Chapter 4E FLYING CONTROLS - TAIL PLANE

(completely revised)

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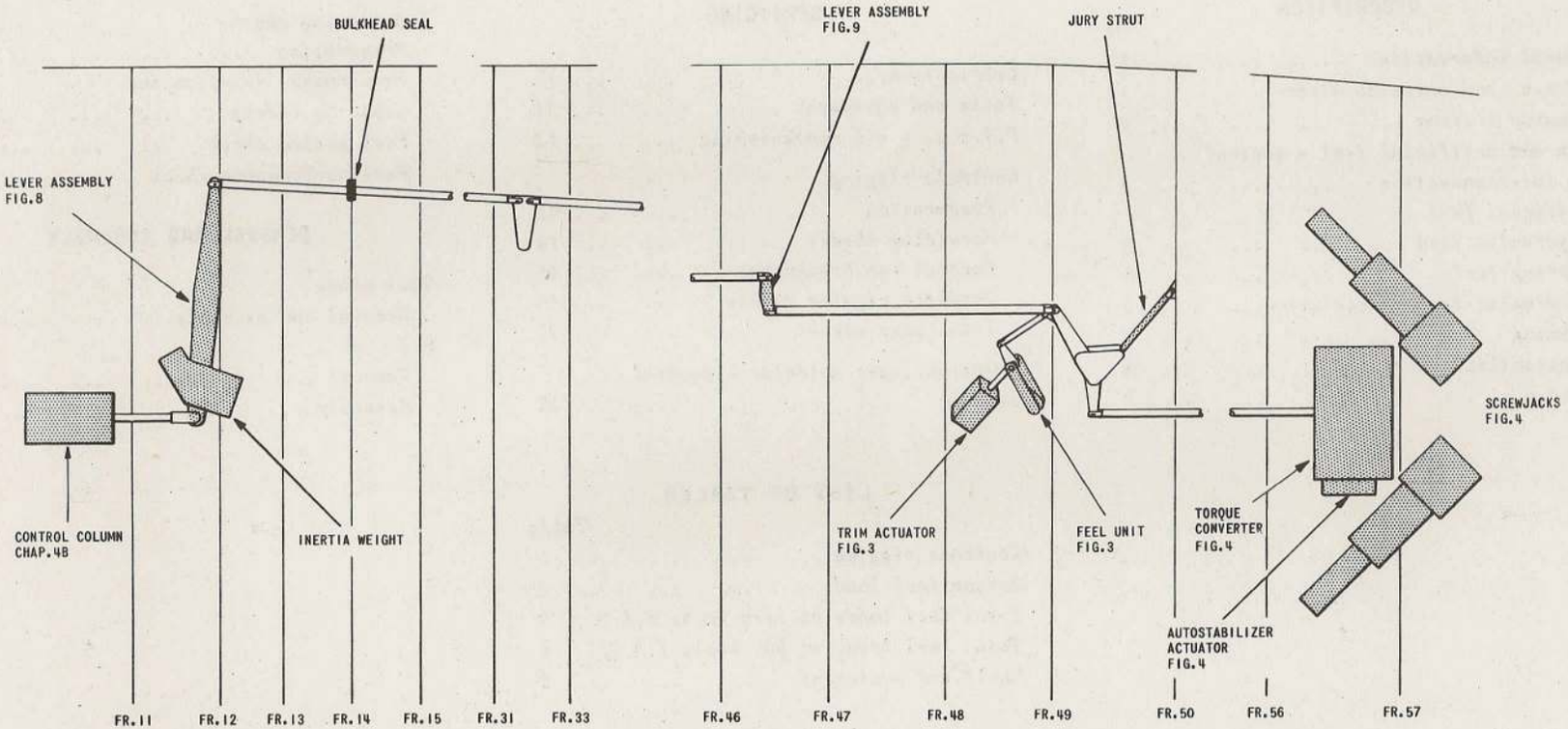

ADDITIONAL INFORMATION

HYDRAULIC SYSTEM - CHAP.6
ELECTRICAL SYSTEM - BOOK 2 - SECT.5 AND 7, CHAP.3

FIG.1. SYSTEM LAYOUT (MECHANICAL)

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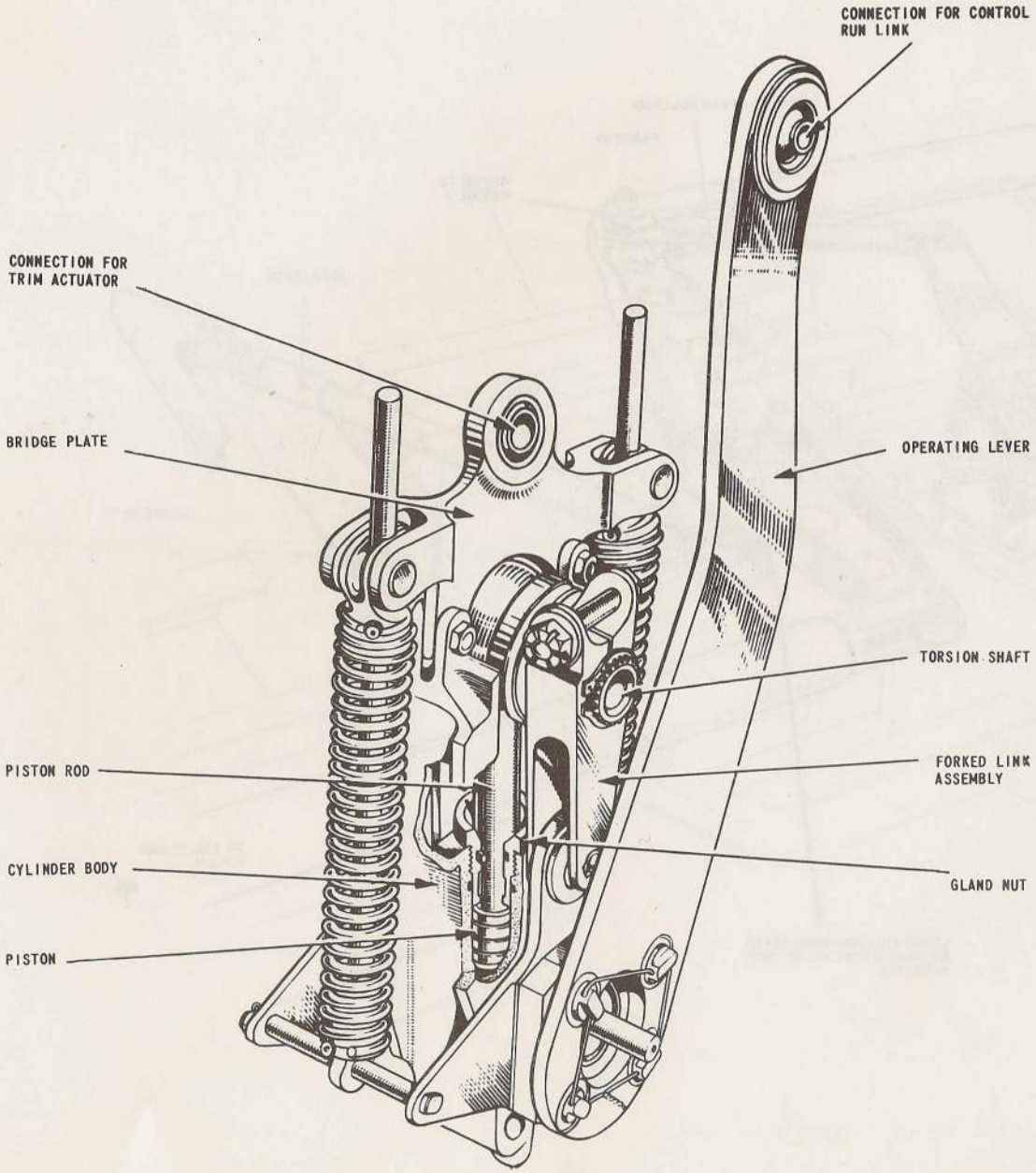

Fig. 2. Feel unit A2907-1

DESCRIPTION

General information

1. The slab tail plane is moved by a powered flying control unit (p.f.c.u.). This consists of two independent hydraulic motors driving common 1st and 2nd stage gearboxes which operate two screwjacks. The screwjacks are connected to the tail plane by triangular levers. The motors are powered by the No. 1 and No. 2 controls hydraulic systems respectively, ensuring continued operation of the tail plane, although at a reduced rate, should either hydraulic system or motor fail. Operation of the p.f.c.u. is controlled by a rod-and-lever system connected to the control column for operation by the pilot. An electric actuator, and an electro/hydraulic autostabilizer move the control run to satisfy trim or autopilot demands respectively. Artificial feel is provided by a hydraulic/spring feel unit interposed between the trim actuator and the control run.

P.f.c.u. and autostabilizer-actuator liaison

2. The p.f.c.u. and autostabilizer actuator, individually or together, provide three modes of tail plane control. The tail plane is moved by the p.f.c.u. which receives its authority from different sources according to which of the following modes is selected:-

MANUAL, in which the control run has full authority over the p.f.c.u.

AUTOSTABILIZED, in which the control

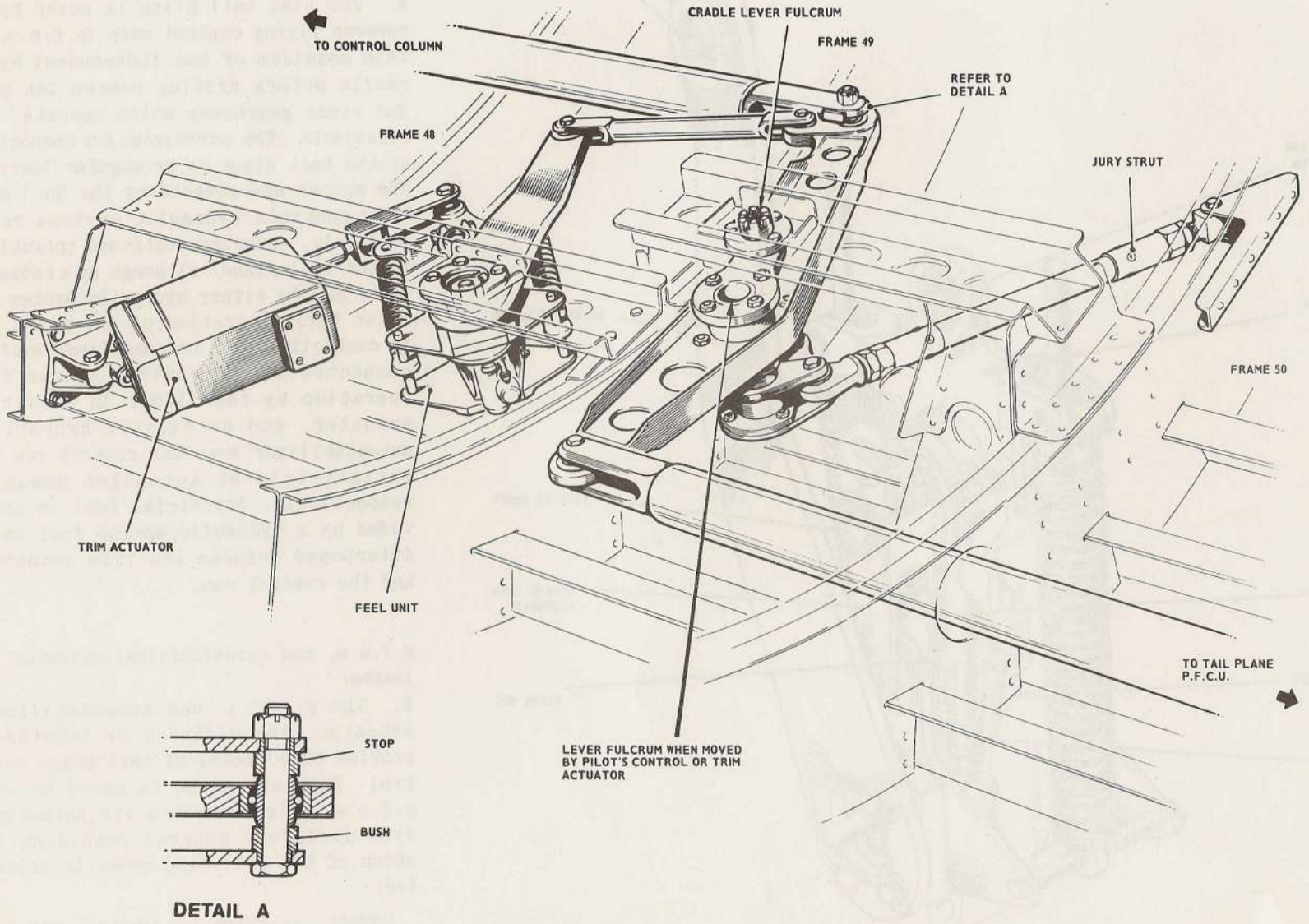

FIG.3. TRIM ACTUATOR AND FEEL UNIT INSTALLATION

◀ DETAIL A AMENDED ▶

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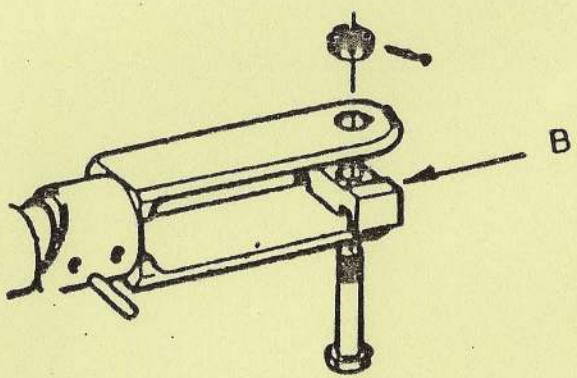
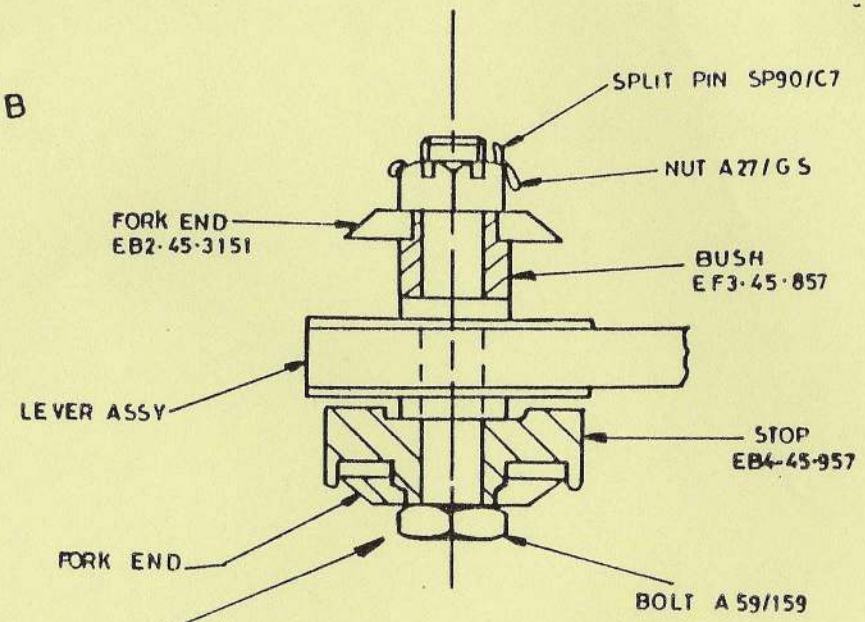
COMMAND TEMPORARY
AMENDMENT No 8
AP101B-1003-1A

This page to be inserted in Sect 3, Chap 4E, facing figure 3.

DETAIL 'A'



FORK END



VIEW 'B' ON END OF FORK END SHOWING ASSEMBLY OF THE STOP AND BUSH

run has full authority over the p.f.c.u. but short period oscillations are damped by the autostabilizer actuator which receives commands from the pitch gyro.

FLIGHT CONTROL SYSTEM, in the auto- mode in which the p.f.c.u. is controlled by the autostabilizer actuator which receives its commands from the flight control computer. If necessary the control column can override the flight control system demands.

Trim and artificial feel – control run interconnection

3. A lever assembly, protected by a heat shield, between frames 49 and 50 on the starboard lower side of the fuselage, is the point at which artificial feel loading and trim change demands are applied to the control run and control column.

Artificial feel

Hydraulic feel

4. Centring forces on the control column, simulating aerodynamic loading on the tail plane, are applied by the hydraulic feel unit. Subjected to metered hydraulic pressure from the feel simulator control unit *(Chap.6)*, the feel unit resists displacement of the control column to give a representative feel, above a fixed value base loading, relative to the speed and altitude of the aircraft.

Spring feel

5. The spring-feel unit consists of two opposed coil springs attached to the hydraulic feel unit, and assists in providing centring forces and a sense of feel to the control column; it will continue to do so should hydraulic failure occur.

Hydraulic-feel cancellation

6. Hydraulic feel, on both tail plane and rudder controls, can be cancelled by operation of the feel selector switch on the port console.

Trimming

7. Change of trim is effected by use of the four-position trim switch on the control column handle; e.g. a nose-down attitude is corrected by moving the switch aft to decrease the tail-plane incidence. Operation of the switch energizes a linear actuator connected to the feel unit. The body of the actuator pivots about its mounting bracket on frame 48 and the ram extension is connected to the feel unit body *(fig.3)*. Movement of the actuator ram displaces the feel unit which pivots about its mounting to the aircraft structure, and, through the linkage to the lever in the control run, moves the control column and the control valves of the tail-plane motor. The disposition of the actuator and feel unit is such that, for a given linear movement of the ram from mid-setting, extension will produce a greater angular displacement of the feel unit lever arm than will retraction; the effect on the tail plane is that, measured from the rigging position, the nose-up trim range is greater than the nose-down range.

Autostabilizer actuator

8. The actuator, supplied with hydraulic pressure from the services system and protected by an accumulator, is mounted on the p.f.c.u. and connected, through a differential linkage, to the control run, to operate the p.f.c.u. in response to amplified signals from the flight control system. Fail-safe devices ensure that the differential linkage will not be damaged by excessive thrust.

P.f.c.u.

9. The p.f.c.u., located between frames 56 and 58, moves the tail planes *(Chap. 3)* identically and simultaneously in response to control column, trimming or flight control system demands. The p.f.c.u. consists of a torque converter and a screwjack assembly: the driving and driven units respectively. Two valve blocks, two hydraulic motors and a first-stage gearbox comprise the torque converter, and a second-stage gearbox and two screwjacks, the screwjack assembly. Hydraulic power from No.1 controls system, directed into the starboard valve block, drives the associated motor which in turn drives the first and second stage gearboxes, the latter extending and retracting the screwjacks. Hydraulic power from No.2 controls system performs a similar function through the port valve block and its associated motor. In failure of either hydraulic system the other motor will continue to drive the gearboxes to operate the two screwjacks. Extension or retraction of the screwjacks causes movement of the triangular-levers linking them to the tail plane with consequent variations in the linkage geometry. To cater for

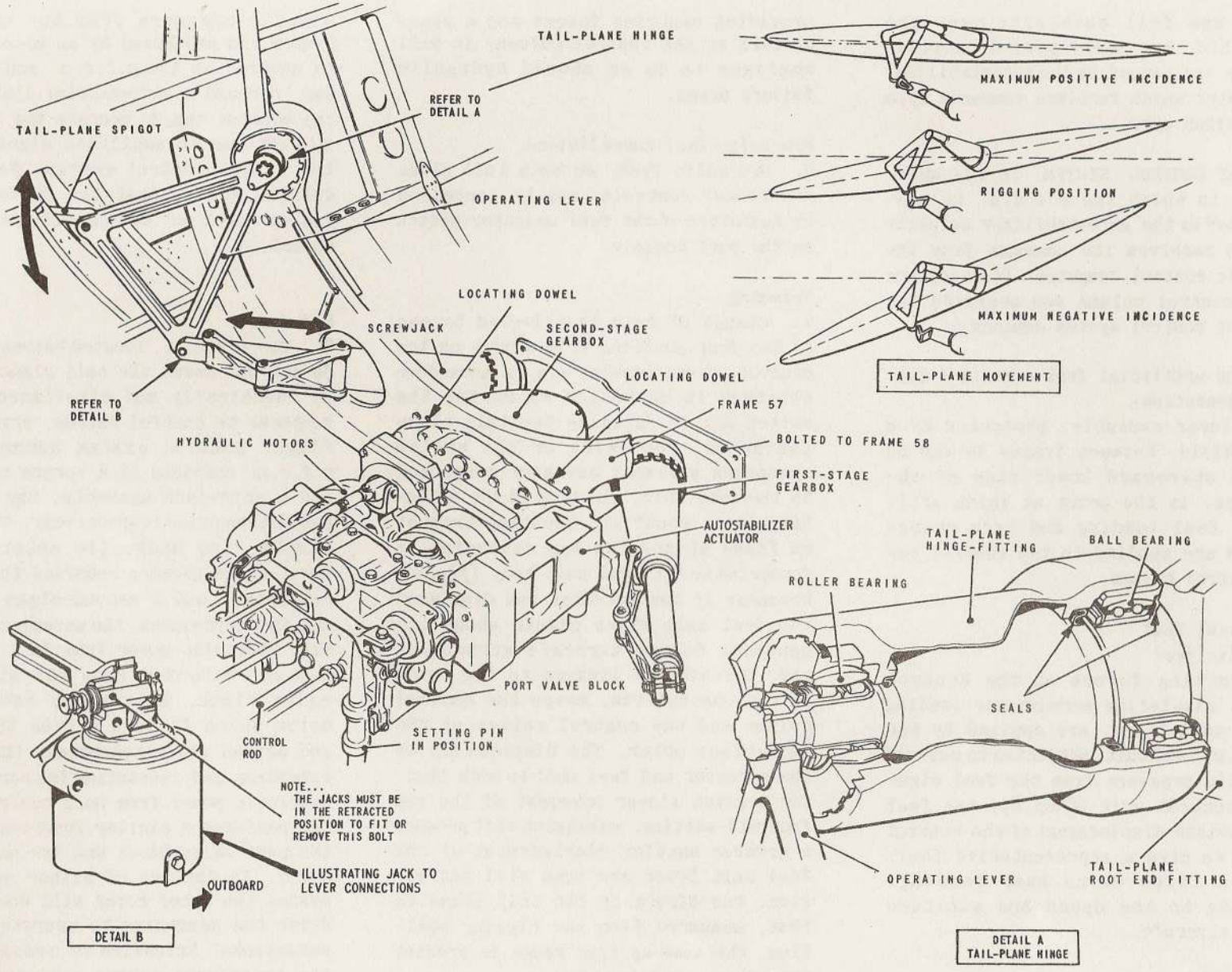


FIG.4. OPERATING MECHANISM

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this variation the screwjacks pivot on their anchorages in the second-stage gearbox.

SERVICING

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cockpit or performing any operations upon the aircraft.

Lubrication

◀ **10.** Details of lubrication are shown in fig.5 and the key to lubricant and application symbols, together with their full designations, are to be found in Leading Particulars. All control rods are designed to run dry in their roller guides and are not to be lubricated. ▶

Tools and equipment

11. For tools and equipment used in servicing, or removal and assembly operations, refer to Table 5.

P.f.c.u. - oil replenishing

12. The jacks and gearboxes are internally lubricated with oil OX-38, the screw housings of the former being automatically filled from the second stage gearbox. The oil-filler, oil-level and oil-drain plugs of the gearboxes are accessible behind access panel 103. To replenish either gearbox, set the jacks to mid-stroke, i.e. tail planes neutral. Remove the blanking caps from the appropriate filler and level plugs and, using the fluid replenishing can connect the delivery hose to the filler plug, and fill the gearbox until oil flows from the level plug. Allow the surplus oil to drain out and then refit the blanking caps.

Controls rigging *(Table 1)*

Preparation

13. Prepare the aircraft by removing the appropriate access panels *(Sect.2, Chap.4, Table 3)*, and, if necessary, the detachable floor panel No.21 *(Sect. 2, Chap.4, fig.8)*.

Servicing checks

14. For normal servicing checks refer to Table 1 and carry out checks 1 (omit (C) and (E)), 2A, 6(B) and (D), 7 (omit (C) and (E)) and 8. If any of the conditions in Table 1 cannot be satisfied carry out the complete set of checks 1 to 8. Check for security, freedom of movement without noticeable backlash, lubrication and cleanliness.

Control run breakdowns

WARNING

In view of the possibility of fouls occurring in the control run if bolts are fitted incorrectly, particular attention is drawn to the fact that in some cases bolts are fitted inverted (fig.8 and 9).

15. If it is necessary to break-down the control system, fit the neutral setting rig and/or rigging pins, where possible at points both sides of the breakdown area. Upon completion of the work carry out checks for fouling or straining, freedom of movement, range of movement and security.

Complete rigging checks

16. To carry out full rigging checks, refer to Table 1 and execute all the listed operations.

Trim range checks

17. For trim range checks refer to Table 1 and carry out checks and any necessary adjustments detailed in check 8.

Autostabilizer actuator - neutral setting

18. Before the tail-plane controls are rigged for neutral position, the autostabilizer actuator must be set in the neutral position as follows:-

(1) Check that the F.C.S. is installed and serviceable.

(2) Connect external a.c. and d.c. supplies.

(3) Set the following switches:-

F.C.S. engage switch on control column handle	OFF
Stab switch on control unit	OFF
Instrument master switch	ON
Master switch on control unit	ON

(4) Remove the hydraulic system hand-

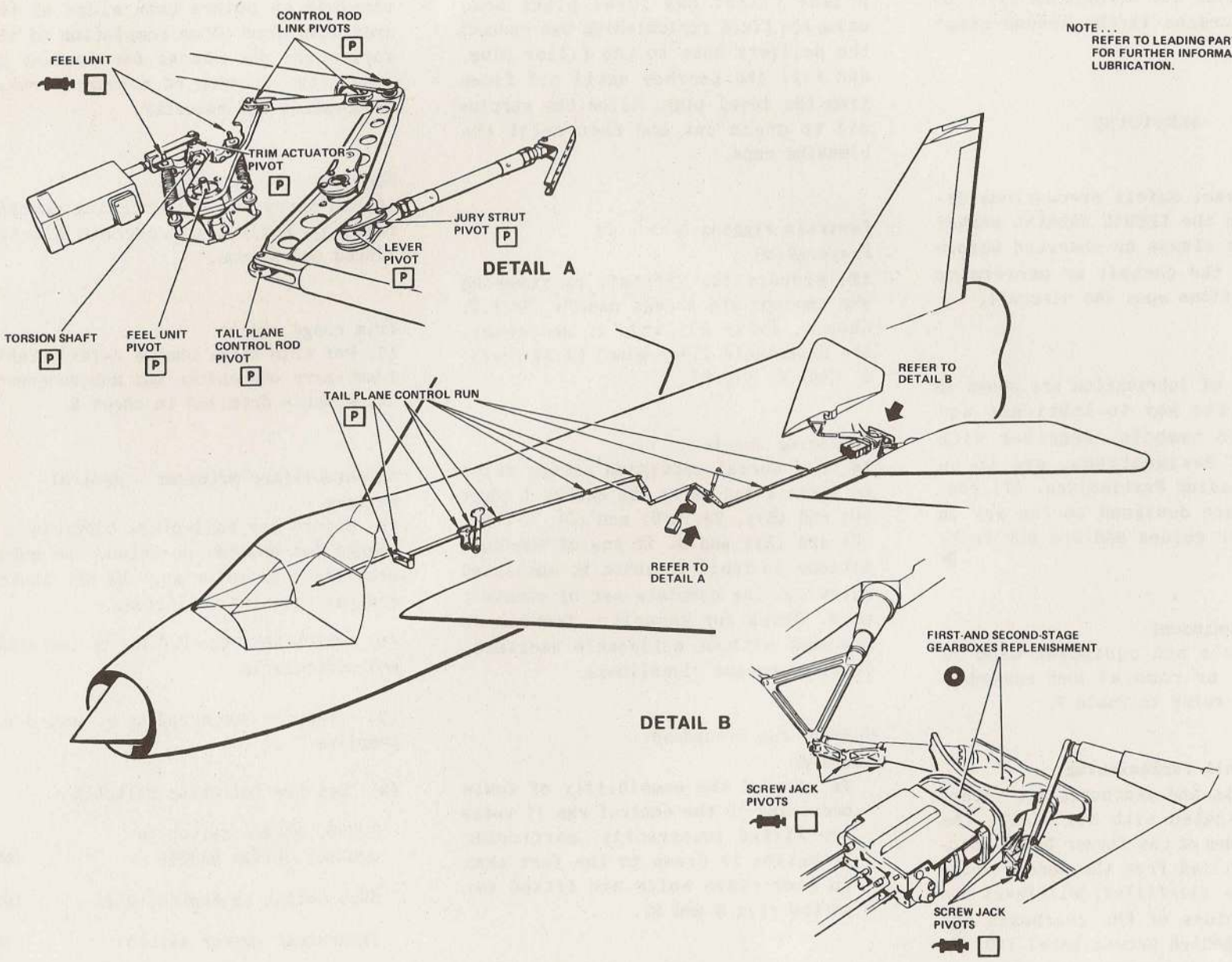


FIG.5. LUBRICATION OF CONTROLS

◀ REDRAWN ▶

TABLE 1 CONTROLS RIGGING

1

CHECKS

(A) Connect hydraulic servicing trolleys to control and services systems. Connect an electrical servicing trolley.

(B) Refer to para.18 for autostabilizer neutral setting.

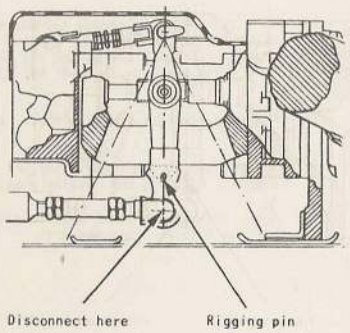
(C) Operate control column until all pressure is exhausted from tail-plane accumulators (rate not to exceed one stroke between stops in five seconds).

(D) Set trim to neutral by cockpit indicator.

(E) Disconnect control rod at p.f.c.u. input lever and fit rigging pin.

(F) Fit neutral setting rig to control column.

ADJUSTMENTS, IF NECESSARY



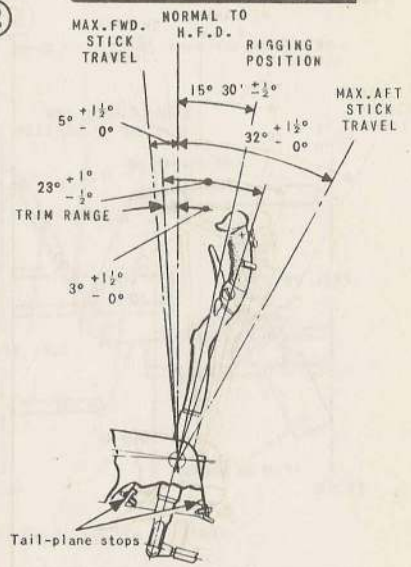
2

CHECKS

(A) Check that maximum movement of control column is available.

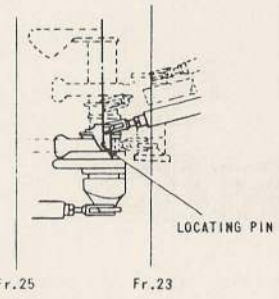
(B) Set control column in rigging position.

ADJUSTMENTS, IF NECESSARY

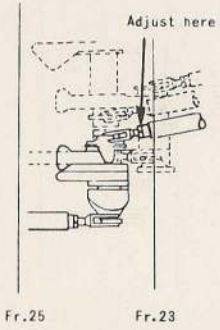


3

(A) With control column in rigging position check setting of torque tube lever at spar 1 (access panel 26S).

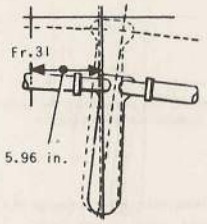


If setting is incorrect, adjust upper control rod at torque tube.

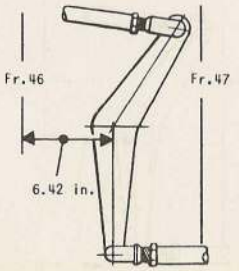


4

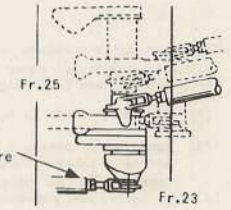
(A) Check setting of lever at Fr.31-32.



(B) Check setting of lever at Fr.46-47.



(A) If setting is incorrect, adjust control rod connected to lower lever on torque tube.



(B) If setting is incorrect adjust on upper control rod.

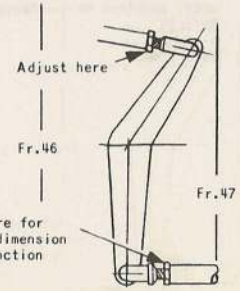


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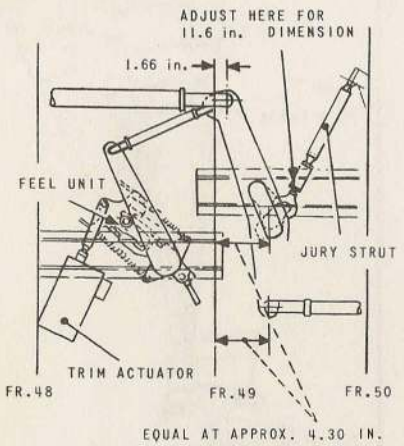
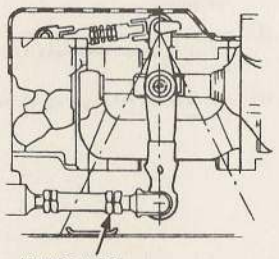
TABLE 1 CONTROLS RIGGING - CONTINUED

Checks	ADJUSTMENTS, IF NECESSARY
5	
(A) Check setting of lever at Fr.49-50.  	If setting is incorrect:- (A) Check that jury strut is nominal length of 11.6 in. (B) Disconnect link to feel unit operating arm. (C) Adjust control rod at lever at Fr.46-47 to obtain 1.66 in. dimension, and length of jury strut to obtain 4.30 in. dimension. (D) Adjust and connect link to feel unit. Note... Pressurize services system to minimum of 1000 lb/in^2 to centre feel unit.
6	
With power in the controls systems (A) Check that tail plane input lever and autostabilizer are in neutral position using rigging and setting pin. (B) With tail plane incidence gauges, port and starboard, in position, check alignment of tail planes and set them in rigging position, i.e.-8° 56' ± 30'. (C) Reconnect control rod to p.f.c.u. input lever. (D) Remove neutral setting rig and all rigging, locating and setting pins. (E) Screw in control column stop to give minimum movement fore-and-aft.	(A) Do not leave pin in autostabilizer. (B) If tail planes are out of alignment re-mesh gears (para.24). (C) Adjust length of control rod if necessary. 
7	
With hydraulic pressure in controls and services systems, electrical power available, autostabilizer on (para.18) and feel selected ON:- (A) Trim tail plane to mid trim position. (B) Apply pitot pressure equivalent to 250 knots and move control column slowly forward, unscrewing control column stop until pointers on tail-plane incidence gauges read +3°15' + ½°. (C) Lock stop. (D) Maintain pitot pressure at 250 knots and move control column slowly aft, unscrewing stop until pointers on incidence gauges read -22° 22' ± ½°. (E) Lock stop.	No fouling or straining to take place during these checks or adjustments. Note Slight lumpiness which may be felt at extremes of tailplane travel is acceptable
8	
(A) Operate trim switch and check trim range which should be:- Trim switch forward Tail-plane angle + 2° 15' ± ½° Trim switch aft Tail-plane angle − 12° 24' ± ½°	If trim range is incorrect, move control column to neutral and disconnect trim actuator ram from feel unit body. Adjust length of trim actuator ram: connect to feel unit body and check trim range.
Remove servicing trolleys and incidence gauges. Inspect all limit stops, control rod adjusters and turnbarrels for correct locking and, where applicable, correct thread engagement.	

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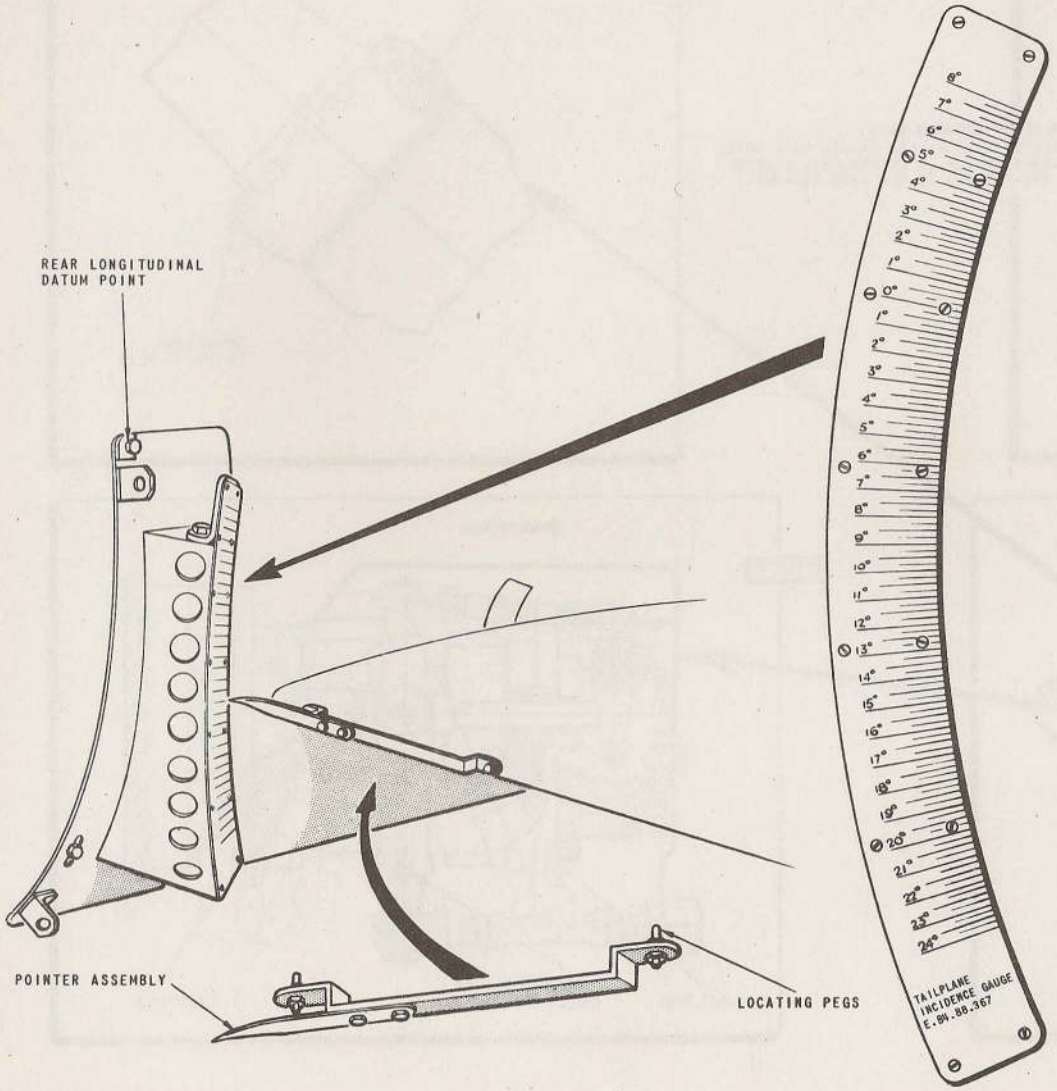

Fig.6. Setting gauge D2101-1

pump handle from its stowage in the port wheel well, fit it to the pump (access panel 79P) and operate the pump to provide pressure for centring the actuator.

(5) Check for centre position using a rigging pin inserted through the guide brackets on the p.f.c.u. Ensure that the spring-loaded rod enters the hole in the linkage by checking that the red painted end of the rod does not protrude from the handle of the rigging pin.

(6) Allow hydraulic pressure to exhaust itself before carrying out operation (7).

(7) Set the master switch on the controller and the instrument master switch to OFF.

Note...

1. Ensure that the rigging pin is removed.

2. It is essential that the ground electrical supplies are connected and that the instrument and F.C.S. master switches remain ON throughout the tail-plane checks to ensure that the autostabilizer remains in neutral.

3. Care must be taken to ensure that no movement of controls occurs while personnel have their hands in the vicinity of the tail-plane actuator, also that the STAB switch remains in the OFF position.

Functioning checks

Preparation

19. The checks detailed in para. 20-22

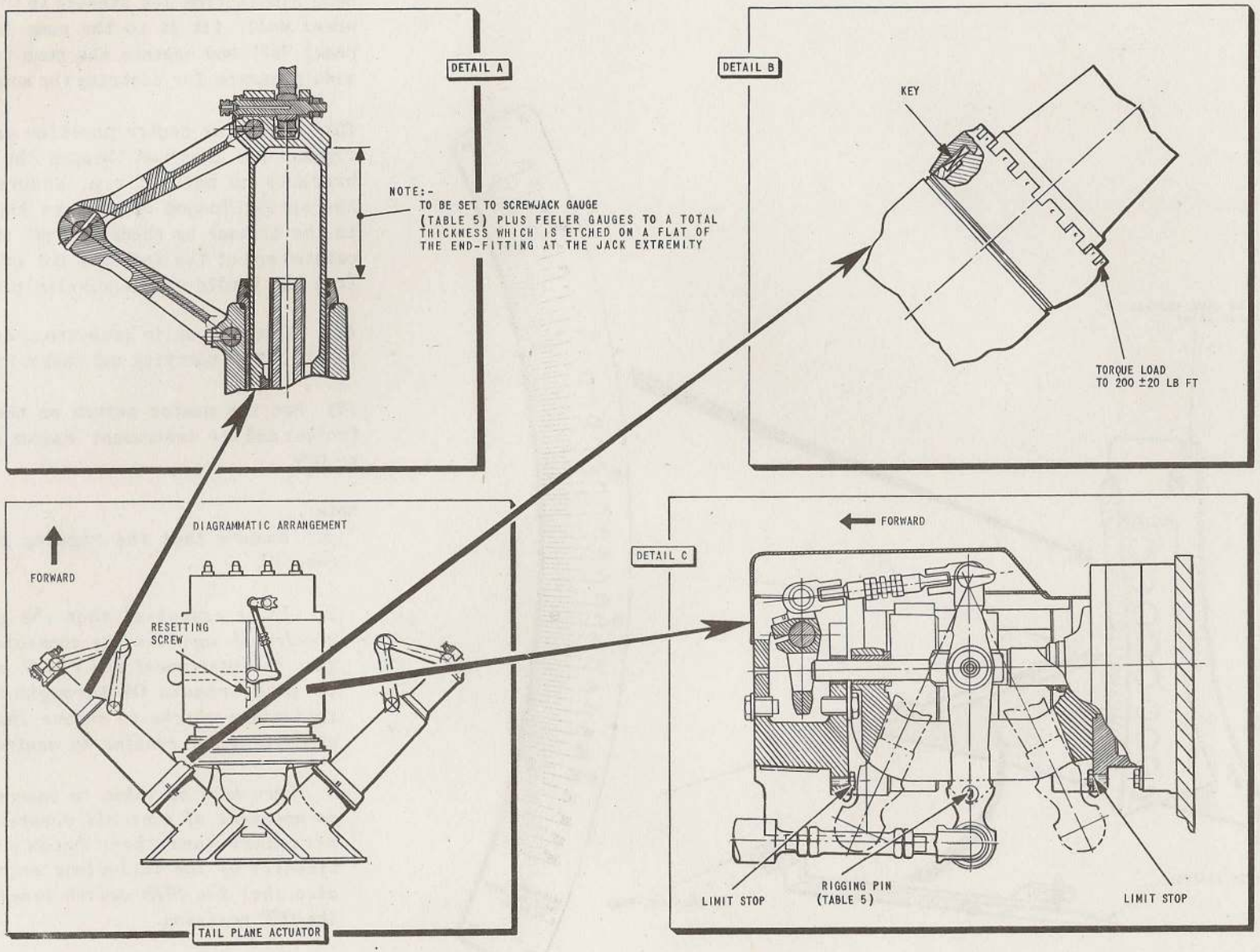

FIG.7. P.F.C.U. SETTINGS

A2103-4

may be carried out only after the controls system has been correctly rigged. The checks given in para. 20, and the pressure test and accumulator capacity test given in Chap. 6 must always be made after a replacement p.f.c.u. has been fitted, while the checks given in para. 20-22 must be carried out after a replacement feel unit has been fitted. Prepare the aircraft as follows:-

(1) Connect a hydraulic servicing trolley to the services and No. 1 controls system ground test couplings (access panel 45P) and the No. 2 controls system (access panel 67P), and an electrical servicing trolley to the ground servicing connection in the port wheel well.

(2) Fit the pitot-static test adapter to the pressure head and connect it to the test rig by means of a rubber hose.

Note...

To ensure that 'feel' is selected correctly when required, the services system must be pressurized to a minimum pressure of 1000 lb/in^2.

(3) Fit the neutral setting rig to the control column and, using an inclinometer, set the control column to the rigging position *(Table 1)*, operating the trim switch if necessary.

Smoothness, friction, and centring checks

20.

(1) Select 'feel' OFF *(para. 19(2) note)*. Move the control column through its full range of movement and check carefully that consistent smoothness is felt throughout the movement. The cause of any perceptible roughness must be traced and eliminated before proceeding with further checks.

Note...

Sudden movement of the control column may cause judder when the aircraft is on trestles; this is acceptable in the trestled condition but not when the aircraft is on the ground.

(2) Using a 4 lb x ½ oz tubular spring balance 15.5 in. from the control column pivot, slowly apply force and check that to initiate movement of the control surface, the force required does not exceed:-

Forward 16 oz Aft 15 oz

(3) Check for centring by displacing the control column to one extreme and allowing it to return, under restraint, towards neutral. Measure the final 'hands off' out-of-centre position. Repeat the check to the opposite extreme. The final out-of-centre position must not exceed 3 deg either side of neutral.

(4) With hydraulic power in the services system, select feel ON at zero knots *(para. 19(2) note)* and repeat instructions (1) and (3). The final out-of-centre positions must not exceed 2½ deg either side of neutral.

Feel spring check

21.

(1) With hydraulic power connected to the No. 1 or No. 2 controls system and to either of the ground couplings of the services system *(para. 19)*, select feel OFF *(para. 19(2) note)*. Start the hydraulic servicing trolleys and trim the control column to the mid trim position.

(2) Attach a 30 lb capacity spring balance to the control column 15.5 in. from the pivot point. Check that the forces required to displace the control column agree with the figures shown in Table 2.

TABLE 2

Spring feel loads

COLUMN ANGLE *(deg)*	SPRING FEEL LOADS *(lb)*
15 fwd.	6 ± 1
10 aft	7 ± 1
16 aft	13 ± 2

Feel performance check

22.

(1) With hydraulic and electrical power connected *(para. 19(1))* trim the control column to the mid trim position and select 'feel' ON at zero knots *(para. 19(2) Note)*.

(2) Attach a 30 lb capacity spring balance to the control column 15.5 in. from the pivot point. Check that the forces required to displace the control column agree with the figures in Table 3. Remove the spring balance.

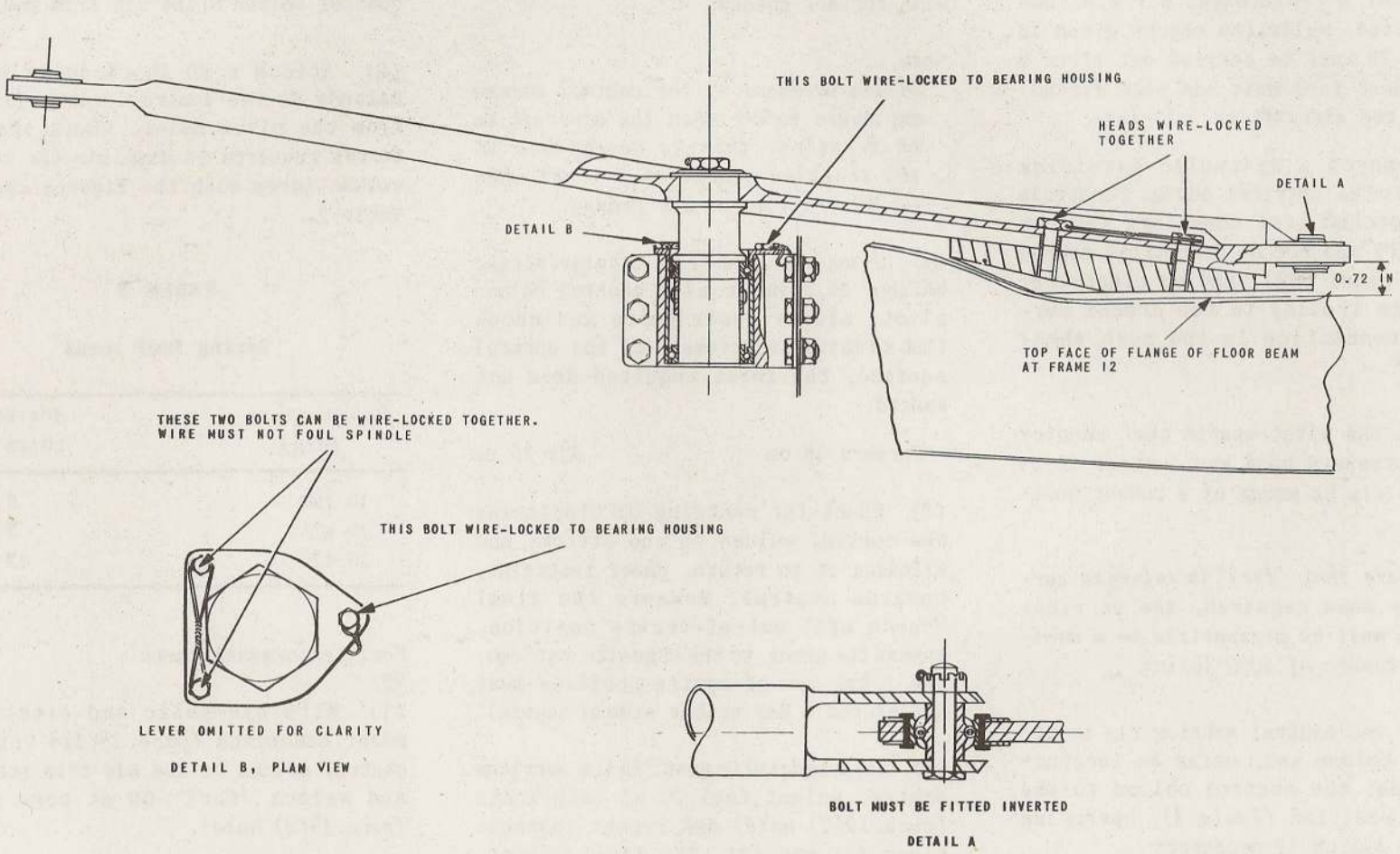

FIG.8. LEVER ASSEMBLY - FRAMES 11-12

A2255-3

TABLE 3

Total feel loads at zero knots I.A.S.

COLUMN ANGLE *(deg)*	FEEL LOAD *(lb)*
15 fwd.	12 ± 2
10 aft	13 ± 2
16 aft	25 ± 3

(3) With conditions as in (1) and (2), but using a 60 lb capacity spring balance and with the system pressurized to represent 500 knots I.A.S., check that the feel forces agree with Table 4. Remove the spring balance.

TABLE 4

Total feel loads at 500 knots I.A.S.

COLUMN ANGLE *(deg)*	FEEL LOAD *(lb)*
15 fwd.	48 ± 4
10 aft	42 ± 4

REMOVAL AND ASSEMBLY

Note...
Bonding is to be restored to its previous state following breakdown of systems.

Tail plane
Removal and assembly
23. For removal and assembly of the tail plane refer to Chap.3.

P.f.c.u.
Removal (fig.4)
24. To remove the p.f.c.u.

(1) Remove the lower reheat jet pipe *(Sect.4, Chap.1)*, the heat shield surrounding the control unit, panels 93 and 103, and the hydraulic pipe fairleads on the debris guard.

(2) Release all hydraulic pressure from the autostabilizer actuator and the tail plane and rudder, No.1 and No. 2 controls system accumulators (rate of operation of the control column not to exceed one stroke between limit stops in five seconds) Drain the services and the No.1 and No.2 controls system hydraulic system reservoirs (access panel 63P), and release the air pressure.

(3) Disconnect the control run from the control unit input lever *(Table 1, detail 1)*.

(4) Disconnect the hydraulic pipe unions to the p.f.c.u. valve block and autostabilizer actuator; and the electrical connections to the latter. Blank the pipe unions and the valve block and autostabilizer actuator connections immediately each connection is broken.

(5) Remove the locking wire from the bolt heads securing the valve block, motors, and the first-stage gearbox assembly to frame 57. Support the unit, remove the bolts, and withdraw the unit forward to disengage the splined shaft.

(6) Remove the oil drain plug from the second-stage gearbox, and drain the lubricant into a suitable container.

(7) Using the spline key turn the gearbox shaft until the jacks are retracted, i.e. tail planes at negative incidence (this is necessary to obtain clearance for removing the bolts connecting the jacks to the tail-plane operating levers).

(8) Support the tail planes, and remove the bolt connecting each jack to its associated lever *(detail B)*.

(9) Remove the starboard jack from the screwjack assembly. Use the torque spanner with an adapter to start the retaining collar.

Note...
On no account must the port screwjack be removed.

(10) Support the unit. Fit a 4 B.A. bolt into the tapped hole of each locating dowel (front face of frame 57), and withdraw the dowels. Break the locking wire and remove the two support bolts from frame 57. Remove the locking wire and withdraw the bolts securing the unit to frame 58. Remove the unit by lifting and turning, to guide the port screwjack through the frame. Retain the shim removed from frame 58.

Assembly (fig.7)
25. If a replacement control unit is to be fitted, drain the oil from the screwjack assembly, and remove the starboard jack. Do not remove the port screwjack.

(1) Position the second-stage gearbox between frames 57 and 58, and fit the shim, previously removed, between the

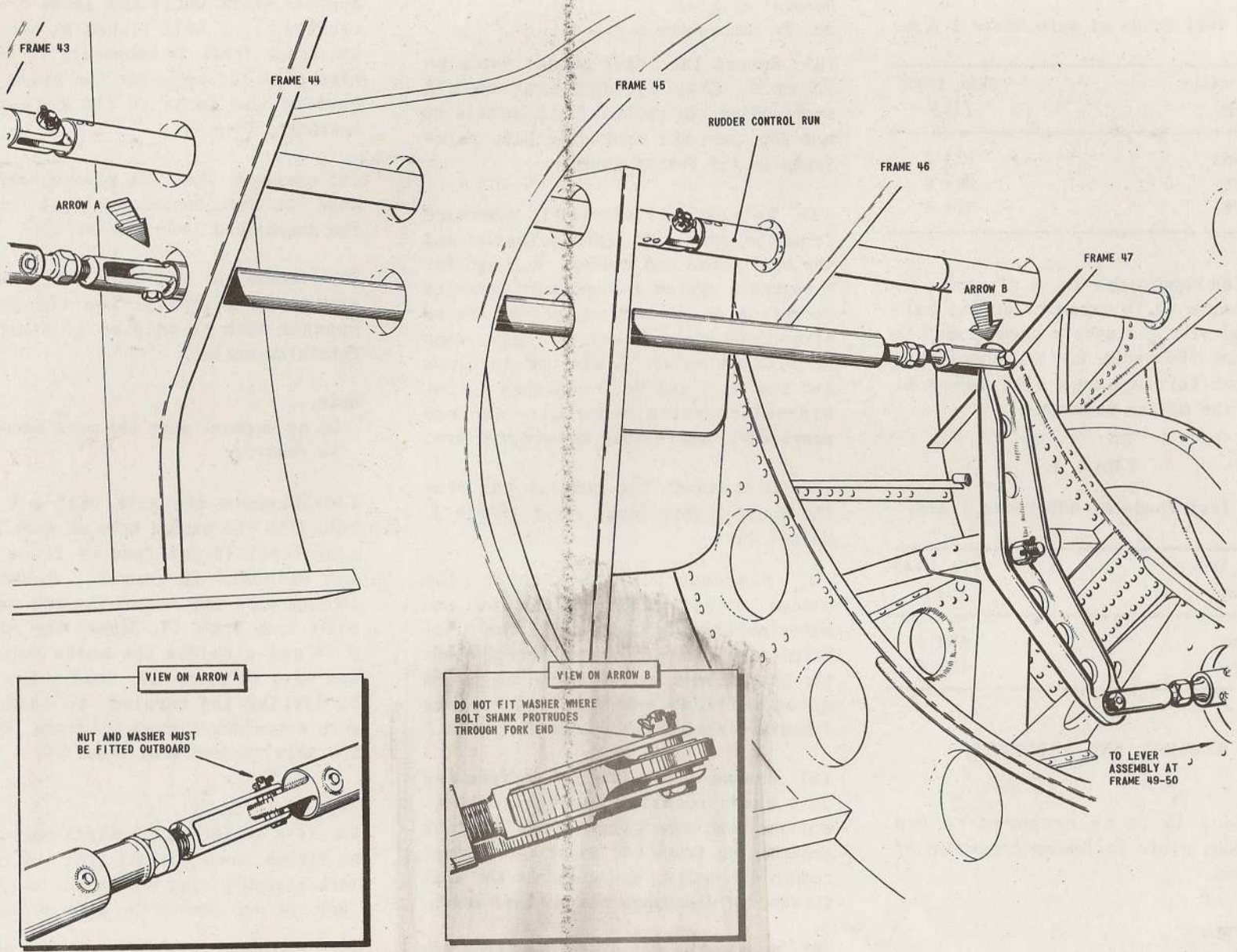

FIG.9. LEVER-ROD ASSEMBLY - FRAMES 43-47

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unit and the forward face of frame 58. Insert the two locating dowels through frame 57 to pick up with the corresponding holes in the flange of the unit (the dowel heads must not stand proud of the frame counterbores). Bolt the unit to frame 58, and fit the two support bolts through frame 57. Wire-lock all bolt heads.

(2) Using the spline key rotate the shaft to set the jack in neutral position to the dimension given in fig.7, detail A. Check with the screwjack setting gauge.

(3) Set the starboard jack in neutral position to the same dimension. Assemble to the gearbox, fitting the key in the keyways formed in the jack body and the bevel gear housing; if the bevel gears do not mesh:-

(a) Ease the jack from the gearbox and gradually rotate the jack bevel clockwise until the gears can mesh. Refit to the gearbox, and measure the jack extension.

(b) Ease the jack from the gearbox, and rotate the jack bevel a full tooth counter-clockwise. Refit, and again measure the jack extension.

(c) Compare the measurement obtained, in (a) and (b) and set the jack to that nearest to the required dimension.

(4) Check that the key is fitted, and screw up the jack retaining collar until tight, but do not lock it.

(5) Using the spline key, wind the jacks to the retracted position (to provide for fitting the greaser bolt connecting the jack to the tail plane operating lever). Connect the jack to ▶ the levers, bolt heads inboard. ◀

(6) Wind the jacks to the neutral position *(detail A)*, and check that both tail planes are at neutral position. If the tail planes are not in alignment, adjust as follows:-

(a) Unscrew the jack retaining collar on the starboard jack, and ease the jack from the gearbox.

(b) Move the jack bevel gear one tooth in the direction required to retract or extend the jack, whichever is necessary.

(c) Refit the jack, fitting the key and tightening the retaining collar; check that the tail planes are now aligned.

(7) Using the torque spanner and adapter tighten the jack retaining collar to 200 ± 20 lb ft *(detail B)*. Wire-lock the collar to the jack body. Wire-lock the nuts at each jack connection to the operating lever, and fit the grease nipples.

(8) Fill the gearbox with oil OX-38 *(para.12)*.

(9) Using the spline key, turn the tail planes through their full range, and check that:-

(a) The jack anti-torsion links do not fully extend when the tail planes are at maximum positive incidence.

(b) The jacks do not bottom when the tail planes are at maximum negative incidence.

(10) Using the spline key, wind the tail planes until the port screwjack is extended to the dimensions given in fig. 7, detail A.

(11) Before assembling the torque converter refer to A.P.105D-0405-16AC for the method of establishing the neutral setting.

(12) Install the torque converter assembly from above, taking care that the spline is not disturbed by more than half a tooth on mating, and that hydraulic pipes are not fouled or damaged. Mate the splined shafts, bolt the unit to the frame, and wire-lock the bolt heads.

(13) Connect No.1 and No.2 controls hydraulic couplings to the p.f.c.u. and services hydraulic couplings to the autostabilizer actuator. Refit the fairleads on the debris guard.

(14) Set the control column and the system levers in neutral position *(Table 1, detail 1)*.

(15) Connect the control rod to the input lever of the torque converter assembly, adjusting, if necessary, on the turnbarrel adjuster on the rod. Remove the rigging pin from the input lever and the setting pin from the autostabilizer linkage.

(16) Check the nitrogen pressure in the tail-plane and rudder No.1 and No.2 controls systems accumulators, fill and pressurize the hydraulic fluid reservoirs *(Chap.6)*. Connect a hydraulic servicing trolley to each of the controls hydraulic systems ground couplings (access panels 45P and 67P).

(17) Operate the hand pump on the trolleys sufficiently to check that the tail planes remain aligned with the neutral position on the rigging gauge; if movement does occur, correct the alignment by operating the hand pump again whilst carefully adjusting on the turnbarrel adjuster at the input lever. Check that the rigging pin will enter the input lever after adjustment.

(18) Check the hydraulic connections for leakage, and wire-lock them; lock the turnbarrel adjuster. Bleed the controls and services systems *(Chap.6)*.

(19) Fulfil the instructions given in Table 1, detail 6, 7 and 8.

(20) Carry out the smoothness, friction and centring checks given in para.20 and the tail-plane operational and accumulator capacity checks *(Chap.6)*.

TABLE 5

Tools and equipment

Ref.No.	Part No.	Description	Application/remarks
26DK/95063	EB2.88.2993	Key, spline	
26DK/95404	CH.116242/1	Gauge, screwjack	
1L/231		Spanner, torque, 30-225 lb ft	Tail-plane operating mechanism
27KH/2778	CH.105732	Adapter, torque spanner	Use with 1L/231
26DK/1484340	EF3.88.2539	Pin, rigging	Tail-plane p.f.c.u.
26DK/95127	EB1.88.1093	Pin, locating	Control rigging
26DK/95134	CH.109215	Pin, setting	Autostabilizer setting
1H/118		Balance, spring, tubular, 0-4 lb	Tail plane control movement
1A/1275138		Balance, spring, 0-30 lb	
1A/4273		Balance, spring, 0-60 lb	
26DK/95572	EB4.88.367	Gauge, incidence, tail plane, port	
26DK/95573	EB4.88.368	Gauge, incidence, tail plane, stbd.	
26DK/95778	EB3.88.143	Rig, setting, control column and rudder bar	
4F/3603		Trolley, hydraulic servicing Mk.3	C/W No.1,2,3, and 4 conversion kits
4FE/3761 or 4FE/4257		Trolley, electrical servicing	15kVA/10kW I.C.E.-driven
4FE/3786 or 4FE/4257 or 4FE/5147		Trolley, electrical servicing	15kVA/10kW, electrical-driven
6C/2106 or		Sets, test, pitot static, Mk.3	
6C/3131		Sets, test, pitot static, Mk.5	

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