GROUP C.3

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

◀ (Including Mods.1103 and 1023) ▶

LIST OF CONTENTS

Introduction

1. This Group contains the description and operation of the tank pumps, tank pumps failure warning and pressure refuelling circuits, together with information on the servicing required to maintain the equipment in an efficient condition. Routeing and theoretical diagrams are also included. For a general description of the aircraft's electrical system, reference should be made to Groups A.1, A.2 and A.3. Detailed information on the standard components used, will be found in the Air Publications listed in Table 1.

DESCRIPTION

Tank pumps

2. The electrically-operated booster pumps, incorporated one in each inverted flight trap of the port and starboard front fuel tanks, are supplied with current via the engine master switch *(Group C.1 of this chapter)*. The pumps are controlled by two independent on/off switches marked PORT and STBD, which are located on the centre instrument panel and each pump is protected by a circuit breaker situated on the forward face of this panel. To minimize radio interference, the supply to the pumps is taken through a suppressor mounted on the port side of the keel member between frames 20 and 21. Provision is made for testing each pump in turn, by means of a two-position

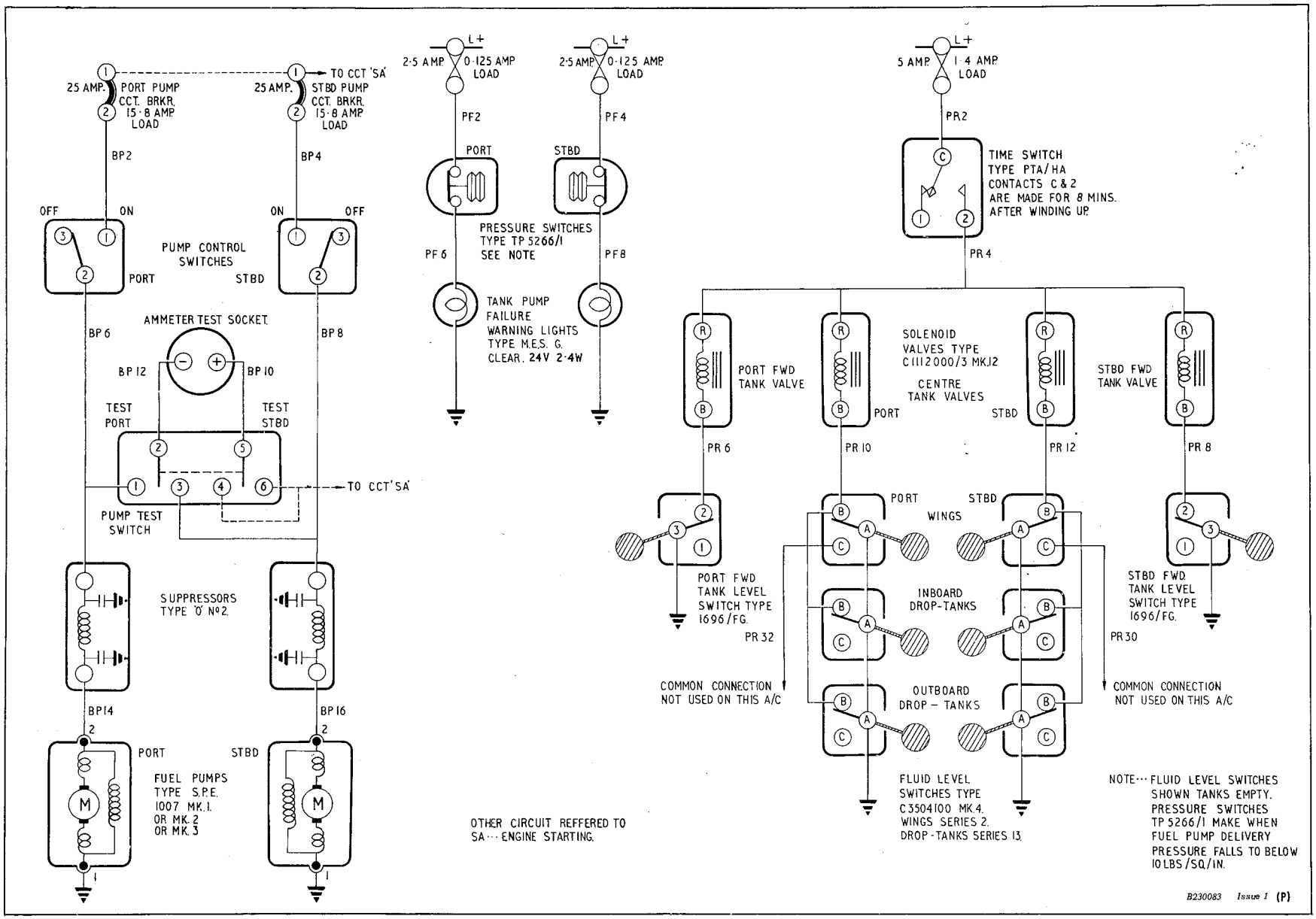

Fig.1 Tank pumps, failure warning and pressure refuelling - theoretical (pre Mod.1023)

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test switch marked FUEL PUMP TEST, and mounted together with an ammeter test socket, at the rear end of the a.c. circuit breaker panel on the starboard side of the cabin.

Operation

3. With the engine master switch and both pump control switches in the ON position, current will flow from the main positive supply line to both tank pumps. The pumps will then commence operation and supply fuel to the engine-driven fuel pumps, via the flow proportioner. The flow proportioner is operated by the fuel flow and ensures equal amounts of fuel are supplied by both pumps, the delivery pressures of which are matched to a closer tolerance than normal. As the fuel is drawn from the front tanks, fuel in the remaining tanks is transfered to the front tanks under air pressure, so that normally both sides of the fuel system will empty simultaneously. The individual pump control switches are provided to enable the fuel levels to be manually balanced should such action become necessary, by switching off the pump in the tank with the lowest level and allowing the tank with the operative pump to supply a greater proportion of fuel to the engine-driven pump. When balance is regained, the inoperative pump should be switched on again or excessive out of balance in the opposite sense, will result.

TABLE 1

Equipment type and Air Publication reference

Equipment Type	Air Publication
Tank pumps	
◀ Pumps, Type SPE.1007, Mk.1 or Mk.2 or Mk.3 *(Mod.1103)*	A.P.113E–0438–1 ▶
Suppressor, Type 0.2	A.P.4343C, Vol.1, Book 3, Sect. 5
Control switches, Rotax Type D.5404	A.P.4343C, Vol.1, Book 1, Sect. 1
Test switch, Rotax Type D.5503	A.P.4343C, Vol.1, Book 1, Sect. 1
Circuit breaker, Type A.4	A.P.4343B, Vol.1, Book 2, Sect.10
Test socket, Crabtree 3 pole, 2 amp.	A.P.4343B, Vol.1, Book 1, Sect.10
Tank pump failure warning	
Pressure switches, Type T.P.5266/1	A.P.1275A, Vol.1, Sect.24
Warning lamps, Rotax Type H.4501	A.P.4343E, Vol.1, Book 4, Sect.18
Pressure refuelling	
Time switch, Venner Type PTA/HA	A.P.4343C, Vol.1, Book 1, Sect. 3
Solenoid valves, Flight Refuelling C.1112000/3 Mk.12	A.P.4343E, Vol.1, Book 1, Sect. 1
Fluid level switches	
Front tanks, Smiths Type 1696/FG Wing tanks, Flight Refuelling C.3504100 Mk.4, Series 2 Drop tanks, Flight Refuelling C.3504100 Mk.4, Series 13	... ... A.P.1275A, Vol.1, Sect.24
◀ Normal/Isolated switch, C.W.C. Type XD.784, No.4 ...	A.P.4343C, Vol.1, Book 1, Sect. 1 ▶

4. Should either pump be overloaded, due to a fuel surge etc., the respective circuit breaker will operate to isolate the pump from the circuit. When this occurs the affected circuit breaker must be re-set, then if the fault was of a temporary nature the pump will recommence operation in the normal manner. If the circuit breaker will not remain on, this indicates that the fault is of a permanent nature and consequently engine speed must be reduced and the other pump switched off or excessive out of balance will result. Under this condition the fuel will be supplied to the engine-driven pumps under gravity and transfer air pressure.

5. The two-position test switch and ammeter socket, used to test the tank pumps for correct functioning as described in para. 14 of this group, are coupled to the engine starter circuit breaker *(Group C.1 of this*

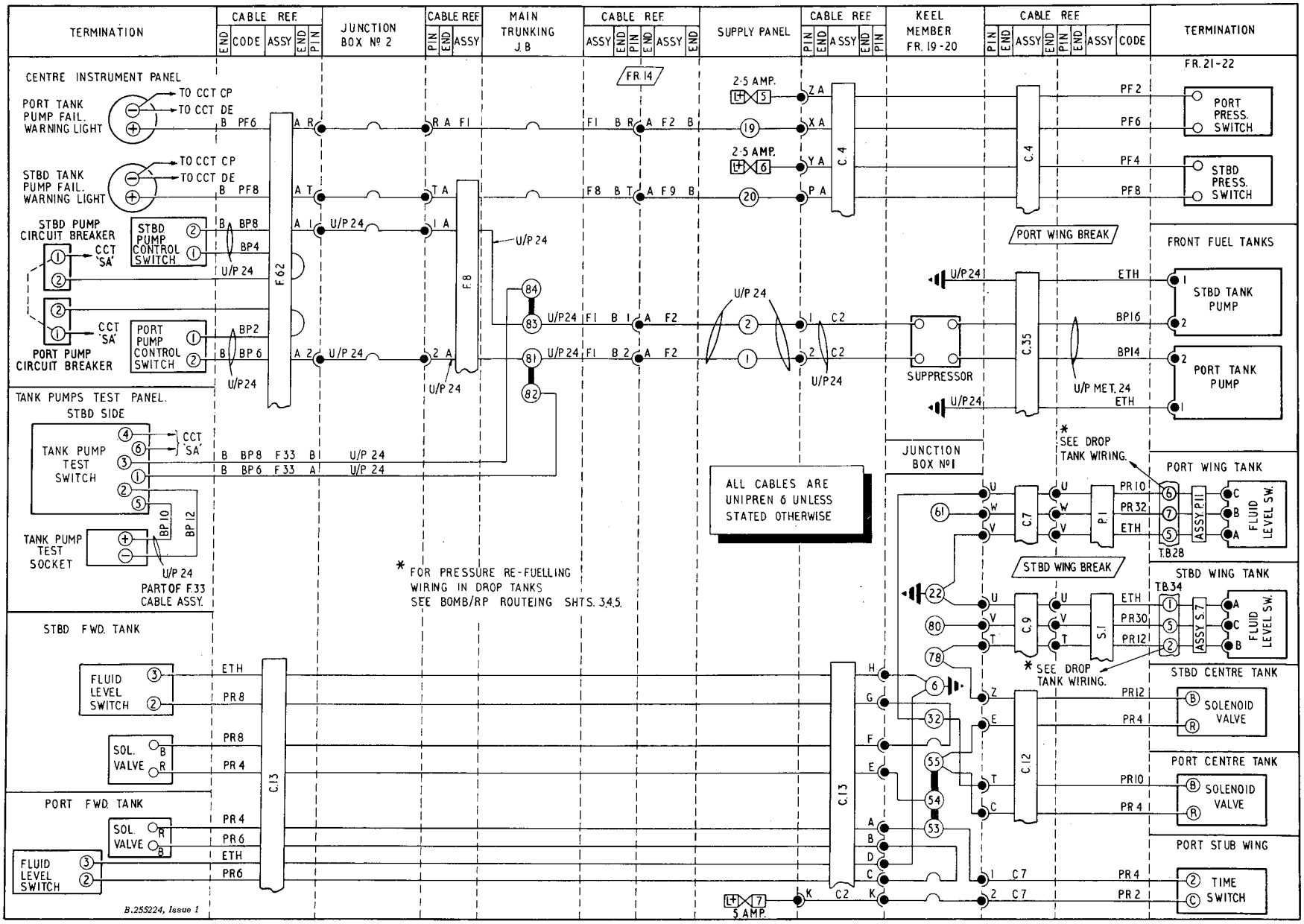


Fig.2 Tank pumps, failure warning and pressure refuelling - routeing (pre Mod.1023)

chapter) 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 a full description of the fuel system, reference should be made to Section 4, Chapter 2 of this volume.

Tank pump failure warning

6. Two lamps, situated below the pump control switches on the centre instrument panel, are provided to give warning when either of the fuel booster pumps fail. Each lamp is operated by a separate pressure switch, coupled by a pipe into the appropriate booster pump outlet. The switches are located together at the bottom of the centre fuselage in the region of frames 23 and 24.

Operation

7. The pressure switch contacts close on falling pressure, thus should either pump fail and its outlet pressure drop, the appropriate switch will operate and complete the supply to the warning lamp, which will light to indicate pump failure.

Pressure refuelling

8. The aircraft is refuelled under pressure through a standard 1½inch 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 four solenoid operated refuelling valves, located in the port and starboard front and centre fuel tanks. These valves are controlled by fluid level switches located one in each front, outboard wing and drop tank. For drop tank wiring outboard of T.B.28 and ◀ 34 refer to Group G.1, Fig. 11 *(pre Mod.1023)* and Group G.1, App.1, Fig.6, *(post Mod.1023).* ▶

Operation (pre Mod.1023)

9. To fully understand the operation 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.

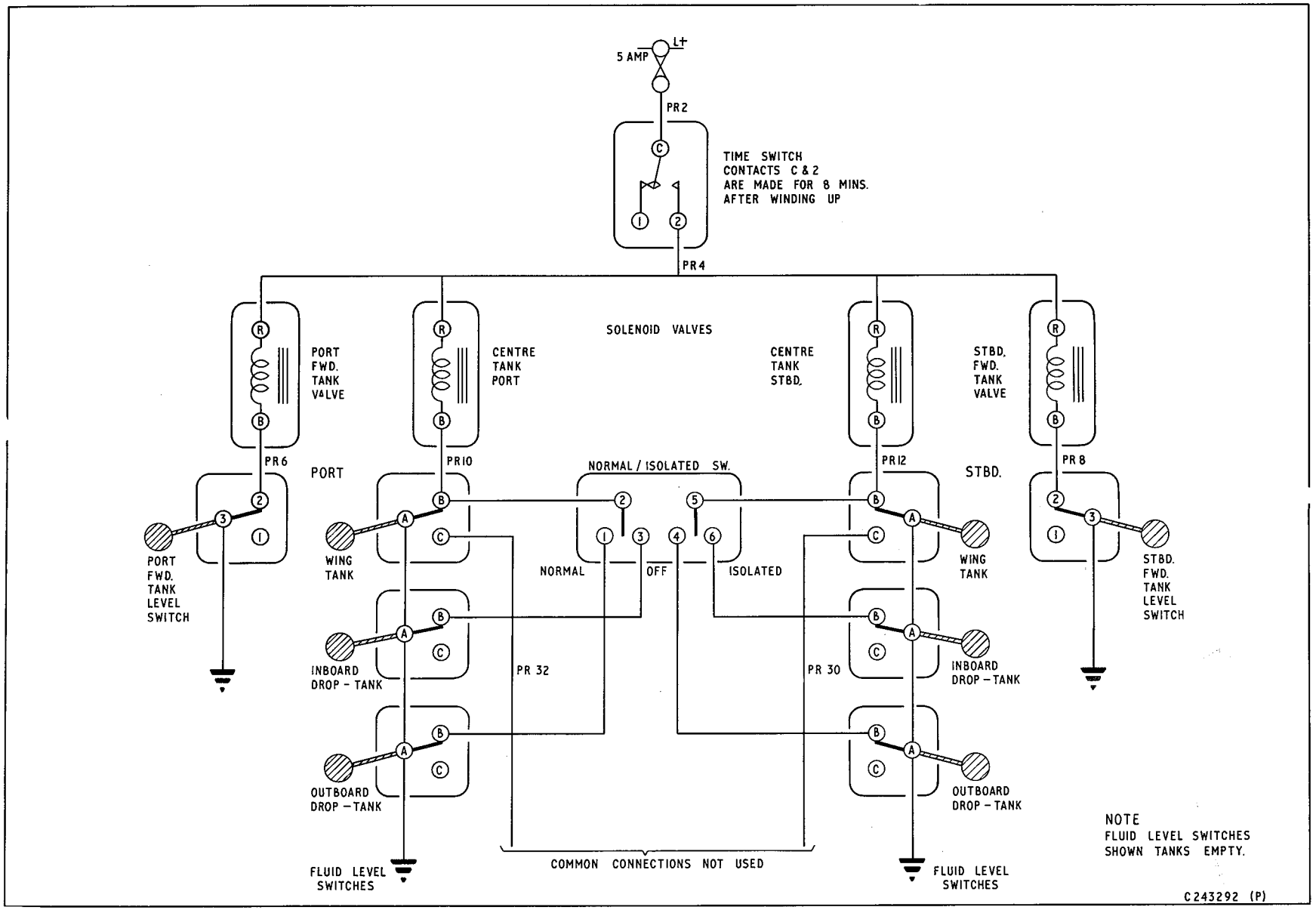
10. At the commencement of the refuelling operation, the bowser hose is connected to the aircraft's refuelling coupling, the hose bonded to the aircraft structure and the pump started with its controls set to REFUEL. The time switch is then set and makes contacts C and 2, thus completing the circuit to all the four refuelling valve solenoids. The refuelling valves open when the solenoids are energized to allow fuel from the bowser to pass into the front and centre tanks. When the front tanks are full the fluid switches in these tanks open and de-energize the solenoids of the front tank refuelling valves, thus closing the valves to cut off the fuel to these tanks.

11. When the centre tanks are full, fuel flows down the transfer pipes to the wing tanks, and when these latter tanks are also full, the fluid level switches in the outer tank of the wing tank system open and de-energize the solenoids of the centre tank refuelling valves thus cutting off the fuel to the centre and wing tanks. If drop tanks are fitted, the opening of the wing tank fluid level switches will not de-energize the solenoids of the centre tank refuelling valves, as each drop tank contains a fluid level switch wired in parallel with those in the wing tanks. Under these conditions the fuel will flow down the transfer pipes from the wing tanks to the drop tanks and the solenoids of the refuelling valves in the centre tanks will only be de-energized when all the fluid level switches open as the tanks are filled.

◀ **Operation (post Mod.1023)**

12. Mod.1023 introduces a three position NORMAL/ISOLATED switch into the refuelling control circuit between the centre tank solenoid valves and the inboard and outboard drop tank fluid level switches. This switch does not alter the refuelling procedure for the front, centre or wing tanks which remains as described in paras. 9, 10 and 11. The NORMAL/ISOLATED switch, positioned adjacent to the refuelling time switch in the port main undercarriage wheel bay, provides the following three alternatives when refuelling the aircraft with both inboard and outboard drop tanks fitted.

(1) All four drop tanks may be filled.
(2) Only the inboard drop tanks may be filled.
(3) All four drop tanks may remain empty. ▶



◀ Fig.3 Pressure refuelling - theoretical (post Mod.1023) ▶

◀ **13.** The following paragraph and reference to Fig.3 of this Group will explain how the above three alternatives of drop tank refuelling are accomplished. With the NORMAL/ISOLATED switch selected to NORMAL, Fig.3 shows that the fluid level switch which breaks the circuit to the centre tank solenoid valve and stops refuelling is that of the outboard drop tank. Since the layout of the refuelling system is such that the centre tanks, wing tanks and inboard drop tanks must be full before fuel will pass into the outboard drop tanks, this ensures that all tanks controlled by the centre tank solenoid valve are refuelled. With the NORMAL/ISOLATED switch selected to ISOLATED it will be seen that the fluid level switch which breaks the circuit to the centre tank solenoid valve and stops refuelling is that of the inboard drop tank. It follows, therefore, that the outboard drop tanks remain empty with this selection. With the NORMAL/ISOLATED switch selected OFF it will be seen from Fig.3 that both the inboard and outboard drop tank fluid level switches are isolated and the centre tank solenoid valves will close and stop refuelling as soon as the wing tanks fluid level switches break. All four drop tanks, therefore, remain empty. ▶

Time switch

14. Refuelling is complete when all the refuelling valves have closed. The time switch must then be switched off, if it has not already completed its full travel. If not switched off after refuelling, the time switch will automatically switch itself off after approximately eight 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 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 Section 4, Chapter 2 of this volume.

SERVICING

General

15. For a general servicing of the electrical system as a whole, reference should be made to Group A.1 of this chapter. The contacts of the pressure refuelling time switch should be kept clean and inspected for signs of pitting which, if present, 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 keeping all the components clean and carrying out the normal routine tests of security and serviceability, as described in the appropriate Air Publications, quoted in Table 1, the only other servicing required is the tank pump testing as described in the following paragraph.

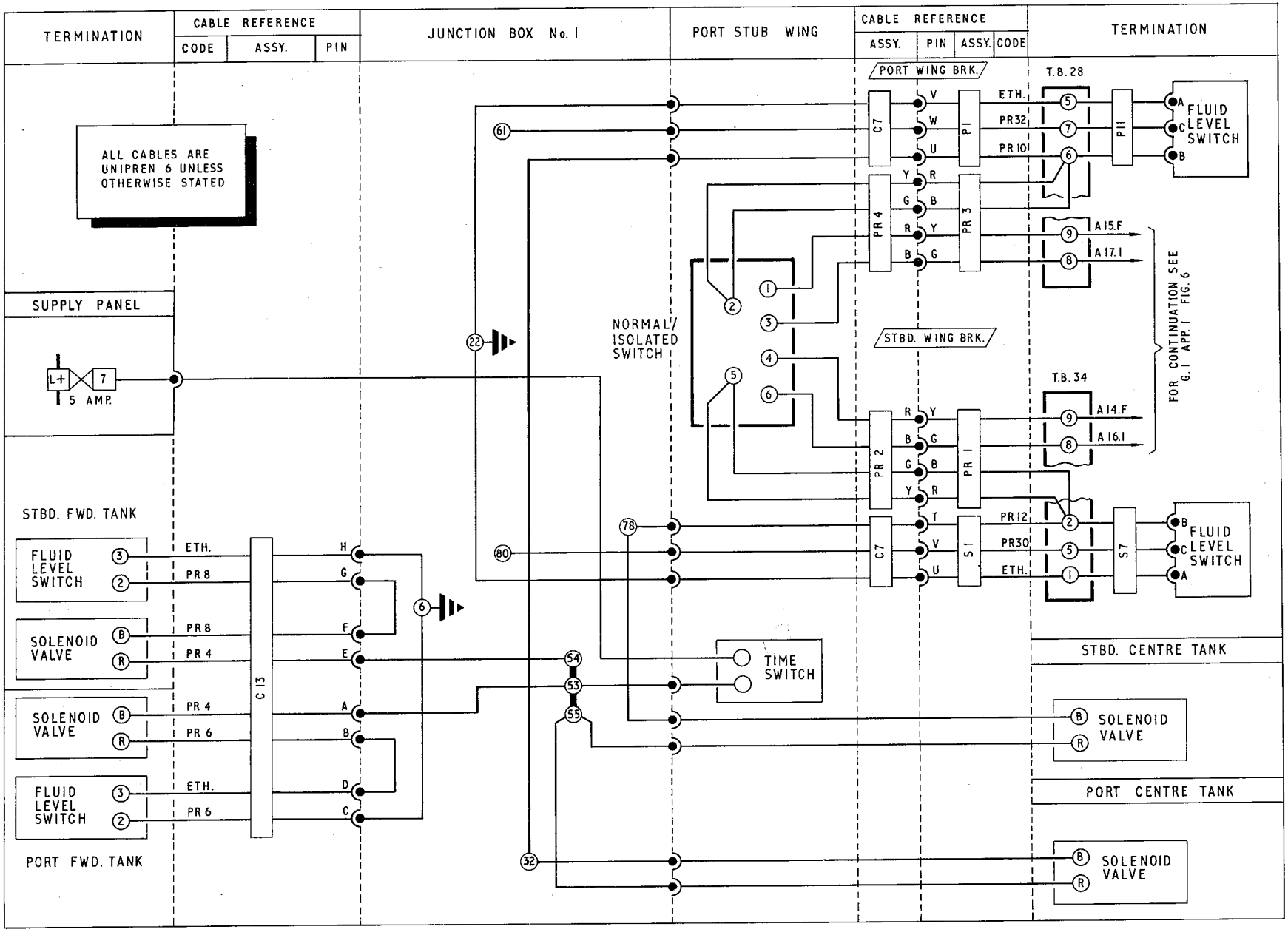
Tank pump testing

16. To test the pumps for correct functioning, connect an ammeter to the test socket located on the a.c. circuit breaker panel in the cabin. 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 operation of the test switch located adjacent to the ammeter test socket. If the pumps are operating satisfactorily, the ammeter should show a steady reading not exceeding 13.5 amp. at 24 volts. If the reading is above this value, the cause must be investigated and rectified before the next flight. After test, reset the circuit breakers, if tripped during the test.

REMOVAL AND ASSEMBLY

General

17. The removal of the tank pumps, refuelling valves and fluid level switches is fully described and illustrated in the fuel tank removal procedure, which will be found in Section 4, Chapter 2 of this volume. Once access has been obtained, the removal of the remaining components forming the tank pumps, failure warning and pressure refuelling circuits, should present no unusual difficulties. The location and access to all the components is indicated in Group A.3 of this chapter, while the removal of the centre instrument panel, which carries the control switches, warning lamps and circuit breakers, is given in Chapter 2 of this section.



◀ Fig.4 Pressure refuelling - routeing (post Mod.1023) ▶

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