

# Control Valve

## MIL 21000



# Installation/Operating Manual





CONTROLS SUPPLY CHAIN  
VALVES ACTUATORS INSTRUMENTATIONS

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Installation/Operating Manual MIL 21000

Original operating manual

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## Glossary

### **Certificate of decontamination**

A certificate of decontamination is enclosed by the customer when returning the product to the manufacturer to certify that the product has been properly drained to eliminate any environmental and health hazards arising from components in contact with the fluid handled.

### **Pressure Equipment Directive 2014/68/EU (PED)**

The 2014/68/EU Directive sets out the requirements to be met by pressure equipment intended to be placed on the market in the European economic area.



## 1 General

### 1.1 Principles

This operating manual is valid for the type series and variants indicated on the front cover.

The operating manual describes the proper and safe use of this equipment in all phases of operation.

In the event of damage, immediately contact your nearest KSB sales organisation responsible to maintain the right to claim under warranty.

### 1.2 Target group

This operating manual is aimed at the target group of trained and qualified specialist technical personnel.


### 1.3 Other applicable documents

**Table 1:** Overview of other applicable documents

Document	Contents
Type series booklet	Description of the valve
Data sheet	Description of the technical data for the automatic recirculation valve
General assembly drawing	Sectional drawing of the valve
List of components	Description of all components



### 1.4 Symbols

**Table 2:** Symbols used in this manual





Symbol	Description
✓	Conditions which need to be fulfilled before proceeding with the step-by-step instructions
▷	Safety instructions
⇒	Result of an action
⇔	Cross-references
1. 2.	Step-by-step instructions
	Note Recommendations and important information on how to handle the product

### 1.5 Key to safety symbols/markings

**Table 3:** Definition of safety symbols/markings

Symbol	Description
 <b>DANGER</b>	<b>DANGER</b> This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
 <b>WARNING</b>	<b>WARNING</b> This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
<b>CAUTION</b>	<b>CAUTION</b> This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.



Symbol	Description
	<b>Explosion protection</b> This symbol identifies information about avoiding explosions in potentially explosive atmospheres in accordance with EU Directive 2014/34/EU (ATEX).
	<b>General hazard</b> In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	<b>Electrical hazard</b> In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	<b>Machine damage</b> In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.



## 2 Safety

### 2.1 General

- This operating manual contains general installation, operating and maintenance instructions that must be observed to ensure safe operation of the system and prevent personal injury and damage to property.
- Comply with all the safety instructions given in the individual sections of this operating manual.
- The operating manual must be read and understood by the responsible specialist personnel/operators prior to installation and commissioning.
- The contents of this operating manual must be available to the specialist personnel at the site at all times.
- Information and markings attached directly to the product must always be complied with and kept in a perfectly legible condition at all times. This applies to, for example:
  - Manufacturer
  - Type designation
  - Pressure class
  - Nominal size
  - Flow direction arrow
  - Year of construction
  - Valve body material
- The operator is responsible for ensuring compliance with all local regulations not taken into account.
- The design, manufacture and testing of the valve are subject to a QM system to DIN EN ISO 9001 as well as the current regulations and directives for pressure equipment.
- Bear in mind that valves exposed to creep-rupture conditions have a limited service life and have to meet the applicable regulations stipulated in the technical codes.
- In the case of customised special variants, further restrictions may apply with regard to the operating mode and service life. Refer to the relevant sales documentation for applicable limitations.
- The operator is responsible for any eventualities or incidents which may occur during installation performed by the customer, operation and maintenance.

### 2.2 Intended use

- Only operate valves which are in perfect technical condition.
- Do not operate the valve in partially assembled condition.
- Only use the valve for fluids specified in the product literature. Take the design and material variant into account.
- Only operate the valve within the operating limits described in the other applicable documents.
- The valve's design and rating are based on predominantly static loading in accordance with the codes applied. Consult the manufacturer if the valve is subjected to dynamic loads or any other additional influences.
- Consult the manufacturer about any other modes of operation not described in the product literature.
- Do not use the valve as a foothold.



### 2.3 Personnel qualification and training

- All personnel involved must be fully qualified to transport, install, operate, maintain and inspect the product this manual refers to and be fully aware of the interaction between the valve and the system.
- The responsibilities, competence and supervision of all personnel involved in transport, installation, operation, maintenance and inspection must be clearly defined by the operator.
- Deficits in knowledge must be rectified by means of training and instruction provided by sufficiently trained specialist personnel. If required, the operator can commission the manufacturer/supplier to train the personnel.
- Training on the valve must always be supervised by specialist technical personnel.

### 2.4 Consequences and risks caused by non-compliance with this manual

- Non-compliance with these operating instructions will lead to forfeiture of warranty cover and of any and all rights to claims for damages.
- Non-compliance can, for example, have the following consequences:
  - Hazards to persons due to electrical, thermal, mechanical and chemical effects and explosions
  - Failure of important product functions
  - Failure of prescribed maintenance and servicing practices
  - Hazard to the environment due to leakage of hazardous substances

### 2.5 Safety awareness

In addition to the safety information contained in this operating manual and the intended use, the following safety regulations shall be complied with:

- Accident prevention, health regulations and safety regulations
- Explosion protection regulations
- Safety regulations for handling hazardous substances
- Applicable standards, directives and laws

### 2.6 Safety information for the operator/user

- Actuator-operated valves are intended for use in areas which cannot be accessed by unauthorised persons. Operation of these valves in areas accessible to unauthorised persons is only permitted if appropriate protective devices are fitted at the site. This must be ensured by the operator.
- Fit protective equipment (e.g. contact guards) supplied by the operator for hot, cold or moving parts, and check that the equipment functions properly. Do not touch rotating parts.
- Do not remove any protective equipment (e.g. contact guards) during operation.
- Provide the personnel with protective equipment and make sure it is used.
- Contain any leakage of hazardous fluids (e.g. explosive, toxic, hot) so as to avoid any danger to persons and the environment. Adhere to all relevant laws.
- Eliminate all electrical hazards. (In this respect refer to the applicable national safety regulations and/or regulations issued by the local energy supply companies.)



## 2.7 Safety information for maintenance, inspection and installation

- Modifications or alterations of the valve require the manufacturer's prior consent.
- Use only original spare parts or parts/components authorised by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Use suitable tools for maintenance, inspection and installation.
- Carry out work on the valve during standstill only.
- The valve body must have cooled down to ambient temperature.
- The pressure in the valve body must have been released and the valve must have been drained.
- When taking the valve out of service always adhere to the procedure described in the manual.
- Decontaminate valves which handle fluids posing a health hazard.
- Protect the valve body and the bonnet from any impacts.
- As soon as the work has been completed, re-install and re-activate any safety-relevant devices and protective devices. Before returning the product to service, observe all instructions on commissioning. (⇒ Section 6.1, Page 23)

## 2.8 Unauthorised modes of operation

- The valve is operated outside the limits stated in the operating manual.
- The valve is not operated in accordance with the intended use.



(⇒ Section 2.2, Page 8)

### 3 Transport/Storage/Disposal

#### 3.1 Checking the condition upon delivery

1. On transfer of goods, check each packaging unit for damage.
2. In the event of in-transit damage, assess the exact damage, document it and notify KSB or the supplying dealer and the insurer about the damage in writing immediately.

#### 3.2 Transport

	<p><b>⚠ DANGER</b></p>
	<p><b>The valve/actuator unit could slip out of the suspension arrangement.</b> Danger to life from falling parts!</p> <ul style="list-style-type: none"> <li>▷ Only transport the valve/actuator unit in the specified position.</li> <li>▷ Never attach lifting accessories to the actuator.</li> <li>▷ Observe the information on weights, centre of gravity and fastening points.</li> <li>▷ Observe the applicable local accident prevention regulations.</li> <li>▷ Use suitable, permitted lifting accessories, e.g. self-tightening lifting tongs.</li> </ul>
	<p style="background-color: #fff; border: 1px solid black; padding: 2px;"><b>CAUTION</b></p> <p><b>Improper transport</b> Damage to the valve!</p> <ul style="list-style-type: none"> <li>▷ Protect the valve and components against external forces (e.g. impacts, blows, vibrations).</li> </ul>

To transport the valve, suspend it from the lifting tackle as illustrated.



A



B



C

Fig. 1: Transporting the valve



**Table 4:** Transporting the valve


Photo	Weight [kg]	Transport
A	< 500	Attach the lifting accessory to the actuator's eyebolt.
B	> 500 to < 1200	Run the lifting accessories through the actuator yoke.
C	> 1200	Attach the lifting accessories to the flanges. Use four ropes for transport. Tie them together directly under the upper section of the actuator to prevent the valve from tilting.

1. Upon receipt, unpack the valve and check it for in-transit damage.
2. Report any in-transit damage to the manufacturer immediately.
3. Dispose of packaging material in accordance with local regulations.



### 3.3 Storage/preservation

If commissioning is to take place some time after delivery, we recommend that the following measures be taken for storing the valve:

	<b>CAUTION</b>
	<p><b>Damage due to frost, humidity or dirt</b> Corrosion/contamination of the valve!</p> <ul style="list-style-type: none"> <li>▷ Store the valve in a dry, dust-free and vibration-free, frost-proof room where the atmospheric humidity is as constant as possible.</li> <li>▷ Protect the valve against contamination, e.g. with suitable caps or film.</li> </ul>

Storage and/or temporary storage of the valves must ensure that even after a prolonged period of storage the valves' function is not impaired.

The temperature in the storage room must not exceed +40 °C.


For storing a valve which has already been operated, observe the measures to be taken for shutdown. (⇒ Section 6.3, Page 24)

### 3.4 Return to supplier

1. Drain the valve as described in the manual.
2. Flush and clean the valve, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the valve has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen also neutralise the valve and blow through with anhydrous inert gas to ensure drying.
4. When returning valves used for handling Fluids in Group 1 always complete and enclose a certificate of decontamination.  
Indicate any safety measures and decontamination measures taken.

	<b>NOTE</b>
	<p>If required, a blank certificate of decontamination can be downloaded from the following web site: <a href="http://www.ksb.com/certificate_of_decontamination">www.ksb.com/certificate_of_decontamination</a></p>

### 3.5 Disposal

	<b>⚠ WARNING</b>
	<p><b>Fluids handled, consumables and supplies which are hot or pose a health hazard</b> Hazard to persons and the environment!</p> <ul style="list-style-type: none"> <li>▷ Collect and properly dispose of flushing fluid and any residues of the fluid handled.</li> <li>▷ Wear safety clothing and a protective mask if required.</li> <li>▷ Observe all legal regulations on the disposal of fluids posing a health hazard.</li> </ul>

1. Dismantle the valve.  
Collect greases and other lubricants during dismantling.
2. Separate and sort the valve materials, e.g. by:
  - Metals
  - Plastics
  - Electronic waste
  - Greases and other lubricants
3. Dispose of materials in accordance with local regulations or in another controlled manner.

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## 4 Description of the Valve

### 4.1 General description

- Top-guided single-seated control valve

Valve for controlling and shutting off fluids such as air, water, steam, gas and oil.

### 4.2 Product information

#### 4.2.1 Product information as per Pressure Equipment Directive 2014/68/EU (PED)

The valves satisfy the safety requirements of Annex I of the European Pressure Equipment Directive 2014/68/EU (PED) for fluids in Groups 1 and 2.

#### 4.2.2 Product information as per Regulation No. 1907/2006 (REACH)

For information as per European chemicals regulation (EC) No. 1907/2006 (REACH) see <https://www.ksb.com/en-global/company/corporate-responsibility/reach>.

### 4.3 Designation

**Table 5:** Designation example

Position						
1	2	3	4	5	6	7
3	7	2	1	1	0	4

**Table 6:** Designation key

Position	Code	Description
1-2	Actuator type	
	20	Manual actuation
	37	Diaphragm actuator (air-to-close)
	38	Diaphragm actuator (air-to-open)
	67	Piston actuator (air-to-close)
	68	Piston actuator (air-to-open)
3-4	Design	
	21	Top-guided single-seated control valve
	70	Top-guided single-seated control valve in angle pattern
5	Valve disc design	
	0	Undefined
	1	Contoured (parabolic plug)
	7	Single-stage, anti-cavitation / low-noise plug
	8	Two-stage, anti-cavitation plug
6	Trim type	
	0	Undefined
	1	Linear
	2	Equal-percentage
	3	Customised
7	Seat type	
	0	Undefined
	4	Clamped (quick change)
	5	Threaded
	6	Soft-seated

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#### 4.4 Marking

**Table 7:** General marking

Parameter	Values
Nominal size [inch]	NPS ...
Nominal pressure class	Class ...
Manufacturer's mark	KSB
Type series/Model	MIL ...
Year of construction	20..
Material	.....
Flow direction arrow	→
Traceability of the material	.....
CE conformity marking(if required and possible)	<b>CE</b>
Identification number of the notified body	0045
Customer's marking	e.g. plant/system No., etc.

In accordance with the current regulations and directives for pressure equipment the valves are marked as shown in the following table:

#### Fluids in Groups 1 and 2

Class	<1"	1 ¼"	1 ½"	2"	>2"
	25	32	40	50	>50
150					
>300					

**Fig. 2:** CE conformity marking: Fluids in Groups 1 and 2

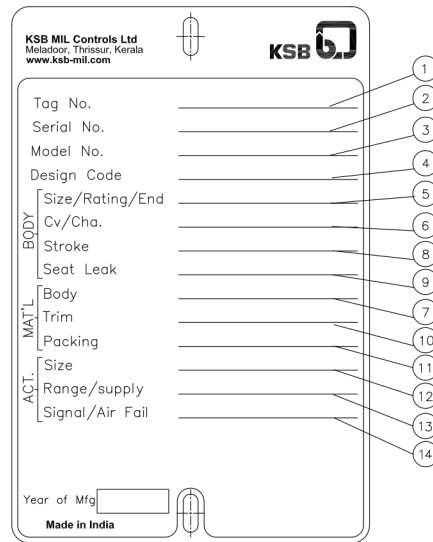
#### Fluid groups

In accordance with the current regulations and directives for pressure equipment, Group 1 comprises all fluids posing physical or health hazards, e.g. fluids defined as

- Explosive
- Extremely flammable
- Highly flammable
- Very toxic
- Toxic
- Oxidising

Fluid group 2 comprises all other fluids not referred to in Group 1.

### 4.5 Name plate



**Fig. 3: Valve name plate (example)**

1	TAG number	2	Serial number
3	Model number	4	Design
5	Nominal valve size	6	Cv value
7	Valve body material	8	Actuator stroke
9	Leakage class	10	Trim material
11	Gland packing material	12	Actuator size
13	Spring range	14	Actuating signal

### 4.6 Design details

#### Design

- Top-guided single-seated control valve
- Straight-way pattern with horizontal seat
- PTFE gland packing ≤ 180 °C
- Graphite gland packing > 180 °C
- Parabolic plug
- Standard bonnet: temperature range -29 °C to 427 °C
- Leakage class IV to ANSI FCI 70.2

#### Variants

- Leakage class V and VI to ANSI FCI 70.2
- Version with heating jacket (steam up to 25 kg/cm<sup>2</sup>)
- Flushing connection
- Extended bonnet: temperature range -100 °C to 540 °C
- Cryogenic bonnet: temperature range -196 °C to -100 °C
- Bellows-sealed bonnet
- Angle-pattern body design with venturi seat (MIL 70000)
- Two-stage design with anti-cavitation / low-noise plug
- Quick-change trim
- Eco-Lock gland packing to ISO 15848-1 fugitive emission requirements
- Spring-loaded gland packing (live loading)



- Anti-cavitation plug
- Low-noise plug
- Soft-seated valve disc ( $C_v > 6$ ) or soft seat with PTFE sealing element ( $C_v \leq 6$ ) for leakage class VI

#### 4.7 Function

**Design** Rugged, heavy plug shank guiding section provides maximum support to ensure valve disc/plug stability. The valve disc is guided by a guide bush in the lower area of the bonnet. This valve disc guiding feature minimises lateral pressure on the valve disc, prevents trim vibrations and ensures stable operation even in high-temperature service.

**Stem sealed by gland packing** The gland packing is tightened at the gland follower (14) by studs (16) and nuts (15).

**Stem sealed by bellows** In the bellows housing (28), the stem (1) is sealed by the bellows (29). The back-up gland packing (3) is tightened at the gland follower (14) by means of studs (16) and nuts (15).

**Function** The valve is operated by a pneumatic actuating element (actuator).

#### 4.8 Scope of supply

Depending on the model, the following items are included in the scope of supply:

- Valve
- Actuator
- Valve operating manual
- Actuator operating manual

#### 4.9 Noise characteristic

When operated within the operating conditions documented in the order confirmation and/or characteristic curves booklets, the valve will not exceed a sound pressure level of 80 dB in acc. with IEC 60534-8-4. Unfavourable piping layouts or off-design operating conditions may give rise to physical phenomena like cavitation, resulting in significantly higher sound pressure levels.

## 5 Installation at Site

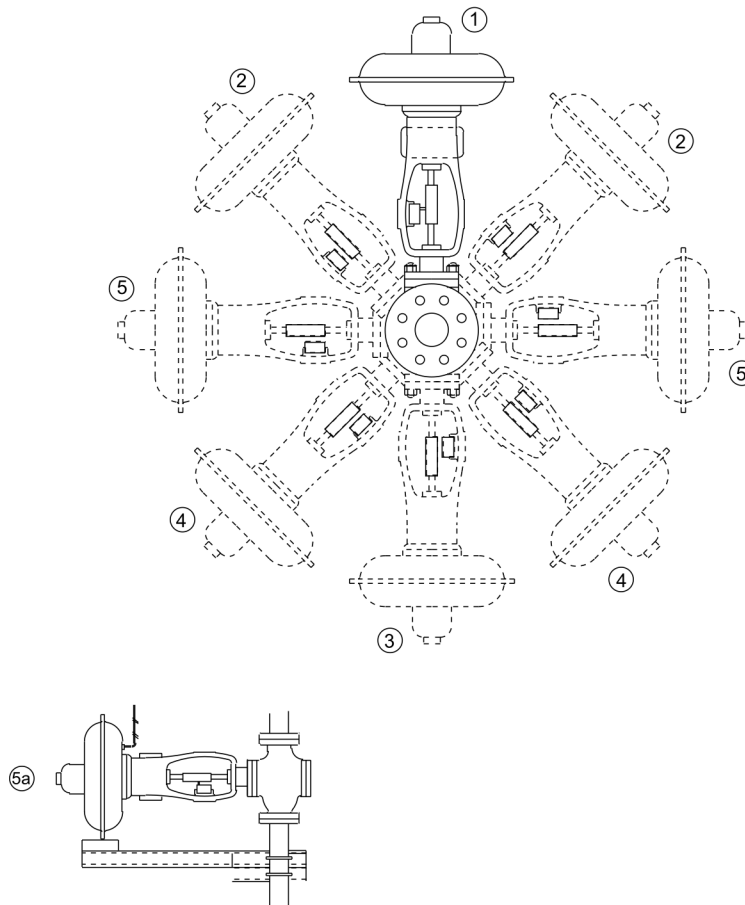
### 5.1 General information/Safety regulations

Responsibility for positioning and installing the valve lies with the consultant, the engineering contractor or the operator. Planning errors and installation errors can prevent the reliable function of the valves and pose a substantial safety hazard.

	<p><b>⚠ WARNING</b></p>
	<p><b>Damage to pressure enclosure or add-on parts</b> Leakage from or rupture of the valve Valve/add-on parts not functional</p> <ul style="list-style-type: none"> <li>▸ Check the valve for in-transit damage prior to installation.</li> <li>▸ Check any add-on parts for in-transit damage.</li> <li>▸ Do not install damaged valves.</li> </ul>

### 5.2 Installation position

Control valves with actuators should preferably be installed vertically in horizontal pipes (position 1). Installation with the stem in an inclined or horizontal position, e.g. in vertical pipes (positions 2 and 5), is also permitted. Site-supplied supports must be provided for actuators installed in a horizontal position (position 5a). Avoid any installation positions with the actuator hanging downward (positions 3 and 4, risk of malfunction).



**Fig. 4: Installation positions**

The valve bodies are marked with an arrow indicating the flow direction.



Install the valves in such a way that the actual flow direction of the fluid matches the arrow on the valve body.

Recommended flow direction for versions with a parabolic plug (MIL 21100) or low-noise plug (MIL 21700 / MIL 21900): flow-to-open


Recommended flow direction for version with anti-cavitation plug (MIL 21700 / MIL 21800): flow-to-close


### 5.3 Preparing the valve


	<b>CAUTION</b>
	<p><b>Outdoor installation</b> Damage due to corrosion!</p> <ul style="list-style-type: none"> <li>▷ Provide weather-proof protection to protect the valve against moisture.</li> </ul>

1. Thoroughly clean, flush and blow through all vessels, pipes and connections.
2. Remove the protective covers on both body ends before installing the valve in the pipe.
3. Check that the inside of the valve is free from any foreign objects. Remove any foreign objects.
4. If required, install a strainer in the pipe.

### 5.4 Piping

	<b>⚠ WARNING</b>
	<p><b>Impermissible piping forces</b> Leakage from or rupture of the valve body!</p> <ul style="list-style-type: none"> <li>▷ Connect the pipes to the valve without transmitting any stresses or strains.</li> <li>▷ Take structural measures to prevent any piping forces from being transmitted to the valve.</li> <li>▷ Avoid mechanical loads beyond normal levels, e.g. piping forces, moments and vibrations.</li> </ul>

	<b>CAUTION</b>
	<p><b>Weld beads, scale and other impurities</b> Damage to the valve!</p> <ul style="list-style-type: none"> <li>▷ Take suitable measures to protect the valve against impurities.</li> <li>▷ Remove any impurities from the piping.</li> <li>▷ If necessary, install a strainer.</li> </ul>

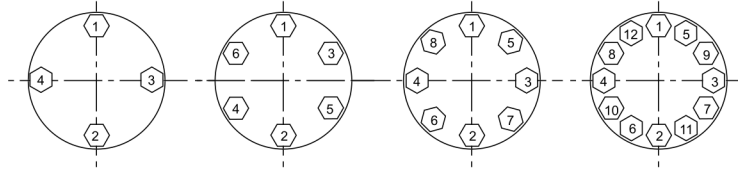
	<b>CAUTION</b>
	<p><b>Painting of the piping</b> Valve function impaired! Loss of important information provided on the valve!</p> <ul style="list-style-type: none"> <li>▷ Protect stem and plastic components prior to applying paint.</li> <li>▷ Protect printed name plates prior to applying paint.</li> </ul>

#### 5.4.1 Flange connection

**Fasteners** Only use fasteners and sealing elements of approved materials. Always use all flange bolt holes provided when connecting the valve to the pipe.

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**Flange connection**



**Fig. 5:** Sequence for flange bolt tightening


- ✓ The mating flange faces are clean and undamaged.
- ✓ Fasteners and sealing elements are available.
- ✓ Verify that the pipe is correctly aligned and the flanges are parallel.
  1. Align the valve between the pipe flanges.
  2. Use an appropriate tool to evenly tighten the fasteners in the specified tightening sequence. (⇒ Section 7.3, Page 43)

**5.4.2 Welding the valve into the pipe**

Responsibility for welding the valve into the pipe and for any heat treatment required lies with the commissioned construction company or the plant operator.


	<b>CAUTION</b>
	<p><b>Weld beads, scale and other impurities</b> Damage to the valve!</p> <ul style="list-style-type: none"> <li>▸ Take suitable measures to protect the valve against impurities.</li> <li>▸ Remove any impurities from the piping.</li> <li>▸ If necessary, install a strainer.</li> </ul>
	<b>CAUTION</b>
	<p><b>Incorrect earthing during welding work on the piping</b> Damage to the valve (scorching)!</p> <ul style="list-style-type: none"> <li>▸ Never earth the electric welding equipment on the valve's functional parts.</li> </ul>



	<b>CAUTION</b>
	<p><b>Non-compliance with the max. permissible application temperature</b> Damage to the valve!</p> <ul style="list-style-type: none"> <li>▷ Complete the weld seam in several steps to ensure that the temperature in the middle of the body does not exceed the max. permissible application temperature.</li> </ul>


- The welding process, filler metals as well as welding data are defined by the responsible welding authority.
- Provide sufficient clearance for removal of the valve and, if necessary, the actuator.
- Maintain cleanliness when welding the valve into the pipe. No contaminants must enter the inside of the valve body; otherwise the seat/disc interface and/or the stem may become damaged.
- ✓ The valve is installed in accordance with the appropriate piping isometry.
- ✓ Comply with the welding processes, filler metals and welding data laid down in the documented welding procedure.
- ✓ The weld ends of valve and pipe have been centred.
  1. Verify that the butt weld ends are clean and undamaged.
  2. Prior to welding the valve into the pipe, run the valve disc to the middle position.
  3. Weld the valve into the pipe in such a way that the valve/pipe welds are not subjected to stresses, strains or torsion. During the welding process, make sure the gap towards the pipe is uniform and without any radial offset.

#### 5.4.3 Installing a valve with threaded ends

	<b>CAUTION</b>
	<p><b>Tightening the threaded connection with an unsuitable tool</b> Damage to the valve! Leakage at the valve body! Leakage of fluid!</p> <ul style="list-style-type: none"> <li>▷ Tighten the threaded connection with an open-ended spanner only.</li> </ul>



- ✓ The threaded ends are clean and undamaged.
  1. During installation, make sure there is not dirt on the thread.
  2. Apply sealing material to the pipe threads only, not to the valve threads.
  3. Use an open-ended spanner to tighten the threaded connection.

#### 5.5 Valves with actuator

	<b>NOTE</b>
	<p>If the valves are fitted with actuators, ensure that the actuator's operating manual is also observed.</p>

### Pneumatic actuators

#### Connecting the control air supply

	 <b>DANGER</b>
	<p><b>Work on valves with energy storage, e.g. spring mechanisms or compressed air storage</b></p> <p>Danger to life resulting from incorrect assembly</p> <ul style="list-style-type: none"> <li>▷ Ensure that work on the actuator is performed by qualified specialist personnel.</li> <li>▷ Observe the actuator's operating manual.</li> </ul>

For pneumatic actuators, the control pressures specified on the name plate must be observed. Non-observance may damage the actuator.

If required, consult the manufacturer for closing torques and opening torques or actuating forces.



**Control air line** Control air line 1/4 inch NPT or 1/2 inch NPT



**Changing the stroke** The stroke can be changed on site.

- Shortening stroke: Extend the stem by the respective difference.
- Extending stroke: Shorten the stem by the respective difference.



For a new stem, contact the manufacturer.

### Electric actuators

	 <b>DANGER</b>
	<p><b>Unqualified personnel performing work on valves with actuator</b></p> <p>Danger of death from electric shock!</p> <ul style="list-style-type: none"> <li>▷ Ensure that the connection to the power supply and the process control system is performed by a trained electrician.</li> <li>▷ Observe regulations IEC 60364 and, for explosion-proof models, EN 60079.</li> </ul>

	 <b>WARNING</b>
	<p><b>Incorrect connection to the mains</b></p> <p>Damage to the power supply network, short circuit!</p> <ul style="list-style-type: none"> <li>▷ Observe the technical specifications of the local energy supply companies.</li> </ul>

### 5.6 Insulation

	 <b>WARNING</b>
	<p><b>Cold/hot piping and/or valve</b></p> <p>Risk of thermal injury!</p> <ul style="list-style-type: none"> <li>▷ Insulate the valve.</li> <li>▷ Fit warning signs.</li> </ul>



For any insulation fitted on the valve observe the following:

- The valve's function must not be impaired.
- The bonnet must remain freely accessible and visible.

## 6 Commissioning/Start-up/Shutdown

### 6.1 Commissioning/Start-up

#### 6.1.1 Prerequisites for commissioning/start-up



	 <b>DANGER</b>
	<p><b>Risk of pressure surges / water hammer</b> Danger to life caused by burns or scalds!</p> <ul style="list-style-type: none"> <li>▷ Do not exceed the valve's maximum permissible pressure.</li> <li>▷ The operator shall provide general safety measures for the system.</li> </ul>

Before commissioning/start-up of the valve ensure that the following requirements are met:

- The valve has been connected to the piping at both ends.
- The actuator has been connected to the power supply in accordance with the actuator's operating manual.
- The piping has been flushed.
- For valves with electric or pneumatic actuators travel limits have been set.
- The material, pressure data and temperature data of the valve are compatible with the operating conditions of the piping. (⇒ Section 6.2, Page 23)
- The material's chemical resistance and stability under load have been checked.

#### 6.1.2 Actuation/operation

The valve is operated by means of a pneumatic actuator.

	 <b>WARNING</b>
	<p><b>Improper handling of pneumatic actuator</b> Crushing of fingers! Damage to the actuator or the valve!</p> <ul style="list-style-type: none"> <li>▷ Ensure that any objects and parts of the body are removed from the actuator coupling area prior to starting the actuator.</li> </ul>

### 6.2 Operating Limits

#### 6.2.1 Pressure/temperature ratings

**Table 8:** Permissible operating pressure [bar] (to ASME B16.34)

Class	[°C]															
	-29 to 38	50	100	150	200	250	300	325	350	375	400	425	450	475	500	538
150	19,8	19,5	17,7	15,8	13,8	12,1	10,2	9,3	8,4	7,4	6,5	5,5	4,6	3,7	2,8	1,4
300	51,7	51,7	51,5	50,2	48,6	46,3	42,9	41,4	40,0	37,8	34,7	28,8	23,0	17,1	11,6	5,9
600	103,4	103,4	103,0	100,3	97,	92,7	85,7	82,6	80,0	75,7	69,4	57,5	46,0	34,2	23,2	11,8
900	155,1	155,1	154,6	150,5	145,8	139,0	128,6	124,0	120,1	113,5	104,2	86,3	69,0	51,3	34,7	17,7
1500	258,6	258,6	257,6	250,8	243,2	231,8	214,4	206,6	200,1	189,2	173,6	143,8	115,0	85,4	57,9	29,5
2500	430,9	430,9	429,4	418,1	405,4	386,2	357,1	344,3	333,5	315,3	289,3	239,7	191,7	142,4	96,5	49,2

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## 6.2.2 Ambient temperature

Observe the following parameters and values during operation:

**Table 9:** Permissible ambient temperatures

Ambient condition	Value
Ambient temperature	-10 °C to +60 °C
Humidity	5 % to 95 % rH

## 6.3 Shutdown

### 6.3.1 Measures to be taken for shutdown

During prolonged shutdown periods, ensure that the following conditions are met:

1. Drain fluids which change their physical condition due to changes in concentration, polymerisation, crystallisation, solidification, etc. from the piping.
2. If required, flush the piping with the valves fully opened.
3. Shut down the pneumatic actuator as specified in the actuator's operating manual.

### 6.4 Returning to service

For returning the equipment to service, observe the sections on commissioning/start-up (⇒ Section 6.1, Page 23) and the operating limits (⇒ Section 6.2, Page 23) .

In addition, carry out all servicing/maintenance operations before returning the valve to service. (⇒ Section 7, Page 25)



## 7 Servicing/Maintenance

### 7.1 Safety regulations

	<b>⚠ DANGER</b>
	<p><b>Valve under pressure</b> Risk of injury! Leakage of hot and/or toxic fluids! Risk of burns!</p> <ul style="list-style-type: none"> <li>▷ Depressurise the valve and its surrounding system prior to any maintenance work and installation work.</li> <li>▷ If there is fluid leakage, depressurise the valve.</li> <li>▷ Allow the valve to cool down until the temperature of the fluid in all valve areas in contact with the fluid is lower than the fluid's vaporisation temperature.</li> <li>▷ Use original spare parts and appropriate tools, even in emergencies.</li> </ul>

The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.

	<b>⚠ WARNING</b>
	<p><b>Fluids handled, consumables and supplies which are hot and/or pose a health hazard</b> Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Observe all relevant laws.</li> <li>▷ When draining the fluid take appropriate measures to protect persons and the environment.</li> <li>▷ Decontaminate valves used in fluids posing a health hazard.</li> </ul>

	<b>⚠ WARNING</b>
	<p><b>Actuator parts moving due to pre-loaded springs when auxiliary energy supply fails</b> Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Observe the actuator's operating manual.</li> </ul>

A regular maintenance schedule will help avoid expensive repairs and contribute to trouble-free, reliable operation of the valve with a minimum of servicing/ maintenance expenditure and work.

	<b>NOTE</b>
	<p>Before removing the valve from the piping, ensure that the pipe has been taken out of service and released for repair/maintenance work.</p>



	<b>NOTE</b>
	<p>All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. Find your contact in the attached Addresses booklet or visit <a href="https://www.ksb.com/en-global/contact">https://www.ksb.com/en-global/contact</a>.</p>

Never use force when dismantling and reassembling the valve.

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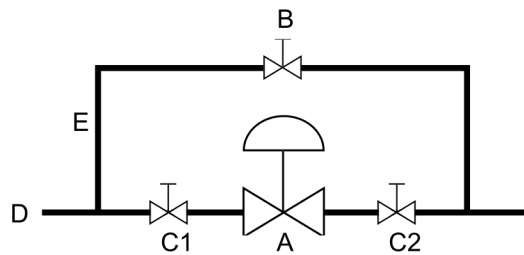
## 7.2 Servicing/inspection

### 7.2.1 Supervision of operation

	 <b>DANGER</b>
	<p><b>Leakage at gland packing</b>          Fluid escaping into the environment!</p> <ul style="list-style-type: none"> <li>▷ Tighten the gland packing until no more fluid escapes.</li> <li>▷ If re-tightening of the screwed/bolted connection does not restore seal integrity, the gland packing must be replaced.</li> </ul>

- Monitor the gland packing.  
 If any leakage occurs at the gland packing, re-tighten the bolts/screws to ensure the valve is sealed to atmosphere.
- Monitor the body/bonnet joint.  
 The body/bonnet joint must not show any signs of leakage. If any leakage occurs at the body gasket, re-tighten the bolts/screws at the body/bonnet joint to the tightening torque indicated (⇒ Section 7.3, Page 43) .

### 7.2.2 Maintenance and inspection with the valve installed





**Fig. 6:** Piping schematic

A	Control valve
B	Bypass shut-off valve
C1	Shut-off valve
C2	Shut-off valve
D	Main pipe
E	Bypass line

1. Close shut-off valve C1.
  2. Open bypass shut-off valve B.
  3. After the control valve has been drained, close shut-off valve C2.
- ⇒ The fluid flows through the bypass line.

### 7.2.3 Inspection work

#### 7.2.3.1 Lapping the seat

	<p style="background-color: #FFD700; margin: 0;"><b>CAUTION</b></p> <p><b>Improper lapping of seating surfaces</b> Damage to the seating surfaces of seat ring and valve disc!</p> <ul style="list-style-type: none"> <li>▷ Always have lapping performed by trained personnel.</li> <li>▷ Use a suitable paste for lapping.</li> <li>▷ Ensure that line contact is maintained. Ensure the seating surface angles relative to the centreline are different: 28° for the valve disc and 30° for the seat ring.</li> </ul>
	<p style="background-color: #4F81BD; color: white; margin: 0;"><b>NOTE</b></p> <p>If tight shut-off cannot be restored by lapping, the seat ring and valve disc must be replaced.</p>

**Version with low-noise plug** Maintenance for versions with low-noise plug (MIL 21700, MIL 21800 and MIL 21900) must be carried out in the same way as for versions with threaded seat or quick-change trim.

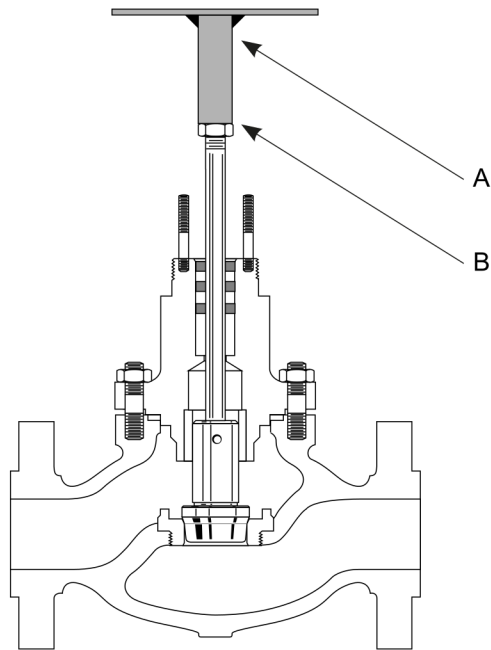
Maintenance of the seat is limited to lapping the seat (⇒ Section 7.2.3.1, Page 27) and securing the stem (⇒ Section 7.2.5.7.2, Page 41) .

**Bellows-sealed version** Lapping the valve disc and seat ring is not possible:

- If the seat ring is slightly worn, turn down the seating surface of the seat ring on a lathe to 30 degrees relative to the centreline (material removal < 0.25 mm/ 0.010 inches). Replace the seat ring if required.
- Replace the damaged valve disc.

#### 7.2.3.1.1 Lapping a trim with threaded seat ring

- ✓ The valve disc (10) and the seat ring (9) are free from major scratches and any other damage.
  - ✓ Suitable pastes are available.
  - ✓ The seat ring (9) has been installed (⇒ Section 7.2.5.3, Page 36) .
1. Clean the sealing surfaces and threads.
  2. Apply a suitable lubricant to the seat ring thread and the sealing area.
  3. Screw the seat ring (9) into the body (8) using a seat ring fitting/removal tool.
  4. Apply lapping paste to the seating surfaces of the valve disc (10) and the seat ring (9).
  5. Carefully slide the stem/valve disc assembly (1/10) into the body (8) until it will not go any further.
  6. Place the bonnet (2) onto the body (8).
  7. Connect the body (8) and the bonnet (2) using studs (4) and nuts (5).
  8. Evenly tighten the nuts (5) crosswise exerting slight pressure.
    - ⇒ Do not tighten the nuts (5) to the final tightening torque.
  9. Insert two or three packing rings of the gland packing (3) into the gland packing chamber.
    - ⇒ The stem/valve disc assembly (1/10) will be guided during the lapping process.



**Fig. 7: Lapping device**

10. Place a drilled and tapped rod with a T-handle (A) onto the stem (1) and secure it with a locknut (B). As an alternative: Drill a hole through a flat steel plate and fasten the plate to the stem using two locknuts.
11. Apply slight pressure and rotate the stem (1) in short back and forth turns (approx. 8 to 10 times).
12. Lift the valve disc (10) and rotate by 90°. If necessary, repeat the procedure.

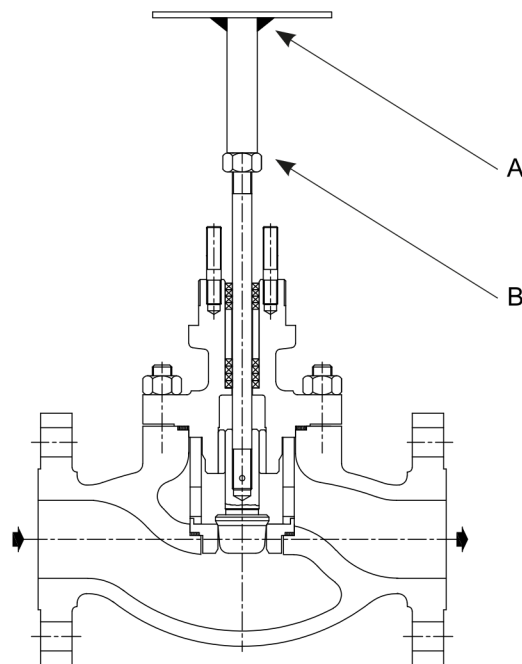
	<b>CAUTION</b>
	<p><b>Avoid excessive lapping</b> Damage to the seating surfaces of seat ring and valve disc!</p> <ul style="list-style-type: none"> <li>▷ Always have lapping performed by trained personnel.</li> <li>▷ Use a suitable paste for lapping.</li> <li>▷ Ensure the valve disc and seat ring are concentric.</li> </ul>

13. Undo the nuts (5).
14. Remove the bonnet (2).
15. Carefully pull out the stem/valve disc assembly (1/10).
16. Thoroughly clean the seating surfaces of the seat ring (9) and the valve disc (10).

**7.2.3.1.2 Lapping a quick-change trim**

- ✓ The valve disc (10) and the seat ring (9) are free from major scratches and any other damage.
  - ✓ Suitable pastes are available.
  - ✓ The required spare parts are available.
  - ✓ Two spiral wound gaskets (17) with the same geometric characteristics are available.
1. Clean the sealing surface in the body (8).
  2. Fit a new spiral wound gasket (17).
  3. Insert the seat ring (9) into the body (8).

- ⇒ The spiral wound gasket (17) stabilises the seat ring (9) during lapping. Use this gasket for the lapping process only.
- 4. Apply lapping paste to the seating surfaces of the valve disc (10) and the seat ring (9).
- 5. Insert the cage (18) into the body (8).
- 6. Carefully slide the stem/valve disc assembly (1/10) into the body (8) until it will not go any further.
- 7. Place the bonnet (2) onto the body (8).
- 8. Align the seat ring (9), the cage (18) and the stem/valve disc assembly (1/10).
- 9. Connect the body (8) and the bonnet (2) using studs (4) and nuts (5).
- 10. Evenly tighten the nuts (5) crosswise exerting slight pressure.
  - ⇒ Do not tighten the nuts (5) to the final tightening torque.
- 11. Insert two or three packing rings of the gland packing (3) into the gland packing chamber.
  - ⇒ The stem/valve disc assembly (1/10) will be guided during the lapping process.



**Fig. 8:** Lapping device

- 12. Place a drilled and tapped rod with a T-handle (A) onto the stem (1) and secure it with a locknut (B). As an alternative: Drill a hole through a flat steel plate and fasten the plate to the stem using two locknuts.
- 13. Apply slight pressure and rotate the stem (1) in short back and forth turns (approx. 8 to 10 times).
- 14. Lift the valve disc (10) and rotate by 90°. If necessary, repeat the procedure.



	<b>CAUTION</b>
	<p><b>Avoid excessive lapping</b> Damage to the seating surfaces of seat ring and valve disc!</p> <ul style="list-style-type: none"> <li>▷ Always have lapping performed by trained personnel.</li> <li>▷ Use a suitable paste for lapping.</li> <li>▷ Ensure the valve disc and seat ring are concentric.</li> </ul>

- 15. Undo the nuts (5).

16. Remove the bonnet (2).
17. Carefully pull out the stem/valve disc assembly (1/10).
18. Thoroughly clean the seating surfaces of the seat ring (9) and the valve disc (10).
19. Remove the cage (18), the seat ring (9) and the spiral wound gasket (17) from the body (8).

## 7.2.4 Dismantling the valve

### 7.2.4.1 General information/Safety regulations

	<p><b>! WARNING</b></p>
	<p><b>Hot surface</b> Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Allow the valve to cool down to ambient temperature.</li> </ul>
	<p><b>! WARNING</b></p>
	<p><b>Unqualified personnel performing work on the valve</b> Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Always have repair work and maintenance work performed by specially trained, qualified personnel.</li> </ul>

Always observe the safety instructions and information. (⇒ Section 7, Page 25)  
In the event of damage you can always contact KSB Service.

### 7.2.4.2 Preparing the valve

1. Interrupt the power supply and make sure it cannot be switched on again unintentionally.
2. Depressurise and drain the valve. (⇒ Section 7.2.2, Page 26)
3. Remove the actuator as specified in the actuator's operating manual.

### 7.2.4.3 Removing the trim

#### 7.2.4.3.1 Removing a trim with threaded seat ring

- ✓ The steps and notes stated in (⇒ Section 7.2.4.1, Page 30) to (⇒ Section 7.2.4.2, Page 30) have been observed or carried out.
1. Undo and remove the nuts (5) that connect the body (8) to the bonnet (2).
  2. Pull the bonnet (2), stem (1) and valve disc (10) out of the body (8) as one unit.
  3. Undo the nuts (15) of the gland follower.
  4. Remove the gland follower (14) and the thrust insert (13).
  5. Pull the stem/valve disc assembly (1/10) out of the bonnet (2).
  6. Remove the gland packing (3) from the bonnet (2).

#### 7.2.4.3.2 Removing a quick-change trim

- ✓ The steps and notes stated in (⇒ Section 7.2.4.1, Page 30) to (⇒ Section 7.2.4.2, Page 30) have been observed or carried out.
1. Undo and remove the nuts (5) that connect the body (8) to the bonnet (2).
  2. Pull the bonnet (2), stem (1) and valve disc (10) out of the body (8) as one unit.
  3. Remove the cage (18), seat ring (9) and spiral wound gasket (17) from the body (8).
  4. Undo the nuts (15) of the gland follower.



5. Remove the gland follower (14) and the thrust insert (13).
6. Pull the stem/valve disc assembly (1/10) out of the bonnet (2).
7. Remove the gland packing (3) from the bonnet (2).

#### 7.2.4.4 Removing a bellows-sealed bonnet

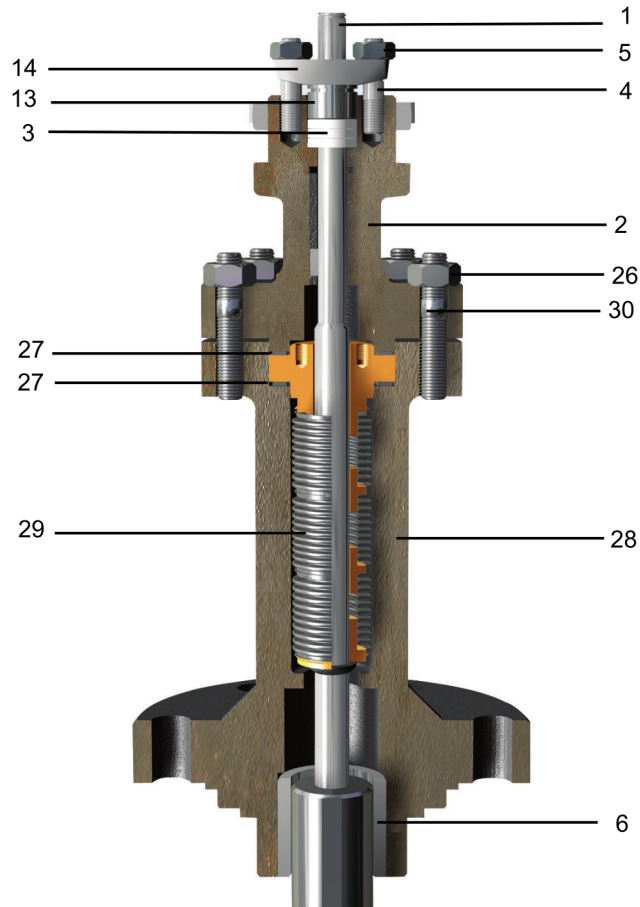



Fig. 9: Bonnet with bellows assembly

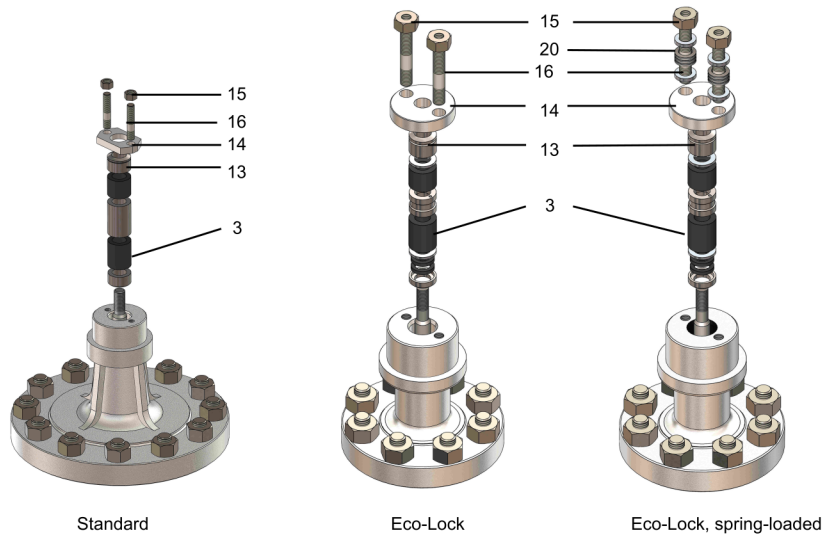
Part No.	Description
1	Stem
2	Bonnet
3	Gland packing
4	Stud
5	Nut
6	Guide bush
13	Thrust insert
14	Gland follower
26	Nut
27	Spiral wound gasket
28	Bellows housing
29	Bellows
30	Stud

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	CAUTION
	<p><b>Impermissible change in the actuator's rotational position</b></p> <p>Damage to the bellows!</p> <ul style="list-style-type: none"> <li>▷ Never rotate the stem. The anti-rotation device comprises a lock on the stem that slides into the upper bush of the bellows inside a rectangular groove.</li> <li>▷ Remove the actuator before changing the rotational position.</li> </ul>

- ✓ The steps stated in (⇒ Section 7.2.4.1, Page 30) to (⇒ Section 7.2.4.2, Page 30) have been carried out.
1. If fitted, disconnect the leakage drain line from the bonnet (2).
  2. Undo the nuts (26).
  3. Remove the studs (30).
  4. Undo and remove the nuts (15) of the gland follower (14).
  5. Pull off the gland follower (14) and the thrust insert (13).
  6. Remove the bonnet (2).
  7. Remove the gland packing (3).
  8. Undo and remove the nuts (5) that connect the body (8) to the bellows housing (28).
  9. Pull the bellows housing (28), bellows (29) and valve disc (10) out of the body (8) as one unit.

#### 7.2.4.5 Removing the gland packing



**Fig. 10:** Exploded view of gland packings

**Table 11:** List of gland packing components

Part No.	Description
3	Gland packing
13	Thrust insert
14	Gland follower
15	Nut



Part No.	Description
16	Stud
20	Disc spring

✓ The steps stated in (⇒ Section 7.2.4.1, Page 30) to (⇒ Section 7.2.4.2, Page 30) have been carried out.

1. Undo and remove the nuts (15) of the gland follower (14).
2. Pull off the gland follower (14) and the thrust insert (13).
3. Remove the gland packing (3) using a hooked tool.  
⇒ Do not damage the gland packing chamber and the stem (1)!
4. Completely remove the gland packing (3).
5. Clean the gland packing chamber and the stem (1).

#### 7.2.4.6 Removing a clamped seat ring

The seat ring must be removed in order to remove the quick-change trim (⇒ Section 7.2.4.3.2, Page 30) .

#### 7.2.4.7 Removing a threaded seat ring

	<b>! DANGER</b>
	<p><b>Contact with toxic, flammable or explosive fluids</b> Risk of injury, e.g. chemical burns on the skin and in the eyes, poisoning and burns!</p> <ul style="list-style-type: none"> <li>▷ Observe the relevant safety instructions, e.g. safety data sheets, for the handling of hazardous substances (wear safety goggles, protective gloves, protective clothing, etc. if required).</li> <li>▷ Wear personal protective equipment (e.g. safety goggles, protective gloves, protective clothing, etc).</li> <li>▷ Use penetrating oil for removal.</li> </ul>

The threaded seat ring is mounted at the factory. After a prolonged period of operation removal may be difficult.

- ✓ The steps stated in (⇒ Section 7.2.4.2, Page 30) have been carried out.
  - ✓ The trim has been removed. (⇒ Section 7.2.4.3.1, Page 30)
  - ✓ A seat ring fitting/removal tool is available.
1. Grasp the seat ring (9) with the seat ring fitting/removal tool and unscrew it from the body (8). To facilitate removal, apply heat or penetrating oil to loosen the seat ring (9).

#### 7.2.4.8 Removing the guide bush

	<b>CAUTION</b>
	<p><b>Improper machining out the guide bush</b> Damage to the bonnet!</p> <ul style="list-style-type: none"> <li>▷ Maintain the dimensions and tolerances of the bonnet.</li> <li>▷ Contact the manufacturer for dimensions and tolerances.</li> </ul>

The guide bush (6) is press-fitted into the bonnet (2) and does not require any maintenance. The guide bush (6) can be removed if necessary.

- ✓ The trim has been removed. (⇒ Section 7.2.4.3.1, Page 30) or (⇒ Section 7.2.4.3.2, Page 30)
1. Pull out the guide bush (6) or remove it by machining out.



### 7.2.4.9 Removing the stem/valve disc assembly

#### 7.2.4.9.1 Removing the stem from the valve disc

##### Removing the existing pin and stem

- ✓ A vice for cylindrical components or protective vice jaws made of plastic or soft metal are available.
- ✓ A V-block is available.
- ✓ A pin punch is available.
- ✓ The stem/valve disc assembly (1/10) or stem/bellows assembly (1/29) have been removed (⇒ Section 7.2.4.3, Page 30) and (⇒ Section 7.2.4.4, Page 31) .
  1. Place the valve disc guiding section on a V-block.
    - ⇒ On the stem/bellows assembly (1/29), the bottom mechanical stop protects the bellows.
  2. Remove the pin (7) using a pin punch. If necessary, drill out the pin (7); use a drill bit that is slightly smaller than the pin diameter.

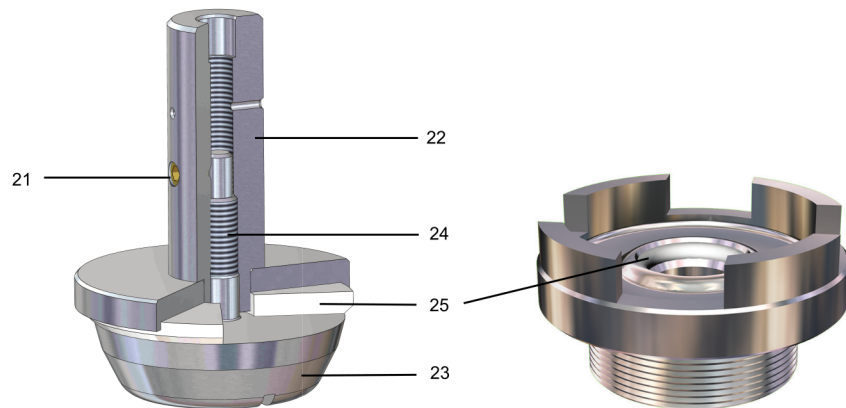
##### Unscrewing the stem from the valve disc

- ✓ The pin (7) and the stem (1) have been removed.
  1. Hold the valve disc (10) in place using a vice with protective jaws.
  2. Lock two nuts against each other at the end of the stem.
  3. Use a spanner to hold the lower nut and unscrew the valve disc (10) from the stem (1). Screw in anti-clockwise direction.

#### 7.2.4.10 Removing the stem/bellows assembly

- ✓ The bonnet incl. bellows has been removed. (⇒ Section 7.2.4.4, Page 31)
  1. Remove the pin (7) using a pin punch. If necessary, drill out the pin; use a drill bit that is slightly smaller than the pin diameter.
  2. Remove the valve disc (10). (⇒ Section 7.2.4.9.1, Page 34)
  3. Pull the stem/bellows assembly (1/29) out of the bellows housing (28). If required, undo the upper bush using a screwdriver in the groove provided for this purpose.
  4. Remove the spiral wound gaskets (27/11).
  5. Check the bellows housing (28), valve disc (10), guide bush (6) and seat ring (9) for damage and wear.

### 7.2.4.11 Removing the components for soft-seated design



**Fig. 11:** Soft-seated valve disc (NPS  $\geq 3$  inches) and seat with PTFE sealing element

**Table 12:** Parts list for soft-seated design

Part No.	Description
21	Adjusting screw
22	Valve disc shank
23	Valve disc bottom section
24	Screwed connection of valve disc bottom section
25	PTFE sealing element

#### Soft-seated valve disc

	<b>CAUTION</b>
	<p><b>Damage to the valve disc guiding section</b>            Damage to the guide bush!            Destruction of the valve disc!</p> <p>▷ Work very carefully to avoid damage during assembly/dismantling.</p>

- ✓ A vice for cylindrical components or protective vice jaws made of plastic or soft metal are available.
  - ✓ A V-block is available.
  - ✓ The stem/valve disc assembly (1/10) has been removed.  
(⇒ Section 7.2.4.3, Page 30)
1. Undo the adjusting screw (21).
  2. Carefully clamp the valve disc assembly in the vice.
  3. **Valves NPS  $\leq 2$  inches:** Slot in the valve disc bottom section (23). Undo the valve disc bottom section (23) in anti-clockwise direction using a rod.  
**Valves NPS  $> 2$  inches:** Machined holes in the valve disc bottom section (23). Undo the valve disc bottom section (23) in anti-clockwise direction using a special pin tool.
  4. **Valves  $< 3$  inches:** Remove the PTFE sealing element (25).  
**Valves  $\geq 3$  inches:** Remove the PTFE sealing element (25) and O-ring.
  5. Clean the components.

## 7.2.5 Assembling the valve

### 7.2.5.1 General information/Safety regulations

	<b>CAUTION</b>
	<p><b>Improper reassembly</b> Damage to the valve!</p> <ul style="list-style-type: none"> <li>▸ Reassemble the valve in accordance with the general rules of sound engineering practice.</li> <li>▸ Use original spare parts only.</li> </ul>

**Spiral wound gaskets** Always use new spiral wound gaskets. Ensure that the new gaskets have the same geometric characteristics as the old ones.

**Tightening torques** For reassembly, tighten all screws and bolts as indicated. (⇒ Section 7.3, Page 43)

**Actuators** Observe the actuator's operating manual.

### 7.2.5.2 Installing the clamped seat ring

- ✓ The required spare parts are available.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
  1. Clean the sealing surfaces.
  2. Fit a new spiral wound gasket (17).
  3. Insert the seat ring (9) into the body (8).

### 7.2.5.3 Installing the threaded seat ring

	<b>CAUTION</b>
	<p><b>Damage to the seat ring</b> Leakage at the disc/seat interface!</p> <ul style="list-style-type: none"> <li>▸ Work very carefully to avoid damage during assembly/dismantling.</li> <li>▸ Never over-tighten the threaded connection.</li> <li>▸ Never strike the sealing surfaces.</li> </ul>

- ✓ The required spare parts are available.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
  1. Clean the sealing surfaces and threads.
  2. Apply a suitable lubricant to the seat ring thread and the sealing area.
  3. Screw the seat ring (9) into the body (8) using a seat ring fitting/removal tool.

### 7.2.5.4 Installing the trim

#### 7.2.5.4.1 Installing the trim with threaded seat ring

- ✓ The required spare parts are available.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.



- ✓ The seat has been lapped. (⇒ Section 7.2.3.1, Page 27)
- ✓ The seat ring (9) has been installed. (⇒ Section 7.2.5.3, Page 36)
- ✓ Observe the notes and steps for the correct installation of the gland packing as indicated in (⇒ Section 7.2.5.6, Page 38) .
  1. Clean the sealing surfaces.
  2. Carefully slide the stem/valve disc assembly (1/10) into the body (8) until it will not go any further.
  3. Fit a new spiral wound gasket (11).
  4. Place the bonnet (2) onto the body (8).
  5. Connect the body (8) and the bonnet (2) using studs (4) and nuts (5).
    - ⇒ Align the bonnet (2); the studs (16) of the gland follower (14) must be positioned at an angle of 90° relative to the flow centreline.
  6. Tighten the nuts to the specified tightening torque (⇒ Section 7.3, Page 43) and tightening sequence (⇒ Section 5.4.1, Page 19) .
  7. Insert the lower packing rings (3), spacer ring / lantern ring (12) into the gland packing chamber.
  8. Insert the upper packing rings (3).
  9. Fit the thrust insert (13) and the gland follower (14).
  10. Insert the stud (16).
  11. Tighten the gland packing (3) (⇒ Section 7.2.5.6, Page 38) .

#### 7.2.5.4.2 Installing the quick-change trim

- ✓ The required spare parts are available.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The clamped seat ring has been installed. (⇒ Section 7.2.5.2, Page 36)
- ✓ The seat has been lapped. (⇒ Section 7.2.3.1, Page 27)
- ✓ Observe the notes and steps for the correct installation of the gland packing as indicated in (⇒ Section 7.2.5.6, Page 38) .
  1. Insert the cage (18) into the body (8).
  2. Carefully slide the stem/valve disc assembly (1/10) into the body (8) until it will not go any further.
  3. Fit a new spiral wound gasket (11).
  4. Place the bonnet (2) onto the body (8).
  5. Align the seat ring (9), the cage (18) and the stem/valve disc assembly (1/10).
  6. Connect the body (8) and the bonnet (2) using studs (4) and nuts (5).
    - ⇒ Align the bonnet (2); the studs (16) of the gland follower (14) must be positioned at an angle of 90° relative to the flow centreline.
  7. Tighten the nuts to the specified tightening torque (⇒ Section 7.3, Page 43) and tightening sequence (⇒ Section 5.4.1, Page 19) .
  8. Insert the lower packing rings (3), spacer ring / lantern ring (12) into the gland packing chamber.
  9. Insert the upper packing rings (3).
  10. Fit the thrust insert (13) and the gland follower (14).
  11. Insert the stud (16).
  12. Tighten the gland packing (3) (⇒ Section 7.2.5.6, Page 38) .



### 7.2.5.5 Installing the bellows-sealed bonnet

- ✓ The required spare parts are available.
- ✓ All dismantled parts have been cleaned and checked for wear. (⇒ Fig. 9)
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.
- ✓ The seat ring has been installed. (⇒ Section 7.2.5.3, Page 36) or (⇒ Section 7.2.5.2, Page 36)
- ✓ The stem/bellows assembly (1/29) has been installed. (⇒ Section 7.2.5.8, Page 42)
  1. Fit a new spiral wound gasket (27).
  2. Insert the cage (18) for the quick-change trim version.
  3. Insert the bellows-sealed bonnet into the bellows housing (28) from the top.
  4. Tighten the nuts to the specified tightening torque (⇒ Section 7.3, Page 43) and tightening sequence (⇒ Section 5.4.1, Page 19) .
    - ⇒ Align the bonnet (2); the studs (16) of the gland follower (14) must be positioned at an angle of 90° relative to the flow centreline.
  5. Fit a new spiral wound gasket.
  6. Fit the bonnet (2) and tighten it with the nuts (26). Tighten (⇒ Section 7.3, Page 43) in specified tightening sequence (⇒ Section 5.4.1, Page 19) .
    - ⇒ Align the bonnet (2); the studs (16) of the gland follower (14) must be positioned at an angle of 90° relative to the flow centreline.
  7. Insert the gland packing (3).
  8. Fit the thrust insert (13) and the gland follower (14).
  9. Fit the nuts (5) on the studs (4).
  10. Do not tighten the nuts (5) excessively.

### 7.2.5.6 Fitting the gland packing

	<b>NOTE</b>
	<p>Always replace the complete gland packing. In an emergency, string packing may be used as a temporary repair measure only. A new gland packing as specified must be installed as soon as possible.</p>

The gland packing comprises a lower and an upper packing set:

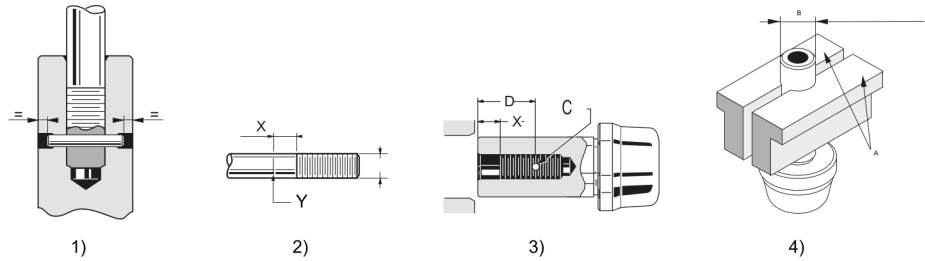
- Standard gland packing: Height of packing sets is identical.
  - Eco-lock gland packing: The upper packing set is higher than the lower packing set.
- ✓ The required spare parts are available.
  - ✓ All dismantled parts have been cleaned and checked for wear.
  - ✓ Any damaged or worn parts have been replaced by original spare parts.
  - ✓ The stem and the gland packing chamber are dry and free from grease.
  - ✓ The gland packing chamber is free from foreign matter, burrs and rust.
    1. Check the stem surface. If the surface is damaged, the stem also needs to be replaced; otherwise the stem seal will soon start leaking again.
    2. Insert the packing rings into the gland packing chamber individually. The joints of the individual packing rings must be staggered by 120°. Observe the sequence indicated in the exploded view. (⇒ Fig. 10Table 11)
    3. Fit the thrust insert (13).
    4. Fit the gland follower (14).
    5. If applicable, fit the disc springs (20) on the studs (16) for spring-loaded gland packings.
    6. Fit the nuts (15) on the studs (16).

7. Do not tighten the nuts (15) excessively.
8. Install the actuator as specified in the actuator's operating manual.
9. Return the valve to service.
10. Tighten the gland packing (3) such that fluid no longer escapes.

### 7.2.5.7 Installing the stem/valve disc assembly

Securing the stem with a locking pin is required when:

- Replacing the stem and valve disc
- Replacing the stem
- Replacing the stem/bellows assembly
- Replacing the valve disc and stem/bellows assembly



**Fig. 12:** Sectional drawings of valve disc guiding section, vice

1)	Correct pin position
2)	Stem: Reference marking (Y)
3)	Drilled hole in valve disc guiding section
4)	Vice for cylindrical components or protective vice jaws made of plastic or soft metal

**Table 13:** Dimensions for connecting the stem and valve disc

B		C		D				X	
[inch]	[mm]	[inch]	[mm]	Standard bonnet		Bellows-sealed bonnet		[inch]	[mm]
				[inch]	[mm]	[inch]	[mm]		
1/2	12,7	0,138	3,50	1,25	32,00	2,20	56,00	0,50	13
5/8	15,88	0,138	3,50	1,55	39,50	-	-	0,63	16
3/4	19,05	0,197	5,00	1,88	47,50	4,63	117,50	0,75	19
1	25,40	0,197	5,00	2,50	63,50	5,59	142,00	1,00	26

#### 7.2.5.7.1 Connecting a new valve disc to the stem

	<b>CAUTION</b>
	<p><b>Damage to the stem/valve disc assembly</b> Leakage at the valve!</p> <ul style="list-style-type: none"> <li>▷ Work very carefully to avoid damage during assembly/dismantling.</li> <li>▷ Use a vice for cylindrical components or protective vice jaws made of plastic or soft metal.</li> </ul>
	<b>NOTE</b>
	<p>To ensure the stability of the stem/valve disc assembly, the stem must be replaced when replacing the valve disc. For versions with bellows, the stem/bellows assembly must be replaced when replacing the valve disc.</p>



### Connecting the stem to the valve disc (standard design)

- ✓ A vice for cylindrical components or protective vice jaws made of plastic or soft metal are available.
- ✓ A V-block is available.
  1. Measure the depth of the pilot recess in the valve disc (10) (dimension X) and make a reference mark on the stem (1) at the same distance from the thread.
  2. Hold the valve disc (10) in place using a vice with protective jaws.
  3. Lock two nuts against each other at the end of the stem (1).
  4. Screw the stem (1) firmly into the valve disc (10) using a spanner on the upper nut.
    - ⇒ The reference mark should be aligned with the end of the valve disc guiding section.

### Connecting the stem to the valve disc (version with bellows)

- ✓ A vice for cylindrical components or protective vice jaws made of plastic or soft metal are available.
- ✓ A V-block is available.
  1. Secure the stem/bellows assembly (1/29) in a vice with protective jaws.
  2. Lock nuts against each other at the end of the stem (1). Use a spanner on the upper nut to prevent rotation.
  3. When inserting the guide bush (6) into the bellows housing (28), screw the valve disc (10) onto the stem (1).
  4. Slightly pull out the valve disc (10) from the bellows housing (28).
    - ⇒ The pin (7) is freely accessible.

### The valve disc guiding section has been fully drilled

- ✓ The stem (1) and the valve disc (10) have been screwed together.
- ✓ For versions made of hardened stainless steel 440C or solid Stellite, the valve disc guiding section has already been drilled.
  1. Place the valve disc guiding section on a V-block.
  2. Drill the stem to the same diameter (C) as that of the drilled hole in the valve disc guiding section.
  3. Drill through the stem/valve disc assembly (1/10) using a suitable drill bit.

### The valve disc guiding section has been marked with a centre punch mark

- ✓ The stem (1) and the valve disc (10) have been screwed together.
- ✓ A drill bit with a diameter that matches the drilled hole in the valve disc (10) or a drill bit with diameter C are available.
  1. Place the valve disc guiding section on a V-block.
  2. Drill through the valve disc guiding section using a suitable drill bit.

### The valve disc guiding section has no drilled hole or centre punch mark

- ✓ The stem (1) and the valve disc (10) have been screwed together.
- ✓ A drill bit with diameter C is available.
  1. Measure dimension D.
  2. Place the valve disc guiding section on a V-block.
  3. Make a centre punch mark in the centre of the valve disc guiding section.
  4. Drill through the stem/valve disc assembly (1/10) using a suitable drill bit.



#### NOTE

Debur the drilled hole of the valve disc guiding section by making a slight chamfer.



### Pinning the stem/valve disc assembly

- ✓ A suitable pin (7) is available.
  1. Apply a lubricant to the pin (7).
  2. Insert pin (7) into the drilled hole in the valve disc (10) by hand.
  3. Press-fit the pin (7) into the drilled hole using a hammer.
    - ⇒ Check the correct position of the pin (7).
  4. Clamp the valve disc (10) into a lathe and check that the valve disc is concentric with the stem (1).
  5. If necessary, place the stem/valve disc assembly (1/10) in a collet chuck and align the valve disc (10).
  6. If necessary, adjust the position of the stem (1) using a soft-faced hammer.

### 7.2.5.7.2 Connecting the new stem to the valve disc

#### Connecting the stem to the valve disc

- ✓ A vice for cylindrical components or protective vice jaws made of plastic or soft metal are available.
- ✓ A V-block is available.
- ✓ The stem is available as a spare part.
- ✓ The valve disc (10) and drilled hole are neither damaged nor deformed.
  1. Measure the depth of the pilot recess in the valve disc (10) (dimension X) and make a reference mark on stem (1) at the same distance from the thread.
  2. Hold the valve disc (10) in place using a vice with protective jaws.
  3. Lock two nuts against each other at the end of the stem.
  4. Screw the stem (1) firmly into the valve disc (10) using a spanner on the upper nut.
    - ⇒ The reference mark should be aligned with the end of the valve disc guiding section.

#### Drilling a hole in the new stem



#### NOTE

If the drilled hole in the valve disc guiding section has been slightly damaged when removing the pin, use a drill bit and pin with a slightly larger diameter than that of the normal pin.

- ✓ The stem (1) and the valve disc (10) have been screwed together.
  1. Place the valve disc guiding section on a V-block.
  2. Drill the stem (1) to the same diameter as that of the hole in the plug/valve disc guiding section.
  3. Use the drilled hole in the valve disc (10) as a guide. Drill through the stem/valve disc assembly (1/10) using a suitable drill bit.

### Pinning the stem/valve disc assembly

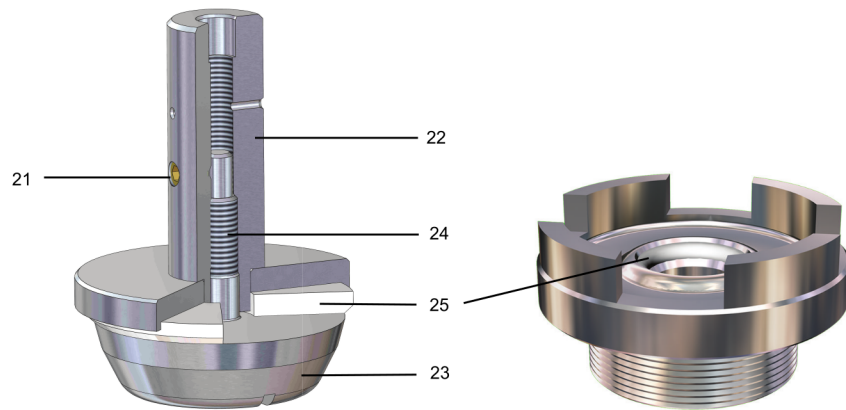
- ✓ A suitable pin (7) is available.
  1. Apply a lubricant to the pin.
  2. Insert the pin (7) into the drilled hole of the valve disc by hand.
  3. Press-fit the pin (7) into the drilled hole using a hammer.
    - ⇒ Check the correct position of the pin (7).

4. Clamp the valve disc (10) into a lathe and check that the valve disc is concentric with the stem (1).
5. If necessary, place the stem/valve disc assembly (1/10) in a collet chuck and align the valve disc (10).
6. If necessary, adjust the position of the stem (1) using a soft-face mallet.

#### 7.2.5.8 Installing the stem/bellows assembly

- ✓ The required spare parts are available.
  - ✓ All dismantled parts have been cleaned and checked for wear.
  - ✓ Any damaged or worn parts have been replaced by original spare parts.
  - ✓ The sealing surfaces have been cleaned.
1. Clean the sealing surfaces.
  2. Fit a new spiral wound gasket (27).
  3. Insert a new stem/bellows assembly (1/29) into the bellows housing (28) from the top.
  4. Fit the stem (1) into the valve disc (10). (⇒ Section 7.2.5.7.2, Page 41)

#### 7.2.5.9 Fitting the components for soft-seated design




**Fig. 13:** Soft-seated valve disc (NPS ≥ 3 inches) and seat with PTFE sealing element

**Table 14:** Parts list for soft-seated design

Part No.	Description
21	Adjusting screw
22	Valve disc shank
23	Valve disc bottom section
24	Screwed connection of valve disc bottom section
25	PTFE sealing element



### Soft-seated valve disc

	<b>CAUTION</b>
	<p><b>Damage to the valve disc guiding section</b></p> <p>Damage to the guide bush! Destruction of the valve disc!</p> <p>▷ Work very carefully to avoid damage during assembly/dismantling.</p>

- ✓ A vice for cylindrical components or protective vice jaws made of plastic or soft metal are available.
- ✓ A V-block is available.
  1. If available, apply a lubricant to the O-ring.
  2. **Valves < 3 inches:** Insert a new PTFE sealing element (25).  
**Valves ≥ 3 inches:** Insert a new O-ring and a new PTFE sealing element (25).
  3. Fit the valve disc bottom section (23) and tighten it hand-tight.
    - ⇒ The PTFE sealing element (25) is evenly compressed.
  4. Firmly tighten the valve disc bottom section (23) using a suitable tool.
  5. Allow to set for four hours.
  6. Re-tighten the valve disc bottom section (23) using a suitable tool.
  7. Allow to set for four more hours.
  8. Re-tighten the valve disc bottom section (23) using a suitable tool.
    - ⇒ The PTFE sealing element (25) should then have set evenly.
  9. Insert the adjusting screw (21).

### Soft seat ring

The PTFE sealing element is crimped to the seat ring and cannot be replaced. If the PTFE sealing element in the seat ring has become damaged or is eroded, the seat ring must be replaced.

## 7.3 Tightening torques

**Table 15:** Tightening torque for screwed/bolted connections on body and bonnet

Size	Material					
	B8/All SS				B7/alloyed steel/Inconel	
	[lbf-ft]		[Nm]		[lbf-ft]	[Nm]
	Min.	Max.	Min.	max.		
1/2 - 13 UNC - 2A	22	24	30	32	29	40
5/8 - 11 UNC - 2 A	44	48	60	65	59	80
3/4 - 10 UNC - 2 A	79	85	107	115	104	141
7/8 - 9 UNC - 2 A	127	136	172	185	168	228
1 - 8 UNC - 2 A	190	204	258	277	252	342
1 1/8 - 8 UN - 2 A	279	300	379	407	370	501
1 1/4 - 8 UN - 2 A	393	422	533	572	520	705
1 1/4 - 7 UNC - 2 A	381	409	516	555	504	683
1 1/2 - 8 UN - 2 A	703	755	954	1024	930	1262
1 5/8 - 8 UN - 2 A	906	973	1229	1320	1199	1626
1 3/4 - 8 UNS - 2 A	1145	1230	1553	1668	1515	2055
2 - 8 UN - 2 A	1742	1870	2362	2537	2304	3125
2 1/2 - 8 UN - 2A	3490	3748	4734	5084	4617	6263
2 3/4 - 8 UN - 2A	4689	5035	6360	6830	6203	8413
M12 x 15,5	20	22	27	29	27	36
M12 x 1,75	19	21	26	28	25	34

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Size	Material					
	B8/All SS				B7/alloyed steel/Inconel	
	[lbf-ft]		[Nm]		[lbf-ft]	[Nm]
	Min.	Max.	Min.	max.		
M16 x 1,5	51	55	69	74	67	91
M16 x 2	48	51	65	69	63	85
M20 x 1,5	104	111	140	151	137	186
M20 x 2	98	105	133	143	130	176
M18 x 2	70	75	95	102	92	125
M24 x 2	176	189	238	256	233	315
M24 x 3	161	172	218	234	212	288
M27 x 3	236	253	320	343	312	423
M33 x 2	479	515	650	698	634	860
M33 x 3	450	483	610	655	595	807
M36 x 2	629	675	853	916	832	1128
M36 x 4	559	600	758	814	739	1003
M39 x 3	765	821	1037	1114	1012	1372
M42 x 3	966	1037	1310	1407	1278	1733
M42 x 4,5	895	961	1214	1304	1184	1606
M45 x 3	1200	1289	1628	1748	1588	2153
M45 x 5	1092	1172	1481	1590	1444	1959
M48 x 5	1345	1444	1824	1959	1779	2413
M56 x 5,5	2163	2323	2934	3151	2862	3882
M60 x 3	2944	3162	3994	4289	3895	5283
M64 x 3	3596	3862	4878	5238	4757	6453

Table 16: Tightening torques for gland packing nuts

Stem Ø		Bore	Bolt	Tightening torque			
[inch]	[mm]	[mm]	[inch]	[lbf-ft]	[Nm]	[lbf-ft]	[Nm]
5/16	7,97	19,15	3/8	10	13	5	7
5/16	7,97	24,25	3/8	17	23	8	11
5/16	7,92	26,05	3/8	20	27	10	13
3/8	9,51	19,15	3/8	9	12	4	6
1/2	12,68	22,35	3/8	11	15	5	7
5/8	15,85	25,5	1/2	17	23	9	12
3/4	19,02	31,85	1/2	28	38	14	19
7/8	22,19	31,85	1/2	22	31	11	15
1	25,37	41,33	1/2	46	62	23	31
1,125	28,54	41,33	1/2	39	52	19	26
1,25	31,72	48,05	1/2	56	76	28	38
1,5	38,08	54,1	1/2	64	86	32	43
2	50,72	75	1/2	132	178	66	89



## 8 Trouble-shooting

	<b>⚠ WARNING</b>
	<p><b>Improper remedial work on the valve</b> Risk of injury!</p> <p>▷ For any work performed in order to remedy faults on the valve observe the relevant information given in this operating manual and/or the product literature provided by the accessories manufacturers.</p>

If problems occur that are not described in the following table, consultation with the KSB service is required.

**Table 17:** Trouble-shooting

Fault	Possible cause	Remedy
Leakage at the seat/disc interface	Incorrect calibration	<ol style="list-style-type: none"> <li>1. Check the coupling.</li> <li>2. Re-calibrate.</li> </ol>
	Incorrect assembly / coupling	<ol style="list-style-type: none"> <li>1. Undo the coupling connection.</li> <li>2. Check actuator stroke and valve travel independently of each other.</li> <li>3. Re-establish the coupling connection.</li> <li>4. Match valve travel with actuator stroke scale.</li> </ol>
	Damaged trim	Replace trim (contact the manufacturer).
	Foreign matter in the valve body	<ol style="list-style-type: none"> <li>1. Dismantle the valve.</li> <li>2. Clean internal parts.</li> <li>3. Assemble the valve.</li> </ol>
	Incomplete valve travel	Check actuator pressure supply and spring range.
Hunting / unstable operation	Malfunction of the accessories	Check that the accessories are correctly adjusted as per catalogue / operating manual.
	Change in operating flow parameters	Check the valve specification sheet. In the event of any deviations, contact the manufacturer.
	Leakage in the pneumatic circuit	Eliminate the leakage in the pneumatic circuit.
	Mismatch in nominal tubing size	The nominal size of the external tubing (system's control air connection) must correspond to the nominal size of the internal tubing.
Insufficient flow	Change in operating flow parameters	Check the valve specification sheet. In the event of any deviations, contact the manufacturer.
	Flow passage is blocked.	Dismantle, clean and re-assemble the valve.
Noise / vibrations	Cavitation	<ol style="list-style-type: none"> <li>1. Check the trim for any damage.</li> <li>2. Check the flow parameters.</li> <li>3. Contact the manufacturer if necessary.</li> </ol>
	Improper installation	Check the flow direction against the flow direction arrow. (Note: Linear actuators are best suited for vertical installation.)

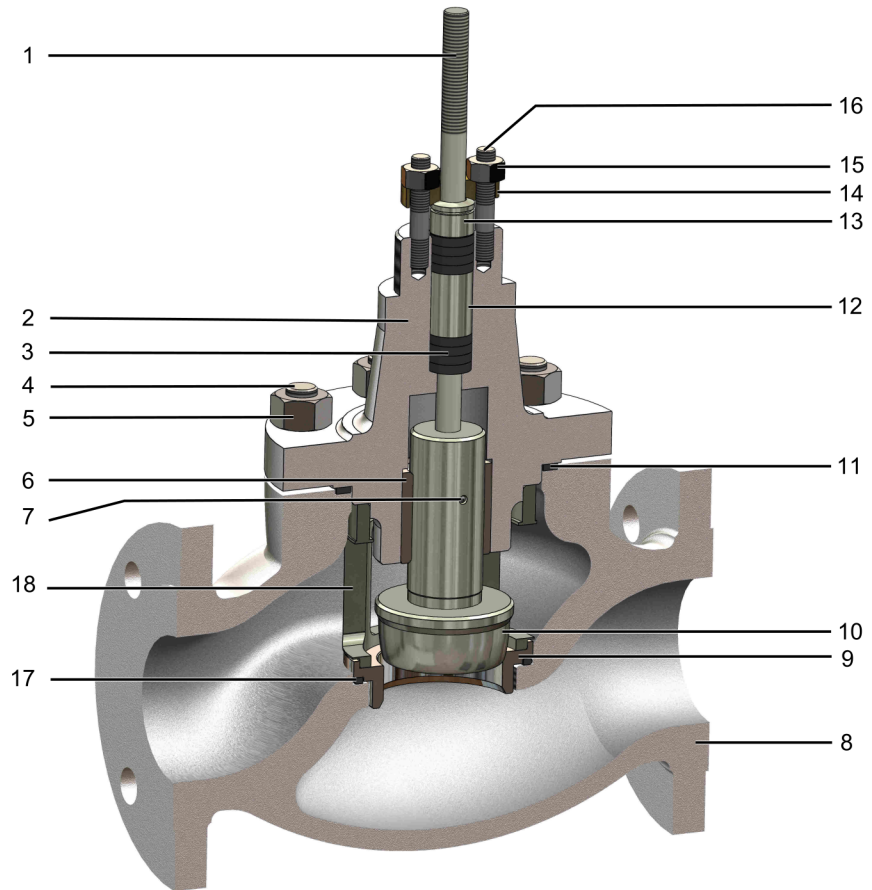
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Fault	Possible cause	Remedy
Excessive flow	Change in operating flow parameters	Check the valve specification sheet. In the event of any deviations, contact the manufacturer.
	Damage to the valve internals	<ol style="list-style-type: none"><li>1. Check the trim for any damage.</li><li>2. Contact the manufacturer if necessary.</li></ol>
Jerky stem movement	Excessively tightened gland packing	<ol style="list-style-type: none"><li>1. Loosen the nuts at the gland follower.</li><li>2. Tighten the nuts to the specified tightening torque (⇒ Section 7.3, Page 43) .</li></ol>
	Misalignment of actuator and valve	<ol style="list-style-type: none"><li>1. Undo the coupling connection.</li><li>2. Check actuator stroke and valve travel independently of each other.</li><li>3. Re-establish the coupling connection.</li></ol>
	Signs of rubbing contact in the valve disc guiding area	<ol style="list-style-type: none"><li>1. Check the valve internals.</li><li>2. Contact the manufacturer in the event of damage.</li></ol>
Leakage at the gland packing	Gland packing wear	<ol style="list-style-type: none"><li>1. Replace gland packing.</li><li>2. Insert additional packing ring.</li></ol>
	Material and fluid temperature are not compatible.	Check the gland packing materials against the valve specification sheet (graphite for high temperature).
	Poor surface finish / scoring on stem	Replace valve disc/stem assembly and gland packing.
	The gland packing has become loose.	Tighten the gland packing to the specified tightening torque (⇒ Section 7.3, Page 43) .
The valve does not respond properly to the control command.	Problem with the interaction of actuator and fitted accessories	Check actuator and accessories.

## 9 Related Documents

### 9.1 General assembly drawing with list of components



**Fig. 14:** Sectional drawing of MIL 21000 with quick-change trim

**Table 18:** Parts list

**i** The materials listed in the table are for reference only. Other materials are available on request depending on the application.

Part No.	Description	Material	Note
1 <sup>1)</sup>	Stem	316 SST	-
		17.4 PH SST H 1075	-
		ASTM A638 Gr. 660	-
2	Bonnet	ASTM A216 Gr. WCC	-
		ASTM A217 Gr. WC6	-
		ASTM A217 Gr. WC9 / C5	-
		ASTM A351 Gr. CF8 / CF8M / CF3 / CF3M	-
3 <sup>1)</sup>	Gland packing	PTFE	≤ 180 °C
		Graphite	> 180 °C
4	Stud	ASTM A193 Gr. B7	-
5	Nut	ASTM A194 Gr. 2H	-
6	Guide bush	440 C SST	Heat-treated

<sup>1</sup> Recommended spare parts



Part No.	Description	Material	Note
6	Guide bush	316 SST	-
7 <sup>1)</sup>	Pin	316 SST	-
8	Body	ASTM A216 Gr. WCC	-
		ASTM A217 Gr. WC6	-
		ASTM A217 Gr. WC9 / C5	-
		ASTM A351 Gr. CF8 / CF8M / CF3 / CF3M	-
9 <sup>1)</sup>	Seat ring	410 SST / 316 SST	-
10 <sup>1)</sup>	Valve disc/plug	410 SST	-
		316 SST	-
		316 SST	Stellite No. 6
		17.4 PH SST H 900	-
		ASTM A743 Gr. CA6NM	Nitrided
11 <sup>1)</sup>	Spiral wound gasket	316L SST + graphite	-
12	Spacer ring / lantern ring	304 SST	-
13	Thrust insert	304 SST	-
14	Gland follower	ASTM A105	-
15	Nut	ASTM A194 Gr. 8	-
16	Stud	ASTM A193 Gr. B8	-
17 <sup>2)</sup>	Spiral wound gasket	316L SST + graphite	-
18 <sup>2)</sup>	Cage	304 SST	-
		CA6NM	Nitrided
19 <sup>3)</sup>	Anti-cavitation / low-noise cage	ASTM A351 Gr. CF8M	-
		CA6NM	Nitrided

<sup>2</sup> Only for version 21004

<sup>3</sup> Only for versions 21800 and 21900.



## 10 EU Declaration of Conformity for MIL 21000

**Control valve**

MIL 21000

Class 150 - 2500

NPS ½ - 12 inches

satisfies the safety requirements laid down in the European Pressure Equipment Directive 2014/68/EU.

**Other standards/codes:**

ASME B16.34, EN 12516-2, ASME SEC VIII Div 1

**Suitable for:**

Fluids in Groups 1 and 2

**Conformity assessment procedure:**

Module H

**Name and address of the notified body responsible for approval and surveillance:**

TÜV NORD Systems GmbH & Co. KG  
22525 Hamburg (Germany)

**Identification number of the notified body:**

0045





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