- Precise and reproducible chlorine dioxide production thanks to calibratable metering pumps for the initial 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.
- Integrated measurement of ClO₂ and chlorite plus control of ClO₂.
- Highest level of safety provided as standard thanks to construction and operation in accordance with DVGW specifications W 224 and W 624.

Bello Zon® CDL Legio Zon®

Ideal for small water quantities and for both continuous and discontinuous treatment: The specialist in combating legionella and other germs supplies 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 self-explanatory menu navigation ensure 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 through 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.
- We can measure all the key water parameters required for optimum system design in our water laboratory.
- System planning.
- Commissioning and system maintenance by our trained service technicians.

3 Chlorine Dioxide Plants Bello Zon®

3.2 Performance Overview Of Chlorine Dioxide Systems

Type		CDL	CDV	CDK
Output [kg/h]	20			
	10			
	2			
Output [g/h]	100			
	10			
	1			

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

P_PMA_BEZ_0025_SW

Chlorine dioxide is establishing itself more and more as a universal disinfectant in applications such as disinfecting drinking 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 best eco-compatibility
- Safe and reliable plant technology
- World-wide availability of know-how and service

3 Chlorine Dioxide Plants Bello Zon®

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

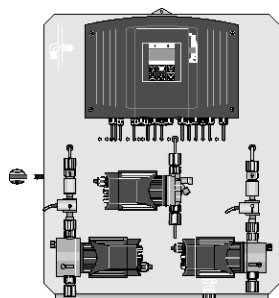
Desired concentration after chlorine dioxide metering: _____ mg/l

Other requirements:

3

3 Chlorine Dioxide Plants Bello Zon®

3.4 Bello Zon® Chlorine Dioxide Plants Type Legio Zon®



pk_7_075_V2
Legio Zon® (without cover)

The Bello Zon® plants Legio Zon® are fully pre-mounted and are delivered ready for connection. A stylish cover protects against incorrect operation. Legio Zon® has an integrated metering pump whose capacity is matched to system requirements.

- Generation of 0-10 g/h of chlorine dioxide in batch mode, equally suitable for both continuous and discontinuous operation
- High level of safety in accordance with DVGW specifications W 224 as well as W 624 and no hazardous operating conditions thanks to the optimum chlorine dioxide concentration (2 g/l)
- High stability of the generated chlorine dioxide solution lasting over several days
- High operational safety thanks to automatic restart following a mains failure, automatic monitoring functions and maintenance messages
- Controller with menu-guided operation, flushing and service functions

The following optional accessories are available

- Corrosion-resistant metering point with integrated mixing elements
- Pressure-retaining valve
- Drip pan for 1 chemicals container 25 l and 10 l each
- Photometer for determination of chlorine dioxide and chlorite
- Ready-to-use chemicals in 25 l or 10 l containers

Technical Data

Type	Dosing capacity g/h	Max. operating pressure bar	Capacity of dosing pump ClO ₂	Operating temp. °C	Dimensions (approx.) H x W x D (mm)	Weight (approx.) kg	Power consumption (max.)	
							230 V A	110/115 V A
CDL5	0-5	10	3 l/h (10 bar) 3.4 l/h (5 bar) *	10-40	650 x 550 x 310	24	2.7	8.4
CDL10	0-10	7	7.1 l/h (7 bar) 8.4 l/h (3.5 bar) *	10-40	650 x 550 x 370	28	2.7	8.4

* Hose connection dimensions of ClO₂ output: 6 x 4 mm

Inputs:

- Water meter (contact or frequency)
- External digital input (can be configured for pause, shock dosage, high dosage or manual)
- External fault

Outputs:

- Operating alarm relay
- Warning relay
- Fault alarm relay

3 Chlorine Dioxide Plants Bello Zon®

3.4.1 Identcode Ordering System for Legio Zon® Systems

Chlorine dioxide systems type Legio Zon® CDLa

CDLa	System type
05	CDLa 5 = 5 g/h
10	CDLa 10 = 10 g/h
	Application
0	Legionella (Legio Zon®)
1	Without ClO ₂ pump
	Version
P	ProMinent
J	Japan
H	Switzerland (version conforming to SVGW)*
	Power supply
0	230 V, 50/60 Hz
1	115 V, 50/60 Hz
3	100 V, 50/60 Hz
	Cover
0	Without hood
1	With hood
	Chlorine dioxide pump integrated
0	None
1	With pump 1002
	Injection lance
0	without suction lance
1	Lance for 10/25 l tank
9	Suction lance for 10/25 l storage tank and collecting pan
	Language
C	Czech
D	German
E	English
F	French
I	Italian
J	Japanese
M	Hungarian
P	Polish
S	Spanish

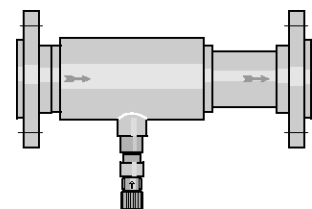
* Version pursuant to SVGW: diluent water connection G 3/4", pressure relief valve type MFV with wall bracket included in the scope of delivery.

3

3 Chlorine Dioxide Plants Bello Zon®

3.4.2 Accessories And Service Kits For CDL and Legio Zon®

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.
Pressure relief valve MFV 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 chemical container CDL	1026744

Service kits for Legio Zon®

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

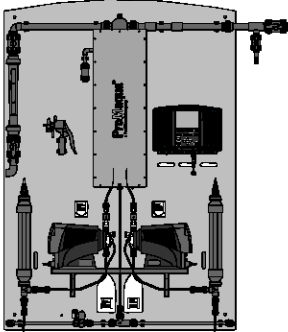
	Order no.
1-year service kit for Legio Zon®CDL5	1027263
3-year service kit for Legio Zon®CDL5	1027417
1-year service kit for Legio Zon®CDL10	1031549
3-year service kit for Legio Zon®CDL10	1031550

For CDLa without ClO₂ pump

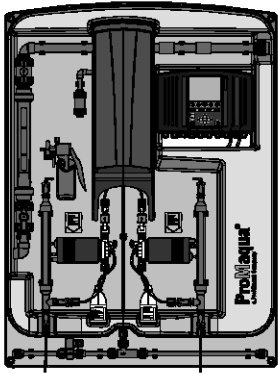
	Order no.
1-year service kit for Legio Zon®CDL5	1042829
3-year service kit for Legio Zon®CDL5	1042831
1-year service kit for Legio Zon®CDL10	1042830
3-year service kit for Legio Zon®CDL10	1042832

3 Chlorine Dioxide Plants Bello Zon®

3.5 Bello Zon® Chlorine Dioxide Plants Type CDVc



P_PMA_BEZ_0008_SW
CDVc 240-2000 (figure shows optional configuration)



P_PMA_BEZ_0009_SW
CDVc 20-120 (figure shows optional configuration)

Complete chlorine dioxide systems Bello Zon® CDVc, wired ready for connection, are used for the production, metering and monitoring of 20 to 2,000 g/h of chlorine dioxide with diluted base chemicals. A completely newly developed reactor concept ensures the innovative production and metering of chlorine dioxide. Instead of the PVC hitherto used in the industry, PVDF is used for the first time. This results in higher operating safety and a better purity of the generated chlorine dioxide. The stroke lengths of the latest generation of ProMinent® metering pumps are monitored online. Hazardous operating statuses owing to incorrect operation of stroke length adjustment of the pumps can thus be avoided.

The precise production of chlorine dioxide is managed by the central plant control. Chlorine dioxide, chlorite, pH or redox potential sensors DULCOTEST® can be connected directly via the two mA inputs. The chlorine dioxide in the treated water, as well as its main by-product chlorite, can thus be monitored and documented online. Using the integrated PID controller, the chlorine dioxide concentrations in the water can be adjusted automatically depending on the measurement. All status messages and measured values are documented in the integrated data logger and visualised in the clear colour display via the screen recorder. Using the embedded web server, the user interface can be called up remotely including all of the values and messages shown on the display. All that is needed to view this is a browser, with no need for further software.

The plants meets all of the requirements of the DVGW guidelines W 224 and W 624 with regard to design and operation and are intended for operation with pre-diluted chemicals Bello Zon® chlorite (7.5 % NaClO₂) and acid (9 % HCl).

In the bypass version for storage module, the plants are designed for filling of intermediate storage tanks for ClO₂ solution. For this purpose, the plants include a water supply line consisting of a shut-off valve, pre-filter, pressure reducer, solenoid valve (alternatively 230 V or 24 V), water meter and needle valve. The float flow meter integrated in the bypass line is designed for the low flow rate required to produce a stock solution of 500 - 2,000 ppm of ClO₂.

Advantages

- Efficient operation thanks to the production, metering, and monitoring of ClO₂ with only one system
- Maximum operating safety and purity of the ClO₂ generated with PVDF reactors
- Maximum 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 clear menu navigation in plain text

Features

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

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.-max./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 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 values with bypass pump, 115 V values without bypass pump

3 Chlorine Dioxide Plants Bello Zon®

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)
06	Bypass PVC-U for storage module with water supply 230 V (only CDVc 45-600)
07	Bypass PVC-U for storage module with water supply 24 V (only CDVc 45-600)
	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	None
1	LAN interface, embedded web server
	Approvals
01	CE-mark
	Temperature monitoring
0	without temperature monitoring
	Hardware
0	Standard
	Software
0	Standard

3 Chlorine Dioxide Plants Bello Zon®

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 are to be replaced in the course of regular maintenance.

Spare parts kit for CDVc plants

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

Spare parts kits for CDVb plants

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

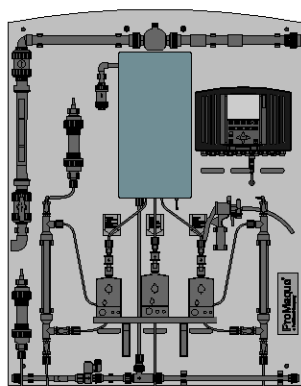
Spare parts kits for CDVa plants

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

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

3 Chlorine Dioxide Plants Bello Zon®

3.6 Bello Zon® Chlorine Dioxide Plants type CDKc



P_PMA_BEZ_0023_SW
CDKc 420 (figure shows optional configuration)¹⁾

Chlorine dioxide systems Bello Zon® CDKc, wired ready for connection, are used for the production, metering and monitoring of 150 to 12,000 g/h of chlorine dioxide with concentrated base chemicals. A completely newly developed reactor concept ensures the innovative production and metering of chlorine dioxide. Instead of the PVC hitherto used in the industry, PVDF is used for the first time. This results in higher operating safety and a better purity of the generated chlorine dioxide. The stroke lengths of the latest generation ProMinent® metering pumps are monitored online. Hazardous operating statuses owing to incorrect operation of stroke length adjustment of the pumps can thus be avoided.

The precise production of chlorine dioxide is managed by the central plant control. Chlorine dioxide, chlorite, pH or redox potential sensors DULCOTEST® can be connected directly via the two mA inputs. The chlorine dioxide in the treated water, as well as its main by-product chlorite, can thus be monitored and documented online. Using the integrated PID controller, the chlorine dioxide concentrations in the water can be adjusted automatically depending on the measurement. All status messages and measured values are documented in the integrated data logger and visualised in the clear colour display via the screen recorder. Using the embedded web server, the user interface can be called up remotely including all of the values and messages shown on the display. All that is needed to view this is a browser, with no need for further software.

The plants 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 sodium chlorite 24.5 % in accordance with DIN EN 938 and hydrochloric acid 30...33 % in accordance with DIN EN 939.

In the bypass version for storage module, the plants are designed for filling of intermediate storage tanks for ClO₂ solution. For this purpose, the plants include a water supply line consisting of a shut-off valve, pre-filter, pressure reducer, solenoid valve (alternatively 230 V or 24 V), water meter and needle valve. The float flow meter integrated in the bypass line is designed for the low flow rate required to produce a stock solution of 500 - 2,000 ppm of ClO₂.

Advantages

- Efficient operation thanks to production, metering, and monitoring of ClO₂ with only one system
- Maximum operating safety and purity of the produced ClO₂ through use of PVDF reactors
- Maximum reliability thanks to pumps with stroke length monitoring
- 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 the metering pumps
- Control with large colour display, integrated data logger and screen recorder
- Measurement, documentation, and visualisation of ClO₂, chlorite or ORP

Technical Data

Type ¹⁾	Chlorine dioxide dosing capacity* ¹⁾		Max. operating pressure**	Connection dimensions of chlorite and acid metering pumps	Operating temp.	Dimensions*** H x W x D (mm)	Weight*** kg	Power consumption (max.)****	
	min.-max./hour g/h	min./day g/d						230 V	115 V
			bar		°C	mm		A	A
CDKc 150	7.5-150	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 7500	375-7,500	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 Chlorine Dioxide Plants Bello Zon®

3.6.1 Identcode Ordering System for CDKc Plants

CDKc	Metering rate of ClO₂	
02	CDKc 170 = 170 g/h	
04	CDKc 420 = 420 g/h	
06	CDKc 900 = 900 g/h	
08	CDKc 2100 = 2100 g/h	
10	CDKc 3000 = 3000 g/h	
12	CDKc 7500 = 7500 g/h	
14	CDKc 12000 = 12,000 g/h	
	Version	
P	ProMaqua	
	Operating voltage	
A	230 V ±10 %, 50/60 Hz (for version with bypass 04)	
B	100-115 V ±10 %, 50/60 Hz (not available for version with bypass 04 or 06)	
	Bypass version, bypass monitoring	
02	Bypass PVC-U with float flow meter	
04	Bypass PVC-U with float flow meter and pump (VA) only with 230 V operating voltage (only with CDKc 170-900 g/h)	
06	Bypass PVC-U for storage module with water supply 230 V (only with CDKc 170-900 g/h)	
07	Bypass PVC-U for storage module with water supply 24 V (only with CDKc 170-900 g/h)	
	Calibrating device	
1	with calibrating device	
	Suction lance, suction fitting for chemicals	
0	without	
2	Suction lance for 200 l container	
3	Flexible suction assembly 5 m	
	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	without	
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	None	
1	LAN interface, embedded web server	
	Approvals	
01	CE mark	
	Temperature monitoring	
0	without temperature monitoring	
	Hardware	
0	Standard	
	Software	
0	Standard	

3

3 Chlorine Dioxide Plants Bello Zon®

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 compl. 230 V CDKa 150	740740
Spare parts kit compl. 230 V CDKa 420	740743
Spare parts kit compl. 230 V CDKa 750	1000172
Spare parts kit compl. 230 V CDKa 1500	1000856
Spare parts kit compl. 230 V CDKa 6000	1004814
Spare parts kit compl. 230 V CDKa 10000	1006647
Spare parts kit compl. 115 V CDKa 150	740741
Spare parts kit compl. 115 V CDKa 420	740744
Spare parts kit compl. 115 V CDKa 750	1000173
Spare parts kit compl. 115 V CDKa 1500	1000855
Spare parts kit compl. 115 V CDKa 6000	1004815
Spare parts kit compl. CDKc 170	1036454
Spare parts kit compl. CDKc 420	1036455
Spare parts kit compl. CDKc 900	1036456
Spare parts kit compl. CDKc 2100	1036457
Spare parts kit compl. CDKc 3000	1036458
Spare parts kit compl. CDKc 7500	1036459
Spare parts kit compl. CDKc 12000	1040079

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

3 Chlorine Dioxide Plants Bello Zon®

3.7 Bypass Line Accessories

Premixers made from PVC

The premixers of Types CDVb 15-120 are fully integrated in the plant, provided they were ordered by 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 2000	DN 40	50	2 - 10
CDKa 150 – 420	DN 25	32	0.5 - 2
CDKa 750	DN 32	40	1 - 3.5
CDKa 1500	DN 40	50	1.5 - 10
CDKa 6000 – 10000	DN 50	63	6 - 10
CDKc 170 - 900	DN 25	32	0.5 - 2
CDKc 2100 - 3000	DN 40	50	2 - 10
CDKc 7500	DN 40	50	6 - 10

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

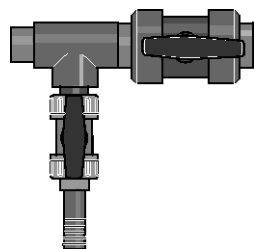
Type	Material	Connection suction/discharge side	Pump capacity at 2 bar	Nominal rating	Nominal current	Order no.
		inch	m ³ /h	W	A	
ZHM 3	SS	RP 1¼" / 1"	1.2	500	2.3	1038925

Accessories

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

3 Chlorine Dioxide Plants Bello Zon®

Flushing assembly



pk_7_013
Flushing assembly

To allow the reactor and pre-mixer to be flushed clear for maintenance purposes or after a long shutdown period, a flushing valve must 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.

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

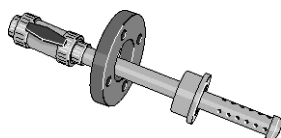
Ball-check valve

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

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

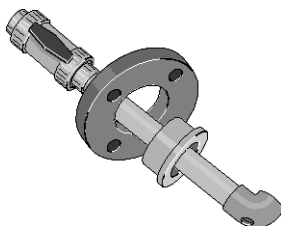
PVC-U chlorine dioxide dosing point

For uniform distribution of the chlorine-enriched bypass water in the main water pipeline, an injection pipe must be used to optimise the mixing and distribution of the chlorine dioxide. The injection pipes must 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	Max. flow rate	Pulse rate	Order no.
	m³/h	m³/h		
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 suited to water flow measurement in the fields of ground water, drinking water, waste water and sludge.

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

3 Chlorine Dioxide Plants Bello Zon®

3.8 Chemicals Supply Accessories

Suction lances and accessories

Suction lances here have a rigid construction that can be precisely matched to the chemicals container. 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 motorised 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 containers with 2 m long suction hose (6/4 mm)	CDVc 20-120	802077
Suction lance for connection to 5-60 litre non-reusable containers 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 170-3000	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 170-3000	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 170-3000	1036175

Vacuum cylinder chamber for CDVa and CDVb plants

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

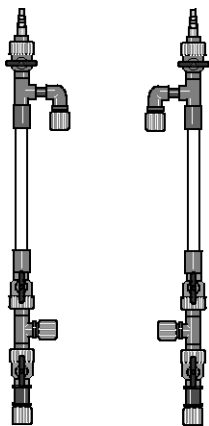
The CDVc plants in the version "with calibration device" already include the function "Suction aid".

	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 suction hose 6/4 mm	1001636
Diameter suction hose 8/5 mm	1001637
Diameter suction hose 12/9 mm	1001638
Diameter suction hose 19/16 mm	1001639



pk_7_010

3 Chlorine Dioxide Plants Bello Zon®

Safety collecting pans for chemicals containers

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	External dimension	Effective area	Collecting volume l
	kg	WxDxH mm	WxD mm	
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
Bello Zon® Acid 500 l*	950132

* 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
Bello Zon® Chlorite 500 l*	950137

* loan container

3 Chlorine Dioxide Plants Bello Zon®

3.9 Safety Accessories And Analysis

Gas warning device GMA 36 – chlorine dioxide

The gas warning device Type GMA 36 for chlorine dioxide is designed as a compact measurement 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
Relay contact "Warning", self-resetting	230 / 1 V/A
Relay contact "Alarm", latching	230 / 1 V/A
Relay contact "Horn", 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.
"never mix up chemical containers"	english	607318

Warning label for chlorine dioxide room

PVC film, yellow/black, 200 x 80 mm

Text	Language	Order no.
"entry for authorised persons only"	english	607319

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 1/2" union nut.

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

3

3 Chlorine Dioxide Plants Bello Zon®

Reactor chamber vent valve

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

	Order no.
Reactor chamber vent valve	791801

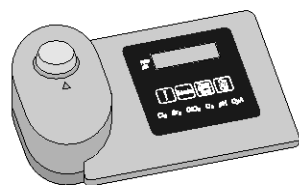
Safety collecting pans for the chemicals containers, see Chap. 3.6

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



P_DT_0074_SW
Photometer

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

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

3 Chlorine Dioxide Plants Bello Zon®

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 off spare cells: round cells with covers for DPD phenol red and cyanuric acid detection (DT1 and DT2B)	1007566
3 off 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 Nr. 1	1039732
Chlorine dioxide tablets Nr. 2	1039733

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 Electrolysis Plants CHLORINSITU®

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

In **tubular cell electrolysis** (types CHLORINSITU® II), the electrochemical reaction takes place in one chamber, so that the produced chlorine gas 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 apparatus. 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 must thus only be designed for medium chlorine demand because capacity peaks are compensated from 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 must 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 the 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 vacuum systems
- Improved working conditions for the operating personnel
- No risk of interchanging of dangerous chemical containers

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

P_PMA_EL_0025_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:

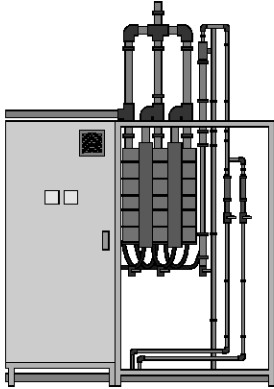
Consumption of disinfectant up to now: _____ kg/week

Other requirements:

P_PMA_EL_0001_SW

4 CHLORINSITU® and Dulco®Lyse electrolysis systems

4.4 Tubular Cell Electrolysis Plants CHLORINSITU® II



P_PMA_EL_0003_SW

Electrolysis systems of the CHLORINSITU® II series generate sodium-calcium hypochlorite with a concentration of 5 g/l. For this purpose, a saturated solution of sodium chloride is produced in a salt dissolving tank included with the delivery that is then electrolysed in an open cell after corresponding dilution. The resulting solution is collected in a storage tank and, from there, metered with separate metering pumps as needed. Because of the moderate pH value of approx. 8.5 to 9, the pH value of the treated water is significantly less affected than when using commercially available sodium-calcium hypochlorite (pH 12-13.5). The hydrogen produced is then diluted with fresh air using an ATEX-approved ventilator and is dissipated harmlessly. Both the salt-dissolving and the diluent water come from a softener integrated in the system. Thus, lime deposits can be prevented and the long service life of the electrolytic cell can be ensured.

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

Electrolysis systems of the CHLORINSITU® II series are specifically suitable for applications where a robust and clearly laid-out technology is required, and where the entrainment of sodium chloride into the water to be treated is not problematic.

- Robust, simple technology
- Compact, space-saving design
- 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
- Improved working conditions for operating personnel
- No risk of confusing hazardous chemical containers

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	1000
300	3 x 400 V	2.65	1.1	65.0	–	1,050 x 600 x 1,550	200	1500
400	3 x 400 V	3.40	1.5	86.0	–	1,250 x 600 x 2,000	380	2000
500	3 x 400 V	4.15	1.9	108.0	–	1,250 x 600 x 2,000	380	2500
600	3 x 400 V	4.90	2.3	129.0	–	1,250 x 600 x 2,000	380	3000
800	3 x 400 V	6.40	3.0	172.0	–	1,250 x 600 x 2,000	520	3500
1000	3 x 400 V	7.90	3.8	215.0	–	1,250 x 600 x 2,000	520	4500
1200	3 x 400 V	9.40	4.6	258.0	–	1,250 x 600 x 2,000	520	5500
1400	3 x 400 V	10.90	5.3	301.0	–	1,250 x 600 x 2,000	520	6000
1600	3 x 400 V	12.40	6.1	344.0	–	1,250 x 600 x 2,000	760	7000
1800	3 x 400 V	13.90	6.9	387.0	–	1,650 x 600 x 2,000	760	8000
2000	3 x 400 V	15.40	7.7	430.0	–	1,650 x 600 x 2,000	760	9000
2200	3 x 400 V	16.90	8.4	473.0	–	1,650 x 600 x 2,000	760	10000
2400	3 x 400 V	18.40	9.2	516.0	–	1,650 x 600 x 2,000	760	11000

Scope of supply:

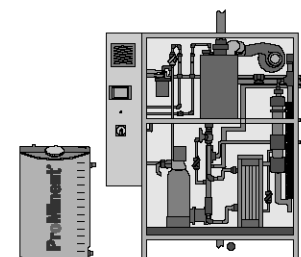
Connection-ready electrolysis system mounted on a powder-coated stainless steel frame with programmable logic controller (PLC) in control cabinet, integrated softening system, electrolysis cell, ATEX-certified bleeding system and supplied salt dissolving tank with level monitor. Level sensors to monitor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

Remarks:

Electrolysis systems of type CHLORINSITU® II, III, IV and IV plus 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 Membrane Electrolysis Plants CHLORINSITU® III



P_PMA_EL_0004_SW

Electrolysis systems of the CHLORINSITU® III type generate sodium hypochlorite with a concentration of approx. 20-25 g/l without major entrainment of sodium chloride from the electrolytic cell into the finished product. For this purpose, a saturated solution of sodium chloride is produced in a salt-dissolving tank included with the delivery that is then electrolysed in a membrane cell. Sodium hydroxide and hydrogen are produced in the chloride-free cathode chamber and chlorine gas and scaled down residual brine are produced in the anode chamber separated by the membrane. The resulting chlorine gas is bound with sodium hydroxide, collected in a storage tank as sodium-calcium hypochlorite and from there metered with separate metering pumps as needed. Because of the moderate pH value of approx. 9 to 9.5, the pH value of the treated water is significantly less affected than when using commercially available sodium-calcium hypochlorite (pH 12-13.5). The hydrogen produced is then diluted with fresh air using an ATEX-approved ventilator and is dissipated harmlessly. The salt dissolving water comes from a softener integrated in the plant, thereby preventing the formation of lime deposits and ensuring the long service life of the electrolytic cell. The efficiency of the electrolysis is monitored by an integrated pH measurement of the sodium hydroxide production.

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

Electrolysis systems of the CHLORINSITU® III series are specifically suitable for applications where an ultra-pure and low-chloride sodium-calcium hypochlorite is required.

- Robust, simple technology
- Minimum acid consumption for pH correction
- Excellent service life of electrolysis cells
- Compact, space-saving design
- Safe system control with remote diagnosis by modem
- Low-chloride sodium-calcium hypochlorite with a high chlorine concentration
- Cost-effective operation thanks to the use of sodium chloride as an inexpensive raw material and lower chemical consumption for pH correction

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	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	1200
1500	3 x 400 V	6.70	3.2	73.0	100	1,650 x 600 x 2,000	380	1800
2000	3 x 400 V	8.70	4.2	97.0	200	1,650 x 600 x 2,000	520	2500
2500	3 x 400 V	10.70	5.3	121.0	200	1,750 x 1,200 x 2,000	520	3000
3000	3 x 400 V	12.70	6.3	145.0	200	1,750 x 1,200 x 2,000	520	3300
3500	3 x 400 V	14.70	7.4	169.0	200	1,750 x 1,200 x 2,000	520	4000

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.

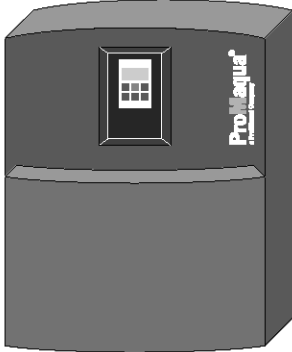
Remarks:

Electrolysis systems of type CHLORINSITU® II, III, IV and IV plus 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

Membrane Electrolysis Plants CHLORINSITU® IV compact



P_PMA_EL_0007_SW

Electrolysis systems of CHLORINSITU® IV compact type generate ultra pure chlorine gas in a vacuum process. For this purpose, a saturated salt solution is produced in the supplied salt dissolving tank that is then electrolysed in a membrane cell. Sodium hydroxide and hydrogen are produced in the cathode chamber while ultra pure chlorine gas and diluted residual brine are produced in the anode chamber from which it is separated by the membrane. The resulting chlorine gas is suctioned off through an injector integrated in the system and dissolved in the water to be treated as hypochlorous acid. The generated hydrogen 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 to be treated. The salt dissolving water comes from an integrated softening system, thereby preventing the formation of lime deposits and ensuring the long service life of the electrolysis cell.

The microprocessor controller integrated in the system digitally indicates the actual feed rate and monitors all key functions. All operating and error messages are shown in plain text on the clearly laid out display. The feed rate can be controlled manually or externally.

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

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

Technical Data

Type/ output g/h	Voltage supply	Power Uptake kW	Salt con- sumption 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).

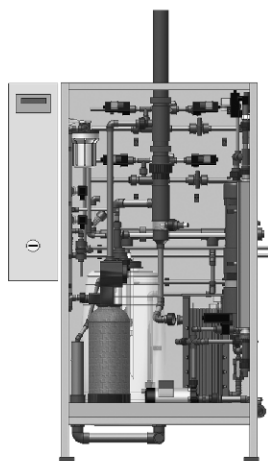
	Order no.
CHLORINSITU® IV compact 25	1036461
CHLORINSITU® IV compact 25 with pH correction	1036462
CHLORINSITU® IV compact 50	1036463
CHLORINSITU® IV compact 50 with pH correction	1036464
CHLORINSITU® IV compact 25 with integral pH and chlorine controller	1041405
CHLORINSITU® IV compact 25 with integral 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 Membrane Electrolysis Plants CHLORINSITU® IV



P_PMA_EL_0005_SW

Electrolysis systems of CHLORINSITU® IV type generate ultra pure chlorine gas in a vacuum process. For this purpose, a saturated salt solution is produced in the supplied salt dissolving tank that 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 suctioned off through an injector integrated in the system and dissolved as hypochlorous acid in the water to be 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, the diluted residual brine is disposed of. The salt dissolving water comes from an integrated softening system, thereby preventing the formation of lime deposits and ensuring the long service life of the electrolysis cell.

The systems are controlled with 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 through contact inputs.

Options:

- Analog input
- MOD-bus or PROFIBUS®
- Multiple injection points

Electrolysis systems of CHLORINSITU® IV type are suitable for all applications which require metering of hypochlorous acid with simultaneous pH value correction.

- Robust technology
- Compact, space-saving design
- Safe vacuum systems engineering
- 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 inexpensive cooking salt as a raw material and lower chemical consumption for pH correction.

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 supplied salt dissolving tank 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.

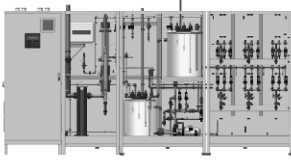
Remarks:

Electrolysis systems of type CHLORINSITU® II, III, IV and IV plus 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

Membrane Electrolysis Plants CHLORINSITU® IV plus



P_PMA_EL_0006_SW

Electrolysis systems of CHLORINSITU® IV plus type generate ultra pure chlorine gas in a vacuum process. For this purpose, a saturated salt solution is produced in the supplied salt dissolving tank that 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 further processed in two ways. Firstly as in CHLORINSITU® IV type systems the gas is suctioned off through an injector supplied with the system and dissolved as hypochlorous acid in the water to be treated. If the complete production output is not needed, excess chlorine gas can also be combined with the produced sodium hydroxide and then temporarily stored as sodium hypochlorite, as is the case with CHLORINSITU® III type systems. The system thus does not have to be adjusted to the maximum demand of chlorine gas but can be adjusted to the average daily demand. Process water consumption peaks in demand are covered by the additional metering of sodium-calcium hypochlorite from the temporary storage. As with chlorine gas, metering will be carried out through a central injector system.

The chloride-free sodium hydroxide is likewise stored temporarily and can be transferred into the water to be 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, the diluted residual brine is disposed of. The salt dissolving water comes from an integrated softening system, thereby preventing the formation of lime deposits and ensuring the long service life of the electrolysis cell.

The systems are controlled with 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 through contact inputs; analog inputs are likewise available.

Electrolysis systems of CHLORINSITU® IV plus type represent a particularly cost-effective alternative for all applications which require metering of hypochlorous acid with simultaneous pH value correction.

- Robust technology
- Compact, space-saving design
- Safe vacuum systems engineering
- 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 inexpensive cooking salt as a raw material and lower chemical consumption for pH correction.

4 CHLORINSITU® and Dulco®Lyse electrolysis systems

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
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 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:

Electrolysis systems of type CHLORINSITU® II, III, IV and IV plus 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

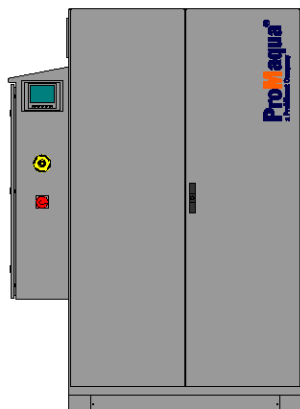
Other requirements:

P_PMA_ECA_0001_SW

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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.

Electrolysis systems of Dulco®Lyse type generate ultra pure chlorine gas in a vacuum process. For this purpose, a saturated salt solution is produced in the supplied salt dissolving tank that 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 generated hydrogen 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 cooking salt is required)
- Compact, space-saving design
- Economic operation thanks to use of inexpensive cooking salt as a raw material
- Control of the system with an integrated modem for remote diagnostics

Technical Data

Type/ output g/h	ECA production at 400 ppm l/h	No. of cells	Voltage supply	Power Uptake kW	Dimensions H x W x D mm	Salt solution tank volume l	
Dulco®Lyse 50	50	125	2	230 V / 50 Hz	1.65	2,100 x 1,500 x 355	130
Dulco®Lyse 100	100	250	4	230 V / 50 Hz	1.95	2,100 x 1,500 x 355	130
Dulco®Lyse 150	150	375	2	3 x 400 V / 50 Hz	2.25	2,100 x 1,500 x 355	130

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 container with level monitoring
- Automatic monitoring of the water hardness downstream of the softening system

	Order no.
Dulco®Lyse 50	1041423
Dulco®Lyse 100	1041424
Dulco®Lyse 150	1041425

Spare parts and maintenance kits

	Type	Order no.
Annual maintenance kit	Dulco®Lyse 50	1041426
Annual maintenance kit	Dulco®Lyse 100	1041427
Annual maintenance kit	Dulco®Lyse 150	1041428
3-yearly maintenance kit	Dulco®Lyse 50	1041429
3-yearly maintenance kit	Dulco®Lyse 100	1041430
3-yearly maintenance kit	Dulco®Lyse 150	1041431
Membrane cell	Dulco®Lyse 50	1041432
Membrane cell	Dulco®Lyse 100	1041433
Membrane cell	Dulco®Lyse 150	1041434
Membrane	Dulco®Lyse 50	1041435
Membrane	Dulco®Lyse 100	1041436
Membrane	Dulco®Lyse 150	1041437

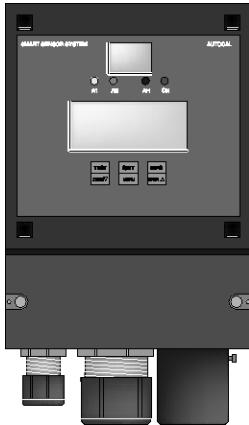
4 CHLORINSITU® and Dulco®Lyse electrolysis systems

4.11 Gas Warning Device For Monitoring For Chlorine Gas

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

Gas warning device type GMA 36

for monitoring for 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
Relay contact "Warning", self-resetting	230 / 1 V/A
Relay contact "Alarm", latching	230 / 1 V/A
Relay contact "Horn", 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

4

5 Calcium hypochlorite system ProCal

5.1 Calcium hypochlorite system ProCal

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, can be stored as a salt. It is only dissolved when required.

Advantages of calcium hypochlorite:

- Very easy handling.
- High 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 drinking 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.

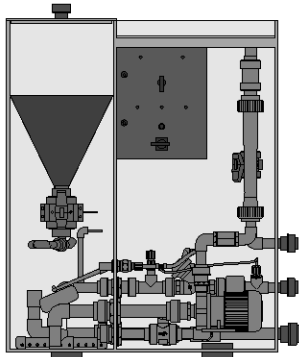
5.1.2 ProCal systems engineering

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 an impulse-pause signal. This signal controls the adding of granulate to the mixing chamber.

5 Calcium hypochlorite system ProCal

5.1.3 Calcium hypochlorite system ProCal



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 multichannel 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 2000 m ³ /h (2000 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

Drip pan with grating

Material	Weight	External dimension WxDxH	Effective area WxD	Collecting volume
	kg	mm	mm	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

Leakage sensor

	Order no.
Leakage sensor with approval mark	1009340

6 Membrane Technology

6.1 Overview 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 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 wide spread and may include different types of water.

Typical applications include drinking water, river water, process water, swimming pool water, seawater and waste water.

The tasks range from drinking water purification to meet physical and microbiological limit values in accordance with the German Drinking Water Ordinance up to the pre-treatment of seawater 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 facilitate an 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 be designed as a backwashing filter optionally.
- 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.

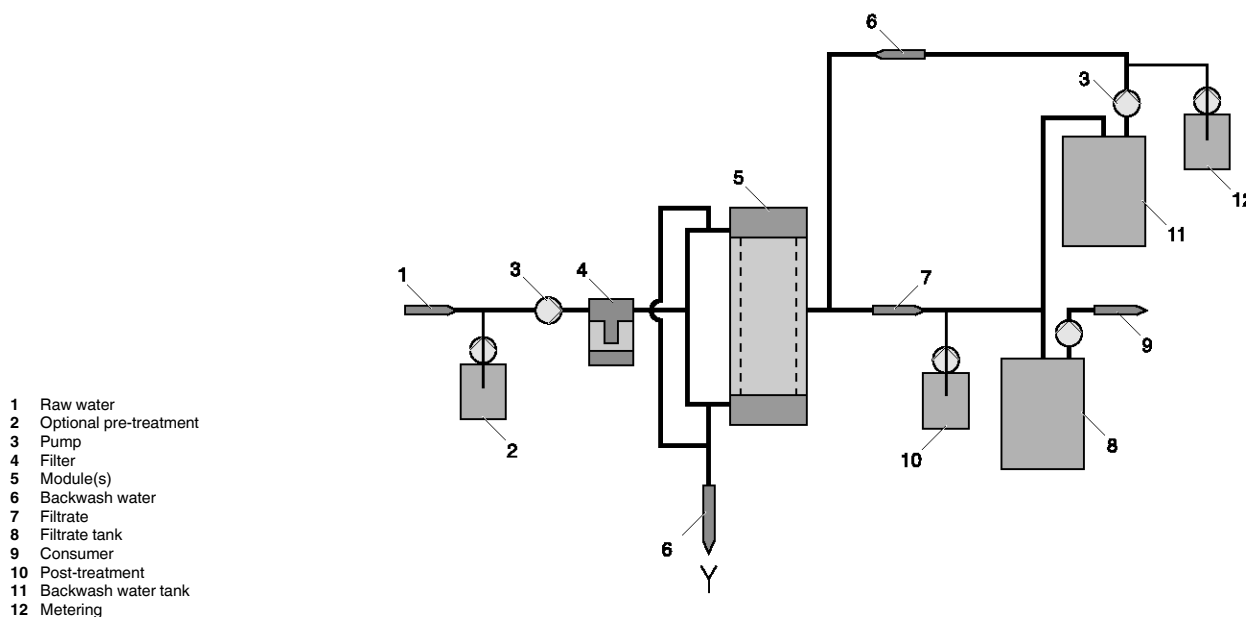
Ultrafiltration systems are available with a filtration capacity ranging from 1 to 80 m³/h at a water yield of > 96 %.

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 drinking water supplies. Ultrafiltration is predominantly used for the treatment of freshwater, in particular surface water, spring water or well water. In principle, brackish water and seawater can also be treated, e.g. as pre-treatment for a following 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:



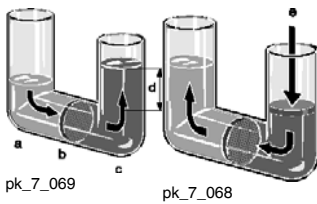
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Our engineers are using their wide experience in the water treatment to determine the ultrafiltration system which is adopted to the specific raw water requirements. If desired and/or required, the best-suited pre- and post-treatment is also determined. For this purpose, numerous further ProMinent® and ProMaqua® products are available. Thus, the customer is offered a complete package of solutions from one single source.

The filtration capacity of the 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



- 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: The cutoff 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. Advantage: 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. For this process, ProMaqua uses high-quality nano filtration membranes.

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 measurement 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

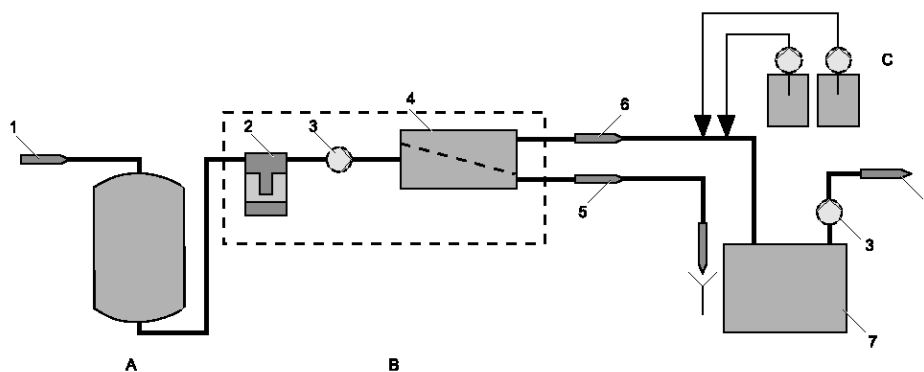
- Easy and safe operation ensured by ultramodern microprocessor control with integrated conductivity measurement and plain text display of operating status
- Efficient operation with a permeate yield of up to 80 % and up to 90 % separation of dissolved ions
- Low energy requirements through the use of 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 drinking 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 seawater, e.g. as a pre-treatment stage for further desalination in a reverse osmosis system.

Our engineers are using their wide experience in the water treatment to determine the nanofiltration system which is adopted to 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 the Dulcosmose® standard nanofiltration systems ranges from 1 to 50 m³/h. Other capacity ratings are available on request.

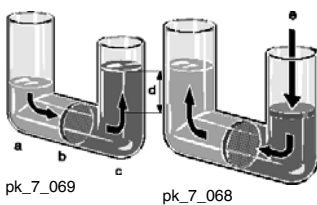
6 Membrane Technology

6.4 Performance Overview 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. An 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 for this process in its Dulcosmose® reverse osmosis plants.

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 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 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 measurement 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 sea water desalination)
- Long service life of the 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

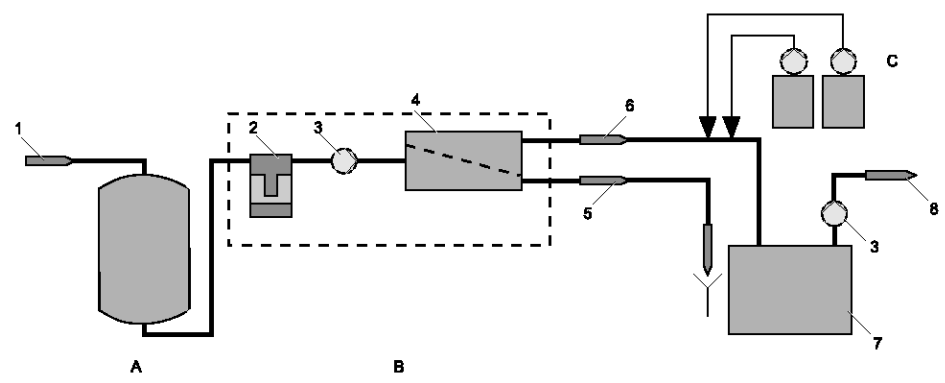
6 Membrane Technology

Applications of Dulcosmose® reverse osmosis plants

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

A typical general plant schematic 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:

- drinking 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 treatment of this raw water to determine - on the basis of the particular raw water analysis – the optimum variants for the suitable reverse osmosis plant for the customer. At the same time, the most suitable pretreatment 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

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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)

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6 Membrane Technology

6.5.2 Questionnaire on the design of an RO system

Clean water requirement: _____ m ³ /h	Available space HxWxD: _____ m
Clean water requirement: _____ m ³ /day	Location of the system: _____ Floor
Operating hours: _____ h/day	Location of the users: _____ Floor
Required clean water pressure: _____ bar	Existing clean water tank: _____ m ³
Raw water temperature, min./max.: _____ °C	Existing clean water pump: _____ m ³ /h _____ bar
Required quality of clean water:	Lift yes <input type="checkbox"/> no <input type="checkbox"/>
Conductivity: _____ µS/cm	H x W x D: _____ mm
pH value: _____	Door dimensions
Bacteriological quality:	H x W _____ mm
Drinking Water Directive <input type="checkbox"/>	Crane on site: yes <input type="checkbox"/> no <input type="checkbox"/>
Germ-free and sterile <input type="checkbox"/>	Lifting capacity: _____ t
Intended use of clean water: _____	Raw water pressure: _____ bar
Type of raw water:	Raw water connection: _____ "
Drinking water <input type="checkbox"/>	Clean water pipes available yes <input type="checkbox"/> no <input type="checkbox"/>
Well water <input type="checkbox"/>	Material: _____ Ø _____ "
Brackish water <input type="checkbox"/>	Mains voltage: _____ V/Hz
Lake water <input type="checkbox"/>	
or _____ <input type="checkbox"/>	
Fluctuations: yes <input type="checkbox"/> no <input type="checkbox"/>	
State fluctuations:	
Conductivity: _____ µS/cm	HCO ₃ : _____ mg/l
pH value: _____	SO ₄ : _____ mg/l
Ca: _____ mg/l	Cl: _____ mg/l
Mg: _____ mg/l	NO ₃ : _____ mg/l
K: _____ mg/l	F: _____ mg/l
Na: _____ mg/l	PO ₄ : _____ mg/l
Ba: _____ mg/l	CO ₂ (free): _____ mg/l
Sr: _____ mg/l	SiO ₂ : _____ mg/l
Fe: _____ mg/l	COD*: _____ mg/l
Mn: _____ mg/l	
Al: _____ mg/l	

*COD = chemical oxygen demand

6 Membrane Technology

6.6 Dulcoclean® Ultrafiltration Systems

6.6.1 Ultrafiltration Systems Dulcoclean® UF Range

This range is the all-purpose, compact ProMaqua model for modern drinking water treatment. These systems are equipped with very robust ultrafiltration membranes and are operated in an economical dead-end process. Compared to the cross-flow mode, this process requires significantly less water and energy. Backwashing processes are performed at regular intervals to prevent blockage of the modules. Adjusted to the raw water quality, cleaning is supported by the addition of chemicals as required. The system is controlled by a PLC. The system offers a high level of flexibility and operating safety, thanks to the wide range of different control options. Variations and changes in the raw water quality can thus be easily compensated for. All relevant events are detected electronically.

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

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.

Plant	Filtration capacity* at 15 °C m ³ /h	Number of 8" membranes No.	Dimensions H x W x D mm
Dulcoclean® UF 1	2.7 - 4.5	1	1,864 x 588 x 1,137
Dulcoclean® UF 2	5.4 - 9.0	2	1,864 x 588 x 1,638
Dulcoclean® UF 4	10.8 - 18.0	4	1,864 x 588 x 2,638

* Filtrate performance depends on the water quality

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

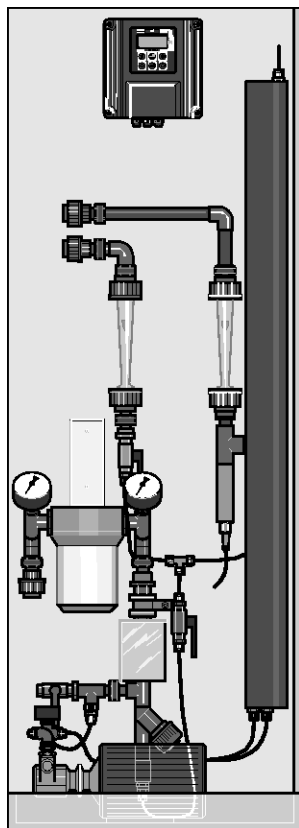
Optionally available are a fully automatic neutralisation system for the treatment of acid and alkaline backwash water, an integrity test as well as customized data logging.

6 Membrane Technology

6.7 Dulcosmose® Reverse Osmosis Plants

6.7.1 Dulcosmose® Reverse Osmosis Plants, ecoPRO

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



pk_7_062_V2

This range is the cost-effective standard system for modern drinking 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 piping or piping with pressure hoses throughout.

The system sizes ecoPRO 600-1500 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**

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*
ecoPRO 100	100	1	0.37	1,400 x 500 x 320	650
ecoPRO 200	200	2	0.55	1,400 x 500 x 320	650
ecoPRO 300	300	1	1.10	1,500 x 600 x 400	650
ecoPRO 550	550	2	1.10	1,500 x 600 x 400	650
ecoPRO 600	600	2	1.50	1,850 x 800 x 800	1,000
ecoPRO 900	900	3	1.50	1,850 x 800 x 800	1,000
ecoPRO 1200	1,200	4	1.50	1,850 x 800 x 800	1,000
ecoPRO 1500	1,500	5	2.20	1,850 x 800 x 800	1,000

* differing salinities affect the performance data accordingly

** as O₂

6 Membrane Technology

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

This range is the standard model for modern drinking 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 facilitate a cost-effective PVC piping. 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:

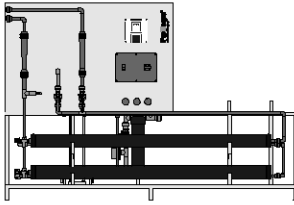
salt content max.	1,000 mg/l*
pH range	3.0 ... 10.0
silt density index max.	3
free chlorine max.	0.1 mg/l
total Fe, Mn max.	0.2 mg/l
total hardness max.	0.1 °dH
bacteria count max.	100 KBE/ml
turbidity max.	0.5 NTU
COD max.	5 mg/l**

* 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
				H x W x D mm
ecoPRO 1800	1,800	6	2.2	1,750 x 2,500 x 750
ecoPRO 2400	2,400	8	2.2	1,750 x 2,600 x 750
ecoPRO 2700	2,700	9	2.2	1,800 x 3,500 x 750



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6 Membrane Technology

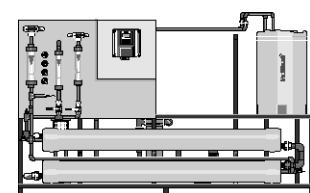
6.7.2

Dulcosmose® Reverse Osmosis Plants, TW Range

This range represents the universal model for modern drinking water desalination. Equipped with the latest generation of "ultra low-pressure" membranes, these plants achieve maximum permeate capacity at low operating pressures, so ensuring reduced investment and running costs. The low operating pressures allow the use of cost-effective PVC pipework 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, redox potential or pH measurement, and dosing 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:



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	Number of 8" membranes	Connected load	Dimensions	
				H x W x D	mm
	l/h	No.	kW		
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 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

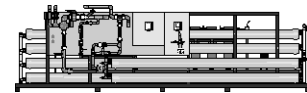
6.7.3

Dulcosmose® Reverse Osmosis Plants, BW Range

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, so 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 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:



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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).

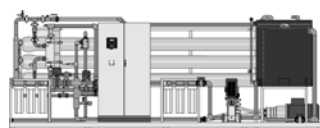
6 Membrane Technology

6.7.4 Dulcosmose® Reverse Osmosis Plants, SW Range

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, so 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 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 without	Connected load with	Dimensions H x W x D mm
			energy recovery kW	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

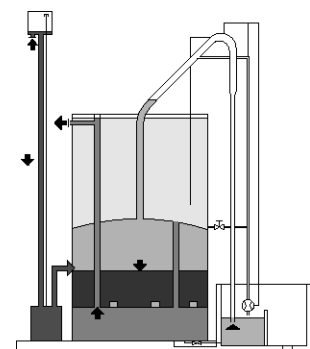
** Separate cleaning tank

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

6 Membrane Technology

7 Gravity Filter

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 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 gradually increasing drop in pressure.

The “back washing phase” begins once the minimum permitted pressure level is reached in the “operating phase”. Here, the impurities are flushed out of the filter layer. During the operating phase, water passes downwards through the filter, 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, creating a fluidised bed.

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

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

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 personell
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 sands 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 Filter

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 enquiry.	
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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