OPERATING INSTRUCTIONS

Original instructions

Hygienic valves

GEA VARIVENT® Shuttle valve type FDD (XKR and XWR)

GEA Tuchenhagen GmbH
Dokumentnummer: 430BAL008691
Sprache: EN-GB / Datum: 17.03.2026

Table of Contents

1 General

This chapter contains basic instructions for using the valve and explanations of illustration conventions. It also contains information about the design and structure.

The term valve in these Operating Instructions refers to Hygienic valves.

1.1 Information about the document

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.

1.1.1 Purpose and structure of the document

The objective of these Operating Instructions is to provide information on how to operate the valve. To achieve this, it is divided into several chapters which are oriented on the various life phases of the valve. Compliance with the instructions will enhance the valve's longevity and reliability, and reduce the likelihood of harm to individuals or damage to property. The Operating Instructions also acts as the basis for creating operating instructions.

1.1.2 Design elements

In this document, the following design elements are used as orientation aids.

General orientation aids

- Figure numbers
- Table numbers
- Chapter numbers
- Page numbers
- Headers and footers
- References
- Lists

Lists

Bullet points are shown in lists and do not prescribe a specific sequence.

- Bullet point
- Bullet point
  - Sub-point
  - Sub-point
- Bullet point

Numbered lists

In a sequence of actions, the order of the action steps is specified by a numbered list. Partial results and the result of a sequence of actions are marked by arrows.

1. Action step one
2. Action step two
   2.1 First sub-step two
   2.2 Second sub-step two
   → Partial result
3. Action step three
   → Partial result
4. Action step four

⇒ Outcome

INFO

Informational texts contain additional information about a description or action step.

1.1.3 Reading obligation and storage

Every person who works on or with the valve must have read these Operating Instructions. They must be available to these persons at all times.

1.2 Manufacturer address

GEA Tuchenhagen GmbH

Am Industriepark 2-10

Germany

21514 Büchen

1.3 Customer service

Phone: +49 4155 49-0

Fax: +49 4155 49-2035

flowcomponents@gea.com

www.gea.com

1.4 More Information about the GEA Group

www.GEA.com

Overview of technologies and products

1.5 Declaration of conformity

Engineering for a better world.

EU Declaration of conformity within the meaning of the EC machine directive 2006/42/EC

Manufacturer: **GEA Tuchenhagen GmbH**
Am Industriepark 2-10
21514 Büchen, Germany

Hereby, we declare that the machine designated in the following

Designation:	Valve with acutator
Type:	VARIVENT® / ECOVENT®

by virtue of its design and construction and in the versions placed on the market by us, complies with the essential health and safety requirements of the following directive:

Relevant EC directives:	2006/42/EC	EC Machinery Directive
Applicable harmonized standards, in particular:	EN ISO 12100: 2010	

Remarks:

- In the event of a modification to the machine that was not agreed with us, this declaration loses its validity
- Furthermore, we declare that the specific technical documentation for this machine has been drawn up in accordance with Annex VII, Part A, and undertake to forward this documentation by means of data medium upon justified request by the national authorities

Person authorised for compilation and handover of technical documentation:

GEA Tuchenhagen GmbH
Am Industriepark 2-10
21514 Büchen, Germany

Büchen, 18 July 2025

Sören de Boon
Senior Vice President
Business Unit Valves & Pumps

i.V. Stephan Dirks
Senior Director Product Engineering & Development
Business Line Hygienic Valves/ BU Valves & Pumps

251718_EC-Declaration_VAR-ECO

Translated copy of the EU - Declaration of conformity in accordance with the Pressure Equipment Directive 2006/42/EU

Manufacturer:	GEA Tuchenhagen GmbH Am Industriepark 2-10 21514 Büchen
We hereby declare that the machine named below	
Designation:	Valve with actuator
Type:	VARIVENT® / ECOVENT®
due to its design and construction as well as in the versions sold by us, meet the basic safety and health requirements of the following guideline:	
Relevant EC directives:	2006/42/EC EC Machinery Directive
Applicable harmonized standards, in particular:	EN ISO 12100: 2010
Remarks:	• This declaration will become invalid if any alterations are made to the machine which have not been agreed with us • We also declare that the relevant technical documentation for this machine has been prepared in accordance with Annex VII, Part A, and agree to submit the documentation on justified request of national authorities on a data carrier
Person authorised for compilation and handover of technical documentation:	GEA Tuchenhagen GmbH Am Industriepark 2-10 21514 Büchen, Germany
Büchen, 18th July 2025	
Sören de Boon Senior Vice President Business Unit Valves & Pumps	Signed by Stephan Dirks Senior Director Product Engineering & Development Business Line Hygienic Valves/ BU Valves & Pumps

Engineering for a better world.

UK- Declaration of conformity by Supply of Machinery (Safety) Regulations 2008

Manufacturer: **GEA Tuchenhagen GmbH**
Am Industriepark 2-10
21514 Büchen, Germany

Hereby, we declare that the machine designated in the following

Designation:	Valve with actuator
Type:	VARIVENT® / ECOVENT®

by virtue of its design and construction and in the versions placed on the market by us, complies with the essential health and safety requirements of the following directive:

Relevant UK legislation:	Supply of Machinery (Safety) Regulations 2008
Applicable harmonized standards, in particular:	EN ISO 12100: 2010

Remarks:

- In the event of a modification to the machine that was not agreed with us, this declaration loses its validity
- Furthermore, we declare that the specific technical documentation for this machine has been drawn up in accordance with Annex VII, Part A, and undertake to forward this documentation by means of data medium upon justified request by the national authorities

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Büchen, 23 July 2025

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2 Safety

This chapter describes the minimum requirements for the intended use of the valve. It forms the basis for safe operation of the valve.

2.1 Intended use

The valves comprise two non-knocking shuttle valves of the type XKR or XWR which are welded to form one assembly.

The assembly is used to activate "flow diversion", "leak detection" and "flow".

Shuttle valves of the type X are pressure accumulator jigs (without safety function) in compliance with the Pressure Equipment Directive 97/23/EC. They are classified in accordance with Annex II, Article 3, Section 3.

In the event of any deviations, a separate Declaration of Conformity will be included with the device.

Proper use of the valve also includes compliance with these Operating Instructions.

INFO The medium should preferably flow in the opening direction of the valve disk to avoid pipe hammers when the valve is opened or closed.

INFO Do not install the valve as spring-to-open, as it will then open when there is a power or air failure and lead to product mixing.

INFO In a closed pipe system, hydraulic pressure build-up may occur when the valve switches and result in seal damage.

INFO 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 is borne solely by the operating company.

2.1.1 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 unit within the limits of its designated use also involves adhering to the operating, maintenance and servicing instructions.

2.1.2 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.

2.1.3 Pressure equipment directive

The valve is a piece of pressure equipment (without safety function) in the sense of the pressure equipment directive 2014/68/EU: Classified according to Annex II in category 1.

According to the scope of directive 2014/34/EC, article 1, paragraph 2, f), the exception of the directive applies, due to conformity with the Machinery Directive 2006/42/EC.

The nominal diameters smaller than DN 25 are subject to article 4, paragraph 3 of the Pressure Equipment Directive which specifies sound engineering practice.

Nominal diameters ≥ IPS 4“; DN 125 valid for the fluid group II.

In the event of any deviations, GEA Tuchenhagen GmbH will supply a special Declaration of Conformity.

2.1.4 ATEX directive

In areas with an explosive atmosphere, only valves suitable for use in such areas may be used.

Refer to and observe the additional instruction manual “ATEX version valves”. For details regarding the marking of valves for potentially hazardous areas also refer to the additional instruction manual “ATEX version valves”.

If these valves are used in areas with a potentially explosive atmosphere, it is mandatory to comply with directive 2014/34/EC with respect to all ignition hazards.

2.2 Modification

Subsequent alterations of the valve are not permitted. Otherwise you will have to undergo a new conformity process in accordance with the EC Machinery Directive on your own.

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

2.3 Structure of warning notices

Warning notices warn of hazards that may exist when performing certain actions. In this document, the following warning notices are used. The extent of the hazards is categorized into risk levels and can be recognized by the corresponding signal words.

2.3.1 Preceding warning notices

Preceding warning notices are used when there is a hazard during a sequence of actions. Warning notices are colour-highlighted and supplemented by a pictogram in the event of possible personal injury.

⚠SIGNAL WORD

Nature and source of the hazard

Consequence of disregarding the warning.

- Measure to avoid or escape the danger.

Figure 2-1 - Structure of a preceding warning notice

2.3.2 Integrated warning notices

Integrated warning notices are used when there is a hazard involved in a single action step.

1. **SIGNAL WORD** Nature and source of the hazard
   Consequence of disregarding the warning.
   - Measure to avoid or escape the danger.

Figure 2-2 - Structure of an integrated warning notice

2.3.3 Signal words

ATTENTION

The signal word ATTENTION indicates a hazard that could result in property damage if not avoided.

CAUTION

The signal word CAUTION indicates a hazard with a low risk level which could result in light to medium injuries if not avoided.

WARNING

The signal word WARNING indicates a hazard with a medium risk level which could result in death or severe injury if not avoided.

DANGER

The signal word DANGER indicates a hazard with a high risk level which will result in death or serious injury if not avoided.

2.4 Personnel qualification

The following basic requirements must be fulfilled for all actions carried out on the valve.

- These Operating Instructions have been read and understood.
- Safety tasks in and around the valve are regulated and assigned.
  - Maintaining order
  - Compliance with safety requirements
  - Securing hazard zones

Additionally, the following groups of people must possess the personnel qualifications or skills listed below and be authorised by the operator to perform actions on the valve.

Operating staff

- Trained by the operating company, a qualified customer specialist or a GEA service expert

Customer specialist

- Technical training

Trained customer specialist

- Technical training in a specific field of expertise
- Training by GEA personnel or participation in training courses of the GEA Tuchenhagen

GEA service expert

- Personnel from GEA Tuchenhagen, see *1.3 Customer service*

Where necessary, reference is made to the respective group of individuals in these Operating Instructions.

2.5 General safety instructions

The valve was built in accordance with the state of the art and recognised safety regulations at the time of its launch. However, the safety measures stipulated by the operator and listed below must still be adhered to in order to ensure safety.

2.5.1 General hazard

Source	Consequences	Measures
Faulty valve	Injury and damage	Check that the valve is fully functional.
Non-compliance with these Operating Instructions	Injury and damage	Read and familiarise yourself with these Operating Instructions.
Operating materials	Injuries	• Wear personal protective equipment. • Avoid contact with operating materials.

Table 1: General hazard

2.5.2 Mechanical hazard

Source	Consequences	Measures
Moving or rotating components	• Being drawn in or caught • Entrapment • Crushing • Impact	• Remove jewellery. • Tie hair back or wear a hair net. • Wear tight-fitting clothing.
• Gravity • Falling objects	• Impact • Crushing	• Do not walk under suspended loads. • Eliminate stumbling hazards.

Table 2: Mechanical hazards - moving or rotating components

2.5.3 Electrical hazard

Source	Consequences	Measures
Electromagnetic processes	Effects on electronic medical implants	Keep a safe distance if you have a medical implant.
Electrostatic processes	• Electrical shock • Fire • Chemical reaction	• Avoid contact with components • Check the voltage of components. • Wear personal protective equipment. • Remove any leaked flammable substances.

Table 3: Electrical hazard – electromagnetic

2.5.4 Thermal hazard

Source	Consequences	Measures
Objects or materials at high or low temperature	• Freezing • Burns • Scalding	• Wear personal protective equipment. • Wait for room temperature to be reached.

Table 4: Thermal hazards

2.6 Personal protective equipment

To prevent possible personal injuries, the personal protection equipment must be worn.

In addition, GEA recommends keeping the requirements listed below.
- Locally applicable accident prevention regulations
- Instruction manual from the operator or employer

2.7 Safety devices

No safety devices are attached to this valve.

2.8 Residual dangers

Despite all safety measures, the following residual risks can still cause personal injury and property damage at any time.

- Improper use
- Material fatigue

Danger zones

Please observe the following notes:

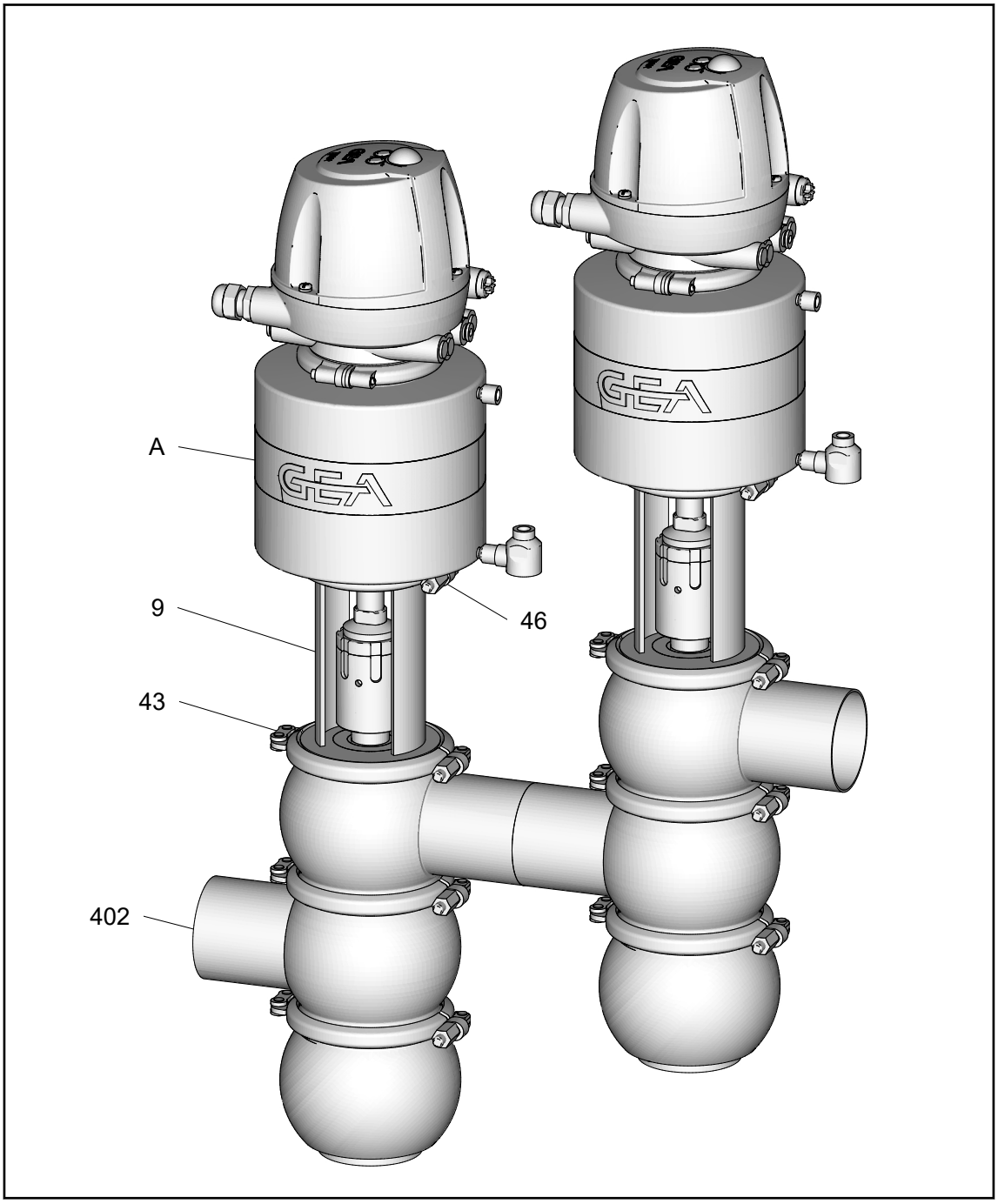


Figure 2-3 - Danger zone at the valve

- In the event of malfunctions, shut down the valve (disconnect from the power and air supply) and secure it against being used.
- Before starting any maintenance, servicing 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.

- Never reach into the lantern (9), the valve housings (402) or into the sockets of the valve housings when the valve is switching. Fingers can be crushed or cut off.
- On a spring-closing valve, there is a risk of injury upon releasing the clamp connection (43/46) as the released spring pretension will suddenly lift the actuator (A). For this reason, relieve the spring tension by pressurising the actuator with compressed air – via a solenoid valve or via mounting tool see chapter *9.5 Removing the valve*– before releasing the hinged clamps.
- The housing sockets have very sharp edges. When transporting and installing the valve be sure to wear suitable protective gloves.
- During transport and assembly of the valve, always screw the control top and the switch bar out and lift the valve with the eyebolt screwed in. See chapter *4.3 Transport*.

Dangerous situations can be avoided by safety-conscious and proactive behaviour of the personnel 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.

Danger	Cause	Measure
	Spring tension in the actuator	Danger to life caused by the pressurised spring in the actuator. Do not open the actuator, rather return it to GEA Tuchenhagen for proper disposal.
Risk 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 collecting vessels. • Dispose of lubricants in accordance with the pertinent regulations.

Table 5: Residual dangers and measures

Instructions for the Safe Handling of Electronic Components During Welding Work

ATTENTION

Stray welding currents during welding
Can cause damage to electronic components
- Follow the steps below to prevent this.

1. Before starting welding work, carry out the following preparations:
   1.1 Ensure the device is switched off and no electrical connections are active.
   1.2 Disconnect the device from the power supply.
   → This protects the electronic components from potential damage caused by stray welding currents.
2. Establish a correct grounding connection:
   2.1 Place the ground connection of the welding machine as close as possible to the welding point.
   → This minimises the risk of stray welding currents and helps protect nearby electronic components from damage.
3. After completing the welding work, proceed as follows:
   3.1 Remove the welding machine's ground connection.
   3.2 Reconnect the device to the power supply.
   3.3 Perform a function test.

2.9 Safety signs

The safety symbols listed below are attached to the valve.

The position of the applicable safety symbols on the valve are shown in an overview, see *3.1.3 Signs*.

Warning signs

General warning sign

Hazard for persons, conveyed by the additional sign.

Warning, risk of hand injuries

Hazard posed by closing mechanical components on the valve.

Warning, spring tension

Hazard posed by spring tension. Do not open the actuator.

2.10 Emergency measures

In case of any emergencies on the valve, the operating regulations must be observed and the following actions implemented.

Fire

- Call local specialists
- Use extinguishing agents as outlined in the operating regulations
- Exit the hazard zone
- Warn individuals that are endangered

Injuries

- Administer first aid
- Call local emergency services

3 Description

This chapter contains instructions on how to install the valve and its functions.

3.1 Structure and function

3.1.1 Design

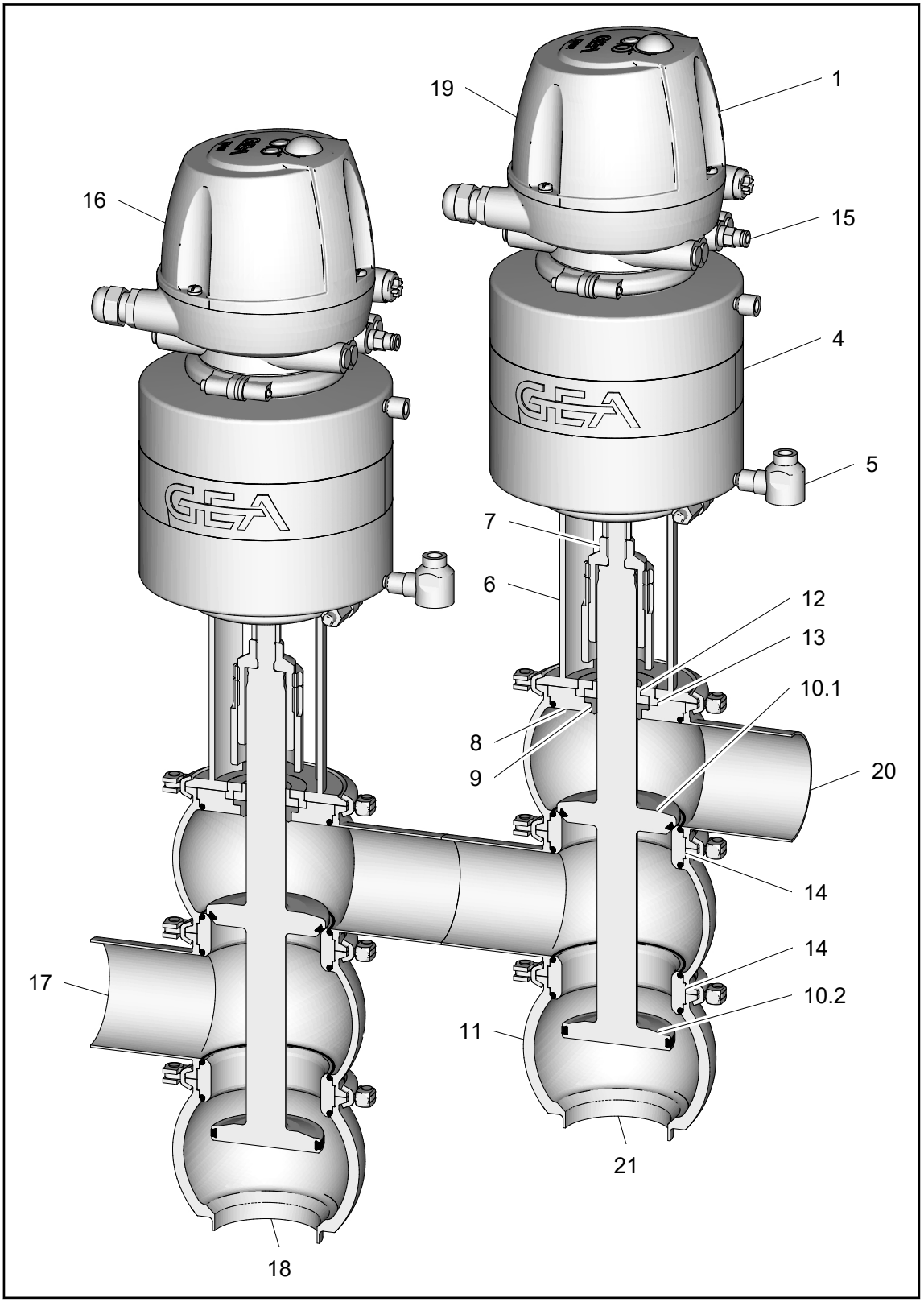


Figure 3-1 - Design of the valve

Design

No.	Designation
1	Control top
4	Actuator
5	Quick bleed valve
6	Lantern
7	Limit stop
8	Seal ring
9	Seal ring
10.1	Valve disk X 1
10.2	Valve disk X 2
11	Valve housing See spare parts drawings for housing configuration
12	Bearing
13	Bearing disk
14	Seat ring
15	Air connection
16	Shuttle valve
17	Inlet connection
18	Diversion connection to the surge tank
19	Leak detection valve
20	Flow connection
21	Leak detection connection to the surge tank

3.1.2 Functional description

3.1.2.1 Short description

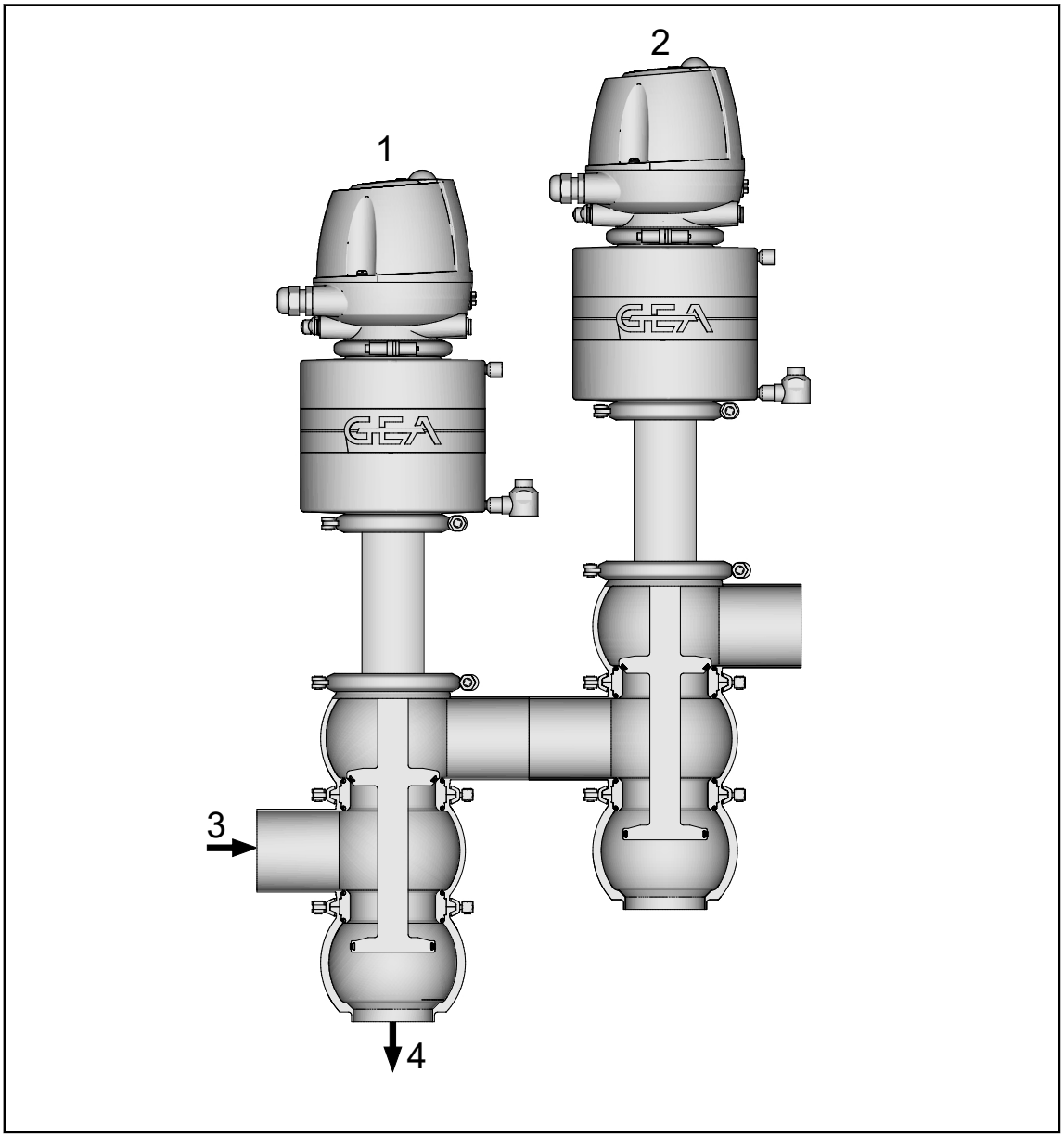
The valves are available for different installation requirements with diversion connection in vertical design (type XKR) or horizontal design (type XWR). See attached dimension sheets.

The spring-to-close actuator (NC) has an air-actuated and spring-actuated closing design. It can be activated directly at the actuator by a suitable air connection or through the control top with a solenoid valve (if necessary).

The air connection at the actuator is equipped with a quick bleed valve to accelerate activation. See chapter *5.6 Checking the pneumatic connection*.

The control top is delivered as standard with two sensors for detecting the non-actuated and the actuator valve position. See chapter *5.6.3 Electrical connection with T.VIS control top*. A solenoid valve is available.

3.1.2.2 Position of flow diversion

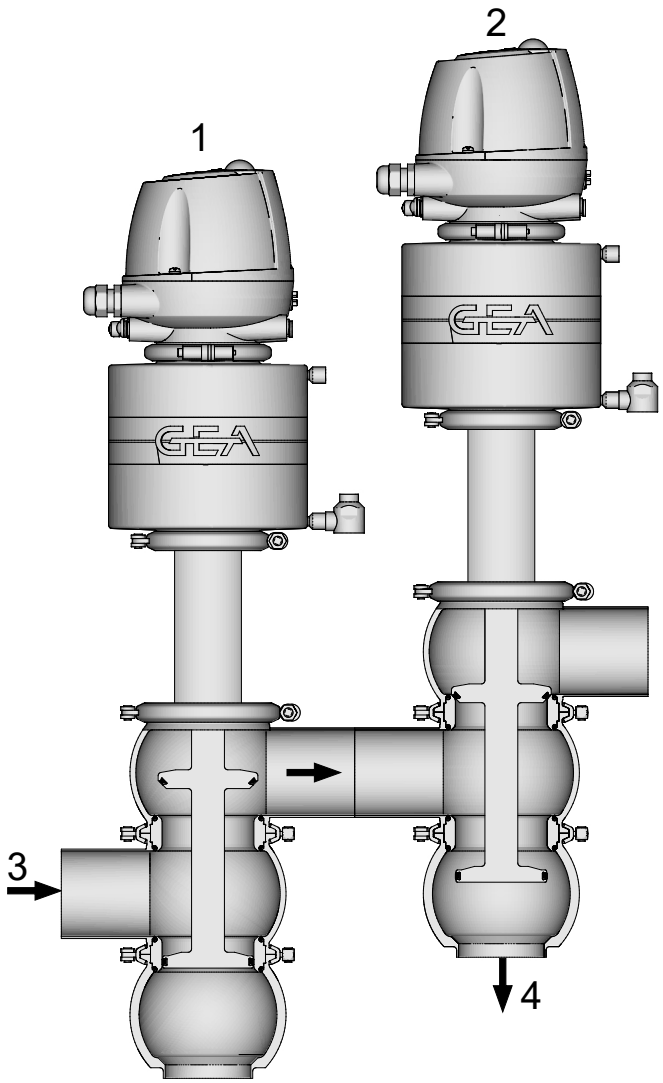


No.	Designation
1	Shuttle valve
2	Leak detection valve
3	Inlet connection
4	Diversion connection to the surge tank

The initial position of the valve after assembly is the position "flow diversion", in which the shuttle valve directs the product back to the surge tank during phases with impermissible pasteurising temperature.

The valve position is detected by the sensors installed in the control top. The interface module with the two sensors for determining the valve position is installed in the control top. The sensors determine the valve position, after which the interface module generates the corresponding feedback and sends this to the main control (see operating instructions for the control top T.VIS M-15/FDD or T.VIS M-20/FDD).

3.1.2.3 Position flushing time delay for leak detection



No.	Designation
1	Shuttle valve
2	Leak detection valve
3	Inlet connection
4	Leak detection connection to the surge tank

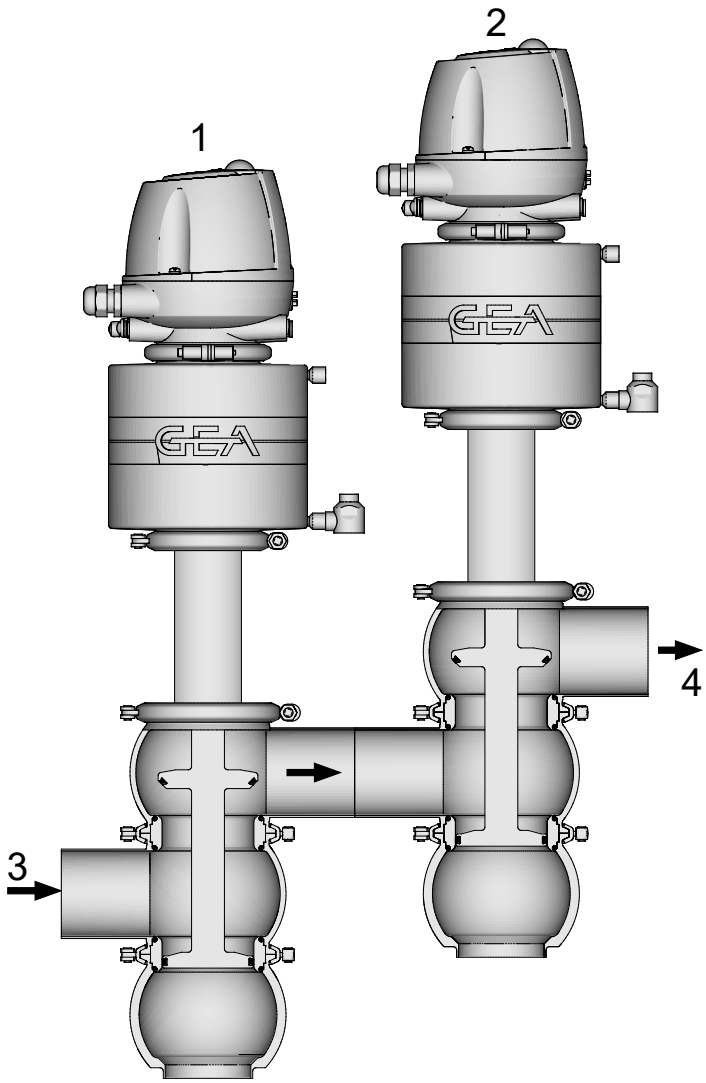
The shuttle valve switches to the position "leak detection" as soon as the legally prescribed pasteurising temperature has been reached. The release time is controlled by a separate unit, device, the controller of the shuttle valve.

In this position, the space shared by the shuttle valve and the leak detection valve is cleaned and the milk is routed back out of the leak detection connection of the leak detection valve to the surge tank. The return flow pipe to the surge tank must be separated from the return flow pipe of the shuttle valve.

In the "leak detection" position, the shuttle valve is in the actuated position. The leak detection valve is in closed position, which is detected by the sensor in the control top.

The shuttle valve remains in the "leak detection" position until the controller of the shuttle valve sends the signal for transition to the "flow" position.

3.1.2.4 Flow position



No.	Designation
1	Shuttle valve
2	Leak detection valve
3	Inlet connection
4	Flow connection

The "flow" position makes product flow through the leak detection valve to the heat holder and the downstream sections of the pasteurising equipment.

In the "flow" position both valves are in actuated position.

3.1.2.5 Spring-to-close actuator function (NC)

Spring-to-close actuator function (NC)

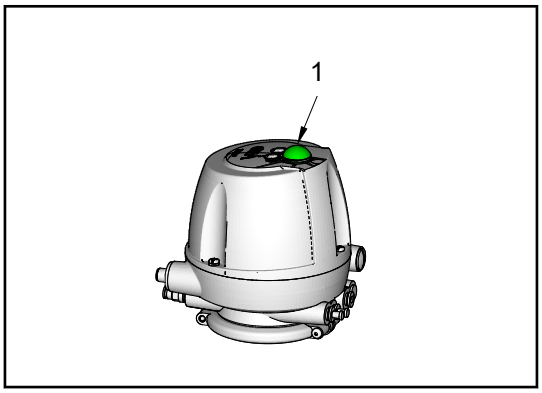


Figure 3-2 - Valve closed in idle position (NC)

The actuator is of the spring-to-close type (NC). The valve is closed in the idle position.
Identification on the T.VIS control top once the installation (SET-UP) has been completed:

- Permanent light (1) green: valve is closed (in idle position)
- Permanent light (1) yellow: valve is open (actuator is activated)

3.1.2.6 Modifying the actuator closing direction

INFO When the idle position is reversed by turning the actuator, the actuation forces may no longer be sufficient for the application. Therefore, check the actuator size before changing the closing direction.

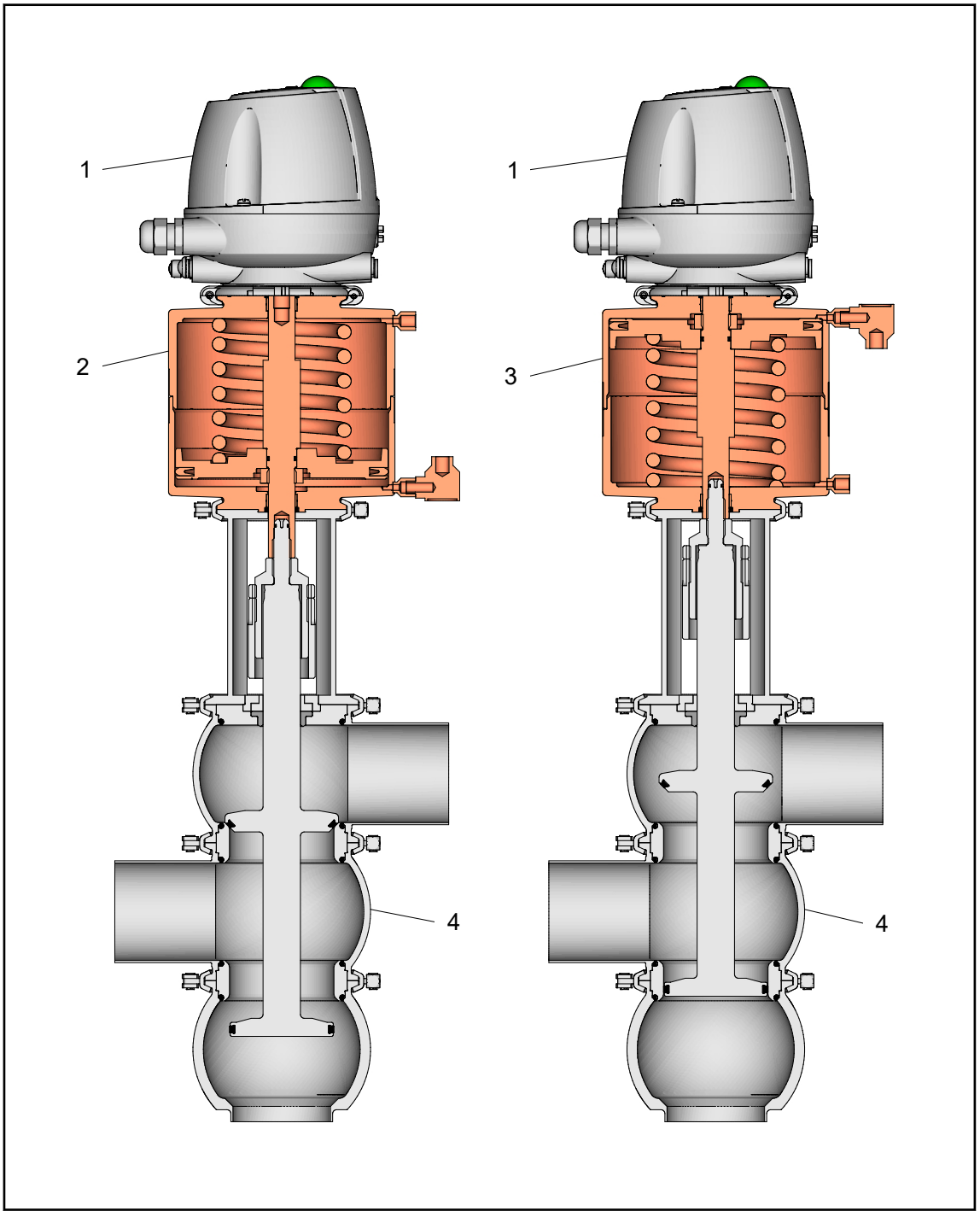


Figure 3-3 - 3.3 Reverse idle position

No.	Designation
1	Feedback side
2	Installation position spring-to-close actuator (NC), idle position closed
3	Installation position spring-to-open actuator (NO), idle position
4	Valve side

Reversing the idle position

Prerequisites

- The valve has been removed, see *9.5 Removing the valve*.
- sufficient actuator size for application, check the actuator size if necessary

1. Turn the actuator to reverse the idle position.
2. Remove the valve, see *9.7 Installing the valve*.

⇒ The idle position is reversed.

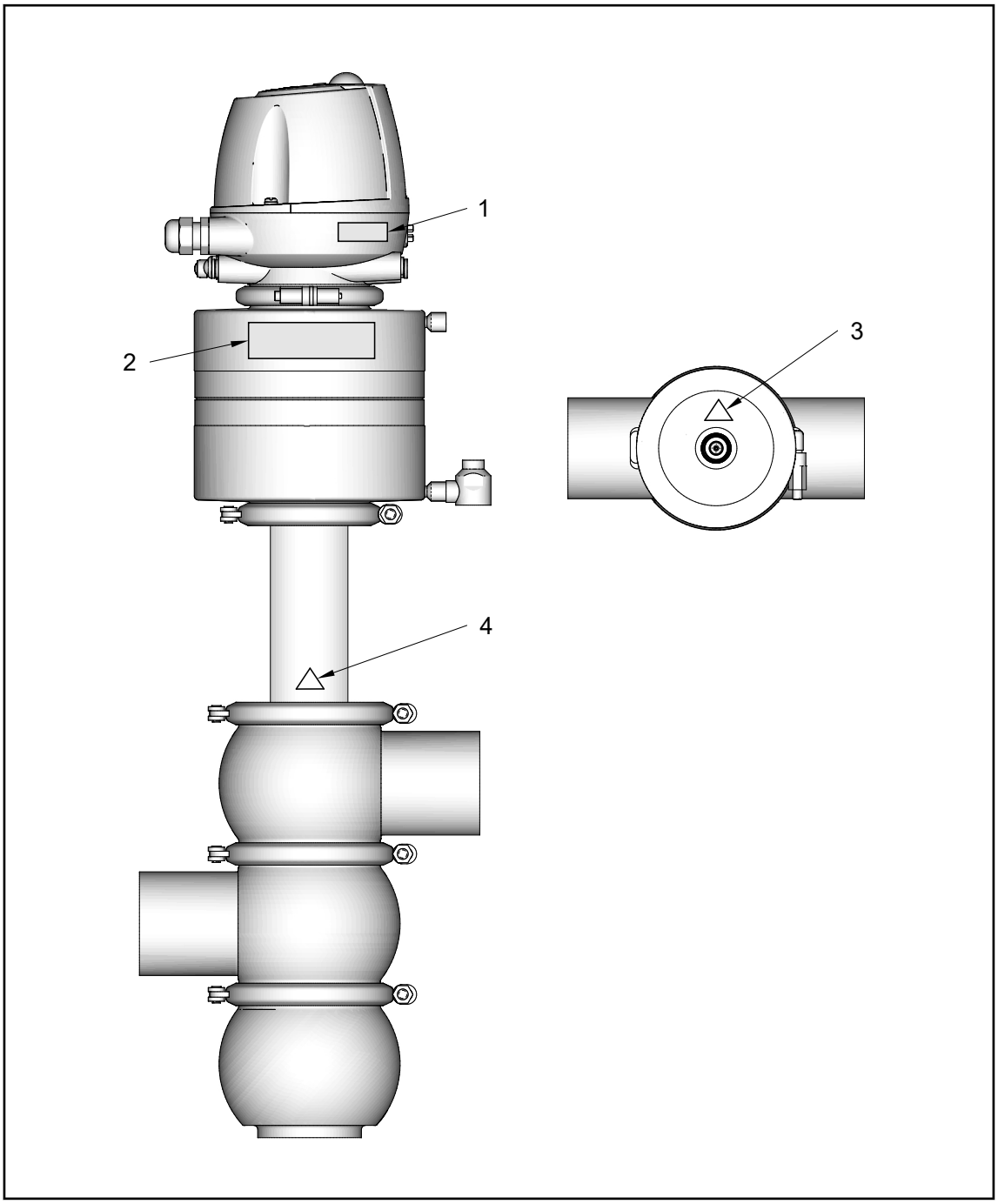
INFO After modification, reset the proximity switches and feedback button!

3.1.3 Signs

Overview and layout

All safety symbols and other signs must meet the following criteria throughout the life cycle of the valve.

- Complete
- Attached as shown
- Clean and legible



No.	Signs
1	Type plate T.VIS; adhered to T.VIS
2	Type plate valve; adhered to actuator
3	Warning: do not open, taut springs; adhered to actuator
4	Warning: crushing (refers to the lantern) adhered to actuator after lantern

The representation and meaning of the safety symbols used are listed in an overview corresponding to their category, see chapter *2.9 Safety signs*

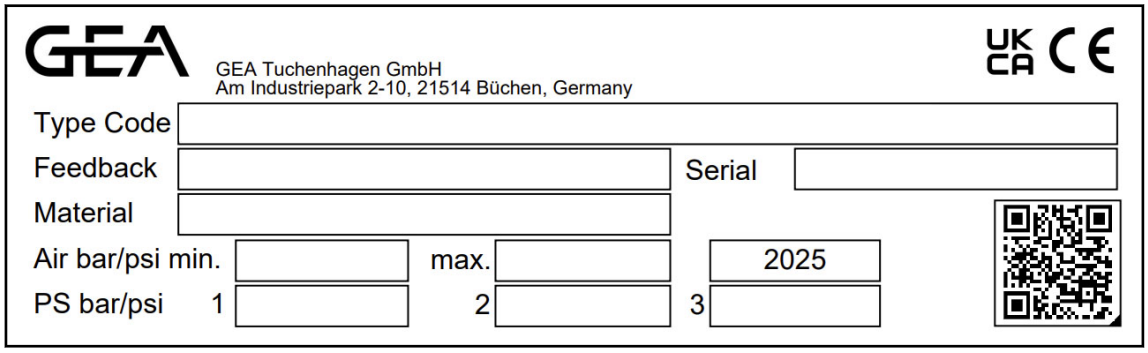
3.1.4 Protective devices

No safety devices are attached to this valve.

3.2 Technical data

3.2.1 Type plate

The type plate clearly identifies the valve.



The type plate provides the following key data:

Key data of the valve

Characteristics	Values
Type code	Valve type
Feedback	Order code control top T.VIS
Serial	Serial number
Material	e.g. 1.4404(AISI316L) / EPDM
Control air pressure bar/psi	6 (87)
Product pressure bar/psi	5 (72.5)

3.2.2 Technical data

Refer to the following tables for the key technical data of the valve:

Technical data: valve

Designation	Description
Size	1" to 6" OD
Material of product contact parts	Stainless steel 1.4404 / 316L (standard)
Fitting position	Any position, if valve and pipe system can drain properly

Technical data: Ambient temperatures

Designation	Description
- Valve	0 to 45 °C (32 to 113 °F), standard < 0 °C (32 °F): Use control air with low dew point. Protect valve rods against freezing.
- Initiator	-20 to +80 °C (-4 to +176 °F)
- Control top type T.VIS M-15, A-15	-20 to +50 °C (-4 to +122 °F)
Product temperature and operating temperature	depending on the sealing material

Table 6: Technical data - Ambient temperatures

Technical data: Compressed air supply, product pressure

Designation	Description
Air hose	
• Metric	Material PE-LD Outside Ø 6 mm (+/- 0.1 mm) Inside Ø 4 mm
• Inch	Material PA Outside Ø 6.35 mm (+/- 0.1 mm) Inside Ø 4.3 mm
Control air	acc. to ISO 8573-1
• 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.

Designation	Description
• Oil content:	Quality class 3 preferably oil free max. 1 mg oil to 1 m^3 air
Control air pressure	6 bar (87 psi), min. 4 bar (58 psi), max. 8 bar (116 psi) Configuration with standard actuator Alternative combinations of product pressure and control air pressure on request
Product pressure	5 bar (72.5 psi) configuration with standard actuator max. 10 bar (116 psi) configuration with correspondingly designed actuator > 10 bar (145.0 psi) for static applications and on request

Table 7: Technical data - Compressed air supply

Valve weights

Size		Weight [kg] per valve (approx.)	Weight [kg] per device (approx.)
Inch OD	OD 1"	10	20
	OD 1.5"	18	36
	OD 2"	18	36
	OD 2.5"	25	50
	OD 3"	25	50
	OD 4"	36	52
	OD 6"	82	164

3.2.3 Resistance and permitted operating temperature of the sealing materials

The resistance and permitted operating temperature of the sealing materials depend 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.

The maximum operating temperature is defined by the seal type and its mechanical load.

Due to the versatile conditions of use (e.g. usage duration, switching frequency, type and temperature of product and cleaning agents as well as usage environment), GEA Tuchenhagen recommends that the user carries out resistance tests.

Resistance:

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

Seal resistance / permissible application temperature of the seal materials

Medium	Maximum operating temperatures	EPDM	FKM	HNBR
Alkalis up to 3%	up to 80 °C (176°F)	+	o	+
Alkalis up to 5%	up to 40 °C (104°F)	+	o	o
Alkalis more than 5%	up to 80 °C (176°F)	+	–	–
Alkalis more than 5%	(no temperature specification)	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 100 °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		–	+	+

Table 8: Resistance and permitted operating temperature of the sealing materials

Temperature resistance of the sealing materials

Sealing materials	General temperature resistance*
EPDM	-40 to +135 °C (-40 °F to 275 °F)
FKM	-10 to +200 °C (+14 °F to +392 °F)
HNBR	-25 to +140 °C (-13 °F to +284 °F)

* The general resistance of the material does not correspond to the maximum operating temperature.

Table 9: Temperature resistance of the sealing materials

3.2.4 Pipe ends - General table of measurements

INFO Not every valve is available in every size. For information about the available sizes of valves, see *3.2.2 Technical data*.

Dimensions for pipes in inch OD

Inch OD	Outside diameter	Wall thickness	Inside diameter	Outside diameter acc. to BS 4825
0.5"	12.7	1.65	9.4	X
0.75"	19.05	1.65	15.75	X
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

Table 10: Dimensions pipe OD

3.2.5 Lubricants

Lubricant designation	Material no.
Rivolta F.L.G. MD-2 (1000 g)	413-071
Rivolta F.L.G. MD-2 (100 g)	413-136

Table 11: Lubricants

4 Storage and transport

This chapter contains information about transporting the valve. It also describes the minimum requirements for storage after delivery and for any necessary intermediate storage.

The target group of this chapter is all persons who carry out actions related to the transport or storage of the valve.

4.1 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.

4.2 Storage

The valves, valve inserts or spare parts should be stored in a dry place, free of vibration and dust, and protected from light. 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 beforehand and suitable measures must be taken to protect it from damage.

INFO We recommend storing at a temperature of ≥ 5 °C for a period of 24 hours prior to any handling (removal of the housing / activation of actuators with compressed air) so that any ice crystals formed by condensation water can melt.

4.3 Transport

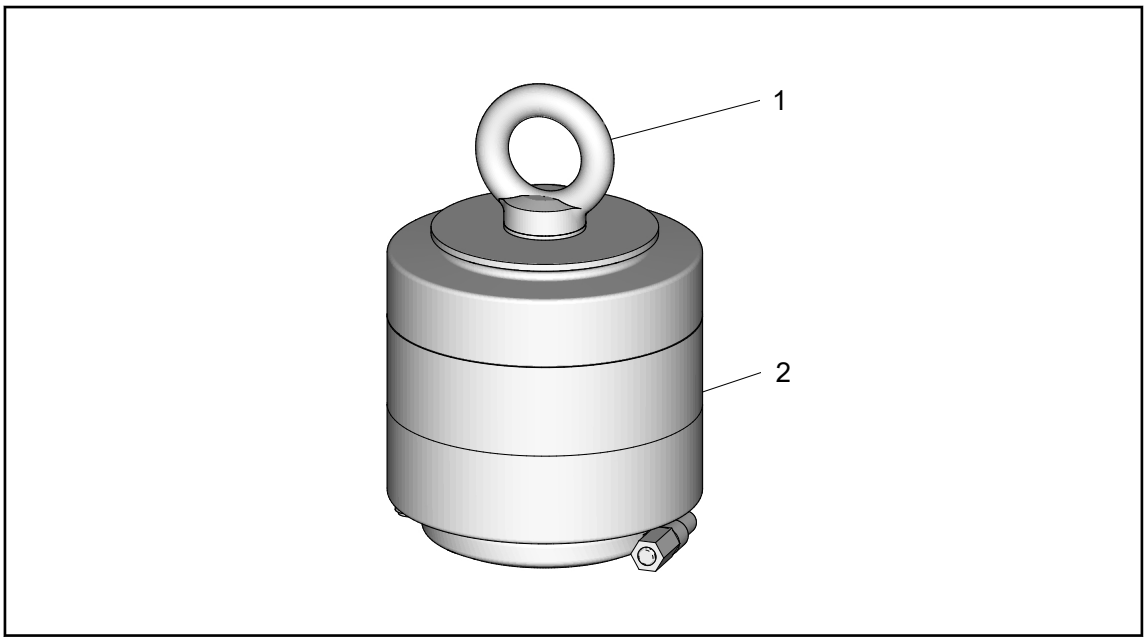


Figure 4-1 - Valve transport

For transport, the following principles apply:

- When transporting the valve be sure to unscrew the control top and the switch bar from the actuator (2) and use the screwed-in eye bolt (1) to lift the valve.
- Only use suitable hoist and slings for transporting the package units/valves.
- 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.
- Control tops must be protected from animal and vegetable fats.
- Only allow qualified staff to transport the valve.
- Movable parts must be properly secured.
- Only use approved, fully functional load lifting devices and lifting accessories which are suitable for the intended purpose. Observe the maximum load-bearing capacities.
- Secure the valve against slipping. Take the weight of the valve and the position of the point of gravity into account, see *Valve weights*.
- 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 jerky movements when putting down the unit.

5 Assembly and installation

This chapter contains information and instructions about the assembly and installation of the valve.

The target group of this chapter is all persons who carry out actions related to the valve.

5.1 Notes on installation

The valve can be installed in any position. Steps must be taken to ensure that the valve housing and the pipe system can drain properly.

If the valve is installed in the horizontal position, pay attention that the vent hole in the actuator is aligned horizontally on one side.

To avoid damage, ensure that the valve is installed into the pipe system without tension and no objects remain in the system after assembly (e.g. tools, screws, lubrication oils).

If the valve is installed horizontally, the stress on the valve stem seals is higher than in the vertical installation position. Therefore, support the actuator and regularly check the valve for leakage.

5.2 Control top

If different valves are operated via a control top, it must be ensured for each of the connected valves that the air supply does not fall below the required operating points.

5.3 Install the valve with detachable pipe connection elements

Prerequisites

- The pipe is drained, and cleaned or rinsed, if necessary.
- The pipe section for the valve to be mounted must be separated from the remaining pipe system.

⚠CAUTION

Liquids in pipes

Danger of injury due to liquid spraying out.

- Therefore, before loosening pipe connections or clamp connections: Drain the pipeline and, if necessary, clean or flush it.
- Separate the pipe section in which the valve is to be fitted from the rest of the piping system to prevent product entering again.

1. Fit valves with detachable pipe connection elements – using suitable connection fittings – directly into the pipe system.

⇒ Valve is installed.

5.4 Install valve with welding ends

Prerequisites

- The pipe is drained, and cleaned or rinsed if necessary.
- The pipe section for the valve to be mounted must be separated from the remaining pipe system.

⚠WARNING

Spring tension in the valve (NC)

Danger of injury when opening the clamp connections on the actuator or on the housing as the released spring pretension will suddenly lift the actuator.

- Therefore, release the spring tension before detaching the clamp connections by supplying the actuator with compressed air at max. 8 bar.

ATTENTION

Sensitive valve parts

Damage to the valve parts can lead to a malfunction.

- Protect the valve parts against impact stress.

ATTENTION

Welding distortions

The housing can warp during welding.

- Tack the pipe sockets of the housings without and gaps and tension to the pipe and housing and weld.

ATTENTION

Stray welding currents during welding

Can cause damage to electronic components

- For avoidance measures, see *Instructions for the Safe Handling of Electronic Components During Welding Work*.

1. Release the spring tension and remove the valve insert, see *9.5.1 Remove control top and withdraw valve insert from housing*.
2. Weld the housing, without seal rings, into position, ensuring that the connection is free of stress.
   - 2.1 Fit the housing into place and tack it. Take the installation position of the valve housing into account, see *9.7.2 Assembly of the housing combination*.
   - 2.2 Flush the housing with forming gas from the inside to push the oxygen out of the system.
   - 2.3 Weld the housing into the pipe system; use welding filler if necessary. Where technically possible, use the WIG-orbital welding process with pulse configuration, according to the EHEDG D.35 guideline.
3. Passivate the seam after welding.
4. Insert the seals.
   → When assembling the valve, always replace the housing O-rings to ensure that the valve is tight.

5. Install the valve insert and depressurise the actuator (A), see *9.7.5 Mount control top and insert valve insert into housing*.

⇒ Install the valve with welded ends.

INFO Welding method: We recommend using the automatic orbital welding method. All welding work should only be performed by certified welders or machine operators (orbital welders).

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

5.5 Electrical connection with T.VIS control top

⚠DANGER

Live parts
Electrical shocks can cause serious personal injuries or death.

- Only allow properly qualified staff to work on the electrical equipment.
- Prior to establishing electrical connections, check the maximum permissible operating voltage.

⚠DANGER

Explosive gases or dusts
An explosion can cause serious personal injuries or death.

- Observe the installation and operating regulations for use in potentially explosive areas!

Prerequisites

- Valve is installed

1. Connect the control top in accordance with the connection diagram and the instructions in the operating instructions for T.VIS control tops.

⇒ Control top is connected.

INFO The proximity switches are set ex-works. Settings can become changed during transport and installation and may need to be reset, see the instruction manual for the control top.

5.6 Checking the pneumatic connection

5.6.1 Air requirement

Actuator type	Actuator Ø [mm]	Air requirement (dm^3_n/stroke) dm^3_n at 1.01325 bar at 0 °C as per DIN 1343
A...	98	0.16
B...	109	0.26
C...	135	0.42
D...	170	0.7
E...	210	1.1
R...[1]	170	1.6
S...[1]	210	2
T...[1]	210	2.2

[1]Actuators with a booster cylinder for increasing the pneumatic actuating force when lower control air pressures are used

5.6.2 Establishing hose connections

INFO To ensure reliable operation, the compressed air hoses must be cut exactly at a right angle.

Tools

- Hose cutter

1. Shut off the compressed air supply.
2. Use the hose cutter to cut the pneumatic hoses at a right angle.
3. Push the air hose into the air connector on the control top.
4. Re-open the compressed air supply.

⇒ Hose connection has been established.

Hose connection diagram with T.VIS control top

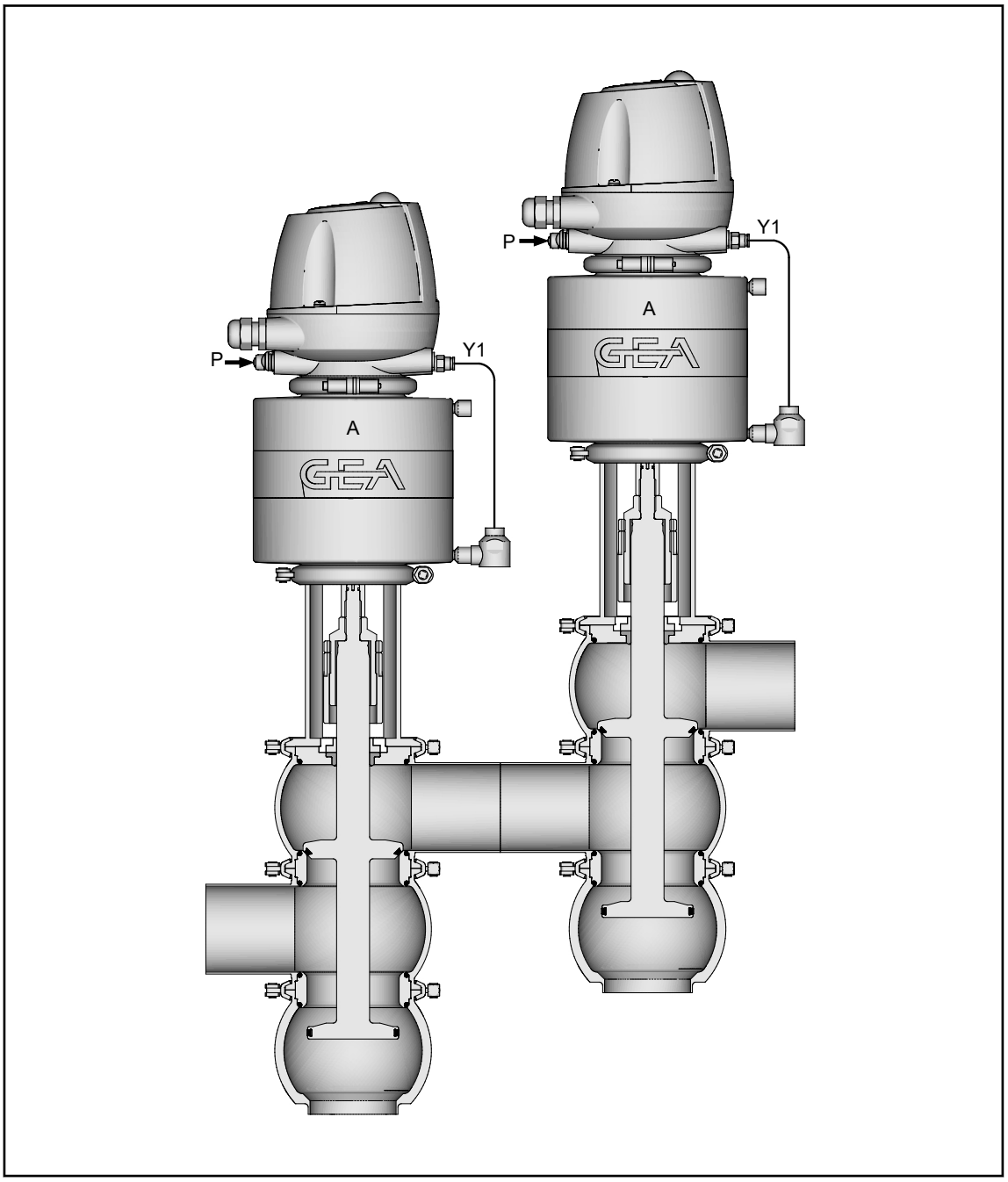


Figure 5-1 - Hose Connection Diagram

Position	Designation
A	Actuator
P	Central air supply
Y1	Outlet

5.6.3 Electrical connection with T.VIS control top

⚠DANGER

Live parts
Electrical shocks can cause serious personal injuries or death.

- Only allow properly qualified staff to work on the electrical equipment.
- Prior to establishing electrical connections, check the maximum permissible operating voltage.

⚠DANGER

Explosive gases or dusts
An explosion can cause serious personal injuries or death.

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⚠DANGER

Explosive gases or dusts
An explosion can cause serious personal injuries or death.

- Observe the installation and operating regulations for use in potentially explosive areas!

Prerequisites

- Valve is installed

1. Connect the control top in accordance with the connection diagram and the instructions in the operating instructions for T.VIS control tops.

⇒ Control top is connected.

INFO The proximity switches are set ex-works. Settings can become changed during transport and installation and may need to be reset, see the instruction manual for the control top.

6 Commissioning

This chapter contains information for the initial and any subsequent commissioning of the valve. It also describes the necessary checks and tests.

The target group of this chapter is all persons who carry out actions related to the valve.

6.1 Preparing commissioning

For initial 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.

Notes on commissioning

Before starting commissioning observe the following:

- Make sure that there are no foreign materials in the system.
- Actuate the valve once by applying compressed air.
- Clean the pipe system prior to the first product run.
- During commissioning, regularly check all sealing points for leaks. Replace defective seals.

6.2 Restarting

The following principles apply for restarting:

- Only allow properly qualified staff to set the valve into operation.
- Make sure all connections are connected properly.
- 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.

7 Operation and control

This chapter contains information on operating and shutting down the valve.

The target group of this chapter is the operators of the valve.

7.1 Monitoring operation

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

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 mounted 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.

7.2 Shutdown

The following principles apply for shutdown:

- Switch off the compressed air.
- Switch off the valve.
- 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.
- In case of longer shut-downs, observe the storage conditions, see *4.2 Storage*.

8 Cleaning

This chapter contains information about cleaning the valve. It also contains information about cleaning intervals and the use of cleaning agents.

The target group of this chapter is all persons who carry out actions related to cleaning the valve.

8.1 General

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 and product.

The cleaning effect must be checked regularly by the operating company!

8.1.1 Cleaning process examples

Typical cleaning parameters in dairy operations

Example of a two-phase cleaning process:

- Sodium hydroxide solution and sodium hydroxide based combination products in concentrations from 0.5% to 2.5% at 75 °C (167 °F) to 80 °C (176 °F)
- Phosphoric or nitric acid, and combination products based thereon in the concentrations of 0.3 % to 1.5% at approx. 65 °C (149 °F).

Example of a cleaning operation in one cleaning step:

- Formic acid and formic acid-based combination products at up to 85 °C (185 °F).

Typical cleaning parameters in breweries

Example of a two-phase cleaning process:

- Sodium hydroxide solution and sodium hydroxide based combination products in concentrations of 1% to 4% at about 85 °C (185 °F).
- Phosphoric or nitric acid, and combination products based thereon in the concentrations of 0.3 to 1.5% at 20 °C (68 °F).

8.1.2 Cleaning results

The cleaning result depends on the following factors:

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

These factors can be combined in such a way as to make an optimal cleaning result probable.

8.2 Passivation

Before a system with long pipes and tanks is commissioned, it usually needs to be passivated.

Valve blocks are usually excepted from this.

Passivation is usually carried out with nitric acid (HNO_3) at about 80 °C (176 °F) in a concentration of 3 % and a contact time of 6 to 8 hours.

9 Maintenance

This chapter contains information about valve maintenance, inspection and repairs.

The target group of this chapter is all persons who carry out actions related to the valve.

9.1 Carrying out inspections

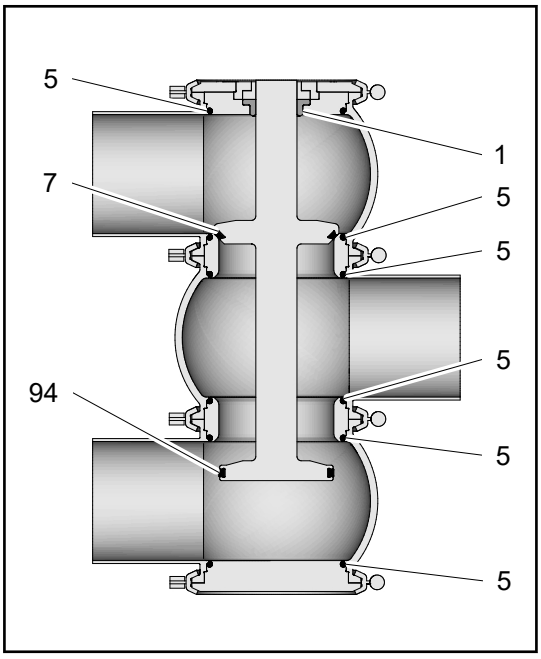
Between the maintenance periods, the valves must be checked for leakage and proper function.

9.1.1 Checking seals that come into contact with the product

Prerequisites

- Access to seals that come into contact with the product

1. Regularly check the seals that come into contact with the product:
   - 1.1 Check the sealing ring (1) between upper housing and lantern.
   - 1.2 Check the V-ring (7) in the valve disks.
   - 1.3 Check the O-rings (5) between the valve housings.



⇒ Seals that come into contact with the product have been tested.

9.1.2 Checking the pneumatic connection

Prerequisites

- Access to the pneumatic connection

1. Check the operating pressure at the pressure reducing and filter station.
2. Regularly clean the air filter in the filter station.
3. Check that the air connections are tight.
4. Check the lines for kinks and leaks.
5. Check the solenoid valves for proper function.

⇒ The pneumatic connection has been checked.

9.1.3 Checking the electrical connection

Prerequisites
- Access to the electrical connection

1. Check that the union nut on the cable gland is tight
2. Check that the cable connections are firmly secured.
3. Check the solenoid valves for proper function.
4. Check that the proximity switch connections are clean.

⇒ The electrical connection has been checked.

INFO The electrical cable must be long enough to allow the control top to be removed via the switch bar!

9.1.4 Checking the signs on the valve

Prerequisites
- Valve is accessible

1. Check the signs on the valve, see also *3.1.3 Signs*.
2. If necessary, replace damaged or missing labels with new labels.

⇒ The signs on the valve have been checked.

9.2 Servicing intervals

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

The actual servicing intervals can only be determined by the operating company 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

Servicing intervals

Applications	Servicing 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

9.3 List of tools

www.assets.gea.com

Link to the service catalogues "Maintenance of valves and pumps"

Tool list- VARIVENT® single-seated valves type X, X_V, X_R

Nominal width	Tool	Part number	Intended Purpose
DN 25 - DN 50 OD 1" - OD 2" IPS 2"	Jaw wrench 10 x 11 mm	408-033	Remove clamp connection
	Jaw wrench 12 x 13 mm	408-034	Remove clamp connection
	Jaw wrench 14 x 17 mm	408-045	
	Jaw wrench 17 x 19 mm (ground)	229-119.01	Remove valve disk
	Jaw wrench 21 x 23 mm (ground)	229-119.05	Remove valve disk
DN 65 - DN 100 OD 2.5" - OD 4" IPS 3" - IPS 4"	Jaw wrench 12 x 13 mm	408-034	Remove clamp connection
	Jaw wrench 17 x 19 mm (ground)	229-119.01	Remove clamp connection
	Jaw wrench 21 x 23 mm (ground)	229-119.05	Remove valve disk
DN 125 - DN 150 OD 6" IPS 6"	Jaw wrench 12 x 13 mm	408-034	Remove clamp connection
	Jaw wrench 17 x 19 mm (ground)	229-119.01	Remove clamp connection
	Jaw wrench 22 x 24 mm	229-119.03	
	Jaw wrench 30 x 32 mm	408-041	Remove valve disk
All nominal widths	Torque wrench bit 6.3 (1-5 Nm)	408-449	Half-rings control top assembly
All nominal widths	Torque wrench ¼" (2.5-25 Nm)	408-424	Fit the clamp connection
All nominal widths	Torque wrench for plug-in tool size 1 (2.5-25 Nm)	408-494	Mount the switch bar
All nominal widths	V-ring insertion tool	229-109.88	Mount the V-rings
All nominal widths	Hex key, size 3	408-121	Half-rings T.VIS disassembly / assembly
All nominal widths	Eyebolt T.VIS	221-104.98	Transport the valve

Nominal width	Tool	Part number	Intended Purpose
All nominal widths	Screwdriver cross recess size 1		Actuate (Y1) on manual operating element (S)
All nominal widths	Screwdriver cross recess size 2	406-125	Hood T.VIS disassembly / assembly
All nominal widths	Hose cutter	407-065	
All nominal widths	Belt wrench	408-142	Releasing actuator
All nominal widths	Vice support	470-001	
All nominal widths	Scriber 250 mm	414-001	For removing seals

9.4 Prior to removal

Prerequisites

- Ensure that no active processes are running in the relevant area during maintenance and servicing work .

1. Drain all pipe system elements that lead to the valve and, if necessary, clean or rinse them.
2. Disconnect the power supply.
3. Take the valve out of the pipe section, with all housings and housing connections if possible.

9.5 Removing the valve

The following description refers to a standard-version valve with control top T.VIS.

INFO For valves without control top, refer to *9.5.2 Remove valve insert without control top from housing*.

The design, tools used and torques required can deviate from the description for other nominal widths. The relevant information can be found in these operating instructions.

The use of a workbench with vice is recommended.

9.5.1 Remove control top and withdraw valve insert from housing

Prerequisites

- The pneumatic and electrical connections on the plant side can remain on the control top.

⚠WARNING

Spring tension in the valve (NC)

Danger of injury when opening the clamp connections on the actuator or on the housing as the released spring pretension will suddenly lift the actuator.

- Therefore, release the spring tension before detaching the clamp connections by supplying the actuator with compressed air at max. 8 bar.

ATTENTION

The shaft of the valve disc and double disk are sealing surfaces and must not be damaged.

Damage to these parts can cause malfunction.

- Carefully remove valve disk and double disc from housing.

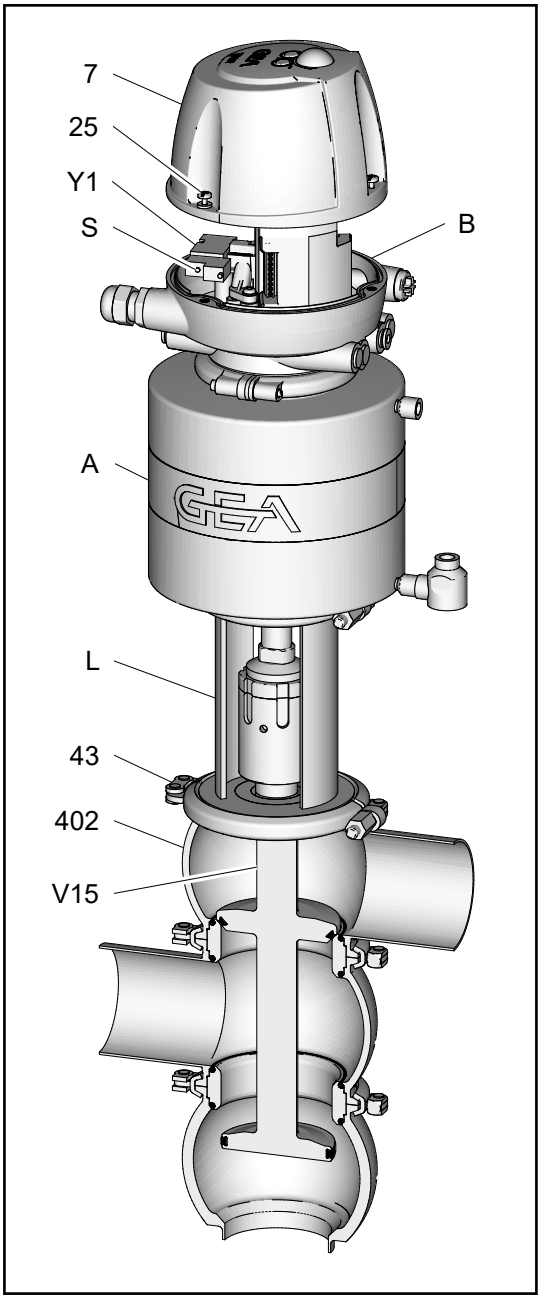
ATTENTION

The switch bar is sensitive and must be protected from impact stress.

Damage to switch bar.

- Protect the switch bar against impact stress.

1. Disconnect the cleaning hose (R).
2. Release the Philips screws (25) and take off the cap (7).
3. Pressurize the actuator with compressed air (max. 8 bar) - by activating the solenoid valve (Y1) at the manual operating element (S).
   → The valve disk (V15) is raised.
   INFO Alternatively, the solenoid valve (Y1) can also be actuated by the plant-side central controller provided by the plant operator. This is particularly beneficial if several valves are to be actuated at the same time.



4. **ATTENTION**
   Before fully removing clamp connection (43), ensure the valve is depressurised.
   - To do this, loosen but do not remove clamp connection (43).
   - Then check if the valve insert can move freely within housing (402). This is only possible if the valve is fully depressurised.
   - Then remove clamp connection (43) between housing (402) and lantern (L).
5. Depressurize the actuator (A) by deactivating the solenoid valve (Y1) at the manual operating element (S).
   → The valve disk (V15) is lowered and the valve insert is pushed out of the housing (402).

6. Release the clamp connection (B12) and pull the control top (B) up and off. The feedback signal of the control system is interrupted. For further information see "Operating instructions for control tops".
   → Control top is removed.
7. Unscrew and remove the switch bar (1) using a jaw wrench (1.2).

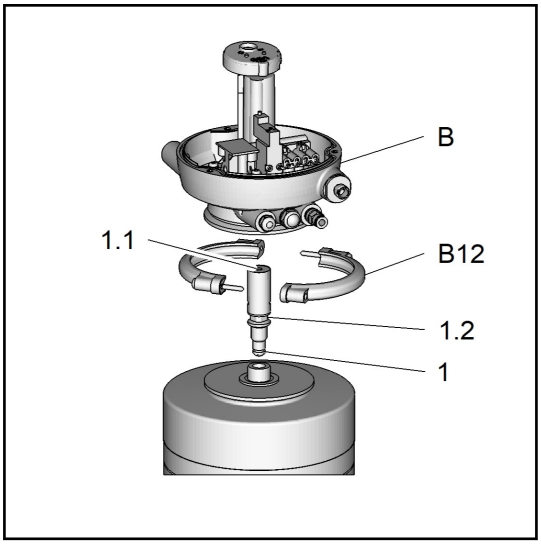
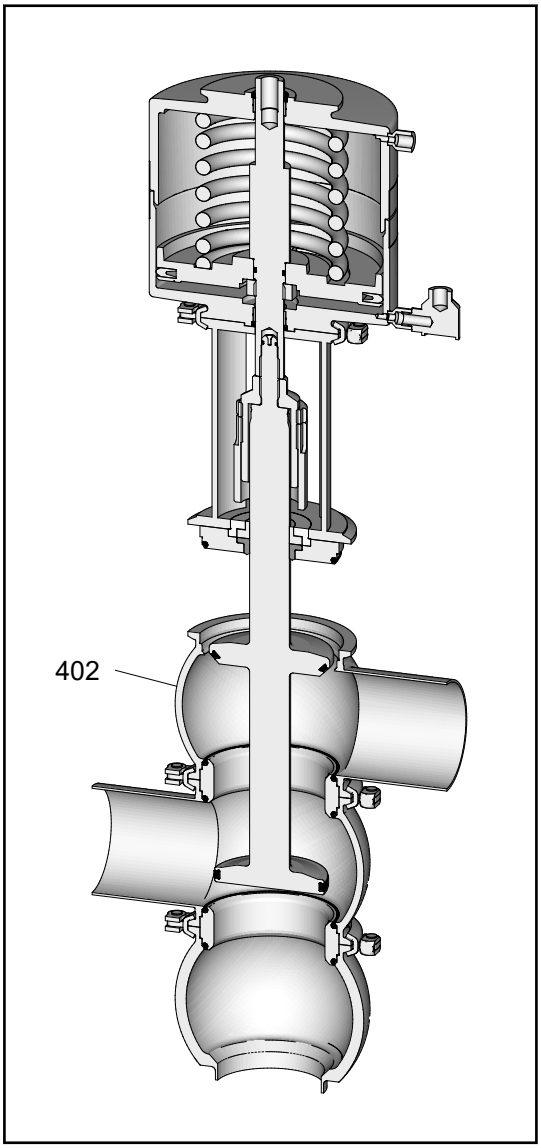


Figure 9-1 - Removing the control top

8. Carefully remove the valve insert out of the housing (402).

→ The valve insert has been disconnected from the housing.



⇒ The control top is removed and the valve insert is disconnected from the housing.

9.5.2 Remove valve insert without control top from housing

Connection 0 – with angled push-in fitting (W)

Prerequisites

- Connection "0" is present

⚠WARNING

Spring tension in the valve (NC)

Danger of injury when opening the clamp connections on the actuator or on the housing as the released spring pretension will suddenly lift the actuator.

- Therefore, release the spring tension before detaching the clamp connections by supplying the actuator with compressed air at max. 8 bar.

ATTENTION

The shaft of the valve disc and double disk are sealing surfaces and must not be damaged.

Damage to these parts can cause malfunction.

- Carefully remove valve disk and double disc from housing.

1. Disconnect the cleaning hose (R).
2. Pressurise actuator (A) at (Y) with compressed air (max. 8 bar).
   → The valve disk (V15) is raised.
3. **ATTENTION**
   Before fully removing clamp connection (43), ensure the valve is depressurised.
   - To do this, loosen but do not remove clamp connection (43).
   - Then check if the valve insert can move freely within housing (402). This is only possible if the valve is fully depressurised.
   - Then remove clamp connection (43) between housing (402) and lantern (L).
4. Depressurise the actuator (A) at (Y).
   → The valve disk (V15) is lowered and the valve insert is pushed out of housing (402).
5. Loosen and remove clamp connection (B12) at actuator cover (138).
6. Loosen air connection (117) with jaw wrench and unscrew.
7. Remove actuator cover (138) with air connection (117) from actuator.
8. Carefully remove the valve insert out of the housing (402).

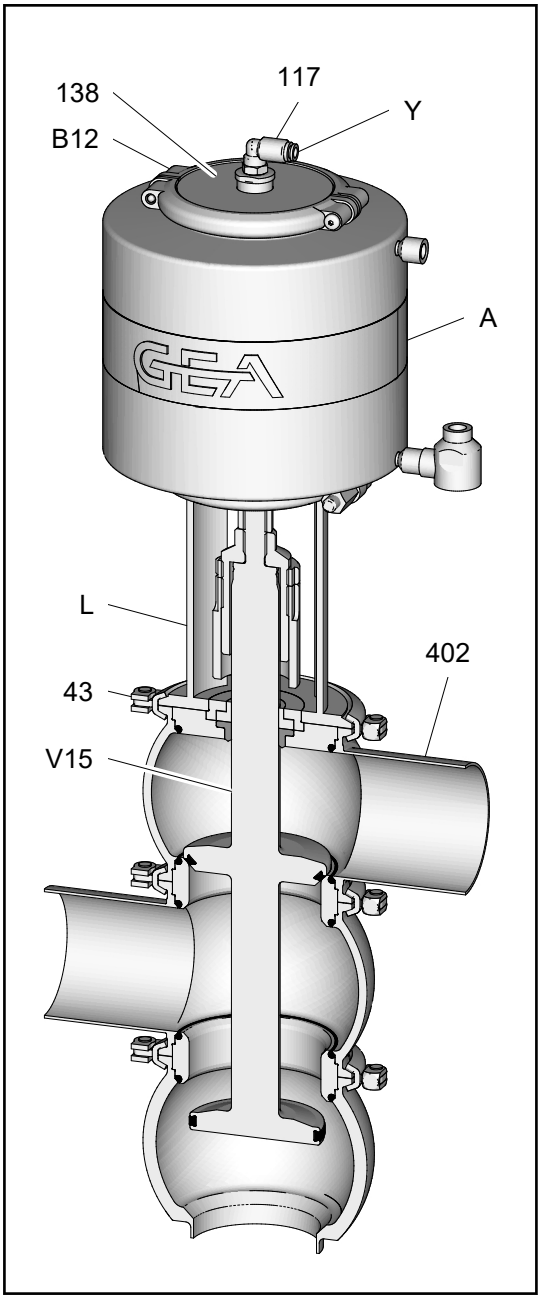


Figure 9-2 - Valve with connection 0 [angled push-in fitting (W)]

⇒ The valve insert has been disconnected from the housing.

Connection INA – Initiator mounting on actuator

Prerequisites

- Connection "INA" is present

⚠WARNING

Spring tension in the valve (NC)

Danger of injury when opening the clamp connections on the actuator or on the housing as the released spring pretension will suddenly lift the actuator.

- Therefore, release the spring tension before detaching the clamp connections by supplying the actuator with compressed air at max. 8 bar.

ATTENTION

The shaft of the valve disc and double disk are sealing surfaces and must not be damaged.

Damage to these parts can cause malfunction.

- Carefully remove valve disk and double disc from housing.

1. Disconnect cleaning hose (R).
2. Pressurise actuator (A) at (Y) with compressed air (max. 8 bar).
   → The valve disk (V15) is raised.
3. **ATTENTION**
   Before fully removing clamp connection (43), ensure the valve is depressurised.
   - To do this, loosen but do not remove clamp connection (43).
   - Then check if the valve insert can move freely within housing (402). This is only possible if the valve is fully depressurised.
   - Then remove clamp connection (43) between housing (402) and lantern (L).
4. Depressurise actuator (A) at (Y).
   → The valve disk (V15) is lowered and the valve insert is pushed out of housing (402).
5. Loosen and remove clamp connection (B12) at actuator cover (138).
6. Unscrew and remove the air connection (246) with a jaw wrench.
7. Remove actuator cover (138) and initiator mounting INA (243) from actuator (A).
8. Carefully remove the valve insert out of the housing (402).

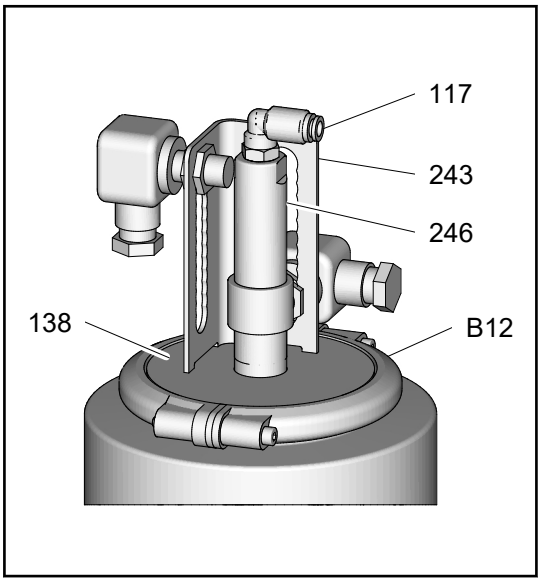


Figure 9-3 - Valve with connection INA [initiator mounting on actuator]

⇒ The valve insert has been disconnected from the housing.

9.5.3 Separating the valve insert from the actuator

Prerequisites

- The valve insert has been disconnected from the housing.

Tools

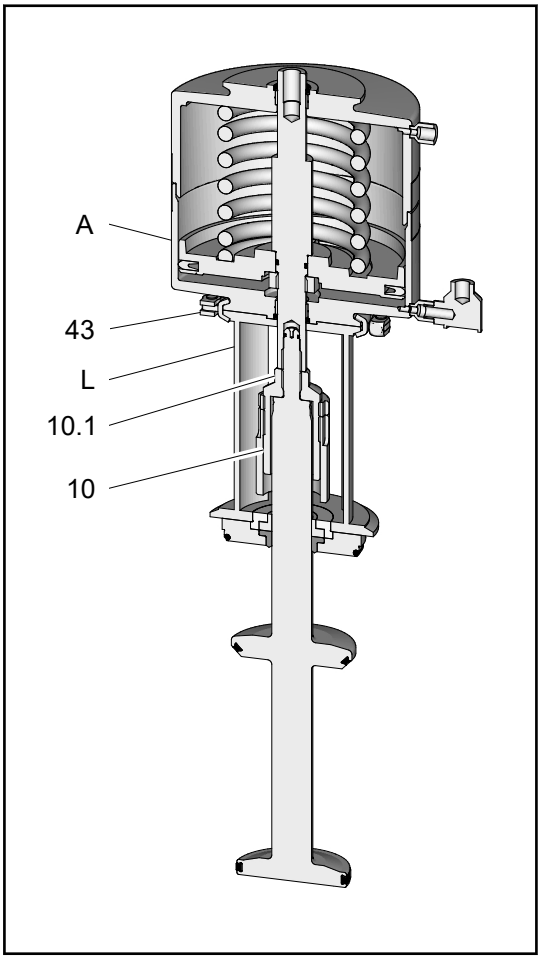
- Mounting tool VT
- Pin punch with handle 6 mm
- Belt wrench

ATTENTION

The surfaces of the valve disc are product-contact and must not be damaged.
Damage to these parts can result in malfunction.

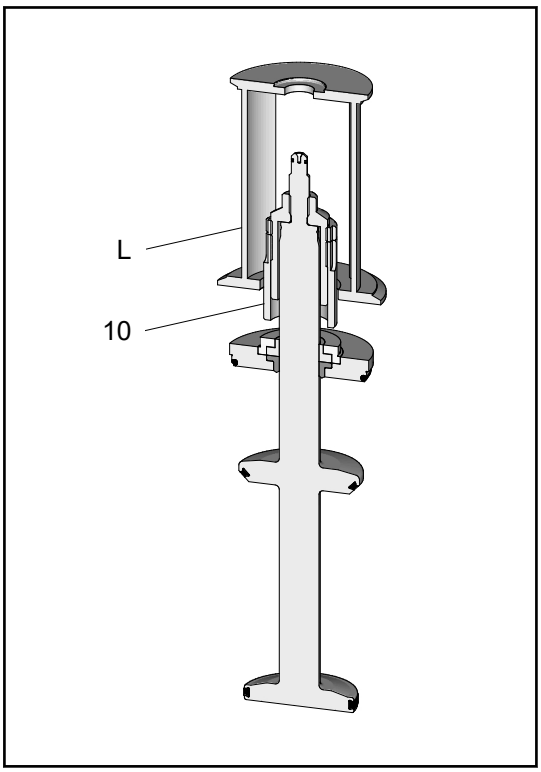
- Bearing and sealing washers must not strike the double disc shaft during removal.

1. Loosen clamp connection (43) between actuator (A) and lantern (L).
   → The lantern can be turned to allow the jaw wrench to be positioned to release the lock nut (10).
2. Hold the lock nut (10) tight on the wrench flat surface (10.1) with a jaw wrench.
3. Loosen actuator (A) using strap wrench and unscrew by hand from valve insert.



4. Carefully remove lantern (L) from valve insert.

→ While doing this, tilt the lantern (L) over the limit stop (10) and pull it upwards at an angle.



⇒ The valve insert has been removed from the actuator.

9.5.4 Dismantling the valve insert

Prerequisites

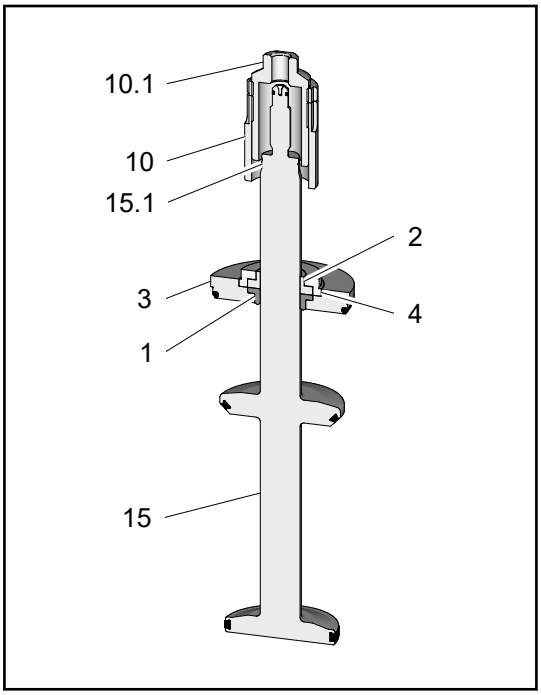
- The valve insert is disconnected from the actuator (A) and lantern (L).

ATTENTION

The surfaces of the valve disc are product-contact and must not be damaged.
Damage to these parts can result in malfunction.

- Bearing and sealing washers must not strike the double disc shaft during removal.

1. Screw the limit stop (10) off the valve disk.
2. Release the lock nut (10) using 2 jaw wrenches on the wrench flat surface of the lock nut (10.1) and the wrench flat surface of the valve disk (15.1) from the valve disk (15) and unscrew.
3. Pull off the bearing disk (4) with the bearing (2) and the sealing washer (3) with the gasket (1) from the valve disk.



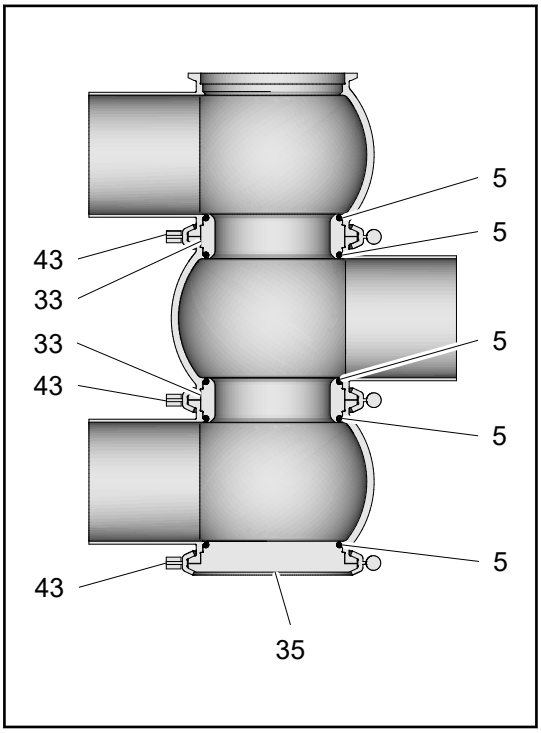
⇒ Valve insert has been disassembled.

9.5.5 Dismantling of the housing combination

Prerequisites

- Loose housing combination available

1. Remove the clamp connections (43) between the housings and the seat rings (33).
2. Remove the clamp connections (43) on the lower housings and remove the blanking plate (35).



⇒ Housing combination is disassembled.
All seals are freely accessible.

9.6 Maintenance

9.6.1 Cleaning the valve

Prerequisites

- The valve has been removed, see *9.5 Removing the valve*.

ATTENTION

Damage to precision areas

The stem of the valve disk, the housing seat, the valve insert and the V-ring groove are precision parts. Damage to these valve components can lead to malfunction.

- Handle the valve with care!

ATTENTION

Damage to the valve

Damage to the valve parts can result in a malfunction.

- Observe the safety information sheets issued by the detergent manufacturers!
- Only use detergents which are non-abrasive and not aggressive towards stainless steel.
- Use only cleaning mediums which do not damage the materials of the control top (PPE, PA).

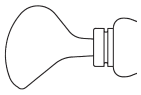
1. Carefully clean the individual parts.

⇒ The valve has been cleaned.

INFO Observe the safety data sheets supplied by the detergent manufacturers. Only use detergents which are non-abrasive and not aggressive towards stainless steel.

9.6.2 Replacing seals

INFO Replace defective seals, but always fit new housing O-rings to ensure the tightness of the valve. Always use genuine spare parts.



V-ring insertion tool

Prerequisites

- The valve has been removed, see *9.5 Removing the valve*.
- V-ring groove must be clean and dry.
- Insert V-Ring without grease.

Tools

- Pickset
- V-ring insertion tool
- Vice support

⚠CAUTION

Sharp-edged tool

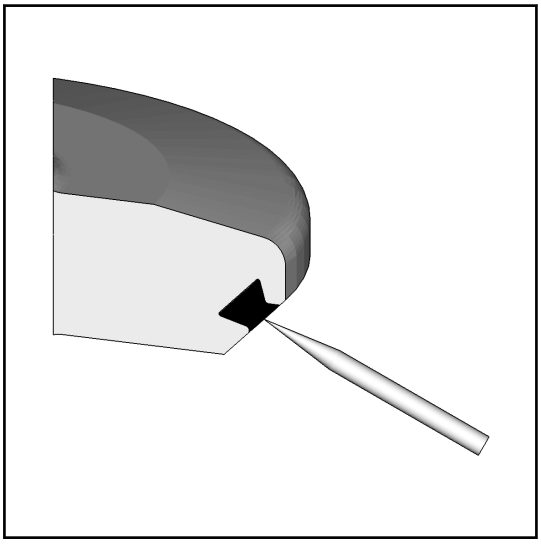
Risk of injury if the pickset tool slips when removing the V-ring.

- Clamp the valve disk with the vice mount into the vice.

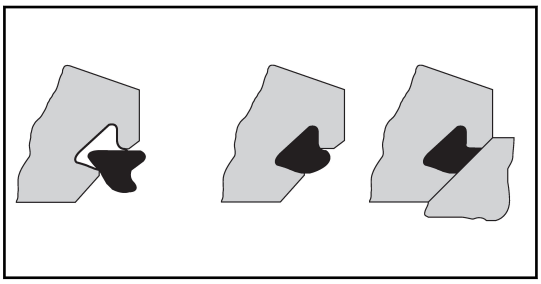
INFO Functional and running surfaces of the valves may not be damaged.

INFO Do not grease the V-ring. To facilitate fitting, use water with a drop of washing-up liquid to remove the surface tension. To ensure that no rust is transferred, the washing-up liquid solution must be mixed in a ceramic, plastic, or stainless steel container.

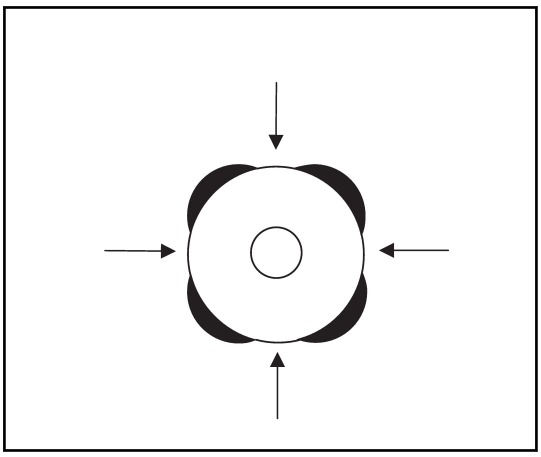
1. Put a tool from the pickset into the V-ring and take it out.



2. Check the V-ring groove: it must be clean and dry.
3. Wet the V-ring with water before fitting.
4. Put in the V-ring. Make sure the installation position of the V-ring is correct.



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



6. Insert the V-ring evenly.

⇒ V-ring has been exchanged.

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

Prerequisites

- The valve has been removed, see *9.5 Removing the valve*.
- Insert V-ring without grease. To facilitate fitting, use water with a drop of washing-up liquid to remove the surface tension. To ensure that no rust is transferred, the washing-up liquid solution must be mixed in a ceramic, plastic, or stainless steel container.

Tools

- V-ring insertion tool
- Pickset
- Vice support

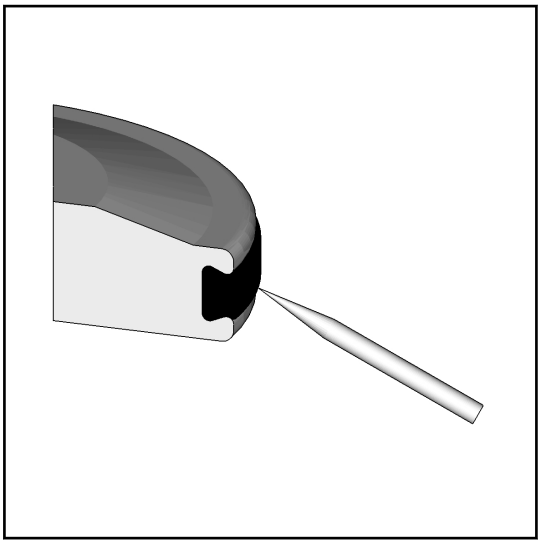
⚠CAUTION

Sharp-edged tool

Risk of injury if the scriber slips when removing the V-ring.

- Grip the valve disk in a vice with protected jaws.
- Unscrew the curved side of the scriber.

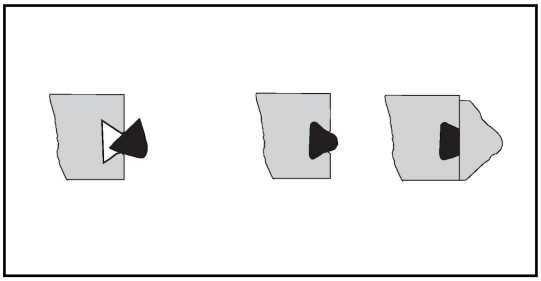
1. Use a scriber to puncture the V-ring and take it out.



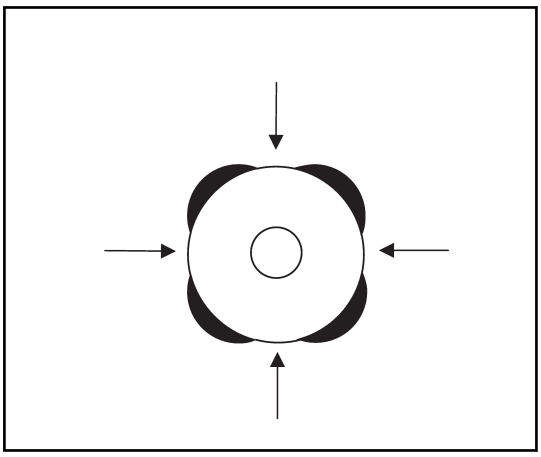
2. Check the V-ring groove: it must be clean and dry.
3. Before fitting, wet V-ring RA with water on the side not in contact with product (rear side).
4. **INFO**

   Ensure that the installation position of the V-ring is correct.

   Insert the V-ring RA.



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



6. Insert the V-ring evenly.
7. Replace all the other seals identified in the spare parts lists.

⇒ V-ring has been exchanged.

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

Replacing more seals

Prerequisites

- The valve has been removed, see *9.5 Removing the valve*.

INFO For nominal widths up to DN 50 or 2”, different seals may be required. For further details and small nominal width please refer to the spare parts list.

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

1. Insert all other seals.

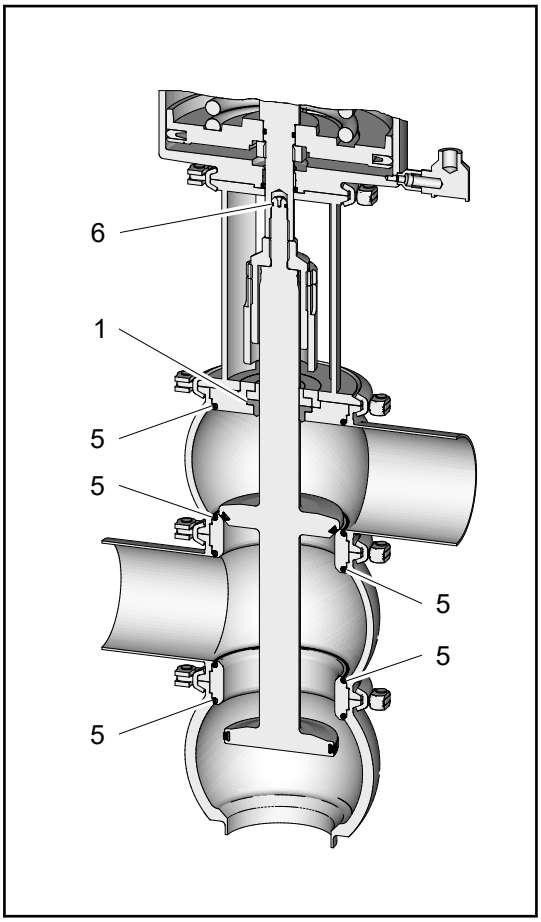


Figure 9-4 - Other Seals

9.6.3 Lubricating seals and threads

Prerequisites

- The valve has been removed, see *9.5 Removing the valve*.

Tools

- Lubricants Rivolta F.L.G. MD-2 and PARALIQ GTE

ATTENTION

Damage to seals and threads

Stainless steel threads tend to seize and stick, and must be greased. Damage to seals and threads can result in 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 data sheets issued by the lubricant manufacturer.

1. Apply a light film of lubricant to all threads.
2. Grease all seals – including the O-rings at the top and bottom of the actuator piston stem – very thinly.
   → Do not grease the V-ring.
3. Grease the inside of the seal ring (1) (contact surface).

⇒ Seals and threads have been lubricated.

INFO 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. They do not affect the taste or the consistency of the products and are compatible with the seals in contact with product. Rivolta F.L.G. MD-2 can be ordered from GEA Tuchenhagen. 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!

9.7 Installing the valve

General notes

The following description refers to a standard-version valve with control top T.VIS.

INFO For valves without control top, refer also to *9.7.6 Insert valve insert into housing without control top*.

The design, tools used and torques required can deviate from the description for other nominal widths. The relevant information can be found in these operating instructions.

The use of a workbench with vice is recommended.

It is assumed that all the seals have already been replaced. Refer in this contact to the chapter on maintenance: *9.6.2 Replacing seals*

9.7.1 Tightening torques

Tighten the following valve connections to the torques specified in the table.

Tightening torques		[Nm]	[lbft]
Valve disk	M14	45	33
Spacer nut	M14	80	59
INI holder	M34	60	44.2
Switch bar	M14	2-2.5	1.5-1.8
Clamps on the control top	M14	1	0.7
Cap		1	0.7
Clamp connection (Cast clamps)	M6	8	5.9
	M8	15	11
	M10	45	33

9.7.2 Assembly of the housing combination

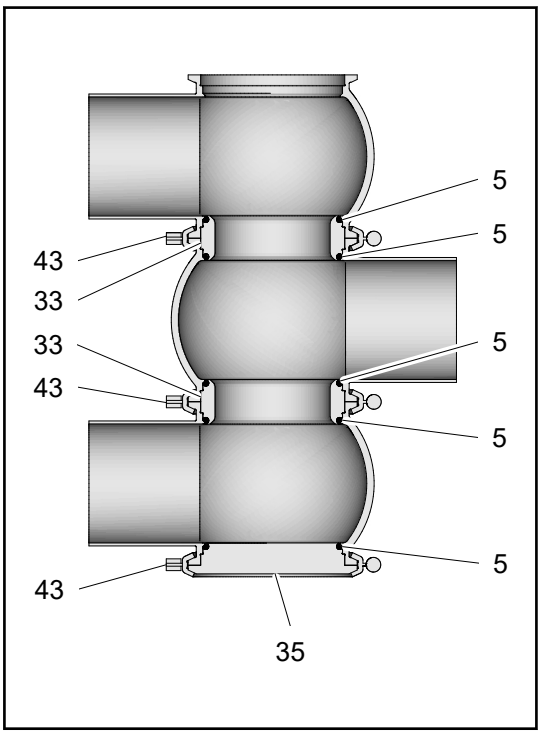
Prerequisites

- Loose housing combination available

Tools

- Torque wrench ¼" (2.5-25 Nm)

1. Equip seat rings (33) with O-rings (5) and place between the housings.
2. Mount the clamp connections (43) between the housings.
   → Ensure that the clamp connections (43) are firmly installed using the required torque.
3. Equip the blanking plate (35) with the O-ring (5) and insert into the lower housing and mount with the clamp connection (43).
   → Ensure that the clamp connection (43) is firmly installed using the required torque.



⇒ Housing combination is assembled.

9.7.3 Assembling the valve insert from individual parts

Prerequisites

- The maintenance work on the valve has been completed.
- All parts of the valve have been cleaned.
- All seals have been replaced. Also see chapter *9.6.2 Replacing seals*
- All threads are lightly greased.

ATTENTION

The surfaces of the valve disc and double disc are product-contact and must not be damaged.

Damage to these parts can result in malfunction.

- Components must not strike the shaft of the double disk.

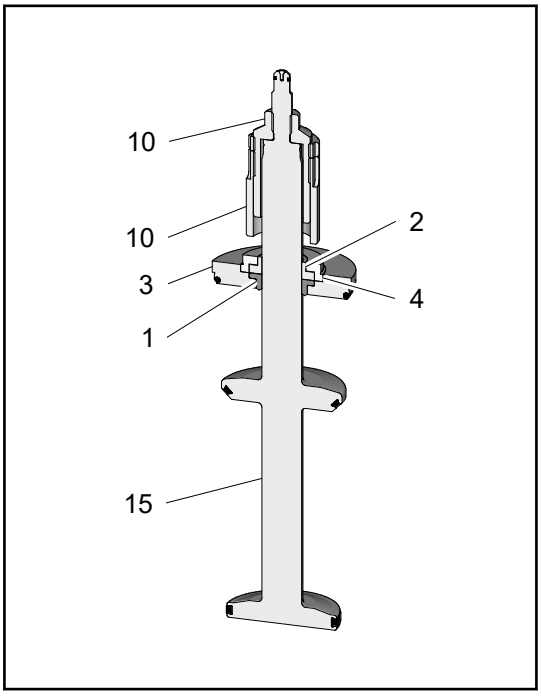
ATTENTION

Sensitive sealing surfaces in the actuator

The sealing surfaces on the cylinder can become damaged.

- Take care no dirt enters the actuator.

1. Push the bearing disk (4) with bearing (2) and seal disk (3) with seal ring (1) onto the valve disk (15).
2. Screw the lock nut (10) to the valve disk (15) using 2 jaw wrenches.
   → Observe torques, see table ‘Tightening torques’. .
3. Screw the limit stop (10) onto the valve disk.



⇒ The valve insert is assembled from individual parts.

9.7.4 Assemble valve insert with actuator

Prerequisites

- Valve insert has been fitted.

Tools

- Mounting tool VT
- Pin punch with handle 6 mm
- Belt wrench

ATTENTION

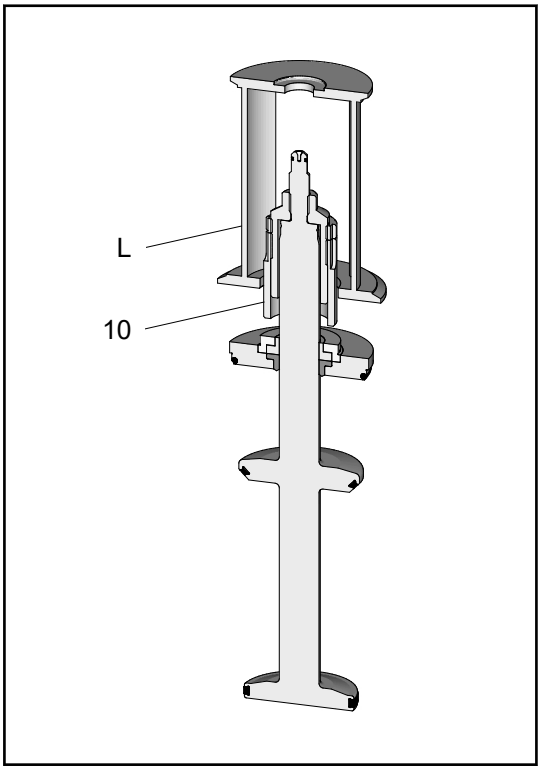
The surfaces of the valve disc and double disc are product-contact and must not be damaged.

Damage to these parts can result in malfunction.

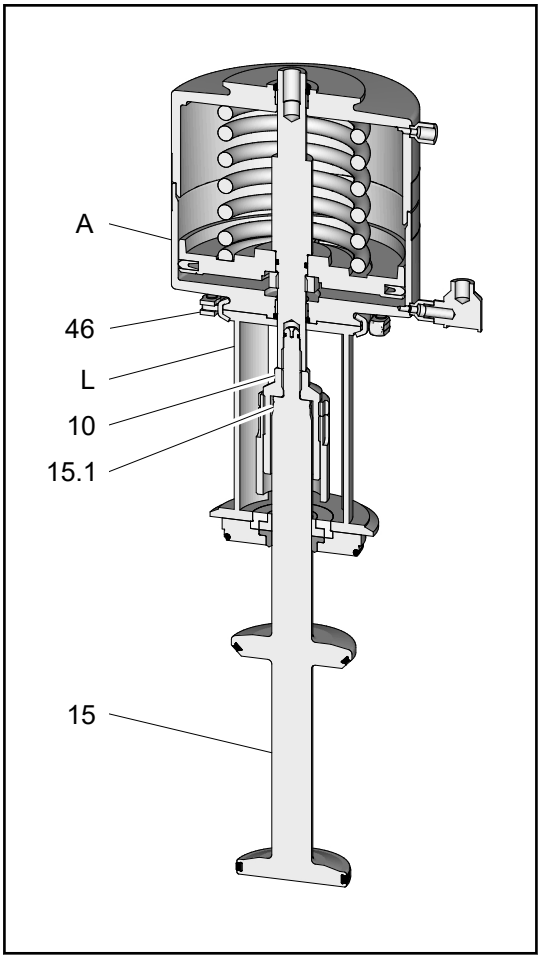
- Components must not strike the shaft of the double disk.

1. Guide the lantern (L) carefully over the valve insert.

→ While doing so, tilt the lantern (L) at an angle and guide it over the limit stop (10) from above.



2. Place the actuator (A) onto the valve disc (15) and connect to the limit stop(10). Then tighten actuator (A) using a strap wrench.
   → While doing so, hold the valve disk (15) tight on the wrench flat surface (15.1).
3. Mount the clamp connection (46) between the actuator (A) and the lantern (L).
   → Ensure that the clamp connection (46) is firmly installed using the required torque.



⇒ The valve insert is assembled with actuator.

9.7.5 Mount control top and insert valve insert into housing

Prerequisites

- The valve insert is assembled with actuator

ATTENTION

The shaft of the valve disc and double disk are sealing surfaces and must not be damaged.

Damage to these parts can cause malfunction.

- Carefully insert valve disc and double disc into the housing.

ATTENTION

The permanent magnet on the switch bar is fragile.

Damage to the permanent magnet.

- Protect the permanent magnet against impact stress.

1. Guide the valve insert carefully through the upper housing (402) until the seal disk (V5) with seal ring (V1) fits snugly in the upper housing (402).

→ The valve insert has been inserted into the housing.

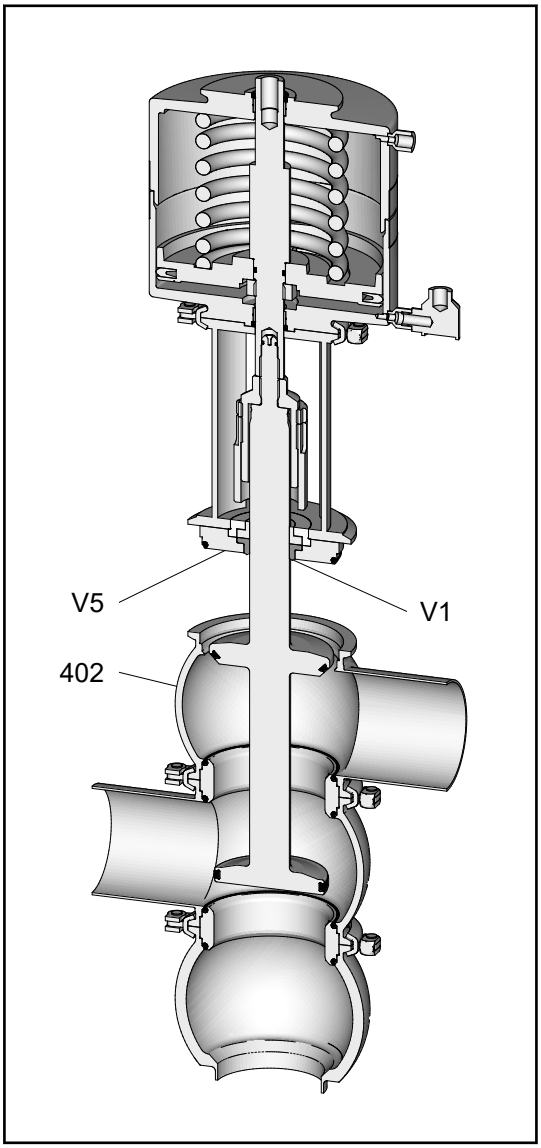


Figure 9-5 - Valve insert in the housing

2. Screw the switch bar (1) into the piston rod and tighten with torque.
3. Fit control top (B) from above onto actuator (A).
4. Install clamp connection (B12) on control top (B) and tighten to specified torque.
   → Control top is fitted.

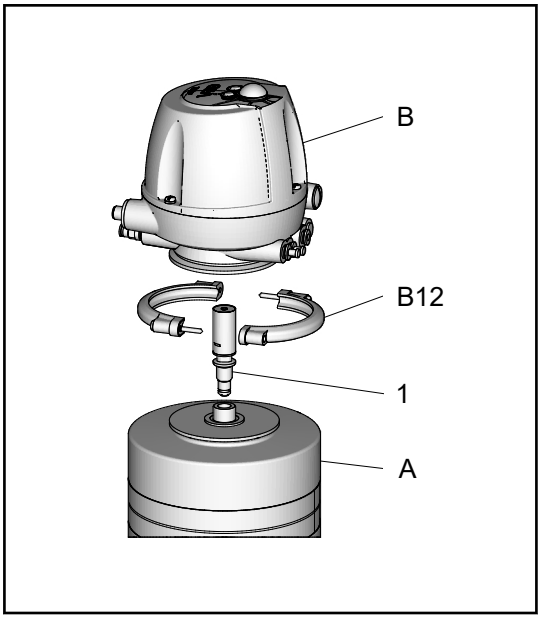


Figure 9-6 - Fitting the control top

5. Pressurize the actuator (A) with compressed air (max. 8 bar) - by activating the solenoid valve (Y1) at the manual operating element (S).
   → The valve disk (V15) is lifted, the valve insert is lowered into the housing (402).
6. Mount lantern (L) with clamp connection (43) to the upper valve housing.
   → Ensure that the clamp connection (43) is firmly installed using the required torque.
7. Depressurize the actuator (A) again by deactivating the solenoid valve (Y1) at the manual operating element (S).
   → The valve disk (V15) is lowered.
8. Place the hood (7) on the control top (B) and fasten using Philips screws (25).

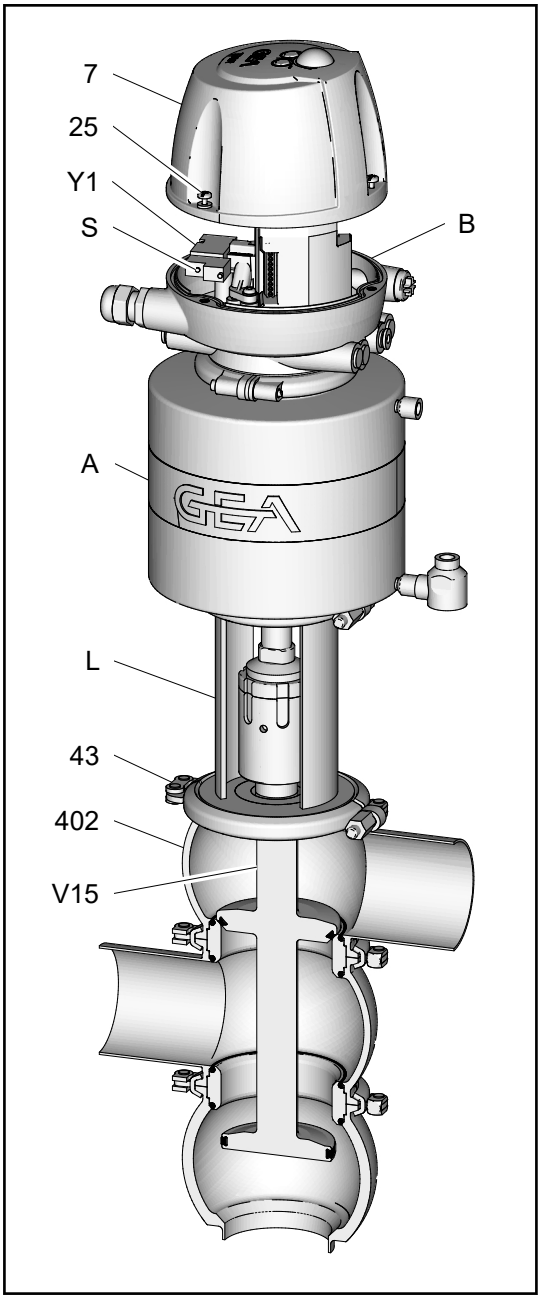


Figure 9-7 - Valve cpl.

9. **INFO**
   Before the hood (7) is fixed in place, check the valve stroke. Refer here to *9.7.7 Checking the function*

⇒ Valve has been completely assembled.

9.7.6 Insert valve insert into housing without control top

Fit connection 0 - with male screw-plug connection (W)

Prerequisites

- The valve insert is assembled with actuator
- Connection "0" is present

⚠WARNING

Spring tension in the valve (NC)

Danger of injury when opening the clamp connections on the actuator or on the housing as the released spring pretension will suddenly lift the actuator.

- Therefore, release the spring tension before detaching the clamp connections by supplying the actuator with compressed air at max. 8 bar.

ATTENTION

The shaft of the valve disc and double disk are sealing surfaces and must not be damaged.

Damage to these parts can cause malfunction.

- Carefully remove valve disk and double disc from housing.

1. Guide the valve insert carefully through the upper housing (402) until the seal disk (V5) with seal ring (V1) fits snugly in the upper housing (402).
2. Set the actuator cover (138) with air connection (117) in place at the top on actuator (A).
3. Fit the hinged clamp (B12) between actuator cover (138) and actuator (A) and tighten with torque.
4. Apply compressed air to the actuator (A) at (Y) (max. 8 bar).
   → The valve disk (V15) is lifted, the valve insert is lowered into the housing (402).
5. Mount lantern (L) with clamp connection (43) to the upper valve housing.
   → Ensure that the clamp connection (43) is firmly installed using the required torque.
6. Depressurize the actuator (A) at (Y).
   → The valve disk (V15) is lowered.

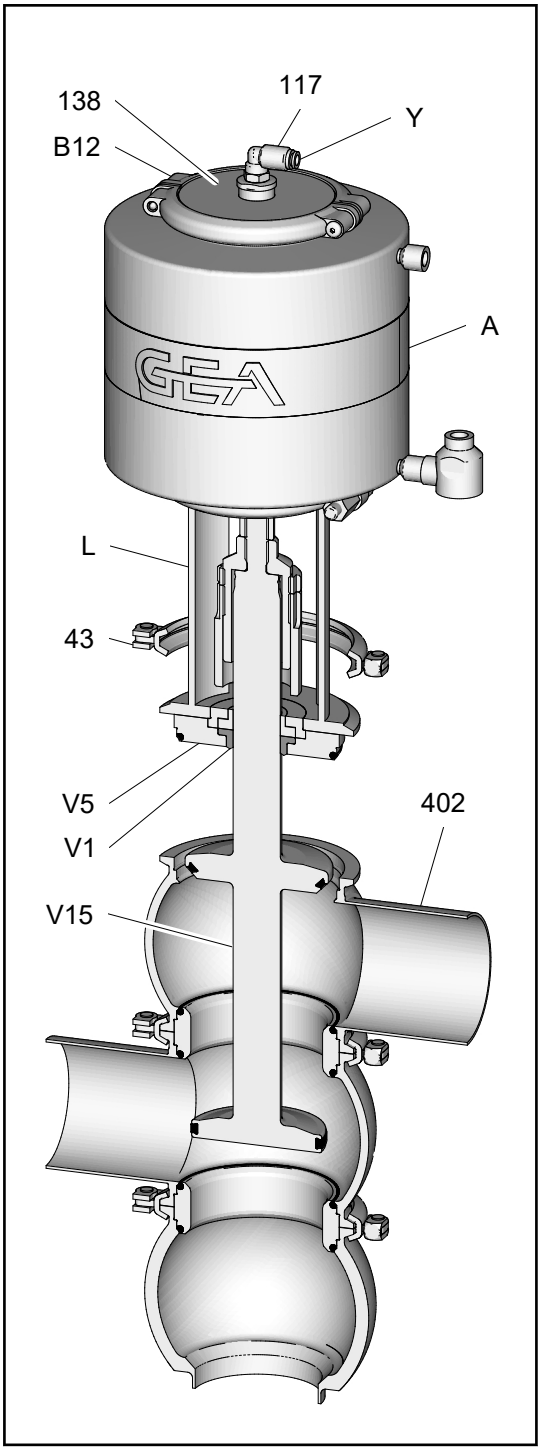


Figure 9-8 - Valve with connection 0 [with male screw-plug connection (W)]

⇒ Valve has been completely assembled.

Install connection INA – initiator mounting on actuator

Prerequisites

- Valve insert is mounted with actuator
- Connection "INA" is present

⚠WARNING

Spring tension in the valve (NC)

Danger of injury when opening the clamp connections on the actuator or on the housing as the released spring pretension will suddenly lift the actuator.

- Therefore, release the spring tension before detaching the clamp connections by supplying the actuator with compressed air at max. 8 bar.

ATTENTION

The shaft of the valve disc and double disk are sealing surfaces and must not be damaged.

Damage to these parts can cause malfunction.

- Carefully remove valve disk and double disc from housing.

1. Carefully guide valve insert through the upper housing (402) until sealing washer (V5) with seal ring (V1) is seated in upper housing (402).
2. Fit initiator mounting INA (243) with air connection (246) onto actuator (A).
3. Install clamp ring (B12) between initiator mounting INA (243) and actuator (A) and tighten to specified torque.
4. Pressurise actuator (A) at (Y) with compressed air (max. 8 bar).
   → Valve disc (V15) is raised, valve insert seats into housing (402).
5. Install lantern (L) on upper valve housing with clamp connection (43).
   → Ensure that clamp connection (43) is tightened to the required torque.
6. Depressurise actuator (A) at (Y).
   → Valve disc (V15) is lowered.

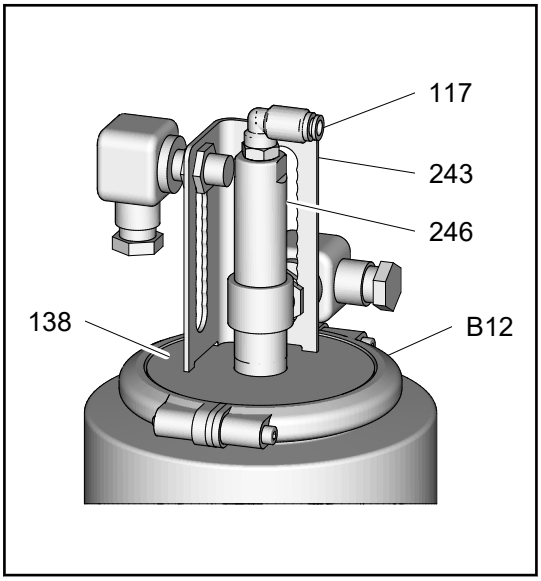


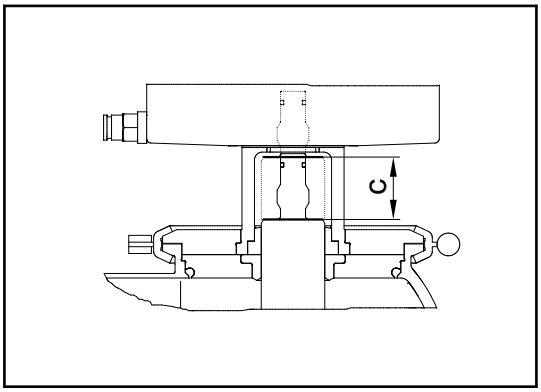
Figure 9-9 - Valve insert with INA connection [initiator mounting on actuator]

⇒ The valve insert has been disconnected from the housing.

9.7.7 Checking the function

Check valve stroke and adjust feedback

1. Actuate the valve with compressed air.
2. Check the valve stroke (c), also refer to table *The valve strokes depending on size*.



3. **INFO**

   Please take the operating instructions for the respective control top into account for adjustment of the feedbacks.

   If the strokes are correct, the feedback can be adjusted and checked.

⇒ The valve stroke has been tested.

The valve strokes depending on size

Valve size		Valve stroke [mm]
Metric	25	16
	40	19
	50	31
	65	30
	80	30
	100	30
Inch OD	1"	12
	1.5"	19
	2"	31
	2.5"	31
	3"	29
	4"	30

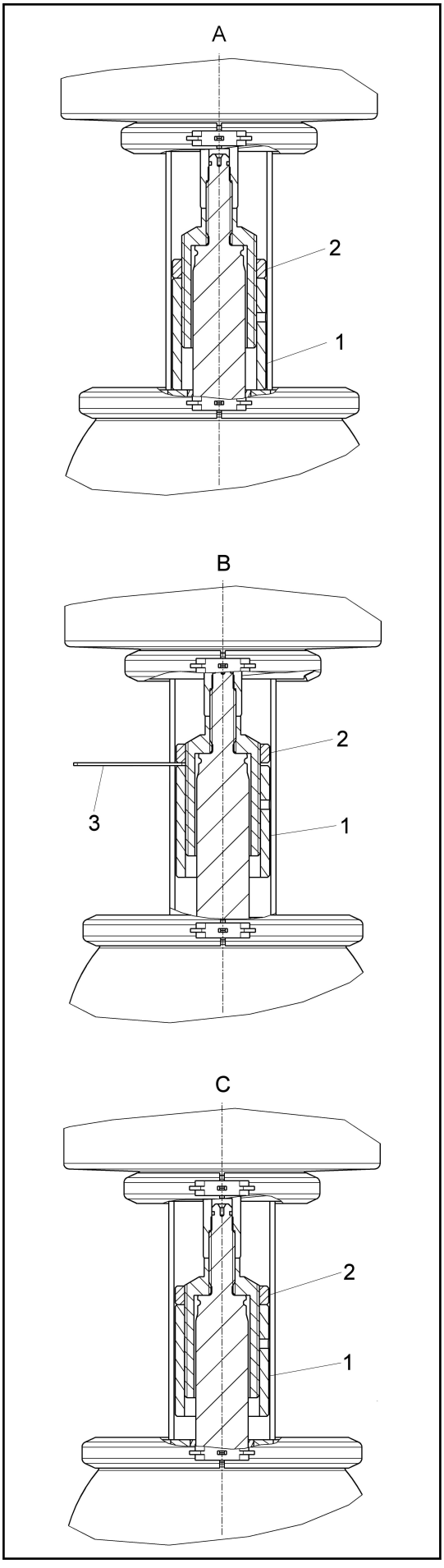
9.7.7.1 Limit stop

The following procedures have been developed by GEA Tuchenhagen in order to observe the "Pasteurized Milk Ordinance" of the FDA for assembly of the mixproof valve.

The test limit stop is delivered with the spacer of the valve, part no. 221-105.32, set to 0.059 inches.

The test limit stop is included in the standard scope of delivery of the divert valve and the leak detection valve.

1. Move the divert valve to the "flow diversion" position.
2. Lower the test limit stop (1) by turning clockwise until it touches the housing plate.
3. Screw the lock nut (2) down until it touches the test lock nut – see Figure A.
4. Move the divert valve to the "flow" position.
5. Screw the test limit stop (1) down from the lock nut (2) by 0.059 inches and use the spacer (3) to set the gap exactly – see Figure B.
6. Lock the test limit stop (1) with lock nut (2) at this point.
7. Switch the valve to the "flow diversion" position.
8. Neither the dosing pump nor other flow-promoting equipment should start up. See "corrective actions" if the dosing pump does not react as given.
9. After the test: Move the valve to the "flow" position.
10. Undo the lock nut (2) and raise the test limit stop (1) to the normal position by turning anti-clockwise as shown in Figure C. Tighten the lock nut (2) on the test lock nut (1).
11. Repeat the above steps with the leak detection valve.



12. If the dosing pump does not react as given, check the divert valve, sensor and wiring to eliminate the problem.

⇒ Limit stop has been checked.

10 Malfunctions

This chapter contains information about how to rectify problems with the valve.

The target group of this chapter is all persons who carry out actions related to the valve.

Fault	Possible cause	Measure
Valve does not work	Fault in the controller	Check the system configuration
	No compressed air or compressed air too low	Check the compressed air supply Check air hoses for free passage and air tightness
	Fault in the electrical system	Check actuation / external controller and routing of electrical wires
	Solenoid valve defective	Replace the solenoid valve
	Faulty installation position of the valve housing	Install the valve housing aligned correctly upwards
Valve does not close	Dirt/foreign material between valve seat and valve disk	Clean valve housing and valve seat
Valve closes too slowly	O-rings in the actuator and control top are dry (friction losses)	Grease O-rings
Leakage in the area of the valve housing	Housing O-rings defective	Removing the valve Change housing O-rings
Leakage on the valve shaft	Seal ring defective	Replace the seal ring

Table 12: Malfunctions

11 Decommissioning, dismantling and disposal

This chapter contains information about decommissioning the valve. It also describes the removal and disposal processes. The target group of this chapter is all persons who carry out actions related to the valve.

11.1 Decommissioning

The following principles apply for decommissioning:
- Switch off the compressed air.
- Switch off the component with 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 *4.2 Storage*.

11.2 Disposal

11.2.1 General information

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 instruction manual for the individual components.

11.2.2 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 the proper disposal free of charge.

Prerequisites
- The valve should be disposed of

1. Remove the actuator.
2. Pack the actuator securely and send it to GEA Tuchenhagen GmbH.

⇒ The valve actuator has been disposed of.

12 Replacement parts

This chapter contains information on ordering replacement parts for the valve and is aimed at all users of the valve.

12.1 Order information

Only original spare parts from GEA may be used. All spare parts are packed in GEA original packaging and marked accordingly.

The spare parts are not included in the scope of supply of the machine.

The specifications listed below must be cited on every spare part order.

- Machine type: see type plate
- Machine number: see type plate
- Order number: see spare parts list
- Name: see spare parts list

12.2 Spare parts lists

https://assets.gea.com/gea/action/browseItems?categoryId=153715&categoryTypeId=2&cachedCriteria=1

Link to the spare parts list - Flow Diversion Device (FDD)

Spare parts VARIVENT® Flow Diversion Device with M-15/FDD or T.VIS M-20/FDD

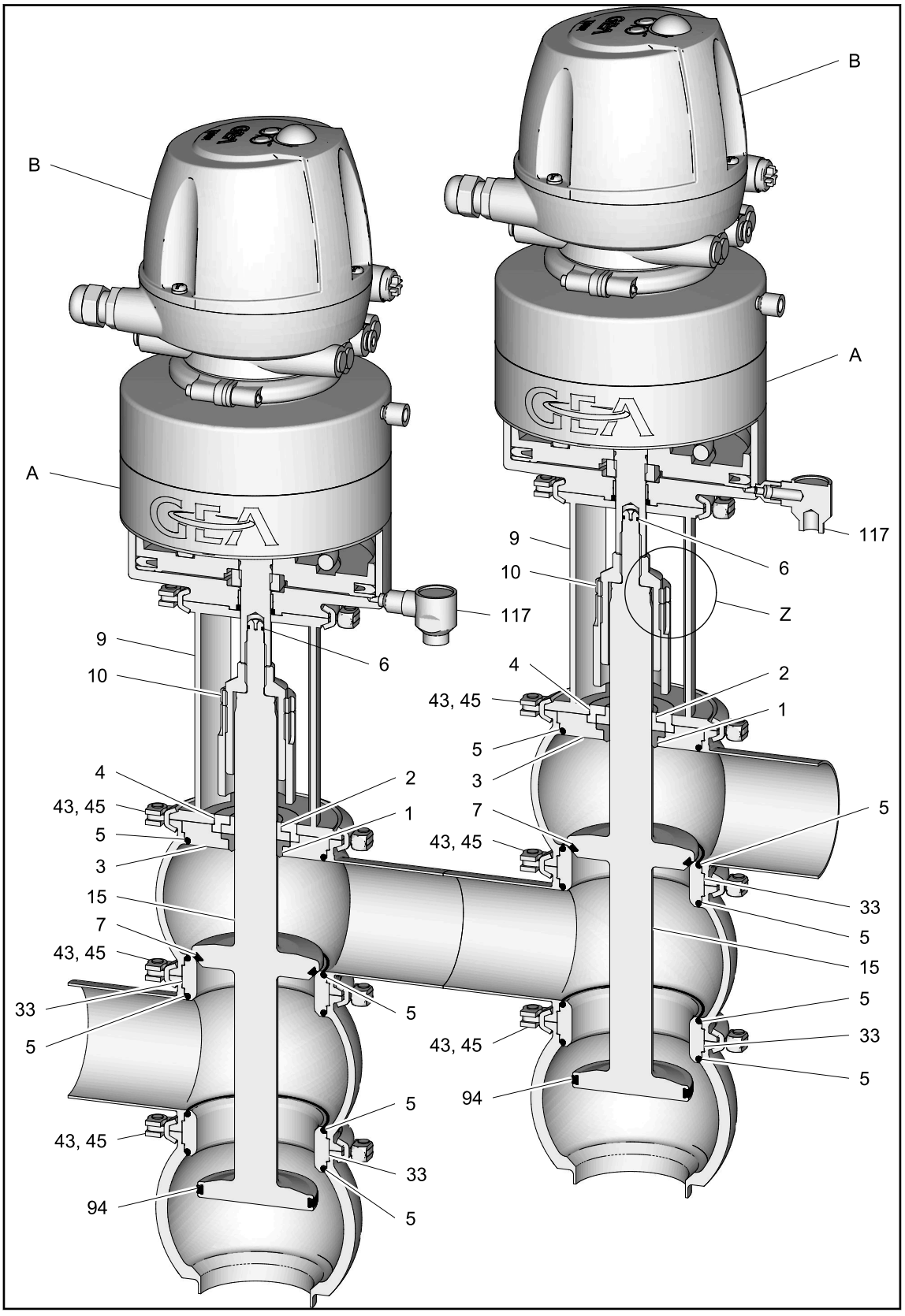


Figure 12-1 - Spare parts - Flow Diversion Device (FDD)

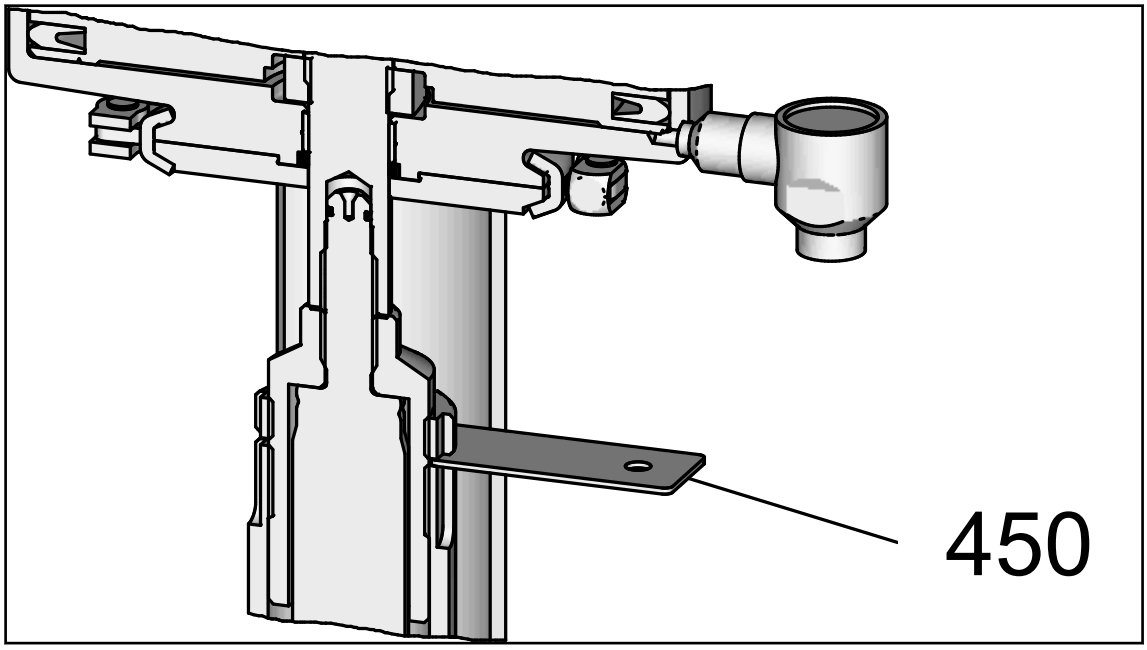
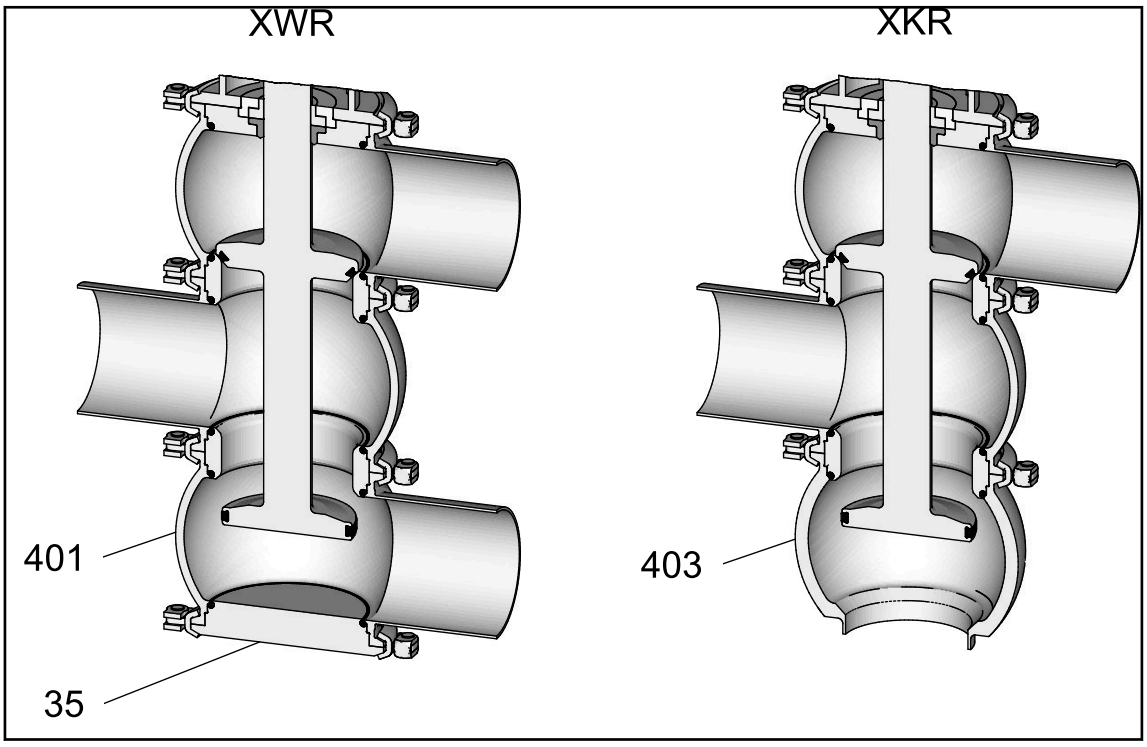


Figure 12-2 - Z: Space piece (450)



Spare parts list - Flow Diversion Device with M-15/FDD or T.VIS M-20/FDD

Item	Designation	Material	1" OD	1.5" OD	2" OD	2.5" OD	3" OD	4" OD
1	Seal ring	EPDM	924-084	924-084	924-084	924-085	924-085	924-085
		FKM	924-082	924-082	924-082	924-083	924-083	924-083
2	Bearing	PTFE/carbon	935-001	935-001	935-001	935-002	935-002	935-002
3	Seal disk	1.4404	221-141.01	221-141.02	221-141.02	221-141.03	221-141.03	221-141.04
4	Bearing disk	1.4301	221-142.01	221-142.02	221-142.02	221-142.03	221-142.03	221-142.03
5	O-ring	EPDM	930-309	930-144	930-144	930-150	930-150	930-156
		FKM	930-168	930-171	930-171	930-176	930-176	930-178
6	O-ring	NBR	930-004	930-004	930-004	930-004	930-004	930-004
7	V-ring	EPDM	932-046	932-021	932-021	932-024	932-024	932-028
		FKM	932-030	932-033	932-033	932-035	932-035	932-039
9	Lantern	14301	221-121.01	221-121.07	221-121.07	221-121.08	221-121.08	221-121.09
10	Limit stop N	1.4404/1.4301	221-156.13	221-156.13	221-156.13	221-156.01	221-156.01	221-156.01
15	Valve disk X_R	1.4404	221-700.06	221-700.05	221-700.04	221-700.03	221-700.01	221-700.02
33	Seat ring X_R	1.4404	221-699.04	221-699.03	221-699.03	221-699.01	221-699.01	221-699.02
35	Blanking plate N	1.4404	221-144.01	221-144.02	221-144.02	221-144.03	221-144.03	221-144.04
43	Hinged clamp	1.4401	701-074	701-075	701-075	701-076	701-076	701-077
45	Hexagon nut	1.4305	912-035	912-035	912-035	912-036	912-036	912-036
94	V-ring RA	EPDM	221-365.13	221-365.07	221-365.07	221-365.08	221-365.08	221-365.09
		FKM	221-365.21	221-365.10	221-365.10	221-365.11	221-365.11	221-365.12

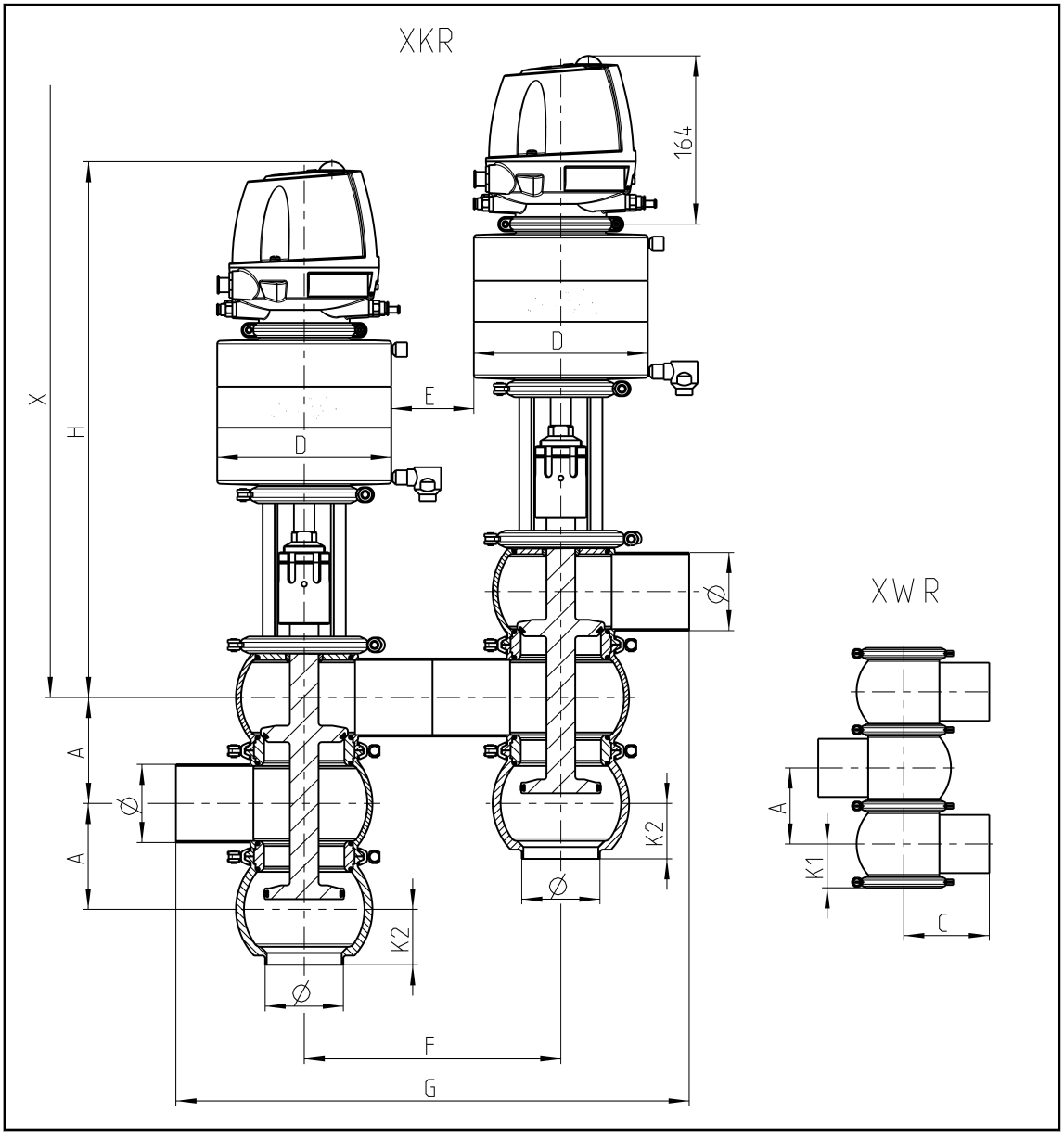
Item	Designation	Material	1" OD	1.5" OD	2" OD	2.5" OD	3" OD	4" OD
117	Quick bleed valve G1/8"	Al	603-038	603-038	603-038	603-038	603-038	603-038
401	Housing V1	1.4404	221-101.27	221-101.28	221-101.29	221-101.30	221-101.31	221-101.32
403	Housing connection X	1.4404	221-672.06	221-672.03	221-672.04	221-672.01	221-672.02	221-672.05
450	Space piece	1.4301	221-105.32					
A	Actuator Z/FDD		See spare parts list for actuator Z/FDD					
B	Control top T.VIS M-15/FDD or T.VIS M-20/FDD		See spare parts list for control top T.VIS M-15/FDD or T.VIS M-20/FDD					

Table 13: Spare parts list - Flow Diversion Device (FDD)

13 Annex

13.1 Dimension sheet

Dimension sheet - Flow Diversion Device with M-15/FDD or T.VIS M-20/FDD



Nominal width	Ø [mm]	A [mm]	C [mm]	D [mm]	S [mm]	F [mm]
OD 1"	25.4 × 1.65	46	90	110	70	180
OD 1.5"	38.1 × 1.65	59	90	135	45	180
OD 2"	50.8 × 1.65	71.5	90	135	45	180

Nominal width	Ø [mm]	A [mm]	C [mm]	D [mm]	S [mm]	F [mm]
OD 2.5"	63.5 × 1.65	90	125	170	80	250
OD 3"	76.2 × 1.65	103	125	170	80	250
OD 4"	101.6 × 2.11	127.5	125	210	40	250

Nominal width	G [mm]	H [mm]	K1 [mm]	K2 [mm]	Expansion X [mm]	Weight [kg]
OD 1"	360	456	30	29	537	15
OD 1.5"	360	465.5	36.5	39	615	23
OD 2"	360	472	43	42	658	30
OD 2.5"	500	515	52	54	741	30
OD 3"	500	521.5	58.5	54	772	30
OD 4"	500	530	71	69	830	30

13.2 List of abbreviations

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 [barg/psig] unless explicitly specified otherwise.
approx.	approximately
°C	Unit of measurement of temperature [degree Celsius]
CIP	Clean in Place
dm^3n	Unit of measurement of volume [cubic decimetre] standard volume (standard litres)
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, Brief 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: Hydrated nitrile butadiene rubber
IP	Protection class
ISO	International Standard of the International Organization for Standardization
kg	Unit of measurement of weight [kilogram]
kN	Unit of measurement of force [kilonewton]
Kv value	Flow coefficient [m³/s] 1 KV = 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
NC	Normally Closed; actuator is spring-to-close, valve is closed in idle position
Nm	Unit of measurement for the tightening torque [newton metre] 1 Nm = 0.737 lbft Pound-Force (lb) + Feet (ft)
NO	Normally Open; actuator is spring-to-open, valve is open in idle position
PA	Polyamide
PE-LD	Low-density polyethylene
PPE	Polyphenylene ether
psi	Anglo-American unit of measurement for pressure [pound-force per square inch] All pressure data expressed in [bar/psi] is assumed to be gauge pressure [barg/psig] 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.
AF	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

Abbreviation	Explanation
Inch	Unit of measurement of length in the Anglo-American language area
Inch OD	Tube measurement according to British Standard (BS), outside diameter
Inch IPS	American pipe measurement, iron pipe size

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