Operating Instructions Manual
OZONFILT® OZVa, Type 3

Please affix device label here!

Please read the operating instructions through completely before commissioning this equipment! Do not discard!
Any part which has been subject to misuse is excluded from the warranty!

Publishing Details:
Operating Instructions Manual
OZONFILT® OZVa, Type 3

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Subject to technical alterations.

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Instructions for use

This operating instructions manual includes all the information required to install, commission and operate the OZONFILT® OZVa. Please read through the operating instructions manual - particularly the safety guidelines - carefully.

Keep the instructions in an accessible place in the vicinity of the system.

These operating instructions incorporate pictograms as follows:

- ▶ Indicate step by step instructions.
- • Indicate enumerated points.

Safety guidelines are indicated with symbols:

WARNING

Could result in loss of life or serious injury if safety guidelines are not observed.

CAUTION

Could result in lesser injuries or damage to property if safety guidelines are not observed.

TAKE CARE

Could result in damage to property if safety guidelines are not observed.

Working guidelines:

GUIDELINE

Guidelines are intended to make your job easier.

1 Information about Ozone

1.1 What is ozone

Under normal environmental conditions, oxygen is a molecule which consists of two atoms. A dual bond links these two atoms. The chemical symbol for this molecule is O_2.

If energy is applied to this molecule, one of the links breaks, allowing another oxygen atom to fit into the space. The result is a molecule consisting of three oxygen atoms – ozone, O_3.

ozone molecule has a tendency to degrade to a lower energy level. It breaks down again after a short period, producing oxygen and heat. This short-life means that ozone cannot be produced in large quantities and stored but has to be produced on-site.

In its concentrated form, ozone is a colourless gas which is some 1.5 times denser than air. Therefore, ozone released near to ground level enriches the oxygen content of the surrounding air. Ozone gets its name from its characteristic odour (from the Greek ozein = to smell), which is perceptible even at a concentration of 1:500 000. This is the odour detected occasionally during electrical storms, or from photocopiers in frequent use. The odour threshold for ozone is in the region of 0.04 mg/m^3. Ozone gas is poisonous and is a powerful germicide. Relatively low concentrations cause extreme irritation to the mucous membranes in the nose and eyes. However, even in very low, non-hazardous concentrations, ozone can be detected by its characteristic odour. This warns anyone in the vicinity well before concentrations reach the higher levels, which could represent a danger to health.

Ozone is the most powerful commercially available oxidant. This is the basis for its application in the treatment and disinfection of drinking water, bathing water, process water and wastewater. Undesirable contaminants are oxidised into easily removable materials. The great advantage of ozone lies in the fact that after use it breaks down into oxygen which is already an inherent part of water itself. Ozone produces none of the unpleasant side effects associated with, for example, chlorine, so that water quality can be maintained at consistently high standards.

1.2 The Use of ozone in water treatment

A commercial application for ozone was made possible only by the invention of the ozone tube by Werner v. Siemens in 1857. In 1873 Fox determined that ozone possessed sterilising properties, which led to the first investigations into the use of ozone as a disinfectant in the treatment of water. At the turn of the century ozone was used for the first time in Germany in water treatment plants (Berlin, Wiesbaden and Paderborn). In 1906 and 1909 the first major water treatment plants to use the ozone process were built in Nizza and Paris.

In the nineteen twenties the ozone-disinfection process passed into obscurity. It was replaced by the more economical and technically simpler indirect chlorine process. The fifties, however, saw renewed efforts to develop applications using ozone. These resulted in the application of ozone not just as a disinfectant but as an oxidant in the treatment of water.

As well as the treatment of drinking water, ozone is used today to treat water in swimming pools, as a disinfectant in the food and drinks industry, to remove iron from tap water, as a bleaching agent in the manufacture of paper and textiles, for flue gas purification in large boiler systems and in the treatment of waste water.

1.3 Manufacturing process

Ozone is produced by the reaction of an oxygen molecule and an oxygen atom. The only commercial method which uses this process employs the principle of silent electrical discharge. The system produces ozone from a gas containing oxygen, usually normal air or pure oxygen. The gas is passed through an electrical field produced between two electrodes. The air is treated to ensure it is dry and free from dust particles.

Part of the oxygen in the air is converted into ozone in the electrical field. The air stream, which now contains ozone, is then fed to wherever it is required (e.g. into a mixing system for dissolving in water requiring disinfection).

1.4 Ozone applications: using ozone in swimming pool water treatment

1.4.1 The aims of water treatment in swimming pools

The aim of treating swimming pool water is to provide water which

- appears clear, clean and inviting to swimmers,
- prevents the growth of algae,
- has no unpleasant odour,
- feels pleasant on the skin,
- is of a pleasant temperature and
- contains no germs which could present a health risk to humans.

The water in swimming pools becomes contaminated with many different materials e.g. dust, organic substances from human bodies (sweat, skin particles, cosmetics) and microscopic organisms (bacteria, fungi and algae spores). At normal pool temperatures microscopic organisms can multiply rapidly and would soon turn a pleasant pool into an unsightly pond with an unstable acidity level (pH value).

Water treatment must therefore remove the contaminants contained within the water, restore the correct acidity level and eliminate undesirable micro organisms.

1.4.2 Conventional water treatment technology using chlorine

The following process are used in conventional water treatment technologies:

Suspended solids are removed from the water cycle via filtration. Filtration is generally carried out using fixed bed filters with filtration media of sand, anthracite and activated carbon.

Non-filterable materials such as suspended fats, or the phosphates which are partly responsible for the growth of algae, are converted into filterable form by flocculation. This process requires the continuous or periodic addition of aluminium salts.

Chlorine is used as a disinfectant where water is to be used by the general public and is also required for the safe disinfection of private pools. Organic substances dissolved in water are oxidised when chlorine is added. The side effect of this process, however, is the formation of undesirable by-products of the chlorine reaction. (Chief of these are, e.g. chlorine carbon compounds, e.g. trihalomethanes and chloramines).

Chloramines are responsible for the characteristic swimming pool odour. They lead to irritation of the skin and of the mucous membranes. Swimmers also absorb trihalomethanes, which are considered carcinogenic, through the lungs.

Products of the chlorine reaction and materials which are not removable by conventional technologies have to be diluted by the regular addition of fresh water in order to keep the water within acceptable safety and hygiene limits. At least 30 l of clean water must be added for every visitor to a public swimming pool.

1.4.3 Advantages of using ozone

The problems of conventional water treatment processes are drastically reduced by the use of ozone. The most effective available oxidant for the treatment of water; ozone is normally used prior to the filtration stage. Here, undesirable contaminants such as chloramines or dissolved solids, are oxidised and retained by the filter.

The result is perceptibly clearer water without the characteristic swimming pool odour. The trihalomethane content is reduced to significantly below permissible levels.

The advantages of using Ozone are as follows:

- The water has no odour.
- The air in the indoor swimming hall is pleasant and clean.
- Avoids bacterial growth on filters along with the associated dangers of infection.
- The flocculating effect of ozone results in a perceptible increase in water clarity.
- After reaction, ozone breaks down into oxygen, which is desirable in water, rather than into chemicals which can present a health hazard.

1.4.4 Ozone generating system for water treatment in swimming pools

Certain requirements must be met in order to use ozone technology in swimming pools:

Ozone must be added to the water in sufficient quantities. In order to ensure optimum dissolving of the ozone in the water, a high ozone concentration is required. DIN 19627 stipulates an ozone concentration of 20 g/m^3 under normal environmental conditions (T = 0 °C, p = 1013.25 mbar) for the treatment of water in swimming pools.

1.5 Glossary of terms in ozone technology

Ozone system

This term refers to the entire ozone system comprising:

- The ozone generating system
- A mixing system with
- A reaction tank and
- An exhaust ozone gas extraction system.

Ozone generating system

The part of the system in which ozone is generated. This section consists of the gas treatment system, ozone gas generator and the electronic controller.

Ozone generating element

Electrode system in which the input gas (air or pure oxygen) is subjected to a silent electrical discharge for the production of ozone.

Ozone generator

Term referring to all ozone generating elements.

Mixing system

The part of the system in which the ozonated gas from the ozone generating elements is mixed with the water requiring treatment. The mixing system consists of the ozone transfer system and a mixing system connected downstream.

Reaction tank

The reaction tank is connected downstream from the ozone mixing system. The reaction of ozone with the contaminants in the process water takes place here.

Exhaust ozone gas extraction system

The part of the system in which exhaust ozone is broken down.

2 System components and what they do

2.1 Overview

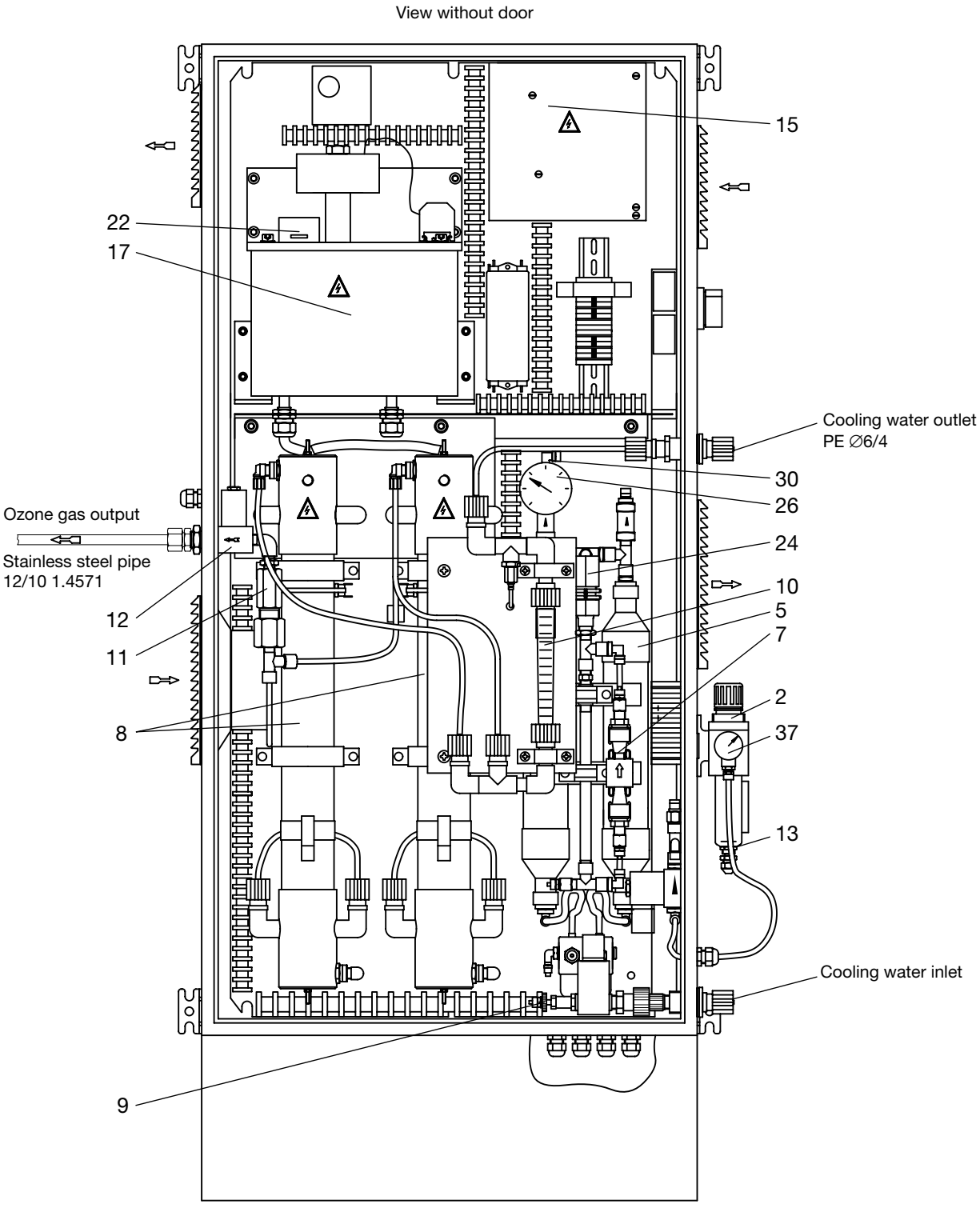


Fig. 1: System cabinet

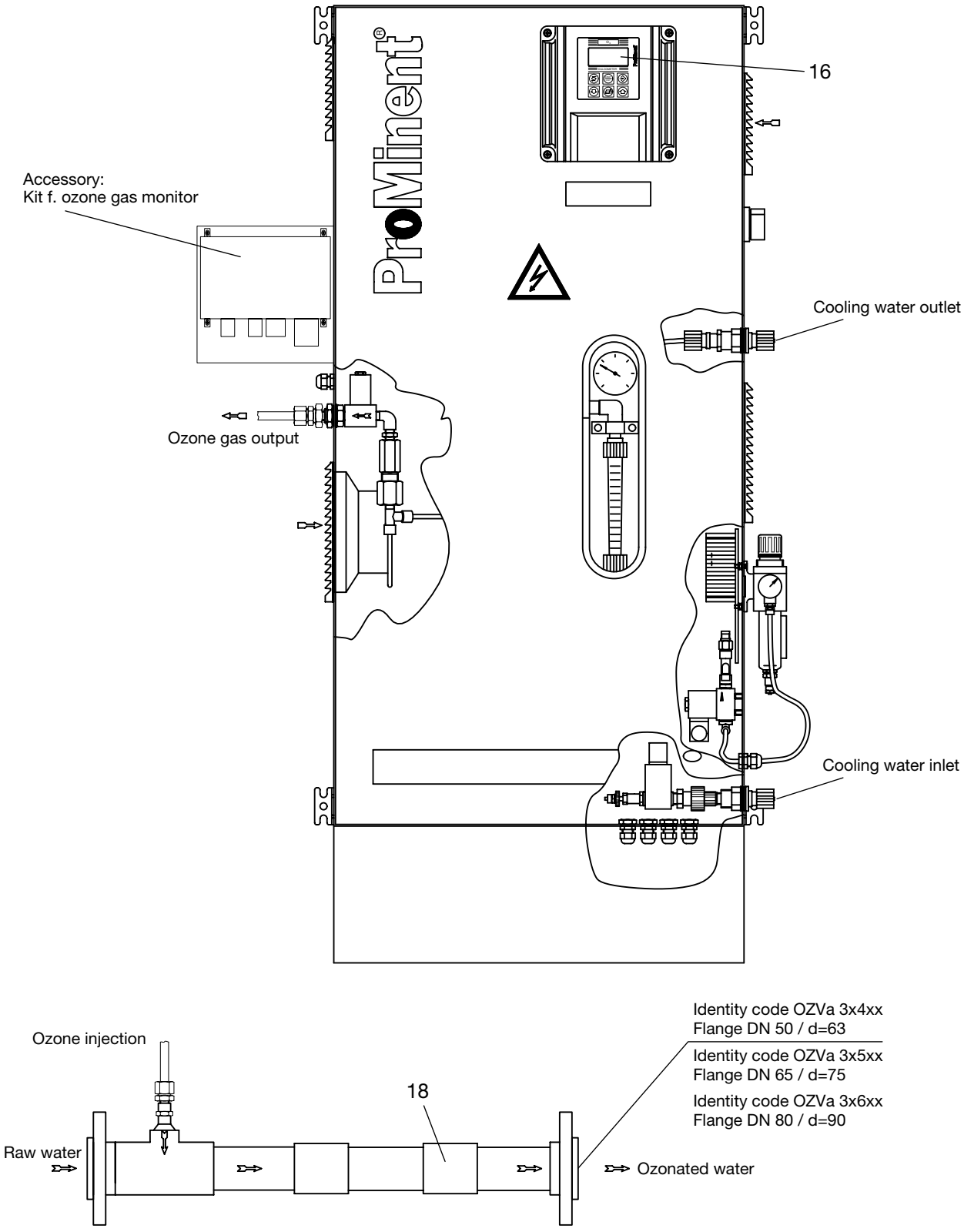


Fig. 2: Front view and mixing system

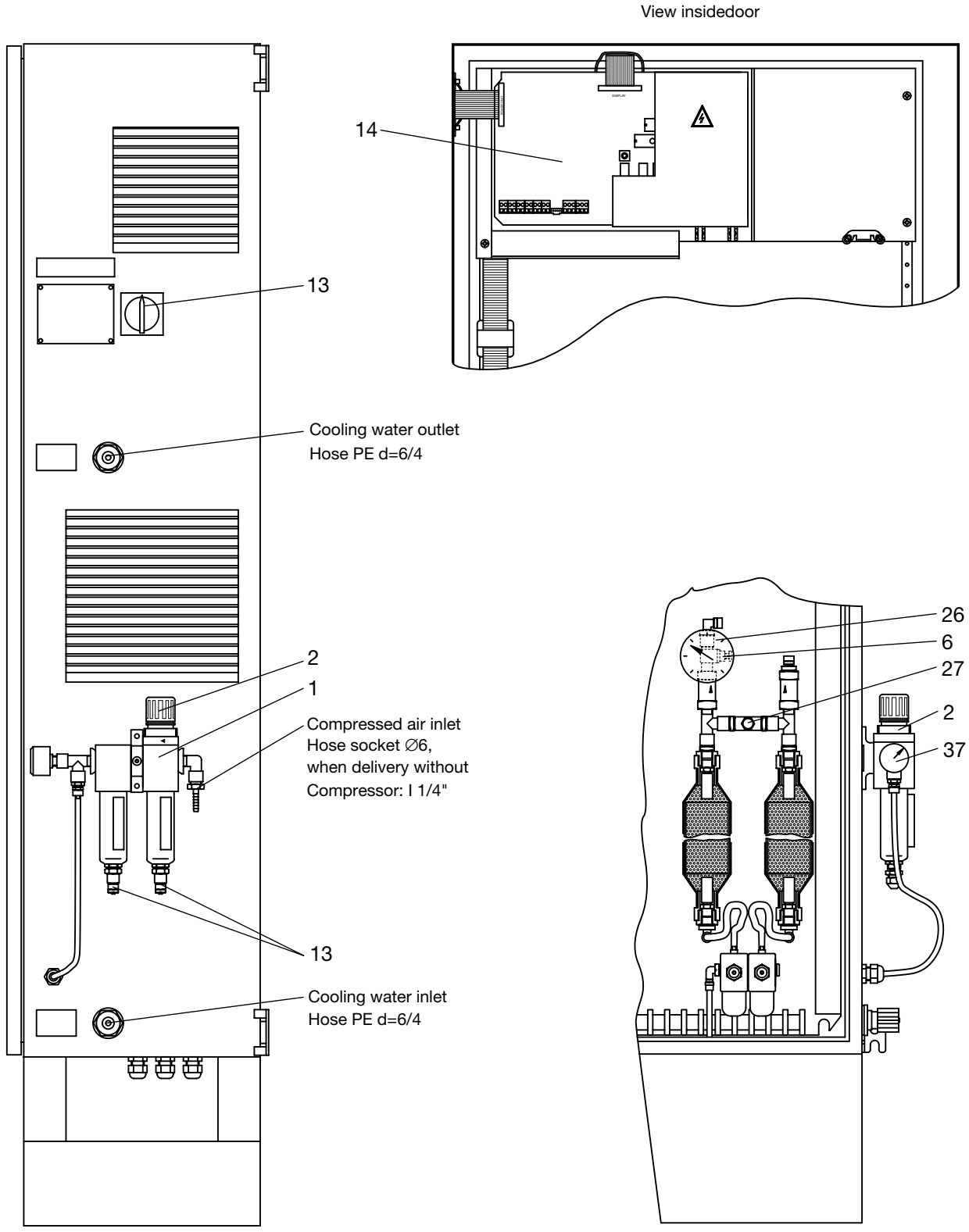


Fig. 3: System cabinet, right side

Fig. 4: Adsorber drier, front view

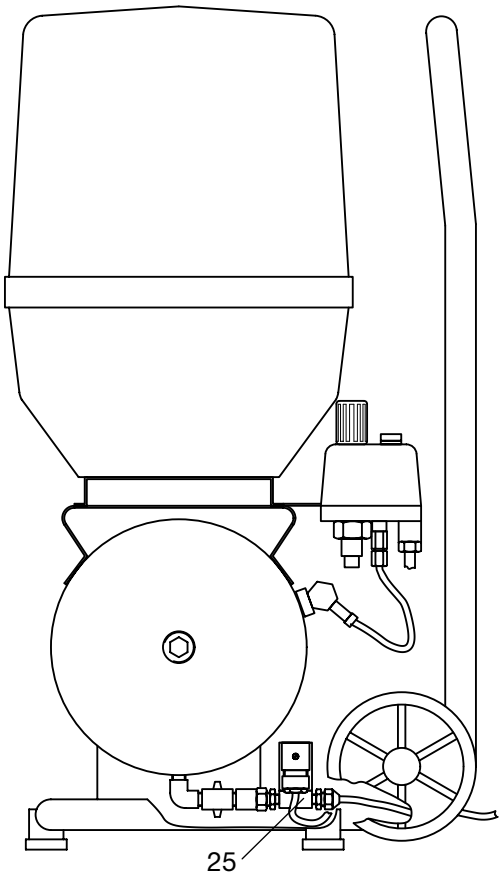


Fig. 5: Compressor unit with solenoid valve for drainage of condensate

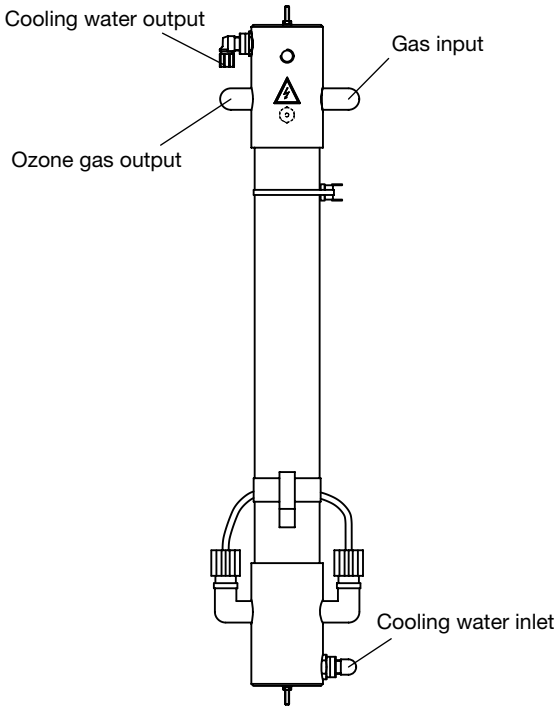


Fig. 7: Ozone generator

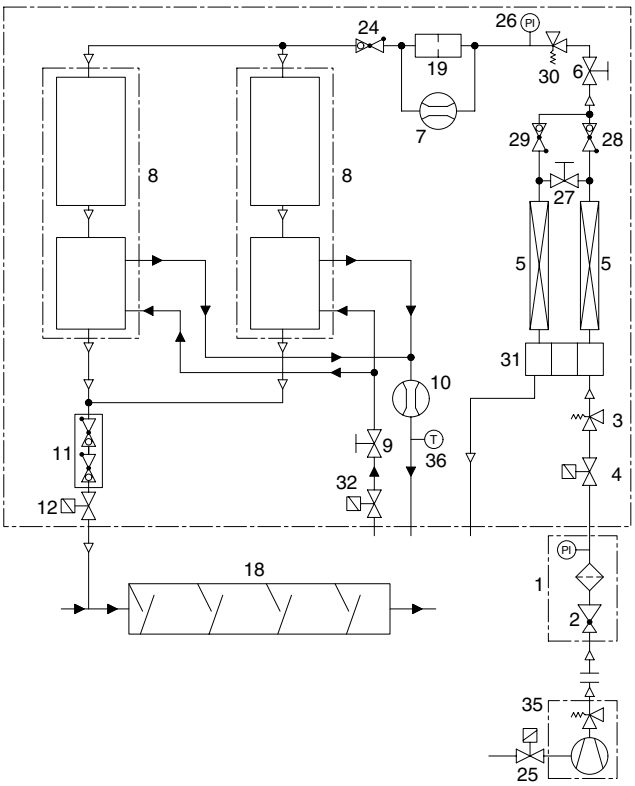


Fig. 6: Pneumatic flow diagram

1 air cleaning unit
2 pressure release valve
3 safety valve system input 7 bar
4 solenoid valve system input
5 drier unit
6 regulating valve operating air for ozone production
7 gas flow controller
8 ozone generator
9 regulating valve cooling water
10 cooling water flow controller with min. contact
11 double spring loaded back pressure valve
12 solenoid valve ozone output
18 mixing pipes
19 blind
24 spring loaded back pressure valve
25 solenoid valve for removing condensat from compressors vessel
26 manometer operating pressure ozone generator
27 regulating valve regeneration air
28 back pressure valve drier
29 back pressure valve drier
30 safety valve ozone generator 2.5-3 bar
31 solenoid valve block driers
32 solenoid valve cooling water input
35 compressor unit w. vessel, safety valve, pressure switch (6 bar < p < 8 bar) and condensat removing solenoid valve
36 temperature cooling water outlet

1	Air cleaning unit - filter	Residual oil and water from the compressed air are extracted by the filter.
2	Pressure release valve	Used to set the system priming pressure of approx. 6 bar.
3	System inlet, bypass valve, 7 bar	The bypass valve limits the system priming pressure to a maximum 7 bar.
4	System inlet, solenoid valve	The solenoid valve serves to direct the compressed air to the adsorber drier.
5	Adsorber drier	The adsorber drier reduces the dewpoint of the air intake to below -60 °C.
6	Regulating valve, process air	The process airflow is adjusted via the regulating valve.
7	Flow meter, gas	The gas flow meter measures and monitors the process airflow.
8	Ozone generator	In the water-cooled ozone generator, part of the oxygen contained in the air is converted into ozone via a process of silent electrical discharge.
9	Corner valve, cooling water inlet	The cooling water flow is adjusted at the corner valve.
10	Flow monitor for cooling water	Detects when the cooling water flow is below the minimum threshold.
11	Spring loaded double non return valve, ozone outlet	The spring loaded double non-return valve situated at the ozone generator outlet prevents any process water from escaping from the mixing tank into the ozone generator.
12	Ozonated air-loading valve	The solenoid valve transfers the ozonated air to the metering point and into the mixing tank situated downstream.
13	Bleed valve for air cleaning unit	Condensate which collects in the glass cylinder of the air-cleaning unit drains out here.
14	Electronic controller	The electronic controller is fitted with a microcomputer which controls and monitors the entire system.
15	HV transformer power supply	Controls the high voltage transformer.
16	Display and control unit	For the display and adjustment of control parameters.
17	High voltage transformer	This transformer produces the voltage; approx. 8000 V, required by the ozone generator.
18	Mixer	Mixes the raw water with the ozonated air.
19	Mixing tank	Where the raw water flow, now containing ozone, is extracted from the mixing tank outlet.
20	Raw water flow monitor	Monitors the flow of raw water.
21	Safety screen	Protects against contact with electrically charged parts.
22	Door trip switch	If the safety screen is removed the door trip switch turns the system off. After replacing the safety screen the system can be switched on again.
23	Main/emergency off switch	The system is switched on at the main switch. This switch also serves as an emergency cut-out switch.
24	Non-return valve, ozone inlet	The spring loaded non-return valve at the entrance to the ozone generator prevents ozonated air passing back out of the ozone generator and into the air drier.
25	Solenoid valve, compressor	The compressor solenoid valve opens periodically in order to release condensate from the pressure vessel.
26	Pressure gauge, ozone operating pressure	This pressure gauge displays the pressure in the ozone generator (maximum pressure 2 bar).
27	Regenerating air regulating valve	The regulating valve on the adsorber drier is used to readjust the regenerating airflow.
30	Ozone generator bypass valve	The bypass valve limits the operating pressure of the ozone generator to approx. 2.5 bar.

2.2 Functions of individual components

2.2.1 The air treatment system

The system requires air compressed to a minimum of 6 bar to be fed to the entrance to the air cleaning unit (2). The air-cleaning unit is designed for a maximum operating pressure of 10 bar.

The compressor (if supplied with the system) draws in surrounding air and compresses it to approx. 6 - 8 bar. The compressor incorporates a pressure vessel and a bypass valve which limits the operating pressure in the pressure vessel to approx. 8 bar. The pressure vessel acts as a buffer and allows the air which has been heated during compression to cool.

The water, which is precipitated during compression, is drained off via a solenoid valve (25) connected to the pressure vessel on the compressor. The solenoid valve is opened at regular intervals by the system controller. Most of the condensate from the compressor is thereby extracted from the pressure vessel.

The remaining condensate from the compressed air is removed from the compressor via the self-bleeding filter (1).

2.2.2 Adsorber drier

The adsorber drier (Fig. 4), connected downstream from the compressor, is designed for ambient temperature of a max. 40 °C and air humidity of up to 85 %. The pressure dewpoint of the air at the outlet (6) of the adsorber drier is less than -60 °C:

Preconditions

- The system priming pressure and the regeneration air quantity are maintained at levels given in 13 “Technical Data”.
- The maximum process airflow is not exceeded.

The process airflow is monitored by the electronic controller (14) to ensure the maximum threshold is not exceeded. If this value is exceeded the system switches off.

A corresponding failure message appears in the display.

The system incorporates two adsorber driers which proceed alternately through drying and regenerating phases. The phase-switching is controlled by the electronic controller (14).

Compressed process air for the ozone generator passes firstly through an adsorber which is dedicated to air-drying. The desiccant contained in the adsorber draws the residual moisture out of the air.

At the same time, a partial flow of dried air which has been decompressed to atmospheric pressure is fed to a second adsorber facing in the opposite direction. This serves to regenerate the desiccant, extracting and disposing of the water that it has adsorbed.

The phase switching time between drying and regeneration is set to ensure a stable pressure dewpoint (< - 60 °C) of process air even in unfavourable conditions.

The flow of process air is adjusted by the regulating valve (6) on the adsorber drier, and the flow of regenerating air is adjusted by regulating valve (27) (see Fig. 4).

The air quantities required for the correct use of the system are given in section 13 “Technical Data”.

WARNING

The system cabinet must be opened and the safety screen removed to adjust the airflows.

Please follow the safety guidelines in sections 5 and 9.

2.2.3 The ozone generator

The ozone generator contains two identical ozone generating elements. One element consists of a metal tube, a high-voltage electrode, an insulator and an earthed electrode. The dried air flows between the outer metal tube and the outer surface of the high-voltage electrode through the ozone generator. It then passes in the opposite direction between the inner surface of the high-voltage electrode and the insulator. By feeding the gas in this way, if the actual generator element seals become defective, it is impossible for ozone to leak out of the system. An alternating high voltage in the medium frequency range is passed between the inner high-voltage electrode and the earthed electrode. Cooling water is passed between the earthed electrode and the inner surface of the insulator. By means of silent electric discharge, a part of the oxygen contained in the air is converted into ozone. The voltage required depends upon the operating pressure; shown on the pressure gauge (26).

2.2.4 The ozone generator electronic controller

The system is fully controlled and monitored by the electronic controller (14).

The controller performs the following tasks:

- Controls the HV transformer power supply (15) for the generation of an alternating high voltage in the medium frequency range,
- Measures and monitors the system supply voltage,
- Measures and monitors the primary voltage of the high voltage transformer (17),
- Measures and monitors the primary current of the high voltage transformer (17),
- Measures and monitors the frequency for the high voltage generator,
- Measures and monitors the gas flow through the ozone generator,
- Measures and monitors the operating hours of the system,
- Monitors the cooling water flow,
- Monitors the process water flow,
- Time-controls the solenoid valves on the adsorber drier,
- Time-controls the water bleed valve on the compressor pressure vessel,
- Control of solenoid valves on the cooling water inlet, at the gas inlet and at the ozone outlet,
- Actuates a fault indicating relay to signal system failures,
- Allows the use of an isolated pause input,
- Allows the use of an isolated standard signal input (0/4-20 mA) for automatic control of the ozone quantity,
- Allows the use of a switch input for an ozone gas detector,
- Displays all relevant system parameters in the display and control panel (16),
- Processes all key commands entered at the display and control panel (16).

2.2.5 The electronic control of the power supply for the ozone generator

The electronic power supply controller (15) supplies an alternating voltage in the medium frequency range to the high voltage transformer (17). The high voltage transformer (17) thereby produces the alternating high voltage required for ozone generation. Supplying a medium frequency range voltage offers significant advantages for ozone generation as compared with the mains frequency supply that is normally used, improving the efficiency of the ozone generation and at the same time reducing the size of the actual ozone generator unit. The electronic controller also allows complete control of all system parameters for the ozone production process.

2.2.6 Mixing system

The ozone is fed to the process water flow via a non-return valve (11) and a solenoid valve (12). The spring loaded double non-return valve (11) prevents water from entering the ozone generator. The solenoid valve (12) is always closed when the system is in pause, stop or failure mode.

Mixing and dissolving is carried out immediately after metering by the mixers (18).

2.3 Safety equipment

2.3.1 Flow monitor

In accordance with German safety directives ZH 1/474 and GUV 18.13 (Directives for the Use of Ozone in Water Treatment), ozone may only access the mixing system when the process water flow is above the minimum flow threshold.

In addition, it is necessary to halt ozone dosage by stopping the circulation pump. This can be performed by the pause input on the electronic controller (14).

The system starts independently at the preset “Ozone reference value” when

- The pause signal is inactive (switch input XPs is closed),
- There is no other failure present.

2.3.2 Trip switch

In order to prevent contact with electrically charged parts, the OZONFILT® OZVa is fitted with a door trip switch (22).

WARNING

Do not short-circuit the door trip switch (22). This can result in life-threatening high-voltages passing through parts of the system. Even when the door trip switch is released, or the main switch is OFF, parts of the system may still be subject to mains voltage. For this reason the system must be disconnected from the mains power supply before any work is carried out on it.

2.3.3 Emergency cut-out in ozone system control room

The safety directives ZH 1/474 and GUV 18.13 stipulate that it must be possible to switch off ozone systems with an emergency cut-out switch (emergency command system). This emergency cut-out switch must be located in an easily accessed and safe position near the door of the ozone system control room. The emergency cut-out switch must cut off the electrical power supply to the system.

2.3.4 Main / Emergency off switch on system

The system is switched on via a mains power supply switch (23). This switch also serves as the emergency cut-out switch.

2.3.5 Bypass valves

The bypass valve (3) at the entrance to the system limits the priming pressure of the system to approx. 7 bar. The bypass valve downstream from the regulator, used to adjust the process airflow (6), limits the pressure in the ozone generators to approx. 2.5 bar. It thereby protects the electronic components from overload.

2.3.6 Non-return valves

The spring loaded non-return valve (24) at the entrance to the ozone generator prevents ozonated air from re-entering the air treatment system from the ozone generator.

The spring loaded double non-return valve at the outlet of the ozone system (11), upstream from the solenoid valve (12) and situated on the outlet side, prevents process water from escaping from the mixer into the ozone generators.

2.3.7 Gas detector

In accordance with the current German commercial trade associations' safety directives (ZH 1/474 and GUV 18.13), rooms in which ozone gas leaks might occur as a result of system failure must be monitored by a gas detector.

These directives apply to ozone systems with ozone generating capacity of 2 g/h or more, irrespective of whether the gas containing ozone is above (positive pressure systems) or below (negative pressure systems) atmospheric pressure.

The gas detector should be located at the point at which the highest concentration of ozone gas could be expected in the event of a system failure. In positive pressure systems the gas detector should be installed in the vicinity of the ozone generating system, in negative pressure systems, in the vicinity of the exhaust ozone gas destructor. The OZVa is a positive pressure system.

The alarm threshold of the gas detector can be set to an ozone concentration of 1.0 mg/m^3.

The gas detector must be fitted with optical and audio warning indicators.

In the case of the OZONFILT® OZVa the gas detector is fitted with an isolated alarm switch. This must be connected to the XOz input on the electronic controller (14) as instructed in the accompanying system circuit diagrams (see also Fig. 8.2 "Electronic In/Outputs").

Outside Germany, please observe applicable national regulations and directives.

3 Functional characteristics of the OZONFILT® OZVa

GUIDELINE

All references in this operating instructions manual relate to the numbering on Figures 1 to 5.

Ozone is generated in the OZONFILT® OZVa and mixed with water requiring treatment. To do this, it transforms a proportion of the oxygen in the surrounding air into ozone.

The functioning characteristics of the system are described with reference to the diagram (Fig. 6), the overview drawing (Fig. 1) and the following descriptions.

Internal system functions:

Electrical current

Mains power is fed to the electronic controller (14). The electronic controller controls the high voltage transformer (17) via the HV power supply (15) which supplies the electrical power used for the silent electrical discharge in the ozone generator.

The electronic controller also:

- Controls the solenoid valves
- Controls the compressor (if one has been supplied with the system)
- Monitors the system
- Controls an alarm system

The electronic controller is fitted with the corresponding terminals required to fulfil these tasks.

Airflow

Air is drawn into the system via an air compressor and compressed to a minimum of 6 bar and a maximum of 8 bar. The compressed gas is fed into an air-cleaning unit (1) where any residual oil and water is extracted. Using a pressure release valve (2) on the air-cleaning unit the system priming pressure is set to approx. 6 bar. The cleaned air is then fed, through a by-pass valve (3) set to 7 bar and a solenoid valve (4), to the adsorber drier (5). The adsorber drier reduces the dewpoint of the air intake to lower than -60 °C. After the adsorber drier (5) the gas passes, via an adjustable regulating valve (6) and a gas flow detector (7), to the ozone generator (8).

In the ozone generator a part of the oxygen contained in the air is converted to ozone via silent electrical discharge.

The pressure gauge (26) displays the operating pressure in the ozone generator.

The ozonated air is fed, via a non-return valve (11) and a solenoid valve (12), to the mixing system (18, 19) where it reacts with water contaminants.

The solenoid valves (4) and (12) halt the airflow in the event of failure or if the system is stopped. This prevents ozone from escaping from the system. The non-return valve (11) also prevents process water from entering the ozone generator. The non-return valve (24) prevents ozonated air from penetrating the air treatment system.

Cooling water flow

The cooling water is fed from the cooling water inlet to the corner valve (9). The cooling water flow can be adjusted via the corner valve. The cooling water is then fed to the ozone generator (8). The flow monitor (10) switches off the system if the water flow falls below the minimum threshold. The cooling water, now heated, is fed to the cooling water outlet. The cooling water flow is halted by a solenoid valve at the cooling water inlet in the event of failure or during a longer period of system standstill.

Raw water flow

The raw water is taken to the mixing system where the metering point (12) of the ozone gas is. In the mixing system (18) the raw water is mixed with the ozonated gas. The ozonated raw water flow (process water) can be extracted from the outlet of the mixing system (19).
The diameter of the mixer needs to be selected according to the raw water flow (see technical data, chapter 13).

Flow diagram of water treatment using the OZONFILT® OZVa, Type 3

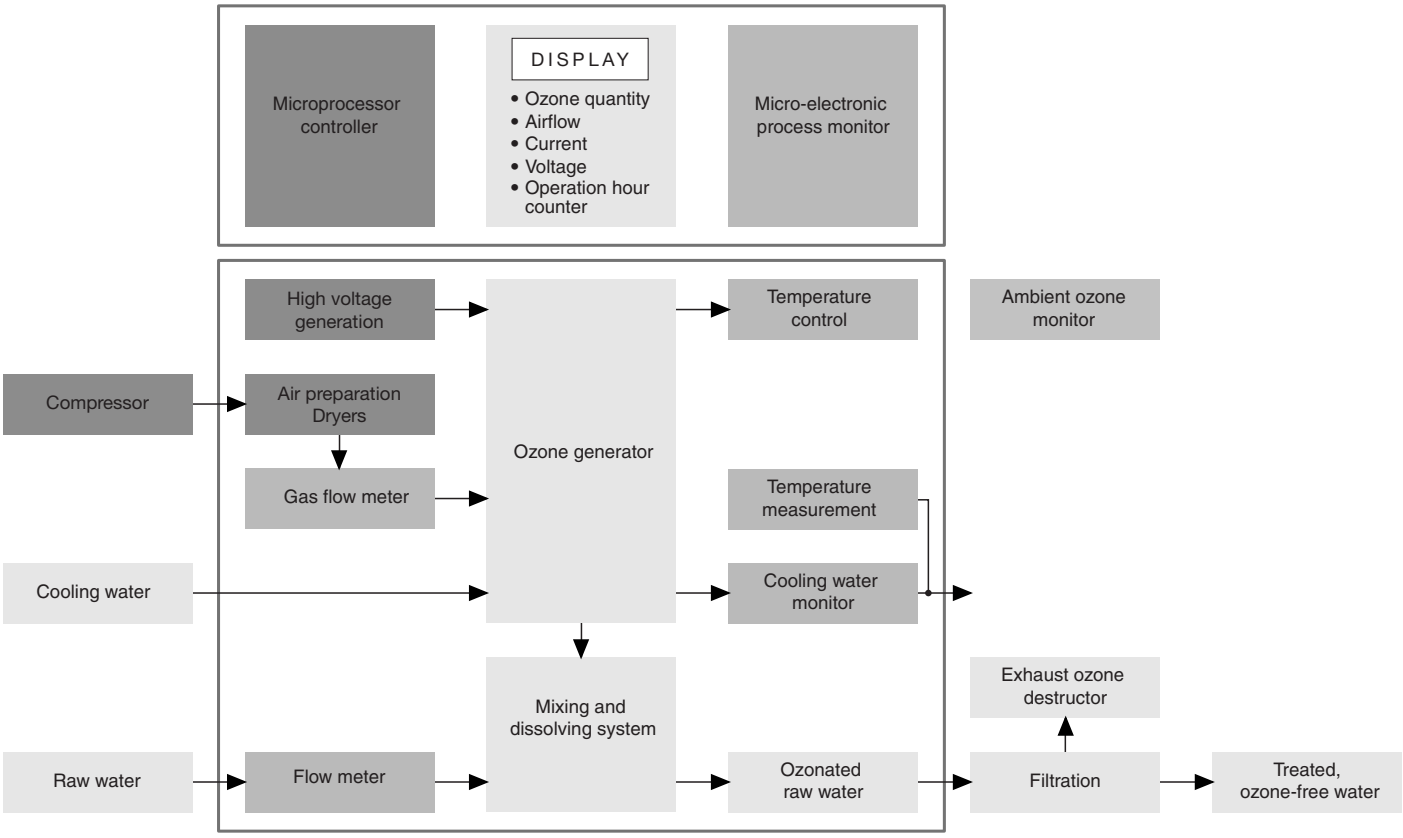


Fig. 7: Flow diagram of system

4 Application, design and integration of the system

4.1 Correct use

The OZONFILT® OZVa is an ozone generating and metering stage which has been developed for general water treatment for the purpose of oxidising water contaminants. Correct usage of this equipment requires the proper installation of the system in a water treatment system.

It is particularly important to follow the procedures outlined in section 7 “Assembly and Installation”. When installing in swimming pool systems it should be noted that the treated water must be entirely free from ozone prior to entering the pool itself.

4.2 System design

The OZONFILT® OZVa system has been designed for water treatment and is used to generate and meter ozone to a flow of raw water. The user can adjust the ozone concentration to any value between 0 and 100 % (see section 10, “Operation”, 10.6.1).

An on-site booster pump, if necessary with a pressure release/bypass valve, is required to supply the correct flow volume. DIN 19643, section 5 (Design) requires that the system should be fitted with a reaction tank downstream, to ensure a sufficient reaction period, and a filter with a layer of activated carbon. This should incorporate a means of venting exhaust ozone gas out of the building via an exhaust ozone gas destructor.

WARNING

Observe all general directives and safety regulations when installing and operating the system.

In Germany in particular the currently valid version of DIN 19627 and the directives for prevention of accidents to industrial employees (ZH 1/474 and GUV 18.13: Guidelines for the Use of Ozone in Water Treatment) must be observed. We recommend that these guidelines be read and the OZONFILT® OZVa ozone system be installed and assembled correspondingly.

GUIDELINE

The operator has the duty to create a working directive (including instructions for avoiding danger, and an alarm plan) taking into account the local conditions on side.

As further sources of information apart from the operating instructions manual, the following German directives of the main league of the trade associations and of the trade association of the chemical industry can be taken into consideration too:
a) ZH 1/474 “Directives for the use of Ozone in water processing”
b) ZH 1/262 “Spezification leaflet 052 Ozone”

4.3 Incorporating OZONFILT® OZVa into water treatment systems: swimming pool water treatment

4.3.1 Design of OZONFILT® OZVa

Swimming pools fitted with an ozonising stage are designed for a flow volume of 1.67 m^3/h per bather. The ozone dosage, depending upon pool temperature, is between 0.8 and 1.5 g/h ozone per m^3/h circulating flow volume. In water temperatures of above 30 °C, an ozone dosage of between 1.2 and 1.5 g/h per m^3/h circulating flow volume is recommended.

The OZONFILT® OZVa system is designed to treat a flow volume of between 10 - 35 m^3/h (depending upon mixer version, refer to chapter 13, Technical Data).

For larger flow volumes, the OZVa is connected in bypass.

If the raw water flow through the mixing system is lower than specified in chapter 13 (Technical Data) the mixing and dissolving performance maybe insufficient.

4.4 Ozone generating system for water treatment in swimming pools

Certain requirements must be met in order to use ozone technology in swimming pools:

Ozone must be added to the water in sufficient quantities. In order to ensure optimum dissolving of the ozone in the water, the ozone concentration in the gas phase must be high. DIN 19627 stipulates an ozone concentration of 20 g/m³ under normal environmental conditions for the treatment of water in swimming pools.

GUIDELINE

After the ozone metering point there must be fitted a reaction tank in which the ozone reaction can take place. The reaction tank should be large enough to ensure that the water takes 3 minutes to flow though the tank at maximum circulation volume (DIN 19643).

TAKE CARE

When treating swimming pool water, the filtration stage connected downstream must incorporate a layer of activated carbon in which the oxidised substances are retained. The exhaust ozone must be completely removed from the liquid before the water can re-enter the swimming pool.

The exhaust gas containing ozone must be vented out of the system via a gas exhaust valve. This gas exhaust valve must be located downstream from an exhaust destructor.

4.5 Installation

Fig. 8 illustrates the typical installation of the OZONFILT® OZVa into a pool water treatment.

See chapter 7.3 for details.

Typical Pool Installation of the OZONFILT® OZVa, Type 3

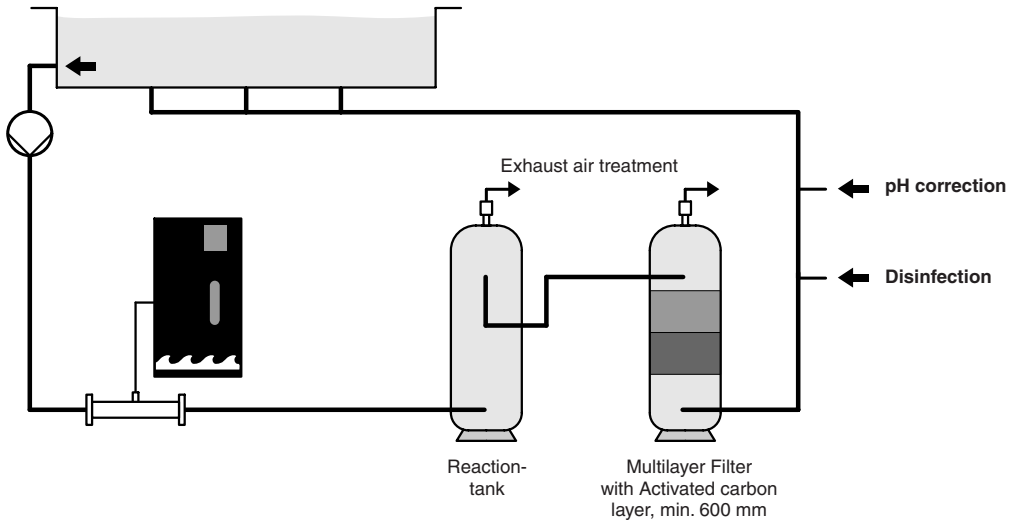


Fig. 8: Installation of OZONFILT® OZVa, Type 3 in a swimming pool

5 Safety Guidelines

OZONFILT® OZVa systems employ the latest technology in order to guarantee the highest level of operating and functional safety. In this section you will find all the information required for the safe operation of the system. Please read and observe the safety guidelines. Keep these instructions in an accessible place in the vicinity of the system.

5.1 Correct use

The OZONFILT® OZVa is an ozone generating and metering system which has been developed for general water treatment for the purpose of oxidising water contaminants. Correct usage of this equipment requires the proper installation of the system into a water treatment system.

5.2 Servicing and repair

WARNING

All maintenance and repair work must be carried out by qualified personnel who have been authorised by ProMinent.

Qualified personnel are persons who, as a result of specialised training and experience, have sufficient knowledge in the field of ozone systems, and are sufficiently familiar with relevant national legislature on safety at work, accident prevention, directives and general technical regulations to be able to correctly judge the safety conditions within an ozone system.

When installing in swimming pool systems it must be ensured that the treated water is completely ozone-free before being fed into the pool.

Interference from unauthorised personnel renders void all guarantees or liability claims on behalf of the operator.

5.3 Displaying safety signs

The warning/prohibition notice accompanying the system must be displayed at the entrance to the control room of the OZONFILT® OZVa in accordance with the German guidelines for ozone systems DIN 19627.

This sign bears the inscription:

“Ozone system - access only to trained personnel”, the hazard symbol and the no smoking symbol.

The sign must be permanently fixed in position and clearly recognisable.

5.4 General guide to safety equipment

WARNING

- **Never decommission safety equipment!**
- **Never bypass or short-circuit a safety device!**

5.5 Electrical safety equipment

5.5.1 Emergency cut-out in ozone system control room

The safety directives ZH 1/474 and GUV 18.13 stipulate that it must be possible to switch off ozone systems by an emergency cut-out switch (emergency command system). This emergency cut-out switch must be located in an easily accessed and safe position near the door of the ozone system control room. The emergency cut-out switch must cut off the power supply to the system.

5.5.2 Main / Emergency cut-out (23) switch on system (Fig. 3)

The system is switched on via a mains power switch (23). This switch also serves as the emergency cut-out switch.

5.5.3 Trip switch (22)

WARNING

Do not short-circuit the door trip switch (22). This can result in life-threatening high-voltages passing through parts of the system. Even when the door trip switch is locked, or the main switch is OFF, parts of the system may still be subject to mains voltage. The system must be disconnected from the mains power supply before any work is carried out on it.

5.6 Operating safety equipment

5.6.1 Flow monitor

In accordance with safety directives ZH 1/474 and GUV 18.13 (Directives for the Use of Ozone in Water Treatment), ozone may only access the mixing system when the process water flow is above the minimum flow threshold.

For this reason it is necessary to stop the ozone generation if the raw water flow is below a lower limit (suggestion: 50 % of the nominal flow through the mixer).

There are two possibilities to perform the interlocking:

- if the installation allows it, the system can be interlocked with a potential free contact at the circulation pump connected to the pause input of the plant (refer to chapter 8.2). When the circulation of the main water stream is stopped, then the ozone plant is automatically switched into pause state.
- if the interlock of the system with the circulation pump is not possible, it is necessary to install a flow monitor with minimum contact at the raw water input of the mixing unit. The minimum contact must be connected to the input XPD of the controller board (refer to chapter 8.2).

The flow monitor device with min.-contact is not included in standard delivery content.

The system starts automatically at preset “Ozone reference valve” when

- the pause signal is inactive (switch input XPs is closed),
- the flow monitor (if connected to input XPD) registers a, sufficiently high raw water flow,
- there is no other failure present and
- the system is not deactivated via “STOP/START” key.

Refer to chapter 8.2 and the terminal diagrams for details of the electrical installation.

5.6.2 Gas detector

In accordance with the current German commercial trade associations’ safety directives (ZH 1/474 and GUV 18.13), rooms in which ozone gas leaks might occur as a result of system failure must be monitored by a gas detector. These directives apply to ozone systems with ozone generating capacity of 2 g/h or more, irrespective of whether the gas containing ozone is above (positive pressure systems) or below (negative pressure systems) of the atmospheric pressure.

The gas detector should be located at the point at which the highest concentration of ozone gas could be expected in the event of a system failure. In positive pressure systems the gas detector should be installed in the vicinity of the ozone generating system, in negative pressure systems, in the vicinity of the exhaust ozone gas destructor.

The alarm threshold of the gas detector can be set to an ozone concentration of 1.0 mg/m^3.

The gas detector must be fitted with optical and audio warning indicators.

Outside Germany, please observe applicable national regulations and directives.

6 Delivery Range, Storage and Transport of the system

6.1 Options

The system comprises several component groups:

Minimum installation:

Control cabinet with

a) Air cleaning unit (on the outside of the control cabinet),

b) Adsorber drier and airflow monitoring unit,

c) Ozone generator,

d) Electronic controller with display and control panel,

e) Electronic HV transformer power supply for the ozone generator,

f) Mixing system.

Enhanced installation (on request only):

g) Compressor (the compressor is located outside the control cabinet),

h) Ozone gas detector.

The compressor is included in the equipment if indicated in the order. The ozone gas detector, required in order to comply with conditions for the correct use of the system, is available as an optional accessory.

TAKE CARE

Those component groups required in order to comply with the conditions for correct use of the system, e.g. the adsorption filter, reaction tank and exhaust ozone exhaust gas destructor, are not included in the delivery range of this system.

6.2 Storage

TAKE CARE

The system must be stored at a temperature of between 5 °C and 40 °C.

6.3 Transport

WARNING

- **The system must be transported with care. Take extra precautions to protect the system from jolting en route.**
- **When unpacking, ensure the system is placed on a stable base.**

7 Assembly and Installation

7.1 Safety Guidelines

WARNING

The system produces ozone gas using high voltages. For safety reasons, this system must be maintained and commissioned by qualified personnel. Unauthorised handling of the system or any part of the system may result in life-threatening high voltage electrical shocks or the leakage of toxic gas.

Qualified personnel must receive training in this system from the manufacturer.

7.2 System location requirements

The system produces ozone gas using high voltages. For safety reasons, this system must be maintained and commissioned by qualified personnel. Unauthorised handling of the system or any part of the system may result in life-threatening high voltage electrical shocks or the leakage of toxic gas.

Qualified personnel must receive training in this system from the manufacturer.

The directives for the use of ozone for water treatment (ZH 1/474 and GUV 18.13) stipulate that ozone systems are to be located in closed secure rooms to which access is permitted only to authorised personnel.

In addition, rooms where ozone systems are located must not contain any permanent workplaces. If this requirement is not met, technical measures must be taken to ensure that the ozone concentration in the room cannot exceed the MAK value of 0.2 mg/m^3 (as for toilets with no direct exit to the outdoors).

The control room must be monitored by a gas detector which will switch off the system in the event of a gas leak.

The surrounding air must be free from dust and aggressive fumes.

The surrounding temperature must not exceed 35 °C and the relative humidity must not exceed 85 % (non-condensing).

7.2.1 Displaying safety signs

The warning/prohibition notice accompanying the system must be displayed at the entrance to the control room of the OZONFILT® OZVa in accordance with DIN 19627.

This sign bears the inscription:

“Ozone system - access only to trained personnel”, the hazard symbol and the no smoking symbol.

The sign must be permanently fixed in position and clearly recognisable.

7.3 Requirements of the system components

TAKE CARE

Ozone-resistant material must be used for all system components which can come into contact with ozone in either gas form or in an aqueous solution. This applies especially to the pipe work system, the reaction tank, the activated carbon filter including all exhaust gas components and wherever there may be possible contact with ozone.

7.3.1 Mixing modules

The mixing modules need to be selected according to the water flow:

Flow volume of the process water through the OZONFILT® OZVa:

Flow volume	Diameter	Identity code (see device label)
10 - 15 m³/h	DN 50	OZVa x x 4 x X
15 - 25 m³/h	DN 65	OZVa x x 5 x X
25 - 35 m³/h	DN 80	OZVa x x 6 x X

Pressure range at the ozone outlet 0.8 - 2.0 bar.

For the connection of the ozone gas outlet to the dosage point at the mixing module a stainless steel pipe connection is necessary.

In the standard delivery of the OZVa two steel pipes (1.40 m length, diameter 12/10, material 1.4571, order number 15743) and one angle union (90° D12-D12, order number 1006397) are enclosed.

Longer steel pipes and more angle unions are available on request.

CAUTION

The pipe length and the number of connections has to be minimized, for safety reasons.

According to the German safety guidelines a gas warning device is necessary in each room with a connection point of the ozone gas pipe.

CAUTION

The pipework has to be tested for leakages.

In order to do that the OZONFILT® OZVa is set to 0 % ozone production and switched on with nominal gas flow at the expected operation back pressure.

7.3.2 Reaction tank (optional accessory)

In order to exploit the capacity of the ozone thoroughly, the reaction time at pool installations must be at least 3 minutes. This can be achieved by installing a reaction tank or increasing the freeboard of the filter located downstream. This is where the water contaminants are oxidised and disinfection takes place. The exhaust gas remaining in the water must be vented out of the system by means of an “exhaust ozone gas extraction system”.

7.3.3 Filtration (optional accessory)

In a swimming pool system the ozonising stage must be followed by a filter. The filter removes destabilised colloids, clumped and coated micro organisms, ozone-flocculated organic reaction products and dissolved, residual ozone from the water. For this purpose, open rapid filters complying with DIN 19695 as multi-layer filters, activated carbon filters or mixed bed filters are used.

The filtration system must be fitted with a powerful gas exhaust system for the extraction of gas containing exhaust ozone. The gas extraction system must be ozone-resistant and should be checked at regular intervals to ensure it is functioning correctly.

CAUTION

If the function of the gas extraction system in the filters or reaction tank is not guaranteed there exists the danger that ozonated water will pass through the system into, e.g. the swimming pool. This must be prevented from happening at all costs by adequate maintenance of the reaction tank and the filter system.

The filtration system should be installed so that it cannot run dry. The clean water pipe should be fitted above the upper liquid level so that the highest point is situated above the filter. A pipe bleed valve should be installed at this point.

In order to avoid airlocks the clean water outlet (leading to the pool) should be regulated after ventilation. The regulating mechanism should be situated beneath the surface of the water.

A non-return valve is fitted inside into the raw water inlet (coming from the pool) to prevent water flowing back into the pool.

7.3.4 Exhaust ozone gas extraction system (optional accessory)

ProMinent uses activated carbon cartridges for the removal of exhaust ozone. The water should be extracted from the exhaust gas mixture which emerges from the reaction tank and the filter using a suitable pipe outlet. The purified air is eventually vented out of the building.

7.4 Mechanical Assembly

7.4.1 System cabinet

WARNING

After unpacking, care should be taken that the system is placed on a stable base.

The OZVa 4 is supplied in a floor standing control cabinet.

The system should be put in a place which allows easy access for maintenance work.

Additional fixing at the backwall is necessary. If this is not possible the cabinet has to be secured against falling over.

At the left and rigtht side a space of 30 cm at least is necessary for proper operation of cooling fans, and for easy access to the air cleaning unit for maintenance purposes.

Assembly materials

The following assembly components are supplied with the system:

- 4 stern screws M8x80
- 8 rubber spacers (for assembly with mounting plates only)
- 4 washers, 24 mm Ø
- 4 nuts M8

Assembly steps

Assembly

- ▶ Drill 4 x 10 mm Ø holes for the plugs (as shown in the drilling plan).
- ▶ Screw M8 bolts into plugs.
- ▶ Put the cabinet in place.
- ▶ Place washers over bolts.
- ▶ Fix the system in position using the nuts provided.

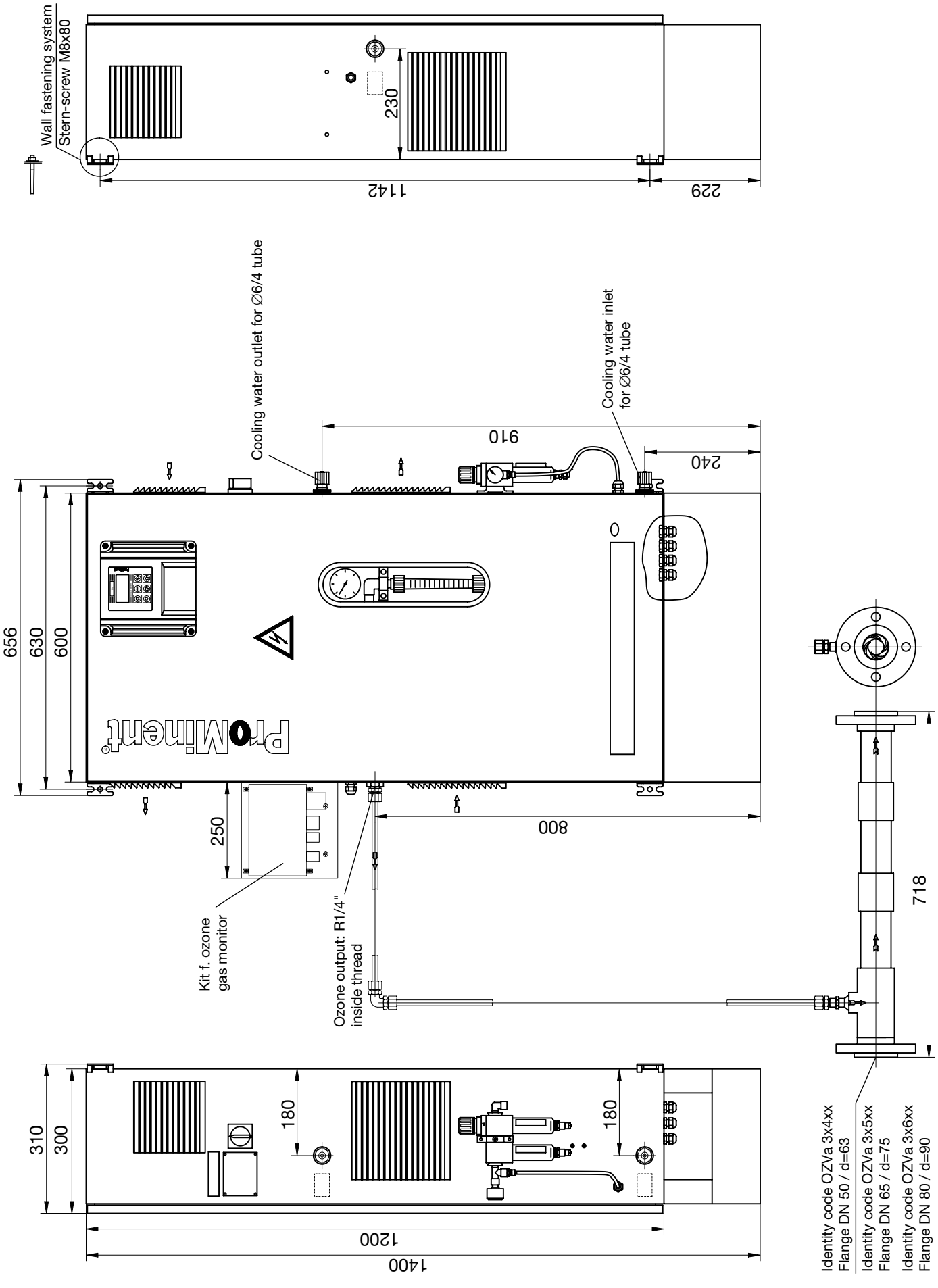


Fig. 11: Measurements and installation plan

7.4.2 Raw water pipes

All pipes

- To the system (raw water inlet: see Fig. 1) and
- From the system (ozonated water outlet: see Fig. 1)

should be made of rigid PVC, range 5. Ensure that they are laid free from stress. Keep all connecting pipes as short as possible (max. 5 m).

The raw water pipe leading to the system must be fitted with a non return valve in an ozone-resistant material.

The outlet pipe should be arranged in such a way that it is rising continuously. If the connection point on the reaction tank/filter is lower than the line itself, the height difference must be compensated by a pipe inserted vertically. The height difference at the outlet of the OZONFILT® OZVa must not exceed 1 m.

7.4.3 Compressed air system

▶ If the system is supplied with a compressor this is connected using the delivery hose supplied (Ø 12 mm) from the hose nozzle of the compressor to the air cleaning unit inlet (2) on the left hand side of the system. The hose ends are clamped tightly to each nozzle (compressor and system inlet) using the hose clamps supplied.

▶ **The hose and the connections have to be tested for leakages after installation.**

The PE tube supplied with the compressor (4 mm) is attached to the hose nozzle on the solenoid valve (25) on the compressor. This is used to bleed the condensate from the pressure vessel. The hose should be fed to a suitable container in which to collect the condensate expelled from the pressure vessel.

During automatic condense bleeding, small amounts of water can drain out of the hose on the bleed valve (25) on the compressor and the bleed valves (13) on the air-cleaning unit (2). The quantity of condensate referred to depends upon the air humidity in the location where the system is in use. It is recommended that the condensate be collected in a container with a capacity of more than 5 litres (not supplied with system). The container should be emptied regularly in order to prevent it from overflowing.

▶ This also applies to the bleed valves (13) on both filter containers on the air-cleaning unit (2). For condensate drainage, use the polythene (Ø 6x4) delivery hoses (supplied). Delivery hoses should be attached to the hose nozzles located on the underside of both filters. Both delivery hoses must be fed to the collection container.

▶ **All condensate hoses should be fixed in a suitable way in order to prevent undue movement during bleeding.**

TAKE CARE

Take care that the regenerating air hose projecting from the bottom of the system (PE delivery hose, one open end) does not become blocked. The regenerating air hose must be allowed to bleed unobstructed.

▶ If the system was not supplied with a compressor, a suitable pneumatic connection should be created from the air compression system to the inlet of the air cleaning unit (2) on the right hand side of the system.

CAUTION

The connection from the air compression system to the main system must be sufficiently pressure resistant for the air compression system. The maximum positive operating pressure, however, must not exceed 10 bar (see section 13 “Technical Data”).

7.4.4 Cooling water system

- The cooling water system connections are made using PE delivery hoses (diameter 6x4) which are attached to the system cabinet using the PVC connector set provided (see Fig. 2).
- Ensure, when attaching hoses, that the O-rings are located in the groove of the PVC threaded connector.
- The connection of the delivery hose to the cooling water inlet with the cooling water supply can be created with the screw-in threaded connector (6/4-3/8"a), nickel-coated brass).

Specifications for the cooling water quality for the **ozone generator**:

TAKE CARE

If water priming pressure fluctuates widely or the water supply system has become fouled, a filtration pressure relief valve should be installed upstream from the cooling water inlet.

Flow volume (cooling water):	40 - 100 l/h
Cooling water inlet pressure:	Max. 5 bar, no pressure surges
Cooling water outlet:	Zero pressure
Cooling water quality:	Drinking water, **not desalinated water**
Water temperature:	< 30 °C in ambient temperatures below 35 °C < 25 °C in ambient temperatures from 35-40 °C

8 Electrical installation

8.1 Guidelines to electrical connections

All electrical power leads to the system are passed into the system through the strain-relieving threaded connectors on the underside of the system (see Fig. 2). The power leads are laid in the ducts provided. After installation the threaded connectors are tightened. Any unused connectors are sealed using the blind plugs provided.

TAKE CARE

The system is fully wired and ready for use. It simply needs connecting to a single-phase mains power supply. Ensure that *phase, zero and earth leads* are connected in accordance with the system circuit diagram.

The system must be permanently connected to the power supply. It may not be plugged into a mains power supply via a domestic power cable!

Faulty connection to the power supply prevents correct functioning of safety equipment, in particular the trip switch, which deactivates the system when the door is opened.

It must be possible to isolate the electrical socket with an emergency switch (emergency cut-out system). This should be installed in an easily accessed position near to the entrance door to the system room.

- ▶ It must be possible to deactivate the ozone system by stopping the water treatment system booster pump via the pause input XPs on the controller circuit board (see 8.2) “Electrical In and Outputs”).
- ▶ If the system is supplied with a compressor, the time controller must be electrically connected to the solenoid valve (25) to control the condensate bleed function on the pressure vessel on the compressor. The connection lead (approx. 1.5 m long) with lead end is fed out through the strain-relieving threaded connectors on the underside of the system. It then simply requires screwing onto the solenoid valve on the compressor’s pressure vessel. Take care that the rubber washer provided is placed under the lead end.
- ▶ The compulsory gas detector must be fitted with an electrically isolated contact which is connected to the clamps X3:11 and X3:12 (see circuit diagram).
- ▶ All other electrical connections must be made in accordance with the accompanying system circuit diagram.

8.2 Electrical inputs and outputs

The system is provided with the following inputs and outputs for the control of the ozone generator (see Fig. 13 “Electrical connections on the controller circuit board“):

- An ozone gas detector can be connected to the clamps X3:11 and X3:12 (see circuit diagram). The gas detector used must be provided with an isolated alarm switch which is connected to the clamps.
- Standard signal input (X3:7 and X3:8 (0/4-20 mA)) for the control of the ozone quantity within a range of 0 % to 100 %. A current of 0 and/or 4 mA (depending upon the pre-settings in menu option “0/4-20 mA”) corresponds to an ozone quantity of 0 %. A current of 20 mA corresponds to an ozone quantity of 100 %.
  The XmA input is only active if the ozone quantity setting in the menu option “Internal/ external” has been activated (display: “1”). The XmA input is electrically isolated from all other electrical system components.
- Switch input XPs (X3:4 and X3:5) is a contact via which the system can be switched to PAUSE mode. The switch input XPs is electrically isolated from all other electrical system components.
- Alarm output XUsr (X3:1,2,3) is used to transmit failure signals. The output is a change over contact.
  It can be connected by the user to mains voltage (230 V_{eff} / max. 8 A).

All electrical outputs are wired in such a way as to switch off the ozone generator should a fault in any of the leads develop.

TAKE CARE

The XOz, XPs and XPD inputs on the terminal X3 are switch inputs. They cannot be configured with external voltage! The contacts connected to the inputs must be potential free, otherwise the controller will be damaged!

Connection	Function switch contact	Status description	Voltage and current	Configuration terminal X3
XOz	Switch input for ozone gas warning device	Open: ozone alarm Closed: normal	Open: +12 V Closed: 1.2 mA	11: input 12: ground
XmA	Electrically isolated current input 0/4-20 mA for the control of the quantity of ozone	0/4 mA: 0 % 20 mA: 100 %	Resistance: approx. +1.7 V at 20 mA	6: +21 V/20 mA 7: input 8: ground
XPs	Electrically isolated switch input for pause function	Open: pause Closed: normal	Open: +15 V Closed: 10 mA	4: ground 5: input
XPD	Switch input for flow controller with minimum contact	Open: raw water low Closed: raw water flow on	Open: +12 V Closed: 1.2 mA	13: input 14: ground
XUsr	Alarm relay	Pin 3 → Pin 1: alarm Pin 3 → Pin 2: normal	Voltage free, can be connected by the user to 230 V/max. 8 A	1: N/C contact 2: N/O contact 3: common

9 Commissioning

WARNING

Commissioning must be carried out by qualified personnel in accordance with ZH 1/474 and GUV 18.13.

Outside Germany, the national regulations for the operation of ozone systems must be observed.

Qualified personnel for this system are persons who have received training and authorisation from ProMinent.

Interference from unauthorised personnel renders void all guarantees or liability claims on behalf of the operator.

The system produces toxic gas using high voltages of up to 8000 V. Unauthorised access to the system or any part of the system may result in lives being endangered.

Once the system has been installed, a function inspection must be carried out in order to detect any possible damage in transit. It must firstly be ensured that:

- All electrical, pneumatic and hydraulic connections are in order.
- The mains cutout is activated.
- The door is closed so that the trip switch in the door is released.
- The system's main switch is on.
- All other system parameters are within permissible limits (cooling water, gas flow system priming pressure, process water…. See section 13 "Technical Data").
- The system is in operating mode "Start without ozone generation" (see section 10 "Operation", 10.4.2).
- No "pause" status has been activated.

TAKE CARE

Before an "Ozone reference value" is set to 3 % or greater, make particularly sure that the ozone generator is full of cooling water, i.e. when a continuous water flow with no air bubbles is visible through the viewing window on the float-type flow meter (10) (see Fig. 1).

Normally there are no further calibration measures necessary when commissioning this system. If, however, the operating parameters have deviated from the technical specifications while the system was in transit, corrections can be made as described below:

9.1 Setting the system priming pressure

The system priming pressure can be set at the pressure release valve on the air-cleaning unit (2) and read from the air-cleaning unit pressure gauge.

It is recommended that the system priming pressure be set to 5.6 bar before commissioning.

9.2 Setting the process airflow

The process airflow can be adjusted at the regulating valve (6) on the adsorber drier. The "Gas flow" display in the display and control panel is selected to monitor changes.

It is recommended that the system process airflow is checked and set to its nominal value if necessary before commissioning (see section 10 "Operation", 10.1.1). In each case the process air-regulating valve (6) is fixed after adjustment with the locking nut.

GUIDELINE

The process airflow can increase slightly within a 5 sec period during the switchover phase of the adsorber drier. For this reason the process airflow should be set during the operating phase in which only one of the adsorber driers is in operation. This is when regenerating air is being expelled from the PE delivery hose that exits from the underside of the system (6x4, one open end).

9.3 Setting the regenerating airflow

The regenerating airflow can be adjusted by the regulating valve (27) connected to the adsorber drier. For this, a float-type airflow monitor, calibrated to 20 °C and 1013 mbar, should be connected to the PE delivery hose that exits from the underside of the system (6x4, one open end). The regenerating air can only be measured during the operating phase of one of the two driers. For a period of 5 sec in the switchover phase from one drier to the other, the regenerating air cannot be measured.

It is recommended that the regenerating airflow is checked and set to its nominal value if necessary during commissioning (see section 10 “Operation”, 10.1.1). In either case, the regenerating air regulating valve (5) must be fixed with the locking screw after adjusting the setting.

TAKE CARE

If the airflow for regeneration of the adsorber driers is too low, there is a risk that damp air may enter the ozone generator. This can reduce ozone generation and, in the worst case, can cause irreparable damage to the ozone generator. The correct airflow for regeneration can be found in section 10 “Operation”, 10.1.1.

9.4 Setting the cooling water flow

The cooling water flow can be adjusted at the corner valve (9) above the cooling water inlet to the system. The set value can be read off the float-type flow monitor (10) in the system cabinet.

A cooling water flow according to the Technical Data, chapter 13, is recommended at the commissioning stage.

9.5 Inspecting seal

It is essential to carry out an inspection of the pneumatic system seals during commissioning. Ensure that the system is running in normal operating mode without ozone generation (Operating mode “Start without ozone generation”).

Stop the system after an operating period of approx. 2 minutes using the STOP/START push switch. After waiting for a further minute, a constant generator pressure will have been established. This can be read off the pressure gauge (26) inside the system cabinet. The value shown may drop by a maximum of 0.2 bar in the next 10 minutes. Please check this.

10 Operation

The system is switched on by turning the main switch (23) to setting “1”. The main switch (23) is situated on the right hand side of the control cabinet.

10.1 Compressor

10.1.1 Operating with external compressed air supply

If the system is operated via an external compressed air supply, the following values relating to the pressure range and the air quality must be adhered to.

		OZVa 3
Air treatment	Total air quantity:	2250 Nl/h
	Process air quantity:	1750 Nl/h
	Regenerating air quantity:	500 Nl/h
	Maximum pressure at system input inlet at air-cleaning unit (1):	10 bar
	Nominal operating pressur e at system input inlet at air-cleaning unit (1):	5.5-6.5 bar
	Bypass valve setting (3) System inlet:	approx. 7 bar
	Bypass valve setting (3) at ozone generator inlet:	approx. 2.7 bar
	Pressure at ozone outlet:	0.8-2.0 bar

10.1.2 Operating with compressor supplied with system

If the system is supplied with a compressor, this must be connected to the power supply and switched on. After a few minutes, the pressure in the pressure vessel will have reached approx. 8 bar. The compressor then switches off automatically via a pressure switch. If the pressure in the pressure vessel falls below 6 bar as a result of compressed gas being extracted, the compressor automatically switches on again until the pressure in the pressure vessel reaches approx. 8 bar once more.

In normal operating mode, i.e. air quantities extracted at the rate described in 10.1.1 and at a priming pressure of 6 bar, the cycle times of the compressor are as follows:

	OZVa 3
• Compressor running time between 6 and 8 bar:	approx. 27 sec
• Compressor standing time:	approx. 42 sec

These times were measured in a new compressor in warmed-up state. Values may deviate slightly in older compressors or in higher ambient temperatures.

TAKE CARE

Air leakages in the system or compressor function failures can be recognised, e.g. as follows:

- **The minimum system operating pressure is not reached, despite correct pressure relief valve setting at air-cleaning unit (2) or**
- **The operating times of the compressor deviate considerably from the values given above.**

If the OZONFILT® OZVa is stopped, the compressor must not be allowed to continue running since no air is being extracted from the pressure vessel.

If the compressor does continue to run, air leakages are probably the cause. These may be

- In the compressor itself,
- In the air-cleaning unit (2),
- In the solenoid valve block (4) at the system inlet or
- In any hose connections between the compressor outlet and the system inlet.

The pressure vessel of the compressor has a solenoid valve (25) via which the condensate from the pressure vessel is expelled once an hour. For this purpose the controller opens the solenoid valve for approx. 6 sec each hour.

Significantly increased compressor running times shorten the operating life.

10.2 Function events sequence

After the system has been switched on for the first time at the main switch (23), the system is in “STOP” mode (“STOP Key” on display and control panel). After a few minutes the compressor reaches the required operating pressure of 6 bar. The system is then ready to operate.

The system can be started using the START/STOP key if

- PAUSE mode has not be externally activated and
- If an additional flow monitor is connected to XPD (X3:13,14) of the controller board and if the flow detector registers sufficient water flow and allows the system to commence operation.

GUIDELINE

The required ozone quantity (“Ozone reference value” display) is set to 0 % the first time the system is commissioned. If the system is started by pressing the START/STOP key, however, the system will be in normal operating mode without ozone generation (high voltage switched off). In order to switch on the ozone generator, the “Ozone reference value” should be set to at least 3 %.

10.3 Keypad operation

The keypad on the display and control panel is used to:

- Stop/start the whole system,
- Set the required ozone quantity,
- Display the system dimensions in turn and
- Set different system parameters.

START/STOP key

Starts/stops system (toggle action). If a failure occurs the system is automatically switched off by the controller. Once the failure is remedied, use this key to restart the system.

CHANGE DISPLAY key

This key is used to change from the current to the subsequent display value. The display changes cyclically i.e. after displaying the last value, automatically returns to the first value “Ozone reference value”.

BACK key

This key is used to return to first display value “Ozone reference value” from any other display value.

ENTER key

This key is used to acknowledge a failure and to confirm settings changes. If this key is pressed after a failure has occurred, the failure message display is replaced with a display of the current value.

UP key

UP and DOWN keys are used to alter values shown in the display and control panel if this is allowed, i.e. if the change value symbol is flashing on the display.

DOWN key

See UP key

10.4 Important system modes

10.4.1 Operating mode “Start” with ozone generation

The system is in the “Start” mode, with ozone generation, when

- It has not been externally placed in PAUSE mode,
- The “Ozone reference value” has been set to 3 % or more,
- The system has not been stopped by the STOP/START key and
- No other failure requiring acknowledgement is displayed on the display/control panel.

10.4.2 Operating mode “Start” without ozone generation

If the “Ozone reference value” is set to less than 3 % the system will operate in normal operating mode:

- Gas flow on,
- Cooling water flow on and
- Process water flow on.
- The high voltage required for ozone generation is switched off, however, and ozone is not generated.
- In this operating mode the fault indicating relay on the controller circuit board (14) is not activated!

If the “Ozone reference value” is increased to 3 % or more, the ozone generator will switch on automatically!

10.4.3 Operating mode “Failure”

If a failure occurs the controller will transfer the system to “STOP” mode.

- The gas in and outlets and
- The cooling water inlet solenoid valves will close and
- The high voltage required for ozone generator will be switched off.
- The corresponding failure message will appear in the display and control panel (see section 12 “Troubleshooting” and 10.5.2 “Display and Control Panel”).
- The fault indicating relay on the controller circuit board (14) is activated and triggers an external failure signal (X3:1,2,3).

10.4.4 Operating mode “Process water flow low”

See chapter 5.6.1.

If an additional flow monitor is connected to XPD (X3:13,14) of the controller board and if the flow of water requiring ozonising (process water) is interrupted or falls below the lower threshold of the flow monitor, the controller switches the system to “STOP” mode. This is a normal operating mode and the fault indicating relay is not activated in this case!

If the process water flow is at a sufficient level, the system automatically starts up again.

10.4.5 Operating mode “Stop”

The “STOP” operating mode can be activated in two ways:

- When a failure occurs and has stopped the machine.
- When the system has been stopped using the STOP/START key.

When switching to the “STOP” mode

- The gas inlets and outlets and
- The cooling water inlet solenoid valves close and
- The high voltage generator is switched off.
- The message: “STOP key” alternates with the current display message on the display and control panel.
- If the “STOP” mode was the result of a failure.

10.4.6 Operating mode “Pause”

The PAUSE switch input can be activated externally. In PAUSE mode

- The gas in and outlets and
- The cooling water inlet solenoid valves close and
- The high voltage generator is halted.
- The message: “PAUSE” alternates with the current display message on the display and control panel. After removing the pause message (contact on XPs input on controller circuit board closed) the system will automatically switch to the operating mode active prior to the activation of the PAUSE switch.

10.4.7 System response to power connection

When it is connected to the power supply the system responds in one of two ways depending upon the software in the EPROM on the electronic controller (14):

1. The system initiates in “STOP” mode and must be started manually by pressing the STOP/START key, irrespective of the operating mode that was active before the system was last disconnected from the power supply.
2. The system initiates in the operating mode that was active before the system was last disconnected from the power supply. This means that the system controller memorises the operating mode as the system is being shut down. This applies to:
   - The preset “Ozone reference value”,
   - The status of the STOP/START key,
   - And the failure status.

   The system does **not** start ozone generation independently if, before the system was last shut down
   - A failure was present which required acknowledgment,
   - Ozone generation had been stopped using the STOP/START key.

Otherwise, ozone generation automatically starts at the preset “Ozone reference value” after power has been switched on.

In the current software version (FW-2.33) the system response to power connection is preset to automatic re-start (option 2). This can be changed by using the hardware key, if necessary.

The current software version can be read off the EPROM on the electronic controller (14).

10.5 Displays

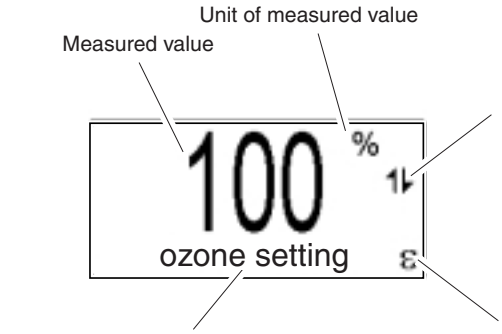
10.5.1 Whole system

The following functions and displays appear in normal operating mode:

- The main switch for the system is set to “ON”,
- The automatic cut off has not been activated (lever points to the left),
- The system priming pressure is 5.5 to 6.5 bar (gauge on air-cleaning unit (1),
- The pressure at the injection point is a maximum of 1.5 bar,
- This corresponds to display value at the the pressure gauge (26) of approximately 2 - 2.2 bar at the nominal air flow of the plant,
- No failure is displayed in the display and control panel.

10.5.2 Display and control panel

The information contained in the display and control panel (16) is displayed as shown below in the menu option relating to setting the required “Ozone reference value”. More information, see chapter 10.6 “Control menu”.



Normal operating: Displayed measured value
mode in case of failure: First cause of failure

Measured value status information:

Display	Operating mode for displayed value
↑↓	Adjustable value
mA	Value can be adjusted via external interface
None	Display value only

Failure display:

Display	Description
None	Normal operating mode
ε	Failure, system stopped
ω	Warning
*	· Failure information
Flashing	· Reference value below 3 %

10.6 Control menu

10.6.1 Ozone reference value; internal operation

The required ozone value is set in percent in the “Ozone reference value” display. In internal operating mode, settings are adjusted using the “UP” and “DOWN” keys. A 100 % reference value setting corresponds to the maximal ozone quantity (see Technical Data, chapter 13).

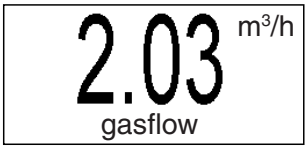
10.6.2 Ozone reference value; external operation

The required ozone value is set in percent in the “Ozone reference value” display. In external operating mode, settings are adjusted using a current interface connected to the XmA input. A 20 mA reference value setting corresponds to a display value of 100 %.

10.6.3 Ozone quantity

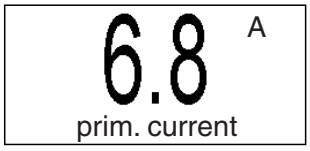
The display shows the current amount of ozone being generated in g/h.

The displayed value is calculated from measured electrical values and is corrected in relation to the current measured value of the process airflow.



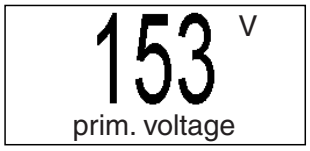
10.6.4 Gas flow

The display shows the current measured value of the gas flow through the ozone generator. The display value is related to Normal conditions (air pressure 1013.25 mbar, temperature 0 °C). See Technical Data (chapter 13) for nominal process airflow.



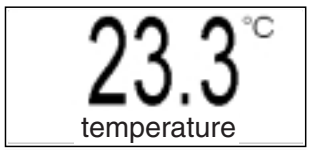
10.6.5 Primary current

The display gives the current flowing on the primary side of the high voltage transformer. The displayed measured value is dependent on the preset “Ozone reference value”.



10.6.6 Transformer voltage

The display gives the voltage present on the primary side of the high voltage transformer. The displayed measured value is dependent on the preset “Ozone reference value” and the operating pressure displayed on the pressure gauge in the system cabinet (26).



10.6.7 Temperature

The display gives the mid temperature measured at the cooling water outlet of the ozone generator. The display is dependent on the “Ozone reference value” and the temperature of the cooling water inlet.

10.6.8 Internal/External

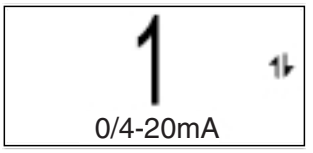
Here, the UP and DOWN keys are used to change the ozone quantity settings options:

0 = Internal: The ozone quantity can be set in % increments using the keypad, as described above, in the “Ozone reference value” display.

1 = External: The ozone quantity is set via a 0-20 mA or 4-20 mA current interface connected to the XmA input.

Any changes in operating mode are confirmed using the “Enter” key.

If the operating mode is changed, the system starts up in “Stop” mode and must be restarted by the operator.



10.6.9 0/4-20 mA

If the current interface was selected in the previous display for setting the ozone quantity, this display can be used to set the type of current interface:

0 = 0-20 mA - current interface

1 = 4-20 mA - current interface

Any changes in operating mode are confirmed using the “Enter” key.

10.6.10 Language

Setting required display language:

0 = German

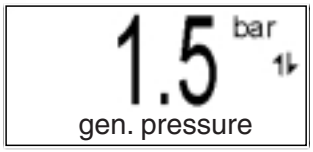
1 = English

2 = French

3 = Spanish

4 = Italian

Only German and English are currently available. Changes to the language are confirmed using the “Enter” key.

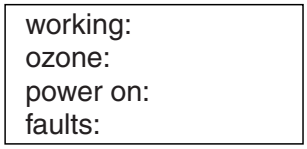


10.6.11 Generator pressure

This display is used to enter the pressure present in the installed system so that the ozone quantity can be precisely corrected in relation to this pressure. The pressure is read from the gauge (26) in the system cabinet.

The display value is altered using the UP and DOWN keys and confirmed using ENTER.

The value displayed when the system is first commissioned is the factory setting.



10.6.12 Operating parameters

This display shows the following values:

- Working hours of the system with mains switched on.
- Working hours with ozone generation switched on.
- Number of mains switches (main switched on).
- Number of occured failures.

11 System Maintenance

Check the liquid levels in the containers on the air-cleaning unit on the outside of the OZONFILT® OZVa at regular intervals, at least once a week and more often if necessary. The container is normally emptied automatically. If condensate is visible, the relevant container should be emptied by hand.

Check the filter elements (visible from outside the air cleaning unit) regularly, but at least once a week. If they are obviously very dirty, the filter must be replaced.

TAKE CARE

If condensate is visible in the pipe that feeds from the air-cleaning unit into the system, the system must be automatically decommissioned and inspected by ProMinent-authorised personnel. Check and maintain inlet filter of the compressor in accordance with the operating instructions of the compressor, if supplied with the system.

Safety guidelines for maintenance activities

WARNING

All maintenance and repair work must be carried out by qualified personnel who have been authorised by ProMinent.

Qualified personnel are persons who, as a result of specialised training and experience, have sufficient knowledge in the field of ozone systems, and are sufficiently familiar with relevant national legislature on safety at work, accident prevention, directives and general technical regulations to be able to correctly judge the safety conditions within an ozone system.

Interference from unauthorised personnel renders void all guarantees or liability claims on behalf of the operator.

12 Troubleshooting

The failures described in the table below cause the system to shut down.

There are delays of varying lengths, depending upon the type of failure, between initial failure recognition and system shut down, During the delay, a star flashes instead of the failure symbol in the lower right-hand corner of the LCD display. The system is switched off in stages:

- Firstly the high voltage is switched off. The system continues to run for approx. 6 seconds longer without generating ozone. During this period, the remaining ozone is extracted from the generator.
- Solenoid valves then pneumatically and hydraulically isolate the system (gas inlet, gas outlet, cooling water inlet).
- A failure message appears in the display and control panel, giving the cause of the failure.

The failures highlighted in bold in the table below activate the fault indicating relay (XUSr) on the controller circuit board (see section 8.2 “Electrical In and Out puts”). These must be acknowledged, after remedying the fault, at the display and control panel. The ozone generator must be restarted manually using the STOP/START key.

No.	Shut down by	Failure message in the display and control panel	Reason for shut down OZVa 3	Comments
1	Safety system	none	Current consumption too high	
2	Door trip switch	none	Door open	
3	Gas detector	ozone alarm!!	Ozone gas leak	
5	Flow monitor; cooling water	cooling water ↓	Cooling water flow below minimum level	
6	Flow monitor, process water	water ↓	Flow of water for ozonising too low. The system starts up again when the cause of the problem has been eliminated! The fault indicating relay on the controller circuit board is not activated.	Only if a flow monitor is connected to the input XPD (X3:13,14)
7	Gas flow monitor	gasflow ↓	Gas flow below lower limit	
8	Monitoring of current	current dyn.↑	Several consecutive excessive current impulses. Defect in HV transformer or ozone generator.	
11	Ozone reference value setting below 3 %	none	Ozone generator switched off when ozone reference value is set to values below 3 %	Operation stage without high voltage
12	Gas flow monitor	gasflow ↑	Gas flow above upper limit	
13	Electronic current meter	prim. current ↑	Current in HV transformer above upper limit	
14	Electronic voltmeter	transformer voltage ↑	Voltage in HV transformer above upper limit	Decrease pressure at the injection point to values below 2 bar
15	Pt 100 temperature sensor in upper section of ozone generator	temperature ↓	Temp. at cooling water outlet of ozone generator < 5 °C	
		temperature ↑	Temp. at cooling water outlet of ozone generator > 45 °C	Increase cooling water flow or decrease cooling water inlet temperature
16	Power supply for system	dc voltage ↓	Line voltage below 200 V, of fuse at power board (15) blown	
		dc voltage ↑	Line voltage above 253 V	

13 Technical Data, Standards, Directives

13.1 Technical Data

System type:
OZONFILT® OZVa, ozone generating and metering system.

Compulsory accessories for swimming pool applications:
Reaction tank with ventilation equipment,
Filter with activated carbon layer and ventilation equipment,
Exhaust ozone gas destructor,
Ozone gas detector.

Plant room:
With mechanical ventilation (3-fold air change) and gas detector.

Ozone generating module

Type OZONFILT®	Unit	OZVa 3
Number of generator modules		2
Ozone output, measured in accordance with DIN at air 20 °C, cooling water: 15 °C, flow rate: 70 l/h	g/h	35
Max. humidity of surrounding air	%	85, non-condensing
Max. ambient temperature	°C	40
Airflow for ozone generation	m³/h	1.75
Airflow for regeneration	m³/h	0.5
Ozone concentration in the gas phase related to normal conditions at full capacity	g/m³	20
Ozone connector		G ¼" inside thread
Cooling water connector		
Cooling water requirement	m³/h	0.04 - 0.1
Cooling water inlet pressure	bar	< 5
Cooling water outlet		Zero pres. outlet
Cooling water temperature ambient temp. < 35°C	°C	< 30
Cooling water temperature ambient temp 35 - 40°C	°C	< 25
PE delivery hose connector	mm	6 x 4
Cooling water quality		Drinking water, not desalinated
Air connector (air-cleaning unit)		
Total air quantity	Nm³/h	2.25
Process air quantity	Nm³/h	1.75
Regenerating air quantity	Nm³/h	0.5
Nominal operating pressure	bar	5.5 - 6.5
Maximum pressure	bar	10
Safety valve setting (system input)	bar	approx. 7
Safety valve setting (ozone generator)	bar	approx. 2.7

	Unit	OZVa 3
Electrical connections		
Typ. power consumption for ozone generation	kW	< 0.75
Power factor	cos f	> 0.99, at full capacity
Total power consumption	kW	< 1, at full capacity
Mains power supply	V / Hz / A	230 / 50 - 60 / 6
Main fuse	A	6
Enclosure rating	IP	43
Switch input, pause (XPs)		Isolated, load: +15 V/max. 10 mA
Switch input, ozone warning device (XOz)		Isolated, load: +12 V/max. 1.5 mA
Standard signal input, Ozone reference value (XmA)		Isolated, resistance: +1.7 V at +20 mA input current
Alarm output (XUsr)		Isolated, change-over 230 V/max. 8 A, free contact

Mixing equipment module

	Unit	OZVa 3
Flow volume for OZVa xx4xX	m³/h	10 - 15
Flow volume for OZVa xx5xX	m³/h	15 - 25
Flow volume for OZVa xx6xX	m³/h	25 - 35
Flow volume for OZVa xx7xX	m³/h	35 - 50
Raw water connector for OZVa xx4xX	DN	50
Raw water connector for OZVa xx5xX	DN	65
Raw water connector for OZVa xx6xX	DN	80
Raw water connector for OZVa xx7xX	DN	100
Raw water temperature	°C	< 35
Pressure range in raw water pipe	bar	< 2
Total dimensions		
Width (mm)		710
Height (mm)		1400
Depth (mm)		310
Weight (kg)		121

Compressor

	Unit	OZVa 3
Compressor mains power supply	V / Hz	230 / 50 or 60
Average power consumption		
at max. operating pressure, 50 Hz	kW	1.02
at 60 Hz for continous operation	kW	1.59
Typical power consumption		
50 Hz	kW	0.4
60 Hz	kW	0.5

13.2 Standards and Directives

System complies with DIN 19627 “Ozone Generators for Water Treatment”, as well as ZH 1/474 or GUV 18.13
“Directives for the Use of Ozone for Water Treatment.”

Applicable EU Guidelines:
The system is constructed in accordance with the following standards:
EU - Low Voltage directives (73/23/EWG)
EU - EMV - Directive 89/336/EWG i.d.F. 92/31/EWG

Related harmonised standards, in particular:
DIN EN 60204 - 1
EN 50081 - 1/2, EN 50082 - 1/2
EN 60555 - 2, EN 60553 - 3

Related national standards and other technical specifications, in particular:
E DIN 19627
DIN VDE 0110 T1 and T2
DIN VDE 0700 T1
VDE 0101
ZH1/474

13.3 Permissions/Approvals for the OZONFILT® OZVa

The system carries the CE symbol.

OZV a Ozone generating system

a **Series version**

Ozone quantity

1	5 g/h
2	15 g/h
3	35 g/h
4	40 g/h

Operating voltage

0	230 50/60 Hz
1	115 50/60 Hz

Mixing system

0	None				
1	With mixer	(flow	0.5	to	3 m³/h)
2	With mixer	(flow	3	to	5 m³/h)
3	With mixer	(flow	5	to	10 m³/h)
4	With mixer	(flow	10	to	15 m³/h)
5	With mixer	(flow	15	to	25 m³/h)
6	With mixer	(flow	25	to	35 m³/h)
7	With mixer	(flow	35	to	50 m³/h)

Compressor

0	None
1	With standard compressor*
2	With oil-free compressor for OZVa 5

* OZVa 1: oil-lubricated; OZVa 2, 3 and 4: oil-free

Language

D	German
E	English

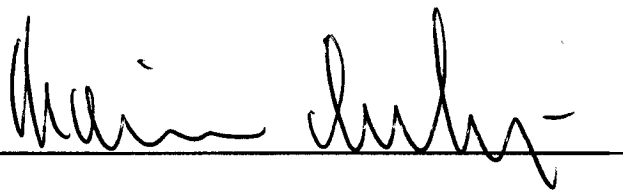
OZV a _ _ _ _ _

EC Declaration of Conformity

We,

ProMinent Dosiertechnik GmbH
Im Schuhmachergewann 5 - 11
D - 69123 Heidelberg

hereby declare that, on the basis of its functional concept and design and in the version brought into circulation by us, the product specified in the following complies with the relevant, fundamental safety and health stipulations laid down by EC regulations.
Any modification to the product not approved by us will invalidate this declaration.

Product description :	***Ozonfilt® ozone generator***
Product type :	***OZVa***
Serial number :	***see type identification plate on device***
Relevant EC regulations :	***EC - machine regulation (98/37/EEC)*** ***EC - low voltage regulation (73/23/EEC)*** ***EC - EMC - regulation (89/336/EEC subsequently 92/31 EEC)***
Harmonised standards used, in particular :	***DIN EN 292-1, DIN EN 292-2*** ***DIN EN 60204-1*** ***DIN EN 50081-1/2, DIN EN 50082-1/2*** ***DIN EN 61000-3-2, DIN EN 61000-3-3***
National standards and other technical specifications used, in particular :	***DIN 19627*** ***DIN VDE 0700 T1*** ***DIN VDE 0110 T1, T2*** ***ZH1/474*** ***VBG 4***
Date/manufacturer´s signature :	***26.01.2000*** 
The undersigned :	*Dr.- Ing. R. Dulger, President*