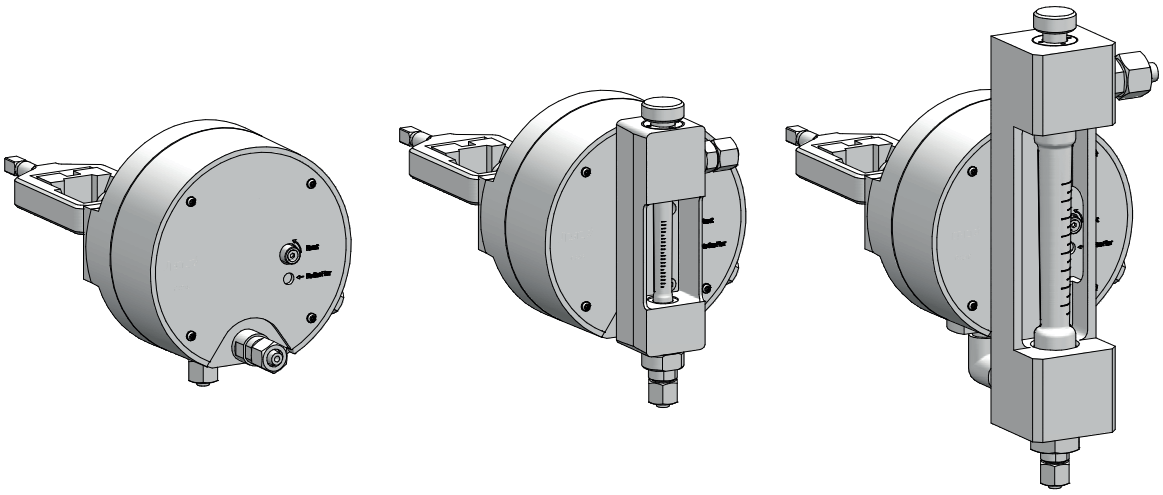
Vacuum regulator
C 2216-V / C 2216-VF
Operating instructions



Read the operating manual!

The user is responsible for installation and operation related mistakes!

Original operating instructions
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BA-20430-02-V03

Dosing | Liquids
Conveying | Gases
Control | Systems

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1 Notes for the Reader

This operating manual contains information and behaviour rules for the safe and designated operation of the device.

Observe the following principles:

- read the entire operating instructions prior to inaugurating the device.
- Ensure that everyone who works with or on the device has read the operating manual and follows it.
- Maintain the operating manual throughout the service life of the device.
- Pass the operating manual on to any subsequent owner of the device.

1.1 General non-discrimination

In this operating manual, only the male gender is used where grammar allows gender allocation. The purpose of this is to make the text easy to read. Men and women are always referred to equally. We would like to ask female readers for understanding of this text simplification.

1.2 Explanation of the signal words

Different signal words in combination with warning signs are used in this operating manual. Signal words illustrate the gravity of possible injuries if the risk is ignored:

Signal word	Meaning
DANGER!	Refers to imminent danger. Ignoring this sign may lead to death or the most serious injuries.
WARNING!	Refers to a potentially hazardous situation. Failure to follow this instruction may lead to death or severe injuries.
CAUTION!	Refers to a potentially hazardous situation. Failure to follow this instruction may lead to minor injury or damage to property.
PLEASE NOTE	Refers to a danger which, if ignored, may lead to risk to the machine and its function.

Tab. 1: Explanation of the signal words

1.3 Explanation of the warning signs

Warning signs represent the type and source of a danger:

Warning sign	Type of danger
	Danger point
	Danger from poisonous substances
	Danger from corrosive substances
	Danger of damage to machine or functional influences

Tab. 2: Explanation of the warning signs

1.4 Identification of warnings

Warnings are intended to help you recognise risks and avoid negative consequences.

This is how warnings are identified:

Warning sign	**SIGNAL WORD**
Description of danger. Consequences if ignored. ⇨ The arrow signals a safety precaution to be taken to eliminate the danger.	

1.5 Instruction for action identification

This is how pre-conditions for action are identified:

✓ Pre-condition for action which must be met before taking action.

🛠 A resource such as a tool or auxiliary materials required to perform the operating instructions.

This is how instructions for action are identified:

➔ Separate step with no follow-up action.

1. First step in a series of steps.
2. Second step in a series of steps.

▸ Result of the above action.

✓ **Action completed, aim achieved.**

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2 Safety

2.1 General warnings

The following warnings are intended to help you eliminate the dangers that can arise while handling the device. Risk prevention measures always apply regardless of any specific action.

Safety instructions warning against risks arising from specific activities or situations can be found in the respective sub-chapters.



DANGER!

Danger to life from chlorine poisoning!

Chlorine is poisonous. In severe cases, breathing in chlorine may lead to death. It irritates the eyes, the respiratory system and the skin.

- ⇨ Install a gas warning device.
- ⇨ Use sufficient personal protective equipment.
- ⇨ When carrying out any work on the system, use a respirator mask with a Type B gas filter that complies with EN 14387.
- ⇨ Always comply with the accident prevention regulations that apply at the place of use.
- ⇨ Get rid of leaks without delay. You must get rid of even very minor leaks without delay. Together with the humidity, chlorine forms hydrochloric acid and corrosion results in rapidly increasing leakage.
- ⇨ Use only chlorine-resistant seals.
- ⇨ Only use seals once. Reusing them leads to leaks.



DANGER!

Increased danger to life from chlorine escape

A fatal quantity of chlorine gas can be released from a leakage.

- ⇨ If chlorine escapes, leave the room immediately.
- ⇨ Use sufficient personal protective equipment.
- ⇨ If chlorine gas escapes, wear a Type 2 self-contained breathing apparatus that complies with EN 137.
- ⇨ Only initiate counter measures after putting on the protective equipment.
- ⇨ Given a serious escape and insufficient equipment or qualifications, leave the work to professional emergency services personnel. Do not take any unnecessary risks.



WARNING!

Increased risk of accidents due to insufficient qualification of personnel!

Chlorinators and their accessories must only be installed, operated and maintained by personnel with sufficient qualifications. Insufficient qualification will increase the risk of accidents.

- ⇨ Ensure that all action is taken only by personnel with sufficient and corresponding qualifications.
- ⇨ Prevent access to the system for unauthorised persons.

2.2 Information about chlorine

Chlorine is a hazardous substance. The chemical element chlorine is a greenish-yellow, toxic gas with a pungent odour, which can be detected in the air at concentrations below 1 ppm (= 1 ml/m³).

Chlorine is 2.5 times heavier than air and accumulates at ground level.

Chlorine is extremely toxic for water organisms. The reason for the toxicity of chlorine is its extraordinary reactivity. It reacts with animal and vegetable tissue and thus destroys it.

Air with a chlorine gas content of 0.5 -1% leads to a quick death in mammals and humans, as it attacks the respiratory tract and the pulmonary alveolus (formation of hydrogen chloride or hydrochloride acid).



PLEASE NOTE

Faults due to insufficient chlorine quality

Impurities in the chlorine gas form deposits in devices and valves and can attack the components chemically. This can lead to malfunctions.

- ⇨ Only use technically pure chlorine that meets the following requirements:
  - Mass content of chlorine at least 99.5%
  - Water content max. 20 mg/kg

  Chlorine that complies with EN 937 meets these requirements.

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2.3 Hazards due to non-compliance with the safety instructions

Failure to follow the safety instructions may endanger not only persons, but also the environment and the device.

The specific consequences can be:

- failure of important functions of the device and of the corresponding system,
- failure of required maintenance and repair methods,
- danger to persons,
- danger to the environment caused by substances leaking from the system.

2.4 Working in a safety-conscious manner

Besides the safety instructions specified in this operating manual, further safety rules apply and must be followed:

- accident prevention regulations
- safety and operating provisions,
- safety provisions for handling dangerous substances (mostly the safety data sheets to dosing media),
- environmental protection provisions,
- applicable standards and legislation.

2.5 Personal protective equipment

Based on the degree of risk posed by the dosing medium and the type of work you are carrying out, you must use corresponding protective equipment. Read the Accident Prevention Regulations and the Safety Data Sheets to the dosing media find out what protective equipment you need.

You will require the minimum of the following personal protective equipment:

Personal protective equipment required	
	Respirator mask
	Protective clothing
	Safety shoes
	Protective gloves

Tab. 3: Personal protective equipment required

Wear the following personal protective equipment when performing the following tasks:

- Commissioning,
- All work on gas-bearing system parts,
- Replacing the supply tanks,
- Shut-down,
- Maintenance work,
- Disposal.

2.6 Personnel qualification

Any personnel who work on the device must have appropriate special knowledge and skills.

Anybody who works on the device must meet the conditions below:

- attendance at all the training courses offered by the owner,
- personal suitability for the respective activity,
- sufficient qualification for the respective activity,
- training in how to handle the device,
- knowledge of safety equipment and the way this equipment functions,
- knowledge of this operating manual, particularly of safety instructions and sections relevant for the activity,
- knowledge of fundamental regulations regarding health and safety and accident prevention.

All persons must generally have the following minimum qualification:

- training as specialists to carry out work on the device unsupervised,
- sufficient training that they can work on the device under the supervision and guidance of a trained specialist.

These operating instructions differentiate between these user groups:

2.6.1 Specialist staff

Thanks to their professional training, knowledge, experience and knowledge of the relevant specifications, specialist staff are able to perform the job allocated to them and recognise and/or eliminate any possible dangers by themselves.

2.6.2 Trained persons

Trained persons have received training from the operator about the tasks they are to perform and about the dangers stemming from improper behaviour.

Trained persons have attended all trainings offered by the operator.

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2.6.3 Personnel tasks

In the table below you can check what qualifications are the pre-condition for the respective tasks. Only people with appropriate qualifications are allowed to perform these tasks!

Qualification	Activities
Specialist staff	■ Assembly ■ Commissioning ■ Taking out of operation ■ Maintenance ■ Repairs ■ Fault rectification ■ Disposal
Trained persons	■ Control ■ Transportation ■ Storage

Tab. 4: Personnel qualification

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3 Intended use

3.1 Notes on product warranty

Any non-designated use of the device can impair its function and the protection provided. This leads to invalidation of any warranty claims!

Please note that liability is on the side of the user in the following cases:

- the device is operated in a manner which is not consistent with these operating instructions, particularly safety instructions, handling instructions and the section "Intended Use".
- Information on usage and environment (see section 5 „Technical data“ on page 11) is not adhered to.
- If people operate the device who are not adequately qualified to carry out their respective activities.
- No original spare parts or accessories of Lutz-Jesco GmbH are used.
- Unauthorised changes are made to the device.
- The user uses different dosing media than those indicated in the order,
- Maintenance and inspection intervals are not adhered to as required or not adhered to at all.
- The device is commissioned before it or the corresponding system has been correctly and completely installed.
- Safety equipment has been bridged, removed or made inoperative in any other way.

3.2 Intended purpose

The device is exclusively intended for the dosing of a chlorine dioxide solution in a vacuum procedure. It reduces the positive pressure from the chlorine gas supply to a pressure lower than the atmospheric air pressure. The dosing quantity can also be displayed and adjusted on the device version with a flow meter.

It may only be used with technically pure chlorine with a minimum mass content of 99.5 %

3.3 Prohibited dosing media

The device must not be used for the following media and substances:

- Any gases except chlorine gas,
- Chlorine gas of insufficient quality

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4 Product description

4.1 Scope of delivery

Please compare the delivery note with the scope of delivery. The following items are part of the scope of delivery:

Variant C 2216-V

- Vacuum regulator with inlet valve, integrated safety blow-off valve and optical empty notification
- Electrical empty notification (optional)
- 5 m hose with fastening material as a blow-off line
- Operating instructions

Variant C 2216-VF

- Additional flow meter on the front side

4.2 Design and function

4.2.1 Structure of the device

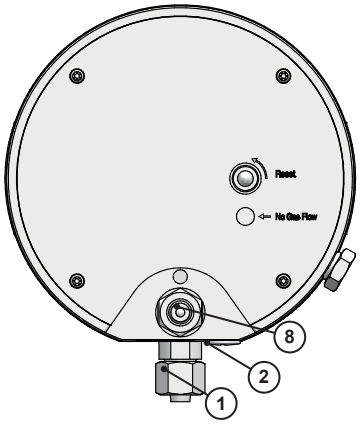


Fig. 1: C 2216-V - Front view

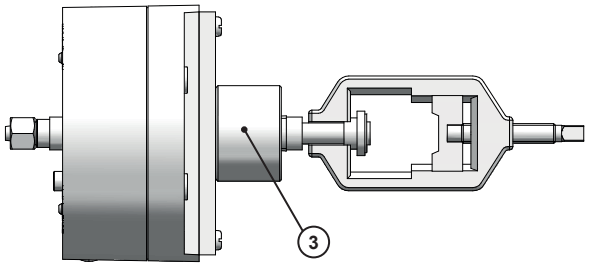


Fig. 2: C 2216-V - Top view

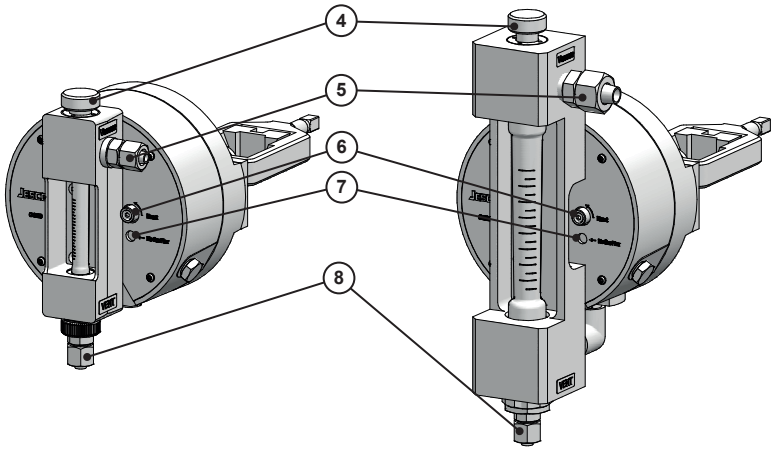


Fig. 3: Structure of the C 2216-VF 4 and 10 kg/h Cl_2

Item	Description
1	Dosing connector
2	Reed switch input
3	Input chlorine gas
4	Flow meter with manual regulation valve

Tab. 5: Structure of the devices

Item	Description
5	Chlorine gas output
6	Reset button
7	Visual empty notification
8	Safety blow-off valve

Tab. 5: Structure of the devices

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4.2.2 Function description

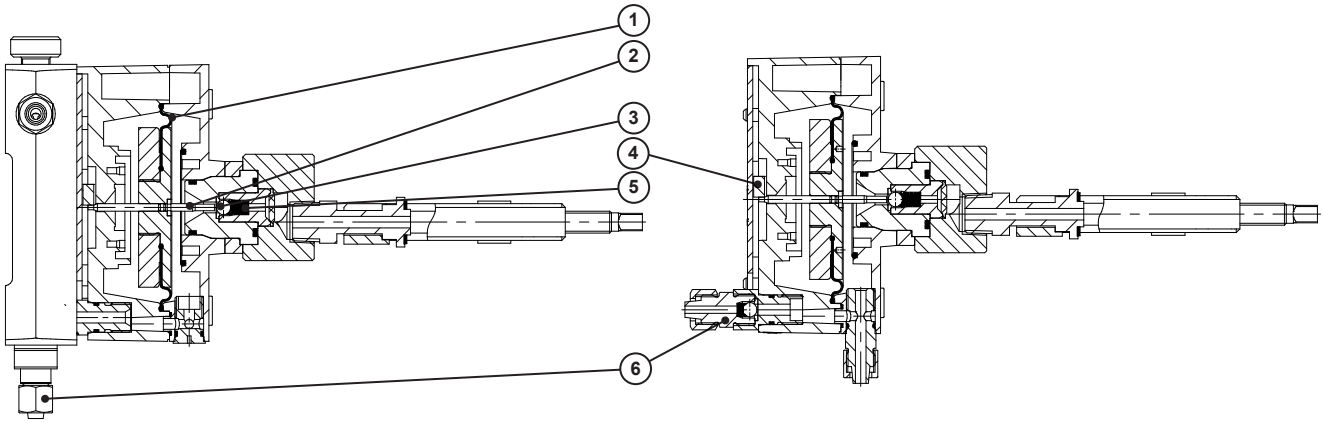


Fig. 4: Section Vacuum regulator C 2216-VF 4kg/h Cl_2 (left) and Vacuum regulator C 2216-V (right)

The vacuum regulator is a pressure reducing valve fitted directly to the chlorine gas tank and enables dosing in a total vacuum system. The device performs a range of functions.

Vacuum regulation

After activation of the injector, a vacuum establishes itself at the device output. The vacuum applies a force to the working diaphragm (1) of the full-vacuum chlorinator, which is directed to the right. This force is transferred to the valve ball (3) in the inlet valve via the valve rod (2) so that the chlorine gas can enter the vacuum system. Following a collapse of the vacuum, the chlorine cylinder pressure and the locking spring (5) suddenly press the valve ball on the valve seat and stop the chlorine gas flow.

Safety blow-off valve

If the inlet valve of the vacuum regulator does not close completely due to impurities, positive pressure can develop in the vacuum piping system and cause undesired chlorination. This is blocked by the integrated safety blow-off valve (6). Even the smallest positive pressure causes the valve ball in the valve to press a spring together. In this situation, the valve ball lifts up from the valve seat and opens a flow channel for chlorine gas to the extent that it can flow over the blow-off line in the direction of a gas sensor.

Visual empty notification

With decreasing chlorine gas pressure, the vacuum in the diaphragm chamber and the diaphragm disc created by the injector is moved in the direction of the inlet valve. Too strong a vacuum will trigger the empty notification from the chlorine tank. The message is communicated optically: the red pennant (4) on the front of the vacuum regulator becomes visible in a window (8). Optionally, the empty notification can also be signalled electrically via the interruption of a reed switch.

Flow indication with manual control

An optional flow meter is mounted on the front side of the C 2216. The position of the float (9) indicates the flow volume. The chlorine gas flow can be adjusted using the needle valve (7) located directly in the flow meter housing.

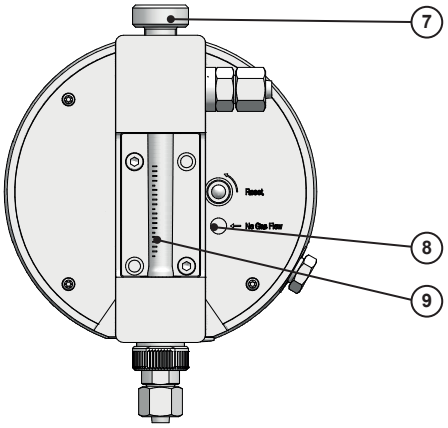


Fig. 5: Vacuum regulator C 2216-VF 4 kg/h Cl_2, Front view

4.3 Rating plate

The rating plate contains information on the safety and functional method of the product. The rating plate must be kept legible for the entire service life of the product.

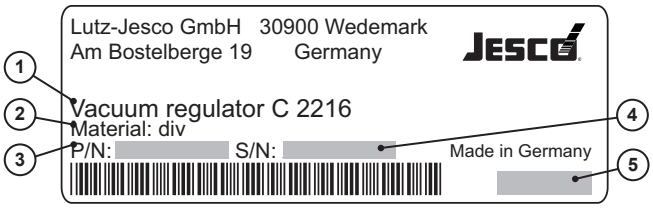


Fig. 6: Rating plate

No.	Description
1	Product name
2	Components coming into contact with the media
3	Part number
4	Serial number
5	Production date

Tab. 6: Rating plate

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5 Technical data

Description			Value	
Throughput			up to 10 kg Cl_2/h	
dosage range			0.025 / 0.08 / 0.2 / 0.5 / 1 / 2 / 2.5 / 4 / 5 / 6 / 8 / 10 kg/h Cl_2	
Vacuum regulator	Inlet pressure		1.5 – 16 bar	
	Operating vacuum		0.95 bar absolute	
	Opening pressure of the safety blow-off valve		0.2 – 0.5 bar	
	Connections	Discharge	Yoke connection (1.030“-14 NGO, BSW 1“)	
		Vacuum	8/12 PE hose (4 kg/h), 12/16 PE-hose (10 kg/h)	
		Blow-off valve	8/12 PE hose	
Measuring tube	Accuracy		± 2 % of scale value	
	Setting ratio		1:20	
	Material		Glass	
	Length		0.025 – 4 kg/h Cl_2	80 mm
			5 – 10 kg/h Cl_2	160 mm
Material in contact with the media	plastics		PVC, PVDF, PTFE, ABS	
	Metals		Hastelloy, nickel-plated brass, silver	
	Seals, diaphragms		FPM	
Maximum contact load rating of the electrical empty notification			max. 48 V DC / 0.5 A / 10 W	
Weight	C 2216-VF		0.025 – 4 kg/h Cl_2	2.4 kg
			5 – 10 kg/h Cl_2	3.2 kg
	C 2216-V			2.2 kg
Ambient temperature			0 – 50 °C (avoid direct sunlight)	
Air humidity			max. 95 %, non condensing	

Tab. 7: Technical data

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6 Dimensions

All dimensions in mm

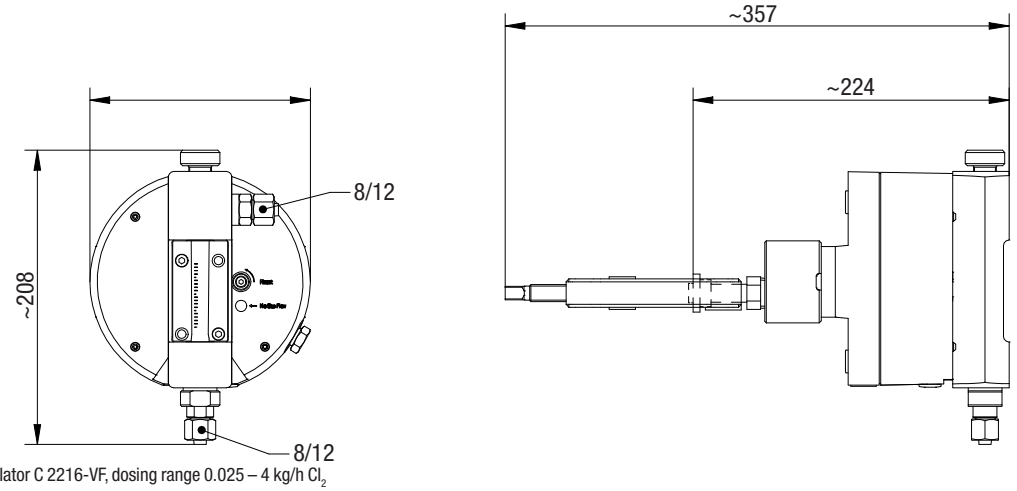


Fig. 7: Vacuum regulator C 2216-VF, dosing range 0.025 – 4 kg/h Cl_2

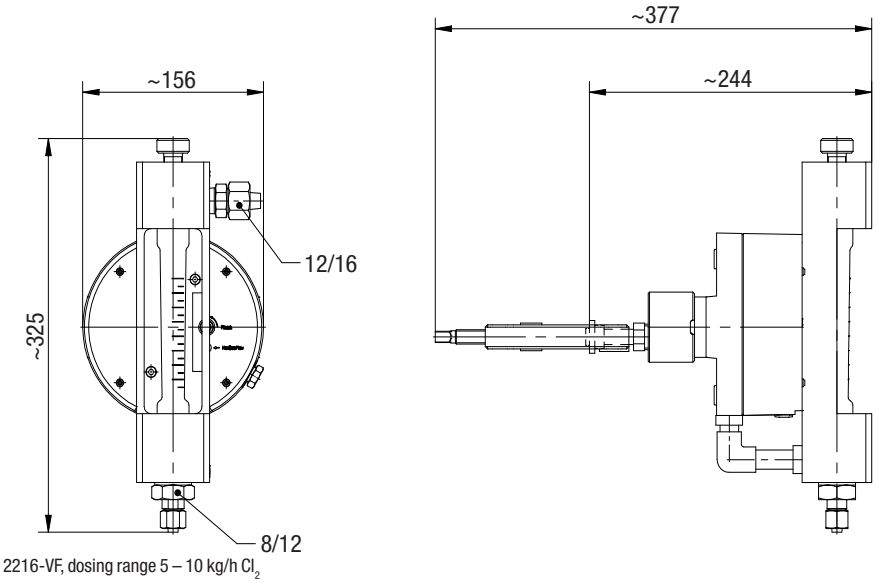


Fig. 8: Vacuum regulator C 2216-VF, dosing range 5 – 10 kg/h Cl_2

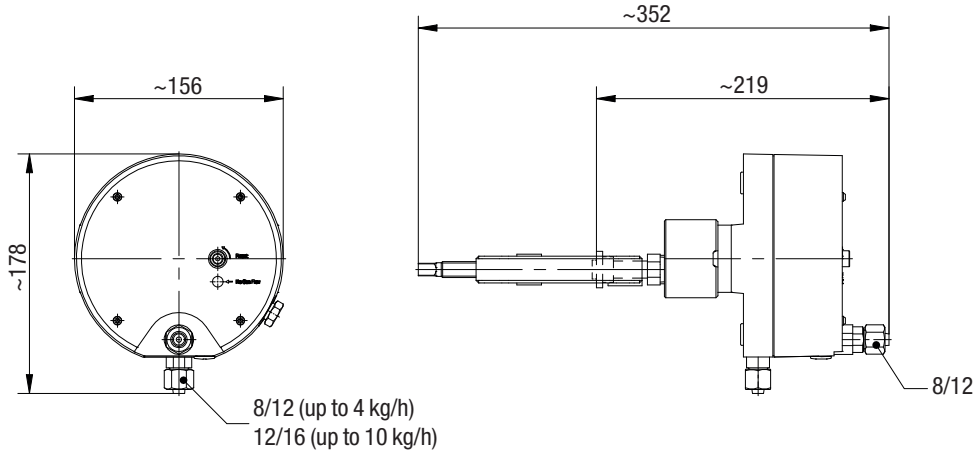


Fig. 9: Vacuum regulator C 2216-V

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7 Installation



PLEASE NOTE

Damage to the system due to incorrect installation

The failure to observe installation instructions (e.g. use of unsuitable tools, incorrect torque) can damage the system parts.

⇨ Use suitable tools only.

⇨ Only apply the appropriate amount of force to the plastic parts. Plastic threads (especially PVC threads) can be tightened and loosened more easily by applying a thin layer of amount of silicone grease or PRFE grease.

⇨ Note the specified torque.

7.1 Installation location and Alignment

Installation location

The room must fulfil the following requirements:

- Secured against access by unauthorised persons,
- Protected against weather conditions,
- Frost-free
- The permissible ambient temperature is adhered to (see Section 5 "Technical data" on page 11).
- Room of sufficient size to allow trouble-free assembly as well as inspection and maintenance of the device at all times.
- The room can be ventilated well.
- The room must comply with the locally valid prescriptions.

Alignment

Align the device as demonstrated in chapter 7.5 „Installation examples“. Only then will the throughflow and empty notification display function correctly.

7.2 Preparation



DANGER!

Danger of death resulting from an unsuitable chlorine tank!

Chlorine gas dosing systems pose an increased security danger, if connected to a chlorine tank not in a perfect condition.

⇨ Always perform a visual check before connecting the chlorine tank.

⇨ Do not connect a chlorine tank which is in a visibly bad condition (e.g. visible soiling or damage to the valve).

⇨ Do not use a chlorine tank lacking its protective cap or cover.

The following requirements must be given before connecting the device to the chlorine tank:

✓ The protective cap or cover of the chlorine tank has been removed and the tank valve was subjected to a visual check. The sealing surface of the tank valve must be free of soiling and damage.

✓ The chlorine tank has been put into the position specified for use and has been secured with the corresponding equipment. Chlorine cylinders are fixed in an upright position using holding straps or -chains; chlorine drums are fixed in a horizontal position on roller bearings.

✓ The tank contents had sufficient time to pacify and take on room temperature, after the tank was brought into position.

7.3 Installing the device

7.3.1 Chlorine input (pressure)



PLEASE NOTE

Damage to the system by liquid chlorine

The device is only suited for gaseous chlorine. Liquid chlorine can damage the device.

⇨ Ensure that the chlorine tank has assumed room temperature before assembling the device.

⇨ Never connect the device directly to the gas take-off valve of the chlorine drum. Liquid chlorine can be present in the feed pipe to this valve. Install a moisture eliminator with a heating collar at the input of this device, in order to evaporate this residual volume and to avoid condensation.



PLEASE NOTE

Damage of the device from soiling

Chlorine gas combines with air humidity and soiling to create deposits which can damage the device.

⇨ Remove the protective plug on the inlet valve only immediately before assembly of the device.

⇨ Do not use a device lacking its protective plug.

Pre-conditions for actions:

✓ The system is prepared in accordance with section 7.2 „Preparation“ on page 13.

✓ The chlorine cylinder valve is closed.

✓ The connection seal on the inlet valve is clean, undamaged and dry.

✓ The protective cap on the inlet valve is still present.

🛠 Ring open-end spanner 3/8“

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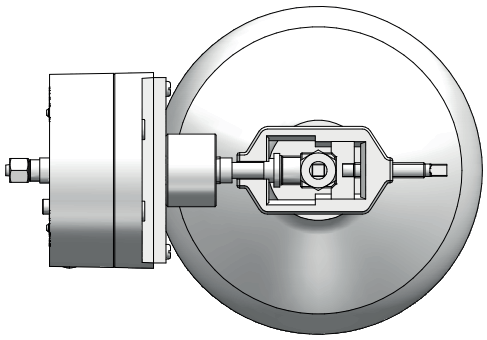


Fig. 10: C 2216-V fitted on the chlorine cylinder

Perform the following steps:

1. Remove the protective plug from the inlet valve.
2. Fit the device on the cylinder valve. Ensure that the connection seal remains in position during assembly.
3. Tighten the square head bolt carefully using a ring open-end spanner and avoid a torque of more than 20 Nm.

✓ **Device fitted with yoke connection.**

7.3.2 Chlorine outlet (vacuum)

When installing a chlorinator, the chlorine gas piping must be held under a vacuum as far as possible. Given leakages in the vacuum piping system, the ambient air will be sucked in and chlorine gas cannot be removed. As a result, the vacuum regulator should be connected as closely as possible to the chlorine gas supply (e.g. directly on the chlorine tank). The injector should be installed as closely as possible on the infeed point of the chlorine solution.

The figure shows the two sections of the vacuum system with the lines L_1 and L_2. The pressures p_1 and p_2 represent the vacuum, Δp_1 and Δp_2 the pressure loss in the respective lines. If the dosing device is mounted on the vacuum regulator, as with the vacuum regulator 2216-VF, the first section with L_1, p_1 and Δp_1 can be ignored.

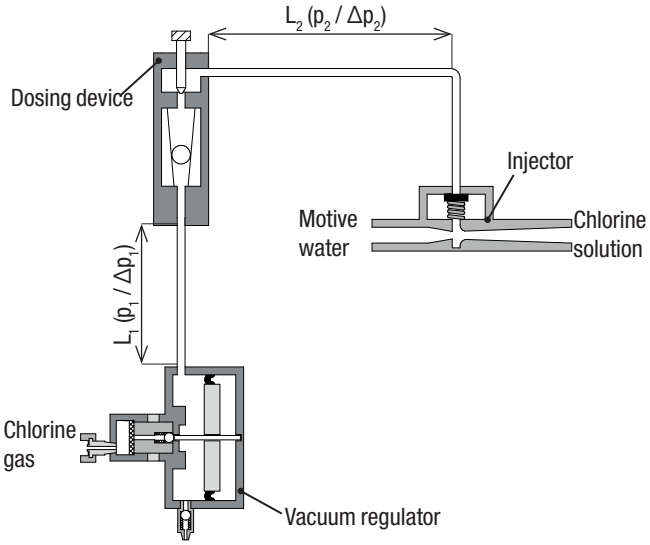


Fig. 11: Sections of the vacuum system

Depending on the installation location of the components, long vacuum lines are possible in individual sections. To enable the injector to perform independently of its installation location, the pressure loss Δp in the vacuum lines should not be too high. The pressure loss in the individual sections must not be the same. Differences in pressure loss resulting from various line diameters and lengths are permissible, as long as a total pressure loss Δp_{tot} is not exceeded. Δp_{tot} was set to 40 mbar for the calculations.

The following tables state the max. line lengths L_1 and L_2 from PE hoses of the sizes 8/12 and 12/16 for a particular injector performance. When calculating the length of the lines L_2 both the pressure loss Δp and the vacuum p was varied.

Vacuum line L_1:

Pressure loss	Δp_1 = 20 mbar	
Vacuum	p_1 = 0.9 bar (a)	
Mass flow of chlorine	PE hose Ø 8/12 (DN 8)	PE hose Ø 12/16 (DN 12)
1 kg/hr	75 m	500 m
2 kg/hr	22 m	150 m
3 kg/hr	11 m	75 m
4 kg/hr	6 m	45 m
5 kg/hr		30 m
6 kg/hr		22 m
8 kg/hr		13 m
10 kg/hr		9 m

Tab. 8: Max. line length L_1 (pressure decrease = 20 mbar)

Vacuum line L_2:

Pressure loss	Δp_2 = 20 mbar			
Vacuum	p_2 = 0.5 bar (a)		p_2 = 0.75 bar (a)	
Mass flow of chlorine	PE hose Ø 8/12 (DN 8)	PE hose Ø 12/16 (DN 12)	PE hose Ø 8/12 (DN 8)	PE hose Ø 12/16 (DN 12)
1 kg/hr	40 m	280 m	60 m	420 m
2 kg/hr	12 m	83 m	18 m	120 m
3 kg/hr	5 m	41 m	9 m	60 m
4 kg/hr	3 m	24 m	5 m	35 m
5 kg/hr		16 m		25 m
6 kg/hr		12 m		18 m
8 kg/hr		7 m		11 m
10 kg/hr		5 m		7 m

Tab. 9: Max. line length L_2 (pressure decrease = 20 mbar)

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7.3.3 Mounting the dosing line

Pre-conditions for actions:

✓ The dosing device is connected to the chlorine supply.

✓ The transport protection of dosing device output has been removed.

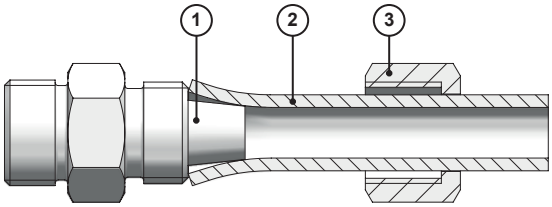


Fig. 12: Fitting the hose connection

Perform the following steps:

1. Cut the hose (2) a at right angles.
2. Slide the union nut (3) onto the hose.
3. Slide the hose end onto the grommet of the hose connection (1). You can heat the hose end so as to make it easier to slide it onto the grommet.
4. Tighten the union nut by hand.

✓ **Dosing line fitted.**

7.3.4 Mounting the blow-off line on the safety blow-off valve

A hose serves as a blow-off line, the open end of which ends in proximity to the gas sensor. An activated carbon cartridge is often fitted to the open end of the hose. This helps avoid an alarm following system-conditioned short pressure pulses (e.g. during switching).

Pre-conditions for actions:

✓ The chlorine input of the vacuum regulator has been fitted.

✓ The dosing line of the vacuum regulator has been fitted.

✓ The transport protection on the safety blow-off valve has been removed.

Perform the following steps:

1. Cut the hose (2) a at right angles.
2. Slide the union nut (3) onto the hose.
3. Slide the hose end onto the grommet of the hose connection (1). You can heat the hose end so as to make it easier to slide it onto the grommet.
4. Tighten the union nut by hand.

✓ **Blow-off line fitted on the safety blow-off valve.**

7.3.5 Connect the electrical empty notification (optional)

Perform the following steps:

1. Loosen the union nut on the cable screw connection.
2. Slide the reed switch into the housing to its fullest extent.
3. Re-tighten the union nut of the cable screw connection.
4. Connect the cabling of the reed switch to your external measurement and control module

✓ **Reed switch connected.**

Adjustment and checking the reed switch

Do not adjust the reed switch during operation.

Perform the following steps:

1. Loosen the union nut on the cable screw connection until it is possible to move the cable of the reed switch.
2. Check that the reed switch is in the vacuum regulator housing to its fullest extend.
3. Re-tighten the union nut of the cable screw connection.
4. Turn the reset button counterclockwise to its fullest extend when the red pennant is visible in the optical empty notification window.
5. Connect the open ends of the reed switch to a multimeter and set the multimeter to the continuity tester. An acoustic or optical signal can be detected.

✓ **The reed switch has been adjusted successfully.**

If the multimeter does not issue a signal and the optical empty notification does not show red, the reed switch may be defective.

➔ Replace the reed switch.

If the multimeter issues a signal and the optical empty notification shows red, the reed switch may be adjusted incorrectly or defective.

➔ Check the adjustment of the reed switch in the device. Afterwards, turn the reset button counterclockwise until you feel it advancing to its fullest extent and check the reed switch again.

The reed switch is open, although the multimeter issues a closing signal.

➔ Should a reset of the empty notification not result in closure of the contact, consult the manufacturer of the vacuum regulator.

7.4 Completing the installation

After completing installation, you must check that all the connections are leak-proof (see section 8.1 „Leak test with ammonia“ on page 18 and section 8.2 „Checking the vacuum system“ on page 19).

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7.5 Installation examples

7.5.1 Installation on chlorine cylinders

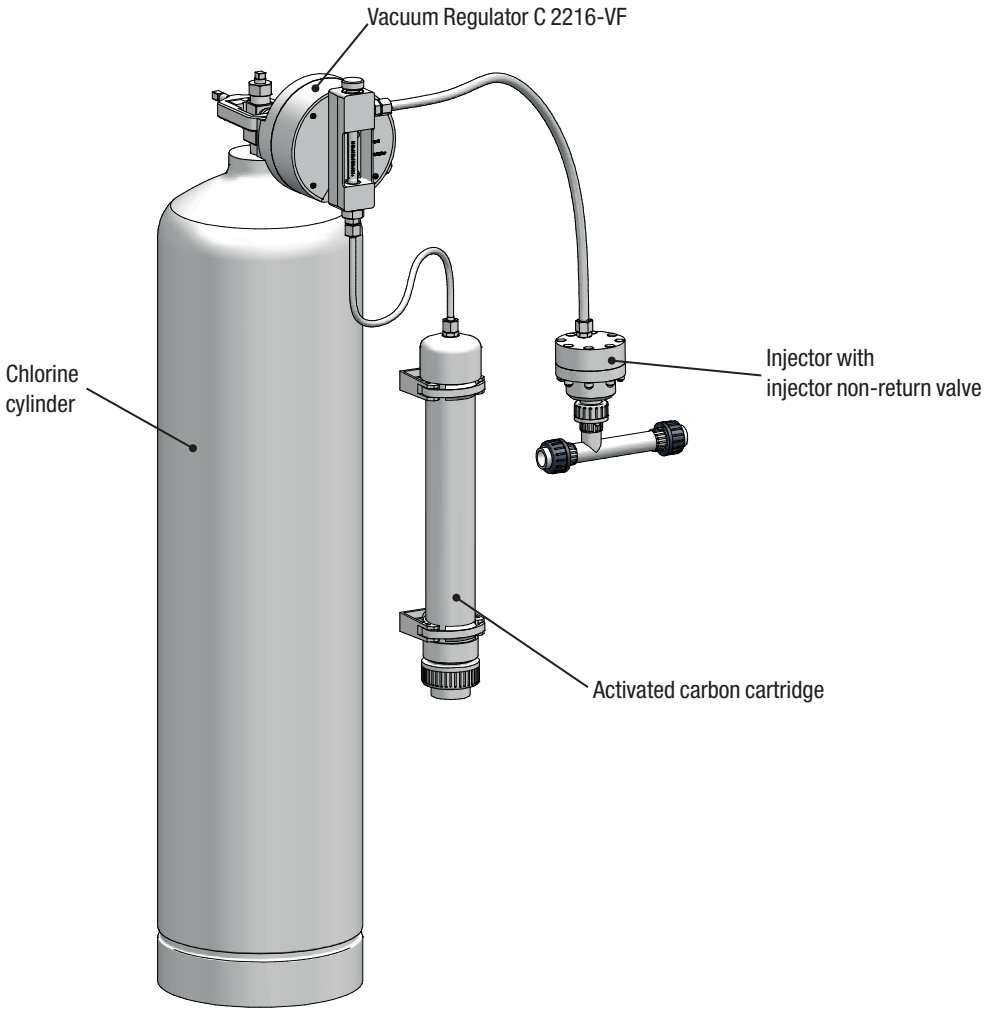


Fig. 13: Installation on chlorine cylinders

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7.5.2 Installation on chlorine drums

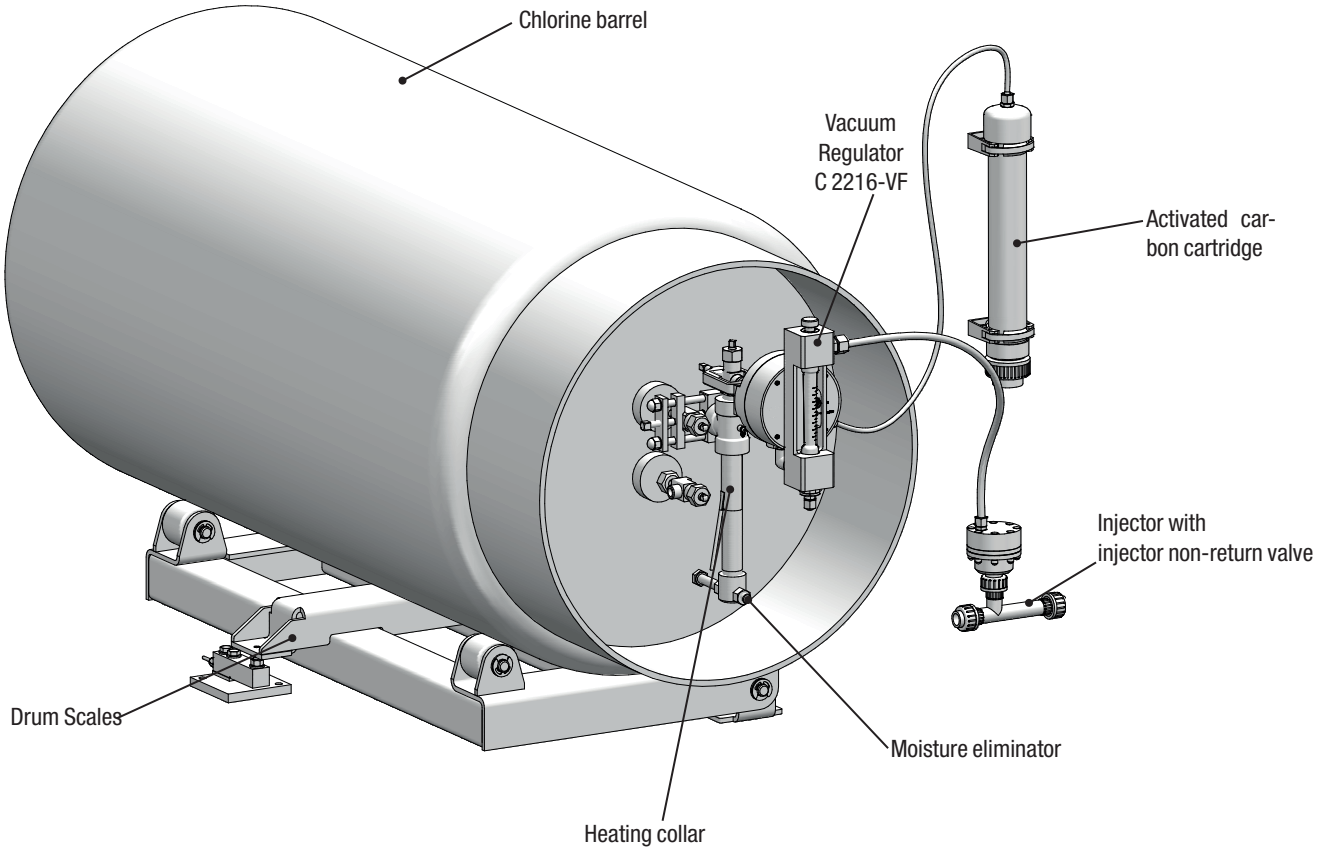


Fig. 14: Installation on chlorine drums

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8 Commissioning

DANGER!

Chlorine gas can escape due to systems that are leaky or not installed correctly!

Chlorinators constitute an increased safety risk if they have not been properly installed, if an adequate leak test has not been performed or if the devices are not in good condition.

- ⇨ Before placing the system into operation, have it checked by technical personnel to ensure that it is in the proper condition and leak-tight.
- ⇨ The condition of the installation must be checked for adequate tightness on a regular basis.
- ⇨ Get rid of leaks without delay. You must get rid of even very minor leaks without delay. Together with the humidity, chlorine forms hydrochloric acid and corrosion results in rapidly increasing leakages.

8.1 Leak test with ammonia

With devices directly installed on the cylinder, the overpressure system is limited to the cylinder connection and the vacuum regulator inlet valve. For all other systems, it is necessary to check the overpressure system to inlet valve.

DANGER!

Danger to life from chlorine poisoning

If you start the leak test with chlorine before the entire plant has been installed and the injectors are ready for operation, chlorine may not be extracted immediately in the case of a leak.

- ⇨ Make sure that all the components in the plant are installed correctly and the injectors are ready for operation before starting the leak test.
- ⇨ Put on protective clothing before carrying out the leak test.

Precondition for action:

- ✓ The device has been installed in accordance with section 7 „Installation“ on page 13.
- ✓ The chlorine tank valve is closed.
- ✓ The injector is ready for operation.
- ✓ Personal protective equipment is used.
- 🛠 Cylinder with ammonia (NH_3)

Perform the following steps:

1. Briefly open the chlorine container valve and close it again.

PLEASE NOTE

Damage to the plant by the ammonia solution

If the ammonia solution comes into contact with the plant, this leads to corrosion on the equipment.

- ⇨ Make sure that you do not spill any ammonia.

2. Carry out the ammonia test on the entire pressure system: Ammonia steam with chlorine forms a white vapour and makes even very small leaks and the presence of small volumes of chlorine in the surrounding air visible. To do this, hold an open bottle containing the ammonia solution close to the pipe and make slight pumping motions with the plastic bottle.

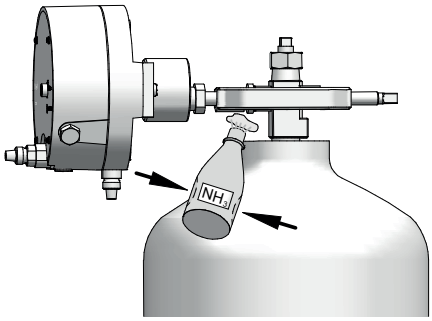


Fig. 15: Leak test with ammonia bottle

3. If you find leaks: Use the injector to suck off the chlorine immediately!
3. After this, repair the leak.
4. Carry out the leak test again.
5. If you do not find any leaks: Open the valve of the chlorine tank and leave it open.
6. Carry out the ammonia test again.

✓ **Leak test with ammonia completed.**

You must get rid of even very minor leaks without delay. Together with the humidity, chlorine forms hydrochloric acid and corrosion results in increased leakage.

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8.2 Checking the vacuum system



PLEASE NOTE

Operating faults through leakages in the vacuum system

Small leaks in the vacuum system will not be recognised in normal operation, since no chlorine escapes. Air will enter the system with moisture. The air humidity reacts with the chlorine. This results in corrosion and can lead to deposits which result in malfunctions.

⇨ Follow the specifications in this section regarding the inspection of the vacuum system.

⇨ The leak test must be performed by sufficiently-qualified personnel.

Pre-conditions for actions:

✓ The vacuum system is fully assembled.

✓ All the open connections of the vacuum system were closed.

✓ The injector is ready for operation.

Perform the following steps:

1. Connect the chlorine supply to the chlorine tank valves or a valve in the device supply line.
2. Open the regulation valve for adjusting the dosing quantity on the flow meter.
3. Turn the reset button anti-clockwise to its fullest extent.
4. Switch the injector on. After a short time, the float in the flow meter must stop moving and the red pennant of the empty notification must be visible in the inspection glass.
5. Switch off the injector. Wait 5 minutes. During this time, the reset button must be able to rotate around it axis.
6. Should the float not be still or if the reset button cannot move freely, there is a leak in the system. This must be found and remedied through checking all components up to and including the vacuum regulator.

When the system is vacuum-tight:

7. Open the valve on the chlorinator. The device makes a noise and is then ready to operate.
8. Turn the reset button anti-clockwise to its fullest extent.

✓ **A leak test was performed in the vacuum system.**

8.3 Switching on the system

The device does not require any special operation. The device opens and chlorine gas flows given a sufficient vacuum and sufficient chlorine supply. The device will not open given an insufficient vacuum.

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9 Operation

The vacuum regulator not require any special operation. The device opens given a sufficient vacuum and sufficient chlorine supply. Given a low vacuum, the device halts the chlorine gas flow. In devices with a flow meter, the dosing quantity can be set manually on the needle valve of the flow meter. The following mean:

- Turning in a clockwise direction: Reduces the dosing quantity
- Turning counterclockwise: Increases the dosing quantity

9.1 Shutting down in an emergency



DANGER!

Increased danger to life from chlorine escape

Chlorine is poisonous. In severe cases, breathing in chlorine may lead to death. It irritates the eyes, the respiratory system and the skin.

⇨ If chlorine escapes, leave the room immediately.

⇨ Use sufficient personal protective equipment.

⇨ If chlorine gas escapes, wear a Type 2 self-contained breathing apparatus that complies with EN 137.

⇨ Only initiate counter measures after putting on the protective equipment.

⇨ Given a serious escape and insufficient equipment or qualifications, leave the work to professional emergency services personnel. Do not take any unnecessary risks.

The measures depend on the type of accident and should be planned and executed by professional personnel.

9.2 Check intervals

You must check the components of the chlorine system for leaks on a daily basis and after maintenance or commissioning work.

Perform a leak test in accordance with 8.1 „Leak test with ammonia“ on page 18 every time that you change the chlorine tank.

10 Shutdown and disposal

10.1 Short-term shutdown

Perform the following steps:

1. Close the chlorine tank valves.
2. Use the injector to suck off the remaining chlorine.
3. Switch off the injector.

✓ **Chlorinator shut down for the short term.**

10.2 Long-term shutdown

Perform the following steps:

1. Close the chlorine tank valves.
2. Use the injector to suck off the remaining chlorine.
3. Switch off the injector.
4. Close all the connections to protect the lines and devices from humidity and dirt.

✓ **Chlorinator shut down for the long term.**

10.3 Disposal

Pre-conditions for actions:

✓ Section 10.2 „Long-term shutdown“ on page 20 was performed.

Perform the following steps:

1. Consult your supplier or the manufacturer to learn more about the various methods of disposal.
2. Ensure that the delivery package can be dispatched safely.
3. Take advantage of the manufacturer's offer for free-of-charge disposal.

✓ **The device was disposed of.**

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11 Maintenance

Subject the chlorinator to regular maintenance, to prevent malfunctions. Perform the maintenance in the following intervals:

Interval	Maintenance
After 1 year	Minor maintenance: ■ Cleaning the device ■ Replace all O-rings and seals ■ Replace the valve seats. ■ Replace the springs and valve balls (only with visible wear)
After 3 years	Major maintenance: ■ Cleaning the device ■ Replace all O-rings and seals ■ Replace the valve seats. ■ Replace the valve balls and spring ■ Replace all the diaphragms

Tab. 10: Maintenance intervals

In some cases, regional regulations may require shorter maintenance intervals. Carry out maintenance before recommissioning the system after a long period out of service.
Maintenance intervals not depend only on how frequently the equipment is used. Chemical wear of elastomers, for example, begins with the initial medium contact and continues irrespective of the usage.

11.1 Maintenance accessories

The following accessories are required for maintenance:

- Silicone grease, medium viscosity, 35 g (for rubbing into the seals)
- Plastic tool (for dismantling O-rings)
- Face spanner Ø 3 mm (for assembly of the large diaphragm in the vacuum regulator and the valve bushing in the flow meter)
- Test adapter (to check the inlet valve)

The spare parts for maintenance are provided by Lutz-Jesco GmbH as a maintenance set. See section 13.4 „Maintenance sets“ on page 35.

Lutz-Jesco GmbH offers various test adapters for testing the inlet valve. See section 13.6 „Test adapter“ on page 35.

11.2 Preparing the system for maintenance

DANGER!

Danger to life from chlorine poisoning!

Do not carry out maintenance or any other work on the chlorinator until the system has been decommissioned and all of the chlorine gas has been removed from the lines. Otherwise, chlorine gas may escape.

⇨ Proceed in accordance with the following instructions.

⇨ Wear the protective equipment specified in section 2.5 „Personal protective equipment“ on page 6.

Perform the following steps:

1. Close the valves of the chlorine tank.
2. Use the injector to suck off the remaining chlorine.
3. Switch off the injector.
4. Close all the connections to protect the lines and devices from humidity and dirt.

✓ **The system is ready for maintenance.**

11.3 Maintenance of the inlet valve

For a complete overview of the components of the inlet valve, see Fig. 23 „Spare parts inlet valve“ on page 34. The figures in this chapter relate to this image.

Pre-conditions for actions:

✓ The chlorinator was prepared in accordance with section 11.2 „Preparing the system for maintenance“ on page 21.

🛠 Spare parts

🛠 Cotton swabs

🛠 Cleaning alcohol

🛠 Size 4 allen key, ring open-end spanner 3/8“

🛠 Slotted screwdriver 1.2 x 12

11.3.1 Dismantling the inlet valve

Perform the following steps:

1. Disconnect the device from the chlorine tank.
2. Remove the two flat head screws (3) with which the fixing plate (2) is fixed to the vacuum regulator housing.
3. Pull the inlet valve out from the vacuum regulator with a light turning movement.
4. Remove the O-ring (4) from the valve cap (5) of the inlet valve.
5. Remove the four screws (1) with which the fixing plate is fixed to the valve body (12) of the inlet valve.

▶ The spring (9) presses the inlet valve apart.

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6. Remove the fixing plate and the valve cap from the valve body.
   ▶ The filter bracket with ball guide (10) is exposed.
7. Remove the filter bracket with ball guide (7) from the valve cap.
8. Remove the spring, the valve ball and the valve seat from the valve cap.
9. Remove the O-ring from the valve cap.
10. Remove the felt filter (11) from the valve body.

✓ **Inlet valve dismantled.**

11.3.2 Clean the inlet valve

Perform the following steps:

1. Thoroughly clean all the components which are not wear parts with warm water or cleaning alcohol (e.g. isopropyl alcohol).
2. Perform a visual inspection of the valve body interior (12). If there are red spots on the nickel-plating, this component can be used further. If the damage is located on the sealing surface of the O-ring (10), replace the valve body.

✓ **Inlet valve cleaned.**

> In most cases damages of the nickel-plating are resulting from humidity penetrating the inlet valve if the cylinder is exchanged or stored without using a sealing plug.

11.3.3 Fitting the inlet valve

> When using a pre-fitted inlet valve, check the inlet valve for leaks, see section 11.3.4 „Checking the inlet valve“ on page 22, before continuing.

Pre-conditions for actions:

✓ All parts have been dried well after cleaning.

✓ All parts are in a good condition.

🛠 Spare parts

Perform the following steps:

1. Remove the two O-rings (4 and 6), the valve seat (7) and the felt filter (11) from the maintenance set.
2. Fit the O-rings in the grooves of the valve cap intended for the purpose (5). Place the valve seat in the recess within the valve cap.
3. Place the valve ball (8) on the valve seat (7) and then place the spring (9) on the valve ball.
4. Guide the filter bracket (10) with ball guide in the valve cap.
5. Fix the valve body (12) in a vice with the cylinder connection facing downwards.
6. Insert a new felt filter (11) in the valve body.
7. Lightly press the filter bracket with ball guide into the valve cap. Fit the valve cap in the valve body with the filter bracket with ball guide going first. Ensure that the O-ring (6) remains in position.
8. Guide the fixing plate (2) over the valve cap.
9. Press the valve cap into the valve body with the fixing plate.
10. Fit the fixing plate to the valve body using the four screws (1). Tighten the screws with min. 3 Nm.

✓ **Inlet valve fitted.**

11.3.4 Checking the inlet valve

Pre-conditions for actions:

✓ The maintenance of the inlet valve was performed in accordance with section 11.3 „Maintenance of the inlet valve“ on page 21.

🛠 Test adapter

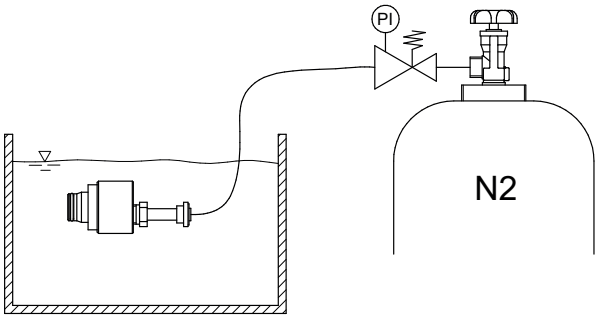


Fig. 16: Checking the inlet valve

Perform the following steps:

1. Use a blunt object to press in the ball of the inlet valve shortly, to ensure that the ball sits securely.
2. Mount the inlet valve together with the new connection seal onto the test adapter.
3. Connect a supply of nitrogen or dry air to the G 1/4” threaded connection of the test adapter. To effect this, install a hose between the cylinder connection of the inlet valve and the pressure-relief valve of the gas supply.
4. Push the inlet valve under water. If the inlet valve is equipped with a pressure gauge, it must not be immersed in water.
5. Observe the valve for a number of minutes. No bubbles may rise.
6. If a leak develops on the valve output, take the valve from the water, exert forceful pressure on the valve ball to open and repeat the test. If the leakage continues, it is necessary to replace the valve seat or the valve ball.
7. Allow the inlet valve to dry well before re-fitting it.

✓ **Inlet valve checked.**

11.3.5 Fit the inlet valve on the vacuum regulator

Precondition for action:

✓ The inlet valve has been checked in accordance with section 11.3.4 „Checking the inlet valve“ on page 22.

> Return the inlet valve to the vacuum regulator only after you have checked it for leaks and only after successful maintenance of the vacuum regulator.

1. Rub the O-ring (4) with silicone grease lightly.

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2. Fit the inlet valve into the housing of the vacuum regulator using light rotation movements.
3. Fit the fixing plate to the housing floor of the vacuum regulator using the two screws. Use a little fitting grease.
4. Tighten the screws with approx. 3 Nm.

✓ **Inlet valve fitted on the vacuum regulator.**

11.4 Maintenance on the flow meter

Pre-conditions for actions:

✓ The chlorinator was prepared in accordance with section 11.2 „Preparing the system for maintenance“ on page 21.

✓ A maintenance set is available.

🛠 Cotton swabs

🛠 Cleaning alcohol

11.4.1 Dismantling the flow meter

Flow meter up to 4 kg Cl_2/h

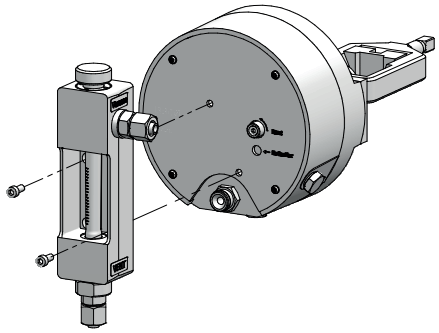


Fig. 17: Dismantle the flow meter up to 4 kg Cl_2/h from the vacuum regulator

Fig. 21 on page 30 provides an overview of the components of the flow meter; Fig. 20 on page 28 provides an overview of the vacuum regulator. The figures in this chapter relate to these images.

Perform the following steps:

1. Loosen the two screws on the measuring glass bracket (5).
2. Rotate the flow meter clockwise and remove it from the connection pin (6, Fig. 20).
3. Rotate the connection pin out of the vacuum regulator and remove the two O-rings (5, Fig. 20) of the connection pin using a suitable tool.
4. Hold the measuring glass (7) tightly and unscrew the lower clamping screw (9) from the measuring glass bracket.
5. Remove the two O-rings (8) from the clamping screw with a suitable tool.
6. Take out the measuring glass and remove the two gaskets (6).
7. Rotate the valve screw (1) out of the valve bushing (3) and remove the two O-rings (2) with a suitable tool.
8. Using the face spanner, unscrew the valve bushing from the measuring glass bracket. Remove the two O-rings (4) with a suitable tool.
9. Unscrew the hose clamp connection (14 and 15) from the measuring glass bracket and remove the O-ring (16) using a suitable tool.
10. Unscrew the safety blow-off valve (10 to 14) from the clamping screw.
11. Remove the valve seat (10) from the clamping screw.
12. Remove the valve ball (13) and the spring (12) from the safety blow-off valve.

✓ **Flow meter dismantled.**

Flow meter up to 10 kg Cl_2/h

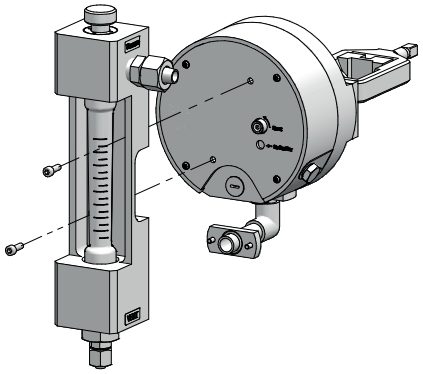


Fig. 18: Dismantle the flow meter up to 10 kg Cl_2/h from the vacuum regulator

Fig. 22 on page 32 provides an overview of the components of the flow meter; Fig. 20 on page 28 provides an overview of the vacuum regulator. The figures in this chapter relate to these images.

Perform the following steps:

1. Loosen the two screws on the measuring glass bracket (5).
2. Loosen and remove the two screws (29) on the rear-side of the measuring glass bracket Fig. 20) the holder plate (28, Fig. 20) and pull off the flow meter from the pipe bracket (30, Fig. 20) to the vacuum regulator.
3. Loosen and remove the two screws on the holder plate on the underside of the vacuum regulator and remove the vacuum regulator from the pipe bracket. Remove the two O-rings (27, Fig. 20) on the holder plates.
4. Hold the measuring glass (7) tightly and unscrew the lower clamping screw (9) from the measuring glass bracket.
5. Take out the measuring glass and remove the two gaskets (6).
6. Rotate the valve screw (1) out of the valve bushing (3) and remove the two O-rings (2) with a suitable tool.
7. Using the face spanner, unscrew the valve bushing from the measuring glass bracket. Remove the two O-rings (4) with a suitable tool.
8. Unscrew the hose clamp connection (15 and 16) from the measuring glass bracket and remove the PTFE strip.
9. Remove the two O-rings (8) with a suitable tool.
10. Unscrew the safety blow-off valve (10 to 14) from the clamping screw.
11. Remove the valve seat (10) from the clamping screw.
12. Remove the valve ball (13) and the spring (12) from the safety blow-off valve.

✓ **Flow meter dismantled.**

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11.4.2 Cleaning the flow meter:

Perform the following steps:

1. Take the measuring glass and remove the plastic end stops and the float from the glass. Clean the measuring glass with warm water or cleaning alcohol.
2. Clean the plastic end stops, the float and all other parts with warm water or cleaning alcohol. Perform a visual check on all parts. Replace the damaged parts.

✓ **Flow meter cleaned.**

11.4.3 Mounting the flow meter

Fig. 21 on page 30 and Fig. 22 on page 32 provide an overview of the components of the flow meter; Fig. 20 on page 28 provides an overview of the vacuum regulator. The figures in this chapter relate to these images.

Pre-conditions for actions:

✓ All parts have been dried well after cleaning.

✓ All parts are in a good condition.

✓ Spare parts are available.

Perform the following steps:

1. Fit two new O-rings (4) on the valve bushing (3). Rub the O-rings with silicone grease lightly.
2. Insert the valve bushing in the measuring glass bracket (5) and screw it so far in using the face spanner until it is flush with the measuring glass bracket.
3. Position the float and the plastic end stops in the measuring glass.
4. Fit two new O-rings (8) on the clamping screw (9). Rub the O-rings with silicone grease lightly. Insert a new valve seat in the clamping screw.
5. Return the spring (12) to the safety blow-off connection. Place the valve ball (13) on the spring and screw the safety blow-off valve into the clamping screw.
6. Place the clamping screw in the measuring glass bracket and screw it two revolutions into the measuring glass bracket.
7. Insert a new gasket (6) on the sealing surface of the clamping screw.
8. Insert a new gasket on the sealing surface on the sealing surface on the output of the measuring glass and position the measuring glass in the measuring glass bracket.
9. Press the measuring glass onto the sealing surface of the valve bushing and screw the clamping screw into the measuring glass bracket by hand until the measuring glass can no longer be turned.
10. Fit two new O-rings (2) on the valve screw (1). Rub the O-rings with silicone grease lightly.
11. Insert the valve screw into the valve bushing and screw it in until you feel real resistance.
12. Unscrew in the valve screw by five revolutions.
13. Depending on the design of the flow meter, fit the hose clamp connection to the measuring glass bracket either with a new O-ring or with three layers of PTFE band.

✓ **Flow meter mounted.**

11.4.4 Fit the flow meter on the vacuum regulator

Fit the flow meter on the vacuum regulator only after performing maintenance of the vacuum regulator.

Perform the following steps:

Flow meter up to 4 kg Cl_2/h

1. Fit two O-rings (5) on the connection pin (6). Rub the O-rings with silicone grease lightly.
2. Fit the connection pin in the housing cover (13).
3. Fit the flow meter onto the connection pin with a slight rotation movement, until the flow meter touches the vacuum regulator.
4. Coat both screws with a little fitting grease and use them to secure the flow meter to the vacuum regulator.

Flow meter up to 10 kg Cl_2/h

1. Fit a holder plate (28) and then an O-ring (27) on both sides of the pipe bracket.
2. Slide the shorter side of the pipe bracket into the lower drillholes of the housing floor (22) and connect with two screws (29).
3. Slide the flow meter on the longer side of the pipe bracket and secure the flow meter to the vacuum regulator with two screws.
4. Connect the holder plate of the pipe bracket to the flow meter with two screws.

✓ **Flow meter fitted on the vacuum regulator.**

11.5 Perform maintenance on the vacuum unit.

Pre-conditions for actions:

✓ The chlorinator was prepared for maintenance.

✓ A maintenance set is available.

✓ The inlet valve has been removed.

✓ The flow meter has been removed (only C 2216-VF).

11.5.1 Dismantle the vacuum regulator

For a complete overview of the components of the vacuum regulator, see Fig. 20 on page 28. The figures in this chapter relate to this image.

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Perform the following steps:

1. Rotate the plugs (6) out of the vacuum regulator and remove the O-ring (5) using a suitable tool. The plugs are located:
   - The C 2216-VF up to 4 kg Cl_2/h on the underside of the housing floor (22).
   - The C 2216-VF up to 10 kg Cl_2/h and in the lower area of the housing cover (14).
2. Remove the front cover on the fore side of the vacuum regulator.
3. Remove the four protective caps (24) on the housing floor (22) of the vacuum regulator.
4. Loosen and remove the four screws (23) on the housing floor of the vacuum regulator and disconnect the housing cover (14) and the housing floor from each other.
5. Hold the diaphragm disc with a face spanner and loosen the diaphragm ring (17) from the diaphragm disc. Remove the diaphragm (18).
6. Remove the O-rings (20 and 21) in the vacuum regulator.

Only with the vacuum regulator C 2216-V:

7. Turn the hose clamp connection (25 and 26) out of the housing floor and remove the O-ring (5).
8. Unscrew the safety blow-off valve (6 to 11) from the housing cover and remove the O-ring.

✓ **Vacuum regulator dismantled.**

11.5.2 Clean the vacuum regulator

Perform the following steps:

1. Clean all parts thoroughly with warm water or cleaning alcohol.
2. Subject all parts to a visual check and replace the damaged parts.

✓ **Vacuum regulator cleaned.**

11.5.3 Fit the vacuum regulator

For a complete overview of the components of the vacuum regulator, see Fig. 20 on page 28. The figures in this chapter relate to this image.

Pre-conditions for actions:

✓ All parts have been dried well after cleaning.

✓ All parts are in a good condition.

🛠 Spare parts

Perform the following steps:

1. Rub the edges of the diaphragm (18) with silicone grease lightly.
2. Guide the diaphragm under the threaded pin of the diaphragm disc (19). Place the diaphragm in the groove of the diaphragm disc with the dome pointing downwards and screw the diaphragm ring (17) to the diaphragm initially by hand. Then hold the diaphragm ring tightly and tighten the connection on the diaphragm disc with the face spanner.
   - Diaphragm fitted.
3. Fit the O-rings (20, 21) in the corresponding grooves within the housing floor (22).
4. Place the housing sections on each other. Ensure the correct position of the diaphragm.
5. Fit the four screws (23) with a little fitting grease. Tighten the screws with approx. 2 Nm.
6. Fit the front protective caps (24).

Only with the vacuum regulator C 2216-VF:

7. Fit a new O-ring (5) on the plug (6). Rub the O-ring slightly with silicone grease and rotate the plug into the housing floor.

Only with the vacuum regulator C 2216-V:

8. Fit a new O-ring on the safety blow-off valve. Rub the O-ring slightly with silicone grease and fit the safety blow-off valve in the housing cover.
9. Fit a new O-ring on the hose clamp connection. Rub the O-ring slightly with silicone grease and fit the hose clamp connection in the housing floor.

✓ **Vacuum regulator fitted.**

11.5.4 Check the vacuum regulator

11.5.4.1 Check for leaks

Precondition for action:

✓ The vacuum unit has been installed.

✓ The inlet valve was checked successfully, dried and fitted to the vacuum regulator.

✓ The injector is ready for operation.

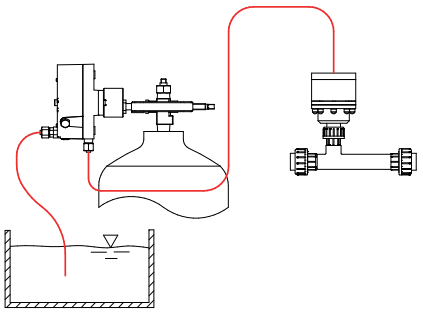


Fig. 19: Check for leaks

Perform the following steps:

1. Fit the device on a sealed chlorine cylinder.
2. Connect the injector to the device output.
3. Switch on the injector.
4. Connect a hose to the connection after 30 seconds.
5. Push the open end of the hose under water.
   - The water may not rise in the hose.

Additionally, only with the leakage test of the C 2216-VF:

- The ball in the flow meter rises, then drops slowly and indicates zero after a short time.

✓ **Leakage test concluded.**

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11.5.4.2 Checking the safety blow-off valve

Precondition for action:

✓ Leakage test is concluded.

✓ Compressed air or nitrogen with an appropriate pressure-relief valve are at hand.

Perform the following steps:

1. Fit the device on a sealed chlorine cylinder.
2. Connect the compressed air or nitrogen to the output of the vacuum regulator.
3. Fit a transparent hose on the output of the safety blow-off valve.
4. Push the open end under water.
5. Increase the pressure slowly until it reaches 0.5 bar.

▶ A constant flow is visible from 0.3 bar at the latest.

✓ **Check of the safety blow-off valve completed.**

11.6 Finishing maintenance

Perform the following steps:

1. Make a note of the date and scope of the maintenance performed.
2. Attach a sticker displaying the maintenance date to the device.
3. Fit the device in the system.
4. To restart the system, proceed in accordance with the instructions in section 8 „Commissioning“ on page 18.

✓ **Maintenance completed.**

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12 Troubleshooting

All possible errors are listed in this table.

Problem	Possible cause	Remedy
Empty notification during operation.	The chlorine tank is empty.	Connect a new chlorine tank.
	The chlorine tank is closed or partially closed.	Open the value completely.
	The filter in the inlet valve is blocked.	Clean or replace the filter.
	The empty notification has not been reset.	Reset the empty notification.
Vacuum insufficient.	Leak in the vacuum line.	Check all screw connections and O-rings in the vacuum line.
	Leak point on the vacuum regulator (can be recognised by permanent air suction on the vent line).	Perform maintenance on the vacuum unit.
	Reduced injector capacity through: ■ deposits in the injector ■ soiling in the motive water filter ■ back pressure too high ■ excess pressure loss on the injector non-return valve	■ Perform maintenance of the injector. ■ Clean the filter. ■ Measure the back pressure and compare the findings with the technical data of the injector. ■ Perform maintenance of the injector non-return valve.
Vent line takes in air constantly.	The diaphragm has not been fitted correctly.	Perform maintenance of the vacuum unit.
	Safety blow-off valve is soiled.	Perform maintenance of the vacuum unit.
Chlorine smell in the room.	The safety blow-off valve opens because the inlet valve does not close correctly. Usually due to soiling.	Perform maintenance of the inlet valve.
	Leakage from soiling or damage to the connection seals.	Replace the connection seals.
	The injector non-return valve has a leak and back-flowing water generates positive pressure in the vacuum line. The safety blow-off valve opens.	Perform maintenance of the injector non-return valve.
Soiling in the flow meter.	Insufficient chlorine quality.	See section 3 „Intended use“ on page 8.
	Slight leak in the vacuum system means penetration of a little moisture, which results in soiling.	Find leaks and redress them.
The float jumps in the flow meter and / or the maximum dosing capacity is not reached.	The filter in the inlet valve is blocked.	Perform maintenance of the inlet valve.
	The dosing valve and / or the measuring glass of the flow meter are soiled.	Perform maintenance of the flow meter.
	The injector performance varies as the motive water pressure is not constant (float jumps).	Check the water supply. If necessary, install a pressure-relief valve to stabilise the motive water pressure.
	Vacuum insufficient.	See problem “Insufficient vacuum”.
Ice or too much condensation at the inlet valve	Chlorine withdrawal is too high.	Attach further chlorine tanks.
	Pressure loss at valves not fully opened causes strong cooling due to expansion.	Always open the valves completely.

Tab. 11: Troubleshooting

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Problem	Possible cause	Remedy
Water in the device.	Leaky injector non-return valve.	Perform maintenance of the injector non-return valve.
	The end of the vent line is not protected against water entrance.	Install the vent line again, with the end of the line pointing downwards.

Tab. 11: Troubleshooting

13 Spare parts

Items included in the maintenance set (see 13.4 „Maintenance sets“ on page 35) are marked with *.

13.1 Vacuum Regulator C 2216-V / C 2216-VF

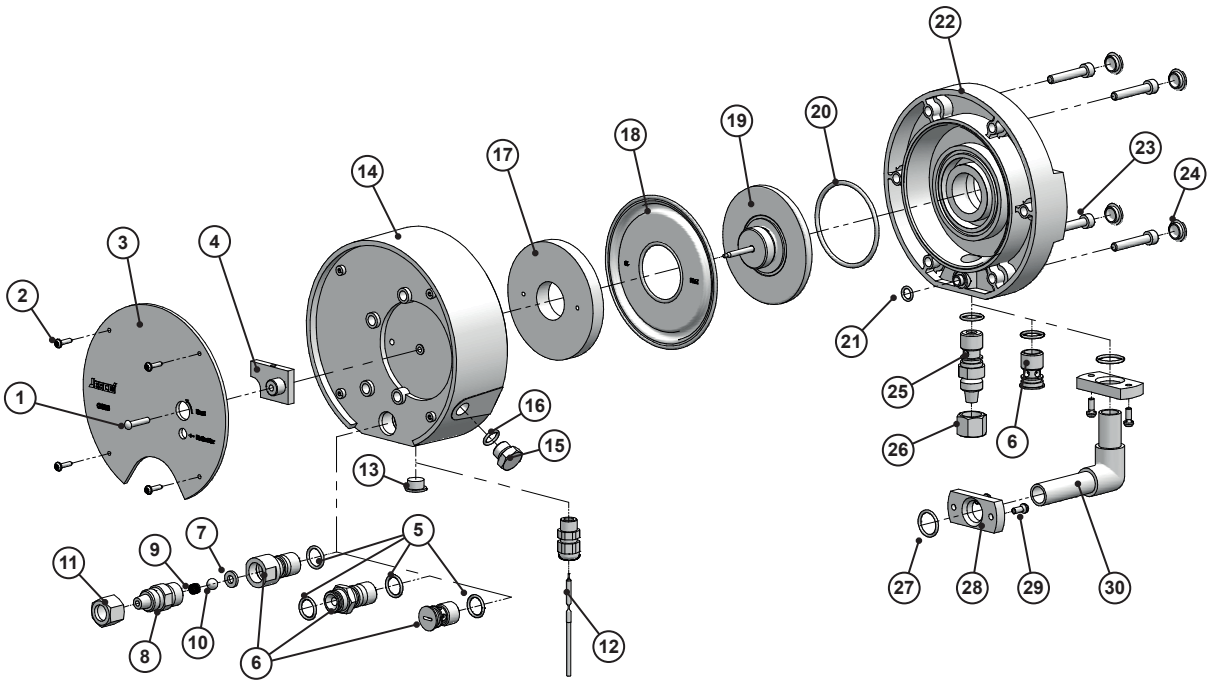


Fig. 20: Spare parts vacuum regulator C 2216-V / C 2216-VF

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Item	No.	Description	
1	1	Half-round rivet	
2	4	PT screw	
3	1	Front cover	
4	1	Pennant with rotary knob	
5*	1	O-ring	for C 2216-VF 10 kg Cl_2/h
	2		for C 2216-V and C 2216-VF 4 kg Cl_2/h
6	1	Connection pin	for C 2216-VF 4 kg Cl_2/h
		Plugs	for C 2216-V
		Adapter	
7*	1	Valve seat	
8	1	Hose clamp connection	for C 2216-V
9*	1	Compression spring	
10*	1	Ball	
11	1	Union nut	
12	1	Reed switch with cable	
13	1	Cap	
14	1	Housing cover	
15	1	Sealing plug	
16*	1	O-ring	
17	1	Diaphragm ring	
18*	1	Ring diaphragm	
19	1	Diaphragm disc with valve rod	
20*	1	O-ring	
21*	1	O-ring	
22	1	Housing floor	
23	4	Screws	
24	4	Protective cap	
25	1	Hose clamp connection	for 8/12 hose
			for 12/16 hose
26	1	Union nut	for 8/12 hose
			for 12/16 hose
27*	2	O-ring	
28	2	Holder plates	
29	4	PT screw	
30	1	Pipe bracket	

Tab. 12: Spare parts Vacuum regulator C 2216-V

* contained in maintenance kit.

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13.2 Flow meter for C 2216-VF

13.2.1 Flow meter up to 4 kg Cl_2/h

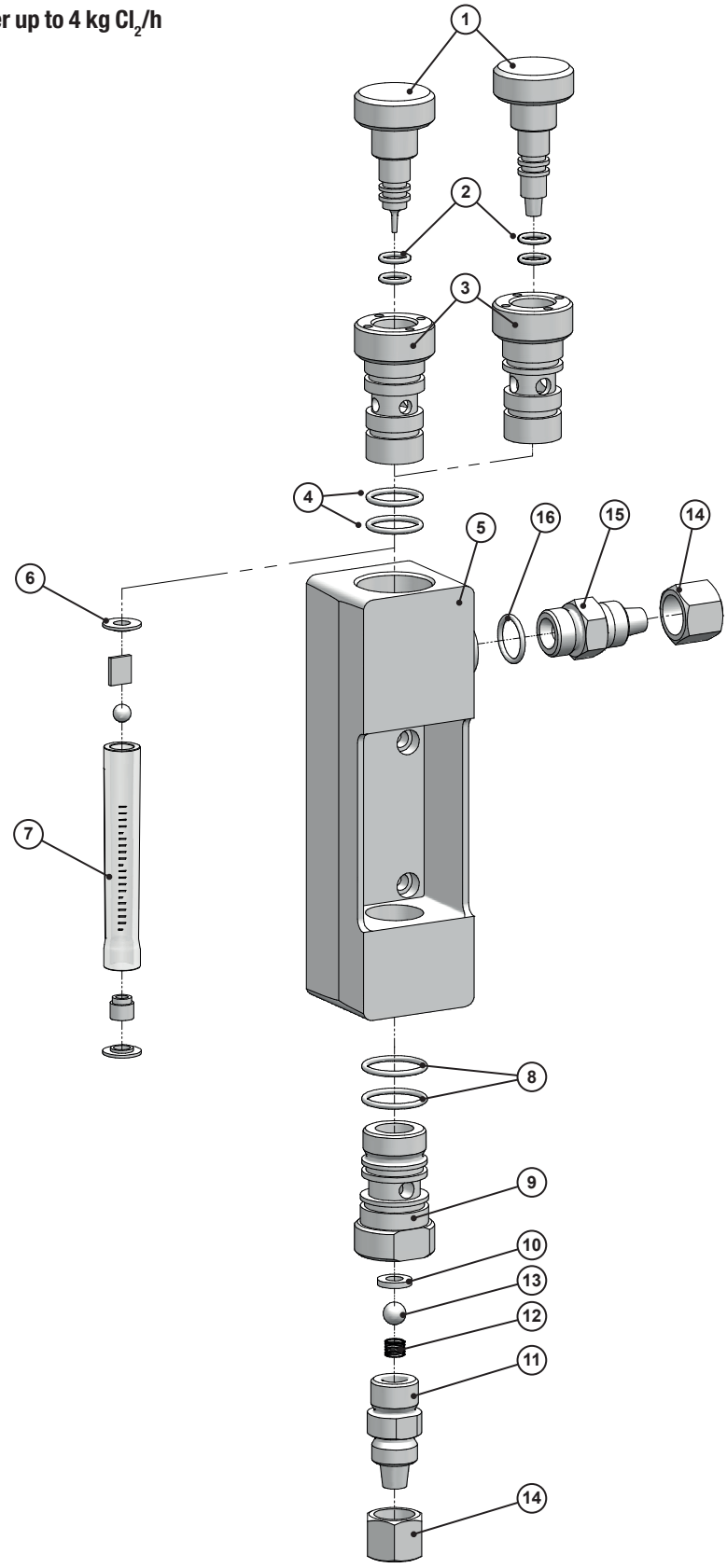


Fig. 21: Spare parts flow meter up to 4 kg Cl_2/h for C 2216-VF

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Item	No.	Description	
1	1	Valve screw	to 500 g Cl_2/h
			to 4 kg Cl_2/h
2*	2	O-ring	
3	1	Valve bushing	to 500 g Cl_2/h
			to 4 kg Cl_2/h
4*	2	O-ring	
5	1	Measuring glass holder	
6*	2	Gasket	
7	1	Measuring glass with float and stops	
8*	2	O-ring	
9	1	Clamping screw	
10*	1	Valve seat	
11	1	Hose clamp connection	
12*	1	Compression spring	
13*	1	Ball	
14	2	Union nut	
15	1	Hose clamp connection	
16*	1	O-ring	

Tab. 13: Spare parts flow meter up to 4 kg Cl_2/h for C 2216-VF

* contained in maintenance kit.

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13.2.2 Flow meter up to 10 kg Cl_2/h

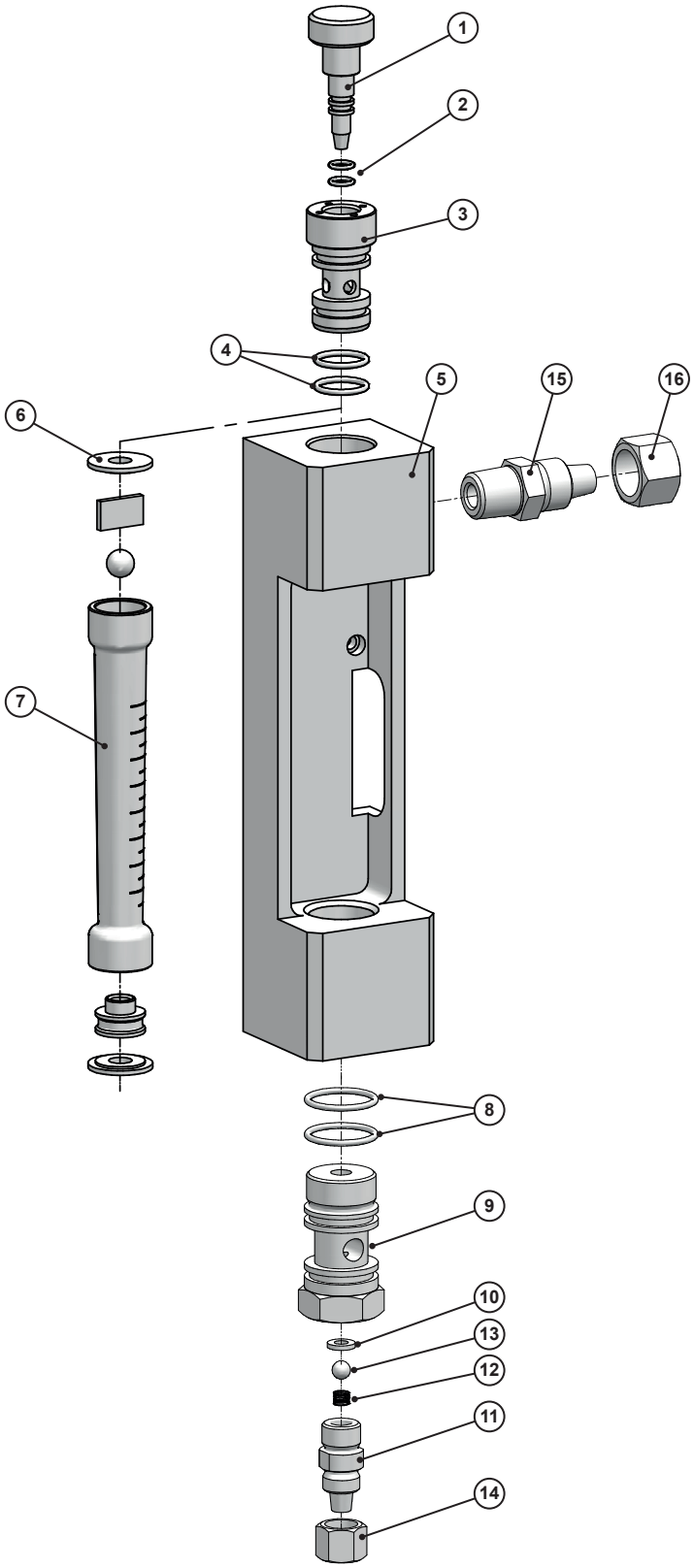


Fig. 22: Spare parts flow meter up to 10 kg Cl_2/h for C 2216-VF

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Item	No.	Description
1	1	Valve screw
2*	2	O-ring
3	1	Valve bushing
4*	2	O-ring
5	1	Measuring glass holder
6*	2	Gasket
7	1	Measuring glass with ball and stops
8*	2	O-ring
9	1	Clamping screw
10*	1	Valve seat
11	1	Hose clamp connection
12*	1	Compression spring
13*	1	Ball
14	1	Union nut
15	1	Hose clamp connection
16	1	Union nut

Tab. 14: Spare parts flow meter up to 10 kg Cl_2/h for C 2216-VF

* contained in maintenance kit.

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13.3 Inlet valve

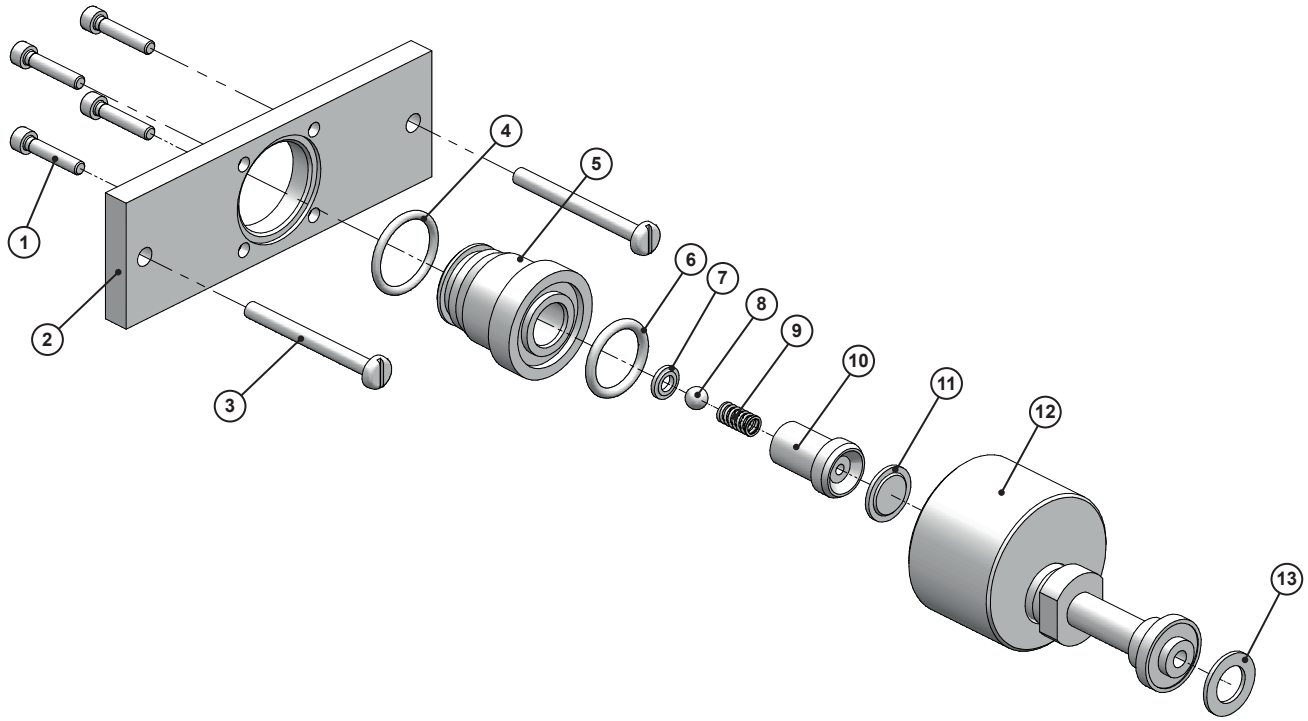


Fig. 23: Spare parts inlet valve

Item	No.	Description
1	4	Cylinder head screws
2	1	Fixing plate
3	2	Flat head screws
4*	1	O-ring
5	1	Valve cap
6*	1	O-ring
7*	1	Valve seat
8*	1	Valve ball
9*	1	Valve spring
10	1	Filter bracket with ball guide
11	1	Felt filter
12	1	Valve body
13	1	Flat gasket

Tab. 15: Spare parts inlet valve

* contained in maintenance kit.

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13.4 Maintenance sets

The following maintenance kits are available:

- Maintenance set without inlet valve
- Maintenance set for inlet valve

13.5 Spare modules

The following spare modules are available:

- Valve body complete
- Inlet valve complete
- Safety blow-off valves for 2216-V and C 2216-VF

13.6 Test adapter

The following test adapters are available:

- BSW 1"
- 1.030“-14 NGO (820)

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14 Notes to EU conformity

The devices fall under the purview of the pressure equipment directive 2014/68/EU.

The values stated below do not exceed the limit values in according to article 4, paragraph 1. Therefore, it is designed and manufactured in accordance with valid good engineering practice This pressure devices may not carry a CE marking and an EU declaration of conformity will not be issued.

Designation of the device:	Vacuum regulator
Type:	C 2216-V, C 2216-VF
Pressure stage:	PN16
max. temperature:	50 °C
Medium:	Chlorine, fluid group 1

The devices fulfil all the demands made by the directive(s):

2014/68/EU Pressure equipment directive

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15 Declaration of no objection

Please copy the declaration, stick it to the outside of the packaging and return it with the device.

Declaration of no objection

Please fill out a separate form for each appliance!

We forward the following device for repairs:

Device and device type: ..... Part-no.: .....

Order No.: ..... Date of delivery: .....

Reason for repair: .....

.....

.....

Dosing medium

Description: ..... Irritating: ☐ Yes ☐ No

Properties: ..... Corrosive: ☐ Yes ☐ No

We hereby certify, that the product has been cleaned thoroughly inside and outside before returning, that it is free from hazardous material (i.e. chemical, biological, toxic, flammable, and radioactive material) and that the lubricant has been drained.

If the manufacturer finds it necessary to carry out further cleaning work, we accept the charge will be made to us.

We assure that the aforementioned information is correct and complete and that the unit is dispatched according to the legal requirements.

Company / address: ..... Phone: .....

..... Fax: .....

..... Email: .....

Customer No.: ..... Contact person: .....

Date, Signature: .....

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16 Warranty claim

Warranty claim

Please copy and send it back with the unit!

If the device breaks down within the period of warranty, please return it in a cleaned condition with the complete warranty claim.

Sender

Company: ..... Phone: ..... Date: .....

Address: .....

Contact person: .....

Manufacturer order no.: ..... Date of delivery: .....

Device type: ..... Serial number: .....

Nominal capacity / nominal pressure: .....

Description of fault: .....

.....

.....

.....

.....

.....

.....

.....

Service conditions of the device

Point of use / system designation: .....

.....

.....

Accessories used (suction line etc.): .....

.....

.....

.....

.....

Commissioning (date): .....

Duty period (approx. operating hours): .....

Please describe the specific installation and enclose a simple drawing or picture of the chemical feed system, showing materials of construction, diameters, lengths and heights of suction and discharge lines.

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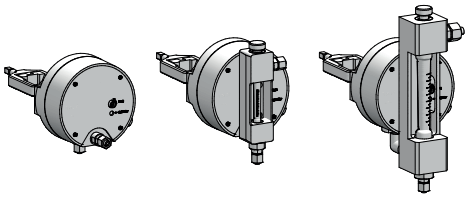
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Operating instructions
Vacuum Regulator C 2216-V / C 2216-VF

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