Chapter 2 FUEL SYSTEM

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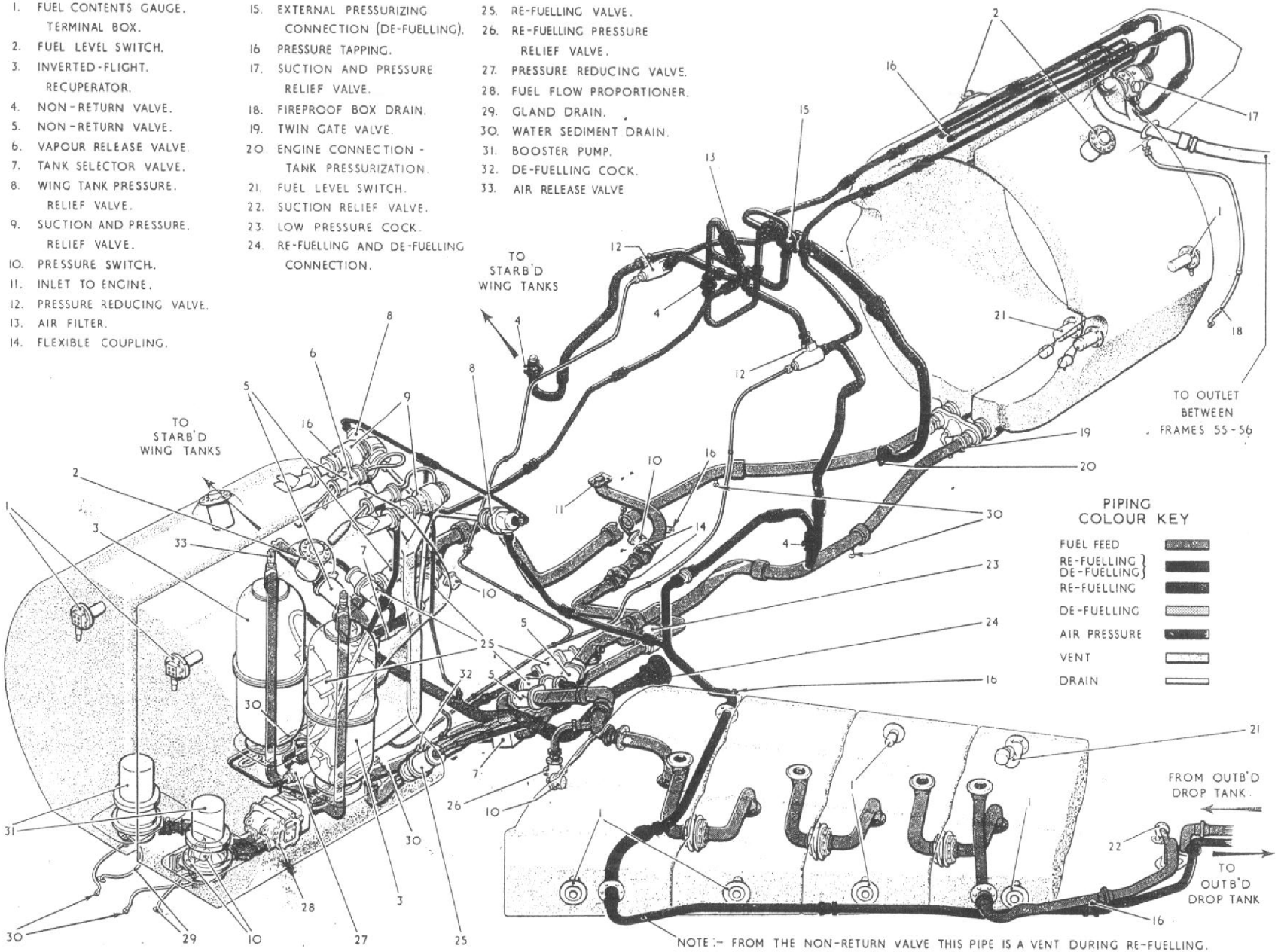

NOTE :- FROM THE NON-RETURN VALVE THIS PIPE IS A VENT DURING RE-FUELLING.

Fig.1 Fuel System Installation

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DESCRIPTION AND OPERATION

Introduction

1. The fuel system installation consists of four flexible bag-type tanks installed within the fuselage and four in each wing. In addition, and according to operational necessity, drop tanks may be carried on pylons assembled under the wings. The system, including the drop tanks, has been designed for pressure refuelling. Delivery of fuel to the engine is from the front pair of fuselage tanks, the supply being supplemented by means of electrically-driven booster pumps, one of which is submerged in each of the two front tanks.

2. Transfer of fuel from the remaining tanks to the fuselage front tanks is accomplished by air pressure obtained from a restricted tapping on the engine compressor. Provision is made to ensure an adequate supply of fuel when the aircraft is flying under negative 'g' conditions.

Fuselage tanks

3. The four fuselage tanks are flexible rubber bag-type tanks reinforced with madapollan vulcanized on the outside. Over this reinforcement are three layers of glass cloth, the tanks afterwards being finished with fire-proof lacquer. Two of these tanks are installed in the centre fuselage forward of the main spar frame and the other two in the rear fuselage where they encircle the rear of the engine.

4. Each front tank is provided with an electrically-driven immersed fuel booster pump. These supplement the flow to the engine-driven pump unit which increases the pressure still further before the fuel is passed to the high pressure cock. Also housed in each front tank is an inverted flight recuperator. A description of these and their function is given in para. 14.

5. All four fuselage tanks are provided with a combined suction and pressure relief valve *(para. 22)*. These valve units are similar in construction except that the rear tank units accommodate a third valve used as a non-return for fuel tank pressurization purposes. Non-return valves are fitted in the transfer pipe lines between the rear tanks and the tank selector cocks to prevent reverse flow during refuelling. Ganged cocks are inserted, one in each transfer pipe, at their breakdown points in the region of the transport joint; these are only accessible when the transport joint butt strap is removed. Known as the 'twin gate valve', these cocks should always be turned off during removal of the rear fuselage from the remaining structure. The front tanks are fitted with vapour release valves *(para. 9)*.

Wing tanks

6. Each wing accommodates four tanks in bays formed between ribs A and 1, 1 and 2, 2 and 3, and between ribs 3 and G. They are of the flexible rubber bag type with nylon net reinforcement vulcanized on the outside and finished with fire-proof lacquer. The four tanks are interconnected and for practical purposes, may be considered as one tank. The fuel from these tanks is transferred to the fuselage tanks by air pressure *(para. 10–11)*, interconnection being by means of transfer pipes, one of which runs from each inboard tank to its respective selector cock in the centre fuselage. These pipes each contain a non-return valve to prevent reverse flow during refuelling. The tanks are provided with a pressure relief valve *(para. 23)* and a suction relief valve *(para. 24)*.

Drop tanks

7. Provision is made, on the underside of each wing, for the fitting of pylons designed to carry various external stores, including drop tanks. The tanks, when fitted, are connected to the wing tanks, by means of transfer pipes. These pipes and the air pipes which feed air, pressurized by the engine, into the drop tanks for fuel transfer purposes, are joined to the drop tanks by means of self-sealing fuel and air valves *(fig. 9 and 10)* which interconnect the air and fuel pipes when the drop tanks are jettisoned. A by-pass valve, consisting of a ducted plate which interconnects the air and fuel pipes, is assembled to the wing when a pylon is not fitted. Each drop tank has its own float switch which, like their counterparts in the wing tanks with which they are in parallel, come into action automatically during refuelling of the tanks. The fitting of the pylons to the wings is described in Sect. 3, Chap. 2, the fitting of the drop tanks in Sect. 2, Chap. 2 and the electrical circuits in Sect. 5, Chap. 1.

Refuelling valves

8. The refuelling valves, one of which is fitted into the pipe line to each tank, are servo controlled, the servo being operated by the refuelling pressure. They are in direct connection with the standard refuelling coupling in the port wheel bay.

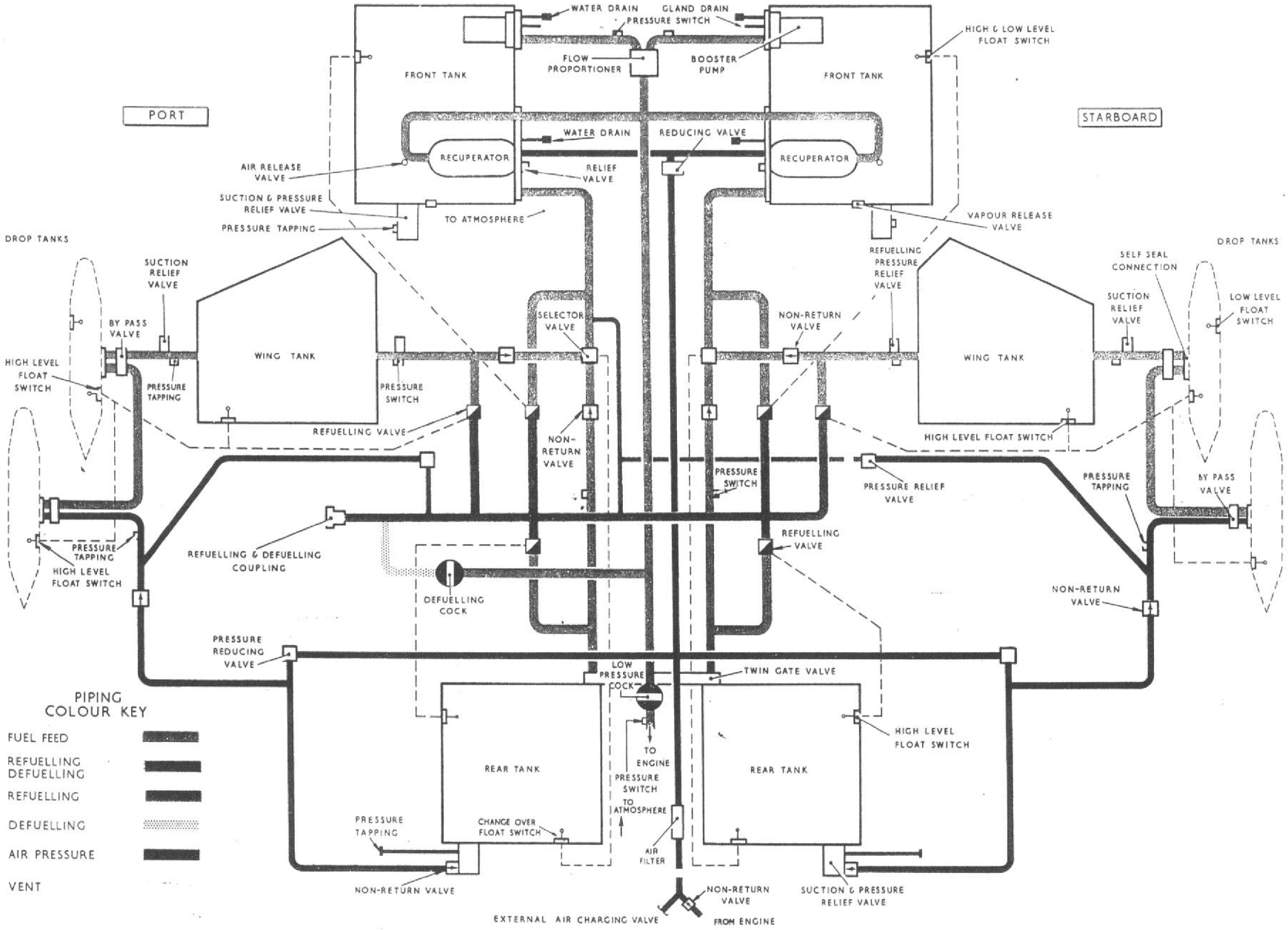


Fig. 2 Fuel system diagram

Vapour release valves *(fig. 3)*

9. The vapour release valves, one of which is fitted to each front tank, are rubber-faced poppet valves controlled by cork floats. The floats have a weighted arm which renders the valve inoperative when the tanks are subjected to negative 'g' conditions. The function of the valves is described in para. 12 and 30.

Fuel tanks pressurization

10. For the transfer of fuel to the front tanks, at all altitudes and rates of flow, a pressure of about 6 lb/in² is required. The air supply for tank pressurization is taken from a restricted tapping on the engine compressor. From this tapping a pipe conveys the air through a non-return valve and an air filter to a junction from which one pipe continues, through a pressure reducing valve, to split up and feed air to the recuperator in each front tank. The other two pipes from the junction turn outwards, each to join a reducing valve. From the reducing valves, the pipes branch to feed the rear and wing tanks, (or drop tanks if fitted). Non-return valves are inserted in the pipe lines to the wing tanks; the rear tank feed utilizes the non-return valve which is incorporated in the tank suction and pressure relief valve unit *(para. 22)*. The pressure reducing valves serving the rear tanks, the wing tanks and, when fitted, the drop tanks, have an outlet pressure of 6 lb/in² and that for the recuperators 10 lb/in². A branch pipe from the engine air pressure pipe is in connection with an external air charging connection mounted in the spine of the centre fuselage.

Fuel transfer

11. Air pressure from the fuel tank pressurization system *(para. 10)*, causes the displacement of fuel from the rear tanks via non-return valves and selector cocks to the front tanks. When the rear tanks are empty, low-level switches, one in each rear tank, operate the selector cocks to close the rear tanks transfer pipes and open the transfer pipes from the wing tanks. Air pressure in the wing tanks then causes displacement from these tanks via non-return valves and the selector cocks to the front tanks. When drop fuel tanks are fitted, displacement from these tanks is to the outboard wing tanks. Thus, the drop tanks empty before the wing tanks. Normally, the selector cocks are operated automatically, but switches situated in the cabin enable the automatic control to be over-ridden, should such action become necessary. A cock position indicator is mounted adjacent to the switches.

Note . . .

When 230 gal. drop tanks, Part No. E.264903 (Mod. 1242 – identified by a 2 in. X 12 in. blue band painted each side of the tank and overlapping the nose and centre portions of the tank), are fitted, the tank rear compartment is emptied first as the transfer air pressure passes first into this compartment from either the wing air pressure pipe or from the outboard drop tank (when fitted). It should be noted that the amount of fuel entering or leaving the rear compartment is not gauged and that the gauge in the drop tank will register full (F/18) on refuelling as soon as the forward compartment is filled. On fuel being drawn from the tank the gauge will remain at F/18 until such time as the rear compartment is empty and the fuel level in the front compartment commences to drop.

Note . . .

The assembly of the fuel selector cock actuator is described in Sect.5, Chap.5.

12. Under certain conditions of flight, particularly during inverted flying, air may pass into the front tanks. Air also comes out of solution from the fuel at altitudes, or the fuel may boil. The expansion of this air, or vapour, while climbing, may prevent fuel transfer, allowing the front tanks to drain while fuel remains in the other tanks. To prevent this, a vapour release valve *(para. 9)* is fitted to each front tank. When the fuel level falls, the valves open, allowing air or vapour to escape to atmosphere and the fuel to transfer. The valve is over-ridden during negative 'g' conditions to prevent fuel draining out of the vent pipe. Should the air pressure system fail, very little fuel will transfer from the wing or rear tanks and the

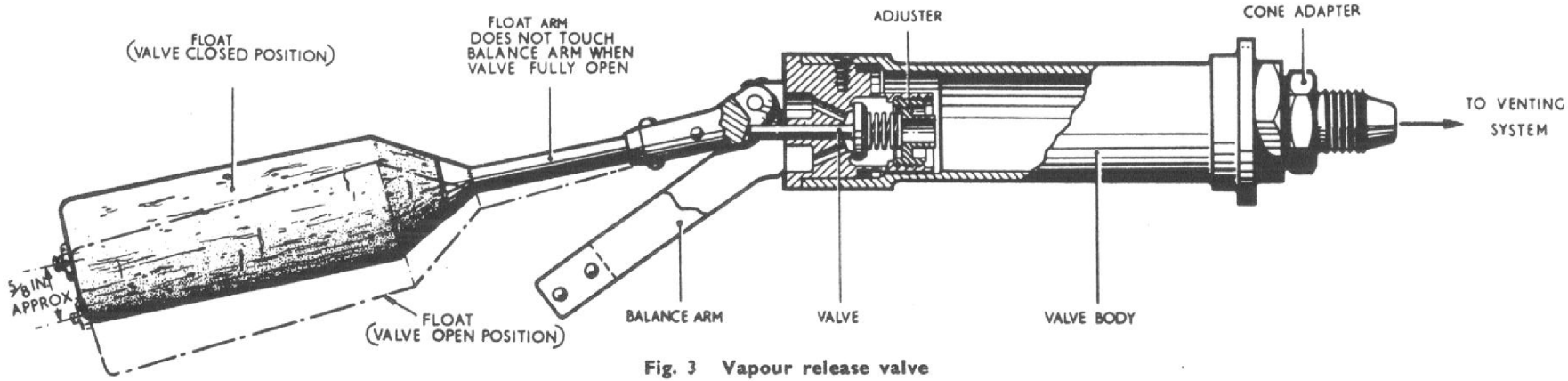


Fig. 3 Vapour release valve

fuel transfer indicator in the cabin will operate. The transfer switches operating the indicator are also coupled to the fuel contents gauges, giving an EMPTY indication for the rear or wing tanks when pressure fails. Thus, when transfer failure is indicated, the contents of the front tanks only is shown, this being the only fuel available to the engine.

Fuel flow proportioner

13. A fuel flow proportioner is fitted in the main delivery line from the booster pumps. It consists of two cells of equal capacity, each equipped with a vane type rotor, a non-return valve and a by-pass valve. The non-return valves are open under normal conditions but if the rotors become stiff or inoperative the by-pass valves open to allow the fuel to flow unmetered. The inlet of each cell is connected to its associated tank system and the outlet from each delivers into a common manifold. Providing that the inlet pressures to the unit do not differ by more than 2 lb/in², the flow proportioner ensures that equal amounts of fuel are taken from both sides of the tank system. For more detailed information refer to A.P.106C series.

Inverted flight recuperators

14. The two inverted flight recuperators are rubber bags contained in metal cases and mounted, for convenience, one in each front tank. Fuel is fed to one end of the recuperators by means of branch pipes from the main delivery line to the engine, just down-stream of the flow proportioner, while air pressure from the tank pressurization system is fed to the other end through a reducing valve which has an outlet pressure of 10 lb/in². This air pressure is sufficient to force the stored fuel out of the recuperators to the engine when the fuel supply from the pumps fails, for example, during inverted flying. A relief valve, set to 11 lb/in², allows the air to discharge to atmosphere when the booster pumps again provide sufficient pressure for re-charging the recuperators.

Note ...

(1) Design of the pressure reducing valve, Type 48/8, includes a close tolerance poppet valve and small diameter orifices, therefore it is liable to malfunction if contaminated by foreign particles. To guard against this the air side of the valve has been provided with an air filter. The valve is also susceptible to contamination by fuel when a malfunction of other components (such as a split recuperator bag) causes fuel to enter the air side of the pressurization system.

(2) As a precautionary measure, the valve is to be changed and the associated pipelines cleaned internally whenever fuel is suspected of having entered any part of the tank pressurization system.

Delivery

15. Fuel is delivered to the engine-driven fuel pumps from the front tanks by means of electrically-driven immersed booster pumps designed for two-speed operation. Normally, they run in low speed but either is capable, in high speed, of supplying the maximum fuel demand of the engine. The pumps are started and stopped by independent switches situated in the cabin and the high or low speed operation is controlled by pressure switches tapped into the pump outlet pipes. These pressure switches operate at 8 lb/in² with falling pressure and 12 lb/in² with rising pressure. Failure of pressure from one pump operates, through a relay, an indicator in the cabin and switches the other pump to high speed. Should one booster pump fail during ground running of the engine the associated switch should be selected OFF and, if necessary, the ground run completed on the serviceable booster pump which will automatically transfer to high speed operation. If both booster pumps are switched OFF the fuel low pressure warning light must be monitored while the engine is running and rev/min restricted to below the figure at which the light illuminates. Continued engine running with the fuel low pressure warning light illuminated could result in damage to the engine-driven fuel pump. The electrical system is described in Sect.5, Chap.1.

16. From the booster pumps, the fuel passes to the flow proportioner *(para.13)* and then through the low-pressure cock to the engine. Branch pipes from this main delivery line feed the recuperators *(para.14)*. The pipe line carrying fuel from the low-pressure cock to the engine carries a pressure switch, this operates the low-pressure warning indicator in the cabin.

High pressure cock and throttle control

17. The throttle control is mounted on the cabin port shelf and moves forward from CLOSED to OPEN. The first part of this movement opens the high-pressure fuel cock.

Low-pressure fuel cock control

18. The low pressure fuel cock control is mounted on the cabin port shelf and moves forward from OFF to ON. The cock is fitted in the main pipe line from the flow proportioner to the engine inlet. It should never be turned OFF before the throttle is closed.

Fuel contents gauges

19. The fuel contents gauges are grouped together on the fuel control panel in the cabin. The tank units, which are assembled by the tank manufacturers, consist of small condensers on flexible straps. These are fitted into pockets in the tanks and are secured by press fasteners. The condensers operate the gauges through amplifier units. The 100 gallon drop tanks are not gauged, the 230 gallon drop tanks have a contents indicator visible through a window in the nose shell of the tank.

Fuel pump test switches

20. A selector switch and an ammeter socket are provided in the cabin for testing the fuel pumps. The fuel pump circuit breakers must be tripped before the pumps are tested.

Engine-driven pump

21. The high-pressure engine-driven fuel pump is of the dual multi-plunger type consisting of two pumps in the same casing interconnected by spur gears which drive a third shaft carrying a hydro-mechanical governor rotor. The pump delivery is controlled by servo pistons which alter the stroke of the pump plungers. For further information on the engine-driven pump and the engine fuel system generally, reference should be made to the engine handbook.

Suction and pressure relief valves (*fig. 4*)

22. The suction and pressure relief valve, fitted in each fuselage tank consists of a body containing an adjustable spring-loaded relief valve, a cap ring and a cap ring sealing cap. The valves in the front tank units are set to lift at 10¾ to 11¼ lb/in² and those in the rear tanks at 8¼ lb/in². The pressure relief valve in each unit incorporates a small suction relief valve set to open at ½ lb/in². The action of the small valve is opposite to that of the main valve in that it admits air into the tank should the pressurization system fail, preventing negative pressure and possible collapse of the tank. The valve units in the rear tanks incorporate an adapter which contains a third valve. This valve is lightly loaded, being set to open at ½ lb/in². It serves as a non-return valve in the fuel tank pressurization system, being in connection with the reducing valve in the air system.

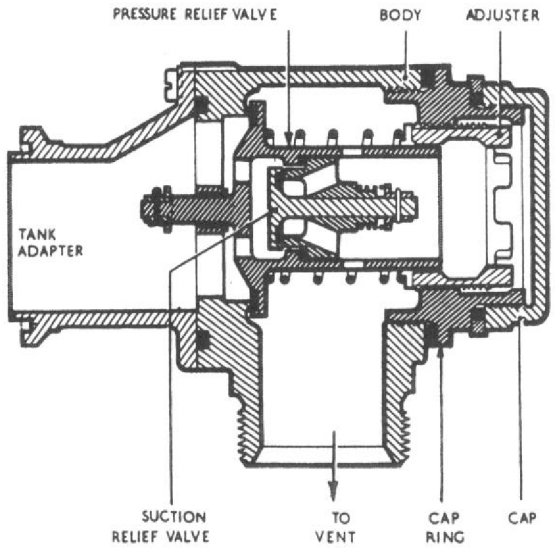


Fig. 4 Suction and pressure relief valve

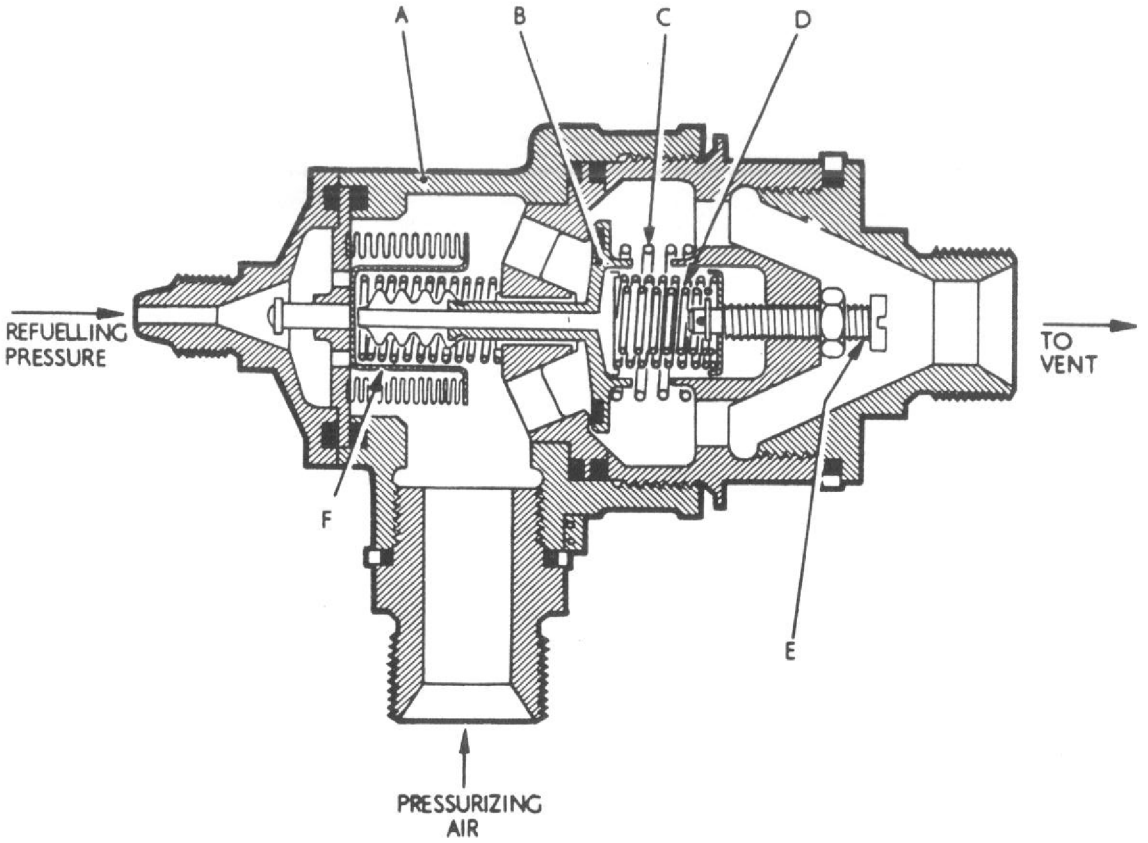


Fig. 5 Wing tank pressure relief valve

They are also in connection through the same piping system, with the external air charging connection located in the spine of the centre fuselage. Through this connection, air pressure is delivered to the rear and wing tanks to facilitate defuelling of the system *(para. 31)*.

Wing tanks pressure relief valves (fig. 5)

23. One of these valve units is incorporated in each wing tank circuit. Each unit consists of a body (A) which contains a spring-loaded rubber-faced poppet valve (B). Opening pressure of the valve is dependent

on the force exerted by the springs (C) and (D). The double spring (D) is loaded by the adjusting screw (E) to allow the valve to open at 7½ lb/in² for normal venting purposes. During refuelling the bellows assembly (F), actuated by the refuelling pressure, expands and off-loads the double spring (D). The small outer spring (C) then controls the opening pressure to 2 lb/in². A bleed pipe is provided from the refuelling system to the transfer pipe to allow the refuelling pressure to leak away after refuelling so that the relief valve recovers its 7½ lb/in² setting.

Wing tanks suction relief valve (fig. 5A)

24. The wing tanks are provided with a lightly loaded rubber-faced poppet valve, one of which is inserted in the piping system in the region of each outboard wing tank. Designed to open at ½ lb/in², they serve as inward vents to relieve the tanks should they be subjected to negative pressure and thus obviate possible collapse of the tanks.

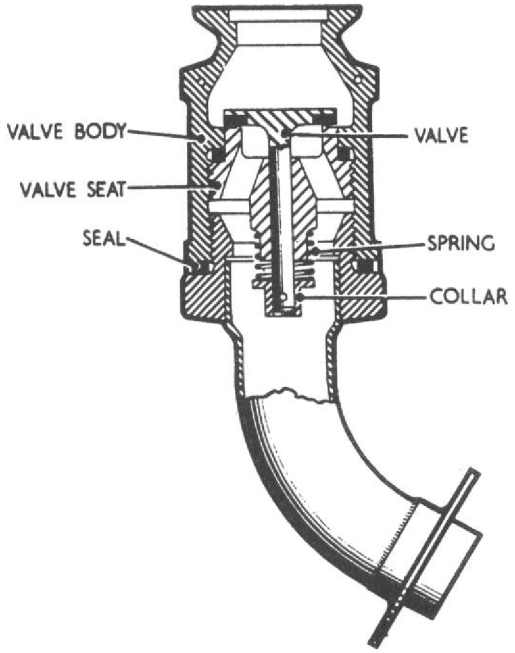


Fig. 5A Suction relief valve (wing tanks)

Refuelling pressure relief valve (fig. 6)

25. A refuelling pressure relief valve is fitted in the underside of each stub wing. These are spring-loaded rubber-faced poppet valves which safeguard the wing tanks in the event of a refuelling valve failure.

Fuel filter de-icing (fig. 7)

26. Aircraft fuel normally contains a small quantity of water dissolved from the atmosphere. As the fuel temperature falls, some of this water comes out of solution and forms ice crystals when the fuel temperature drops to approx.—10 deg. C or below. To eliminate a blockage of the system due to an accumulation of ice crystals on the engine fuel filter element, a fuel filter de-icing system is provided.

27. The fuel filter de-icing tank, which is mounted in the engine bay, is provided with a suction and pressure relief valve *(fig. 7)*. The valve is set to maintain a pressure of 6 to 6½ lb/in² in the tank and a suction of ½ lb/in², with an airflow through the valve of approximately 1 cu. ft/min. *(Refer to para. 34B for testing)*, the pressure setting preventing excessive alcohol loss due to boiling. The de-icing fluid is pumped into the fuel delivery pipe by a pump, the relief valve of which is set at 80 lb/in² to ensure an adequate flow of de-icing fluid against the fuel delivery pressure. The system is controlled by an automatic control valve. Icing is detected by an increase in the pressure drop through the filter, which operates a differential pressure switch. This switch, through a relay, starts the pump and opens the solenoid valve. When the ice is cleared and the fuel pressure returns to normal, the pressure switch opens. This stops the pump and closes the valve. A non-return valve is fitted in the pipe line from the pump to the fuel system. The metering jet, where alcohol enters the fuel line, has a 1/16 in. dia. orifice protected by a small filter.

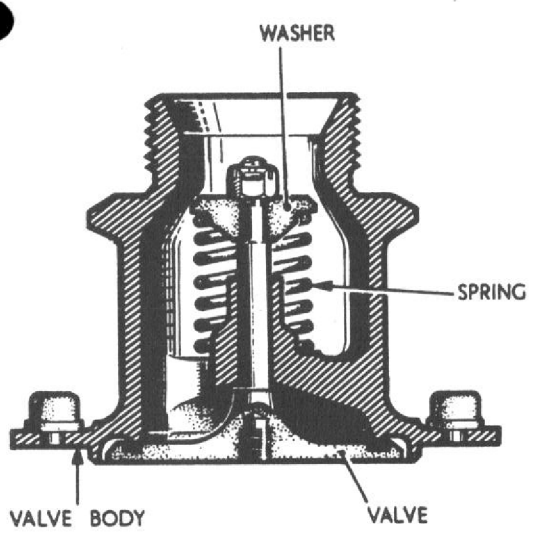


Fig. 6 Refuelling pressure relief valve

28. A fluid contents indicator *(fig. 7)* for the fuel filter de-icing tank is located on the gearbox filler access door landing in the bottom of the fuselage, just forward of the rear spar frame and adjacent to the tank filler couplings. The indicator is marked for FULL and USED indication only. A reset plunger incorporated in the unit, must be depressed to reset the indicator after the tank has been filled. The procedure for the replenishing of the tank is described in Sect. 2, Chap. 2.

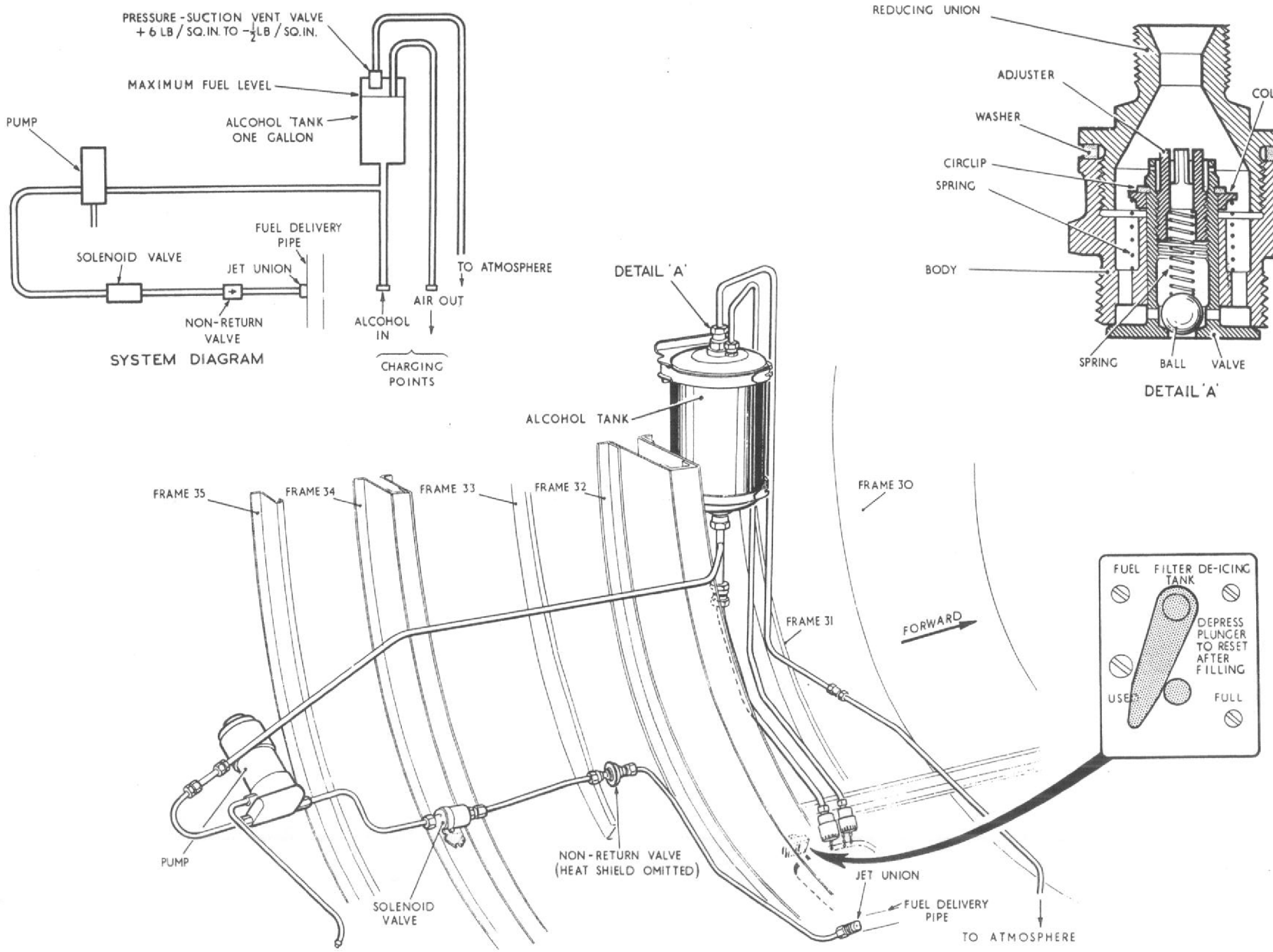


Fig. 7 Fuel filter de-icing system

Refuelling

29. The aircraft is refuelled by pressure through a standard coupling in the port wheel bay. *The L.P. fuel cock control in the cabin, and the defuelling cock, accessible through the engine starter access door aft of the main spar in the bottom of the fuselage, must be turned OFF before operations are commenced.* A time switch, adjacent to the coupling must be turned ON. This switch energizes the refuelling circuit *(Sect. 5, Chap. 1)*. The float switches in the front, rear, outboard wing tanks and drop tanks [providing drop tank refuelling selection has been made *(Sect. 2, Chap. 2)*] remain ON until the switches are immersed. The refuelling valves, fitted in the pipe lines to the tanks, are essentially servo-controlled poppet valves, the servos being operated by the refuelling pressure. A solenoid, when energized, opens the servo exhaust and allows the valve to open. During refuelling, the fuselage tanks are filled directly from their respective valves. When the tanks are full, the float switches are immersed and go to OFF; this releases the solenoid in the valve. The inboard wing tanks are filled direct from their refuelling valves. When full, they overflow into the second wing tanks, thence to the third and finally to the outboard wing tanks, and drop tanks if fitted. When the outboard tanks are filled, *(or drop tanks, when fitted and selected)*, the float switches operate to close the refuelling valves.

30. During refuelling, the front tanks are vented to atmosphere through the vapour release valve *(para. 9)*, and when these are immersed, through the tank relief valves *(para. 22)* which are set to release at 11 lb/in², this setting prevents the transfer pressure plus the head of fuel, forcing fuel out of the vents in a steep dive. The rear tanks are vented through the tank relief valves set to release at 8¼ lb/in². The tank pressure relief valves incorporate suction relief valves which are set to open at a pressure below ½ lb/in². These valves operate in an opposite or inward direction and allow air to enter the tanks should the pressure fail, thus avoiding a negative pressure and consequent collapse of the tanks. The wing tanks are vented through a relief valve *(para. 23)* which normally opens at 7½ lb/in². During refuelling, however, fuel pressure is applied to a bellows incorporated in the valve casing which off-loads the valve and reduces the opening pressure to 2 lb/in². This keeps the refuelling pressure in the system at an acceptable value. A refuelling relief valve set at 11–13 lb/in², is fitted to the underside of each wing to safeguard the tanks in the event of a refuelling valve failure. This condition is catered for in the fuselage tanks by large vent pipes. Non-return valves are fitted in the transfer pipes to prevent back flow from the front to the rear and wing tanks during refuelling. The procedure for refuelling the system is described in Sect. 2, Chap. 2.

Defuelling

31. Defuelling is effected from the refuelling coupling in the port wheel bay. *The defuelling cock, accessible through the engine starter access floor, aft of the main spar in the bottom of the fuselage, must be turned ON and the selector cock switches in the cabin put to AUTO during defuelling. The L.P. cock must be turned OFF.* An air pressure of 10 lb/in² is necessary to transfer the fuel from the wing and drop tanks and the rear tanks to the front tanks from where it is sucked overboard by bowser pump or pumped out by the aircraft booster pumps. Air is fed through the external air supply connection mounted in the spine of the centre fuselage, the air passing through the reducing valves into the wing (or drop tanks) and rear tanks in the same manner as for normal pressurization. The procedure for defuelling is detailed in Sect. 2, Chap. 2, para. 4.

Note . . .

To completely drain the system, especially the recuperators, pressurizing air must be maintained at 10 lb/in² during defuelling.

SERVICING

General

32. Scrupulous cleanliness is essential during all servicing of the fuel system. The fuel pumps and their accessories are manufactured to a high degree of accuracy and in order to ensure maximum pumping efficiency, tolerances are reduced to a minimum. Consequently, the efficiency of the components will be seriously impaired if foreign matter, however small, is allowed to enter the system. When components are removed for servicing, all orifices exposed as a result of such removal, as well as the pipe ends which connect to them, must be blanked off immediately to prevent the ingress of dirt or moisture. The servicing of certain components of the fuel system is described in the Air Publications appropriate to the component concerned, to which reference should be made when it is found that the servicing of a particular component is not included in this chapter. The procedure for filling, priming and draining the system is described in Sect. 2, Chap. 2.

Note . . .

On Aircraft Pre-mod. 1325, wherever it is necessary to pressurize the fuel system using an external air supply connected to the ground pressurization connection, the integrity of the non-return valve fitted in the pipe line between the air filter and the engine must first be established as follows:—

Disconnect the flexible air pressurizing hose at the engine end, connect and start the external air supply and blow air through the disconnected hose; if the non-return valve has failed, detached parts of the valve will be discharged from the open end of the hose. Where no defects are found, shut off external air supply, reconnect flexible hose and proceed with normal pressurization. Change non-return valve if found defective.

Water drains

33. Drain valves are provided in the lowest points of the fuel system from which water can be drawn off during servicing. The procedure for doing so is given in Sect. 2, Chap. 2.

Replacement of fuel pipe lines

34. Before replacing fuel pipe lines that have been removed during servicing, or fitting new pipe lines, ensure that they are clean and smooth internally, as sharp edges at joints, nipples, etc., can cause aeration of the fuel. Ensure also that, when replaced, the arrows on the pipes and non-return valves point in the direction of flow. When re-fitting the pipes, ensure that the Flight Refuelling pipe connectors *(fig. 8)* are assembled correctly. The procedure for the assembly of these connectors, which must be strictly adhered to, is as follows:—

(1) Ensure that the two pipes *(fig. 8, item 4)*, to be connected, are in alignment.

(2) Fit the inner sleeve *(1)* over the one pipe end, and the outer sleeve *(2)* over the opposing pipe end.

(3) Fit the split collars *(3)* over the pipes, beyond the beading as shown, by removing the circlip *(5)* and replacing when the collars are in position.

(4) After first ensuring that there is a gap of 0.135 in. max. to 0.060 in. min. between the pipe ends, fit the rubber sleeve *(6)* over the ends of each pipe, at the same time ensuring that the gap between the pipes is maintained: this is very important.

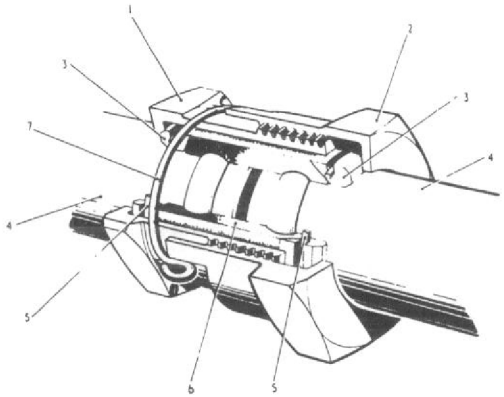


Fig. 8 Pipe connector (Flight Refuelling)

(5) Screw the outer sleeve on to the inner sleeve after first smearing the threads with anti-seize compound ZX-28.

(6) Tighten the coupling by hand, then finally tighten with spanners a $\frac{1}{4}$ to $\frac{1}{2}$ turn beyond hand-tightening.

(7) Fit locking circlip *(7)* by inserting the plain end into one of the three $\frac{1}{16}$ in. holes in the hexagon of the inner sleeve so that the formed end of the circlip is between two of the castellations.

After ensuring that all pipe connections are tight and effectively locked, the piping of the circuit affected by such replacement should be pressure tested as follows:—

Engine feed lines—28 lb/in². This can be satisfactorily approximated by pressurizing the tanks to operating pressure (6 lb/in²) and switching on the tank booster pumps.

Refuelling lines (L.P. cock OFF)—50 lb/in². This can be carried out with the use of the refuelling bowser.

CAUTION. . .
If the 50lb/in² test pressure is exceeded, fuel will be discharged through the refuelling relief valves and vent pipe.

Transfer pipes—14 lb/in² *(including head of fuel)*. The tank pressure test described in para. 37 will cover this requirement.

Air supply line (engine to tanks)—Apply an air pressure of 120 lb/in² to the spine air connection, using a Pneumatic Servicing Trolley and an adapter Part No. A.208035, check for leaks. The tank pressure gauges should be observed and should not register more than 6 lb/in².

Note . . .

During the foregoing tests it is essential to ensure that all tank vent lines are clear to guard against damage to the tanks in the event of a leaking reducing valve.

For a general test of the system including the tanks, refer to para. 37.

Vapour release valves—inspection

34A. At periods determined by the Aircraft Servicing Schedule the vapour release valves must be removed from the fuel system *(para. 48)* and examined for:-

(1) Sticky deposit, scoring or other marks, on the poppet valve stem. If found, the valve assembly is to be rejected.

(2) Any burr on the float arm fork which bears on the poppet valve stem. If found, carefully remove the burr and check for subsequent free movement of the valve.

(3) Complete freedom of the float arm and negative 'g' arm pivots. Relieve any stiction by cleaning the affected parts.

Before refitment to the aircraft, depress the poppet valve by finger pressure and check that the valve returns without restriction. Where the valve is sluggish to return the assembly must be rejected.

Note . . .

On no account should the vapour release valve be dismantled and the spring setting disturbed.

Testing of pressure and suction relief valve—fuel filter de-icing tank (fig. 7)

34B. The ball (pressure) valve of the combined pressure and suction relief valve must be adjusted so that a pressure of 6 to 6½ lb/in² is maintained at the valve end, with an airflow of approximately 1 cu. ft/min. passing through the valve at the opposite (reducing union) end. In addition, with the body of the valve connected to a tank of approximately 13 gallon capacity, pressure in the tank must not fall from 3 to 2¾ lb/in² in less than one minute. With the valve end open to atmosphere and an airflow of approximately 1 cu. ft/min. applied at the reducing union end and passing through the valve, the suction valve should ensure that the air pressure does not rise above ½ lb/in². With a suitable blank screwed on to the body, enclosing the valves, there should be no external leakage when an air pressure of 15 lb/in² is applied at the reducing union end.

Refuelling pressure relief valves

35. The refuelling pressure relief valves in the underside of each stub wing should be checked to ensure that they are free to operate by screwing a $\frac{1}{4}$ in. B.S.F. bolt into the valve and pulling the valve down. *This is particularly important if the aircraft has not been flown for an appreciable length of time.*

Low-pressure fuel cock control

36. Adjustment of the low-pressure fuel cock control must be so arranged that with the control lever in the cabin set to the OFF position in its quadrant, the cock is fully closed.

Ground pressure testing the fuel system

37. The fuel system installation should be pressure tested as follows:—

(1) Remove vent pipe extension and fit bung *(Part No. A.207899)* into the front tanks vent pipe *(bottom skin of centre fuselage).*

(2) Fit blanking covers *(Part No. A.207818)* over the refuelling pressure relief valve in underside of each stub wing *(to fit, remove two screws through access door).*

(3) Fit adapters *(Part No. A.195020)* and pressure gauges *(service supply)* to tapping points on front tank relief valves *(access doors, top centre fuselage, either side of spine in region of main spar).*

(4) Remove spine fairing over rear transport joint and connect pressure gauges to pipes leading from rear tanks relief valves.

Fit bung *(Part No. A.207563)* into rear tanks vent pipe *(rear fuselage, port)*, connect bung to Fuel System Ground Pressure Test Control Box *(Part No. B.207700)*

Fit adapter *(Part No. A.211191)* to the ground pressure test connection in the spine of the centre fuselage and connect to the Fuel System Ground Pressure Test Control Box *(Part No. B.207700)* and thence to the external supply trolley.

(7) Apply an air pressure of 13 to $13\frac{1}{2}$ lb/in² *with all tanks full.* This pressure should be maintained for 10 minutes without any sign of leakage at any point in the system.

Note . . .

It is very important that the test is carried out with all tanks full. Under no circumstances is the test pressure to be allowed to exceed 14 lb/in².

(8) When the test has been satisfactorily completed, all bungs, blanking covers and other test equipment must be removed immediately and the vent pipe extension refitted.

Note . . .

The setting of the Control Box, Pt. No. B.207700, may change after periods without use and as it is essential that the outlet pressure is within the limits of $13\frac{1}{2} \pm \frac{1}{2}$ lb/in², it is recommended that the following checks be carried out to the Control Box at regular nine-monthly intervals:—

(1) Connect a pressure gauge registering 0–30 lb/in² to the outlet cock and apply an air pressure of approx. 100 lb/in² to the inlet connection. Check that the pressure indicated on the gauge is $13\frac{1}{2} \pm \frac{1}{2}$ lb/in². If the pressure is outside these limits proceed with operations as detailed in sub-para. (2) to (4).

(2) Remove the cover of the Control Box and with an air pressure of approx. 100 lb/in² applied to the inlet connection, screw in the adjusting screw of the centre reducing valve until the pressure relief valve (the valve nearest the outlet cock) opens and can be adjusted to 'blow off' at $15 \pm \frac{1}{4}$ lb/in².

(3) With the pressure relief valve adjusted to release pressure at $15 \pm \frac{1}{4}$ lb/in² screw out the adjusting screw of the centre reducing valve until the gauge registers $13\frac{1}{2} \pm \frac{1}{2}$ lb/in².

(4) Re-lock the adjusting screws, replace the cover of the Control Box and seal the screw heads with a suitable material.

Between these periodic checks the Control Box may be considered serviceable, provided that, when in use, the pressure measured at the tapping in the wheel bay is between 11–$13\frac{1}{2}$ lb/in².

Ground pressure testing the fuel filter de-icing system

38. A test switch to operate the system on the ground is located adjacent to the solenoid valve in the engine bay. This switch is used in conjunction with special ancillary test equipment which consists of a pressure gauge, relief valve and associated piping. The procedure for ground pressure testing the system is as follows:—

(1) The alcohol tank must be full, the fuel system primed, the L.P. cock OFF and the throttle closed *(i.e. H.P. cock OFF).*

(2) Remove the blanking cap from the drain valve on the fuel delivery pipe in the engine bay, and fit the pipe of the test equipment *(Part No. C.209813)* in its place. *(The fitting of the pipe opens the valve).*

(3) Place the relief valve of the test equipment into a suitable container.

(4) Connect an external air supply to the alcohol tank vent pipe and apply an air pressure of 10 lb/in². Inspect for leakage in low pressure system from tank to pump.

(5) If no leakage occurs in the low pressure system remove external air equipment from tank vent and carry out functioning test described in para. 39, sub-para. (2) and (3).

Functioning check, fuel filter de-icing system

39. The functioning check of the fuel filter de-icing system, using the same equipment as described in para. 38, is as follows:—

(1) Prepare the aircraft as described in para. 38, sub-para. (1), (2) and (3).

(2) Operate the test switch to start the pump and note the pressure on the test equipment pressure gauge, which should be 35 to 40 lb/in². Disconnect and remove the test equipment and replace the drain valve.

(3) Finally, the de-icing tank must be topped up and an engine run carried out immediately to clear the fuel pipe line of alcohol.

WARNING

The test switch must NOT be operated unless the test equipment with its relief valve is connected to the drain valve.

Pressure reducing valves—air pressurization

39A. The pressure reducing valves in the air pressurization system should be checked, at those periods stated in the Aircraft Servicing Schedule, as follows:–

(1) Fit a pressure gauge to the test connection on the air pressurizing pipe located in each wheel bay.

(2) Run the engine at 5 500 rev/min and note the pressure recorded on the gauges.

(3) Increase and decrease the engine revolutions between 7 000 rev/min and idling speed several times and check that the gauges record a pressure between 5½ and 6½ lb/in^2 at 5 500 rev/min and over.

Where pressures are outside the limits given in sub-para.(3) the affected valve(s) must be renewed.

Wing tank pressure relief valve—air pressurization

39B. With the fuel contents of the aircraft approximately 100 gallons below full capacity, irrespective of the fitment of drop tanks, the wing tank pressure relief valves in the air pressurization system should be checked at those periods stated in the Aircraft Servicing Schedule, as follows:–

(1) Locate the ¼ in. plug (*fig.1, item 16*) in the air pressurization pipe in each wheel bay. Remove the plug and fit:–

Banjo bolt (*Part No. A.G.S. 1135B*).
Banjo body (*Part No. A.G.S. 1130B*).
Bonded seals (*Part No. Dowty G.D. 1307B*).

(2) Make up suitable adapter pipes to attach a 0–10 lb/in^2 pressure gauge (*Ref.6A/3343*) *and* a pneumatic servicing trolley (*Ref. 4F/1805*) to the double-ended banjo.

(3) Pressurize the wing tanks separately.

Note . . .

The inlet into the fuel system should not exceed 10 lb/in^2.

(4) Check that the pressure at which the wing tank pressure relief valves vent to atmosphere is between 6¾ and 8 lb/in^2. When the pressure relief valves vent to atmosphere, air will flow out of the vent on the bottom of the fuselage just forward of frame 25.

(5) Disconnect the pneumatic servicing trolley and fit a blank in lieu to the banjo body.

(6) Refuel the aircraft at full pressure and during refuelling check that the port and starboard gauges read between 1 and 3 lb/in^2.

(7) If the pressures recorded do not comply with sub-para.(4) and (6) the wing tank pressure relief valve (*fig.1, item 8*) is unserviceable and must be replaced by a new or serviced valve.

Fuel and air valve for inboard pylon (*fig. 9*)

40. The fuel and air valve unit should be checked for leaks as follows:—

(1) Blank off port 'B', apply an air pressure of 5 lb/in^2 to port 'A' and immerse the unit in paraffin for 2 minutes. Increase the pressure to 20 lb/in^2 and immerse for a further 2 minutes. The unit must be leak proof.

(2) Remove the blanking plug from port 'B', raise the valve *(Part No. A.219054)* by 0·55 in. *(using tank adapter Part No. A.206906 with suitable blanking cap)* and apply a pressure of 3 lb/in^2 to the port 'A'. There should be no leakage at port 'B' when the unit is immersed in paraffin.

Note . . .

It is essential to ensure that the inside of the valve body and the working parts of the valve are entirely free of any foreign matter and that the valve assembly functions smoothly.

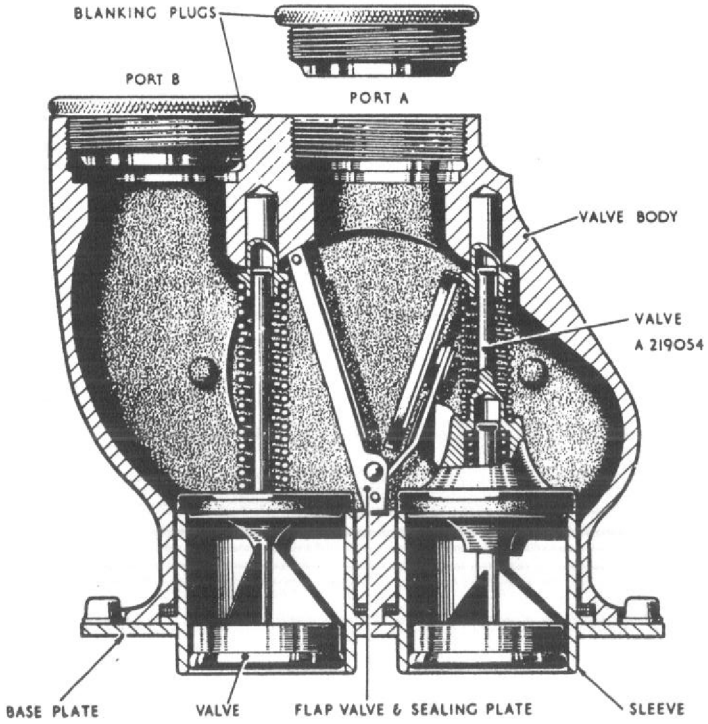


Fig. 9 Fuel and air valve for inboard pylon

Fuel and air valve for outboard pylon *(fig. 10)*

41. The fuel and air valve unit should be checked for leaks as follows:—

(1) Blank off port 'B', apply an air pressure of 5 lb/in² to port 'A' and immerse the unit in paraffin for 2 minutes. Increase the pressure to 20 lb/in² and immerse for a further 2 minutes. The unit must be leak proof.

(2) Remove the blanking plug from port 'B', raise the valve *(Part No. F.220353)* by 0·65 in. *(using tank adapter Part No. A.206906 with suitable blanking cap)* and apply a pressure of 3 lb/in² to the port 'A'. There should be no leakage at port 'B' when the unit is immersed in paraffin.

Note . . .

It is essential to ensure that the inside of the valve body and the working parts of the valve are entirely free of any foreign matter and that the valve assembly functions smoothly.

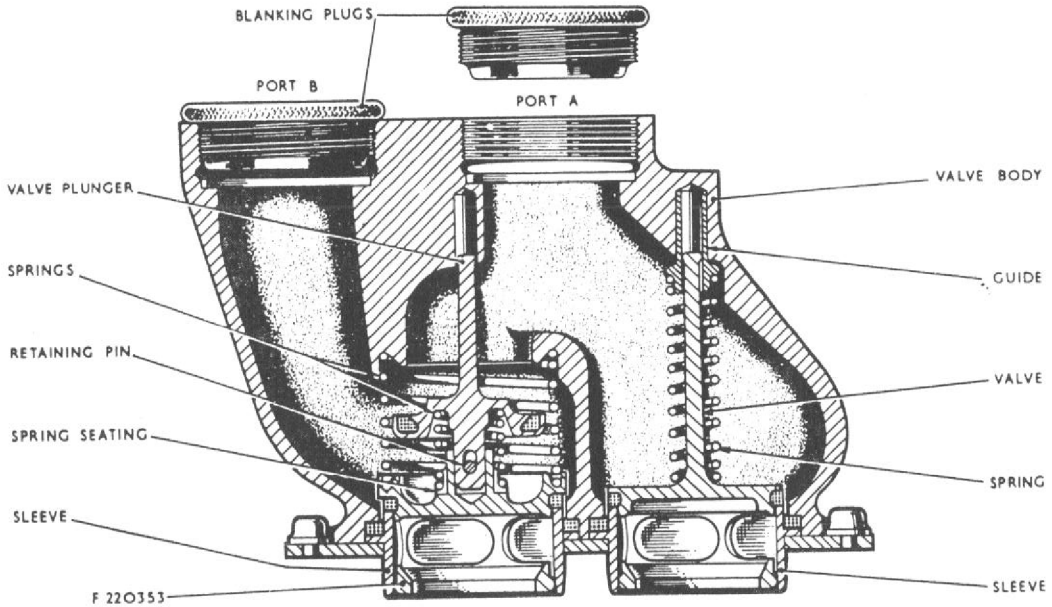


Fig. 10 Fuel and air valve for outboard pylon

REMOVAL AND ASSEMBLY

General

42. When handling the tanks, extreme care must be taken to ensure that they are not damaged. They should not be dragged across the floor. When taken out of the aircraft, they should be laid on felt, and during removal or installation they should not be folded any more than is absolutely necessary. The capacitors for the fuel gauges are built into the structure of the tanks and may be damaged if the tanks are subjected to rough handling. Implements or materials of any kind should not be inserted into the tanks to push them into the shape of the tank bays, to do so will damage the tanks and the capacitors. When assembly is complete, ensure that all pipes and non-return valves have been assembled correctly (*i.e., arrows on the components pointing in the direction of flow*). Where pipe connection sleeves incorporate an inspection hole, the sleeves must be screwed on to the threaded fitting until the thread covers or partially covers the inspection hole. When the fuel filter de-icing pump is removed, it must be inhibited with oil OX–275.

Fuselage flexible fuel tanks – post Mod.836

42A. Fuselage fuel tanks with Mod.836 incorporated were manufactured by Fireproof Tanks Ltd. and their part numbers include the suffix FT/H. A fuel resistant adhesive was used during manufacture and these tanks, when subjected to folding, are liable to incur lifting and wrinkling of the glass-cloth covering. This in no way affects the efficiency of the tanks as fuel containers nor the ability of the glass-cloth covering to protect the tank against heat soakage. Therefore in these respects the tanks are satisfactory for installation.

Manacle clamp connectors.

42B. Manacle clamps are used at several locations on fuel pipe or component connections, examples are shown in Sect.3, Chap.2, fig.6 (item 6) and in fig.24 (items 15 and 20) in this chapter.

42C. Whenever any manacle clamp is removed, the internal faces of the machined groove are to be closely examined for signs of fretting and corrosion attack. The clamp halves are to be subjected to a dye penetrant test for cracks along the centre line as shown in fig.10A. Where corrosion or cracks are found, the clamps are to be renewed.

42D. Before assembling manacle clamps, check that the pipe or component flanges are correctly aligned and parallel to each other. The sealing ring (fig.10B) should hold the flanges slightly apart, so that the clamping pressure compresses the ring, but the gap between the flanges is not to exceed 0.040in. If these conditions are not satisfactory, suspect incorrect assembly (such as rotational positioning of pipe or component) or distortion.

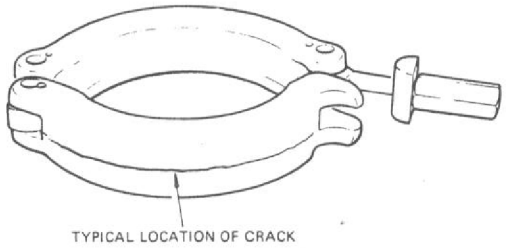


Fig.10A Manacle clamp failure

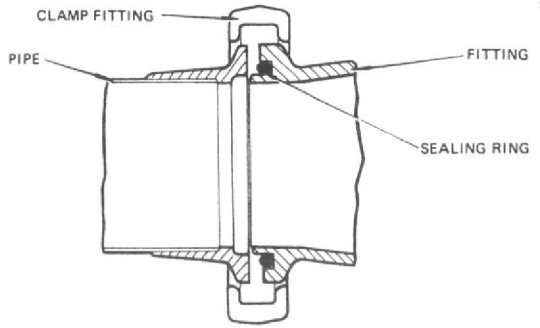


Fig.10B Clamped connection details

Removal of front fuel tanks *(fig.11)*

43. Either the port or starboard front tanks may be removed first. The removal of the port tank is described, the removal of the starboard tank is similar unless otherwise stated. The removal sequence is given in the following paragraphs. Notes on assembly are also included. Before attempting to remove either fuel tank, proceed as follows:–

(1) Render the aircraft electrically safe.

(2) Drain the fuel system.

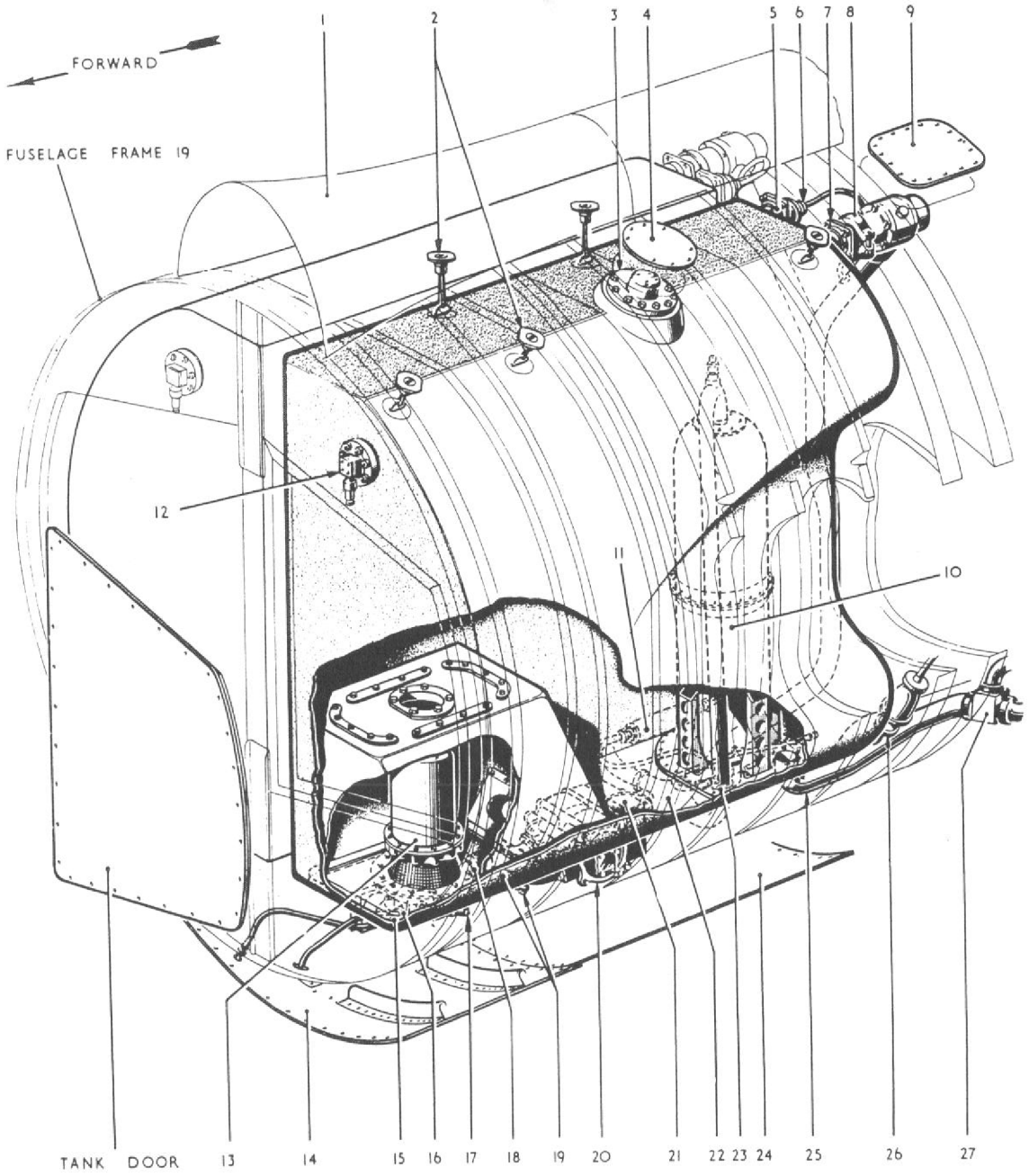
(3) Remove the gun package.

(4) Remove the wireless access door under the fuselage

(5) In the case of the port tank, remove the wireless sets and structure (*Sect.6, Chap.1 and 2*) and the cable clipping on the tank panel. Remove the tank panels on frame 19 after disconnecting the attached electrical fittings.

(6) Remove the fuel pump access panel (*14*), the fuel system access panel (*24*) and the engine starter access panel.

(7) Remove the fuel level switch access panel (*4*) and the fuel vent connection access panel (*9*).



◀ **Fig. 11 Removing front fuel tanks** ▶

Removing fuel contents gauge terminal box (*fig. 11*)

44. Remove the fuel contents gauge terminal box as follows :—

(1) Remove the nuts attaching the fuel gauge terminal box *(12)* to the fuselage *(frame 19)*.

(2) Withdraw the terminal box sufficiently to disconnect the electrical cables, then remove the terminal box, with the sealing ring, making sure that the detached cables do not fall back into the tank.

Removal of fuel level switch (fig. 11 and 12)

45. Remove the fuel level switch as follows : —

(1) Remove the terminal box cover.

(2) Disconnect the electrical leads.

(3) Remove all nuts securing the flange of the switch to the tank structure.

(4) *Before* removing the switch, screw all three knurled knobs clockwise to their *fullest extent*, moving each knob a small amount in turn.

(5) Carefully withdraw the switch, using the knurled knobs. As soon as the switch is withdrawn approx. 3 in., rotate the switch through 180 deg., ease the float through the tank aperture, moving the switch outwards and downwards to clear the lower float.

Sub-para. 4 and 5 apply to Flight Refuelling type switches only.

Note . . .

When re-assembling the switch, it is most important that the instructions given in para. 54 are complied with.

Removal of tank retaining cords (*fig. 11*)

46. Remove the tank retaining cords as follows:—

(1) Remove the section of the fuselage spine *(1)* from frame 18 to frame 23.

(2) Remove the screws from the tank retaining nuts *(2)*.

(3) Working from front to rear, insert one hand between the fuel tank and the inner skin of the fuselage and, while compressing the tank with this hand, use the other to cut the retaining cords with a suitable blade.

(4) Pull out the severed cords and put back the screws.

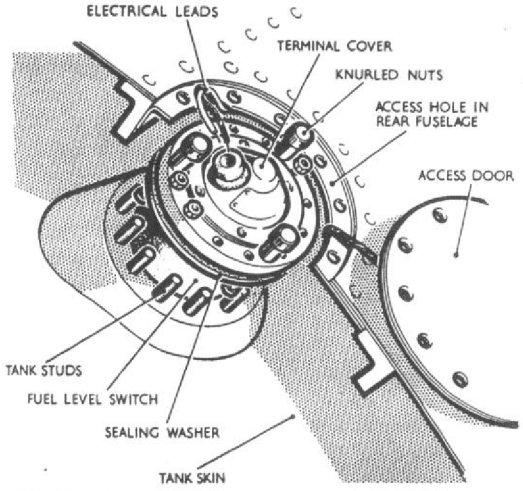


Fig. 12 Removal of fuel level switch—front tank

Disconnection of suction and pressure relief valve (*fig. 11*)

47. At the connection of the suction and pressure relief valve, disconnection should be effected as follows:—

(1) Unscrew the nut on the clamp eyebolt, swing the clamp *(8)* open and remove the clamp.

(2) Remove the circlip and the two halves of the collar.

(3) Unscrew the four bolts and remove the two halves of the locking plate *(7)* on the rear face of the main spar.

Removal of vapour release valve (*fig. 11*)

48. Remove the vapour release valve as follows:—

(1) Disconnect pipe at *(6)*.

(2) Unscrew the vapour release valve retaining nut.

(3) Withdraw the vapour release valve *(5)*.

(4) Unscrew four bolts and remove the two halves of the locking plate on the rear face of the main spar.

Removing blanking plate (*fig. 11*)

49. Remove the blanking plate *(21)* as follows :—

(1) Unscrew the nuts and remove the locking lug.

(2) Remove the blanking plate *(21)* and sealing ring. *(While on the same location remove the heating pipe from under the front port tank. Release the strapping on electrical cables under the tank and spread the cables apart or remove as necessary).*

Removing booster pump (*fig. 11*)

50. To remove the booster pump proceed as follows :—

(1) Disconnect the electrical lead *(17)* on the booster pump *(13)*.

(2) Disconnect the water sediment drain at *(15)* and the fuel drain at *(16)*.

(3) Disconnect the two pressure pipes at the pressure switch and at *(18)* on the pipes from the flow proportioner to the booster pump and remove *(port only)*.

(4) Disconnect the fuel delivery pipe *(18)* on the pump.

(5) Remove the nuts attaching the booster pump to the support plate and tank and remove the pump *(13)*.

Removing the inverted flight recuperators (fig. 11)

51. To remove the inverted flight recuperator proceed as follows:—

(1) Remove the six screws attaching the transfer pipe *(25)* to the cover plate and disconnect the branch pipes at the refuelling valve *(26)*. Disconnect the pressure balance pipe *(port only)*. Disconnect the transfer pipe at the tank selector valve *(27)* and remove the transfer pipe with sealing ring.

(2) In the case of the port tank, proceed as follows:—

Remove the clamp attaching the four-way branch pipe *(22)* to the flow proportioner *(20)*. Remove the clamp attaching the four-way branch pipe to the recuperator charging pipe. Unscrew the connection of the four-way branch pipe to the recuperator cover plate *(23)*. Unscrew the connection of the four-way branch pipe to the fuel delivery pipe and remove the four-way branch pipe with sealing washers.

(3) In the case of the starboard tank, observe the following:—

The four-way branch pipe does not have to be removed, but the recuperator charging pipe must be disconnected at the four-way branch pipe and at the recuperator cover plate and then removed.

(4) When removing either tank, remove the water sediment drain pipe, the pressurizing pipe and the vent pipe attached to the recuperator.

(5) In the case of starboard tank removal, remove the pressurizing pipe and pressurizing branch pipe from the pressure reducing valve *(11)*, remove the nuts and packing from the U bolts attaching the pressure reducing valve to the fuselage structure and remove the pressure reducing valve.

(6) When removing either tank, take off the 32 nuts and remove the inverted flight recuperator cover plate and sealing ring and then remove the recuperator *(10)*.

The tank, which is now ready for removal, should be carefully folded and withdrawn through the tank door in frame 19, ensuring that the sealing washers are left on the studs attached to the tank at the fuel contents gauge terminal box *(12)*, at the fuel level switch *(3)*, at the booster pump *(13)* and at the recuperator cover plate *(23)*. Pipe lines must be blanked off immediately after removal to prevent the ingress of dirt or moisture. Should there be any fuel on the outside of the tank it must be wiped off. Blanking plates and caps must be fitted over all apertures.

Assembly of front tanks (fig. 13 and 14)

52. The procedure for the assembly of the front fuel tanks is a reversal of the removal procedure, but the following points should be observed:—

(1) Ensure that the tank bay is clean and free from all foreign matter, nuts, washers etc.

(2) For ease of installation the inside of the tank bay and the outer surface of the tank should be dusted with french chalk.

(3) All internal fittings, pumps, contents gauges etc., should be examined for damage and corrosion.

(4) The Flight Refuelling connectors (fig. 8) must be assembled to the pipes as described in para. 34.

(5) All sealing rings and sealing washers should be renewed.

(6) The suction and pressure relief valve connection and the vapour release valve connection must each be fitted with the guide *(Part No. A.194464)*.

(7) When fitting the vapour release valve connection to the tank, ensure that the locating lug on the connection is at the top. This will obviate the possibility of the vapour release valve being fitted incorrectly. If this valve is fitted upside down, expansion of air or fuel vapour inside the tanks may prevent fuel transfer allowing the front tanks to drain while fuel remains in the other tanks. It is possible to fit the vapour release valve connection in any one of six positions, but the correct position is with the locating lug at the top when the tank is in position.

◀(7A) After fitting check, through the float switch aperture, that the vapour release valve float is free of obstruction, i.e. is not fouling the tank wall or the fuel gauging unit captive nut.

(8) Ensure that the suction and pressure relief valve connection and the vapour release valve connection are correctly inserted in the retaining holes in the main spar and that the grooves are engaged correctly with the locking plates on the aft face of the main spar. Unless these precautions are taken it is possible for the connections to be fractured.

(9) Before tightening the slip knots, ensure that the tank is correctly positioned by filling with fuel and pressurizing to 6 lbf/in^2. ▶

Assembly

53. Proceed with the assembly of the tank as follows:—

(1) Remove the screws from the five tank retaining nuts.

(2) Obtain about 40 yards of 8 oz. kite cord *(Ref. 32A/107)*, cutting the cord into five lengths of about 8 yards each.

(3) Thread the cut lengths of kite cord through the nuts into the tank bay and out through the tank door in frame 19.

(4) Pass the cords through the 'D' rings on top of the tank *(fig. 13 and fig. 14)*, form each cord into a loop about 12 in. long and securely whip the end.

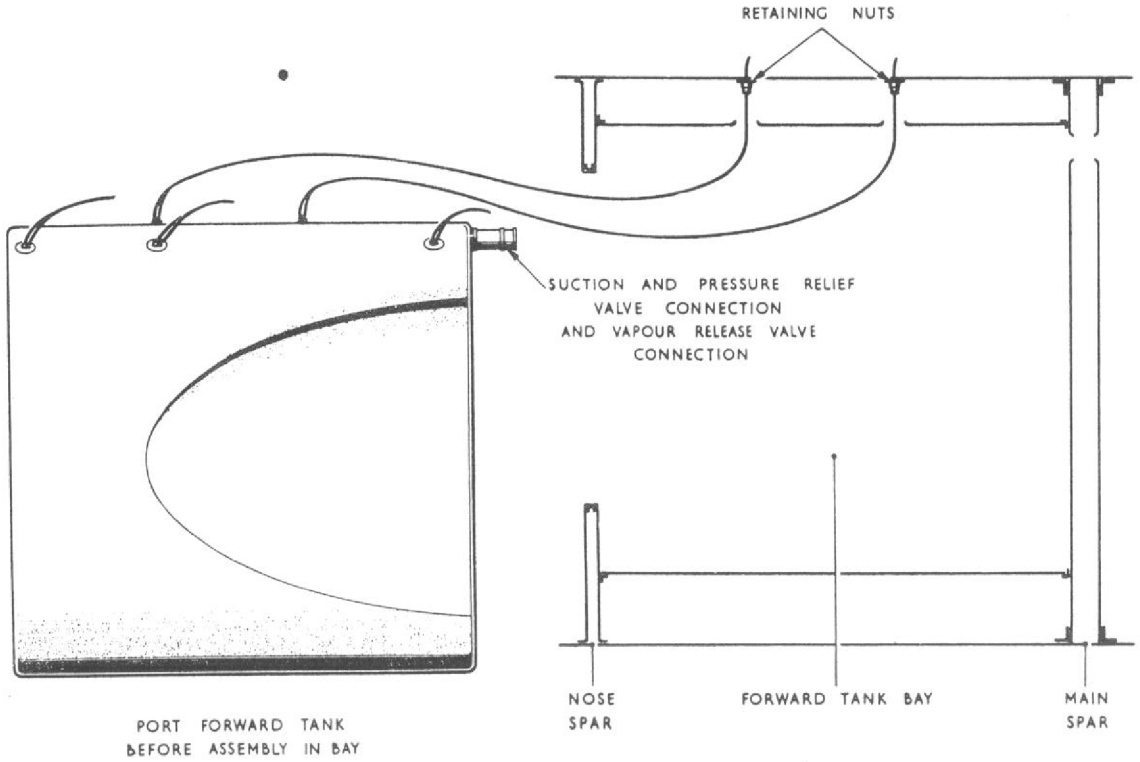


Fig. 13 Method of installing front tanks

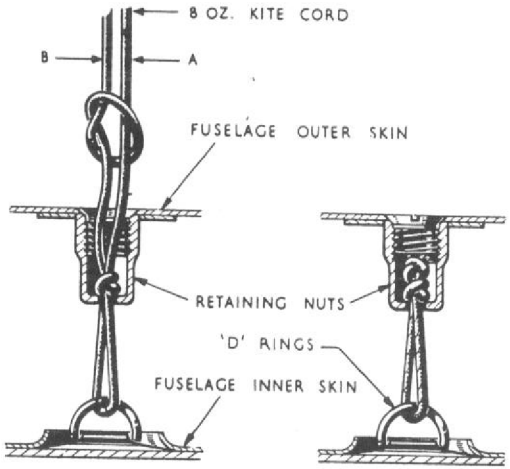


Fig. 14 Securing tank cords

(5) Carefully fold the tank and push it into the tank bay. Pull all cords until the tank is held against the tank bay skin by the cords and the loops appear through the tank retaining nuts.

(6) Cut the cords below the whipping and tie one cord A round the other B in a slip knot *(fig. 14)* and pull the knot down into the retaining nut. Tie another slip knot, cord B round cord A this time, and work down into the retaining nut as far as possible. Cut both ends of the cord at outer skin level.

(7) Replace the screws in the retaining nuts and lock by peening the skin into the slot.

Assembly of fuel level switch (fig. 12)

54. Before fitting a replacement switch *(Part No. D.215808)*, remove the outer casing, remove any packing material from the float chambers, wash out with kerosine, refit the outer casing, ensuring that the screws are tight. Proceed with the assembly of the fuel level switch as follows:—

(1) After ascertaining that all knurled knobs are screwed fully in, insert the complete switch into the tank with the lower float downwards.

(2) As soon as the float has entered the tank aperture, rotate the switch through 180 deg.

(3) Carefully insert the switch body into the tank aperture and engage with the tank studs.

(4) With the switch in position on the studs, turn all knurled knobs in an anti-clockwise direction to their *full extent* and press the switch flange into position.

(5) Refit nuts and secure.

(6) Re-connect the electrical leads.

(7) Replace terminal box cover.

Sub-para. (1), (2) and (4) are applicable to Flight Refuelling type switches only.

Removal of rear tanks (*fig. 15 to 22*)

55. Either the port or starboard tank may be removed first The removal of the port tank is described, and, except where stated otherwise, the removal of the starboard tank is similar. The sequence to be followed is given in the following paragraphs.

Preliminaries

56. Before attempting to remove either of the rear tanks, or components from the rear tanks, proceed as follows:—

(1) Render the aircraft electrically safe *(Sect. 5, Chap. 1)*.

(2) Drain the fuel system *(Sect. 2, Chap. 2)*.

(3) Remove the tail cone *(Sect. 3, Chap. 1)* and jet pipe *(Sect. 4, Chap. 1)*.

(4) Drain any residual fuel from the pipes between the front and rear tanks.

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

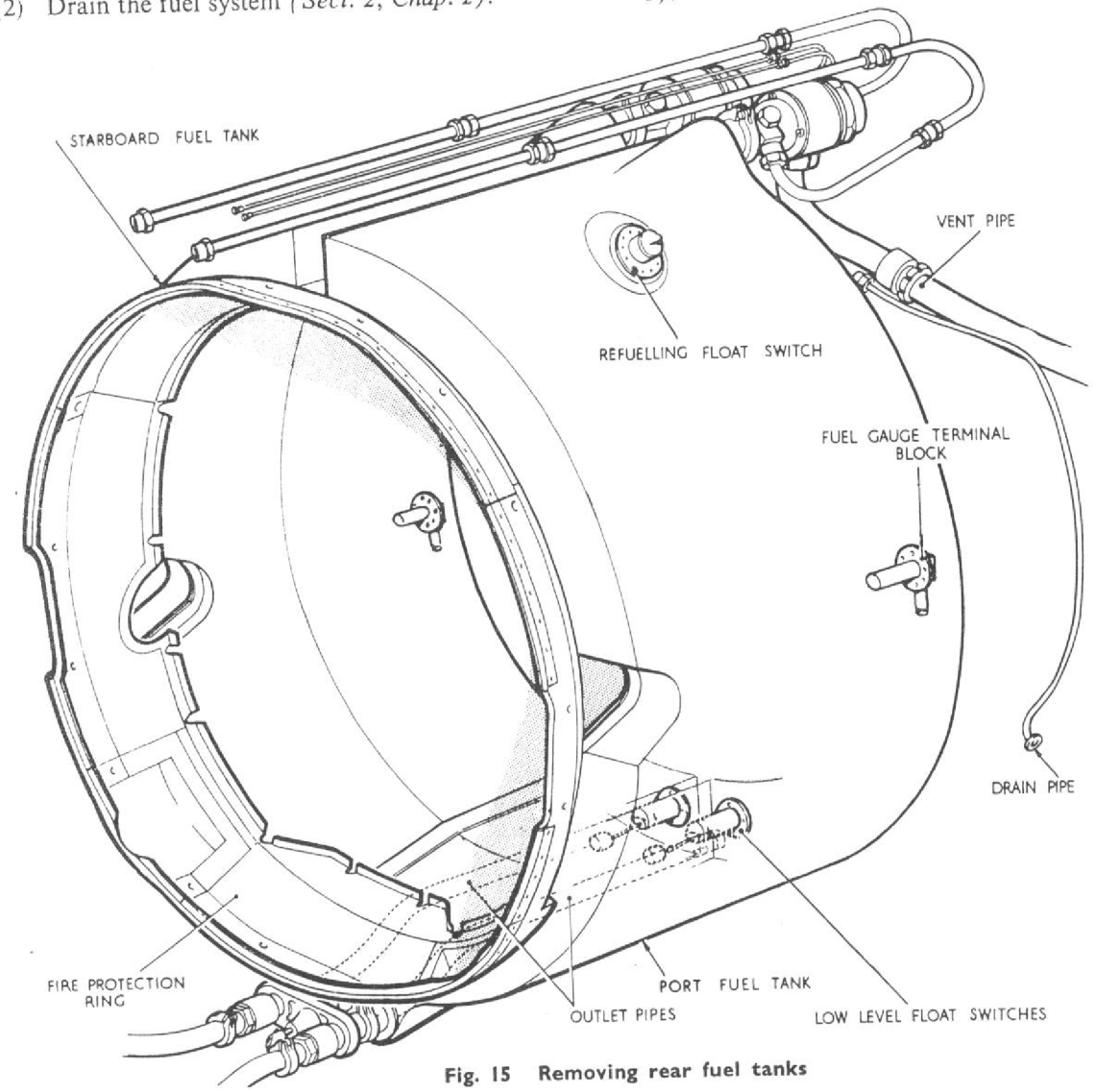


Fig. 15 Removing rear fuel tanks

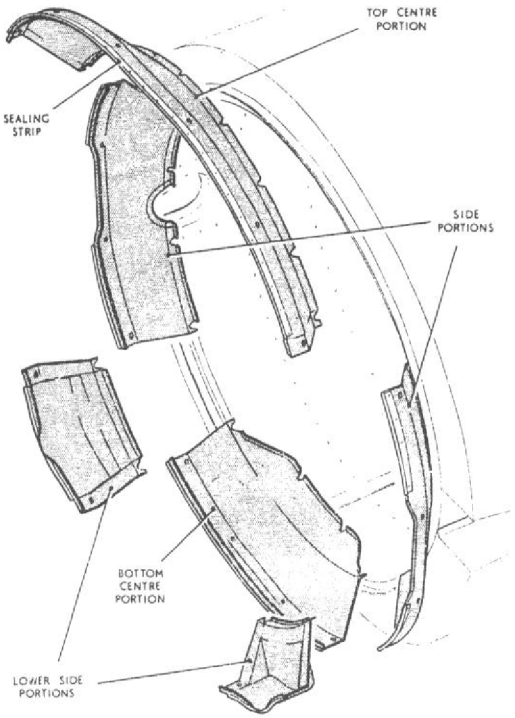


Fig. 16 Fire protection ring

Removing fire protection ring (*fig. 16*)

57. The fire protection ring should be removed in the following order:—Top centre, lower side *(port and starboard)*, side portions *(port and starboard)* and the bottom centre portion by slackening the bolts and washers securing the ring to the detachable support panel and removing the bolts and washers securing it to frame 40B.

Removing twin gate valve (fig. 15 and 17)

58. To remove the twin gate valve proceed as follows:—

(1) Unscrew and remove the screwed connections from the forward face of the twin gate valve.

(2) Remove the valve control handle.

(3) Disconnect and remove the clamp fittings from the tank connections and the rear face of the valve.

(4) Remove the twin gate valve. *(While at this location, remove the connectors and sealing washers from the tanks by unscrewing the nuts from the tank studs.)*

(5) Remove the fuel outlet pipe D.218734 port, or D.218735 starboard, from the tank.

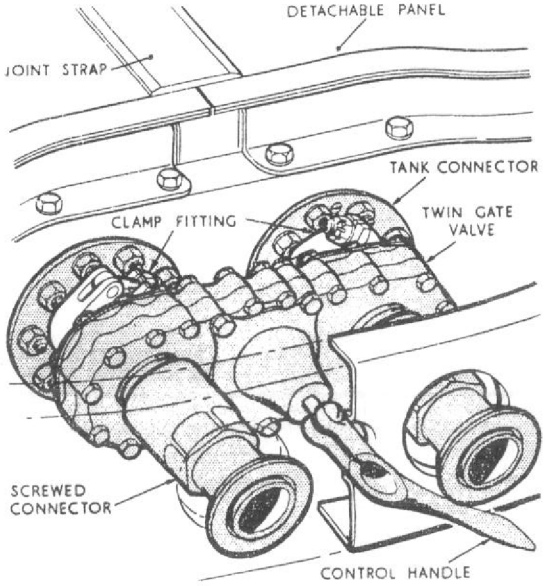


Fig. 17 Twin gate valve

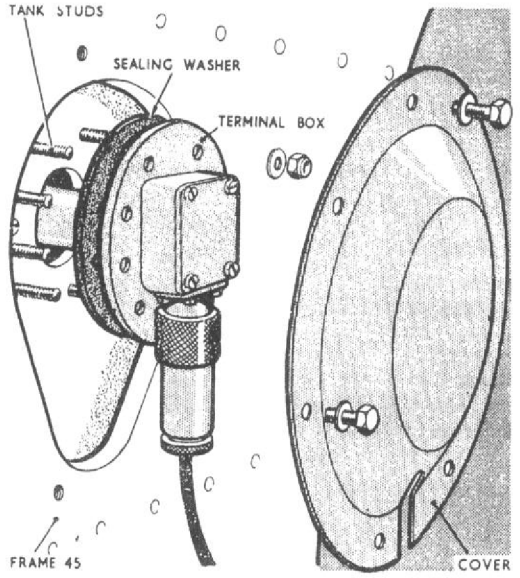


Fig. 18 Fuel gauge terminal block

Removing fuel gauge terminal box (fig. 15 and 18)

59. To remove the fuel gauge terminal box proceed as follows:—

(1) Remove the access door at the fuel gauge terminal box, adjacent to frame 45.

(2) Remove the cover from the terminal box by removing the bolts and washers.

(3) Disconnect the electrical lead at the terminal box.

(4) Unscrew the nuts, remove the washers, and withdraw the terminal box sufficiently to expose the electrical cable connections and disconnect the cables. Secure the cables so that they will not fall back into the tank.

(5) Remove the terminal box and sealing washer.

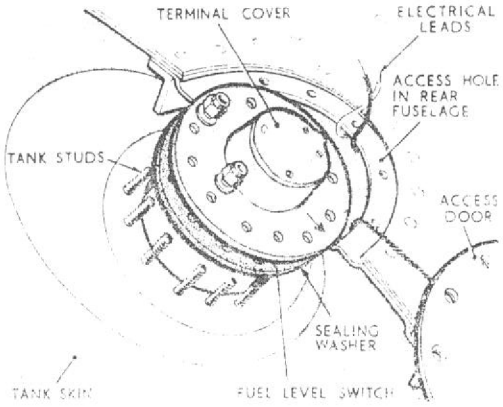


Fig. 19 Refuelling float switch

Removing refuelling float switch (fig. 15 and 19)

60. To remove the refuelling float switch proceed as follows:—

(1) Remove the access door over the refuelling float switch between frames 43 and 44.

(2) Remove the terminal cover from the switch and disconnect the two electrical cables. Replace the cover and stow the cables.

(3) Remove the nuts and washers securing the switch and remove the switch.

Removing low level float switches (fig. 15 and 20)

61. To remove the low level float switches proceed as follows:—

(1) Disconnect the electrical connection.

(2) Remove the two bolts from the retractable drain support bracket and move the bracket around out of the working area.

(3) Remove the cover plate and reinforcing plate.

(4) Remove the nuts securing the tank and switch to the structure and carefully withdraw the switch into the tank.

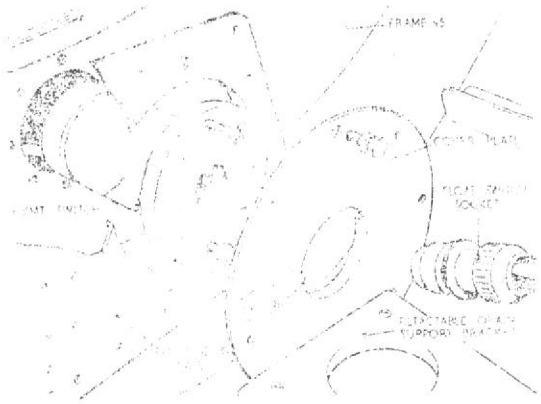


Fig. 20 Removal of low level float switches

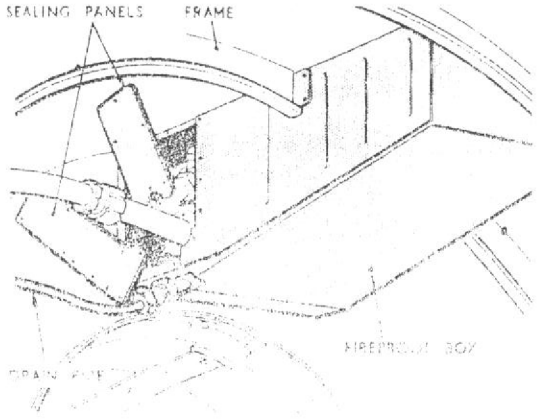


Fig. 21 Fireproof box

Removing the fireproof box (fig. 21)

62. To remove the fireproof box proceed as follows:—

(1) Disconnect and remove the drain pipe from the fireproof box.

(2) Remove the two sealing panels from the port side of the fireproof box by unscrewing the securing bolts.

(3) Unscrew the remaining bolts and remove the box.

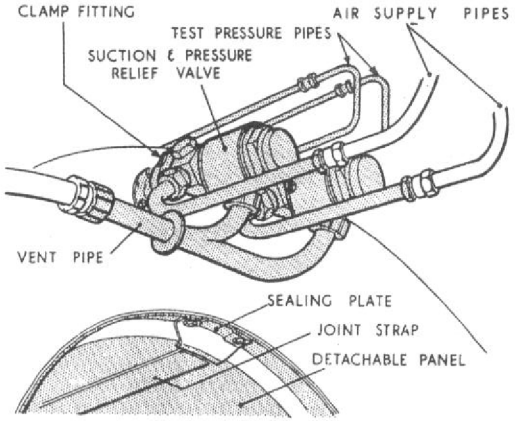


Fig. 22 Suction and pressure relief valve

Removing suction and pressure relief valve (fig. 15 and 22)

63. To remove the suction and pressure relief valve proceed as follows:—

(1) Remove the fireproof box *(para. 62)*, then disconnect and remove the short length of pipe from the suction and pressure relief valve to the union of the air supply pipes.

(2) Remove the branched vent pipe from the base of the suction and pressure relief valve.

(3) Disconnect the test pressure pipes from the suction and pressure relief valve.

(4) Release the clamp fitting securing the suction and pressure relief valve to the connector on the tank and remove the valve. *(While at this location, remove the connector and sealing washer by unscrewing the nuts and removing the washers from the tank studs.)*

Removing detachable panels and tank (fig. 15 and 23)

64. To remove the detachable panels and tank proceed as follows:—

(1) Remove the top and bottom joint straps by unscrewing the bolts from the interior of the fuselage.

(2) Remove the two sealing plates *(fig. 22)* at the top and bottom joints at the rear end of the detachable panels.

(3) Remove one of the tank supporting panels by removing the bolts from the rear and forward ends of the tank panel.

(4) Ease the tank out of its bay and remove it from the aircraft.

(5) Check that there are four sealing washers to each tank and that there are none left in the tank bay. As soon as possible, blank off all orifices in the tank to prevent the ingress of dirt or moisture. Preferably new washers, two to each orifice, should be fitted, on installing a tank but the washers removed during the removal may be used provided they are serviceable.

Assembly of rear tanks

65. The assembly of the rear tanks is a reversal of the removal procedure, but the following points should be noted:—

(1) Ensure that the tank bay is clean.

(2) Observe the precautions given in para. 42 before handling the tanks.

(3) Grease the outside of the tanks, the interior of the tank bay and the detachable panels with M.S.4 Silicone release agent before installing the tanks. *(Only the minimum quantity of grease is to be used and operators must not permit grease from the hands handling the tank to contaminate the sealing washers as this may constitute a fuel leak path.)*

(4) When replacing the fuel transfer pipe, it is important to ensure that it enters its retaining clip at the aft end by observation through the float switch aperture, later pipes have 'TOP' stamped on a label on the pipe and this label must be at the top when viewed through the float switch aperture. The bonding lug on the pipe flange must also be at top dead centre. Failure to observe these precautions will lead to float arm fouling the pipe.

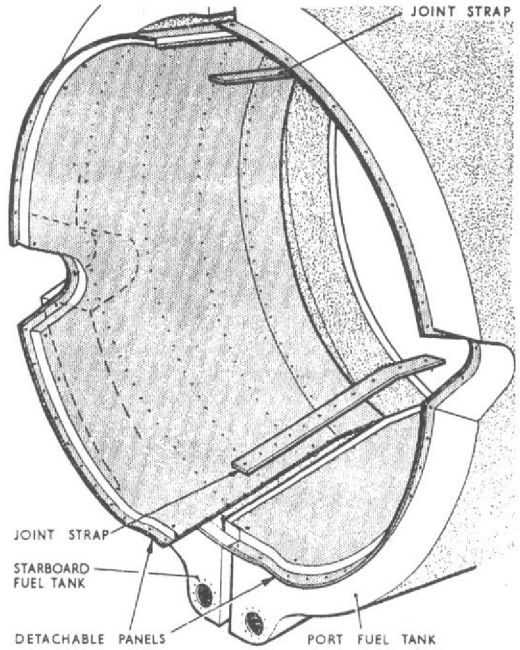


Fig. 23 Detachable panels

(5) It is important to ensure that the lower tank studs *(in the gate valve position)* and the upper tank studs *(in the suction and pressure relief valve position)* are located before the remaining tank studs, as otherwise scuffing of the tank may occur at the tank attachment mouldings.

(6) The twin gate valve *(at the transport joint)* must be wire-locked in the open position, i.e. the handle of the valve must be moved to as far to port as it will go.

(7) The Flight Refuelling connectors *(fig. 8)* must be assembled to the pipes as described in para. 34.

(8) Fit the fuel level switch as described in A.P.1275A, Vol. 1.

(9) All internal fittings, pipes, contents gauges, etc., should be examined for damage and corrosion.

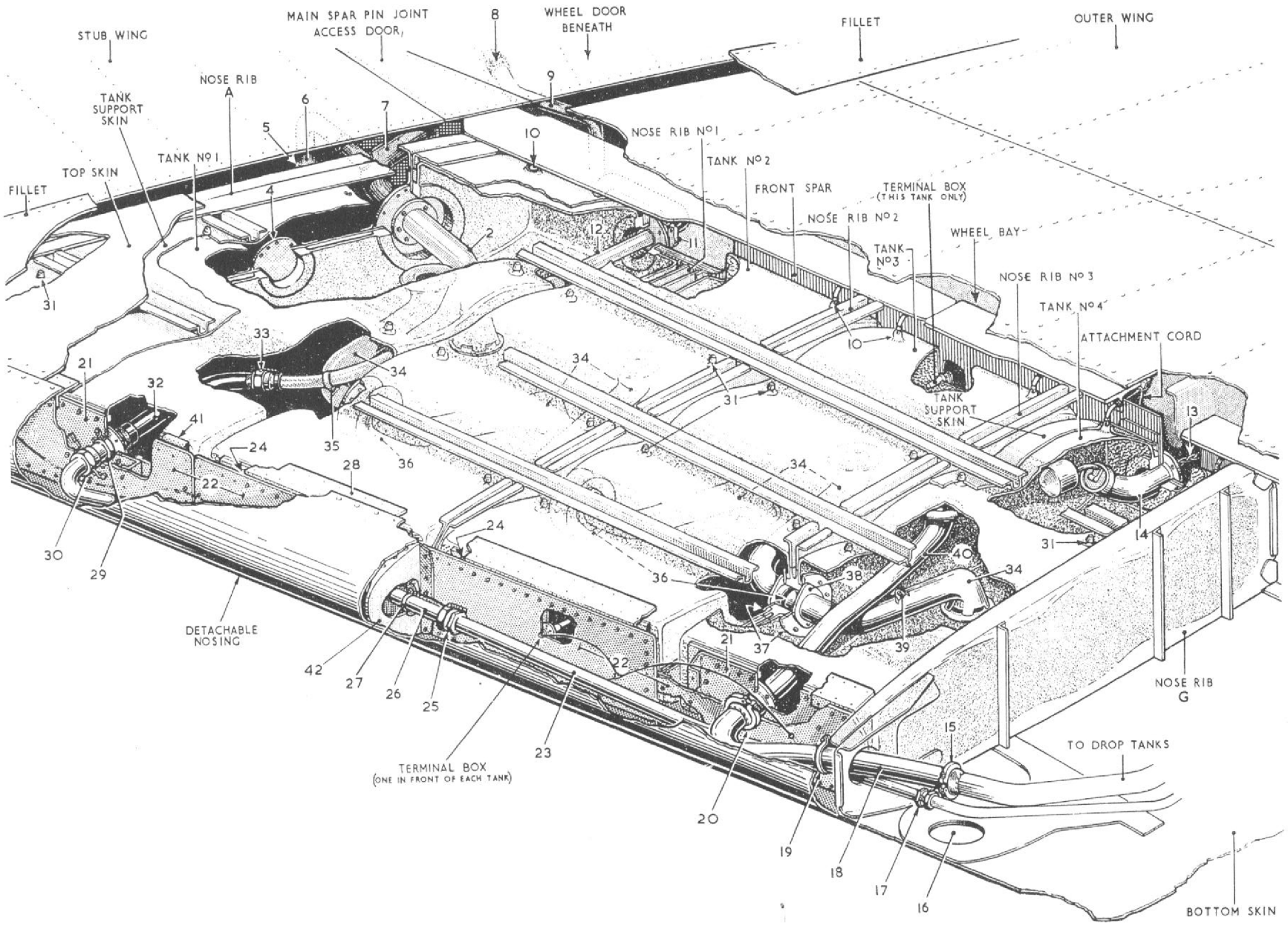


Fig. 24 Removal of wing fuel tanks

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Removal of wing fuel tanks *(fig. 24)*

General

66. The removal of the port wing tanks is described, the removal of the starboard wing tanks being similar. The removal should be carried out in the order given in the following paragraphs.

Preliminaries

67. Preparatory to the removal of the wing tanks, the following operations should be carried out:—

(1) Render the aircraft electrically safe *(Sect. 5, Chap. 1)*.

(2) Drain the fuel system *(Sect. 2, Chap. 2)*.

(3) Disconnect the refuelling pressure relief valve *(5)*, the pipe *(6)* and the branch pipe *(7)* in the stub wing as described in the wing removal *(Sect. 3, Chap. 2)*.

Removal of the outlet pipe assembly *(2)*

68. Remove the tank stud nuts and washers securing the outlet mounting plate to nose rib A, then withdraw the pipe assembly. Push the tank studs inwards to free the tank from the structure.

Removal of blanking plate (4)

69. Remove the nuts and washers and remove the blanking plate.

Removal of the nosing

70. Remove the screws securing the nosing to the leading edge spar *(28)* at nose rib A, nose rib G and in the upper surface at nose ribs 1, 2 and 3, and remove the nosing.

Removal from the leading edge of the transfer pipe *(18)* **and the air pressure pipes** (23) **and** (26)

71. Through the general access hole *(16)* remove the locking wire, slacken off the nut and open the clamp coupling *(15)*. Likewise open the clamp coupling *(20)* and also remove the clip *(19)*. Remove the locking wires from the unions *(17)* and *(25)* and disconnect the unions. Remove the air pressure-pipe *(23)*, then the transfer pipe. Dismantle the clip *(27)*, remove the locking wire from the union *(30)* and disconnect the union. Remove the air pressure pipe *(26)*. Disconnect and remove the co-axial cable from the terminal boxes.

Removal of the four leading edge spar webs (22)

72. Detach the four wing nosing ribs *(42)* by removing the bolts and washers securing them to the leading edge spar webs. Remove the bolts and washers securing the four mounting plates *(21)* and *(24)* to the four leading edge spar webs and the necessary bolts and washers round the web perimeters, then remove the webs from the structure.

Removal of the four mounting plates (21) **and** (24)

73. Remove the locking wires from the adapter *(29)*, unscrew and retain the bonded washer for re-assembly. Remove from No. 1 tank the bolts, washers, locking lug and seal securing the flexible air pressure pipe *(32)* flange. Remove the bolts securing the terminal box and ease the terminal box away from the mounting plate to enable the tank cables to be disconnected from the back of the terminal box, then remove the terminal box complete with seal. Remove the nuts and washers securing the tank and remove the mounting plate *(21)*. Retain the seals for re-assembly. For No. 2 and 3 tanks remove the terminal box and tank securing nuts as described above, remove the mounting plates *(24)* and retain the seals for re-assembly. Remove from No. 3 tank the terminal box at the rear of the tank. For No. 4 tank remove the nuts and washers securing the inlet transfer pipe *(40)* flange, remove the terminal box as described above, remove the tank securing nuts and mounting plate *(21)* and retain the seals for re-assembly.

Removal of the inlet pipe (40)

74. Through the access hole in tank No. 4 free the lug *(39)* and withdraw the inlet pipe.

Removal of the flexible air pressure pipe (32)

75. Through the access hole in tank No. 1 remove the locking wire from the union nut *(33)* and unscrew *(using 2 spanners to avoid wrenching the joint)* then remove the flexible pipe.

Removal of rigid air pressure pipe (12)

76. Through the access hole in tank No. 1 remove the stiff-nut, bolt and clip *(35)* to free the air pipe from the interconnection pipe *(34)*. Through the stub wing general access doors, immediately aft of the main spar pin joint, remove the locking wire and loosen the nipple *(8)* then remove the coupling *(11)*. With the outboard end of the pipe *(9)* turned upwards, remove the nuts and washers securing the pipe flange to the front spar web and withdraw the pipe. Push the tank studs inwards to free the tank from the structure.

Removal of the refuelling level switch (14)

77. Remove the electric cable plug *(13)* from its socket in the wheel bay. Remove the nuts and washers securing the flange to the front spar web and withdraw the switch. Push the tank studs inwards to free the tank from the structure.

Removal of the tank interconnection pipes (34)

78. The six tank interconnection pipes are similar but not interchangeable and care must be taken to ensure their return to the appropriate tank upon re-assembly. Reaching through any two adjoining tanks remove the two $\frac{1}{4}$ in. bolts and nuts and four sealing washers *(38)* then withdraw the pair of interconnection pipes and seals, one from each tank. Similarly withdraw the two remaining pairs of pipes and seals. To free the tanks from one another remove, at each interconnection *(36)*, the six remaining 2 B.A. nuts and twelve sealing washers and extract from each tank the clamp ring *(37)*. In readiness for removal, ease the tank walls inwards from the nose rib webs.

Tank button attachments *(31)*

79. Adjacent to the stringers, withdraw from the support skins the integral rubber tank buttons, lubricate with ZX-36 *(Ref. 34B/1459)* if necessary. The buttons are located as follows :—

Seven on the top and eight on the bottom surface of tank No. 1.

Six on the top and six on the bottom surface of tanks No. 2 and 3.

Four on the top and four on the bottom surface of tank No. 4.

Tank eyelet cord attachments *(10)*

80. Cut the sixteen attachment cords spaced along the rear face of the front spar, these being located adjacent to the four rear corners of each tank. The tanks may now be withdrawn forwards, with care, from the structure. In order to clear the packing pieces *(41)* at the two front corners it is necessary to concertina tank No. 1.

Assembly of wing fuel tanks

Preliminaries

81. Before commencing assembly, the following precautions should be taken:—

(1) Ensure that the aircraft has been rendered electrically safe *(Sect. 5, Chap. 1)*.

(2) Ensure that the precautions given in para. 42 have been observed.

(3) Ensure that the tank bays are free from foreign matter.

(4) All internal fittings, pipes, contents gauges, etc., should be examined for damage and corrosion.

Assembly

82. Select sixteen 5 yard lengths of kite cord *(Ref. No. 32A/107)* and wax about 18 in. of one end and knot the other end of each cord. The wax assists threading and durability. Thread each of the sixteen attachment tubes *(10)* from the rear side of the front spar, with a waxed end of cord and from the front pull the cords through the tank bays and secure the waxed ends to the appropriate tank eyelet. Dust the outside of each tank and the inside of tank bays with french chalk. Coat all tank buttons *(31)* with ZX-36 *(Ref. 34B/1459)* to assist insertion. Proceed as follows :—

(1) Concertina the tanks sufficiently to pass them through the apertures in the leading edge spar *(28)*, taking up in the wheel bay the slack on the cords and from the inside push the tank walls into position against the adjacent structure. Pull each cord tightly through its bracket, to be found on the top or bottom skin and secure with a knot as shown. Cut off and remove the surplus kite cord.

(2) Proceed in the reverse order as described in the removal *(para. 78 and 79)*. When assembling the clamp rings *(37)* and the inter-connection pipes *(34)* pass the bonded washers along the bolts by hand as far as possible and then tighten up by turning the bolt heads to ensure even seating of the washers, otherwise the threads may drag the seals from their bonds, giving rise to leakage.

Note . . .

When refitting the tank interconnection pipes refer to A.P.4117B, Vol. 1 and 6, Book 2, Part. 3.

(3) Proceed in the reverse order as described in the removal *(para. 77)* ensuring that the "U" seal has its large flange forward when fitted to the front spar web and that the tank bolts when engaged pass through both flanges of the "U" seal.

(4) Proceed in the reverse order as described in the removal *(para. 76)* ensuring that the "O" seal is seating evenly while tightening up.

(5) Proceed in the reverse order as described for removal *(para. 74 and 75)*.

(6) Proceed in the reverse order as described for removal *(para. 73)*, ensuring that the bonded washer is replaced beneath and not above the wiring lug. When replacing the terminal box in the rear of No. 3 tank ensure that the sealing washer is undamaged and that the Pye socket is situated on the inboard side approximately 30 deg. from top dead centre.

(7) Proceed in the reverse order as described for removal *(para. 70, 71 and 72)*. The Flight Refuelling connectors *(fig. 8)* must be assembled to the pipes as described in para. 34.

(8) Proceed in the reverse order as described for removal *(para. 68 and 69)*.

(9) Complete in the reverse order using new locking wire. All seals should be renewed on re-assembly of components.

Assembling 230 gallon drop tank

83. The 230 gallon drop tank is constructed in three main portions to facilitate manufacture and transport, the nose and tail shells afterwards being attached to the centre shell by special mushroom-headed bolts with special sealing washers. Rubber sealing rings are sandwiched between the main components during assembly. Prior to assembly, it is essential to ensure that all joint faces are scrupulously clean. The assembly of the drop tank is effected as follows :—

Note . . .

The three sections of the tank should be adequately supported on trestles with formers during the process of assembly.

(1) Fit a rubber sealing ring over the forward joint face of the centre shell (the forward end is furthest from the fuel and air connections), and ensure that the ring is not twisted or distorted in any manner.

(2) Align the seam on the top of the nose shell with the seam on the top of the centre shell, with the water drain plugs at the bottom. Turn the disc of the drive to the mechanical contents indicator of the nose shell to bring the slot in the disc to the lower position (indicator registering 'EMPTY') and, when bringing the two shells together, ensure that the spigot on the drive from the float in the centre shell enters the slot in the disc of the nose shell. When the spigot is aligned in the slot, carefully slide the nose shell onto the centre shell.

(3) Assemble four of the special clamping tools *(Ref. 4G/5663)* so that the stepped pin of each is located in a bolt hole of the nose shell and the spigot in a corresponding blind hole of the centre shell. The blind holes are arranged so that the tools clamp at top and bottom and mid-way down each side of the tank. When fitting the special clamping tools, they should be opened to their full extent and then closed until the stepped pin and the spigot enter their respective holes.

(4) Close the special clamping tools slowly and evenly so that the rubber sealing ring is not distorted or damaged as the joint ring of the nose shell overlaps the joint ring of the centre shell. Insert a special mushroom-headed bolt with special washer into the holes on either side of each tool, engage the threads of the bolts with the tank nuts and fully tighten the bolts.

(5) Insert special mushroom-headed bolts and special washers into all the available bolt holes. Engage the threads, but do not tighten. Remove the clamping tools and fit special mushroom-headed bolts and washers into the holes left vacant by removal. Tighten all bolts. The bolts should be tightened in small increments and diametrically in pairs to eliminate any risk of malignment or distortion of the shells.

(6) Insert a hand into the rear of the centre shell and operate the float to ensure that the indicator, seen through the window of the nose shell, registers correctly. No error should occur, since the indicator has been adjusted by the manufacturer prior to dispatch. If, however, the indicator is not registering correctly, rectification may be made by slight and careful bending of the arm of the float in the centre shell.

(7) Align the top seam of the tail shell with the seam of the centre shell. Assemble the tail shell to the centre shell in the same manner as that described for the assembly of the nose shell in sub-para. 3 to 5, after fitting a rubber sealing ring as in sub-para. 1.

(8) Assemble fuel and air adapters *(Part No. A.206906/1)* with sealing ring *(Part No. A.241673)* and bonded seal *(Ref. 28F/8016813)*, if not already fitted. Assemble the tank suspension lug *(Part No. M.L. Aviation FX.1095–480C)* if not already fitted, by screwing the lug right in to the shoulder and unscrewing not more than half a turn until the lug centre line is perpendicular to the tank centre line.

Note . . .

Mod. 1074 provides improved anti-corrosive protection around the edge of the top member to obviate the possibility of the corrosion of the top member and the tank.

Dismantling 230 gallon drop tank

84. The dismantling of the tank is effected by removing the special mushroom-headed bolts at the joint faces and withdrawing the nose and tail shells. It is recommended that the bolts at the clamping positions are removed first and the clamping tools fitted to support the end shells whilst the remaining bolts are removed. This procedure will also relieve the bolts from the pressure of the sealing ring and thus facilitate the removal of the bolts. The bolts should be removed in diametrically opposite pairs and, when all bolts and clamping tools are removed, the shells should be carefully eased away from the ring faces of the centre shell. Retain all bolts and washers for re-assembly.

Note . . .

The tank should be adequately supported by nose, tail and centre section trestles with formers during the process of dismantling.

Testing 230 gallon drop tank

85. The procedure for testing the 230 gallon drop tank for leaks is as follows :—

(1) Paint the tank rivets, seams, joints and bolt heads with a mixture of whitening and methylated spirit.

(2) Pour four to five gallons of kerosine into the tank and seal all openings.

(3) Tilt the tank at varying angles and agitate so that the fluid is swilled around all the internal surface of the tank and inspect for leaks. This procedure must be repeated at intervals for a total period of 10 minutes.

(4) When the test has been satisfactorily completed, drain the tank and seal all apertures until the tank is required for service.

100 gallon drop tank

86. The assembling, dismantling and testing of the 100 gallon drop tank is described in A.P.4117A, Vol. 1 and 6, Sect. 3, Chap. 1.

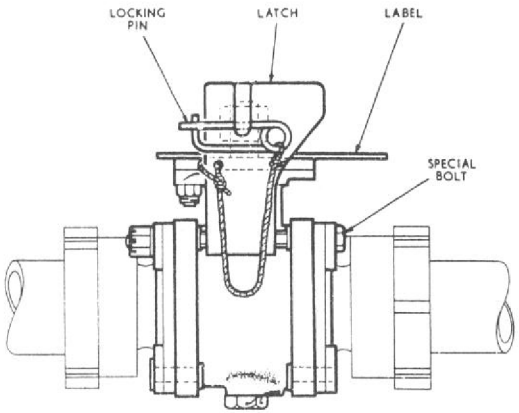

Fig. 25 Defuelling cock locking latch

Assembly of defuelling cock locking latch (fig. 25)

87. Aircraft embodying Mod. 1031 are provided with a nylon locking latch on the defuelling cock to secure it in the closed (flight) position. The latch consists of a slotted plate which pivots on a special bolt incorporated in the cock assembly. When turned up, the slot in the latch engages with the cock lever and the lever is then secured by the insertion of a locking pin into a hole in the lever. The locking pin is secured to the latch assembly by means of balloon cord. The special bolt engages with the threaded hole in the foot of the latch. The lock nut is screwed up finger tight, after the latch is centralized by adjustment of the bolt, and secured with a split pin. Assemble the latch as follows :—

(1) Screw in the special bolt, allowing the latch to assume a mid-position clear of the cock end flanges.

(2) Assemble the nut and washer, and secure with a split pin. *The bolt must be free to rotate to facilitate the movement of the latch from the engaged position.*

(3) Adjust the latch by turning the bolt so that the slot engages the lever. *There should be no movement of the lever, with the cock in the fully closed (flight) position.*

(4) With the cock in the OFF (flight) position and latch engaged with the cock lever insert and secure the locking pin.

TABLE 1

Component and Air Publication reference

Component	Manufacturer	Part No. or Ref.	Air Publication
Defuelling cock	Saunders Valve Co.	42/A/10	A.P.4737A, Vol. 1 & 6, Sect. 1
Low pressure cock	Saunders Valve Co.	51/B/12	A.P.4737A, Vol. 1 & 6, Sect. 1
Pipe connectors	Flight Refuelling	F.R.S.110/L F.R.S.110/K F.R.S.110/H F.R.S.132/F	A.P.4511, Vol. 1 & 6, Sect. 5
Refuelling coupling	Avery Hardoll	F.C.110 or F.C.110 Mk. 11	A.P.4511, Vol. 1 & 6, Sect. 3
	Flight Refuelling	C.724000/1	
Flexible coupling	King Aircraft Corp.	C.5338	
Flow proportioner	Rotol Ltd.	F.F.P.2/2	A.P.4737A, Vol. 1 & 6, Sect. 9
Fuel booster pump	Self Priming Pump Co.	S.P.E.2009A, Mk. 7 or S.P.E.2009A, Mk. 6	A.P.4343D, Vol. 1, Book 2
Inverted flight recuperator	Self Priming Pump Co.	R.C.38A, Mk. 5	
Float switches			A.P.1275A, Vol. 1, Sect. 24
Refuelling valves	Flight Refuelling	C.1117000/6A C.1117000/6B	A.P.4511, Vol. 1 & 6, Sect. 2
Tank selector valves	Saunders Valve Co.	216/C.H./80/P3 216/C.J./80/P3	
Twin gate valve	Saunders Valve Co.	812/BR/03	

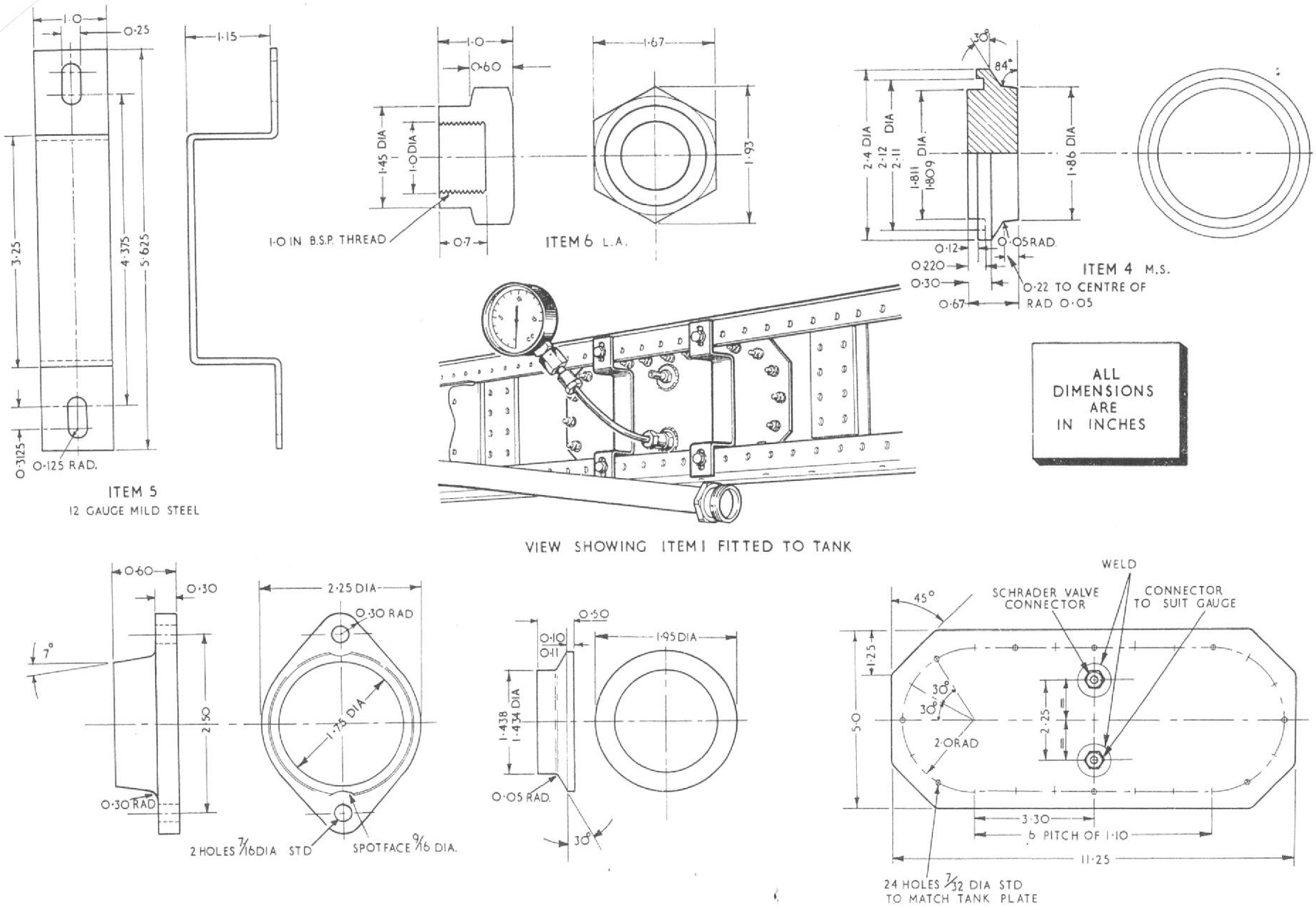

Fig. 26 Test equipment for wing tanks

T.P. 17640/1

Testing wing tanks for leakage in situ *(fig. 26)*

88. The wing tanks can be tested for leakage in situ with the test equipment shown in the illustration. The procedure for testing the tanks, when leakage is suspected, in order to locate the leaking tank, is as follows :—

(1) Render the aircraft electrically safe (*Sect. 5, Chap. 1*).

(2) Drain the fuel system (*Sect. 2, Chap. 2*).

(3) Remove the nosing (*para. 70*)

(4) Remove the transfer pipe and the air pressure pipes (*para. 71, fig. 24, items 18, 23 and 26*). Blank off the transfer pipe orifice with the blank (*fig. 26 item 3*).

(5) Disconnect and remove the co-axial cables from the terminal boxes.

(6) Remove the leading edge spar webs from No. 2 and 3 tanks (*para. 72*).

(7) Remove the mounting plates from No. 2 and 3 tanks (*para. 73*) and before finally removing disconnect the electrical leads from the terminal boxes behind the mounting plates.

(8) Remove the tank interconneetion pipe—tank No. 2 to 3 from either No. 2 or No. 3 tank and fit a blank (*fig. 26, item 2*).

(9) Fit the wing tank test panels (*fig. 26, item 1*) complete with a 0–10 lb/in² pressure gauge to No. 2 and 3 tanks and secure to the tanks with the nuts and washers removed at operation (7) and to the spar booms with the straps (*fig. 26, item 5*).

(10) Remove the branch pipe (*fig. 24, item 7*) from No. 1 tank [*para. 67(3)*] and fit the blank (*fig. 26, item 4*).

(11) With a foot pump pressurize the tanks to 5 lb/in² pressure, and allow them to remain pressurized for at least 15 minutes. Note any pressure drop which occurs. If the tanks are serviceable no drop should occur.

(12) Having established which pair of tanks is leaking, depressurize the tanks.

The following sub-paragraphs assume that No. 1 and 2 tanks are leaking, and No. 3 and 4 are serviceable.

(13) Remove the test panels from No. 2 and 3 tanks.

(14) Remove the leading edge spar web and the mounting plate at No. 1 tank.

(15) Remove the interconnection pipe—tank No. 2 to No. 1 tank from No. 2 tank and fit a blank (*fig. 26, item 2*).

(16) To eliminate any possibility of a leak from the air pipe in No. 1 tank, fit a blank (*fig. 26, item 6*) at the pipe coupling (*fig. 24, item 33*).

(17) Fit the wing tank test panels to No. 1 and 2 tanks and test as described in operation (11).

(18) On completion of the tests, remove the test equipment and blanks.

Tanks 3 and 4 can be tested in similar manner. Change the faulty tank(s) and on completion carry out a pressure test in accordance with para. 37.

Note . . .

When the tank is found to be leaking at the tank interconnection it should be examined and repaired in accordance with A.P.106B–0215–16

Fuel transfer pipes in centre fuselage (SI/Hunter/120)

89. These pipes have been wrapped with Tape, insulating cambric varnish (Ref. No. 5F/940122) around each pipe where they pass frame 37. Each end of the wrapping being secured with Cord (Ref. No. 32A/1058027). On removal of the pipes or a pipe the wrappings should be removed and the pipes examined as follows:–

(1) Examine both pipes for chafing.

(2) Where no chafing has occurred, or where the pipe is only lightly polished, retain the pipe in use.

(3) Where chafing has occurred the pipe is to be rejected and a serviceable pipe fitted.

(4) Re-apply tape around each pipe where the pipes pass frame 37 and secure the wrapping at each end with cord.

(5) Re-fit the pipes ensuring that a minimum clearance of 0·10in. exists between the pipes and frame 37.

(6) Test the fuel system in accordance with para.37.

Fuel vent pipe (Pt. No. C201525/25) at frame 26 (STI/Hunter/380A)

90. Whenever the engine is removed ensure that this pipe has not been chafed by the starter motor fuel and air pipes. Examine the pipe by feel for chafing or the presence of a repair saddle. Renew any pipe where chafing is evident or any pipe with a repair saddle fitted.

◀ **Refuelling coupling (STI/Hunter/389)**

91. The chain attached to the refuelling coupling sealing cap is to be secured to the aircraft structure by one of the upper line of four bolts (*above* the refuelling coupling) which secure the refuelling-coupling mounting to the stub-wing diaphragm.

92. With the sealing cap in place on the coupling and the chain secured in this manner, the length of the chain is to be insufficient to allow the chain to become trapped between the periphery of the sealing cap and the undercarriage door when the door closes (the critical arc of the periphery is between clock-face reference 5 o'clock and 8 o'clock when viewed on the face of the cap).

93. Before dismantling this assembly, check that trapping cannot have previously occurred. If it can, remove any covering from the chain, examine it for signs of deformation and renew it if damaged.

94. On assembly, adjust the length of the chain to remove any possibility of trapping and cover the chain with a suitable length of P.V.C. tubing Ref. 5F/9708463. This covering must always be present and intact. ▶