# AP 105D-1302-16

HUNTER

# SERVO VALVES
# FAIREY HYDRAULICS
# PART No. FHS 891, 892 and 1064

## GENERAL AND TECHNICAL INFORMATION
## REPAIR AND RECONDITIONING



BY COMMAND OF THE DEFENCE COUNCIL

Frank Cooper.

Ministry of Defence

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## MODIFICATION RECORD

This publication is technically up to date in respect of the modifications listed below.

FHB 90

FHB 129

FHB 131

FHB 162

## CAUTIONARY NOTICE

### Acid damage

The cleaning fluid for many hydraulic components is trichloroethane or some other form of chlorinated solvent. If traces of solvent are left in components they can combine with minute amounts of water, present in operational hydraulic systems, to form hydrochloric acid. It is essential that when hydraulic components are cleaned with a chlorinated solvent all traces of the solvent must be removed from internal surfaces and passages, before assembly, using the air blast method or other effective means.

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# SERVO VALVES, PART NO.FHS 891, 892 AND 1064

(Completely revised)

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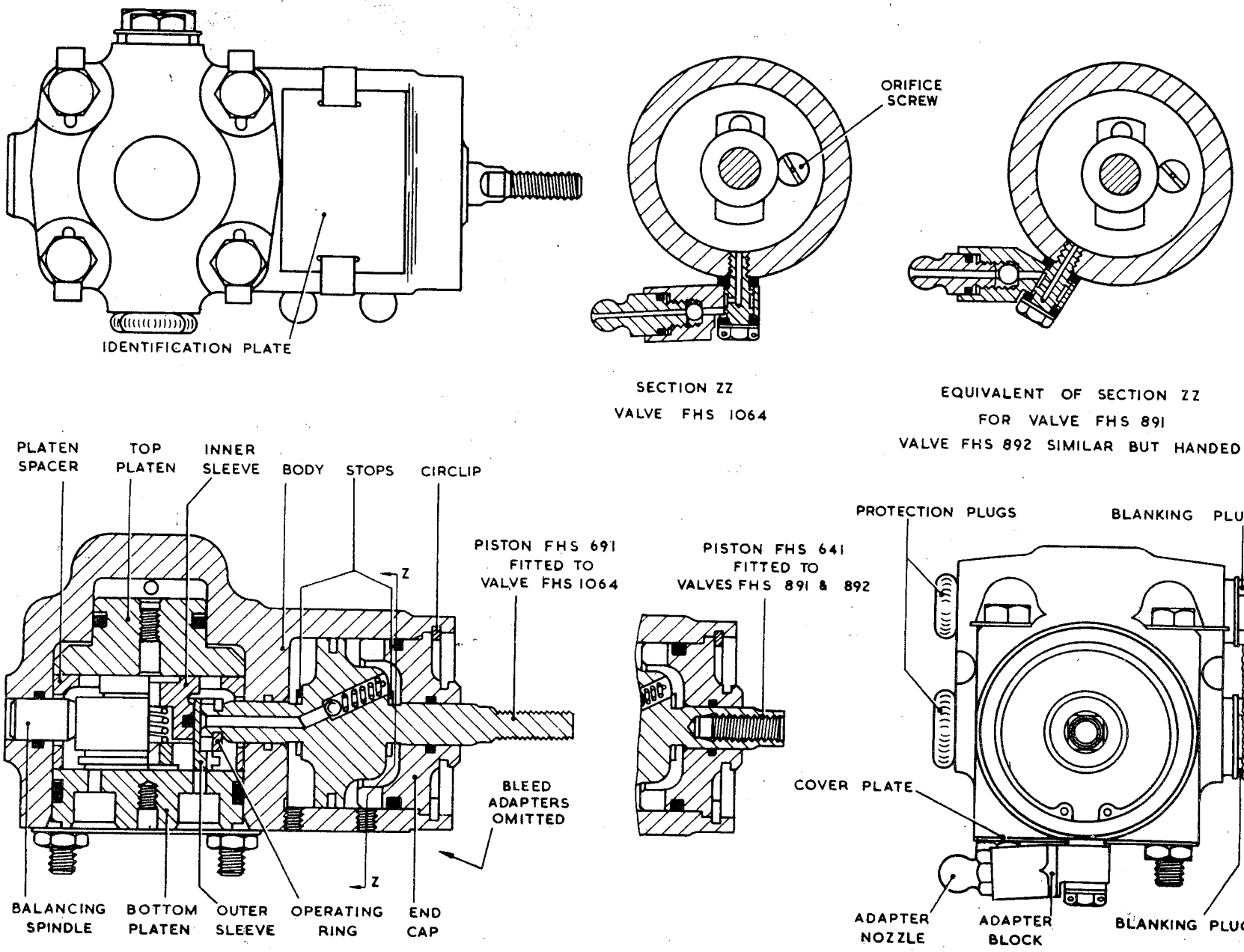



Fig. 1 General assembly

## LEADING PARTICULARS

| | |
|---|---|
| Servo valve FHS 891 | Ref. No. 27KF/1213 4542477 |
| Servo valve FHS 892 | Ref. No. 27KF/1210 4542576 |
| Servo valve FHS 1064 | Ref. No. 27KF/1420 4542587 |
| Fluid, OM–15 (D.T.D. 585) | Ref. No. 34B/9100572 |
| Operating spindle stroke | |
| FHS 891 and FHS 892 | 0.13 ±0.01 in. |
| FHS 1064 | 0.1 ±0.01 in. |
| Length | |
| FHS 1064 | 5 in. |
| FHS 891 and FHS 892 | 4.25 in. |
| Width | |
| FHS 1064 | 3 in. |
| FHS 891 and FHS 892 | 3.125 in. |
| Height | 3.125 in. |
| Weight (approx.) | 2¼ lb. |

## INTRODUCTION

1. The purpose of each valve is to regulate a supply of hydraulic fluid to a jack in response to the movements of the control column of an aircraft.

## COMPARISON

2. The three valves are identical except for the following:–

FHS 1064 – A piston which connects to the aircraft control run has a male thread; stops on the piston stem limit the stroke to the dimension given in Leading Particulars. Bleed orifices from the piston chamber are at the bottom of the chamber and have bleed adapters suited to this position.

FHS 891 and FHS 892 – In both valves the piston has a female thread; the piston stops limit the stroke to the dimension given in Leading Particulars. The bleed orifices are in the lower part of the piston chamber but are at an angle of 30 deg. to the vertical centre-line of the valve and have bleed adapters to suit. The positions of the bleed orifices and bleed adapters are handed on the two valves.

## DESCRIPTION (fig. 1)

3. The valve body is divided into two compartments, one containing the hydraulic fluid mechanism and the other a damping piston. The lower portion of the wall of the piston compartment is pierced by two threaded bleed orifices which are on the centre-line of valve FHS 1064 but at 30 deg. to the centre-lines of valves FHS 891 and FHS 892 (Section ZZ of fig. 1). Bleed adapters are secured to the bleed orifices by banjo bolts.

4. Each bleed adapter consists of a body with a fluid duct through the centre. A drilled nozzle, which is fitted with a seal, screws into the body; a steel ball is interposed between the nozzle and the adapter body so that the junction of the nozzle and the body ducts is closed when the nozzle is screwed in and opened when screwed out. The bleed adapters are shaped to suit the aircraft installation.

5. The piston compartment is closed by an end cap secured by a circlip, through which projects a spindle, integral with the piston. The end of the spindle provides an external connection for the valve control; it is threaded externally 5/16 in. dia. B.S.F. on FHS 1064 and internally 1/4 in. dia. B.S.F. on valves FHS 891 and FHS 892. The spindle continues on the other side of the piston head and passes through a web separating the two compartments of the valve. A groove around the end of the spindle fits into a slot in an operating ring in the second compartment of the valve; a duct through the spindle leads back from this compartment to a spring-loaded ball valve in the piston head.

6. The stroke of the piston is determined by the thicknesses of stops on each side of the piston head, according to the part number of the valve (para. 2). A tapped hole through the piston head carries a countersunk orifice screw which nas a 0.060 in. dia. hole through its axis.

7. Seals are fitted between the end cap and the body and between the end cap and the piston spindle. The piston head and the web separating the two compartments of the valve have ring grooves but no seals are fitted.

8. The second compartment of the valve contains a top platen and a bottom platen, which are separated by a platen spacer. Two concentric sleeves, termed the inner sleeve and the outer sleeve, fit between the platens. The mating surfaces of the sleeves and platens are kept in contact by a compression spring between the two sleeves; the pressure of this spring is supplemented by hydraulic pressure when the space enclosed by the inner diameters of the sleeves is filled with pressure fluid.

9. The outer sleeve is encircled by the operating ring which is slotted to fit the groove in the piston spindle. A similar slot in the opposite side of the ring fits over a groove in the end of a balancing spindle which slides in a hole in the valve body.

10. Seals are fitted between the two sleeves, and between the valve body and the top platen, the valve body and bottom platen, and the valve body and balancing spindle. Two holes through the flanged portion of the top platen allow fluid which may seep past the seal from the space above the top platen to escape into the space between the platens, outside the sleeves.

11. The upper hydraulic fluid connection (fig. 1) is the pressure fluid connection and leads directly to a space between the upper surface of the top platen and the valve body, which is connected by a hole through the centre of the top platen to the space enclosed by the lower surface of the platen and a counterbore in the upper surface of the inner sleeve. The counterbore is concentric with a hole through the inner sleeve, which leads to a space within the inner diameters of the sleeves. Three holes through the outer sleeve connect the space within the sleeves to the upper surface of the lower platen.

12. The lower hydraulic fluid connection is the return fluid connection and leads from a space enclosed by the two platens, the outer diameters of the sleeves, and the valve body. Two holes through the bottom platen are counterbored to receive the connecting pieces and are fluid ducts whose functions alternate between outlet and return during the operation of the valve.

13. Four special attachment bolts pass through the valve body. The cover plate shown in fig. 1 is secured to the bolts with 1/4 in. dia. B.S.F. nuts, and encloses the two rubber plugs fitted into the connecting piece holes. These plugs and the cover plate are supplied for protection purposes only and must be removed before the valve is installed. The bolts then serve to attach the valve; tab washers are provided under the heads of the bolts to lock the bolts on assembly.

## OPERATION

14. The principle of operation is illustrated in fig. 2. Movement of the piston is transmitted by the operating ring to the inner and outer sleeve assembly. When the piston is moved into the valve body, pressure fluid supplied to the inside of the sleeves is directed to one of the ports through the bottom platen; fluid returning through the other port through the bottom platen passes to the outside of the sleeves and on to the return connection. When the piston is moved out of the valve body the direction of flow through the ports in the bottom platen is reversed. In the intermediate or neutral position, both the ports through the bottom platen are closed by the sleeve assembly.

15. In both directions of piston movement, the movement is damped by hydraulic fluid, which is transmitted from one side of the piston head to the other through the limited opening in the orifice screw. The ball valve in the piston head ensures that the piston chamber is kept filled with hydraulic fluid.

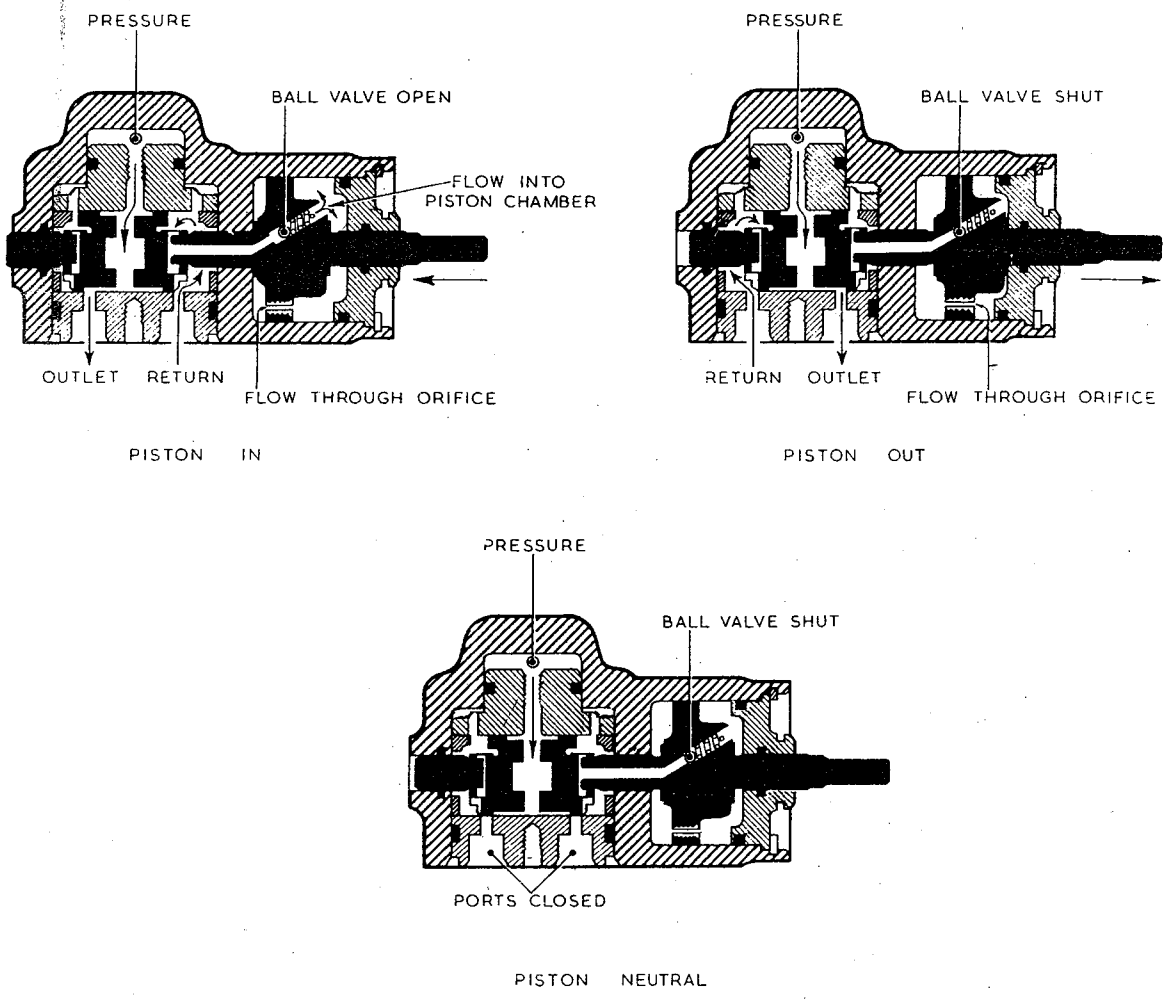



Fig. 2 Principle of operation

## SERVICING

### SPECIAL TOOLS AND TEST EQUIPMENT

16. The following special tools and test equipment are required.

| Description | Part No. | Ref. No. |
|---|---|---|
| Back-lash checking rig ... ... | FHQ 163 | 27KF/696 |
| End cap extractor | FHQ 231 | 27KF/693 |
| Platen tool ... | FHQ 165 | 27KF/692 |
| Seal manipulating tools (set of 3) | FHQ 100 | 27KF/ 4542618 |
| Universal test fixture ... | FHQ 103 | 27KF/695 |
| Vice blocks ... | FHQ 264 | 27KF/976 |
| Stroke centring fixture ... | FHQ 1878 | 27KF/3102 |

17. In addition to the special tools and test equipment a lock-nut and eye end will be needed to attach to the valve operating spindle during testing.

### DISMANTLING

CAUTION...

When dismantling the valve, mark the end cap, bottom platen, outer sleeve and operating ring to guide assembly (unless they are already marked). Replacements for the last three parts are marked as shown in fig. 3. The marks must be towards the operating spindle when the parts are assembled.

18. (1) Release the retaining strip and remove the identification plate.

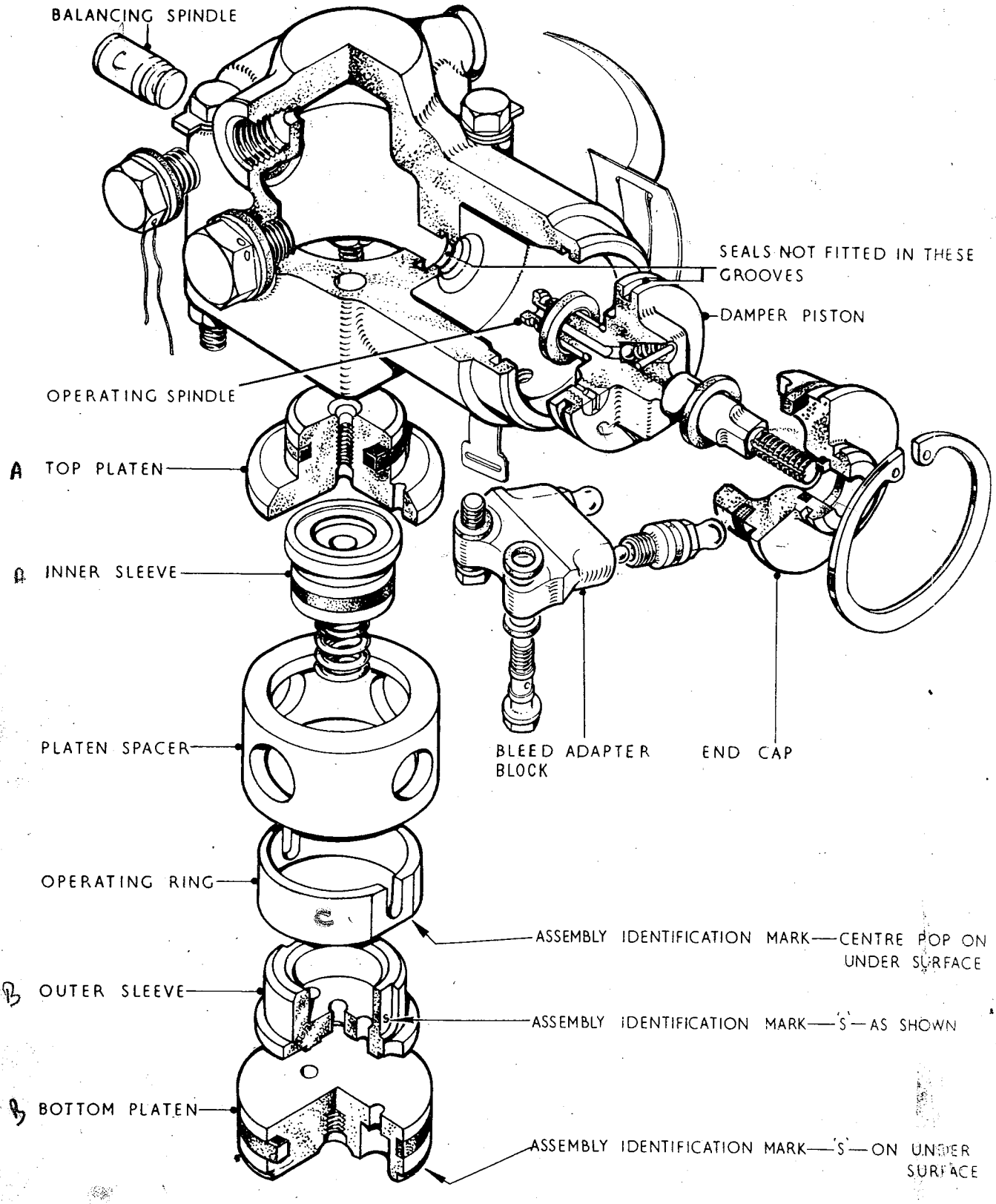



Fig. 3 Exploded view of valve FHS 1064

(2) Unscrew the banjo bolts, remove bleed adapter block complete with gaskets.

(3) Hold the body in a vice between vice blocks FHQ 264.

(4) Unscrew the four nuts securing the protection plate and remove the nuts and protection plate. Withdraw the bolts from the valve body.

(5) Using the seal manipulating tool FHQ 100, remove the two rubber blanking plugs from the connecting piece holes in the bottom platen.

(6) Screw the platen tool FHQ 165 into the bottom platen and withdraw the platen.

(7) Extract the inner and outer sleeves.

(8) Remove the tool from the bottom platen and remove the seal, using the seal manipulating tool FHQ 100.

(9) Separate the sleeves and extract the spring; remove the seal from the inner sleeve.

(10) Remove the operating ring and extract the balancing spindle.

(11) Remove the blanking plugs with their sealing washers, and the protection plugs.

(12) Remove the circlip holding the end cap to the body.

(13) Note relative position of end cap to body and, using the end cap extractor FHQ 231, remove the end cap and withdraw the piston.

(14) Remove the platen spacer.

(15) Remove the seals from the end cap.

(16) Remove the top platen, using the platen tool FHQ 165, and remove the tool and seal from the platen.

(17) Remove the body from the vice and extract the balancing spindle seal from the body.

(18) Unscrew the adapters from the bleed adapter block taking care to retain the steel ball released during this operation.

Note...

(a) Do not remove the ball valve, orifice screws or stop collars from the piston unless the sub-assembly is defective.

(b) The following are mated parts; keep each group together:—

(i) The bottom platen and the outer sleeve.

(ii) The piston, operating ring, and balancing spindle.

## EXAMINATION AND REPAIR

19. Discard the seals, gaskets and tabwashers. Wash the remaining parts in trichloroethane and examine them for serviceability. Wear limits are shown in Table 3. Renew or repair all unserviceable items. Fairey hydraulic standard repairs (FHSR) and general repair instructions appear in A P 105B–0001–1F. The points of application for FHSR are shown in fig. 5.

## ASSEMBLING

### Pre–assembly checks

Piston group check

20. (1) Examine the piston and ensure that the ball, spring, and spring retaining pin are fitted, and are retained by peening of the piston material over the end of the pin and into the slot in the end of the screw.

(2) Ensure that the correct orifice screw is fitted (0.060 in. dia. hole).

(3) Ensure that a stop collar is fitted each side of the piston with the chamfer towards the piston. Fit the stops as necessary to limit the piston stroke according to the valve part number (Leading Particulars) so that the valve stroke about the 'neutral' is matched to within 0.01 in.

Note...

(a) The suffix number to the part number of the piston stops gives the thickness to the limits +0.003 and −0.000 in. Piston stop FHS 696/60 for example, indicates a shim of thickness between 0.060 and 0.063 in.

(b) The accuracy of the fits between the outer sleeve and the bottom platen, and between the inner sleeve and top platen cannot be checked dimensionally. If the parts appear to be serviceable they should be accepted for assembly. The accuracy of the fits will be revealed during the course of testing (para. 29).

Backlash check

21. Dry assemble the outer sleeve, operating ring and piston, and check the backlash using the backlash test fixture FHQ 163. The backlash should not exceed 0.001 in.

Concentricity check

22. Dry assemble the body, balance spindle, operating ring, piston, and end plug. Ensure that correct relative assembly is observed (see CAUTION preceding para. 18). Check that the piston will stroke and rotate freely over any part of the stroke. Remove from the rig and dismantle.

Piston stroke check

23. Ensure that each part is absolutely clean, dip in clean hydraulic fluid (Leading Particulars) and reassemble as in para. 22, including relevant seals. Fit the appropriate end pad to the opening spindle and attach the valve to the stroke centring fixture FHQ 1878. Insert the centring pin and set the dial indicator to zero. Remove the centring pin, stroke the operating spindle fully in both directions and check the stroke registered on the dial indicator is within the limits given in Leading Particulars (see also para. 20, sub-para 3). Remove from the rig and dismantle.

Matched assemblies

24. (1) The following parts are matched assemblies and may only be renewed in their groups. Renewal of these groups will necessitate a new check of the back-lash (para. 21).

(a) The bottom platen and outer sleeve.

(b) The piston, operating ring, and balancing spindle.

(2) The top platen and inner sleeve are supplied as a pair and should be fitted as a pair.

Final assembly

25. Ensure that each part is scrupulously clean and dip it in clean hydraulic fluid before fitting. Renew all seals, gaskets and tab-washers and prime the damping chamber (para. 26) at some convenient stage of assembly.

(1) Fit a seal to the balancing spindle orifice in the body.

(2) Hold the valve body in a vice between the vice blocks FHQ 264.

(3) Fit a seal to the top platen, screw in the platen tool FHQ 165, insert the top platen into the body and remove the tool.

(4) Fit the platen spacer so that the smaller holes are towards the positions for the balancing spindle and the piston.

(5) Press the balancing spindle into the body so that the grooved end projects through the platen spacer.

(6) Insert the piston into the damper chamber so that the grooved end projects through the platen spacer.

(7) Fit seals to the end cap and press the end cap into the body. Ensure that the slot in the end cap aligns the bleed adapter orifice.

(8) Fit the end cap circlip.

(9) Fit the operating ring.

(10) Fit a seal to the inner sleeve, place the spring into the bore of the inner sleeve and press the outer sleeve over the inner sleeve seal.

(11) Place the sleeve assembly into position with the inner sleeve towards the top platen.

(12) Fit a seal to the bottom platen and screw in the platen tool FHQ 165.

(13) Press the bottom platen into position and remove the tool.

(14) Fit tabwashers to the four body bolts and insert them through the holes in the body.

(15) Blank off both bleed adapter orifices, using a suitable blanking plug and gasket.

(16) At this stage of assembly the valve should be tested in accordance with para. 29.

(17) Leave the valve full of fluid and fit rubber blanking plugs (FHS 1436) to the orifices in the bottom platen of the valve and retain them by fitting a cover plate to the four attachment bolts with ¼ in. B.S.F. nuts.

(18) Fit blanking plugs according to fig. 1 and fit protection plugs to the remaining hydraulic fluid orifices.

(19) Remove the blanking plugs from the bleed adapter orifices.

(20) Fit a steel ball in each orifice of the bleed adapter block and screw in adapters.

(21) Fit the banjo bolts to the adapter block, placing a gasket between the head of the bolt and the adapter and also between the adapter and valve body. Fit the adapter block to the damper chamber orifices.

(22) Wire-lock the blanking plugs to the body.

(23) Wire-lock the bleed adapter banjo bolts together.

(24) Fit the identification plate and the retaining strip, ensuring that the valve identification number on the plate is that of the tested valve.

PRIMING THE DAMPER CHAMBER

26. Either of two methods may be used. Where the valve is separate from a jack the first method should be used. The second method may be more convenient if the valve is fitted to a jack and the unit may be placed so that the bleed adapter orifices are uppermost.

First method

27. (1) Remove the damper chamber bleed adapters.

(2) Hold the valve so that the adapter

orifices are uppermost then immerse the valve in clean hydraulic fluid.

(3) Move the valve operating spindle fully in and out until all air is expelled from the damper chamber.

(4) Refit the adapters.

Second method

28. (1) Connect fluid pressure and return pipelines to the connection orifices on the valve body.

(2) Slacken the nipples on the bleed adapters.

(3) Place the unit on the bench with the bleed adapters uppermost; provide a suitable tray to collect the fluid issuing from these holes.

(4) Turn on the fluid pressure supply (3000 lb/in²) then move the operating spindle alternately in and out until fluid, free of air bubbles, is flowing from the nipple orifice nearest to the damper chamber end cap.

(5) Screw in and tighten this nipple.

(6) Continue to move the operating spindle until fluid, free of air bubbles, issues from the remaining nipple orifice.

(7) Screw in and tighten the nipple.

(8) Turn off the fluid pressure supply. Remove the pipelines and fit blanking plugs to the connection orifices.

TESTING

29. Test at normal room temperature (50 to 65° F.) on a suitable test rig incorporating a filter capable of 5–micron filtration. Use the fluid specified in Leading Particulars. The hydraulic fluid orifices are threaded ⅛ and ¼ in. B.S.P. female.

(1) Fit a locknut and eye end (para. 17) to the valve operating spindle.

(2) Blank each bleed adapter orifice in the valve body using a bleed screw Part No. FHS 707 and a gasket Part No. FHS 784.

(3) Fit the valve to the platform of the universal test fixture FHQ 103 so that the holes in the bottom platen fit over the connecting pieces and secure the valve with all four bolts through the valve body. Tighten these bolts evenly.

(4) Test in accordance with Table 1. Fault diagnosis is given in Table 2.

AFTER TESTING

30. When the tests have been satisfactorily completed:–

(1) Remove the eye end and locknut from the valve operating spindle.

(2) Remove the bleed screws from the damper chamber and complete the assembly of the valve as detailed in para. 25, items 17–24 inclusive.

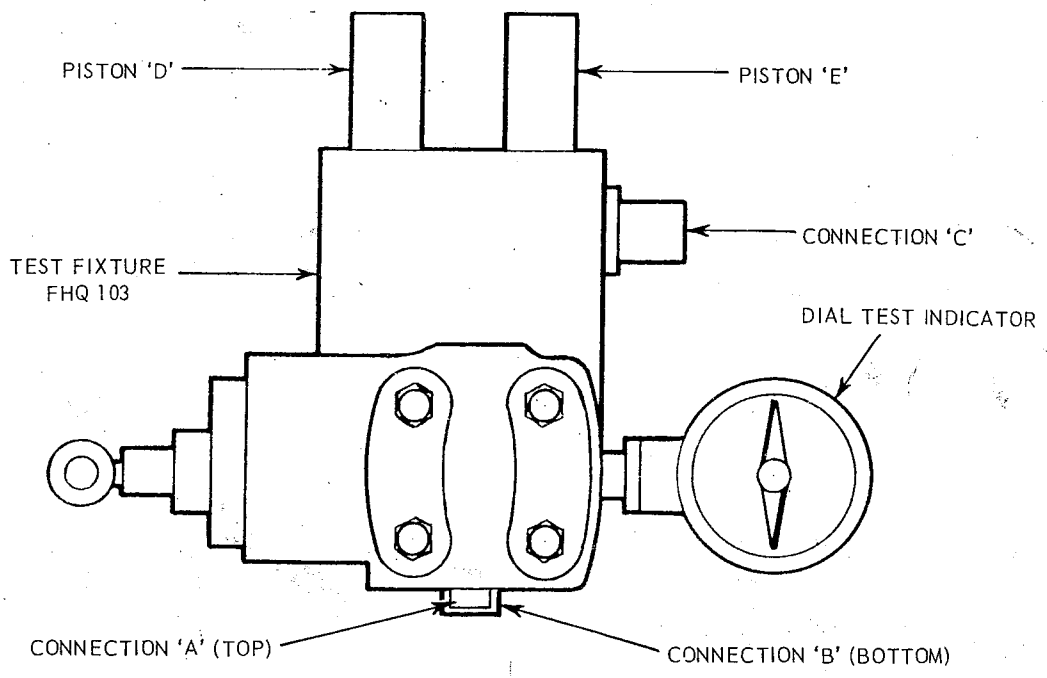



Fig. 4 Test connections

## TABLE 1 Test schedule

| Test No. | Minimum and maximum pressures in lbf/in² at connections A and C | B | Valve Selection | Procedure | Requirements |
|---|---|---|---|---|---|
| Note ... | Before commencing the tests below ensure that all air has been expelled from the unit | | | | |
| 1 | 3850<br>4150 | Reservoir | Out | Maintain pressure for 3 minutes | No external seepage |
| 2. | 3850<br>4150 | Reservoir | In | As for Test No. 1 | As for Test No. 1 |
| 3 | 2880<br>3120 | Atmosphere | Neutral | Maintain pressure with pump on. Check seepage at connection 'B' in the fourth minute | Seepage at connection 'B' in the fourth minute not to exceed 35 cc/min. |
| 4 | 2880<br>3120 | Atmosphere | In | As for Test No. 3 | As for Test No. 3 |
| 5 | 2880<br>3120 | Atmosphere | Out | As for Test No. 3 | As for Test No. 3 |
| 6 | 1920<br>2080 | 380<br>420 | Neutral | Reduce pressure at connection 'A' and maintain for 3 minutes | No external seepage |
| 7 | Blank | 1<br>10 | In or Out | Maintain pressure for 6 hours | No external seepage |
| 8 | Remove damper bleed screws | | | | |
| 9 | Atmosphere | Atmosphere | Alternate | Check backlash in operating medium | .001 in. maximum |
| 10 | Atmosphere | Atmosphere | Maximum | Check valve stroke | See Leading Particulars |
| 11 | Atmosphere | Atmosphere | Alternate | Check minimum operating load over any part of stroke | 7 lb. maximum |
| 12 | Refill damper chamber, replace bleed screws and expel all air | | | | |
| 13 | 2880<br>3120 | Reservoir | Alternate | Check minimum operating load: | |
| | | | | (a) Over full valve stroke – both directions | (a) 6 lb. max. load to be matched to within 2½ lb. |
| | 2880<br>3120 | Reservoir | Alternate | (b) 'Off centre' – both directions | (b) 2½ lb. maximum |
| | 2880<br>3120 | 384 | Alternate | (c) As (b) above | (c) 3 lb. maximum |

**TABLE 1 Test schedule (continued)**

| Test No. | Minimum and maximum pressures in lbf/in² at connections A and C | B | Valve Selection | Procedure | Requirements |
|---|---|---|---|---|---|
| 14 | 960<br>1040 | Atmosphere | | 1. Centralize the valve with the two pistons in approximately mid position<br>2. Move the selector in one direction until either piston starts to extend set D.I. to zero.<br>3. Move the selector in the opposite direction until the other piston starts to extend.<br>4. The D.I. reading is the pressure overlap and must be 0.001 in. to 0.006 in. | |
| 15 | 960<br>1040 | Atmosphere | | 1. Return the valve to centre.<br>2. Select OUT until piston 'E' starts to retract.<br>3. Set the D.I. to zero.<br>4. Select IN until piston 'D' starts to retract.<br>5. The D.I. reading at (4) above is the return overlap and is to be 0.002 in. to 0.006 in. | |
| 16 | 960<br>1040 | Atmosphere | | 1. Return the valve to centre.<br>2. Move selector in until piston 'E' starts to extend<br>3. Set the D.I. to zero<br>4. Continue to move the selector in until piston 'D' starts to retract.<br>5. The D.I. reading is the amount that the pressure is selected before return and the reading must be 0.000 in. to 0.003 in. | |
| 17 | 960<br>1040 | Atmosphere | | 1. Return the valve to centre<br>2. Move the selector out until piston 'D' starts to extend.<br>3. Set the D.I. to zero<br>4. Continue to move the selector out until piston 'E' starts to retract<br>5. The D.I. reading is the amount that pressure is selected before return and the reading must be 0.000 in. to 0.003 in. | |
| 18 | 2880<br>3120 | Reservoir | Neutral | Maintain pressure with pump ON check valve 'stiction' after 5 minute stand. Repeat for second period pulling off in the opposite direction | 10 lb. maximum |
| 19 | After completion of the above tests, blank fluid connections with temporary plugs Ref. AGS 595/A.B. and plate FHS 505. | | | | |
| | Note ... The unit MUST be left full of fluid | | | | |
| | Note ... Test No. 18 may be omitted where the valve concerned is to be re-tested at a later date after assembly to a jack. Where the valve is to be held as a spare, the complete schedule is to be complied with. | | | | |

**TABLE 2 Fault diagnosis**

| | Fault | | Diagnosis |
|---|---|---|---|
| 1 | Excessive seepage from connection B when valve is neutral | 1 | (1) Defective seal on top platen of valve<br>(2) Defective seal between sleeves of valve<br>(3) Damaged sleeve and/or platen faces in valve<br>(4) Broken spring between sleeves in valve |
| 2 | Leakage between the balancing spindle and the valve body. | 2 | Defective seal in the valve balancing spindle orifice |
| 3 | Leakage between the operating spindle and the valve end cap | 3 | Defective inner seal in the valve end cap |
| 4 | Leakage between the valve end cap and the valve body | 4 | Defective outer seal on the valve end cap |
| 5 | Leakage between the valve body and the test rig platform | 5 | Defective seal between the bottom platen and the valve body |
| 6 | Valve tends to select without assistance | 6 | (1) Foreign matter between the faces of the bottom platen and the test fixture platform<br>(2) Foreign matter between the faces of the platen spacer and the top platen |

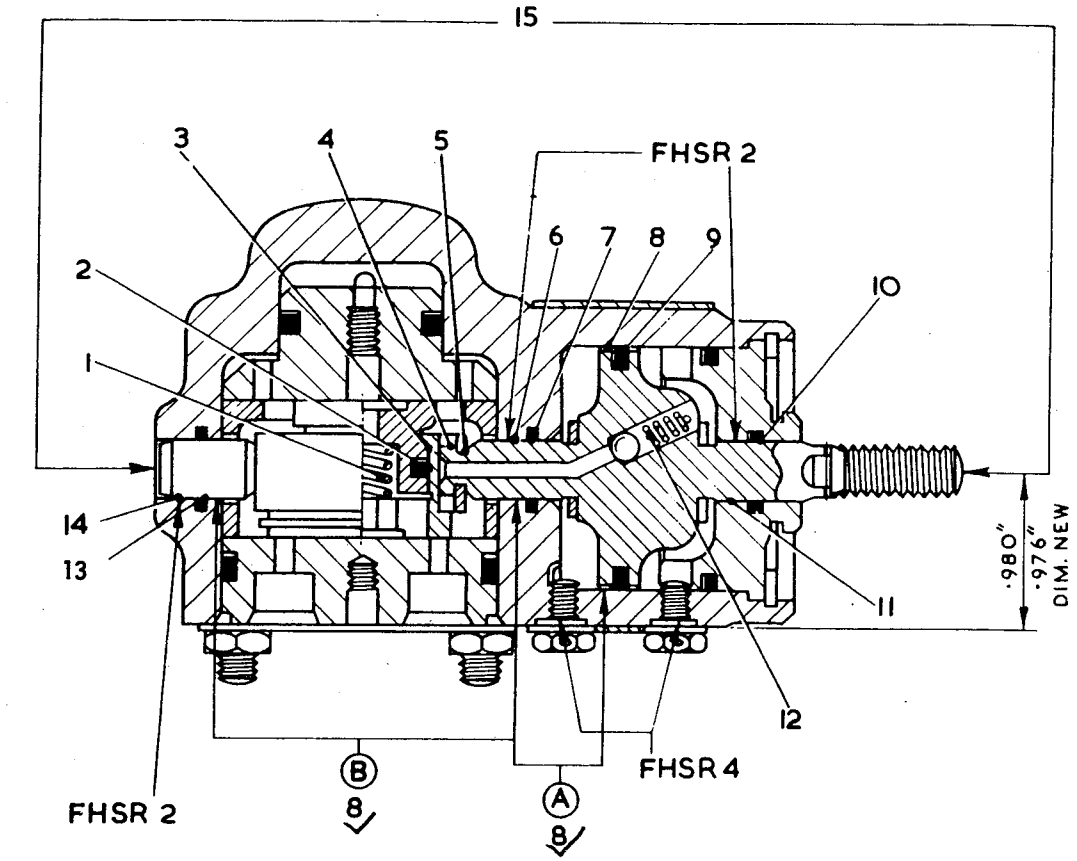
TABLE 3 Fits, clearances and repair tolerances

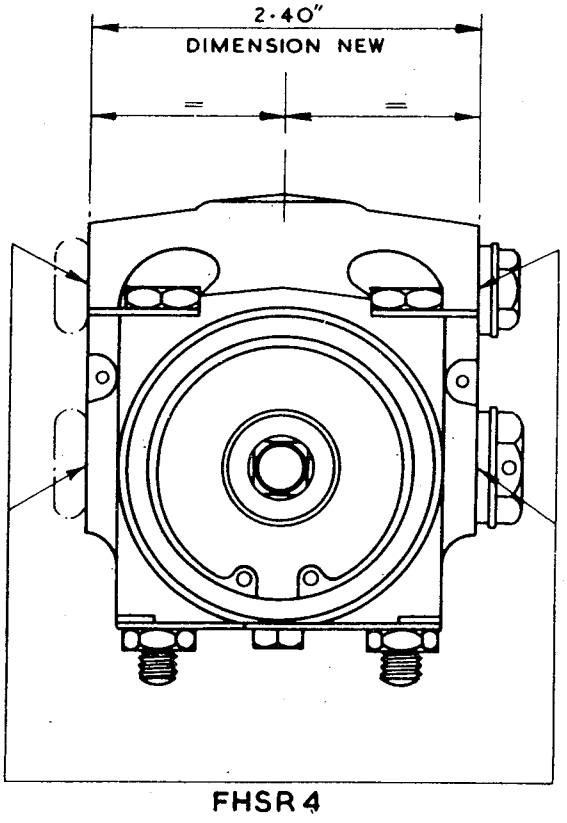
( All dimensions are in inches )

| Ref. No. in Fig. 5 | Parts and Description | Dimension New | Permissible Worn Dimension | | Clearance New | Permissible Worn Clearance |
|---|---|---|---|---|---|---|
| | | | Inter-changeable Assembly | Selective Assembly | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| 1 | SPRING | Effort when compressed 0.34 in. = 7 – 9 lb | | | | |
| 2 | SEAL IN OUTER SLEEVE | | | | | |
| | Sleeve i/d | 0.8080<br>0.8070 | 0.8085 | 0.8100 | –0.0090<br>–0.0240 | –0.0050 minimum |
| | Seal (fitted) o/d | 0.8310<br>0.8170 | – | – | | |
| 3 | INNER SLEEVE IN OUTER SLEEVE | | | | | |
| | Outer sleeve i/d | 0.8080<br>0.8070 | 0.8085 | 0.8100 | 0.0040<br>0.0020 | 0.0050 |
| | Inner sleeve o/d | 0.8050<br>0.8040 | 0.8035 | 0.8020 | | |
| 4 | PISTON IN OPERATING RING | | | | | |
| | Ring slot i/d | 0.1940<br>0.1900 | 0.1950 | 0.1980 | 0.0100<br>0.0040 | 0.0120 |
| | Piston o/d | 0.1860<br>0.1840 | 0.1830 | 0.1780 | | |
| 5 | OPERATING RING IN PISTON | | | | | |
| | Piston groove width | See Ref. No. 15 | | | | |
| | Ring thickness | | | | | |
| 6 | PISTON IN VALVE BODY | | | | | |
| | Body i/d | 0.37525<br>0.37475 | 0.3765 | 0.3775 | 0.00225<br>0.00075 | 0.0035 |
| | Piston o/d | 0.3740<br>0.3730 | 0.3730 | 0.37125 | | |
| 7 | PISTON IN SEAL | | | | | |
| | Seal (fitted) i/d | 0.3710<br>0.3630 | – | – | –0.0020<br>–0.0110 | –0.0010 minimum |
| | Piston o/d | 0.3740<br>0.3730 | 0.3730 | 0.37125 | | |
| 8 | PISTON IN VALVE BODY | | | | | |
| | Body i/d | 1.5010<br>1.4995 | 1.5030 | 1.5060 | 0.0080<br>0.0035 | 0.0100 |
| | Piston o/d | 1.4960<br>1.4930 | 1.4930 | 1.4895 | | |

TABLE 3 ( continued )

| Ref. No. in Fig. 5 | Parts and Description | | Dimension New | Permissible Worn Dimension | | Clearance New | Permissible Worn Clearance |
|---|---|---|---|---|---|---|---|
| | | | | Inter-changeable Assembly | Selective Assembly | | |
| (1) | (2) | | (3) | (4) | (5) | (6) | (7) |
| 9 | SEAL IN VALVE BODY | | | | | | |
| | Body | i/d | 1.5010<br>1.4995 | 1.5030 | 1.5060 | −0.00600<br>−0.02750 | −0.0050 minimum |
| | Seal (fitted) | o/d | 1.5270<br>1.5070 | – | – | | |
| 10 | PISTON IN SEAL | | | | | | |
| | Seal (fitted) | i/d | 0.3710<br>0.3630 | – | – | −0.0020<br>−0.0110 | −0.0010 minimum |
| | Piston | o/d | 0.3740<br>0.3730 | 0.3730 | 0.37125 | | |
| 11 | PISTON IN END CAP | | | | | | |
| | Eng cap | i/d | 0.3755<br>0.3745 | 0.3765 | 0.3775 | 0.0025<br>0.0005 | 0.0035 |
| | Piston | o/d | 0.3740<br>0.3730 | 0.3730 | 0.37125 | | |
| 12 | SPRING | | Effort when compressed 0.25 in. = 2 lb<br>Effort when compressed 0.28 in. = 0.53 lb | | | | |
| 13 | BALANCING SPINDLE IN SEAL | | | | | | |
| | Seal (fitted) | i/d | 0.3710<br>0.3630 | – | – | −0.0020<br>−0.0110 | −0.0010 minimum |
| | Spindle | o/d | 0.3740<br>0.3730 | 0.3730 | 0.37125 | | |
| 14 | BALANCING SPINDLE IN VALVE BODY | | | | | | |
| | Body | i/d | 0.37525<br>0.37475 | 0.3765 | 0.3775 | 0.00225<br>0.00075 | 0.0035 |
| | Spindle | o/d | 0.3740<br>0.3730 | 0.3730 | 0.37125 | | |
| 15 | ASSEMBLY OF:–<br>Piston<br>Operating ring<br>Outer sleeve<br>Balancing spindle | | Total backlash over these items must not exceed 0.0010 in. | | | | |




LIMITS OF ECCENTRICITY

A 0.004 IN.

B 0.002 IN.

TOTAL D.T.I. READINGS .

Fig. 5 Key diagram for repairs and clearances



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