• Operating manual
• Installation instructions for partly completed machinery

0570.821/25-EN - ORIGINAL

Diaphragm Valves for industry and building services
Manually and Pneumatically Actuated Valves

SISTO-10/-10S/-10M
SISTO-16RGA MaXX, SISTO-16RGA, SISTO-16TWA/HWA/DLU
SISTO-16/-16S
SISTO-20/-20M
SISTO-KB/-KBS

Swing Check Valves for industry and building services

SISTO-RSK/-RSKS

Pneumatic Actuators for industry and building services

SISTO-LAP Piston Actuators
SISTO-LAD Diaphragm Actuators

SISTO-10

SISTO-16RGA MaXX

SISTO-16TWA

SISTO-16

SISTO-20

SISTO-KB

SISTO-RSK

SISTO-LAP

SISTO-LAD

Contents

Glossary

Type series booklet

The type series booklets for the individual products can be downloaded at:
www.sisto.lu or
www..ksb.com

LAD-AZ = OPEN/CLOSED = “Double-acting“ actuators

– Air-to-open
– Air-to-close

LAD-OF = opening spring = actuator “Fail-open“

– Spring-to-open
– Air-to-close

LAD-SF = closing spring = actuator “Fail-closed“

– Air-to-open
– Spring-to-close

LAP-AZ = OPEN/CLOSED = “Double-acting“ actuators

– Air-to-open
– Air-to-close

LAP-OF = opening spring = actuator “Fail-open“

– Spring-to-open
– Air-to-close

LAP-SF = closing spring = actuator “Fail-closed“

– Air-to-open
– Spring-to-close

1 General

1.1 Principles

This operating manual/these installation instructions for partly completed machinery apply to all diaphragm valves, pneumatic actuators and swing check valves of the company SISTO Armaturen. The operating manual installation instructions for partly completed machinery describes the proper and safe use of this equipment in all phases of operation.

In the event of damage, discrepancies and questions, immediately contact SISTO Armaturen sales organisation responsible in order to maintain the right to claim under warranty.

Correct installation and maintenance or repair will ensure smooth operation of the valves and the pneumatic actuators.

The manufacturer shall not accept any liability for the valves and the pneumatic actuators if this operating manual/these installation instructions for partly completed machinery are not complied with.

The descriptions and instructions set forth in the operating manual/ installation instructions for partly completed machinery refer to the standard models but are also applicable to variants.

The sectional drawings shown in this operating manual/these installation instructions for partly completed machinery provide examples of the general design of the valves and pneumatic actuators.

For illustrations relating to specific type series and further information refer to the respective type series booklets.

The numbers in brackets [ ] refer to the part numbers in the list of components.

1.2 Contact data

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E-mail: sisto@ksb.com
www.sisto.lu

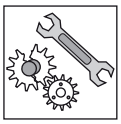
1.3 Target group

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

1.4 Other applicable documents

Document	Description
Type series booklets (download at: www.sisto.lu or at www.ksb.com)	Description of the valves and actuators

1.5 Key to safety symbols/markings

Symbol	Description
	**DANGER** In conjunction with the signal word DANGER this symbol indicates a high-risk hazard, which if not avoided, will result in death or serious injury.
	**WARNING** In conjunction with the signal word WARNING this symbol indicates a medium-risk hazard, which if not avoided, could result in death or serious injury.
	**CAUTION** In conjunction with the signal word CAUTION this symbol indicates a low-risk hazard, which if not avoided, could result in minor injury.
	**Electrical hazard** In conjunction with one of the signal words, this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	**ATTENTION** In conjunction with the signal word ATTENTION this symbol indicates a hazard for the machine and its functions.
	**NOTE** This symbol indicates recommendations and important information on how to handle the product.

2 Safety

DANGER

All the information contained in this section refers to hazardous situations.
In addition to the present general safety information the action-related safety information given in the other sections must be observed.

2.1 General

This operating manual/installation instructions for partly completed machinery contains general installation, operating and maintenance instructions that must be observed to ensure safe operation and prevent personal injury and damage to property.

Comply with all the safety instructions given in the individual sections of this operating manual.

The operating manual/installation instructions for partly completed machinery must be read and understood by the responsible specialist personnel/operators prior to installation and commissioning.

The contents of this operating manual/these installation instructions for partly completed machinery must be available to the specialist personnel at the site at all times.

Information attached directly to the valve or the pneumatic actuator (e.g. nominal pressure) must always be complied with and be kept in a perfectly legible condition at all times.

The operator is responsible for any eventualities or incidents, which may occur during installation performed by the customer, operation and maintenance.

The operator is responsible for ensuring compliance with all local regulations.

Valves or pneumatic actuators must only be operated by skilled personnel.
Incorrect operation of a valve or pneumatic actuator may have adverse effects on the entire system, for example:

- Leakage of the fluid handled
- System/machine brought to a standstill
- Impairment/reduction/increase of the system's/machine's function/ effect.

For any queries or in the event of damage, contact the manufacturer.

For any queries and repeat orders, in particular for purchasing spare parts, please specify if possible:

- type series or variant details
- order number
- year of construction
- part-no.

The operating manual/installation instructions for partly completed machinery must be kept for the entire life cycle of the equipment.

When assembling components from various manufactures, the operating manuals of the individual components must also be complied with.

The design, manufacture and testing of SISTO Armaturen valves are subject to a QM system to DIN EN ISO 9001 as well as the European Pressure Equipment Directive 2014/68/EU and the Machinery Directive 2006/42/EC if applicable.

Compliance with these requirements is based on normal, static loading, e.g.

- Flow velocities typical of the fluid handled,
- Typical temperature gradients.

Valves manufactured by SISTO Armaturen are not designed for use in systems handling unstable fluids.

Other than normal loads and operating conditions (temperature, pressure, vibrations, oscillations, special corrosive, chemical or abrasive influences, etc.) must be specified fully and clearly in the purchase order, so that the valve manufacturer can prepare and suggest suitable measures. Such measures may influence

- Selection of the materials
- Wall thickness allowance
- Variants

The valves and pneumatic actuators must not be operated outside the permissible operating range. The application limits are indicated on the nameplate or in the applicable type series booklet. The pressure/temperature ratings, in particular, must not be exceeded. Operation outside the above-mentioned conditions will result in overloads the valves and pneumatic actuators cannot withstand.

Non-observance of this warning may cause personal injury and damage to property, for example:

- Injuries resulting from fluid leakage (cold/hot, toxic, pressurised, etc.).
- Impairment of the valve/pneumatic actuator's function or their destruction.

For valves equipped with actuators from other manufacturers, the operating manual of the actuator must be adhered to without fail.

2.2 Intended use

- The intended use of the valves and pneumatic actuators is documented in the corresponding type series booklets.
- The valves and pneumatic actuators must only be operated in perfect technical condition in the temperature range and pressure range indicated in the corresponding type series booklet.
- Only the fluids indicated in the type series booklet for the corresponding valve type must flow through the valves. The resistance of the valve design to the fluid flowing through it must be checked by the operator prior to commissioning.

SISTO pneumatic actuators can be used with the control medium air according to ISO 8573-1.

- Operation above 0 °C, purity class 5.4.4 should be used: filter 40 µm, oil concentration 5 mg/m³, dew point 3 °C.
- Operation until -10 °C purity class 5.3.4 should be used: filter 40 µm, oil concentration 5 mg/m³, dew point -20 °C.

To determine the required air quality, take into account the specification of all components used in the system.

2.3 Consequences and risks caused by non-compliance with these instructions

Non-compliance with safety information can jeopardize the safety of personnel, the environment and the valve or the pneumatic actuator itself.

Non-compliance with this operating manual/these installation instructions for partly completed machinery will result in loss of warranty and forfeiture of any and all rights to claims for damages.

Non-compliance can, for example, have the following consequences:

- Failure of important valve or pneumatic actuator functions,
- Failure of prescribed maintenance and servicing practices,
- Hazard to persons by electrical, mechanical and chemical effects,
- Hazard to the environment due to leakage of hazardous substances.

2.4 Safety awareness

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

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

2.5 Safety information for the operator/user

The valves are intended for use in areas which cannot be accessed by unauthorised persons. Operation of the valves in areas which can be accessed by unauthorised persons is only permitted if appropriate protective equipment are fitted at the site. This is the responsibility of the integrator or operator.

- Fit protective equipment (e.g. contact guards) supplied by the operator for hot, cold or moving parts, and check that the equipment functions properly.
- Do not remove any protective equipment (e.g. contact guards) during operation.
- Electrical hazards must be eliminated. (For details refer to VDE regulations and the safety regulations laid down by the local energy supply companies, for instance).
- The operator has to ensure that the guards for live components are regularly checked for any damage. The valve must never be operated without appropriate protection.
- Standard SISTO diaphragm valves are designed in such a way that any rupture of the diaphragm will be indicated by fluid handled escaping from a leakage indication hole in the valve bonnet or from the stem protection below the handwheel. This must be taken into account when planning the system.
- Design variants with re-pluggable leakage indication hole in fully sealed valves can be supplied upon the manufacturer's agreement.

2.6 Safety information for maintenance, inspection and installation

- The operator is responsible for ensuring that all maintenance, inspection and installation work be performed by skilled and trained personnel.
- Only perform work on an unpressurised, cooled down and completely drained valve. The temperature of the fluid in all the valve's chambers must be lower than the fluid's vaporisation temperature.
- Shut down the valve or pneumatic actuator before performing any work on it. The shutdown procedure described in the operating manual installation instructions for partly completed machinery must be adhered to without fail.
- As soon as the work has been completed, re-install and re-activate any safety relevant devices and protective devices. Before returning the product to service, observe all instructions on commissioning.

2.7 Unauthorised modification and manufacture of spare parts

Modifications or alterations of the valve or pneumatic actuator are only permitted after consultation with the manufacturer's prior consent.
Use only original spare parts and parts authorised by the manufacturer. The use of other parts can invalidate any liability of the manufacturer for resulting damage.

2.8 Unauthorised modes of operation

The warranty relating to the operating reliability and safety of the valve and pneumatic actuator supplied is only valid if the equipment is used in accordance with its intended use as described in Section 2.3. The limits stated in the technical literature must not be exceeded under any circumstances.

3 Transport and Storage

The valves and pneumatic actuators are ready for operation upon delivery if not agreed otherwise. The connection ports are closed with suitable material (caps, plugs, covers).

The packaging material must be disposed in accordance with the disposal regulations/environmental protection regulations.

3.1 Checking the condition upon delivery

Upon receipt of the goods, check immediately that the goods are complete and undamaged.

3.2 Corrosion protection

As a standard, valves and pneumatic actuators made of non-corrosion-resistant materials are coated with a primer offering adequate corrosion protection under ambient conditions normally encountered in buildings. If the equipment is intended for use in a corrosion-inducing atmosphere, the user must apply a protective coating on site.

All valves with PTFE, TFM, PFA or ETFE lining are corrosion-protected to category C2, durability "L", in accordance with DIN EN ISO 12944.

3.3 Transport

Take suitable precautions to prevent damage during transport.

Ensure sufficient stability. Use standard-compliant transport equipment.

	NOTE
	The valves must never be suspended by the hand-wheel or by the actuator (if mounted).

Valves with actuators shall be transported by means of ropes attached to the line connection ports, taking into account the centre of gravity.

Use any lifting lugs provided.

For the weight of the valve or pneumatic actuator refer to the relevant type series booklet.

After delivery and prior to installation, check the valve or pneumatic actuator for any in-transit damage.

3.4 Storage

Storage/temporary storage must ensure that even after a prolonged period of storage the function of the valve or pneumatic actuator will not be impaired. The following requirements must be met:

- Storage in packaged condition (to protect the seating surfaces against damage).
- Measures are taken to protect the equipment against dirt, humidity, frost and corrosion (e.g. by using foils or caps; storage in dry, closed rooms).
- The storage temperature must be between +10 °C and +30 °C.

Ensure sufficient stability. Use standard-compliant transport equipment.

4 Product information (REACH)

Product information as per Regulation No. 1907/2006 (REACH): For information as per chemicals Regulation (EC) No. 1907/2006 (REACH), see http://www.ksb.com/reach.

5 Marking

5.1 Marking of the valves

The valves are marked in accordance with Pressure Equipment Directive:

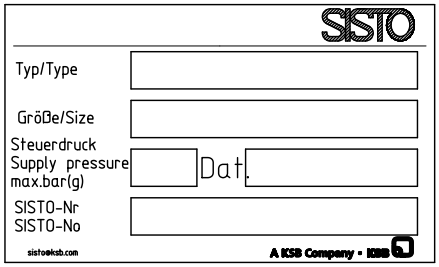
- Manufacturer
- Year of construction
- Type or order number
- DN
- PN or max. permissible pressure/temperature
- Material

The CE marking on the valve indicates that the valve is in conformity with the European Pressure Equipment Directive 2014/68/EU (not on SISTO-16TWA, SISTO-16RGA and SISTO-20M).

5.2 Marking of the pneumatic actuators

The nameplate indicates the following information:

- **Type:** Type series designation, weight
- **Size:** Actuator size, spring code, stroke
- **Supply pressure:** Pmax (max. control pressure)
- **Date:** Date of manufacture
- **SISTO-No.:** Ident.-number



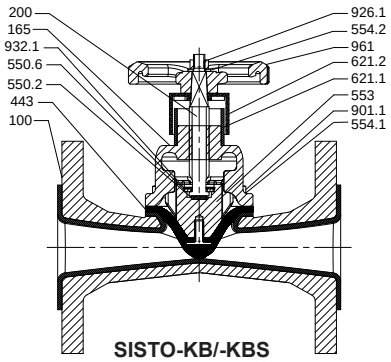
Spring-loaded actuators are additionally marked with a sign reading **"WARNING: Loaded spring, do not disassemble!"**.

6 Diaphragm valves with handwheel

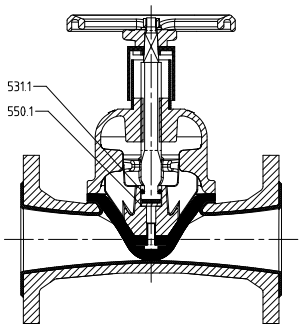
Type series	DN	PN	Material	Type series booklet No. [1]
SISTO-KB SISTO-KBS	15 - 200 15 - 200	10 10	see Type series booklet	8651.1 8651.101
SISTO-10 SISTO-10S SISTO-10M	15 - 300 15 - 200 15 - 80 (Rp $^1/_2$" - 3")	10 10 10		8641.1 8641.101 8641.102
SISTO-16TWA/HWA/DLU	15 - 200	16		8635.33
SISTO-16	15 - 200 250 - 300 15 - 80 (Rp $^1/_2$" - 3")	16 10 16		8635.1
SISTO-16S	15 - 200	16		8635.101
SISTO-20	15 - 200 250 - 300 15 - 80 (Rp $^1/_2$" - 3")	16 10 16		8643.1
SISTO-20M	10 - 50 (Rp $^3/_8$" - 2")	16		8638.12
SISTO-16RGA MaXX SISTO-16RGA	15 - 80 (Rp $^1/_2$" - 3") 15 - 80 (Rp $^1/_2$" - 3")	16 16		8638.1 8638.1/17

[1] Download at www.sisto.lu

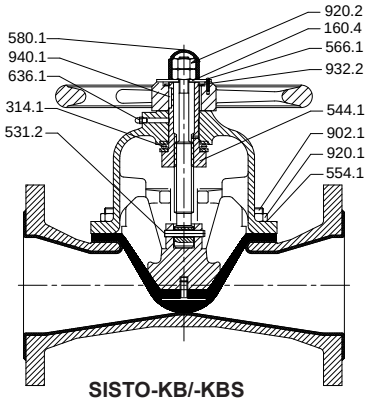
Sectional drawings on weir-type valves



SISTO-KB/-KBS
Design DN 15-40

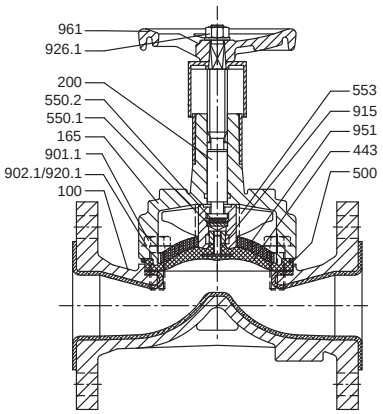


SISTO-KB/-KBS
Design DN 50-100

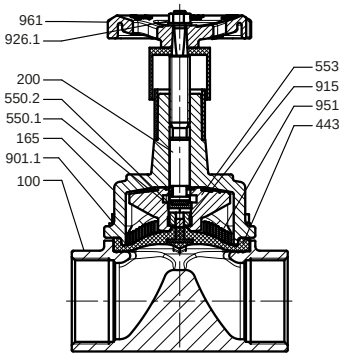


SISTO-KB/-KBS
Design DN 125-200

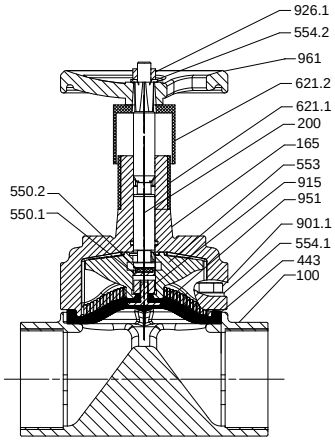
Sectional drawings on the full bore valves



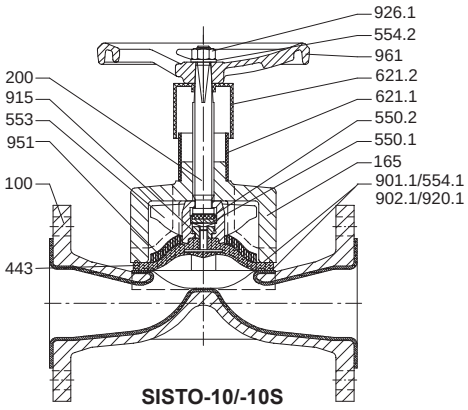
SISTO-16/-16S
SISTO-16TWA/HWA/DLU
SISTO-20



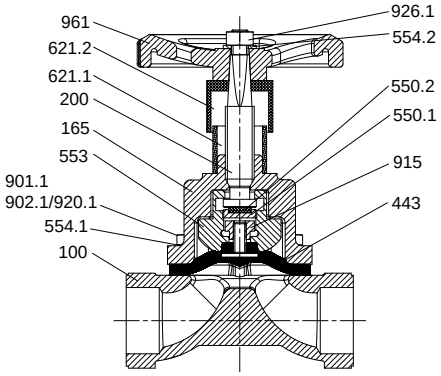
SISTO-16/-20 with
threaded socket ends



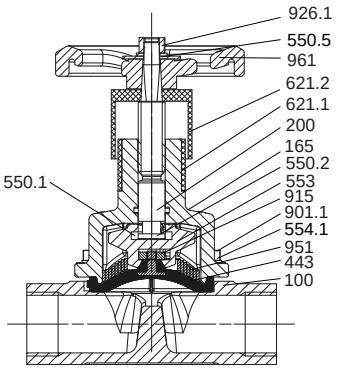
SISTO-16RGA MaXX
SISTO-16RGA



SISTO-10/-10S



SISTO-10M



SISTO-20M

Parts list

Part No.	Description
100	Body
160.4	Handwheel cover
165	Bonnet
200	Stem
314.1	Thrust bearing
443 [2]	**Diaphragm**
500	Ring
531.1	Locking sleeve
531.2	Locking sleeve
544.1	Threaded bush
550.1	Bearing disc
550.2	PTFE-disc
550.6	Segmental disc
553	Compressor
554.1	Washer
554.2	Washer

Part No.	Description
566.1	Grooved pin
580.1	Cap
621.1	Position indicator, lower part
621.2	Position indicator, upper part
636.1	Lubricating nipple
901.1	Hexagon head bolt
902.1	Stud
915	Floating nut
920.1	Nut
926.1	Prevailing torque nut
932.1	Circlip
932.2	Circlip
940.1	Key
951	Support spiral
961	Handwheel

[2] Recommended spare

6.1 Function

The valves consist of the pressure-retaining parts, i.e. body [100] and bonnet [165], and the functional unit.

The body [100] and the upper valve section or bonnet [165] are connected by hexagon head bolts [901.1] or studs [902.1] and nuts [920.1].

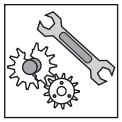
The functional unit consists:
- bonnet [165]
- handwheel [961]
- stem [200]
- compressor [553] with floating nut [915] (if any)
- diaphragm [443].

6.2 Installation

6.2.1 General information/Safety information

Responsibility for positioning and installing the valves always lies with the engineering company, construction company or operator/user.

Planning and installation errors may impair the reliable function of the valves and pose a substantial safety hazard. Compliance with the following requirements is of particular importance.



ATTENTION

- The piping shall be laid in such a way as to prevent detrimental thrust and torsional forces, as well as vibrations and tensions from being transmitted to the valve bodies in installed and operating condition, to avoid impairment of valve function and/or valve rupture.
- The caps on the connection ports shall be removed immediately prior to installation.
- The flanged ends of the flanged valves described in this manual comply with flange standard EN 1092-1/-2, incl. finish of sealing surfaces for elastomer or fluoropolymer gaskets.

NOTE

Do not paint any parts which are relevant to the function of the valve, such as moving stems and position indicator components.
Do not use valve handwheels [961] as footholds.

WARNING

For safety reasons, valves and piping systems operated at high (> +50 °C) or low (< 0 °C) temperatures must be insulated, or a warning sign must point out the risk of personal injury involved when touching the hot or cold components

Valves with polyamide (Rilsan) coating must be insulated with suitable materials if the ambient temperature is permanently low compared to the fluid temperature.

In keeping with German energy-saving regulations (EnEV) we recommend that valves handling warm fluids should be insulated to save energy.

Valves with external moving elements must be fitted with protective covers, or other suitable measures must be taken to prevent accidents.

WARNING

Risk of injury! Valve under pressure!
Risk of burns!

Valves used as dead-end valves in a pipeline should be protected against unauthorised or unintentional opening. This applies especially in abnormal operating conditions and when pneumatic actuators are used. If this is not complied with, escaping fluid handled could lead to injuries and even danger to life.

6.2.2 Installation position

Diaphragm valves can be installed in any position. The recommended installation position is with the stem pointing vertically upwards.

6.2.3 Special designs

For positioning and installing special valve designs please, contact the consultant, construction company or operator.

6.2.4 Insulation

An insulation does not impair the function of the valve. SISTO Armaturen recommends to make sure that the sealing areas at the bonnet joints and at the stem passage are easily accessible and visible.

6.3 Installation instructions

6.3.1 Flanged valves

NOTE

- The mating flange faces must be clean and undamaged.
- The gaskets on the mating faces must be properly centered.
- Use only fasteners and sealing elements made of approved materials.

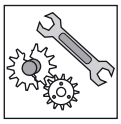
NOTE

- Valves with polyamide coating (Rilsan) must only be used with elastic sealing elements.
- Valves with PTFE/TFM/PFA lining must not be used in combination with metallic seals.
- Valves with soft rubber lining or PTFE/TFM/PFA lining do not require flange gaskets due to the properties of the materials used, provided that the mating flanges of the piping comply with the same technical codes as the valves.
- Always use all flange bolt holes provided when connecting valve and pipe flanges.

Use suitable tools to tighten the bolts evenly and crosswise to the torques stipulated for the flanged connection in accordance with the gasket manufacturer‘s instructions.

6.3.2 Welding instructions

Responsibility for welding the valves into the piping and for any heat treatment required lies with the commissioned company or the plant operator.



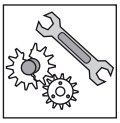
ATTENTION

When welding valves with butt weld ends into the piping or when performing welding work at a pipeline after the valves have been installed (pipeline installation) make sure that no contamination enters the valve body to prevent damage to linings or diaphragms [443].

NOTE

When welding the valve into the pipeline, take special precautions e.g. welding in several steps and at high welding speed, so that the temperature rise in the middle of the valve body [100] does not exceed the max. permissible operating temperature. The upper valve section including diaphragm [443] must be removed prior to welding the valve body [100] into the piping.

On valves with socket weld ends, the insertion depth given in the applicable technical code must be complied with. A gap between the pipe end and the socket base is to prevent impermissible stresses in the weld.



ATTENTION

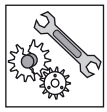
To prevent scorching, welding cables must not be attached to valves whose functional valve elements or valve surface have to meet specific roughness requirements.

6.4 Commissioning/Start-up/Shutdown

(Please also refer to Section 6.2, Installation)

6.4.1 General

Prior to commissioning/start-up compare the material, pressure and temperature data on the valves with the operating conditions of the piping to check the material's chemical resistance and stability under load.



ATTENTION

Surge pressures, which might occur, must not exceed the max. permissible pressure. Safety measures are required to be taken by the operator.

In new systems and particularly after repair, the complete piping system must be thoroughly flushed with the valves fully open so that particles and/or welding beads that might damage the valves are removed.

The responsibility for the media and method used for cleaning the piping system lies with the party carrying out the cleaning.

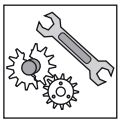
CAUTION

Risk of injury!

Venting the valve by undoing, e.g., the bonnet/cover bolting is dangerous and therefore not permitted. To prevent damage to the valve material or joint seals, the usual start-up and shutdown velocities must be adhered to.

6.4.2 Valve actuation

Viewed from above, the manually operated valves are closed by turning the handwheel [961] in clockwise direction, and opened by turning the handwheel [961] in counter-clockwise direction. Valve variants which deviate from this rule are marked accordingly.



ATTENTION

Valves with handwheels must only be actuated by hand. As the valve can be damaged by applying excessive force, it the use of levers for turning the handwheel [961] is not allowed.

Shut-off valves are normally used in such a way that they are either fully open or fully closed.

If, while opening or closing the valve, a resistance can be felt, the valve is in its final position and the operation must be stopped.
Continued actuation may result in increased wear of the valve.

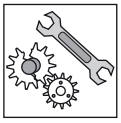
CAUTION

Risk of burns!

The handwheel can get hot during operation. If in doubt, only operate the handwheel with protective gloves.

6.4.3 Functional check prior to commissioning

Check the shut-off function of the installed valve prior to commissioning/ start-up by opening and closing it several times.
If required, evenly re-tighten the body [100]/bonnet [165] bolting as well as the bolting at the mating flanges (see Section 6.9).



ATTENTION

Prevent jamming!

Before re-tightening the body [100]/bonnet [165] bolting open the valve by two full handwheel turns.

6.4.4 Shutdown

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

1. Drain fluids which change their physical condition due to changes in concentration, polymerisation, crystallisation, solidification, etc. from the piping.
2. If required, flush the piping with the valves fully opened.

6.5 Maintenance

6.5.1 Safety information

The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel. The operating manual/installation instructions for partly completed machinery must be read and understood by the responsible specialist personnel/operators prior to installation and commissioning.

It is imperative that the below safety instructions and the general information on safety as per Section 2, Safety, be observed for all servicing and maintenance work to be performed at the valves.

Use appropriate spare parts and tools, even in emergencies.

WARNING

Risk of injury from valve under pressure!
Risk of burns!

Never open a valve under pressure. Danger to life!

The valve and its surrounding system must be depressurised prior to any maintenance work and installation work.

This applies to the following steps:

- before undoing the flange bolting between the valve and the pipe
- before removing the bonnet [165]
- before removing any drain or vent plugs.

Allow the valve to cool down so that the temperature is below the fluid's vaporisation temperature in all areas in contact with the fluid in order to effectively prevent any risk of scalding.

DANGER

Harmful and dangerous fluids!

If toxic or easily inflammable fluids were handled or fluids whose residues may cause corrosion when coming into contact with atmospheric humidity, drain the valve and flush or vent it.
Wear personal protective equipment where necessary.

Depending on the installation position, fluid residues may be left in the valve; these must be collected and properly disposed of.
Prior to any transport, flush and drain the valve thoroughly.
If you have any questions please contact the manufacturer.

6.5.2 Maintenance

NOTE

The operator/user is responsible for fixing appropriate inspection and servicing intervals as required by the service conditions of the valves.

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

NOTE

- On any diaphragm valve, the diaphragm [443] is the highest stressed component.
- The diaphragm [443] is not only subjected to mechanical stress but also to wear caused by the fluid handled.

  We recommend to regularly check the diaphragm [443] at intervals to be individually stipulated depending on service conditions and actuation frequency and replace them if required.
- To check the diaphragm [443], remove the bonnet from the valve body. See Section 6.6/6.7, "Replacing the diaphragm".

Observe the safety information in Section 2 and Section 6.5.1.

All valve components have been designed to be largely maintenance-free. The materials of the sliding parts have been selected for minimum wear.

The service life of the valve can be extended by taking the following measures:

- Checking the function by opening and closing the valve at least twice a year.
- Lubricating the moving parts with standardised lubricants to DIN 51825 which are suitable for the application of the valve.

6.6 Replacing the diaphragm on weir-type valves (SISTO-KB/-KBS)

1. Bring the valve to the closed position using the handwheel to facilitate removal of the diaphragm.
2. Undo the bolts [901.1] or nut [920.1] to remove the bonnet.
3. Unscrew the diaphragm [443] from the compressor [553] by turning it counter-clockwise.
4. When fitting the replacement diaphragm observe the material marking on the diaphragm [443].

NOTE

After dismantling, clean all parts. Damage to the parts must be prevented. Check parts for damage and replace if necessary.

Proceed as follows to fit the new diaphragm:

5. The contact surfaces of the diaphragm [443] inside the body [100] and the bonnet [165] must be clean and dry.
6. Turn the handwheel [961] in clockwise direction to take the upper valve section to the closed position. Do not turn any further!
7. Remove any protection from the fastening grub screw of the diaphragm [443].
8. Screw in the diaphragm [443] up to the stop in the compresor [553]. To avoid overloading the diaphragm [443], do not screw it in any further!
9. Screw it back by a maximum of 180° to align it correctly.
10. Turn the handwheel [961] in counter-clockwise, i.e. opening, direction until the diaphragm [443] rests against the bonnet [165]. Do not turn any further!
11. Place the bonnet [165] on the body [100] and tighten the fixing screws [901.1] or the hexagon nuts [920.1] of the bonnet by hand. Then turn the handwheel one turn counterclockwise.
12. Tighten the bonnet bolts evenly and crosswise in accordance with the tightening torques table.

The required torques are given in Section 6.9.

ATTENTION

Do not tighten bonnet screws while the system is pressurized or under high temperatures (> +40 °C).

ATTENTION

If the diaphragm is not screwed far enough into the compressor, the closing force will act directly on the diaphragm screw and not via the compressor. This will result in damage and premature failure of the diaphragm and leakage of the valve.

If the diaphragm is screwed in too far, the valve seat will no longer seal properly. The function of the valve is no longer guaranteed.

6.7 Replacing the diaphragm on the full bore valves (SISTO-10/-16/-20)

1. Undo the bolts [901.1] or nut [920.1] to remove the bonnet.
2. Turn the handwheel [961] in clockwise direction to take the upper valve section to the closed position. Do not turn any further!
3. Unscrew the diaphragm [443] from the compressor [553] and the floating nut [915] by turning it counter-clockwise.
4. When fitting the replacement diaphragm observe the material marking on the diaphragm [443].

NOTE

After dismantling, clean all parts. Damage to the parts must be prevented. Check parts for damage and replace if necessary.

Proceed as follows to fit the new diaphragm:

5. The contact surfaces of the diaphragm [443] inside the body [100] and the bonnet [165] must be clean and dry.
6. Turn the handwheel [961] in clockwise direction to take the upper valve section to the closed position. Do not turn any further!
7. On valves with support spiral [951]:
   Place the support spiral [951] into the bonnet [165]. Verify that the last winding of the support spiral [951] protrudes beyond the sealing lip. The last winding of the support spiral [951] must not end on a compressor [553] ridge.
8. Remove any protection from the fastening grub screw of the diaphragm [443].
9. Screw the diaphragm [443] into the floating nut [915] up to the stop in the compressor [553]. To avoid overloading the diaphragm [443], do not screw it in any further!
10. Screw it back by a maximum of 180° to align it correctly.
11. Turn the handwheel [961] in counter-clockwise, i.e. opening, direction until the diaphragm [443] rests against the bonnet [165]. Do not turn any further!
12. Make sure that the centring boss of the diaphragm [443] aligns with the “pocket“ in the valve body [100] (is not relevant for MD 40 and SISTO-10/-10S).
13. When fitting the bonnet [165] with the diaphragm [443] on the body [100] make sure that the sealing protrusion of the diaphragm [443] is positioned transversely to the flow direction.
14. Place the hood [165] on the housing [100] and tighten the fixing screws [901.1] or the hexagon nuts [920.1] of the hood by hand.
15. Tighten the bonnet bolts evenly and crosswise in accordance with the tightening torques table.

The required torques are given in Section 6.9.

ATTENTION

Do not tighten bonnet screws while the system is pressurized or under high temperatures (> +40 °C).

NOTE

Diaphragms [443] marked “MD 40“ and featuring a fastening button on the back are buttoned into the compressor [553] by means of this button.
Simultaneous pulling and turning on one side will easily remove the diaphragm [443] from the compressor [553].

NOTE

The metal backing ring used for multi-part diaphragms (TFM/EPDM) must be aligned such that its grooved face rests against the back of the plastic diaphragm.
Mounted in this way, the ring‘s smaller face will point towards the bonnet flange.

6.8 Valve reassembly

Valve reassembly shall be effected in reverse order to dismantling.

HINWEIS

To maintain functional reliability, new sealing elements must be used when the valve is reassembled.

After reassembly and prior to commissioning/start-up, the valves must be subjected to shell and leak testing to DIN EN 12266-1.
Observe Section 6.3.1.

6.9 Tightening torques (Nm)

Tightening torques of body/bonnet bolting (only apply to the valve's temperature range between +5 °C and +40 °C)

SISTO-10/-10S/-10M

Lining/ Coating [3]	Nominal diameter (DN)	15	20	25	32	40	50	65	80	100	125	150	200	250	300
	Diaphragm length (ML)	58	58	67	90	90	108	132	158	226	260	364	415	415	415
Without coating Hard lining Coated	*EPDM, NBR, CSM, IIR*	6	6	8	15	15	25	35	50	35	45	65	75	75	75
Without coating Hard lining Coated	*TFM/EPDM (2-layer)*	8	8	10	18	18	30	40	55	40	50	70	85	85	85
Soft lining	*EPDM, NBR, CSM, IIR*	6	6	8	13	13	22	35	45	35	40	50	60	60	60
Soft lining	*TFM/EPDM (2-layer)*	6	6	8	15	15	25	35	50	35	40	55	65	65	65

SISTO-16

Lining/ Coating [3]	Nominal diameter (DN)	15	15	20	25	25	32	40	50	65	80	100	125	150	200	250	300
	Diaphragm diameter (MD)	40	65	65	65	65	92	92	115	168	168	202	202	280	280	415	415
	Diaphragm	4 hole	2 hole	4 hole	2 hole	4 hole	4 hole										
Without coating Coated	*EPDM, NBR, CSM, IIR*	3	10	4	10	4	10	10	15	20	20	40	40	50	50	75	75
Without coating Coated	*TFM/EPDM (2-layer)*	4	20	15	20	15	25	25	40	55	55	80	80	100	100	85	85
Hard lining	*EPDM, NBR, CSM, IIR*	-	10	6	10	6	12	12	18	24	24	48	48	60	60	75	75
Hard lining	*TFM/EPDM (2-layer)*	-	18	13	18	13	22	22	36	50	50	70	70	90	90	85	85
Soft lining	*EPDM, NBR, CSM, IIR*	-	8	5	8	5	10	10	15	20	20	40	40	50	50	60	60
Soft lining	*TFM/EPDM (2-layer)*	-	10	6	10	6	12	12	18	24	24	48	48	60	60	65	65

SISTO-16, body materials 1.4409, with flanged ends/socket ends

Lining/ Coating [3]	Nominal diameter (DN)	15	20	25	32	40	50	65	80	100	125	150	200
	Diaphragm diameter (MD)	40	40	65	65	65	92	115	168	168	202	280	280
	Diaphragm												
Without coating Coated	*EPDM, NBR, CSM, IIR*	3	3	8	8	8	10	15	20	20	40	50	50
Without coating Coated	*TFM/EPDM (2-layer)*	4	4	15	15	15	25	40	55	55	80	100	100

[3] Hard lining = NRH; PFA; PTFE; TFM; ETFE
Coating = ECTFE; Rilsan
Soft lining = IIR; CSM

SISTO-16HWA/DLU

Lining/ Coating [4]	Nominal diameter (DN)	15	15	20	25	25	32	40	50	65	80	100	125	150	200
	Diaphragm diameter (MD)	40	65	65	65	65	92	92	115	168	168	202	202	280	280
	Diaphragm	4 hole	2 hole	4 hole	2 hole	4 hole	4 hole								
Without coating Coated	*EPDM, NBR, CSM, IIR*	3	10	4	10	4	10	10	15	20	20	40	40	50	50
Without coating Coated	*TFM/EPDM (2-layer)*	4	20	15	20	15	25	25	40	55	55	80	80	100	100
Hard lining	*EPDM, NBR, CSM, IIR*	-	10	6	10	6	12	12	18	24	24	48	48	60	60
Hard lining	*TFM/EPDM (2-layer)*	-	18	13	18	13	22	22	36	50	50	70	70	90	90
Soft lining	*EPDM, NBR, CSM, IIR*	-	8	5	8	5	10	10	15	20	20	40	40	50	50
Soft lining	*TFM/EPDM (2-layer)*	-	10	6	10	6	12	12	18	24	24	48	48	60	60

SISTO-16RGA MaXX

Lining/ Coating [4]	Nominal diameter (DN)	15	20	25	32	40	50	65	80
	Diaphragm diameter (MD)	40	40	65	65	65	92	115	168
Without coating	*SISTOMaXX (EPDM/W270)*	3	3	8	8	8	10	15	20

SISTO-16RGA

Lining/ Coating [4]	Nominal diameter (DN)	15	20	25	32	40	50	65	80
	Diaphragm diameter (MD)	40	40	65	65	65	92	115	168
Without coating	*EPDM, NBR*	3	3	4	4	4	10	15	20

SISTO-16S

Lining/ Coating [4]	Nominal diameter (DN)	15	15	20	20	25	25	32	40	50	65	80	100	125	150	200
	Diaphragm diameter (MD)	40	65	65	65	65	65	65	92	115	115	168	202	202	280	280
	Diaphragm	4 hole	2 hole	2 hole	4 hole	2 hole	4 hole	2 hole								
Without coating Coated	*EPDM, NBR, CSM, IIR*	-	10	10	4	10	4	10	10	15	15	20	40	40	50	50
Without coating Coated	*TFM/EPDM (2-layer)*	-	20	20	15	20	15	20	25	40	40	55	80	80	100	100
Hard lining	*EPDM, NBR, CSM, IIR*	3	10	10	6	10	6	10	12	18	18	24	48	48	60	60
Hard lining	*TFM/EPDM (2-layer)*	4	18	18	13	18	13	18	22	36	36	50	70	70	90	90
Hard lining	*TFM/PVDF/ EPDM (3-layer)*	4	-	-	13	-	13	18	22	36	36	50	70	70	90	90
Soft lining	*EPDM, NBR, CSM, IIR*	-	10	10	5	10	5	10	10	15	15	20	40	40	50	50
Soft lining	*TFM/EPDM (2-layer)*	-	10	10	6	10	6	10	12	18	18	24	48	48	60	60

[4] Hard lining = NRH; PFA; PTFE; TFM; ETFE
Coating = ECTFE; Rilsan
Soft lining = IIR; CSM

SISTO-16TWA

Body material	Nominal diameter (DN)	15	20	25	32	40	50	65	80	100	125	150	200
	Diaphragm diameter (MD)	40	40	65	65	65	92	115	168	168	202	280	280
	Diaphragm												
1.4409 (GX2CrNiMo19-11-2)	*SISTOMaXX (EPDM/W270)*	3	3	8	8	8	10	15	20	20	-	-	-
5.1301 (EN-GJL-250)/ Rilsan	*SISTOMaXX (EPDM/W270)*	-	-	-	-	-	-	-	-	-	40	50	50

SISTO-20

Lining/ Coating [5]	Nominal diameter (DN)	15	15	15	20	25	32	40	50	65	80	100	125	150	200	250	300
	Diaphragm diameter (MD)	40	65	65	65	65	92	92	115	168	168	202	202	280	280	415	415
	Diaphragm	4 hole	2 hole	4 hole	4 hole	4 hole											
Without coating Coated	*EPDM, NBR, CSM, IIR*	3	10	4	4	4	10	10	15	20	20	40	40	50	50	75	75
Without coating Coated	*TFM/EPDM (2-layer)*	4	20	15	15	15	25	25	40	55	55	80	80	100	100	85	85
Hard lining	*EPDM, NBR, CSM, IIR*	3	10	6	6	6	12	12	18	24	24	48	48	60	60	75	75
Hard lining	*TFM/EPDM (2-layer)*	4	18	13	13	13	22	22	36	50	50	70	70	90	90	85	85
Hard lining	*TFM, PVDF, EPDM (3-layer)*	4	-	13	13	13	22	22	36	50	50	70	70	90	90	85	85
Soft lining	*EPDM, NBR, CSM, IIR*	-	8	5	5	5	10	10	15	20	20	40	40	50	50	60	60
Soft lining	*TFM/EPDM (2-layer)*	-	10	6	6	6	12	12	18	24	24	48	48	60	60	65	65

SISTO-20 body materials 1.4409, with flanged ends/socket ends

Lining/ Coating [5]	Nominal diameter (DN)	15	20	25	32	40	50	65	80	100	125	150	200
	Diaphragm diameter (MD)	40	40	65	65	65	92	115	168	168	202	280	280
	Diaphragm												
Without coating Coated	*EPDM, NBR, CSM, IIR*	3	3	8	8	8	10	15	20	20	40	50	50
Without coating Coated	*TFM/EPDM (2-layer)*	4	4	15	15	15	25	40	55	55	80	100	100

SISTO-20M

Lining/ Coating [5]	Nominal diameter (DN)	10	15	20	25	32	40	50
	Diaphragm diameter (MD)	40	40	40	65	65	92	92
Without coating	*EPDM*	3	3	3	4	4	10	10

SISTO-KB/-KBS

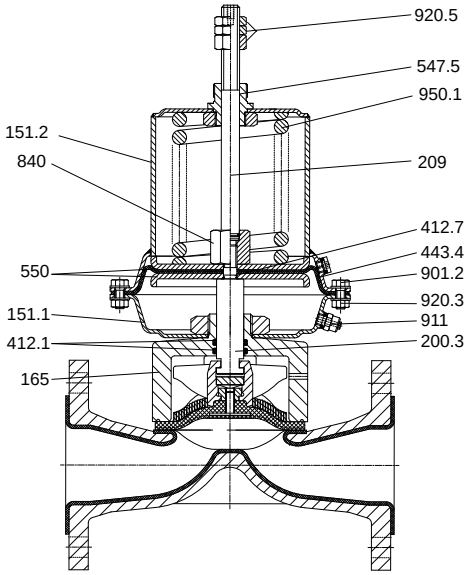
Lining/ Coating [5]	Diaphragm	Nominal diameter (DN)											
		15	20	25	32	40	50	65	80	100	125	150	200
Without coating Hard lining Coated	*EPDM, NBR, CSM, IIR*	6	6	12	12	12	30	35	45	45	50	60	70
Soft lining	*EPDM, NBR, CSM, IIR*	5	5	10	10	10	25	30	40	35	40	45	50

[5] Hard lining = NRH; PFA; PTFE; TFM, ETFE
Coating = ECTFE; Rilsan
Soft lining = IIR; CSM

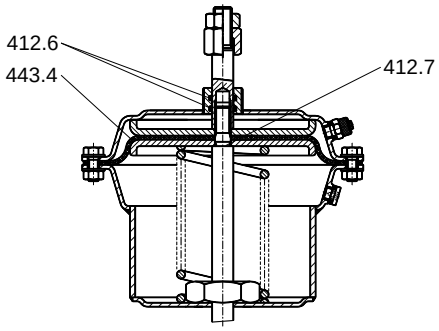
7 Pneumatic diaphragm actuator (SISTO-LAD)/pneumatic piston actuator (SISTO-LAP) with and without valve

Type series	DN	PN	Material	Type series booklet No. [6]
SISTO-LAD	-	-	see Type series booklet	9211.1
SISTO-LAP	-	-		9210.1

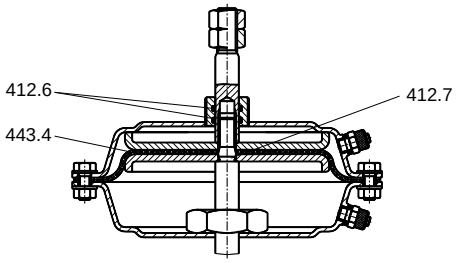
Sectional drawings type LAD



SISTO-diaphragm valve with mounted SISTO-LAD-SF

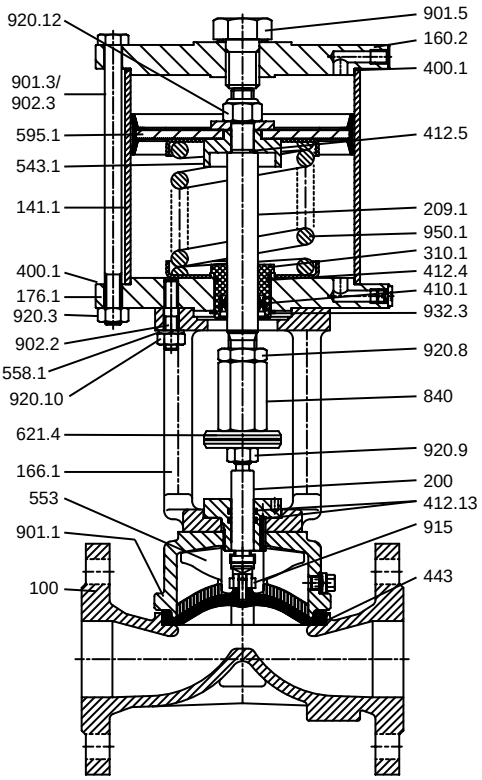


SISTO-LAD-OF

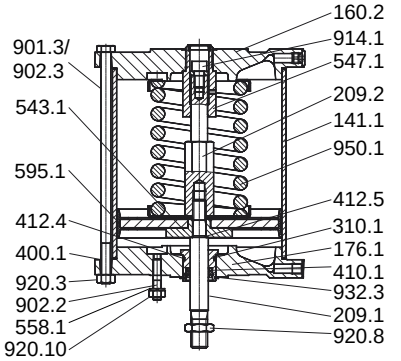


SISTO-LAD-AZ

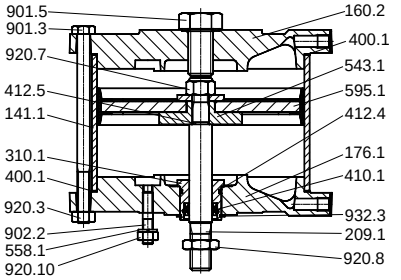
Sectional drawings type LAP



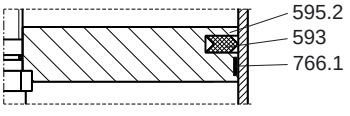
SISTO diaphragm valve with mounted SISTO-LAP-OF



SISTO-LAP-SF



SISTO-LAP-AZ



Piston 300 with K-ring

[6] Download at www.sisto.lu

Parts list

Part No.	Description
100	Body
141.1	Cylinder
151.1	Lower housing section
151.2	Upper housing section
160.2	Top end cap
165	Bonnet
166.1	Yoke
168.2	Yoke
176.1	Bottom end cap
200	Stem
200.2	Stem
200.3	Stem
209	Piston rod
209.1	Lower piston rod
209.2	Upper piston rod
209.4	Upper piston rod
310.1 [7) 9)]	**Plain bearing**
400.1 [7) 9)]	**Gasket**
410.1 [7) 9)]	**Seal/wiper set**
412.1 [7) 9)]	**O-ring**
412.2	O-ring
412.4 [7) 9)]	**O-ring**

Part No.	Description
412.5 [7) 9)]	**O-ring**
412.6 [7) 9)]	**O-ring**
412.7 [7) 9)]	**O-ring**
412.13	O-ring
443 [8)]	**Diaphragm**
443.4 [7)]	**Actuator diaphragm**
485.1	Stem coupling
527.1	Locating sleeve
543.1	Spacer bush
544.3	Threaded bush
547.1	Guide bush
547.5	Guide bush
550 [9)]	**Diaphragm plate**
553	Compressor
558.1	Lock washer
593 [7) 9)]	**Piston seal**
595.1 [7) 9)]	**Piston assembly**
595.2	Piston
621.4	Position indicator
766.1 [7) 9)]	**Guide band**
840	Coupling
901.1	Hexagon head bolt

Part No.	Description
901.2	Hexagon head bolt
901.3	Hexagon head bolt
901.5	Hexagon head bolt
902.2	Stud
902.3	Stud
911	Compressed air port
914.1	Hexagon socket head cap screw
915	Floating nut
920.3	Nut
920.5	Nut
920.7	Nut
920.8	Nut
920.9	Nut
920.10	Nut
920.12	Nut
920.14	Nut
920.15	Nut
920.16	Nut
932.3	Circlip
933.1	Splint pin
950.1	Spring
961	Handwheel

7.1 Function pneumatic diaphragm actuator SISTO-LAD

Pneumatic diaphragm actuators with diaphragm valves or pneumatic diaphragm actuators without diaphragm valves are available in the following designs:

- ”Fail-close” = SF
- ”Fail-open” = OF
- ”Double-acting” = AZ.

NOTE

The valves/actuators are automatically taken to their fail-safe positions as soon as the control air is intentionally or unintentionally released. The visible moving parts of the valve (both manual and automatic actuation) also serve as position indicators.

The valves with pneumatic diaphragm actuator consist of the pressure-retaining parts, i.e. body [100] and bonnet [165], and the functional unit.

The body [100] and actuator or bonnet [165] are connected by bolts [901.1] or studs [902.1] and nuts [920.1].

Functional unit of the pneumatic diaphragm actuator SISTO-LAD	
with diaphragm valve	**without diaphragm valve**
Actuator housing sections [151.1/151.2]	Actuator housing sections [151.1/151.2]
Actuator diaphragm [443.4]	Actuator diaphragm [443.4]
Diaphragm plate [550]	Diaphragm plate [550]
Spring [950] for OF- and SF-designs	Spring [950] for OF- and SF-designs
Stem [200.3]	Stem [200.3]
Piston rod [209]	Piston rod [209]
Bonnet [165]	
Compressor [553] with floating nut [915]	
Diaphragm [443]	

7.2 Function pneumatic piston actuator SISTO-LAP

Pneumatic piston actuators with diaphragm valves or pneumatic piston actuators without diaphragm valves are available in the following designs:

- ”Fail-close” = SF
- ”Fail-open” = OF
- ”Double-acting” = AZ.

NOTE

The valves/actuators are automatically taken to their fail-safe positions as soon as the control air is intentionally or unintentionally released. The visible moving parts of the valve (both manual and automatic actuation) also serve as position indicators.

The valves with pneumatic piston actuator consist of the pressure-retaining parts, i.e. body [100] and bonnet [165] with yoke [166.1], and the functional unit.

The body [100] and the actuator or bonnet [165] with yoke [166.1] are connected by bolts [901.1] or studs [902.1] and nuts [920.1].

Functional unit of the pneumatic piston actuator SISTO-LAP	
with diaphragm valve	**without diaphragm valve**
Bottom end cap [176.1]	Bottom end cap [176.1]
Cylinder [141.1]	Cylinder [141.1]
Top end cap [160.2]	Top end cap [160.2]
Piston [595]	Piston [595]
Spring [950.1] for OF- and SF-designs	Spring [950.1] for OF- and SF-designs
Piston rods [209.1/209.2]	Piston rods [209.1/209.2]
Bonnet [165] with yoke [166.1]	
Compressor [553] with floating nut [915]	
Diaphragm [443]	

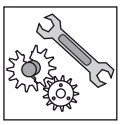
[7)] Recommended spare parts (= complete set of sealing elements)
[8)] Recommended spare parts
[9)] We recommend having these parts replaced in our factory

7.3 Installation

7.3.1 General information/Safety regulations

Responsibility for positioning and installing the pneumatic actuators always lies with the engineering company, construction company or operator/user.

Planning and installation errors may impair the reliable function of the pneumatic actuators and pose a substantial safety hazard. Compliance with the following requirements is of particular importance:



ATTENTION

- The piping shall be laid in such a way as to prevent detrimental thrust and torsional forces, as well as vibrations and tensions from being transmitted to the valve bodies in installed and operating condition, to avoid impairment of valve function and/or valve rupture.
- The caps on the connection ports shall be removed immediately prior to installation.
- The flanged ends of the flanged valves described in this manual comply with flange standard EN 1092-1/-2, incl. finish of sealing surfaces for elastomer or fluoropolymer gaskets.

NOTE

Do not paint any parts which are relevant to the function of the valve, such as moving stems and position indicator components.
Do not use valve handwheels [961] as footholds.

WARNING

For safety reasons, valves and piping systems operated at high (> +50 °C) or low (< 0 °C) temperatures must be insulated, or a warning sign must point out the risk of personal injury involved when touching the hot or cold components.

In keeping with German energy-saving regulations (EnEV) we recommend that valves handling warm fluids should be insulated to save energy.

CAUTION

Risk of crushing through moving parts!

Pneumatic actuators with external moving elements must be fitted with protective covers, or other suitable measures must be taken to prevent accidents.

7.3.2 Installation position

Diaphragm valves with pneumatic actuators must be installed with the stem in a vertical position. If this condition cannot be met, adequately support the valve on site or consult the manufacturer. We generally recommend supporting actuators to withstand vibrations in the piping (see Figures 1 and 2).

Valves with gearboxes or actuators as well as pneumatic actuators mounted on valves from other manufacturers must be installed with the stem in the vertical position. If this condition cannot be met, adequately support the valve on site or consult the manufacturer.

WARNING

Risk of electrical hazard!

Electrical connection shall be effected by suitably trained personnel only.

7.3.3 Special designs

For positioning and installing special valve designs please, contact the consultant, construction company or operator.

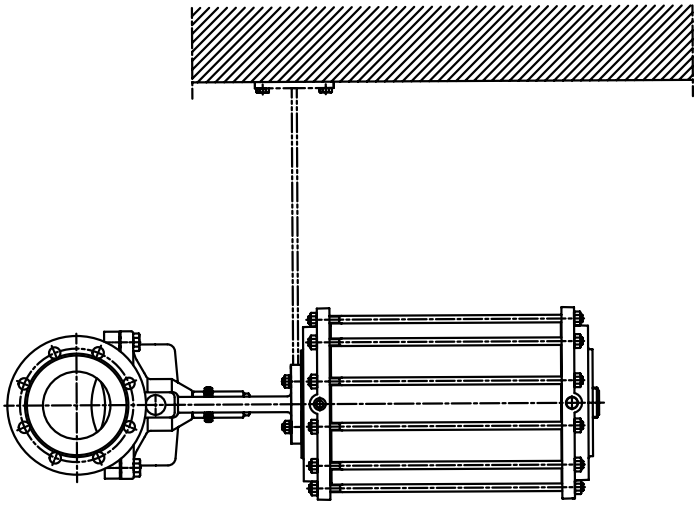


Figure 1: Sketch of the support of a pneumatic actuator – horizontal

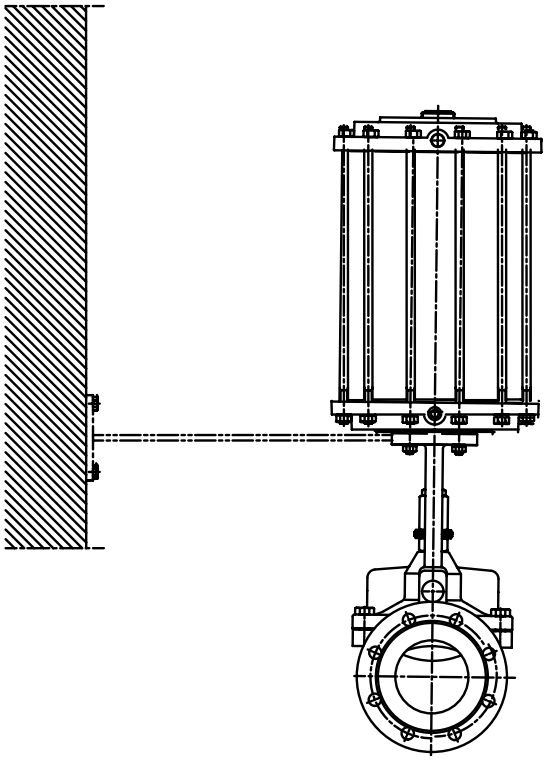


Figure 2: Sketch of the support of a pneumatic actuator - vertical

7.3.4 Insulation

An insulation does not impair the function of the valve. SISTO Armaturen recommends to make sure that the sealing areas at the bonnet joints and at the stem passage are easily accessible and visible.

7.4 Installation instructions

7.4.1 Flanged valves

See Section 6.3.1 page 9.

7.4.2 Welding instructions

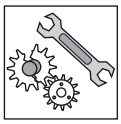
See Section 6.3.2 page 9.

7.5 Commissioning/Start-up/Shutdown

(Please also refer to Section 7.3, Installation)

7.5.1 General

Prior to commissioning/start-up compare the material, pressure and temperature data on the valves with the operating conditions of the piping to check the material's chemical resistance and stability under load.



ATTENTION

Surge pressures, which might occur, must not exceed the max. permissible pressure. Safety measures are required to be taken by the operator.

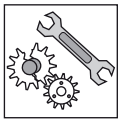
In new systems and particularly after repair, the complete piping system must be thoroughly flushed with the valves fully open so that particles and/or welding beads that might damage the valves are removed.

The responsibility for the media and method used for cleaning the piping system lies with the party carrying out the cleaning.

CAUTION

Risk of injury!

Venting the valve by undoing, e.g., the bonnet/cover bolting is dangerous and therefore not permitted. To prevent damage to the valve material or joint seals, the usual start-up and shutdown velocities must be adhered to.



ATTENTION

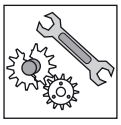
SISTO pneumatic actuators can be used with the control medium air according to ISO 8573-1.

- Operation above 0 °C, purity class 5.4.4 should be used: filter 40 µm, oil concentration 5 mg/m³, dew point 3 °C.
- Operation until -10 °C purity class 5.3.4 should be used: filter 40 µm,oil concentration 5 mg/m³, dew point -20 °C.

To determine the required air quality, take into account the specification of all components used in the system.

7.5.2 Valve actuation

Viewed from above, the manually operated valves are closed by turning the handwheel [961] in clockwise direction, and opened by turning the handwheel [961] in counter-clockwise direction. Valve variants which deviate from this rule are marked accordingly.



ATTENTION

Valves with handwheels must only be actuated by hand. As the valve can be damaged by applying excessive force, it the use of levers for turning the handwheel [961] is not allowed.

Shut-of valves are normally used either fully open or fully closed.

If, while opening or closing the valve, a resistance can be felt, the valve is in its final position and the operation must be stopped.
Continued actuation may result in increased wear of the valve.

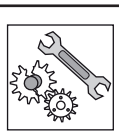
CAUTION

Risk of burns!

The handwheel can get hot during operation. If in doubt, only operate the handwheel with protective gloves.

7.5.3 Functional check prior to commissioning

Check the shut-off function and integrity of the installed valves prior to commissioning/start-up by opening and closing them several times.
If required, evenly re-tighten the body [100]/bonnet [165] bolting as well as the bolting at the mating flanges (see Section 6.9/7.11).



ATTENTION

Prevent jamming!

Before re-tightening the body [100]/bonnet [165] bolting open the valve by two full handwheel turns.

7.5.4 Valves with actuator

ATTENTION

On valves with electric or pneumatic actuators, the actuator strokes/forces must be limited. Non-compliance could result in substantial valve damage!

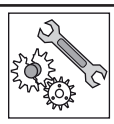
Electrical actuators supplied with the valves are ready for operation and wired as follows:

- Valve "CLOSED": travel-dependent
- Valve "OPEN": travel-dependent

The wiring diagrams are located in the terminal boxes.

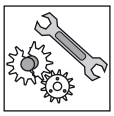
NOTE

If the valves are fitted with actuators, ensure that the actuator's operating manual is also observed.



ATTENTION

Changing to force-dependent limit switching may reduce the service life of the diaphragm [443].



ATTENTION

Risk of overload!

For pneumatic actuators, the control pressures specified in the order shall be complied with. Non-observance may damage the actuator.

Closing and opening torques or actuating forces shall be enquired from the manufacturer, if necessary.

7.5.5 Shutdown

Measures to be taken for shutdown:

1. Shutdown the valve.
2. Stop pneumatically auxiliary energy and depressurize actuator.
3. Further procedure for pneumatic piston actuator (type LAP), see Section 7.13.

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

1. Drain fluids which change their physical condition due to changes in concentration, polymerisation, crystallisation, solidification, etc. from the piping.
2. If required, flush the piping with the valves fully opened.

7.6 Maintenance

7.6.1 Safety information

The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel.
The operating manual/installation instructions for partly completed machinery must be read and understood by the responsible specialist personnel/operators prior to installation and commissioning.

It is imperative that the below safety instructions and the general information on safety as per Section 2, be observed for all service and maintenance work to be performed at the diaphragm valves and the pneumatic actuators.

Use appropriate spare parts and tools, even in emergencies.

DANGER

Risk of injury from valve under pressure!
Risk of burns!

Never open a valve under pressure! Danger to life!

The valve and its surrounding system must be depressurised prior to any maintenance work and installation work.

This applies to the following steps:

- before undoing the flange bolting between the valve and the pipe
- before removing the bonnet [165]
- before removing any drain or vent plugs
- before removing a bolted-on actuator.

Allow the valve to cool down so that the temperature is below the fluid's vaporisation temperature in all areas in contact with the fluid in order to effectively prevent any risk of scalding.

DANGER

Harmful and dangerous fluids!

If toxic or easily inflammable fluids were handled or fluids whose residues may cause corrosion when coming into contact with atmospheric humidity, drain the valve and flush or vent it.
Wear personal protective equipment where necessary.

Depending on the installation position, fluid residues may be left in the valve; these must be collected and properly disposed of.
Prior to any transport, flush and drain the valve thoroughly.

For actuated valves, also observe the following additional instructions:

WARNING

Risk of electrical hazard!

If actuators powered by an external source of energy (electric or pneumatic) need to be removed from the valves or dismantled, the energy supply must be shut down prior to starting any work and the instructions in Sections 2, 7.6.1 and the operating manual of the actuator must be observed.

WARNING

Risk of injury by loaded spring!

Actuators with integrated spring mechanism contain pre-loaded springs. They shall only be dismantled with extreme caution, using the requisite locking devices.
Wear personal protective equipment where necessary.
Danger to life by releasing spring energy.

If you have any questions please contact the manufacturer.

7.6.2 Maintenance

NOTE

It is recommended to regularly check the actuators for leaks and functionality.
The operator/user is responsible for fixing appropriate inspection and servicing intervals as required by the service conditions of the valves an pneumatic actuators.

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

NOTE

- On any diaphragm valve, the diaphragm [443] is the highest stressed component.
- The diaphragm [443] is not only subjected to mechanical stress but also to wear caused by the fluid handled.

  We recommend to regularly check the diaphragm [443] at intervals to be individually stipulated depending on service conditions and actuation frequency and replace them if required.

NOTE

To check the diaphragm [443], remove the bonnet from the valve body. See Section 7.7/7.8, "Replacing the diaphragm".

Observe the safety information in Section 2 and Section 7.6.1.

All valve components and pneumatic actuators have been designed to be largely maintenance-free. The materials of the sliding parts have been selected for minimum wear.

The service life of the valve can be extended by taking the following measures:

- Checking the function by opening and closing the valve at least twice a year.
- Lubricating the moving parts with standardised lubricants to DIN 51825 which are suitable for the application of the valve.

7.7 Replacing the diaphragm on weir-type valves (SISTO-KB/-KBS) with pneumatic actuator (type LAD/ type LAP)

The valve bonnet can only be removed together with the actuator.

1. Run the actuator with the mounted bonnet to closed position:
   - "Fail-close" (SF) actuator, valve pressure must be released
   - "Fail-open" (OF) actuator and "Double-acting" (AZ) actuator by applying compressed air to the upper control air port.
2. Undo the bolts [901.1] or studs [902.1] and nuts [920.1] to remove the upper valve section with the actuator.
3. Unscrew the diaphragm [443] from the compressor [553] by turning it counter-clockwise.
4. When fitting the replacement diaphragm [443] refer to the material marking on the diaphragm [443].

NOTE

After dismantling, clean all parts. Damage to the parts must be prevented. Check parts for damage and replace if necessary.

Proceed as follows to fit the new diaphragm:

5. The contact surfaces of the diaphragm [443] inside the body [100] and the bonnet [165] must be clean and dry.
6. Run the actuator with the mounted bonnet to closed position.
   - "Fail-close" (SF) actuator: valve pressure must be released
   - "Fail-open" (OF) actuator and "Double-acting" (AZ) actuator: by applying compressed air to the upper control air port.
7. Remove any protection from the fastening grub screw of the diaphragm [443].
8. Screw in the diaphragm [443] up to the stop in the compressor [553]. To avoid overloading the diaphragm [443], do not screw it in any further!
9. Screw it back by a maximum of 180° to align it correctly.
10. The upper valve section must be taken to the closed position before the bonnet [165] is fitted (see Para. 6).
11. Place the bonnet [165] on the body [100] and tighten the fixing screws [901.1] or the hexagon nuts [920.1] of the bonnet by hand.
12. Tighten the bonnet bolts evenly and crosswise in accordance with the tightening torques table.
13. Run the actuator to the open position. Verify the tightening torques of the bonnet bolts.

The required torques are given in Section 6.9 and 7.11.

ATTENTION

Do not tighten bonnet screws while the system is pressurized or under high temperatures (> +40 °C).

ATTENTION

If the diaphragm is not screwed far enough into the compressor, the closing force will act directly on the diaphragm screw and not via the compressor. This will result in damage and premature failure of the diaphragm and leakage of the valve.

If the diaphragm is screwed in too far, the valve seat will no longer seal properly. The function of the valve is no longer guaranteed.

7.8 Replacing the diaphragm on the full bore valves (SISTO-10/-16/-20) with pneumatic actuator (type LAD/type LAP)

The valve bonnet can only be removed together with the actuator.

1. Run the actuator with the mounted bonnet to open position:
   - "Fail-close" (SF) actuator: by applying compressed air to the actuator
   - "Fail-open" (OF) actuator and "Double-acting" (AZ) actuator valve pressure must be released.
2. Undo the bolts [901.1] or studs [902.1] and nuts [920.1] to remove the upper valve section with the actuator.
3. Run the actuator with the mounted bonnet to closed position.
   - "Fail-close" (SF) actuator: valve pressure must be released
   - "Fail-open" (OF) actuator and "Double-acting" (AZ) actuator: by applying compressed air to the upper control air port.
4. Unscrew the diaphragm [443] from the compressor [553] and the floating nut [915] by turning it counter-clockwise.
5. When fitting the replacement diaphragm refer to the material marking on the diaphragm [443].

NOTE

After dismantling, clean all parts. Damage to the parts must be prevented. Check parts for damage and replace if necessary.

Proceed as follows to fit the new diaphragm [443]:

6. The contact surfaces of the diaphragm [443] inside the body [100] and the bonnet [165] must be clean and dry.
7. Run the actuator with the mounted bonnet to closed position.
   - "Fail-close" (SF) actuator: valve pressure must be released
   - "Fail-open" (OF) actuator and "Double-acting" (AZ) actuator: by applying compressed air to the upper control air port.
8. On valves with spiral-supported diaphragm [951]: Make sure to place the support spiral [951] into the bonnet [165]. Verify that the last winding of the support spiral protrudes [951] beyond the sealing lip. The last winding of the support spiral [951] must not end on a compressor [553] ridge.
9. Remove any protection from the fastening grub screw of the diaphragm [443].
10. Screw in the diaphragm [443] up to the stop in the compresor [553]. To avoid overloading the diaphragm [443], do not screw it in any further!
11. Screw it back by a maximum of 180° to align it correctly.
12. The upper valve section must be taken to the open position before the bonnet [165] is fitted:
    - "Fail-close" (SF) actuator: by applying compressed air to the actuator
    - "Fail-open" (OF) actuator and "Double-acting" (AZ) actuator valve pressure must be released.
13. Make sure that the centring boss of the diaphragm [443] aligns with the "pocket" in the valve body [100] (not relevant for MD 40 and SISTO-10/-10S).
14. When fitting the bonnet with the diaphragm [443] on the body [100] make sure that the sealing protrusion of the diaphragm [443] is positioned transversely to the flow direction.
15. Place the bonnet [165] on the body [100] and tighten the fixing screws [901.1] or the hexagon nuts [920.1] of the bonnet by hand.
16. Run the actuator to the closed position (see Para. 7) and tighten the bonnet bolts evenly and crosswise in accordance with the tightening torques table.
17. Run the actuator to the open position. Verify the tightening torques of the bonnet bolts.

The required torques are given in Section 6.9 and 7.11.

ATTENTION

Do not tighten bonnet screws while the system is pressurized or under high temperatures (> +40 °C).

NOTE

Diaphragms [443] marked "MD 40" and featuring a fastening button on the back are buttoned into the compressor [553] by means of this button. Simultaneous pulling and turning on one side will easily remove the diaphragm [443] from the compressor [553].

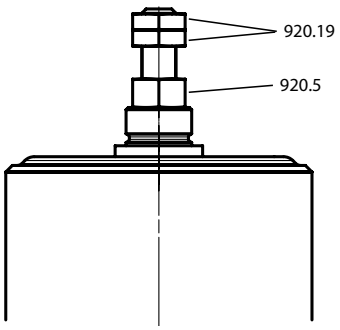
NOTE

The metal backing ring used for multi-part diaphragms TFM/EPDM) must be aligned such that its grooved face rests against the back of the plastic diaphragm. Mounted in this way, the ring's smaller face will point towards the bonnet flange.

7.9 Manual override of pneumatic diaphragm actuator (LAD-SF)

The diaphragm actuators in the "Safety position closed (SF)" variant are equipped with a manual override as standard (Figure 3).

1. Secure both upper hexagon nuts [920.19] with an appropriate tool.
2. Screw the lower hexagon nut [920.5] in further by turning it right. This will raise the actuator. It is vital to ensure that the piston rod does not turn as well!
3. Once the fault has been resolved, turn the hexagon nut [920.5] against the two upper hexagon nuts [920.19] again. Counter the hexagon nut [920.5] with the hexagon nuts [920.19].
4. Check the stroke and readjust if it has become misaligned.



7.10 Replacing the actuator diaphragm of pneumatic diaphragm actuator (type LAD)

WARNING

Risk of injury by loaded spring!

The “Fail-close” (SF) and the “Fail-open” (OF) actuators are fitted with pre-loaded springs.
Danger to life by releasing spring energy!

Actuator (type LAD) “Fail-close“ (SF)	Actuator (type LAD) “Fail-open“ (OF)	“Double-acting“ actuator (AZ) (type LAD)
1. Vent the actuator and disconnect it from the compressed air supply. 2. Unscrew the nut [920.3] and the Hexagon screw [901.2] and replace it with a threaded rod. The threaded rod should be of strength class 8.8 and be at least 300 mm long. Screw nut [920.3] on the threaded rod until it stops. 3. Repeat step 2 for opposing nuts [920.3] until at least 4 hexagon bolts [901.2] have been replaced by threaded rods. If the actuator has more than 8 hexagon head screws [901.2], half of them must be replaced by threaded rods. 4. Unscrew the remaining nuts [920.3] around the actuator housing from the bolts [901.2]. 5. Unscrew the nuts [920.5] from the sliding stem [209]. 6. Loosen the nuts [920.3] on the threaded rods evenly until the spring [950.1] is fully relaxed. 7. Remove the upper actuator housing section [151.2]. 8. Unscrew the coupling [840] (secured with “Loctite 243“) with the piston rod [209] from the stem [200]. 9. Pull off the upper diaphragm plate [550]. 10. Replace the defective actuator diaphragm [443.4]. 11. Reassembly is affected in reverse order to dismantling. 12. Connect the actuator to the compressed air supply.	1. Vent the actuator and disconnect it from the compressed air supply. 2. Unscrew the nut [920.3] and the Hexagon screw [901.2] and replace it with a threaded rod. The threaded rod should be of strength class 8.8 and be at least 300 mm long. Screw nut [920.3] on the threaded rod until it stops. 3. Repeat step 2 for opposing nuts [920.3] until at least 4 hexagon bolts [901.2] have been replaced by threaded rods. If the actuator has more than 8 hexagon head screws [901.2], half of them must be replaced by threaded rods. 4. Unscrew the remaining nuts [920.3] around the actuator housing from the bolts [901.2]. 5. Using the locked hexagon nut [920.5], unscrew the piston rod [209] (“Loctite 243 secured) from the stem [200]. 6. Evenly undo the nuts [920.3] on the tie bolt until the spring [950.1] tension is relieved. 7. Remove the upper actuator housing section [151.2]. 8. Pull off the upper diaphragm plate [550]. 9. Replace the defective actuator diaphragm [443.4]. 10. Reassembly is affected in reverse order to dismantling. 11. Connect the actuator to the compressed air supply.	1. Vent the actuator and disconnect it from the compressed air supply. 2. Unscrew all nuts [920.3] from the upper actuator housing section [151.2]. 3. Using the locked hexagon nut [920.5], unscrew the piston rod [209] (“Loctite 243 secured) from the stem [200]. 4. Pull off the upper diaphragm plate [550]. 5. Replace the defective actuator diaphragm [443.4]. 6. Reassembly is affected in reverse order to dismantling. 7. Connect the actuator to the compressed air supply.

Note:
When tightening the coupling [840]/ piston rod [209] on the stem [200], make sure to secure the connection with “Loctite 243“ again and verify that the bolt holes of the diaphragm [443] align with the bolt holes of the lower actuator housing section [151.1]. The actuator diaphragm [443.4] must be free from creases. Stem [200] rotation is prevented by a flat end joint in the compressor [553].

NOTE

- The nuts [920.5] act as travel stops in closing direction. They should be set so as to ensure that the valve shuts off tightly at the relevant operating pressure.
- If during the functional test with the valve installed in the pipeline and subjected to line pressure the nut [920.5] is found to abut the upper actuator housing section [151.2], run the actuator to the open position and unscrew the nuts [920.5] by half a turn from the piston rod [209].
- Then lock the nut [920.5] again, holding the lower nut [920.5] tightly in position.

7.11 Tightening torques (Nm) for pneumatic diaphragm actuator (type LAD)

Tightening torques for the connecting screws/bolts between the upper and lower actuator sections (only apply to the valve‘s temperature range between +5 °C and +40 °C)

	Size		
	100	150	220
Actuator diaphragm [443.4] between upper housing section [151.2] and lower housing section [151.1].	10	12	15

7.12 Manual override of pneumatic piston actuators (type LAP)

7.12.1 Manual override of “Double-acting“ actuator (LAP-AZ)

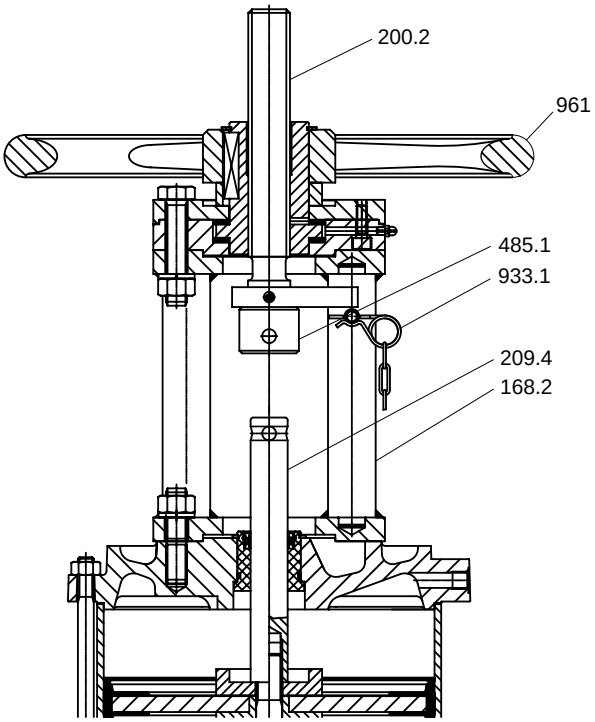


Figure 4: “Double-acting“ actuator (LAP-AZ)

If the auxiliary energy supply fails, the actuator can be operated manually by means of the emergency handwheel [961] mounted on the pneumatic actuator (LAP).

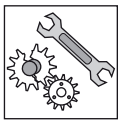
For the pneumatic actuator to be operated via the emergency handwheel [961] in emergencies, the two systems must be connected with each other:

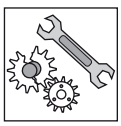
1. Turn the handwheel [961] in clockwise direction to position the upper stem [200.2] and stem coupling [485.1] on the upper piston rod [209.4].
2. Connect the stem coupling [485.1] and the piston rod [209.4] using the splint pin [933.1] supplied.

Actuator in closed position: Turn the handwheel [961] clockwise.

Actuator in open position: Turn the handwheel [961] counter-clockwise.

In normal operation, the emergency handwheel [961] is disengaged from the pneumatic actuator.

	**ATTENTION** **Risk of system malfunction**! Automatic operation of the pneumatic actuator with the manual override engaged could result in actuator/valve damage and system malfunction.

	**ATTENTION** **Risk of system malfunction!** Before reactivating normal operation: 1. Remove the splint pin [933.1]. 2. Turn the handwheel [961] counter-clockwise until the stem [200.2] has been returned to its initial position. 3. Finally, remove the splint pin [933.1] and insert it into the drilled hole provided in the yoke [168.2] below the anti-rotation device fitted on the stem.

7.12.2 Manual override of “Fail-open“ actuator (LAP-OF)

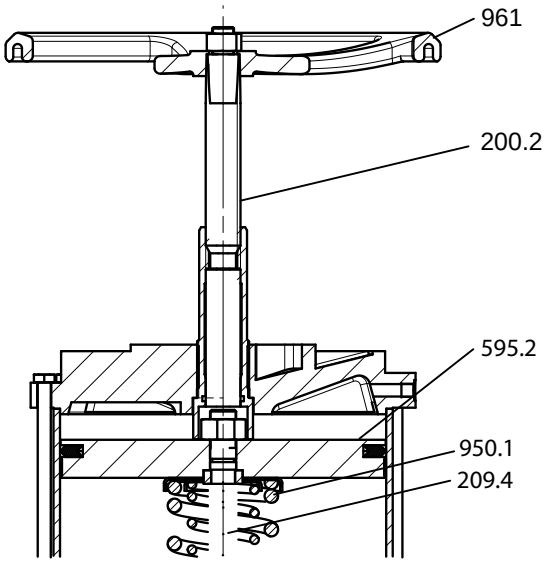


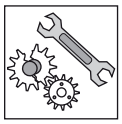
Figure 5: “Fail-open“ actuator (LAP-OF)

If the auxiliary energy supply fails, the actuator can be manually operated in closing direction by means of the emergency handwheel [961] mounted on the pneumatic actuator (LAP).

To operate the pneumatic actuator via the emergency handwheel [961] in emergencies, proceed as follows:

1. Turn the handwheel [961] clockwise.
2. The stem [200.2] will compress the spring pack via the piston [595.2], thus closing the valve.
3. The emergency handwheel [961] cannot be used to actuate a mechanically blocked valve.

In normal operation, the emergency handwheel [961] is without function.

	**CAUTION** **Risk of system malfunction!** Before reactivating normal operation: • Turn the handwheel [961] counter-clockwise to return the stem [200.2] to its initial position up to the stop. Otherwise valve travel would be restricted, resulting in a reduced volume flow through the valve.

7.12.3 Manual override of “Fail-close“ actuator (LAP-SF)

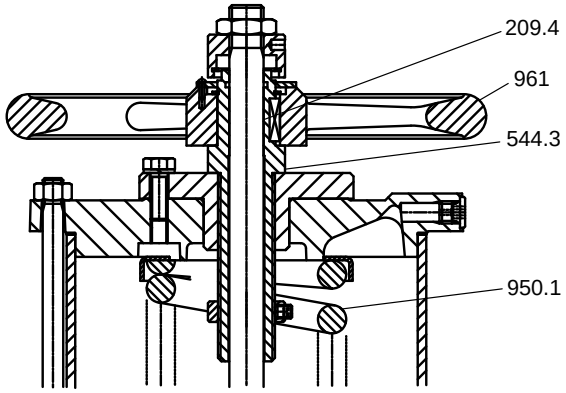


Figure 6: “Fail-close“ actuator (LAP-SF)

If the auxiliary energy supply fails, the actuator can be manually operated in opening direction by means of the emergency handwheel [961] mounted on the pneumatic actuator (LAP).

To operate the pneumatic actuator via the emergency handwheel [961] in emergencies, proceed as follows:

1. Turn the handwheel [961] counter-clockwise.
2. The threaded bush [544.3] will contract the spring pack [950.1] via the upper piston rod [209.4], thus opening the valve.
3. The emergency handwheel [961] cannot be used to close a mechanically blocked valve.

In normal operation, the emergency handwheel [961] is without function.

ATTENTION

Risk of system malfunction!

Before reactivating normal operation:

- Turn the handwheel [961] clockwise to return the threaded bush [544.3] to its initial position up to the stop**.**

Otherwise valve travel would be restricted, preventing the valve from reaching the fully closed position and providing tight shut-off.

7.12.4 Manual override with travel stop in closing direction (LAP-AZ)

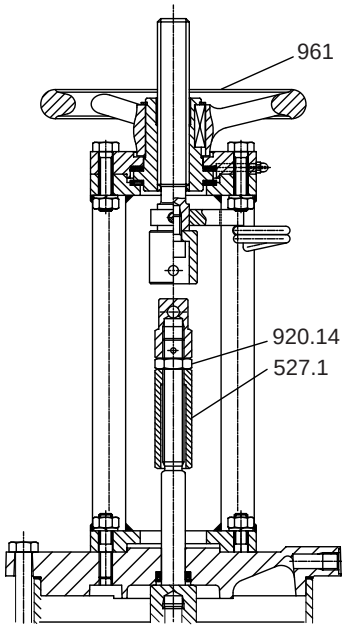


Figure 7: “Double-acting“ actuator (LAP-AZ)

“Double-acting“ actuator (LAP-AZ):

For operating the emergency handwheel [961]: see Section 7.12.1.

For setting the travel stop:

1. Loosen the nut [920.14] which locks the locating sleeve [527.1] in position.
2. The actuator must be in the “OPEN“ position.
3. The travel stop in closing direction can now be positioned as required by turning it clockwise.
4. Screw the nut [920.14] down against the locating sleeve [527.1] and lock it firmly.

ATTENTION

Risk of system malfunction!

Vibrations may result in the locked nuts working loose. The travel stop, therefore, needs to be checked regularly.

7.12.5 Manual override with travel stop in opening direction (LAP-OF/LAP-SF)

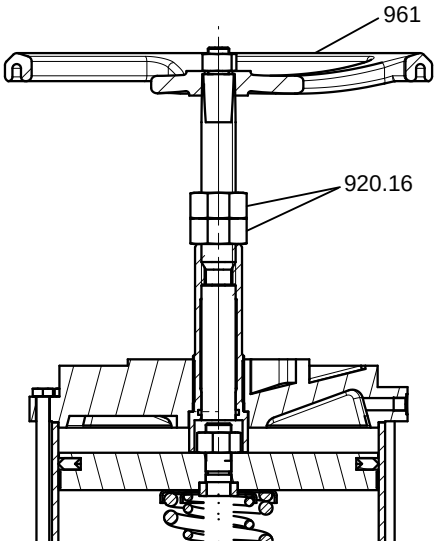


Figure 8: “Fail-open“ actuator (LAP-OF)

“Fail-open“ actuator (LAP-OF):

For operating the emergency handwheel [961]:

1. Loosen the two nuts [920.16] and screw them into their upper limit position.
2. Further procedure see Section 7.12.2.

For setting the travel stop:

1. Loosen the two nuts [920.16] and screw them upwards.
2. The actuator must be in the “CLOSED“ position.
3. Then turn the handwheel [961] into “CLOSED“ position until travel is restricted as required.
4. Screw the two nuts [920.16] downwards up to the stop and lock them firmly.

ATTENTION

Risk of system malfunction!

Vibrations may result in the locked nuts working loose. The travel stop, therefore, needs to be checked regularly.

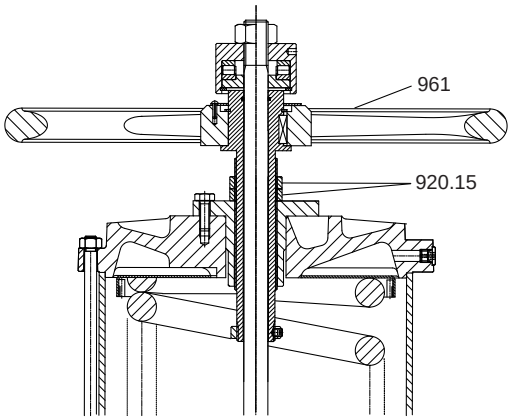


Figure 9: “Fail-close“ actuator (LAP-SF)

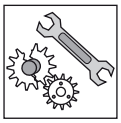
“Fail-close“ actuator (LAP-SF):

For operating the emergency handwheel [961]:

1. Loosen the two nuts [920.15].
2. Further procedure see Section 7.12.3.

For setting the travel stop:

1. Loosen the two nuts [920.15] and screw them upwards.
2. The actuator must be in the “CLOSED“ position.
3. Then turn the handwheel [961] in closing position until is restricted as required.
4. Screw the two nuts [920.15] downwards up to the stop and lock them firmly.



ATTENTION

Risk of system malfunction!

Vibrations may result in the locked nuts working loose. The travel stop, therefore, needs to be checked regularly.

7.13 Removing/Mounting a pneumatic piston actuator (type LAP)

Dismantling

1. Vent the actuator and disconnect it from the compressed air supply.
2. Loosen the nut [920.8] by approx. 1 turn.
3. Unscrew the nut [920.10] (4 nos.).
4. Turn the coupling [840] clockwise, using a suitable tool, until the piston rod [209.1] is fully unscrewed.
5. Lift the actuator off the yoke [166.1].

WARNING

Risk of injury by loaded spring!

- Further dismantling of the spring-loaded actuators may only be carried out at the supplying factory.
- Actuators of the spring-to-open and spring-to-close type are fitted with a spring mechanism. The studs [902.3], nut [920.3] or the bolts [901.3], which serve as tie bolts, must never be cut through or unscrewed.

Danger to life by releasing spring energy!

Reassembly

1. Use a stud [902.2] to align the actuator with the bolt circle of the yoke [166.1] and place the actuator on the yoke [166.1] (**IMPORTANT:** Note position of compressed air supply connection!).
2. Tighten the nuts [920.10] crosswise.
3. Screw the coupling [840] onto the piston rod [209.1] by 3 to 4 turns. If necessary, use compressed air supply to move the piston rod [209.1] (OF/AZ) carefully in closing direction.
4. Take the actuator to the open position using the compressed air supply. Screw the coupling [840] onto the piston rod [209.1] up to the stop, then release one turn.
5. Lock the coupling [840] in position with the nut [920.8].
6. Connect the actuator to the compressed air supply.

NOTE

The function test should be carried out while the piping system is pressurized.
If the nut [920.9] rests on the yoke [166.1], the valve might not seal properly
Actuators with piston rods protruding from both cylinder end caps:
If the nut [920.5] rests on the top end cap [160.2], the valve might not seal properly.

To remedy the fault, move the actuator into its open position.

Actuators with piston rod extending from one end only:

1. Loosen the hexagon nut [920.8].
2. Turn the coupling [840] approx. half a turn counter-clockwise.
3. Re-lock the nut [920.8] with the coupling [840].

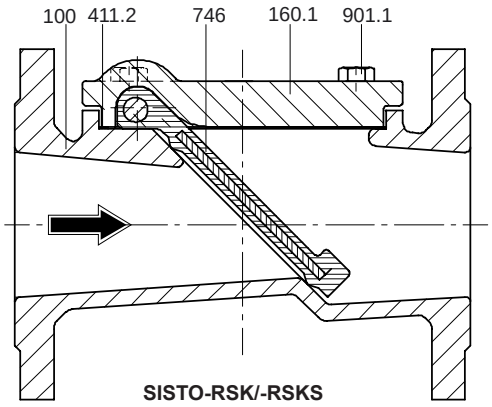
Actuators with piston rods protruding from both cylinder end caps:

1. Loosen the upper nut [920.5].
2. Turn the lower nut [920.5] approx. half a turn counter-clockwise.
3. Re-lock the upper nut (920.5).

8 Swing Check Valves

Type series	DN	PN	Material	Type series booklet No. [10]
SISTO-RSK/-RSKS	25-300	16	see Type series booklet	8675.1

Sectional drawing



SISTO-RSK/-RSKS

Parts list

Part No.	Description
100	Body
160.1	Cover
411.2 [11]	**Joint ring**

Part No.	Description
746 [11]	**Valve disc**
901.1	Hexagon head bolt

8.1 Function

SISTO-RSK/-RSKS swing check valves consist:
- Body [100]
- Cover [160.1]
- Joint ring [411.2]
- Valve disc [746].

The cover [160.1] and body [100] are connected by hexagon head bolts [901.1].

The upper end of the valve disc [746] is clamped tightly between the cover [160.1] and the body [100], allowing the lower end to move freely in the swing check valve's flow path.

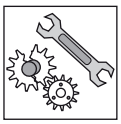
This ensures that the valve disc [746] is pressed against the seat in one direction, shutting off the flow.

8.2 Installation

8.2.1 General information/Safety regulations

Responsibility for positioning and installing the valves always lies with the engineering company, construction company or operator/user.

Planning and installation errors may impair the reliable function of the valves and pose a substantial safety hazard. Compliance with the following requirements is of particular importance:



ATTENTION

- The piping shall be laid in such a way as to prevent detrimental thrust and torsional forces, as well as vibrations and tensions from being transmitted to the valve bodies in installed and operating condition, to avoid impairment of valve function and/or valve rupture.
- The caps on the connection ports shall be removed immediately prior to installation.
- The flanged ends of the flanged valves described in this manual comply with flange standard EN 1092-1/-2, incl. finish of sealing surfaces for elastomer or fluoropolymer gaskets.

WARNING

For safety reasons, valves and piping systems operated at high (> +50 °C) or low (< 0 °C) temperatures must be insulated, or a warning sign must point out the risk of personal injury involved when touching the hot or cold components.

In keeping with German energy-saving regulations (EnEV) we recommend that valves handling warm fluids should be insulated to save energy.

8.2.2 Installation position

The swing check valves are marked with an arrow indicating the flow direction. They must generally be installed such that the flow direction of the fluid corresponds to the direction shown by the arrow on the valve.

8.2.3 Installing swing check valves

- Swing check valves can be installed horizontally and vertically.
- Vertical installation is only permitted if the fluid does not contain any solids.
- For vertical installation, ensure the flow direction is upward.

For direct installation at a centrifugal pump:
Use pipe bends of at least R/D = 1 upstream and downstream of the swing check valve.
Regarding the flow resistance, the optimum position of the free disc end is in the area of the highest fluid flow velocity.

For installation in a pipeline:
Implement stabilisation distances of at least the nominal size upstream and downstream of the swing check valve.

[10] Download at www.sisto.lu

[11] Recommended spare parts

8.2.4 Special designs

For positioning and installing special valve designs please, contact the consultant, construction company or operator.

8.2.5 Insulation

SISTO Armaturen recommends making sure that the sealing areas in the cover/bonnet joints are easily accessible and visible.

8.3 Installation instructions

NOTE

- The mating flange faces must be clean and undamaged.
- The gaskets on the mating faces must be properly centered.
- Use only fasteners and sealing elements made of approved materials.

NOTE

- Valves with soft rubber lining do not require flange gaskets due to the properties of the materials used, provided that the mating flanges of the piping comply with the same technical codes as the valves.
- Always use all flange bolt holes provided when connecting valve and pipe flanges.

Use suitable tools to tighten the bolts evenly and crosswise to the torques stipulated for the flanged connection in accordance with the gasket manufacturer‘s instructions.

8.4 Commissioning/Start-up/Shutdown

(Please also refer to Section 8.2, Installation)

8.4.1 General

Prior to commissioning/start-up compare the material, pressure and temperature data on the valves with the operating conditions of the piping to check the material’s chemical resistance and stability under load.

ATTENTION

Surge pressures, which might occur, must not exceed the max. permissible pressure. Safety measures are required to be taken by the operator.

In new systems and particularly after repair, the complete piping system must be thoroughly flushed with the valves fully open so that particles and/or welding beads that might damage the valves are removed.

The responsibility for the media and method used for cleaning the piping system lies with the party carrying out the cleaning.

CAUTION

Risk of injury!

Venting the valve by undoing, e.g., the bonnet/cover bolting is dangerous and therefore not permitted. To prevent damage to the valve material or joint seals, the usual start-up and shutdown velocities must be adhered to.

8.4.2 Shutdown

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

1. Drain fluids which change their physical condition due to changes in concentration, polymerisation, crystallisation, solidification, etc. from the piping.
2. If required, flush the piping with the valves fully opened.

8.5 Servicing/Maintenance

8.5.1 Safety information

The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel.
The operating manual/installation instructions for partly completed machinery must be read and understood by the responsible specialist personnel/operators prior to installation and commissioning.

It is imperative that the below safety instructions and the general information on safety as per Section 2, Safety, be observed for all service and maintenance work to be performed at the diaphragm valves.

Use appropriate spare parts and tools, even in emergencies.

WARNING

Risk of injury from valve under pressure!
Risk of burns!

Never open a valve under pressure. Danger to life!

The valve and its surrounding system must be depressurised prior to any maintenance work and installation work.

This applies to the following steps:

- before undoing the flange bolting between the valve and the pipe
- before removing the cover [160.1]

Allow the valve to cool down so that the temperature is below the fluid‘s vaporisation temperature in all areas in contact with the fluid in order to effectively prevent any risk of scalding.

DANGER

Harmful and dangerous fluids!

If toxic or easily inflammable fluids were handled or fluids whose residues may cause corrosion when coming into contact with atmospheric humidity, drain the valve and flush or vent it.
Wear personal protective equipment where necessary.

Depending on the installation position, fluid residues may be left in the valve; these must be collected and properly disposed of.
Prior to any transport, flush and drain the valve thoroughly. If you have any questions please contact the manufacturer.

8.5.2 Maintenance

NOTE

The operator/user is responsible for fixing appropriate inspection and servicing intervals as required by the service conditions of the valves.

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

NOTE

- On SISTO-RSK/-RSKS swing check valves, the valve disc [746] is the highest stressed component.
- The valve disc [746] is not only subjected to mechanical stress but also to wear caused by the fluid flowing through the valve. We recommend regularly checking the valve disc [746] at intervals to be individually stipulated depending on the operating conditions and actuation frequency, and replacing the valve disc if necessary.
- To check the valve disc [746], remove the cover [160.1] from the valve body. See Section 8.6, “Replacing the valve disc“.

Observe the safety information in Section 2, Section 8.5.1.

All valve components have been designed to be largely maintenance-free. The materials of the sliding parts have been selected for minimum wear.

8.6 Replacing the valve disc

1. Undo the bolts [901.1] to dismantle the cover [160.1].
2. The valve disc [746] is now lying loosely in the body [100] and can be replaced.
3. When replacing the valve disc [746], thoroughly clean all sealing surfaces before fitting the new disc.
4. The replacement valve disc [746] is fitted in reverse order. Make sure to centre the valve disc [746] in the cover [160.1].
5. Evenly tighten the bolts [901.1] crosswise in accordance with the tightening torques table.

The required torques are given in Section 8.8.

8.7 Valve reassembly

Valve reassembly must be effected in reverse order to dismantling.

NOTE

To maintain functional reliability, new sealing elements and gland packings must be used when the valve is reassembled.

After reassembly and prior to commissioning/start-up, the valves must be subjected to shell and leak testing to DIN EN 12266-1.
Observe Section 8.3.

8.8 Tightening torques (Nm)

Tightening torques of bonnet/cover bolting (only apply to the valve's temperature range between +5 °C and +40 °C)

SISTO-RSK

Lining/ Coating [12)]	Nominal diameter (DN)								
	025	032	040	050	065	080	100	125	150
Without coating	8	12	12	10	10	15	15	20	20
Soft lining	8	15	15	10	10	10	10	15	15
Hard lining	8	20	20	15	15	20	20	30	30

SISTO-RSKS

Lining/ Coating [12)]	Nominal diameter (DN)											
	025	032	040	050	065	080	100	125	150	200	250	300
Without coating	8	-	-	12	12	20	20	20	20	20	20	25
Soft lining	8	-	-	15	15	20	20	15	15	25	25	30
Hard lining	8	-	-	20	20	30	30	30	30	40	40	50

[12)] Hard lining = NRH; PFA; PTFE; TFM; ETFE
Coating = ECTFE; Rilsan
Soft lining = IIR; CSM

9 Trouble-shooting

9.1 General

Valves and pneumatic actuators made by SISTO Armaturen are robust in design. Nevertheless, malfunctions e.g. caused by maloperation, lack of maintenance or improper use cannot be ruled out completely.
All repair and maintenance work shall be performed by competent personnel using suitable tools and original spare parts.

WARNING

Risk of injury! Improper remedial work on the valve/ the pneumatic actuator.

For any work performed in order to remedy faults on the valve or the pneumatic actuator observe the relevant information given in this operating manual/installation instructions for partly completed machinery.

We recommend to have this work performed by our service personnel.

If you have any questions contact the manufacturer.

9.2 Faults and remedies

Problem	Possible cause	Remedy
Leakage at the mating flanges	• Contaminations/solids in the fluid. • Erosion, corrosion, abrasion. • Excessive loads from pipeline forces or thermal stresses.	• Dismantle, clean • Replace sealing elements.
Leakage at the bolting of body [100] - bonnet [165] or cover [160.1] - top end cap [160.2]	• Compressive-stress relaxation. • Gasket has settled as a result of high temperature fluctuations. • Impermissible pressure loads. • Poor maintenance. • Deterioration of sealing elements due to poor resistance to temperature or fluid handled.	• Re-tighten the bolts [901.1] at the bonnet/cover. • **For SISTO-RSK/-RSKS only:** Replace the sealing element [411.2, joint ring] after having removed the bonnet/cover bolting [901.1]. Clean the sealing surfaces carefully before inserting a new gasket.
Leakage at the stem neck/leakage indication hole caused by diaphragm rupture	• Ruptured diaphragm [443].	• Replace defective diaphragm [443], see “Replacing the diaphragm“ section.
Seat leakage	• Foreign matter at the weir.	• Remove foreign matter from the weir and replace diaphragm [443] if necessary.
	• Foreign matter in/on the diaphragm lip or damage.	• Remove foreign matter in/at the diaphragm lip and replace diaphragm [443] if necessary.
	• Stop nut [920] for closed position incorrectly adjusted.	• Re-adjust stop nut [920] or replace diaphragm [443] if necessary.

10 Disposal

WARNING

Fluids handled, consumables and supplies which are hot or pose a health hazard!

Hazard to persons and the environment!

- Collect and properly dispose of flushing fluid and any residues of the fluid handled.
- Wear safety clothing and a protective mask if required.
- Observe all legal regulations on the disposal of fluids posing a health hazard.

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

11 Supplement regarding aspects of Directive 2014/34/EU

Security

This symbol refers to safety precautions, which must be respected in reference to the use of valves potentially explosive atmospheres according to the 2014/34/EU to avoid personal injuries and damages to property.

- You have to mind that inadmissible operating methods are avoided if the valves are used in potentially explosive atmospheres. In particular, the overstepping of the limitated operating maximum temperature is unacceptable.
- The user is bound to only install and use explosion-proof working material in potentially explosive atmospheres.

Installation

- In principle valves have to be included in the equipotential setting of the system if they are used in potentially explosive atmospheres.
- For use in potentially explosive atmospheres, the spring area of pneumatic diaphragm actuators and piston actuators has to be connected to an explosion-proof air reservoir

Operation

- The surface temperature of the valve‘s body corresponds to the temperature of the transported material. In each case the system‘s user is responsible for the observance of the working temperature. The highest authorized temperature of the material depends on the temperature class in each case.
- The heating of the valves components by the environment or by sun radiation shall be avoided.
- Additional mechanical load on the products (for example external forces and torques) must be avoided.

Servicing/Maintenance

- The user is responsible for maintenance works so that no ignition sources appear (for example electrostatic discharge, mechanically created spark).
- The user should periodically verify the equipment tightness of the body and the different tightness ranges for example with the help of a maintenance program.
- In principle, dust and dirt should be avoided on all valve surfaces.
- You have to use a wet cotton cloth to avoid electrostatic discharge while you are cleaning plastic surfaces and plastic-coated surfaces.
- The spare parts must be exclusively original SISTO parts.
- To prevent thermite reactions for actuators made of aluminium, contact with iron oxides must be ruled out. In addition, the valve must be protected against mechanical impacts.

Declaration

- Valves are components and they do not have their own potential source of ignition and are thus not covered by the 2014/34/EU Directive and must not be indicated by the reference ATEX.

If the instructions laid down for “safety, installation, operation and maintenance/servicing” are not complied with, proper operation of the valve within the meaning of Directive 2014/34/EU is not ensured. In this case, the valves must not be used in potentially explosive atmospheres.

The use of faulty valves in potentially explosive atmospheres is not authorized in each case.

Document 8630.8507/14-10

DECLARATION OF CONFORMITY

Hereby we,

SISTO ARMATUREN S.A.
18, rue Martin Maas
L-6468 Echternach

declare, that the valves listed below comply with the specific safety requirements in accordance with appendix 1 of the Pressure Equipment Directive 2014/68/EU.

Description of the valve types:

Diaphragm Valves
Manually and Pneumatically Actuated Valves

SISTO-KB		PN 10	DN 32 - 200
SISTO-KBS		PN 10	DN 32 - 200 (ND 1 ¼ " - 8")
SISTO-10		PN 10	DN 32 - 300
SISTO-10S		PN 10	DN 32 - 200 (ND 1 ¼ " - 8")
SISTO-10M		PN 10	Rp 1 ¼ " - 3"
SISTO-16HWA/DLU		PN 16	DN 32 - 200
SISTO-16		PN 16	DN 32 - 200
		PN 10	DN 250 - 300
		PN 16	DN 32 - 80 (Rp 1 ¼ " - 3")
SISTO-16S		PN 16	DN 32 - 200 (ND 1 ¼ " - 8")
SISTO-20	DIN	PN 16	DN 32 - 200
		PN 10	DN 250 - 300
		PN 16	DN 32 - 80 (Rp 1 ¼ " - 3")
	ISO	PN 20	DN 32 - 125
SISTO-B		PN 10	DN 32 - 100
SISTO-C		PN 16	DN 32 - 300

Swing Check Valves

SISTO-RSK/-RSKS		PN 16	DN 32 - 300

suitable for: Fluid group 1 and 2

Conformity Assessment Procedure: Modul H

Name and address of the authorizing and monitoring notified body:
TÜV Rheinland - Zertifizierungsstelle
für Druckgeräte der
TÜV Rheinland Industrie Service GmbH
Am Grauen Stein
D-51105 Köln

Number of notified body: 0035

Number of Certificate: 01 202 L/Q-04 0004

Nominal sizes ≤ DN 25 (Rp 1") are developed and manufactured according to the same specifications as fittings > DN 25 (Rp 1") and are therefore subject to „sound engineering practice" in accordance with Article 4(3). A CE marking is not affixed.

Head of
Design and Development

Integrated Management
Manager

Echternach, 08.04.2021

SISTO Armaturen S.A.
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Subject to technical modification without prior notice

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