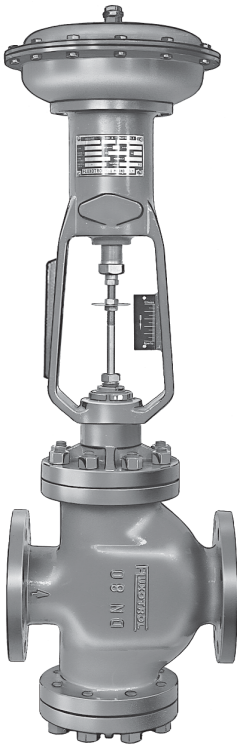

5953 and 5954 Series Self-Operated Valves

Installation and Maintenance Instructions



1. General Safety information
2. General Product information
3. Installation
4. Maintenance
5. Spare parts
6. Fault finding

1. General Safety information

Safe operation of the unit can only be guaranteed if it is properly installed, commissioned and maintained by a qualified person (see Section 1.11) in compliance with the operating instructions. General installation and safety instructions for pipeline and plant construction, as well as the proper use of tools and safety equipment must also be complied with.

1.1 Intended use

Referring to the Installation and Maintenance Instructions, name-plate and Technical Information Sheet, check that the product is suitable for the intended Use/application. The products listed below comply with the requirements of the European Pressure Equipment Directive 2014/68/EU (PED) and carry the mark CE when so required. The products fall within the following Pressure Equipment Directive categories:

Unit	Connection	Group 1 Gases	Group 2 Gases	Group 1 Liquids	Group 1 Liquids
Actuator mod. 595/596	Direct	-	SEP	-	SEP
	Water pot IT	-	SEP	SEP	SEP

- I) The products have been specifically designed for use on steam which is in Group 2 of the above mentioned Pressure Equipment Directive. The product's use on other fluids may be possible but, if this is contemplated, Spirax Sarco should be contacted to confirm the suitability of the product for the application being considered.
- II) Check material suitability, pressure and temperature and their maximum and minimum values. If the maximum operating limits of the product are lower than those of the system in which it is being fitted, or if malfunction of the product could result in a dangerous overpressure or over temperature occurrence, ensure a safety device is included in the system to prevent such over-limit situations.
- III) Determine the correct installation situation and direction of fluid flow.
- IV) Spirax Sarco products are not intended to withstand external stresses that may be induced by any system to which they are fitted. It is the responsibility of the installer to consider these stresses and take adequate precautions to minimize them.
- V) Remove protection covers from all connections and protective film from all name-plates, where appropriate, before installation on steam or other high temperature applications.

1.2 Access

Ensure safe access and if necessary a safe working platform (suitably guarded) before attempting to work on the product. Arrange suitable lifting gear if required.

1.3 Lighting

Ensure adequate lighting, particularly where detailed or intricate work is required.

1.4 Hazardous substances in the pipeline

Consider what is in the pipeline or what may have been in the pipeline at some previous time. Consider: flammable materials, substances hazardous to health, extremes of temperature.

1.5 Hazardous environment around the product

Consider: explosion risk areas, lack of oxygen (e.g. tanks, pits), dangerous gases, extremes of temperature, hot surfaces, fire hazard (e.g. during welding), excessive noise, moving machinery.

1.6 The system

Consider the effect on the complete system of the work proposed. Will any proposed action (e.g. closing isolation valves, electrical isolation) put any other part of the system or any personnel at risk? Dangers might include isolation of vents or protective devices or the rendering ineffective of controls or alarms. Ensure isolation valves are turned on and off in a gradual way to avoid system shocks.

1.7 Pressure systems

Ensure that any pressure is isolated and safely vented to atmospheric pressure. Consider double isolation (double block and bleed) and the locking or labelling of closed valves. Do not assume that the system has depressurised even when the pressure gauge indicates zero.

1.8 Temperature

Allow time for temperature to normalise after isolation to avoid the danger of burns and consider whether protective clothing (including safety glasses) is required.

1.9 Tools and consumables

Before starting work ensure that you have suitable tools and/or consumables available. Use only genuine Spirax Sarco replacement parts.

1.10 Protective clothing

Consider whether you and/or others in the vicinity require any protective clothing to protect against the hazards of, for example, chemicals, high / low temperature, radiation, noise, falling objects, and dangers to eyes and face.

1.11 Permits to work

All work must be carried out or be supervised by a suitably competent person. Installation and operating personnel should be trained in the correct use of the product according to the Installation and Maintenance Instructions. Where a formal 'permit to work' system is in force it must be complied with. Where there is no such system, it is recommended that a responsible person should know what work is going on and, where necessary, arrange to have an assistant whose primary responsibility is safety. Post 'warning notices' if necessary.

1.12 Handling

Manual handling of large and/or heavy products may present a risk of injury. Lifting, pushing, pulling, carrying or supporting a load by bodily force can cause injury particularly to the back. You are advised to assess the risks taking into account the task, the individual, the load and the working environment and use the appropriate handling method depending on the circumstances of the work being done.

1.13 Residual hazards

In normal use the external surface of the product may be very hot. If used at the maximum permitted operating conditions the surface temperature of some products may reach temperatures of 250°C (482°F). Many products are not self-draining. Take due care when dismantling or removing the product from an installation (refer to 'Maintenance instructions'). Self-acting valves may operate unexpectedly during normal service. The risk of personal injury should be assessed for each installation. Where appropriate, suitable guarding should be fitted.

1.14 Freezing

Provision must be made to protect products which are not self-draining against frost damage in environments where they may be exposed to temperatures below freezing point.

1.15 Safety information – Product specific

These valves contain a PTFE component. Within its working temperature range PTFE is a completely inert material, but when heated to its sintering temperature it gives rise to gaseous decomposition products or fumes which can produce unpleasant effects if inhaled. The inhalation of these fumes is easily prevented by applying local exhaust ventilation to atmosphere as near to their source as possible. Smoking should be prohibited in workshops where PTFE is handled because tobacco contaminated with PTFE will during burning give rise to polymer fumes. It is therefore important to avoid contamination of clothing, especially the pockets, with PTFE and to maintain a reasonable standard or personal cleanliness by washing hands and removing any PTFE particles lodged under the fingernails.

1.16 Disposal

Unless otherwise stated in the Installation and Maintenance Instructions, this product is recyclable and no ecological hazard is anticipated with its disposal providing due care is taken.

1.17 Returning products

Customers and stockists are reminded that under EC Health, Safety and Environment Law, when returning products to Spirax Sarco they must provide information on any hazards and the precautions to be taken due to contamination residues or mechanical damage which may present a health, safety or environmental risk. This information must be provided in writing including Health and Safety data sheets relating to any substances identified as hazardous or potentially hazardous.

Caution

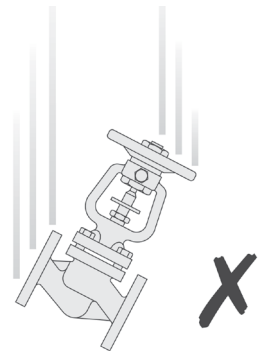
If the product is not used in the manner specified by these instructions, the protection provided may be impaired.

1.18 Working safely with cast iron products on steam

Cast iron products are commonly found on steam and condensate systems. If installed correctly using good steam engineering practices, it is perfectly safe. However, because of its mechanical properties, it is less forgiving compared to other materials such as SG iron or carbon steel. The following are the good engineering practices required to prevent waterhammer and ensure safe working conditions on a steam system.

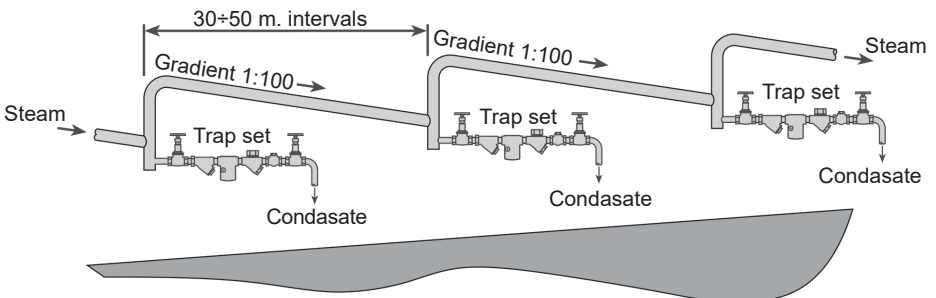
Safe Handling

Cast Iron is a brittle material. If the product is dropped during installation and there is any risk of damage the product should not be used unless it is fully inspected and pressure tested by the manufacturer. Please remove label before commissioning.

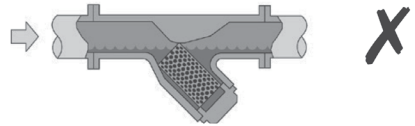
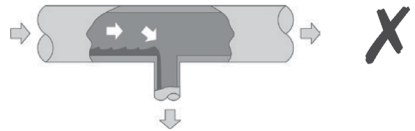
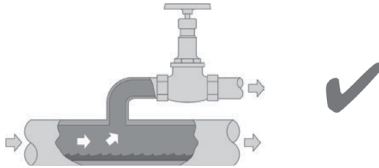
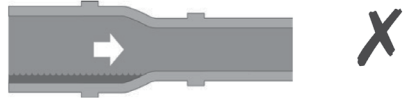
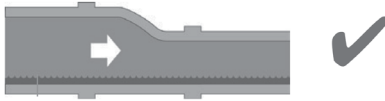
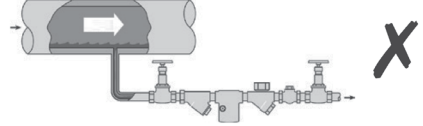
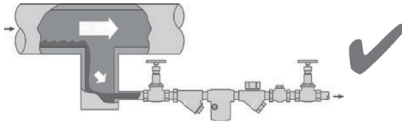


Prevention of water hammer

Steam trapping on steam mains:



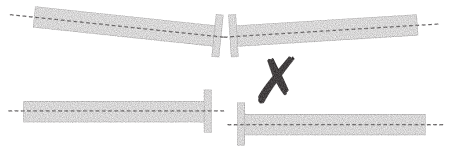
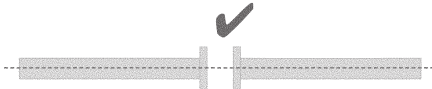
Steam Mains - Do's (✓) and Dont's (X):



Prevention of tensile stressing

Pipe misalignment:

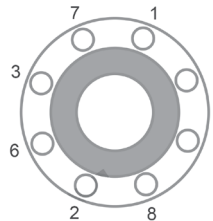
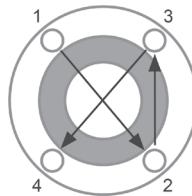
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Installing products or re-assembling after maintenance:



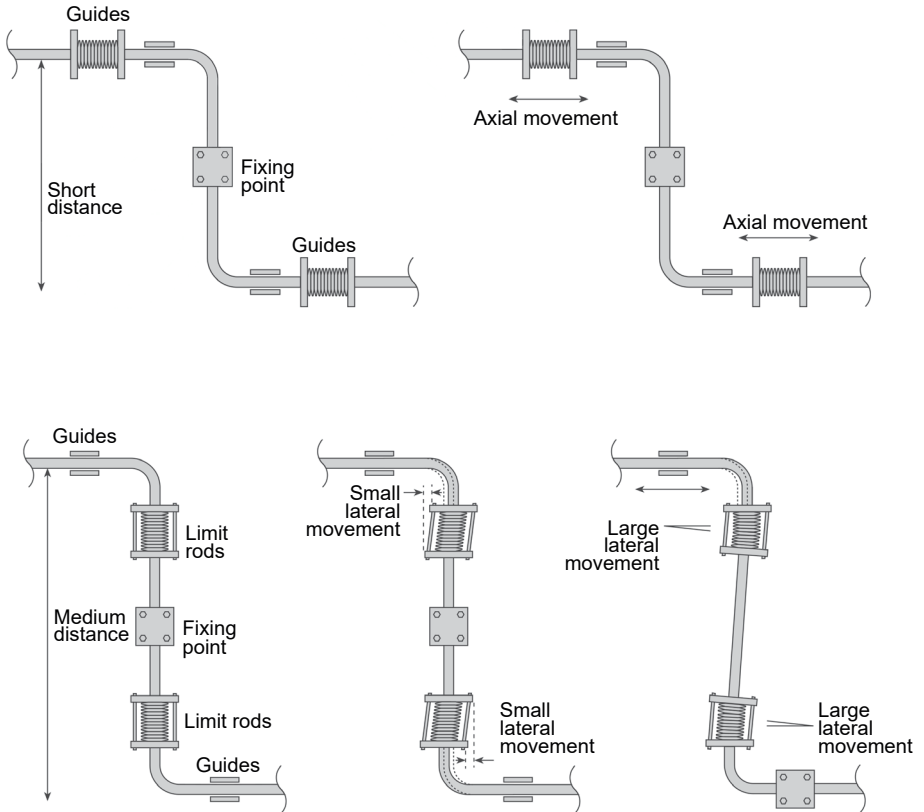
Do not over tighten.
Use correct torque figures.



Flange bolts should be gradually tightened across diameters to ensure even load and alignment.

Thermal expansion:

Examples showing the use of expansion bellows. It is highly recommended that expert advise is sought from the bellows manufacturer.



2. General product information

2.1 Description

Series 5953 e 5954 Pressure Reducing and Relief Valves is a range of direct acting self-powered valve of robust construction, designed to operate under arduous conditions being ideal to control the pressure in water, steam, air and inert gas circuits.

A soft-seated PTFE version is available ("G" suffix) for air/gas applications that require tight shut-off (limited to 200 °C). It is recommended that for these applications, a maximum pressure turndown ratio of 10:1 is observed.

The valve is controlled by the downstream pressure which acts directly on the diaphragm, opposing the force to which the spring is calibrated. Under stable conditions diaphragm force and spring force are in a state of balance, but an increase or decrease in demand raises or lowers the downstream pressure which in turn acts against the spring to close or open the valve to adjust the flowrate and maintain a constant downstream pressure.

Series 5953 and 5954 Valves are periodic maintenance free.

Note: When operating a pressure reduction on liquids, it is possible that cavitation occurs. In such situations, it is essential to use control valves which are specifically designed to avoid damages that cavitation may cause both to the valve internal parts and to the components mounted immediately downstream.

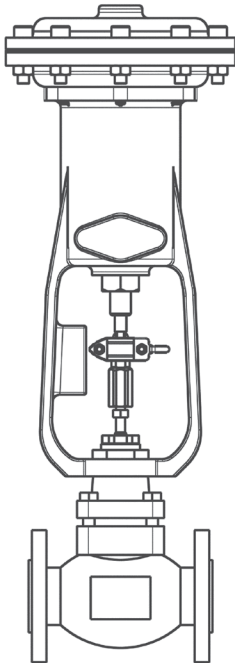


Fig. 1 - 5953 Reducing Valve

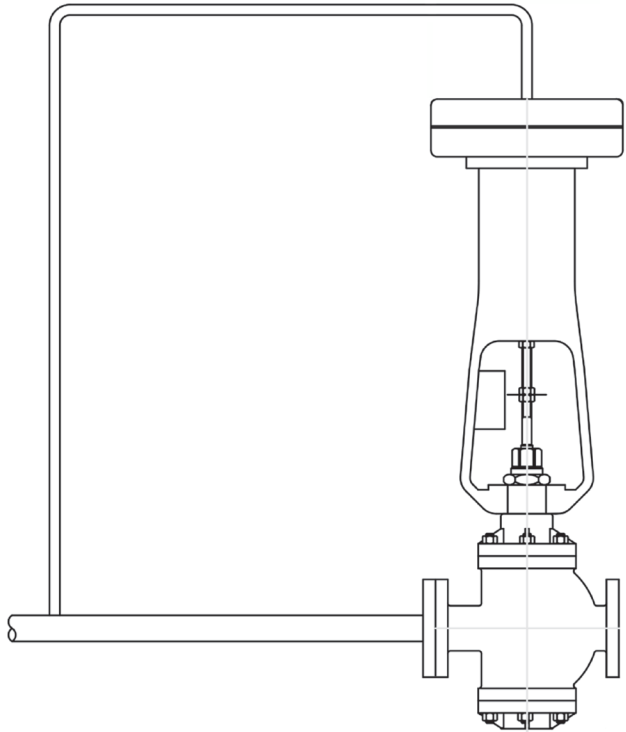


Fig. 2 - 5954 Overflow Valve

2.2 Valve Body - Technical data

Valve Body Technical details with values expressed in bar according to ANSI standards, for valves in ASTM A216 Gr. WCB carbon steel and in ASTM A351 Gr. CF 8M stainless steel.

2.3 595-596 Actuators - Technical data

Available types	595	Reverse-acting	Cast Steel	Diaphragm Dimensions	150/250
	596	Direct-acting	SG Iron	Diaphragm Dimensions	150/250

Body design conditions

	595-150	595-250
PMA - Maximum design pressure	15 bar	4,5 bar
TMA - Temperatura massima ammissibile	110°C*	
Minimum design temperature	0°C	0°C

2.4 Water seal pot - Technical data

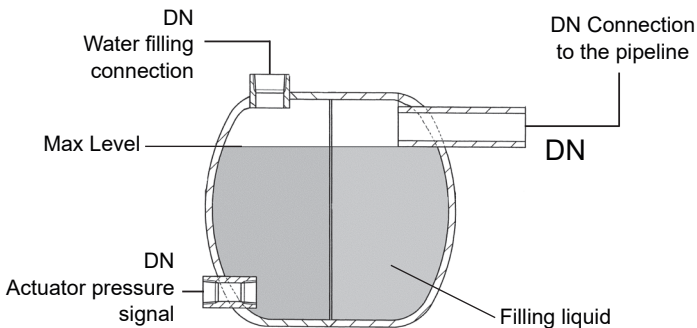


Fig. 3 - IT Water seal pot

Note: Water seal pot is used for temperatures > 110 ° C.

Water seal pot is filled up to maximum level as shown in the picture.

For use on steam, it is suggested to use water as the filling liquid. For other working fluids is suggested to use water or glycerine, consistent with the nature of the process fluid.

Caution: The fill fluid should have a density greater than the process fluid.

Technical data

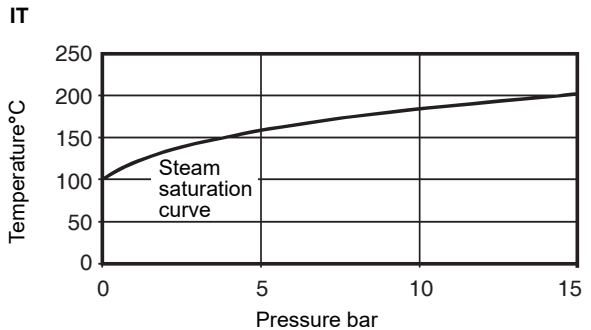
Connections

Version	IT	
Connection to the pipeline	Butt weld	$\frac{3}{8}$ " BW
Connection to the actuator	Screwed	$\frac{1}{8}$ " gas
Materials pot housing	Carbon steel	

Pressure / temperature limits

	IT
Body design condition	PN16
PMA - Maximum allowable pressure	@ 250°C 15 bar
TMA - Maximum allowable temperature	@ 15 bar 250°C
Minimum allowable temperature	0°C
PMO - Maximum operating pressure for saturated steam service	15 bar
TMO - Maximum operating temperature*	250°C
Minimum operating temperature	0°C
Designed for a maximum cold hydraulic test pressure of	24 bar

Pressure - temperature limits



The IT Water seal pot can be used in the entire area of the chart

3. Installation

Nota: Before actioning any installation observe the 'Safety information' in Section 1.

3.1 General information

The valve should be installed vertically in a horizontal pipeline.

For operating temperatures below 110°C the valve may be installed with the actuator either vertically upwards or vertically downwards (see Fig. 4).

For operating on steam or temperatures above 110°C the valve must be installed vertically downwards with the spring/actuator below the pipework with a water seal pot fitted on the downstream control signal line to the actuator, a typical installation is shown in Fig. 5.

Full attention must be given to correctly install the valve as indicated by the flow direction arrow on the valve body.

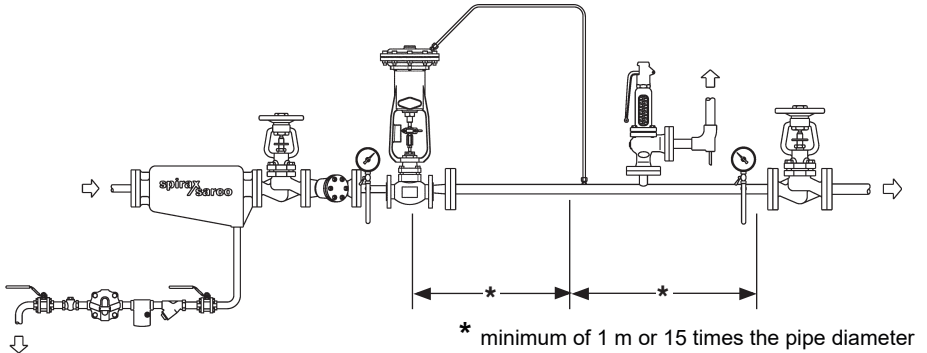


Fig. 4 - Typical installation for downstream temperatures below 110°C, in which the valve can also be installed with the actuator upwards.

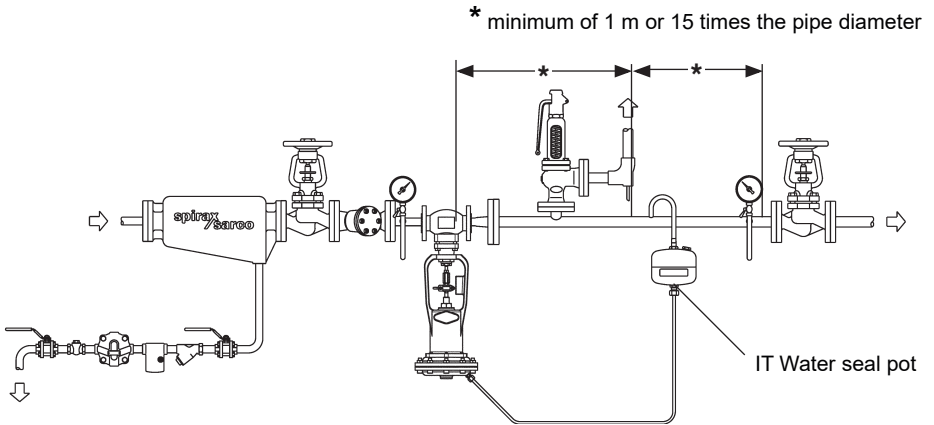


Fig. 5 - Typical installation for downstream temperatures higher than 110°C

3.2 Pressure control pipe

The valve actuator signal connection must be piped directly to the downstream side. To provide a good control signal the downstream sensing point should be positioned a minimum of 1 metre or 15 pipe diameters away from the valve or change in pipework direction on either side. It is recommended that the actuator signal pipe should be 8 mm diameter copper or stainless steel of 1 m minimum length.

3.3 Preventing dirt

Before installing the valve the system pipework should be flushed out to remove any residual dirt or scale that may be present. The valve should be protected by a pipeline strainer of the same size as the upstream pipework. For steam and air applications the strainer should be installed on its side to prevent the accumulation of water.

3.4 Removal of condensate

For steam installations a separator should be installed on the upstream side of the valve fitted with a suitable steam trap.

3.5 Pressure gauges

To assist in commissioning the valve and monitoring operating conditions it is essential to fit pressure gauges on both upstream and downstream sides of the valve.

3.6 Safety valve

It is recommended that a suitable safety valve is installed on the downstream side of the valve to protect downstream equipment from excessive pressure.

The valve should be set to lift at a pressure below the safe working pressure of the downstream equipment and sized to pass the full capacity, should it fail in the fully open position. The safety valve outlet pipework should discharge to a protect and safe place.

3.7 Isolating valves

It is recommended that manually operated isolating valves are installed upstream and downstream of the pressure reducing valve station to provide means of isolation for cleaning and maintenance.

3.8 Water seal pot

If fitted, the water seal pot must be charged with water prior to the valve being put into service. Remove the water seal pot filling plug and fully charge the vessel with soft water. Replace the filling plug.

To commission the valve, slowly open the upstream manual isolating valve to avoid waterhammer. The pressure reducing valve is now ready for operation.

3.9 Setting the desired downstream pressure

The valve is supplied 'non-calibrated' with the spring adjuster at its lowest adjustment position. The required downstream pressure may be set against either a dead end condition or flowing condition, depending on the requirements of the application, taking into account the effect of proportional offset. The desired downstream pressure is obtained by rotating the spring adjuster whilst monitoring the downstream pressure gauge.

Adjustment can be made using a 32 mm standard open ended spanner.

Compressing the control spring downstream set pressure is increased, while relaxing the spring tension reduces the downstream set pressure.

4. Maintenance

Nota: Before actioning any maintenance program observe the 'Safety information', Section 1.

Product specific - Safety Information

This product should not be dismantled without first releasing the compression on the control spring.

4.1 General information

The valve is maintenance free, but it is recommended that the valve is dismantled every 12 to 18 months for routine inspection of the component parts. Items showing signs of wear should be replaced. Details of available spares are given in Section 5. Prior to routine inspection or fitting spare components, firstly ensure the reducing valve is isolated and that the upstream and downstream pressures are reduced to zero, rotating spring adjuster (9) to reduce spring(s) compression to zero.

The downstream pressure signal pipe should be disconnected from the actuator.

Note: This product contains PTFE/steel composite brushes. The precautions laid down in Section 1.15 should be taken.

Numbers in brackets refer to the parts number as shown on the valve section drawings in the terminal part.

4.2 Routine maintenance

After an initial period in operation it is recommended that **the tightness of the nuts (29)** which fix the bonnet (32) and the bottom flange (38) to the valve body and which could have loosened due to the temperature variations, mechanical vibrations or stress, be checked.

This important operation will avoid leakage of fluid through the body gaskets, which would be difficult to eliminate later.

Questa operazione è molto importante onde evitare perdite delle guarnizioni del corpo, perdite che, accentuandosi, difficilmente potrebbero essere eliminate con un tardivo serraggio dei dadi.

The stuffing-box must be checked frequently. During **the first hours** of operating, to eliminate possible leakage, screw-in the stuffing box nut (23) slightly (**1/4 revolution only for teflon/graphite or graphite stuffing box**), fluid pressure itself will assure tightness of the packing. Do not tighten the stuffing box nut excessively as this can then cause valve locking. To reduce stem friction, it is suggested that the stem (22) be lubricated with a special silicone oil at least once per month or when it becomes dry.

4.2.1 Trouble shooting (failures and possible causes)

For successful performance of the valve, the stem (22) of the valve must move freely according to the air pressure changes on the diaphragm. If this action is not obtained, check the following:

Stuffing box

Check that the stuffing box packing (27) is not over-tightened so as to prevent free movement of the valve stem (avoid high friction).

Diaphragm

In case of diaphragm damage, the valve will no longer perform a complete stroke. If the diaphragm is no longer flexible or is damaged, replace it immediately (see paragraph 4).

Plug guides

Check the guides of the plug. If necessary, clean or grind them.

Leakage of fluid through the valve in the closed position.

In case of insufficient tightness: it will be necessary to bear in mind the limits of maximum leakage of fluid allowed with the valve in the closed position for the different types of valve construction with metal to metal seating or with gasket soft seating.

Such limits are indicated in the valve technical specification of the different executions. Check that between plug and seat no foreign material exists and that the contact area is not excessively damaged, if necessary carefully grind them by using fine grinding compound mixed with machine oil. For extensive damage, replacement of seat and plug becomes necessary (for disassembling the valve, see paragraph 5).

4.3 How to renew the actuator diaphragm and the sealing washer (Fig. 6)

- Before replacing spare parts, separate the actuator from the valve
- Rotate the spring adjuster (9) to fully discharge the spring (12).
- Remove bolts and nuts (15, 16), the cover (20) and the diaphragm (19) from the actuator.
- Fit the new diaphragm (19).
- Replace the cover (20) of the actuator.
- Replace bolts and nuts (15, 16).
- Fix the actuator assembly to the valve by tightening the actuator mounting ring
- Reconnect the line of the pulse inlet.
- Before operating the valve, water seal pot should be filled with water (when installed).
- Re-commission the valve.

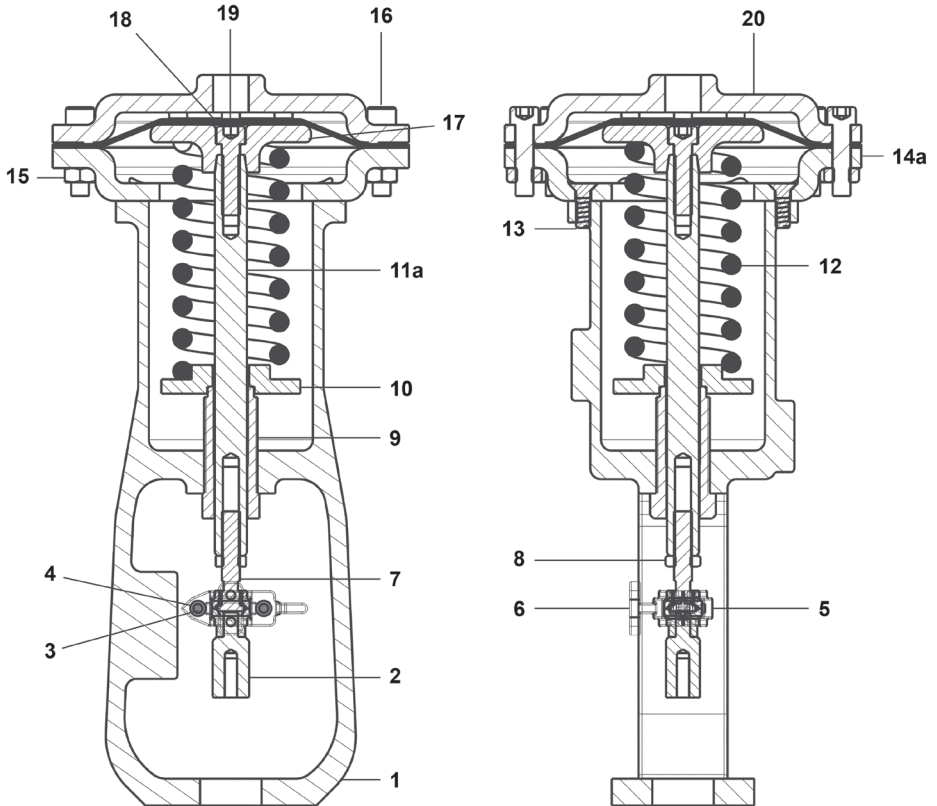


Fig. 6 - Actuator Mod. 595

4.3.1 How to renew or change the control spring(s) (Fig. 6)

- Rotate the spring adjuster (9) to fully discharge the compression of the spring (12).
- Disconnect the downstream pressure signal piping.
- Undo the actuator mounting nuts and separate the actuator from the valve.
- Remove bolts and nuts (c), the cover (d) and the diaphragm (e) from the actuator.
- Undo the locking screw (g) and remove the diaphragm plate (f).
- Replace the spring and reassemble in reverse order the plate, and the locking screw.
- Reassemble the diaphragm, cover, screws and nuts.
- Adjust the stroke of the valve and reconnect the inlet pulse piping.
- Re-commission the valve.

5. Spare parts

Parts List

Note: When placing an order for spare parts please clearly specify the full product description as found on the label of the valve body, as this will ensure that the correct spare parts are supplied.

Part. N.	Description
1	Upper diaphragm casing
2	Diaphragm plate
3	Diaphragm casing bolts and nuts
*4	Diaphragm
5	Diaphragm rod
6	Lower diaphragm casing
7	Spring adjusting ring nut
9	Spring adjusting screw
10	Actuator Counter spring
11	Hexagon socket cap screw (except 592 type)
12	Yoke
14	Travel indicator plate
15	Fixing or travel stop bolts
19	Stem hexagon locknut
20	Travel disc hexagon locknut (for Industrial valves only)
21	Travel indicator disc (for industrial valves series only)
22	Stem
23	Stuffing box nut
24	Yoke Nutlock
*27	Stuffing box packing assembly
29	Body nuts
30	Lantern (except series 25 and cast iron valves)
31	Plug fixing pin (where fitted)
32	Bonnet
33	Valve Plug
*34	Body gaskets
35	Valve body
36	Seat ring/s
37	Guide bushing (where fitted)
38	Blind bottom flange
39	Body studs
42	Lower plug locknuts
61	Self-adjusting spring
70	Washers

* Recommended spare parts

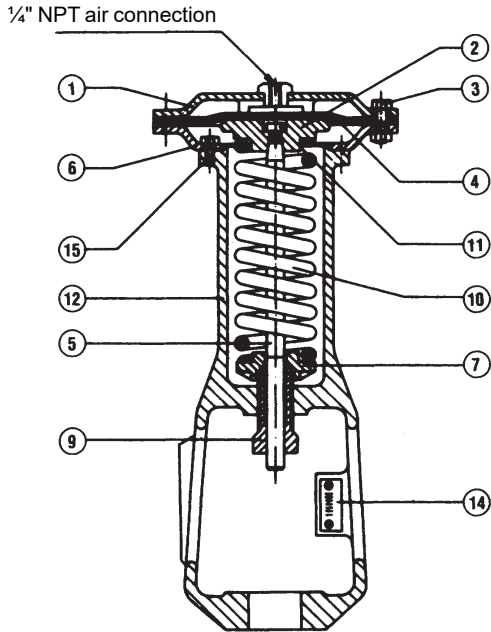


Fig. 7 - Model 592 diaphragm pneumatic actuator reverse acting

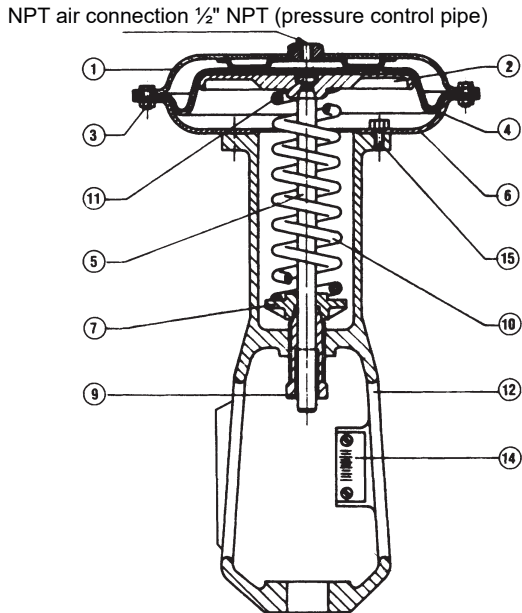


Fig. 8 - Model 595 diaphragm pneumatic actuator size 250 for self-regulating valves

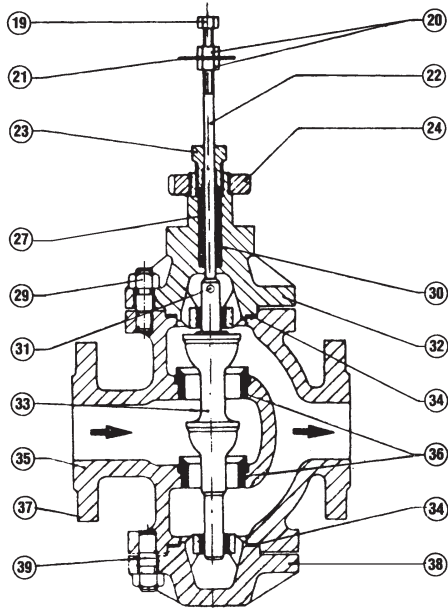


Fig. 9 - Model 3 double seated valve body direct acting

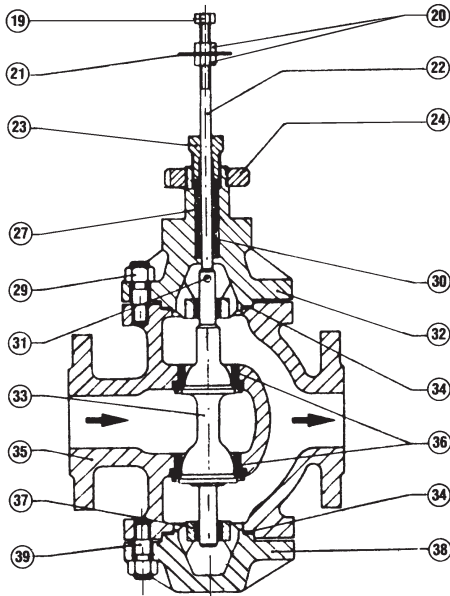


Fig. 10 - Model 4 double seated valve body reverse acting

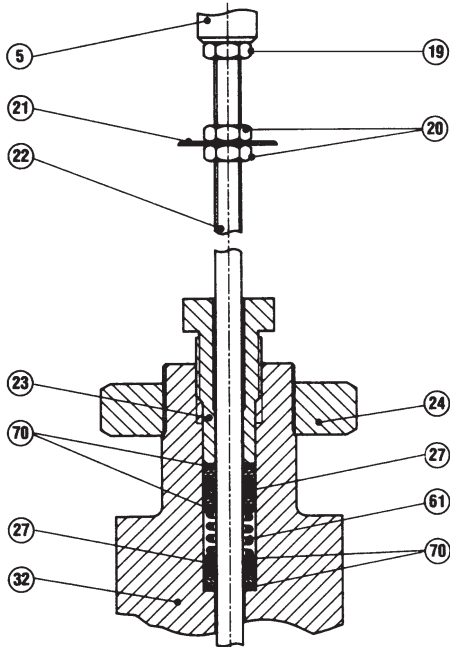


Fig. 11 - Stuffing box assembly with teflon/ graphite rings

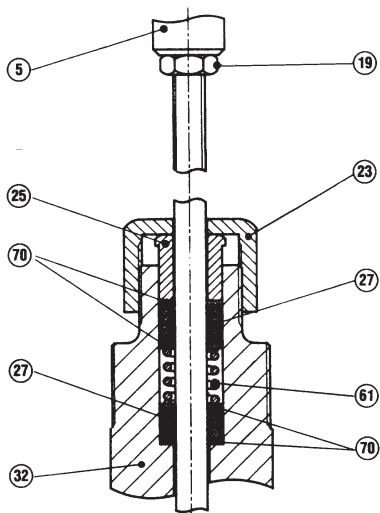


Fig. 12 - Stuffing box assembly with graphite rings

6. Fault finding

Before investigating any fault ensure that both upstream and downstream isolating valves are shut.

Symptom	Possible cause	Remedy
Downstream pressure increases above it's 'set' pressure.	<ol style="list-style-type: none"> 1. Blockage of the pressure signal pipe or coupling. 2. Leakage across actuator diaphragm or actuator diaphragm clamp gasket. 3. Damage or erosion to valve head / seat. 	<ol style="list-style-type: none"> 1. Disconnect the pressure signal pipe from the actuator coupling and blow through the pipe and coupling to clear obstruction. 2. Remove the actuator housing and inspect the diaphragm and diaphragm clamp washer, replacing as necessary. 3. Remove the bonnet / spring / actuator assembly and inspect the valve head and seat for damage or wear and replace as necessary.
<p>Under full load condition, downstream (Mod. 5953) pressure drop is lower of the required pressure control.</p> <p>Under full load condition, upstream (Mod. 5954) pressure drop is higher of the required pressure control.</p>	The valve is achieving maximum lift, but is undersized for the duty required.	Check maximum installed load condition required and valve size selected and installed.
Valve is correctly sized but is not supplying full load.	The valve is not achieving full lift position at maximum load.	Check full lift setting as described in Section 4.3.
On low flow conditions, downstream pressure is hunting.	<ol style="list-style-type: none"> 1. Over sensitive pressure control signal. 2. High pressure turndown ratios. 3. Downstream pressure tapping is too close to valve. 	<ol style="list-style-type: none"> 1. Remove 8 mm pressure signal pipe and actuator/ water seal pot couplings and replace with 6 mm signal pipe and couplings. 2. Consider two valves in series to reduce turn down ratios. 3. Ensure the downstream pressure signal tapping is not located within a turbulent area and is at least 1 m (40") from any valve or fitting.
Unable to adjust downstream set pressure	The actuator is not being subjected to downstream pressure.	Remove the signal pipe from the actuator and check for sludge build-up and blockage

SERVICE

For technical support, please contact our local Sales Engineer or our Head Office directly:

Spirax Sarco S.r.l. - Technical Assistance

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