GRUNDFOS ALLDOS

# Vacuum Regulators GS 147-148

# Operation Manual

**Read this manual completely and keep it!**

**No warranty in case of damages caused by incorrect operation.**

# Imprint

**Vacuum Regulators GS 147-148**
**Operation Manual**
**Version 1.0**

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# Contents

# 1 Of General Interest

## 1.1 Structure of the Documentation

The documentation of ALLDOS vacuum regulators GS 147-148 consists of three parts:

- ❏ information paper "*Function and Safety of Chlorination Plants*":
  - general safety instructions for handling chlorine
- ❏ the *Operation Manual* (this paper):
  - technical data
  - instructions for commissioning and operation
  - specific safety instructions

  Working described here may be executed by the user.
- ❏ the *Service Manual*:
  - instructions for maintenance and repair

  Work described there may only be executed by **authorized qualified personnel!**

If you require further information or if any problems arise which are not reflected in detail in this manual, contact ALLDOS directly for the information needed.

## 1.2 Using this Paper

- ❏ Descriptions are written as plain text.
- ❏ Lists are indicated by squares (❏), sublists by dashes (-).
- ❏ Operation steps are indicated by bullets (●), substeps by small bullets (•).
- ❏ Cross-references are indicated by *italic letters* and an arrow (➜).
- ❏ The headings ***WARNING***, ***CAUTION*** and ***NOTE*** have the following meaning:

***WARNING*** ***Danger of injuries and accidents!***

***CAUTION*** ***Danger of incorrect operation or damage to the product!***

***NOTE*** ***There is an exceptional feature.***

## 1.3 Warranty

The warranty period is 24 months from the date of delivery by ALLDOS.

Warranty in accordance with our general terms of sale and delivery shall only be valid, if

- ❏ the product is used according to the information within this paper,
- ❏ the product is not being opened or used improperly,
- ❏ maintenance and repair is implemented exclusively by authorized and qualified personnel,
- ❏ original spare parts are used for repairs,
- ❏ only parts approved by ALLDOS are being used in the whole gas dosing plant.

Warranty is not valid for typical wearing parts, e. g.

- ❏ gaskets, O-rings, diaphragms

# 2 Safety Instructions

***WARNING*** ***Before commissioning, read the ALLDOS information paper "Function and Safety of Chlorination Plants".***

## 2.1 Application of the Product

ALLDOS vacuum regulators GS 147-148 may be used for reducing the pressure (overpressure) of the gases chlorine ($Cl_2$), ammonia ($NH_3$) and sulphur dioxide to subatmospheric pressure (vacuum) as described in this manual.

***WARNING*** ***Other applications are not intended and are not permitted. ALLDOS Eichler GmbH accept no responsibility for damages caused by unintended use.***

## 2.2 Obligations of the Operating Authority

The operating authority of the plant is responsible for

- ❏ obeying the following regulations (in Germany):
  - Unfallverhütungsvorschrift *Chlorung von Wasser* (GUV 8.15)
  - Unfallverhütungsvorschrift *Druckbehälter* (GUV 2.6)
  - Unfallverhütungsvorschrift *Gase* (GUV 9.9)
  - Verordnung über Arbeitsstätten (ArbStättV)
  - Verordnung über gefährliche Arbeitsstoffe (ArbStoffV)
  - obeying local safety regulations, if necessary
- ❏ instructing the operation personnel
- ❏ providing the stipulated safety equipment (➜ *information paper* "*Function and Safety of Chlorination Plants*")
- ❏ arranging regular maintenance

## 2.3 Averting Dangers

The vacuum regulator is the most important safety device of a gas dosing plant.

***WARNING*** ***Danger of gas break-out in case of***

- ❏ ***impure gas***
- ❏ ***penetration with re-liquefied gas***
- ❏ ***irregular cleaning and maintenance***
- ❏ ***unintended use***

- ● Only use clean gas
- ● Install a suitable filtering device before the vacuum regulator
- ● Arrange regular cleaning and maintenance
- ● Avoid liquefaction by a correct course of temperature
  - temperature must rise in the way of the line to the vacuum regulator

***WARNING*** ***Do not open the device!***
***Cleaning, maintenance and repair only by authorized personnel!***

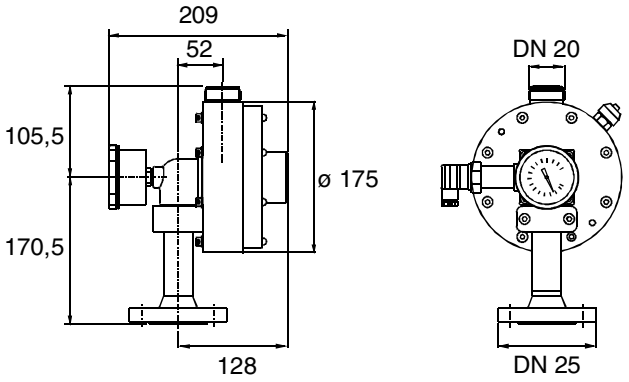
# 3 Technical Data

| *Dosing media $Cl_2$* | *Order no.* | *Flow rate* | | | |
|---|---|---|---|---|---|
| | 147-040 | 1 - 40 | kg/h | 50 - 2100 | #/day |
| | 148-070 | 3,5 - 70 | kg/h | 200 - 3700 | #/day |
| | 148-120 | 6 - 120 | kg/h | 400 - 6200 | #/day |
| | 148-200 | 10 - 200 | kg/h | 500 - 10500 | #/day |
| *Dosing media $NH_3$* | *Order no.* | *Flow rate* | | | |
| | 147-020N | 0,5 - 20 | kg/h | 25 - 1000 | #/day |
| | 148-035N | 2 - 35 | kg/h | 100 - 2000 | #/day |
| | 148-060N | 3 - 60 | kg/h | 200 - 4000 | #/day |
| | 148-100N | 5 - 100 | kg/h | 300 - 5000 | #/day |
| *Dosing media $SO_2$* | *Order no.* | *Flow rate* | | | |
| | 147-038S | 1 - 38 | kg/h | 50 - 2000 | #/day |
| | 148-065S | 3,5 - 65 | kg/h | 200 - 3300 | #/day |
| | 148-115S | 6 - 115 | kg/h | 400 - 5700 | #/day |
| | 148-190S | 10 - 190 | kg/h | 500 - 9900 | #/day |

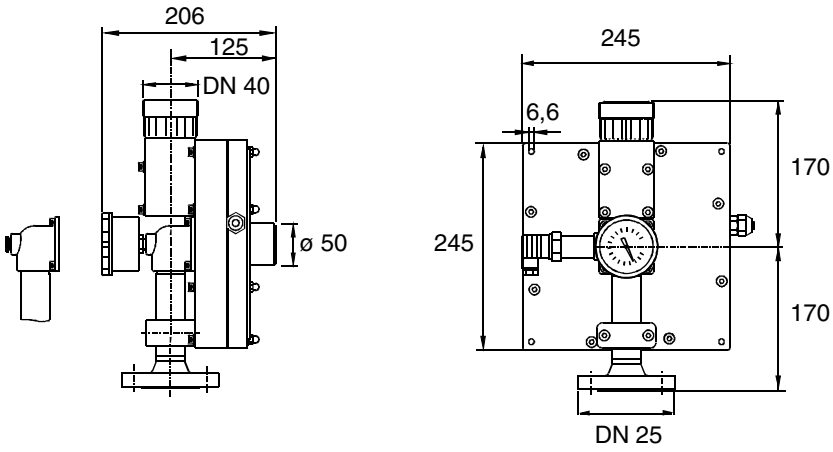
| | |
|---|---|
| *Control range* | GS 147: 1:40<br>GS 148: 1:20 |
| *Maximum admission pressure (bar)* | 11 |
| *Minimal admission pressure (bar)* | 2 |
| *Pressure line connection (flange) (inlet)* | DN 25 |
| *Pressure line to be used* | seamless drawn steel pipes according to DIN 2441, R 1" |
| *Vacuum line connection (outlet)* | GS 147: DN 20<br>GS 148: DN 40 |
| *Vacuum line to be used* | GS 147: PVC-Rohr DN 20<br>GS 148: PVC-Rohr DN 40 |
| *Overpressure valve connection* | 8 x 11 |
| *Overpressure line to be used* | PE tube 8 x 11 |

## 3.1 Dimensioned Drawings

### 3.1.1 GS 147




### 3.1.2 GS 148



# 4 Installation

## 4.1 Transport and Storage

- Handle with care, do not throw!
- ❏ Dry and cool storage place.

## 4.2 Unpacking

- Observe when unpacking:
  - No humidity should get into gas-leading parts!
  - No foreign matter should get into gas-leading parts!
  - Remove plugs not until the connections shall be made!
- Mount as soon as possible after unpacking.

## 4.3 Mounting

**Requirements for mounting:**

- ❏ Installations at the pressure side from the containers resp. the evaporator are present and checked for tightness
- ❏ Piping has been rinsed with nitrogen
  - no more soiling present
- ❏ Filter and liquid gas trap (e. g. ALLDOS Liqu-Filt 524) resp. pressure reducing valve has been installed directly before the vacuum regulator
- ❏ Directly before the vacuum regulator the highest temperature in the course of the pressure gas lines is present.
  - If necessary, wrap a heater band around the pressure line connection of the vacuum regulator.

***WARNING*** ***Ensure that all container valves are closed before mounting.***
***Only use the intended line types!***

***CAUTION*** ***Do not install the vacuum regulator on walls, plates or something similar. Danger of distortion!***
***The device will only be carried by the connection with the pressure line.***
***Ensure that all piping is free of distortion.***
***Do not mount the device in a distorted manner.***

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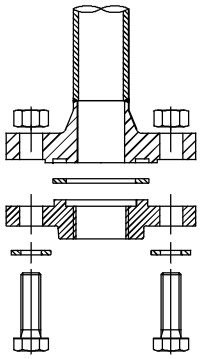
### 4.3.1 Pressure Line Connection

***NOTE*** ***Ensure that the pressure lines are as short as possible.***

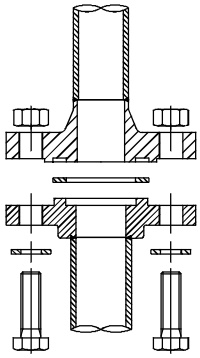
**Required tools and accessories:**

❑ 2 fork wrenches 19 mm



**With connection set:**

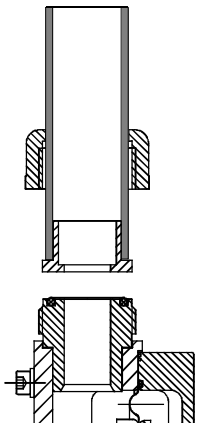
- Put in flat gasket.
- Screw the pressure line connection (flange) to the screwed flange.
- Screw the pressure line into the connection piece.
  - tighten with hemp or weld the threat



**Without connection set:**

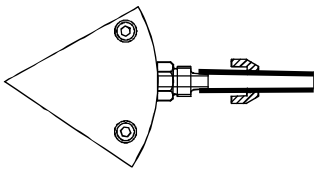
- Put in flat gasket.
- Screw the pressure line connection (flange) to the flange of the pressure line resp. the flange of the component before.

### 4.3.2 Vacuum Line Connection



- Push the union nut onto the pipe (in the right direction)
- Place the union end in the pipe
  - glue together with PVC glue
- If not yet present, place the O-ring on the connection
- Place the pipe on the connection
- Tighten the union nut by hand

### 4.3.3 Overpressure Line Connection



- Push the union nut onto the tube (in the right direction)
- Put the tube onto the branch neck of the overpressure valve
- Tighten the union nut by hand

***WARNING***

- ***The overpressure line has to lead downwards, as chlorine is heavier than air.***
- ***Do connect the overpressure line to a suitable absorption vessel!***
  - ***The overpressure line must not dip into the absorption fluid!***
- ***The overpressure line must not end in the room or lead to the open air!***

# 5 Commissioning

Check tightness of the **total plant** before start-up.

➜ *Observe manual of the gas dosing system!*

***WARNING*** ***Check the tightness not until the total plant is ready for start-up.***
***Danger of gas leakage!***

## 5.1 Checking the Tightness of Pressure Gas Lines

Pressure gas lines are all lines from the gas containers to the vacuum regulator.

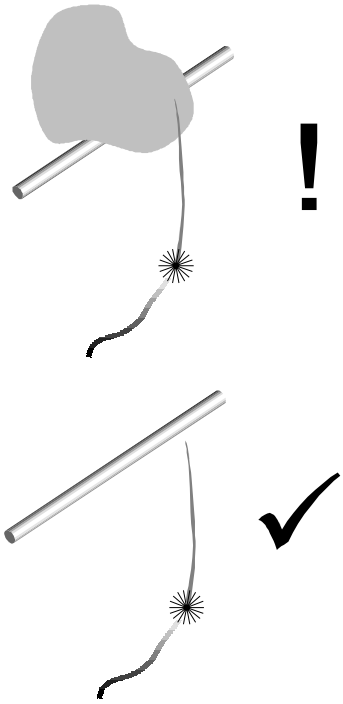
- If the plant is equipped with a nitrogen rinsing device: Check tightness roughly with nitrogen (all dosing media)
- Detailed checking:
  - with burning sulphur (dosing medium $NH_3$)
  - with ammonia (dosing media $Cl_2$ and $SO_2$)

**All dosing media: Checking the tightness with nitrogen**

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

***WARNING*** ***Maximum nitrogen pressure 16 bar!***
***Danger of damages and gas leakage when being exceeded!***

- Apply soap water to all components under pressure
  - Formation of bubbles and/or pressure drop at manometer:
    **Leakage in pressure lines!**
    - **Depressurize the plant!**
    - **Eliminate leakage!**
    - **Check tightness again!**
  - No formation of bubbles, pressure at manometer does not drop significantly within one hour: **Pressure lines are tight.**

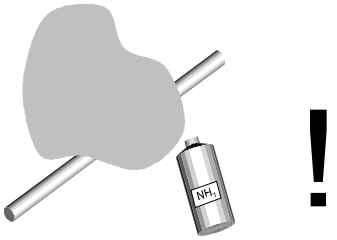


**Dosing medium $NH_3$: Checking the tightness with burning sulphur ($SO_2$)**

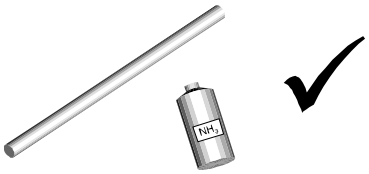
- Open all container valves and container connection valves and quickly close them again
- Slowly pass the burning sulphur strip along pressure-gas leading parts
  - Formation of white mist: **Leakage in pressure lines!**
    - **Depressurize the plant!**
    - **Eliminate leakage!**
    - **Check tightness again!**
  - No formation of white mist: **Pressure lines are tight.**

**Dosing media $Cl_2$ and $SO_2$: Checking the tightness with ammonia**

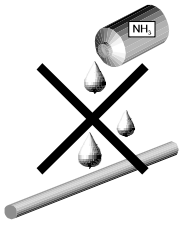
- Open all container valves and container connection valves and quickly close them again
- Slowly pass the open ammonia bottle along pressure-gas leading parts
  - Formation of white mist: **Leakage in pressure lines!**
    - **Depressurize the plant!**
    - **Eliminate leakage!**
    - **Check tightness again!**




  - No formation of white mist: **Pressure lines are tight.**




***WARNING*** ***Liquid ammonia must not come in contact with parts of the plant!***
***Danger of leakages by corrosion!***



# 6 Operation

## 6.1 Function

- ❏ Reducing the gas pressure (overpressure) to subatmospheric pressure (vacuum)
- ❏ In case of too high pressure in the device (e. g. if the inlet valve is soiled or damaged) the overpressure valve opens.
  - Gas will be lead to the absorption vessel.
- ❏ In case of the gas container getting empty or blocked gas supply (too high vacuum in the device) the vacuum shut-off valve closes.
  - Gas containers will not be evacuated with the injector vacuum.

## 6.2 Display Elements

- ❏ Manometer
  - displays the gas pressure at the inlet (admission pressure)

***WARNING*** ***Do not exceed the admission pressure!***
***Danger of gas break-out!***

## 6.3 Operating

***NOTE*** ***The device is passive. All adjustment has to be made at other parts of the gas dosing plant.***

➜ *Observe manuals of the other components.*

## 6.4 Possible Faults

| Fault | To be recognized by: | Probable cause | Correction |
|---|---|---|---|
| Gas leakage | - Gas odour<br>- Formation of mist at the connections when checking the tightness | Connections not tight | Check connections and re-tighten them. |
| | Gas escapes at the overpressure line while the plant is not running | Inlet valve not tight | Clean the inlet valve, replace damaged parts, use better gas. |
| | Loss of pressure at the manometer while the plant is not running and the gas supply is closed. | Inlet valve or connections not tight | Clean the inlet valve or the connections, replace damaged parts, use better gas. |
| Overpressure valve not tight | Vacuum present in the overpressure line while the plant is running (to be felt by putting on a finger) | Spring corroded or soiled | Replace or clean the spring. Do not remove the suspension wire of the spring! |
| | | O-ring (19) defective | Replace O-ring |
| | | Diaphragm defective | Replace diaphragm |
| Disturbed regulation | Vibrations and booming of the device | Diaphragm distored or mounted incorrectly | Mount the diaphragm correctly, slightly apply teflon grease to the guide tappet. |
| Desired dosing flow is not reached | Vacuum present in the overpressure line while the plant is running (to be felt by putting on a finger) | Diaphragm damaged. | Replace the diaphragm. |
| | Manometer of the vacuum regulator | Admission pressure too low (< 2 bar) | Adjust pressure reducing valve to a higher value, clean the filter. |
| | Manometer of the vacuum regulator | Gas containers empty | Replace gas containers by full ones |
| | | Shut-off valves in the pressure lines closed or not perfectly open | Open the shut-off valves |
| Re-liquefaction of the gas | Formation of ice on filter or pressure line connection during start-up, damages of PVC enclosure parts (only visible when the device is open) | Temperature at the pressure line connection lower than the temperature of the other pressure gas lines | Wrap a heater band around the filter and/or the pressure line connection and warm them up. Close gas supply before the filter, adjust the gas dosing system to minimal dosing flow and start the |

# 7 Maintenance

**Rates for cleaning and maintenance:**

- ❏ at least every 12 months
- ❏ in case of malfunction

***WARNING*** ***Do not open the device!***
***Cleaning, maintenance and repair only by authorized personnel!***

***WARNING*** ***Switch off the whole plant before doing cleaning and maintenance work!***
***Danger of gas breakout!***

***WARNING*** ***Check the tightness before restarting!***
***Danger of gas breakout!***

# 8 Spare Parts Sets

We suggest to store some spare part sets to ensure fast replacing of wearing parts (only by authorized personnel), if necessary.

**Spare parts set, consisting of**

valve seat, spring, diaphragm and 1 set of O-rings

| **Orde no.** | **type (dosing media)** |
|---|---|
| 553-1082 | 147-040 ($Cl_2$) |
| 553-1083 | 148-070 ($Cl_2$) |
| 553-1084 | 148-120 ($Cl_2$) |
| 553-1085 | 148-200 ($Cl_2$) |
| 553-1282 | 147-020N ($NH_3$) |
| | 147-038S ($SO_2$) |
| 553-1283 | 148-035N ($NH_3$) |
| | 148-065S ($SO_2$) |
| 553-1284 | 148-060N ($NH_3$) |
| | 148-115S ($SO_2$) |
| 553-1285 | 148-100N ($NH_3$) |
| | 148-190S ($SO_2$) |