Also
AP 1050 B67

AP 105D-1311-16

(Superseding AP 4601A, Vol 1, Sect 2, Chap 27, App 1
and AP 4601, Vol 6, Sect 2, Chap 27, App 1)

POWERED FLYING CONTROL

FAIREY HYDRAULICS

PART No. AH 1525

GENERAL AND TECHNICAL INFORMATION
REPAIR AND RECONDITIONING INSTRUCTIONS

BY COMMAND OF THE DEFENCE COUNCIL

Frank Cooper

Ministry of Defence

Sponsored for use in the

ROYAL NAVY by HAD(N)

ROYAL AIR FORCE by D Air Eng (RAF)

Prepared by Fairey Hydraulics Limited, Heston, Hounslow, Middlesex.
Publications authority: ATP/MOD(PE)

Service users should send their comments through
the channel prescribed for that purpose in:

AP (N) 140 Chap 1 Annex A (RN)
AP 100B–01 Order 0504 (RAF)

MODIFICATION RECORD

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

FHB 118

FHB 129

FHB 141

FHB 156

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.

Reference D/D/FLYING(PE)/14/31/1.

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BOSCOMBE DOWN

The attached is forwarded for your information and action as necessary.

Initiating Authority: HQSTC.

Subject: Hunter A/c Elevator P.F.C.U.

To: ASM.
'E' Engineer
MWS

28 March 1980

Flying Eng (PE)
St Giles Court
01-632-6767

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MODUK AIR HARROGATE FOR SM33A1. MODUK NAVY FOR DGA(N). MOD PE FOR ALY ENG, MAP2C AND AEP1. BAE KINGSTON FOR RTO(A). FAIREY HYDRAULICS FOR AQD. SUBJECT HUNTER AIRCRAFT ELEVATOR PFCU. A CHANGE OF POLICY ON THE LIFING OF PFCUS STC 51305/2 MEOST2 DATED 5 OCT 79 REFERS. THE 3000 HRS LIFE OF THE PFCU IS CANCELLED AND REPLACED WITH A LIFE FOR THE INDIVIDUAL COMPONENTS. EXTENSION END BH 16011 AND OUTPUT LEVER BH 30379 WHICH ARE RESTRICTED TO 2000 HRS, AND JACK BODY 30225 IS RESTRICTED TO 3000 HRS. AMENDMENT ACTION TO SCHEDULES IS BEING TAKEN
BT.

Leading Particulars

Control unit AH 1525	Ref. No. 27KF/3267
Jack AH 30227	Ref. No. 27KF/
Servo valve FHS 1064	Ref. No. 27KF/1420
Release unit CH 23645	Ref. No. 27KF/32
Fluid, OM–15, D.T.D. 585	Ref. No. 34B/9100572
Jack stroke –	
Maximum	2.858 in
Minimum	2.790 in
Working pressure	3000 lb/in²
Overall dimensions (approx.)–	
Length (retracted)	22 in
Width	4.25 in
Height	9.5 in
Weight (approx.)	12 lb

WARNING: THE LIFE OF THIS CONTROL UNIT IS 2000 FLYING HOURS. THIS CAN BE INCREASED TO 3000 HOURS SUBJECT TO THE EXTENSION END PART NO. BH 18011 OF JACK PART NO. AH 30227 AND THE OUTPUT LEVER ASSEMBLY PART NO. BH 30379 BEING RENEWED BETWEEN 1000 AND 2000 HOURS. THE P.F.C.U. RECORD CARD IS TO BE SUITABLY ANOTATED.

SEE SIGNAL REF LIFED ITEMS

INTRODUCTION

1. The purpose of the control unit is to move an aircraft control surface in accurate relationship to the movement of the control column. The unit incorporates a means of allowing manual reversion operating on the by-pass principle, fully described in A.P.105D–0002–1. The release unit is retained solely as an anchorage for the jack ram and is locked so that the release pawl is permanently engaged with the ram notch.

2. The control unit consists of a jack AH 30227 (A.P.105D–1307–1), a valve FHS 1064 (A.P. 105D–1302–1) and a locked release unit CH 23645 (A.P.105D–1314–1) in a beam and linkage assembly.

DESCRIPTION

3. Details of the beam and linkage are shown in Figure 2. The release unit trunnions locate within the bearings of the beam block assembly, the two halves of which are mated together by two dowels and the assembly is secured within the beam by the two bolts (A).

4. The input lever consists of two lever assemblies of opposite hand, secured together by bolts (H) and (J) and separated by distance tubes. The lever pivots about bolts (K) fitted through the lugs of the block assembly. The control unit input pick-up is at bolt (G) and the lever movement is transferred to the servo valve by the lever-to-valve connecting link.

5. The jack extension end is connected to the output lever by axis pin (B), the lever pivots within the beam about axis pin (D) and the output pick-up to the aircraft control surface is at axis pin (C). Two distance collars centralize the extension end within the lever fork.

SERVICING

SPECIAL TOOLS

6. The following special tools are required for servicing the unit:–

Description	Part No.	Ref. No.
Manipulating tool	FHQ 164	27KF/688 4642623.
Vice blocks	FHQ 762	27KF/6

DISMANTLING

7. (1) Fit protection plugs to the valve fluid connection orifices.

(2) Remove bolts (E) and (F) (Fig. 2), and remove the valve connecting link.

(3) Remove the valve spindle eye end and the eye end locknut.

(4) Unscrew the release unit locking bolt until the pawl is clear of the ram notch.

(5) Remove axis pin (B), the two distance collars and the two bolts (A). Withdraw the jack and valve complete with release unit and block assembly from the beam.

(6) Withdraw the jack ram from the release unit.

(7) Remove axis pin (D), the output lever and the two lever distance collars.

(8) Remove bolt (C) from the output lever.

(9) Remove the input lever assemblies from the blocks by removing bolts (K), and dismantle the levers, removing bolts (J), (H) and (G).

(10) Separate the two blocks of the block assembly and remove the release unit.

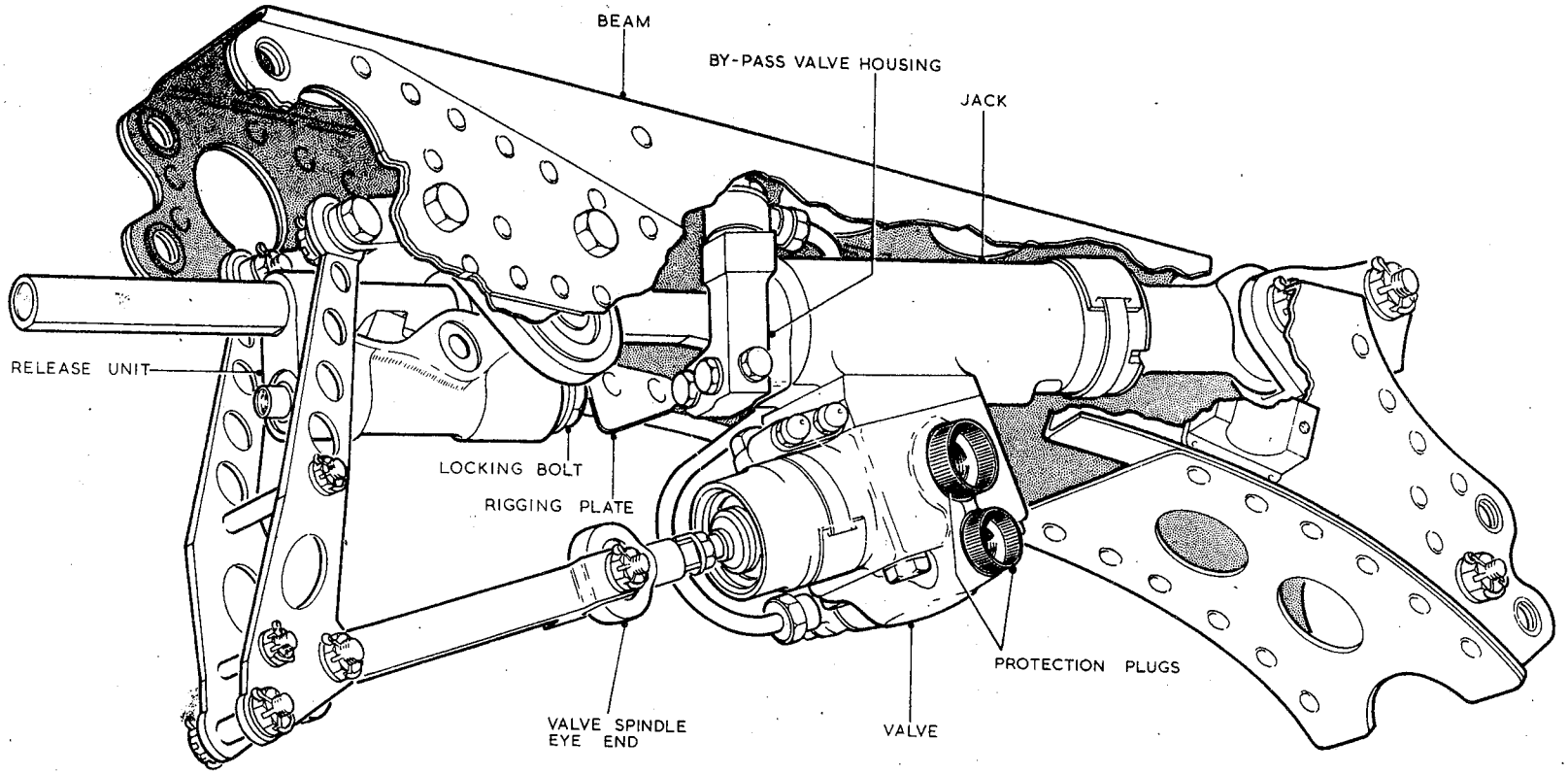


Fig. 1 General assembly

(11) Remove the external pipe from the jack and valve assembly and fit a protection cap, with seal, to the by-pass valve housing banjo adapter. Remove the banjo bolt and adapter from the servo valve and fit a blanking plug, with seal, to the valve fluid orifice.

(12) Support the jack between vice blocks FHQ 762, disengage the tabwashers and evenly unscrew the four valve attachment bolts. Lift the valve squarely from the jack platform ensuring that the valve bottom platen is retained within the valve.

(13) Remove the jack to valve connecting pieces, using tool FHQ 164, place them in a protective bag and attach the bag to the jack.

(14) Fit rubber protection plugs to the valve platen fluid orifices and attach the valve base cover plate, using the four valve attachment bolts and ¼ in B.S.F. nuts.

(15) Fit rubber protection plugs to the jack platform orifices and secure the platform protection plate, using ¼ in dia B.S.F. screws.

8. Dismantling instructions for the jack, valve and release unit are given in the relevant publications (see para. 2).

EXAMINING

9. Instructions for examining the jack, valve and release unit are given in the relevant publications. Clean the remaining parts in an approved cleaning fluid and examine them for ◀ serviceability. Table 3 gives limits of wear.

REPAIR

FHR 269 – Fitting bushes to beam at block attachment

10. If the holes in the beam exceed the maximum permissible diameter for selective assembly, drill and ream right through to $^{13}/_{32}$ in dia. Newall B, and fit repair bushes FHSO 74. Dress both ends of the bushes flush with the faces of the beam. ▶

ASSEMBLING

◀ Note ...

Instructions for fitting bonded seals, including torque loading, appear in AP 105B–0001–1F. ▶

11. Ensure that the jack, valve and release unit have been tested and are serviceable. Lightly lubricate all fluid adapters, seals and sealing washers with clean hydraulic fluid immediately before fitting, and assemble the control unit as follows:–

(1) Insert bolt (C) (Fig. 2) into the output lever and fit the washer, nut and split pin.

(2) Position the output lever in the beam, locate the two distance collars one either side of the lever and insert axis bolt (D), fit the washer, nut and split pin.

(3) Assemble the input lever by fitting bolts (H) and (J) and the two distance tubes, secure with washers, nuts and split pins.

(4) Fit bolt (G), its washer, nut and split pin.

(5) Ensure that the two dowels are firmly located in either one of the blocks of the block assembly. Position the blocks, one either side of the release unit, engaging the block bearings with the unit trunnions, align the dowels and holes and press the two blocks together.

(6) Assemble the input levers to the block assembly by inserting bolts (K), secure with washers, nuts and split pins.

(7) Support the jack between vice blocks FHQ 762.

(8) Remove the protection plates and rubber plugs from the valve base and the jack platform.

(9) Fit the connecting pieces complete with new seals into the jack platform orifices, ensure that the mating faces are scrupulously clean and press the valve squarely on to the platform. Tighten the four attachment bolts evenly but do not lock the tabwashers until after the completion of fluid testing.

(10) Remove the protection cap from the jack by-pass banjo adapter and the plug from the valve fluid orifice. Fit the valve banjo bolt and adapter, using a new sealing washer each side of the adapter. ▶◀

(11) Fit the by-pass pipe. The pipe is 'S' shaped, and is to be fitted with the larger radius of the 'S' adjacent to the valve. This will allow the smaller radius to follow more closely the jack body contour, avoid the protruding jack platform and provide a maximum of clearance for the pipe when the jack and valve are assembled to the beam; the clearance at any point between the pipe and the beam must not be less than 0.060 in. Ensure, however, that clearance exists between pipe and jack body especially across the corner formed by the body flat adjacent to the pipe connection at the by-pass housing.

(12) Fit the locknut, a new tabwasher and the eye end to the valve operating spindle. The locknut should not be locked until after final adjustment of the eye end at unit installation.

(13) Test the jack and valve assembly in accordance with para. 12. After testing, complete the unit assembly in accordance with para. 13.

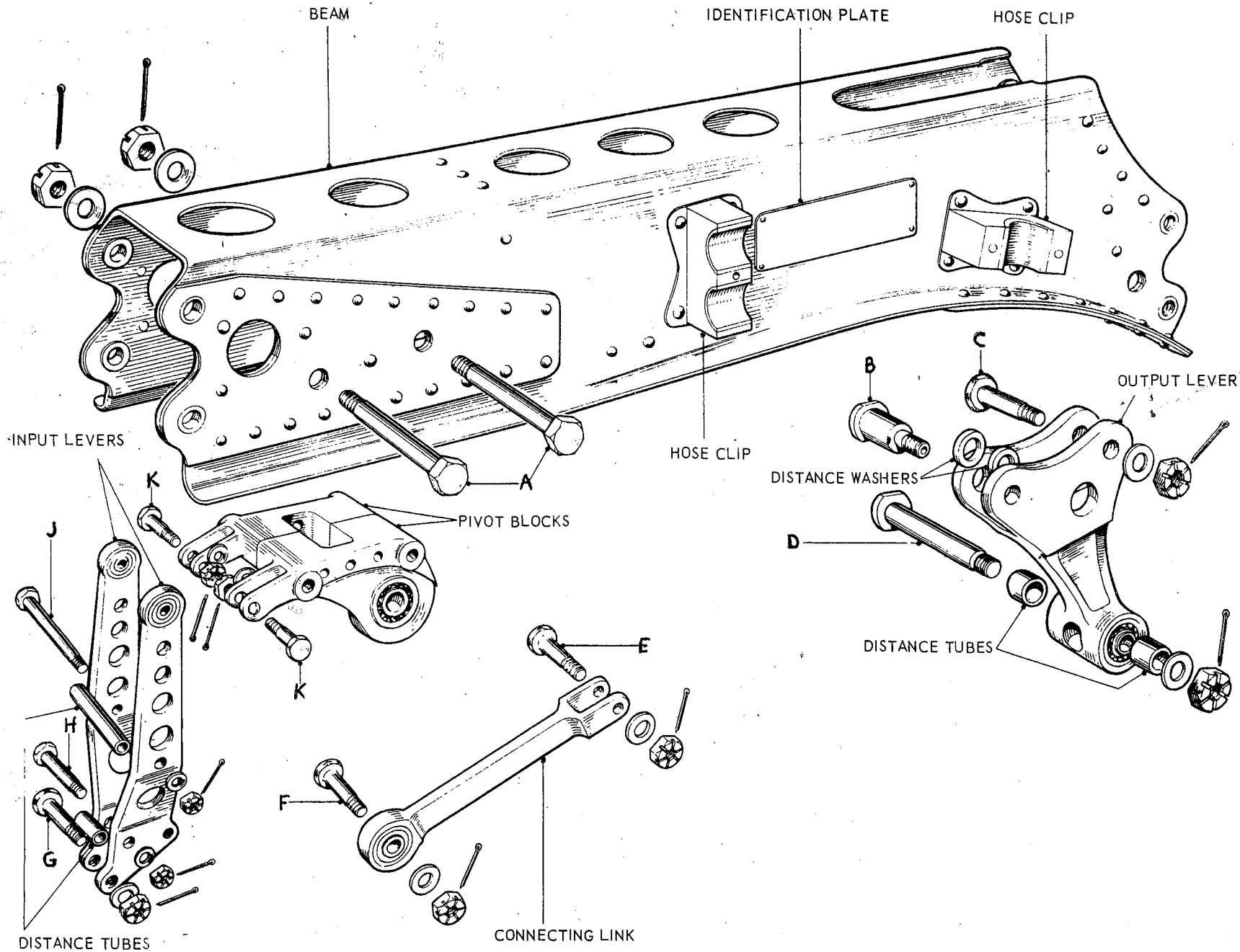


Fig.2 Beam and linkage dismantled

TESTING

12. The test rig used must include in the pressure line a filter capable of 5–micron filtration and the tests, scheduled in Table 1, should be carried out at normal room temperature (50 to 68° F) using the fluid specified in 'Leading Particulars'. The pressure connection 'A' (Fig. 3) is ⅛ in B.S.P. and the return connection 'B' is ¼ in B.S.P. Fault diagnosis is given in Table 2.

Note ...

When testing units embodying ram seals introduced by Mod. FHB 118, it must be remembered that with this type of rubber/fabric seal a dampness of the jack ram during operation can be accepted as inherent. Slight leakage may occur after prolonged periods of standing, this, except in isolated cases will disappear when the unit is exercised. If doubt exists as to the seal serviceability, wipe the unit dry, operate the ram through six reversals at normal system pressure (2880/3120 lbf. in^2), release pressure and again dry the unit, re-pressurize and repeat through a further six reversals. If no evidence of seepage is now apparent, the unit seals can be considered serviceable. Seepage past the ram seals into the extension end must be assessed in the knowledge of this note, but, in general, slight seepage from the extension end bleed hole after prolonged standing may be ignored, provided that it does not persist.

AFTER TESTING

13. When the tests have been satisfactorily completed:–

(1) Fully retract the ram and leaving the unit filled with fluid, fit protection plugs, with seals, to the valve fluid orifices.

(2) Lock the valve attachment bolts by bending over the tabwashers.

(3) Wire-lock the valve damper chamber bleed screws together.

(4) Wire-lock by-pass pipe outer sleeve adapters and their adjacent banjo bolts together.

(5) Liberally coat the ram notch and the release unit pawl and lightly lubricate the exposed portion of the ram with grease XG–275.

(6) Slacken the release unit locking bolt and slide the jack ram into the unit. Position the jack, valve and release unit in the beam, align the holes in the block assembly with those of the beam and insert bolts (A) (Fig. 2), secure with washers, nuts and split pins.

(7) Position the two distance collars, one each side of the jack extension end bearing and connect the jack to the output lever by inserting axis pin (B), secure with washer, nut and split pin.

(8) Stroke the jack in the beam and ensure the ram slides freely through the release unit. If not free check beam for distortion or incorrect assembly of levers and distance washers.

(9) Align the jack ram notch with the release unit pawl and tighten the unit locking bolt to a torque loading at 60 lbf. in. Wire-lock the locking bolt to the release unit.

(10) Position the valve connecting link and insert bolts (E) and (F), secure with washers, nuts and split pins.

(11) Fully stroke the jack in each direction and check that the by-pass pipe is clear of the beam by at least 0.06 in at all positions of the stroke.

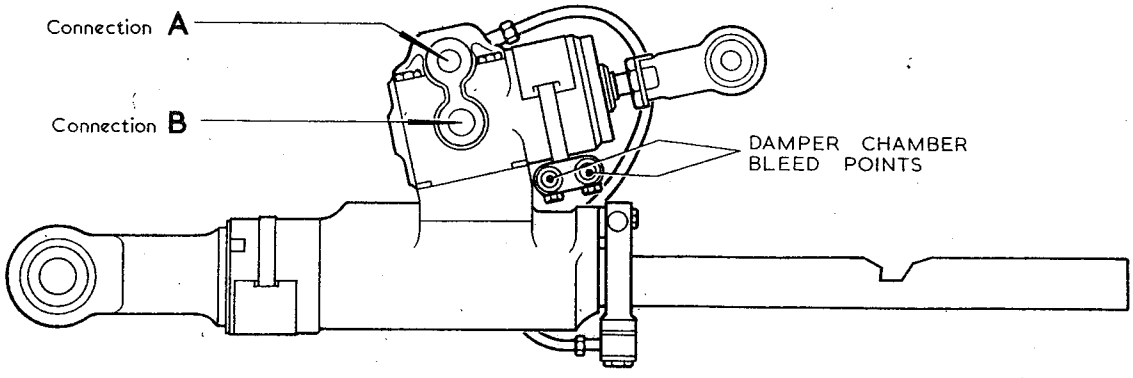


Fig.3 Test connections

TABLE 1 – Test Schedule

Test No.	Minimum and maximum pressure in lbf. in^2 at connections A	B	Valve selection	Procedure	Requirements
Note...	Before commencing the tests below ensure that all air has been expelled from the unit, including the valve damper chamber				
1	3850 4150	Reservoir	In	Maintain pressure for 3 minutes	No external seepage
2	1 10	Blank	In	Reduce pressure at connection A and maintain for 2 minutes	No external seepage
3	3850 4150	Reservoir	Out	Maintain pressure for 3 minutes	No external seepage
4	1 10	Blank	Out	Reduce pressure at connection A and maintain for 2 minutes	No external seepage
5	2880 3120	Atmosphere	Out	Maintain pressure for 3 minutes with pump ON. Check seepage in the fourth minute	Not to exceed 100 c.c. in the fourth minute
6	2880 3120	Atmosphere	In	As for Test No. 5 above	As for Test No. 5 above
7	1920 2080	960 1040	Neutral	Maintain pressure for 2 minutes	No external seepage
8	1020 2080	1 10	Neutral	Reduce pressure at connection B and maintain for 2 minutes	No external seepage
9	2880 3120	Reservoir	Alternate	Move the control valve fully in and out then:–	
				(1) Measure the operating load at which the valve spindle starts to move irrespective of the speed of movement. Repeat over all parts of the stroke	(1) Maximum: 6 lb matched within 2½ lb
				(2) Adjust the valve spindle until the ram is stationary and clear of its stops. Then measure the operating load on the valve spindle necessary to cause the ram to move	(2) Maximum: 2½ lb
				(3) Repeat (2) for movement of the ram in the opposite direction	(3) Maximum: 2½ lb
10	2880 3120	Reservoir	Neutral	Maintain pressure for 5 minutes with the rig pump ON. After this period measure the operating load at which the valve spindle starts to move, irrespective of the speed of movement. Repeat for second 5 minute period measure the load in the opposite direction	Maximum: 10 lb

TABLE 1 — Test schedule (continued)

Test No.	Minimum and maximum pressure in lbf. in² at connections A	B	Valve Selection	Procedure	Requirements
11	As required	Atmosphere	0·03 in. In	(1) Gradually raise pressure at connection A and observe flow at connection B. When flow falls to normal seepage rate, note pressure at connection A (2) Increase pressure to 2880/3120 lbf. in² then gradually decrease and note pressure when flow re-commences	(1) Maximum: 500 lbf. in² (2) Minimum: 200 lbf. in²
12	As required	Atmosphere	0·03 in. Out	As for Test No. 11 above	As for Test No. 11 above

Note ...

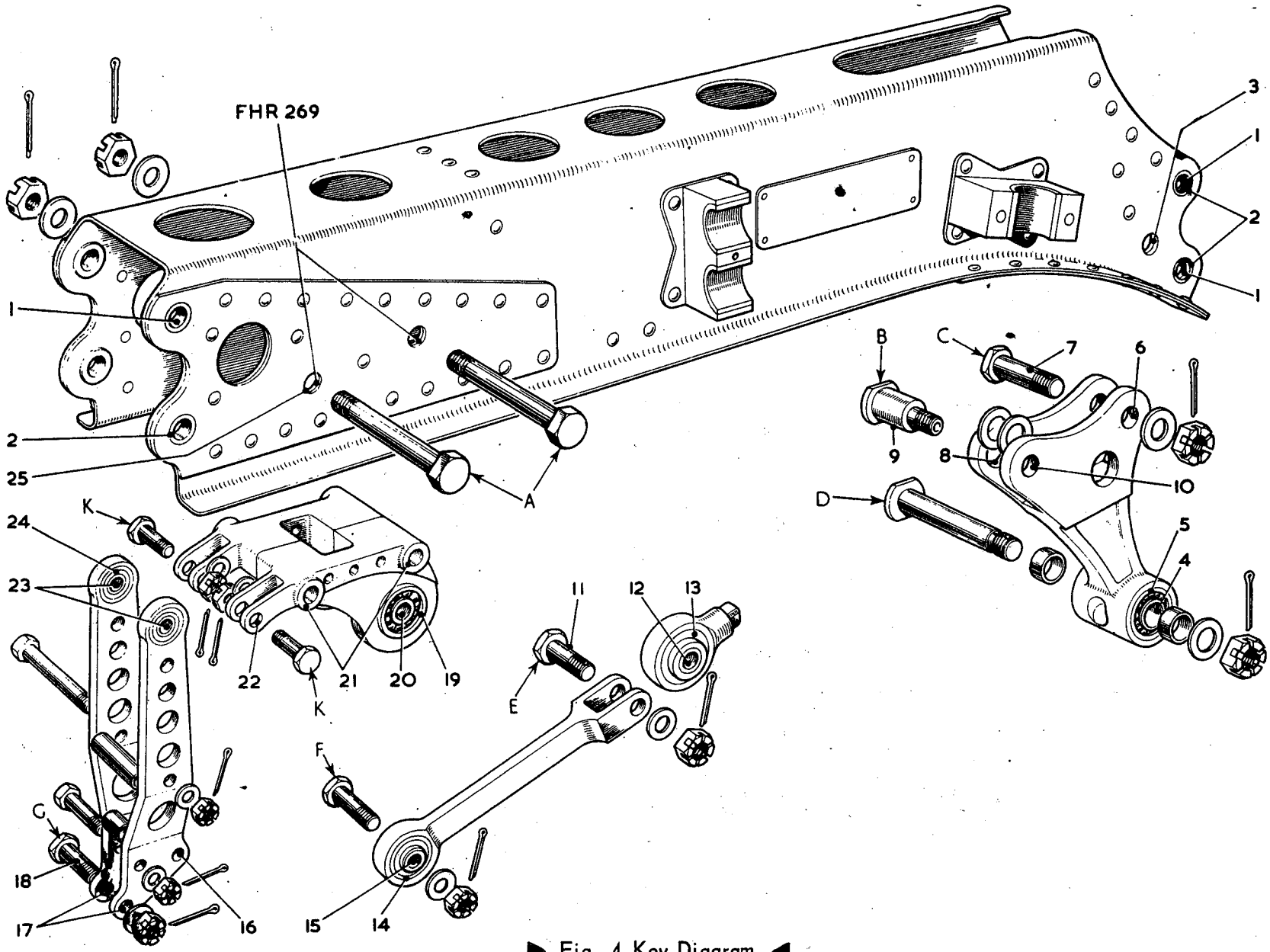
(1) To select the valve operating spindle to neutral, adjust its position until the jack ram is stationary at some intermediate point in its stroke.

(2) Test 9 (2) and (3). This load is known as the 'operating load off-centre'. The initial movement of the valve spindle to its extremes of travel are essential to off-set possible 'valve stiction'.

(3) Test 10: The measured load is the operating load which will be required to make an initial movement of the operating spindle after the valve has been standing with pressure applied. This increased operating load is termed 'valve stiction'.

TABLE 2 — Fault diagnosis

Fault	Diagnosis
1 Excessive seepage from connection B when valve is neutral	1 See valve fault diagnosis (A.P. 105D–1302–1)
2 Excessive seepage from connection B when valve is selected and jack ram is at extreme of travel	2 (1) Defective jack piston head seals (2) Excessive jack cylinder bore wear (3) Leakage past by-pass valve
3 External leakage from valve	3 See valve fault diagnosis (A.P. 105D–1302–1)
4 External leakage from jack	4 See jack fault diagnosis (A.P. 105D–1307–1)
5 Leakage between valve and jack platform	5 (1) Defective valve bottom platen seal (2) Defective connecting piece seal
6 Valve tends to select without assistance	6 (1) Foreign matter between the faces of the valve bottom platen and the jack platform (2) Foreign matter between the faces of the valve platen spacer and the top platen
7 Jack 'creeps' when the valve is neutral	7 Foreign matter between the faces of the valve outer sleeve and the bottom platen
8 Incorrect by-pass valve operating pressures at Table 1, Tests No. 11 and 12	8 See jack fault diagnosis (A.P. 105D–1307–1)



▶ Fig. 4 Key Diagram ◀

TABLE 3 – FITS, CLEARANCES AND REPAIR TOLERANCES

(All dimensions are in inches)

Ref. No. in Fig. 4 (1)	Parts and Description (2)			Dimension New (3)	Permissible Worn Dimension		Clearance New (6)	Permissible Worn Clearance (7)	Remarks (8)
					Inter-changeable Assembly (4)	Selective Assembly (5)			
1	FERRULES (4 off)		i/d	0·3130 0·3120	0·3130	–	–	–	
2	FERRULES (4 off) IN BEAM	Beam	i/d	0·4067 0·4057	0·4067	0·4070	0·0002 –0·0010	0·0002	
		Ferrules	o/d	0·4067 0·4065	0·4065	0·4055			
3	AXIS PIN (D) IN BEAM	Beam	i/d	0·5005 0·4995	0·5005	0·5010	0·0013 –0·0002	0·0013	
		Pin	o/d	0·4997 0·4992	0·4992	0·4982			
4	AXIS PIN (D) IN BEARINGS	Bearings	i/d	0·5002 0·4997	0·5002	0·5007	0·0010 0·0000	0·0010	
		Pin	o/d	0·4997 0·4992	0·4992	0·4987			
5	BEARINGS IN OUTPUT LEVER	Lever	i/d	1·1252 1·1242	1·1252	1·1257	0·0010 –0·0005	0·0010	
		Bearings	o/d	1·1247 1·1242	1·1242	1·1232			
6	BOLT (C) IN OUTPUT LEVER	Lever	i/d	0·3755 0·3745	0·3755	0·3760	0·0013 –0·0002	0·0013	
		Bolt	o/d	0·3747 0·3742	0·3742	0·3732			
7	BOLT (C) IN OUTPUT ROD	Rod	i/d	–	–	–	–	–	Rod is airframe part
		Bolt	o/d	0·3747 0·3742	0·3742	–			

TABLE 3 (continued)

Ref. No. in Fig. 4	Parts and Description			Dimension New	Permissible Worn Dimension		Clearance New	Permissible Worn Clearance	Remarks
					Inter-changeable Assembly	Selective Assembly			
(1)	(2)			(3)	(4)	(5)	(6)	(7)	(8)
8	AXIS PIN (B) IN OUTPUT LEVER	Lever	i/d	0·6257 0·6245	0·6257	0·6262	0·0015 –0·0002	0·0015	
		Pin	o/d	0·6247 0·6242	0·6242	0·6230			
9	AXIS PIN (B) IN BEARING (of jack extension end)	Bearing	i/d	0·6252 0·6247	0·6252	0·6257	0·0010 0·0000	0·0010	
		Pin	o/d	0·6247 0·6242	0·6242	0·6237			
10	AXIS PIN (B) IN OUTPUT LEVER	Lever	i/d	0·3755 0·3745	0·3755	0·3760	0·0013 –0·0002	0·0013	
		Pin	o/d	0·3747 0·3742	0·3742	0·3732			
11	BOLT (E) IN CONNECTING LINK FORK	Fork	i/d	0·3130 0·3120	0·3130	0·3135	0·0013 –0·0002	0·0013	
		Bolt	o/d	0·3122 0·3117	0·3117	0·3107			
12	BOLT (E) IN BEARING (servo valve eye end)	Bearing	i/d	0·3127 0·3122	0·3127	0·3132	0·0010 0·0000	0·0010	
		Bolt	o/d	0·3122 0·3117	0·3117	0·3112			
13	BEARING IN EYE END (servo valve)	Eye end	i/d	0·8747 0·8742	0·8747	0·8752	0·0005 –0·0005	0·0005	
		Bearing	o/d	0·8747 0·8742	0·8742	0·8737			

TABLE 3 (continued)

Ref. No. in Fig. 4	Parts and Description			Dimension New	Permissible Worn Dimension		Clearance New	Permissible Worn Clearance	Remarks
					Inter-changeable Assembly	Selective Assembly			
(1)	(2)			(3)	(4)	(5)	(6)	(7)	(8)
14	BEARING IN CONNECTING LINK	Link	i/d	0·9016 0·9008	0·9016	0·9021	0·0010 –0·0003	0·0010	
		Bearing	o/d	0·9011 0·9006	0·9006	0·8998			
15	BOLT (F) IN CONNECTING LINK BEARING	Bearing	i/d	0·2502 0·2497	0·2502	0·2507	0·0010 0·0000	0·0010	
		Bolt	o/d	0·2497 0·2492	0·2492	0·2487			
16	BOLT (F) IN INPUT LEVER	Lever	i/d	0·2505 0·2495	0·2505	0·2510	0·0013 –0·0002	0·0013	
		Bolt	o/d	0·2497 0·2492	0·2492	0·2482			
17	BOLT (G) IN INPUT LEVER	Lever	i/d	0·2505 0·2495	0·2505	0·2510	0·0013 –0·0002	0·0013	
		Bolt	o/d	0·2497 0·2492	0·2492	0·2482			
18	BOLT (G) IN BEARING	Bearing	i/d	–	–	–	–	–	Bearing is airframe part
		Bolt	o/d	0·2497 0·2492	0·2492	–			
19	BEARINGS IN PIVOT BLOCK	Block	i/d	1·1247 1·1242	1·1247	1·1252	0·0005 –0·0005	0·0005	
		Bearing	o/d	1·1247 1·1242	1·1242	1·1237			

TABLE 3 (continued)

Ref. No. in Fig.4	Parts and Description			Dimension New	Permissible Worn Dimension		Clearance New	Permissible Worn Clearance	Remarks
					Inter-changeable Assembly	Selective Assembly			
(1)	(2)			(3)	(4)	(5)	(6)	(7)	(8)
20	RELEASE UNIT TRUNNIONS IN BEARING	Bearing	i/d	0·5002 0·4997	0·5002	0·5004	0·0010 0·0002	0·0010	
		Trunnions	o/d	0·4995 0·4992	0·4992	0·4987			
21	MOUNTING BOLTS (A) IN PIVOT BLOCK	Block	i/d	0·3130 0·3120	0·3130	0·3135	0·0013 –0·0002	0·0013	
		Bolt	o/d	0·3122 0·3117	0·3117	0·3107			
22	BOLTS (K) IN PIVOT BLOCK FORKS	Fork	i/d	0·2505 0·2495	0·2505	0·2510	0·0013 –0·0002	0·0013	
		Bolts	o/d	0·2497 0·2492	0·2492	0·2482			
23	BOLTS (K) IN INPUT LEVER BEARINGS	Bearing	i/d	0·2502 0·2497	0·2502	0·2507	0·0010 0·0000	0·0010	
		Bolts	o/d	0·2497 0·2492	0·2492	0·2487			
24	BEARINGS IN INPUT LEVER	Lever	i/d	0·7502 0·7492	0·7502	0·7507	0·0010 –0·0005	0·0010	
		Bearing	o/d	0·7497 0·7492	0·7492	0·7482			
25	MOUNTING BOLTS (A) IN BEAM	Beam	i/d	0·3130 0·3120	0·3130	0·3135	0·0013 –0·0002	0·0013	
		Bolt	o/d	0·3122 0·3117	0·3117	0·3107			

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