

# Vaccuperm VGB-103

Compact dosing regulator

Installation and operating instructions



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## Original installation and operating instructions

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**Warning**

Prior to installation, read these installation and operating instructions. Installation and operation must comply with local regulations and accepted codes of good practice.

## 1. Safety instructions

These installation and operating instructions contain important information for the user of the product:

- Technical data
- Instructions for commissioning and use
- Safety instructions

If you require further information, or if problems occur that are not described in detail in this manual, please contact Grundfos.

## 1.1 Symbols used in this document

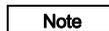
This manual contains the following standardised safety instructions about possible residual risks:

**Warning**

If these safety instructions are not observed, it may result in personal injury.

**Caution**

If these safety instructions are not observed, it may result in malfunction or damage to the equipment.

**Note**

Notes or instructions that make the job easier and ensure safe operation.

## 1.2 Safety advice for handling chlorine

### 1.2.1 Hazards of chlorine gas

**Warning**

Toxic by inhalation.

Irritating to eyes, respiratory system and skin.

- Causes whooping cough, dyspnoea and lacrimation.
- Has a slight paralysing effect to the central nervous system.
- Concentrations of more than 10 ppm chlorine gas in the respiratory air mean an acute danger to life.
- Inhaling air with a high concentration of chlorine gas for a long time is lethal.

### 1.2.2 Hazards of liquid chlorine

- Causes burns of skin.
- Causes reddening and blistering of skin.

### 1.2.3 Rules of conduct

- Change chlorine containers only with gas mask.
- Enter contaminated rooms only with protective suit and compressed-air respirator.
- In case of flight wear gas mask, if possible. Observe wind direction.

## 1.3 Protective equipment

### 1.3.1 Personal protective equipment

The operating authority of a chlorine gas dosing system has to provide respiratory equipment (full-sight gas mask), personally fitted, labelled by name, with an effective chlorine filter (B2P3) and at least 1 spare filter per gas mask, for each operator. The protective equipment must be stored easily accessible outside the chlorine rooms.

- For systems with chlorine drums at least 2 protective suits with compressed-air respirators must be available.

### 1.3.2 Obligations of the operating authority

- Introducing the operators to handling the protective equipment.
- The operators must use the personal protective equipment regularly, or carry out exercises with it at least every 6 months.
- The gas mask filters must be replaced regularly
  - after the expiry of the date of durability
  - at least 6 months after opening (note the opening date on the filter)
  - after contact with chlorine.
- Observe employing prohibition according to the local laws.

### 1.3.3 Storage of the protective equipment

- Outside the chlorine rooms
- Well visible
- Easily available at any time
- Protected from dust and moisture.

## 1.4 First aid in case of accidents

### 1.4.1 First aid after inhaling chlorine

1. Keep calm.
2. Remove injured persons from the dangerous area.
3. Helpers must pay attention to personal protection.
4. Remove contaminated clothes.
5. Calm down injured persons and keep them warm with blankets.
6. Supply fresh air, use oxygen respirator, if possible.
  - No mouth-to-mouth resuscitation!
7. Call medical aid or transport to hospital
  - lying
  - sitting in case of difficulty in breathing.
  - State chlorine as the cause.

### 1.4.2 First aid after chemical burn of the skin

1. Keep calm.
2. Remove contaminated clothes.
3. Rinse skin with plenty of water.
4. Bandage the wound aseptically.
5. Seek medical aid.
  - State chlorine as the cause.

### 1.4.3 First aid after chemical burn of the eyes

1. Keep calm.
2. Rinse eyes with plenty of water while the patient is lying.
  - Protect healthy eye, if necessary.
  - Spread eyelids widely, let the eye move to all sides.
3. Seek ophthalmologist.
  - State chlorine as the cause.

### 1.4.4 First aid after internal chemical burn

1. Keep calm.
2. Drink water in short sips.
  - If possible, take medical charcoal.
3. Seek medical aid.
  - State chlorine as the cause.

## 1.5 Handling chlorine containers

Chlorine is stored in grey steel cylinders or drums in lockable chlorine rooms. Due to safety precautions, chlorine containers are only filled up to 95 % of their capacity.

Kind of gas, weight, owner, producing date and date of the last testing have to be noted clearly on the container.

Observe the following:

- Store chlorine containers fireproof.
- Protect chlorine containers from heat and sunlight.
- Chlorine containers should not be modified or repaired by the user.
- Keep full and empty containers closed.

### 1.5.1 Steel cylinders

- Contents: 50 kg or 65 kg
- Extract chlorine gas from the upright standing cylinder via the valve.

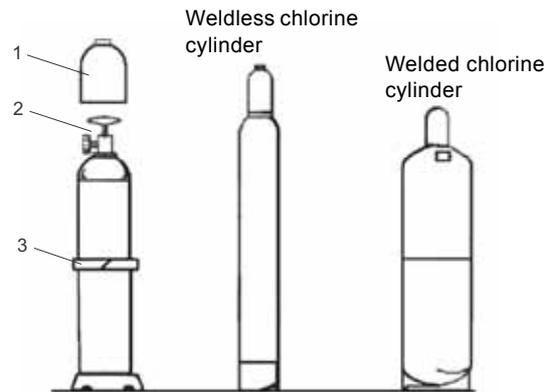


Fig. 1 Design of cylinder

Pos.	Description
1	Protective cap
2	Valve
3	Holding clip for securing the cylinder

### 1.5.2 Chlorine drums

- Contents: 500 kg or 1000 kg
- Extraction of chlorine gas via the riser pipe valve.
- Extraction of liquid chlorine via the dip pipe valve.

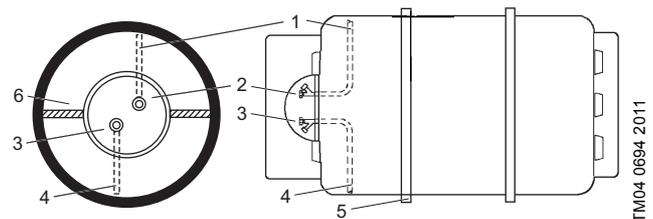


Fig. 2 Design of drum

Pos.	Description
1	Riser pipe for chlorine gas extraction
2	Valve for chlorine gas extraction
3	Valve for liquid chlorine extraction
4	Dip pipe for liquid chlorine extraction
5	Tyre
6	Mark for adjustment of drum

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### 1.5.3 Basic rules



#### Warning

Handling of chlorine containers only by experienced personnel.

Observe safety regulations for chlorine containers.

- Treat containers carefully, do not throw!
- Protect containers from turning over or rolling away, e.g. with chains or clips.
- Protect containers from direct sunlight and temperatures over 50 °C.
- Transport containers only with valve protection nut and protective cap.



#### Warning

These rules apply for both full and empty containers, as empty containers still contain rests of chlorine and therefore are under pressure.

### 1.5.4 Valid regulations



#### Warning

Local laws and regulations for handling, transport and storage of chlorine must be observed.

In Germany, the following regulations apply:

- Regulations for accident prevention "Chlorination of water" with process instructions (GUV-V D5)
- Regulations concerning places of work (ArbStättV)
- Technical rules for pressurized gases (TRG 280, 310 and 330)
- Operation of baths (BGR 108)
- Chlorine gas dosing systems for water treatment (DIN 19606)
- Chlorine for water treatment (DIN 19607)

## 1.6 Chlorine rooms

Chlorine rooms are rooms, where a chlorine gas dosing system and/or chlorine containers are located. The chlorine in these rooms is under pressure.

### 1.6.1 Regulations for chlorine rooms

According to the German regulations for accident prevention "Chlorination of water", such rooms have to meet the following requirements:

- They should not have connections to other rooms, and must be separated gas-tight and fire-resistant.
- They must be at ground level, dry and air-conditioned. The recommended room temperature is 18-20 °C. It should be neither lower than 0 °C nor higher than 50 °C.
- Overpressure lines of dosing equipment must not end in the open air.
- Ventilation openings leading into the open air must be limited to 2 x 20 cm<sup>2</sup>.
- Appropriate exhaust devices with downstream absorption systems must be installed.
- Chlorine gas must not get into lower-lying rooms, shafts, pits, canals or aspirating holes of ventilation systems.
- Chlorine rooms must be equipped with a water sprinkling system to precipitate the escaping chlorine gas.
  - The sprinkling system must have a run-off with air trap.
  - Operation must be possible manually from outside the chlorine rooms.
- A chlorine gas warning system must be installed
  - with optical and acoustical alarm device,
  - with connection to the water sprinkling system,
  - with a warning system that reactivates automatically after switch-off (e.g. for container exchange).

- The floor of a chlorine room must be even, the exit not below ground level and not higher than a possible loading ramp.

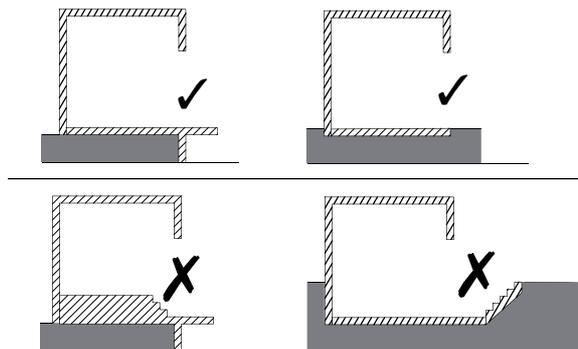


Fig. 3 Requirements of chlorine rooms

- Chlorine rooms must have a direct exit to the open air.
- Doors must be lockable, open outwards, and it must be possible to open the doors without a key from inside the room.
- Chlorine rooms must not be dedicated for the permanent stay of people.
- Eating, drinking, or storing food in chlorine rooms is prohibited.

### 1.6.2 Labelling of chlorine rooms

In Germany, according to DIN 4844, the following warning signs must be installed outside the entrance of a chlorine room:



Fig. 4 Warning sign and supplementary sign "Chlorination plant: Access only for instructed persons"

Inside a chlorine room, the mandatory sign "Use the gas mask" and the "Instruction sheet for first aid in case of chlorine gas intoxications" must be installed.



Fig. 5 Mandatory sign (DIN 4844)

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## 2. Introduction

The VGB-103 compact dosing unit comprises a vacuum regulator and a dosing regulator.

### 2.1 Correct usage

VGB-103 is exclusively designed for dosing chlorine gas into a vacuum line. It is connected directly to the chlorine container.

### 2.2 Inappropriate usage

Operational safety is only guaranteed, if the product is used correctly. All operating methods conflicting with correct usage are not permitted, and lead to the expiry of all liability claims.



#### Warning

Unauthorised structural modifications to the product may result in serious damage to equipment and personal injury.

It is forbidden to open, modify, bridge, remove, bypass or disable components, especially safety equipment.

### 2.3 Qualification of the users

Based on his professional training and experience, the user must have a good knowledge of the operation of chlorine gas dosing systems. He must be so familiar with the relevant laws and regulations governing safety in the workplace and accident prevention, and with the recognised standards of good practice, that he is able to judge the safe working condition of a chlorine gas dosing system.

The user is responsible for operation and monitoring of the product at the installation site.

The responsibilities of the user:

- Read this manual before operating.
- Be trained by qualified Grundfos personnel in the operation of the product.
- Observe the relevant regulations governing safety in the workplace and accident prevention.
- Wear appropriate protective clothing in accordance with national regulations for the prevention of accidents when operating the system and handling chemicals.

### 2.4 Responsibilities of the operator

The operator of the product is responsible for the following:

- Ensure that this manual is kept clearly accessible in the immediate vicinity of the system for the entire service life.
- Meet the installation requirements specified by the manufacturer (environmental conditions, required water connections and fittings, electrical connection, protective pipe for dosing line if necessary, audible or optical warning device if necessary).
- Ensure that water lines and armatures are regularly checked, serviced and maintained.
- Obtain official approval for storing chemicals, if necessary.
- Train users in the operation of the system.
- Ensure that the regulations for the prevention of accidents are observed in the installation site.
- Provide all users and service personnel with protective clothing (e.g. face mask, gloves, protective apron) in accordance with the national regulations.

### 2.5 Maintenance and service personnel

The product may only be maintained and serviced by personnel authorised by Grundfos.

## 2.6 Type key VGB-103 compact dosing unit

The type key serves for the identification of the product, not for configuration purposes.

Code	Example	VGB-103	-250	/1	-S	-1	-O	, -B	0
VGB	<b>Vaccuperm Gas Basic</b>								
	<b>Dosing flow</b>								
100	5-100 g/h								
250	10-250 g/h								
500	25-500 g/h								
1000	50-1,000 g/h								
2000	100-2,000 g/h								
3000	150-3,000 g/h								
4000	400-4,000 g/h								
	<b>Pressure connection</b>								
1	G 1								
2	G 3/4								
3	US yoke								
	<b>Inlet valve</b>								
B	Basic				only with cylinder				
S	Short				only with cylinder				
L	Long, 230-240 V, 50/60 Hz				only with drum				
M	Long, 110-115 V, 50/60 Hz				only with drum				
	<b>Pressure indication</b>								
0	Without pressure gauge								
1	With pressure gauge				Cylinder: connection on the left				Drum: connection on top
	<b>Filter</b>								
O	Outside								
U	Inside								
	<b>Direct installation</b>								
B	Cylinder, pressure input on the front								
D	Drum, pressure input on the left								
	<b>Residual pressure device</b>								
1	Yes								
0	No								

## 2.7 Transport and storage

- Transport carefully, do not throw!
- Store in a dry and cool place.

## 2.8 Unpacking

Observe when unpacking:

- The delivery must be complete.
- No humidity and no foreign matters should get into gas-leading parts.
- Mount the components of the dosing system as soon as possible after unpacking.

### 3. Technical data

#### 3.1 General technical data

Accuracy	± 4 % of upper limit
Permissible medium	Cl <sub>2</sub>
Setting range	1:20
Empty signal	Optical empty indication
Flowmeter	According to the floater principle, ball in measuring glass, length of measuring glass 70 mm
Weight	1 kg
Pressure gauge	0-10 bar, with/without limit contact for setting the minimum admission pressure
Short inlet valve	Suitable for cylinder connection, without liquid trap (standard)
Long inlet valve	Suitable for drum connection and liquid trap

#### 3.2 Dosing flow

5-100 g/h	0.2 - 5 lbs/day
10-250 g/h	0.5 - 14 lbs/day
25-500 g/h	1.5 - 26 lbs/day
50-1,000 g/h	2.5 - 50 lbs/day
100-2,000 g/h	5-100 lbs/day
150-3,000 g/h	10-150 lbs/day
400-4,000 g/h	30-220 lbs/day

#### 3.3 Connections

Vacuum connection to the injector	for hose 8/11 mm
Pressure connection to the adsorption filter	for hose 8/11 mm
	Union nut G 1
Pressure connection at the inlet valve	Union nut G 3/4
	Closed yoke (US)

#### 3.4 Accessories

The following accessories are not included in the standard delivery:

- Hoses of different lengths
- Holding plate for wall fixing when changing containers
- Ammonia water for tightness check
- Liquid trap with long inlet valve

3.5 Dimensions

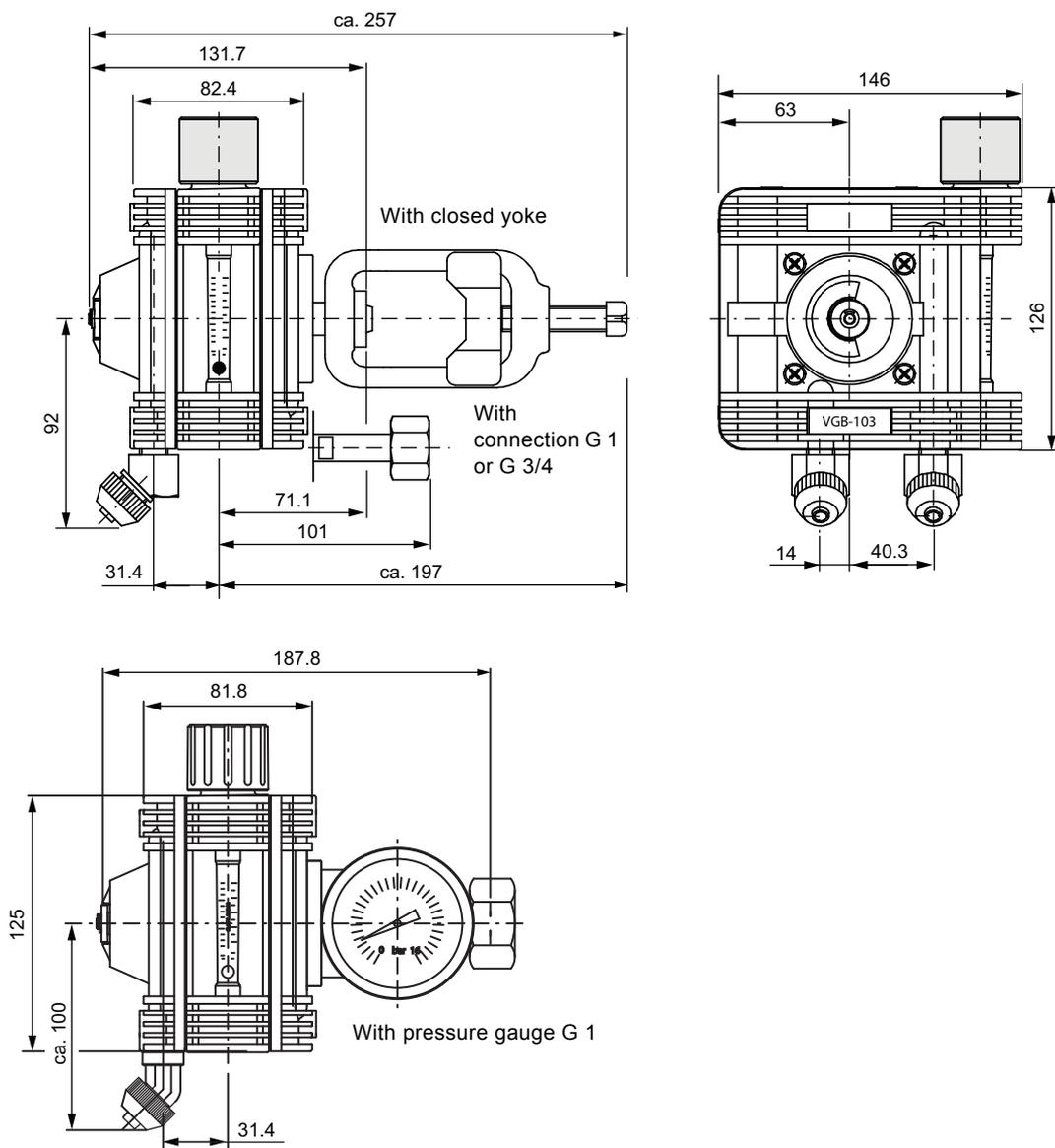


Fig. 6 VGB-103 compact dosing unit

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### 3.6 Physical and chemical data of chlorine

Under normal conditions of pressure and temperature, chlorine is a yellowish green gas with a pungent odour, which exists as  $\text{Cl}_2$  molecule.

It is not flammable, but can promote the flammability of metals, hydrocarbons, etc.

Atomic weight	35.457 u
Molecular weight $\text{Cl}_2$	70.941 u
Density (liquid)	1.57 g/cm <sup>3</sup> at -34.05 °C
Density (gas)	3.214 g/l at 0 °C, 1 bar
1 litre of liquid chlorine at 0 °C	is equivalent to 457 litres (0.457 m <sup>3</sup> ) of chlorine gas
1 kg of liquid chlorine at 0 °C	is equivalent to 311 litres (0.311 m <sup>3</sup> ) of chlorine gas
Specific gravity	2.486 (specific gravity of air: 1)
Boiling point	-34.05 °C (1 bar)
Melting point	-101.5 °C
Evaporation heat	269 kJ/kg (at 0 °C)
Heat conductivity	0.527 kJ/m <sup>2</sup> h (liquid chlorine)
Degree of purity according to DIN 19607	99.5 %
TLV (Threshold Limit Value)	1.5 mg/m <sup>3</sup> (0.5 ppmv)

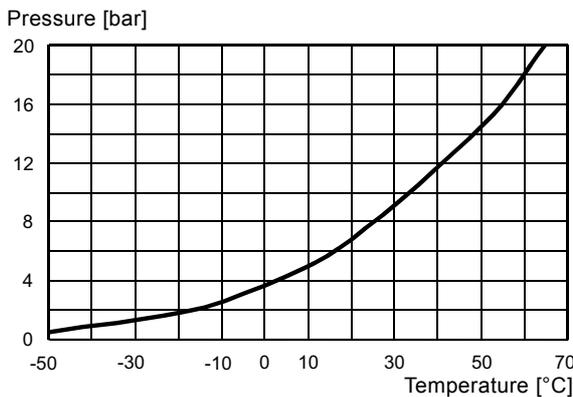


Fig. 7 Vapour pressure curve of chlorine

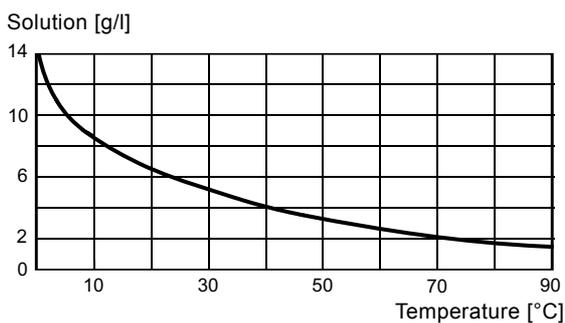


Fig. 8 Solubility of chlorine gas in water

## 4. Design and function

### 4.1 Description of the device

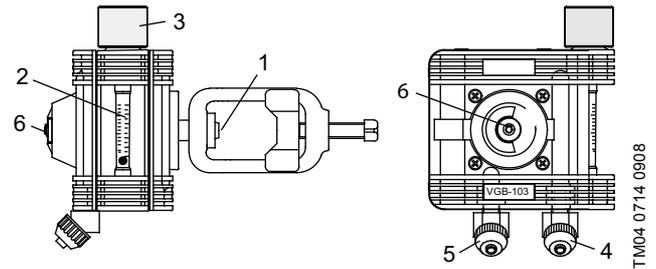


Fig. 9 Components of the compact dosing unit

Pos.	Description
1	Inlet valve with pressure connection for fixing the VGB-103 compact dosing unit to the chlorine cylinder.
2	Measuring glass for indication of the dosing flow
3	Adjustment knob for setting the dosing flow
4	Connection for the vacuum line (to the injector)
5	Connection for the overpressure line (to the adsorption filter)
6	Empty signal: red mark

The rate valve is not a perfectly closing shut-off valve. Do not try to stop the chlorine gas dosing system by closing the rate valve!

#### Caution

Switching off the chlorine gas dosing system, see section [7.5.3 Switching off while the system is running](#)

#### 4.1.1 Empty signal

The red mark (6) on the vacuum regulator is the empty indication. It indicates that the residual pressure in the chlorine container is too low, or the chlorine container valve is closed. When the chlorine quantity is sufficient, the green mark is visible.

#### Note

The empty indication works only when the regulator is in operation.

When the container is emptied, a residual pressure of approx. 2 bar remains. The container is not completely evacuated. Corrosion and soiling due to the penetration of humidity in the event of container exchange is thus prevented.

#### 4.1.2 Pressure gauge

The pressure gauge indicates the gas pressure at the inlet valve (admission pressure). The pressure gauge is optionally available with limit contact for setting a minimum admission pressure, e.g. for monitoring from a control room.

#### 4.1.3 Liquid trap

The liquid trap prevents liquefied gas from penetrating the vacuum regulator. The temperature is automatically adjusted to approx. 60 °C.

## 4.2 Functional principle

The compact dosing unit comprises a vacuum regulator and a dosing regulator.

### 4.2.1 Vacuum regulator

The vacuum regulator is a pressure reducing valve, which reduces the overpressure from the chlorine tank side to the negative pressure on the vacuum side. The valve at the vacuum regulator opens, when after switching on the injector a sufficient vacuum has built up at the outlet side.

The regulator is passive.

**Note** Regulation of the dosing quantity has to be made at other components of the system.

### 4.2.3 Vacuum chlorine gas dosing system

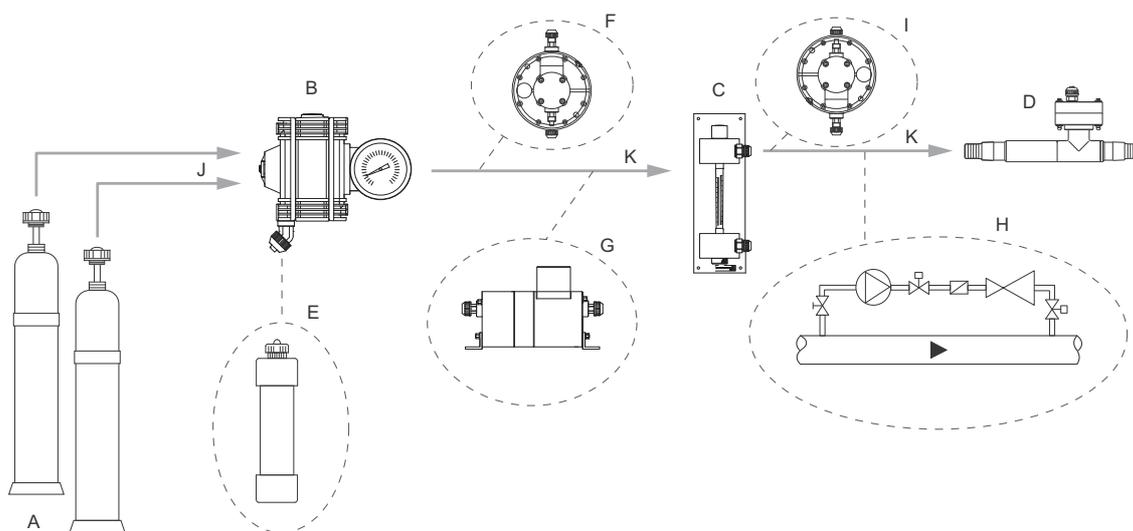


Fig. 10 Principle of a vacuum chlorine gas dosing system

Pos.	Description
A	Chlorine cylinder
B	Vacuum regulator
C	Dosing regulator
D	Injector
E	Adsorption filter (option)
F	Safety valve (option)
G	Change-over device (option)
H	Water apparatus (option)
I	Differential pressure regulator (option)
J	Chlorine gas pressure line
K	Chlorine gas vacuum line

#### Functioning of a vacuum chlorine gas dosing system

Handling, transport and storage of chlorine for the disinfection of drinking and pool water are a challenge for plant engineers. This is the reason why the vacuum principle has been used in dosing systems for a long time. The pressure of the chlorine gas is reduced to a vacuum.

This method prevents escape of chlorine gas. In the event of a pipe burst no chlorine gas can escape, only ambient air is drawn in.

Vacuum chlorine gas dosing systems are composed of three principal components.

The vacuum regulator includes the following safety components.

- Safety relief valve: If the gas inlet valve of the regulator is soiled, the safety relief valve opens. The gas escapes through the overpressure line into the adsorption filter. If the filter is full, the gas sensor triggers an alarm.
- If the vacuum on the negative pressure side collapses, the valve in the regulator closes, and the chlorine gas flow is stopped.
- Liquid trap (option): A liquid trap can be installed upstream in order to prevent liquid chlorine from penetrating the regulator.

### 4.2.2 Dosing regulator

The dosing regulator regulates the chlorine gas flow with a valve. The flow is read at the top of the ball in the measuring glass.

#### Vacuum regulator (B)

The vacuum regulator is a pressure reducing valve, which reduces the overpressure from the chlorine tank side to the negative pressure on the vacuum side. The valve opens, when a sufficient vacuum has built up on the outlet side. Vacuum regulators with pressure gauge and liquid trap are available for more safety.

#### Dosing regulator (C)

The chlorine gas flow is adjusted with the dosing regulator. This can be effected manually or automatically via motor control.

#### Injector (D)

Injectors have the task to bring chlorine gas into the water flow. They operate according to the principle of water jet pumps. The injector body comprises a nozzle with a successional diffuser.

Between the nozzle and the diffuser there is a narrow annular gap, where chlorine gas is sucked out of the dosing line through the injector head. A diaphragm non-return valve at the end of the vacuum line prevents the ingress of water into the vacuum line.

#### Differential pressure regulator (I)

Regulates the difference of the pressures before and after the rate valve to a constant value. Adjusted dosing flow stays constant even when the injector vacuum varies.

## 5. Assembly and installation

### 5.1 Selection of vacuum lines



Warning  
Observe section 1. *Safety instructions*.

The vacuum needed for the transport of chlorine gas is built up by the injector, and maintained by the vacuum lines. Rigid PVC pipes or flexible PE hoses are used as vacuum lines.

The following tables show the recommended diameter of vacuum lines, depending on the line length and dosing quantity.

#### 5.1.1 Vacuum lines between vacuum regulator and dosing regulator

Max. length [m] of the vacuum lines between vacuum regulator and dosing regulator*	Dosing quantity [g/h]						
	40	100	250	500	1000	2000	4000
0	DN 8	DN 8	DN 8	DN 8	DN 8	DN 8	DN 10
10	DN 8	DN 8	DN 8	DN 8	DN 8	DN 8	DN 10
20	DN 8	DN 8	DN 8	DN 8	DN 8	DN 10	DN 15
30	DN 8	DN 8	DN 8	DN 8	DN 8	DN 10	DN 15
40	DN 8	DN 8	DN 8	DN 8	DN 8	DN 15	DN 15
50	DN 8	DN 8	DN 8	DN 8	DN 10	DN 15	DN 15
75	DN 8	DN 8	DN 8	DN 8	DN 10	DN 15	DN 15
100	DN 8	DN 8	DN 8	DN 8	DN 10	DN 15	DN 20

\* For the calculation, a pressure loss of  $p = 12.5$  mbar in the vacuum line was assumed.

#### 5.1.2 Vacuum lines between dosing regulator and injector

Max. length [m] of the vacuum lines between dosing regulator and injector**	Dosing quantity [g/h]						
	40	100	250	500	1000	2000	4000
0	DN 8	DN 8	DN 8	DN 8	DN 8	DN 8	DN 8
10	DN 8	DN 8	DN 8	DN 8	DN 8	DN 8	DN 8
20	DN 8	DN 8	DN 8	DN 8	DN 8	DN 8	DN 10
30	DN 8	DN 8	DN 8	DN 8	DN 8	DN 8	DN 10
40	DN 8	DN 8	DN 8	DN 8	DN 8	DN 8	DN 10
50	DN 8	DN 8	DN 8	DN 8	DN 8	DN 10	DN 15
75	DN 8	DN 8	DN 8	DN 8	DN 8	DN 10	DN 15
100	DN 8	DN 8	DN 8	DN 8	DN 8	DN 10	DN 15

\*\* For the calculation, a pressure loss of  $p = 50$  mbar in the vacuum line was assumed.

## 5.2 Connecting the compact dosing unit



### Warning

Before connecting, ensure that the valve of the chlorine container is closed.

The compact dosing unit has to be operated in the chlorine room.

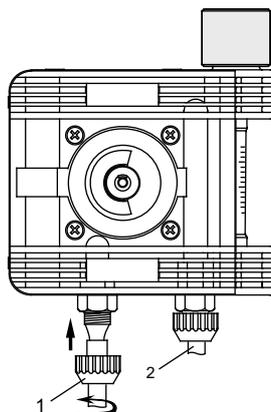


Fig. 11 Connections

Pos.	Description
1	Vacuum line (to the injector)
2	Overpressure line

1. Position chlorine containers and protect them from turning over or rolling away.
2. Clean and dry the connections, if necessary.
3. Remove the protective cap from the container valve.



### Warning

Replace the gaskets of the pressure connection at any change of container.

Use the filter at the pressure connection.

4. Insert the gasket at the pressure connection of the compact dosing unit.
  - Replace the filter at the pressure connection, if necessary.

### Caution

Do not align the device by turning the housing. If necessary, hold up with a 13-mm fork wrench.

Make sure that the vacuum connections are clean and dry.

5. Mount the compact dosing unit onto the container connection.

For details on vacuum lines, see section [5.1 Selection of vacuum lines](#).

### Caution

Only tighten the union nuts of the vacuum connections by hand. Do not use any tools. Danger of damages!

6. Connect the overpressure line (2) to the adsorption filter.
7. Connect the vacuum line to the injector.

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## 5.3 Installation example

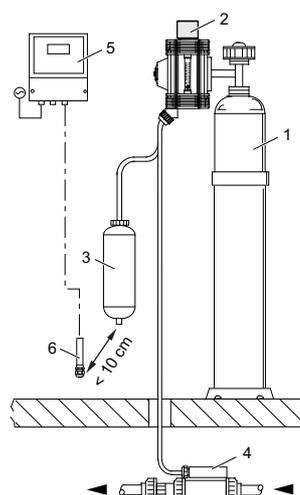


Fig. 12 Chlorine gas dosing system with one cylinder

Pos.	Description
1	Chlorine cylinder
2	VGB-103 compact dosing unit
3	Adsorption filter
4	Injector
5	Gas warning device Gas sensor
6	The sensor has to be installed at a maximum distance of 10 cm below the outlet hole of the adsorption filter.

## 6. Startup



### Warning

The chlorine gas dosing unit can only be started after its good condition has been checked by an expert, see [2.3 Qualification of the users](#), and especially gas-leading parts have been checked for their tightness.

Check the tightness of the entire system before start-up. Check the tightness of the valves using ammonia water (small plastic bottle). White mist indicates leakages.

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## 6.1 Checking the tightness

Due to the heavy corrosiveness of humid chlorine gas, all leakages increase quickly. Therefore, even the smallest leakage must be eliminated immediately.



Warning

Check the tightness only if the entire system is ready for start-up.

Danger of chlorine gas escape!

### 6.1.1 Checking the chlorine solution lines and the injector

Observe the installation and operating instructions of the injector.

### 6.1.2 Checking the vacuum lines

Vacuum lines are all lines between vacuum regulator and injector.

1. Close all chlorine container valves.
2. Close the rate valve.
3. Open the shut-off valve at the injection unit.
4. Open the motive water valve.
5. Switch on the booster pump.
6. Open the rate valve.
  - If the floater shows a gas flow, or the vacuummeter indicates more than -9 m water column, the vacuum lines are leaky.
7. Close the rate valve.
8. Switch off the booster pump.
9. Close the motive water valve.
10. Close the shut-off valve at the injection unit.
11. Check the vacuum lines and connections. Re-tighten them carefully, if necessary.
12. Repeat the tightness check.
  - If the floater shows no gas flow, and the vacuummeter indicates -9 m water column or less, the vacuum lines are tight.

Reasons for insufficient operating vacuum:

**Note**

Injector too small, defective, or blocked.

Booster pump too small, or defective.

### 6.1.3 Checking the gas pressure lines

Gas pressure lines are all lines leading from the chlorine containers to the vacuum regulator.

1. If the system is equipped with a nitrogen rinsing device, check the tightness roughly with nitrogen.
2. Detailed checking is made with ammonia.

### Checking the tightness with nitrogen

1. Close all chlorine container valves.
2. Open container connection valves and all shut-off valves up to the chlorine gas dosing system.
3. Open the connection valve of the nitrogen cylinder.
4. Slowly open the valve of the nitrogen cylinder, until the lines have a pressure of about 10 bar (read at the pressure gauge of the vacuum regulator).



Warning

Maximum nitrogen pressure 16 bar.

Danger of damages and leakages when exceeded.

5. Apply soap water to all components under pressure.
  - If bubbles form and/or pressure drops at the pressure gauge, the pressure lines are leaky.
6. Depressurise the system.
7. Eliminate the leakage.
8. Repeat the tightness check.
9. If no bubbles form, and the pressure at the pressure gauge does not drop significantly within one hour, the pressure lines are tight.

## Checking the tightness with ammonia

Warning

Ammonia is irritating to eyes, respiratory system and skin.

Ammonia is very toxic for water organisms.

When checking the tightness with ammonia, wear tight protective goggles, gloves and clothes.



Fig. 13 Hazard notes for ammonia

Even very small leakages become evident with ammonia vapour, which reacts with chlorine gas forming white mist.



Warning

Liquid ammonia must not come in contact with lines or parts of the system, because it is very corrosive.

Remove drops immediately with a dry cloth.

### Checking the pressure connections (after change of container)

1. Open the container valve and immediately close it again.
2. Open the flexible plastic bottle filled with ammonia water.
3. Slightly press the bottle in a pumping manner, allowing the ammonia mist to rise up. Slowly pass the open ammonia bottle along gas-leading parts.
4. If white mist forms, the pressure connection is leaky.

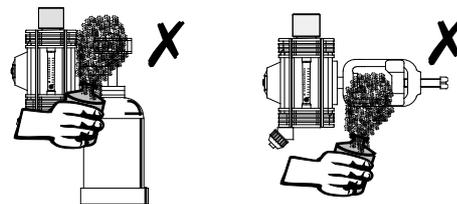


Fig. 14 Ammonia and chlorine gas form white mist

5. Depressurise the system.
6. Eliminate the leakage.
7. Repeat the tightness check.
8. If no white mist forms, the pressure connection is tight.

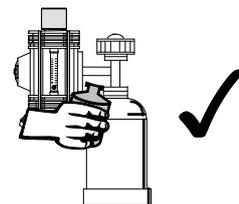


Fig. 15 Pressure connection is tight

TM04 8410 2111

TM04 0710 0908

TM04 0711 0908

### Checking the inlet valve

1. Loosen the union nut at the overpressure connection of the vacuum regulator, and remove the overpressure line.
2. Close the inlet valve.
3. Open the chlorine container valve.
4. Open the flexible plastic bottle filled with ammonia water.
5. Slightly press the bottle in a pumping manner, allowing the ammonia mist to rise up. Slowly pass the open ammonia bottle along gas-leading parts.
6. If white mist forms, the inlet valve is leaky.
7. Depressurise the system.
8. Check the inlet valve and repair it.
9. Repeat the tightness check.
10. If no white mist forms, the inlet valve is tight.

## 6.2 Chlorine extraction

### 6.2.1 Connecting the chlorine container

1. Chlorine containers must be stored at least for 8 hours in the container room, so that the content can adapt to the ambient temperature.



#### Warning

Chlorine containers must not have a higher temperature than other parts of the system. Danger of liquefaction and escape of chlorine!

2. Turn chlorine drums on their support until the dip pipe and the riser pipe are placed vertically (observe the markings on the drum).
3. Protect chlorine containers from turning over or rolling away.
4. Dry the piping and the extraction system with dry nitrogen or dry air.
5. No foreign matter must get into the system.
6. Provide the pressure connection with a new gasket.
7. Connect the chlorine container. When using drums, observe that the lower valve is normally intended for the extraction of liquid chlorine.
8. Slowly open the container valve.

### 6.2.2 Container valves

Operate the valves at the chlorine containers only manually without force. Close the valves of full or empty chlorine containers with closing nut (marked chlorine or Cl<sub>2</sub>) and gasket.



#### Warning

Do not open container valves using force!

### Stuck valves

Stuck valves can be loosened by wrapping a cloth with warm water around the valve. If this is not possible, return the container to the manufacturer.

- Never use an open flame to heat up the valve!
- Never use wrench lengthening!

### 6.2.3 Checking the tightness

Before start-up, check the tightness of the entire system, see section [6.1 Checking the tightness](#).

### 6.2.4 Chlorine extraction

Do not completely evacuate the chlorine container.

A residual pressure of approx. 2 bar must remain in the container for the following reasons:

**Caution** To avoid penetration of humidity, which will cause corrosion.

To avoid withdrawal of chlorine gas pollutants, which will cause clogging of the pressure reducing valve in the long run.

### Chlorine gas extraction

At 15 °C about 1 % of the content of a container can be extracted per hour.

**Caution** When extracting more, there is danger of formation of ice on containers and piping, which will cause malfunction.

The table shows the maximum extraction quantity depending on the used container size.

Container	Container size [kg]	Extraction quantity [g/h]
Cylinder	50	max. 500
	65	max. 650
Drum	500	max. 5000
	1000	max. 10000

In case of higher chlorine requirement, several chlorine containers of the same temperature have to be connected with header lines.

### Extraction of liquid chlorine

With chlorine gas dosing systems, the extraction of liquid chlorine is only possible from chlorine drums. The valve on the dip pipe of the drum must be connected, and an evaporator must be used.

### 6.2.5 After chlorine extraction

**Caution** In order to avoid the penetration of humidity causing corrosion, close the connecting lines directly after chlorine extraction.

1. If the container is emptied down to a residual pressure of 2 bar, the container valve must be closed, in order to avoid the withdrawal of pollutants or penetration of humidity.
2. Disconnect the container from the system.
3. Mount the protective nut on the valve.
4. Mount the protective cap.

## 7. Operation

The chlorine gas dosing flow is set at the adjustment knob of the compact dosing unit, see section [4.1 Description of the device](#).

### 7.1 Switching on the chlorine gas dosing system

1. Close the adjustment knob (2).
2. Open the shut-off valve at the injection unit.
3. Open the motive water valves.
4. Open the motive water supply of the injector.
5. Open the chlorine container valve.
6. Slowly open the adjustment knob (1), until the ball in the measuring glass indicates the desired gas flow.

### 7.2 Setting the dosing flow

To increase the dosing flow, turn the adjustment knob very slowly counter-clockwise.

#### Caution

If the maximum dosing flow is reached, don't turn the adjustment knob any further, because there is no locking.

To reduce the dosing flow, turn the adjustment knob very slowly clockwise.

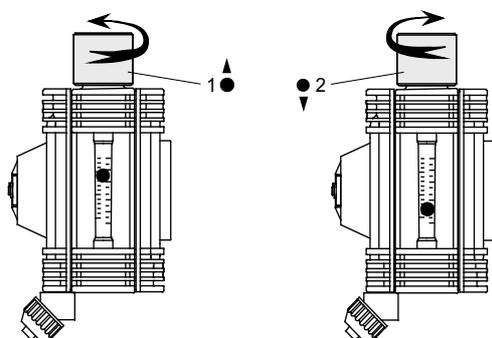


Fig. 16 Setting the dosing flow

TM04 0715 0908

Pos.	Description
1	Turning the adjustment knob counter-clockwise will increase the dosing flow.
2	Turning the adjustment knob clockwise will reduce the dosing flow.

### 7.3 Reading the dosing flow

The dosing flow is read at the top of the ball in the measuring glass.

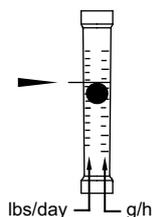


Fig. 17 Reading the dosing flow

TM04 0717 0908

The scale of the measuring glass is adjusted to a gas temperature of 20 °C.

#### Note

In case of extremely different temperatures the dosing flow may differ from the value being shown.

### 7.4 Changing the chlorine container while the system is running

The red mark (empty indication) at the vacuum regulator shows that the minimum pressure of the chlorine container is reached. The container must be exchanged.



#### Warning

Put on the required protective equipment.

1. Close the chlorine container valve.
2. Let the system run until the measuring glass shows no more gas flow.
3. Close the adjustment knob (2).
4. Turn off the motive water supply.
5. Close the motive water valves.
6. Close the shut-off valves before and after the injector.
7. Unscrew the compact dosing unit from the connection of the container.
  - Place the unit into the wall support, if existing.
8. Screw the protective cap onto the empty chlorine container; put the empty container away, and protect it from rolling away or turning over.
9. Position the new chlorine container, and fix it correctly.
10. Remove the protective cap from the new chlorine container.
  - All connections must be absolutely clean and dry.



#### Warning

Replace the gaskets at any change of chlorine container.

Never use the compact dosing unit without filter!

11. Insert the gasket at the pressure connection of the compact dosing unit.
  - Exchange the filter, if necessary.
12. Screw the compact dosing unit onto the chlorine container.

#### Caution

Do not align the unit by turning the housing!  
If necessary, hold up with a 13-mm fork wrench.



#### Warning

Check the tightness before re-starting the system.

13. Check the tightness as described in section [6.1 Checking the tightness](#).
14. Re-start the system.

## 7.5 Switching off the chlorine gas dosing system

### 7.5.1 Emergency stop in case of gas escape



Warning

If gas escapes, immediately leave the room and put on protective equipment.

Start counter measures according to local safety regulations.

### 7.5.2 Emergency stop in case of small leakages

1. Put on protective equipment.
2. Immediately close the chlorine container valve.
3. Let the system run until all parts are evacuated.
4. Switch off the system as described in the following.



Warning

Repairs of components of the system are to be carried out only by authorised persons.

### 7.5.3 Switching off while the system is running

1. Close the chlorine container valve.
2. Let the system run, until the measuring glass shows no more gas flow.
3. Close the adjustment knob (2).
4. Turn off the motive water supply.
5. Close the motive water valves.
6. Close the shut-off valves before and after the injector.

## 8. Maintenance

### Intervals for cleaning and maintenance

- At least every 12 months.
- Before every start-up.
- In case of malfunction.



Warning

Maintenance has to be carried out only by authorised and qualified personnel.

Before starting cleaning and maintenance work, switch off the entire system.

Danger of chlorine gas escape!



Warning

Make sure that the system cannot be started accidentally while working at it.



Warning

Before re-starting, check the tightness.

Danger of chlorine gas escape!

## 9. Fault finding

Fault	Cause	Remedy
1. Maximum dosing flow is not reached.	a) Insufficient injector vacuum.	Check the injector. Repair it, if necessary. Observe the manual of the injector.
		Check the motive water pump. Repair it, if necessary.
		Check the dirt trap before the injector. Clean it, if necessary.
	b) Leakage in the vacuum line between dosing regulator and injector.	Eliminate the leakage.
	c) Vacuum line between dosing regulator and injector too long.	For details on vacuum lines, see section <a href="#">5.1.2 Vacuum lines between dosing regulator and injector</a>
	d) Soiled vacuum line.	Replace the vacuum line.
	e) Soiled filter at the pressure connection of the dosing regulator.	Call the service.
	f) Closed chlorine container valve.	Open the chlorine container valve.
2. Leaky pressure connection.	g) Empty chlorine container.	Replace empty chlorine container by a full one.
	h) Adjusting spindle of the dosing regulator not suitable (diameter too small).	Call the service.
	a) Gasket at the pressure connection damaged.	Replace the gasket.
	b) Sealing surfaces soiled with residues of old gaskets.	Clean sealing surfaces.
	c) Sealing surface at the chlorine container damaged.	Use another chlorine container.
3. Gas escapes at the overpressure line.	d) Pressure connection loose.	Tighten pressure connection.
	e) Sealing surface at the pressure connection of the vacuum regulator damaged.	Call the service.
4. Despite correctly displayed dosing capacity, the desired chlorine solution concentration is not reached.	a) Re-liquefied gas gets into the inlet valve.	Reduce the extraction amount, ensure a correct temperature sequence.
	b) Inlet valve soiled or damaged.	Call the service.
5. The ball in the measuring glass is caught.	a) Leakage in the vacuum line between vacuum regulator and dosing regulator.	Eliminate the leakage.
	a) Measuring glass or ball soiled.	Call the service.
6. Formation of ice on the chlorine container.	a) Extraction quantity is set too high. If more than 1 % of the content is extracted per hour, there is danger of formation of ice at the container.	Use a dosing system with several chlorine containers. Call the service.
	b) Chlorine gas dosing system too small.	Use a bigger chlorine gas dosing system.
7. Water in the measuring glass.	a) Diaphragm non-return valve is defective.	Call the service.
8. Vacuum varies despite constant operating conditions.	a) Spring in the differential pressure regulator soiled or damaged.	
9. The dosing capacity varies despite constant operating conditions.	a) Diaphragm in the differential pressure regulator soiled or damaged.	

## 10. Disposal

This product and all its associated parts must be disposed of in an environmentally friendly manner. Use appropriate waste collection services. If this is not possible, contact the nearest Grundfos company or service workshop.

## Declaration of conformity

**GB: EU declaration of conformity**

We, Grundfos, declare under our sole responsibility that the products VGA-111, VGA-113, VGA-117, VGA-146, VGB-103, VGS-141, VGS-143, VGS-145, VGS-147, VGS-148, to which the declaration below relates, are in conformity with the Council Directives listed below on the approximation of the laws of the EU member states.

**DE: EU-Konformitätserklärung**

Wir, Grundfos, erklären in alleiniger Verantwortung, dass die Produkte VGA-111, VGA-113, VGA-117, VGA-146, VGB-103, VGS-141, VGS-143, VGS-145, VGS-147, VGS-148, auf die sich diese Erklärung beziehen, mit den folgenden Richtlinien des Rates zur Angleichung der Rechtsvorschriften der EU-Mitgliedsstaaten übereinstimmen.

**FR: Déclaration de conformité UE**

Nous, Grundfos, déclarons sous notre seule responsabilité, que les produits VGA-111, VGA-113, VGA-117, VGA-146, VGB-103, VGS-141, VGS-143, VGS-145, VGS-147, VGS-148, auxquels se réfère cette déclaration, sont conformes aux Directives du Conseil concernant le rapprochement des législations des États membres UE relatives aux normes énoncées ci-dessous.

**RS: Deklaracija o usklađenosti EU**

Mi, kompanija Grundfos, izjavljujemo pod punom vlastitom odgovornošću da je proizvod VGA-111, VGA-113, VGA-117, VGA-146, VGB-103, VGS-141, VGS-143, VGS-145, VGS-147, VGS-148, na koji se odnosi deklaracija ispod, u skladu sa dole prikazanim direktivama Saveta za usklađivanje zakona država članica EU.

**CZ: Prohlášení o shodě EU**

My firma Grundfos prohlašujeme na svou plnou odpovědnost, že výrobky VGA-111, VGA-113, VGA-117, VGA-146, VGB-103, VGS-141, VGS-143, VGS-145, VGS-147, VGS-148, na které se toto prohlášení vztahuje, jsou v souladu s níže uvedenými ustanoveními směrnice Rady pro sblížení právních předpisů členských států Evropského společenství.

**ES: Declaración de conformidad de la UE**

Grundfos declara, bajo su exclusiva responsabilidad, que los productos VGA-111, VGA-113, VGA-117, VGA-146, VGB-103, VGS-141, VGS-143, VGS-145, VGS-147, VGS-148 a los que hace referencia la siguiente declaración cumplen lo establecido por las siguientes Directivas del Consejo sobre la aproximación de las legislaciones de los Estados miembros de la UE.

**PT: Declaração de conformidade UE**

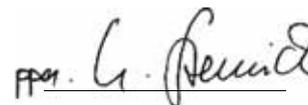
A Grundfos declara sob sua única responsabilidade que os produtos VGA-111, VGA-113, VGA-117, VGA-146, VGB-103, VGS-141, VGS-143, VGS-145, VGS-147, VGS-148, aos quais diz respeito a declaração abaixo, estão em conformidade com as Directivas do Conselho sobre a aproximação das legislações dos Estados Membros da UE.

- Machinery Directive (2006/42/EC). Standards used: DIN EN ISO 12100:2010.
- Low Voltage Directive (2014/35/EU). Standards used: EN 60204-1:2007  
EN 61010-1:2011-07\*
- EMC Directive (2014/30/EU)\*. Standards used: EN 55014-1:2006+A1:2009+A2:2011  
EN 55014-2:2016  
EN 61000-6-1:2007  
EN 61000-6-3:2011
- Other regulations applied: DIN 19606:2010-09
- RoHS Directives (2011/65/EU and 2015/863/EU). Standard used: EN 50581:2012

\* Only valid for products with electrical components

This EU declaration of conformity is only valid when published as part of the Grundfos installation and operating instructions (publication numbers 95714202, 95714224, 98028175, 95714246, 95714278, 95713929, 95714262, 95714296).

Pfintzal, 1st March 2018



Ulrich Stemick  
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Person authorised to compile technical file and empowered to sign the EU declaration of conformity.



Установки вакуумные для дозирования газов типа Vassiperm сертифицированы на соответствие требованиям Технических регламентов Таможенного союза: ТР ТС 004/2011 «О безопасности низковольтного оборудования»; ТР ТС 010/2011 «О безопасности машин и оборудования»; ТР ТС 020/2011 «Электромагнитная совместимость технических средств».

Сертификат соответствия:

ТС RU С-ДК.АИ30.В.01214, срок действия до 17.12.2019 г.

Выдан: Органом по сертификации продукции «ИВАНОВО-СЕРТИФИКАТ» ООО «Ивановский Фонд Сертификации».

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Установки вакуумные для дозирования газов типа Vassiperm декларированы на соответствие требованиям Технического регламента Таможенного союза ТР ТС 032/2013 «О безопасности оборудования, работающего под избыточным давлением».

Декларация соответствия:

ТС N RU Д-ДК.АИ30.В.05343, срок действия до 08.10.2020 г.

Истра, 1 марта 2016 г.

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