Translation of the Original Operating Instructions

VARIVENT®
Control Valve A

Edition 2016-06-07
English

Product	Control Valve A
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	These Operating Instructions are the English translation of the original operating instructions in the sense of the EU Machinery Directive.
Wordmarks	The designation VARIVENT® is a protected trademark of GEA Tuchenhagen GmbH.

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Notes for the Reader

The present Operating Instructions are part of the user information for the valve. The Operating Instructions contain all the information you need to transport, install, commission, operate and carry out maintenance for the valve.

Binding Character of These Operating Instructions

These Operating Instructions contain the manufacturer's instructions to the operator of the valve and to all persons who work on or use the valve regarding the procedures to follow.

Carefully read these Operating Instructions before starting any work on or using the valve. Your personal safety and the safety of the valve can only be ensured if you act as described in the Operating Instructions.

Store the Operating Instructions in such a way that they are accessible to the operator and the operating staff during the entire life cycle of the valve. When the location is changed or the valve is sold make sure you also provide the Operating Instructions.

Notes on the Illustrations

The illustrations in these Operating Instructions show the valve in a simplified form. The actual design of the valve can differ from the illustration. For detailed views and dimensions of the valve please refer to the design documents.

Symbols and Highlighting

In these Operating Instructions, important information is highlighted by symbols or special formatting. The following examples illustrate the most important types of highlighting.

DANGER

Warning: Fatal Injuries.
Failure to observe the warning can result in serious damage to health, or even death.
➔ The arrow identifies a precautionary measure you have to take to avoid the hazard.

EXPLOSION HAZARD

Warning: Explosions.
Failure to observe the warning can result in a severe explosion.
➔ The arrow identifies a precautionary measure you have to take to avoid the hazard.

WARNING

Warning: Serious Injuries.
Failure to observe the warning can result in serious damage to health.
➔ The arrow identifies a precautionary measure you have to take to avoid the hazard.

CAUTION

Warning: Injuries.
Failure to observe the warning can result in minor or moderate damage to health.
➔ The arrow identifies a precautionary measure you have to take to avoid the hazard.

IMPORTANT NOTE

Warning: Damage to Property.
Failure to observe the warning can result in serious damage to the valve or in the vicinity of the valve.
➔ The arrow identifies a precautionary measure you have to take to avoid the hazard.

Carry out the following steps: = Start of a set of instructions.

1. First step in a sequence of operations.
2. Second step in a sequence of operations.
   ➥ Result of the previous operation.

✓ The operation is complete, the goal has been achieved.

NOTE
Further useful information.

Abbreviations and Terms

Abbreviation	Explanation
BS	British Standard
bar	Unit of measurement of pressure [bar] All pressure data expressed in [bar/psi] is assumed to be gauge pressure [bar_g/psi_g] unless explicitly specified otherwise.
approx.	approximately
°C	Unit of measurement of temperature [degree Celsius]
dm^3_n	Unit of measurement of volume [cubic decimetre] Volume (litre) at standard temperature and pressure
DN	DIN nominal width
DIN	German standard issued by DIN (Deutsches Institut für Normung e.V, German Institute for Standardization)
EN	European Standard
EPDM	Material designation Short designation according to DIN/ISO 1629: Ethylene Propylene Diene Rubber
°F	Unit of measurement of temperature [degree Fahrenheit]
FKM	Material designation, short designation according to DIN/ISO 1629: Fluorine rubber
h	Unit of measurement of time [hour]

Abbreviation	Explanation
HNBR	Material designation Short designation according to DIN/ISO 1629: Hydrogenated Acrylonitrile Butadiene Rubber
IP	Protection class
ISO	International standard issued by the International Organization for Standardization
kg	Unit of measurement of weight [kilogram]
kN	Unit of measurement of force [kilonewton]
K_V value	Flow coefficient [m^3/s] 1 K_V= 0.86 x Cv
l	Unit of measurement of volume [litre]
max.	maximum
mm	Unit of measurement of length [millimetre]
µm	Unit of measurement of length [micrometre]
M	Metric
Nm	Unit of measurement of work [newton metre] UNIT OF TORQUE 1 Nm = 0.737 lbft Pound-Force (lb) + Feet (ft)
PA	Polyamide
PE-LD	Low-density polyethylene
psi	Unit of measurement of pressure [psi] All pressure data expressed in [bar/psi] is assumed to be gauge pressure [bar_g/psi_g] unless explicitly specified otherwise.
PTFE	Polytetrafluoroethylene
SET-UP	Self-learning installation During commissioning and maintenance, the SET-UP procedure carries out all the necessary settings for the generation of messages.
a/f	Indicates the size of spanners width across flats
T.VIS	Tuchenhagen Valve Information System
V AC	Volt alternating current
V DC	Volt direct current
W	Unit of measurement of power [Watt]
TIG	Welding method Tungsten inert gas welding
Inch	Unit of measurement of length in the Anglo-American language area
Inch OD	Pipe dimension acc. to British standard (BS), Outside Diameter
Inch IPS	US pipe dimension Iron Pipe Size

Safety

Safety Note

The valve is operationally reliable. It was built according to state-of-the-art standards.

Nevertheless, the valve can pose dangers, especially if

- the valve is not used in accordance with its intended use,
- the valve is not used correctly,
- the valve is operated under impermissible operating conditions.

Operator's Duties

In your capacity as operator of the facility you bear a particular responsibility for the proper and safe handling of the valve in your facility. Only use the valve when it is in perfect condition to prevent danger to persons and property.

These Operating Instructions contain the information you and your staff need for the safe and reliable operation during the entire service life of the valve. Be sure to read these Operating Instructions carefully and ensure that the measures described here are observed.

The operator's duty of care includes planning the necessary safety measures and monitoring that these measures are observed. The following principles apply:

- Only allow qualified staff to work on the valve.
- The operator must authorize the staff to carry out the relevant tasks.
- Working areas and the entire environment of the valve must be neat and clean.
- The staff must wear suitable work clothing and personal protective equipment. As the operator of the facility make sure that work clothing and personal protective equipment are used.
- Instruct the staff with regard to any properties of the product which might pose a health risk and the preventative measures to be taken.
- Have a qualified first-aider on call during the operation, who can initiate the necessary first-aid measures in case of an emergency.
- Clearly define processes, lines of authority and responsibilities associated with the valve. Everybody must know what to do in case of an emergency. Instruct the staff in this respect at regular intervals.
- The signs relating to the valve must always be complete and legible. Check, clean and replace the signs as necessary at regular intervals.

NOTE

Carry out regular checks. This way you can ensure that these measures are actually observed.

Qualification of Staff

This section contains information about the qualifications that staff working on the valve must have.

Operating and maintenance staff must

- have the necessary qualification to carry out their tasks,
- be instructed with regard to possible dangers,
- know and observe the safety instructions given in the documentation.

Only allow qualified electricians to carry out work on the electrical equipment or have a qualified electrician supervise the work.

Only allow specially trained staff to carry out any work on explosion-protected equipment. When working on explosion-protected equipment observe the standards DIN EN 60079-14 for gases and DIN EN 50281-1-2 for dusts.

The following minimum qualifications are required:

- Vocational training as a specialist who can work on the valve independently.
- Sufficient instruction to work on the valve under the supervision and direction of a qualified specialist.

Each member of staff must meet the following requirements to be allowed to work on the valve:

- Personal qualification for the relevant task.
- Sufficient professional qualification for the relevant task.
- Instructed with regard to the function of the valve.
- Instructed with regard to the operating sequences of the valve.
- Familiar with the safety devices and their function.
- Familiar with these Operating Instructions, especially with the safety instructions and the information which is relevant for the task on hand.
- Familiar with the basic regulations with regard to occupational health and safety and accident prevention.

For work to be carried out on the valve the following user groups are distinguished:

User groups

Staff	Qualifications
Operating staff	Adequate instruction and sound knowledge in the following areas: • Function of the valve • Valve operating sequences • What to do in case of an emergency • Lines of authority and responsibilities with respect to the task

User groups (Cont.)

Staff	Qualifications
Maintenance staff	Adequate instruction as well as sound knowledge of the design and function of the valve. Sound knowledge in the following areas: • Mechanical equipment • Electrical equipment • Pneumatic system Authorization with regard to safety engineering standards to carry out the following tasks: • Setting devices into operation • Earthing of devices • Marking of devices The relevant certificates of qualification must be submitted before work can be carried out on ATEX certified machines.

Supplementary Regulations

In addition to the instructions in this documentation the following also has to be observed:

- pertinent accident prevention regulations,
- generally accepted safety rules,
- national regulations applicable in the country of use,
- work and safety instructions applicable in the facility,
- installation and operating regulations for use in potentially explosive areas.

Instructions for the Safe Operation

Dangerous situations during the operation can be avoided by safety-conscious and proactive behaviour of the staff.

General Principles

To ensure the safe operation of the valve the following principles apply:

- The Operating Instructions must be kept ready to hand at the valve's place of use. They must be complete and in clearly legible form.
- Only use the valve for its intended use.
- The valve must be functional and in good working order. Check the condition of the valve before starting work and at regular intervals.
- Wear tight-fitting work clothing for all work on the valve.
- Ensure that nobody can get hurt on the parts of the valve.
- Immediately report any faults or noticeable changes on the valve to the person responsible.
- Observe the accident prevention regulations and all local regulations.

Installation

For installation, the following principles apply:

- Only properly qualified staff is allowed to install, assemble and set the valve into operation.
- Ensure that adequate working and traffic areas are available at the place of installation.
- Observe the maximum load-bearing capacity of the installation surface.
- Observe the transport instructions and markings on the part(s) to be transported.
- Remove any nails protruding from transport crates immediately after opening the crate.
- Under no circumstances should anyone stand under a suspended load.
- During assembly, the valve safety devices might not be working effectively.
- Reliably secure machine parts which have already been connected against inadvertently being switched on.

Commissioning/Setup Mode

For commissioning, the following principles apply:

- Take protective measures against dangerous contact voltages in accordance with pertinent regulations.
- The valve must be completely assembled and correctly adjusted. All screw connections must be securely tightened. All electrical cables must be installed correctly.
- Reliably secure machine parts which have already been connected against inadvertently being switched on.
- Relubricate all lubricating points.
- Make sure lubricants are used properly.
- After conversion of the valve, residual risks must be reassessed.

Setting into Operation

For setting into operation, the following principles apply:

- Only allow properly qualified staff to set the valve into operation.
- Establish all connections correctly.
- The safety devices for the valve must be complete, fully functional and in perfect condition. Check the function before starting any work.
- When the valve is switched on, the danger zones must be free.
- Remove any liquids that have escaped without leaving residues.

Operation

For operation, the following principles apply:

- Monitor the valve during the operation.
- Safety devices must not be changed, removed or taken out of service. Check all safety devices at regular intervals.
- All guards and hoods must be fitted as intended.
- The place of installation of the valve must be adequately ventilated at all times.
- Structural alterations of the valve are not permitted. Immediately report any changes on the valve to the person responsible.
- Always keep danger zones clear. Do not leave any objects in the danger zone. Only allow persons to enter the danger zone when the machine is de-energized.
- Regularly check that all emergency stop devices are working correctly.

Shutting Down

For shutting down, the following principles apply:

- Switch off the compressed air.
- Switch off the valve via the main switch.
- Padlock the main switch (if fitted) in the off position to prevent it from being switched back on. The key to the padlock must be deposited with the person responsible until the machine is restarted.
- For longer periods of standstill, observe the storage conditions, see Storage (page 21).

Maintenance and Repair

Before starting any maintenance and repair work on the electrical devices of the valve, carry out the following steps in accordance with the "5 safety rules":

- Isolate from the power supply
- Take appropriate measures to prevent switch on
- Test absence of voltage
- Earthing and short-circuiting
- Cover or safeguard any adjacent live parts.

For maintenance and repair, the following principles apply:

- Observe the intervals specified in the maintenance schedule.
- Only allow qualified staff to carry out maintenance or repair work on the valve.
- Before starting any maintenance or repair work, the valve must be switched off and secured against being switched back on. Work may only be started once any residual energy has been discharged.
- Block access for unauthorized persons. Put up notice signs which draw attention to the maintenance or repair work going on.
- Do not climb on the valve. Use suitable access aids and working platforms.
- Wear suitable protective clothing.
- Only use suitable and undamaged tools to carry out maintenance work.
- When replacing parts only use approved, fully functional load lifting devices and lifting accessories which are suitable for the intended purpose.
- Before setting the unit back into operation refit all safety devices as originally provided in the factory. Then check that all safety devices are working correctly.
- Make sure lubricants are used properly.
- Check pipes are firmly secured, also check for leaks and damage.
- Check that all emergency stop devices are working correctly.

Disassembly

For disassembly, the following principles apply:

- Only allow qualified staff to disassemble the valve.
- Before starting disassembly, the valve must be switched off and secured against being switched back on. Work may only be started once any residual energy has been discharged.
- Disconnect all power and utility lines.
- Markings, e.g. on lines, must not be removed.
- Do not climb on the valve. Use suitable access aids and working platforms.
- Mark the lines (if unmarked) prior to disassembly to ensure they are not confused when re-assembling.
- Protect open line ends with blind plugs against ingress of dirt.
- Pack sensitive parts separately.
- For longer periods of standstill, observe the storage conditions, see Storage (page 21).

Environmental Protection

Harm to the environment can be avoided by safety-conscious and proactive behaviour of the staff.

For environmental protection the following principles apply:

- Substances harmful to the environment must not be discharged into the ground or the sewage system.
- Always observe the pertinent regulations relating to waste avoidance, disposal and utilization.
- Substances harmful to the environment must be collected and stored in suitable containers. Clearly mark the containers.
- Dispose of lubricants as hazardous waste.

Electrical Equipment

For all work on electrical equipment, the following principles apply:

- Access to electrical equipment should only be allowed to qualified electricians. Always keep unattended switch cabinets locked.
- Modifications of the control system can affect the safe and reliable operation. Modifications are only permitted with the express permission of the manufacturer.
- After completion of all work, check that the protective devices are fully functional.

Signage

Dangerous points on the valve are indicated by warning signs, prohibition signs and mandatory signs.

The signs and notes on the valve must always be legible. Any illegible signs must be replaced immediately.

Signs on the valve

Sign	Meaning
	General hazard warning
	Warning Crushing
	Explosive atmosphere hazard warning

Residual Risk

Hazard Areas

Please observe the following notes:

- In the event of malfunctions, shut down the valve (disconnect from the power and air supply) and secure it against being used.
- When the valve is switching, never reach into the valve housing (391), the lantern (9) or into the valve inlet X (on pneumatic actuators). Fingers can be crushed or cut off.
- When releasing the grooved cap nut (252) of the non-actuated valve (spring-to-close version) there is a risk of the bellows and the round thread of the grooved cap nut being damaged. Before releasing the grooved cap nut (252) therefore relieve the spring tension by pressurizing the actuator with compressed air. The valve is opened.
- The housing sockets have very sharp edges. When transporting and assembling the valve therefore be sure to wear suitable protective gloves.
- Before starting any service, maintenance or repair work, disconnect the valve from the power supply and secure it against inadvertently being switched back on again.
- Only allow a qualified electrician to carry out any work on the electrical power supply.
- Check the electrical equipment of the valve at regular intervals. Immediately remedy loose connections and molten cables.
- If work on live parts cannot be avoided, call in a second person, who can operate the main switch in case of an emergency.

Residual Dangers

Dangerous situations can be avoided by safety-conscious and proactive behaviour of the staff and by wearing personal protective equipment.

Residual dangers on the valve and measures

Danger	Cause	Measure
Danger to life	Inadvertent switch-on of the valve	Effectively disconnect all components, effectively prevent switch-on.
	Electric power	Observe the following safety rules: 1 Isolate from the power supply. 2 Take appropriate measures to prevent switch on. 3 Test absence of voltage. 4 Earthing and short-circuiting. 5 Cover or safeguard any adjacent live parts.
	Spring tension in the actuator	Danger to life caused by compression spring in the actuator. Do not open actuators but return them to GEA Tuchenhagen for proper disposal.
Danger of injury	Danger presented by moving or sharp-edged parts	The operator must exercise caution and prudence. For all work: • Wear suitable work clothing. • Never operate the machine if the cover panels are not correctly fitted. • Never open the cover panels during the operation. • Never reach into openings. As a precautionary measure, wear personal protective equipment in the vicinity of the valve: • Protective gloves • Safety shoes
Environmental damage	Operating materials with properties which are harmful to the environment	For all work: • Collect lubricants in suitable containers. • Dispose of lubricants in accordance with the pertinent regulations.

Declaration of Conformity

Declaration of Conformity

in accordance with the EC Machinery Directive 2006/42/EC

We hereby declare that the machine designated as follows, based on its design and type as well as in the version brought by us to market, complies with the basic safety and health protection requirements of the EU- machine directive.

This declaration will become invalid if any alterations are made to the machine which have not been agreed with us.

Designation of the machine:	Valve with drive
Machine type:	VARIVENT®
Relevant EU directives	2006/42/EC
Applicable harmonized standards:	DIN EN ISO 12100

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Transport and Storage

Scope of Supply

On receipt of the valve check whether

- the details on the type plate correspond to the data in the order and delivery documents,
- the equipment is complete and all components are in good order.

Transport

For transport, the following principles apply:

- Only use approved, fully functional means of transport, lifting gear and slings that are suitable for the purpose to transport the package units/valves. Observe the maximum load-bearing capacities.
- Observe the pictograms on the package.
- Handle valves with care to avoid damage caused by impact or careless loading and unloading. The outside synthetic materials are susceptible to breaking.
- Only allow qualified staff to transport the valve.
- Movable parts must be properly secured.
- Secure the valve against slipping. Take the weight of the valve into account and the position of the point of gravity.
- Under no circumstances should anyone stand under a suspended load.
- Take care when transporting the valve. Do not grip sensitive parts of the unit to lift or push the unit or to support yourself. Avoid putting the unit down with a jerk.

Storage

The valves, valve inserts or spare parts should be stored in a dry place, free of vibrations and dust. To avoid damage, leave the components in their original packaging if possible.

If, during transport or storage, the valve is going to be exposed to temperatures ≤ 0°C, it must be dried and suitable measures be taken to protect it from damage.

NOTE

We recommend that the valve should be stored at a temperature of ≥ 5°C for a period of 24 hours prior to any handling (disassembling the housings / activation of actuators) so that any ice crystals formed by condensation water can melt.

Intended Purpose

Designated Use

The modulating control valve is used to control flow rates and pressures in automated process plants.

NOTE
The manufacturer will not accept any liability for damage resulting from any use of the valve which is not in accordance with the designated use of the valve. The risk of such misuse lies entirely with the operator of the facility.

Requirements for the Operation

The prerequisite for the reliable and safe operation of the valve is proper transportation and storage as well as professional installation and assembly. Operating the valve within the limits of its designated use also involves adhering to the operating, inspection and maintenance instructions.

Pressure Equipment Directive

The control valves are pressure equipment (without safety function) in the sense of the pressure equipment directive 97/23/EC. They are classified according to Annex II, article 3, section 3. In the event of any deviations, GEA Tuchenhagen GmbH will supply a special Declaration of Conformity.

ATEX Directive

If the control valves are used in areas with a potentially explosive atmosphere, you must absolutely comply with directive 94/9/EC with respect to all ignition hazards.

The supplementary ATEX operating instructions for VARIVENT valves must be observed. For details regarding the marking of valves for potentially explosive areas also refer to the additional ATEX operating instructions for VARIVENT valves.

If used in explosion-proof areas, the regulations laid down in the European standards DIN EN 60079-0 and DIN EN 60079-11 must be observed.

Improper Operating Conditions

The operational reliability of the valve cannot be ensured under improper operating conditions. Therefore avoid improper operating conditions.

Operating the valve is not permitted if

- Persons or objects are in the danger zone.
- Safety devices are not working or were removed.
- Malfunctions have been detected on the valve.
- Damage has been detected on the valve.
- Maintenance intervals have been exceeded.

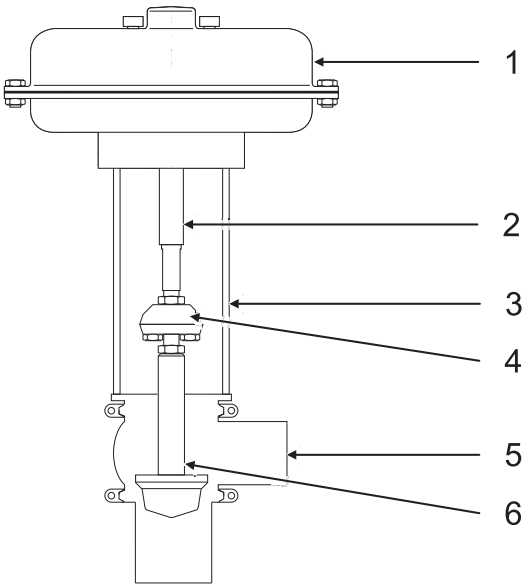
Conversion Work

You should never make any technical modifications to the valve. Otherwise you will have to undergo a new conformity process in accordance with the EC Machinery Directive on your own.

In general, only original spare parts supplied by GEA Tuchenhagen GmbH should be fitted. This ensures the reliable and economical operation of the valve.

Design and Function

Design



No.	Designation
1	Diaphragm actuator
2	Actuator spindle
3	Lantern
4	Coupling
5	Valve housing
6	Valve insert with control cone

The lantern (3) forms the connection between the actuator housing and the upper valve housing (5). It holds the pneumatic positioner. The coupling (4) connects the valve insert (6) with the actuator spindle (2). The coupling is linked to the stroke scanning lever of the positioner.

Function

Spring-to-close actuator (Z)

The valve is closed in the non-actuated position.

In the standard version, the control valve is supplied with a spring-to-close actuator – spring closed in the non-actuated position –, i.e.:
If the input signal at the positioner increases, the control valve opens.

Spring-to-open actuator (A)

The valve is open in the non-actuated position.

If the input signal at the positioner increases, the control valve closes.

Installation and Commissioning

Notes on Installation

GEA Tuchenhagen recommends that the valve should be installed vertically (actuator up, housing bottom). If the control valve is not installed vertically, the stress on the valve stem seals is higher than when installed vertically. Therefore, regularly check the control valve for leakage.

To prevent damage, make sure that

- the valve is installed in the pipe system free of tension and
- no foreign materials (e.g. tools, bolts, lubricants) are left in the system.

Fitting the Valve with Detachable Pipe Connection Elements

CAUTION

If pipes contain liquids, these can spurt out when the pipes are opened.
Danger of injury as a result of hot or aggressive liquids.

➔ Before releasing any pipe or clamp connections, drain and, if necessary, clean or flush the pipe.

➔ Separate the pipe section in which the valve is to be fitted from the rest of the piping system to prevent product entering again.

Carry out the following steps:

➔ Fit the control valve directly into the pipe system using suitable connection fittings.

✓ Done

Control Valve with Welding Ends

Requirement:

- The valve housing must be dismantled for welding.

WARNING

Spring tension in the valve

Danger of injury when releasing the hinged clamps (2, 4) as the released spring pretension will suddenly lift the actuator.

➔ Therefore, release the spring tension before detaching the hinged clamps by pressurizing the actuator with compressed air at max. 6 or 7 bar (depending on the type of positioner) or by mechanically adjusting the control cone.

IMPORTANT NOTE

Damage caused by welding

The control valve can be damaged by distortion due to welding and when the position of the grooves is altered.

➔ Before starting any welding work, remove all built-in parts from the valve.

➔ To ensure that a proper weld is formed when the valve is welded into the pipe, make sure that the root side of the weld is protected against oxidation by forming gas.

➔ Use welding filler if necessary.

Carry out the following steps:

1. Release the spring tension.
2. Remove the valve insert, see chapter “Maintenance“ > “Disassembly“ (page 38).
3. Weld the housing, without sealing rings, into position as follows, ensuring that the connection is free of stress.
4. Fit the housing into place and tack it.
5. Always close the housing before welding.
6. Flush the housing with forming gas from the inside to push the oxygen out of the system.
7. Weld the housing into the pipe system; use welding filler if necessary. Use the TIG welding with pulse method.
8. Passivate the seam after welding.
9. Fit the seals.

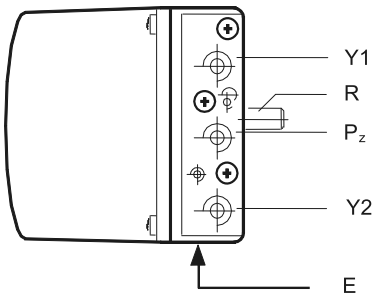
10. Assemble the valve and depressurize the actuator.
➥ The valve disk is lowered.

✓ Done

NOTE
Welding method: we recommend using the TIG welding method.

When assembling the valve always replace the housing O-rings to ensure that the valve is tight.

Pneumatic Connections



Pneumatic connections

Item	Explanation
E	Exhaust air outlet with sound absorber at the bottom of the housing
P_z	Supply air
R	Feedback source
Y1	Signal pressure on single and double-acting actuators
Y2	Signal pressure on double-acting actuators

Requirement:

- The control air pressure may be max. 6 or 7 bar. Please observe the max. supply air pressure specified for the positioner used.

Tools required:

- A hose cutter
- Air hoses with a diameter of 6/4 mm

Carry out the following steps:

1. Shut off the compressed air supply.
2. Use the hose cutter to cut the pneumatic hoses square.
3. Establish the pneumatic connections in accordance with the codes on the positioner. Observe the operating instructions for the positioner!
4. Hand-tighten the cap nuts.

✓ Done

Electrical Connections

DANGER

Live parts

Electrical shock can result in serious personal injury or death.

➔ Only allow properly qualified staff to carry out work on the electrical equipment.

➔ Prior to establishing electrical connections check the maximum permissible operating voltage.

EXPLOSION HAZARD

Explosive gases or dusts

An explosion can result in serious personal injury or death.

➔ Observe the installation and operating regulations for use in potentially explosive areas.

Carry out the following steps:

1. Pass the cable through the cable gland and connect it according to the wiring diagram (in the protection cap of the positioner). Observe the operating instructions for the positioner.
2. Tighten the strain-relief device on the cable gland.

✓ Done

Commissioning

Checks Prior to Commissioning

Before starting commissioning observe the following:

Mechanical

- Check that all visible screws are firmly secured.
- Make sure that there are no foreign materials in the system.
- Check that all movable parts of the control valve can move freely.
- Clean the pipe system prior to the first product run.
- Check the pipe connections for proper installation and tightness.
- During commissioning, regularly check all sealing points for leaks. Replace defective seals.

Pneumatic

- Check the compressed air system for proper installation and tightness.
- Check whether the compressed air pressure is correct and max. 6 or 7 bar (depending on the positioner).
- Let the valve switch once.

Electrical

- Check whether all electrical connections are in accordance with the wiring diagrams.

Testing the Valve Function Without Product

Carry out the following steps:

1. Actuate the control valve by means of compressed air or signal current and let it switch once.
2. Check whether the type of action and the valve stroke are correct, see “Valve Stroke Table“ (page 32).
3. Clean the system.

✓ Done

Valve Stroke

Valve Stroke Table

Actuator type/size	Valve stroke (mm)
MFI-20	20
MFI-30	30
MFIII-30	30
MFIII-60	60

Tests During the Product Run

Carry out the following steps:

➔ Check by visual inspection whether
– all valve functions are correct and
– all seals are free of leakage.

✓ Done

Operation

In the event of malfunctions immediately deactivate the control valve and secure it against inadvertent reactivation. Have any defects rectified immediately.
If the compressed air supply to the control valve fails, the valve assumes the non-actuated position, which depends on the actuator type (spring-to-open or spring-to-close). It must be ensured that no hazardous conditions in the plant can arise in the event of failure of the compressed air supply.

Cleaning and Passivation

Cleaning

All parts in contact with product must be cleaned at regular intervals. Always observe the safety data sheets issued by the cleaning agent manufacturers. Only use cleaning agents which do not cause damage to the seals and the inner parts of the valve. When the pipe is cleaned, the cleaning medium also flows through and cleans the valve housings.
With respect to the cleaning method and parameters like detergents, temperatures, times and intervals, the component manufacturer can merely make recommendations but cannot provide any generally applicable details. Method and parameters should be determined and defined by the operator in accordance with the relevant process.
The cleaning effect must be checked regularly by the operator!

Cleaning Process Examples

Typical Cleaning Parameters in Dairy Operations

Example of a two-phase cleaning process:

- Sodium hydroxide and combination products based on sodium hydroxide in concentrations from 0.5% to 2.5% at 75°C to 80°C.
- Phosphoric acid or nitric acid and combination products based on these acids in concentrations from 0.3 to 1.5% at approx. 65°C.

Example of a cleaning operation in one cleaning step:

- Formic acid and combination products based on formic acid at 85°C.

Typical Cleaning Parameters in Breweries

Example of a two-phase cleaning process:

- Sodium hydroxide and combination products based on sodium hydroxide in concentrations from 1% to 4% at approx. 85°C.
- Phosphoric acid or nitric acid and combination products based on these acids in concentrations from 0.3 to 1.5% at 20°C.

Cleaning Parameters

The cleaning effect depends on the following factors:

- Temperature
- Time
- Mechanics
- Chemicals
- Degree of soiling.

These factors can be combined in various ways to achieve an optimal cleaning result. Please define the cleaning parameters yourself in accordance with your product and process and regularly verify the result.

We recommend a flow velocity of at least 2 m/s.

Passivation

Before commissioning a plant, passivation is commonly carried out for long pipes and tanks. Valve blocks are usually excepted from this.
Passivation is typically performed using nitric acid (HNO_3) at approx. 80°C (176 °F) at a concentration of 3 % and a contact time of 6 to 8 hours.

Malfunctions

In the event of malfunctions immediately deactivate the control valve and secure it against inadvertent reactivation. Malfunctions may only be remedied by qualified staff, who must observe the safety instructions.

Malfunction	Cause	Remedy
Valve does not work	Fault in the control system	Check the system configuration
	No compressed air Compressed air pressure too low	Check the compressed air supply Check air hoses for free passage and air tightness
	Fault in the electrical system	Check actuation and routing of electrical lines
	Valve disk blocked mechanically	Clear the blockage
	Stroke scanning lever has shifted	Readjust the stroke scanning lever
	Actuator not working correctly as a result of the control air being soiled	Check the control air quality Replace the positioner
	Diaphragm defective	Replace the diaphragm
Valve does not close tight	Dirt/foreign materials in the valve housing	Clean the valve housing
	Valve stroke too short as air pressure too low	Check the compressed air supply
Leakage at the housings	O-ring/V-ring defective	Dismantle the valve housing, replace the seals

Maintenance

Inspections

Between the maintenance periods, the control valves must be checked for leakage and proper function.

Product Contact Seals

Carry out the following steps:

➔ Regularly check the seals.

✓ Done

Pneumatic Connections

Carry out the following steps:

1. Check the operating pressure at the pressure reducing and filter station.
2. Clean the air filter at regular intervals.
3. Check that the air hoses sit firmly in the air connections.
4. Check the lines for kinks and leaks.

✓ Done

Electrical Connections

Carry out the following steps:

➔ Check that the proximity switch connections are clean.

✓ Done

Maintenance Intervals

To ensure the highest operational reliability of the valves, all wearing parts should be replaced at longer intervals.

The actual maintenance intervals can only be determined by the user since they depend on the operating conditions, for instance:

- daily period of use,
- switching frequency,
- type and temperature of the product,
- type and temperature of the cleaning solution,
- ambient conditions.

Maintenance Intervals

Applications	Maintenance Intervals (guideline values)
Media at temperatures of 60 °C to 130 °C (140 °F to 266 °F)	approx. every 3 months
Media at temperatures of < 60 °C (<140 °F)	approx. every 12 months

Prior to Disassembly

Requirement:

- Make sure that during maintenance and repair work no process is in operation in the area concerned.

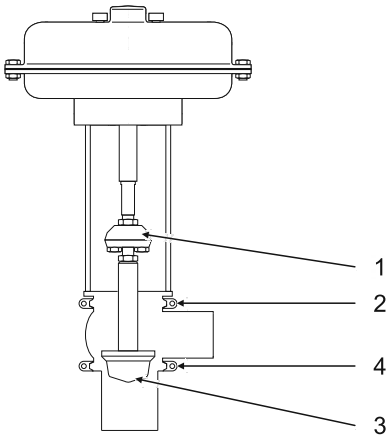
Carry out the following steps:

1. Drain all pipe system elements that lead to the valve and, if necessary, clean or rinse them.
2. Shut off the control air supply.
3. Disconnect the power supply.
4. Detach the pipe connection of the valve.

✓ Done

Disassembly

This section describes disassembly of various components.



Requirement:

- No solenoid valve must have been activated electrically or manually.

WARNING

Spring tension in the valve

Danger of injury when releasing the hinged clamps (2, 4) as the released spring pretension will suddenly lift the actuator.

➔ Therefore, release the spring tension before detaching the hinged clamps by pressurizing the actuator with compressed air at max. 6 bar or by mechanically adjusting the control cone.

Carry out the following steps:

1. Release the spring tension.
2. Move the control cone to the open position. either by actuating with compressed air, by using the pneumatic emergency switch bar or by adjusting the control cone at the coupling.
3. Remove the hinged clamps (2) between the lantern and the upper valve housing and detach the housing from the lantern.
4. Interrupt the compressed air supply to the connection.
5. Detach the control cone (3) from the coupling (1) and draw off the valve insert parts from the valve spindle.
6. Remove the hinged clamps (4) and the cover at the lower valve housing.

✓ Done

Maintenance

Cleaning the Valve

IMPORTANT NOTE

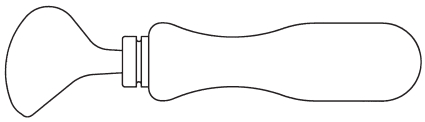
Sealing grooves and contact surfaces are precision areas.
Damage to the valve can result in a malfunction.
➔ Observe the safety information sheets issued by the detergent manufacturers!
➔ Only use detergents which are not aggressive towards the materials of the valve, and which are non-abrasive.

Carry out the following steps:

➔ Carefully clean the individual parts.

✓ Done

Replacing Seals



Insertion tool

Requirement:

- Use the insertion tool to fit the V-ring.
- Insert V-rings without grease. To facilitate fitting, use water with a drop of washing-up liquid to remove the surface tension. In order that no rust is transferred, the washing-up liquid solution must be made up in a ceramic, plastic, or stainless steel container.

Replacing the O-Ring

Carry out the following steps:

➔ Replace all seals which are identified in the spare parts drawing, but only exchange the housing O-rings if they are defective. Also observe the short instructions enclosed with the sealing kits.

Replacing the V-Ring

CAUTION

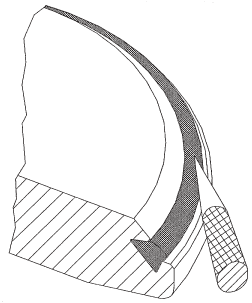
The scriber can slip off when the V-ring is removed.
Danger of injury!

➔ Grip the valve disk in a vice with protected jaws.

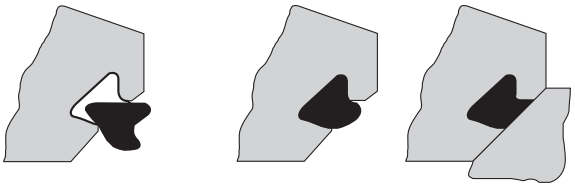
➔ Unscrew the curved side of the scriber.

Carry out the following steps:

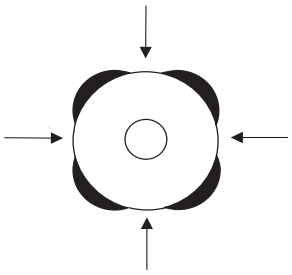
1. Put a scriber into the V-ring and take it out.



2. Before fitting, wet the V-ring on the side not in contact with product (rear side). Pay attention that water does not drip into the V-ring groove on the valve disk.
3. Put in the V-ring. Make sure the installation position of the V-ring is correct (see illustration).



4. Use the insertion tool to press in the V-ring – evenly press in at several opposite points along the circumference.



5. Insert the V-ring evenly.

✓ Done

NOTE
Used seals must not be used again, since the proper function of the seal can then no longer be ensured.

Lubricating Seals and Threads

CAUTION

Damage to seals and threads
Damage to seals and threads can result in a malfunction.
- ➔ Ensure that an adequate film of lubricant is applied. No grease residues must be visible once the valve has been assembled completely.
- ➔ For product contact seals only use suitable greases and oils.
- ➔ Observe the safety information sheets issued by the lubricant manufacturer!

Carry out the following steps:

1. Lightly grease the valve disk thread.
2. Apply a light film of lubricant to all seals which do not come into contact with product.
   ➔ Do not grease the V-ring
3. Grease all screws.
4. Grease the balancer.

✓ Done.

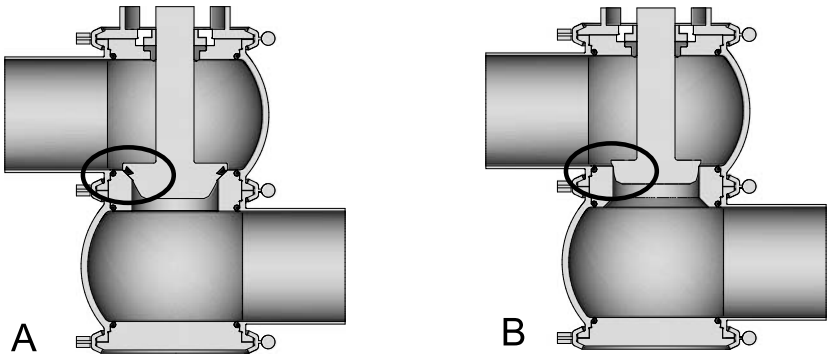
NOTE
GEA Tuchenhagen recommends Rivolta F.L.G. MD-2 and PARALIQ GTE 703. These lubricants are approved for foodstuff and are resistant to beer froth. They have the NSF-H1 (USDA H1) registration. PARALIQ GTE 703 can be ordered from GEA Tuchenhagen under material no. 413-064, and Rivolta F.L.G. MD-2 can be ordered under material no. 413-071. Using other types of grease can result in malfunctions or in premature seal failure. The warranty will also become null and void.
A Manufacturer's Declaration for these products can be obtained from GEA Tuchenhagen if required.
A thin film of grease is required on the seals to ensure the proper function of the fittings. It reduces friction and extends the service life of the seals. This is absolutely harmless from a health and hygienic point of view.
Running dry must be avoided!

Assembly

Carry out the following steps:

1. Assemble control valve and housing in the reverse order of disassembly.

   ! Pay attention that the seat rings are positioned correctly:
   Soft sealing valve disks: inclined seating surface must face the valve disk (A).
   Metallically sealing valve disks: pointed edge must face the valve disk (B).



2. Restore the tension of the actuator spring.
3. Check the valve function by actuation using compressed air or signal current.

✓ Done

Dismantling the Actuator Housing Cover

Requirement:

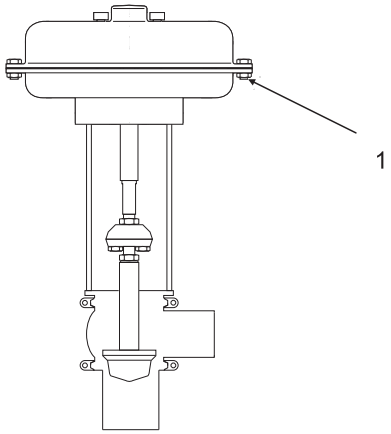
- Depending on the type and size of the control valve, prestressed actuators can be fitted with a certain number of over-long screws. If this is not the case, at least 2 opposite short screws must be replaced by long ones.

WARNING

Spring tension in the valve
Danger of injury when opening the housing cover as the released spring pretension will suddenly lift the housing cover.
➔ Therefore never slacken all the screws of the housing cover at the same time.

Carry out the following steps:

1. Remove the hex nuts (1) of the short screws.



2. Slacken the hex nuts of the long screws slowly and at evenly distributed points along the circumference so that the two housing parts drift apart and the spring pretension is reduced.

✓ Done

Checking the Function

Setting the Stroke

Carry out the following steps:

1. Actuate the valve with compressed air.
2. Set the stroke in accordance with the “Valve Stroke Table“ (page 44).

✓ Done

Valve Stroke

Valve Stroke Table

Actuator type/size	Valve stroke (mm)
MFI-20	20
MFI-30	30
MFIII-30	30
MFIII-60	60

Disposal

General Notes

Dispose of the valve in an environmentally friendly manner. Observe the statutory waste disposal regulations applicable at the place of installation.

The valve is made of the following materials:

- Metals
- Synthetic materials
- Electronic parts
- Lubricants containing oil and grease

Separate the different materials and dispose of them correctly sorted. Also observe the instructions regarding disposal in the operating instructions for the individual components.

Valve Actuator Disposal

DANGER

The spring forces in the actuator can be as high as 24 kN.
The pre-stressed spring can cause serious personal injury or death.
➔ Never open the actuator.
➔ GEA Tuchenhagen accepts unopened actuators and arranges for proper disposal free of charge.

Carry out the following steps:

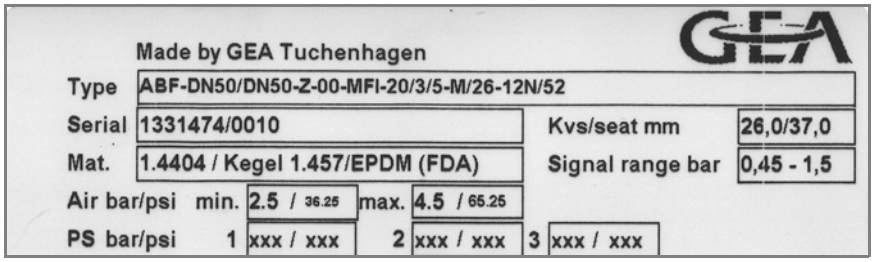
1. Remove the actuator, see “Disassembly“ (page 38).
2. Safely pack the actuator and send it to GEA Tuchenhagen GmbH.

✓ Done

Technical Data

Type Plate

The type plate clearly identifies the valve.



Type plate of Control Valve A

The type plate provides the following key data:

Key data of the valve

Type	Control Valve A
Serial	Serial number
Material	1.4404 / cone 1.457/EPDM (FDA)
Control air pressure bar/psi	min. 2.5 / 36.25; max. 4.5 / 65.25
Product pressure bar/psi	.....
Kvs value/seat diameter mm	26.0/37.0
Signal pressure bar	0.45 - 1.5

Technical Data

Technical data: Valve

Designation	Description
Size	DN 25 to DN 150 1" to 6" OD 2" to 6" IPS
Installation position	Any position (if valve and pipe system can drain properly)
Material of product contact parts	Stainless steel 1.4404 (AISI316L)
Product pressure	DN 25 to 65 = max. 16 bar / 232 psi (standard) DN 80 to 150 = max. 10 bar / 145 psi (standard)

Technical data: Temperatures

Designation	Description
Ambient temperature	-20 to 80 °C < 0 °C: use control air with a low dew point. Protect valve stems against freezing.
Operating temperature	Depending on the sealing material

Technical data: Compressed air supply

Designation	Description
Air hose	
- Metric	Material PE-LD Outside Ø 6 mm Inside Ø 4 mm
- Inch	Material PA Outside Ø 6.35 mm Inside Ø 4.3 mm
Control air pressure	max. 6 or 7 bar (87 or 101 psi), depending on the type of positioner
Control air	acc. to ISO 8573-1:2001
– Solid particle content:	Quality class 6 Particle size max. 5 µm Particle density max. 5 mg/m^3
– Water content:	Quality class 4 max. dew point +3 °C If the unit is used at higher altitudes or at low ambient temperatures, the dew point must be adapted accordingly.
– Oil content:	Quality class 3, preferably oil free max. 1 mg oil in 1 m^3 air

Resistance of Sealing Materials

The resistance of sealing materials depends on the type and temperature of the medium conveyed. The exposure time can adversely affect the service life of the seals. The sealing materials comply with the regulations of FDA 21 CFR 177.2600 or FDA 21 CFR 177.1550.

Resistance:

- + = good resistance
- o = limited resistance
- – = no resistance

Table of resistance of seals

Medium	Temperature	Sealing material (general operation temperature)		
		EPDM -40...+135°C -40...275°F	FKM -10...+200 °C +14...+392°F	HNBR -25...+140 °C -13...+284°F
Caustics up to 3%	up to 80 °C (176°F)	+	o	+
Caustics up to 5%	up to 40 °C (104°F)	+	o	o
Caustics up to 5%	up to 80 °C (176°F)	+	–	–
Caustics at more than 5%		o	–	–
Inorganic acids up to 3%	up to 80 °C (176°F)	+	+	+
Inorganic acids up to 5%	up to 80 °C (176°F)	o	+	o
Inorganic acids up to 5%	up to 100 °C (212°F)	–	+	–
Water	up to 80 °C (176°F)	+	+	+
Steam	up to 135 °C (275°F)	+	o	o
Steam, approx. 30 min	up to 150 °C (302°F)	+	o	–
Fuels/hydrocarbons		–	+	+
Product with a fat content of max. 35%		+	+	+
Product with a fat content of more than 35%		–	+	+
Oils		–	+	+
* Depending on the installation conditions				

Pipe Ends

Dimensions for Pipes in DN

Metric DN	Outside diameter	Wall thickness	Inside diam- eter	Outside diameter acc. to DIN 11850
25	29	1.5	26	x
40	41	1.5	38	x
50	53	1.5	50	x
65	70	2.0	66	x

Dimensions for Pipes in DN

Metric DN	Outside diameter	Wall thickness	Inside diameter	Outside diameter acc. to DIN 11850
80	85	2.0	81	x
100	104	2.0	100	x
125	129	2.0	125	x
150	154	2.0	150	x

Dimensions for Pipes in Inch OD

Inch OD	Outside diameter	Wall thickness	Inside diameter	Outside diameter acc. to BS 4825 Part 1
1"	25.4	1.65	22.1	x
1.5"	38.1	1.65	34.8	x
2"	50.8	1.65	47.5	x
2.5"	63.5	1.65	60.2	x
3"	76.2	1.65	72.9	x
4"	101.6	2.11	97.38	x
6"	152.4	2.77	146.86	x

Dimensions for Pipes in Inch IPS

Inch IPS	Outside diameter	Wall thickness	Inside diameter	Outside diameter acc. to BS 4825 Part 1
2"	60.3	2	56.3	x
3"	88.9	2.3	84.3	x
4"	114.3	2.3	109.7	x
6"	168.3	2.8	162.7	x

Tools

List of tools

Tools	Material no.
Belt wrench	408-142
Hexagon screwdriver a/f 2 (for hexagon socket screws)	408-120
Hexagon screwdriver a/f 4 (for hexagon socket screws)	408-122
Hexagon screwdriver a/f 5 (for hexagon socket screws)	408-123

List of tools (Cont.)

Tools	Material no.
Hexagon screwdriver a/f 6 (for hexagon socket screws)	408-124
Hexagon screwdriver a/f 7 (for hexagon socket screws)	--
Screwdriver, crosstip size 2	406-125
Screwdriver, blade width 3.5	406-103
Open end spanner a/f 8x10	408-032
Open end spanner a/f 13x17	408-036
Open end spanner a/f 19x22	408-038
Open end spanner a/f 22x24	408-039
Open end spanner a/f 24x27	408-040
Open end spanner a/f 36x41	408-042
Open end spanner a/f 41x46	--
Hose cutter	407-065
Pin punches or T-bars Ø 5 mm	403-210
Current loop simulator (mA transmitter)	--
V-ring insertion tool	229-109.088

Lubricants

Lubricants	Material no.
Rivolta F.L.G. MD-2	413-071
PARALIQ GTE 703	413-064

Weights

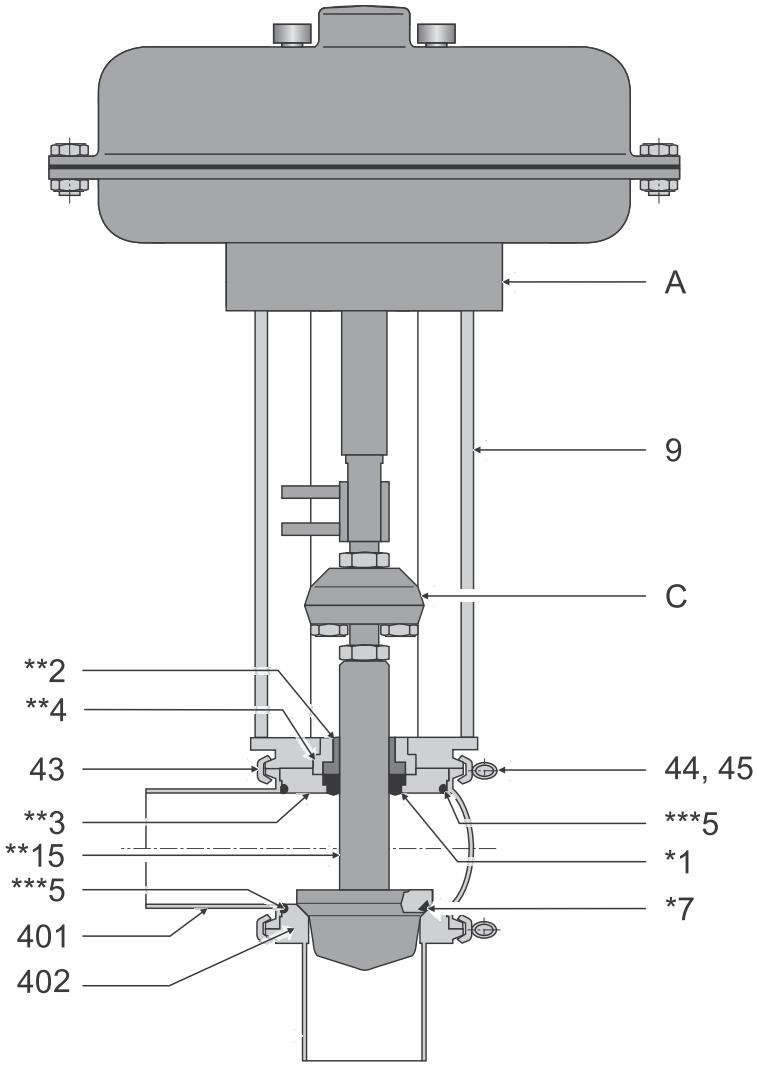
Size	Weight* [kg]
DN 25, 1"	approx. 15.6
DN 40, 1.5"	approx. 16.6
DN 50, 2"	approx. 16.8
DN 65, 2.5"	approx. 41.1
DN 80, 3"	approx. 41.6
DN 100, 4"	approx. 44.8

Size	Weight* [kg]
DN 125	approx. 55.1
DN 150, 6"	approx. 61.1

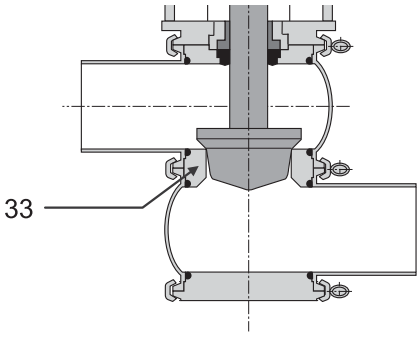
*Weights for housing combination L. Other weights on request.

Spare Parts Lists – Control Valves

Control Valve A



Control valve with EPDM or FPM valve seat seal



Control valve
with metallic valve seat seal

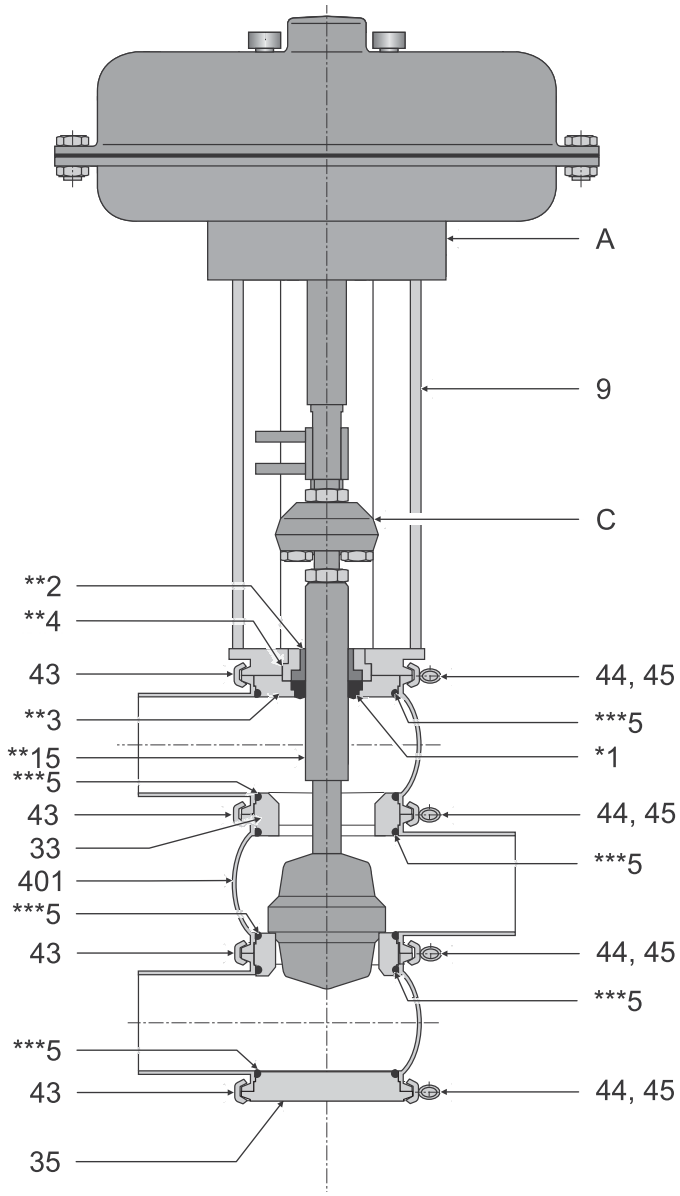
Spare Parts List Control Valve A

No.	Designation
A	Actuator
C	Coupling element
1	Sealing ring
2	Bearing
3	Sealing disk
4	Bearing disk
5	O-ring
7	V-ring
9	Lantern
15	Control cone
33	Seat ring
35	Cover
43	Hinged clamp
44	Hex screw
45	Hex nut
401	Housing, 1 socket(s)
402	Housing connection A
* Sealing set, complete	
** Valve insert complete without seals	
*** Order as well when conversion work is to be carried out	

Specify when ordering:

- Valve type with device number and nominal width or
- Valve type, nominal width, control cone type ..., with or without V-ring groove, Kvs...
- Control cone F = equal-percentage characteristic curve
- Control cone J = linear characteristic curve

Control Valve A...W



Spare parts drawing Control Valve A...W

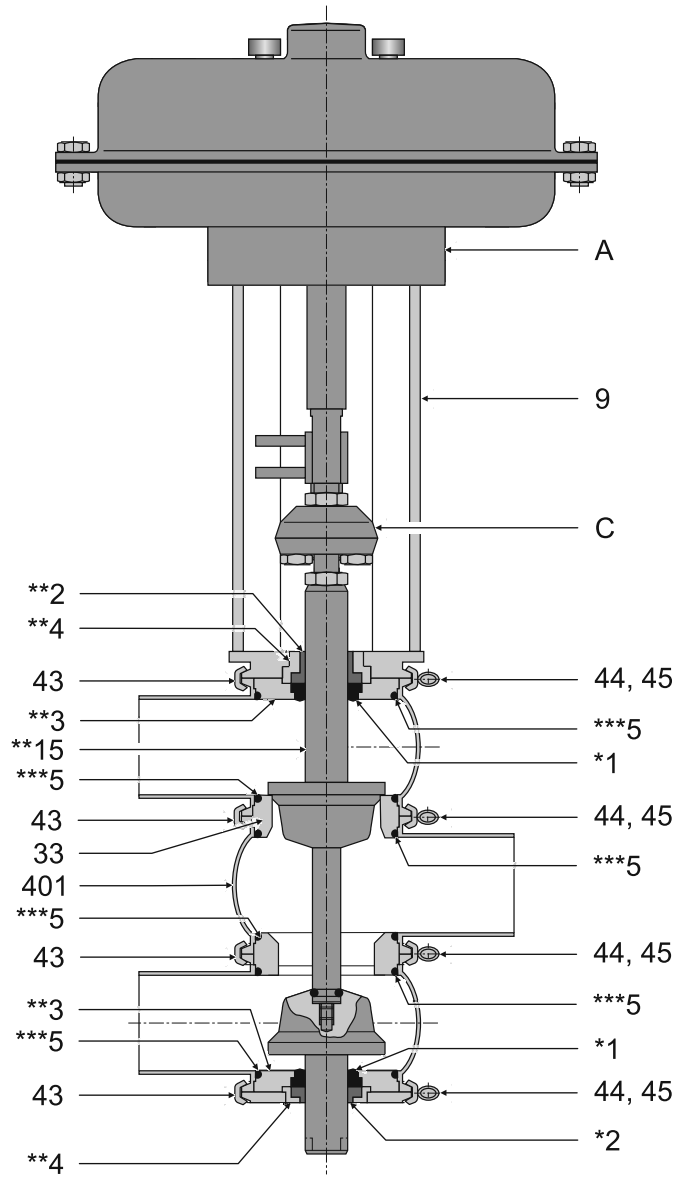
Spare Parts List Control Valve A...W

No.	Designation
A	Actuator
C	Coupling element
1	Sealing ring
2	Bearing
3	Sealing disk
4	Bearing disk
5	O-ring
7	V-ring
9	Lantern
15	Control cone
33	Seat ring
35	Cover
401	Housing, 1 socket(s)
43	Hinged clamp
44	Hex screw
45	Hex nut
* Sealing set, complete	
** Valve insert complete without seals	
*** Order as well when conversion work is to be carried out	

Specify when ordering:

- Valve type with device number and nominal width or
- Valve type, nominal width, control cone type ..., with or without V-ring groove, Kvs...
- Control cone F = equal-percentage characteristic curve
- Control cone J = linear characteristic curve

Control Valve A...X



Spare parts drawing Control Valve A...X

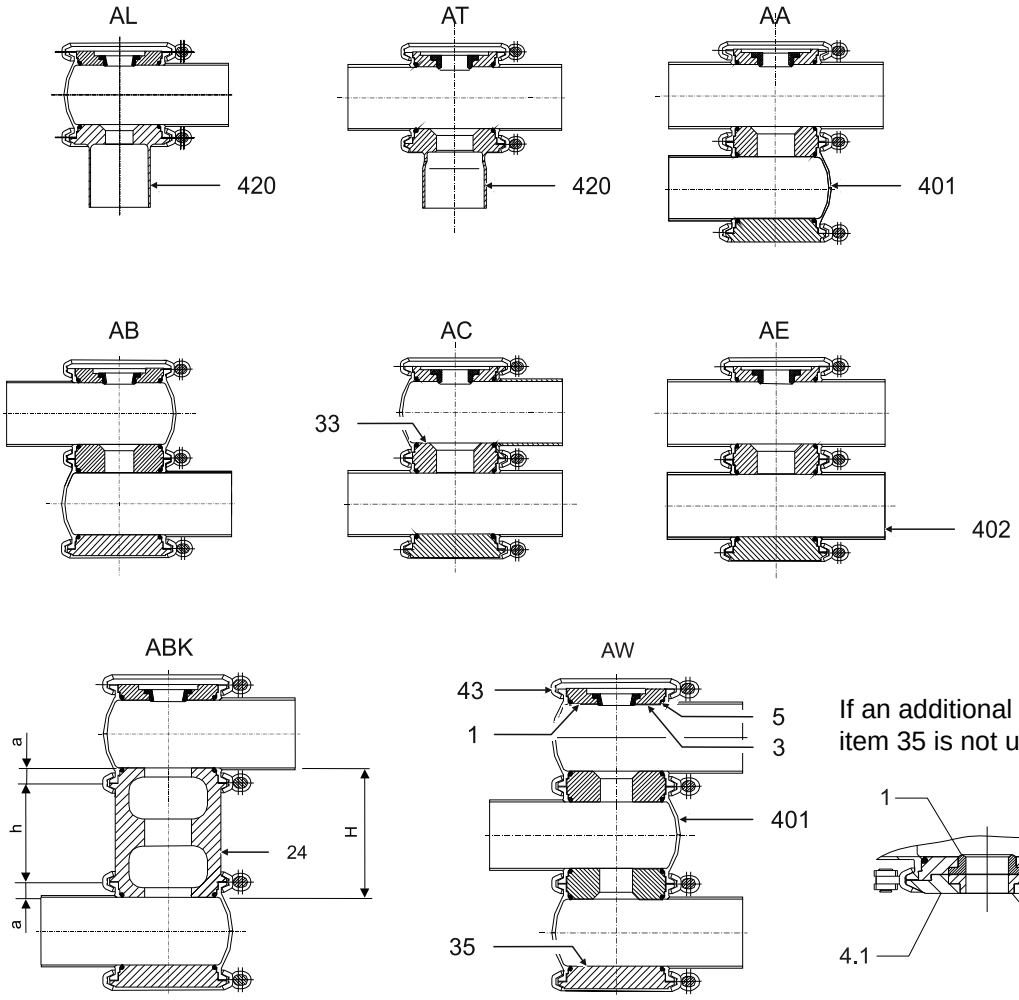
Spare Parts List Control Valve A...X

No.	Designation
A	Actuator
C	Coupling element
1	Sealing ring
2	Bearing
3	Sealing disk
4	Bearing disk
5	O-ring
7	V-ring
9	Lantern
15	Control cone
33	Seat ring
35	Cover
401	Housing, 1 socket(s)
43	Hinged clamp
44	Hex screw
45	Hex nut
* Sealing set, complete	
** Valve insert complete without seals	
*** Order as well when conversion work is to be carried out	

Specify when ordering:

- Valve type with device number and nominal width or
- Valve type, nominal width, control cone type ..., with or without V-ring groove, Kvs...
- Control cone F = equal-percentage characteristic curve
- Control cone J = linear characteristic curve

Control Valve Housings for ARCA Diaphragm Actuator



If an additional bearing is used item 35 is not used

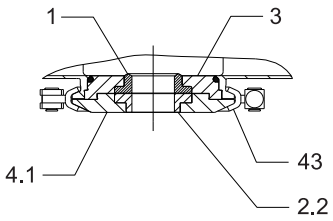


Table of dimensions

Dimension	DN 25	DN 40	DN 50	DN 65	DN 80	DN 100	DN 125	DN 150
a	12	12	12	15	15	15	15	15
h	15	52	52	75	75	80	170	170
H	39	76	76	105	105	115	200	200

When ordering, also specify the housing connection, item 420, or the seat ring, item 33, in addition to the housing combination. Does not apply for ABK!
For housing combinations AA, AB, AC and AE, an additional bearing is possible for nominal widths DN 125 and 6" IPS. This also applies for housing combinations AW and ABK in the nominal widths from DN 40 and from 2" OD.

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Spare Parts List, Items 1-5, 24, Metric Sizes (DN 25 - DN 65)

Item	Designation	Material	DN 25	DN 40	DN 50	DN 65
1	Sealing ring	EPDM FKM	924-084 924-082	924-084 924-082	924-084 924-082	924-085 924-083
2.1	Bearing, top Bearing, top 3A	PTFE/carbon SUSTA-PVDF	935-004 --	935-004 --	935-004 --	935-002 935-099
2.2	Bearing, bottom Bearing, bottom 3A	PTFE/carbon SUSTA-PVDF	935-001 935-098	935-001 935-098	935-001 935-098	935-002 935-099
3	Sealing disk	1.4404	221-141.01	221-141.02	221-141.02	221-141.03
4.1	Bearing disk D	1.4305	--	221-142.10	221-142.10	221-142.11
5	O-ring	EPDM FKM	930-309 930-168	930-144 930-171	930-144 930-171	930-150 930-176
24	3-stage seat	1.4404	229-168.19	229-168.21	229-168.22	229-168.27

Spare Parts List, Items 1-5, 24, Metric Sizes (DN 80 - DN 150)

Item	Designation	Material	DN 80	DN 100	DN 125	DN 150
1	Sealing ring	EPDM FKM	924-085 924-083	924-085 924-083	924-088 924-087	924-088 924-087
2.1	Bearing, top Bearing, top 3A	PTFE/carbon SUSTA-PVDF	935-002 935-099	935-002 935-099	935-003 935-102	935-003 935-102
2.2	Bearing, bottom Bearing, bottom 3A	PTFE/carbon SUSTA-PVDF	935-002 935-099	935-002 935-099	935-003 935-102	935-003 935-102
3	Sealing disk	1.4404	221-141.03	221-141.04	221-141.07	221-141.05
4.1	Bearing disk D	1.4305	221-142.11	221-142.12	221-142.13	221-142.13
5	O-ring	EPDM FKM	930-150 930-176	930-156 930-178	930-372 930-178	930-260 930-259
24	3-stage seat	1.4404	229-168.23	229-168.24	--	--

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Spare Parts List

Control Valve Housings for ARCA Diaphragm Actuator

Spare Parts List, V-Ring (DN 25 - DN 65)

Designation	Hole dia.	KVS Value	Material	DN 25	DN 40	DN 50	DN 65
V-ring	11	2.5	EPDM FKM	932-058 932-049	--	--	--
	16	4.0	EPDM FKM	932-058 932-049	--	--	--
	19	7.0	EPDM FKM	932-017 932-029	932-017 932-029	--	--
	24	11.0	EPDM FKM	932-017 932-029	932-017 932-029	932-017 932-029	--
	32	18.0	EPDM FKM	--	932-046 932-030	932-046 932-030	932-046 932-030
	37	26.0	EPDM FKM	--	--	932-019 932-032	932-019 932-032
	48	43.0	EPDM FKM	--	--	--	932-021 932-033
	62	50.0	EPDM FKM				932-023 932-034
	62	68.0	EPDM FKM	--	--	--	--
	62	85.0	EPDM FKM	--	--	--	--
	73	100	EPDM FKM	--	--	--	--
	90	150	EPDM FKM	--	--	--	--
	96	260	EPDM FKM	--	--	--	--
	115	260	EPDM FKM	--	--	--	--
	135	380	EPDM FKM	--	--	--	--

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Spare Parts List, V-Ring (DN 80 - DN 150)

Designation	Hole dia.	KVS Value	Material	DN 80	DN 100	DN 125	DN 150
V-ring	11	2.5	EPDM FKM	--	--	--	--
	16	4.0	EPDM FKM	--	--	--	--
	19	7.0	EPDM FKM	--	--	--	--
	24	11.0	EPDM FKM	--	--	--	--
	32	18.0	EPDM FKM	--	--	--	--
	37	26.0	EPDM FKM	932-019 932-032	--	--	--
	48	43.0	EPDM FKM	932-021 932-033	932-021 932-033	--	--
	62	50.0	EPDM FKM				
	62	68.0	EPDM FKM	932-023 932-034	932-023 932-034	--	--
	62	85.0	EPDM FKM	932-023 932-034	--	--	--
	73	100	EPDM FKM	--	932-024 932-035	932-024 932-035	--
	90	150	EPDM FKM	--	932-027 932-038	932-027 932-038	932-027 932-038
	96	260	EPDM FKM	--	--	932-028 932-039	--
	115	260	EPDM FKM	--	--	932-059 932-063	932-059 932-063
	135	380	EPDM FKM	--	--	932-045 932-044	932-045 932-044

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Spare Parts List, Seat Ring A, Metallic Seal, Metric Sizes (DN 25 - DN 65)

Item	Hole dia.	KVS Value	Material	DN 25	DN 40	DN 50	DN 65
33	5	0.4	1.4404	221-107.84	--	--	--
	7	1.0	1.4404	221-107.83	--	--	--
	11	2.5	1.4404	221-107.52	--	--	--
	16	4.0	1.4404	221-107.54	--	--	--
	19	11.0	1.4404	221-107.53	221-107.59	--	--
	24	11.0	1.4404	221-107.58	221-107.60	221-107.60	--
	32	18.0	1.4404	--	221-107.61	221-107.61	221-107.63
	37	26.0	1.4404	--	--	221-107.62	221-107.64
	48	43.0	1.4404	--	--	--	221-107.65
	62	50.0	1.4404	--	--	--	221-107.66
	62	68.0	1.4404	--	--	--	--
	62	85.0	1.4404	--	--	--	--
	73	100	1.4404	--	--	--	--
	90	150	1.4404	--	--	--	--
	96	260	1.4404	--	--	--	--

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Spare Parts List, Seat Ring A, Metallic Seal, Metric Sizes (DN 80 - DN 150)

Item	Hole dia.	KVS Value	Material	DN 80	DN 100	DN 125	DN 150
33	5	0.4	1.4404	--	--	--	--
	7	1.0	1.4404	--	--	--	--
	11	2.5	1.4404	--	--	--	--
	16	4.0	1.4404	--	--	--	--
	19	11.0	1.4404	--	--	--	--
	24	11.0	1.4404	--	--	--	--
	32	18.0	1.4404	--	--	--	--
	37	26.0	1.4404	221-107.64	--	--	--
	48	43.0	1.4404	221-107.65	221-107.67	--	--
	62	50.0	1.4404	--	--	--	--
	62	68.0	1.4404	221-107.66	221-107.68	--	--
	62	85.0	1.4404	221-107.66	--	--	--
	73	100	1.4404	--	221-107.69	221-107.71	--
	90	150	1.4404	--	221-107.70	221-107.72	221-107.74
	96	260	1.4404	--	--	221-107.73	--
	115	260	1.4404	--	221-107.70	221-107.72	221-107.75
	135	380	1.4404	--	--	221-107.73	221-107.76

Spare Parts List, Seat Ring A for V-Ring Seal, Metric Sizes (DN 25 - DN 65)

Item	Hole dia.	KVS Value	Material	DN 25	DN 40	DN 50	DN 65
33	11	2.5	1.4404	221-107.51	--	--	--
	16	4.0	1.4404	221-107.49	--	--	--
	19	7.0	1.4404	221-107.50	221-107.59	--	--
	24	11.0	1.4404	221-107.48	221-107.60	221-107.60	--
	32	18.0	1.4404	--	221-107.61	221-107.61	221-107.63
	37	26.0	1.4404	--	--	221-107.62	221-107.64
	48	43.0	1.4404	--	--	--	221-107.65
	62	50.0	1.4404	--	--	--	221-107.66
	62	68.0	1.4404	--	--	--	--
	62	85.0	1.4404	--	--	--	--
	73	100	1.4404	--	--	--	--
	90	150	1.4404	--	--	--	--
	96	260	1.4404	--	--	--	--

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Spare Parts List, Seat Ring A for V-Ring Seal, Metric Sizes (DN 80 - DN 150)

Item	Hole dia.	KVS Value	Material	DN 80	DN 100	DN 125	DN 150
33	11	2.5	1.4404	--	--	--	--
	16	4.0	1.4404	--	--	--	--
	19	7.0	1.4404	--	--	--	--
	24	11.0	1.4404	--	--	--	--
	32	18.0	1.4404	--	--	--	--
	37	26.0	1.4404	221-107.64	--	--	--
	48	43.0	1.4404	221-107.65	221-107.67	--	--
	62	50.0	1.4404	--	--	--	--
	62	68.0	1.4404	221-107.66	221-107.68	--	--
	62	85.0	1.4404	221-107.66	--	--	--
	73	100	1.4404	--	221-107.69	221-107.71	--
	90	150	1.4404	--	221-107.70	221-107.72	221-107.74
	96	260	1.4404	--	--	221-107.73	--
	115	260	1.4404	--	221-107.70	221-107.72	221-107.75
	135	380	1.4404	--	--	221-107.73	221-107.76

Spare Parts List, Items 35, 36, 43-45, 401, 402, Metric Sizes (DN 25 - DN 65)

Item	Designation	Material	DN 25	DN 40	DN 50	DN 65
35	Cover	1.4404	221-144.01	221-144.02	221-144.02	221-144.03
36	Locking ring	1.4301	--	--	221-143.02	221-143.03
43	Clamp connection KL	1.4401	221-507.02	221-507.04	221-507.04	221-507.09
44	Hex screw	A2-70	--	--	--	--
45	Hex nut	1.4305	912-035	912-035	912-035	912-036
401	Housing, 1 socket(s)	1.4404	221-101.19	221-101.21	221-101.22	221-101.05
402	Housing, 2 socket(s)	1.4404	221-102.41	221-102.43	221-102.44	221-102.05

Spare Parts List, Items 35, 36, 43-45, 401, 402, Metric Sizes (DN 80 - DN 150)

Item	Designation	Material	DN 80	DN 100	DN 125	DN 150
35	Cover	1.4404	221-144.03	221-144.04	221-144.06	221-144.05
36	Locking ring	1.4404	221-143.03	221-143.04	221-143.06	--
43	Clamp connection KL	1.4401	221-507.09	221-507.11	221-507.13	221-507.14
44	Hex screw	A2-70	--	--	901-296	901-296
45	Hex nut	1.4305	912-036	912-036	912-025	912-025
401	Housing, 1 socket(s)	1.4404	221-101.06	221-101.07	221-101.18	221-101.17
402	Housing, 2 socket(s)	1.4404	221-102.06	221-102.07	221-102.29	221-102.17

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Spare Parts List, Housing Connection A, Metallic Seal, Metric Sizes (DN 25 - DN 65)

Item	Hole dia.	KVS Value	Material	DN 25	DN 40	DN 50	DN 65
420	11	2.5	1.4404	221-132.75	--	--	--
	16	4.0	1.4404	221-132.78	--	--	--
	19	7.0	1.4404	221-132.80	221-132.94	--	--
	24	11.0	1.4404	221-132.79	221-131.91	221-132.95	--
	32	18.0	1.4404	--	221-107.61	221-132.96	221-132.98
	37	26.0	1.4404	--	--	221-132.97	221-407.04
	48	43.0	1.4404	--	--	--	221-132.56
	62	50.0	1.4404	--	--	--	221-407.05
	62	68.0	1.4404	--	--	--	--
	62	85.0	1.4404	--	--	--	--
	73	100	1.4404	--	--	--	--
	90	150	1.4404	--	--	--	--
	96	260	1.4404	--	--	--	--

Spare Parts List, Housing Connection A, Metallic Seal, Metric Sizes (DN 80 - DN 150)

Item	Hole dia.	KVS Value	Material	DN 80	DN 100	DN 125	DN 150
420	11	2.5	1.4404	--	--	--	--
	16	4.0	1.4404	--	--	--	--
	19	7.0	1.4404	--	--	--	--
	24	11.0	1.4404	--	--	--	--
	32	18.0	1.4404	--	--	--	--
	37	26.0	1.4404	221-132.99	--	--	--
	48	43.0	1.4404	221-131.10	221-131.13	--	--
	62	50.0	1.4404	--	--	--	--
	62	68.0	1.4404	221-131.11	221-131.17	--	--
	62	85.0	1.4404	221-131.11	--	--	--
	73	100	1.4404	--	221-131.23	221-131.29	--
	90	150	1.4404	--	221-131.27	221-131.30	--
	96	260	1.4404	--	--	221-131.31	--

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Spare Parts List

Control Valve Housings for ARCA Diaphragm Actuator

Spare Parts List, Housing Connection A for V-Ring Seal, Metric Sizes (DN 25 - DN 65)

Item	Hole dia.	KVS Value	Material	DN 25	DN 40	DN 50	DN 65
420	11	2.5	1.4404	221-132.82	--	--	--
	16	4.0	1.4404	221-132.83	--	--	--
	19	7.0	1.4404	221-132.84	221-132.57	--	--
	24	11.0	1.4404	221-132.85	221-132.89	221-132.58	--
	32	18.0	1.4404	--	221-132.90	221-132.59	221-132.61
	37	26.0	1.4404	--	--	221-132.60	221-407.91
	48	43.0	1.4404	--	--	--	221-132.92
	62	50.0	1.4404	--	--	--	221-407.93
	62	68.0	1.4404	--	--	--	--
	62	85.0	1.4404	--	--	--	--
	73	100	1.4404	--	--	--	--
	90	150	1.4404	--	--	--	--
	96	260	1.4404	--	--	--	--

Spare Parts List, Housing Connection A for V-Ring Seal, Metric Sizes (DN 80 - DN 150)

Item	Hole dia.	KVS Value	Material	DN 80	DN 100	DN 125	DN 150
420	11	2.5	1.4404	--	--	--	--
	16	4.0	1.4404	--	--	--	--
	19	7.0	1.4404	--	--	--	--
	24	11.0	1.4404	--	--	--	--
	32	18.0	1.4404	--	--	--	--
	37	26.0	1.4404	221-132.62	--	--	--
	48	43.0	1.4404	221-132.63	221-132.65	--	--
	62	50.0	1.4404	--	--	--	--
	62	68.0	1.4404	221-132.64	221-132.66	--	--
	62	85.0	1.4404	221-132.64	--	--	--
	73	100	1.4404	--	221-132.67	221-132.69	--
	90	150	1.4404	--	221-132.68	221-132.70	--
	96	260	1.4404	--	--	221-132.71	--

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Spare Parts List

Control Valve Housings for ARCA Diaphragm Actuator

Spare Parts List, Items 1-5, 24, Inch OD

Item	Designation	Material	1" OD	1.5" OD	2" OD	2.5" OD	3" OD	4" OD
1	Sealing ring	EPDM FKM	924-084 924-082	924-084 924-082	924-084 924-082	924-085 924-083	924-085 924-083	924-085 924-083
2.1	Bearing, top Bearing, 3A	PTFE/carbon SUSTA-PVDF	935-004 --	935-004 --	935-004 --	935-002 935-099	935-002 935-099	935-002 935-099
2.2	Bearing, bottom Bearing, 3A	PTFE/carbon SUSTA-PVDF	935-001 935-098	935-001 935-098	935-001 935-098	935-002 935-099	935-002 935-099	935-002 935-099
3	Sealing disk	1.4404	221-141.01	221-141.02	221-141.02	221-141.03	221-141.03	221-141.04
4.1	Bearing disk D	1.4305	--	221-142.10	221-142.10	221-142.11	221-142.11	221-142.12
5	O-ring	EPDM FKM	930-309 930-168	930-144 930-171	930-144 930-171	930-150 930-176	930-150 930-176	930-156 930-178

Spare Parts List, Seat Ring A, Metallic Seal, Inch OD

Item	Hole dia.	KVS Value	Material	1" OD	1.5" OD	2" OD	2.5" OD	3" OD	4" OD
33	11	2.5	1.4404	221-107.52	--	--	--	--	--
	16	4.0	1.4404	221-107.54	--	--	--	--	--
	19	11.0	1.4404	221-107.53	221-107.59	--	--	--	--
	24	11.0	1.4404	221-107.58	221-107.60	221-107.60	--	--	--
	32	18.0	1.4404	--	221-107.61	221-107.61	221-107.63	--	--
	37	26.0	1.4404	--	--	221-107.62	221-107.64	221-107.64	--
	48	43.0	1.4404	--	--	--	221-107.65	221-107.65	221-107.67
	62	50.0	1.4404	--	--	--	221-107.66	--	--
	62	68.0	1.4404	--	--	--	--	221-107.66	221-107.68
	62	85.0	1.4404	--	--	--	--	221-107.66	--
	73	100	1.4404	--	--	--	--	--	221-107.69
	90	150	1.4404	--	--	--	--	--	221-107.70

Spare Parts List, Seat Ring A for V-Ring Seal, Inch OD

Item	Hole dia.	KVS Value	Material	1" OD	1.5" OD	2" OD	2.5" OD	3" OD	4" OD
33	11	2.5	1.4404	221-107.51	--	--	--	--	--
	16	4.0	1.4404	221-107.49	--	--	--	--	--
	19	7.0	1.4404	221-107.50	221-107.59	--	--	--	--
	24	11.0	1.4404	221-107.48	221-107.60	221-107.60	--	--	--
	32	18.0	1.4404	--	221-107.61	221-107.61	221-107.63	--	--
	37	26.0	1.4404	--	--	221-107.62	221-107.64	221-107.64	--
	48	43.0	1.4404	--	--	--	221-107.65	221-107.65	221-107.67
	62	50.0	1.4404	--	--	--	221-107.66	--	--
	62	68.0	1.4404	--	--	--	--	221-107.66	221-107.68
	62	85.0	1.4404	--	--	--	--	221-107.66	--
	73	100	1.4404	--	--	--	--	--	221-107.69
	90	150	1.4404	--	--	--	--	--	221-107.70

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Spare Parts List

Control Valve Housings for ARCA Diaphragm Actuator

Spare Parts List, Items 35, 36, 43-45, 401, 402, Inch OD

Item	Designation	Material	1" OD	1.5" OD	2" OD	2.5" OD	3" OD	4" OD
35	Cover	1.4404	221-144.01	221-144.02	221-144.02	221-144.03	221-144.03	221-144.04
36	Locking ring	1.4301	--	--	221-143.02	221-143.03	221-143.03	221-143.04
43	Clamp connection KL	1.4401	221-507.02	221-507.04	221-507.04	221-507.09	221-507.09	221-507.11
401	Housing, 1 socket(s)	1.4404	221-101.27	221-101.28	221-101.29	221-101.30	221-101.31	221-101.32
402	Housing, 2 socket(s)	1.4404	221-102.52	221-102.53	221-102.54	221-102.55	221-102.56	221-102.57

Spare Parts List, Housing Connection A, Metallic Seal, Inch OD

Item	Hole dia.	KVS Value	Material	1" OD	1.5" OD	2" OD	2.5" OD	3" OD	4" OD
420	11	2.5	1.4404	221-407.06	--	--	--	--	--
	16	4.0	1.4404	221-407.07	--	--	--	--	--
	19	7.0	1.4404	221-407.08	--	--	--	--	--
	24	11.0	1.4404	--	221-132.48	--	--	--	--
	32	18.0	1.4404	--	221-407.11	--	--	--	--
	37	26.0	1.4404	--	--	221-407.14	--	--	--
	48	43.0	1.4404	--	--	221-132.98	221-407.20	221-407.23	--
	62	50.0	1.4404	--	--	--	221-107.66	--	--
	62	85.0	1.4404	--	--	--	--	221-407.24	--

Spare Parts List, Housing Connection A for V-Ring Seal, Inch OD

Item	Hole dia.	KVS Value	Material	1" OD	1.5" OD	2" OD	2.5" OD	3" OD	4" OD
420	11	2.5	1.4404	221-132.87	--	--	--	--	--
	19	7.0	1.4404	221-132.45	221-132.40	221-132.42	--	--	--
	24	11.0	1.4404	221-131.85	221-131.86	221-132.43	--	--	--
	32	18.0	1.4404	--	221-132.88	--	--	--	--
	37	26.0	1.4404	--	221-132.41	221-132.44	221-132.54	221-132.37	--
	48	43.0	1.4404	--	--	--	221-132.38	221-132.36	--
	62	50.0	1.4404	--	--	--	--	221-407.44	
	62	68.0	1.4404	--	--	--	--	--	--
	62	85.0	1.4404	--	--	--	--	221-407.44	--
	73	100	1.4404	--	--	--	--	--	221-131.26
	90	150	1.4404	--	--	--	--	--	221-132.39

Spare Parts List, Items 1-5, 24, Inch IPS

Item	Designation	Material	2" IPS	3" IPS	4" IPS	6" IPS
1	Sealing ring	EPDM FKM	924-084 924-082	924-085 924-083	924-085 924-083	924-088 924-087
2.1	Bearing, top Bearing, 3A	PTFE/carbon SUSTA-PVDF	935-004 --	935-002 935-099	935-002 935-099	935-003 935-102
2.2	Bearing, bottom Bearing, 3A	PTFE/carbon SUSTA-PVDF	935-001 935-098	935-002 935-099	935-002 935-099	935-003 935-102

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Spare Parts List

Control Valve Housings for ARCA Diaphragm Actuator

Spare Parts List, Items 1-5, 24, Inch IPS (Forts.)

Item	Designation	Material	2" IPS	3" IPS	4" IPS	6" IPS
3	Sealing disk	1.4404	221-141.02	221-141.03	221-141.04	221-141.05
4.1	Bearing disk D	1.4305	221-142.10	221-142.11	221-142.12	221-142.14
5	O-ring	EPDM FKM	930-144 930-171	930-150 930-176	930-156 930-178	930-372 930-178

Spare Parts List, Seat Ring A, Metallic Seal, Inch IPS

Item	Hole dia.	KVS Value	Material	2" IPS	3" IPS	4" IPS	6" IPS
33	24	11.0	1.4404	221-107.60	--	--	--
	32	18.0	1.4404	221-107.61	--	--	--
	37	26.0	1.4404	221-107.62	221-107.64	--	--
	48	43.0	1.4404	--	221-107.65	221-107.67	--
	62	68.0	1.4404	--	221-107.66	221-107.68	--
	62	85.0	1.4404	--	221-107.66	--	--
	73	100	1.4404	--	--	221-107.69	--
	90	150	1.4404	--	--	221-107.70	221-107.74
	96	260	1.4404	--	--	--	--
	115	260	1.4404	--	--	--	221-107.75
	135	380	1.4404	--	--	--	221-107.76

Spare Parts List, Seat Ring A for V-Ring Seal, Inch IPS

Item	Hole dia.	KVS Value	Material	2" IPS	3" IPS	4" IPS	6" IPS
33	24	11.0	1.4404	221-107.60	--	--	--
	32	18.0	1.4404	221-107.61	--	--	--
	37	26.0	1.4404	221-107.62	221-107.64	--	--
	48	43.0	1.4404	--	221-107.65	221-107.67	--
	62	68.0	1.4404	--	221-107.66	221-107.68	--
	62	85.0	1.4404	--	221-107.66		--
	73	100	1.4404	--	--	221-107.69	--
	90	150	1.4404	--	--	221-107.70	221-107.74
	115	260	1.4404	--	--	--	221-107.75
	135	380	1.4404	--	--	--	221-107.76

Spare Parts List, Items 35, 36, 43-45, 401, 402, Inch IPS

Item	Designation	Material	2" IPS	3" IPS	4" IPS	6" IPS
35	Cover	1.4404	221-144.02	221-144.03	221-144.04	221-144.05
36	Locking ring	1.4301	--	--	--	--
43	Clamp connection KL	1.4401	221-507.04	221-507.03	221-507.11	221-507.14
401	Housing, 1 socket(s)	1.4404	221-101.37	35	221-101.36	221-101.17
402	Housing, 2 socket(s)	1.4404	221-102.62	221-102.59	221-102.60	221-102.17

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Spare Parts List

Control Valve Housings for ARCA Diaphragm Actuator

Spare Parts List, Housing Connection A, Metallic Seal, Inch IPS

Item	Hole dia.	KVS Value	Material	2" IPS	3" IPS	4" IPS	6" IPS
420	62	150	1.4404	--	--	--	221-131.55
	90	85.0	1.4404	--	--	--	221-131.55
	115	260	1.4404	--	--	--	221-407.01
	135	380	1.4404	--	--	--	221-407.02

Spare Parts List, Housing Connection A for V-Ring Seal, Inch IPS

Item	Hole dia.	KVS Value	Material	2" IPS	3" IPS	4" IPS	6" IPS
420	90	150	1.4404	--	--	--	221-132.72
	115	260	1.4404	--	--	--	221-132.73
	135	380	1.4404	--	--	--	221-132.74

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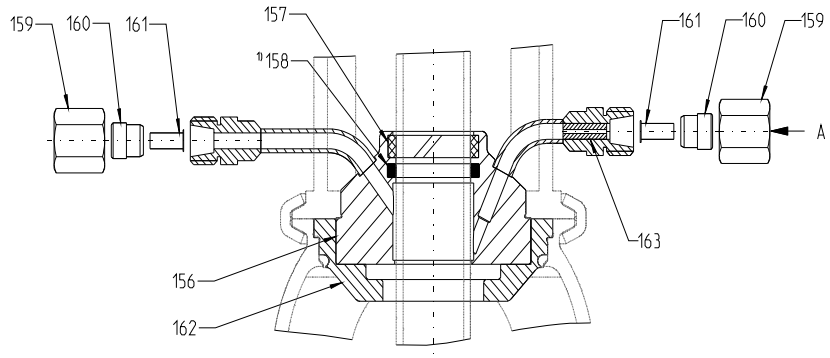
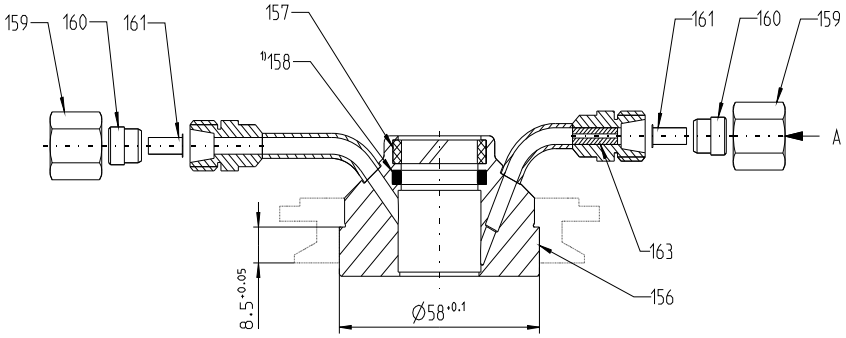
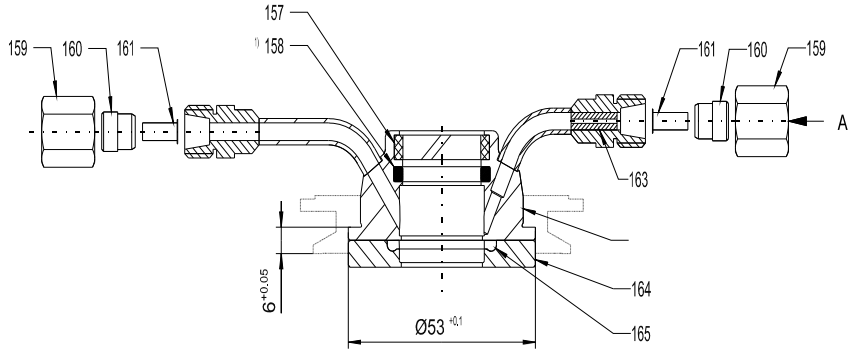
Sterile lock HSP



Sterile lock HSP DN 65 - 6" IPS



Sterile lock HSP DN 40/50; 1.5/2" OD; 2" IPS



IMPORTANT NOTE
Admission pressure at "A"
1 bar max. at free outlet

Sterile lock HSP DN 25; 1" OD

Spare Parts List

Item	Designation	Material	DN 25 1" OD	DN 40/50 1.5/2" OD 2" IPS	DN 80/65 2.5/3" OD 3" IPS	DN 100 4" OD 4" IPS	DN 125	6" IPS
Sterile lock HSP cpl., top		--	--	221-601.19	221-601.09	221-601.10	221-601.11	221-601.12
Sterile lock HSP cpl., bottom		--	--	221-601.07	221-601.09	221-601.10	221-601.11	221-601.12

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Spare Parts List (Cont.)

Item	Designation	Material	DN 25 1" OD	DN 40/50 1.5/2" OD 2" IPS	DN 80/65 2.5/3" OD 3" IPS	DN 100 4" OD 4" IPS	DN 125	6" IPS
156	Sterile lock HSP, top	--	221-601.05	221-601.02	221-601.03	221-601.03	221-601.04	221-601.04
	Sterile lock HSP, bottom	--	221-601.05	221-601.02	221-601.03	221-601.03	221-601.04	221-601.04
157	Guide ring, top	Turcite	935-050	935-050	935-051	935-051	935-059	935-059
	Guide ring, bottom	Turcite	935-050	935-050	935-051	935-051	935-059	935-059
158*	O-ring, top	EPDM FKM	930-268 930-164	930-268 930-164	930-243 930-244	930-243 930-244	930-356 930-357	930-356 930-357
	O-ring, bottom	EPDM FKM	930-268 930-164	930-268 930-164	930-243 930-244	930-243 930-244	930-356 930-357	930-356 930-357
159	Cap nut	1.4571	933-459	933-459	933-459	933-459	933-459	933-459
160	Cutting ring	1.4571	933-458	933-458	933-458	933-458	933-458	933-458
161	Support sleeve	1.4571	933-380	933-380	933-380	933-380	933-380	933-380
162	Sealing disk, top	1.4404	221-141.01	221-141.02	221-600.02	221-600.03	221-600.04	221-600.05
	Sealing disk, bottom		221-141.01	221-600.01	221-600.02	221-600.03	221-600.04	221-600.05
163	Plug	PVDF	221-000870	221-000870	221-000870	221-000870	221-000870	221-000870
164	Sterile lock ring	1.4301	229-168.28	--	--	--	--	--
165	O-ring	EPDM FKM	930-252 930-165	--	--	--	--	--

* The O-ring (Item 158) is not included in the sterile lock HSP cpl. and must be ordered separately.

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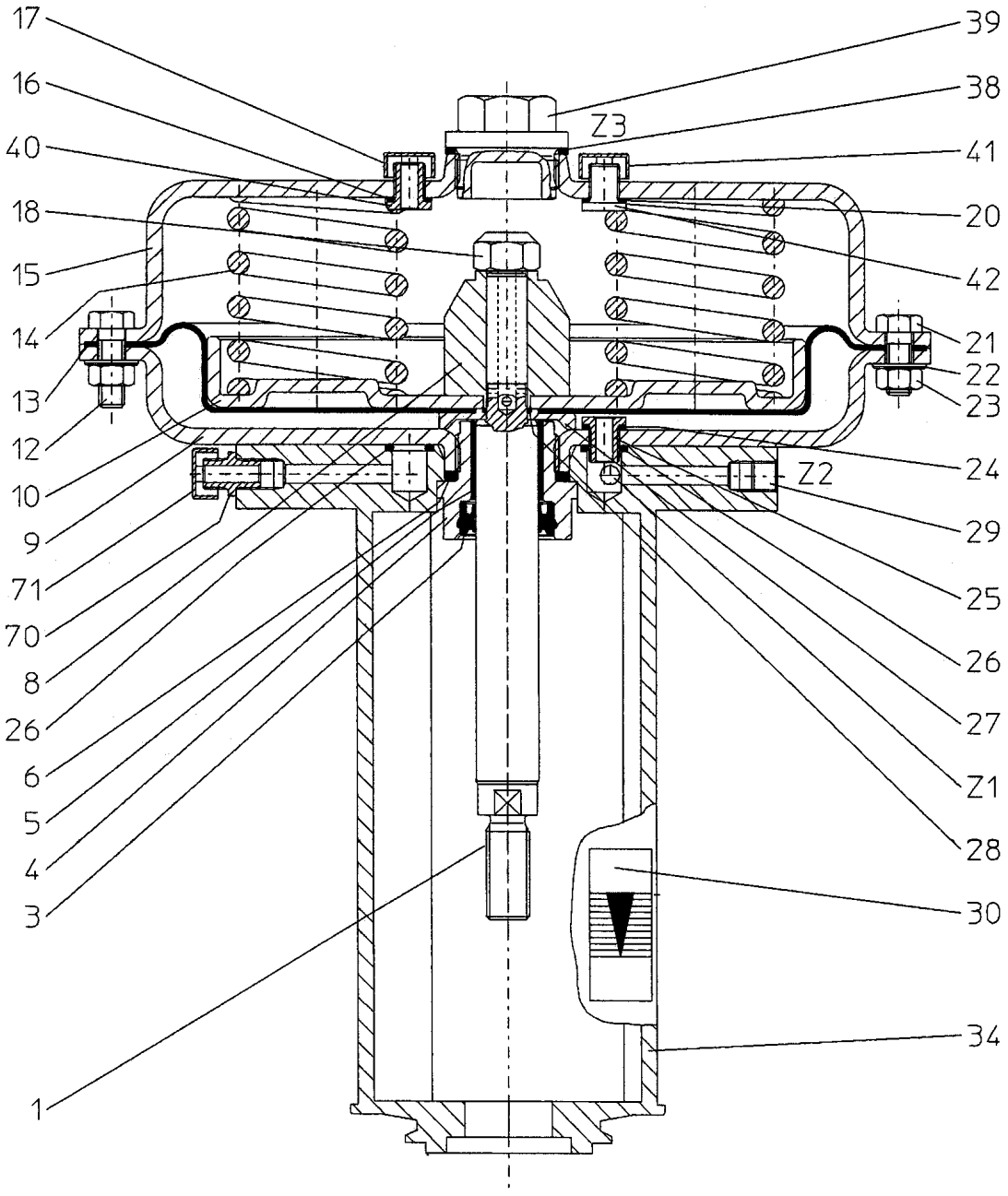
Spare Parts List – Control Valve Actuator A



Spare Parts List Actuator A

No.	Designation	No.	Designation
1	Spindle	22	Washer
3	Sealing ring	23	Hex nut
4	Bush	24	Seal
5	Plain bearing	25	Threaded sleeve

Spare Parts List Actuator A (Cont.)

No.	Designation	No.	Designation
6	O-ring	26	O-ring
8	Reversing sleeve	27	Cup
9	Diaphragm cover	28	O-ring
10	Diaphragm disk	29	Diaphragm cover
12	Hex screw	30	Diaphragm disk
13	Diaphragm	34	Lantern
14	Pressure spring	38	Seal
15	Spring cover	39	Locking screw
16	Seal	40	Threaded sleeve
17	Protection cap	41	Protection cap
18	Hex nut	43	Piping
20	Seal	70	Double nipple
21	Hex screw	71	Protection cap

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