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SELECTOR UNIT DOWTY ROTOL TYPE 08818YA02

GENERAL AND TECHNICAL INFORMATION REPAIR AND RECONDITIONING INSTRUCTIONS

BY COMMAND OF THE DEFENCE COUNCIL

Frank Cooper.

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GENERAL AND TECHNICAL INFORMATION

CONTENTS

Introduction

1 The selector is an electrically operated valve which directs a flow of fluid to a specific service, or alternatively allows fluid from that service to pass to a return line. The solenoid operates a pilot valve which directs fluid to control the movement of a slide valve; this in turn directs the main flow of fluid through the selector. The unit is fitted with standard pipe adapters at the supply and service connections, and a two-way banjo union secured by a banjo bolt at the return connection.

Description

2 The slide valve has a central slot and operates across the main fluid supply drilling through the selector; it seats against the face of a connection block in which a passage leads to the service connection tapping. The position of the slide will connect the service either to "supply" or to "return".

3 Movement of the slide is caused by the application of fluid, which passes through a filter to two actuating pistons of different diameters fitted at the ends of the slide. Sealing rings are fitted on both pistons and the seal of the small piston is supported by an anti-extrusion ring. The large piston is adjacent to the pilot valve assembly and the small piston operates in the

bore of a sleeve. The flow of fluid to the small piston is direct from the main supply, but the flow to the large piston is controlled by the pilot valve, which is above the slide valve and on one side of the main supply bore. The pilot valve, the slide valve and the pistons are interconnected to the main supply and return by a system of fluid ways.

4 Three annular grooves in the bore for the pilot valve connect the fluid ways X, Y and Z to the pilot valve, which consists of a flanged spindle, spring-loaded away from the ball which it operates. The ball is between a return seat and a pressure seat, and a plug retains the sub-assembly. The main supply is thus connected through the fluid way X and drillings in the retaining plug and the pressure seat to the ball which, when not held against the pressure seat by the spindle, permits fluid to pass through the fluid way Z to the large actuating piston. When the ball is held against the pressure seat the fluid displaced by the large piston can pass through the fluid way Z, through the return seat and fluid way Y to the return line.

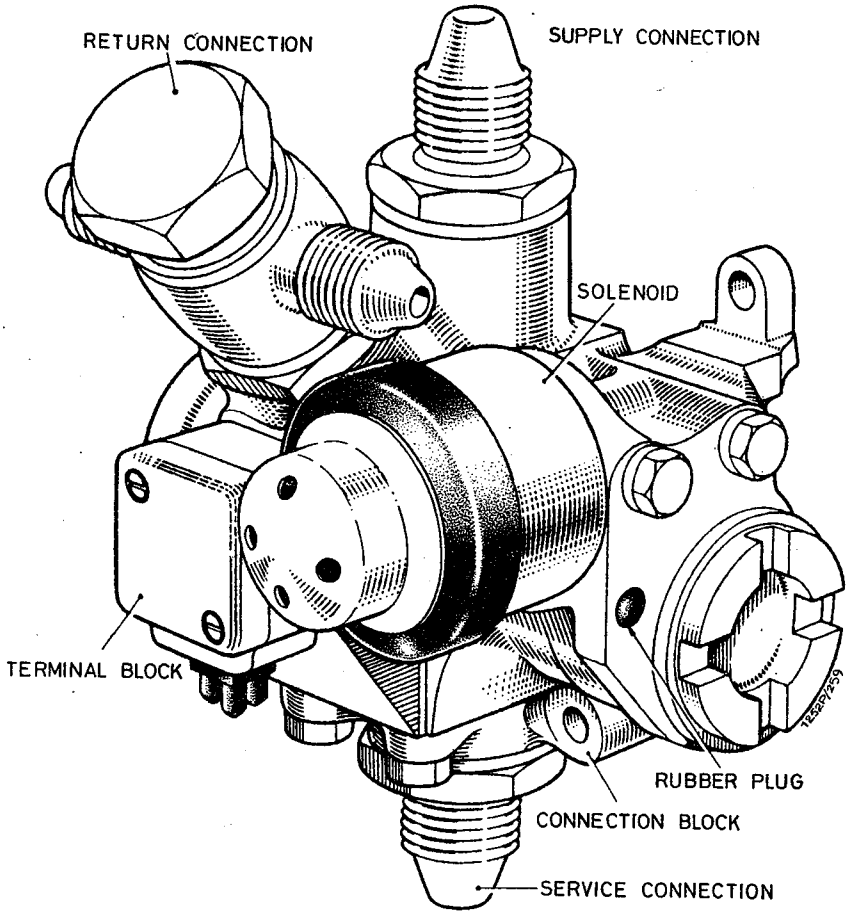
5 The spindle projects through a sealing ring, a washer and a housing to contact the plunger of the solenoid which is mounted on the main body by studs and sleeve nuts. Electrical contacts from the solenoid wiring engage corresponding contacts, which consist of spring-loaded ferrules secured to leads, assembled in a block backed by an insulating mat and housed in the body below the pilot valve. Leads from the block pass through an insulated tube to a terminal block which is secured to the body by screws. A rubber blanking plug seals the end of the insulated tube and a shroud fitted over the solenoid prevents the solenoid plunger being pressed, thus avoiding inadvertent operation.

6 A spring-loaded thimble, carrying a sealing ring, ensures that the slide valve maintains contact with the connection block. The actuating pistons are retained in the body by sealed plugs and are held against the ends of the slide by pressure of the supply fluid.

Principle of operation (fig.3)

7 When the solenoid is de-energised, the spindle in the pilot valve is held away from the ball by its spring. Fluid from the supply connection passes along the drilling X to the annular groove round the pilot valve retaining plug and through the radial and central drillings of the plug and the drilling of the pressure seat to the ball. The ball is forced against the return seat and the fluid flows through the gap and the drilling Z to the bore for the large actuating piston. Simultaneously, supply fluid has passed from the supply connection direct to the bore for the small actuating piston via the drilling V. The difference in surface areas of the pistons, causes a greater force to be applied at the large piston and move the slide valve to align its slot with that of the connection block; supply fluid then flows to the service connection.

8 When the solenoid is energised, its plunger pushes the spindle of the pilot valve to thrust the ball valve against the pressure seat. The fluid from the supply connection is thus cut off from the bore for the large actuating piston and the pressure on this piston is relieved through the open return seat. Supply fluid flows directly through the drilling V to the bore for the small actuating piston, with the result that the slot of the slide valve is moved out of alignment with the slot of the connection block. The flow of the supply fluid through the selector is thus cut off and the return fluid at the service connection passes round the end of the slide valve and through the drilling W to the return connection.



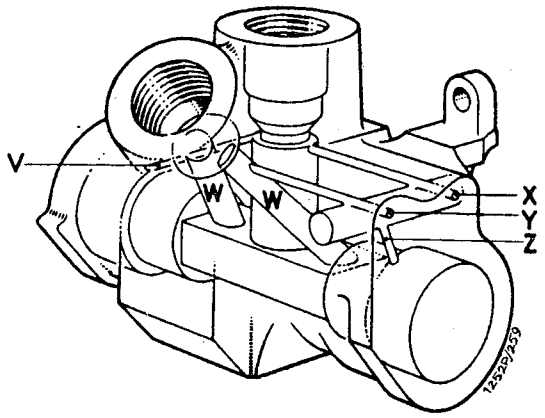


Fig. 1 Selector

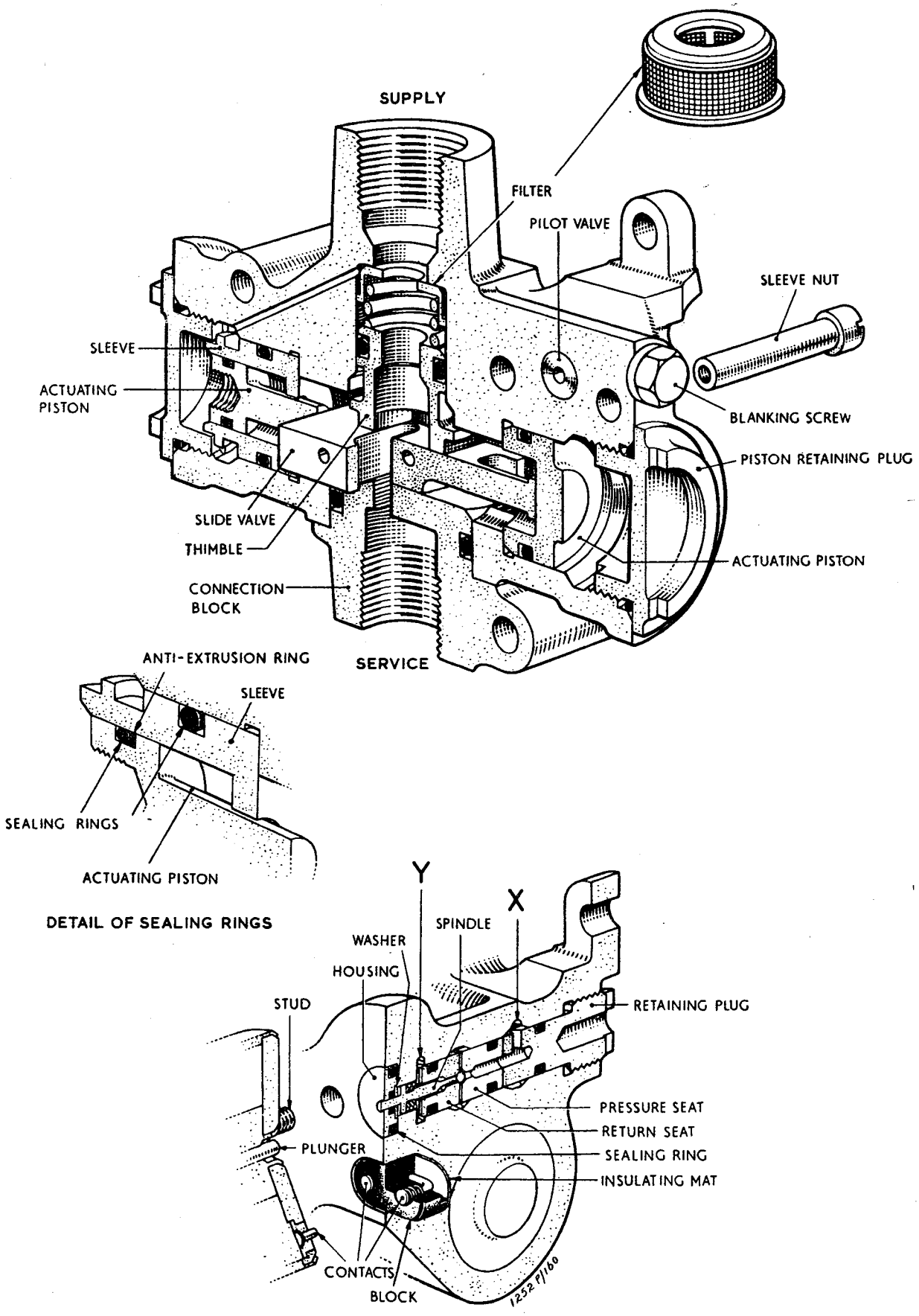


Fig. 2 Selector assembly

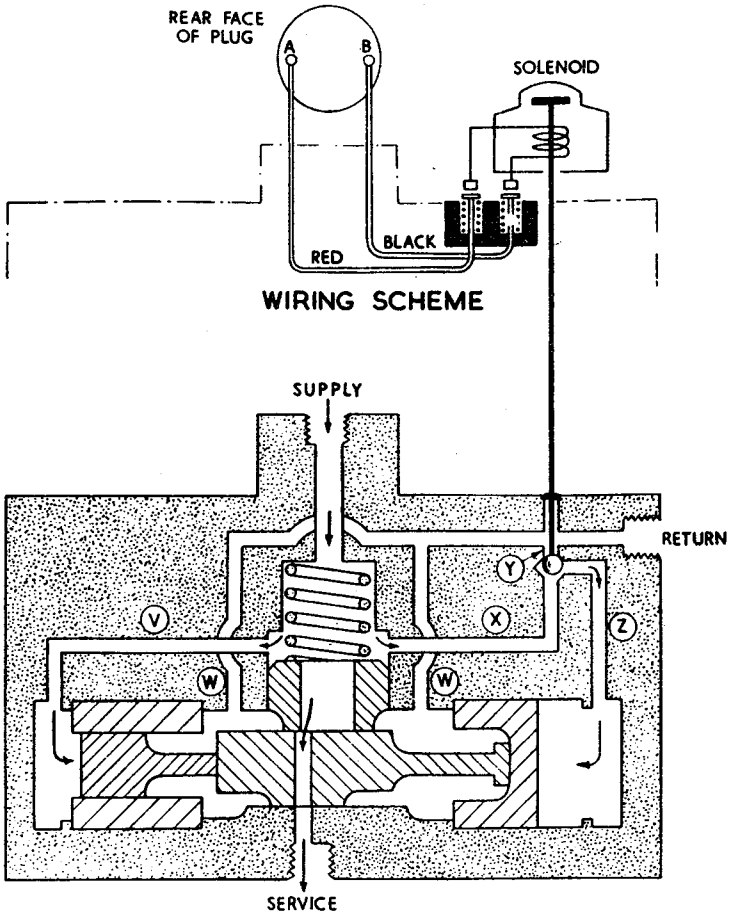


Fig. 3 Principle of operation

SERVICING

Leakage

9 External leakage may indicate a faulty seal which must be renewed. Internal leakage will result in loss of pressure in the supply line or sluggish action of the selector. The selector must be tested to locate the faulty seal, which must be renewed. Leakage past the slide valve or pilot valve may be due to scoring, foreign matter between the mating faces or a worn or damaged pilot valve. If cleaning is ineffective the parts should be renewed.

Dismantling

10

10.1 Remove the solenoid sleeve nuts and withdraw the solenoid from the body. The solenoid should not be further dismantled.

10.2 Unscrew and remove the adapters and bonded seals from the supply and service connections. Unscrew and remove the banjo bolt, the two-way banjo union and bonded seals from the return connection.

10.3 Unscrew and remove the bolts securing the connection block. Remove the connection block, remove and discard the sealing ring.

10.4 Remove the piston retaining plugs and sealing rings. Withdraw the actuating pistons and the sleeve.

10.5 Withdraw the slide valve, the thimble, the spring and the filter.

10.6 Remove the housing , the sealing rings, the washer, the spindle and the spring from the pilot valve assembly.

10.7 Remove the retaining plug, the pressure seat, the ball and the return seat of the pilot valve assembly. Remove and discard sealing rings.

Note ...

The plunger block, the terminal block, the rubber plug and the blanking setscrews should not be disturbed unnecessarily.

Cleaning

11

WARNING ...

CLEANING AGENT SHOULD BE USED IN A WELL VENTED AREA, AWAY FROM NAKED FLAMES. CARE SHOULD BE TAKEN NOT TO BREATH THE FUMES OR ALLOW UNDUE CONTACT WITH THE SKIN.

CAUTION ...

Chlorinated solvents can combine with minute amounts of water found in operating hydraulic systems to form hydrochloric acid which will corrode internal metallic surfaces. It is imperative that all internal surfaces are dry and free from any traces of residual solvent prior to assembly and installation. For those applications where it is difficult to remove all traces of solvent, clean unused white spirit is recommended.

To enable all items to be visually inspected for damage and wear, each part must be thoroughly cleaned using the appropriate approved cleaning agents and methods. When cleaning is completed, parts must be dried using compressed air, clean lint-free cloth or tissues and all subsequent handling must be with clean PVC or polythene gloves. If delays occur before assembly, parts must be suitably protected against corrosion.

TABLE 1 SPECIAL TOOLS

Stores Ref.	Part No.	Description
27Q/13601	ST.1923	Assembly post for seal of pilot valve plug and pressure seat.
27Q/13602	ST.1952	Assembly post for seal of pilot valve return seat.
27Q/13605	ST.1953	C spanner for piston retaining plug.
27Q/13603	ST.1964	Assembly post for seal of actuating piston.
27Q/13600	ST.1966	Spring compressor for assembling slide valve.
27Q/14641	ST.2081	Assembly post for sealing ring of earlier pattern piston retaining plug.
	ST.2757	Adapter for use with tension wrench-piston retaining plugs.

Assembling

12 All sealing rings are to be lightly coated with oil OM-15 before being assembled in the unit.

12.1 Fit the sealing rings to the return and pressure seats and the retaining plug, and insert the return seat, the ball and the pressure seat in the pilot valve bore in that order. Screw in the retaining plug.

12.2 Fit the spring over the pilot valve spindle and insert the spindle in the bore and through the return seat to oppose the ball. Fit new sealing rings to the housing. Locate the washer to the housing and fit the housing to the body over the spindle with the sealing rings leading.

12.3 Fit the sealing ring to the thimble, then insert the filter, the spring and the thimble, into the body.

12.4

12.4.1 Hold the thimble in place through the connection block aperture.

12.4.2 Position the special tool ST.1966 through the supply connection tapping and allow the prongs of the centre piece to engage with the shoulder in the thimble.

12.4.3 Push the pin into the centre piece to ensure that the prongs are held in contact with the shoulder.

12.4.4 Turn the nut to draw the thimble against the spring, to allow for the insertion of the slide valve with the stemmed end of the slide adjacent to the pilot valve assembly.

12.4.5 Locate the slide valve centrally under the thimble. Withdraw the pin to its fullest extent and remove the complete assembly tool by giving it a sharp pull.

12.5 Fit the sealing ring to the connection block and secure the block in the body with the four bolts.

Note ...

The attachment lug of the block is to be adjacent to the pilot valve.

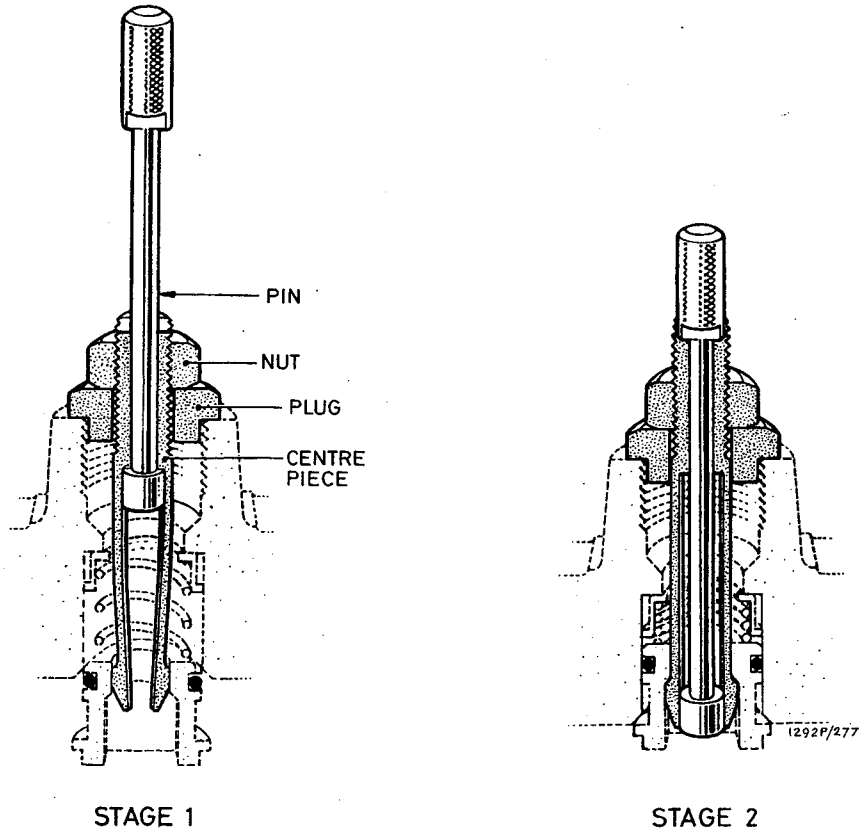


Fig. 4 Use of special tool ST.1966

12.6 Fit a new anti-extrusion ring and sealing ring to the smaller actuating piston and a new sealing ring to the sleeve and the larger actuating piston. The feeder on the side of the anti-extrusion ring is to be cut off flush with the surface before assembly. The ring is then to be radially cut and assembled with that surface adjacent to the centre line of the valve. Locate the large actuating piston to the stemmed end of the slide valve, fit a sealing ring to the piston retaining plug and screw the plug into the body to retain the piston.

12.7 Position the small actuating piston in the sleeve, locate the assembly to the other end of the slide valve and screw in the piston retaining plug fitted with a sealing ring.

12.8 Before attaching the solenoid:-

12.8.1 Ensure that the mating faces of each are clean.

12.8.2 Check for true engagement between solenoid and valve body in order that correct transfer of heat is made from the solenoid to the valve.

12.8.3 Check by electrical test that the leads between the plug and the plunger block have been wired correctly.

12.8.4 Refer to fig.5 and coat solenoid mounting face with grease MS-4.

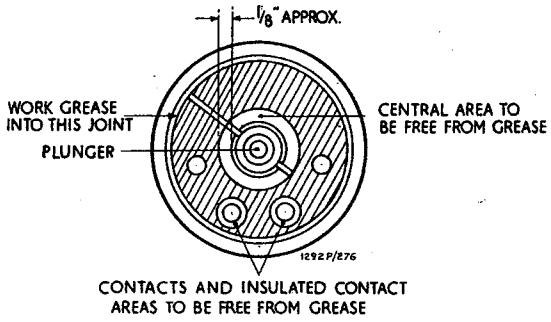


Fig. 5 Solenoid greasing details

12.9 Fit new bonded seals to the supply and service connection adapters and screw them into their appropriate ports in the body. Fit a bonded seal both sides of the two-way banjo union, insert banjo bolt through two-way union and screw into the return port of the body.

12.10 After final assembly and test, fit the adapter ST.2757 to each piston retaining plug and with a tension wrench apply a torque load of 50 to 55 lbf. ft. Wirelock the blanking setscrews, piston retaining plugs, connection block bolts and sleeve nuts.

Testing

13 The following items are required:-

13.1 A static hydraulic test rig.

13.2 A separate hand pump with a pressure gauge.

13.3 A power hydraulic test rig having a pump capable of a peak pressure of 4000/4300 lbf/in^2 and of delivering 2 gall. per minute at a pressure of 3700 lbf/in^2.

13.4 A blanking adapter fitted with a bleeder plug.

13.5 A 500 volts D.C. electrical insulation resistance testing set.

13.6 An electrical test circuit to supply 24/28 or 16 volts D.C. as required.

13.7 One connection of the two-way banjo union fitted to the return connection is to be blanked for the duration of testing.

13.8 A slave jack (any convenient suitable jack).

14 In the event of internal leakage during tests, the operating condition of the selector (ie. solenoid energised or de-energised) is to be noted and the calibration test, detailed in para.19, carried out under the same operating condition.

Electrical test

15 Before and at the conclusion of the following tests, the 500 volts D.C. electrical insulation testing set is to be connected across one solenoid connection terminal and the valve body. The insulation resistance should not be less than 20 megohms.

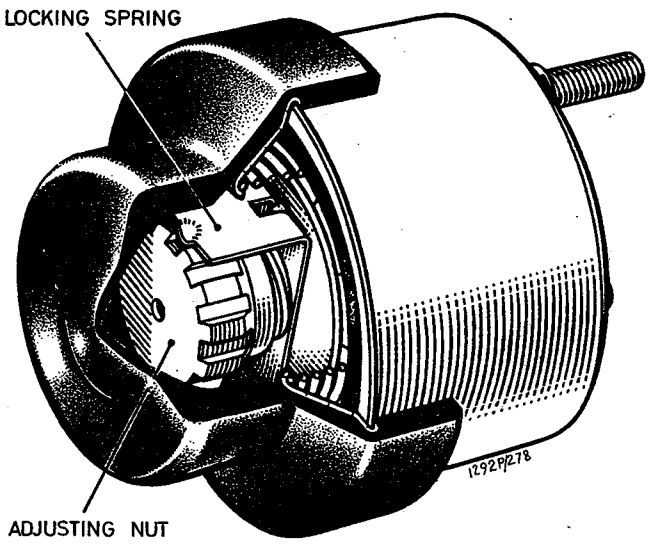


Fig. 6 Location of solenoid plunger adjusting nut

Adjustments and pressure tests

16

16.1 Connect the supply line of the static hydraulic test rig to the supply connection, blank off the service connection and close the bleeder plug of the blanking adapter.

16.2 Remove the shroud from the solenoid and slacken the plunger adjusting nut.

16.3 Connect the 16 volts D.C. supply of the electrical test circuit to the terminal block.

16.4 Energise the solenoid and apply a pressure of 1000 lbf/in^2. Screw down the adjusting nut until the ball valve is lifted from its seat, indicated by a drop in pressure and a spurt of fluid from the return connection.

16.5 Continue to screw down the adjusting nut until a pressure of 5200 lbf/in^2 can be held without leakage. Ensure that the locking spring is engaged in a serration of the nut and then screw down the nut by a further three 'clicks' of the locking spring.

16.6 De-energise the solenoid and apply a pressure of 5200 lbf/in^2. Energise the solenoid and the pilot valve should operate, indicated by a drop in pressure and a spurt of fluid from the return connection. Raise the pressure to 5200 lbf/in^2. Further leakage from the return connection should not occur.

16.7 De-energise the solenoid and raise the pressure to 500 lbf/in^2, if it has fallen below this figure, to centralise the slide valve. Release the pressure.

16.8 With the solenoid de-energised, open the bleeder plug at the service connection. It should be possible to pass fluid freely from the supply connection to the service connection. Close the bleeder plug, gradually apply a pressure of 300 lbf/in^2 and then slowly increase it to 6600 lbf/in^2. Leakage is not permissible. Release the pressure.

16.9 Energise the solenoid and raise the pressure to 200 lbf/in^2. Open the bleeder plug and the pressure should be maintained. Release the pressure and de-energise the solenoid.

16.10 Apply a pressure of 150 lbf/in^2, open the bleeder plug and the pressure should be released. Close the bleeder plug.

16.11 Connect the supply line of the separate hand pump to the return connection. Energise the solenoid and apply and maintain a pressure of 3000/3500 lbf/in^2 at the supply connection. Open the bleeder plug and it should be possible to pass fluid freely from the return connection to the service connection.

16.12 Close the bleeder plug and gradually apply a pressure of 100 lbf/in^2 at the return connection, then increase it slowly to 1500 lbf/in^2. Leakage is not permissible. Release the pressures first at the return connection by opening the bleeder plug and then at supply connection by de-energising the solenoid. Disconnect the supply lines, remove the blanking adapter and disconnect the 16 volts supply of the electrical test circuit from the terminal block.

Power rig tests

17 During the following tests the fluid temperature must not rise above 45 deg. C.

17.1 Connect the 24/28 volts supply of the electrical test circuit to the terminal block.

17.2 Connect the supply connection and the return connection to a supply line and the return line of the power test rig respectively, the service connection to the piston head end of the slave jack, and the piston rod end of the jack to a second supply line of the rig.

17.3 Operate the power rig and the selector for 500 jack cycles. One cycle consists of extending and closing the jack with the pump generating peak pressure at the end of each stroke.

17.4 On the conclusion of the 500 cycles, apply the following check for the satisfactory operation of the pilot valve.

17.5 Energise the solenoid to close the jack and, when the pump has built up to peak pressure, disconnect the pipe line from the return connection. Leakage from this connection must not exceed 0·37 c.c. per minute. Reconnect the pipe line.

17.6 De-energise the solenoid to extend the jack and, when the pump has built up to peak pressure, disconnect the pipe line from the return connection. Leakage from this connection must not exceed 0·37 c.c. per minute. Reconnect the pipe line.

17.7 Disconnect the terminal block from the 24/28 volts supply, reconnect it to the 16 volts supply and check that the selector works satisfactorily at the lower voltage.

17.8 Disconnect the selector from the power rig and the jack.

Static rig checks

18 These checks are to be made at the conclusion of the power rig tests.

18.1 Check the pilot valve adjustment as detailed in para. 16.1 to 16.7.

18.2 Repeat the test in para. 16.8 but do not apply pressure in excess of 5200 lbf/in^2.

18.3 Energise the solenoid and raise the pressure slowly to 200 lbf/in^2. Open the bleeder plug and pressure should be maintained. Slowly increase the pressure to 300 lbf/in^2 and then increase it gradually to 5200 lbf/in^2. Leakage is not permissible. Release the pressure and de-energise the solenoid.

18.4 Close the bleeder plug and raise the pressure to 150 lbf/in^2. Open the bleeder plug and the pressure should be released. Close the bleeder plug.

18.5 Repeat tests in para. 16.11 and 16.12.

Internal leakage calibration

19

19.1 Connect a supply line of the power rig to the supply connection and a short length of pipe to the return connection.

19.2 Apply and maintain a pressure of 300/500 lbf/in^2 and operate the selector to place the slide valve in the leaking position previously noted. Blank off the service connection and wait for drainage from the return connection to cease or fall below a rate of 0·55 c.c. per minute.

19.3 Increase the pressure in stages to 1000 lbf/in^2, 4000 lbf/in^2 and 6600 lbf/in^2 and measure the rate of leakage from the return connection immediately on reaching each pressure. At any pressure stage or at any intermediate pressure, leakage must not exceed 1·33 c.c. per minute.

19.4 Release the pressure, disconnect the pipes and the electrical supply and remove the blanking adapter.

Note ...

Before wirelocking at the conclusion of all tests, retighten the piston retaining plugs using adapter ST.2757 and a torque spanner and applying a torque of 50/55 lbf. ft.

REPAIR AND RECONDITIONING INSTRUCTIONS

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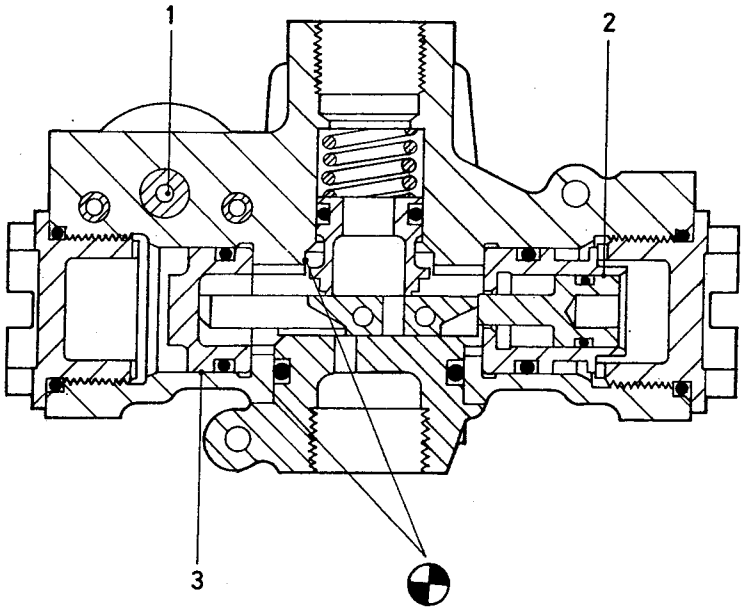


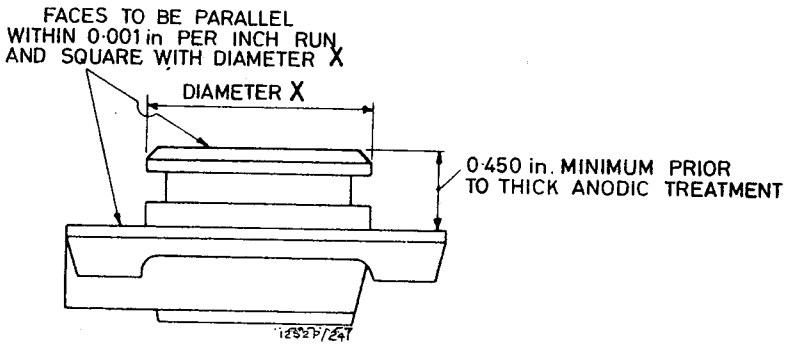
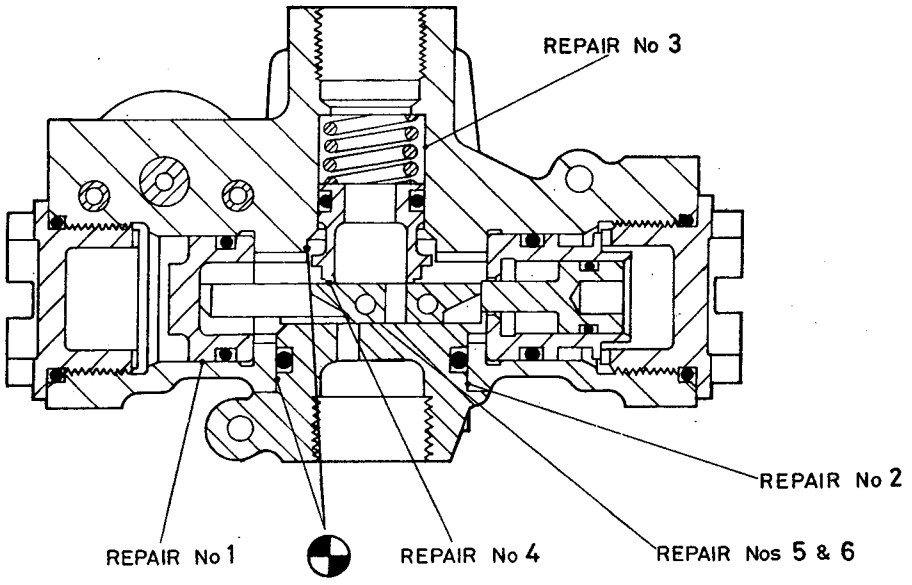


Fig. 1 Fits and clearances - locations

FITS, CLEARANCES AND REPAIR TOLERANCES

Ref. No. on Fig. 1	Parts and Description		Dimension New	Permissible Worn Dimension		Permissible Clearance	
				Interchangeable Assembly	Selective Assembly	New	Worn
1	Pilot valve seat	i/d	0·09425 / 0·09325	0·09500	0·09575	0·00250 / 0·00050	0·00400
	Pilot valve spindle	o/d	0·09275 / 0·09175	0·09100	0·09025		
2	Sleeve	i/d	0·5005 / 0·4995	0·5010	0·5015	0·0025 / 0·0005	0·0035
	Piston	o/d	0·4990 / 0·4980	0·4975	0·4970		
3	Valve body	i/d	0·87575 / 0·87450	0·87630	0·87670	0·00350 / 0·00075	0·00450
	Centralising piston	o/d	0·87375 / 0·87225	0·87180	0·87130		



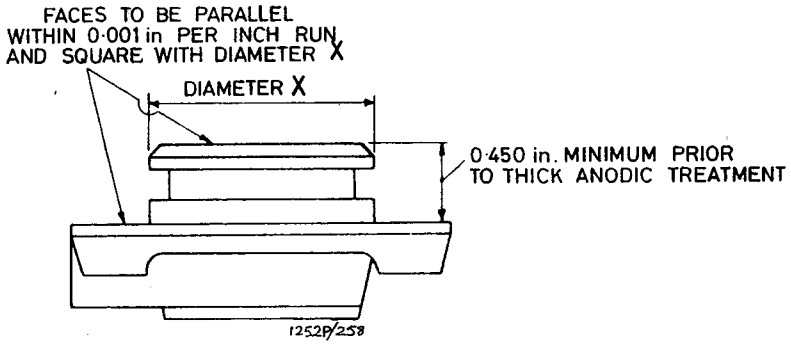


Fig. 2 Repair - locations

REPAIR

General

When carrying out repairs, certain references are made to PS (eg. PS405-3). In these cases, reference must be made to Dowty Rotol Specification Manual, Publication 872.

REPAIR No.1

Repair to valve body (fig.2)

Repair procedure

Scores in the bore are to be polished out providing the permissible worn dimension is not exceeded and that a smooth toolmark free finish is achieved. Mark repair number R420 diagram 2A1 adjacent existing part no. to PS405-3.

REPAIR No.2

Repair to valve body (fig.2)

Repair procedure

Minor scores or abrasions in the bore, not deeper than 0·004 in. are to be polished out locally to blend with existing bore provided that the total area affected does not exceed 2 in. of the circumference. Mark repair number R420 diagram 2A2 adjacent existing part no. to PS405-3.

REPAIR No.3

Repair to valve body (fig.2)

Repair procedure

Scores in the bore are to be polished out to a maximum diameter of 0·721 in. over a minimum depth of 1·550 in. Surface finish to be 16 micro-inches C.L.A. max. and concentricity with diameters marked ⌖ to be within 0·002 in. T.I.R. Mark repair number R420 diagram 2A3 adjacent existing part no. to PS405-3.

REPAIR No.4

Repair to slide and thimble (fig.2)

Repair procedure

Superficial scores on mating surfaces are to be remedied by lightly lapping. Mark repair number R420 diagram 2B adjacent existing part no. to PS405-3.

REPAIR No.5

Repair to connection block (fig.2)

Repair procedure

Superficial scores on the bearing surface are to be lightly lapped out, ensuring the thick anodic surface is not penetrated. Mark repair number R420 diagram 2B1(a) adjacent existing part no. to PS405-3.

REPAIR No.6

Repair to connection block (fig.2)

Repair procedure

1 Scores which have penetrated the thick anodic surface are to be remedied as follows:-

(1) Grind back metal removing 0·004 in. within the dimension quoted on fig.2.

(2) A flat surface with a finish of 4 micro-inches C.L.A. max. must be achieved.

(3) Hard anodise and finally lap in accordance with PS104, achieving a final surface finish of 4 micro-inches C.L.A. max.

2 Mark repair number R420 diagram 2B1(b) adjacent existing part no. to PS405-3.

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