

# Installation, Operating & Maintenance Instructions

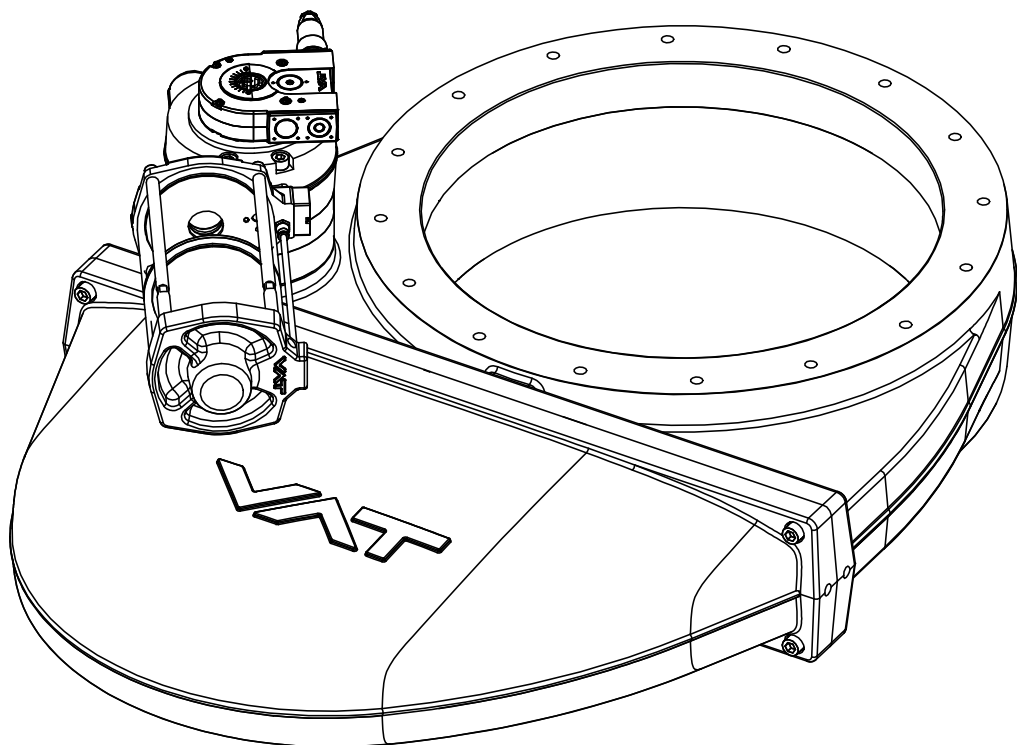
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## Large pendulum valve with double acting pneumatic actuator

**Series 168**  
**DN 400 – 500 mm (I. D. 16" – 20")**

This manual is valid for the following product ordering numbers:  
**168..-.....-.....**



Sample picture

## Imprint

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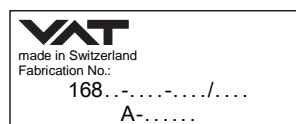
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# 1 Description of product

## 1.1 Identification of product

The fabrication number and order number are fixed on the product directly or by means of an identification plate.



← Fabrication number  
← Order number

## 1.2 Use of product

Use product for clean and dry vacuum applications only. Other applications are only allowed with the written permission of VAT.

## 1.3 Related documents

- Product data sheet
- Dimensional drawing

## 1.4 Important information



This symbol points to a very important statement that requires particular attention.

### Example:



VAT disclaims any liability for damages resulting from inappropriate packaging.

## 1.5 Technical data

See product data sheet and dimensional drawing.

## 2 Safety

### 2.1 Compulsory reading material

Read this chapter prior to performing any work with or on the product. It contains important information that is significant for your own personal safety. This chapter must have been read and understood by all persons who perform any kind of work with or on the product during any stage of its serviceable life.

|  |  |
|--|--|
|  | NOTICE   |
|  | <p><b>Lack of knowledge</b><br/>                 Failing to read this manual may result in property damage.<br/>                 Firstly, read manual.</p> |



These Installation, Operating & Maintenance Instructions are an integral part of a comprehensive documentation belonging to a complete technical system. They must be stored together with the other documentation and accessible for anybody who is authorized to work with the system at any time.

### 2.2 Danger levels



|  |   |
|--|---|
|  | ⚠ DANGER  |
|  | <p><b>High risk</b><br/>                 Indicates a hazardous situation which, if not avoided, will result in death or serious injury.</p> |

|  |  |
|--|--|
|  | ⚠ WARNING  |
|  | <p><b>Medium risk</b><br/>                 Indicates a hazardous situation which, if not avoided, could result in death or serious injury.</p> |

|  |  |
|--|--|
|  | ⚠ CAUTION  |
|  | <p><b>Low risk</b><br/>                 Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.</p> |

|  |  |
|--|--|
|  | NOTICE   |
|  | <p><b>Command</b><br/>                 Indicates a hazardous situation which, if not avoided, may result in property damage.</p> |

## 2.3 Personnel qualifications

|   |   |
|---|---|
|  |  <b>WARNING</b>  |
|   | <p><b>Unqualified personnel</b><br/>           Inappropriate handling may cause serious injury or property damage.<br/>           Only qualified personnel are allowed to carry out the described work.</p> |

## 2.4 Safety labels


| Label   | Part No.   | Location on valve |
|---|------------|-------------------|
|  | T-9001-156 | Protective cover  |

Table 2-1

## 3 Design and Function

### 3.1 Design

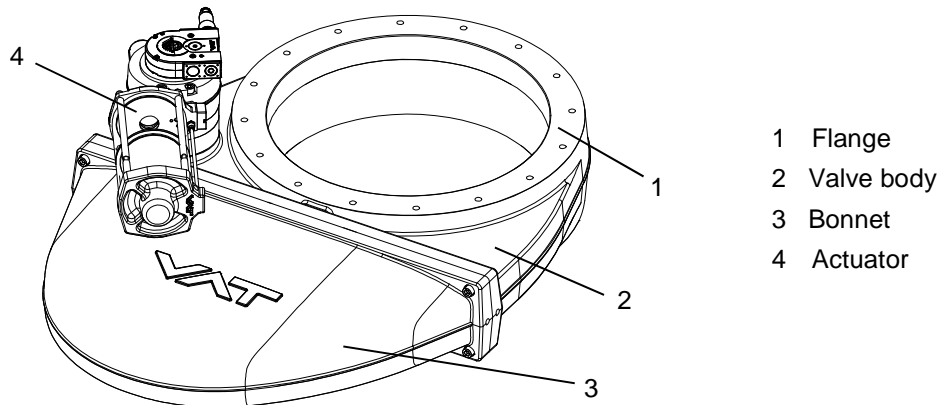
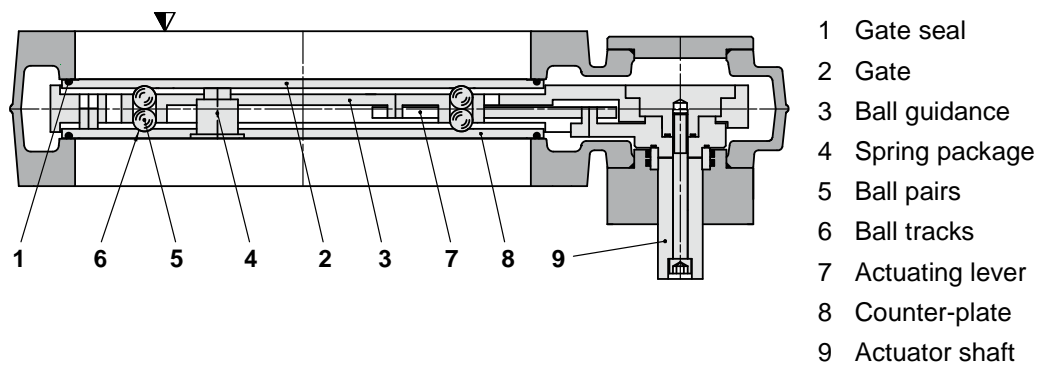


Figure 3-1

### 3.2 Function

The valve features the VATLOCK sealing technology. This means, the valve is mechanically locked in the closed position. In the open position, the mechanism is not locked. Leaf springs hold gate and counter-plate against the carriage with the ball retainers. The ball pairs are in the detents. For closing, the mechanism is moved forward into the closing position. The locking starts after the leaf spring stop touches the body. The ball retainers move the ball pairs out of the detents. Gate and counter-plate are spread apart. The gate seal is pressed against the sealing surface without scuffing. The arrangement of the ball pairs ensures an increase of the sealing force with vacuum on either side of the gate. During opening the movements proceed in the reverse order; see «Figure 3-2».




▼ Valve seat side

Figure 3-2



## 4 Installation

|   |   |
|---|---|
|  | <b>⚠ WARNING</b>  |
|   | <p><b>Unqualified personnel</b><br/>Inappropriate handling may cause serious injury or property damage.<br/>Only qualified personnel are allowed to carry out the described work.</p> |

|   |   |
|---|---|
|  | <b>⚠ WARNING</b>  |
|   | <p><b>Heavy weight</b><br/>Physical overstraining.<br/>Use a crane to lift the product.</p> |

### 4.1 Unpacking



- Make sure that the supplied products are in accordance with your order.
- Inspect the quality of the supplied products visually. If it does not meet your requirements, please contact VAT immediately.
- Store the original packaging material. It may be useful if products must be returned to VAT.





The valve can be lifted only at the eyebolt threads;  
see dimensional drawing.



1. Lift valve carefully and put it down on a clean surface or mount it to a clean system.

### 4.2 Installation into the system

|   |  |
|---|--|
|  | <b>⚠ WARNING</b>   |
|   | <p><b>Movable parts</b><br/>Human body parts may get jammed and severely injured.<br/>Do not connect or supply electrical power and compressed air before the product is completely mounted in the system.</p> |

|   |   |
|---|---|
|  | <b>NOTICE</b>   |
|   | <p><b>Contamination</b><br/>Product may get contaminated.<br/>Always wear cleanroom gloves when handling the product.</p> |

| <b>NOTICE</b> |   |
|---------------|---|
|               | <p><b>Inappropriate tools</b><br/>Sealing surfaces may get damaged.<br/>Do not use sharp-edged tools.</p> |

| <b>NOTICE</b> |  |
|---------------|--|
|               | <p><b>Wrong tightening torque</b><br/>Valve body and screws may get damaged.<br/>Use tightening torque according the size of the screws.</p> |

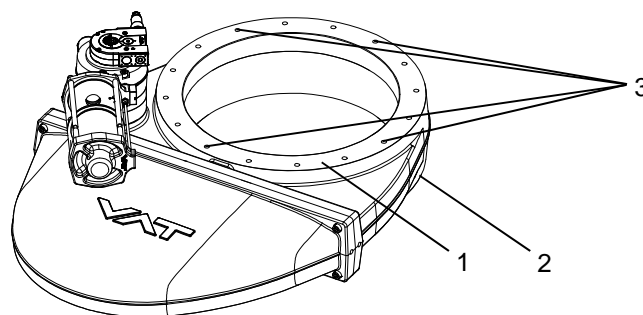
| <b>NOTICE</b> |  |
|---------------|--|
|               | <p><b>Too long screws</b><br/>Valve body may get deformed and / or malfunctions may occur.<br/>Use only screws recommended by VAT.</p> |

1. Remove protective covers from body flanges.
2. Clean sealing surfaces and seals of both flanges;  
see (1) and (2) according to «Figure 4-1».



The valve seat side is marked with the symbol «∇» on flange «A».

3. Lift the valve to the mounting position.
4. Mount the four screws (3) according to «Figure 4-1», evenly in crosswise order until the seal touches the sealing surface.
5. Tighten all screws with the torques appropriate for their property classes.



- 1 Flange A
- 2 Flange B
- 3 Screws

Figure 4-1

#### 4.2.1 Admissible forces and bending moments



Forces from evacuating the system, from the weight of other components or from baking can lead to deformation of the valve body and to malfunction of the valve. The stress has to be relieved by suitable means; see «Table 4-1» below.

The following forces or bending moments are admissible:

| DN (nom. I. D.) |      | Axial tensile or compressive force «FA» |      | Bending moment «M» |          |
|-----------------|------|---|------|--------------------|----------|
| mm              | inch | N                                       | lbf  | Nm                 | lbf · ft |
| 400             | 16   | 7840                                    | 1760 | 980                | 722      |
| 500             | 20   | 8820                                    | 1980 | 1078               | 800      |

If a combination of both forces («FA» and «M») occurs, the values mentioned above are invalid. Please contact VAT for more information.

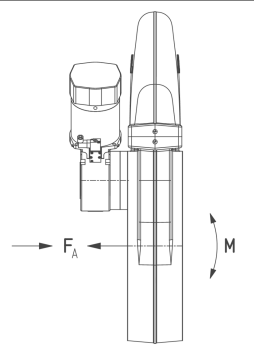


Table 4-1

### 4.3 Compressed air connection

|  |  |
|--|--|
|  | <b>WARNING</b>   |
|  | <p><b>Valve in open position</b><br/>           Risk of injury when compressed air is connected to the valve.<br/>           Connect compressed air only when:</p> <ul style="list-style-type: none"> <li>- valve is installed in the vacuum system</li> <li>- moving parts cannot be touched</li> </ul> |

Use clean, dry or slightly oiled air only.

Admissible air pressure range, see product data sheet.

1. Connect compressed air according to the product data sheet and dimensional drawing.

### 4.4 Electrical connection

|  |  |
|--|--|
|  | <b>DANGER</b>  |
|  | <p><b>Electric shock</b><br/>           Parts being under voltage will result in serious injury or death.<br/>           Do not touch parts being under voltage.</p> |

|  |   |
|--|---|
|  | <b>NOTICE</b>   |
|  | <p><b>Wrong voltage</b><br/>           Electrical components may get damaged.<br/>           Supply electrical components with the correct voltage.</p> |

1. Connect solenoid valve according to the product data sheet and dimensional drawing.
2. Connect position indicator according to the product data sheet and dimensional drawing.

## 5 Operation



### **WARNING**

#### **Unqualified personnel**

Inappropriate handling may cause serious injury or property damage.  
Only qualified personnel are allowed to carry out the described work.



### **WARNING**

#### **Movable parts**

Human body parts may get jammed and severely injured.  
Do not operate before product is installed completely into the vacuum system.

### 5.1 Normal operation

Valve is opened and closed pneumatically.

### 5.2 Operation under increased temperature

Maximum allowed temperature, see product data sheet.

### 5.3 Behavior in case of compressed air pressure drop

See product data sheet.

### 5.4 Behavior in case of power failure

See product data sheet.

#### 5.4.1 Manual emergency operation

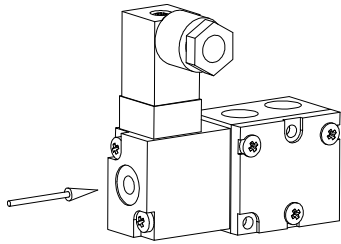


### **WARNING**

#### **Movable parts**

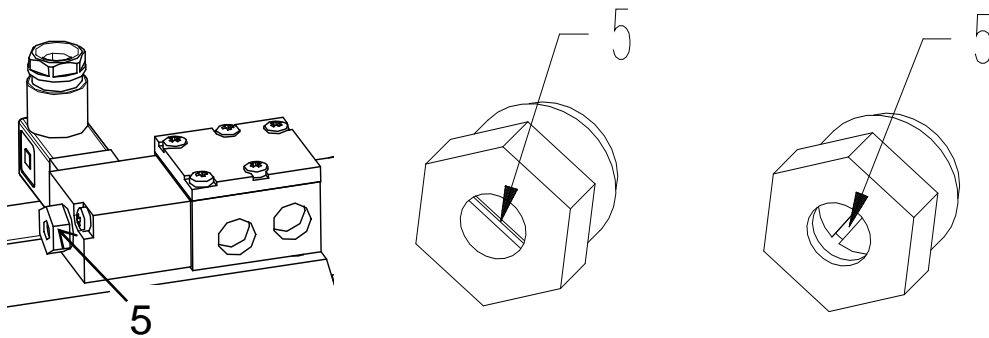
Human body parts may get jammed and severely injured.  
Keep human body parts away from movable parts.

**Standard solenoid valve**



Press push-button: valve opens  
 Release push-button: valve closes

**Solenoid valve with lockable emergency operation (option)**



Standard solenoid valve with manual emergency operation (5)

Solenoid valve in "NORMAL" position

Solenoid valve in "MANUAL" position (push and turn 90°)

Figure 5-1

## 5.5 3-position actuator (optional)

### 5.5.1 3-position actuator control logic

#### Without solenoid valve

| Gate position | Air inlet port |       |     |
|---------------|----------------|-------|-----|
|               | OPEN           | CLOSE | MID |
| Open          | +              | -     | -   |
| Intermediate  | -              | +     | +   |
| Close         | -              | +     | -   |

+ = Air pressure applied on specific port  
 - = Air pressure not applied specific port

#### With solenoid valve

| Gate position | Solenoid |    |
|---------------|----------|----|
|               | V1       | V2 |
| Open          | +        | -  |
| Intermediate  | -        | +  |
| Close         | -        | -  |

+ = Power on coil  
 - = No power on coil

#### Impulse Solenoid (optional)

| Gate Position | V1      |         | V2      |         |
|---------------|---------|---------|---------|---------|
|               | MV<br>1 | MV<br>2 | MV<br>1 | MV<br>2 |
|               | Open    | +       | -       | -       |
| Intermediate  | -       | +       | +       | -       |
| Close         | -       | +       | -       | +       |

+ = Power on coil  
 - = No power on coil

### 5.5.2 Adjustment procedure of third position

1. Remove complete air pressure supply from the gate valve actuator.
2. Unlock clamping screw (3).
3. Turn the adjustment screw (4) clockwise (closing direction) or counter-clockwise (opening direction) to adjust the third position.
4. Lock clamping screw (3).
5. Apply air pressure according to chapter «5.5.1 3-position actuator control logic» to move the gate into the intermediate position. Repeat item 1 to 4 until required third position is adjusted.
6. Turn the adjustment screw (5) of the position indicator (PI) to the right or the left until the positing indicator switch for the intermediate position is closed.  
(Pin 3 and 4 closed; See product data sheet)

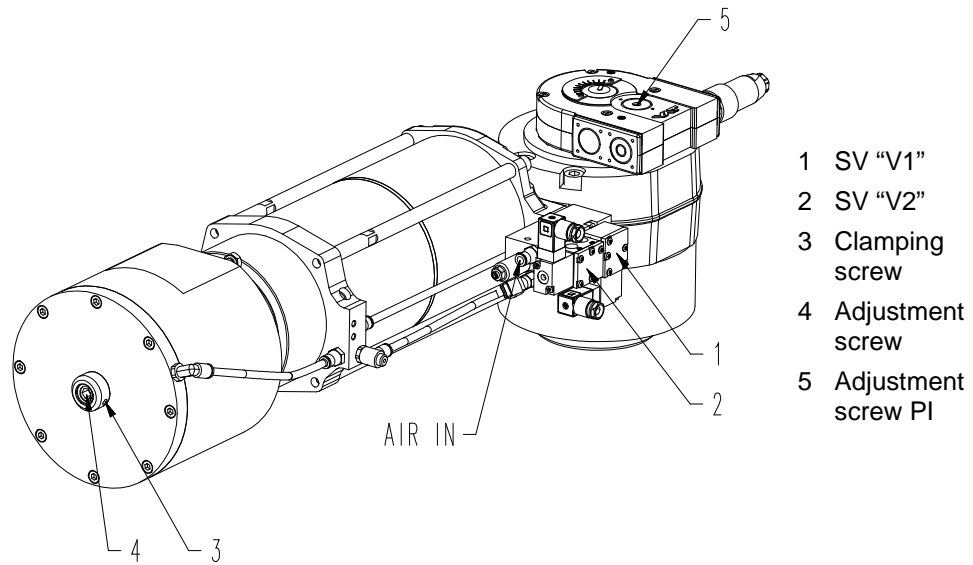


Figure 5-2

### 5.6 Trouble shooting





| Failure                     | Check                                      | Action   | See  |
|-----------------------------|--|--|--|
| Valve does not close / open | Air pressure                               | Connect compressed air                                   | «4.3 Compressed air connection»                  |
|                             | Operating pressure                         | Adjust operating pressure                                | Product data sheet                               |
|                             | Voltage at solenoid valve                  | Connect voltage  | «4.4 Electrical connection»                      |
| Leak at gate                | Gate seal all right?                       | Replace valve gate                                       | «6.3 Replacement of valve gate / mechanism unit» |
|                             | Gate damaged or contaminated?              | Replace valve gate                                       | «6.3 Replacement of valve gate / mechanism unit» |
|                             | Operating pressure                         | Adjust operating pressure                                | Product data sheet                               |
| Leak at body                | Bonnet seal and sealing surface all right? | Clean sealing surface, if necessary, replace bonnet seal | «6.3 Replacement of valve gate / mechanism unit» |

Table 5-1

If you need any further information, please contact one of our service centers. You will find the addresses on our website [www.vatvalve.com](http://www.vatvalve.com).



## 6 Maintenance

|   |   |
|---|---|
|    | <p style="text-align: center;"><b>⚠ WARNING</b></p> <p><b>Unqualified personnel</b><br/>Inappropriate handling may cause serious injury or property damage.<br/>Only qualified personnel are allowed to carry out the described work.</p>                         |
|    | <p style="text-align: center;"><b>⚠ WARNING</b></p> <p><b>Heavy weight</b><br/>Physical overstraining.<br/>Use a crane to lift the valve insert.</p>  |
|    | <p style="text-align: center;"><b>⚠ WARNING</b></p> <p><b>Hazardous components</b><br/>Human body parts may get jammed and severely injured.<br/>Before starting maintenance:<br/>– disconnect compressed air supply<br/>– disconnect electrical power supply</p> |
|  | <p style="text-align: center;"><b>⚠ WARNING</b></p> <p><b>Movable parts</b><br/>Human body parts may get jammed and severely injured.<br/>Keep human body parts away from movable parts.</p>  |

### 6.1 Maintenance intervals

Under clean operating conditions the valve does not require any maintenance during the specified cycles; see product data sheet. After these cycles, VAT recommends replacing the mechanism unit; see chapter «6.3 Replacement of valve gate / mechanism unit».

For more information or a general overhaul please contact one of our service centers. You will find the addresses on our website [www.vatvalve.com](http://www.vatvalve.com).

## 6.2 Required tools

- Torque wrench 128 Nm
- Cleanroom wiper soaked with alcohol (2% methyl ethyl ketone)
- O-Ring removal tool; see «Table 11-1» on page 27

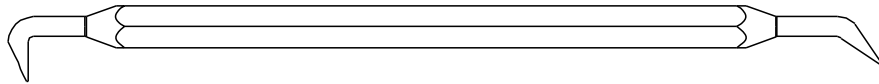


Figure 6-1

## 6.3 Replacement of valve gate / mechanism unit

|  |  |
|--|--|
|  | NOTICE   |
|  | <p><b>Contamination</b></p> <p>Product may get contaminated.<br/>Always wear cleanroom gloves when handling the product.</p> |
|  | NOTICE   |
|  | <p><b>Inappropriate tools</b></p> <p>Sealing surfaces may get damaged.<br/>Do not use sharp-edged tools.</p>                 |

Numbers in brackets refer to the drawings in chapter «12.1 Assembly drawing» and «12.2 Gate mechanism assembly drawing».



Pay attention! Remove the bonnet (19) only if the valve is in open position.

1. Vent chambers on either side to atmospheric pressure.
2. Disconnect electrical power supply.
3. Open the valve with the emergency button from solenoid valve.



Heavy bonnet (2/1)! In advance of the following steps make sure, that the bonnet is securely supported to prevent any hazard due to the heavy weight of the bonnet. Use the attachments points indicated in the dimensional drawing to mount eyebolts for lifting.

4. Remove the bonnet screws (61/1).
5. Remove the bonnet carefully (2/1).
6. Place bonnet (2/1) on a clean and flat surface and securely support it to prevent any hazards.

7. Remove the position indicator screws (42/1/33).
8. Remove position indicator (42).
9. Remove the centering ring screws (42/7).
10. Remove centering ring (42/4).
11. Remove the plunger screws (42/6).
12. Remove plunger (42/5).



Heavy gate mechanism (21)! In advance of the following steps make sure, that the gate mechanism is securely supported to prevent any hazard due to the heavy weight of the gate mechanism.

13. Remove the gate mechanism fastening screw (61/10).
14. Remove gate mechanism (21).
15. Place gate mechanism (21) on a clean and flat surface and securely support the gate mechanism (21) to prevent any hazards.
16. Clean gate seal (32) and counter-plate seal (33); see «Figure 12-2» on page 29, with cleanroom wiper or replace the seals if necessary; use O-ring removal tool.
17. Clean seat and counter seat surface of the valve body (1/1); use cleanroom wiper.
18. Clean bonnet seal (2/2) with cleanroom wiper or replace bonnet seals if necessary.
19. Clean bonnet seal surface at the valve body (1/1) with cleanroom wiper.



Heavy gate mechanism (21)! In advance of the following steps make sure, that the gate mechanism is securely supported to prevent any hazard due to the heavy weight of the gate mechanism.

20. Install gate mechanism (21).
21. Fasten the gate mechanism (21) with the mechanism fastening screw (61/10) with a torque of 128 Nm. (Screw needs to be slightly greased)



Installed eyebolts on the gate mechanism can seriously damage the valve! Remove eyebolts of the gate mechanism in advance of the following steps.

22. Install bonnet (2/1) and fasten the bonnet screws (61/1).
23. Close the valve with the emergency button from solenoid valve.
24. Install the plunger (42/5) with the two plunger screws (42/6).
25. Install the centering ring (42/4) with the centering screws (42/7).
26. Install the position indicator (42) with the position indicator screws (42/1/33).

27. Connect electrical power supply.

Valve is ready for use.








## 7 Repairs


Repairs may only be carried out by the VAT service staff. In exceptional cases, the customer is allowed to carry out the repairs, but only with the prior consent of VAT.

Please contact one of our service centers. You will find the addresses on our website [www.vatvalve.com](http://www.vatvalve.com).

## 8 Dismounting and Storage


|   |  |
|---|--|
|    | <p style="text-align: center;"><b>⚠ WARNING</b></p> <p><b>Unqualified personnel</b><br/>         Inappropriate handling may cause serious injury or property damage.<br/>         Only qualified personnel are allowed to carry out the described work.</p>  |
|    | <p style="text-align: center;"><b>⚠ WARNING</b></p> <p><b>Heavy weight</b><br/>         Physical overstraining.<br/>         Use a crane to lift the product.</p>  |
|    | <p style="text-align: center;"><b>⚠ WARNING</b></p> <p><b>Hazardous components</b><br/>         Human body parts may get jammed and severely injured.<br/>         Before dismounting the product</p> <ul style="list-style-type: none"> <li>– disconnect compressed air supply</li> <li>– disconnect electrical power supply</li> </ul> |
|  | <p style="text-align: center;"><b>⚠ WARNING</b></p> <p><b>Movable parts</b><br/>         Human body parts may get jammed and severely injured.<br/>         Keep human body parts away from movable parts.</p>   |
|  | <p style="text-align: center;"><b>NOTICE</b></p> <p><b>Contamination</b><br/>         Product may get contaminated.<br/>         Always wear cleanroom gloves when handling the product.</p>   |

## 8.1 Dismounting

|   |  |
|---|--|
|  | <b>NOTICE</b>  |
|   | <p><b>Valve in open position</b><br/>Valve mechanism may get damaged if valve is in open position.<br/>Close valve before dismounting the valve from the system.</p> |

1. Close valve.
2. Carry out the steps according to chapter «4 Installation» in reverse order.  
Pay attention to the safety instructions!





## 8.2 Storage

|   |  |
|---|--|
|  | <b>NOTICE</b>  |
|   | <p><b>Wrong storage</b><br/>Inappropriate temperatures and humidity may cause damage to the product.<br/>Valve must be stored at:<br/>– relative humidity between 10% and 70%<br/>– temperature between +10 °C and +50 °C<br/>– non-condensing environment</p> |

|   |   |
|---|---|
|  | <b>NOTICE</b>   |
|   | <p><b>Inappropriate packaging</b><br/>Product may get damaged if inappropriate packaging material is used.<br/>Always use the original packaging material and handle product with care.</p> |

1. Clean / decontaminate valve.
2. Cover all valve openings with a protective foil.
3. Pack valve appropriately, by using the original packaging material.

## 9 Packaging and Transport


|   |   |
|---|---|
|    | <p style="text-align: center;"><b>⚠ WARNING</b></p> <p><b>Unqualified personnel</b><br/>                 Inappropriate handling may cause serious injury or property damage.<br/>                 Only qualified personnel are allowed to carry out the described work.</p>                                       |
|    | <p style="text-align: center;"><b>⚠ WARNING</b></p> <p><b>Heavy weight</b><br/>                 Physical overstraining.<br/>                 Use a crane to lift the product.</p>   |
|    | <p style="text-align: center;"><b>⚠ WARNING</b></p> <p><b>Harmful substances</b><br/>                 Risk of injury in case of contact with harmful substances.<br/>                 Remove harmful substances (e. g. toxic, caustic or microbiological ones) from valve before you return the valve to VAT.</p> |
|  | <p style="text-align: center;"><b>NOTICE</b></p> <p><b>Inappropriate packaging</b><br/>                 Product may get damaged if inappropriate packaging material is used.<br/>                 Always use the original packaging material and handle product with care.</p>                                    |



- When returning products to VAT, please fill out the VAT form «Declaration of Chemical Contamination» and send it to VAT in advance. The form can be downloaded from our website [www.vatvalve.com](http://www.vatvalve.com).
- If products are radioactively contaminated, the VAT form «Contamination and Radiation Report» must be filled out. Please contact VAT in advance.
- If products are sent to VAT in contaminated condition, VAT will carry out the decontamination procedure at the customer's expense.



## 9.1 Packaging


| <b>NOTICE</b>   |  |
|---|--|
|  | <p><b>Valve in open position</b><br/>Valve mechanism may get damaged if valve is in open position.<br/>Make sure that the valve is closed.</p> |

1. Cover all valve openings with a protective foil.
2. Pack valve appropriately, by using the original packaging material.



VAT disclaims any liability for damages resulting from inappropriate packaging.


## 9.2 Transport

| <b>NOTICE</b>  |   |
|--|---|
|  | <p><b>Inappropriate packaging</b><br/>Product may get damaged if inappropriate packaging material is used.<br/>Always use the original packaging material and handle product with care.</p> |



VAT disclaims any liability for damages resulting from inappropriate packaging.

## 10 Disposal

|   |  |  |
|---|--|--|
|  | <b>⚠ WARNING</b>   |  |
|   | <b>Harmful substances</b>                                      |  |
|   | Environmental pollution.                                       |  |
|   | Discard products and parts according to the local regulations. |  |

## 11 Spare parts

| <b>NOTICE</b>   |  |
|---|--|
|  | <p><b>Non-original spare parts</b><br/>Non-original spare parts may cause damage to the product.<br/>Use original spare parts from VAT only.</p> |



- Please specify the fabrication number of the product when you place an order for spare parts; see chapter «1.1 Identification of product». This is to ensure that the appropriate spare parts are supplied.
- VAT makes a difference between spare parts that may be replaced by the customer and those that need to be replaced by the VAT service staff.
- «Table 11-1» only contains spare parts that may be replaced by the customer. If you need any other spare parts, please contact one of our service centers. You will find the addresses on our website [www.vatvalve.com](http://www.vatvalve.com).

| Description                    | Part No.   | Quantity per valve | Maintenance procedure see chapter                |
|--------------------------------|------------|--------------------|--|
| Bonnet seal                    | on request | 1                  | «6.3 Replacement of valve gate / mechanism unit» |
| Gate seal /counter-plate seal  | on request | 2                  | «6.3 Replacement of valve gate / mechanism unit» |
| Mechanism, complete lubricated | on request | 1                  | «6.3 Replacement of valve gate / mechanism unit» |
| O-ring removal tool            | on request | 1                  | «6.3 Replacement of valve gate / mechanism unit» |

Table 11-1

# 12 Appendix

## 12.1 Assembly drawing

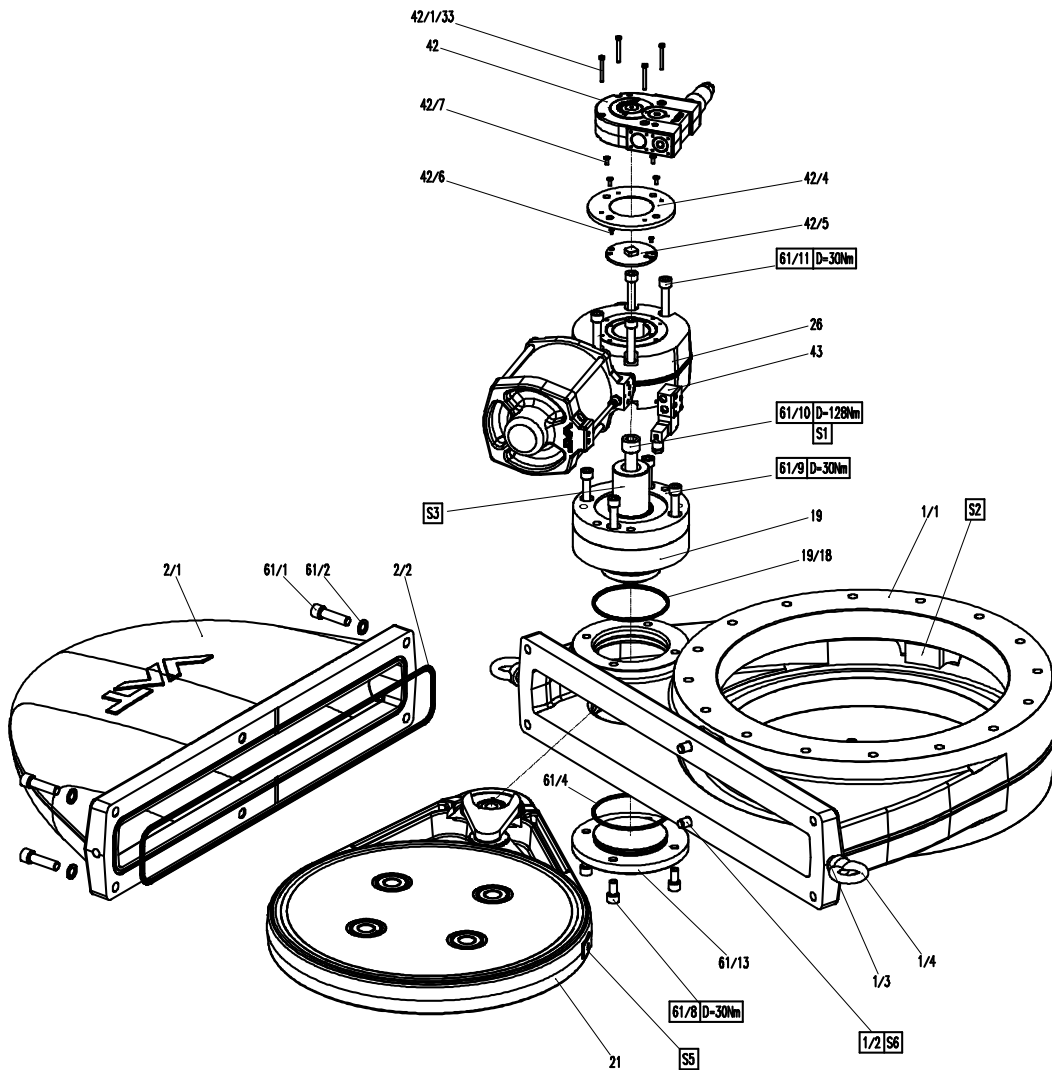


Figure 12-1

| Item    | Description        |
|---------|--------------------|
| 1/1     | Valve body         |
| 2/1     | Bonnet             |
| 61/1    | Bonnet screws      |
| 2/2     | Bonnet seal        |
| 42      | Position indicator |
| 42/1/33 | Pos. ind. screws   |

| Item  | Description           |
|-------|-----------------------|
| 42/4  | Centering ring        |
| 42/7  | Centering ring screws |
| 42/6  | Plunger screws        |
| 42/5  | Plunger               |
| 61/10 | Mech. fastening screw |
| 21    | Gate mechanism        |

## 12.2 Gate mechanism assembly drawing

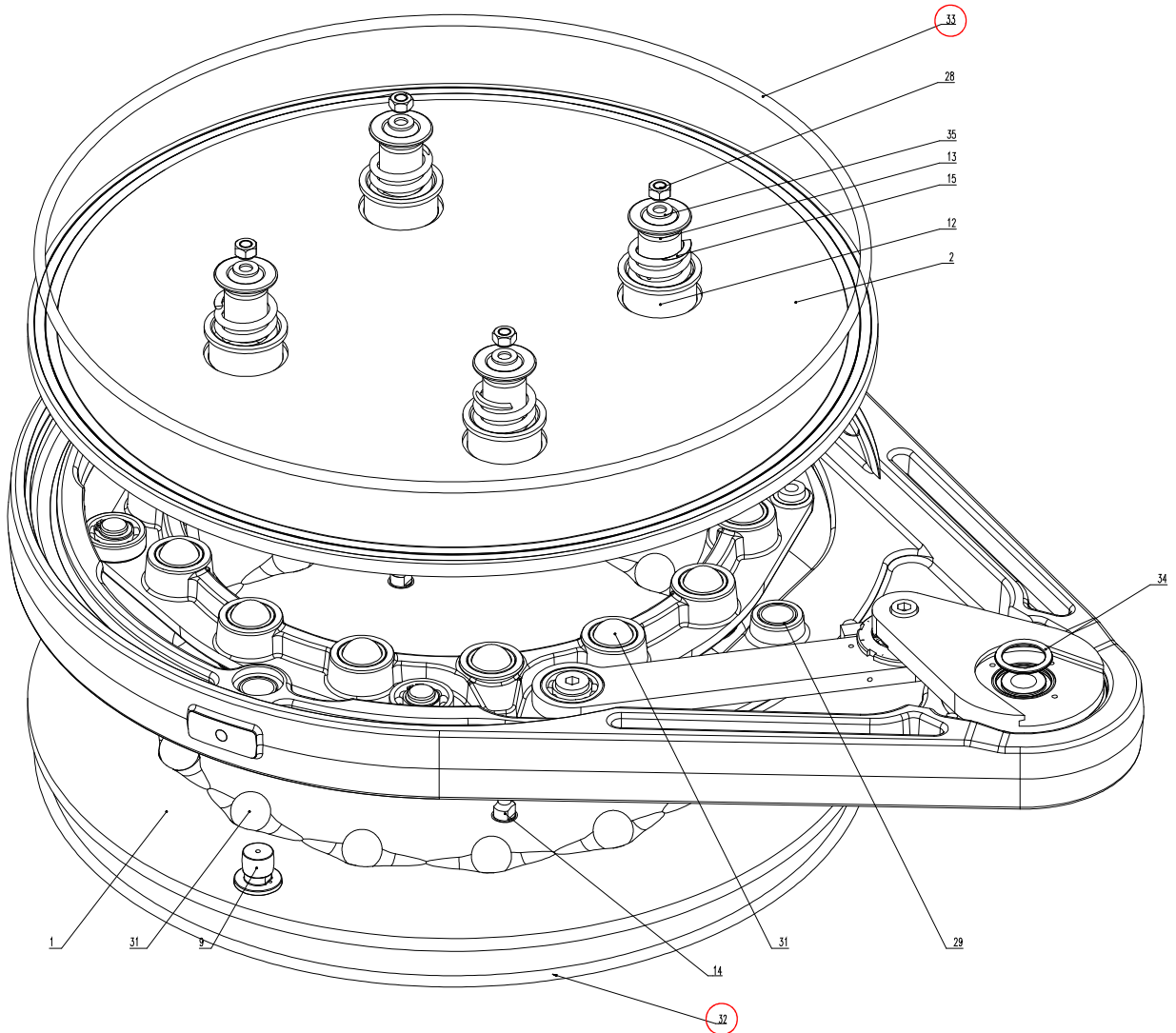


Figure 12-2

| Item | Description        |
|------|--------------------|
| 32   | Gate seal          |
| 33   | Counter-plate seal |