AP 105D-1306-16

HUNTER

POWERED FLYING CONTROLS

FAIREY HYDRAULICS LTD.

PART No. AH 957 AND AH 958

GENERAL AND TECHNICAL INFORMATION

FITS, CLEARANCES AND REPAIR TOLERANCES

BY COMMAND OF THE DEFENCE COUNCIL

Frank Cooper.

Ministry of Defence

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Service users should send their comments through the channel prescribed for the purpose in :
AP(N)140 Chap. 1 Annex A (RN)
AP 100B–01, Order 0504 (RAF)

MODIFICATIONS

The following modifications are included in this publication

FHB 90-
FHB 108
FHB 117
FHB 124
FHB 129-
FHB 130L
FHB 131-
FHB 157-
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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POWERED FLYING CONTROLS, PART NO. AH 957 AND AH 958

Leading Particulars

Control unit AH 957	Ref. No. 27KF/2974
Control unit AH 958	Ref. No. 27KF/2975
Jack assembly AH 25999 (A.P.105D–1305–1)	Ref. No. 27KF/12
Valve assembly FHS 722/5/140/0 (For AH 957 only) (A.P.105D–1308–1)	Ref. No. 27KF/ –
Valve assembly FHS 722/3/140/0 (For AH 958 only) (A.P.105D–1309–1)	Ref. No. 27KF/ –
Release unit CH 23521 (A.P.105D–1304–1)	Ref. No. 27KF/3065
Fluid OM–15, DTD 585	Ref. No. 34B/9100572
Working pressure	3000 lb f/in²
Jack stroke –	
Maximum	2.636 in
Minimum	2.600 in
Overall dimensions (approx) –	
Length (retracted)	19.6 in
Width	4.0 in
Height	4.9 in
Weight (approx)	6.8 lb

◀ WARNING: THE LIFE OF THESE CONTROL UNITS IS 3000 FLYING HOURS.
THE P.F.C.U. RECORD CARD IS TO BE SUITABLY ANOTATED. ▶

INTRODUCTION

1. The purpose of each control unit is to move an aircraft control surface in accurate relationship to the movements of the control column. The unit incorporates a means of manual reversion which operates 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.

DESCRIPTION

2. The control units consist mainly of a jack, a valve and a release unit (see Leading Particulars). The additional items that complete the unit assembly are the fluid connections of the by-pass valve housing and servo valve, complete with sealing washers, an external pipe and the valve spindle eye end.

3. On control unit AH 958 the fluid connections are on the same side of the unit as the by-pass valve housing and consequently a slightly shorter external pipe is used. Apart from these 'handing' differences the two valves and the units are identical.

SERVICING

SPECIAL TOOLS

4. The following special tools are required to service the control unit:–

Description	Part No.	Ref. No.
Seal manipulating tool (set of 3)	FHQ 100	27KF/683
Vice clamps	FHQ 161	27KF/698
Manipulating tool	FHQ 164	27KF/688

DISMANTLING

5. To dismantle the unit proceed as follows:–

(1) Unscrew the release unit locking bolt until the pawl is clear of the ram notch; slide the unit off the ram and screw in the locking bolt sufficiently to ensure that it is retained.

(2) Slacken the locknut and remove the valve eye end.

(3) Remove the external pipe.

(4) Remove the banjo bolt and union from

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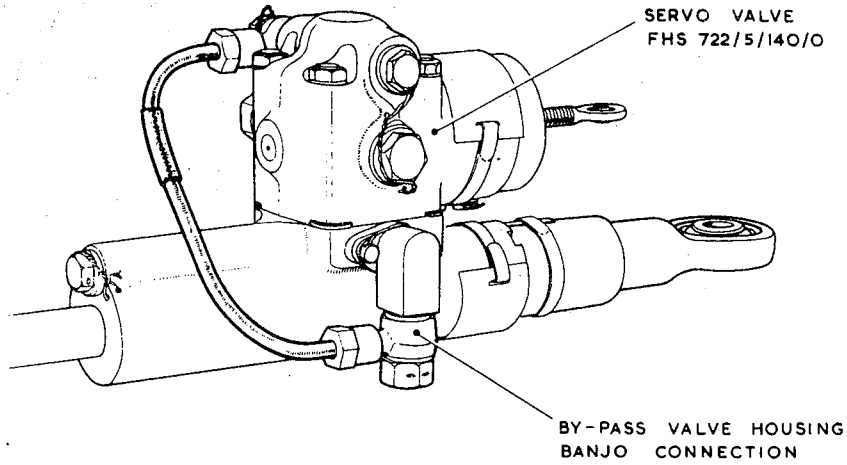
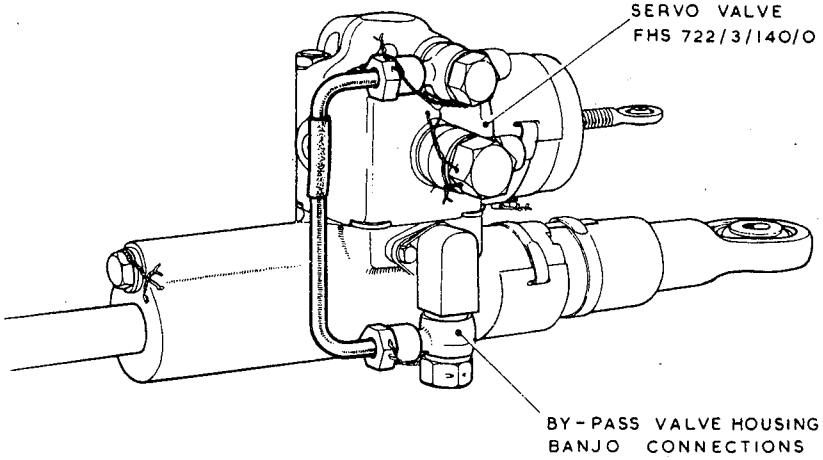
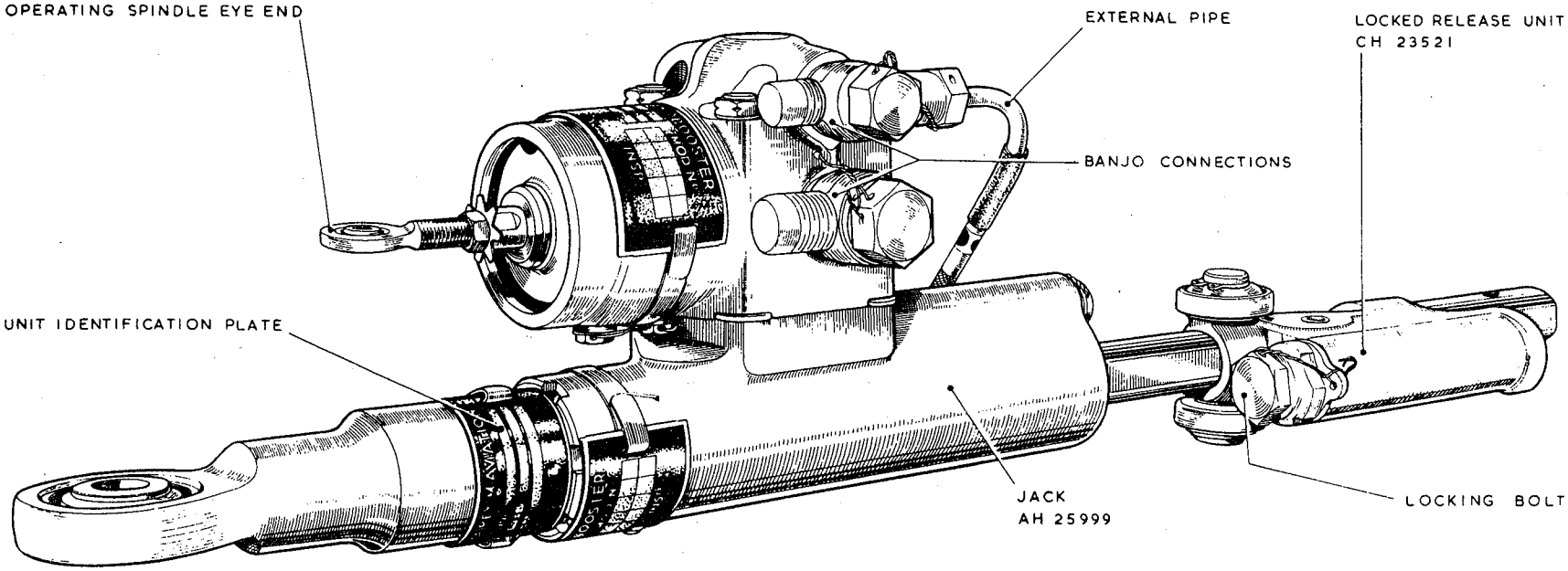


CONTROL UNIT AH 957



CONTROL UNIT AH 958



CONTROL UNIT AH 957

Fig. 1 Control units AH 957 and AH 958

the by-pass valve housing and fit a protection plug to the housing orifice.

(5) Remove the two banjo bolts and unions from the valve and fit protection plugs to the body orifices.

(6) Evenly slacken the four valve attachment bolts; the bolts are each held captive by a platen retaining washer located between valve and jack, for this reason even and progressive slackening of the bolts is to be continued until the valve can be lifted from the jack.

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

(8) Fit protection plugs to the fluid orifices in the valve bottom platen; position the valve base cover plate and secure it, using the four valve attachment bolts and ¼ in B.S.F. nuts.

(9) Fit protection plugs to the jack platform fluid orifices; position the cover plate and secure it with ¼ in dia B.S.F. screws and washers.

(10) Remove the unit identification plate (fig. 1).

6. Instructions for dismantling the jack, valve and release unit will be found in the relevant publications.

EXAMINING

7. Instructions for examining the jack, valve and release unit will be found in the relevant publications. Clean all other parts in approved cleaning fluid and examine them for serviceability. Fits and clearances appear in Table 1.

ASSEMBLING

8. Ensure that the jack, valve and release unit have been tested and are serviceable. Smear the connecting pieces, seals and sealing washers with clean hydraulic fluid immediately before fitting and where bonded sealing washers are used, ensure that the torque loading figures (A.P.105D–0002–1) are not exceeded. Maintain scrupulous cleanliness throughout and assemble the unit as follows:–

(1) Remove the cover plate and protection plugs from the jack platform and fit the connecting pieces complete with new seals into the fluid orifices.

(2) Remove the cover plate from the valve base and withdraw the protection plugs from the bottom platen.

(3) Position the valve over the jack platform and check that the platen orifices align with the connecting pieces. Engage and evenly tighten the four attachment bolts but do not lock the tabwashers until after fluid testing.

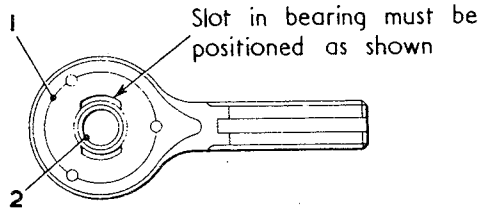


Fig. 2 Key diagram

TABLE 1 – Fits, clearances and repair tolerances

Ref. No on Key diagram	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)
1	BEARING IN EYE END							
	Eye end	i/d	0.5622 0.5617	0.5622	–	0.0004 –0.0005	0.0004	
	Bearing	o/d	0.5622 0.5618	0.5618	–			
2	BEARING	i/d	0.1900 0.1896	0.1900	–	–	–	

(4) Remove the protection plug and loosely assemble the banjo and bolt to the by-pass valve housing, using new sealing washers, one each side of the banjo body.

(5) Remove the blanks and assemble the valve banjo unions and bolts, using new sealing washers, one each side of each banjo body. Position the external pipe, tighten the valve and by-pass housing banjo bolts and the pipe adapters.

(6) Screw the eye end, complete with the locknut and new tabwasher, into the valve spindle and tighten the locknut but do not lock the tabwasher.

(7) Test the jack and valve assembly in accordance with para. 9. The fitting of the release unit is included in para. 10.

TESTING

9. The test rig used must include in the pressure line a filter capable of 5 micron filtration, and the tests should be carried out at normal room temperature (50 to 68°F.), using the fluid specified in Leading Particulars. Test the unit in accordance with the tests scheduled in Table 2. Fault diagnosis is given in Table 3.

Note...

When testing units embodying ram seals introduced by Mod. FHB 117 (pre Mod. FHB 157) 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 6 reversals at normal system pressure (2880/3120 lb/in^2), release pressure and again dry the unit, re-pressurize and repeat through a further 6 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

10. When the tests have been satisfactorily completed:–

(1) Fully retract the ram, disconnect the rig pipe lines and, leaving the unit filled with fluid, fit protection caps, with seals, to the valve fluid connections.

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

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

(4) Wire-lock each of the external pipe adapters and its adjacent banjo bolt together.

(5) Wire-lock the valve return connection banjo bolt to the valve body.

(6) Check that the data on the unit identification plate is correct and attach the plate to the unit in accordance with A.P.105D–0002–1, 'Fitting identification and locking dowel plate assemblies'.

(7) Unscrew the release unit locking bolt to allow movement of the pawl and slide the unit on to the jack ram.

(8) Screw in the locking bolt and ensure that the pawl wedges cleanly in the ram notch; (see relevant aircraft publication for bolt torque loading and locking when installed).

(9) Liberally coat the ram notch and release unit pawl with grease, XG–275.

Note...

To prevent damage to the valve spindle and eye end, the eye end complete with tabwasher and locknut, should be removed from the spindle and tied to the unit until required at installation.

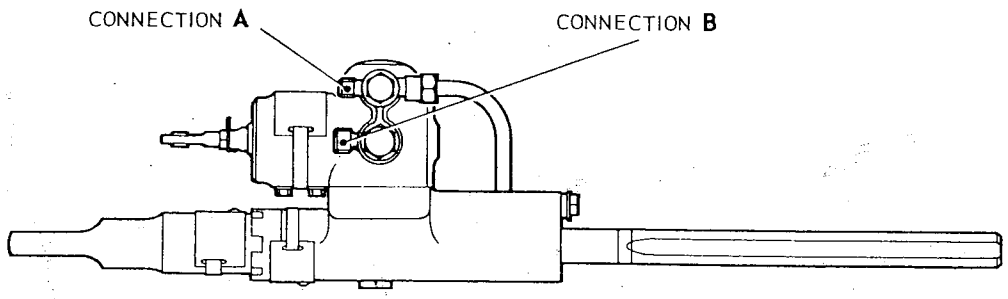


Fig. 3 Test connections

TABLE 2 Test schedule

Test No.	Minimum and maximum pressures in lbf/in² at connections A	B	Valve selection	Procedure	Requirements
Note ... *Before commencing the tests below, bleed the valve damper chamber (A.P.105D–1309–1) and expel all air from the unit.*					
1	3850 4150	Reservoir	In	Maintain pressure for 3 minutes	No external seepage
2	1 10	Blank	In	Maintain pressure for 2 minutes	No external seepage
3	3850 4150	Reservoir	Out	Maintain pressure for 3 minutes	No external seepage
4	1 10	Blank	Out	Maintain pressure for 2 minutes	No external seepage
5	2880 3120	Atmosphere	Out	Maintain pressure for 4 minutes with rig pump 'ON'. Check seepage during the fourth minute	Not to exceed 100 cm³ in the fourth minute
6	2880 3120	Atmosphere	In	As for Test No. 5	As for Test No. 5
7	1920 2080	960 1040	Neutral	Maintain pressure for 2 minutes	No external seepage
8	1920 2080	1 10	Neutral	Maintain pressure for 2 minutes	No external seepage
9	2880 3120	Reservoir	Alternate	Move the valve spindle 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 to 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

TABLE 2 Test schedule (continued)

Test No.	Minimum and maximum pressures in lbf/in² at connections A	B	Valve selection	Procedure	Requirements
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 and measure the load in the opposite direction	Maximum: 10 lb
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'	(1) Maximum: 500 lbf/in²
				(2) Increase pressure to 2880/3120 lbf/in² then gradually decrease and note pressure when flow re-commences	(2) Minimum: 200 lbf/in²
12	As required	Atmosphere	0.03 in Out	As for Test No. 11	As for Test No. 11

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 3 Fault diagnosis

	Fault		Diagnosis
1	Excessive seepage from connection 'B' when valve is neutral	1	See valve fault diagnosis (A.P. 105D–1309–1)
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–1309–1)
4	External leakage from jack	4	See jack fault diagnosis (A.P. 105D–1305–1)
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 2, Tests No. 11 and 12	8	See jack fault diagnosis (A.P. 105D–1305–1)

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