

Chapter 3 TAIL UNIT

LIST OF CONTENTS

DESCRIPTION	Para.	DESCRIPTION	Para.	DESCRIPTION	Para.	
		Rudder-to-fin attachments ...	8		Checking the rudder break-away torque ...	14
SERVICING						
REMOVAL AND ASSEMBLY						
<i>Tail plane</i>		<i>Lubrication</i>		<i>Tail plane</i>		
General information ...	1	General information ...	9	Removal ...	15	
Structure ...	2	Lubricating the hinge-shaft inner bearing		Assembly ...	16	
Spar ...	3	Dismantling ...	10	<i>Rudder</i>		
Bearings ...	4	Re-packing with grease ...	11	Removal ...	17	
<i>Fin and rudder</i>		Assembly ...	12	Assembly ...	18	
General information ...	5	Charging the rudder damper ...	13	◀ Rudder damper		
Fin structure ...	6			Removal and assembly ...	19 ▶	
Rudder structure ...	7					

LIST OF ILLUSTRATIONS

DESCRIPTION	Fig.
Tail plane key diagram ...	1
Fin and rudder key diagram ...	2
Tail-plane removal ...	3
Tail-plane assembly ...	4
Rudder - removal and assembly ...	5

DESCRIPTION

Tail plane*General information*

1. The slab tail plane consists of two separate, similar components, mounted one on each side of the rear fuselage in bearing housings attached to frame 57. The units pivot simultaneously in ball and roller bearings when operated by a twin screwjack p.f.c.u. powered by the No. 1 and No. 2 control hydraulic systems. ▶

Structure (fig. 1)

2. The basic structure of each tail

plane unit is a torsion box in which a single, centrally-disposed spar is connected to front and rear shear walls by transverse ribs. This structure is covered by light-alloy stressed skins, stiffened by stringers. The aerofoil section of the tail plane is completed by the addition of a leading-edge fairing, a conventional stressed-skin trailing-edge structure, and an aluminium-honeycomb tip-structure.

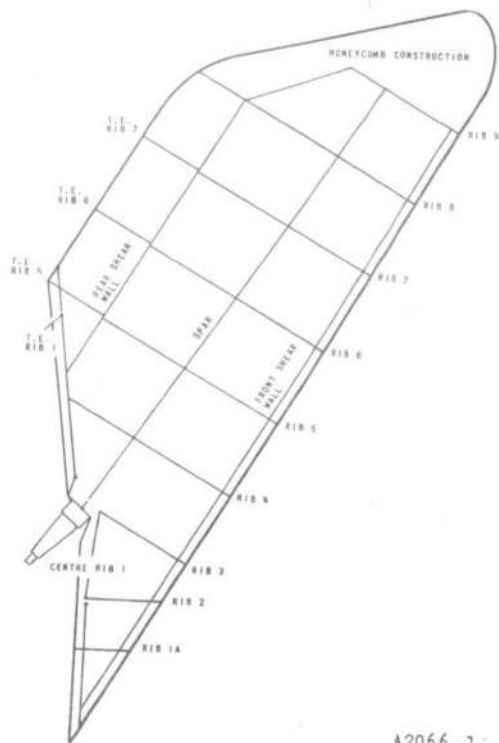
Spar

3. The spar is a composite structure comprising a built-up I-section beam and

a steel forging connected by a tapered lap-joint. The forging is machined at its inboard end, to form the tail-plane hinge shaft which has two bearing surfaces, of different diameters, for the ball and roller bearings in which the tail-plane shaft pivots.

Bearings

4. Each tail-plane hinge shaft pivots in a double-row tapered roller bearing at its inner end and a double-row ball-bearing at its outer end. The outer race of each bearing has a spherical profile which matches the split seating of the



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Fig. 1. Tail-plane key diagram

retaining nut and bearing housing. The inner bearing can be dismantled, for periodic lubrication, using special-to-type tools (para.10).

Fin and rudder

General information

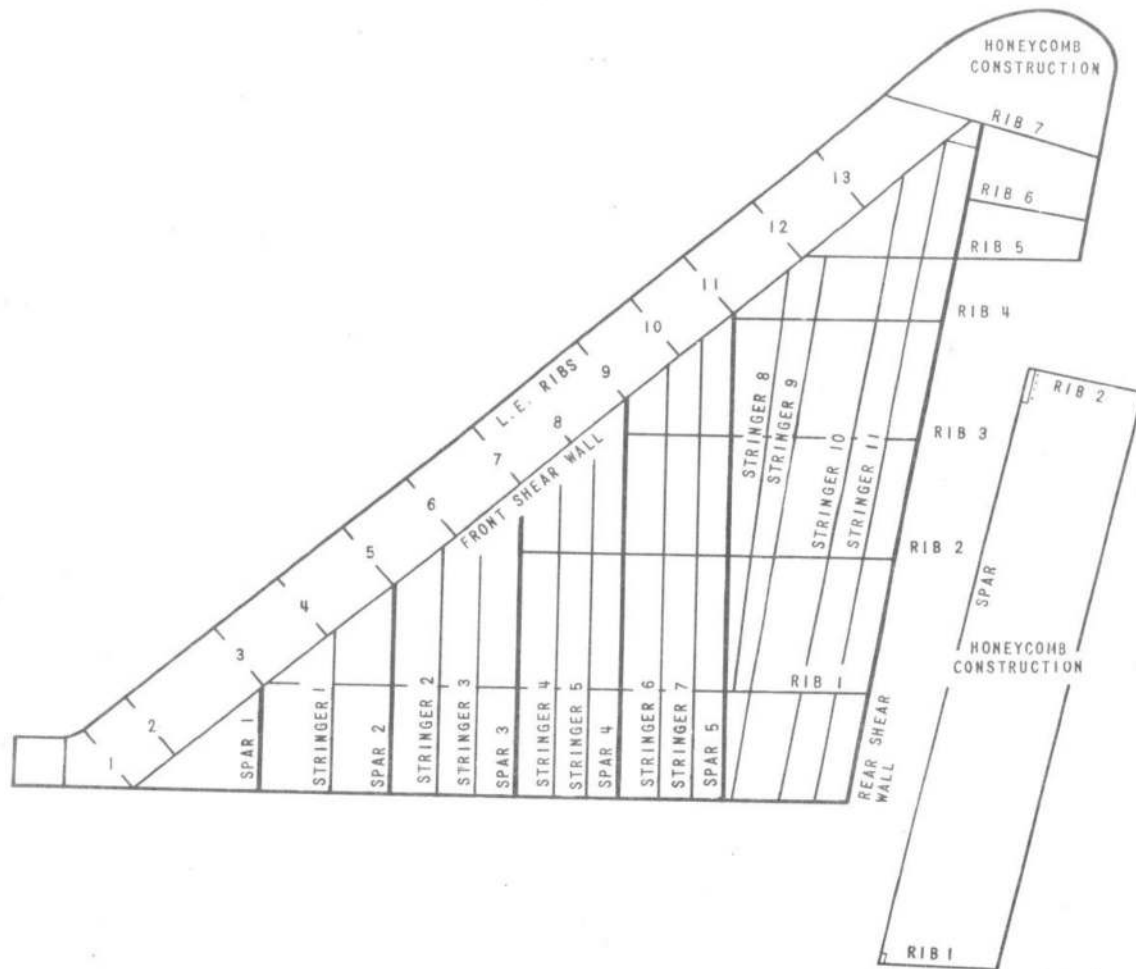
5. The single dorsal fin is bolted to the fuselage frames and carries the rudder hinged in a cut-out in its trailing edge. The removable fin tip is separated from the main structure by a dielectric strip and forms the U.H.F. aerial. An air intake in the leading edge communicates with an internal duct

which conveys cooling air to the auxiliary drive unit (Sect.4, Chap.1).

Fin structure (fig.2)

6. The basic structure of the fin comprises vertical spars and stringers, and horizontal ribs, contained by converging front and rear shear walls, the

whole covered by light-alloy stressed skins. Two additional ribs, and an extension of rib 5, support the aluminium-honeycomb fin tip and the trailing-edge structure above the rudder cut-out. The leading-edge profile is a light-alloy fairing supported by thirteen ribs set perpendicular to the front shear wall. The fin spars extend downward beyond



A2067-2

Fig. 2. Fin and rudder key diagram

the fin area and form the attachments to the fuselage frames.

Rudder structure (fig. 2)

7. The structure consists mainly of an aluminium-honeycomb panel contained by a single spar at the leading edge, two ribs at top and bottom, and a light-alloy skin. A hydraulic damper unit is bolted to the structure in a cut-out at the top of the leading edge. Two rudder hinge brackets are attached to the spar at the bottom and centre hinge positions, and the third is clamped to a splined shaft protruding from the bottom of the damper.

Rudder-to-fin attachments

8. All attachments are made through the hinge brackets. The top two are made to channel brackets, on the fin rear shear wall, with special-to-type bolts and tubular nuts which are locked by circlips inserted in the bolt-and-nut cavities. The bottom hinge-bracket is clamped to the splined rudder-pintle which protrudes upwards through the fuselage skin. For removal and assembly purposes, the rudder is detached from the bottom hinge bracket and, to ensure correct location of the bracket during subsequent reassembly, the securing bolts for attaching the rudder to the bracket are inserted through detachable tapered shear bushes which are jig-fitted during manufacture. If a replacement rudder is being fitted, the bottom bracket of the new rudder must be detached from the rudder and assembled to the pintle.

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

General information

9. Apart from the periodic lubrication of the tail-plane hinge-shaft inner bearing (*para. 10*) lubrication is carried out prior to assembly of components to the airframe. The rudder hinge cavities and tail-plane bearings are packed with grease, XG-278 at this stage. Lubrication of the actuating linkages is described in Chap. 4.

Lubricating the hinge-shaft inner bearing

Note...

This is necessary only when an outer bearing is being replaced (A.P. 101B-1001-5). The tail plane must be removed (*para. 15*) before the bearings can be lubricated or replaced.

Dismantling

10. To dismantle the bearing:-

(1) Secure the dismantling jig Ref. No. 26DK/95375 in a bench vice, and place the bearing over the spigot, locating the flats on the inner sleeves with the flanges of the jig body. Insert the steady bolt supplied with the jig. Straighten the lock-washer tabs and unscrew the bearing nut, using socket

Ref. No. 26DK/95374 and a ½ in. square drive tommy bar.

(2) Lift the bearing components off the inner sleeve and arrange them, on a dust-free surface, so that they may be assembled in the reverse order to that in which they were dismantled.

Re-packing with grease

11. To re-pack the bearing:-

(1) Thoroughly degrease the components and allow them to dry out completely. No dust or grit must enter the components.

(2) Apply grease XG-278 to the bearing cages and running surfaces, ensuring that all surfaces are completely covered.

Assembly

12. To assemble the bearing:-

(1) Place the inner sleeve of the bearing over the spigot of the dismantling jig (*para. 10*) and insert the steady bolt.

(2) Assemble the bearing cages, the spacer and the outer race.

(3) Fit a new lock washer.

(4) Fit the nut and tighten it, using a socket (*para. 10*) and a torque wrench Ref. No. 1C/6686 set to give 100 lb ft torque loading. Check the torque loading by two further applications of the wrench to the socket.

(5) Lock the nut by bending up at least two of the lock-washer tabs.

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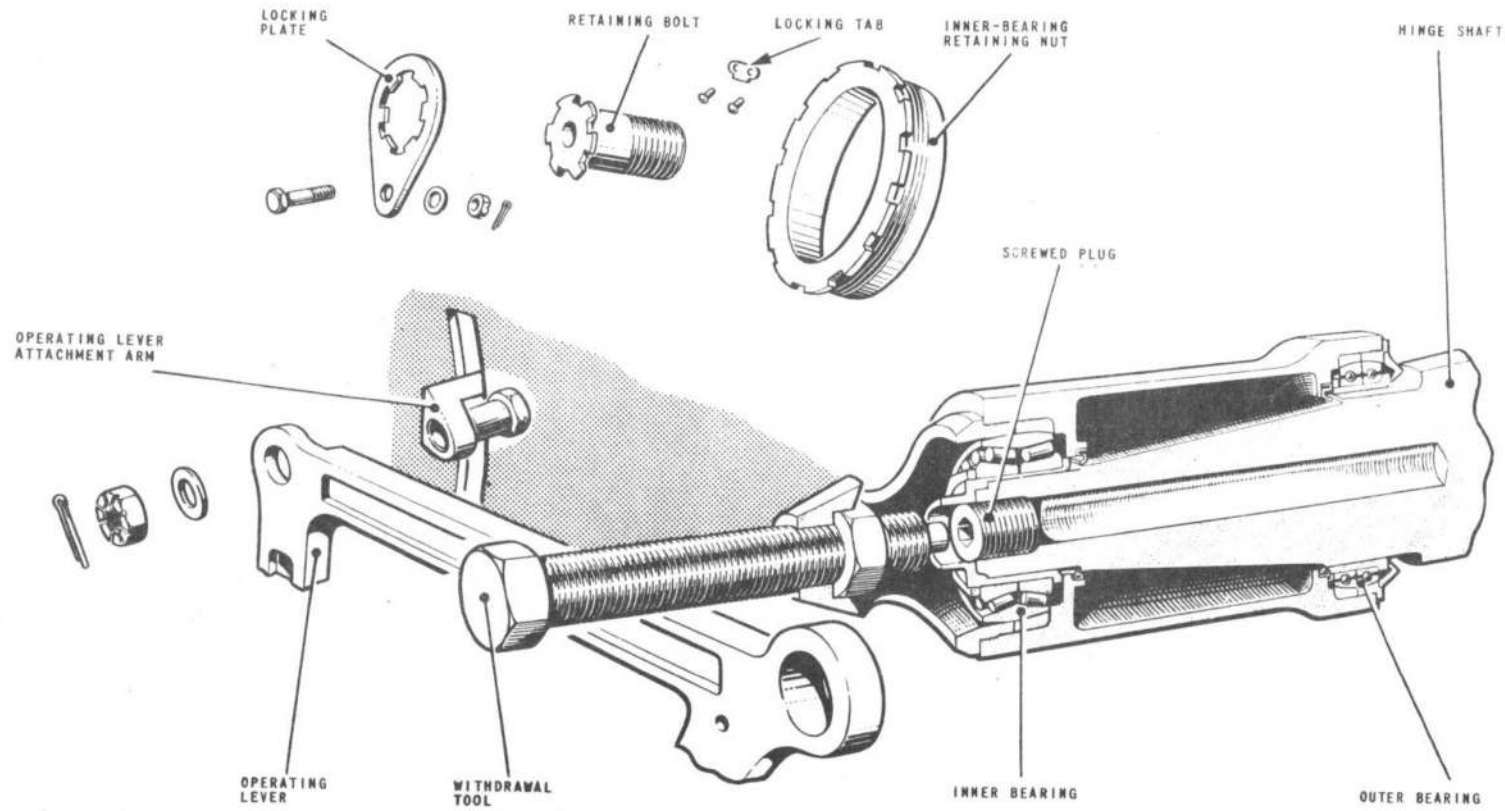


FIG.3. TAIL-PLANE REMOVAL

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Charging the rudder damper**13. To charge the damper:-**

(1) Remove the small panel in the fin port skin at the top of the rudder cut-out, by removing two countersunk screws.

(2) Remove the closing screw from the top of the damper plunger and fit union Ref.No. 26DK/95152.

(3) Connect a lubricating gun Ref.No. 1B/4467, fitted with adapter Ref.No. 27Q/14103 and containing oil OM-15, to the union.

(4) Charge the damper until the plunger protrudes 0.5 in.; do not exceed this dimension.

(5) Remove the gun and adapter, and unscrew the union.

(6) Adjust the pressure in the damper by displacing the valve in the end of the damper plunger until the plunger extension is 0.375 in. Use checking gauge Ref.No. 26DK/95786 which is graduated for measurement and incorporates a probe for valve displacement. If air continues to emerge when the plunger has retracted to 0.375 in. repeat the charging and bleeding operation until all air is removed. The damper shaft may be rotated to assist the removal of air from the working chamber.

(7) Refit the closing screw and the panel.

Note...

1. If the damper is not installed in

the aircraft the charging and bleeding procedure must be accomplished with the damper in a vertical position, plunger uppermost.

2. The dimensions given apply at a temperature of 70-80 deg F. For each 35 deg F increase add 0.03 in. For each 35 deg F decrease subtract 0.03 in. ▶

Checking the rudder break-away torque**14. To check the torque:-**

(1) Remove access panel 86S and release the rudder p. f. c. u. from the rudder king-lever

(2) Insert a ¼ in. dia. bolt through the port end of the rudder slinging point and loop a piece of cord over the bolt head. The cord must contact the rudder skin and extend beyond the trailing edge.

(3) Form a loop of the free end of the cord and attach a spring balance.

(4) Move the rudder fully to port.

(5) Pass the cord around the trailing edge of the rudder and apply a pull, with the spring balance, to move the rudder to starboard through its full travel; the cord must be kept at right angles to the rudder at all positions. At no time, throughout the travel, must the applied pull exceed 4 pounds.

(6) Reverse the bolt and cord and repeat operation (5), moving the rudder to port.

(7) Connect the p. f. c. u. to the king lever, lock the attachment bolt, and refit the access panel.

REMOVAL AND ASSEMBLY**Tail plane**

Removal (fig.3)

15. To remove either tail plane component:-

(1) Exhaust all pressure from the controls hydraulic systems accumulators by moving the rudder until all movement ceases.

(2) Position a fuselage trestle at frame 59 (Sect. 2, Chap. 4).

(3) Remove No. 1 engine reheat jet pipe (Sect. 4, Chap. 1).

(4) Fit the fuselage lower walkway Ref.No. 26DK/95055 (Sect. 2, Chap. 4).

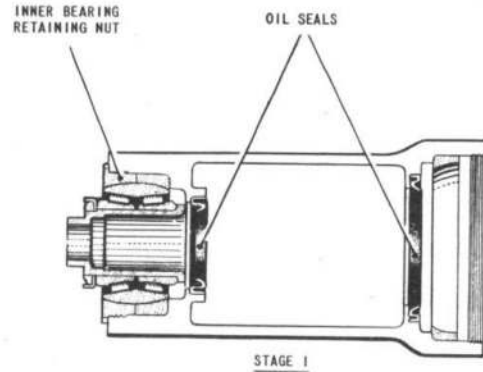
(5) Remove the section of heat shield covering the appropriate tail plane bearing housing, and the small triangular panel from the aft side of the fuselage slot.

(6) Disconnect the tail plane operating lever from the attachment arm, and the p. f. c. u. screwjack.

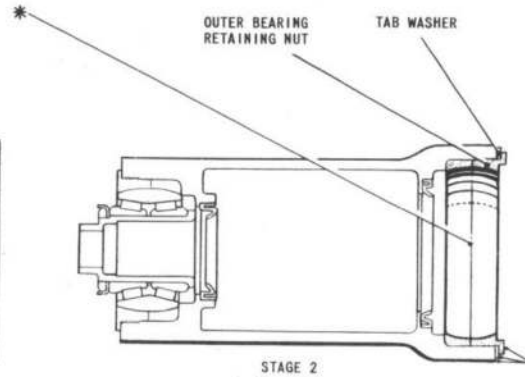
Note...

It will be necessary to move the tail plane in order to remove the bolts. If the first-stage gearbox of the p. f. c. u. is not fitted, spline key Ref.No. 26DK/95063 can be used to rotate the jack drive pinions. If the

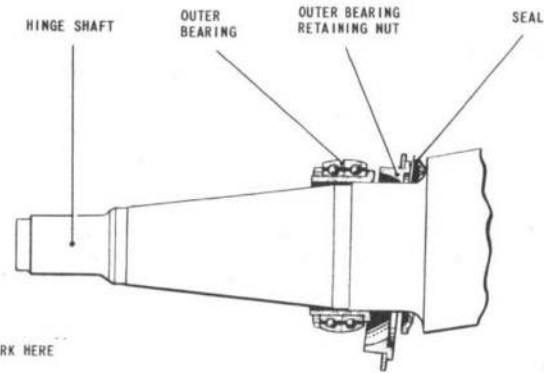
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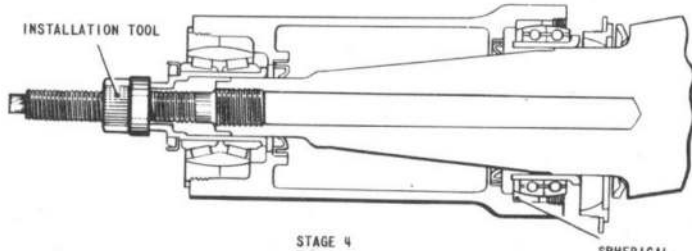
FIT THE INNER AND OUTER OIL SEALS AND THE INNER BEARING TO THE TAIL-PLANE HOUSING. TIGHTEN THE RETAINING NUT WITH BOX SPANNER REF.NO.26DK/95149 AND FIT THE LOCKING TAB. LOCK ITS SCREWS BY CENTRE PUNCHING.



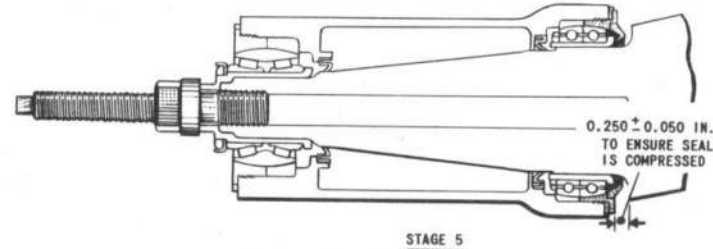
FIT THE OUTER BEARING RETAINING NUT AND TAB WASHER AND TIGHTEN THE NUT WITH BOX SPANNER REF.NO.26DK/95061 UNTIL THE FACES MARKED * ABUT. MARK THE RELATIVE POSITIONS OF NUT, WASHER AND HOUSING AND REMOVE THE NUT.



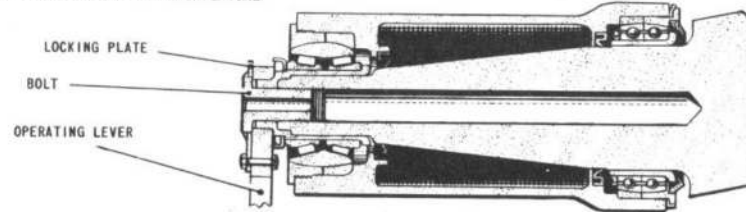
PLACE THE OUTER SEAL AND RETAINING NUT OVER THE TAIL-PLANE HINGE SHAFT, AND PRESS THE OUTER BEARING EVENLY OVER THE SHAFT TO THE POSITION ILLUSTRATED.



ENTER THE TAIL-PLANE HINGE SHAFT INTO ITS HOUSING AND SCREW INSTALLATION TOOL REF.NO.26DK/95178 FULLY INTO THE SHAFT. DRAW THE SHAFT INTO THE INNER BEARING UNTIL THE OUTER BEARING CONTACTS ITS SPHERICAL SEATING.



SCREW THE OUTER BEARING RETAINING NUT INTO THE HOUSING AND TIGHTEN IT WITH SPANNER REF.NO.26DK/95169 AND 26DK/95170, TO ALIGN THE MARKINGS MADE AT STAGE 2. LOCK THE NUT WITH THE TAB WASHER AND POSITION THE SEAL. DRAW THE TAIL PLANE FULLY HOME WITH THE INSTALLATION TOOL.



REMOVE THE INSTALLATION TOOL. ATTACH THE TAIL-PLANE OPERATING LEVER, SECURE IT WITH THE BOLT AND LOCK THE BOLT WITH THE LOCKING PLATE.

FIG.4. TAIL-PLANE ASSEMBLY

◀ DIMENSION ALTERED, STAGE 5 ▶

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p.f.c.u. is complete, connect a hydraulic ground servicing trolley to one of the controls systems, and, using the trolley hand pump to provide pressure, operate the p.f.c.u. control valve to move the tail plane.

- (7) Remove the locking plate from the tail plane operating lever.
- (8) Withdraw the retaining bolt, using spanner Ref.No. 26DK/95150 and remove the operating lever.
- (9) Remove the inner bearing retaining nut, using spanner Ref.No. 26DK/95140, after removing the locking tab.
- (10) Attach tail-plane sling Ref.No. 26DK/95102 to the slinging point, and suspend it from suitable standard lifting tackle; take the weight of the tail plane.
- (11) Insert the screwed plug, which is supplied with withdrawal tool Ref.No. 26DK/95062, as far as it will go into the end of the tail plane hinge shaft.
- (12) Screw the withdrawal tool cage into the bearing housing.
- (13) With the tail plane supported, screw down the withdrawal tool bolt to push the hinge shaft out of its housing.
- (14) Place the tail plane in a stand Ref.No. 26DK/95289.
- (15) Unlock the outer bearing retaining nut tab washer and unscrew the nut, using spanner Ref.No. 26DK/95061.

- (16) Remove the withdrawal tool and screwed plug.

Assembly (fig.4)

16. To assemble a tail-plane component:-

- (1) Coat all exposed surfaces of the hinge shaft and bearing housing with ◀ grease XG-278. ▶
- (2) Assemble the tail plane to the fuselage by following the instructions given in the illustration.
- (3) Connect the tail plane operating lever to the tail plane attachment arm and the screwjack.

◀ Note... ▶

It is essential that the operating lever is correctly lined-up before final tightening is carried out on any one of the three attachment points. ▶

- (4) Refit the heat shield and the triangular panel.
- (5) Remove the fuselage walkway.
- (6) Refit the jet pipe (Sect.4, Chap.1).

Rudder

Removal (fig.5)

17. To remove the rudder:-

- (1) Exhaust all pressure from the controls hydraulic systems accumulators by operating the tail plane until movement ceases.
- (2) Fit the rudder sling Ref.No. 26DK/

95022, suspended from standard lifting tackle.

- (3) Remove the upper of two hexagon-headed bolts in the bottom hinge bracket. The bolt and its nut are visible through the cut-away in the fin skin.

- (4) Withdraw the four countersunk hexagon-drive screws securing the bottom bracket to the rudder structure.

- (5) Insert extractor Ref.No. 26DK/95172 into each of the shear bushes in turn, using the extractor tommy bar, and free the bushes by screwing on the outer nut.

- (6) Release the top hinge bracket from ◀ the fin by removing the split pin, nut, bolt and bushes. ▶

- (7) Free the rudder from its bottom hinge-bracket and remove it from the aircraft.

- (8) If a replacement rudder is being fitted, remove the existing bottom bracket (detail B) and use the bracket supplied with the replacement rudder.

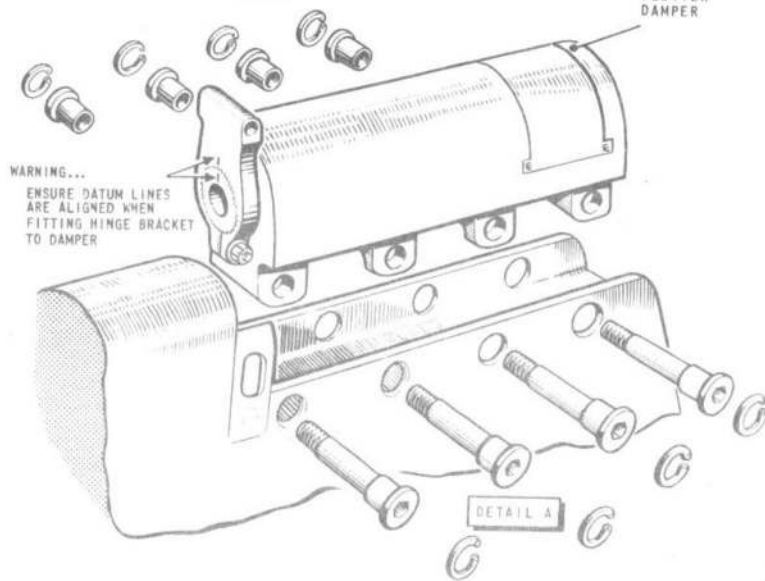
Assembly (fig.5)

18. To assemble the rudder:-

- (1) If the rudder is a replacement item, detach the bottom hinge bracket as described in para. 17 (3) and (4).
- (2) Lightly grease the splines of the ◀ bracket with grease XG-278 and fit it ▶ to the rudder pintle. (Note the position

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RUDDER FLUTTER - DAMPER REMOVAL



SPLINED ATTACHMENT-BRACKET REMOVAL

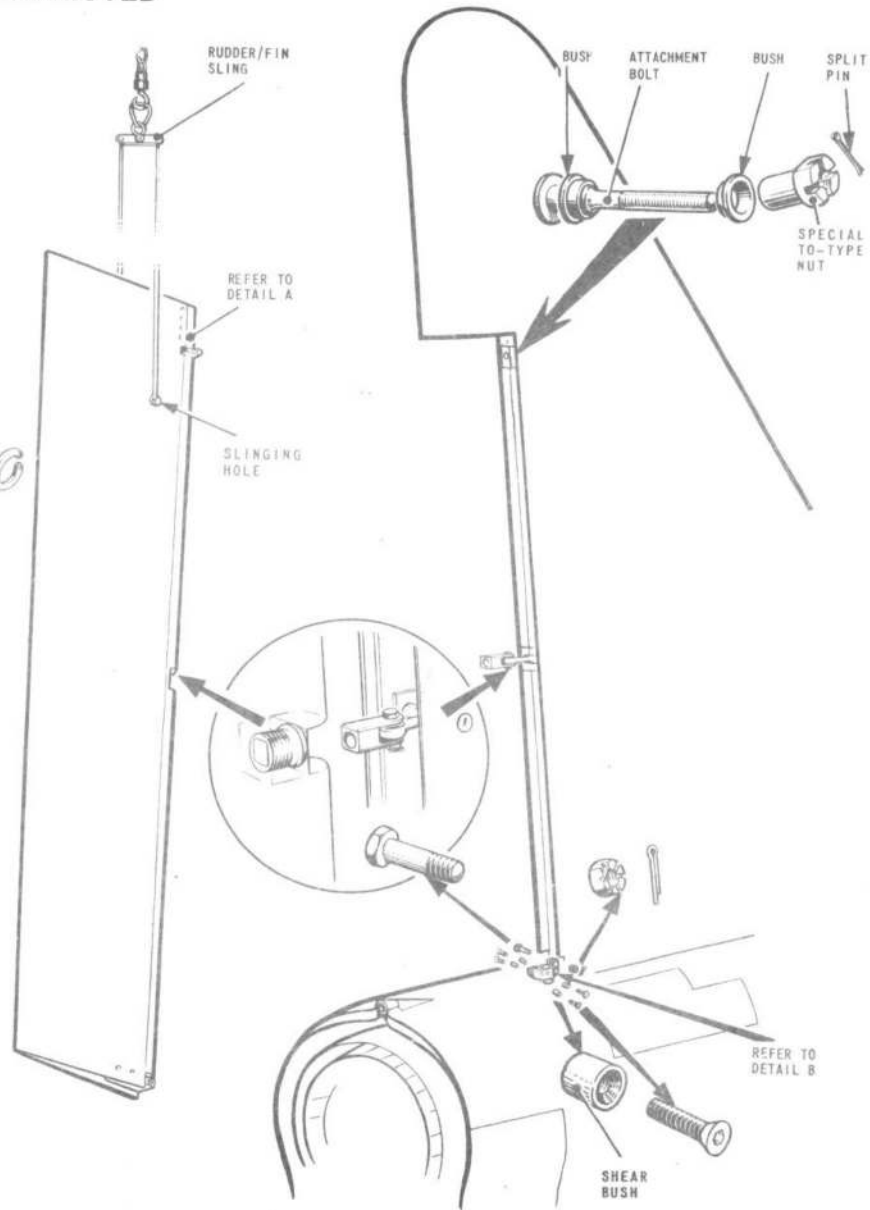
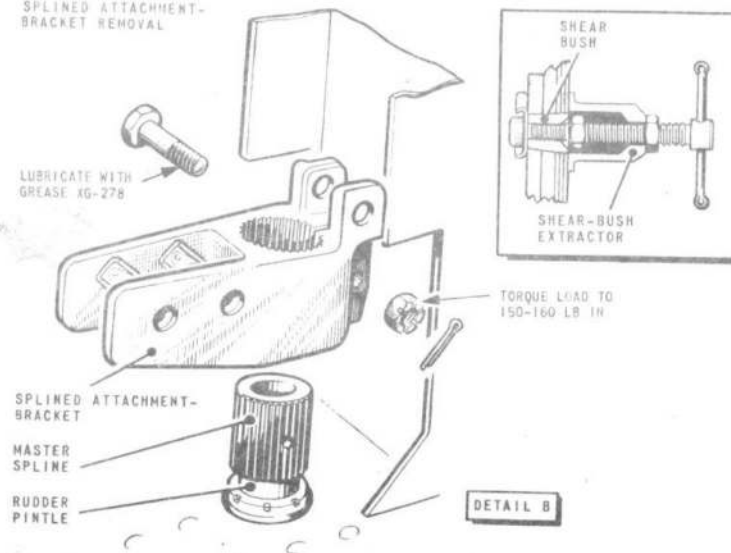


FIG.5. RUDDER-REMOVAL AND ASSEMBLY

◀ MINOR AMENDMENTS ▶

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of the master spline). Insert the clamp
◀ bolt and fit and lock its nut, refer to
fig. 5 for torque loading.

(3) Lightly lubricate the spigot of
the centre hinge with grease XG-278. ▶

(4) Offer up the rudder, line up the
centre hinge spigot, and secure the top

hinge bracket to the fin, using the
existing fastenings.

(5) Fit the shear bushes, the counter-
sunk bolts and the hexagon-headed bolt
to the bottom bracket.

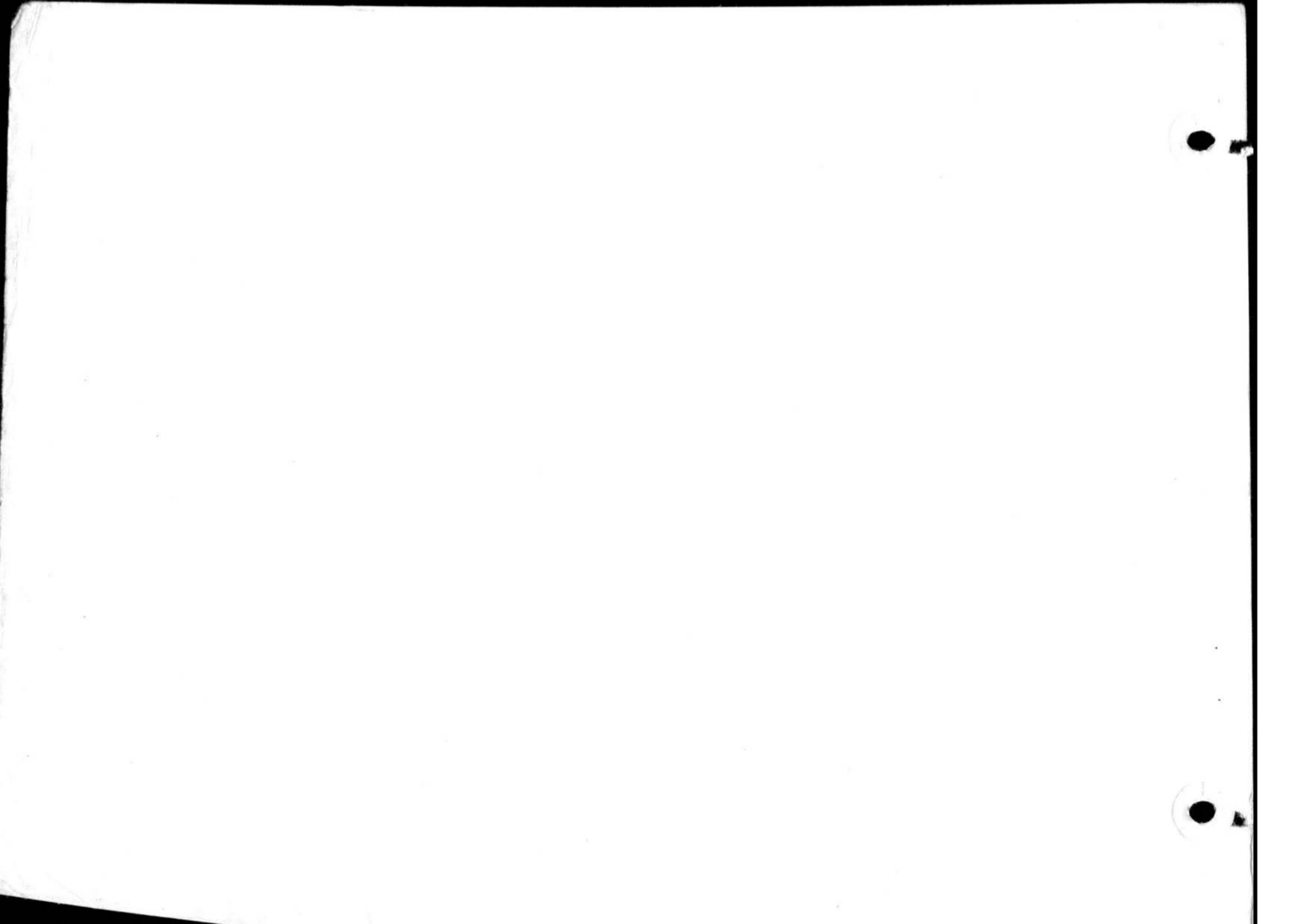
(6) Examine the damper unit and re-
charge it if necessary (para. 13).

(7) Check the rudder break-away torque
(para. 14).

◀ Rudder damper

Removal and assembly

19. To remove or assemble the rudder
damper refer to fig. 5, detail A, paying
particular attention to the WARNING for
spline alignment. ▶



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