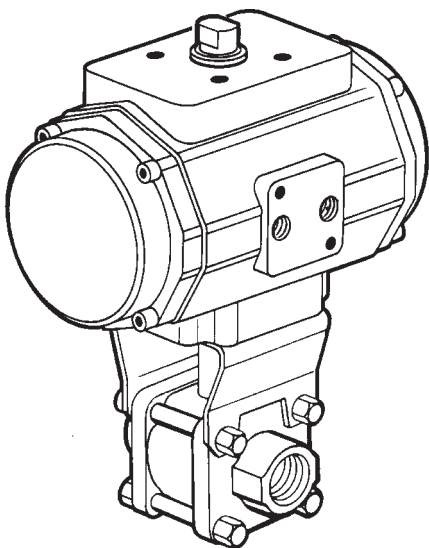

**BVA Rotary Pneumatic Actuators
Mounted to Model 10 and Model 20 Ball Valves
Installation and Maintenance Instructions**



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

1. General

BVA rotary pneumatic actuators are designed for use on 90° ball valves, in particular Model 10 and Model 20. The type BVA is a spring return model where failsafe 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 6 and 7.

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

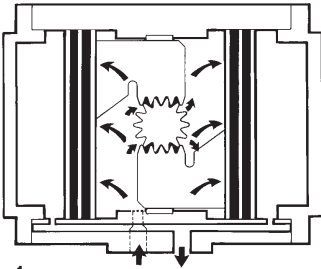


Fig. 1a
Double Acting

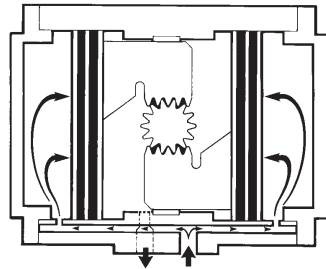


Fig. 1b
Double Acting

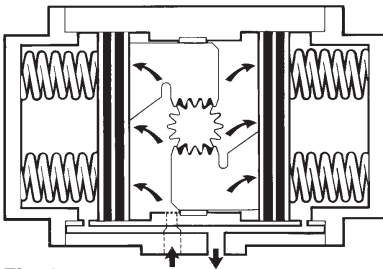


Fig. 1c
Spring return

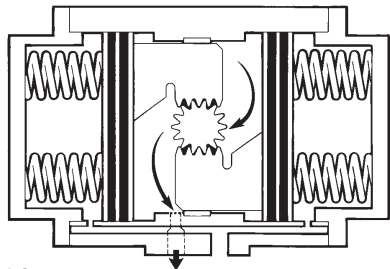


Fig. 1d
Spring return

3. Available models

There are 6 models available. Their suitability for use with the various sizes of Model 10 or Model 20 ball valve is given in Tables 1 and 2.

Ball valve and actuator tables for operating air pressures of 4, 5 or 6 bar. (see note below)

**Table 1. BVA actuators and linkage (BVL) with Model 10 valves.
(For BVAD remove springs, all other details remain the same)**

Valve size	3/8"		1/2"		3/4"		1"		1 1/4"		1 1/2"		2"	
K _v	2.5		6		10		27		49		70		103	
Δp (bar)	BVA	BVL	BVA	BVL	BVA	BVL	BVA	BVL	BVA	BVL	BVA	BVL	BVA	BVL
5														
10	1.2i	30	1.2i	31	1.2i	32	6i	33	15i	34	15i	35	15i	36
15														
20														
25														
30														
35	1.2i	30	1.2i	31	1.2i	32	6i	33	15i	34	15i	35	15i	36
40													*28i	37

NB. Where stainless steel valves are used, linkage kit will have suffix -S e.g. 20i -S (Model 10 only).

Table 2. BVA actuators and Linkage (BVL) with Model 20 valves

Valve size	DN25		DN40		DN50		DN65		DN80		DN100	
K _v	30		81		103		205		300		598	
Δp (bar)	BVA	BVL	BVA	BVL	BVA	BVL	BVA	BVL	BVA	BVL	BVA	BVL
5	6i	62	15i	64	15i *28i	64 65	28i	65	28i	67	50i	68
10	6i	62	15i	64	15i	64	28i	65	28i	67	50i	68
15	*15i	63			*28i	65						
20	6i	62	15i	64	15i	64	28i	65	28i	67	50i	68
25	*15i	63			*28i	65			*50i	68		
30												
35	6i	62	15i	64	†15i	64	28i	65	28i	67	†50i	68
	*15i	63			28i	65			*50i	68	75i	68
40	6i	62	15i	64	28i	65	28i	65	†28i	67	†50i	68
	*15i	63	*28i	65			*50i	66	50i	68	75i	68

* Only where 4 bar air is available

† Only where 6 bar air is available

Example

Valve required = DN40 stainless steel flanged.
 Differential pressure = 12 bar g
 Air pressure available = 5 bar g
 Actuator required = BVA 15i
 Linkage kit required = BVL 64-5

4. Actuator orientation / fitting

4.1 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.

4.2 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 Tables 1 and 2.
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.

Model 10

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 below (Table 3)

Table 3

Valve size DN	Torque N m	
	Cast steel	Stainless steel
10, 15, 20	13 / 15	6 / 7
25, 32	29 / 32	23 / 25
40, 50	38 / 42	33 / 36

Model 20

Fit the mounting bracket / actuator onto the valve mounting pad using the 3 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.

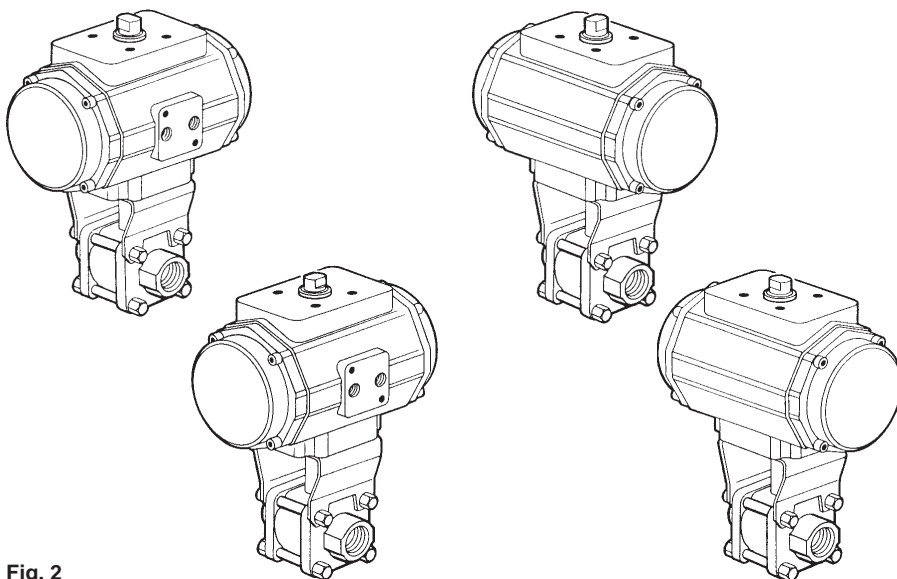


Fig. 2

5. Air supply and electrical connections

5.1 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.

5.2 Supply pressure

Operating pressure range (standard) 4, 5 or 6 bar g. Check TI-P371-02 for details of valve differential pressure limits against supply air pressure.

5.3 Supply connections - no integral solenoid.

BVA - Connect air supply to port marked "A"
 Connection size - BVA 1.2i - G $\frac{1}{8}$ "
 BVA 6i-75i - G $\frac{1}{4}$ "

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.

5.4 Supply connections - integral solenoid.

All models of BVA actuators can be supplied with an integral electrical solenoid valve. See Section 6 for details.

For BVA actuators the air supply connection is on the mounting block connection size $\frac{1}{4}$ " BSP. The exhaust is through a $\frac{1}{8}$ " BSP male connection on top of solenoid. For single acting (Spring return) solenoid should be fitted in 3 / 2 mode, see Fig. 5.

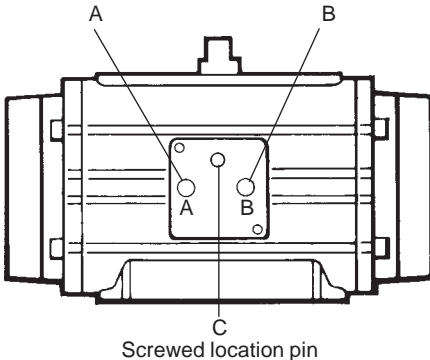


Fig. 3

5.5 Solenoid valve - electrical supply.

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

Power consumption
 MV11 to MV14 = 2 W

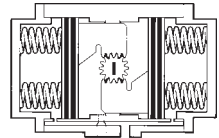
5.6 Air consumption

Table 4 shows the amount of air consumed per 90° stroke in litres.

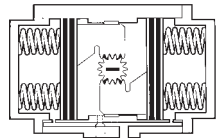
Table 4

Air to port	Model					
	1.2i	6i	15i	28i	50i	75i
A	0.05	0.27	0.6	1.5	1.9	3.2
B	0.07	0.38	0.8	1.6	2.5	4.2

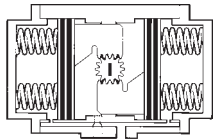
Output shaft perpendicular rotation counter clockwise



Output shaft parallel rotation counter clockwise



Output shaft perpendicular rotation clockwise



Output shaft parallel rotation clockwise

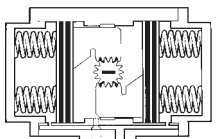


Fig. 4 Rotation with pressure at port A.

5.7 Recommended tubing sizes

In order to provide sufficient flow of supply air to the BVA actuator the following tubing sizes shown in Table 5 are recommended.

Table 5

Model	Runs up to 1.5 m	Runs over 1.5 m
1.2i and 6i	6 mm	6 mm
15i, 28i, 50i and 75i	6 mm	10 mm

Solenoid identification (MV11, 12, 13 and 14)

A Auto (normal) position / manual override

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

B Mounting base fitment

3 / 2 Showing at arrow on block (single action type)

- C Showing screwed location pin must be located far enough into block to prevent poor seal and ensure full contact with gasket face on block (refer to Fig. 3).

*BVA 1.2i solenoid valve is via an SL6 block

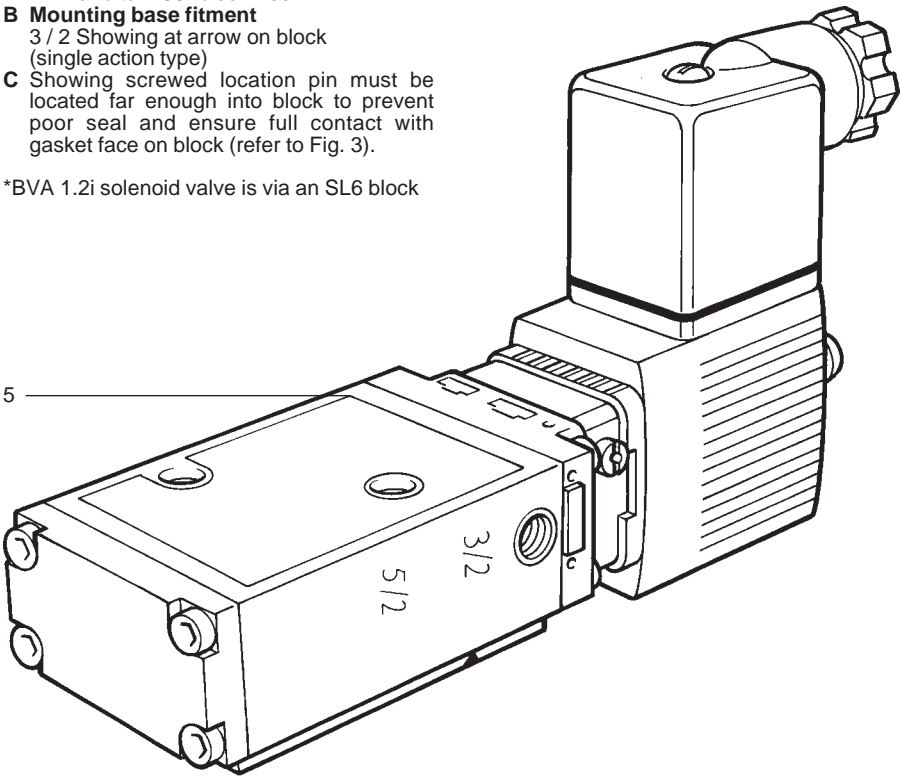


Fig. 5 5/2 or 3/2 function

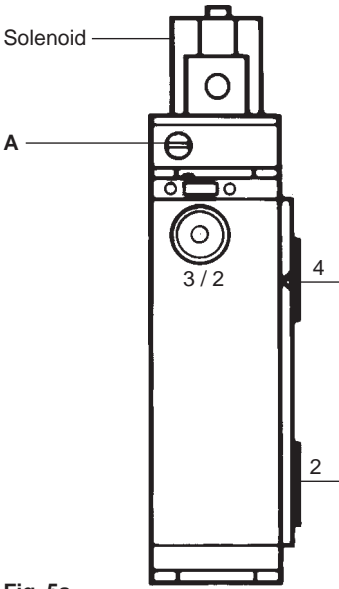


Fig. 5a

Circular Sealing Gaskets (2 off)

Porting

- 1) Inlet 1/4" BSP
- 3) Vent (Single act) 1/8" BSP
- 5) Vent (Double act) 1/8" BSP

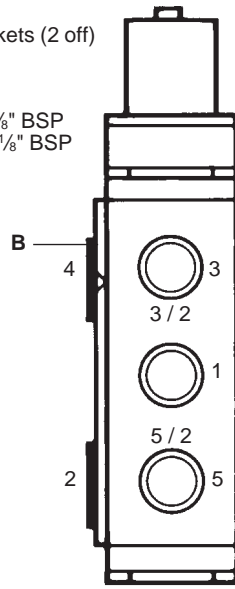


Fig. 5b

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 bottom plate through 180°.

6. 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 6 lists the options available.

Table 6

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

Solenoids are fitted with plug to DIN 43650 Form A.

7. 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 actuator in the desired direction. The plastic position indicator must first be removed as should any ancillary equipment such as switchboxes. On BVA50i and BVA75i models because of the large torque required to operate the actuator with a wrench, a manual override device is available. This is termed:- M02-50 (for model 50i actuators) or M02-75 (for model 75i actuators). It is first bolted to the actuator body (underside) and then the mounting bracket attached to it as described in Section 4.

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.

8. Maintenance

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

8.1 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 Penzoi MP705. 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.

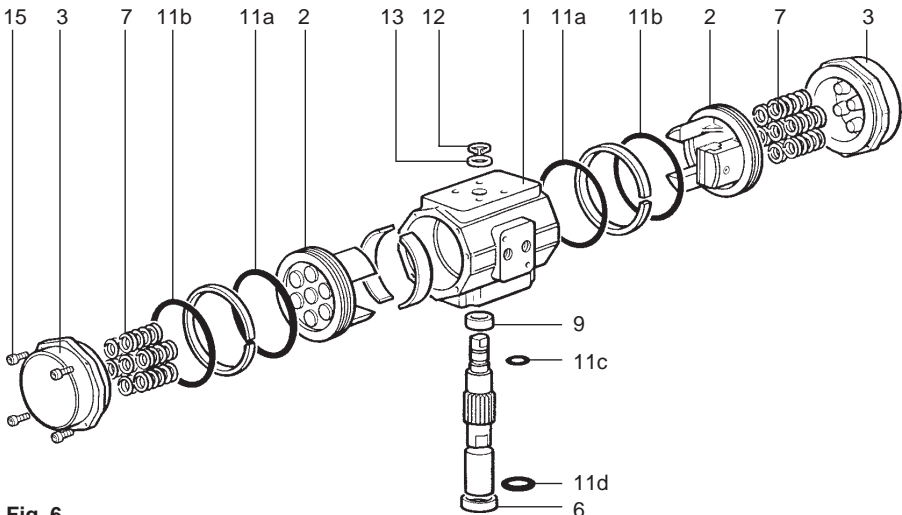


Fig. 6

8.2 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 Each end cap (3) is fitted on to the body (1) with a machined sleeve fit. Remove all screws (15) 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 (12) and the washer (13) 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.

8.3 Actuator reassembly

- 1 Replace the top bearing (9) and bottom bearing (6).
- 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° (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).

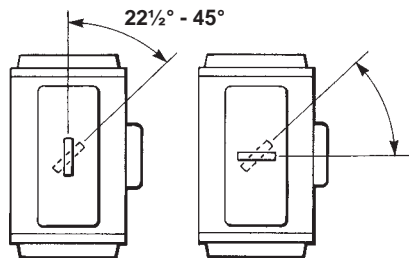


Fig. 7

- 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 and caps (3) taking care to properly fit the sealing 'O' rings.
- 9 Replace the washer (13) over the top shaft extension.
- 10 Install the shaft clip (12) into the mating groove on the top shaft extension.

8.4 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.

Important

If using less than 7 springs in each end cap ensure they are positioned as shown in Fig. 8. Number of springs is dependant on operating air pressure.

4 bar operating air - 10 springs

5 bar operating air - 12 springs

6 bar operating air - 14 springs

BVA 1.5i always has 2 springs.

- 2 Place springs in the end cap pocket using the alignment nibs cast into each end cap.
- 3 With the springs pointing up and the end cap on a solid surface, place the actuator body over the springs and end cap.
- 4 Force the body down and begin by engaging 2 body bolts by hand through the end cap. Take each bolt up in small and equal turns.

Once the end cap is temporarily secured to the body turn the actuator over to its normal position and uniformly take up the end cap bolts. Uniformly load all springs to prevent any from buckling.

- 5 Replace springs in other end cap in a similar manner.

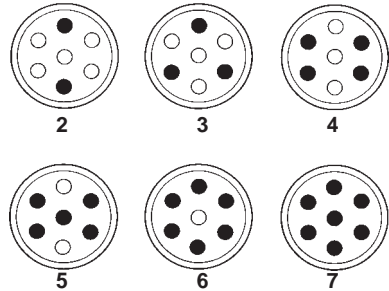


Fig. 8

9. Fault finding

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

9.1 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 - 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 8).

9.2 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 8.2) 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.

10. Spares

'O' Ring set items 11a, 11b, 11c and 11d.
State actuator type on order.

