Chapter 2 FUEL SYSTEM

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DESCRIPTION AND OPERATION

Introduction

1. The normal fuel capacity (approximately 350 gallons) is contained in nine permanent tanks positioned in the fuselage and the main planes. In addition, fuel may be carried in each of the wing tip drop tanks and, on later aircraft as an alternative fitment to bombs, in two underwing drop tanks at each of the main plane pylons. The tank capacities are given in the Leading Particulars. The supply from all tanks is fed into a collector box or negative 'G' reservoir at the base of the fuselage tank. An immersed booster pump in the collector box supplies the fuel through a cabin-controlled cock to the engine low-pressure fuel filter. A diagrammatic arrangement of the system, excluding the drop tanks system, is shown in fig. 1. A detailed description of the engine fuel system is given in A.P.4320A and C, Vol. 1.

Fuel tanks

2. The nine permanent tanks comprise a single rigid fuselage tank of light-alloy construction and four flexible bag type tanks in each wing. Anti-surge valves are fitted in each wing tank. The combined contents of the nine permanent tanks is indicated by the Pacitor system on a single gauge in the cabin. The tank units which operate the gauge are positioned in the fuselage tank and in No. 1 and 3 tanks in each wing.

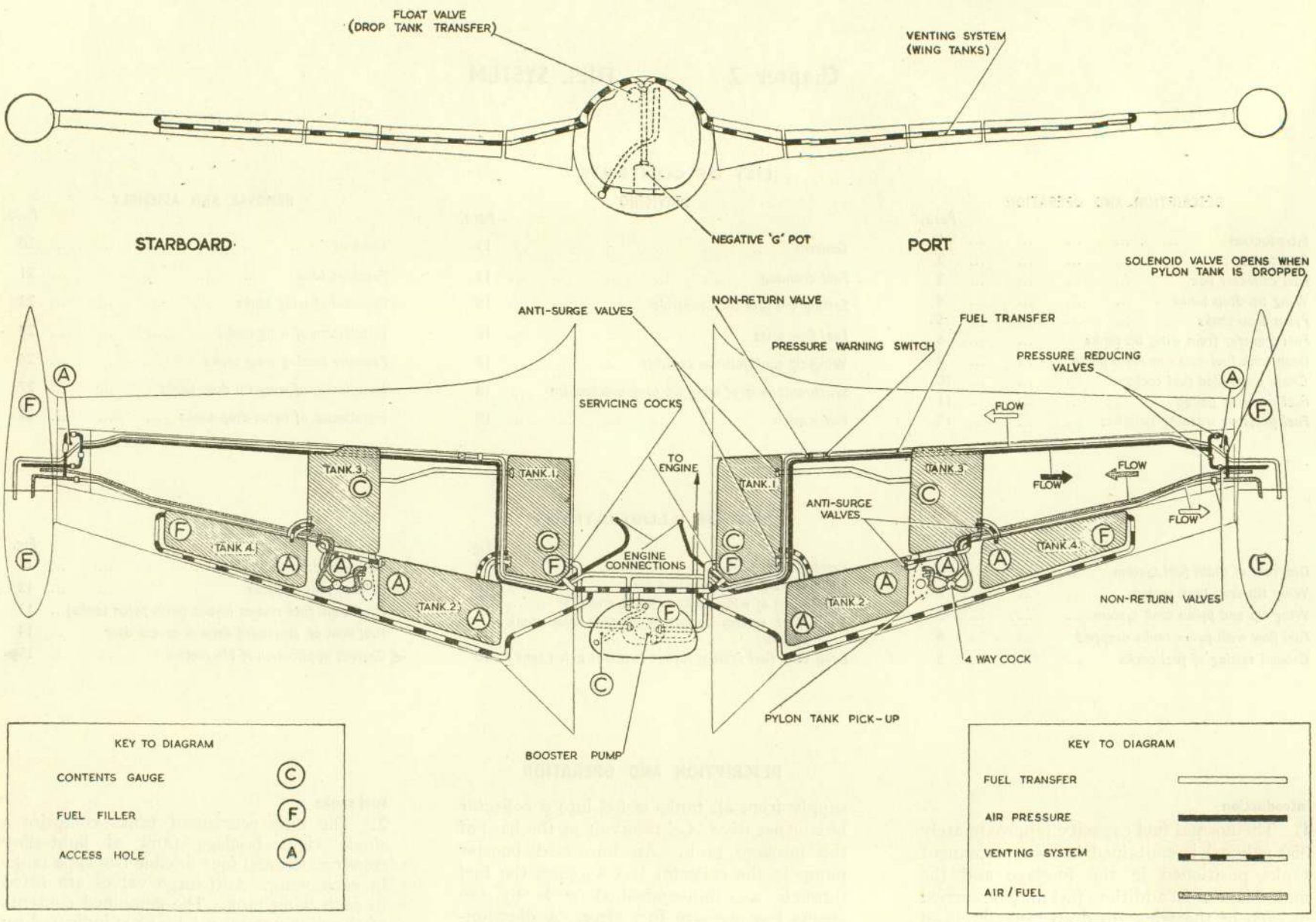


Fig. 1. Diagram of main fuel system

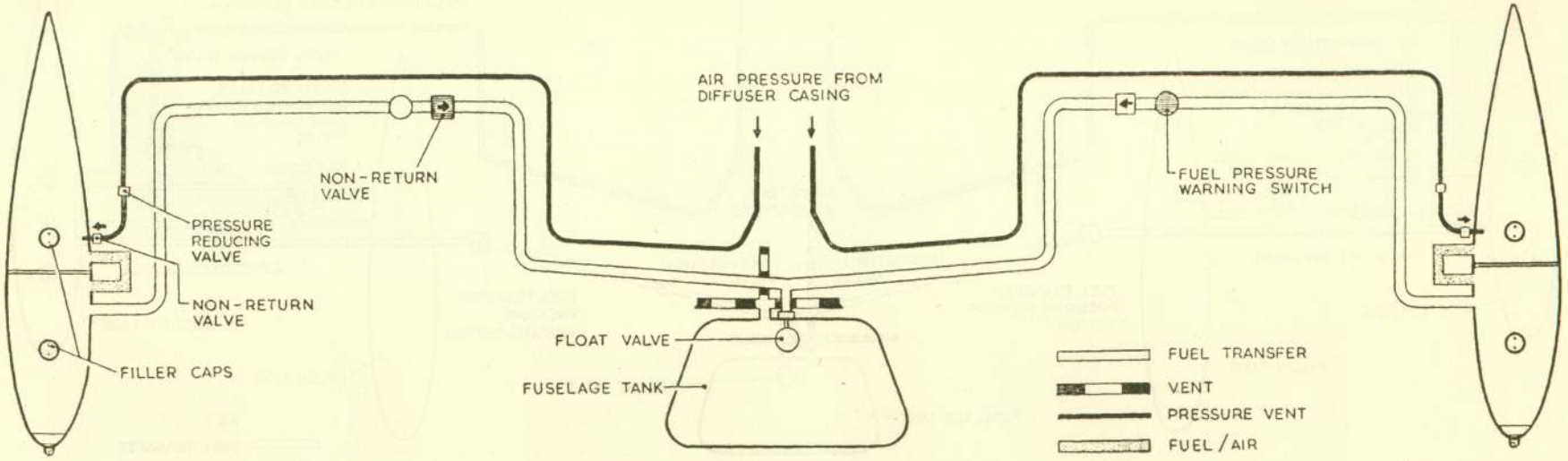


Fig. 2. Wing tip drop tank system

Fuel collector box

3. The collector box, which is housed in the base of the fuselage fuel tank (*fig.* 6), is fed by gravity from all the permanent tanks. An electrically-driven booster pump, which is immersed in the fuel collector box, supplies fuel to the engine at a pressure of 8 to 10 lb. per sq. in. An additional function of the collector box is to safeguard the fuel supply when the aircraft is subjected to negative 'G' or inverted flight. Under this condition, the inlet gravity-operated clack valves to the pump and the vapour vent valve automatically close, thus forming the collector box into a small reservoir of a little less than 4 gallons capacity. This is sufficient to feed the engine for at least 15 seconds inverted flight.

Wing tip drop tanks

4. Provision is made to attach a drop tank at each wing tip and, also on later aircraft, as an alternative fitment to bombs, at each of the underwing pylons. The tanks may be jettisoned either electrically or by a mechanical control. Each wing tip tank is divided by a transverse baffle into two completely separate compartments, and accommodates a navigation lamp in the nose. The transfer connections comprise a manifold of four spigot adapters mounted on the tank, which engage with corresponding plunger connections at the wing tip. When the aircraft is flown without tip tanks, blanking plates must be fitted over the fuel connections and the tip tank release. The fuel connection blanking plate is stowed on the outboard face of rib No. 14, between the leading edge and the release hook. The blanking plate for the release hook is stowed in the main undercarriage ground lock tool bag on the port gun bay door. A diagrammatic arrangement of the system is shown in fig. 2.

Pylon drop tanks

5. The pylon tanks are carried on the bomb pylons on the undersurface of the main planes. The tanks are divided by transverse baffles fitted with anti-surge valves, and a fuel filter, accessible from the undersurface of the tank, is fitted in the fuel transfer pipe. The pylon is the standard bomb pylon with a Vickers E.M. release unit, No. 1, Mk. 1, which is secured by a quick-release pin to the screw jack fork-end fitting. An arrow engraved on the bomb release (fig. 12) is annotated FORWARD, but this word FORWARD is to be ignored and the arrow on the bomb release is to match the arrow stencilled on the bomb pylon. ◀A description of the release unit is given in A.P.1664A, Vol. 1, and servicing instructions are given in A.P.1664A, Vol. 2.▶ A 4-way cock is fitted on the undersurface of the wing outboard of each pylon to control the fuel flow, and is set on the ground either for carriage of wing tip and pylon drop tanks, or tip tanks only. Solenoid valves in the pressure vent lines, divert venting pressure to the forward compartment of the wing tip tanks when the pylon tanks are jettisoned. A full description of the pylon, hoist and mechanical jettison mechanism, together with their servicing is given in Sect. 7, Chap. 4. A diagrammatic arrangement of the system is shown in fig. 3 and 4.

Fuel transfer from wing tip tanks

6. In aircraft where provision for pylon tanks is not yet incorporated, fuel contained in the wing tip tank is transferred to the fuselage tank by compressed air supplied from the engine diffuser casing. Compressed air, reduced to a pressure of 5½ lb. per sq. in. passes through a non-return valve and

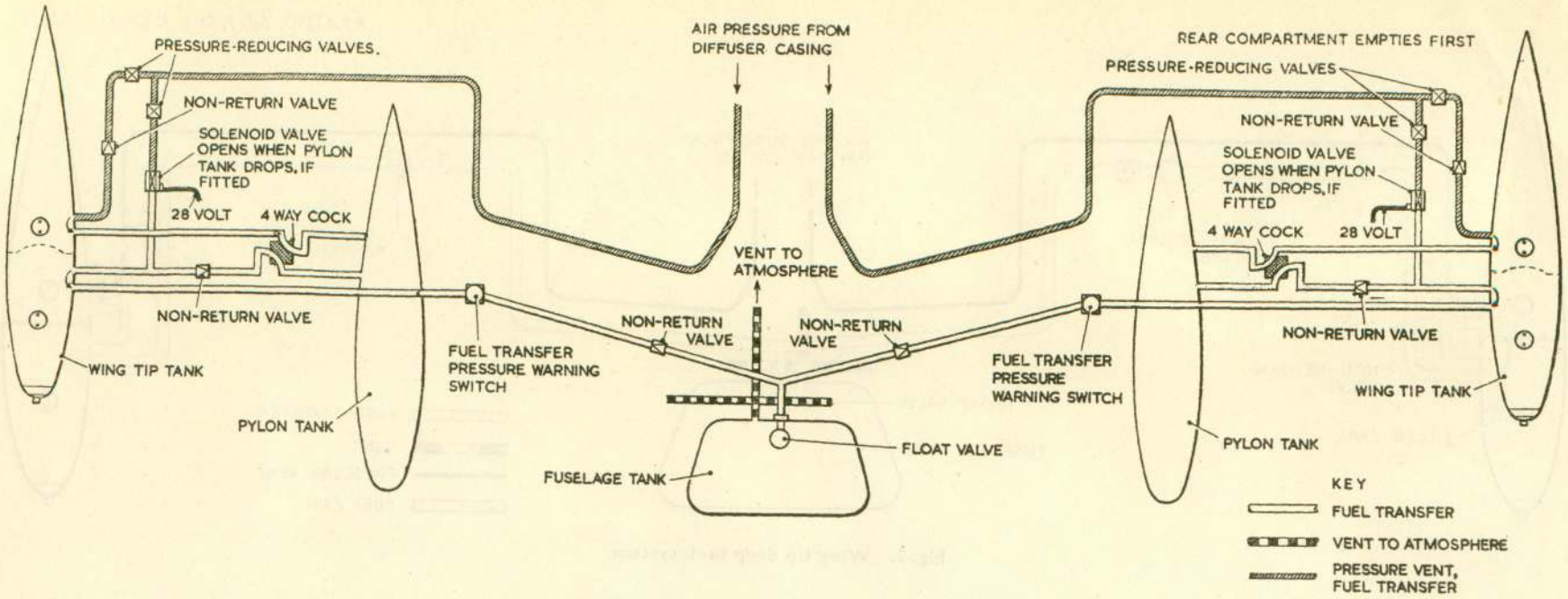


Fig. 3. Wing tip and pylon tank system

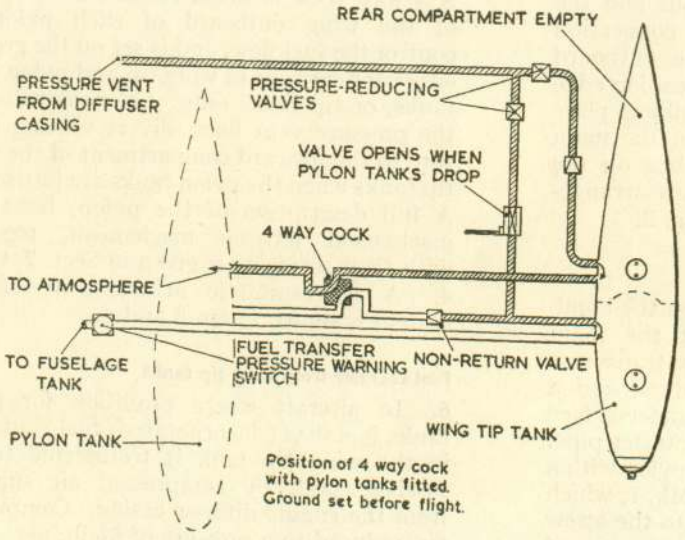


Fig. 4. Fuel flow with pylon tanks dropped

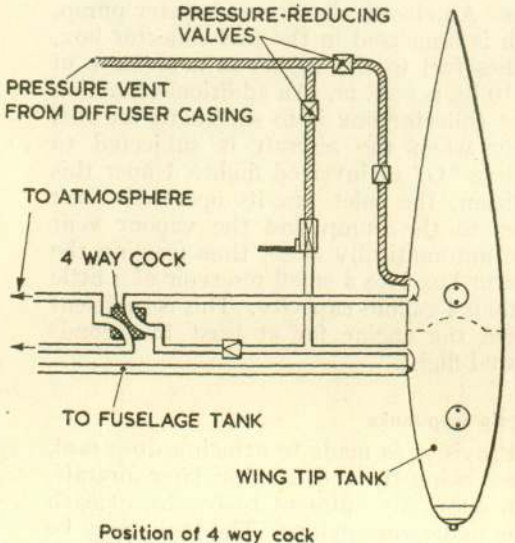


Fig. 5. Ground setting of fuel cocks

transfers fuel from the rear to the front compartment of the wing tip tank (*fig.* 2). In transferring, it will be seen that the fuel passes out from the tank and returns via a U-shaped pipe in the main plane. This pipe which connects the forward and lower plunger connections of the wing tip manifold, is fitted pending the introduction of the pylon drop tank system. From the forward compartment of the tank, the fuel is transferred to the fuselage tank.

7. Later aircraft have provision for fitting drop tanks on the underwing bomb pylons in addition to the wing tip tanks. Compressed air from the engine diffuser casing is reduced to a pressure of 5½ lb. per sq. in. and passes through a non-return valve to the rear compartment of the wing tip tank. Fuel is transferred under pressure through the ground-set 4-way cock to the pylon tank and the front compartment of the wing tip tank, and thence to the fuselage tank (*fig.* 3). In turn, the pylon tank empties, followed by the front compartment of the tip tank. If the pylon tank is jettisoned, a solenoid valve opens and pressure vents the front compartment of the wing tip tank, but any remaining fuel in the rear compartment would vent to atmosphere (*fig.* 4).

Drop tank fuel cocks in main plane

8. When pylon tanks are not carried, the 4-way cock, fitted in each wing just outboard of the pylon on the undersurface of the wing, is closed to allow the fuel to flow from the rear compartment to the front compartment of the tip tank, via the 4-way cock (*fig.* 5).

Note . . .

It is essential to check the correct position of the cocks before flight because, if left open when carrying only tip tanks, the fuel in the rear compartment of the tank would vent to atmosphere, and there would be no transfer of fuel from the front compartment.

9. The fuel transfer to the fuselage tank is controlled by a float valve at the top of this tank. When the fuel level falls below the cut-off level of the float valve, the valve opens to permit transfer from the drop tanks until they are empty. The float valve remains open after the tanks have been emptied so that, if the tanks are not jettisoned, the transfer air pressure is vented back to the fuselage tank and thence to atmosphere. This arrangement ensures that the drop tanks are emptied first before continual supply is drawn from the permanent tanks. If the drop tanks are jettisoned, the transfer air pressure is vented direct to atmosphere.

Cabin controlled fuel cocks

10. The two cabin operated cocks control the fuel supply to the engine combustion chamber burners. One, a low-pressure cock, is situated on the port side of the firewall in the feed line from the booster pump to the engine low-pressure fuel filter. The other, a high-pressure cock or cut-off valve, is incorporated with the throttle valve in the control box on the engine and is used for shutting off the delivery from the engine fuel pumps. Details of the control runs for both of these cocks are contained in Chapter 1 of this Section. A servicing cock is fitted at the supply connection from No. 1 tank at No. 1 rib on each main plane. These cocks, which can be operated only when the aircraft is on the ground, are provided to isolate the fuel contained in the wing tanks during such operations as power unit and fuselage fuel tank removal.

Fuel contents gauge

11. A Pacitor fuel contents gauge, positioned on the right-hand side of the pilot's instrument panel, indicates the total capacity of the fuel tanks irrespective of the attitude of the aircraft. The tank units are installed in the fuselage tank and in No. 1 and 3 tanks in each wing; the units are not interchangeable. For the location of the components of the system and the theoretical wiring diagrams, refer to Section 5, Chapter 2. A full description of the Pacitor fuel contents gauge is given in A.P.1275A, Vol. 1, ◀Sect. 18, Chap. 14.▶

Fuel pressure warning switches

12. Pressure warning switches are installed in the fuel system to give warning when the pressure falls below a certain level. Each switch, which is set at a predetermined figure, completes a circuit which shows a warning light in the cabin when the pressure is no longer maintained. One switch is mounted on the engine low-pressure filter outlet and is set to illuminate a warning lamp should the fuel supply fall below 1¼ lb. per sq. in. A similar type switch is fitted in each main plane in the drop tank supply line to the fuselage tank. The latter switches, which must be set at 2-2½ lb. per sq. in., operate indicators on the starboard instrument panel (*Sect.* 1, *Chap.* 1) to show when fuel transfer from the drop tanks is completed; this switch setting is critical and must be between the limits for each aircraft. Access to these switches is gained by removing the cover plate immediately aft of each main undercarriage leg. A full description of the pressure switches and the method of adjusting is given in A.P.1275A, Vol. 1, Sect. 11, Chap. 31.

SERVICING

General

13. The procedure for replenishing the permanent and drop tanks is given in Sect. 2, Chap. 2. Filler cages are fitted in the necks of the filler holes in No. 1 and 4 wing tanks to avoid damage to the tank sides by the filler nozzle, and these cages must be *in situ* before filling is commenced. The tanks should be kept full, as far as possible, in order to reduce water condensation to a minimum, except under certain conditions (*Sect.* 2, *Chap.* 2). Although a small quantity of water will not affect the running of the engine it may, however, freeze and possibly restrict the fuel flow or damage components. Any

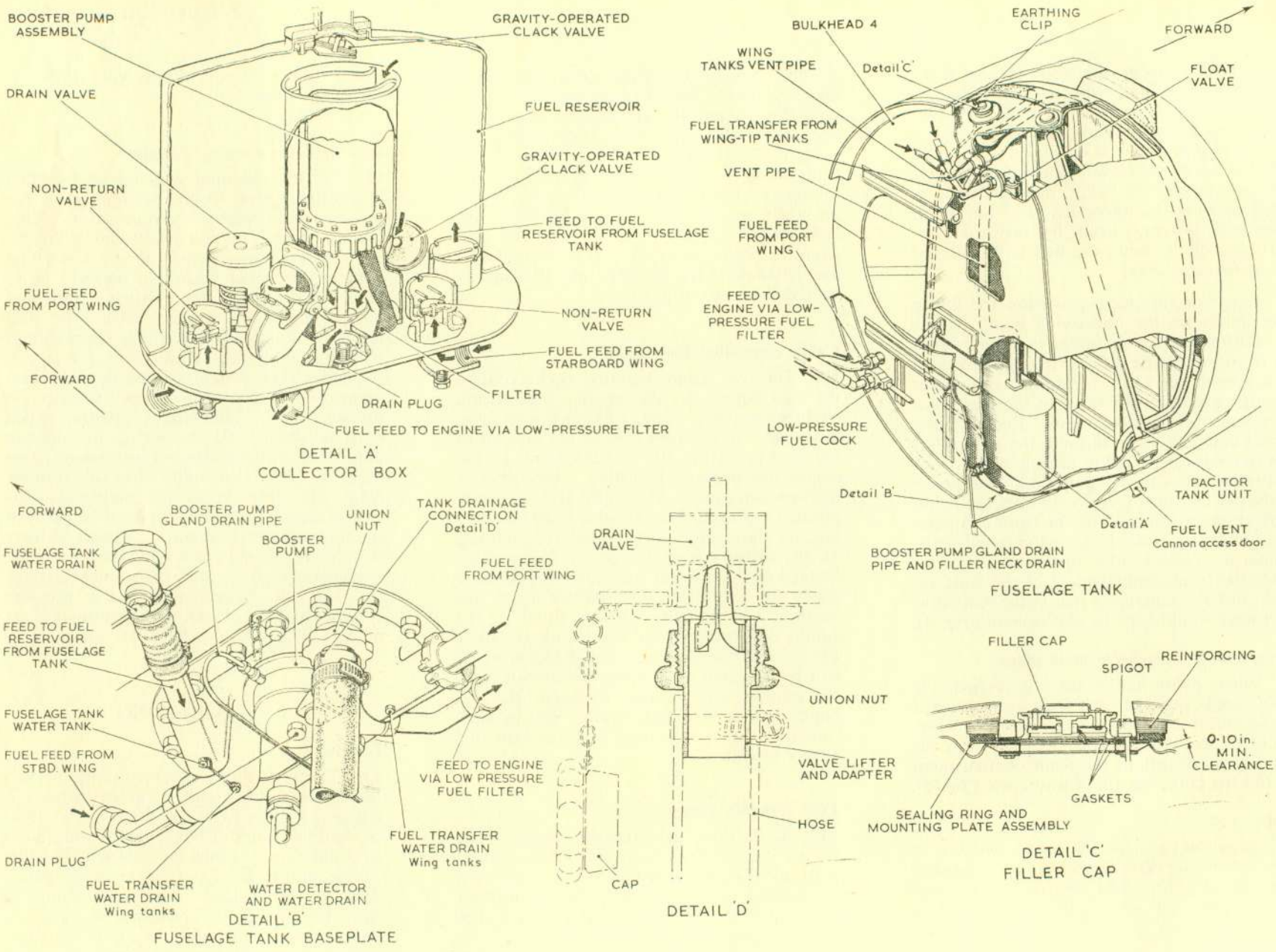


Fig. 6. Fuselage fuel tank

water which may have collected can be drained off at the drain plugs in the elbow connections at the base of the collector box and at the immersed fuel pump beneath the fuselage tank. Ensure that the filler cap washers, particularly those of the drop tanks which must withstand pressure, are maintained in good condition

Fuel draining

14. The complete fuel content, other than that contained in the drop tanks, is drained through the standard S.B.A.C. drain valve (*fig.* 6) in the base plate of the fuselage tank (*Sect.* 2, *Chap.* 2). The drain hose must incorporate a suitable adapter (Part No. A.S.2584) to lift the valve when the hose is connected. The drop tanks are drained individually by removing the drain plugs at the bottom of the tanks. When replacing these drain plugs, ensure that the sealing washers are in good condition as the tanks must withstand pressure during fuel transfer. The fuselage tank only can be drained by closing the port and starboard servicing cocks. The cocks are closed by pulling down the cover plates at the root ends of the under-surface of the wings. To ensure that the cocks do not remain in the closed position, locking plates with warning pennants (*Sect.* 2, *Chap.* 4) must be fitted.

Setting the fuel cock controls

15. The procedure for rigging the low-pressure and high-pressure fuel cock controls with the low-pressure cock and the engine high-pressure cock lever, respectively, is described in Chap. 1 of this Section.

Fuel flow tests

16. Whenever fuel flow tests are carried out, the aircraft must be resting on its wheels. The equipment required comprises a one gallon measure, a stop watch and necessary fuel containers. Check that the electrical supply to the booster pump is not less than 24 volts. Disconnect the fuel supply to the engine at the low-pressure filter, and proceed as follows :—

(1) *Fuselage tank.* With 30 gallons of fuel in the fuselage tank and the wing tanks empty, check that, when a steady flow has been obtained, the time taken to fill a gallon measure does not exceed 7 seconds with the booster pump switched OFF, and 3 seconds with the booster pump switched ON.

(2) *Wing tanks.*

(a) With 30 gallons of fuel in the port wing No. 1 tank only (i.e., no fuel in the starboard wing or fuselage tanks), check that, when a steady flow has been obtained, the time to fill a gallon measure does not exceed 7 seconds with the booster pump switched OFF, and 3 seconds with the booster pump switched ON. Repeat the test for starboard No. 1 wing tank with the port wing and fuselage tanks empty.

(b) Place 30 gallons of fuel in port wing No. 4 tank and, with the other wing tanks empty, check that the fuel flows freely into No. 1 tank. Repeat the test for the starboard wing tanks.

Wing tip tank jettison controls

17. *Safety check.* The cable run for the mechanical jettison control is shown in fig. 11. After *each operation* of the jettison control, *an inspection for the safety and free operation of the mechanism must be made,* as it is possible for the cable to foul at the connector between ribs No. 1B and 2 during the resetting operation, when the cable is returned by the spring at the release unit. Should this occur, it can be freed by pulling the cable in both directions at the access panels on the lower surface of the wing tip (*Sect.* 2, *Chap.* 4).

(1) At the wing tip inspection panels, check that slackness of $\frac{3}{16}$ in. to $\frac{1}{4}$ in. lengthwise exists in the short portion of the cable to the release units. This may be done by moving the lever in the cabin slowly, and checking that the spring-loaded cable has moved $\frac{3}{16}$ in. to $\frac{1}{4}$ in. before the slack in the cable to the release unit has been taken up.

(2) Should adjustment of the cable slackness at the release unit be necessary, or the main plane system be dismantled, the controls must be rigged in the following manner :—

(a) With the cables and spring unit at No. 13 rib connected, adjust the jettison control cable to give the required $\frac{3}{16}$ in. to $\frac{1}{4}$ in. slackness of the short cable to the release unit. This is done at the cabin control box by removing the " spent tube " from the Teleflex box, gripping the Teleflex cables, sliding out the splined lever, adjusting the jettison cable as required and re-assembling the lever in the corrected position.

(b) In the port wing, completely slacken the spring unit at No. 13 rib. Adjust the spring unit in the starboard wing so that a pull of 15 to 20 lb., measured on a spring balance applied at the end of the lever, is required to jettison.

(c) Adjust the spring unit in the port wing so that a pull of 25lb. $\pm$ 5 lb. is required to jettison.

(d) With the cabin lever in the secured position, check at each wing tip that the release unit operating plunger does not protrude through the mounting bracket.

Synchronization of wing tip tank mechanism

18. Check the synchronization of the drop tank mechanism in the following manner :—

(1) Check the cabin control lever for full and free movement. This operation will automatically cock the release unit, then see that no fouling of the jettison control cable has occurred between ribs No. 1B and 2 (*para.* 17).

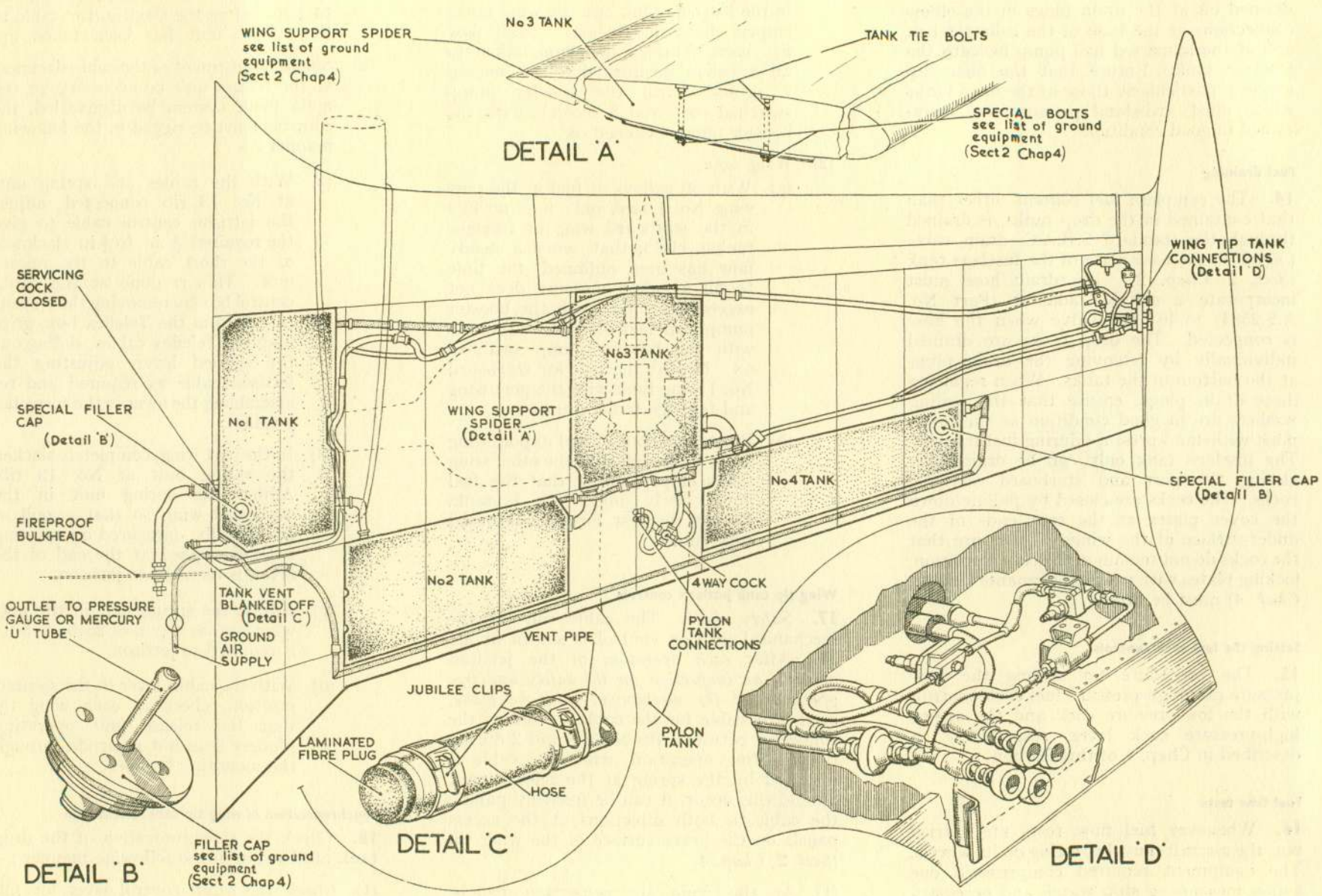


Fig. 7. Flexible wing tanks pressure test

(2) Engage the tank attachment bolt in the release unit and mount a tank at each wing tip, as described in para. 26.

Note . . .

Two men should be stationed at each wing tip to support the tanks when they are released.

(3) Operate the jettison lever in the cockpit. The tanks should fall reasonably together when the lever has moved through approximately two-thirds of its range.

(4) Should the tanks not release together, or the last one not fall well before the control lever reaches its limit of travel, adjust the Teleflex cable as necessary at the appropriate transmitting unit.

Lubrication

19. Whenever the drop tank jettison Teleflex controls are dismantled, e.g. withdrawal of cables from their conduits during main plane removal, the cables should be freely lubricated with low temperature grease (*Sect.* 2, *Chap.* 4) on re-assembly.

REMOVAL AND ASSEMBLY

General

20. The recommended sequences for the removal of the main components of the fuel system are contained in the following paragraphs. It will be clear, however, that deviation from the order given may be necessary to suit particular requirements. In general, unless otherwise indicated, the procedure for assembly or replacement is in each instance the reverse of that given for removal. The method of jacking and trestling the aircraft and the location of access panels and inspection holes, is given in Sect. 2, Chap. 4.

Fuselage tank (*fig.* 6)

21. Before removal, the servicing cocks must be closed, the tank drained, and the aircraft jacked up to give the necessary clearance between the bottom of the fuselage and the ground. Then proceed as follows:—

(1) Remove the gun bay doors, and guns (*Sect.* 7, *Chap.* 3), swing the outer gun mounting bracket forward, and secure on the starboard side of the gun bay, disconnect the gun heating duct and the barometric pressure control total head filter. Remove the gun heating duct and its mounting bracket (with the total head filter complete), and the two lowest hydraulic lines on the port side.

(2) Remove the batteries and their supporting trays, and fold the centre supporting brackets back against the firewall.

(3) Disconnect the electrical lead to the fuel contents gauge unit at the base of the tank on the starboard side, and the lead to the rectifier unit; also the lead to the immersed fuel booster pump, the two leads to the pump suppressor, and the bonding connections.

(4) Disconnect the two breeze plugs on junction box 2, and the fuel feed hose to the engine at the low-pressure fuel cock and the feed hoses from the wing tanks at the forward face of the firewall.

(5) On the starboard side of the tank, disconnect at each end and remove the tank pressure vent pipe.

(6) At the bottom of the tank, disconnect and remove the common drain pipe for the tank filler and immersed fuel booster pump.

(7) At the top of the rear face of the firewall, disconnect the two wing tank vent pipes and the two drop tank transfer pipes from the connecting pipes. Unscrew the connecting pipes from the adapters and remove the adapters from the tank.

◀(8) Remove the twelve 2 B.A. stiffnuts securing the Pacitor unit flange to the tank, and screw three 2 B.A. bolts into the tapped holes provided in the flange (this provides easy separation of the tank and Pacitor unit flanges), then remove the tank unit. There is sufficient clearance for this to be done with the aircraft standing normally on the ground.▶

(9) On the starboard side; remove the gun electrical relay panel from the diagonal bracing strut, and the three terminal blocks on the fuselage side. Disconnect the six looms at the breeze plugs on the forward bulkhead and remove the cleats securing the looms to the airframe.

(10) Remove the two bracing struts at the bottom of the tank bay.

Note . . .

These struts must be replaced if the aircraft is to be manhandled with the tank removed.

(11) Release the four Jubilee clips which secure the tank rear support to the lower cross tube on the forward face of the firewall. Detach the support block and turn the mounting brackets close to the firewall.

(12) Support the tank, release the trunnion on the tank straps from the adjuster and lower the tank vertically from the bay.

◀**22.** The procedure for installing the fuselage tank is mainly the reverse of that given for its removal, but the following precautions must be observed.

(1) Before the tank is installed, the internal structure of the tank bay, aft of the tank base plate and filler cap assembly, must have received one full coat of anti-sulphutic paint to Spec.9/N.M.648 (*Ref. No.* 33*A*/–).

(2) Before the tank is offered up, the sealing ring (detail ..., fig. 6) on the filler cap mounting plate assembly must be examined to ensure that it is in good condition, and traces of old sealing compound cleaned off with Bostik Solvent 6428 (*Ref. No.* 33*C*/1438). A trial in-

stallation must be made to ensure that the sealing ring is compressed against the fuselage. If the joint is not satisfactory, a tapered plywood reinforcing assembly may be fitted to the fuselage shell. Bostik Sealing Compound 1790 (*Ref. No.* 33*C*/1138) is used to make the joint. A maximum gap of $\frac{1}{16}$ in. at one point only is permissible between the fuselage shell, the reinforcing assembly and the sealing ring on the tank. Any such gap must be filled with the sealing compound applied liberally all round the joints, building up thickness where required, and allowed to become semi-plastic before the installation of the tank; there must be no gap when the tank is fitted finally.

Note . . .

The sealing compound must be kept clear of the drain hole in the filler cap assembly.

(3) After the tank has been installed checks must be made to ensure that the tank is centrally positioned, that there is adequate clearance between the tank and the intermediate air-intake ducts, that the tank bears against the support at the rear of the gun bay decking at bulkhead No. 3, and that the tank rear support is located to give maximum support. When the guns have been installed, it is most important to check that there is a minimum clearance of 0·10 in. between the air-intake and tank, and of 1·4 in. between the rearmost point on any gun and any part of the fuel tank or its connecting pipes. The procedure for the replacement of hydraulic pipes and details of the functional checks to be made after breakdown of the hydraulic system are given in Sect. 3, Chap. 6. It must be ensured that the 16 mesh, 28 s.w.g. copper gauge overlaps the hose joints at the ends by approximately 0·50 in. The gauze must be wrapped round the outside of the hose, under the clips and curled over the the ends to protect the hose joint.

(4) Refitting the main tank Pacitor unit is the reverse of removal and, during this operation the upper end of the tank unit should be guided by hand, to its position with the spigot; this is best achieved by using the tank filling aperture as an access hole. There is sufficient clearance for refitting the Pacitor unit with the aircraft standing normally on the ground.

(5) Before the curved vent pipe is assembled through the vent seal housing in the starboard cannon access door (*fig.* 14), entry must be facilitated by adjusting the pipe and lubricating the end with a solution of 10 per cent glycerine and water. Also check that the Bostik Primer No. 1751 (*Ref No.* 33*C*/1139) is serviceable on the inside of the extended fuel vent and the inside of the tapered hole of the access door.

Note . . .

After the first flight following a tank replacement, the fuselage tank retaining strap must be examined for security and tightened where necessary.

Removal of wing tanks

23. Before any of the wing tanks can be removed, the complete fuel system must be drained (*para.* 14). The recommended sequence of operations for removing the individual tanks is given in the following sub-paragraphs. In general, it is recommended that as far as possible the disengagement of the tank support buttons and 'Dot' fasteners should be left until immediately prior to the removal of the tank.

(1) *No.* 1 *tank* (*fig.* 8 (1), (2) *and* (3)).

(a) Remove the lower front and middle engine cowling panels.

(b) On either the upper or bottom surface of the main plane, unscrew the countersunk head ferrule and withdraw the tie-rod.

(c) Remove the screws securing the filler cap mounting plate to the skin plating.

(d) Remove the cover plate over the contents gauge tank unit, and remove the twelve nuts and washers from the bolts securing the tank unit to the tank mounting plate.

(e) On the undersurface of the main plane, remove the securing screws and lower the tank panel.

Note . . .

Before the panel is completely removed, unplug the R.P. electrical lead at the forward inboard corner of the tank bay. On assembly, plug in the lead when offering up the panel.

(f) On the outboard side of No. 1 rib, remove the clips securing the two tank stub pipes to the feed pipe fittings.

(g) On the undersurface of the main plane, remove the access panels immediately forward and aft of the main undercarriage leg, and disconnect the feed pipes from No. 2 and 3 tanks respectively.

(h) On the inboard side of No. 1 rib, disconnect the tank vent connecting pipe from the 3-way adapter pipe, and remove the two bolts securing the split support plate to No. 1 rib. Withdraw the vent pipe into the tank bay.

(i) Disengage the tank support buttons, release the three 'Dot' fasteners at the rear of the tank bay and lower the tank.

(2) *No.* 2 *tank* (*fig.* 8 (1) *and* (2)).

(a) Remove the two circular cover plates over the tank. At each access hole, unscrew the six securing nuts and remove the support ring and tank sealing plate.

(b) From either the upper or lower surface of the main plane, unscrew the five countersunk head ferrules and withdraw the tie-rods.

(c) Remove the cover plate immediately forward of the main undercarriage leg on the undersurface of the main plane, and disconnect the feed pipe to No. 1 tank.

(d) Remove the cover plate immediately inboard of the pylon and disconnect the feed and vent pipes from No. 3 tank.

(e) Disengage the tank support buttons, release the 'Dot' fasteners beneath the tank, and remove the tank through either of the access holes.

(3) *No.* 3 *tank* (*fig.* 8 (1) *and* (2)).

(a) Remove the circular cover plate over the tank.

(b) Disconnect the electrical lead to the contents gauge tank unit and remove the sixteen nuts securing the tank unit mounting flange to the tank. Remove the tank unit together with the support ring.

(c) On either the upper or lower surface of the main plane, unscrew the two countersunk head ferrules and withdraw the tie-rods.

(d) Remove the cover plates immediately inboard and outboard of the pylon and disconnect the feed and vent pipes to No. 2 tank.

(e) On the undersurface of the starboard main plane, remove the circular cover plate outboard of the wheel well and landing lamp (*Sect.* 5, *Chap.* 1) or cover plate on the port main plane and disconnect the feed and vent pipes from No. 4 tank.

(f) At the rear of the tank, disconnect the tank stub pipe from the feed pipe No. 1 tank. Access to this connection is gained by removing the outboard panel in the wheel well rear diaphragm.

(g) Disengage the tank support buttons. release the 'Dot' fasteners beneath the tank, and remove the tank through the access hole.

(4) *No.* 4 *tank* (*fig.* 8 (1), (2) *and* (3)).

(a) Remove the inboard circular cover plate over the tank. Unscrew the six securing nuts and remove the support ring and tank sealing plate.

(b) Remove the outboard circular cover plate over the tank. Unscrew the twelve nuts securing the filler neck mounting flange to the tank and withdraw the filler neck and cage complete.

(c) On either the upper or lower surface of the main plane, unscrew the three countersunk head ferrules and withdraw the tie-rods.

(d) On the undersurface of the starboard main plane, remove the circular cover plate outboard of the wheel well, and the landing lamp (*Sect.* 5, *Chap.* 1) or cover plate on the port main plane, and disconnect the feed and vent pipes to No. 3 tank.

(e) Remove the cover plate on the undersurface of the main plane immediately outboard of the tank, and disconnect the vent pipe from the tank stub pipe.

(f) Disengage the tank support buttons, release the 'Dot' fasteners beneath the tank, and remove the tank through the inboard access hole.

Installation of wing tanks

24. Note...

Before, during and after installing a wing tank, the following points should be noted:—

(a) *There must be no swarf or foreign matter inside the tank bay; a small piece of swarf can cause a leak, but* not *until the tank has been installed for some time.*

(b) *The black waterproof tape, used to cover all internal projections and sharp edges, is covered with an application of two coats of Bostik sealing compound S.*23/95 (*Ref. No.* 33C/1335)*; this should be intact on all taping. If the Bostik skin has flaked or the tape has lost its adhesion, they must be replaced. Where waterproof tape is found to be covered with three coats of D.T.D.*339*A lacquer, this should be removed, the area cleaned, and new tape covered with Bostik sealing compound S.*23/95 *fitted. For more detailed information refer to Vol.* 6. *Ensure that holes are cut through the tape where it passes over drain holes.*

(c) *The inside of the tank bay must be completely dry from fuel; if there is any sign of fuel penetrating behind the black waterproof tape, the tape must be replaced and the lacquer applied, as in* (2). *A warm air blower may be used to dry the tank bay thoroughly.*

(d) *Check that the tank bay screens are secure.*

(e) *The outer surface of the tank must be completely dry from fuel before it is assembled in the wing and clean from swarf and other foreign matter.*

(f) *Remove all paint from tank studs and smear a solution of* 10 *per cent glycerine and water on the studs to assist assembly.*

(g) *Ensure that all jointing faces and stub pipes are dry and free from fuel, and that moulded sleeves are fitted to all stub pipes. Use the special ratchet spanner* (Sect. 2, Chap. 4) *to secure pipe attachment clips in restricted places. When assembling the contents gauge unit, support rings and wing cover plates on No.* 2 *and No.* 4 *tanks, cover the mating surfaces liberally with plastic Hermetite* (*Ref. No.* 33C/1326) *as a protection against moisture ingress. The plastic Hermetite must not be used on the tank moulded ring faces, or the filler necks in No.* 1 *and* 4 *tanks. Strict cleanliness must be observed when using Hermetite in the fitment of components, and it must be applied as indicated in fig.* 15*; no excess of Hermetite should be left, since hardened flakes of this compound would cause blockage at vital points of the system.*

(h) *If difficulty should be experienced in pressing any of the metal pipes into a tank moulding, a very small application of a solution of* 10 *per cent glycerine and water may be used to facilitate the operation. It is essential that this grease is only used when absolutely necessary and that the least possible amount is applied.*

(i) *Under no circumstances must the controlled type rings be used with the plain type tank* (*pre-Mod.* 165) *or vice-versa.*

(1) *No.* 1 *tank* (*fig.* 8 (1), (2) *and* (3)).

Note...

When installing the tank, ensure that the

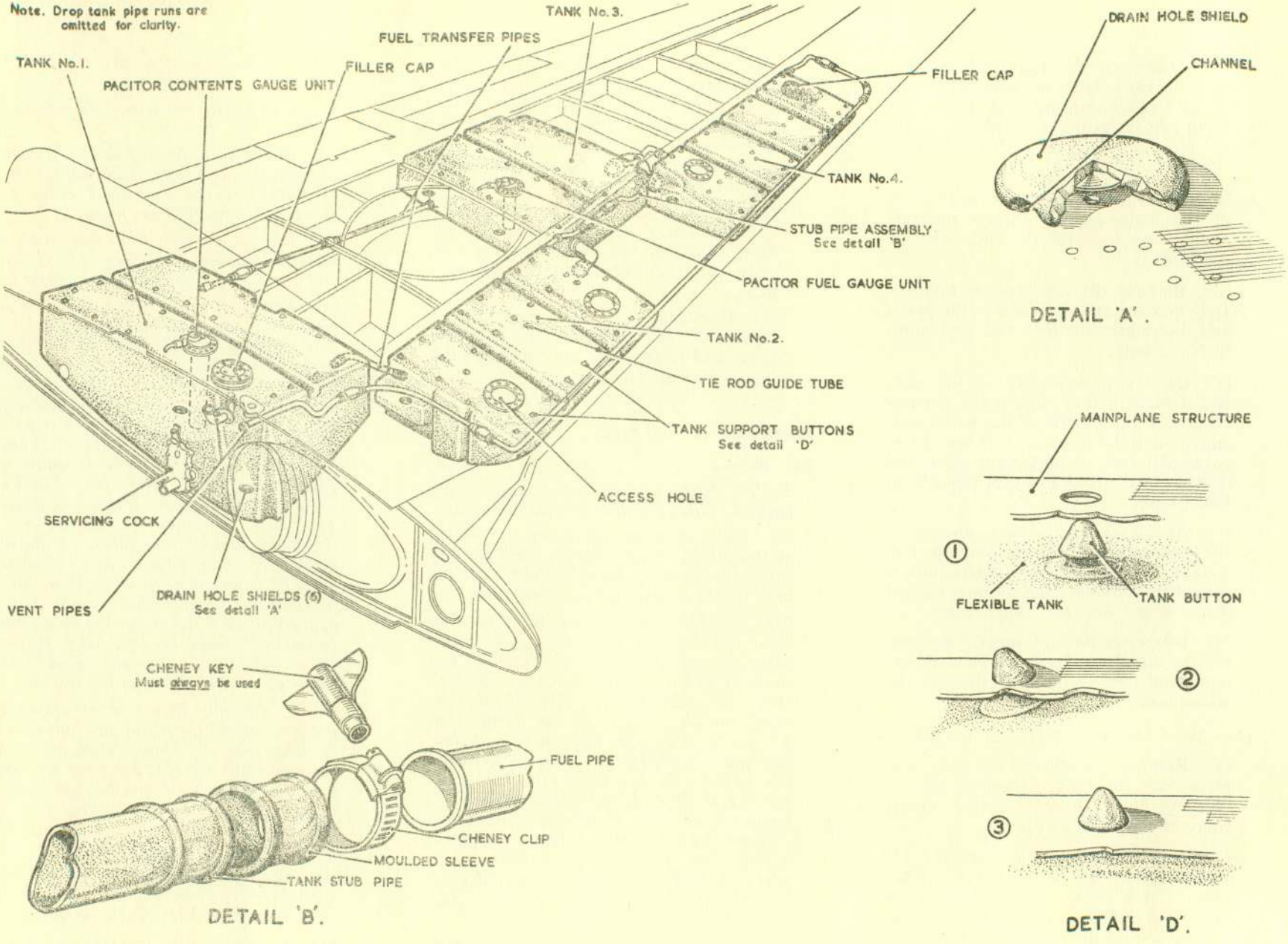


Fig. 8. Installation of wing tanks (1)

connecting pipe is correctly assembled to the tank stub pipe, and re-assemble the vent to the three-way adapter first. If a new tank door has to be fitted, ensure that there is a 45 *deg. chamfer of* 0·08 *in. on the leading edge.*

◀(a) Assemble the short vent pipe to the tank so that the red line on the pipe lines up with that on the tank moulding to ensure correct alignment. To prevent distortion of the tank moulding, the pipe must not be pulled or twisted in any way from its normal position when it is inserted through No. 1 Rib. Assemble the filler neck,▶ check that the cross hatching on the filler neck lower flange lines up with the red marks on the tank, and that the spigot holes in the upper filler neck flange line up with the spigots on the main plane structure. Ensure that the rubber slippers are fitted over the anti-surge valves.

(b) Position all tank stub pipes through the tank screen and wing structure.

Note...

Do not put the stub pipes into position by pushing on the anti-surge valves, a thin smear of a solution of ten per cent glycerine and water on the outside of the stub pipe will assist assembly through the structure.

(c) Connect up three 'Dot' support fasteners at the rear of the tank.

(d) Press the tank support buttons home, leaving the forward inboard diagonal face unbuttoned until the vent connection is made. To make this connection, position the pipe between the tank screen and the rib; fit the clip loosely over the pipe connection, fit the connection over the vent pipe and tighten the clip, using the special Cheney key. Press in the remainder of the studs.

(e) To make the connection to No. 3 tank transfer pipe, use the inspection hole in the undersurface of the wing aft of the main undercarriage, and an inspection hole in the wheel bay. Leave this connection slack until No. 3 tank is fitted.

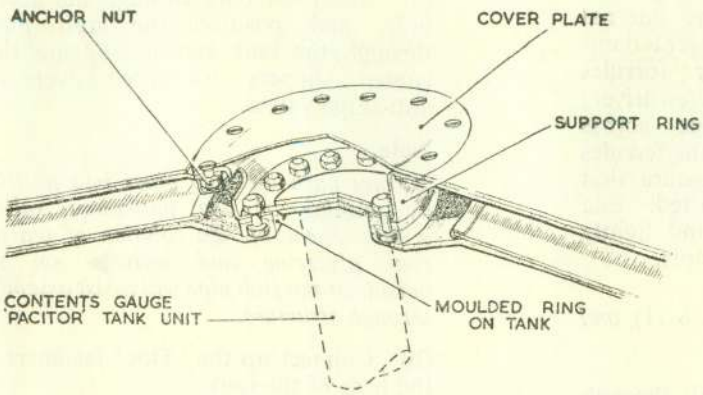
(f) To make the connection to No. 2 tank, use the inspection hole forward of the main undercarriage.

(g) Assemble the large panel to the undersurface of the wing.

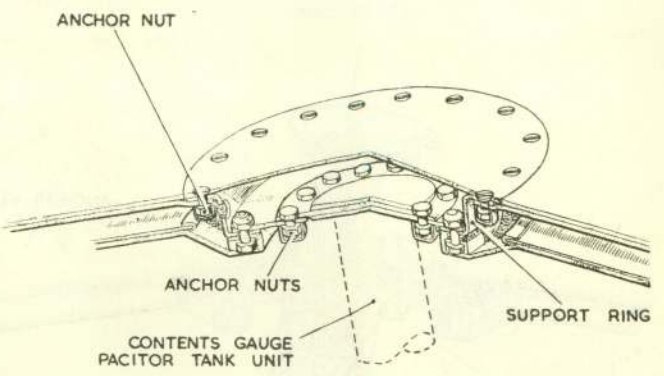
(h) Fit the contents gauge tank unit to the tank mounting plate at the top skin, ensuring correct location of the support ring and cable run; the hole in the support ring for the Pacitor gauge cable must face inboard.

(i) Assemble one ferrule to each of the three tie-rods, file the tie-rods flush with the ferrule, and centre pop the tie-rod end into the slot. Using the special bullet (*Part No.*

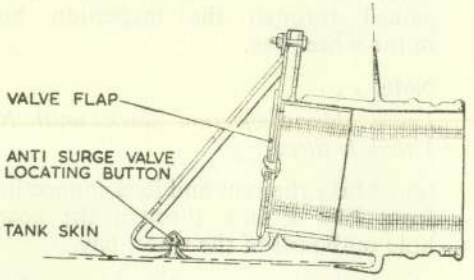
375/6 Wt. No. 30620 D. No. 6327 500 29/5/59 C. S. Co.

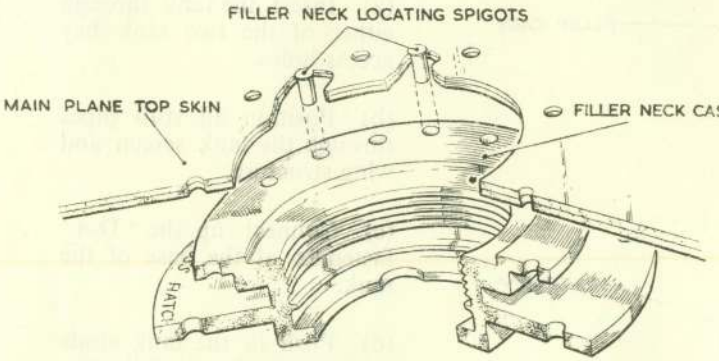


PACITOR UNIT
TANK 1



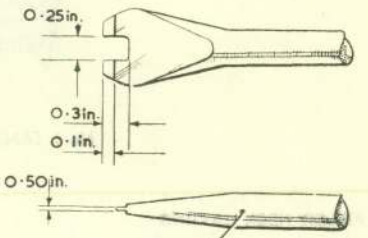
PACITOR UNIT
TANK 3

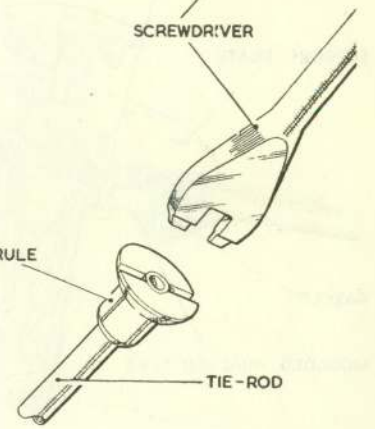


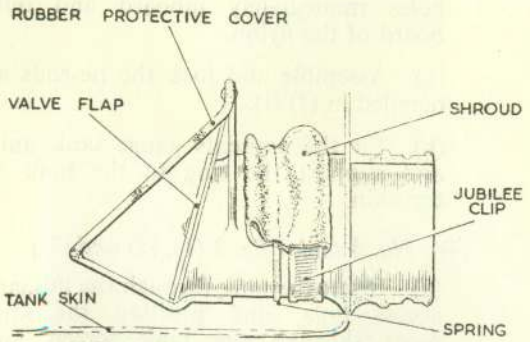


Important. Ensure cross hatch area on filler neck casting, mates with similar area on tank

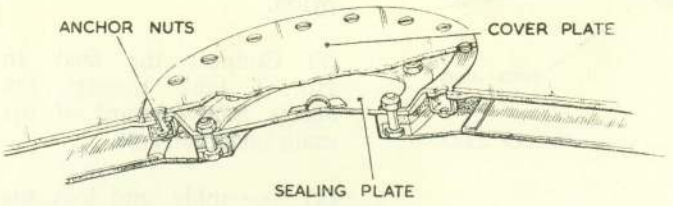
FILLER NECK No. 1 TANK







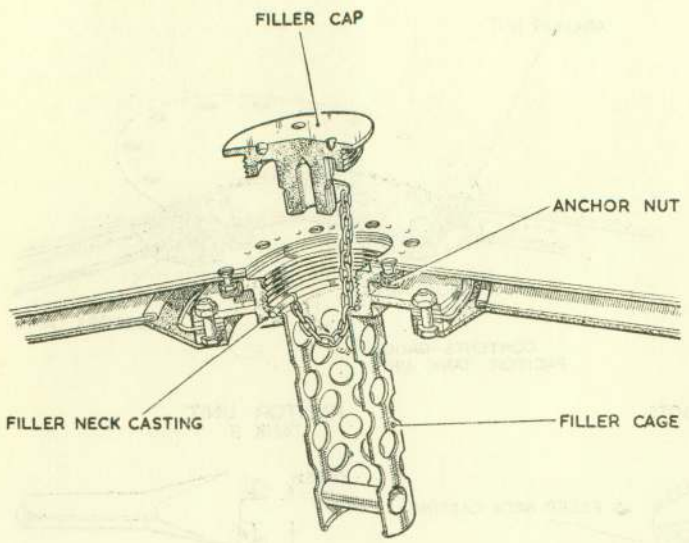
ANTI SURGE VALVES, ATTACHMENT TO WING TANKS



ACCESS HOLE TANKS 2 AND 4

ASSEMBLY OF TIE RODS

Fig. 8. Installation of wing tanks (2)



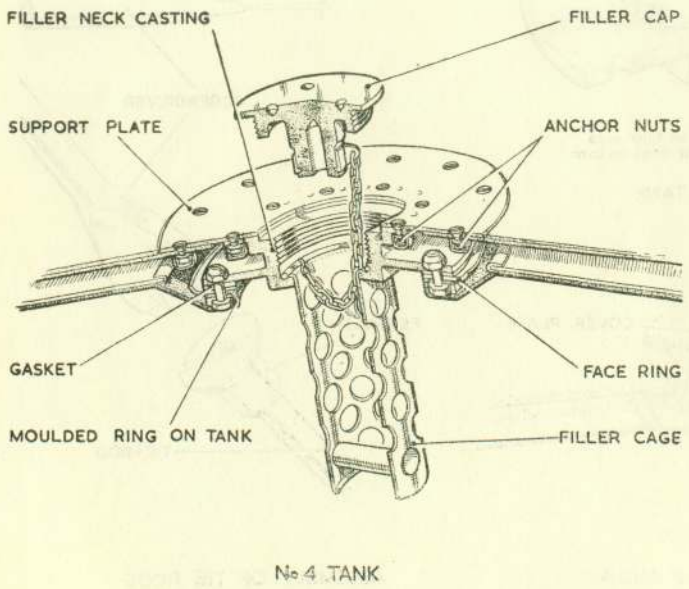


Fig. 8. Installation of wing tanks (3)

XC.SE.227), assemble the rods to the wing, carefully passing the rods through the internal rubber tubes to prevent damage. Fit the other furrules using the special screwdriver; hold a straight edge across the skin adjacent to the ferrules being tightened to ensure that the skin is not distorted. File the tie-rods flush, and lightly centre pop into the slots.

(2) *No.* 2 *tank* (*fig.* 8 (1) *and* (2))

(a) Insert the tank through either of the two tank bay access holes.

(b) Position all stub pipes through the tank screen and wing structure.

(c) Connect up the ' Dot ' fasteners at the base of the tank.

(d) Push in the tank studs as shown in detail of illustration.

(e) Connect the feed pipe and vent pipe to No. 3 tank through the access hole immediately inboard of the pylon.

(f) Connect the feed to No. 1 tank through the access hole forward of the main undercarriage.

(g) Assemble and lock the tie-rods as detailed in (1) (i)

(h) Fit the support rings and sealing plates to the wing.

(3) *No.* 3 *tank* (*fig.* 8 (1) *and* (2))

(a) Insert the tank through the access hole, and position the stub pipes through the tank screen. Ensure that rubber slippers are fitted over the anti-surge valves.

Note. . .

Do not push the stub pipes into position by pushing on the anti-surge valves, a thin smear of ◀*a solution of ten per cent glycerine and water*▶ *on the outside of the stub pipe will assist assembly through structure.*

(b) Connect up the ' Dot ' fasteners at the base of the tank.

(c) Push in the tank studs as shown in detail of illustration.

(d) Connect up the feed pipe to No. 1 tank, access to this connection is gained through the inspection hole in the wheel bay.

Note. . .

Leave this connection slack until No. 1 *tank is fitted.*

(e) Make the vent and feed connections from No. 4 tank through the access hole outboard of the wheel bay.

(f) Make the vent and feed connections from No. 2 tank through the access holes immediately inboard and outboard of the pylon.

(g) Assemble and lock the tie-rods as detailed in (1) (i).

(h) Fit the contents gauge tank unit, and support the ring to the tank at top skin.

(4) *No.* 4 *tank* (*fig.* 8 (1), (2) *and* (3))

(a) Insert the tank through the inboard access hole, and position the stub pipes through the tank screen and wing structure.

(b) Connect up the ' Dot ' fasteners at the base of the tank.

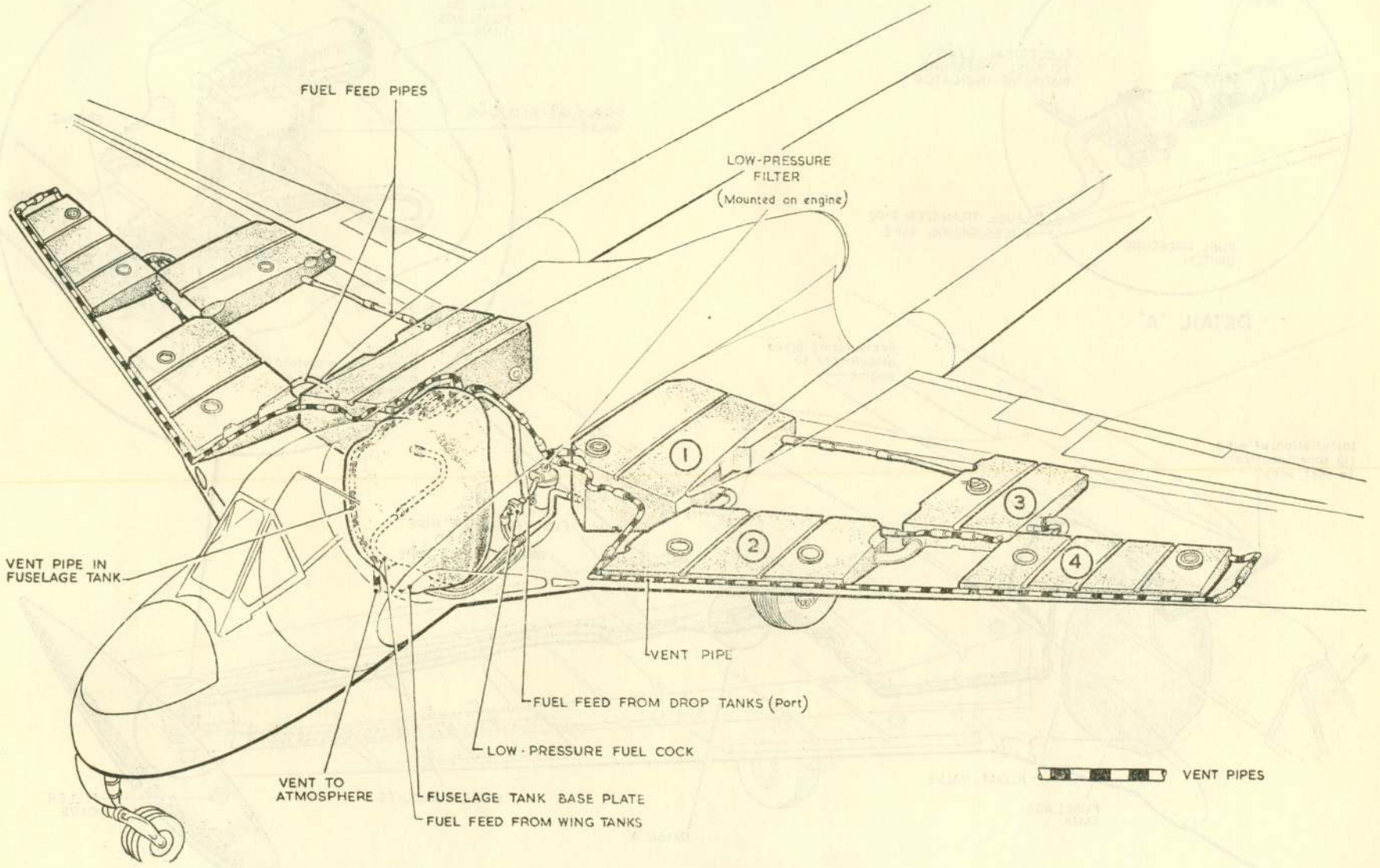


Fig. 9. Main fuel system layout (excluding drop tank system)

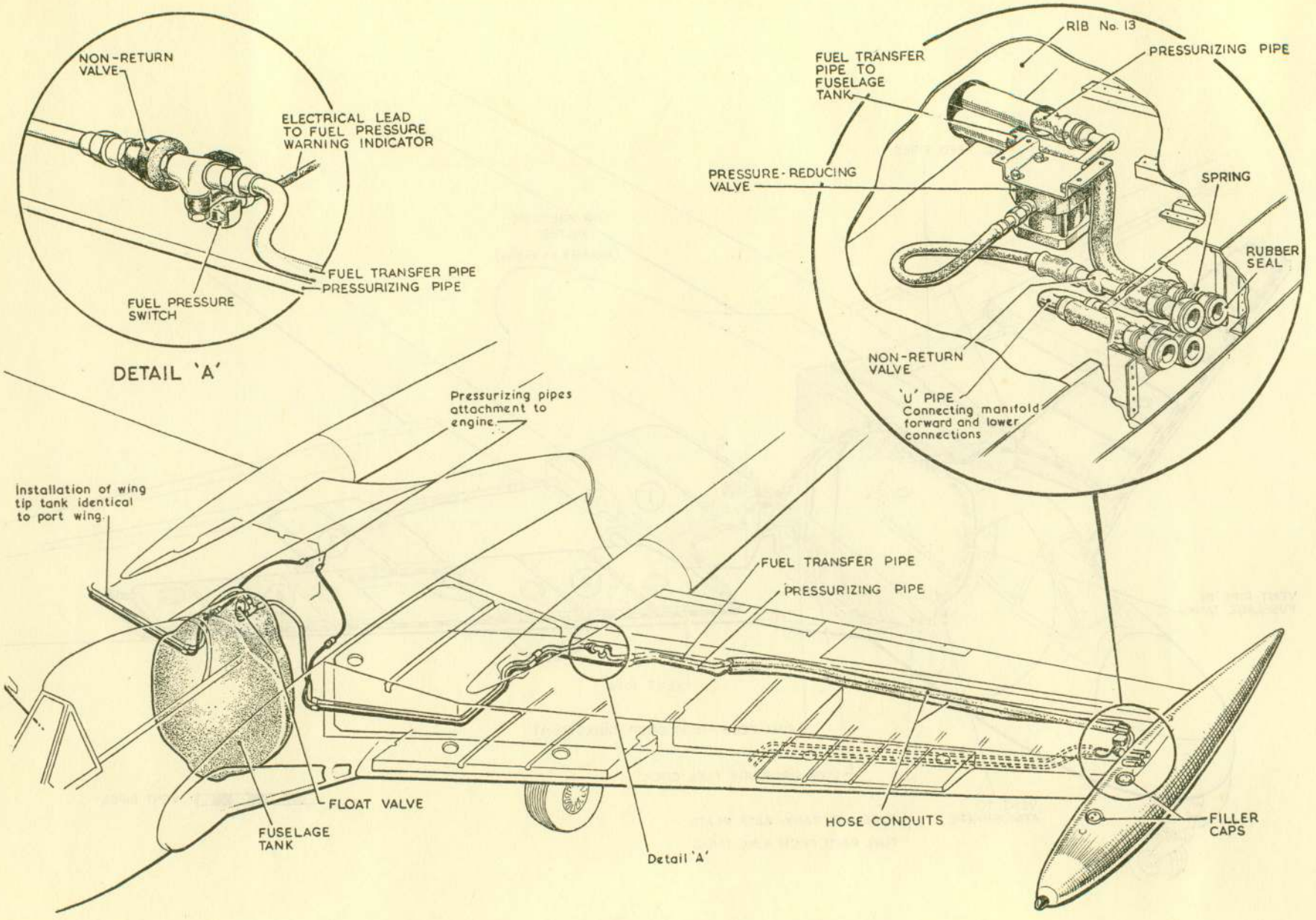


Fig. 10. Drop tank fuel system layout (without pylon tank)

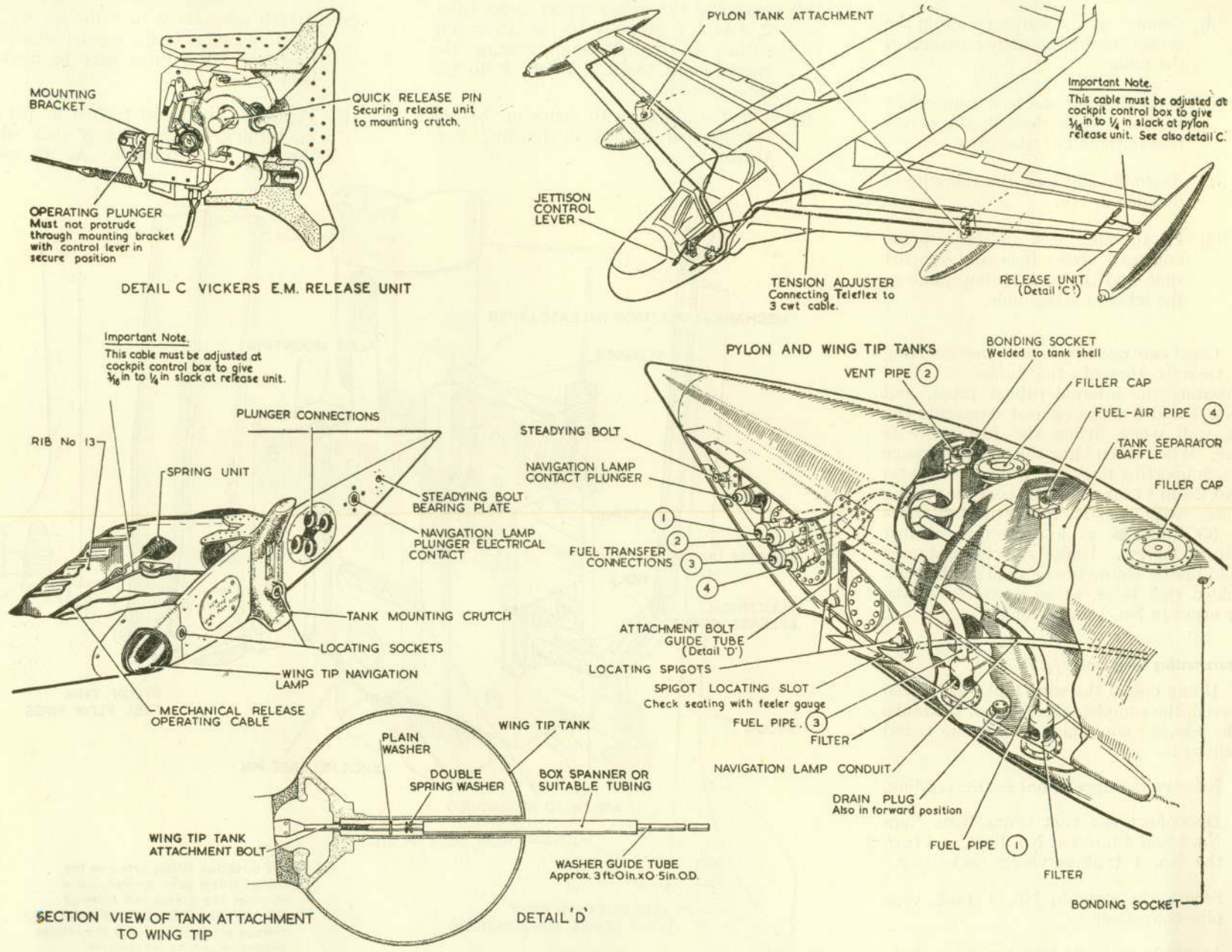


Fig. 11. Wing-tip drop tanks

(c) Push in the tank studs as shown in detail of illustration.

(d) Connect up the vent pipe, using the access hole immediately outboard of the tank.

(e) Make the vent and feed connections to No. 3 tank through the access hole outboard of wheel bay.

(f) Assemble and lock the tie-rods, as detailed in 1(i).

(g) Fit the filler neck and cage to the outboard access hole and support ring, and the tank sealing plate to the inboard access hole.

25. Great care must be taken when inserting the tie-rods through the tanks to avoid perforating the internal rubber tubes, and in No. 1 and 3 tanks against damaging the tank wall when fitting the fuel contents gauge. When assembling the contents gauge units, supporting rings and wing cover plates on No. 2 and 4 tanks, liberally coat the mating surfaces with plastic Hermetite ◀(*Stores Ref.* 33C/1326),▶ as a protection against moisture ingress. Under no circumstances should plastic Hermetite be used on the tank moulded ring faces, or on assembly of the filler necks in No. 1 and 4 tanks.

Pressure testing wing tanks (*fig.* 7)

26. If any one of the wing tanks have been removed, the complete assembly of the tanks in the relevant wing must be pressure tested as follows :—

(1) Remove the upper front engine cowling.

(2) Disconnect the vent connections from No. 1 and 4 tanks at No. 1 rib, and turn the No. 1 tank servicing cocks OFF.

(3) Secure the plug in No. 1 tank vent pipe connection.

(4) Assemble an air pressure pipe line, which must include a *shut-off* cock, to the No. 4 tank vent pipe.

(5) Remove the two tie-rods from No. 3 tank.

(6) Assemble the wing support spider (*Sect.* 2, *Chap.* 4) securely to the underwing surface of No. 3 tank, securing the special bolts (*Sect.* 2, *Chap.* 4) to the tank tie-rods.

(7) Fill the tanks with kerosene to the specification quoted in Leading Particulars.

(8) Fit the special filler caps to No. 1 and No. 4 tanks.

(9) Attach accurate 0 to 5 lb. per sq. in. pressure gauges to the special filler caps (mercury " U " tubes may be used in lieu).

(10) Pressurise the tanks to 3·0 lb. per sq. in. turning off the *shut-off* cock when this has been reached. As an extra

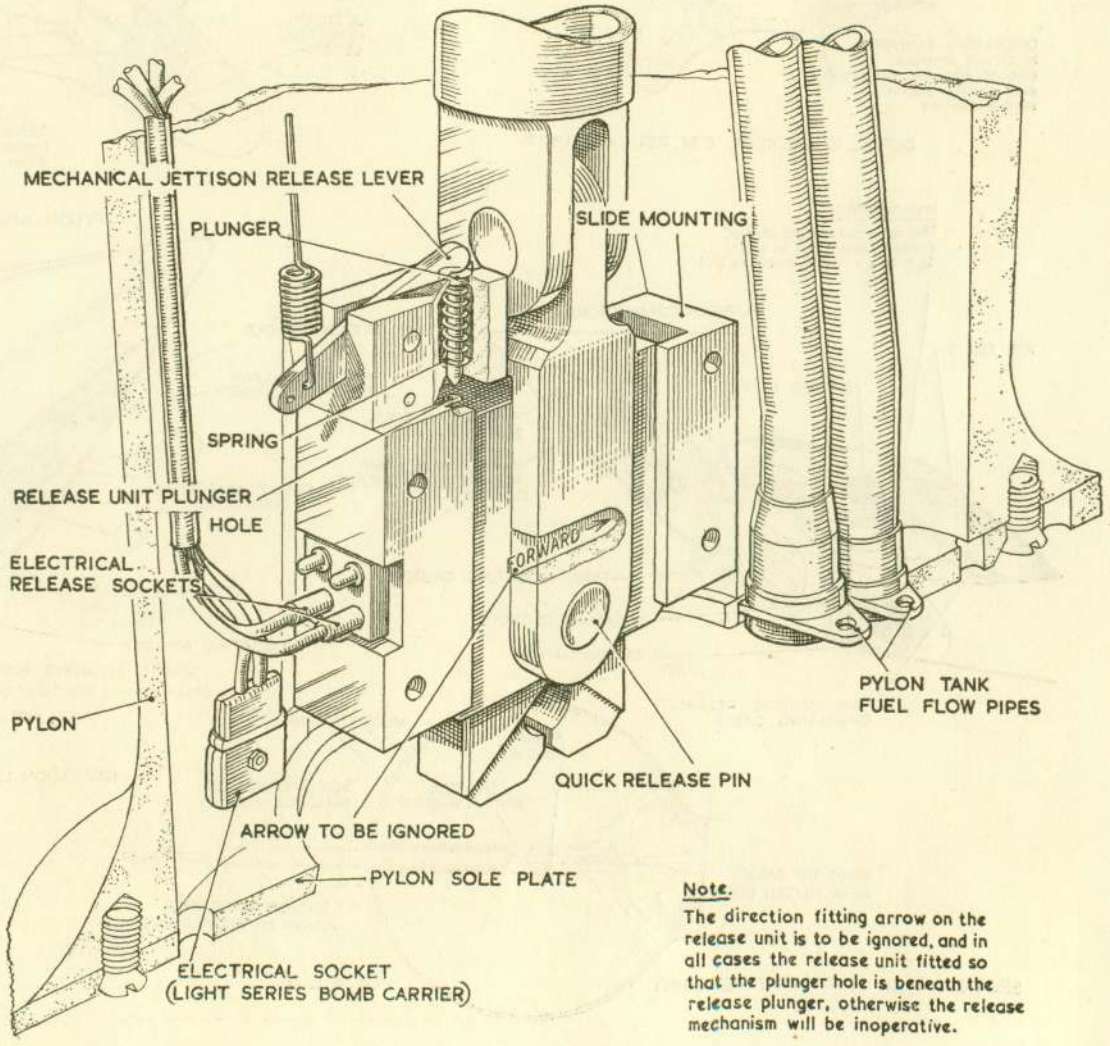


Fig. 12. Release unit in pylon

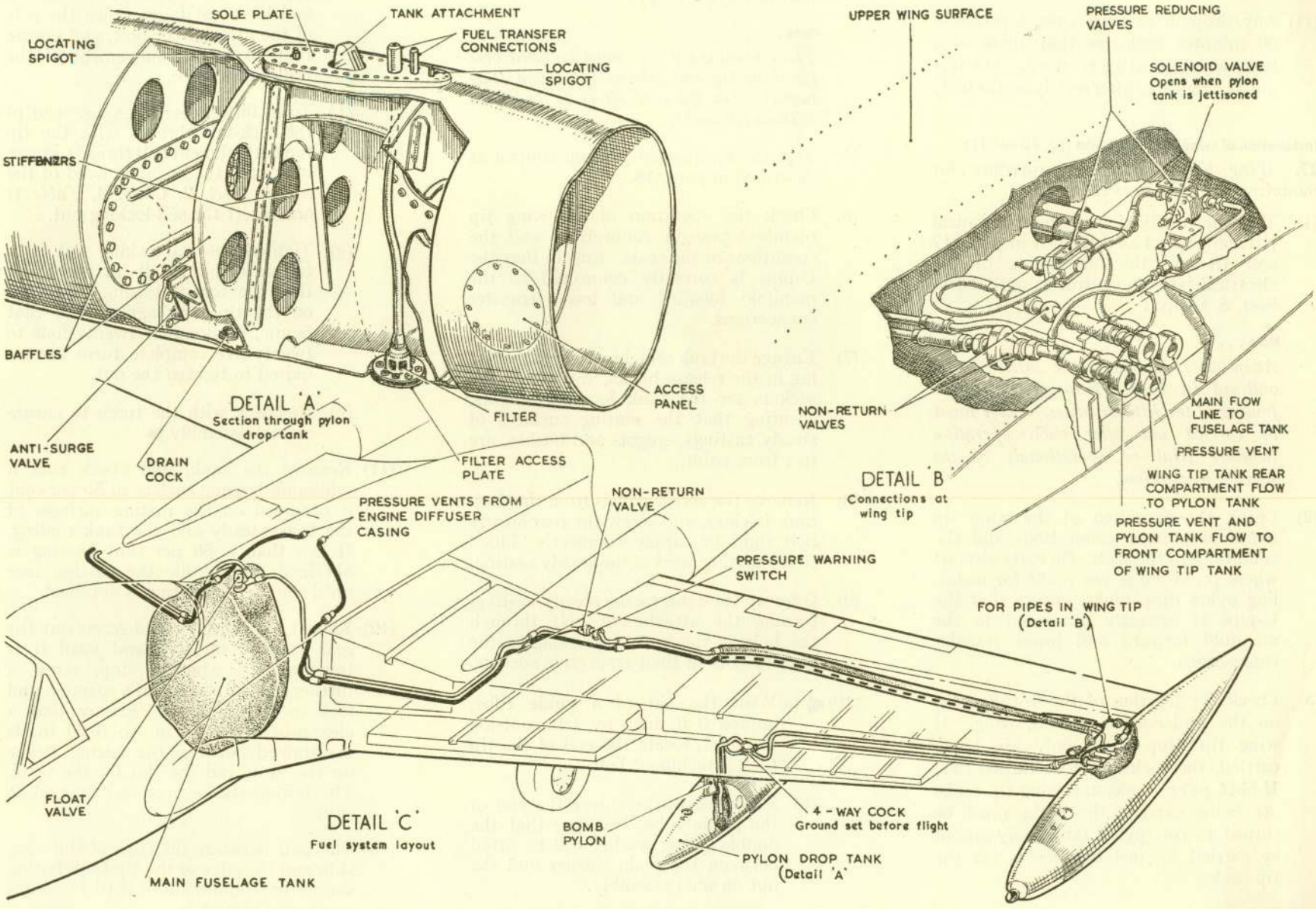


Fig. 13. Drop tank fuel system layout (with pylon tanks)

precaution, it is important to *disconnect the main air supply completely* in case a fault occurs in the *shut-off* cock.

(11) Any drop in pressure over a period of 30 minutes indicates that there is a leak, which must be rectified. The test must be repeated after rectifying the leak.

Installation of wing tip drop tanks (*fig. 10 and 11*)

27. *Wing tip tanks.* The procedure for mounting the tank is as follows :—

(1) Test the functioning of the mechanical jettison control as described in para. 17 and 18 and the functioning of the electrical jettison control as outlined in Sect. 5, Chap. 1.

Note . . .

Attention is drawn to the safety checks outlined in para. 17 *to guard against fouling of the jettison cables. These* must *be carried out after* each *operation* (*whether trial or operational*) *of the jettison mechanism.*

(2) Check the operation of the wing tip manifold plunger connections and the conditions of the seals. On early aircraft where provision is not made for installing pylon drop tanks, ensure that the U-pipe is correctly connected to the manifold forward and lower transfer connections.

(3) Check the position of the 4-way cocks on the undersurface of the wing. If wing tip drop tanks only are being carried, the cocks must be turned OFF. If both pylon tanks and wing tip tanks are being carried, the cocks must be turned to ON (pylon tanks *only* cannot be carried as fuel transfer is via the tip tanks).

Note . . .

Failure to set the cocks correctly will result in loss of fuel to atmosphere and inability to transfer fuel to the main tank.

(4) Remove the blanking plates (*Part No.* 12.PT.1437 *and* 12.W.4863) from the 4-way connector and from the release unit in the wing tip.

Note . . .

These blanking covers must be fitted over the wing tip connections (*port and starboard*) *when the aircraft is to be flown without tip tanks.*

(5) Test the mechanical jettison control as described in para. 18.

(6) Check the operation of the wing tip manifold plunger connections and the conditions of the seals. Ensure that the U-pipe is correctly connected to the manifold forward and lower transfer connections.

(7) Engage the tank attachment bolt bearing lug in the release hooks, and grease the sockets for the tank locating spigots, ensuring that the mating surfaces of steady castings, spigots and bushes, are free from paint.

(8) Remove the access panels from the drop tank fairings, and screw the rear steady bolt right in ; apply engineer's ' blue ' to the mating faces of the steady casting.

(9) Offer up the tank to the steady casting, passing the attachment bolt through the hole in the tank and engaging the tank spigots in their respective sockets.

(10)◀ (a) With the aid of a guide tube, approx 3 ft. long by $\frac{1}{2}$ in. outside diameter, locate the end of the tip tank attachment bolt.

(b) Slide two washers over the end of the guide tube, ensuring that the double spring washer will be fitted between the plain washer and the nut on final assembly.

(c) With a box spanner or similar tube, push the washers fully " home " over the threaded portion of the tip tank attachment bolt.

(d) Remove the guide tube.

(e) Check by torch-light that the washers are correctly assembled and have not fallen down the side of the attachment bolt, and ensure that no further movement of the tank takes place.

(f) To facilitate ease of engagement of the lock-nut threads with the tip tank attachment bolt threads, grease internally the hexagon head of the socket (*Sect.* 2, *Chap.* 4, *Table* 1) and insert the self-locking nut.

(g) Tighten the self-locking nut to a torque load of 300 lb. in. and check that the torque loading stencilled on the tip tank agrees with that figure ; ensure that twenty-four to twenty-five complete turns are required to tighten the nut.

(h) Re-check with the torch to ensure correct assembly.▶

(11) Remove the tank, and check that a minimum bearing surface of 50 per cent is obtained on the mating surfaces of the tank steady and the tank casting. If less than a 50 per cent bearing is obtained, lightly file the casting face until the correct mating is obtained.

(12) Repeat (9) and (10), and screw out the rear steady bolt by hand until it is touching the wing-tip stop, screw a further half turn *out* with a spanner, and lock in this position. Ensure that a clearance of 0·001 in. to 0·20 in. is maintained between the fairing strake on the tank and the slat on the wing. The fairing strake may be trimmed to suit.

(13) The gap between the edge of the wing skin and the edge of the tip tank fairing should be a minimum of 0·01 in. and a maximum of 0·11 in.

(14) Check that there is a compression of $\frac{1}{8}$ in. minimum of the hose joint connections inside the wing tip.

(15) Replace the access panels on the drop tank fairings, and ensure that these panels clear the steady casting by 0·05 in. all round.

(16) If a tip tank is removed and then refitted on the same wing-tip, the rear steady bolt must be re-adjusted as in (12).

(17) If necessary, when fitting a new tip-tank, the strake on the tank may be cut and dressed over the lamp and leading edge if found necessary.

Installation of pylon drop tanks (*fig. 12 and 13*)

28. The procedure for installing the pylon tanks is as follows :—

(1) Remove the bomb pylon cover plates.

(2) Check that the change-over switches in the wheel-well are set to LIVE BOMB OR TANK. The position of the switches is shown on the electrical location diagram in Sect. 5, Chap. 1.

(3) The functioning of the electrical jettison mechanism must be checked as detailed in Sect. 5, Chap. 1.

(4) Test the functioning of the mechanical jettison mechanism in the following manner :—

(a) Sight through the inspection hole in the outboard surface of each pylon and see that the release unit operating plunger is 0·1 in. above the top surface of the release unit.

Note . . .

Check that the operating plunger is positioned above *the release unit plunger hole. With certain units the fitting direction-arrow on the release unit must be ignored, in accordance with the stencilled note on the pylon. Failure to correctly position the unit in this way will render the release mechanism inoperative.*

(b) Check the cabin control lever for full and free movement. This operation will automatically cock the release units.

(c) Engage a test weight in the release unit at each pylon. The pylon tanks may be used for this test, in which case two men must be positioned on each tank to support them when they are released.

(d) With the cabin lever disengaged from its retaining clip, apply a spring balance at the control lever handle and check that a load of 25 lb. ± 5 lb. is required to release both weights. The weights should fall reasonably together, but, when the lever is operated slowly, a slight time lag is permissible provided that both weights fall well before the control lever reaches its limit of travel. Check that, as the lever reaches its limit of travel, a load of 30–50 lb. is indicated on the spring balance.

(e) Should the weights not fall as described in sub-para. (d), adjust the Teleflex cable as necessary at the appropriate transmitting unit.

(5) Check the position of the 4-way cocks on the undersurface of the wing. If *wing-tip drop tanks only* are being carried, the cocks must be turned to OFF. If both *pylon tanks and wing-tip tanks* are being carried, the cocks must be turned to ON. Pylon tanks *only* cannot be carried as fuel transfer is via the tip tanks.

Note . . .

Failure to set the cocks correctly will result in loss of fuel to atmosphere and inability to transfer fuel to the main tank.

(6) Inspect the fuel transfer connections to ensure that they are in good condition and undamaged.

(7) Position the tank immediately below the pylon.

(8) Remove the screwed cap from the upper surface of the main plane over the hoisting point, and, using the pylon hoist spanner and adapter (*Sect.* 2, *Chap.* 4), extend the screw jack.

(9) Engage the tank suspension lug in the release unit, and ensure that the release unit becomes cocked (Certain aircraft may be fitted with a single-extension jack, in which case the tank must be lifted up to engage on the release unit). Hoist the tank, using the pylon hoist spanner, from the upper surface of the main plane, taking care that the tank is properly steadied during hoisting and not allowed to swing. As the release unit reaches the pylon, *it must be guided* into its housing in the pylon or damage may occur to the unit. Remove the spanner from the adapter and fit the torque wrench (*Sect.* 2, *Chap.* 4) adjusted to 500 lb. in., then move the handle of the wrench from right to left until a sudden drop in resistance is felt, indicating that the tank has been correctly stabilized. Test that the release unit is cocked (*Sect.* 5, *Chap.* 1), and inspect the position of the release plunger as described in sub-para. 4(a).

(10) The sequence of operations for the removal of the pylon tanks is the opposite to that given above. At all times, the screw jack should be unscrewed at least one complete turn before releasing the tank either mechanically or electrically ; under no circumstances should it be released with the screw jack fully tightened or damage may result to the jack unit through shock loading. When the release unit has been lowered clear of its housing, the suspension hooks may be opened by operating the mechanical release plunger, which is flush with the top of the unit, with a suitable probe.

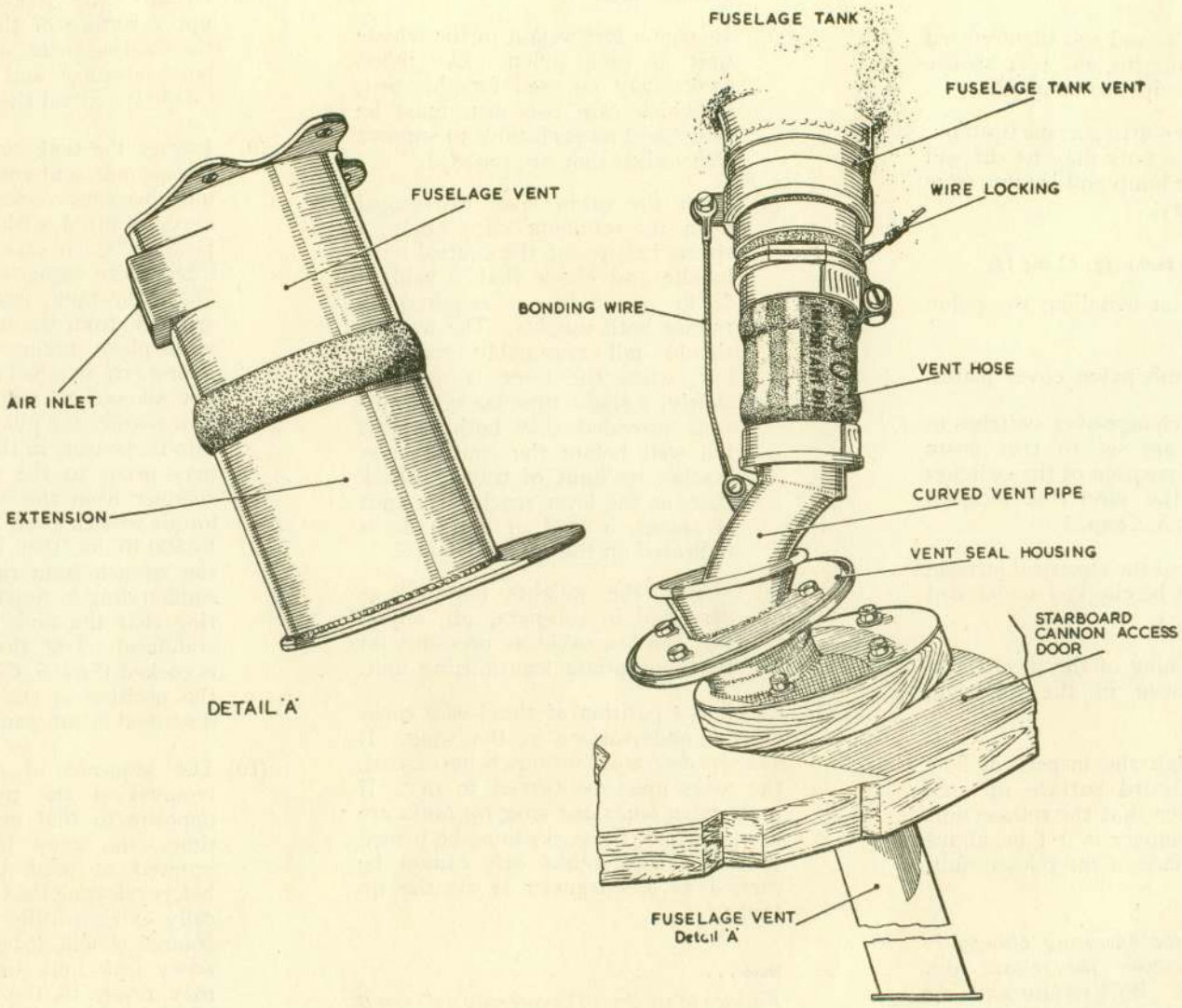
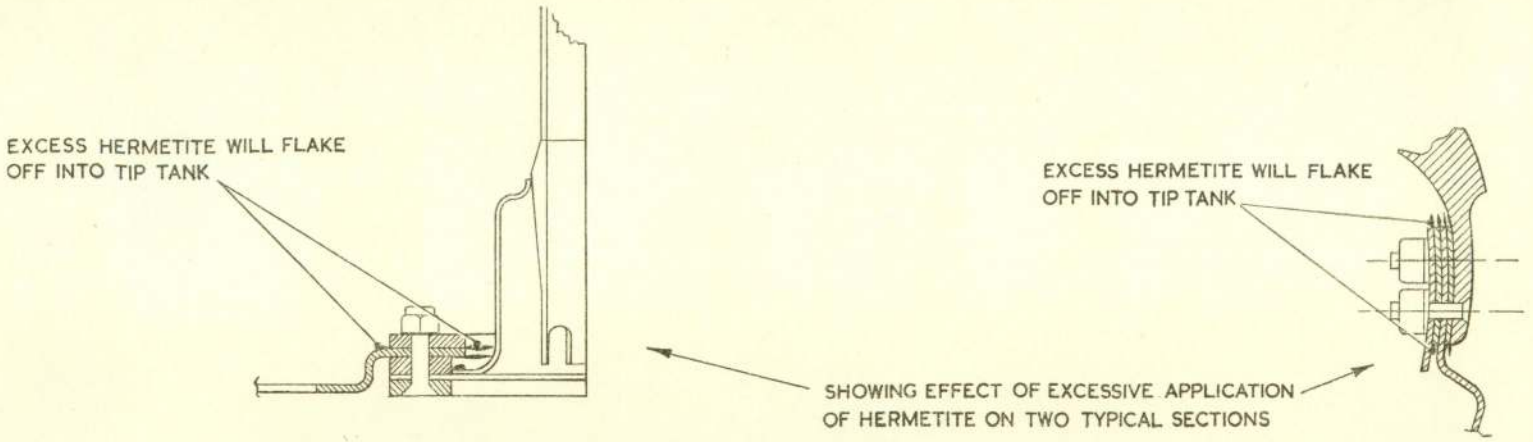
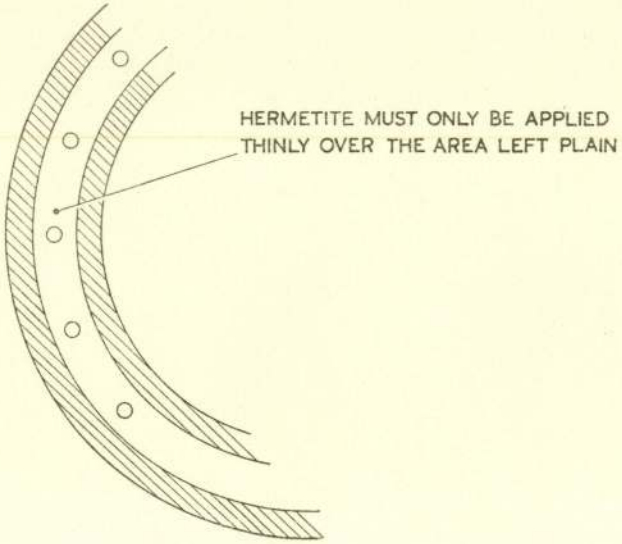
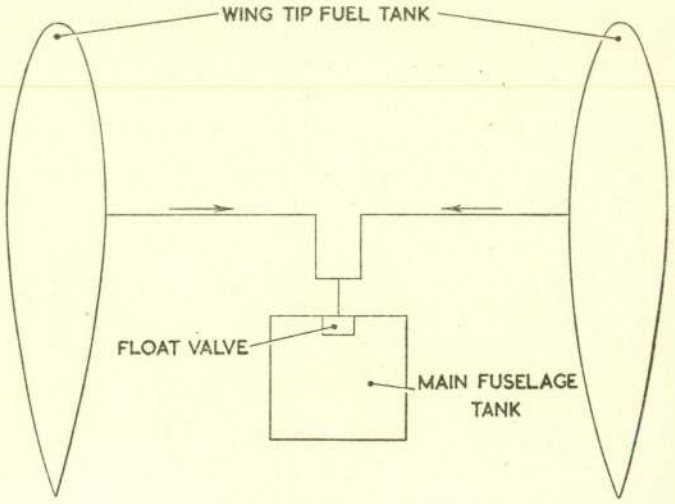


Fig. 14. Fuel vent on starboard cannon access door







Note,

Hermetite must be kept clear of the edge of any internal surface of the wing tip tanks. Where Hermetite could flake off into the tank from both edges of a surface, only the middle portion of that surface around the bolt holes, for approximately half the width will be covered by Hermetite. Similarly, where only one edge is affected, approximately three quarters of the width will be covered by Hermetite

DIAGRAM SHOWING HOW FLAKES OF HERMETITE, WHEN APPLIED EXCESSIVELY IN WING TIP TANKS AS SHOWN ABOVE, MAY BE CARRIED IN THE FUEL SYSTEM TO OBSTRUCT THE FLOAT VALVE IN THE FUSELAGE TANK

Fig. 15. Correct application of Hermetite

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