



**Bulk Solids Handling Equipment**

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# **INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS TYPE TBS PLUG DIVERTER VALVES**

Rota Val Ltd TBS Plug diverter valves are designed to divert the flow of dry solids in pneumatic conveying systems in the diverging or converging modes. Type TBS valves may be used in lean phase conveying systems, dense phase up to 7 bar g or vacuum systems. The compressed air requirement for operation of the pneumatic torque actuator is 5 bar g (70 psig). In standard form, the temperature limitation is 100°C but 200°C can be accommodated with modifications. Plug - body clearances are determined by product temperature and external temperature conditions.

**THE VALVE SHOULD NOT BE USED FOR ANY OTHER DUTY WITHOUT CONSULTING OUR TECHNICAL SALES DEPARTMENT.**

## **HEALTH AND SAFETY**

The valve contains moving parts that can be injurious: it is responsibility of the system installer/user to ensure the safe installation and operation of the valve. In particular it must be adequately protected and guarded **IN COMPLIANCE WITH LOCAL HEALTH AND SAFETY REGULATIONS**. The pneumatic and electrical control system must be isolated before any maintenance or adjustment is carried out: do not operate the valve with any part of it removed. Only competent persons must be used to maintain the valve.

**IT IS THE RESPONSIBILITY OF THE PURCHASER/USER OF THIS EQUIPMENT TO ENSURE THAT THESE HEALTH AND SAFETY INSTRUCTIONS ARE PASSED ON TO THOSE PERSONS LIKELY TO BE AT RISK.**

**IMPORTANT: ALWAYS QUOTE SERIAL No. IF FURTHER INFORMATION OR SPARE PARTS ARE REQUIRED.**

## **RESIDUAL HAZARDS**

The valve is intended for installation in fully enclosed pipework and must not be used whilst any of the connection ports remain unconnected.

Deterioration of the lip seals can lead to leakage around the shaft; deterioration of the inflatable seals can lead to product building up in the body. When disassembling the valve for maintenance purposes, there may be some product lying inside; proper provisions for dealing with any potential leak of the conveyed media must be made.

## **NOISE**

The operation of the valve results in a peak noise of 85dBA, (measured on 'A' weighted scale and 1 m from source). No account can be taken of the noise level associated with the conveying of product due the variations in the applications and the number of products handled. For actual noise levels, measurement must be made on site, under operating conditions, in accordance with local Health & Safety guidelines.

## **HANDLING**

The valve should remain in its packaging until ready for assembly into the system, as such, it may be moved using suitable handling equipment, for example pallet or fork lift trucks. Prior to installation remove all packaging, use slings (or similar) around the flanges or the pipe legs to facilitate lifting. DO NOT lift using the actuator or limit switch housing, take care to protect any pneumatic or electrical control equipment mounted directly on the valve. Consult fig 1 for weight details.

## **TYPICAL WEIGHTS (kg)**

<b>TYPE</b>	<b>VALVE COMPLETE</b>	<b>ACTUATOR</b>	<b>ACTUATOR MOUNTING</b>	<b>END COVER ASSEMBLY</b>	<b>PLUG</b>
50 TBS	63	6	12	7	11
65 TBS	75	10	9	9	13
80 TBS	75	10	9	9	13
100 TBS	116	15	9	18	18
125 TBS	150	21	9	25	28
150 TBS	205	35	18	36	51
200 TBS	260	35	30	69	58

Fig 1

## INSTALLATION

- 1.1 Check the valve externally for damage and internally for foreign objects. Install the valve using compressible gaskets on all flanges. The valve body must not be stressed or used to support any ancillary equipment. (Fig 2)

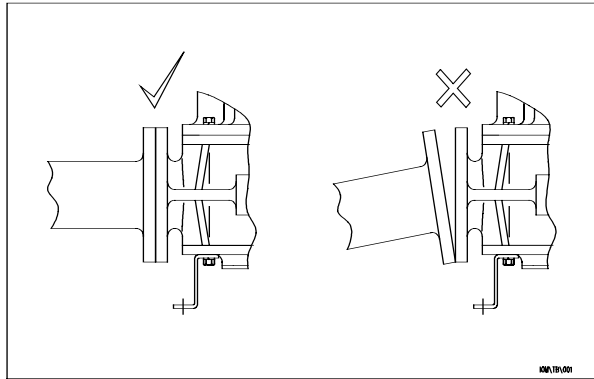


Fig 2

- 1.2 Connect the electrical supply in accordance with Appendix A.
- 1.3 Connect the pneumatic supply at the tee junction (connecting the double solenoid (item 27) with the pressure regulator (Item 39) using 8 mm o/d plastic tubing, the pneumatic circuit is shown in Appendix B.
- 1.4 The actuator is controlled by a double solenoid operated valve, it will ensure the diverter valve remains in position in the event of a power failure
- 1.5 The blowing cycle may allow for a clean air blow-through before changeover or blowing of clean air may continue during changeover (this will clear any minor leakage into the body cavity which may have occurred).

**THE VALVE MUST NOT BE ALLOWED TO CHANGEOVER WHILE PRODUCT IS BEING CONVEYED OR WHEN ANY PRODUCT IS PRESENT IN THE LINE.**

## OPERATION AND COMMISSIONING

- 2.1 Note: The valve cannot be operated using the manual override screws unless the electrical supply to the control box is switched off.
- 2.2 The operation of the valve may be checked using the manual override screws; there are two manual override screws fitted to the double solenoid valve and they operate independently. Ensure the manual override screw is set for automatic operation (position O) when checks are complete (Fig 3).

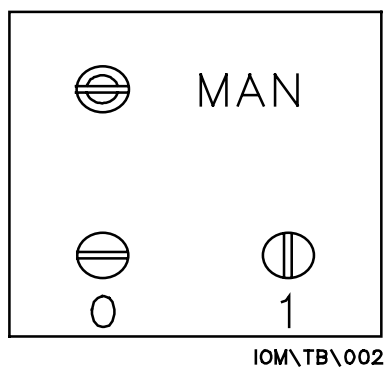


Fig 3

- 2.3 The speed of operation of the valve has been set at the factory, however, it may be adjusted using restrictor valves fitted in each outlet silencer of the double solenoid operated valve. The stroke time should be set between 3.0 and 5.0 seconds.
- 2.4 The actuator, stops, stop housing, drive end and plug have been assembled and set at the factory to ensure precise and correct orientation of the plug with the body, at both ends of its stroke. Any disturbance of any of the components listed will alter the orientation and the positions must be reset. Resetting the plug orientation is only possible with at least one flange disconnected to view the plug's position relative to the body.

**Note:** Any disturbance of any of the components listed will invalidate, the warranty.

- 2.5 The handing of the valve cannot be changed without some minor remachining (the spring pin hole through the stop boss and plug must be redrilled). The valve must be returned to the factory in order not to invalidate the warranty.
- 2.6 Set the pressure regulator to 7 barg.

### **MAINTENANCE**

- 3.1 The inflatable seals and bearings should be inspected on an annual basis and replaced if necessary.
- 3.2 The lip seals and spring pin should be replaced on an annual basis.

### **FAULT FINDING**

- 4.1 Refer to dismantling and reassembly instructions for specific procedures.  
Note: Always isolate pneumatic and electrical supplies before disassembling any part of the valve.
- 4.2 Deterioration in the performance of the valve can arise for a number of reasons, Fig 4 indicates symptoms, possible faults and area or component to check.
- 4.3 Inspection of the valve is preferably performed with the valve removed from the conveying line. However, a preliminary inspection of the internal body cavity may be performed by removing the non drive end cover; this way the plug adjustment is not disturbed which means the valve can be reassembled without the need for readjustment

<u>Symptom</u>	<u>Fault</u>	<u>Reason</u>	<u>Action</u>	
a) Appearance of product in the unused line	i) Misalignment of plug	Adjustment screw position has been altered. Plug position has not been readjusted after maintenance	Re-adjust screws Check inflatable seals	
		Spring pin is bent or broken	Replace spring pin Check inflatable seals	
	ii) Wear on plug or body at interface	Abrasive or erosive wear by product	Check inflatable seal and clearance, replace worn component(s) as necessary	
	iii) Accumulation of product in valve body over a long period	Inflatable seal failure	Check seal control fault finding chart - Appendix A, replace seal and check body and plug for damage.	
		Carry over of product when changing position due to insufficient clean air cycle time or insufficient air velocity	Extend clean air blowing time before changeover or check air velocity and increase blower volume if necessary	
b) Nil or partial movement of plug as indicated by limit switches	i) Seizure of plug in body	Product build up in body bore or on plug face	Increase clearances - contact Rota Val Ltd Technical Sales Department	
		Foreign Particles	Clean out, inspect and replace or repair components as necessary	
		Body distortion due to external loading	Check clearances in situ. Remove external loads	
		Temperature conditions incompatible with clearance	Increase clearances contact Rota Val Ltd Technical Sales Department	
		Bearing Wear (long term)	Replace bearings	
		Bearing failure due to product contamination	Replace lipseals and bearings check inflatable seals	
	ii) Compressed air failure	Damaged line Supply valve failure Solenoid valve failure	Check seal control fault finding chart - Appendix A Check system and rectify as appropriate	
	iii) Electrical failure	Solenoid coil failure Limit switch failure	Check seal control fault finding chart - Appendix A Replace faulty component	
	c) Appearance of dust externally	i) Leakage through shaft lip seals	Worn seal	Replace seal, inspect and replace inflatable seals and bearing as necessary
			High pressure in body cavity (possible back pressure from unused leg)	Check unused line, clean and inspect seal and bearing - Replace if necessary
ii) Body cover joint failure		Loose fixings	Tighten as necessary	
		High pressure in body cavity	Check unused line, clean and inspect seal and bearing - Replace if necessary	
		Interface damage during maintenance	Repair using metal filler and apply sealant if necessary	
iii) Flanged pipe connections joint failure		Loose fixings	Tighten as necessary	
		Gasket failure	Replace gasket	
	Misalignment of flanges/pipes	Check alignment - there should be no misalignment, this could cause body distortion or plug seizure		

Fig 4 Fault Finding Checklist

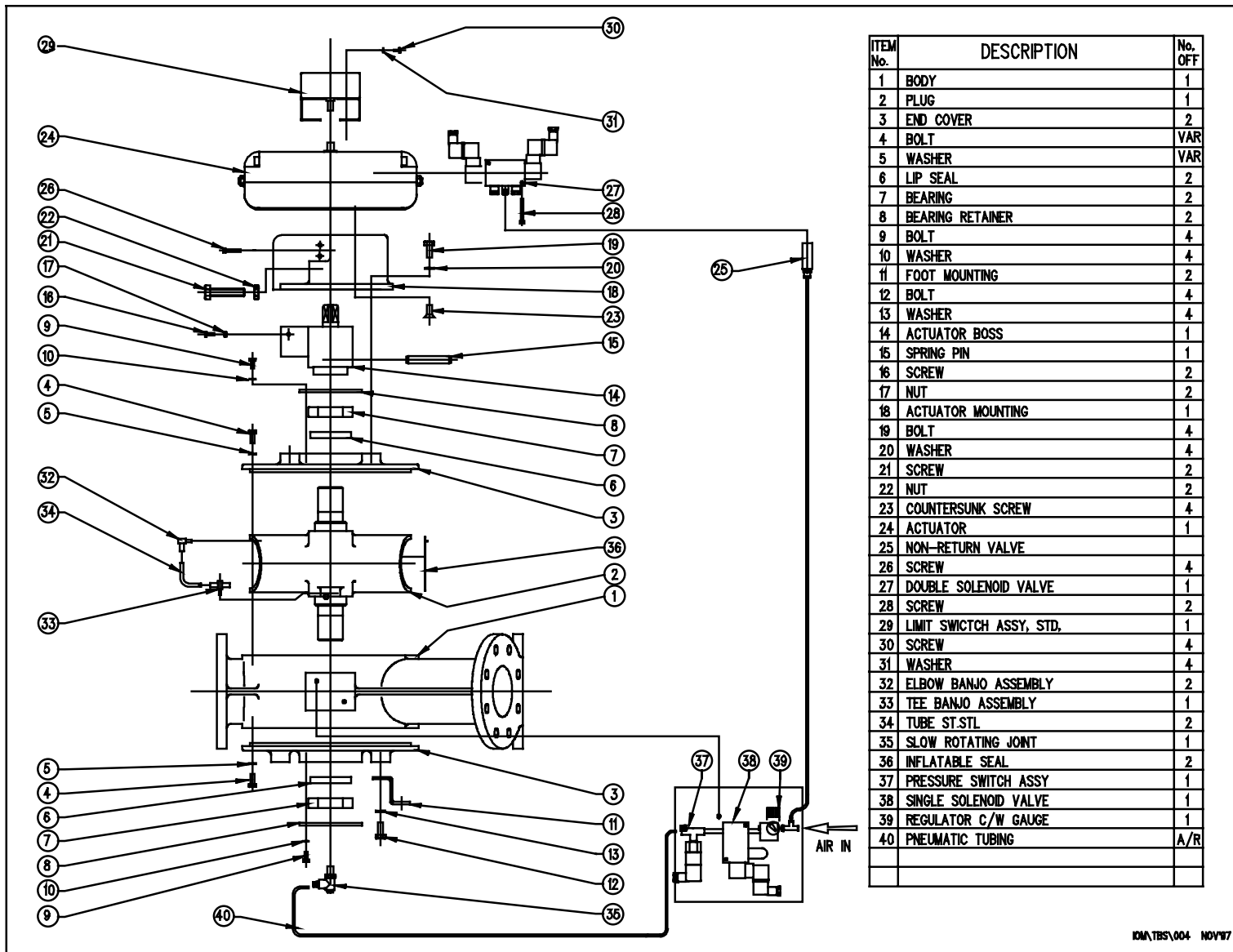
## DISMANTLING

- 5.1 Rota Val Ltd TBS plug diverter valves require only normal fitting skills and no special tools. All parts of the valve must be handled with extreme care to prevent accidental damage, which could render the valve unserviceable. Component weights (where these exceed 5 kg) are indicated in fig 1.
- 5.2 Item numbers refer to fig 5.
- 5.3 Isolate electrical and air supplies, disconnect the electrical connectors and air line from the solenoid valves (27 & 38), disconnect the limit switches and the pressure switch. The valve may now be removed from the conveying line.

**Warning:** The actuator (24) will remain pressurised. Actuate both manual override screws on the double solenoid valve (27) to release the air pressure before attempting to dismantle the valve.

- 5.4 Disconnect and remove the regulator (39), single solenoid valve (38) and pressure switch (37) leaving them all mounted on the mounting plate.
- 5.5 Loosen the lock nuts (22) on each of the stop screws (21) and remove the stop screws.
- 5.6 Remove the actuator mounting fixings (19) and then lift and remove the actuator assy and actuator mounting together. The actuator may now be removed, if required, by removing the 4 counter sunk head screws (23).
- 5.7 Check the square on the stop boss (14) for signs of wear. Check the alignment of the spring pin (15). The spring pin can be removed using a suitable bar to drive it through. Remove the stop boss (14) (this may be difficult due to the close fit of components ~ use two levers under the rim of the boss if necessary).
- 5.8 Remove the slow rotating joint (35) from the non drive end.
- 5.9 Remove the end cover fixings (4) and withdraw the end cover (3) using suitable fixings in the threaded holes provided.
- 5.10 Extract the plug (2) carefully. Inspect the spring pin hole in the plug and stop boss for signs of fretting. Minor deformation can be overcome by increasing the hole size and using a larger diameter spring pin; the two components should be drilled and reamed as an assembly. Inspect the plug bearing and seal journals for signs of wear, these may be reclaimed by a cold repair technique and remachined on centres. Inspect the bore and the faces of the plug for wear, minor damage can be repaired by welding. (Refer to note)
- 5.11 Inspect the body (1) internally for signs of wear, minor damage may be repaired by welding. (Refer to note).

**Note:** Welding the surfaces of the interfaces on the body and the plug may cause some shrinkage, potentially increasing the operating clearance. Normal clearances are 0.25 mm, for temperatures greater than normal ambient conditions clearances are increased, consult Rota Val Ltd technical sales department. Ensure seal groove is free of weld spatter, it may be carefully dressed back to size by hand.



IDM/TBS/004 NOV97

Fig 5

- 5.12 Inspect the seal (36), tubing (34) and fittings (32,33) for signs of wear and damage. These components can be leak tested by refitting the slow rotating joint (35) and applying 1 bar g (max) use a suitable leakage detection fluid. Replace all defective items.
- 5.13 Inspect bearings (7) and lipseals (6) for signs of wear or damage, replace if necessary. To remove the bearing, remove fixings (9) and bearing retainer (8) and extract the bearing. The lip seal can only be removed once the bearing has been extracted.

## REASSEMBLY

- 6.1 The assembly procedure is the reverse of the dismantling procedure, noting the following points.
- 6.2 Ensure all surfaces are clean, free from burrs and accidental damage.
- 6.3 To replace the seals (36) proceed as follows;
  - 6.3.1 Remove any defective seal by levering a section free and pulling, use a lever with no sharp edges (preferably non metallic) to prevent damage to the seal groove.
  - 6.3.2 Clean out the seal area, removing all traces of product and adhesive, ensure the airways remain clear.
  - 6.3.3 Apply a suitable rubber lubricant to the valve O-ring on the new seal. For silicone (white) seals the surface to be fixed must be primed using a polyolefin primer; SBR (black) seals can be fixed directly. Apply adhesive to the bottom section of the seal groove. Do not apply adhesive to the side walls or in the valve connection hole.
  - 6.3.4 Fit the valve into the connection hole and ensure it is pushed fully down. Push the seal section half-way into the groove (so that it is not yet in contact with the adhesive) around the complete circumference.
  - 6.3.5 Push the seal section fully home taking care not to stretch the seal and cause it to ruck up elsewhere. If problems are encountered in fitting, after contact is made with the adhesive, it is generally possible to remove the seal, clean off the adhesive and start again.
  - 6.3.6 Ensure no part of the seal section sits proud of the surface of the plug (if it does the seal must be removed and refitted). Allow at least 2 hours for the adhesive to cure before inflating.
  - 6.3.7 Replace the plug back into the body and after adjusting the valve position ( per section 6.6) ensuring the seal face will have full contact with the body, pressurise the seal to 2 barg. Leave it in this condition for ½ hour (minimum) until the adhesive is partly cured.
  - 6.3.8 Recommended adhesives, lubricants & primers are shown below;

<b>Seal Material</b>	<b>Temp Range</b>	<b>Recommended Adhesive</b>	<b>Recommended Lubricant</b>	<b>Recommended Primer</b>
SBR	-20 °C to + 100°C	Loctite Prism 480	Silicone Grease	Not required
Silicone Rubber	-20°C to + 100°C	Loctite Prism 480	Silicone Grease	Loctite 770 Polyolefin Primer
Silicone Rubber	-40°C to + 200°C	Bostik Bondflex 100 HMA	Silicone Grease	Bostik Bondflex Metal Primer

- 6.4 When installing the plug (2) into the body (1), try to keep the journals of the plug vertical - it is very easy to jam the plug in the body due to its shape and the close clearances.
- 6.5 Drive the spring pin (15) fully through the stop boss (14) and the plug (2). Note; any pin which is damaged due to dismantling or reassembly should be discarded.

- 6.6 Re adjust the stop screws (21) by sighting through the divert and inline ports and ensuring the ports are aligned. Lock the position of the screws using the lock nuts (22). Re adjust the limit switch actuating screws (16) or cams in the switch box (29) (as applicable).

Note: The control system uses feedback from the limit switches to control operating sequences.

**WARNING; SWITCHES MUST BE SET BEFORE ELECTRICAL CONNECTION IS MADE.**

- 6.7 The regulator (39), single solenoid valve (38) and pressure switch (37) should be reconnected as shown in Fig 5. Refer to Appendix B for pneumatic circuit details.
- 6.8 Carry out all procedures contained in “Installation Operating and Commissioning” sections.

## DISPOSAL

The valve may be removed from its installed position using slings as specified in “Handling” section. For disposal purposes, the parts list, Fig 6, specifies material content; components may be recycled, reused or destroyed as dictated by local or national regulations.

ITEM NO.	DESCRIPTION	MATERIAL SPECIFICATIONS		
		CI/SGI	AL/SS	SS/SS
1	BODY	CAST IRON BS 1452 Gd 220	ALUMINIUM BS 1490 LM 25 TF	STAINLESS STEEL BS 3100 Gd 304 C15F
2	PLUG	SG IRON BS 2789 Gd 500/7	STAINLESS STEEL BS 3100 Gd 304 C15F	STAINLESS STEEL BS 3100 Gd 304 C15F
3	END COVER	CAST IRON BS 1452 Gd 220	ALUMINIUM BS 1490 LM 25 TF	STAINLESS STEEL BS 3100 Gd 304 C15F
4	BOLT	BS 3692 GR 8.8	ISO 4107-A2	ISO 4107-A2
5	WASHER	BS 4464 TYPE B	BS 4464-A2	BS 4464-A2
6	LIPSEAL	NITRILE	NITRILE	NITRILE
7	BEARING	SKF	SKF	SKF
8	BEARING RETAINER	CARBON STEEL BS 4360 Gr 43A	CARBON STEEL BS 4360 Gr 43A	CARBON STEEL BS 4360 Gr 43A
9	BOLT	BS 3692 Gr 8.8	ISO 4107-A2	ISO 4107-A2
10	WASHER	BS 4464 TYPE B	BS 4464-A2	BS 4464-A2
11	FOOT MOUNTING	CARBON STEEL BS 1449 PT1	CARBON STEEL BS 1449 PT1	CARBON STEEL BS 1449 PT1
12	BOLT	BS 3692 Gr 8.8	ISO 4107-A2	ISO 4107-A2
13	WASHER	BS 4464 TYPE B	BS 4464-A2	BS 4464-A2
14	ACTUATOR BOSS	CARBON STEEL BS 970 PT3 070M20	CARBON STEEL BS 970 PT3 070M20	CARBON STEEL BS 970 PT3 070M20
15	SPRING PIN	CARBON STEEL	CARBON STEEL	CARBON STEEL
16	SCREW	BS 3692 Gr8.8	BS 3692 Gr8.8	BS 3692 Gr8.8
17	NUT	BS 3692 Gr 8.8	BS 3692 Gr 8.8	BS 3692 Gr 8.8
18	ACTUATOR MOUNTING	SG IRON BS 2789 Gd 420/12	SG IRON BS 2789 Gd 420/12	SG IRON BS 2789 Gd 420/12
19	BOLT	BS 3692 Gr 8.8	BS 3692 Gr 8.8	BS 3692 Gr 8.8
20	WASHER	BS 4464 TYPE B	BS 4464 TYPE B	BS 4464 TYPE B
21	SCREW	BS 3692 Gr 8.8	BS 3692 Gr 8.8	BS 3692 Gr 8.8
22	NUT	BS 3692 Gr 8.8	BS 3692 Gr 8.8	BS 3692 Gr 8.8
23	COUNTERSUNK SCREW	BS 4168	BS 4168	BS 4168
24	ACTUATOR	AUTOMAX	AUTOMAX	AUTOMAX
25				
26	SCREW	BS 3692 Gr 8.8	BS 3692 Gr 8.8	BS 3692 Gr 8.8
27	DOUBLE SOLENOID VALVE	AUTOMAX	AUTOMAX	AUTOMAX
28	SCREW	BS 3692 Gr 8.8	BS 3692 Gr 8.8	BS 3692 Gr 8.8
29	LIMIT SWITCH ASSY. STD.	AUTOMAX	AUTOMAX	AUTOMAX
30	SCREW	BS 3692 Gr 8.8	BS 3692 Gr 8.8	BS 3692 Gr 8.8
31	WASHER	BS 4464 TYPE B	BS 4464 TYPE B	BS 4464 TYPE B
32	ELBOW BANJO ASSEMBLY	NORGREN	NORGREN	NORGREN
33	TEE BANJO ASSEMBLY	NORGREN	NORGREN	NORGREN
34	TUBE ST. STL	STAINLESS STEEL Gr 316	STAINLESS STEEL Gr 316	STAINLESS STEEL Gr 316
35	SLOW ROTATING JOINT	NORGREN	NORGREN	NORGREN
36	INFLATABLE SEAL	SBR/SILICONE	SBR/SILICONE	SBR/SILICONE
37	PRESSURE SWITCH ASSY	SUCO	SUCO	SUCO
38	SINGLE SOLENOID VALVE	JOUCOMATIC	JOUCOMATIC	JOUCOMATIC
39	REGULATOR C/W GAUGE	JOUCOMATIC	JOUCOMATIC	JOUCOMATIC
40	PNEUMATIC TUBING	NYLON	NYLON	NYLON

Fig 6

# APPENDIX A

## PNEUMATIC SEAL CONTROL

### 1. General

1.1. This valve is intended to be operated by a control system supplied by others. the guidelines which follow should be adhered to in order to prevent maloperation of the valve.

**WARNING; FAILURE TO ADHERE TO THE GUIDELINES COULD RESULT IN LINE BLOCKAGES, PRODUCT CONTAMINATION OR EXCESSIVE VALVE WEAR AND INVALIDATE THE WARRANTY.**

1.2. The flow chart in section 2 indicates the sequence of events which must be followed to ensure the seal is always deflated before the plug is allowed to move.

**WARNING; THE PLUG MUST NEVER BE ALLOWED TO MOVE WHILE THE SEAL REMAINS INFLATED.**

1.3. Note the following connection details;

1.4. Control signal must not be switched when air supply is non-operational

1.5. Seal supply solenoid valve must be connected as shown in appendix B, i.e.; seal pressure is relieved when there is no power to the solenoid coil.

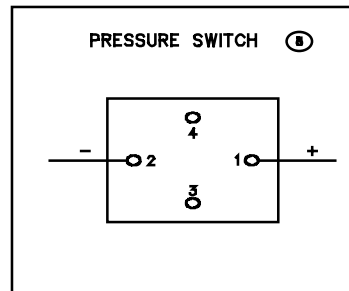
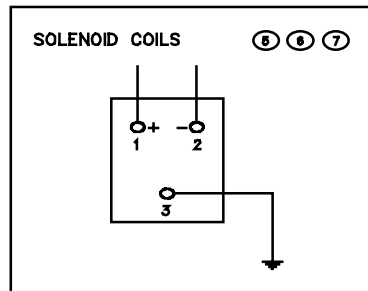
1.6. There must be differentiation within the control system between each position switch; if the valve fails to move the seal must not re-inflate.

1.7. The pressure switch must be connected ‘normally closed’.

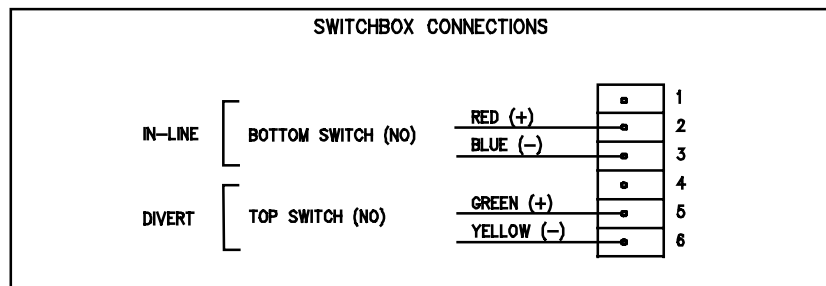
1.8. On initial start-up, the seal must not inflate before the valve has settled in position, this also applies when there has been interruption of air supply to the actuator, e.g. for maintenance; under other circumstances the non-return valve fitted to the inlet of the double solenoid valve will prevent valve rotating out of position.

### 2. Operating Sequence

Refer to figure 7; flow chart on the following page.



F:\DATA\DO\JOM\TBS\015



F:\DATA\DO\JOM\TBS\016

START

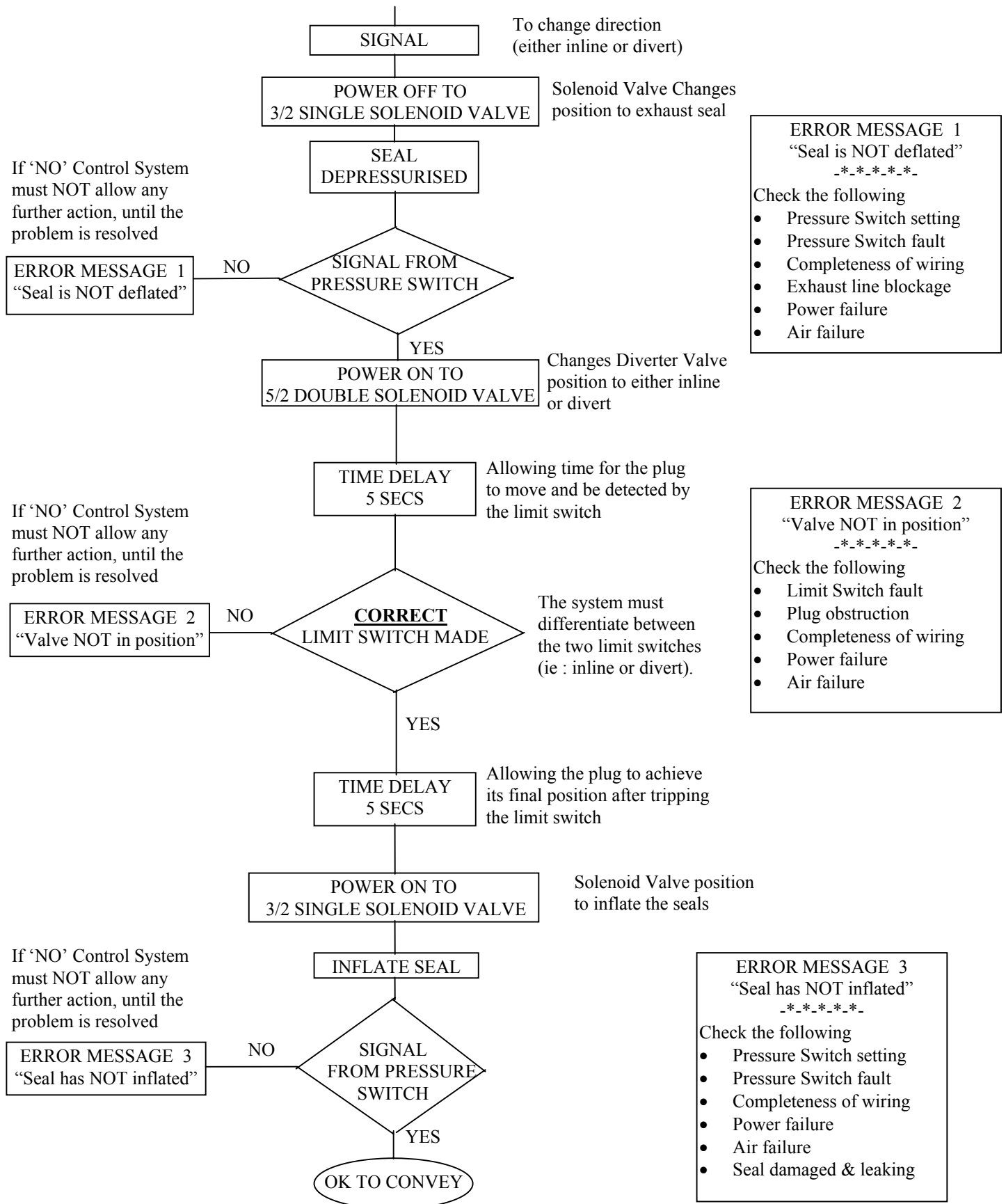


Figure 7

# APPENDIX B

