GROUP C.3

TANK PUMPS, FAILURE WARNING AND PRESSURE REFUELLING (CODE BP AND PR)

(Completely revised)

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Equipment employed

1. The major components employed in the tank pumps and pressure refuelling circuits are listed in Table 1, together with the appropriate Air Publications to which reference should be made for a detailed description and the necessary servicing required to maintain the equipment in an efficient condition:-

DESCRIPTION

Tank pumps

2. The electrically-driven two-speed booster pumps, incorporated one in each front fuel tank, are supplied with current via the engine master switch *(Group C.1)*. The pumps are controlled by independent ON/OFF switches marked PORT and STBD, which are located on the forward end of the cabin starboard shelf and each pump is protected by a 25 amp. circuit

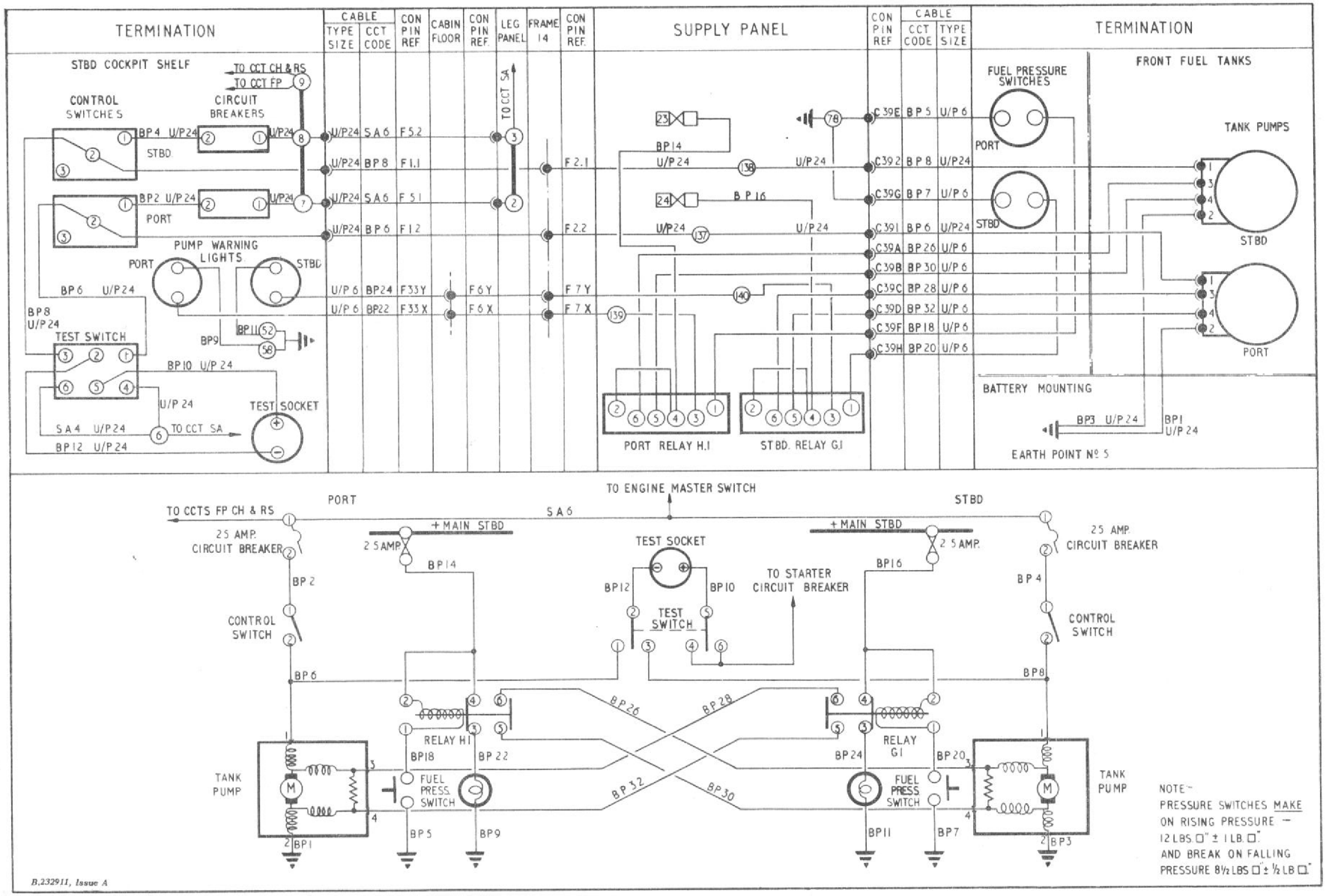

Fig. 1. Tank pumps

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breaker situated at the rear end of this shelf. The pumps normally operate continuously at low speed throughout flight, but either is capable, if run at high speed, of supplying the maximum fuel demand from the engine. The high or low speed operation is controlled by a pair of relays situated on the supply panel, which are energized by pressure switches tapped into the pump outlet pipes and mounted on the port side of the keel member adjacent to the pumps. The relays on the supply panel also control the operation of a pair of warning lamps, which indicate pump failure and are located one adjacent to each pump control switch on the starboard shelf.

TABLE 1

Equipment type and Air Publication reference

Equipment Type	Air Publication
Tank pumps	
Pumps, Type S.P.E.2009, Mk.5 or Mk.6 or 2009A, Mk.5 or Mk.6 or Mk.7	A.P.4343D, Vol.1, Book 2, Sect. 7
Pressure switches, T.P.5250	A.P.1275A, Vol.1, Sect.11
Control switches, C.W.C. Type XD.779, No.4	A.P.4343C, Vol.1, Book 1, Sect. 1
Warning lamps Rotax H.2805 or Smiths 43 CFP/24 Indicators, Dowty C.5165Y, Mk.7	A.P.4343E, Vol.1, Book 4, Sect.18
Relays, Type 9B, No.2	A.P.4343C, Vol.1, Book 2, Sect. 3
Circuit breakers, Type A.4	A.P.4343B, Vol.1, Book 1, Sect.10
Test switch, C.W.C. Type XD.787, No.4	A.P.4343C, Vol.1, Book 1, Sect. 1
Pressure refuelling	
Solenoid valves, Mk.17	A.P.4343E, Vol.1, Book 1, Sect. 1
Indicator, Flight Refuelling, Type B.4507000/17	A.P.4343E, Vol.1, Book 4, Sect.18
Drop Tank refuelling switch C.W.C. Type XD.784	A.P.4343C, Vol.1, Sect.1
Fluid level switches	
Flight Refuelling, Type D.3504100/47 or Hawker Pt.No.D.215808 (Front tanks) Smiths, Type 1696FG (Rear tanks) Flight refuelling, Mk.4 series 2 (Wing tanks) Flight Refuelling Mk.4 series 13 (Drop tanks)	A.P.1275A, Vol.1, Sect.24
Time switch, Venner, Type PTA/HA/W.19055	A.P.4343C, Vol.1, Book 2, Sect. 3

Provision is made for testing each pump, in turn, by means of a two-position test switch, marked TANK PUMPS TEST PORT and STBD, and mounted, together with an ammeter test socket, on the rear end of the cabin starboard shelf.

Operation

3. With the engine master switch made and both pump control switches in the ON position, current will flow from the main positive supply line to both tank pumps. With the pumps operating, the contacts of the pressure switches in their outlet pipes, will close, due to the fuel pressure, and energize relays H.1 and G.1. These relays, in turn, will break the supply to the pump failure warning lamps and short circuit the resistors in the field windings of each pump. The pumps will thus operate in low speed and supply fuel to the engine driven pump via the flow proportioner. The flow proportioner is operated by the fuel flow and ensures that equal amounts of fuel are supplied by both pumps. As the front tanks are emptied, fuel in the remaining tanks is transferred to the front tanks under air pressure. Thus both sides of the fuel system should empty simultaneously.

4. Should either pump be overloaded, due, for example, to a fuel surge, the appropriate circuit breaker will operate and isolate the pump from the circuit. When this occurs, the pressure switch in the outlet pipe of the affected pump will open circuit, due to the loss of output

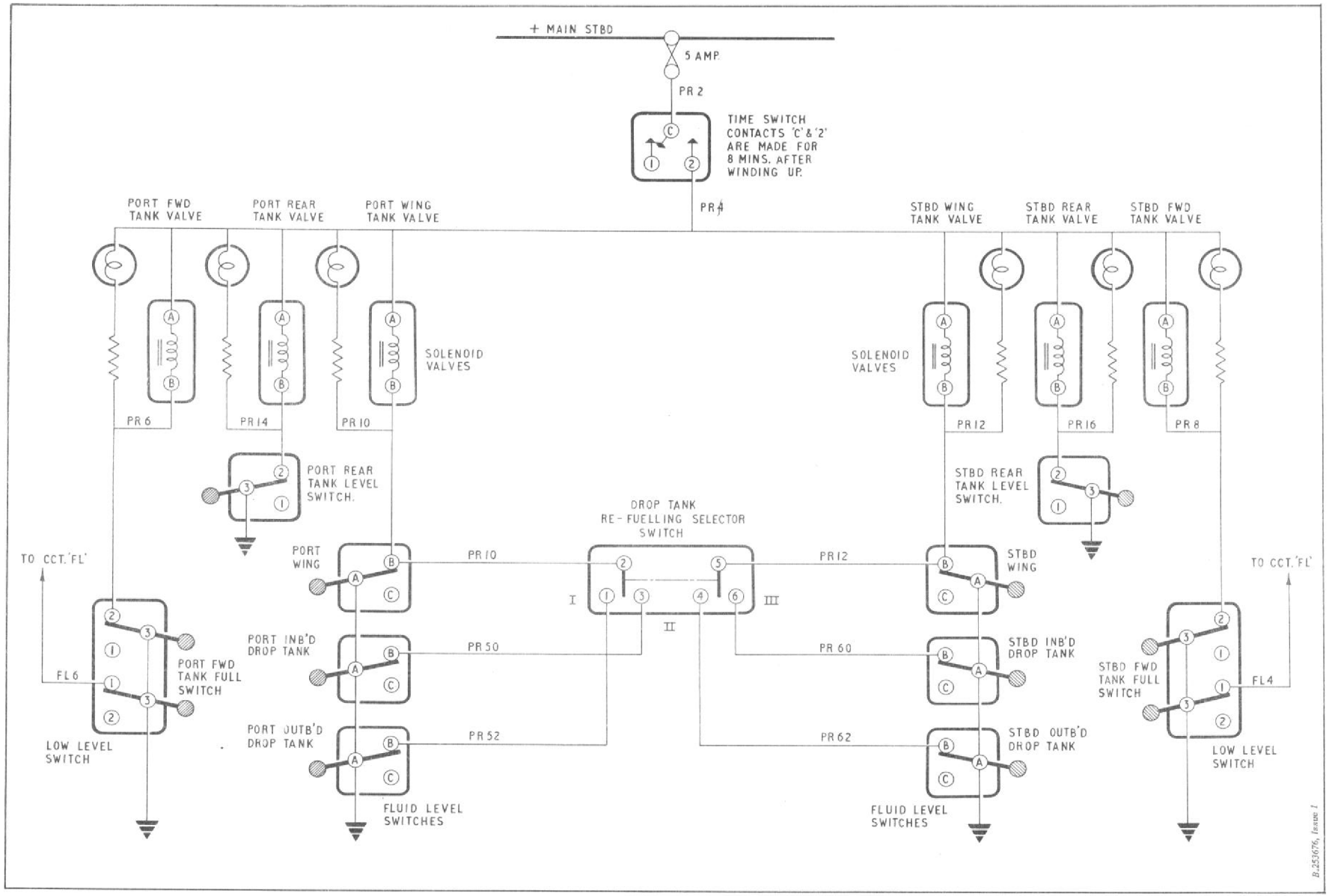

Fig.2. Pressure refuelling (theoretical)

from the pump, and de-energize its relay. With the relay de-energized, a supply will be made, via one set of contacts within the relay, to the warning lamp which will illuminate to indicate pump failure. The other set of contacts in the relay will insert the resistor in the field windings of the operative pump, which will then operate at high speed to supply the necessary fuel to the engine. Under these conditions, the circuit breaker of the overloaded pump must be re-set. Then if the fault was temporary, the pump will re-commence running in the normal manner and the other pump will revert to low speed operation when the pressure switch closes and energizes the relay.

5. If the circuit breaker refuses to hold on, this indicates that the fault is of a permanent nature and, if sufficient fuel is not available in the serviceable side of the system to complete the flight, engine speed must be reduced and the serviceable pump switched OFF by means of its control switch. Under this condition, the fuel will be supplied to the engine equally from both sides of the system under gravity and transfer air pressure. The serviceable pump should, however, be switched on again for landing.

6. The two-position test switch and ammeter socket, used to test the tank pumps for correct functioning, as described in para.13, are coupled to the engine starter circuit breaker *(Group C.1)* and obtain their positive supply from this source. The test switch feeds each pump, in turn, irrespective of the position of the control switches provided that the engine master switch is OFF. For the full description of the fuel system, reference should be made to Sect.4, Chap.2.

Pressure refuelling

7. The aircraft is refuelled under pressure through a standard 1½ in. coupling situated in the port wheel bay, the operation being controlled by a pre-set time switch mounted in the port stub wing adjacent to the refuelling coupling. The time switch energizes six solenoid-operated refuelling valves, located in the fuel pipe lines to the port and starboard front, rear and wing fuel tanks. These valves are each controlled by fluid level switches located in the front, rear and outboard wing tanks (and drop tanks when fitted). Filament lamps, carried in an indicator located in the stub wing, adjacent to the time switch, are wired in parallel with each refuelling valve solenoid to indicate when the valves are open during refuelling. A switch, marked I, II and III, is provided adjacent to the refuelling indicator to enable drop tank refuelling selection to be made. The switch is used in accordance with the refuelling instruction label attached to the port cable cover plate, which is situated below the switch.

Operation

8. To understand the function of the pressure refuelling circuit it is necessary to trace the sequence of operations which take place whenever the aircraft is refuelled. It should be noted that the battery master switch must be set to the ON position, or an external supply connected, before refuelling can commence, as an electrical supply is required to energize the refuelling valves.

9. At the commencement of the refuelling operation, the bowser hose is connected to the refuelling coupling and the pump started with its controls set to REFUEL. The drop tank refuelling switch is placed in either position I, II or III dependent on which drop tanks, if any, are to be filled. The time switch is then set and makes contacts C and 2, thus completing the circuit to all six refuelling valve solenoids and the indicator lamps. The refuelling valves open when the solenoids are energized to allow fuel from the refueller to pass into all tanks and the indicator lamps light to show that the valves are open. As each tank becomes full, its fluid level switch opens and de-energizes the solenoid of the refuelling valve, which closes to cut off the fuel supply to that tank. The indicator lamp will also be extinguished to show that the valve has closed. When drop tanks are fitted, however, the solenoid of the refuelling valve in the wing tank fuel pipeline will not be de-energized until the drop tanks are full.

10. Refuelling is complete when all the

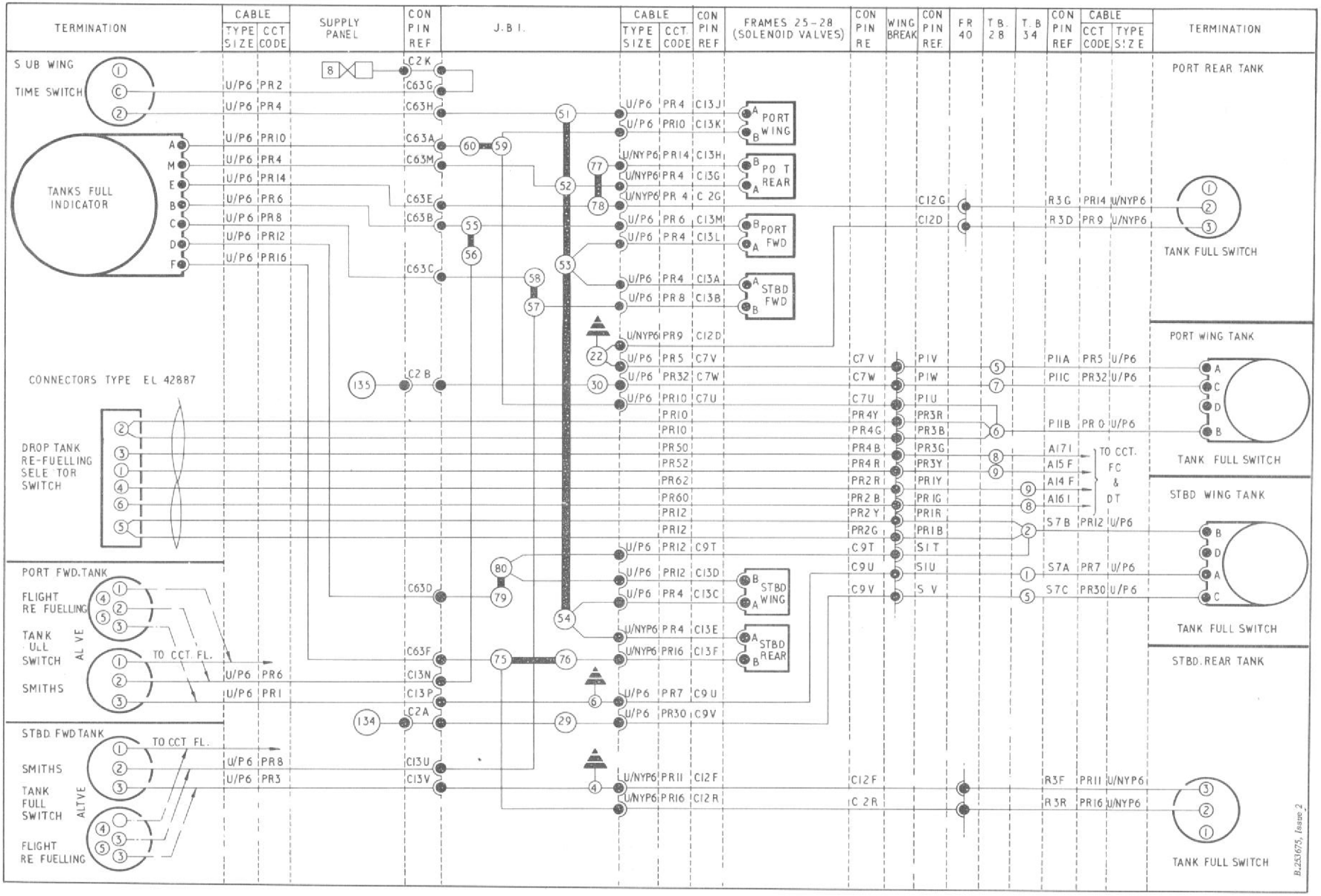

Fig.3 Pressure refuelling (routeing)

refuelling valves have closed and all indicator lamps are extinguished. The time switch should then be switched off, if it has not already completed its full travel. If not switched off, after refuelling, it will automatically switch itself off after approximately 8 minutes. The time switch ensures that the refuelling circuit is disconnected from the positive supply at all times, apart from actual refuelling operations. This ensures that the refuelling valve solenoids do not become energized again, when the fluid level switches close as the fuel is consumed, as this would cause cross-transfer between the tanks, via the refuelling pipe lines. For a full description of the fuel and refuelling system, reference should be made to Sect.4, Chap.2.

Drop tank high level and refuel switches

11. The drop tank high level switches, referred to on fig.2, control the drop tank refuelling operation. The switches, which are located, one in each drop tank, are employed, when the drop tanks are installed, to maintain the wing tank refuelling valve solenoids energized and the valves open until the drop tanks are full. For the wiring outboard of T.B.28 and 34, reference should be made to Group G.1.

SERVICING

General

12. For general servicing of the electrical system, reference should be made to Group A.1. The contacts of the pressure refuelling time switch should be kept clean and inspected for signs of pitting which if found must be removed in the approved manner. These operations should only be carried out by competent personnel, as the switch contains a delicate clockwork mechanism. Apart from checking the filament lamps in the refuelling indicator for serviceability, keeping all the components clean and carrying out the normal routine tests of security and serviceability, as described in the appropriate Air Publications, listed in Table 1, the only other servicing required is the tank pump test, described in para.13.

Tank pump test

13. To test the pumps for correct functioning, connect an ammeter to the test socket located on the cabin starboard shelf. Ensure that the battery master switch is in the ON position, or that an external supply is connected and check that the engine starter circuit breaker is CLOSED. Trip each pump circuit breaker or ensure that the engine master switch is OFF and select each pump in turn by operating the test switch located adjacent to the ammeter test socket. With the pump under test operating at high speed, i.e., the other pump indicator showing OFF, the ammeter should show a reading of less than 25 amp., but if the other pump indicator is showing ON the pump under test will be operating at low speed and a reading of less than 18 amp. should be indicated on the ammeter. If the readings are above these values, the cause must be investigated and rectified before the next flight. After test, reset the circuit breakers, if tripped during test.

Note . . .

The reason for quoting the low speed test current is that, immediately, after refuelling, the fuel pressure switches in the pump outlet pipes may be closed by the refuelling pressure and the pumps will therefore operate at low speed as described in para.3.

REMOVAL AND ASSEMBLY

General

14. The removal of the tank pumps, refuelling valves and fluid level switches is fully described and illustrated in Sect. 4, Chap.2. Once access has been obtained the removal of the remaining components forming the tank pumps and pressure refuelling circuits, should present no unusual difficulties. The removal of the cabin starboard shelf, which carries the control switches and circuit breakers of the tank pumps circuit is fully described in Group A.2, while the location and access to all components is indicated in Group A.3.