A.P.101B-0402-1A
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SECTION 4

POWER UNIT INSTALLATION

LIST OF CHAPTERS OVERLEAF

SECTION 4

POWER UNIT INSTALLATION

LIST OF CHAPTERS

Note:- *A list of contents appears at the beginning of each chapter*

Chapter 1 POWER UNIT

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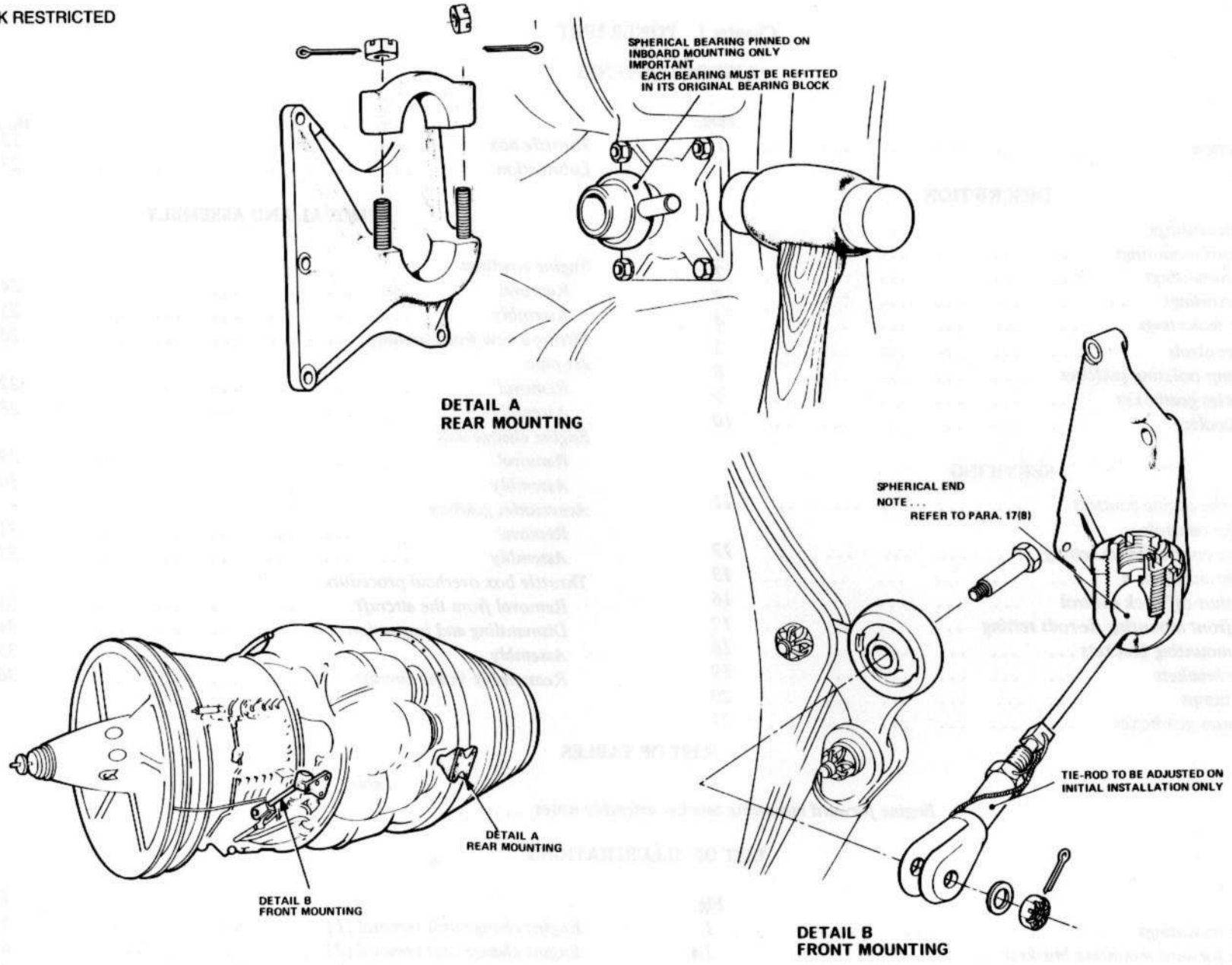


FIG. 1. ENGINE MOUNTINGS

◀ NOTE ADDED TO SPHERICAL END ▶

Introduction

1. This chapter describes the power unit installation, gives details of certain servicing operations, and recommends the method of removing and assembling engines, cowlings, jetpipes, and accessories gearboxes. The fuel system is described in Chapter 2 of this Section. The engines are described in detail in A.P.102C-1522-1.

DESCRIPTION

Engine mountings *(fig.1)*

◀ **WARNING**

The closing panels (Post STI/CAN/583B) must only be removed for access to the engine mounting bracket attachment fasteners. Each bolt securing the panels must be identified during removal of the panels to ensure correct relocation on reassembly of panels. ▶

Forward mountings

2. These consist of ball-ended tie rods pinned to tubular mountings on the engine, the ball ends being suspended in cup brackets attached to the main-plane ribs.

Note...

It is of paramount importance that fouling between the rib structure and the cup brackets be eliminated. The cup brackets should be to STI/Canberra/583 standard as shown in fig.1A.

Rear mountings

2A. These consist of spherical bearing collars fitted to trunnions on the engine nozzle box assembly. The rear inboard bearing collars are pinned to their respective trunnions but the outboard bearing collars float on their trunnions, thus allowing for expansion. The bearing collars fit into the rear engine mountings attached to the main-plane ribs and are secured by clamps. The clamp fixing studs are of unequal thread size, e.g. 3/8 in. BSF and 7/16 BSF thereby preventing incorrect assembly.

Note...

It is important that the clamping caps are refitted to their respective mountings on re-installation of the engines.

Engine cowlings *(fig.2)*

3. Each engine cowling is in four positions which are secured to the main-plane structure by quick-release toggle fasteners, Dzus fasteners, and screw; the service panel in the bottom cowling is attached by four toggle fasteners only. The toggle fasteners are of simple design and are protected by cover plates which are locked with Dzus fasteners. To release a toggle fastener, remove the cover plate and raise the fastener by the ring in the end of the lever.

Jet-pipe mountings *(fig.3)*

4. At its forward end the jet pipe is bolted to the engine transition piece, and is also supported by two lugs which rest on channel-section runners in the main plane. At the rear end the jet pipe is supported by two fitting on the main-plane rear wall; these fittings incorporate screwed spigots with eccentric bosses at their ends which engage in housing brackets on either side of the jet pipe. This arrangement allows the jet pipe to expand under operating conditions, and enables its alignment to be adjusted on installation.

Engine controls *(fig.4)*

5. The throttle and high-pressure shut-off cock control levers are mounted on the engine quadrant on the pilot's console, with the throttle levers inboard. All the control runs are similar in construction and operation; they consist of Simmonds Corsey controls from the control levers to the pressure bulkhead, and thereafter push-pull rods and levers. Relighting switches are incorporated in the handles of the H.P. shut-off cock control levers.

6. From the Simmonds Corsey controls at the pressure bulkhead the controls for the port engine pass down the port side of the fuselage to bell-crank levers in the bomb bay, where their direction is changed outboard. From these levers the control pass through the main-plane, immediately aft of the leading edge, to levers on the engine bay inboard rib, change-over levers being interposed midway to reverse the direction of movement, and from these levers the controls pass direct to the control levers on the engine.

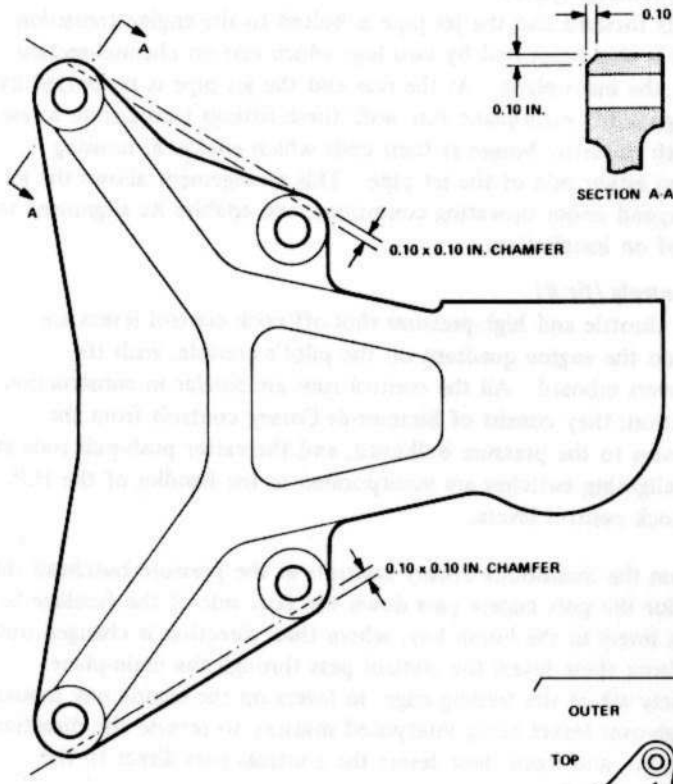
7. The controls for the starboard engine pass aft from the Simmons Corsey controls to the forward end of the centre fuselage, where bell-crank levers change their direction across the fuselage to similar levers on the starboard side. The controls then pass aft, down the fuselage, to further bell-crank levers in the bomb bay. From these levers the controls pass to the engines in a similar manner to those for the port engine.

Fuel pump isolating switches

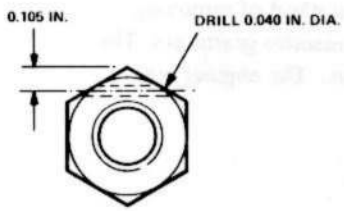
8. These switches safeguard against failure of the servo side of the engine fuel system, by isolating one of the two fuel pumps on the engine from barometric control. The are situated on the pilot's console, immediately aft of the engine controls quadrant.

Accessories gearboxes *(fig.7)*

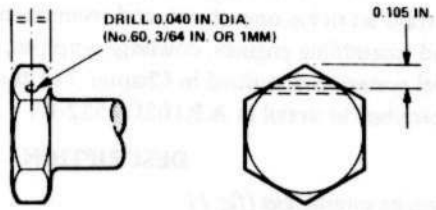
9. An extension shaft from the internal wheel-case of each engine drives an accessories gearbox mounted in the main-plane inboard of the



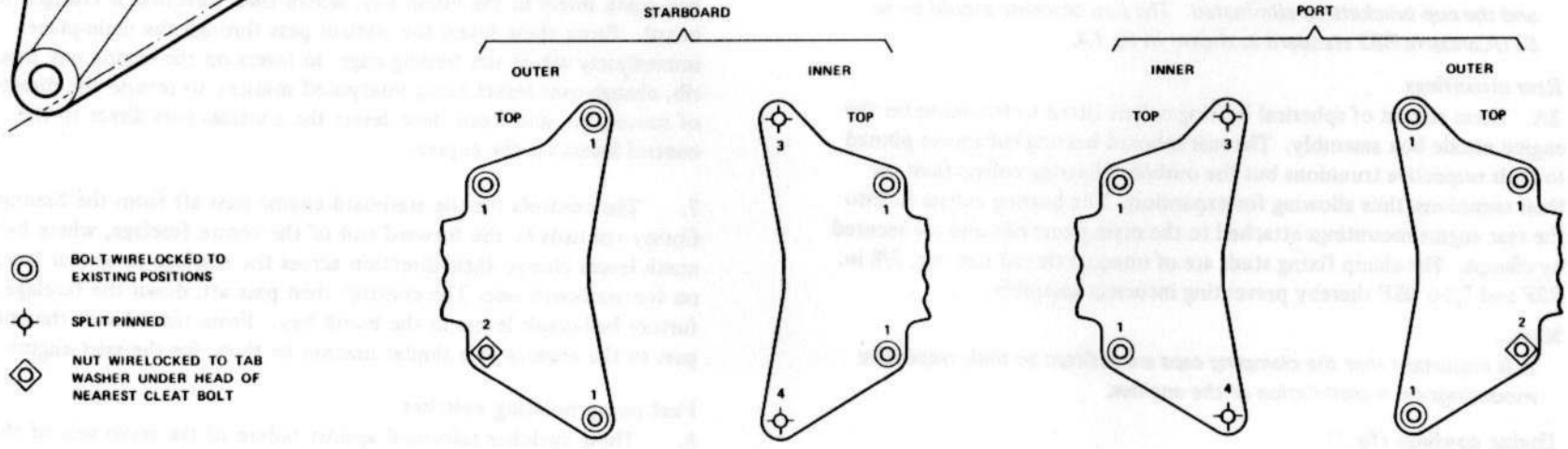
DETAIL A –
VIEW OF TYPICAL ENGINE BRACKET



DETAIL C –
MODIFICATION TO NUT A58GT



DETAIL D –
MODIFICATION TO BOLTS A25/11G AND A25/12G



DETAIL B – BOLT LOCATIONS AND LOCKING

BOLT PART/REF. NUMBERS

1. EEAS·222·11G (26FZ/6119298) *
2. EEAS·222·12G (26DK/CR 17465) *
3. EA1·51·39 (EYE BOLT 26FZ/953)
4. EA1·51·37 (EYE BOLT 26FZ/952)

* IF ITEMS 1 OR 2 ARE NOT AVAILABLE, BOLTS A25/11G (28D/1212386) OR A25/12G (28D/1011260) MAY BE USED WHEN MODIFIED AS SHOWN IN DETAIL D.

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FIG. 1A. ENGINE FORWARD MOUNTING BRACKETS

◄

TABLE 1

ENGINE FORWARD MOUNTING BRACKET ASSEMBLY NOTES

1. All cleats, counterbore threaded holes 5/16 in. diameter to a depth of 0.050 ± 0.010 inch.

   Note : Not applicable to holes repaired to ASD 1867RS or ASD 1883RS.

2. Before fitment of brackets to aircraft, the bolts and washers under the bolt heads are to be selectively fitted to ensure that the plain shank of each bolt protrudes through the bracket by 0.15 ± 0.010 inch for the outboard positions, and by 0.26 ± 0.010 inch for the inboard positions (use slip gauges as a guide). Washers are to be selected from SP127G (0.018 in.) (28W/9470720), SP124G (0.048in.) (28W/9489335) or SP125G (0.104in.) (28W/9706992).

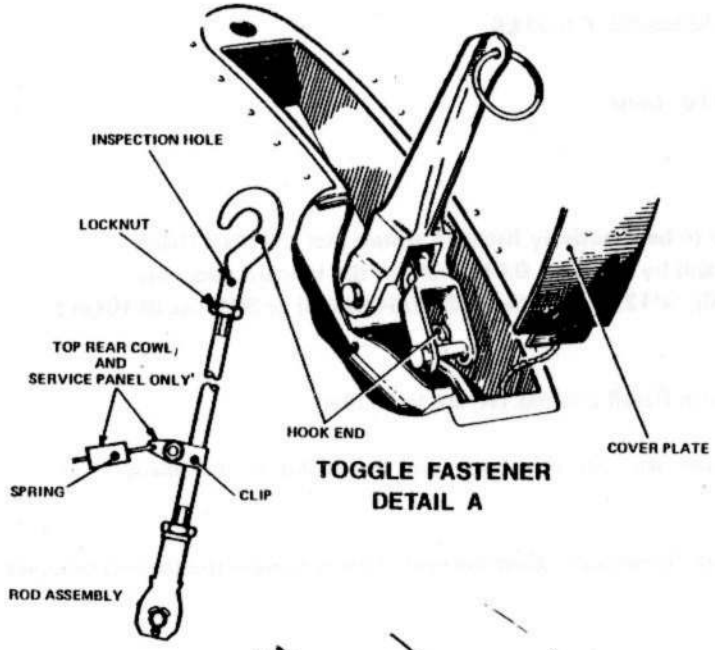
3. At Location 2 nuts A58/GT (28M/4199618) drilled for wirelocking in accordance with Detail C of fig.1A, are to be used.

4. At Locations 2, 3 and 4, ensure that the SP124/G washer (28W/9489335) under the nut does not foul the radius of the cleat. If necessary, the washer may be relieved to clear the radius.

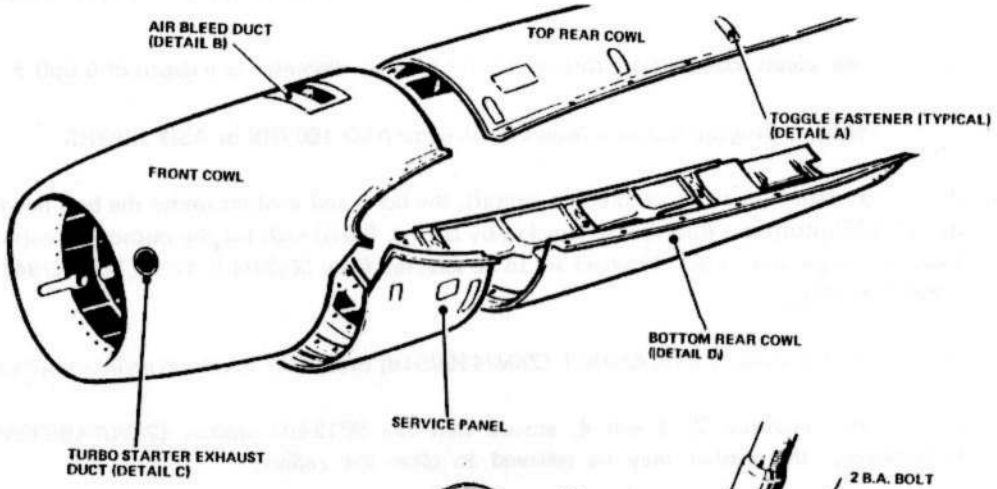
5. At locations 3 and 4 if a foul occurs between countersunk cleat attachment bolts and the eyebolts, then the eyebolt(s) is to have the threads cropped back to 1½ threads minimum from the nut. Restore protective treatment.

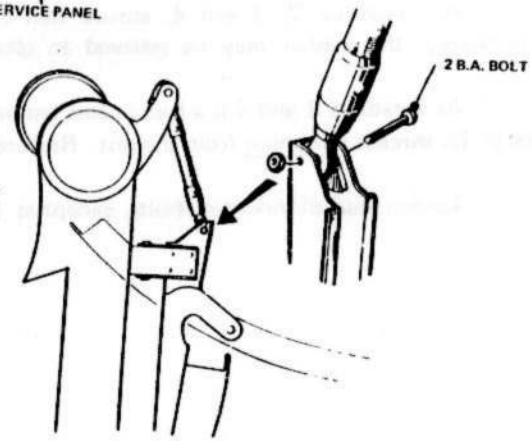
6. Torque load all mounting bolts, except at Locations 3 and 4 to 115 - 125 lbf/in.

►

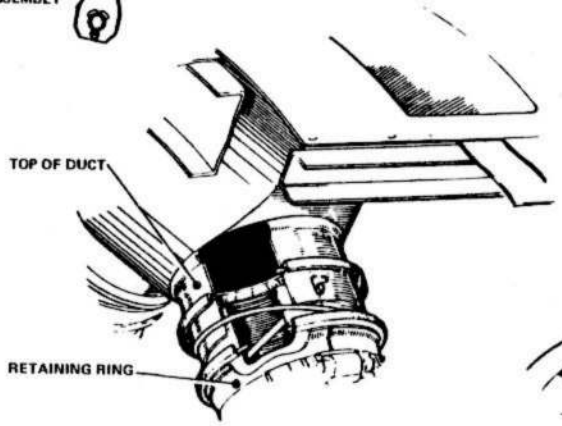


TOGGLE FASTENER
DETAIL A

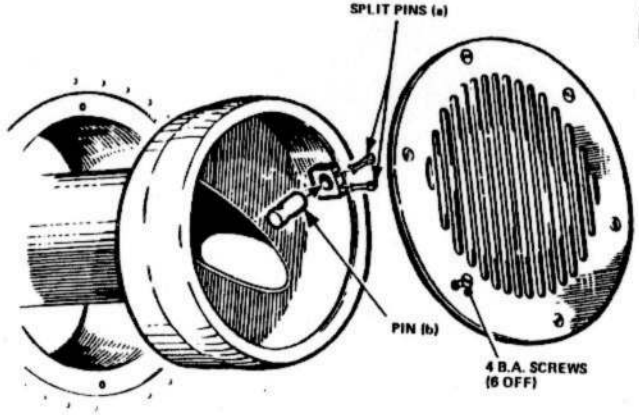




COWLING FLAP
LINKAGE
DETAIL D



AIR BLEED DUCT
DETAIL B



TURBO STARTER
EXHAUST DUCT
DETAIL C

FIG. 2 ENGINE COWLINGS

engine. Each gearbox drives an electrical generator and a hydraulic pump, details of which are given in Leading Particulars.

Engine cooling

10. The cooling system for each engine and jet pipe is divided into three zones. Zone 1 extends from the front of the engine to the cowling hoop, zone 2 from the cowling hoop to the main spar, and zone 3 from the main spar to the rear of the jet pipe. Air enters zone 1 through the two ducts in the underside of the service panel, and is exhausted through two outlets in the upper surface of the engine front cowling. Cooling air enters zone 2 through ducts in the leading edge of the main plane, one on either side of the engine; air from this zone, induced by aerodynamic air flow to the rear of the jet pipe, flows between the jet pipe and the main spar into zone 3. During ground running, cooling air is admitted into zone 2 through an inlet in the bottom rear cowling, adjacent to the main undercarriage.

SERVICING

WARNING

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

Note . . .

The gearbox and sump oil has a deleterious effect on paint, rubber, electric cables etc., care must be taken to avoid spilling it on such parts.

Rigging the engine controls *(fig.4)*

11. The equipment required for rigging the engine controls is detailed in Sect.2, Chap.4, Table 1. In use the control lever setting plate is inserted in the operating slot of the control quadrant, alongside the lever being set, with its lower end resting on the flanges of the quadrant. The plate has a central tongue to indicate the mid position of the control lever, and on either side of the tongue the plate is marked with 15 deg and 30 deg positions. The setting disc is attached to the shaft of the throttle or shut-off cock lever on the engine, its indicator being attached to a convenient point on the engine so that its pointed end registers with the circumference of the disc; the disc is marked off in degrees.

To rig the controls

Engine control levers setting

12.

(1) Insert the throttle-box setting plate in the operating slot of the quadrant and set all levers in line with the midway position marked on the plate. Lock the levers in this position by tightening the friction dampers on the control quadrant.

(2) Disconnect the control rods to the engine at the bell-crank levers on the engine inboard ribs.

(3) Working through the system from the throttle-box control levers, adjust the control rods in turn until all bell-crank levers are set with one arm at 90 deg to the centre line of the aircraft.

(4) Set the bell-crank levers on the engine inboard ribs to their mid positions using gauges EA1.88.547 and 548.

(5) Ensure that the engine throttle operating lever vernier adjusters are set to their Basic Setting positions, and fit the levers to the throttle valve spindles using setting discs and indicators, or a throttle setting kit Part No.BA28664, as follows.

No.1 engine

(6) Mount the setting disc and indicator on the engine throttle control lever, and move the lever to the closed position.

(7) Remove the nut securing the lever to its splined shaft, suspend a plumb line from the centre of the shaft and, without moving the shaft, set the lever to 2 deg outboard of vertical. If necessary, adjust by the vernier splines on the lever and lever hub.

No.2 engine

(8) Mount the setting disc and indicator on the engine throttle control lever and move the lever to the closed position.

(9) Remove the nut securing the lever to its splined shaft, suspend a plumb line from the centre of the shaft and, without moving the shaft, set the lever to 8 deg below horizontal on the inboard side. If necessary adjust by the vernier splines on the lever and lever hub.

(10) Unlock the throttle friction damper on the control quadrant and move the levers through their full travel checking for freedom of movement. Move the levers to the closed position (30 deg aft of the mid position) and lock the friction damper.

(11) Reconnect both No.1 and No.2 throttle control rods at the bell-crank levers on the engine inboard ribs, taking care not to alter the engine lever settings. Adjust the control connecting rods if necessary.

(12) Unlock the throttle friction damper and check the throttle levers for freedom of movement over 60 deg range, simultaneously ensuring

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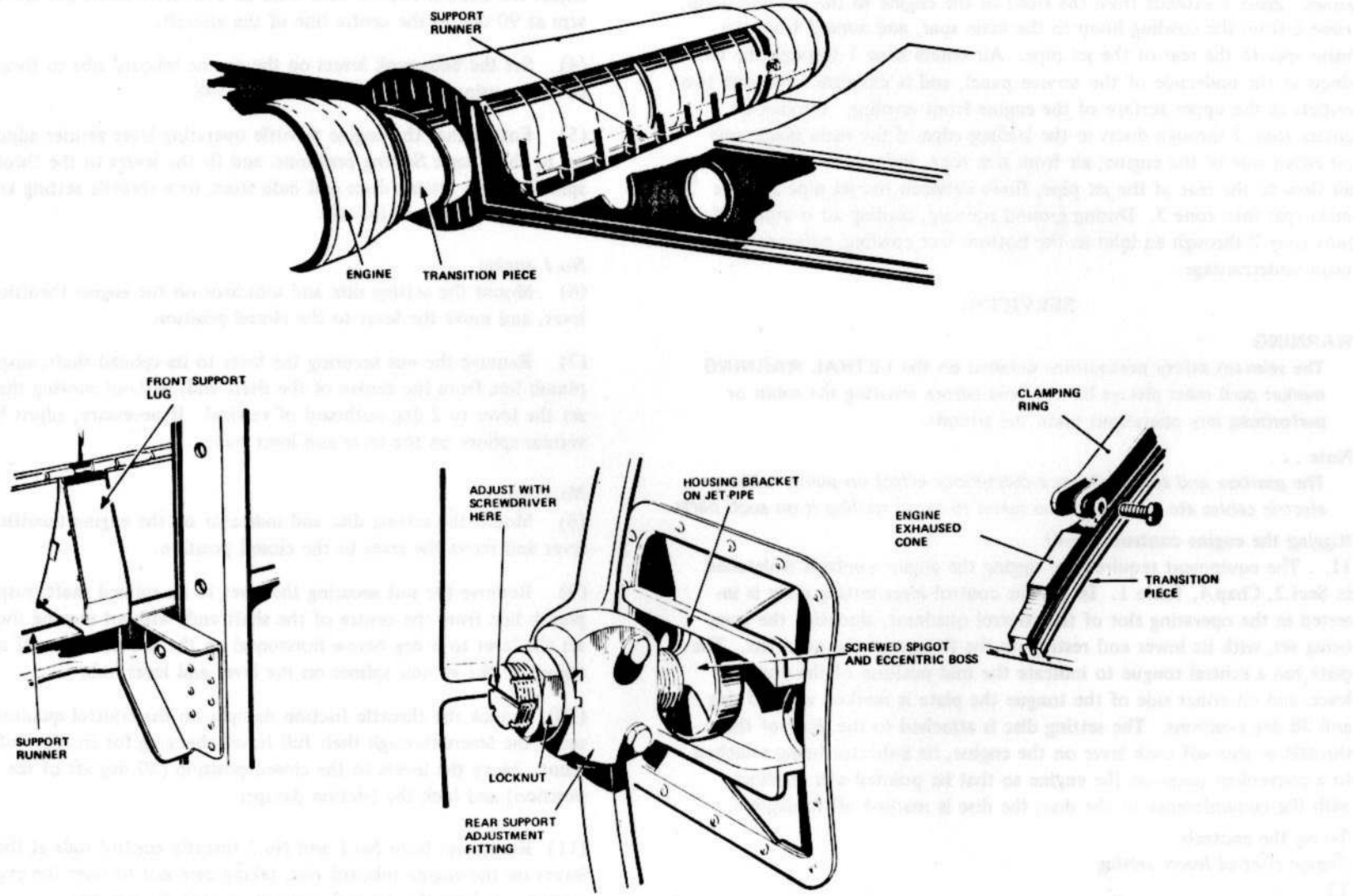

FIG.3. JET - PIPE INSTALLATION

that the engine levers have a full travel of 80 deg. Adjust the control connecting rods if necessary.

Synchronization

13. Synchronization checks should be carried out at various positions on the throttle quadrant from slow running to full throttle. In no case should there be more than 2 deg variation.

14. Adjustment for synchronization is made by progressively adjusting the control rods from throttle-box to engine, and finally, if necessary, adjusting by means of the serrations on the engine throttle levers.

15. Adjust the stops in the control quandrant until, with the engine levers on their stops, there is a clearance of 1/16 in. between the quadrant stops and levers in both the open and closed positions.

H.P. shut-off cock control

16. Set the controls and bell-crank levers as for setting the throttle controls *(para.12(1) and (3))*.

(1) Disconnect the control rods to the engine at the bell-crank levers on the engine inboard rib.

No.1 engine

(2) Mount the setting disc and indicator on the shut-off cock lever, and move the lever to the closed position. Suspend a plumb line from the centre of the spindle, and check that the lever is set 15 deg outboard of vertical.

No.2 engine

(3) Mount the setting disc and indicator on the shut-off cock lever, and move the lever to the closed position. Suspend a plumb line from the centre of the spindle, and check that the lever is set at 10 deg below horizontal on the inboard side.

(4) Unlock the shut-off cock friction damper on the control quadrant, move the levers to the closed position and relock the damper. Reconnect both No.1 and No.2 engine shut-off cock control rods at the bell-crank levers on the engine inboard ribs, taking care not to alter the settings. Adjust the rod lengths to fit if necessary.

(5) Unlock the H.P. shut-off cock friction damper and check for freedom of movement over 60 deg range, simultaneously ensuring that the engine levers have a full travel of 90 deg. Adjust if necessary, by varying the lengths of the control rods from throttle box to engine.

(6) Adjust the stops in the control quadrant until, with the engine shut-off cock levers on their stops, there is a clearance of 1/16 in. between the levers and the quadrant stops in both the open and closed positions.

(7) After setting the throttle and shut-off cock lever controls, remove setting discs and indicators, replace nuts, and lock all adjustment and attachment points.

Engine front mounting tie-rods setting

17. The length of the front mounting tie-rods is set during initial assembly; no alteration should be necessary during subsequent engine changes. If the setting of the front mounting tie-rods has been disturbed, the procedure for re-aligning the engine is as follows:-

(1) Jack the aircraft *(Sect.2, Chap.4)*. The jacks are to be adjusted sufficiently to ensure that the main plane structure remains on a reasonable level plane. There is no need to raise the aircraft with the undercarriage clear of the ground.

(2) Using the gauge *(Sect.2, Chap.4, Table 1)* and a clinometer at the inboard rigging position on each main plane, check and record the main plane incidence.

◀ (2A) For installed E.C.U.s, using a locally manufactured engine compressor casing support block and aircraft main jack (4Q/1045838, 10 ton type), support the front of the E.C.U. whilst making tie-rod adjustments. ▶

(3) Using a sling *(Sect.2, Chap.4, Table 2)* lower the engine on to its rear mountings in the engine bay *(A.P.102C-1522-1)*.

(4) Connect the front mounting tie-rods to the engine.

(5) Remove the turbo-starter *(A.P.102C-1522-16)*.

(6) Place a straight edge and clinometer on the front face of the starter housing and, with the weight of the engine taken on the sling adjust the length of the front mounting tie-rods until the engine longitudinal datum is 0 deg 5 min ± 5 min less than the main plane chord incidence.

Note . . .

A basic main plane incidence of 4 deg 49 min measured at the inboard rigging position, corresponds to a main plane chord incidence of 2 deg. Make allowance for any variation between the basic incidence

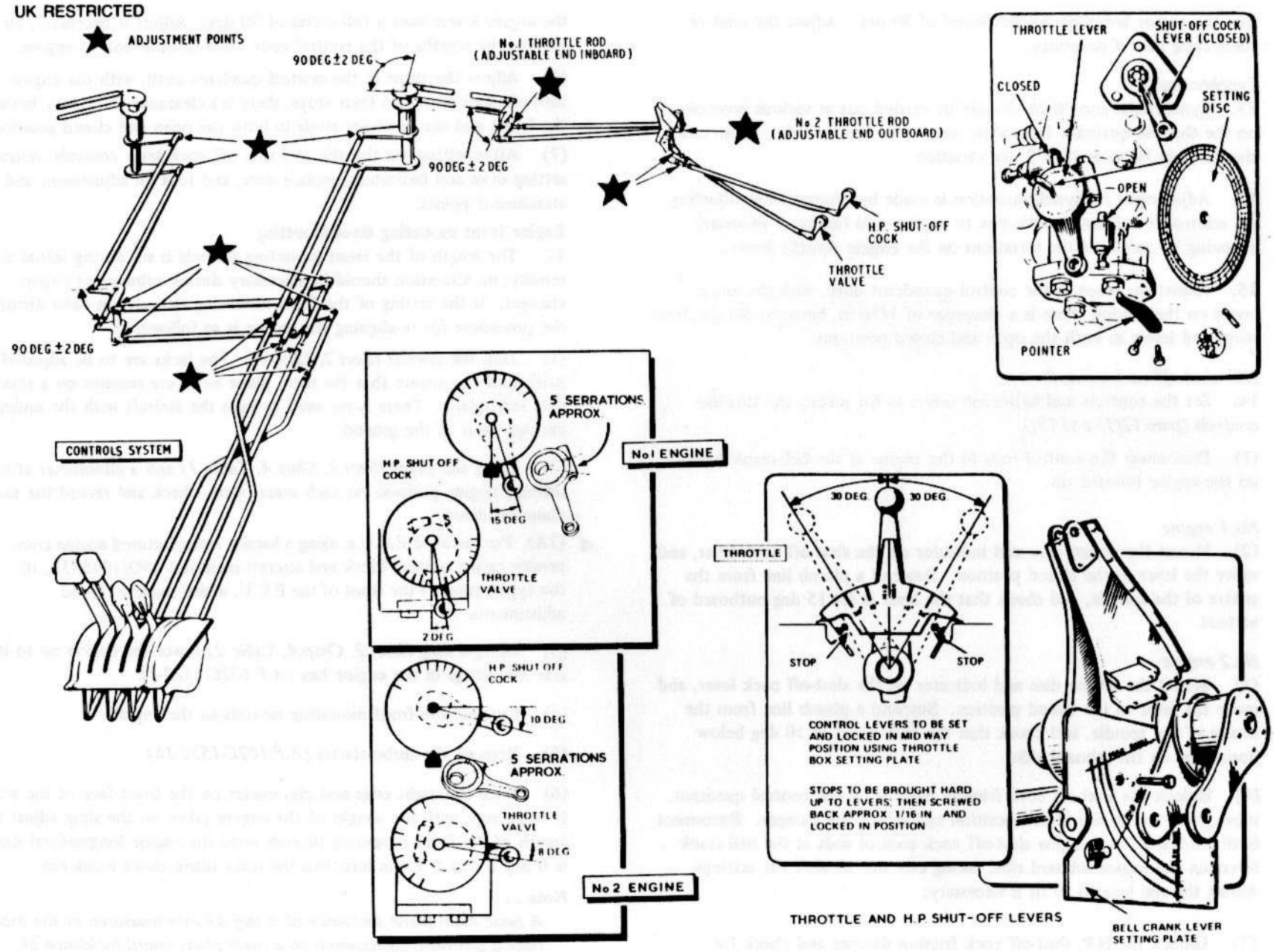

FIG. 4. RIGGING ENGINE CONTROLS

of 4 deg 49 min and the incidence recorded in operation (2). For example, if the reading in operation (2) is 4 deg 33 min, calculate the required engine longitudinal setting as follows:

	deg	min
Basic M/P incidence	*4*	*49*
Actual M/P incidence (refer to note above)	*4*	*33*
"variation" =	*0*	*16*
Actual M/P chord incidence		
= Basic M/P chord incidence	*2*	*00*
Less "variation"	*0*	*16*
=	*1*	*44*
Engine longitudinal setting required		
= Actual M/P chord incidence	*1*	*44*
Less datum factor (op. (6))	*0*	*05 ± 5*
=	*1*	*39 ± 5*

(7) Secure the engine rear mounting spherical bearings with their clamping caps.

◀ (8) Set the front engine mounting *(fig.1, detail B)* as follows:

Grease the spherical end of the tie-rod and adjust the retaining plug, which secures the spherical end, until the tie-rod just falls under its own weight. Lock the retaining plug with its lock nut and wire-lock in this position. Finally, lock both front and rear engine mountings *(fig.1, detail A and B)*. ▶

(9) Refit the turbo-starter.

(10) Remove the sling. For installed E.C.U.s, remove the aircraft main jack and engine compressor casing support block.

(11) Lower the aircraft on to its wheels.

(12) Re-make all connections between the engine and the airframe. The assembly sequence is the reversal of the operations given in para.29 and 30.

(13) Fit the engine front cowl securely, and check the engine intake and the turbo-starter fairing for concentricity.

Note . . .

1. The intake surface of the cowl must be vertically aligned with the engine, but laterally may be 0.125 in. out of alignment in either direction.

2. If, after fitting new tie-rods, the initial check on the engine shows a clinometer reading of 0 deg 0 min, the tie-rods should be shortened to obtain the correct angle (operation (6)).

Engine-mounting brackets

18. Periodic lubrication *(para.23)* is the only servicing normally required on the mounting brackets.

Jet-pipe brackets

19. Periodic lubrication of the threads of the screwed spigots *(para.23)* is the only servicing normally required on the jet-pipe brackets.

Engine sumps

20. Instructions for filling and topping-up the sumps are given in Sect.2, Chap.2.

Accessories gearboxes

21. Instructions for topping-up the oil level and servicing the gearboxes are given in Sect.2, Chap.2, and A.P.103C-0107-16 respectively.

Throttle box

22. Refer to para.33 to 36 for throttle box servicing instructions.

Lubrication

23. The engine control tube connections, the engine mounting spherical bearings and spherical ends, and the jet pipe bracket screwed spigots are to be lubricated with grease XG-287.

Note . . .

The engine control lever pivots are fitted with pre-packed bearings.

REMOVAL AND ASSEMBLY

Engine cowlings *(fig.2)*

Note . . .

1. It is recommended that at least two men be tasked with the removal and refitment of any panel or cowl.

2. Cowls and service panels are marked PORT AND STBD., and are not interchangeable aircraft to aircraft.

Removal

24. To remove the cowlings:-

(1) Raise the cover plates and release the four toggle fasteners *(detail A)* securing the service panel, remove the panel.

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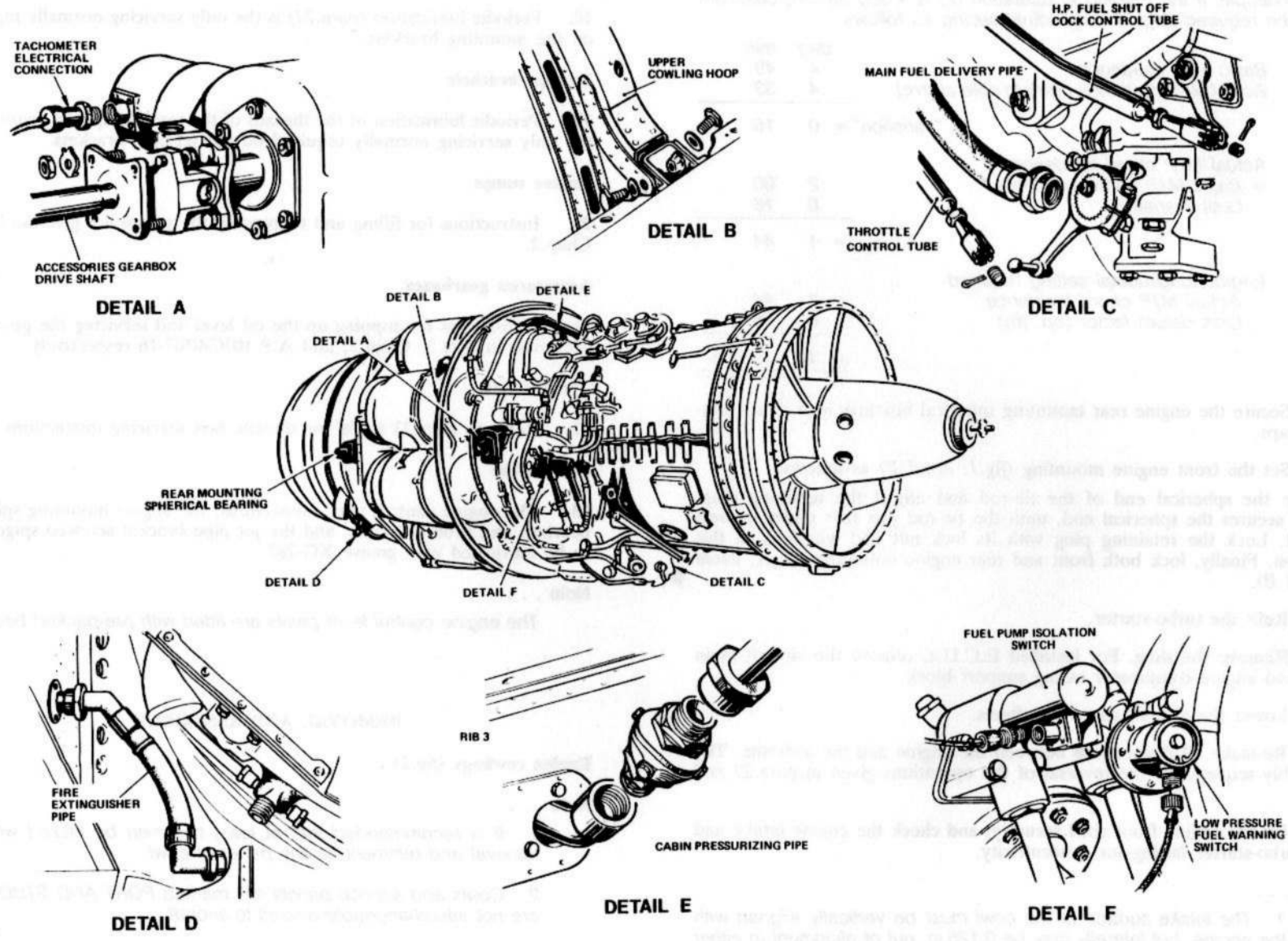

FIG. 5. ENGINE CHANGE UNIT REMOVAL (1)

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(2) Release the bayonet connections on the air bleed ducts *(detail B)*.

(3) Remove the turbo-starter exhaust duct *(detail C)* by removing the six 4 B.A. screws securing the louvre. Remove the louvre and withdraw the two split pins (a) and pin (b). The exhaust duct is now free to be withdrawn.

(4) Remove the ¼ in. B.S.F. front cowling screws and remove the front cowling taking care not to foul the air bleed ducts.

(5) Release the eight toggle fasteners *(detail A)* and ten Dzus fasteners securing the top rear cowl. Remove the cowl.

(6) Disconnect the bottom rear cowling flap linkage *(detail D)* by removing the 2 B.A. nut and bolt.

(7) Remove the eight 2 B.A. screws, and then release six toggle fasteners and ten Dzus fasteners. Remove the bottom rear cowl.

Assembly

25. Assembly is a reversal of the removal procedure plus the following notes:-

Reassembly notes . . .

1. Ensure true alignment, when refitting cowls or panels, by adjusting equally at each end of the rod assemblies. On completion of adjustments check for sufficient thread engagement by using the inspection holes at each end of the rod assembly. Avoid overtensioning of the assembly, the correct tension is indicated by the effort required to manually close the toggle handle. Only reasonable hand pressure should be applied.

2. If any hook assembly is dismantled note that the threaded rod ends are different in length and that in every case the longest threaded end engages with the hook end.

3. Avoid twisting the hook to force engagement without first loosening the locknut. It is essential to obtain correct hook alignment before assembly of a cowl or panel.

4. When reassembling the air bleed ducts, with the duct compressed, adjust the retaining ring to allow the top of the duct free sideways movement of approximately 0.25 in.

5. Before fitting replacement toggle fasteners refer to A.P.101B-0400-5A2 (Safety and Servicing Notes).

6. When refitting the top and bottom rear cowls the four toggle fasteners at the corners of the cowls should be operated simultaneously before operation of the remainder.

7. When refitting the service panel the four toggle fasteners should be operated simultaneously.

Fitting a new front cowling

26. The procedure for fitting a new front cowling is given in A.P.101B-0400-6.

Jet pipe

Removal

27. To remove a jet pipe:-

(1) Remove the tail pipe rear fairing.

(2) Remove the thermocouples.

(3) Remove the twenty-eight bolts securing the jet pipe to the engine transition piece.

(4) Unscrew the jet pipe rear mounting spigots until their eccentric bosses are clear of their housing brackets on the jet pipe.

Note. . .

◀ *1. Before releasing the locknuts on the inboard eccentric mountings, move the thermocouple compensating leads clear of the locknuts to avoid damage to the leads.*

2. During the removal of bolts attaching the transition piece to the jet pipe, care must be exercised to prevent damage to the engine ring and undercarriage main forgings.. ▶

(5) Withdraw the jet pipe aft until its front supporting lugs are clear of their runners, turn the jet pipe through 90 degrees, to enable its elliptical forward end to pass through the ring of the main-plane rear wall and withdraw the jet pipe from the main plane.

Assembly (fig.3)

28. To assemble a jet pipe into the main plane:-

Note . . .

Lightly lubricate (para.23) the screwed spigots before assembly.

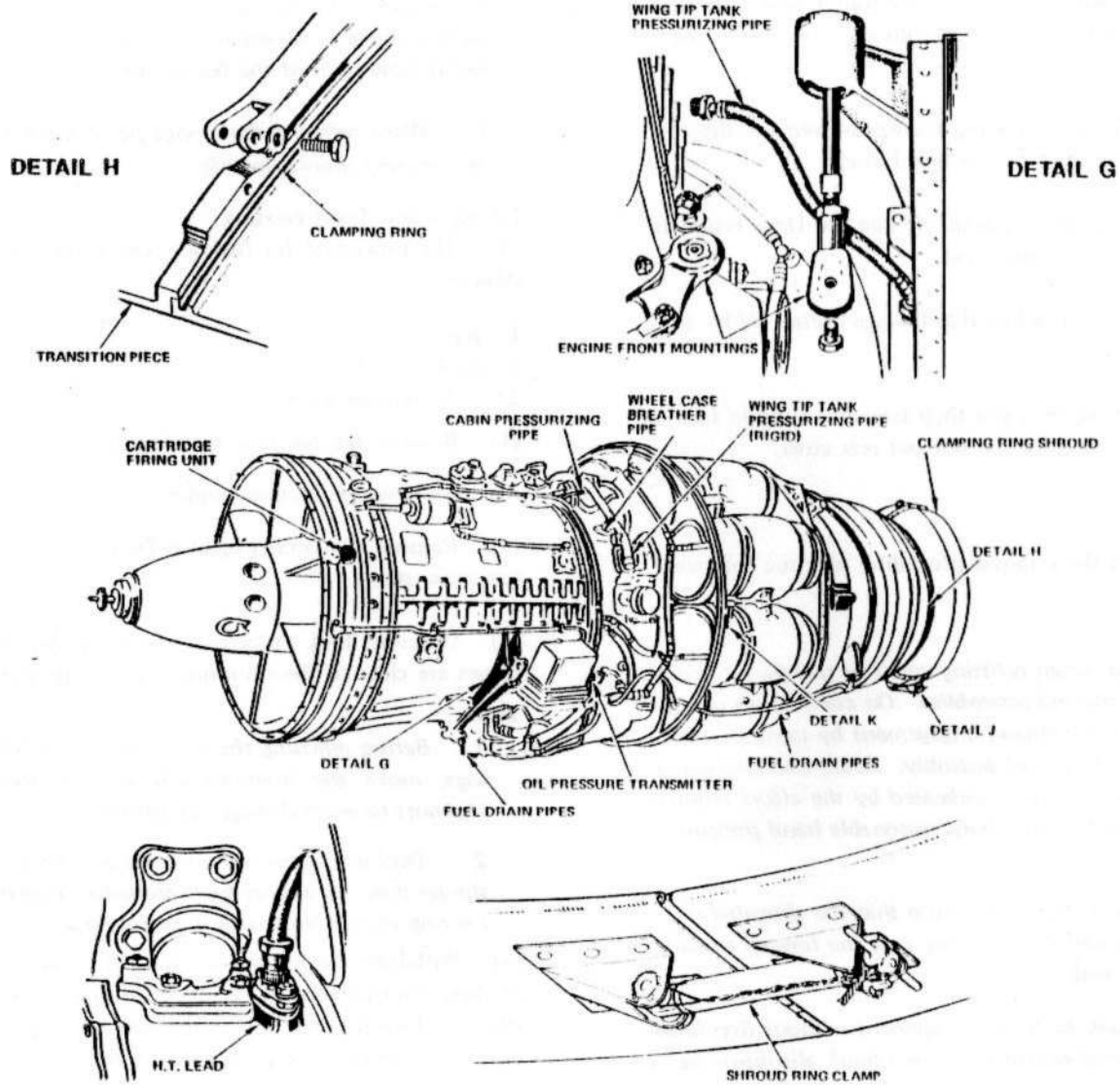

FIG. 6. ENGINE CHANGE UNIT REMOVAL (2)

(1) Ensure that the jet-pipe rear mounting spigots are screwed into their housings as far as possible.

(2) With the jet pipe turned through 90 degrees from its normal position, pass its elliptical end through the ring of the main-plane rear wall. Turn the jet pipe back to its normal position and, with the front support lugs sliding on their runners in the main plane, push the jet pipe into position.

(3) Screw in the jet-pipe rear mounting spigots until their eccentric bosses are within the housing brackets on either side of the jet pipe. Ensure that the eccentrics do not grip the jet pipe.

(4) Connect the jet pipe to the engine transition piece by inserting and tightening the twenty-eight attachment bolts.

(5) Adjust the jet-pipe rear mounting spigots until there is a clearance of 0.15 in. between the face of each eccentric boss and the jet pipe, thus permitting a lateral movement of 0.30 in.

(6) Assemble the tail-pipe rear fairing to the main plane and temporarily secure it in position by inserting only four or five of its attachment bolts.

(7) Check the jet pipe for concentricity with the rear fairing, note the adjustment required and, after removing the rear fairing, make the necessary adjustment at the rear mounting spigots. When adjusting, ensure that the clearance given in operation (5) is maintained.

(8) Replace the tail-pipe rear fairing as in operation (6) and repeat operation (7) until the jet pipe is concentric with the rear fairing.

(9) Ensure that there is sufficient end float on the jet pipe to permit a minimum fore-and-aft movement of the jet pipe of 0.075 in. and a maximum movement of 0.150 in.

(10) Lock the screwed spigots of the rear mountings by tightening their locknuts.

Note . . .

Before tightening the locknuts on the inboard eccentric mountings, move the thermocouple compensating leads clear of the locknuts to avoid damage to the leads.

(11) Fit the thermocouples.

(12) Assemble the tail-pipe rear fairing.

Note . . .

To prevent damage to the thermocouple leads, special care must be taken, before fitting the tail-pipe rear fairing, to ensure that the leads are properly housed in the recesses in the spar connecting ring. Also check that the hydraulic pipes to the flap jack do not foul the fairing or the fairing attachment bolts.

Engine change unit

Removal

29. To remove the engine change unit:-

(1) Jack and trestle the aircraft *(Sect.2, Chap.4)*.

(2) Ensure that the electrical supply is disconnected, the fuel cocks are OFF, and the cartridge starter breech is unloaded.

(3) Remove the cowlings *(para.24)*. Disconnect and remove the upper cowling hoop *(fig.5, detail B)*.

(4) Disconnect the cabin pressurizing pipe at rib 3 *(fig.5, detail E)*.

(5) Disconnect the generator cooling duct injector pipe at rib 3.

(6) Disconnect the fire extinguisher pipe *(fig.5, detail D)*.

(7) Disconnect the main fuel delivery pipe *(fig.5, detail C)*.

(8) Disconnect the wing tip tank pressurizing pipe *(fig.6, detail G)*.

(9) Disconnect the accessories gearbox drive shaft *(fig.5, detail A)*.

(10) Disconnect the throttle and H.P. shut-off fuel cock control tubes *(fig.5, detail C)*.

(11) Refer to the LETHAL WARNINGS marker card. Disconnect the H.T. leads from the igniter plugs *(fig.6, detail K)*.

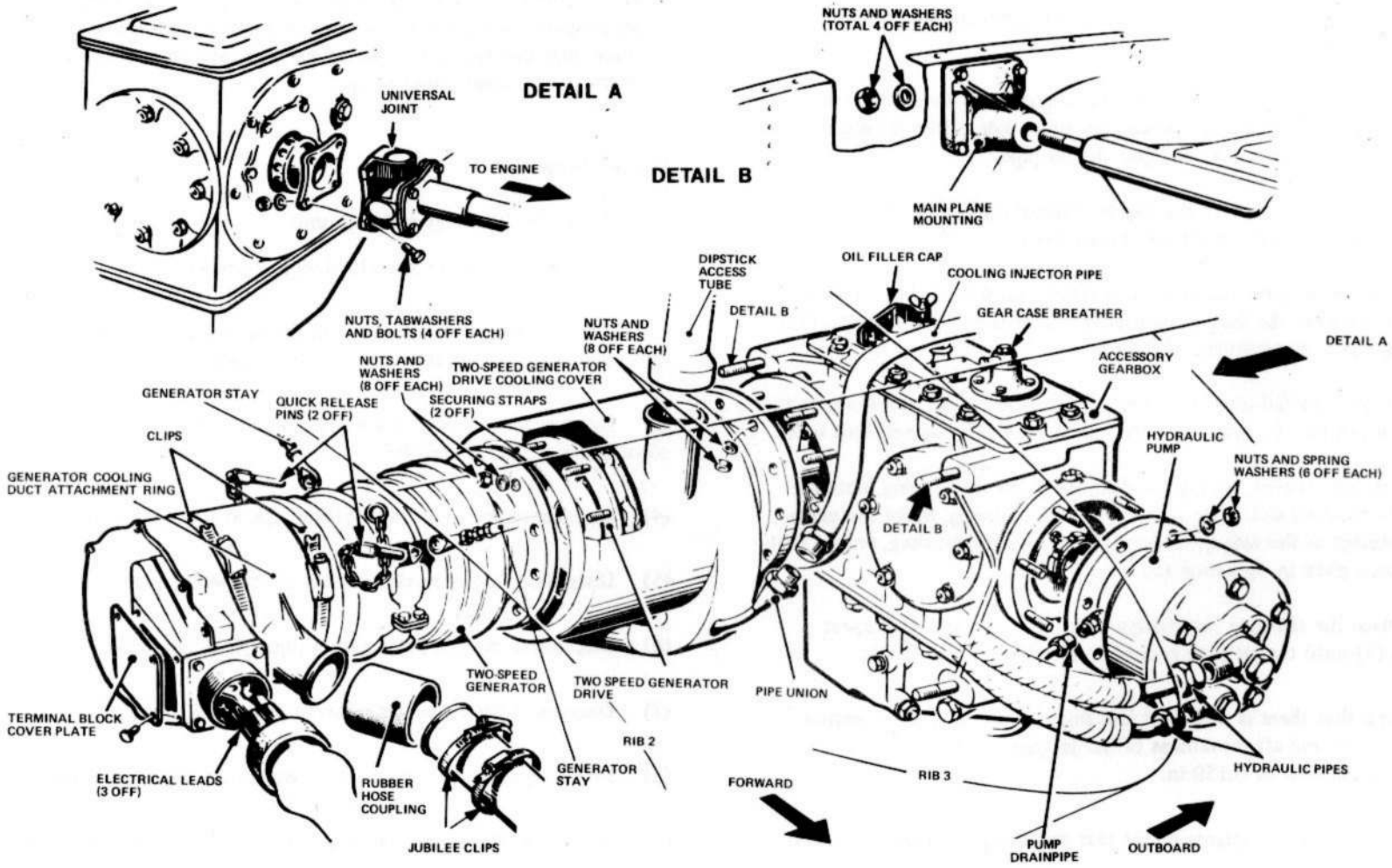

FIG.7. ACCESSORIES GEARBOX - REMOVAL AND ASSEMBLY

◀ANNOTATIONS ADDED▶

(12) Disconnect the electrical connections to the following:-

(a) Fuel pump isolation switch *(fig.5, detail F)*.

(b) L.P. fuel warning switch *(fig.5, detail F)*.

(c) Oil pressure transmitter *(fig.6)*.

(d) Tachometer *(fig.5, detail A)*.

(e) Cartridge firing unit *(fig.6)*.

(13) Disconnect the thermocouple connections, remove the clamping ring shroud *(fig.6)*, and the clamping ring *(fig.6, detail H)* from the transition piece. Move the jet pipe and transition piece as far aft as possible.

(14) Remove the clamping caps from the rear mounting spherical bearing.

(15) Fit an engine sling *(A.P.102C-1522-1)* and take the weight of the engine on the lifting gear.

(16) Remove the bolts from the engine front mountings *(fig.1)*, and lift the engine clear of the rear mounting studs.

(17) Swing the engine forward and upward, taking care that the inner cone does not foul the transition piece.

(18) Disconnect the cabin pressurizing pipe from the engine.

(19) Disconnect and remove the wheel case breather pipe *(fig.6)*.

(20) Disconnect the rigid portion of the wing tip tank pressurizing pipe at the engine *(fig.6)*.

(21) Remove the fuel drain pipes *(fig.6)*.

Assembly

30. Assembly is a reversal of the removal procedure, plus the following notes:-

Reassembly notes . . .

1. When installing a replacement engine change unit, the pipes and components, removed from the engine to be replaced, (para.29 sub-para.(18) to (21)) should be retained for fitting to the replacement unit.

◀ *2. Ensure that the engine front suspension tubes centre shackle is in a vertical position before connecting the airframe tie-rods to the engine front mountings. If it is found necessary to adjust either tie-rod, engine alignment checks must be carried out.*

3. After refitting the transition piece clamping ring shroud, wirelock the shroud spring clamp (fig 6, detail J). ▶

Accessories gearbox *(fig.7)*

Removal

31. To remove an accessories gearbox:-

(1) Remove the main-plane leading edge access panels, and the hydraulic pump access panels *(Sect.2, Chap.4)*.

(2) Disconnect all electrical supplies *(Sect.5, Chap.1)*.

(3) Remove any equipment from the inboard end of the generator, liable to hinder its removal.

(4) Remove the terminal-block cover plate and disconnect the three electrical leads from the generator.

(5) Slacken the two Jubilee clips securing the generator inlet cooling duct, and slide the rubber hose coupling over the duct.

(6) Remove the two clips securing the generator cooling-duct attachment ring, and remove the ring.

(7) Remove the dipstick access tube.

(8) Slacken the two Jubilee clips securing the two-speed drive outlet cooling duct, and slide the rubber hose coupling over the duct.

(9) Unscrew the unions at the engine inboard rib and the two-speed drive, and remove the cooling injector pipe.

(10) Remove the two securing straps, and remove the two-speed drive cooling cover.

(11) Remove the two quick-release pins, and disconnect the generator stays.

(12) Remove the eight nuts and washers securing the generator to the two-speed drive, and remove the generator.

Note . . .

When removing the generator, it is advisable to use a sling and lifting tackle.

(13) Remove the drive coupling from the generator.

(14) Remove the eight nuts and washers securing the two-speed drive to the gearbox, and remove the two-speed drive.

(15) Blank off the gearbox aperture, and fit blanking covers to the two-speed drive.

(16) Release hydraulic pressure *(Sect.3, Chap.6).*

(17) Drain the hydraulic oil from the pump.

(18) Disconnect, and blank off the hydraulic pipes to the pump.

(19) Disconnect the pump drainpipe.

(20) Remove the six nuts and spring washers securing the pump to the gearbox, and remove the pump.

(21) Remove the driving quill and attach it to the blanking cover, and blank off the aperture in the gearbox.

(22) Remove the four nuts, tab washers, and bolts securing the universal drive to the gearbox driving flange *(detail A),* and slide the universal joint along its splines.

(23) Remove the four nuts and washers securing the gearbox to the main-plane mountings, and remove the gearbox.

Note . . .

When removing the gearbox from the main plane, it is advisable to use a sling and lifting tackle.

(24) Remove the gearbox drainpipe and pump drainpipe from the gearbox.

Assembly

32. To assemble an accessories gearbox:-

(1) Fit the pump drainpipe and gearbox drainpipe to the gearbox.

(2) Using a sling and lifting tackle, position the gearbox in the main plane, and secure with the four nuts and washers. Wire-lock the nuts to a suitable part of the structure.

(3) Remove the hydraulic pump drive aperture blanking cover, and retain the gasket.

◀(4) Lightly smear the pump driving quill with grease SP-5 , and ▶ insert into the gearbox driveshaft.

Note . . .

Driving quills and generator couplings are supplied with each accessories gearbox.

(5) Fit the gasket to the pump seating flange on the gearbox.

(6) Offer up the pump to the gearbox, align the splines, and fit the pump over the securing studs on the gearbox flange, ensuring that the bleeder screw is at the top of the pump.

(7) Fit and tighten the six nuts and spring washers.

(8) Ensure that there is no pressure in the hydraulic system *(Sect.3, Chap.6),* and remove the blanks from the pipes.

(9) Fit the pipes, and prime and bleed the pumps *(Sect.3, Chap.6).* Wire-lock the unions.

(10) Connect the drainpipe to the pump, and wire-lock the union.

(11) Remove the blanking cover from the two-speed drive aperture in the gearbox, and retain the gasket.

(12) Remove the blanking covers from the two-speed drive, and retain the gaskets.

(13) Fit the gasket to the two-speed drive seating flange on the gearbox.

(14) Lightly smear the splines of the two-speed drive input shaft with grease SP-5 .

(15) Offer up the two-speed drive to the gearbox, mesh the splines, and secure with the eight nuts and washers. Fill with oil *(para.21)*.

Note . . .

The port engine dipstick must be fitted on the left-hand side of the centre line when viewed from the input drive end. The starboard engine dipstick must be fitted on the right-hand side of the centre line when viewed from the same position.

(16) Lightly grease the generator driving quill with grease SP-5 and insert into the output shaft of the two-speed drive.

(17) Fit the generator coupling to the generator shaft, and secure with bolt and tab washer.

Note . . .

Before installing the generator, check the dimension between the face of the generator mounting flange and the head of the generator-coupling retaining bolt. This dimension must be within 2.062 in. and 2.125 in., to ensure the correct clearance between the driving quill and the head of the generator-coupling retaining bolt (AP103C-0114-16)

(18) Fit the gasket to the generator seating on the two-speed drive.

(19) Assemble the generator to the two-speed drive, and secure with the eight nuts and spring washers.

(20) Fit the cooling cover to the two-speed drive, and secure with the two straps.

(21) Connect the cooling cover to the outlet duct by fitting the rubber hose and securing with the two Jubilee clips.

(22) Fit the cooling injector pipe to the unions at the engine inboard rib and the two-speed drive, and tighten and lock the unions.

(23) Fit the dipstick access tube to the two-speed drive cooling cover.

(24) Fit the generator cooling attachment ring, and secure by fitting and tightening the two clips.

(25) Position the two generator stays, and insert the quick-release pins.

(26) Position the generator inlet cooling duct, slide the rubber hose into position, and fit and tighten the two Jubilee clips.

(27) Connect the three electrical leads to the generator and secure the terminal-block cover plate.

(28) Remove the gearbox-end universal joint from the splines on the driveshaft.

(29) Lightly grease the splines with grease SP-5 , and replace the universal joint.

(30) Secure the universal joint to the gearbox driving flange by fitting the four nuts, tab washers and bolts. Lock the tab washers.

(31) Fill the gearbox *(para.21)*.

Throttle box overhaul procedure *(fig.8)*

Removal from the aircraft

33. To remove the throttle box from the aircraft:-

(1) Disconnect all sources of electrical power.

(2) Remove the access panels from the inboard side of the pilot's console.

(3) Remove the pins and disconnect the throttles and H.P. cocks levers from the Simmonds Corsey controls.

(4) Disconnect the Plessey plug (Cable N76A) from its socket.

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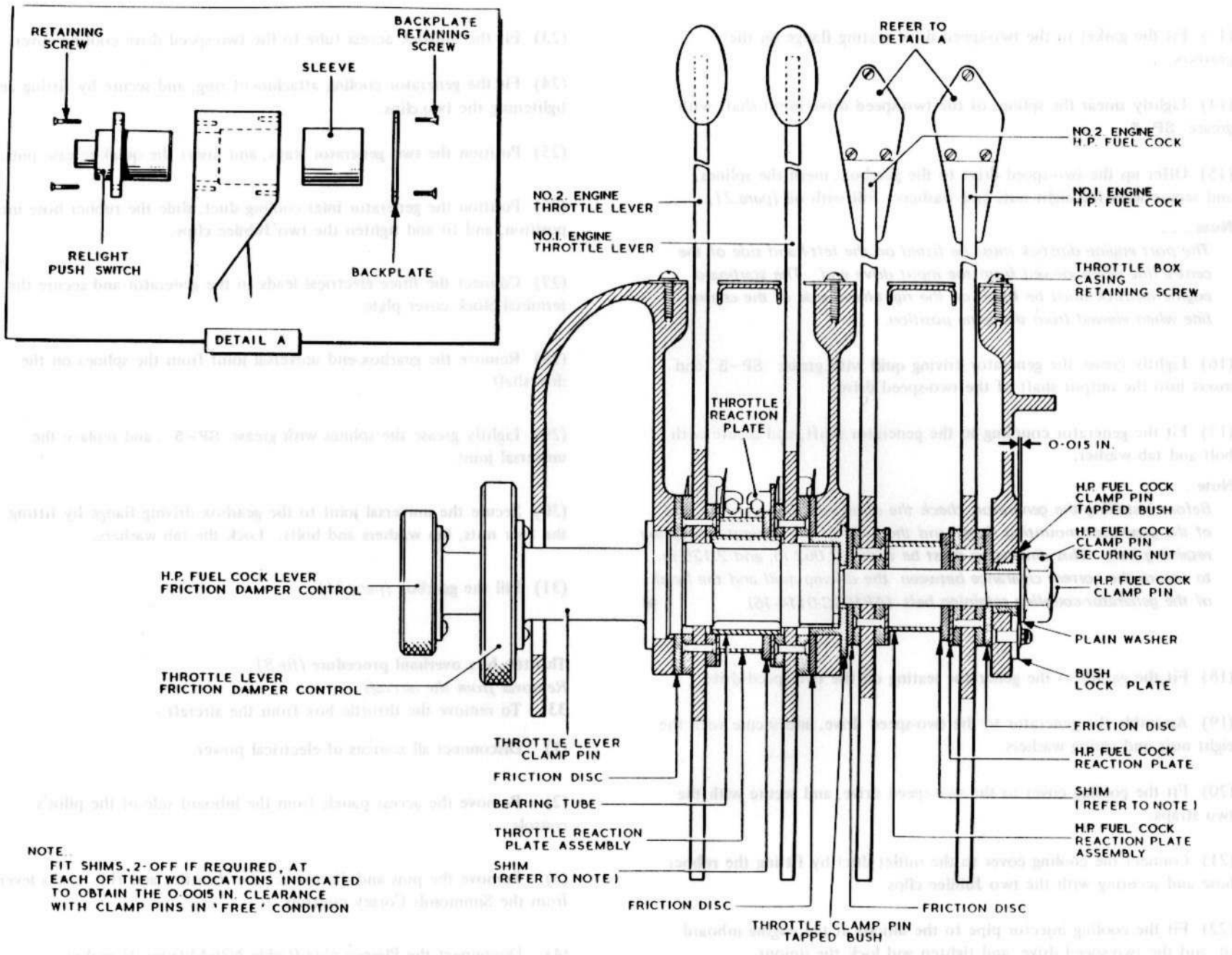

FIG.8. THROTTLE BOX OVERHAUL PROCEDURE

(5) Remove the five 2 B.A. bolts from the inboard side of the throttle box, and the eleven 2 B.A. screws securing the throttle box to the top of the console.

(6) Remove the throttle box complete and examine the box and its housing for obvious damage, cracks at the securing points, distorted or cracked levers, and elongated bolt holes.

Dismantling and inspection

34. Dismantle and inspect as follows:-

(1) *Electrical*

(a) Remove the cable securing clips, and the cable guards from the H.P. cock levers.

(b) Disconnect the cables from the undercarriage warning micro-switch and the fuel pump isolation switches. Remove the securing bolts, and remove the switches from their brackets.

(c) Remove the backplate from each H.P. cock lever knob, and disconnect the switch cables. Remove the two switch securing screws, and remove the switches.

Note . . .

Some early type switches have soldered connections which must be unsoldered before removing.

(d) Check all switches for correct operation, freedom from sticking, strength of spring, and cracked insulation and securing points.

(e) Remove the complete cable assembly from the throttle box, examine for insulation cracks, hardening, deterioration, chafing at the clipping and points of contact, and security of terminal ends. Carry out continuity and insulation tests.

(2) *Mechanical*

(a) Remove the split pin, nut and washer from the H.P. cock lever clamp pin, and slowly unscrew and withdraw the pin, releasing in turn the friction disc, outboard cock lever, shim, inboard cock lever, and friction disc. The reaction plate, and the reaction plate assembly remain in place.

(b) Unscrew and slowly remove the throttle lever clamp pin releasing in turn the friction disc, outboard throttle lever, and friction disc. The reaction plate, and reaction plate assembly remain in place.

(c) Discard the friction discs.

(d) Examine the throttle and H.P. cock levers for signs of excess wear, distortion and cracks.

(e) Remove the reaction plates, and reaction plate assemblies and examine for excessive wear, and elongation of securing holes.

(f) Examine the undercarriage warning microswitch for security and operation, and check for insulation cracks.

(g) Examine all fittings for security and damage.

Assembly

35. Assemble the throttle box as follows:-

(1) *Mechanical*

Note . . .

All friction discs must be renewed.

(a) Assemble the reaction plates, and reaction plate assemblies in their respective positions.

(b) Assemble the friction disc, outboard throttle lever, bearing tube, inboard throttle lever, and friction disc in that order between the inboard jaws of the throttle box, and insert and screw home the throttle lever clamp pin into the screwed bush. With the clamp pin in its 'free' condition, the clearance between the reaction plate, and the reaction plate assembly should be measured. Strip the assembled items and, on reassembly, fit a shim between the reaction plate and the reaction plate assembly, to give a clearance of 0.0015 in. when in the 'free' condition.

(c) Assemble the friction disc, outboard H.P. cock lever, inboard H.P. cock lever and friction disc into the outboard jaws of the throttle box, and insert and screw home the H.P. cock lever clamp pin, fit the plain washer and tighten the nut. With the clamp pin

in the 'free' condition, measure the clearance between the clamp pin tapped bush and the plain washer. Dismantle the H.P. cock lever items and, on reassembly, fit a shim between the reaction plate, and the reaction plate assembly to give a clearance of 0.0015 in. when in the 'free' condition.

Note . . .

A maximum of two shims may be fitted in each case.

(d) Fit the plain washer and nut to the H.P. cock clamp pin, leaving a 0.015 in. clearance between the tapped bush and the plain washer. Lock the nut with a split pin.

(e) Fit the fuel pump isolation switches, and the undercarriage warning microswitch.

(f) Check that the throttle and H.P. cock levers have full, free range of movement in the 'free' condition, and that the throttle levers both contact the undercarriage warning microswitch simultaneously at 1/3rd throttle opening (15 deg mark on indicator plate *(fig.4)*).

(2) *Electrical*

(a) Fit the relight push-button switches in the H.P. cock lever knobs and secure with the attachment plates and screws. Connect the cables to the switch terminals. Fit the cable securing clips and guards.

Note . . .

In early type switches the connections must be soldered in position.

(b) Connect the cables to the undercarriage microswitch, fit the clips and test for continuity.

Reassembly in the aircraft

36.

(1) Position the throttle box assembly on the pilot's console and fit and tighten the eleven 2 B.A. screws on the top, and the five 2 B.A. bolts on the inboard side of the console.

(2) Attach the throttle and H.P. cock levers to their respective Simmonds Corsey control runs, and secure with pins, collars and split pins.

(3) Connect the Plessey plug to its socket and connect the cables to the fuel pump isolation switches.

(4) Check that the throttle and H.P. cock levers have full, unrestricted travel, and set the control levers as detailed in para.13.

(5) Check that with the friction dampers engaged, the loads required to move the controls are:-

Port throttle	2 lb
Starboard throttle	2 lb
Port H.P. fuel cock	8 lb
Starboard H.P. fuel cock	8 lb

These figures are determined by the use of a spring balance *(Sect.2, Chap.4, Table 2)* attached to each lever in turn.

Note . . .

The friction discs are designed to give a damping effect to the controls rather than a positive lock, and enable the pilot to operate the levers to suit varying flight conditions and remain in the position selected without 'creeping'.

(6) Carry out electrical tests as detailed in Sect.5, Chap.1.

(7) Carry out engine control functional tests *(para.13)*.

Chapter 2 FUEL SYSTEM

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LIST OF TABLES

LIST OF ILLUSTRATIONS

Introduction

1. This chapter contains a description of the low pressure fuel system and the associated venting system; the high-pressure system, being an engine system, is described in A.P.102C-1512/22-1. The construction and servicing of the fuel tanks is described in A.P.106B-0100-16 and A.P.106B-0213-16 and a description together with servicing details of the fuel pumps is given in A.P.113E-0438-1.

DESCRIPTION

Fuel tanks

Fuselage

2. Three fuel tanks are carried in the fuselage above the bomb bay. The front and centre (No.1 and 2) tanks are rigid, self-sealing, internally braced structures; the rear (No.3) tank is a crash-proof, collapsible, fuel bag. All three tanks are located within the tank compartment by their filler necks at their upper, and the fuel pumps at their lower surfaces, which are secured to the fuselage skin and the floor of the tank respectively. The rear (No.3) tank is supported in the fuselage by wire runners on the fuselage inner skin and studs on the upper surface of the tank, through which nylon cords are threaded, the cords being pulled tight and secured in the bomb bay; similar studs on the base of the tank pass through holes in the floor of the compartment, and are secured by spreader plates and split rings. The tanks are separated by a removable diaphragm between No.1 and 2, and by the main plane centre section frame between No.2 and 3. The front of the tanks compartment is closed by the rear bulkhead of the front fuselage equipment compartment, and the rear by a removable bulkhead. The tanks are connected at their upper surfaces to a venting gallery passing above the tanks and terminating in a short vent pipe on the outside of the fuselage under the starboard tail plane. This vent pipe is essential to the efficient and safe functioning of the fuel system and therefore, the dimensions and angle of attack shown in fig.15 must be adhered to. Any deviation from these dimensions can cause serious damage.

Wing-tip

3. Two wing-tip tanks may be carried, one on the underside of each main plane at the extreme wing tip. The tanks are rigid and of streamline form; each is secured to the main plane structure by three bolts containing explosive detonators, which screw into the upper surface of the tank and pass through bolt housings at the wing tips, to which they are secured by nuts. The tank filler caps incorporate inward vent valves to prevent collapse of the tanks during a rapid descent in altitude. A navigation lamp is fitted at the extreme centre front of each tank. The electrical wiring from the lamps is connected to two bolts, mounted in insulating blocks on the upper surfaces of the tanks, which make contact with two contact studs on the lower surface of the wing tips when the tanks are fitted. The tanks are jettisoned by firing the detonators within the attachment bolts. To minimize fire hazards during refuelling through static electricity, an earthing socket is fitted to the rear of the tank filler cap.

Vortex generators

4. Two vortex generators are fitted to the inboard side of the wing-tip tank, their purpose being to improve the flying characteristics of the aircraft, in conjunction with those fitted to the wing *(Sect.3, Chap.2)*.

Main fuel system *(fig.1 and 2)*

5. Two submerged booster pumps, Type S.P.E.1003, are fitted into the base of each tank; the port pumps are connected by fuel pipes to a junction box feeding the port engine, the starboard pumps are similarly connected to a junction box feeding the starboard engine. Non-return valves at each inlet to the junction boxes prevent fuel flowing back from the boxes to the tanks not in use. A low-pressure fuel cock located near each pump is provided to control the fuel supply from the tank. Each of these cocks is electrically operated together with its associated pump by a fuel cock and pump switch on the engine instrument panel. Smiths Waymouth tank (capacitor) units are fitted in each tank; these are connected to fuel indicators on the engine instrument panel.

Note. . .

The No.3 tank non return valves (NRVs) fitted in the junction boxes, each have a 1/16 in. dia. hole drilled in their valve plates. These holes, prevent a pressure build-up on engine shut-down thereby preventing damage to certain engine diaphragmed components. Ensure therefore, that when replacing junction boxes or NRVs, these holes are provided in the NRVs serving No.3 tank.

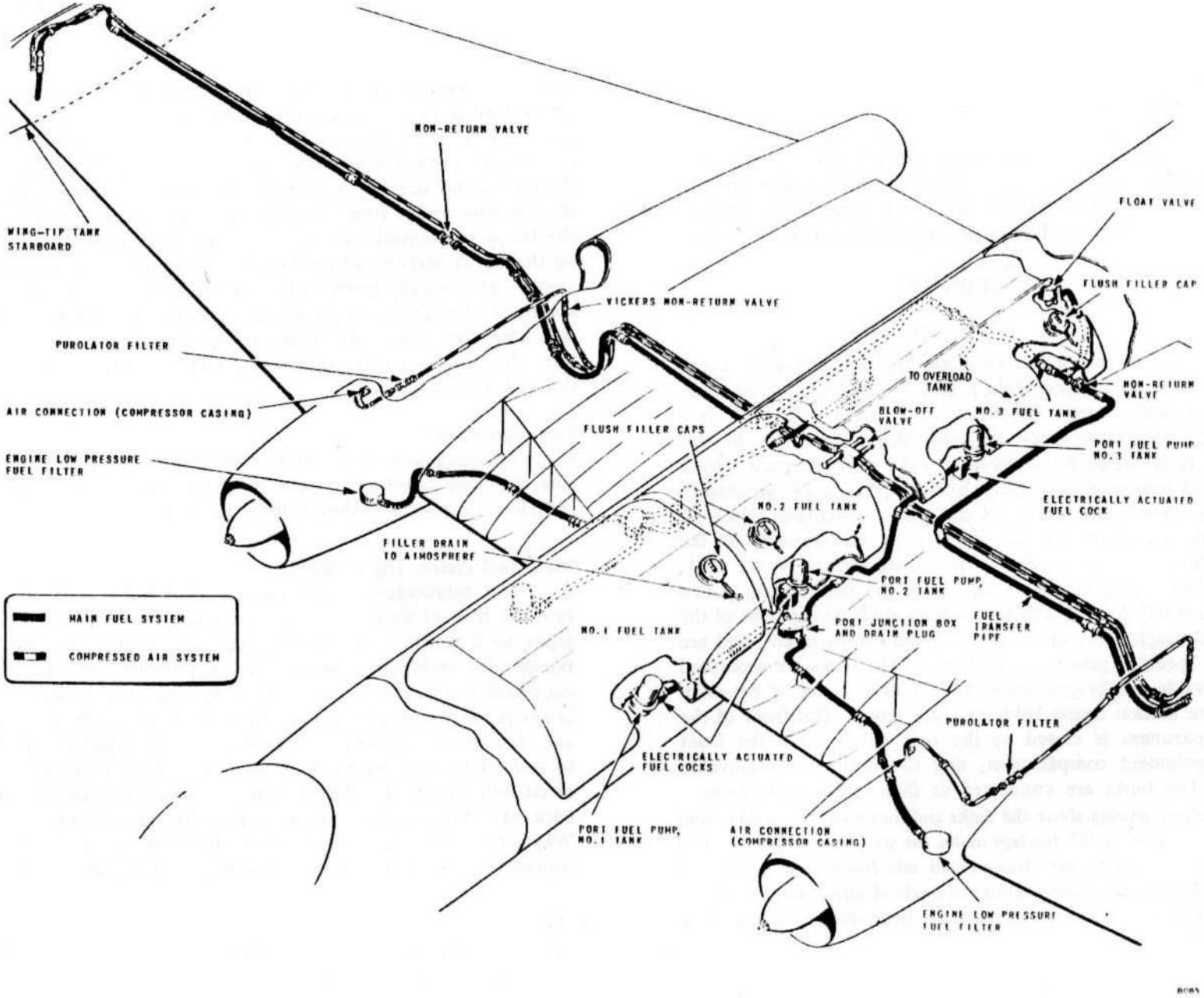


FIG. 1. FUEL SYSTEM INSTALLATION

Auxiliary fuel tank

General information

6. Provision is made (Mod.1490) to carry a 300-gallon auxiliary fuel tank in the bomb bay. The tank may be fitted (post Mod.432 and 1490) to the rear bomb beam *(fig.6)* or fitted (post Mod.3757) to the forward bomb beam *(fig.7)*.

Aft position

7. The tank is held securely in position by straps, attached to the modified rear secondary bomb beam. Fuel is delivered to the main fuel system pipeline (wing-tip to wing-tip) and thence to the No.3 tank by two Type S.P.E.1003 pumps integral with the auxiliary tank. Return flow is prevented by two non-return valves mounted on the roof of the bomb bay. Two electrically actuated cocks are located forward of frame 25. The two control switches for the aft fuel pump/port fuel cock actuator and the forward fuel pump/starboard fuel cock actuator are mounted on the pilot's engine instrument panel. The tank vent pipe is connected to that for the No.3 tank. There is no contents gauge for the auxiliary tank.

Forward position

8. In order to retain the aircraft C of G within acceptable limits on some aircraft, the auxiliary tank, when fitted is held securely in position by straps attached to the modified forward secondary bomb beam. The tank and the system connections are identical with those for the aft position *(para.7)* but the pipe runs are extended.

WARNING

Before switching on the auxiliary tank pumps, check the contents of No.3 tank. Although the fuel is fed into No.3 tank from the auxiliary tank through a float valve, owing to the fuel pump pressure the float valve should not be relied upon to prevent flooding.

Fuel cocks

9. Electrically-actuated low-pressure fuel cocks, located near each pump, control the delivery from the pumps. Each of these cocks is operated together with its associated pump by a fuel cock and pump switch on the engine instrument panel.

Wing-tip tanks fuel system

10. The fuel pipe inside each wing-tip tank passes through the top of the tank and is joined to the pipe in the wing-tip by a metal release pipe and hose connection. The pipes from the wing-tips continue through the main plane structure to the fuselage where non-return valves are incorporated to prevent the tanks feeding into each other; they then join a common pipe connecting to a float valve at the rear of No.3 tank. As fuel in No.3 tank is consumed the float drops and the valve opens to allow fuel to enter the tank. A gauze filter is fitted in the common fuel delivery pipe at the connection to the float valve to prevent the ingress of sediment to the valve.

Wing-tip tanks air system

11. Air pressure for transferring fuel from the wing-tip tanks to No.3 tank is ducted from the engine compressors. The air from each engine passes through a filter to a non-return valve aft of the main spar, and then to a blow-off valve located in the bomb bay, beneath No.3 tank. The blow-off valve maintains an air pressure of approximately 3½ lb/in^2 and releases excess air pressure to atmosphere. From the valve an air pipe is taken outboard through the main plane to each wing tip where it is connected to the tank air pipe by a metal release pipe and hose connection. There is no separate control for the air system: fuel is transferred whenever the engines are running and the fuel level in No.3 tank is low enough to allow the float valve to open. If wing-tip tanks are not fitted, the ends of the air and fuel pipes must be securely plugged.

Fuel gauges

12. The fuel gauges are graduated in pounds. The main graduations on the gauge represents units of 250 lb and the numerals represent multiples of 100 lb in the series of 0, 5, 10, 20, etc. A conversion table of gallons to pounds is given as Table 1.

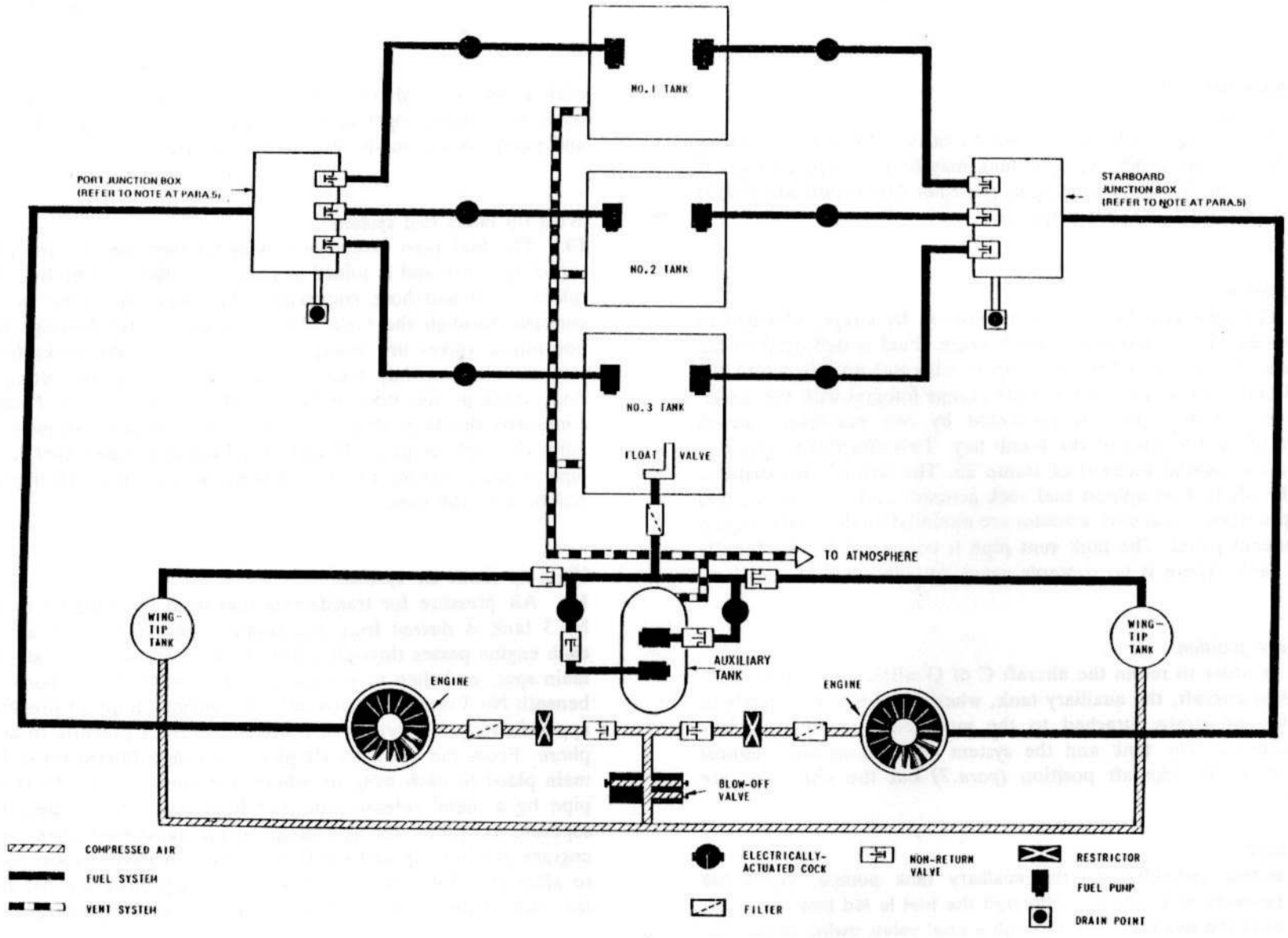


FIG.2. FUEL SYSTEM DIAGRAM

◀ REFERENCE TO PARA.5 ADDED ▶

SERVICING

WARNING

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

◀ Note . . .

During servicing it is beneficial to use a lanolin based grease to lubricate the threads of all elbows, T-pieces and fuel pipelines before reassembly on the aircraft. ▶

Refuelling/defuelling precautions

13. It is essential that the following precautions are observed when refuelling, or defuelling, the aircraft.

WARNING

On no account should No.1 tank be drained whilst fuel remains in No.2 or No.3 tanks or the auxiliary tank, without supporting the fuselage at frame 42. During refuelling operations fill No.1 tank first, during defuelling No.1 tank must always be drained last.

(1) Prior to removing the filler caps, ensure that the fuel hose and refueller are correctly earthed.

(2) The tanks must be filled only from a refueller fitted with a Streamline filter Ref. No.41C/2371 *(A.P.119F-2310-1).*

Draining the fuselage tanks *(fig.3)*

14. The fuselage tanks are drained through drain valve provided in the bases of the port and starboard junction boxes. Drain the tanks as follows:-

(1) Ensure that the 3-position switch on the engine instrument panel for the tank to be drained is set to its normal ground position (cock open - pump off) before the electrical supplies are disconnected.

(2) Disconnect all electrical supplies.

(3) Remove the relevant tank filler caps.

(4) Remove the locking wire from the junction boxes drain valves and connect hoses to the drain valve outlets leading the hoses to a suitable container.

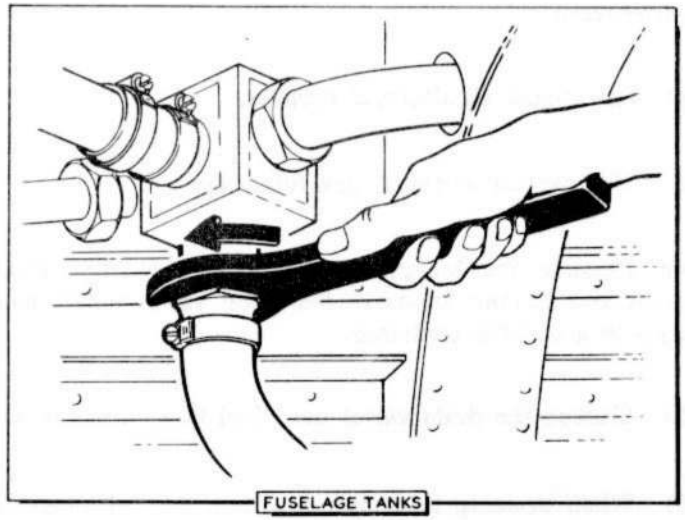
(5) Slacken the drain valves until fuel flows into the container.

(6) When draining is complete tighten and wire-lock the drain valves and remove the drain hoses.

(7) Refit the filler caps.

15. The tanks may be emptied by suction draining, with the hose inserted into the tanks through the filler cap orifices and the refueller unit running in reverse.

continued . . .



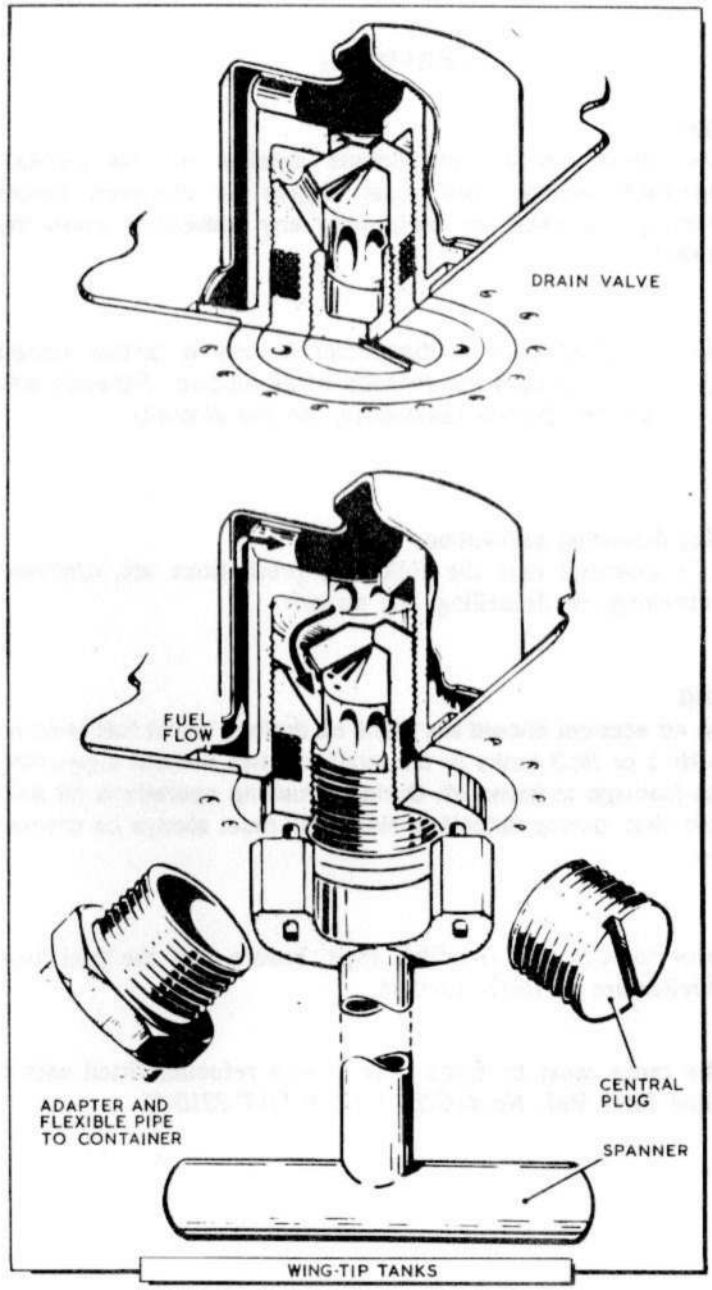


FIG.3. FUEL TANKS DRAINING

◀ *Illustration amended* ▶

◀ **Draining a wing-tip tank** *(fig.3)*

16. To drain a wing-tip tank:-

(1) Remove the central, screwed plug from the drain valve in the bottom of the tank.

(2) Screw an adapter, fitted with a length of hose, into the plug orifice and lead the hose into a suitable container.

(3) Using the spanner *(Sect.2, Chap.4, Table 1)* unscrew the drain valve until fuel flows freely.

(4) Tighten the drain valve when draining is complete and refit the central plug.

Draining the auxiliary tank

17. To drain the auxiliary fuel tank:-

(1) Position a suitable container below the tank drain valve *(fig.6 or 7)*, and open the valve until the fuel flows freely. ▶

(2) When draining is complete, tighten the drain valve and lock it securely with locking wire.

Note . . .

Alternatively, the tank may be emptied by suction draining, with a hose inserted into the tank through the filler cap orifice and the refueller unit running in reverse.

Draining a fuel pump

18. To drain a fuel pump:-

(1) Remove the central plug in the base of the fuel pump cover.

(2) When draining is complete refit and wire-lock the plug.

Wing-tip tank blow-off valve test

19. To test a blow-off valve in the wing-tip air system:-

(1) Using a 5/8 in. B.S.P. spanner, unscrew the blow-off valve from the valve assembly located in the bomb bay below the rear (No.3) fuel tank.

(2) Hold the valve in a vice with the rubber washer free to move.

(3) Fit a suitable anchor tab (local manufacture) for one end of a spring balance, over the thread-protruding above the nut on the rubber washer and secure it with a 2 B.A. nut.

(4) Connect the spring balance to the anchor tab and apply sufficient force to raise the rubber washer just clear of the valve body; this should be 3¼ lb ± 2 oz.

Note . . .

To ensure that the rubber washer is raised evenly, it is recommended that 0.002 in. feeler gauges should be inserted between the washer and the valve body, at opposite sides of the valve. At 3¼ lb ± 2 oz the two feeler gauges should be freed simultaneously.

(5) If the setting at operation (4) is not obtained, the washers on either side of the cup washer, against which the valve spring seats, may be repositioned to effect the required adjustment.

Cleaning the fuel pump filters

20. To clean a fuel pump filter:-

(1) Remove the fuel pump *(para.36)*.

(2) Remove the two screws securing the filter, and remove the filter from the pump.

(3) Wash the filter thoroughly in filtered lead free gasoline.

(4) Refit the filter, and assemble the pump to the tank *(para.37)*.

Fuel pump electrical test

◀ **21.** Refer to A.P.101B-0402-1B, Sect.5, Chap.1, Group Q. ▶

FUEL FLOW, CALIBRATION AND PRESSURE TESTS

Note . . .

It is essential that, to obtain accurate readings, the equipment used and the test procedure detailed is strictly observed. The electrical tests, referred to in para.33 and 34, should be carried out in conjunction with the calibration and pressure tests.

Test equipment

22. The following are required for the tests:-

(1) One calibrated measuring drum of at least 50 gallons capacity.

(2) A Y-shaped pipe adapter from the engine flexible pipes to the measuring drum, comprising:-

(a) A 1¼ in. dia. pipe.

(b) A pressure gauge reading from 0-30 lb/in^2.

(c) A shut-off cock.

(3) A voltmeter and ammeter.

(4) A stop watch.

(5) An external electrical supply.

Test preparation

23.

(1) Position the aircraft on firm level ground and trestle the fuselage at frame 42.

(2) Suitably position the measuring drum on a stand and ensure that ◀ the inlet to the drum is at the same height as the engine delivery pipe. ▶

(3) Disconnect the fuel delivery pipe at each engine and connect up the Y-shaped pipe adapter, incorporating a 0-30 lb/in^2 pressure gauge and a shut-off cock, to the engine flexible pipes; lead the pipe adapter into the measuring drum.

Fuel quantities

24. The quantities of fuel required to carry out the various tests are specified in the paragraph applicable to each individual test.

Note . . .

The tank filler caps must be in position during all tests

TABLE 1
Conversion - gallons to mass units (lb)

Capacity (gal)	Avtur (S.G.-0.80 lb)	Avtag (S.G.-0.78 lb)
3	24	23.4
50	400	390
100	800	780
130	1040	1014
150	1200	1170
160	1280	1248
162	1296	1264
200	1600	1560
250	2000	1950
300	2400	2340
350	2800	2730
400	3200	3120

Fuselage tanks

Free flow test

25. The following test is to be made independently on No.1, 2, and 3 tanks with the following quantities of fuel in the tanks:-

No.1 tank	160 gal
No.2 tank	130 gal
No.3 tank	162 gal

(1) With the aircraft prepared as in para.23, open one of the service cocks on the tank being tested. Open the test cock and drain fuel into the measuring drum. The time taken to deliver 3 gal of fuel must not exceed 27 sec. Take an average of 3 readings. Repeat the check, this time draining the fuel from the other service cock.

Calibration test - No.1 and 2 tanks

26. The following test is to be made on No.1 and 2 tanks in turn:-

(1) With the aircraft prepared as in para.23, fill the tank with approximately 100 gal of fuel.

(2) With an external d.c. supply of $27.5 \pm \frac{0.5}{0}$ volts available and with the port and starboard fuel pump/cock circuit breakers closed, turn on the test cock. On the pilot's engine instrument panel, select the port and starboard 3-position switches for the relevant tank, to cock open - pump on and withdraw fuel into the measuring drum in increments of 50 gal at a rate not exceeding 15 gal per min. When the pressure on the test gauge drops to 8 lb/in², select both 3-position switches to cock closed - pump off and trim the contents gauge to ZERO.

Note . . .

The indicator must be trimmed to ZERO within 1½ minutes of switching off the pumps and cocks.

(3) Fill the selected tank with fuel and check the gauge.

(4) Drain off fuel in increments of 50 gal, checking the calibration of the gauge *(Table 1)* and recording any deviation.

Calibration test - No.3 tank

27. To test No.3 tank:-

(1) With the aircraft prepared as in para.23, fill the tank with approximately 100 gal of fuel.

(2) With an external d.c. supply of $27.5 \pm \frac{0.5}{0}$ volts available and with the port and starboard fuel pump/cock circuit breakers closed, turn on the test cock at the pilot's engine instrument panel, select the port and starboard 3-position switches to cock closed - pump off and withdraw fuel into the measuring drum in increments of 50 gal at a rate not exceeding 15 gal per min. When the pressure on the test gauge drops to 8 lb/in², switch off the pumps and cocks and trim the contents gauge to ZERO.

Note . . .

The indicator must be trimmed to zero within 1½ minutes of switching off the pumps and cocks.

(3) Fill the tank with fuel, recording the number of gallons required for the contents gauge to read FULL. Check this quantity against that given in Table 2.

(4) Select both 3-position switches to cock open - pump on and withdraw fuel in increments of 50 gal at a rate not exceeding 15 gal per min, recording the contents at the decrements given in Table 1 and 2.

TABLE 2
No.3 tank and contents gauge calibration

Contents gauge reading (lb)	Contents in tank usable fuel (gal)	Permissible Error (gal)
FULL	530	+25
4000	500	± 24
3000	375	± 20
2000	250	± 15
1000	125	± 10
500	63	± 7.5
250	32	− 5
0	0	− 0

Wing-tip tanks fuel flow test

Test equipment

28. The following are required for testing the flow from the wing-tip tanks to No.3 tank.

(1) An air supply of 75 lb/in².

(2) A pressure gauge reading up to 100 lb/in².

(3) A stop watch.

Note . . .

Before the commencement of the tests the fuselage must be supported by a trestle at frame 42.

Flow test with ground air supply

29. Disconnect the air supply pipe from each engine compressor casing and connect the ground air supply to both air pipes, and with 50 gal of

fuel in No.3 tank and 150 gal in each wing-tip tank, apply an air pressure of 75 lb/in^2 to both wing-tip tanks and check the following:-

(1) The time taken for 100 gal (measured on No.3 tank fuel contents gauge) to transfer to No.3 tank; this must not exceed 7 minutes.

(2) That the flow from the wing-tip tanks is even. This is to be checked with a dipstick.

30. Disconnect the ground air supply from the starboard air pipe and supply an air pressure of 75 lb/in^2 to the port air pipe for a period of 3 minutes and check with a dipstick that the flow from each wing-tip tank is even. Repeat this operation, this time by applying an air pressure of 75 lb/in^2 to the starboard pipe instead of the port pipe.

31. Fill No.3 tank and with 100 gal of fuel in each wing-tip tank, apply a pressure of 75 lb/in^2 to both air pipes and ensure that the float valve in No.3 tank prevents any flow of fuel into the tank. Disconnect the ground air supply and connect the air supply pipes to the engine compressor casings.

Flow test with engines

32. With No.1 and 2 tanks full, 50 gal in the No.3 tank, port and starboard 3-position switches selected to cock closed, pump off run both engines at 5500 rev/min and check the following:-

(1) The time taken for 50 gal (measured on No.3 tank fuel gauge) to transfer to No.3 tank from the wing-tip tanks; this must not exceed 3½ minutes.

(2) That the flow from each wing-tip tank is even. Check with dip-stick.

Pump delivery tests

33. Bleed all air from the fuel system and adjust the fuel levels in the tanks as follows:-

No.1 tank	160 gal
No.2 tank	130 gal
No.3 tank	162 gal

(1) With the aircraft prepared as in para.23, operate each pump in turn and check that 3 gal of fuel is delivered in not more than 7.3 sec. Take an average of 3 readings. The voltage at the pumps is to be 24V ◀ *(refer to A.P.101B-0402-1B, Sect.5, Chap.1, Group Q for the voltage drop from the busbar to the pump).*

(2) The rate of fuel transfer from the 300 gallon auxiliary tank to No.3 tank must not exceed the following:

Each pump separately - 24 gal in not more than 1 min.
Both pumps together - 60 gal in not more than 2 min.

Take an average of 3 readings. Refer to A.P.101B-0402-1B, Sect.5, Chap.1, Group Q, for the tank pumps electrical tests. ▶

Pressure test (no flow)

34. Fuel pump push-button test switches, one for each pump excluding those fitted in the auxiliary tank, and an ammeter socket, are mounted on a panel inside the E.C.P. Each pump is to be tested separately in the following manner:-

(1) Prepare the aircraft as in para.23, with the test cock turned OFF.

(2) Select the 3-position switch on the pilot's engine instrument panel for the required pump to cock open - pump on and run the pump for 5 min.

(3) Select the 3-position switch to cock open - pump off. With an ammeter plugged into the test socket within the E.C.P., depress the appropriate test push-button switch and compare the pressure and current readings which with 24V at the pump terminals should read 11.5A when sustaining a no-flow pressure of 16.5 lb/in^2.

Note . . .

When checking the pressure and current readings, ensure that all the 3-position switches are in the cock open- pump off position and all the pump circuit breakers are closed.

Miscellaneous tests

35. Sequence of operations:-

(1) Select each of the 3-position switches in turn to cock open - pump on and check that the fuel pressure warning lamps are extinguished

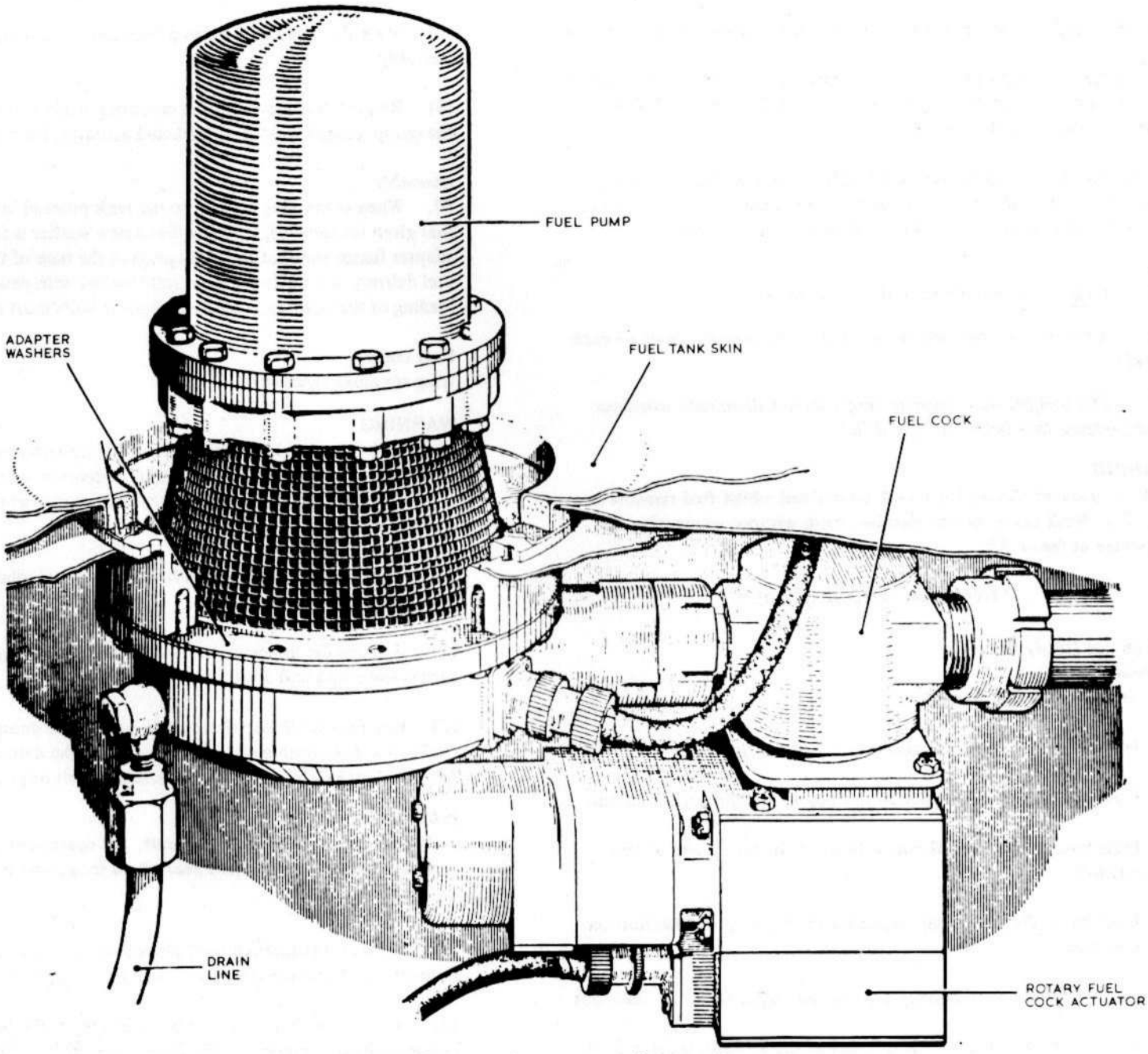


FIG. 4. FUEL PUMP INSTALLATION – FUSELAGE TANKS

◀ *Illustration and annotations amended* ▶

(Note 3), and that the fuel pipe connection at the engine does not leak.

(2) Operate the high pressure cock control levers, and check that the high pressure cocks on the engine move from full OFF to full ON in phase with the control levers.

(3) Check the venting system for freedom from obstruction, by blowing through with air at a pressure not exceeding 3 lb/in^2. Ensure that no foreign matter or moisture is blown into the tanks.

Note . . .

1. *Filler caps must be in position for all tests.*

2. *All tests must be carried out at the fuel delivery pipes to each engine.*

3. *The fuel pressure warning lamps should illuminate whenever the pressure falls below 6 $^{+0.5}_{-0}$ lb/in^2.*

WARNING

On no account should No.1 tank be drained whilst fuel remains in No.2 or No.3 tanks, or the auxiliary tank without supporting the fuselage at frame 42.

REMOVAL AND ASSEMBLY

◀ Fuel pumps *(fig.4)* ▶

Removal

36. To remove a fuel pump:-

(1) Drain the tank *(para.14)* and the fuel pump *(para.18)*.

(2) Isolate the electrical supply to the pump and the cock actuator.

(3) Disconnect the electrical connections at the pump and at the cock actuator.

(4) Disconnect the fuel pump drainpipe at the banjo connection on the pump base.

(5) Disconnect the fuel delivery pipe at the outlet from the fuel cock.

(6) Remove the bolt from the upper end of the actuator bracing strut.

(7) Mark the edges of the pump base and pump adapter, to facilitate assembly.

(8) Remove the nuts from the mounting studs in the adapter and remove the pump, complete with its cock and actuator, from the adapter.

Assembly

37. When assembling a pump to the tank proceed in the reverse order to that given for removal, ensuring that a new washer is fitted to the pump adapter flange and that the drain plugs in the base of the pump and the fuel delivery connections are securely locked with new wire; the torque loading of the adapter to tank attachment bolts must not exceed 25 lb in.

Fuel tanks

Wing tip tanks - removal

WARNING

Personnel are reminded that explosive detonators are incorporated in the wing tip tank attachment bolts. Attention is drawn to the requirements of the LETHAL WARNING marker card at the front of this volume.

38. To remove a wing tip tank from the aircraft, drain the tank *(para.16)* and proceed as follows:-

(1) Remove the upper surface access panels covering the fuel and air pipe connections and attachment bolts.

(2) Ensure that all electrical supply sources are completely isolated *(refer to lethal warning card)* and disconnect the detonator leads at the terminal blocks adjacent to the attachment bolt heads.

WARNING

Do not handle the detonator itself. All operations must be done by holding the electrical leads near where they enter the detonator. THIS IS IMPORTANT.

(3) Unscrew the knurled head plugs from the bolts and withdraw the detonators. Stow in a safe place away from the working area.

(4) Remove the lower surface access panels to the fuel and air pipe connections and slacken off the upper hose clips to the release pipes.

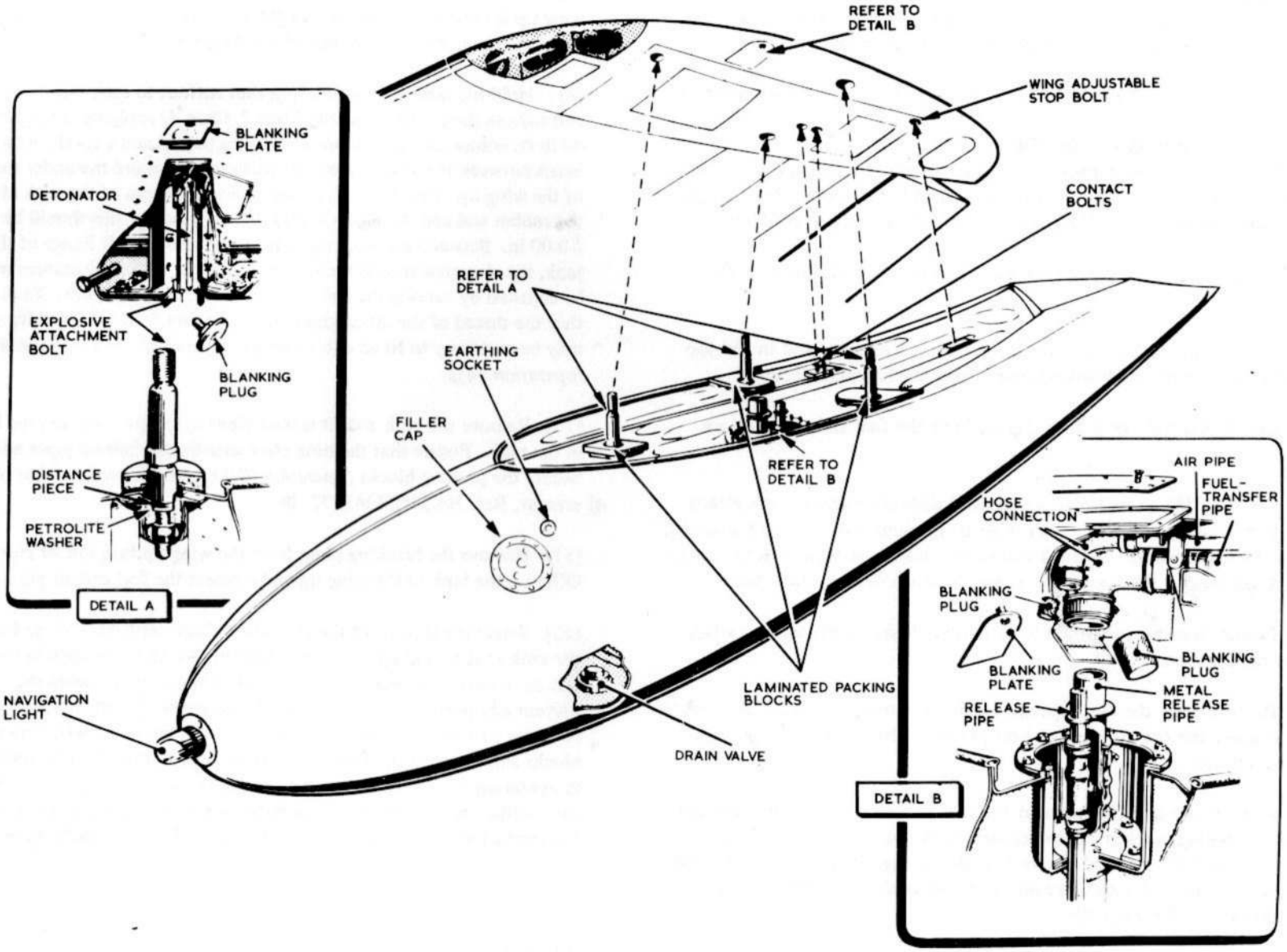


FIG. 5. WING-TIP TANKS INSTALLATION

◀ *Title amended* ▶

(5) Support the tank and remove the three nuts from the attachment bolts using special spanner *(Sect.2, Chap.4, Table 1)* lower the tank at the same time easing the release pipes away from the joints.

(6) Fit blanking plugs to exposed pipe ends and replace the access panels.

◀ *Wing-tip tanks - installation (fig.5)* ▶

39. If a tank has been jettisoned from the aircraft, the wing-tip fuel and air pipe connections must be carefully examined for cuts and other damage and renewed if necessary. The procedure for fitting a tank is as follows:-

(1) Remove the fabric patch from each attachment bolt block on the tank.

(2) Remove the fabric patch from the fuel and air pipe well in the top of the tank; remove the blanking plugs from the fuel and air pipes.

(3) Check that the lower hose clip on both the fuel and air pipes are tight.

(4) Insert a 5/32 in. Petrolite washer and distance piece in each attachment bolt housing *(detail A)*. Insert an attachment bolt into each housing, fit two locknuts on the threaded end of the bolt, lock them together and using a spanner on the upper nut, screw the bolts securely into place.

(5) Ensure that the navigation lamp contact bolts on the upper surface of the tank are clean.

(6) Remove both the fabric patches and the blanking plates at the fuel and air pipes and the attachment bolt positions, from the upper surface of the wing tip.

(7) Remove the blanking plate at the fuel and air pipe position and the screwed blanking plugs at the attachment bolt housing from the lower surface of the wing tip, and ensure that the navigation lamp contact studs are clean. Remove the patch covering the adjustable stop bolt in the lower surface of the wing tip.

(8) Offer up the tank to the wing tip so that the three attachment bolts line up with and enter the wing-tip bolt housings, check that the navigation lamp contact bolts on the tank line up with the contact studs in the wing tip, and that the rear bearing block on the top of the tank lines up with the adjustable stop-bolt in the wing surface. When offering up the tank to the wing tip it must be offered up straight and great care must be taken to avoid damaging the trailing edge of the wing tip.

(9) Hold the tank in position, fit a thin stiffnut to each attachment bolt and tighten them with a spanner *(Sect.2, Chap.4)* applying a torque of 40 lb ft; ensure that the rubber seal is compressed and a good contact exists between the attachment bolt packing blocks and the under surface of the wing tip. Check the clearance between the rim of the tank aft of the rubber seal and the under surface of the wing tip, this should be 0.16 $\pm$0.09 in. Between the wing tip trailing edge and the aft flange of the tank, the clearance should be 0.20 in. $\pm \frac{0.15}{0.10}$ in. These clearances may be adjusted by varying the laminations of the packing blocks. To ensure that the thread of the attachment bolt protrudes through the stiffnut it may be necessary to fit an extra spacing washer into each bolt housing *(operation (4))*.

(10) Remove the tank and fit release pipes to the fuel and air pipe hoses in the tank. Ensure that the hose clips securing the release pipes are tight. Secure the packing blocks *(operation (9))* to the tank with rubber resin ◀ cement, Ref. No.33H/2245977. ▶

(11) Remove the blanking plugs from the wing tip fuel and air pipes. Offer up the tank to the wing tip and connect the fuel and air pipes.

(12) Smear the threads of the attachment bolts with XG-287 and secure the tank to the wing tip as in operation (9). Fit the hose clips to the fuel and air connections, ensuring that the clips are properly tightened. To prevent any possibility of vibration, it is essential that the three attachment bolts are correctly tightened to give complete contact between the packing blocks and the wing tip whilst maintaining the correct tank clearance as in operation (9); the tank must not protrude more than 0.25 in. above the trailing edge. Unlock the adjustable stop bolt and screw down until full contact is made with the tank bearing block, then relock the bolt.

WARNING

Do not handle the detonator itself. All operations must be done by holding the electrical leads near where they enter the detonator. THIS IS MOST IMPORTANT.

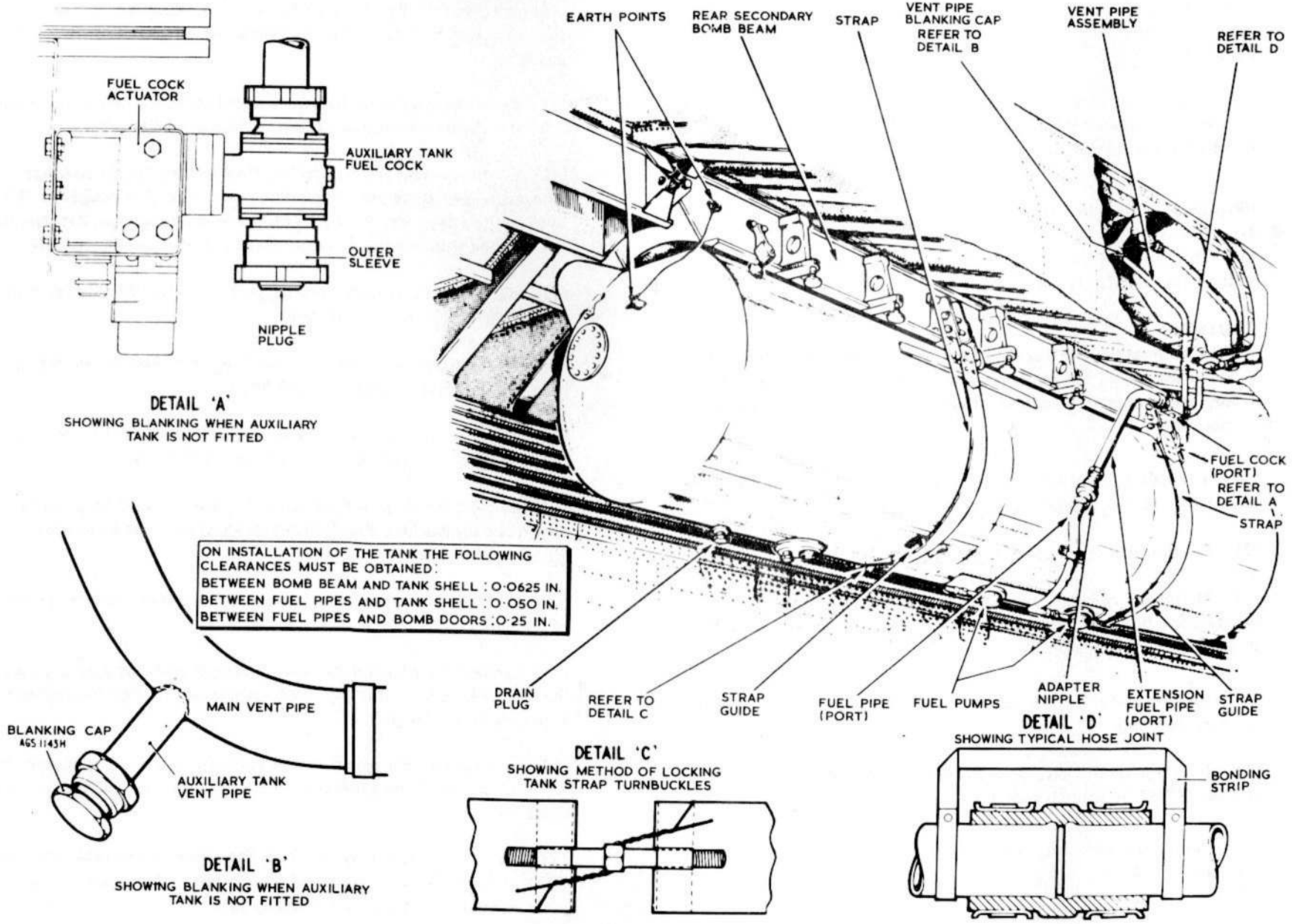


FIG. 6. INSTALLATION OF 300-GALLON AUXILIARY FUEL TANK-AFT POSITION (MOD. 432)

◀ *Title amended* ▶

(13) Insert a detonator assembly into each attachment bolt so that it rests on the bottom of the hole in the bolt without undue pressure from the distance tube; tighten the detonator securing nut. Refer to A.P.110N-0306-1, for full information on the assembly of the detonator.

(14) Connect the detonator leads to the detonator terminal block in the wing tip and replace the blanking plates on the upper surface of the wing tip. Renew the fabric patches.

300-gallon auxiliary fuel tank installation

Aft position (fig.6)

40. The procedure for installing the auxiliary fuel tank in the aft position for aircraft post Mod.432 is as follows:-

CAUTION

Prior to installing the auxiliary tank, examine the associated fuel cocks and piping for contamination by water and/or sludge. If any contamination is present, affected parts must be thoroughly cleaned.

(1) The tank is attached to the rear secondary bomb beam which must be fitted first *(Sect.3, Chap.1)*.

(2) Position the aircraft as described in Sect.2, Chap.4.

(3) Mount the auxiliary fuel tank on a low loading trolley using locally-made blocks giving clearance for the fuel pumps and drain plug in the base of the tank.

(4) Remove and retain the blanking plugs from the two fuel pipes on the tank assembly.

(5) Fit a non-return valve, Part No.SPE.P.24.A, with an adapter nipple, Ref.No.28F/8216, to each fuel pipe.

(6) Couple the extension fuel pipes (Part No.EA3.56.245, starboard, and Part No.EA3.56.247, port) with adapter nipples to the non-return valves.

(7) Remove the blanking cap from No.3 fuel tank vent pipe at the rear of frame 27.

(8) Remove the clip over the hole in the tank bay floor and attach the vent pipe assembly, Part No.EA3.56.249, to the coupling on the vent pipe from No.3 tank using the nipples AGS.903H. Wire-lock the coupling.

(9) Secure the pipe with the clip mounted above the hole in the floor using fine-mesh bonding gauze between the pipe and the clip.

(10) Couple the vent pipe assemblies, Part No.EA3.56.251 and Part No.EA3.56.249, using one rubber hose connection, Part No.EEAS.77.71, two clamping rings, Part No.EEAS.66.5, and two hose clips, Ref. No.28E/8183. Bond with bonding strip and two bonding clips AGS.1661/G.

(11) Remove and retain the blanking plugs, Ref. No.28F/11258, from the two fuel cocks in the bomb bay.

(12) Fit the strap-and-turnbuckle assemblies, Part No.EA3.56.261, to the brackets on the rear secondary bomb beam.

(13) Raise the tank to its position on the bomb beam and ensure that the straps are located in the guides on each side of the tank.

(14) Connect the straps with the trunnion, Part No.EA3.56.47 and EA3.56.49, and turnbuckles, Part No.EA3.56.45. Tighten and wire-lock. Withdraw the trolley.

(15) Close the bomb-bay doors sufficiently to permit access to the top of the tank.

(16) Connect the port and starboard fuel pipes from the auxiliary tank to the fuel cocks in the bomb bay using adapter nipples, Ref. No.28F/8216. Wire-lock the couplings.

(17) Connect the vent pipe from the auxiliary tank to the vent pipe. Part No. EA3.56.251, fitted at operation (10) and make the coupling as in that operation.

(18) Remove the screening cap from the socket of the cable assembly CS2A at frame 24 on the starboard side of the bomb bay, and connect with cable assembly CS2A from the auxiliary tank.

(19) Connect the earthing point at the forward end of the auxiliary tank to the point at the forward end of the bomb beam.

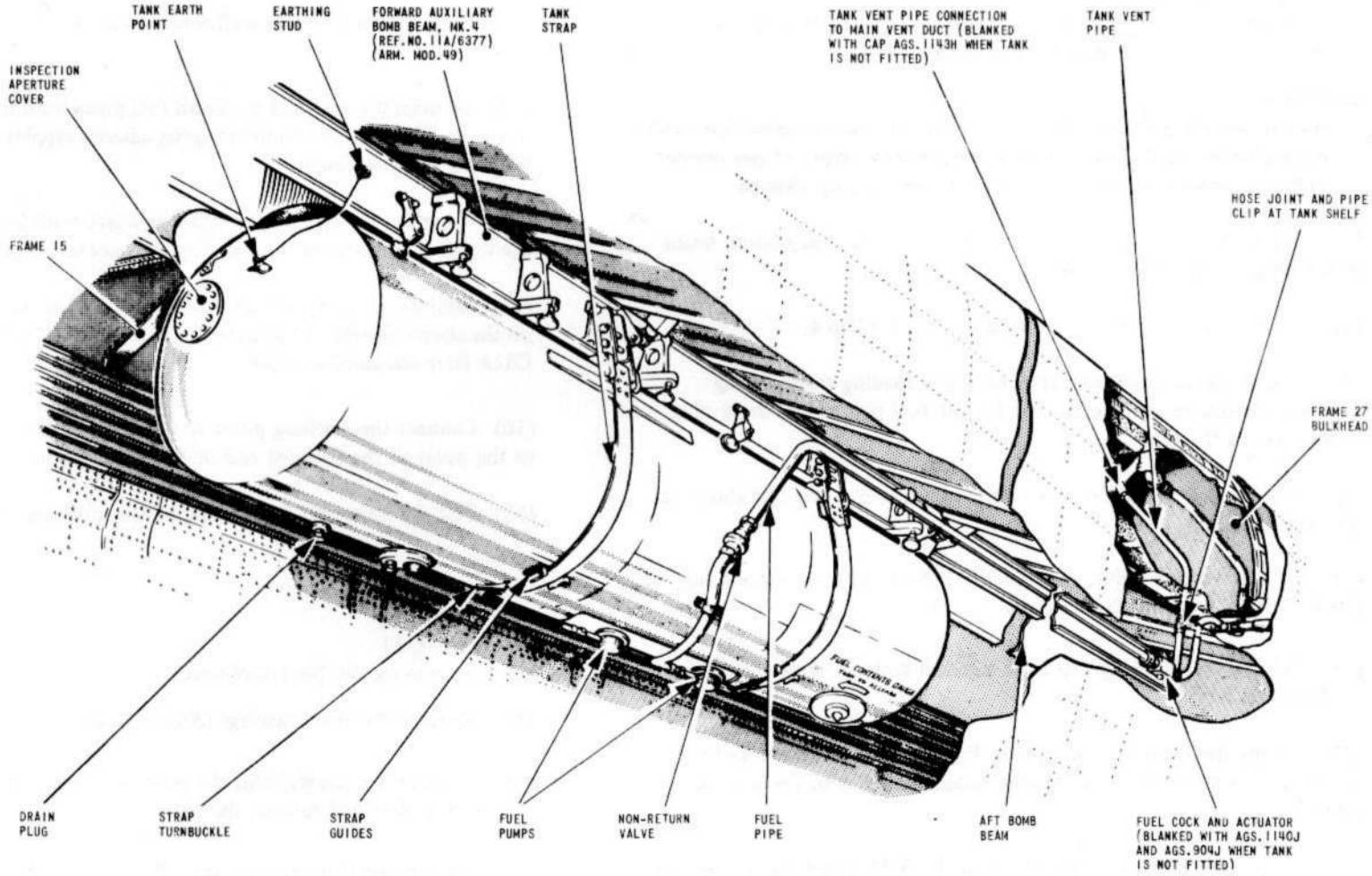


FIG.7. INSTALLATION OF 300-GALLON AUXILIARY FUEL TANK-FWD. POSITION (MOD 3757)

◀ *Annotations amended* ▶

(20) Test for leaks and functioning of the auxiliary tank system *(para.33).*

◀ *Forward position (fig.7)*

41. The procedure for installing the auxiliary fuel tank in the forward position for aircraft post Mod.3757 is as follows:- ▶

CAUTION

Prior to installing the auxiliary tank, examine the associated fuel cocks and piping for contamination by water and/or sludge. If any contamination is present, affected parts must be thoroughly cleaned.

(1) The tank is attached to a modified forward auxiliary bomb beam which must be fitted first. *(Sect.3, Chap.1).*

(2) Position the aircraft as described in Sect.2, Chap.4.

(3) Mount the auxiliary fuel tank on a low loading trolley using locally-made blocks giving clearance for the fuel pumps and drain plug in the base of the tank.

(4) Remove and retain the blanking plugs from the two fuel pipes on the tank assembly.

(5) Fit a non-return valve, Part No.SPE.P.24.A, with an adapter nipple, Ref.No.28F/8216, to each fuel pipe.

(6) Remove the blanking cap from the fuel and vent pipes in the roof of the bomb bay.

(7) Couple the extension fuel pipes (Part No.EA3.57.5059, starboard and Part No.EA3.57.5057, port) with adapter nipples to the non-return valves.

(8) Couple the vent pipe, Part No.EA3.57.5071, using one rubber hose connection, Part No.EEAS.77.71, two clamping rings, Part No.EEAS.66.5, and two hose clips, Ref. No.28E/8183. Bond with bonding strip and two bonding clips, AGS.1661/G.

(9) Fit the strap-and-turnbuckle assemblies to the brackets on the forward auxiliary bomb beam.

(10) Raise the tank to its position on the bomb beam and ensure that the straps are located in the guides on each side of the tank.

(11) Connect the straps with the trunnion and turnbuckles and tighten and wire-lock. Withdraw the trolley.

(12) Close the bomb doors sufficiently to permit access to the top of the tank.

(13) Connect the port and starboard fuel pipes from the auxiliary tank to the fuel pipes in the bomb bay using adapter nipples Ref. No.28F/8216. Wire-lock the couplings.

(14) Connect the vent pipe from the auxiliary tank to the vent pipe in the bomb bay and make the coupling as in operation (8).

(15) Remove the screening cap from the socket of the cable assembly CS2A on the starboard side of the bomb bay, and connect with cable assembly CS2A from the auxiliary tank.

(16) Connect the earthing point at the forward end of the auxiliary tank to the point at the forward end of the bomb beam.

(17) Test for leaks and functioning of the auxiliary tank system *(para.33).*

No.1 fuel tank

Removal (fig.8)

42. To remove the No.1 fuel tank:-

(1) Remove the front fuselage *(Sect.3, Chap.1).*

(2) Remove the screws from the outer and inner edges of the filler-cap attachment plate and remove the plate.

(3) Slacken the clip, securing the filler-cap drain hose, and disconnect the hose from the adapter.

(4) Remove the nuts and washers attaching the filler cap to the tank, remove the filler cap and fit a circular blanking plate in its place. Refit the washers and nuts on the attachment studs.

(5) Remove the venting gallery access panel and remove the nuts attaching the venting gallery elbow to the studs on the tank.

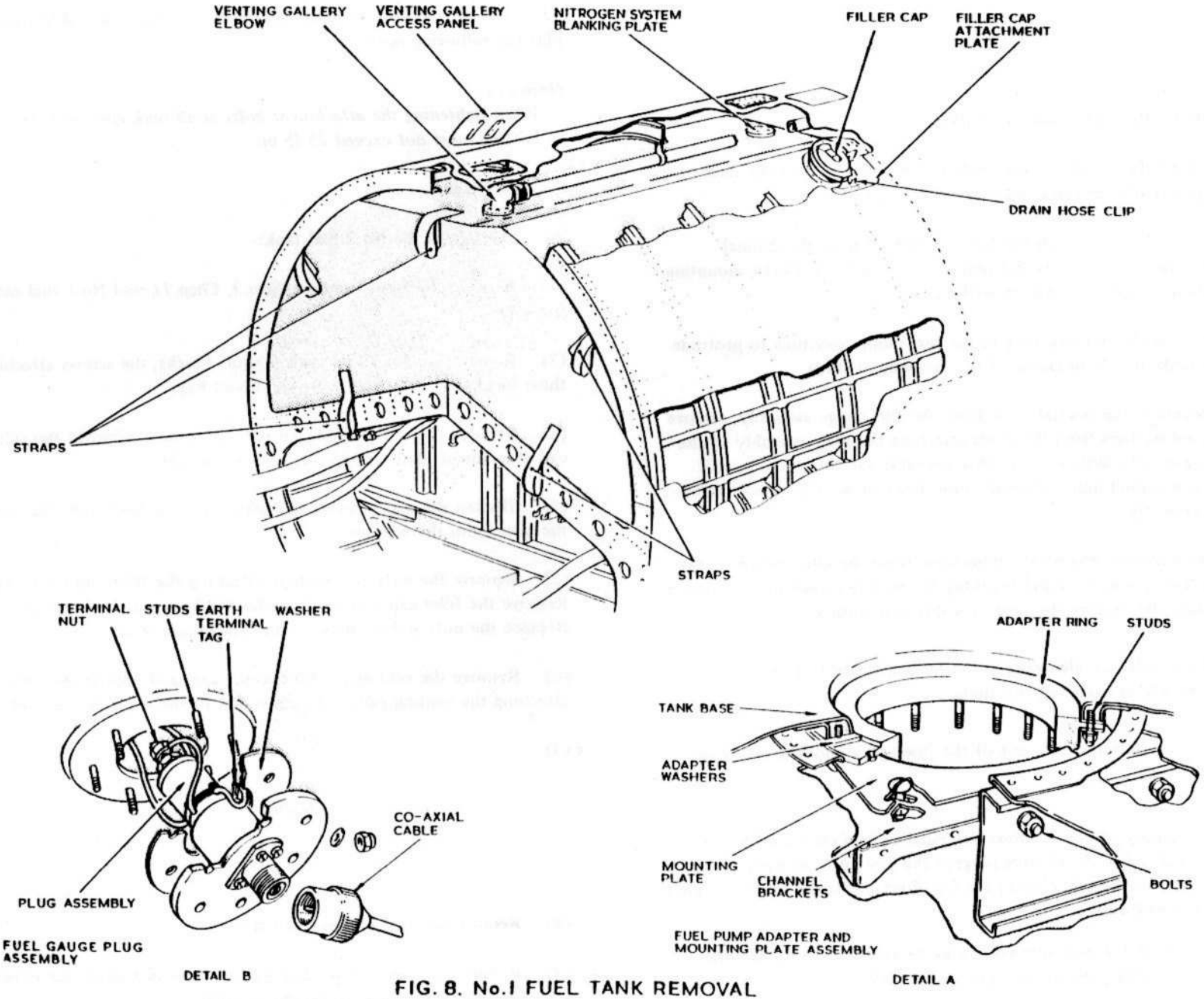


FIG. 8. No.1 FUEL TANK REMOVAL

◄MOD. 5339 EMBODIED►

◄ (6)

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►

(7) Remove the fuel pumps *(para.36)*.

(8) Remove the nuts from the studs securing the base of the tank to the fuel pump adapter rings and mounting plates.

(9) Remove the nuts from the bolts on the sides of the channel brackets, withdraw the bolts and remove the channel brackets, mounting plates, adapter rings and adapter washers.

(10) Fit a circular wooden plug in the fuel pump apertures to protrude from the tank slightly in excess of the attachment studs.

(11) Disconnect the coaxial cable from the fuel gauge assembly, remove the nuts and washers from the studs attaching the plug assembly to the tank, and carefully withdraw the plug assembly far enough to permit the tank (capacitor) unit electrical connections to be disconnected from the plug assembly.

(12) Disconnect the electrical connections from the plug assembly, by removing the terminal nut and breaking the soldered joint to the earth terminal tag, and remove the plug assembly and washer.

(13) Fit a circular wooden plug in the tank aperture to protrude from the tank slightly in excess of the studs.

(14) Carefully slide the tank out of the fuselage by pulling evenly on the five handling straps.

Note...

◄ *1. The venting gallery T-connection must be held clear during tank withdrawal. Also, the wooden plugs in the fuel gauge plug and pump apertures, must be held clear of the bay floor during the first few inches of tank withdrawal.*

2. If the tank is being replaced, it may be necessary to transfer the nitrogen blanking plate to the replacement tank. ►

Installation

43. The installation procedure is a reversal of the removal instructions, plus the following note:-

Note . . .

When tightening the attachment bolts at all tank apertures the torque loading must not exceed 25 lb in.

No.2 fuel tank

Removal (fig.9)

44. To remove the No.2 fuel tank:-

(1) Remove the front fuselage *(Sect.3, Chap.1)*, and No.1 fuel tank *(para.42)*.

(2) Remove the No.1 fuel tank support blocks; the screws attaching these blocks are accessible from the bomb bay.

(3) Remove the screws from the outer and inner edges of the filler cap attachment plate *(fig.8)*, and remove the plate.

(4) Slacken the clip securing the filler cap drain hose and disconnect the hose from the adapter.

(5) Remove the nuts and washers attaching the filler cap to the tank. Remove the filler cap and fit a circular blanking plate in its place. Replace the nuts and washers on the attachment studs.

(6) Remove the venting gallery access panel and remove the nuts attaching the venting gallery T-connection to the studs on the tank.

◄ (7)

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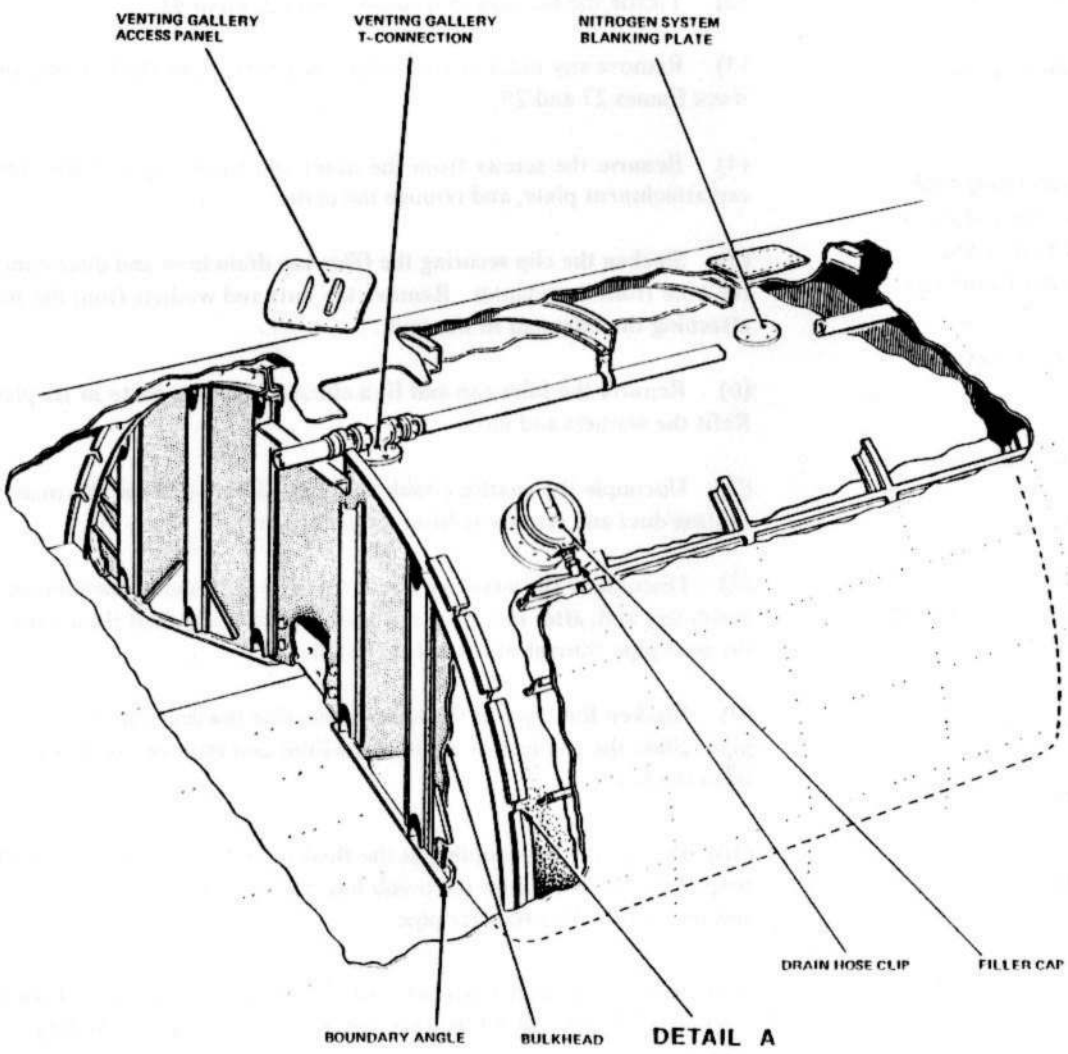
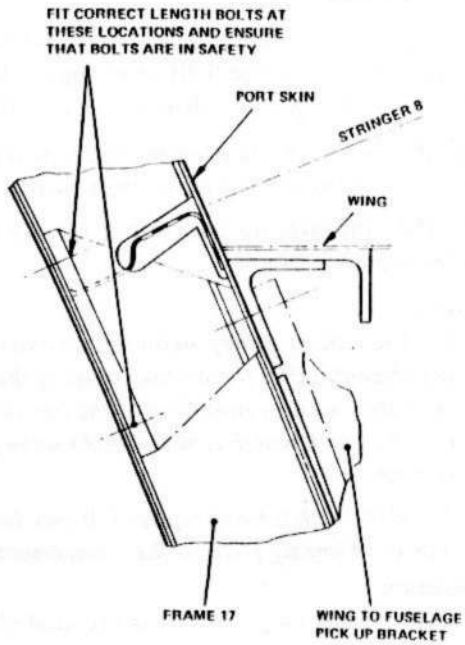
(8) Remove the fuel pumps *(para.36)*.

(9) Remove the fuel pump adapters and mounting plate assemblies as instructed in para.42 operations (8) to (10).





DETAIL A

PORT SHOWN
STBD OPPOSITE HAND

FIG. 9. No. 2 FUEL TANK REMOVAL

◂ MOD. 5339 EMBODIED ▸

(10) Remove the fuel gauge plug assembly as instructed in para.42 operations (11) to (13).

(11) Remove the bolts attaching the bulkhead to the boundary angle at frame 17, remove the bolts attaching the lower centre portion of the bulkhead to the spreader plate and remove the bulkhead.

(12) Remove the bolts attaching the four sections of the boundary angle and remove the boundary angle sections.

(13) Carefully slide the tank out of the fuselage by pulling evenly on the five handling straps.

◄ **Note...**

1. The venting gallery T-connection must be held clear during tank withdrawal. Also, the wooden plugs in the fuel gauge plug and pump apertures, must be held clear of the bay floor during the first few inches of tank withdrawal and again when passing the No 1 tank bay apertures.

2. If the tank is being replaced, it may be necessary to transfer the nitrogen blanking plate to the replacement tank. ►

Installation

45. The installation procedure is a reversal of the removal instructions plus the following notes:-

Note . . .

1. Before inserting the tank into the fuselage, place inclined wooden ramps at the port and starboard sides of the step position and a tapered wooden block, rounded at the top to the shape of the recess on the underside of the tank, against the spreader plate.

2. When the tank is in position, remove the inclined ramps and tapered block.

3. When tightening attachment bolts at all tank apertures the torque loading must not exceed 25 lb in.

4. Fit the correct length bolts at frame 17 bulkhead (fig.9, detail A).

No.3 fuel tank

Removal (fig.10)

46. To remove the No.3 fuel tank:-

WARNING

Before attempting to remove the fuel tank, ensure that the tank bay is adequately ventilated. Fuel fumes are dangerous and before commencing work in the tank bay full safety precautions, as specified in ◄ A.P.106B-0200-1 series, must be taken. ►

Note . . .

All operations at the rear of the tank are performed inside the fuselage, access being gained through the rear hatch.

(1) Disconnect all electrical supplies.

(2) Trestle the fuselage at frame 42 *(Sect.2, Chap.4).*

(3) Remove any radio and/or radar equipment from the tank shelf between frames 27 and 29.

(4) Remove the screws from the outer and inner edges of the filler-cap attachment plate, and remove the plate.

(5) Slacken the clip securing the filler-cap drain hose and disconnect the hose from the adapter. Remove the nuts and washers from the studs attaching the filler-cap to the tank.

(6) Remove the filler-cap and fit a circular blanking plate in its place. Refit the washers and nuts.

(7) Uncouple the auxiliary tank vent pipe (if fitted) from the main venting duct and remove it from the hose joint.

(8) Disconnect the auxiliary tank vent pipe at its next hose joint in the bomb bay and, after removing the pipe clip from the shelf floor, withdraw the vent pipe through the bomb-bay roof.

(9) Slacken the clips on the hose connecting the vent gallery to the vent pipe. Slide the connection clear of the joint and remove the vent pipes from the bracket.

(10) Disconnect the coupling at the float valve. Disconnect the bonding strip at the connection in the bomb bay, slacken the clip at this connection and remove the fuel transfer pipe.

(11) Remove the nuts from the studs attaching the float valve, turn the valve upward through 90 degrees and withdraw it with its sealing washer.

(12) Remove the nuts washers and bolts attaching the pyrotechnic flame detector (if fitted) to the spray tube.

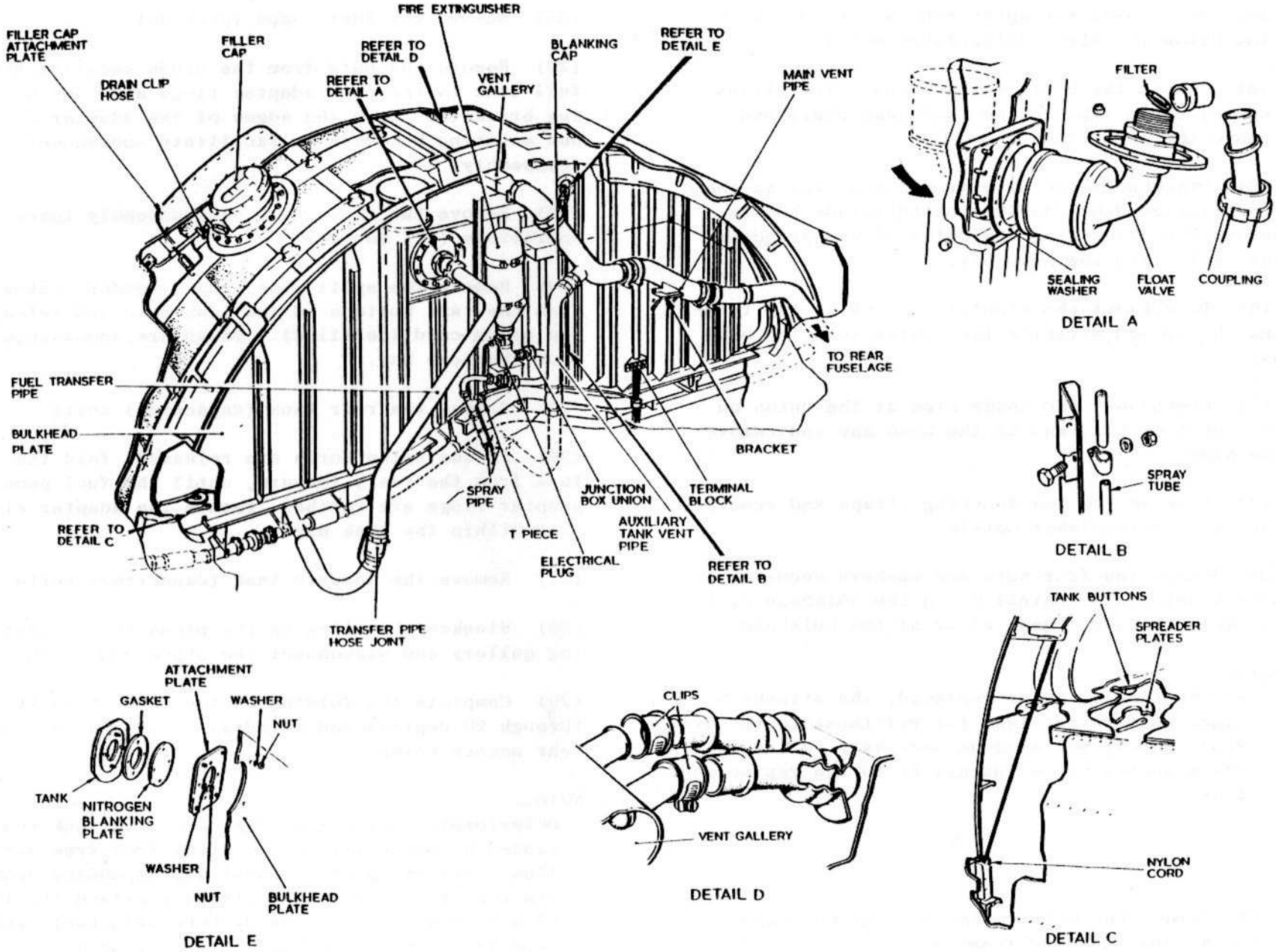


FIG. 10. No. 3 FUEL TANK REMOVAL

◂MOD. 5339 EMBODIED▸

(13) Disconnect the spray tube at the T-connection below the fire extinguisher bottle.

(14) Remove the nuts, washers and bolts attaching the spray tube to the bulkhead plate and remove the spray tube (detail B).

(15) Disconnect the plug from the socket in the operating head of the fire extinguisher bottle. Remove the clips from the bulkhead and withdraw the cable into the bomb bay.

(16) Disconnect the electric cables at the terminal block and withdraw the cables into the bomb bay.

(17) Disconnect the spray pipe at the union on the junction box, and in the bomb bay and remove the pipe.

(18) Release the two mounting straps and remove the fire extinguisher bottle.

(19) Remove the four nuts and washers securing the attachment plate (detail E) to the bulkhead plate and ease the attachment clear of the bulkhead plate

Note...
If the tank is being replaced, the attachment plate must be retained for refitment to the aircraft and it may also be necessary to transfer the blanking plate (detail E) to the replacement tank.

(20) Remove the bolts attaching the bulkhead plate to the bulkhead frame and remove the plate.

(21) Remove the fuel pumps (para.36)

(22) Remove the nuts from the studs securing the fuel tank to the pump adapter rings and pump mounting brackets. Mark the edges of the adapter rings and mounting brackets to facilitate subsequent reassembly.

(23) Remove the fuel gauge plug assembly (para.42, operations (11) to (13)).

(24) Remove the split pins, and spreader plates from the tank buttons on the tank base and release the nylon cord (detail C). These are accessible from the bomb bay.

(25) Remove the rear tank (capacitor) units.

(26) As the nylon cords are released, fold the tank from the rear, forward, until the fuel pump adapter rings are reached, remove the adapter rings from within the tank bay.

(27) Remove the forward tank (capacitor) units.

(28) Slacken the clips on the pipes to the venting gallery and disconnect the pipes (detail D).

(29) Complete the folding of the tank, turn it through 90 degrees and withdraw it aft through the rear access hatch.

Note...
Deterioration of the condition of the tank can be caused by ozone attack resulting from free airflow. Following its removal and depending upon its condition (treatment will not extend the life of a tank which has already been attacked), the tank is to be treated prior to storing or

refitting, by cleaning all its corners, over an area of 24 in, minimum radius, with M.E.K. cleanser Ref. No. 33C/2203584 and subsequently applying three coats of Tredurex Green Lacquer D.T.D.900/4481, Ref. No. 32D/2202498 over the cleaned areas. Each coat is to be allowed to dry before application of the next one. The above procedure is applicable only to tanks manufactured by Fireproof Tanks Ltd.

Installation (fig.11)

47. To install the No.3 fuel tank:-

Note...

1. Ensure that the tank bay is clean and free from any projections or irregularities which may tend to damage the tank.

2. Check that the felt pads covering the nylon cord attachment lugs on the inner skin of the fuselage are secure.

3. Ensure that the order of assembly of the nitrogen blanking assembly is as shown in fig.10 detail E; the position of the gasket in particular should be noted. Incorrect assembly will result in a fuel leak.

4. Before folding, cover any projection such as bolt heads, vent pipes, or other tank fittings with suitable material to prevent damage.

5. Examine all fuel contents gauging system cables and cable assemblies for damage, corrosion and security of attachment prior to fitment of tank to aircraft.

(1) Spread out the fully deflated tank.

(2) Fold over the ends (1) and fold again into one third of the width (2 and 3).

(cont'd)

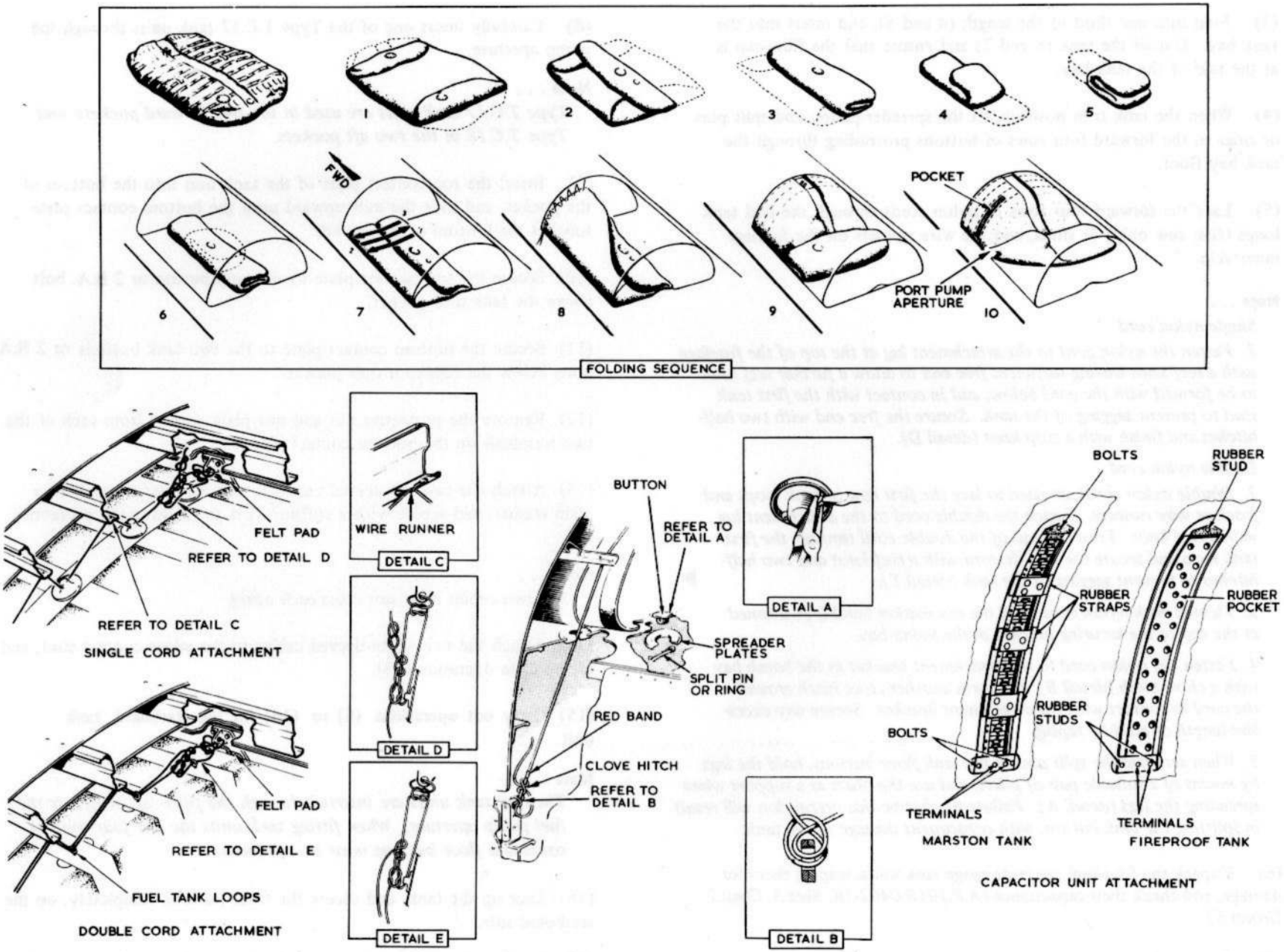


FIG.11. NO.3 TANK INSTALLATION

◀ LACING KNOTS AMENDED ▶

(3) Fold into one third of the length (4 and 5), and insert into the tank bay. Unfold the tank (6 and 7) and ensure that the filler-cap is at the rear of the tank bay.

(4) When the tank is in position, fit the spreader-plates, and split pins or rings to the forward four rows of buttons protruding through the tank bay floor.

(5) Lace the forward four rows of nylon cords through the fuel tank loops (first row only) or studs, and the wire runners on the fuselage inner skin.

Note . . .

Single nylon cord

1. Fasten the nylon cord to the attachment lug at the top of the fuselage with a reef knot leaving sufficient free end to allow a further reef knot to be formed with the cord below, and in contact with the first tank stud to prevent sagging of the tank. Secure the free end with two half-hitches and finish with a stop knot (detail D).

Double nylon cord

2. Double nylon cords are used to lace the first row of tank loops and fuselage wire runners. Fasten the double cord to the attachment lug with a reef knot. Feed one tail of the double cord through the first tank loop and secure the double cord with a reef knot and two half-hitches to prevent sagging of the tank (detail E).

3. Tighten each nylon cord until the red marker band is positioned at the top of the securing bracket in the bomb bay.

4. Fasten the nylon cord to the attachment bracket in the bomb bay with a clove hitch (detail B), and form another clove hitch around the cord in contact with the attachment bracket. Secure any excessive length of cord by taping.

5. When securing the split pins in the tank floor buttons, hold the legs by means of a suitable pair of pliers, and use the pliers as a support when spreading the legs (detail A). Failure to observe this precaution will result in splitting the tank button, with consequent damage to the tank.

(6) Unpack the four fuel contents gauge tank units, inspect them for damage, and check their capacitance *(A.P.101B-0402-1B, Sect.5, Chap.2, Group E).*

(7) Remove the port pump aperture cover plate, and locate the port tank unit pocket on the inner wall of the tank near the pump aperture.

(8) Carefully insert one of the Type T.C.17 tank units through the pump aperture.

Note . . .

Type T.C.17 tank units are used in the two forward pockets, and Type T.C.18 in the two aft pockets.

(9) Insert the top contact plate of the tank unit into the bottom of the pocket, and slide the unit upward until the bottom contact plate touches the bottom of the pocket.

(10) Secure the top contact plate to the tank button or 2 B.A. bolt above the tank unit pocket.

(11) Secure the bottom contact plate to the two tank buttons or 2 B.A. bolts below the capacitor unit pocket.

(12) Remove the protective nut and one plain washer from each of the two terminals on the bottom contact plate.

(13) Attach the two red-sleeved cables to the red contact stud, fit a plain washer, and secure with a stiffnut. Fit and tighten the protective nut.

Note . . .

The two cables must not cross each other.

(14) Attach the two white-sleeved cables to the white contact stud, and secure as in operation (13).

(15) Carry out operations (8) to (14) for the starboard tank unit.

Note . . .

The rear tank units are inserted through the filler-cap orifice or the fuel pump aperture. When fitting tank units the last four rows of cords and floor buttons must be left loose.

(16) Lace up the tank, and secure the floor buttons completely, on the starboard side.

(17) Lace up the tank on the port side, leaving the last four rows of cords loose, and secure the next four rows of the floor buttons.

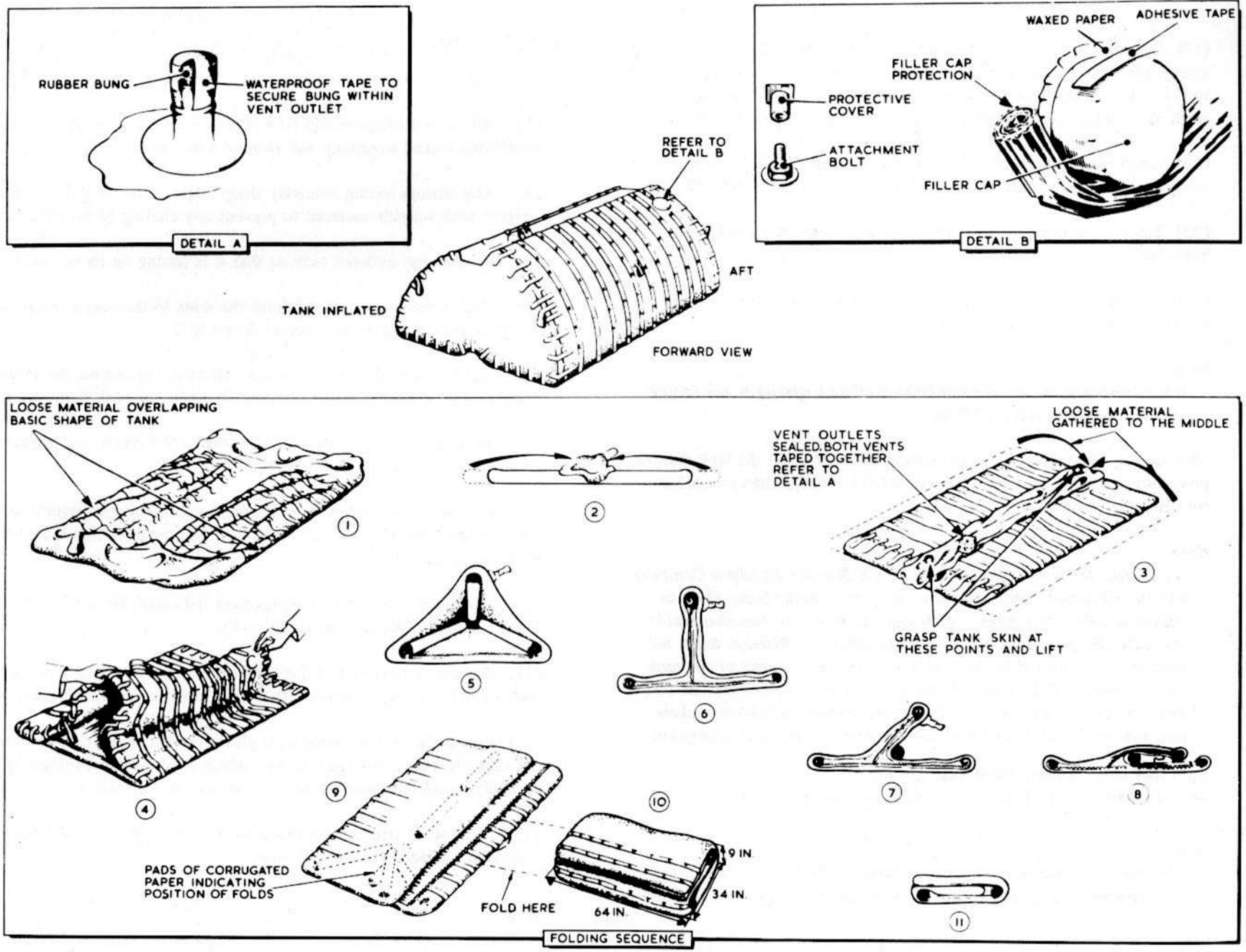


FIG. 12. No.3 FUEL TANK - FOLDING FOR STORAGE

◀ *Detail added* ▶

(18) Insert a Type T.C.18 tank unit through the filler-cap aperture and secure it in the tank unit pocket on the starboard side, as in operations (9) to (11). Attach the three red-sleeved cables to the red stud and the three earthing cables to the remaining contact stud. Secure as in operation (13).

(19) Insert the remaining T.C.18 tank unit through the filler-cap aperture, and secure in the port tank unit pocket as in operations (9) to (14).

(20) Tighten the last four rows of cords, and secure the tank floor buttons.

(21) The remainder of the installation procedure is the reverse of that detailed for the removal of the tank.

Note . . .

When tightening the attachment bolts at all tank apertures, the torque loading must not exceed 25 lb in.

When fitting new tank units to an existing tank, carry out the tank removal procedure described in para.46 *(operations (1) to (28))*, then proceed as for fitting to a new tank.

Note . . .

No.3 tanks are manufactured by both the Marston Excelsior Company and the Fireproof Tank Company, the former tanks being black in colour and the latter green. Although the tanks are interchangeable the methods of securing the tank units differ. In Marston tanks the tank units are housed in three rubber straps and secured to the tank wall by three 2 B.A. bolts vulcanised to the tank inner skin. In Fireproof tanks the tank units are housed in perforated rubber pockets and secured by three rubber studs vulcanised to the tank inner skin.

No.3 fuel tank - folding for storage *(fig.12)*

48. To fold No.3 fuel tank for storage proceed as follows:-

Note . . .

Extreme care must be taken when folding or handling the tank to prevent damage to the thin flexible material from which the tank is made.

(1) Ensure that the tank is thoroughly clean and dry by carrying out the procedure detailed in A.P.106B-0200-1.

(2) Seal all apertures, using plugs and blanking plates. Fit protective coverings to protruding filler-caps, bolts and fittings.

(3) All metal fittings should be wrapped with either waxed paper or mouldable waxed wrapping, and secured with tape.

(4) Any fittings having relatively sharp edges, must have their edges covered with suitable material to prevent any chafing of the tank skin.

(5) Arrange the deflated tank so that it is resting on its normal base.

(6) Gather the loose material from the sides to the centre, retaining the basic plan shape of the tank as shown in 2.

(7) Lift the tank skin at the points indicated and resolve the loose material into a fold running longitudinally down the tank as shown in 3.

(8) Tuck in the ends of the tank as shown in 4, 5 and 6, and insert rolls and sheets of corrugated paper between the folds.

(9) Fold down the centre 7 and 8, and insert corrugated paper in sheets between the folds and, in 3 in. diameter rolls along the inside radius of each turn as shown in 9.

(10) Fold again into thirds along the lines indicated, 10 and 11, and insert corrugated paper in sheets and rolls.

(11) Warning notices concerning the fragile nature of the tank and the method of handling, should be attached in suitable, prominent positions.

(12) Encase the tank in transparent plastic container and partially seal the edges, leaving a small gap through which air should be expelled by carefully applied pressure on the package, before final sealing.

(13) The folded tank is now ready for storing in the special wooden container provided for that purpose.

Note . . .

General rules for the storage of flexible tanks are given in A.P.830, Vol.2 leaflets.

Torque loading of inboard engine rib fuel elbow connections

◄ *(figs. 13 and 14) (Pre-mod. 5237)* ►

49. To torque tighten No.1 and No.2 fuel elbow connections, proceed as follows:-

(1) Smear the threaded ends of the elbows with grease XG-235, Ref. No. 34B/9440585.

(2) Connect the fuel pipelines to the elbows and with the appropriate special adapter (fig.13) torque tighten the unions using a Britool torque wrench, Ref.No.1C/1207077, set at 175 lbf.in. for the inboard union and 165 lbf.in. for the outboard union.

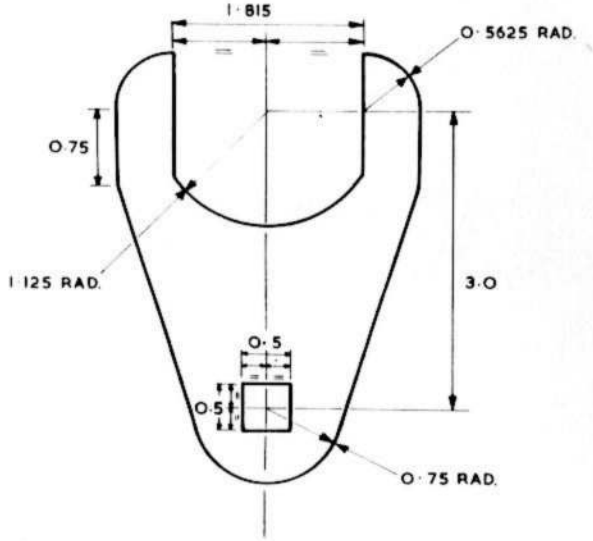
Note...

The torque wrench setting of 175 lbf.in. (inboard) and 165 lbf.in. (outboard) will give an actual torque loading of 200 lbf.in. at the pipeline unions.

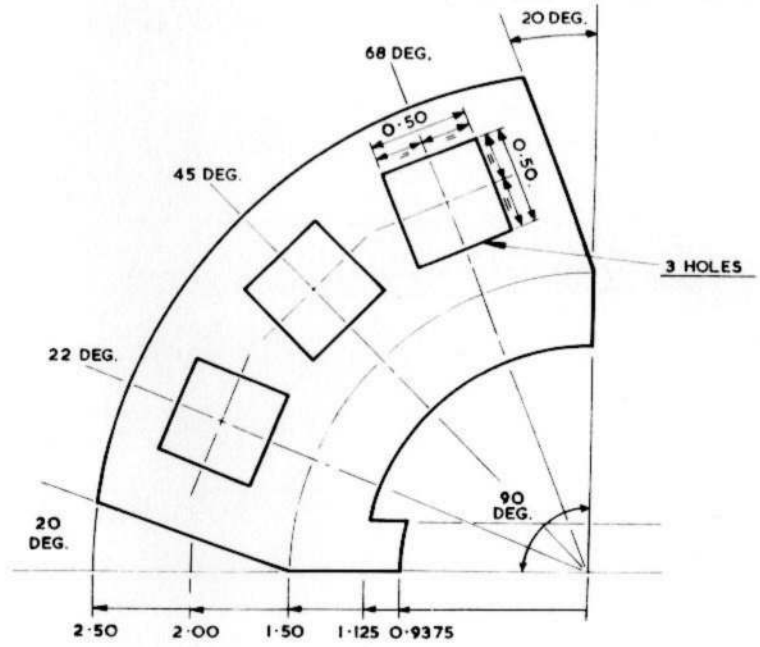
If a Britool torque wrench, Ref.No.1C/1207077, is not used, the torque setting of any alternative wrench is to be calculated from fig.14.

It is essential that the torque wrench is attached to the special adapters with the axis of the wrench in-line with the radius of the pipe (fig.14)

MATERIAL STEEL BAR 30C/9611786.0·25IN. THICK
ALL DIMENSIONS IN INCHES.

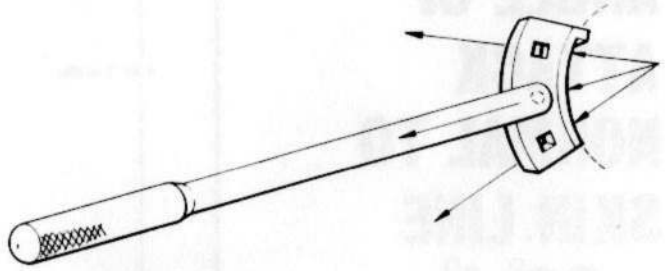


OUTBOARD CONNECTION ADAPTER.

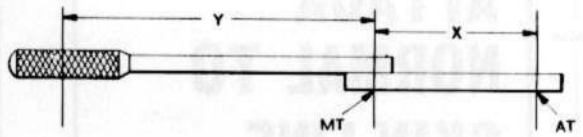


INBOARD CONNECTION ADAPTER.

◄ FIG. 13. MANUFACTURING DETAILS FOR ADAPTERS. (Pre-mod. 5237) ►



ALWAYS CONNECT THE TORQUE WRENCH TO THE ADAPTER WITH THE AXIS OF THE WRENCH IN LINE WITH THE PIPE RADIUS AS SHOWN.



$$MT = \frac{AT \times Y}{(Y+X)}$$

WHERE MT = METERED TORQUE OR TORQUE AT WHICH WRENCH IS TO BE SET, TO GIVE ACTUAL TORQUE AT ELBOW CONNECTION.
AT = ACTUAL TORQUE OF 200 L.B. F.IN.
Y = LENGTH OF ALTERNATIVE TORQUE WRENCH
X = LENGTH OF TORQUE WRENCH ADAPTER (2·0 IN. INBOARD OR 3·0 IN. OUTBOARD.)

◄ FIG. 14. TORQUE LOADING INSTRUCTIONS. (Pre-mod. 5237) ►

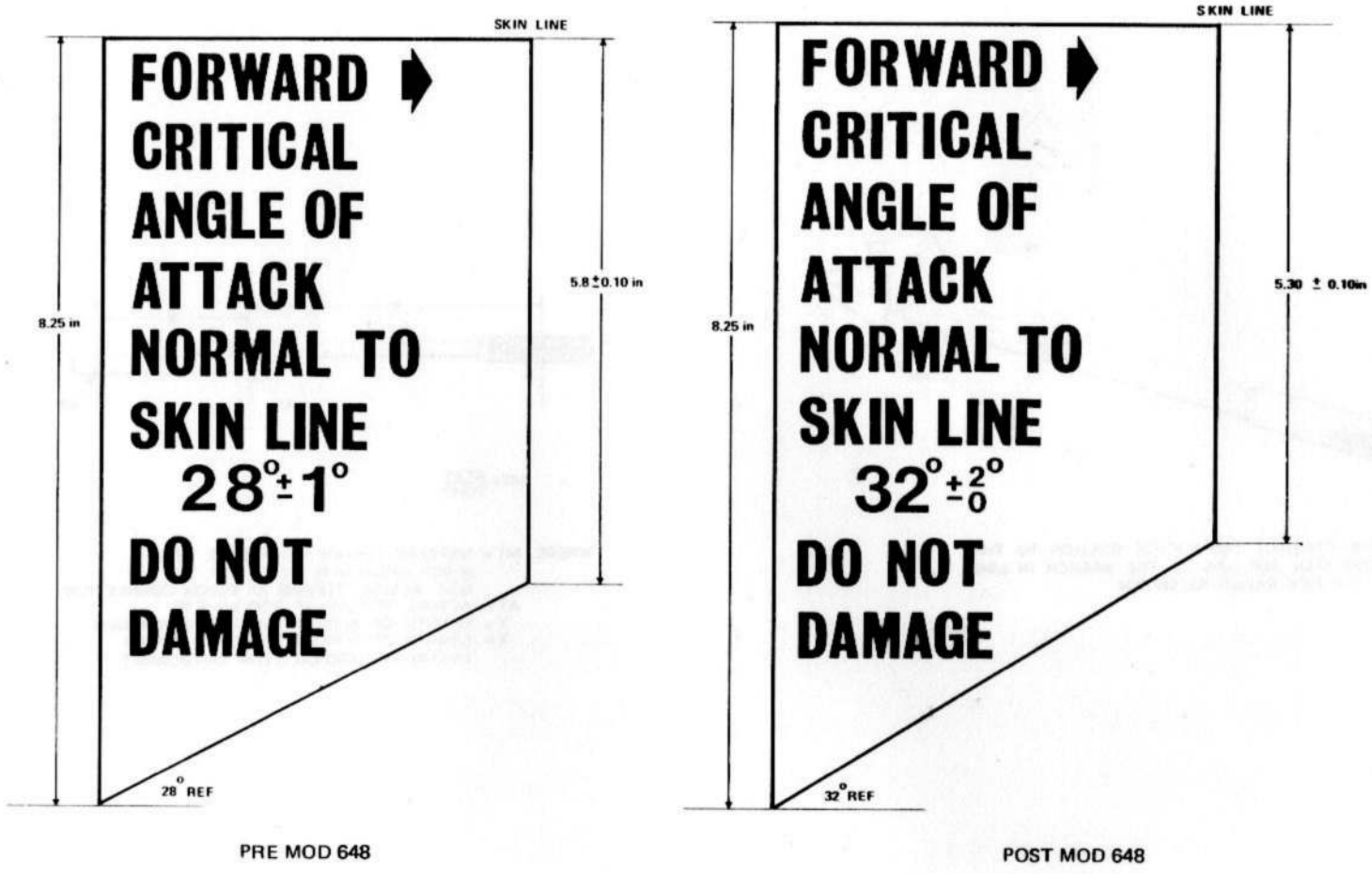


FIG. 15. FUEL VENT PIPE DIMENSIONS

Chapter 5 FIRE PROTECTION SYSTEM

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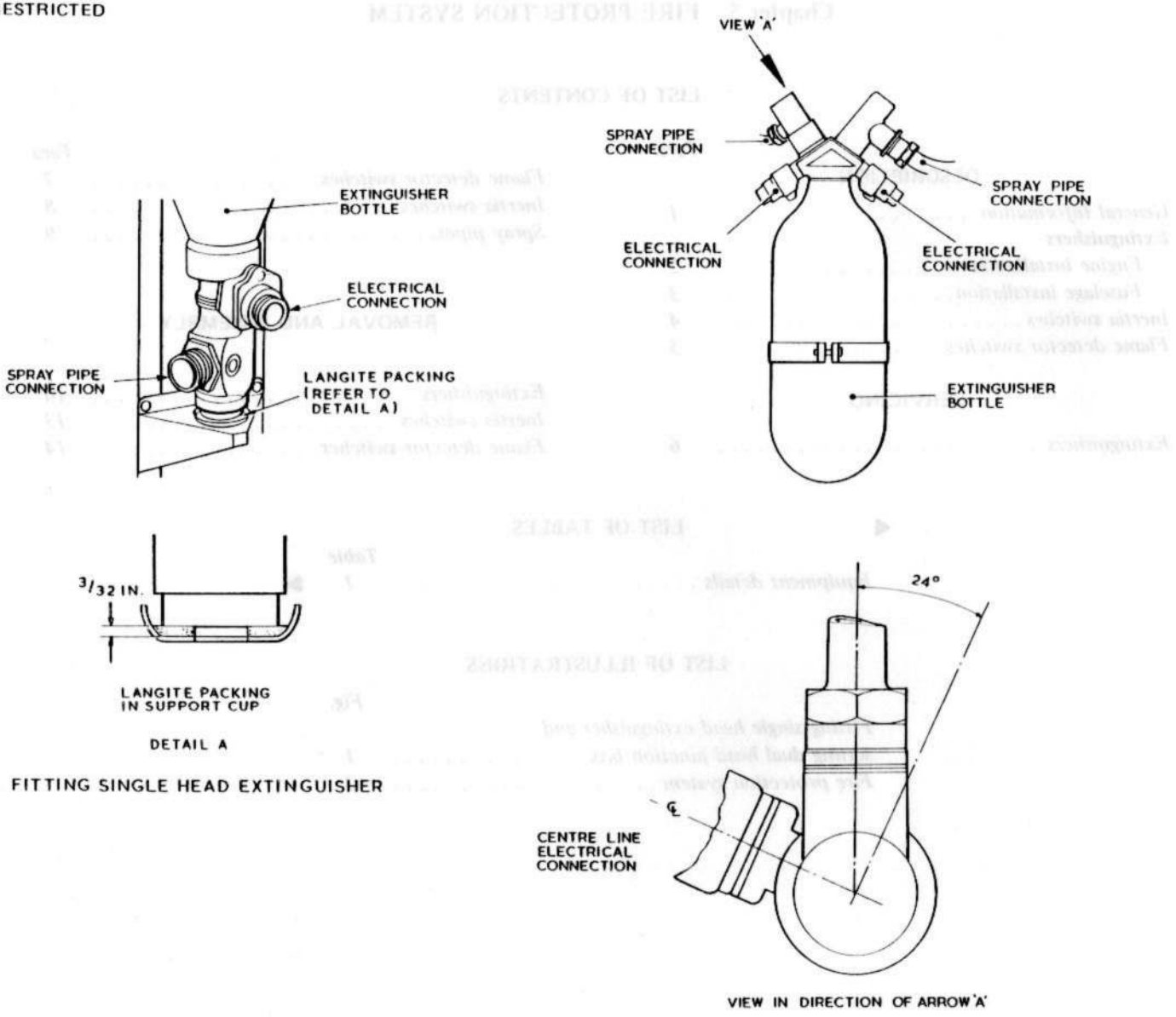

FIG. 1. FITTING SINGLE HEAD EXTINGUISHER AND SETTING DUAL HEAD JUNCTION BOX

WARNING

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

2. If a fire extinguisher cylinder has been discharged, the gas must not be inhaled. Methyl bromide gives off an odourless non-irritant vapour which is highly poisonous. The effects, which may not be apparent at once, may be fatal if large amounts are inhaled before signs develop.

DESCRIPTION

General information

1. The fire protection system consists of three separate installations. The first two protect the engine installations, and the third, the fuel tank compartments and bomb bay; the third system is activated only on the operation of inertia switches *(para.4)*. The electrical circuits connecting the components of the system are described in A.P.101B-0402-1B, Sect.5, Chap.1, Group W. A general description of aircraft fire protection is given in A.P.107E-0001-1.

Extinguishers *(fig.2)*

Engine installation

◄ 2. A Type 14A, Ref.No. 27N/4526468 or Type 138A Ref.No.27N/7185521, methyl bromide fire extinguisher is fitted in each wheel well in the main plane. The Type 14A, or Type 138A extinguisher, is fitted ► with a dual operating head, to which is fitted two junction boxes. One box is connected to the two spray rings surrounding the engine and the other is connected to the fuselage spray pipe (para.3). Two indicator switch units, one for each engine and each comprising a fire warning lamp and push switch, are located on the miscellaneous instrument panel. Depressing either push switch will discharge the entire contents of the appropriate extinguisher through the spray rings of the relevant engine. Operation of the inertia switches (para.4) will automatically discharge the entire contents of both extinguishers through the engine spray rings and through the fuselage spray pipe.

Note . . .

On some aircraft warning of an engine fire is indicated by the illumination of a No.1 or No.2 fire warning lamp; the lamps are located adjacent to the extinguisher push switches on the miscellaneous instrument panel.

Fuselage installation

◄ 3. One Type 12A.Ref.No.27N/4526467 or Type 89A Ref.No.27N/1119550 methyl bromide fire extinguisher is fitted on the rear face ► of frame 27. It is provided with a single automatic operating head to which is fitted a junction box; the latter is connected to the spray pipe in the fuselage. The spray pipe runs the full length of the bomb bay and has extensions at either end which project into the fuselage fuel tank bays. From a four-way connection in the spray pipe, mid-way along the bomb bay, pipes link up with the extinguishers in the main planes. The fuselage extinguisher is operated automatically by inertia switches only (para.4), there being no push switch for manual operation, nor a fire warning lamp in the cabin.

Inertia switches *(fig.2)*

4. Two Type 8C, Ref.No.27N/93, inertia switches are positioned on the forward face of frame 11, in the port and starboard equipment bay compartments respectively. In sudden deceleration, such as would occur in a crash, the switches trip and close electrical contacts which initiate the operation of all extinguishers.

Flame detector switches

5. Fifteen unit resetting flame detector switches are installed in the engine bays, seven in the port and eight in the starboard bay; of the switches in each bay, four are positioned adjacent to the engine transition piece on the front face of the main plane spar, and the remainder are mounted at the forward end of the main plane ribs on either side of the engine. The switches are electrically connected to the fire warning lamps on the miscellaneous instrument panel in the cockpit, and in the event of fire complete the

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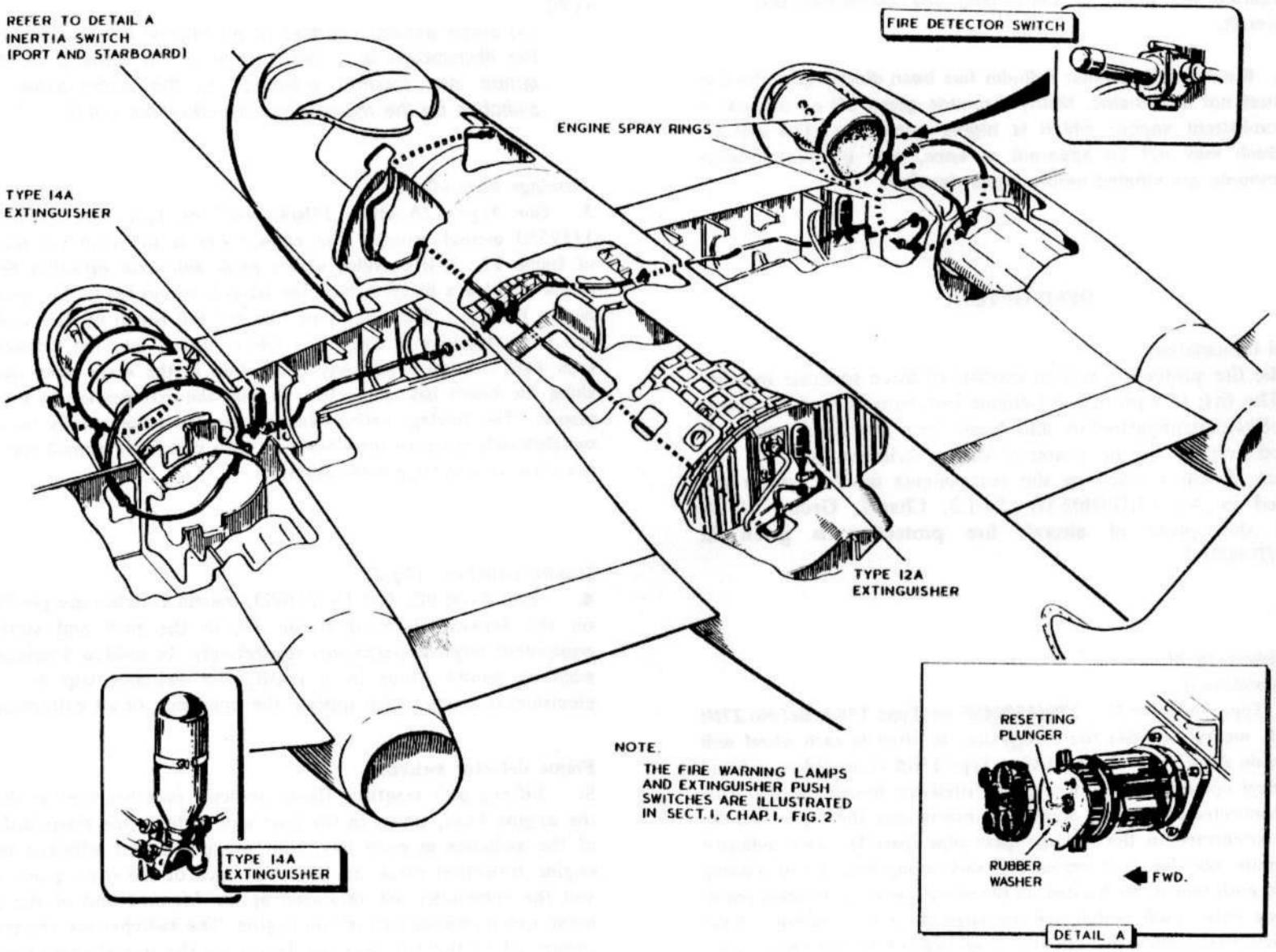

FIG. 2. FIRE PROTECTION SYSTEM

► REFERENCE TO ALTERNATIVE EXTINGUISHER DELETED ◄

circuit; when the fire is extinguished the switches automatically reset and extinguish the warning lamp. A detailed description of the switch is given in A.P.107E-0105-1.

SERVICING

Extinguishers

6. No servicing is required other than to determine whether the extinguishers have been inadvertently discharged. A detachable cup at the bottom of each extinguisher outlet adapter houses a mechanical indicator, which is normally flush with the outer face of the detachable cup. When the extinguisher has been operated, the spindle protrudes approximately ⅛ in., thus giving a positive indication that the extinguisher has been discharged. The full weight of each extinguisher is stamped upon its operating head.

Flame detector switches

7. No servicing is required. For the servicing of the electrical circuits refer to A.P.101B-0402-1B, Sect.5, Chap.1.

Inertia switches

8. To reset an inertia switch:-

(1) Unscrew the four nuts on the cover plate, and remove the cover and rubber washer.

(2) Depress the plunger in the centre of the moulded switch case cover.

(3) Check that the bowed spring is in contact with the piston.

(4) Refit the rubber washer and cover plate, and tighten the four nuts.

Spray pipes

9. The spray pipes and rings are constructed from stainless steel, consequently corrosion is unlikely. Periodic inspection, particularly of the joints and junctions, is the only servicing required.

REMOVAL AND ASSEMBLY

Extinguishers

10. The extinguishers in the main planes are accessible through the wheel wells in the underside of the main planes, and the fuselage extinguisher is accessible through the hatchway in the underside of the rear fuselage *(Sect.2, Chap.4)*. To remove an extinguisher:-

(1) Remove the Breeze plugs from the sockets in the operating head.

(2) Disconnect the spray pipes at the unions on the junction box.

(3) Release the mounting strap and remove the extinguisher.

11. Installation of an extinguisher is the reverse of the removal procedure except that the junction boxes on the dual-head extinguisher must be adjusted, by shimming, to the angles shown in fig.1. When assembling a dual-head extinguisher into the main plane, ensure that it is fitted with the 4-pin electrical socket facing inboard. Ensure that the fuselage extinguisher is firmly gripped endwise.

Note . . .

Before fitting a new extinguisher, the petrolite transit sealing washer must be removed from the extinguisher head. Failure to remove this washer will render the extinguisher inoperative.

◄ **12.** When fitting a Type 12A or Type 89A extinguisher to the ► rear of frame 27 in the fuselage, it is essential that the head of the junction box fits securely into the cup of the support disc of the attachment bracket. To ensure that the head of the junction box is correctly housed in the support cup, the langite packing in the base of the cup must not be thicker than 3/32 in. *(fig.1)*, and the extinguisher must be held firmly in position whilst the attachment

straps are being fitted and tightened. The following procedure should be adopted:-

(1) Remove the langite packing and clean out the support cup.

(2) Obtain a new langite packing piece 3/32 in. thick, chamfer the periphery on one side to fit the cup, and bore a ½ in. hole through the centre.

(3) Fit the packing and secure to the cup, using rubber-resin cement Ref.No.33H/2245977.

(4) Place the extinguisher in position, ensuring that the indicator plunger is in the centre of the ½ in. hole in the packing piece and support cup.

(5) Hold the extinguisher firmly in position, and fit and tighten the attachment straps.

Note . . .

The langite packing piece must not be cemented to the extinguisher.

Inertia switches

13. To remove an inertia switch:-

(1) Ensure that the electrical supply is disconnected.

(2) Unscrew the four nuts securing the cover plate, and remove the cover plate and rubber washer.

(3) Remove the two electrical connections.

(4) Remove the four securing bolts, and remove the switch.

Flame detector switches

14. The unit resetting flame switches are all base-mounted and secured by two 2 B.A. bolts and nuts. To remove a switch:-

(1) Remove the engine cowlings *(Chap.1).*

(2) Disconnect the electrical cables at their entries into the base of the switch.

(3) Remove the bolts securing the switch to the structure, and remove the switch.

TABLE 1

Equipment details

Ref. or Part No.	Equipment	Quantity	Relevant A.P.
5CW/9438526	Fire warning push switch	2	A.P.113D series
5CW/4405748	Fire warning test switch	1	
27N/4526592	Fire detector	15	A.P.107E-0105-1
27N/4526464	Inertia switch	2	A.P.113D-1206-13A
27N/1119550	Fire extinguisher, Type 89A (alternatives)	1	A.P.107E-0400-1A
27N/4526467	Fire extinguisher, Type 12A (alternatives)		
27N/7185521	Fire extinguisher, Type 138A (alternatives)	2	A.P.107E-0400-1A
27N/4526468	Fire extinguisher, Type 14A (alternatives)		
12K/9635263	Cartridge No.1 Mk.3, Type A716-3	1	A.P.110N series
12K/9231213	Cartridge No.1 Mk.3, Type A717-3	2