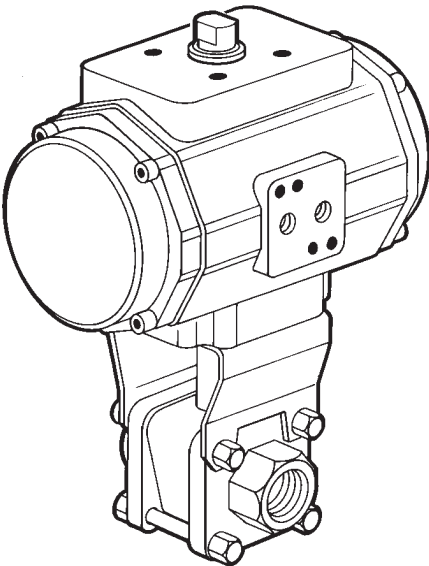

**BVA Rotary Pneumatic Actuators
Mounted to M Series Ball Valves
Installation and Maintenance Instructions**



1. *General*
2. *Operation*
3. *Available models*
4. *Actuator orientation*
5. *Actuator fitting*
6. *Air supply and electrical connections*
7. *Solenoid valve*
8. *Manual operation*
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10. *Fault finding*
11. *Spares*

1. General

BVA rotary pneumatic actuators are designed for use on 90° ball valves, in particular M10V, M10S, M10S ISO, M10F ISO, M10H ISO, M20, M21S ISO and M40 ISO. Versions available are BVAS (single acting), BVAD (double acting). The type BVAS is a spring return model where fail safe operation is required.

The actuator design utilises a double rack

and single pinion of hardened steel. 3 carbon filled PTFE guide bands prevent metal to metal contact between the piston and the body, practically eliminating wear.

Available as extras are manual operators and electrically operated solenoid valves with suitable mounting blocks to attach them to the valve body.

Full details are given in Sections 7 and 8.

2. Operation

The BVA actuator drive shaft rotates through a full 90°. Rotation is accomplished by feeding air into the centre chamber, forcing the two opposing pistons outwards resulting in a counter clockwise rotation of the shaft to the 'open' position see Fig. 1a and Fig. 1c. For spring return actuators (BVAS) closure is accomplished by means of springs within the end caps (Fig. 1d) which force the pistons

together when the air supply to the control chamber has been interrupted. For double acting actuators (BVAD) closure is obtained by feeding air into the end cap chambers, which forces the piston inward.

If the rotation required is opposite to that described, refer to Fig. 4 (section 6, page 5) for the proper procedure to reverse the rotation.

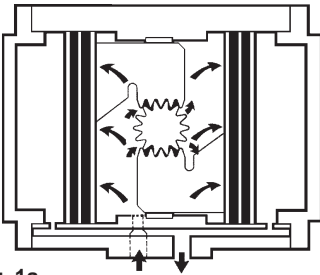


Fig. 1a
Double acting

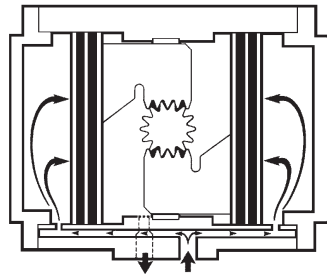


Fig. 1b
Double acting

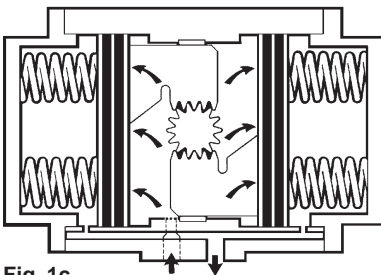


Fig. 1c
Spring return

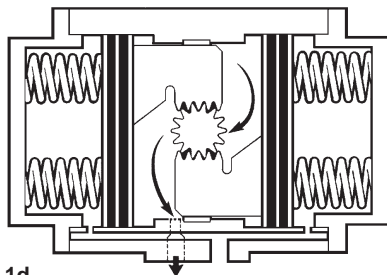


Fig. 1d
Spring return

3. Available models

There are 10 models available. Their suitability for use with the range of Spirax Sarco ball valves is given in the relevant actuator Technical Information Sheets.

BVA actuators for 3 and 1 piece ball valves	TI-P371-02
BVA actuators for M10V and M10S ball valves	TI-P371-10
BVA actuators for M10S ISO and M10F ISO ball valves	TI-P371-11
BVA actuators for M10H ISO ball valves	TI-P371-15
BVA actuators for M20 ball valves	TI-P371-12
BVA actuators for M21S ISO ball valves	TI-P371-13
BVA actuators for M40 ISO ball valves	TI-P371-14

4. Actuator orientation

BVA actuators are normally installed with their major axis parallel to the pipeline. However the actuator can be positioned above, below or alongside the valve without affecting its operation.

The circumferential pinion gear allows re-orientation of the extended output shaft and housing to accommodate installation where physical obstructions might otherwise prove prohibitive. See Fig. 2.

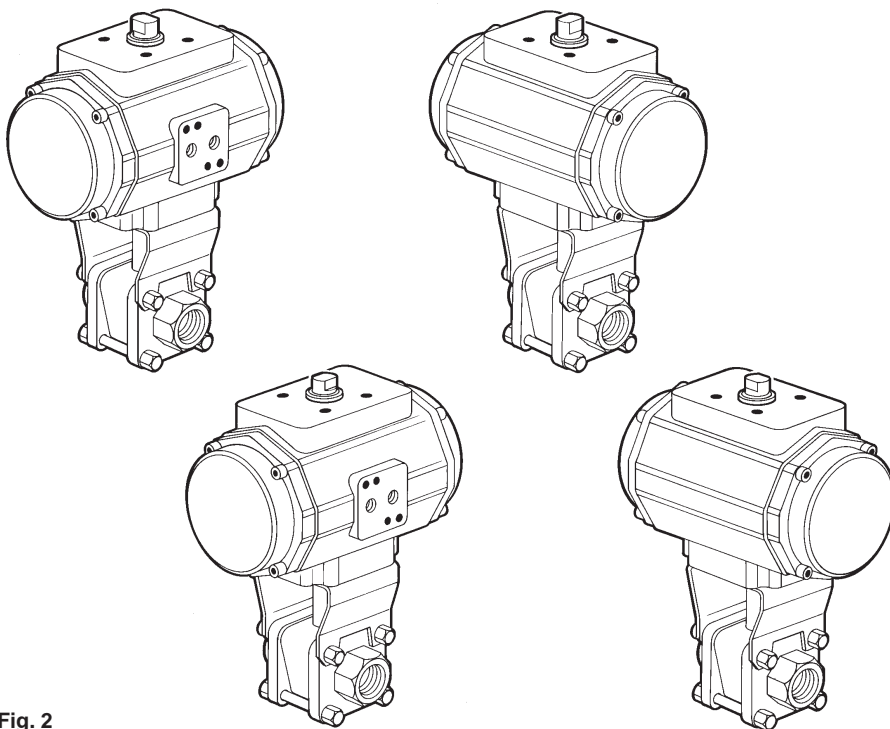


Fig. 2

5. Actuator fitting

1. Determine mode of operation of the valve (normally open or normally closed).
2. Determine desired quadrant for bracket attachment and direction of mounting of actuator (in line or cross line).
3. Ensure correct linkage kit is available by reference to the relevant actuator TI sheets stated in section 3.
4. Attach actuator to valve as follows:-
 - a Rotate valve stem to position necessary to achieve desired operation.
 - b Remove valve handle.
 - c Attach mounting bracket to actuator using 4 bolts and washers provided in mounting kit. Do not fully tighten bolts yet.
 - d Insert adaptor into recessed drive sleeve making sure that it engages with the drive shaft inside.

Caution

Ball valves can trap pressurised media in the cavity. If the valve is installed in the line or has been in operation, make sure there is no pressure to or in the valve body before removing any valve body bolts.

M10V and M10S

Remove 2 upper body bolts, fit mounting bracket / actuator on top of valve making sure the valve stem engages the slot in the adaptor. Fit 2 new longer bolts from mounting kit. Replace nuts and tighten fully to the torque values quoted in Table 1 opposite.

Table 1

Valve size	Torque N m	
	Cast steel	Stainless steel
DN 1/4" - 3/4"	13 - 15	6 - 7
DN 1" - 1 1/4"	29 - 32	23 - 25
DN 1 1/2" - 2 1/2"	38 - 42	33 - 36

M10S ISO, M10F ISO and M10H ISO

Fit the mounting bracket / actuator onto the valve mounting pad using the four bolts supplied with the mounting kit. Tighten the bolts to the torques values quoted in Table 1 above.

M20

Fit the mounting bracket / actuator onto the valve mounting pad using the three bolts supplied with the mounting kit.

M21S ISO and M40 ISO

Fit the mounting bracket / actuator onto the valve mounting pad using the four bolts supplied with the mounting kit.

- e At this time make sure the actuator is in the operational mode desired and that the valve is in the corresponding open or closed position; if not:
 - i. Remove the fasteners at the mounting bracket / actuator end then rotate actuator 90° while still engaged with valve stem; or
 - ii. If integral solenoid is present on double acting model remove solenoid block with 'O' rings, turn them upside down and remount.
- f Check actuator mounting bolts are tight.

Note: If the ball valve is fitted with a self-venting ball, ensure the ball valve is installed so that the vent is on the high pressure side when the valve is closed.

6. Air supply and electrical connections

6.1 Air supply

BVA actuators are factory lubricated hence a lubricated air supply is not required. The air must however be dry and clean. Any other non corrosive gas can be utilised as the operating medium as can light hydraulic oil.

6.2 Supply pressure

Operating pressure range (standard) 4, 5 or 6 bar g. Refer to TI-P371-02 for details.

6.3 Supply connections - no integral solenoid

BVA Connect air supply to port marked "A" Connection size for BVA1.2 - G1/8", BVA2.5 to BVA160 - G1/4

BVA actuator stroke direction can be reversed. To achieve this, remove gear / rack piston assembly, rotate 180° and re-install. This will reverse the direction of rotation of the output shaft. See Fig. 4 for other relationships.

6.4 Supply connections - integral solenoid

All models of BVA actuators can be supplied with an integral electrical solenoid valve. See Section 7 for details.

For BVA actuators the air supply connection is on the mounting block connection size 1/4" BSP. The solenoid exhaust is through a 1/8" BSP male connection on top of the solenoid.

For single acting (spring return) actuators the solenoid should be fitted in 3 / 2 mode (see Fig. 5, page 6 and Fig. 5b, page 7).

6.5 Solenoid valve - electrical supply

Solenoid valves have IP65 plugs suitable for 7 mm O/D cable.

Power consumption
MV11 to MV14 = 2 W

6.6 Air consumption

Table 2 shows the amount of air consumed per 90° stroke in litres. (Port B - double acting only).

Table 2 (See Fig. 3).

Model	Air to port	
	A	B
BVA1.2	0.05	0.06
BVA2.5	0.10	0.11
BVA4	0.16	0.22
BVA6.5	0.33	0.36
BVA10	0.35	0.49
BVA20	0.80	1.00
BVA35	1.80	1.90
BVA60	2.90	3.10
BVA95	4.70	4.90
BVA160	7.30	8.00

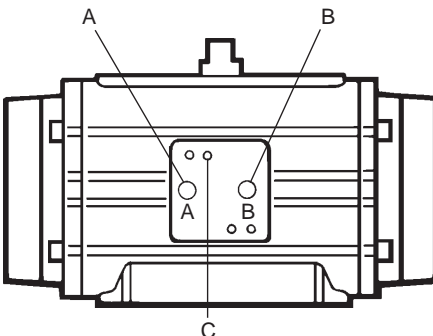
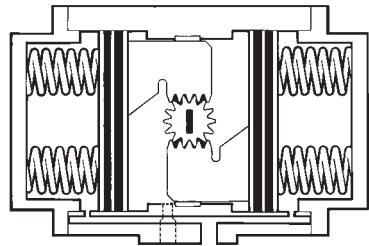
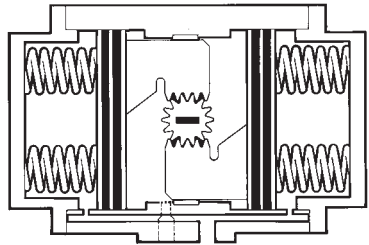


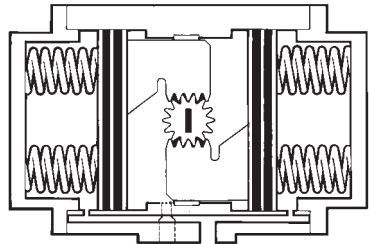
Fig. 3 Position of screwed location pin (supplied in solenoid pack).



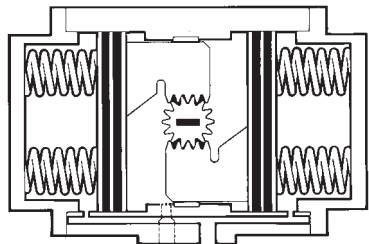
Output shaft perpendicular rotation - counter clockwise



Output shaft parallel rotation - counter clockwise



Output shaft perpendicular rotation - clockwise



Output shaft parallel rotation - clockwise

Fig. 4 Rotation with pressure at port A

6.7 Recommended tubing sizes

In order to provide sufficient flow of supply air to the BVA actuator the following tubing sizes shown in Table 3 are recommended.

Table 3

Model	Runs up to 1.5 m	Runs over 1.5 m
BVA1.2 - BVA20	6 mm	6 mm
BVA35 - BVA160	6 mm	10 mm

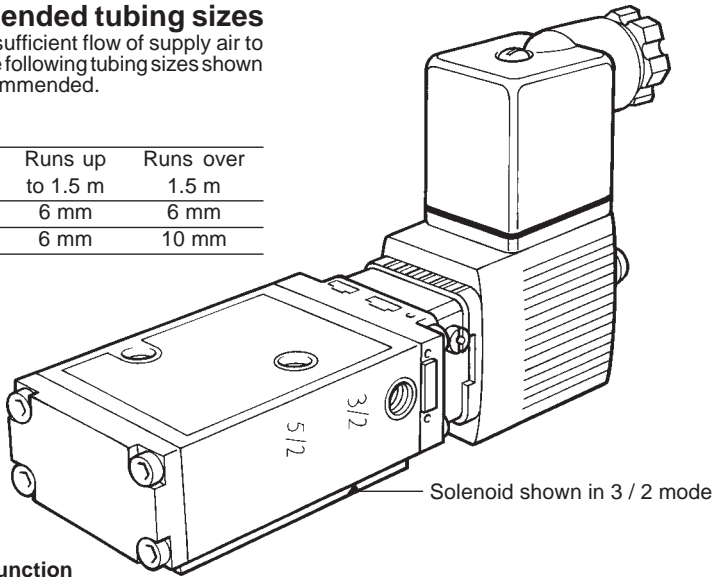


Fig. 5 5/2 or 3/2 function

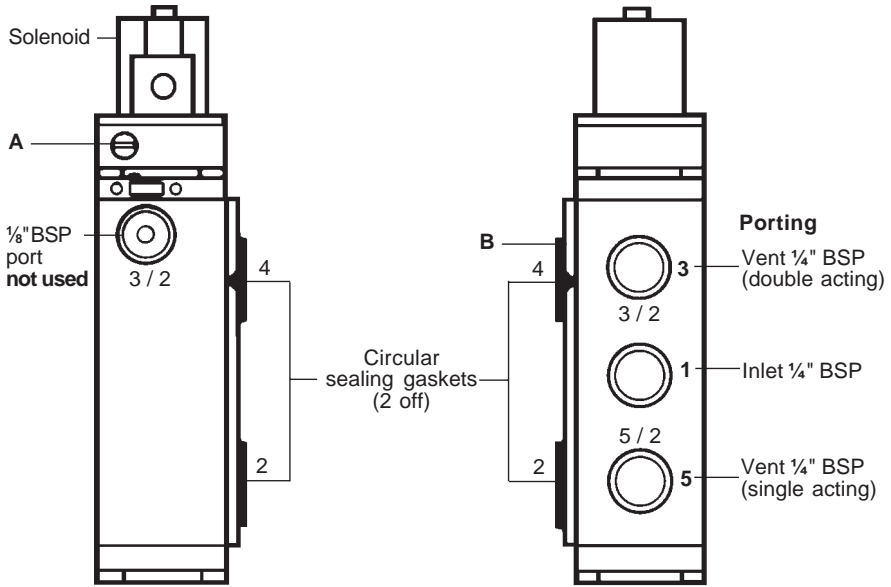


Fig. 5a Front side view

Fig. 5b Rear side view

Solenoid valves are supplied with port 3 blanked suitable for on / off spring return operation. For double acting duty remove the blank and turn the detachable mounting base (B) through 180° such that the arrow lines up against 5/2 on the block.

6.8 Solenoid identification

(MV11, 12, 13 and 14)

A Auto (normal) position / manual override

- i) Auto (normal) position (i.e. slot horizontal as shown in Fig. 5a).
- ii) Manual override. To open valve if / when power failure condition occurs, push screw in and turn 90° clockwise.

B Mounting base fitment

Single acting actuator. The arrow on the side of the detachable mounting base to be opposite 3/2 on the block, as shown in Fig. 5b.

Double acting actuator. The arrow on the side of the detachable mounting base to be opposite 5/2 on the block.

C Screwed location pin (refer to Fig. 3, page 5).

This must be inserted into the actuator mounting block to ensure correct alignment of the solenoid to the actuator block. Ensure it is inserted far enough into the actuator block so that it does not hold the solenoid away from the actuator to cause air leakage.

Note: BVA1.2 type actuators require an additional solenoid adaptor type SL6.

7. Solenoid valve

BVA actuators can be fitted with solenoid valves attached to the body. It is important that the correct solenoid valve is chosen to suit the voltage applied.

Table 4 lists the options available.

Solenoids are fitted with plug to DIN 43650 Form A.

Table 4

Model	Voltage
MV11	230 Vac
MV12	115 Vac
MV13	24 Vac
MV14	24 dc

8. Manual operation

In the event of air failure, BVA actuators can be cycled manually. For manual operation a wrench may be used on the top shaft extension to rotate the actuator in the desired direction. The plastic position indicator must first be removed as should any ancillary equipment such as switchboxes. On BVA 60, BVA95 and BVA160 models because of the large torque required to operate the actuator with a wrench, a manual override device is available. This is termed:- M02-60 (for model 60 actuators) or M02-95 (for model 95 actuators) or M02-160 (for model 160 actuators).

It is first bolted to the actuator body (underside) and then the mounting bracket attached to it as described in Section 5.

Cautionary note on manual operation.

Care must be taken to ensure that the actuator is not operated automatically while manual operation is being performed.

Air must be allowed to exhaust from the actuator for manual operation. This means disconnecting air lines or providing 3-way exhaust valves at the inlet port.

9. Maintenance

Caution: The actuator must be isolated both pneumatically and electrically before any maintenance is carried out.

9.1 General

Periodic checks should be performed to ensure all fasteners remain tight.

All actuators are supplied with sufficient lubrication for their normal working life. If required, recommended lubrication for all actuators is Fina Ceran WR2 (or equal).

Depending upon the conditions under which the actuator is operating i.e. extended duty, non compatible operating medium or abnormal operating conditions, periodic replacement of internal 'O' rings is recommended. Kits containing all the necessary 'O' rings are available from Spirax Sarco.

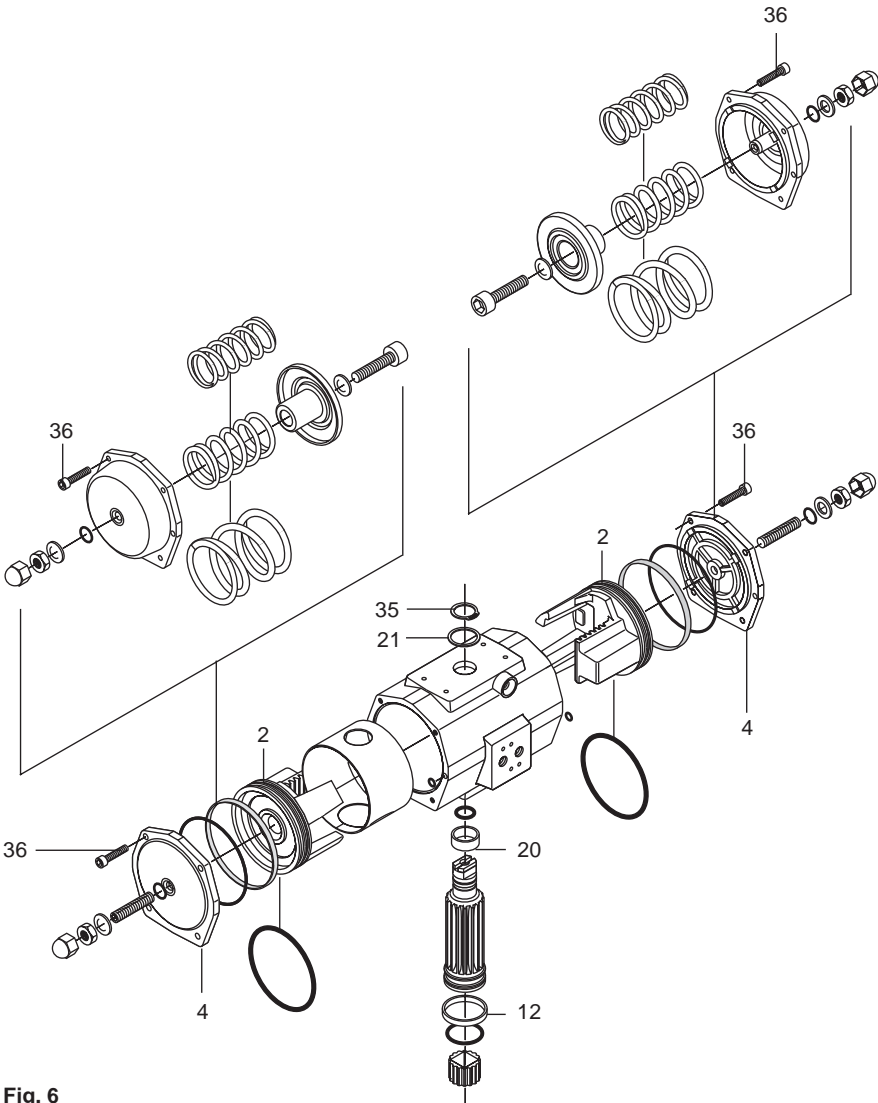


Fig. 6

9.2 Actuator disassembly

1. Disconnect actuator air and electrical supplies.
2. Remove actuator and mounting bracket from valve.

Caution

All valves can trap pressurised media in the cavity. Isolate the piping system in which the valve is mounted then relieve any pressure in the valve body.

3. Remove the actuator bracket (and switchbox if fitted) from the actuator to begin repair (note mounting position of bracket and positioner for easy reassembly). See fig 6.
4. Remove solenoid mounting block by removing bolts. Use care to retain 'O' ring seals.
5. Remove all screws (36) from both end caps. After the screws are removed gently prise off each end cap being careful not to damage the end cap 'O' rings.

Caution:

If the actuator is a spring return model, uniformly loosen all end cap screws on each end cap two or three turns at a time, in sequence, to relieve pre-load of the springs. On larger actuators with springs use caution when removing end caps.

6. The two pistons (2) can be removed by rotating the actuator shaft, driving the piston assemblies outward until the gear rack and pinion have disengaged.
7. Remove retainer ring (35) and the washer (21) from the shaft.
8. Remove the shaft (pinion gear) out through the bottom of the body.
9. New 'O' rings can now be fitted if all actuator surfaces are clean and free from grit and scratches. If the inside walls of the body are scored the actuator will leak after rebuilding. Shallow marks barely detectable to touch are acceptable.
10. Lubricate the actuator thoroughly with grease. Apply a light film of grease to the 'O' rings.

9.3 Actuator reassembly

1. Replace the top bearing (20) and bottom bearing (12).
2. Replace the centre gear through the bottom of the actuator body. The bottom hole in the actuator body is a larger inside diameter than the top hole.
3. Very carefully align the pistons square to the body.
4. Align the centre gear so that the teeth will 'Pick up' the piston assembly's rack teeth when turning the top extension clockwise.

Important:

Proper 90° rotation can only be assured if the centre gear teeth begin to mesh with the piston assembly's teeth at the 'Proper Tooth' between these meshing pairs.

5. To ensure proper meshing of the teeth, rotate the centre gear $22\frac{1}{2}^\circ - 45^\circ$ (one or two teeth) counter clockwise from its normal position with the piston assemblies situated at the body ends. (Normal position is that which provides the proper output shaft orientation - See Fig. 7).

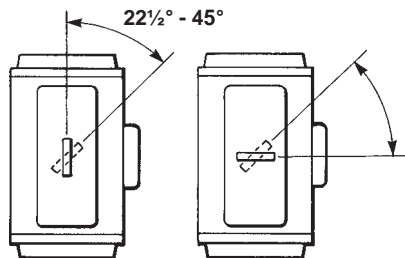


Fig. 7

6. Gently push each piston into the actuator body. Turn the top shaft extension clockwise. Do not allow the pistons to rotate. At the proper point of engagement between the centre gear and the piston assemblies, both pistons will move towards the centre of the body when the shaft is turned clockwise.
7. Once the centre gear and pistons are properly engaged ensure that smooth movement and 90° operation can occur without moving the pistons out of the actuator body. This is important!
8. Replace the actuator end caps (4) taking care to properly fit the sealing 'O' rings.
9. Replace the washer (21) over the top shaft extension.
10. Install the shaft clip (35) into the mating groove on the top shaft extension.

9.4 Spring return actuator

1. When replacing springs in a BVA actuator ensure springs are replaced in the end cap in the identical position from which they were removed.

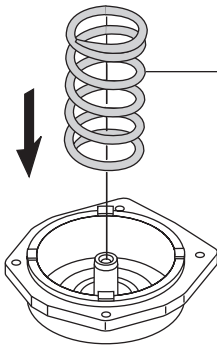
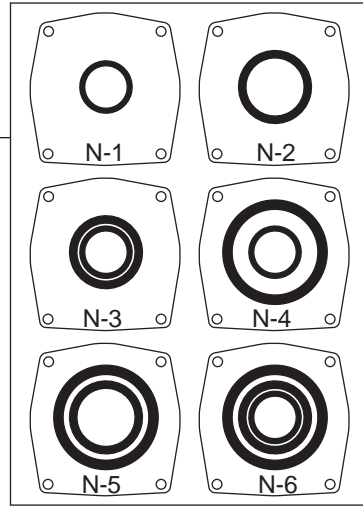


Fig. 8



2. Ensure that end cap 'o' rings and air port 'o' rings are in place on both sides.

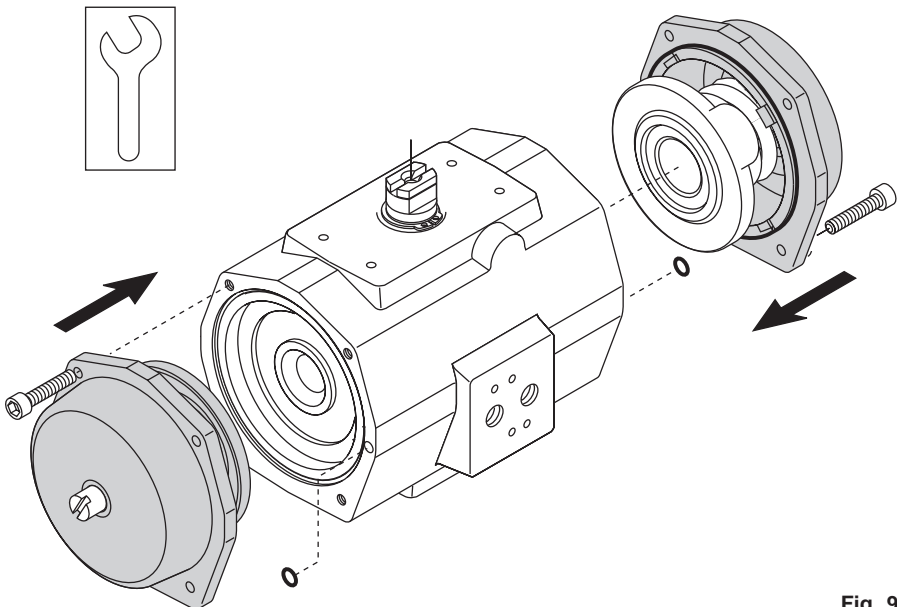


Fig. 9

10. Fault finding

Before dismantling the actuator, consult the instructions given below:-

10.1 Actuator with solenoid valve

A If actuator does not function check that:

1. Valve is free to rotate. This can be done as described above under Manual Operation.
2. Actuator is of correct size.
3. Speed control screws if fitted are loose (if screws are tightened all the way actuator will not operate).
4. Correct voltage is supplied to solenoid (valve coil is tagged with correct voltage).
5. Sufficient air supply is available at the solenoid valve. With a MV11 to MV14 solenoid, a minimum air pressure of 3.5 bar is required when checking supply pressure. Place gauge at solenoid valve inlet and monitor gauge for unexpected pressure drops.

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

1. Apply voltage to solenoid.
Check for clicking sound.
2. If no sound detected;
 - i Carefully unscrew solenoid and solenoid stem from block.
 - ii Re-apply voltage and observe solenoid plunger. If it does not retract replace solenoid valve.
3. If solenoid functions, remove it and mounting block and place on bench. Connect min 3.5 bar air supply and correct voltage. Switch on and off and check air flow. Air should flow out of only one outlet port when the solenoid is energised. (Slight back pressure may be required to shift the valve spool. This may be generated by obstructing the outlet port).

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

1. Check voltage. It must be within 10 % of the specified voltage. (Low voltage will cause leakage out of the back of the solenoid and burn out the coil).
2. Check air supply. Be sure no sharp 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 using new 'O' rings (See Section 9).

10.2 Actuator without solenoid valve

For actuators without solenoid valve or those where the solenoid valve and mounting block are working correctly, remove the actuator from the valve, disassemble (See Section 9.2) and check the following:-

1. Make sure all inlet porting is clear of obstructions.
2. Make certain 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 bound. If bound reassemble per Rebuilding Instructions.
4. If unit inhibits excessive backlash, check teeth on piston racks for wear.
5. With spring return actuators, check for misplaced or broken springs. If springs are broken, check body for scoring.
6. If actuator is free, valve is free and control block (if fitted) is shifting air properly reassemble the actuator and retest. If unit still fails to operate, consult Spirax Sarco.

11. Spares

The spare parts available are shown in heavy outline. Parts drawn in broken line are not supplied as spares.

Available spare

Spares set (BVA) As itemised on drawing

How to order spares

Always order spares by using the description given in the column headed available spare, stating the size and type of ball valve/actuator.

Example: 1 - Spares set for BVA2.5D.

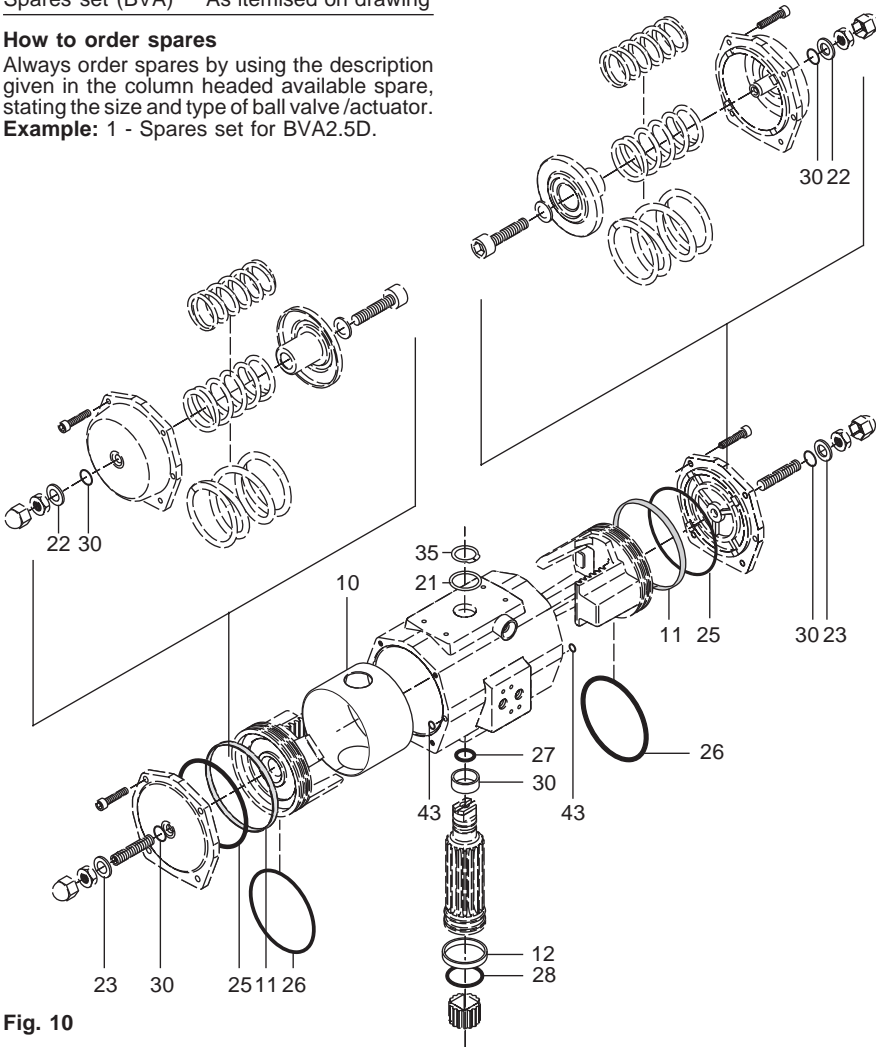


Fig. 10