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Formerly AP 4601A
Vol 4 Pt 6

AP 105D-1302-5F
Issued March 1974

HUNTTER

BAY SERVICING SCHEDULE

SERVO VALVES

PART NO. FHS 891 FHS 892

AND FHS 1064

(FAIREY HYDRAULICS)

BY COMMAND OF THE DEFENCE COUNCIL

J. T. Dunnett

(Ministry of Defence)

FOR USE IN THE
ROYAL AIR FORCE

AMENDMENT RECORD CERTIFICATE

1. This certificate is for Ministry of Defence (Air) ALs only
2. Amendments are to be inserted in numerical sequence except where Non-Availability slips for particular A.L.s are issued.

A.L. No	A.L. MONTH AND YEAR OF ISSUE	AMENDMENT INCORPORATED SIGNATURE	DATE OF INCORPORATION
1			
2			
3			
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SERVO VALVES
SUPPLEMENTARY SERVICING

ITEM No	ITEM	OPERATION

REF NO.	EQUIPMENT AND TOOLS	QTY
	Kit, Tool, Airframe Fitter to Scale A2 AP830 Vol 3 Pt A.	1
1A/4390	Balance, Spring.	1
1B/4571	Pliers, Circlip.	1
1B/4763	Indicator, Dial Test Set.	1
4G/5902	Rig, Test, Power Flying Controls.	1
27KF/4542618	Tool, Seal Manipulating, Pt No.FHQ 100.	1
27KF/692	Tool, Platen, Pt No.FHQ 165.	1
27KF/693	Extractor, End Cap, Pt No. FHQ 231.	1
27KF/695	Fixture, Test Universal, Pt No.FHQ 103.	1
27KF/696	Rig, Checking, Back Lash, Pt No.FHQ 163.	1
27KF/976	Blocks, Vice, Pt No.FHQ 264.	1
27KF/3102	Fixture, Stroke Centering Pt No.FHQ 1878.	1

SPARES

Refer to AP4515P Vol 3 Pt 1 Sect 2 Chap 1

	MATERIALS	NATO CODE NO.	
34B/9100572	Oil, OM-15.	H-515	As required
30A/3055	Wire, Locking, 22 SWG.	"	"

SERVICING NOTES

1. AP105D-0001-5F is to be complied with throughout the work detailed in this schedule.

2. The valves covered by this schedule differ as follows:

a. FHS 891 and FHS 892. The piston shaft is internally threaded and the bleed orifices are at an angle of 30 degrees to the vertical centre line.

b. FHS 1064. The piston shaft is externally threaded and the bleed orifices are situated at the bottom of the piston chamber.

3. All parts are to be cleaned using Oil, OM-15.

4. The following parts are matched assemblies and are only to be renewed in their groups:

a. Bottom platen and outer sleeve.

b. Piston, operating ring and balancing spindle.

c. Top platen and inner sleeve.

5. To ensure correct relative assembly of the bottom platen, outer sleeve, operating ring and end cap is accurately maintained, it is important to ascertain their positions relative to the valve body before dismantling. Indication marks in the form of a letter 'S' on the bottom platen and outer sleeve and a centre pop on the operating ring will be found on parts supplied as spares. These marks are to be towards the operating spindle when the parts are assembled.

6. Unless otherwise stated, component parts are to be lubricated with Oil, OM-15 immediately before assembly.

7. On completion of servicing the unit is to be left full of Oil, OM-15.

TABLE 1

VALVE PT NO.	OPERATING SPINDLE STROKE
FHS 891 AND FHS 892	0.13 ± 0.01 in.
FHS 1064	0.1 ± 0.01 in.

ITEM No	ITEM	OPERATION
1.	Preparation	
1.1	Servicing Notes.	Read.
2.	Dismantling	
2.1	Identification plate.	Remove.
2.2	Bleed adapter block. (a) Bleed plugs. (2 Off). (b) Ball valves. (2 Off). (c) Attachment bolts. (2 Off). (d) Block.	Remove.
	(e) Gaskets.	Remove and discard.
2.3	Servo valve.	Support in vice using blocks Pt No. FHQ 264.
2.4	Protection cover.	Remove.
2.5	Bottom platen. (a) Protection plugs. (b) Platen. (c) Seal.	Remove. Remove using platen tool Pt No.FHQ 165. (See Servicing Note 5). Remove and discard.
2.6 2.7	Inner sleeve. Outer sleeve.	(i) Remove. (ii) Separate and remove spring.
2.8	Inner sleeve seal.	Remove and discard.
2.9 2.10	Operating ring Balancing spindle.	Remove.
2.11	Blanking plugs. (2 Off).	(i) Remove. (ii) Discard bonded seals.
2.12	Protection plugs. (2 Off).	Remove.
2.13	End cap circlip.	Remove.
2.14	End cap.	(i) Note relative position of end cap to body. (ii) Remove end cap using extractor Pt No. FHQ 231. (iii) Remove seals.

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ITEM No	ITEM	OPERATION
2.15	Piston.	Remove. Note: Do not remove ball valve, orifice screws or stop collars unless sub-assembly is defective.
2.16	Platen spacer.	Remove.
2.17	Top platen.	Remove using platen tool Pt No. FHQ 165.
2.18	Servo valve body.	Remove from vice and blocks.
2.19	Balancing spindle seal.	Remove and discard.
3.	Examination	
3.1	Valve body.	
3.2	End cap.	
3.3	Piston.	
3.4	Top platen.	
3.5	Bottom platen.	
3.6	Operating ring.	
3.7	Platen spacer.	
3.8	Balancing spindle.	(i) Clean.
3.9	Inner sleeve.	(ii) Examine.
3.10	Sleeve spring.	
3.11	Outer sleeve.	
3.12	Circlip.	
3.13	Bleed adapter block.	
3.14	Ball valves.	
3.15	Bleed ripples.	
3.16	Blanking plugs.	
3.17	Bleed adapter block attachment bolts.	
NB	During items 4 and 5, components are to be assembled dry.	
4.	Backlash Check	
4.1	Outer sleeve.	Fit to valve body.
4.2	Operating ring.	(See Servicing Note 4).
4.3	Piston.	Fit to valve body.
4.4	Servo valve.	(i) Assemble on test fixture Pt No. FHQ 163. (ii) Check backlash does not exceed 0.001 in. (iii) Remove from test fixture.
4.5	Outer sleeve.	
4.6	Operating ring.	Remove from valve body.
4.7	Piston.	

ITEM No	ITEM	OPERATION
5.	Concentricity Check	
5.1 5.2 5.3 5.4	Balancing spindle. Operating ring. Piston. End cap.	Fit to valve body. (See Servicing Note 5).
5.5	Servo valve.	Check piston will stroke over entire length and rotate freely at any point of the stroke.
5.6 5.7 5.8 5.9	Balancing spindle. Operating ring. End cap. Piston.	Remove from valve body.
6.	Piston Stroke Check	
6.1	Balancing spindle seal.	Fit to valve body.
6.2	End cap seal.	Fit.
6.3 6.4 6.5 6.6	Balancing spindle. Operating ring. Piston. End cap.	Fit to valve body.
6.7	Servo valve.	(i) Fit appropriate end pad to operating spindle and position on stroke centering fixture Pt No. FHQ 1878. (ii) Insert centering pin and set dial test indicator to zero. (iii) Remove centering pin and stroke operating spindle in both directions. (iv) Check stroke registered on dial test indicator is within limits detailed in Table 1. (v) Remove from test fixture.
6.8 6.9 6.10 6.11	Balancing spindle. Operating ring. End cap. Piston.	Remove from valve body.
7.	Assembling	
7.1	Valve body.	(i) Ensure balancing spindle seal has not been damaged or disturbed. (ii) Support in vice using blocks Pt No. FHQ 264.

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ITEM No	ITEM	OPERATION
7.2	Top platen.	(i) Fit new seal. (ii) Fit to valve body using platen tool.
7.3	Platen spacer.	(i) Fit. (ii) Align smaller holes with balancing spindle and piston.
7.4 7.5	Balancing spindle.) Piston.)	Fit, ensuring grooved end projects through platen spacer.
7.6	End cap.	(i) Ensure seal has not been damaged or disturbed. (ii) Fit, ensuring slot aligns with bleed screw holes.
7.7	Circlip.	Fit.
7.8	Operating ring.	Fit. (See Servicing Note 4).
7.9	Inner sleeve.	(i) Fit new seal. (ii) Position spring in bore.
7.10	Outer sleeve.	Press over inner sleeve.
7.11	Inner and outer sleeve assembly.	Fit with inner sleeve leading. (See Servicing Note 4).
7.12	Bottom platen.	(i) Fit new seal. (ii) Fit using platen tool. (See Servicing Note 4).
7.13	Blanking plugs.	(i) Fit new bonded seals. (ii) Fit to valve body.
8.	Priming Damper Chamber	
8.1	Servo valve.	Immerse in clean oil, OM-15 with bleed adapter orifices uppermost.
8.2	Valve piston.	Stroke until all air is expelled.
8.3	Servo valve.	(i) Remove from oil. (ii) Dry thoroughly.
8.4	Bleed adapter orifices.	Fit blanking plugs.
8.5 8.6	Lock nut.) Eye end.)	Fit to operating spindle.
8.7	Servo valve attachment bolts. (4 Off).	(i) Fit new tab washers. (ii) Insert in attachment holes.

Continued

ITEM No	ITEM	OPERATION
9.	Establishing Valve Neutral	
9.1	Connecting pieces.	(i) Fit seals. (ii) Insert into platform on test fixture Pt No. FHQ 103. (iii) Ensure mating faces of valve and platform are clean.
9.2	Servo valve.	(i) Position valve on platform, with operating spindle toward valve operating mechanism and connecting pieces correctly located in holes in bottom platen. (ii) Tighten attachment bolts evenly.
9.3	Valve operating spindle.	Connect to screw operating mechanism.
9.4 9.5	Connexion A. (Fig 1). Connexion C. (Fig 1).	Connect to hydraulic test rig supply.
9.6	Connexion B. (Fig 1).	Connect to return.
9.7	Dial test indicator (DTI).	Position on end of balancing spindle so that plunger is slightly depressed.
9.8 9.9	Connexion A. Connexion C.	Apply pressure of 2000 lbf/in2.
9.10	During this Sub-item operation (ii), disregard piston D and operation (iii), disregard piston E.	
	Valve operating spindle.	(i) Select to move test fixture pistons D and E (Fig 1) alternately in and out. (ii) Select just sufficiently to cause piston E to begin retracting and note DTI reading. (iii) Select just sufficiently to cause piston D to begin extending and note DTI reading.
9.11	Dial test indicator.	Set to neutral by halving the difference in readings obtained in Sub-item 9.10 operations (ii) and (iii) above, and set DTI to zero at this point.

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ITEM No	ITEM	OPERATION
10.	Testing	
10.1	Valve operating spindle.	Select out.
10.2 10.3	Connexion A.) Connexion C.)	(i) Apply pressure to between 3850 and 4150 lbf/in2. (ii) Maintain for 3 minutes. (iii) Ensure no external seepage.
10.4	Valve operating spindle.	(i) Select in. (ii) Repeat Sub-items 10.2 and 10.3. (iii) Release pressure.
10.5	Connexion B.	Disconnect from test rig return line.
10.6	Valve operating spindle.	Select neutral.
10.7 10.8	Connexion A.) Connexion C.)	(i) Apply pressure to between 2880 and 3120 lbf/in2. (ii) Maintain for 3 minutes with pump on. (iii) During fourth minute check seepage at connexion B does not exceed 35cc/min.
10.9	Valve operating spindle.	Select in.
10.10 10.11	Connexion A.) Connexion C.)	Repeat Sub-items 10.7 and 10.8.
10.12	Valve operating spindle.	Select out.
10.13 10.14	Connexion A.) Connexion C.)	(i) Repeat Sub-items 10.7 and 10.8. (ii) Release pressure.
10.15	Connexion B.	Connect to test rig supply line.
10.16	Valve operating spindle.	Select neutral.
10.17 10.18	Connexion A.) Connexion C.)	Apply pressure to between 1920 and 2080 lbf/in2.
10.19	Connexion B.	Apply pressure to between 380 and 420 lbf/in2.
10.20	Servo valve.	(i) Maintain pressure for 3 minutes. (ii) Ensure no external seepage.
10.21 10.22 10.23	Connexion A.) Connexion B.) Connexion C.)	Release pressure.
10.24 10.25	Connexion A.) Connexion C.)	(i) Disconnect from test rig supply line. (ii) Fit blanks.

Continued

ITEM No	ITEM	OPERATION
10.	Testing (Contd)	
10.26	Valve operating spindle.	Select either in or out.
10.27	Connexion B.	(i) Apply pressure to between 1 and 10 lbf/in2. (ii) Maintain for 6 hours. (iii) Ensure no external seepage. (iv) Release pressure.
10.28	Bleed adapter orifices.	Remove blanks.
10.29	Connexion A.	
10.30	Connexion C.	
10.31	Connexion B.	Remove from test rig supply line.
10.32	Valve operating spindle.	(i) Select out and in alternately. (ii) Check backlash does not exceed 0.001 in. (iii) Check valve stroke does not exceed limits laid down in Table 1. (iv) Using spring balance, check operating load at any part of stroke does not exceed 7 lbs.
10.33	Servo valve.	(i) Refill damper with Oil, OM-15. (ii) Expel all air.
10.34	Bleed adapter orifices.	Fit blanks.
10.35	Connexion B.	Connect to test rig return line.
10.36	Connexion A.	(i) Connect to test rig supply line.
10.37	Connexion C.	(ii) Apply pressure to between 2880 and 3120 lbf/in2.
10.38	Valve operating spindle.	(i) Select out and in alternately (ii) Using spring balance check operating load does not exceed 6 lb in both directions Note: Readings are to be within $2\frac{1}{2}$ lbs of each other. (iii) Select neutral. (iv) Using spring balance check initial load required to move spindle from neutral in both directions does not exceed $2\frac{1}{2}$ lbs.

Continued overleaf

ITEM No	ITEM	OPERATION
10.39 10.40	Connexion A. Connexion C.	Release pressure.
10.41	Connexion B.	(i) Disconnect from test rig return line. (ii) Connect to test rig supply line. (iii) Apply pressure of 384 lbf/in2.
10.42 10.43	Connexion A. Connexion C.	Apply pressure to between 2880 and 3120 lbf/in2.
10.44	Valve operating spindle.	(i) Select neutral. (ii) Using spring balance check initial load required to move spindle from neutral in both directions does not exceed 3 lbs.
10.45 10.46	Connexion A. Connexion C.	Release pressure.
10.47	Connexion B.	(i) Release pressure. (ii) Disconnect from test rig supply line.
10.48 10.49	Connexion A. Connexion C.	Apply pressure to between 960 and 1040 lbf/in2.
10.50	Valve operating spindle.	(i) Select neutral with piston D and piston E in mid position. (ii) Move spindle until either piston just begins to extend.
10.51	Dial test indicator.	Set to zero.
10.52	Valve operating spindle.	Move in opposite direction until other piston just begins to extend.
10.53	Dial test indicator.	Ensure reading is between 0.001 and 0.006 in.
10.54	Valve operating spindle.	(i) Select neutral. (ii) Move spindle until piston E just begins to retract.
10.55	Dial test indicator.	Set to zero.
10.56	Valve operating spindle.	Move until piston D just begins to retract.
10.57	Dial test indicator.	Ensure reading is between 0.002 and 0.006 in.
10.58	Valve operating spindle.	(i) Select neutral. (ii) Move until piston E just begins to extend.
10.59	Dial test indicator.	Set to zero.

Continued

ITEM No	ITEM	OPERATION
10.	Testing (Contd)	
10.60	Valve operating spindle.	Move until piston D just begins to retract.
10.61	Dial test indicator.	Ensure reading does not exceed 0.003 in.
10.62	Valve operating spindle.	(i) Select neutral. (ii) Move until piston D just begins to extend.
10.63	Dial test indicator.	Set to zero.
10.64	Valve operating spindle.	Move until piston E just begins to retract.
10.65	Dial test indicator.	Ensure reading does not exceed 0.003 in.
10.66 10.67	Connexion A.) Connexion C.)	Release pressure.
10.68	Connexion B.	Connect to test rig return.
10.69	Valve operating spindle.	Select neutral.
10.70 10.71	Connexion A.) Connexion C.)	Apply pressure to between 2880 and 3120 lbf/in2 and maintain for 5 min with pump on.
10.72	Valve operating spindle.	(i) Using spring balance check load required to move spindle in does not exceed 10 lb. (ii) Select neutral. (iii) Check load required to move spindle out does not exceed 10 lb.
10.73 10.74	Connexion A.) Connexion C.)	Release pressure.
10.75	Servo valve.	(i) Disconnect from test rig. (ii) Remove from test fixture.
11.	Completion	
11.1	Servo valve.	(i) Ensure full of fluid. (ii) Refit rubber protection plugs in bottom platen. (iii) Refit protection cover using $\frac{1}{4}$in. BSF nuts.

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ITEM No	ITEM	OPERATION
11.2 11.3	Pressure port.) Return port.)	Refit protection plugs.
11.4	Bleed adapter orifices.	Remove blanks.
11.5	Bleed adapter.	(i) Refit ball valves. (ii) Refit bleed plugs and gaskets. (iii) Refit attachment bolts and gaskets. (iv) Refit to valve body.
11.6	Eye end.	Remove and retain with valve.
11.7 11.8	Bleed adapter attachment bolts.) Blanking plugs.)	Lock with 22 SWG locking wire.
11.9	Identification plate.	Refit.
11.10	Connecting pieces.	Place in polythene bag and retain with valve.
11.11	Servicing forms.	Sign.

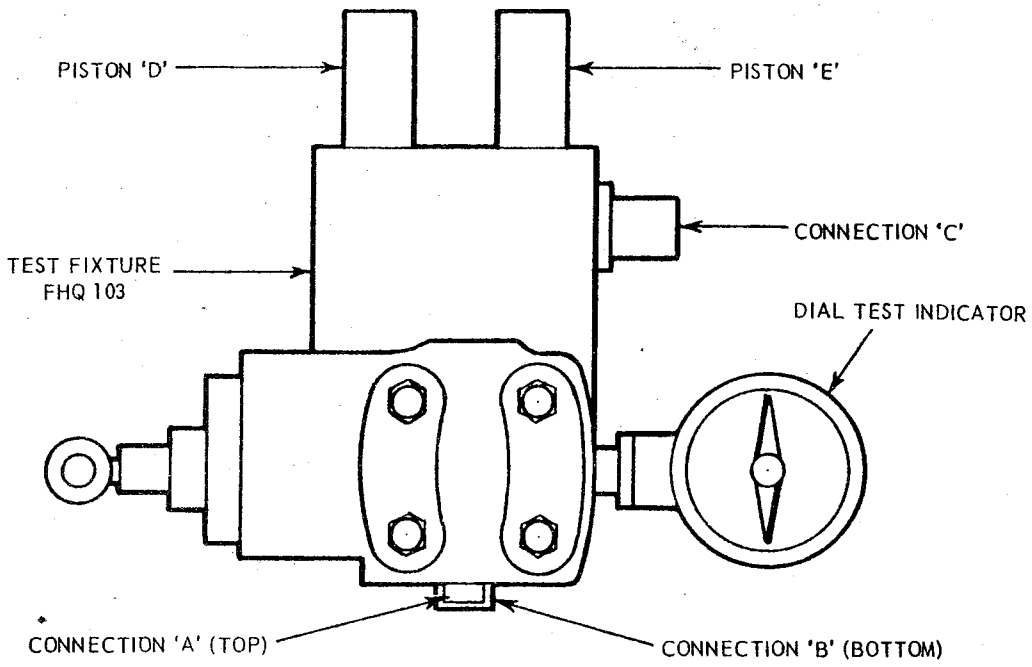

Fig. 1 Test connections

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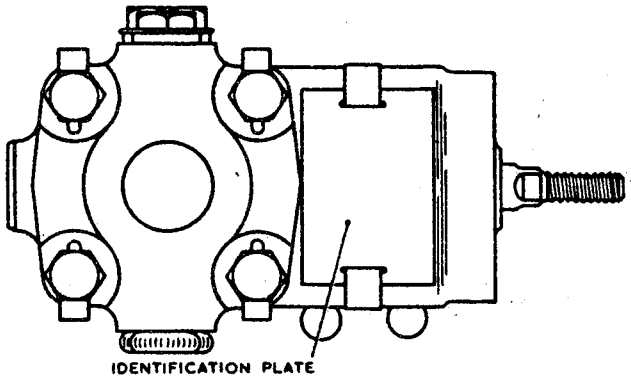
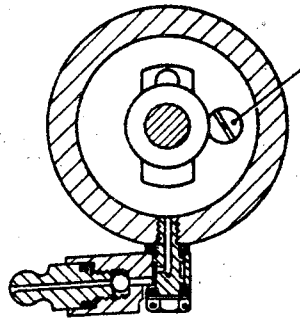
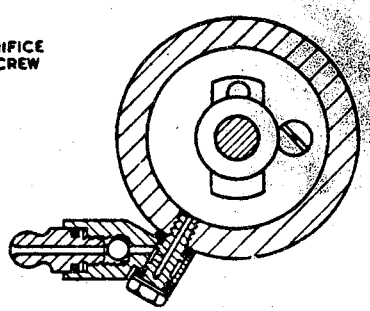
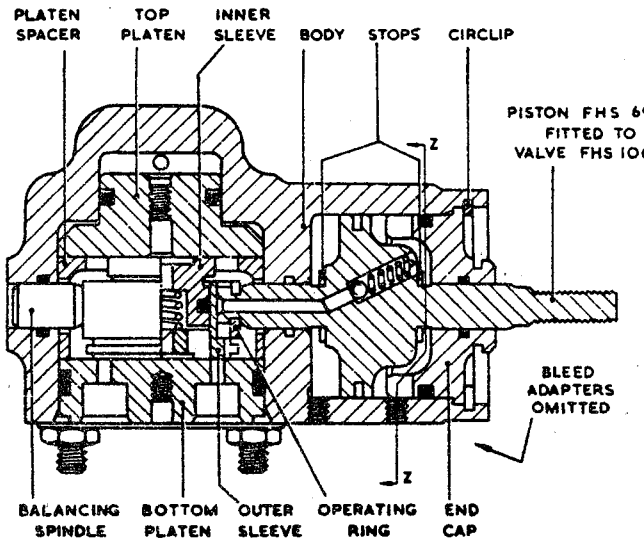


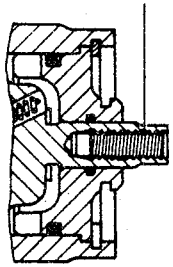


SECTION ZZ
VALVE FHS 1064



EQUIVALENT OF SECTION ZZ
FOR VALVE FHS 891
VALVE FHS 892 SIMILAR BUT HANDED





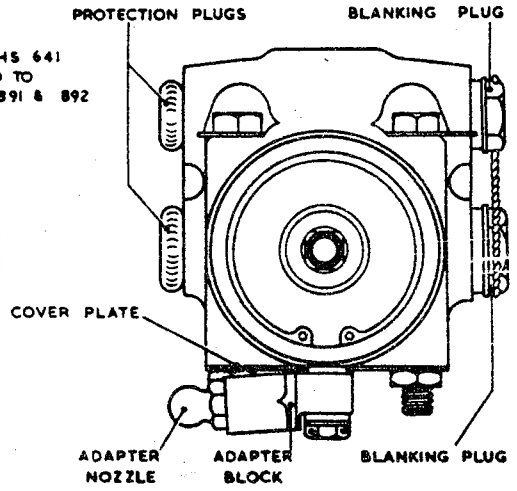


Fig. 2 General assembly

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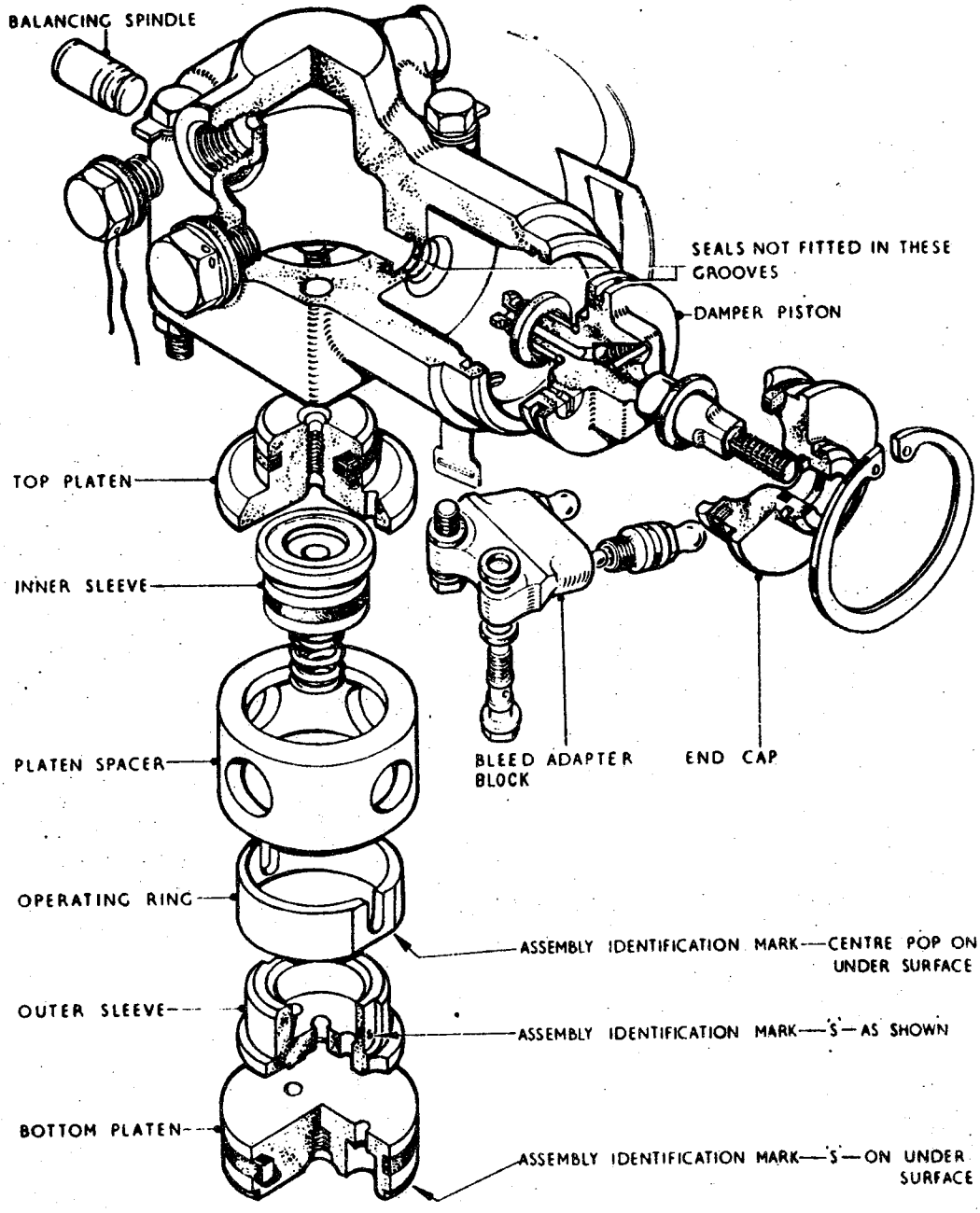

Fig. 3 Exploded view of valve FHS 1064