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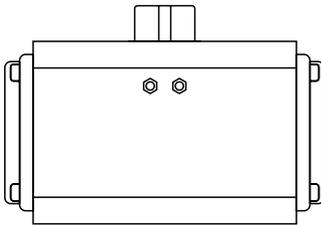
## **BVA300 Series**

# **Pneumatic Actuators for Spirax Sarco Ball Valves**

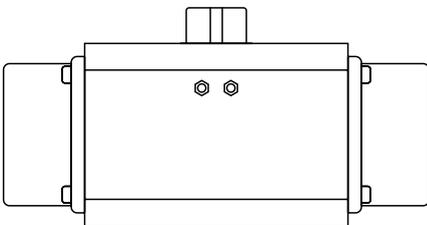
### Installation and Maintenance Instructions

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**BVA300D pneumatic actuator**



**BVA300S pneumatic actuator**

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

# 1. Safety information

These products comply with the ATEX Directive 2014/34/EU for use in potentially explosive atmospheres caused by a mixture of air, gases, vapours, mist or suspended dust within Group II , Category 2.

CE  II 2 G D c T5 T100 °C

Safe operation of these products can only be guaranteed if they are properly installed, commissioned, used and maintained by qualified personnel (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.

## WARNING

Do not attempt to service the actuator without first consulting its Installation and Maintenance Instructions, as the end caps contain springs under load. Failure to follow the instructions could result in injury. The actuator must be vented before dismantling.

## WARNING

If the valve should seize in the partly open position, the springs in the actuator will still be partly compressed, and will consequently be storing a large amount of energy, which could cause injury if released suddenly. If there is any possibility that this is the case follow the instructions given below - 'WARNING - Dismantling a seized valve assembly'.

## WARNING

Maximum air supply to actuator and solenoid is 8 bar.

## WARNING - Dismantling a seized valve assembly

If there is any possibility that the valve has seized in the partially open position, dismantle the valve as follows to avoid a sudden release of spring pressure which could cause injury:

- Hold the valve/actuator assembly in a vice.
- Remove the solenoid valve assembly.
- Connect a pressure regulated compressed air supply (0 - 6 bar g, 0 - 87 psi g), to the air inlet port 'A'.
- Gradually increase the air pressure until the valve stem just begins to rotate.
- Loosen and remove the bolts securing the bracket to the valve body and lift away the actuator/ bracket assembly.
- Place the actuator on the bench and gradually reduce the pressure. The valve body is now ready for dismantling.

## 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 and carry the  mark when so required. It should be noted that products which fall within the 'SEP' (Sound Engineering Practice) category are not required by the Directive to carry the  mark. The products fall within the following Pressure Equipment Directive categories:

Product	Group 1 Gases	Group 2 Gases	Group 1 Liquids	Group 2 Liquids
BVA300 Actuator sizes up to and including BVA335	-	SEP	-	-
Actuator sizes BVA340 and larger	-	1	-	-

- i) The products have been specifically designed for use on compressed air and other high purity applications that are in Group 2 of the above mentioned Pressure Equipment Directive.
- 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 overtemperature occurrence, ensure a safety device is included in the system to prevent such over-limit situations.
- iii) Determine the correct installation situation and orientation of the connected valve.
- 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 minimise 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 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.

## 1.5 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.

## 1.6 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.

## 1.7 Temperature

Allow time for temperature to normalise after isolation to avoid danger of burns. Valves fitted with Viton 'O' rings must not be subjected to temperatures above 315 °C (599 °F). Above these temperatures toxic fumes may be given off. Avoid inhalation of fumes or skin contact.

## 1.8 Tools and consumables

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

## 1.9 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.

## 1.10 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.

## 1.11 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.

## 1.12 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 these products may reach temperatures of 200 °C (302 °F).

These products are not self-draining. Take due care when dismantling or removing the product from an installation (refer to 'Maintenance instructions').

## 1.13 Safety information - Product specific

Installers and users should refer to relevant safety information contained in the Installation and Maintenance Instructions (IM) sheet of the ball valve to which the actuator is connected.

## 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 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. However, if the valve is fitted with Viton 'O' rings, special care must be taken to avoid potential health hazards associated with decomposition/burning of these parts.

### Viton:

- Can be landfilled, when in compliance with National and Local regulations.
- Can be incinerated, but a scrubber must be used to remove Hydrogen Fluoride, which is evolved from the product and with compliance to National and Local regulations.
- Is insoluble in aquatic media.

## 1.16 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.

## 2. General product information

### 2.1 Description

The BVA300 pneumatic actuator range uses a rack and pinion system that creates a linear torque with a quarter turn operation. The range is shown in Table 1, page 11.

### 2.2 Standards for the BVA300 series

#### Actuators sizes up to and including BVA335

Actuators have been designed and manufactured in accordance with the following European Directives:

- European Pressure Equipment Directive 2014/68/EU: classified according to Article 4, Part 3, Cat. SEP. Equipment must not carry the CE label.
- Machines Directive 2006/42/EC.
- Directive 2014/34/EU ATEX, classification Group II, Cat. 2 for use in explosive atmospheres, Zones 1, 2 and 21, 22. Conformity evaluation according to Appendix VIII.  
Marking CE Ex II2 G D c T5 T100 °C.
- EN 15714-3 pneumatic part-turn actuators for industrial valves.

#### Actuators sizes BVA340 and larger

Actuators have been designed and manufactured in accordance with the following European Directives:

- European Pressure Equipment Directive 2014/68/EU: classified according to Category I, Module A Evaluation Procedure of Conformity mod. A certified by the manufacturer ACTREG.  
Marking CE.
- Machines Directive 2006/42/EC.
- Directive 2014/34/EU ATEX, classification Group II, Cat. 2 for use in explosive atmospheres, Zones 1, 2 and 21, 22. Conformity evaluation according to Appendix VIII.  
Marking CE Ex II2 G D c T5 T100 °C.
- EN 15714-3 pneumatic part-turn Actuators for industrial valves.

#### Please note:

Electrical and mechanical accessories are not covered by this statement and will have to carry their own certificate of conformity in order to be assembled with Spirax Sarco actuators.

The suitability of the materials and design of the actuator type in terms of its working conditions are the responsibility of the actuator's end user.

## 2.3 Technical data

<b>Pressure</b>	PN8	
<b>Material</b>	Aluminium	
<b>Service conditions for standard actuators</b>	Maximum pressure	8 bar g
	Minimum temperature	-30 °C
	Maximum temperature	+100 °C
<b>Agreement evaluation process used</b>	Category I Module A	
<b>Technical standards and applied specifications</b>	Solenoid direct assembly according to standard	NAMUR VDI/VDE 3845
	Accessories assembly according to standard	NAMUR VDI/VDE 3845
	Connections to valves according to standard	EN ISO 5211

## 2.4 Compressed air consumption for BVA300 series actuators

### 2.4.1 Compressed air consumption

Nm<sup>3</sup>/stroke

BVA _ _ _	310	315	320	325	330	335	340
<b>Single Acting</b>	0.0001	0.0002	0.0006	0.0008	0.0011	0.0019	0.0029
<b>Double Acting</b>	0.0002	0.0005	0.0011	0.0015	0.0023	0.0036	0.0056

BVA _ _ _	345	350	355	357	360	365
<b>Single Acting</b>	0.0047	0.007	0.01	0.012	0.02	0.03
<b>Double Acting</b>	0.0085	0.01	0.02	0.03	0.05	0.06

**Notes:**

- Normal m<sup>3</sup> per open/close cycle when supplied with air at 6 bar g
- Consumption for BVA310 considering S/06 spring configuration
- Consumption for BVA315 - BVA365 considering S/14 spring configuration

## 2.4.2 Stroke Time

### 2.4.2.1 Stroke Time (seconds) - Opening

BVA _ _ _	310	315	320	325	330	335	340
Single Acting	0.15	0.25	0.35	0.40	0.60	0.85	1.25
Double Acting	0.04	0.08	0.11	0.15	0.15	0.30	0.4

BVA _ _ _	345	350	355	357	360	365
Single Acting	3	3.1	3.6	3.3	4.2	4.8
Double Acting	0.8	1.2	1.8	2.3	2.8	3

### 2.4.2.2 Stroke Time (seconds) - Closing

BVA _ _ _	310	315	320	325	330	335	340
Single Acting	0.16	0.27	0.38	0.47	0.57	0.87	1.05
Double Acting	0.09	0.08	0.1	0.15	0.22	0.4	0.5

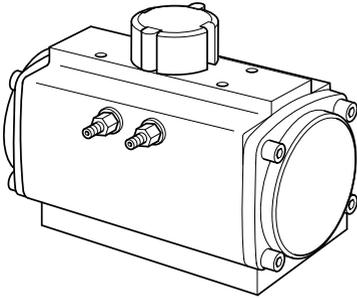
BVA _ _ _	345	350	355	357	360	365
Single Acting	2.5	2.7	3.05	3.7	4.1	4.7
Double Acting	0.9	1.5	2	2.6	3.1	3.5

#### Notes:

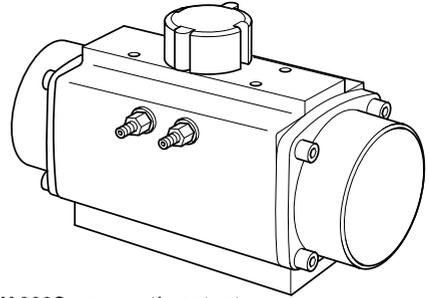
- Typical operating time (seconds). Operating media - compressed air at 6 bar g
- Operating time for BVA310 considering S/06 spring configuration
- Operating time for BVA315 - BVA365 considering S/14 spring configuration

## 2.5 Inspection at delivery and storage

- 2.5.1 All actuators must be examined upon delivery to ensure that they have not suffered any damage during transport. Inform the supplier immediately if there is any damage.
- 2.5.2 Actuators are delivered in the closed position as standard and contain the requisite number of springs for its type. Open position configuration must be specially requested.
- 2.5.3 **Warning** - Actuators must be stored under cover and protected from inclement weather conditions and any inherent dampness, with air inlets properly covered.
- 2.5.4 Actuators should not be unpacked until installation, except for inspection purposes as covered in Section 2.5.1.



**BVA300D pneumatic actuator**



**BVA300S pneumatic actuator**

**Fig. 1 BVA300D and BVA300S pneumatic actuators**

## 2.6 Spring combination by type of actuator

BVA300 pneumatic actuators use a maximum of seven identical pre-compressed springs on each rack.

The quantity of springs is identified as follows:

Example: BVA3\_\_S14

S = springs and 14 is the total number of springs assembled in the actuator.

### 2.6.1 Actuator size BVA310S

The actuator BVA310S uses a combination of 2, 3, or 4 springs on each rack, depending on the required spring combination, as indicated in the diagrams below.

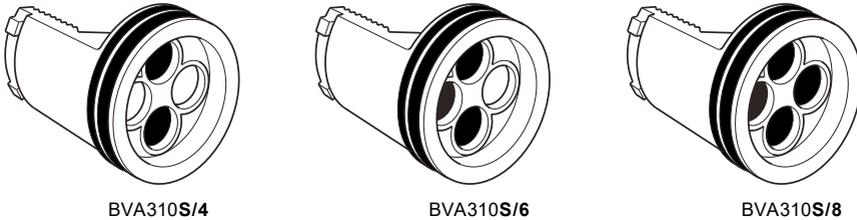


Fig. 2

### 2.6.2 Actuator sizes BVA315S to BVA365S

The actuators BVA315S and BVA365S use a minimum of 4 springs and a maximum of 7 springs on each rack, depending on the required spring combination, as indicated in the diagrams below.

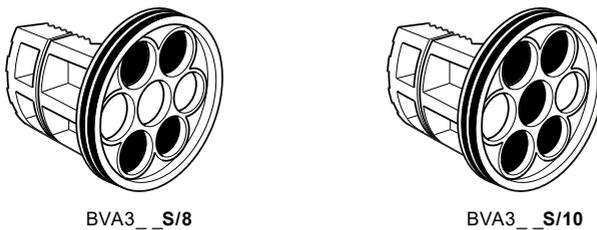
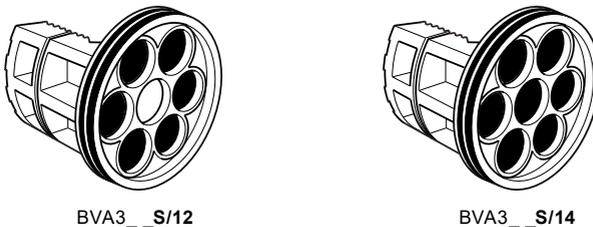


Fig. 3



**Table 1 BVA300 series range**

BVA__ _D Double acting						
BVA310D						
BVA315D						
BVA320D						
BVA325D						
BVA330D						
BVA335D						
BVA340D						
BVA345D						
BVA350D						
BVA355D						
BVA357D						
BVA360D						
BVA365D						
BVA__ _S/_ _ Spring return						
Actuator	Spring combinations					
BVA310S/_ _ →	4	6	8			
BVA315S/_ _ →			8	10	12	14
BVA320S/_ _ →			8	10	12	14
BVA325S/_ _ →			8	10	12	14
BVA330S/_ _ →			8	10	12	14
BVA335S/_ _ →			8	10	12	14
BVA340S/_ _ →			8	10	12	14
BVA345S/_ _ →			8	10	12	14
BVA350S/_ _ →			8	10	12	14
BVA355S/_ _ →			8	10	12	14
BVA357S/_ _ →			8	10	12	14
BVA360S/_ _ →			8	10	12	14
BVA365S/_ _ →			8	10	12	14

# 3. Installation

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

Referring to the Installation and Maintenance Instructions, body markings and Technical Information sheet, check that the product is suitable for the intended installation:

- 3.1** The handling and transportation of actuators must be carried out with extreme caution and using the necessary and appropriate means depending on their size and weight in order to avoid risks to the operators handling them.

**WARNING**

Check the physical condition of actuators in order to detect any damage incurred during transport and/or handling - see Section 2.5.1.

- 3.2** Check materials, pressure and temperature and their maximum values. If the maximum operating limit of the product is lower than that of the system in which it is being fitted, ensure that a safety device is included in the system to prevent overpressurisation.

- 3.3** Actuators should be installed with easy access in order to facilitate periodic inspections and maintenance operations necessary to guarantee the quality of performance for which they have been designed. Actuators are lubricated during assembly, and do not require any further lubrication.

**WARNING**

Actuators must not be subjected to external stress. To ensure this, it is imperative that the actuator and valve are assembled in correct alignment.

**IMPORTANT NOTE**

After installation, and before energising the pipeline, carry out a final operational check of the actuator by opening and closing it, to ensure it functions properly.

The use of dry air increases the lifetime of the actuators, as well as the lifetime of their accessories, solenoids and other pneumatic accessories.

### 3.3.1 Recommended minimum air quality

<b>Oil content</b>	Maximum limit	5 mg/m <sup>3</sup>
	Minimum limit	1 mg/m <sup>3</sup>
<b>Water content</b>	Compressed air must be dry to avoid freezing	
<b>Maximum size of dust particles</b>	40 microns	

Actuators can be installed in line with the piping or at an angle of 90°.

The normal performance of the actuators is to close clockwise and to open anticlockwise. However, this may be inverted easily.

### 3.3.2 Recommended tubing sizes

In order to provide the correct flow of supply air to the BVA actuator the following tubing sizes are recommended:

<b>Model</b>	<b>Tubing runs</b>	
	<b>Runs up to 1.5 m</b>	<b>Runs over 1.5 m</b>
<b>BVA310 to BVA320</b>	6 mm O/D	6 mm O/D
<b>BVA325 to BVA365</b>	6 mm O/D	10 mm O/D

- 3.4** Make sure that the actuator and the valve are in the same position, open or closed.
- 3.5** During and after assembling the actuator to the valve, check their alignment to ensure that the coupling parts work perfectly aligned.
- 3.6** The coupling bolts must be tightened proportionally to distribute the torque stress, before tightening them completely. This applies whether the actuator connects directly to the valve or a mounting bracket.

**IMPORTANT NOTE**

It is advisable to operate the actuator twice before fully tightening the coupling bolts .

- 3.7** The BVA300 series pneumatic actuators are provided with bi-directional pinion travel stops. Side located stops allow a full  $\pm 5^\circ$  travel adjustment between  $85^\circ$  and  $95^\circ$ .  
Adjustment of the counter clockwise and clockwise rotation limits are achieved by unscrewing the locking nut; a 1/3 turn of the locking nut equals  $1^\circ$  of the stroke.

**WARNING!!**

**Do not adjust the manufacturer's setting by more than  $2.5^\circ$  each side the unit otherwise internal parts could be damaged.**

## 4. Commissioning

After installation or maintenance ensure that the system is fully functioning. Carry out tests on any alarms or protective devices.

# 5. Spare parts and Maintenance

**Note:** Before actioning any maintenance programme observe the 'Safety information' in Section 1.

Any parts replacement must be implemented with original Spirax Sarco spare parts, or any warranty implied or expressed is null and void.

The manufacturer will not be responsible for any actuator dysfunction, if original Spirax Sarco parts have not been used.

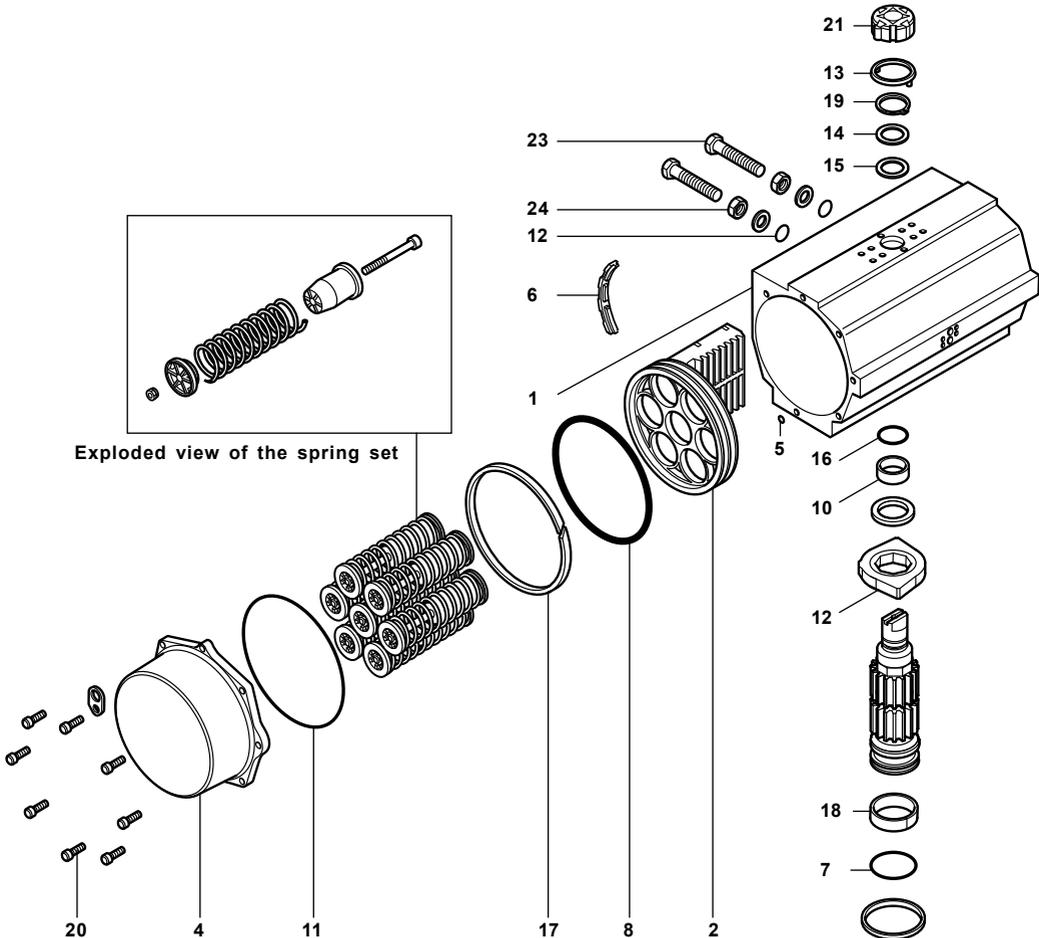
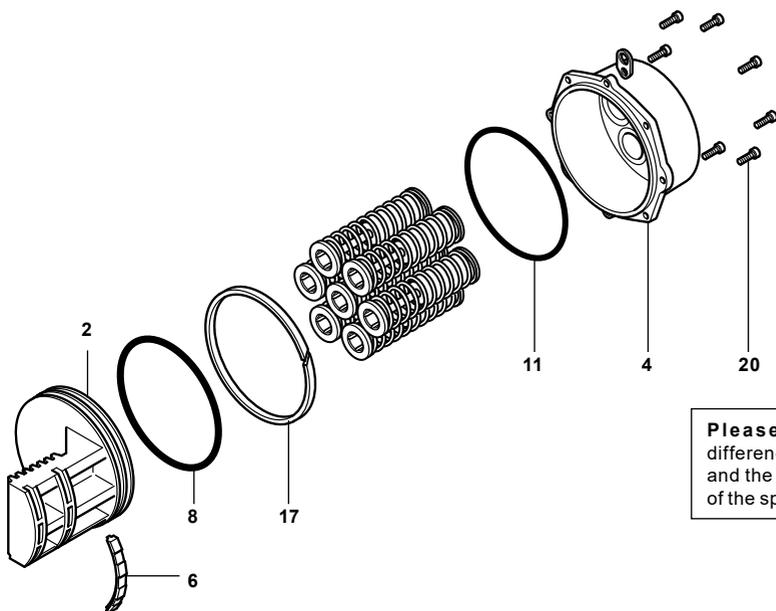


Fig. 4 BVA300\_ series spare parts



**Please note** that the only difference between the BVA300D and the BVA300S is the inclusion of the springs within the end caps.

## 5.1 Spare parts for the BVA300D and BVA300S series

The available spare parts for the BVA300\_ series are listed below. No other parts are available as spares.

The spare parts available are detailed below. No other parts are supplied as spares.

### Available spares

	'O' rings set (available either in NBR or Viton)	7, 8, 11, 12, 16
BVA300 series maintenance kit	Pinion washers	13, 14, 15
	Others	5, 6, 10, 17, 18

### How to order spares

Always order spares by using the description given in the column headed 'Available spares' and state the nomenclature of the pneumatic actuator that they are intended for.

**Note:** all the spares mentioned above are sold together in one spare part kit.

**Example:** 1 - BVA300 series maintenance kit with 'O' rings in NBR for a Spirax Sarco BVA320S/08 pneumatic actuator.

## 5.2 Preventitive maintenance

- 5.2.1 This basically consists of a periodic inspection to check the actuator function.
- 5.2.2 Actuators must be operated at least once every six months. However, if necessary, this may be done sooner.
- 5.2.3 It is recommended to replace 'O' rings, guides and washers at the same time, if this is necessary during the maintenance session.

## 5.3 Reasons for parts repair and replacement

Parts of the actuator will have to be repaired or replaced as soon as leakage is detected through the upper 'O' ring (16) or lower 'O' ring (7) of the pinion, through the 'O' ring (8) of the piston or through the 'O' rings (11) of the end caps.

As soon as this happens, proceed with the disassembly of the actuator and replacement of all the 'O' rings, bushings, slide guides and washers as listed in the spare parts.

## 5.4 Disassembly and reassembly

### 5.4.1 Precautions before disassembly:

- Isolate and test the air and electrical supplies before working on the actuator.
- Disconnect the actuator and its accessories from the air tubing and electrical wiring.
- Disassemble the solenoid from the actuator.
- Disassemble the actuator from the valve and/or from its couplings.

### 5.4.2 Disassembly

Once the precautions prior to the disassembly have been taken, follow the next steps:

- Disassemble the end caps (4) of the actuator by untightening the external bolts (20).

**Please note** - With spring return actuators there is no inherent danger during this operation, as the fastening bolts for the caps are designed with adequate length.

- Unfasten the nuts (24) in order to remove the levelling screws (23).
- Turn the pinion (3) anticlockwise to disengage the pistons (2) in normally closed actuators and clockwise in normally open ones. Remove the pistons from the cylinder.
- Disassemble the position indicator (21 + the rubber 13), the slip washer (19), the soft pinion washer (15) and the metallic pinion washer (14) from the upper side.
- Disassemble the pinion (3) from the lower part of the body (1) of the actuator. To do this operation, disassemble the upper pinion bearing (10) and the stop (12) through the inside of the body.
- Clean all the parts of the actuator.

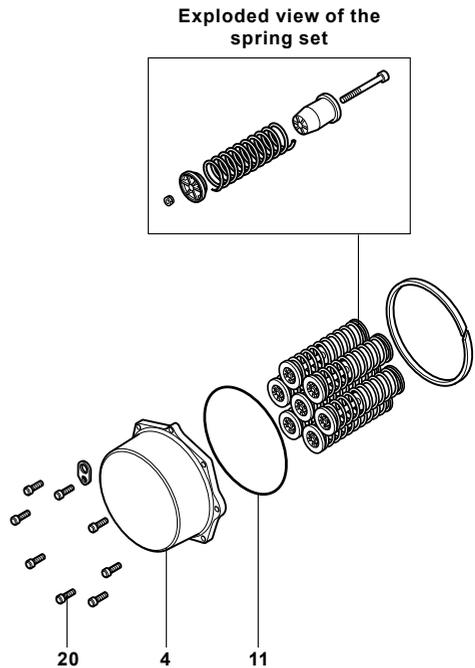
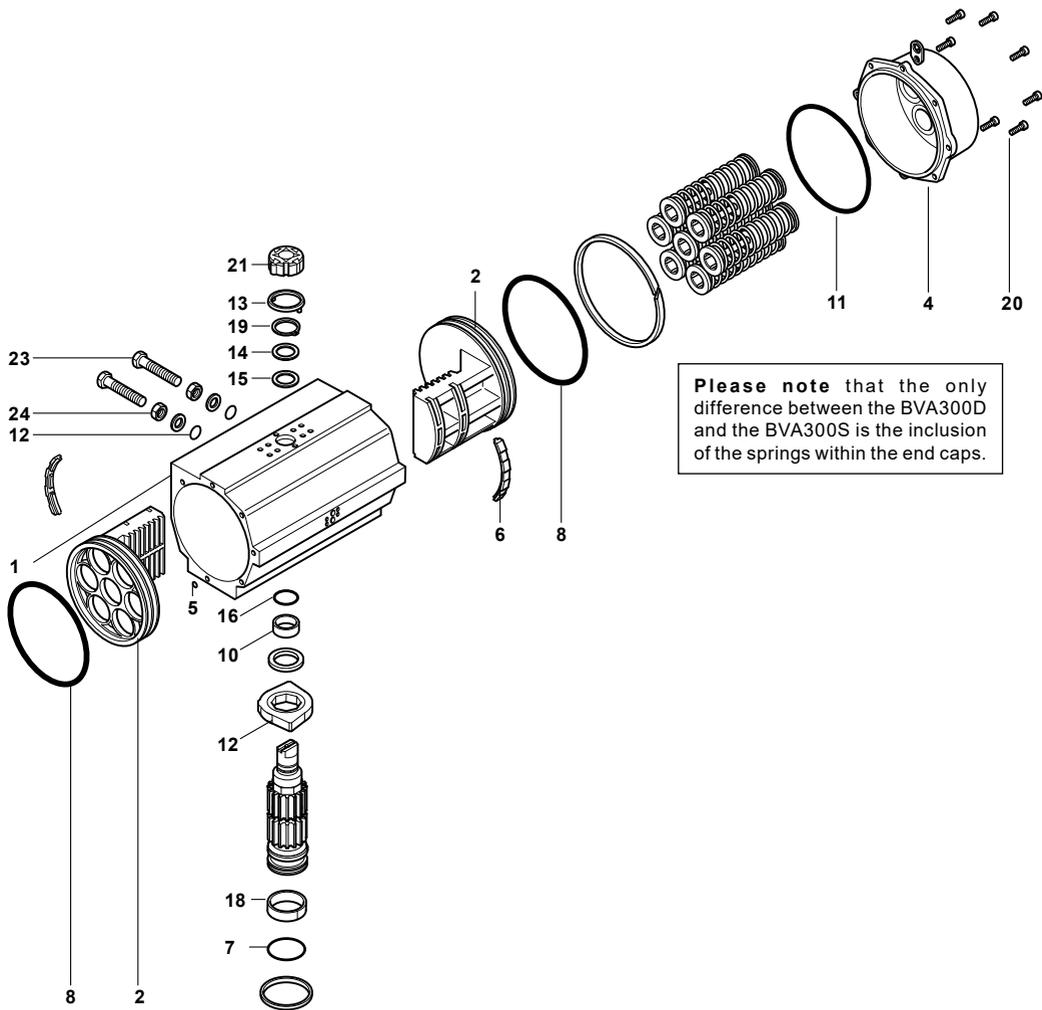


Fig. 5 BVA300 series shown



- Examine all parts in order to inspect for wear.

**Important:** Carefully examine the inside of the cylinder.

- If everything is in good condition, continue to replace the new 'O' rings, bushings, slide guides and washers included in the Spirax Sarco BVA300 series maintenance kit before reassembling the actuator - see Section 5.4.3.
- Lubricate the parts of the actuator with Molicote B 2-2 plus grease. Apply a thin layer of grease on the 'O' rings (7, 8 and 16).

### 5.4.3 Reassembly

After disassembly, and the inspection and lubrication of the relevant parts, proceed to reassemble them following the sequence below:

- Correctly assemble all the parts included in the Spirax Sarco BVA300 series maintenance kit.

**Note:** lubricate where stated in Section 5.4.2.

- Place the pinion (3) in the body (1) from underneath. Once the pinion appears through the inside of the body, assemble the pinion stop (12) in its correct position and also the upper pinion bearing (10).
- Place the soft pinion washer (15), the metallic pinion washer (14), the slip washer (19) and the position indicator (21 and 13) in the upper part of the pinion.
- Assemble both pistons, checking that they engage at the same time when turning the pinion (3) clockwise for normally closed actuators and anticlockwise for normally open actuators.
- Assemble the actuator end caps (4) tighten the bolts (20) in sequence. Check that the open and closed positions coincide with the position indicated in the upper part of the pinion (see Figure 6).

**Important:** Once assembled, operate the actuator a few times and recommission - see Section 4.

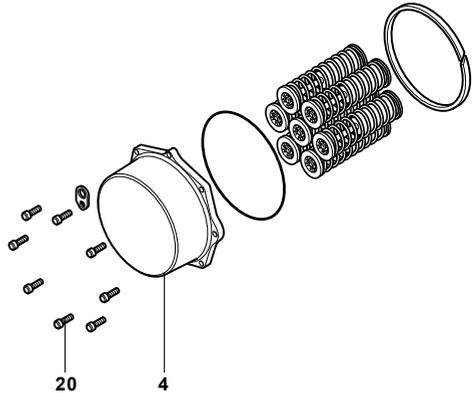
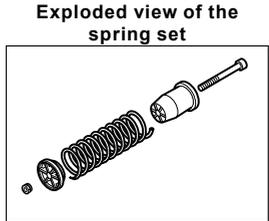
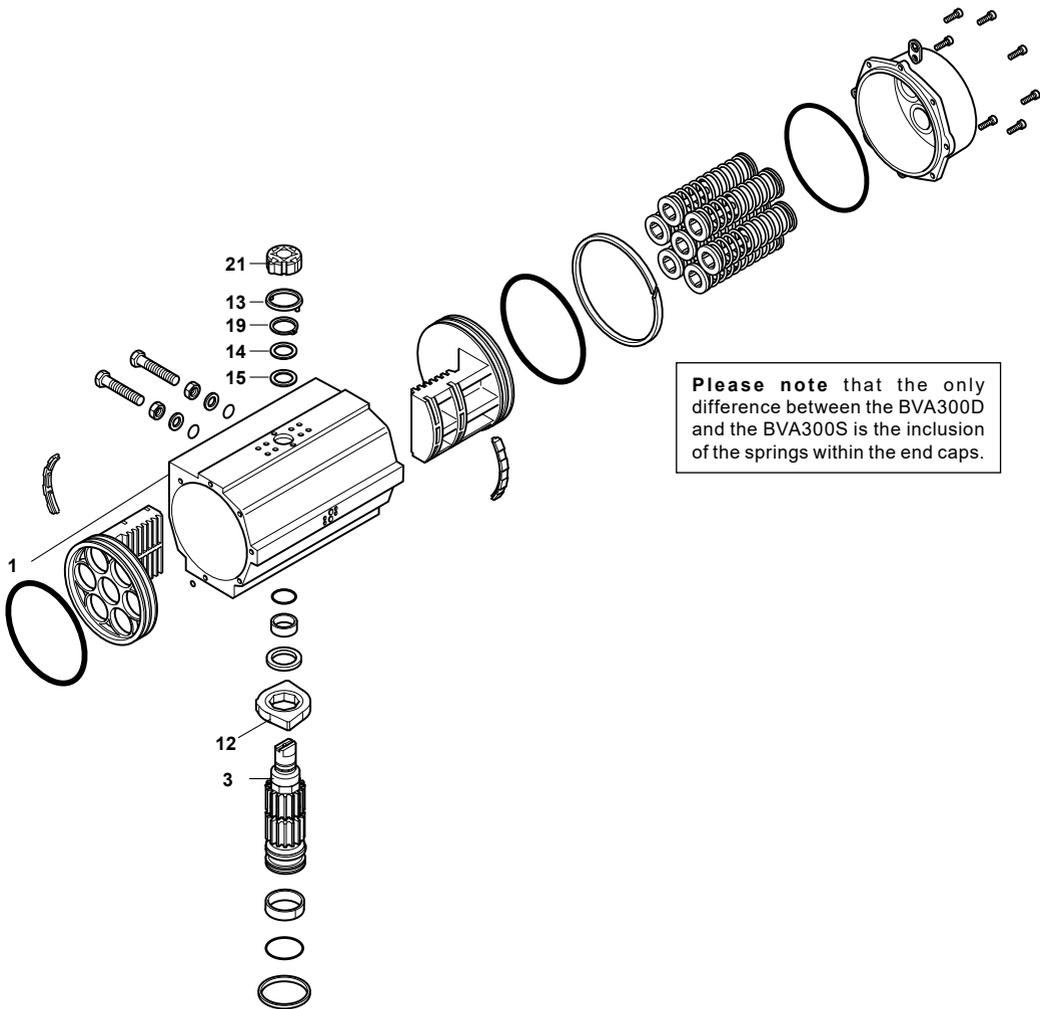


Fig. 6 BVA300 series shown



# 6. Fault finding

Before dismantling the actuator, consult the instructions given below:

## 6.1 Actuator with solenoid valve

### **A If the actuator does not function check that:**

1. The valve is free to rotate.
2. The actuator is of the correct size.
3. The correct voltage is supplied to the solenoid (the valve coil is tagged with the correct voltage).
4. Sufficient compressed air is available at the solenoid valve.

### **B If the proper voltage and air pressure have been verified and the valve is free to move proceed as follows:**

1. Apply the correct voltage to the solenoid valve. Check for a clicking sound.
2. If no sound is detected:
  - i) Carefully unscrew the solenoid and solenoid stem from the block.
  - ii) Re-apply voltage and observe the solenoid plunger. If it does not retract replace the solenoid valve.
3. If the solenoid functions, remove both it and the mounting block for a bench test. Connect with a minimum 3 bar g air supply and correct voltage. Switch it on and off and check the air flow. Air should flow out of only one outlet port when the solenoid is energised.

### **C If the actuator functions but exhibits leak or power loss accompanied by leakage proceed as follows:**

1. Check the voltage. It must be within 10% of the specified voltage.
2. Check the compressed air supply. Ensure that no intense pressure drops occur as the unit is cycled. Loss of pressure can cause incomplete shifting of the spool valve in the block or at one of the piston seals of the actuator. A leaking piston seal will usually leak on either cycle. On spring return actuators, piston seal leakage will show at port B on the air manifold flange. A leaking spool valve will require replacing. Leaking piston seals can be cured by replacing the 'O' rings with new ones.

## 6.2 Actuator without a solenoid valve.

**For actuators without a solenoid valve, (or those where the solenoid valve and mounting block are working correctly), remove the actuator from the valve, disassemble and check the following:**

1. Make sure all porting is clear of obstructions.
2. Make certain the actuator is lubricated and that there is no solidified grease between the pinion and piston racks. If solidified grease is present, clean, dry, regrease and reassemble.
3. Verify that the actuator pinion shaft and/or pistons are not seized. If seized, reassemble as per the reassembly instructions in Section 5.4.
4. If the unit exhibits excessive backlash, check the teeth on the piston racks for wear.
5. With spring return actuators, check for misplaced or broken springs. If springs are broken, check the body for scoring.
6. If the actuator and valve are free, reassemble the actuator and retest. If the unit still fails to operate, consult Spirax Sarco.





