Chapter 5

TEST PANEL FOR REFUELLING AND FLIGHT REFUELLING PANELS

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LEADING PARTICULARS

Type	*Part No.* 1Z.9102
Ref. No.	26*DC*/95206
Dimensions	
Length	13·7″
Width	13·5″
Height	13·5″
Weight	20 *lbs.*
Operating voltage	28 *volts d.c.*

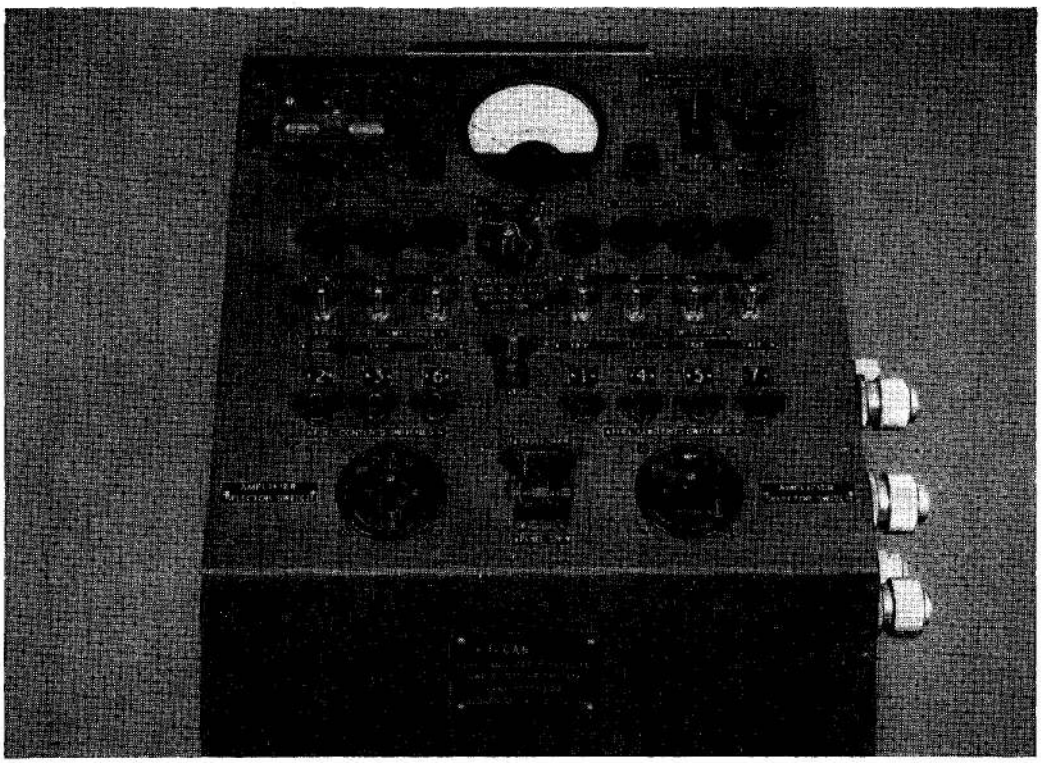

Fig. 1. General view

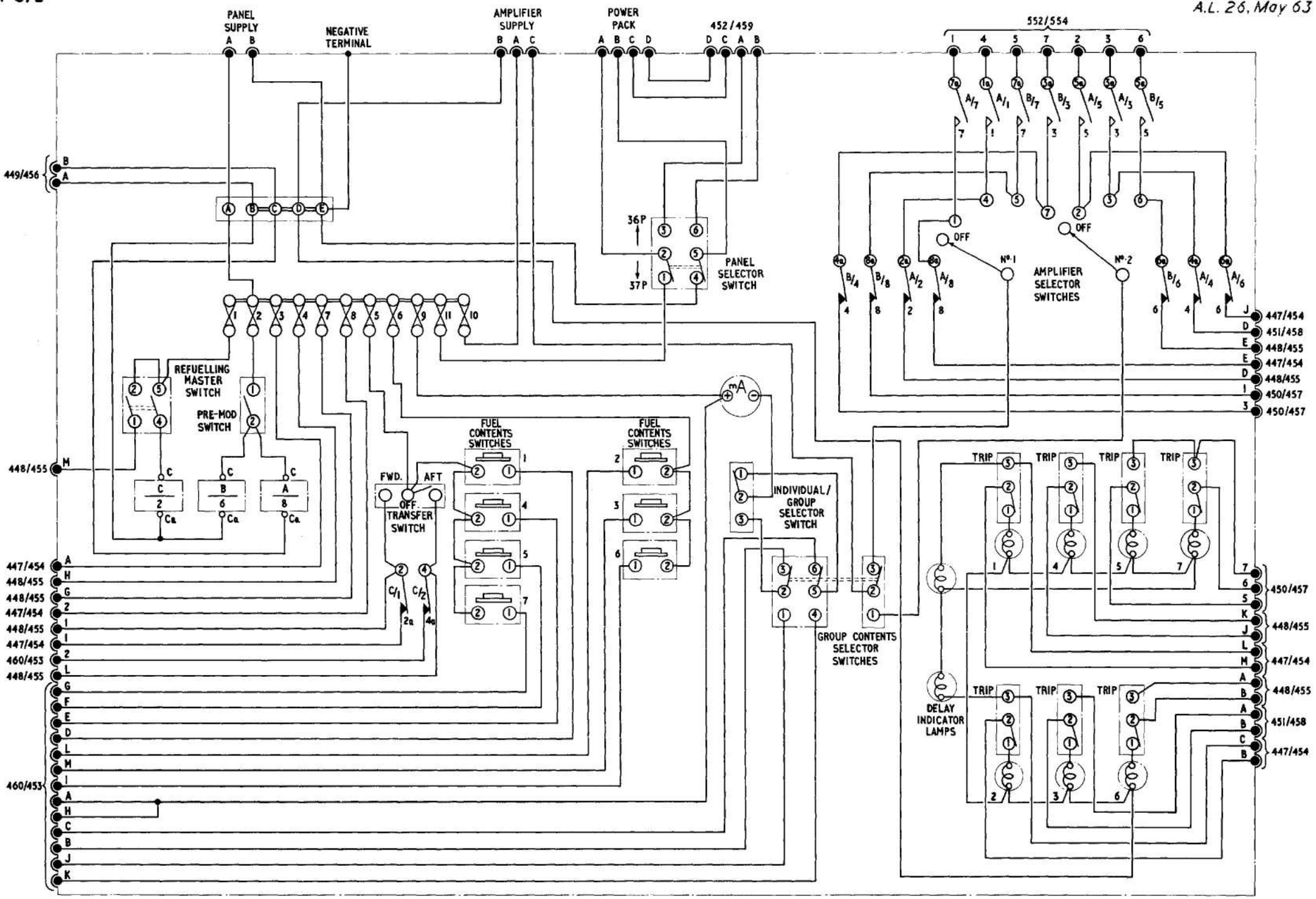

FIG.2 CIRCUIT DIAGRAM (TEST PANEL)

Introduction

1. Due to the shape of the Vulcan aircraft and the disposition of the fuel tanks, it is essential that when fuel is being consumed and during the refuelling operation, a correct distribution of fuel is maintained to keep the C of G within design limits. The refuelling panels 36P and 37P, and the flight refuelling panels 45P and 46P form part of the control system provided for this purpose.

2. The test panel is designed for checking the performance of these refuelling and flight refuelling panels throughout their full working range. These test panels do not provide for ' in situ ' testing, and to simulate the function of the aircraft fuel system a stabilised voltage power pack, a fuel tank amplifier type F.C.A., and a Smiths Waymouth test set type Q.A.A. will also be required.

3. On some earlier aircraft, flight refuelling MOD.38 will not be incorporated. The refuelling panels can therefore be tested separately. It is recommended that whenever possible, the later type refuelling panel be tested in conjunction with its associated flight refuelling panel.

4. The following text contains a description of the test panel and test circuit, and operating and servicing instructions. Information on the Vulcan fuel system and the stabilised voltage power pack is contained in A.P.4505A & B, Vol. 1, Bk. 2, and on the fuel tank amplifier and Smiths Waymouth test set in A.P.1275A, Vol. 1, Sect. 18, and A.P.1275T, Vol. 1, Sect. 5, respectively.

DESCRIPTION

Construction

5. The test panel (*fig.* 1) is a framework of aluminium alloy angle covered by panels of aluminium alloy sheet. With the exception of the back and bottom panels which are secured by 2BA screws and anchor nuts, the panels are rivetted to the framework. The front panel which slopes upward to the rear is the control panel.

6. On the right hand side panel are mounted a 5 way terminal block, a type S2 relay, and the plugs and sockets which are the connections for the extension cables whereby the test panel is connected to the refuelling panel under test, and to the associated test equipment. Each plug and socket is identified by a label attached to the panel adjacent to it, the identification markings corresponding to those on the extension cables and on the connections of the refuelling panels.

7. The left hand side panel accommodates the fuse block, commoning bar and 2 type S4 relays.

Control panel

8. The control panel carries the test panel meter, switches and indicator lamps. Mounted at the panel centre position are two switches which are provided to set the test conditions appropriate to the panel under test. One, the PANEL SELECTOR SWITCH can be selected for either panel 36P or 37P, and the other, the PRE-MOD SWITCH, can be selected ON or OFF dependent on the modification state of the panel. When testing panels with flight refuelling MOD.38 incorporated, this switch will be set to the ON position.

9. The control switch for the flight refuelling panels is located at the top right hand corner of the control panel and is labelled MASTER REFUELLING SWITCH. This switch should be selected to the ON position during that portion of the tests applicable to flight refuelling panels 45P and 46P.

10. At the top of the panel ranging from left to right are the GROUP CONTENTS SELECTOR SWITCH which consists of two double linked switches labelled 1 and 4, and 2 and 3, a MILLIAMETER and the INDIVIDUAL/GROUP SELECTOR SWITCH labelled INDIVIDUAL and GROUP. Immediately below the milliammeter is the FUEL TRANSFER SWITCH which is a three position switch labelled FWD, OFF and AFT.

11. For indvidual tank indication and selection, seven refuelling valve indicator lamps, seven fuel level switches and seven fuel contents push switches are provided. These components are arranged in two groups, one of three on the L.H. side of the panel labelled 2, 3 and 6 respectively, and

the other of four on the R.H. side labelled 1, 4, 5 and 7 respectively, ◀ Two additional indicator lamps each identified DELAY are fitted one above each group. These lamps serve to indicate operation of the time delay fitted in the refuelling panels (para. 23 refers). ▶ Fitted centrally below each group is the AMPLIFIER SELECTOR SWITCH associated with that group.

Panel wiring

12. Ten cable looms are employed to connect the plugs and sockets to the test panel components, and individual cable assemblies are used for other internal connections. Unipren 6 cable is used throughout.

Extension cables

13. To connect the test panel to the associated test equipment and to the refuelling panel under test, eleven extension cables are provided. These cables are used for testing both panels 36P and 37P, and when necessary are identified by two numbers which correspond to the connections on the respective panels. The panel supply cable terminates in a 2 way terminal block which is the connection for the 28 volt d.c. external supply. Details of the extension cable assemblies are given in Table 1.

Test circuit

14. The refuelling panels accommodate the moving coil relays, resistance network and the auto-selector and operating relays which control the refuelling and fuel transfer systems. During the ground refuelling operation, the control system ensures that each tank is filled to the same percentage of its capacity, the tanks within each group are refuelled individually and in sequence commencing with the forward tanks, and an automatic change over is made to the next tank.

15. To check that the control components are functioning correctly and in the proper sequence it is necessary to provide a means of selecting the refuelling capacity and then simulating an increase in tank contents to this level. A stablised voltage power pack, a fuel tank amplifier, and a Smiths-Waymouth test set are used for this purpose, and are interconnected to the test panel and the refuelling panel by means of the extension cables.

16. The block diagram (*fig.* 3) shows the arrangement of the test circuit for testing both the refuelling and flight refuelling panels. The 28 volt d.c. supply is taken via the supply extension cable to the test panel fuse block, from which it is fed to the

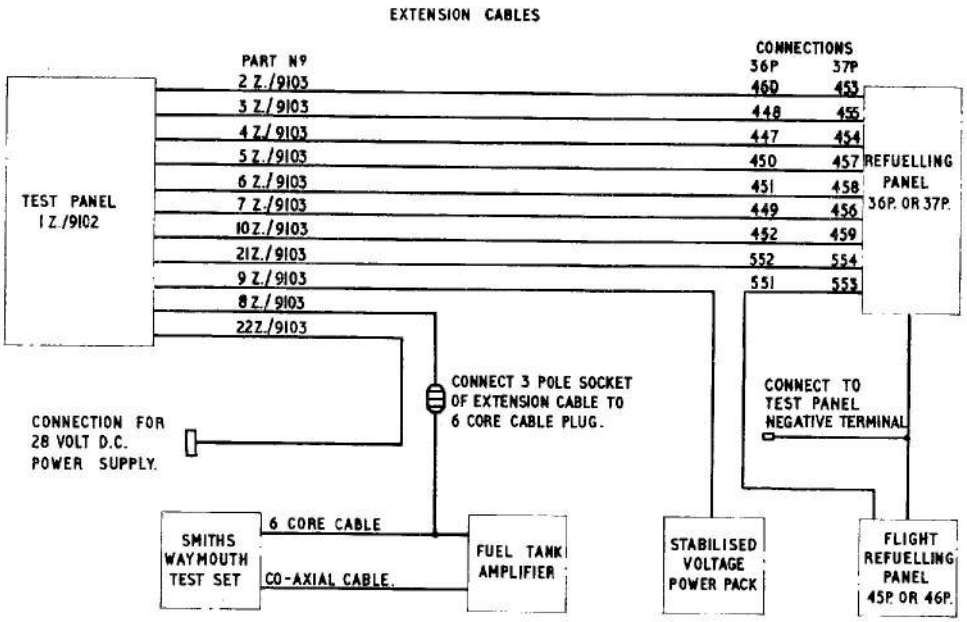

Fig. 3. Arrangement of test circuit

refuelling panel and the amplifier. Supply to the power pack is controlled by the panel selector switch. In the 37P position supply will be from the test panel, in the 36P position from the refuelling panel. When testing the flight refuelling panel, selection of the master refuelling switch to the ON position will energise the type S2 relay and switch the supply via the refuelling panel connection to the flight refuelling panel.

17. Due to the different configuration of the connections on the earlier refuelling panels without flight refuelling incorporated the extension cable identified 552/554 will not be required when testing this type of panel. The two type S4 relays in conjunction with the pre-mod. switch are used to effect the change over in supply to the appropriate connections on the refuelling panel.

OPERATION

General

18. The test panel should be located at any convenient position so that connections can be made to the refuelling panels and to the associated test equipment. A switch controlled 28 volt d.c. supply from a suitable ground source will be required. Before proceeding with any tests the serviceability of the stabilised voltage power pack, the fuel tank amplifier and the Smiths-Waymouth test set must be established. The method of proving the test panel is given in para. 30.

19. Panels 36P and 45P are part of the port fuel system installation and serve tank groups No. 1 and 2. Panels 37P and 46P serve starboard tank groups No. 4 and 3. As the function of the corresponding panels is the same, the test procedure for panel 36P is identical to that of panel 37P, and panel 45P identical to that of panel 46P. In order that the test procedure may be adapted for both sets of panels, components associated with panels 36P and 45P are shown in the normal text, and those associated with panel 37P and 46P in italics.

Pre-test requirements

20. (1) Using the appropriate extension cables connect the test panel to the refuelling panel 36P or 37P and the stabilised voltage power pack.

Note . . .

Extension cable 552/554 *will not be required when testing panels to pre-Mod.* 38 *standard.*

(2) Connect the amplifier to the test panel and the Smiths-Waymouth test set, using the amplifier supply extension cable, and the special 6 core and co-axial cables supplied with the test set.

(3) When applicable, connect the flight refuelling panel 45P or 46P to the refuelling panel, and to the negative terminal on the test panel.

(4) Connect the supply extension cable to the test panel.

(5) Connect the 28 volt d.c. supply to the supply cable terminal block.

Test procedure

Ground refuelling—Test 1

21. This test is intended to prove the proper sequencing of the refuelling circuit in conjunction with operation of the override switches.

(1) No. 1 GROUP (*No.* 4 *GROUP*)

(a) Set the test panel selector switch to 36P or 37P as appropriate to the panel under test.

(b) Set pre-mod. switch to ON for panels with MOD.38 embodied, OFF for panels without MOD.38 embodied.

(c) Set fuel level switches on test panel to ON.

(d) Set all other switches on the test panel to OFF.

(e) Switch ON 28 volt d.c. supply.

Note . . .

Within a few seconds the valve filaments in the stabilised voltage pack will reach operating temperature and the refuelling indicator on panel 36*P* (37*P*) *will light.*

(f) Switch ON tank group master switches on panel 36P (37P) and check that the switches hold in with positive action.

(g) Switch OFF No. 2 group master switch.

(h) Operate the start switch on panel 36P (37P) to select No. 1 tank. This will be indicated by No. 1 group and No. 1 tank indicator lamps on 36P (37P) and the No. 1 refuelling valve indicator lamp on the test panel coming ON. Check that the milliammeter needle on No. 1 moving coil relay on panel 36P (37P) moves to the extreme left of the scale.

(i) Operate No. 1 (No. 4) group override switch on panel 36P (37P) and check the following :

(i) No. 1 tank indicator lamp on panel 36P (37P) is OUT.

(ii) No. 4 tank indicator lamp on panel 36P (37P) is ON.

(iii) No. 1 refuelling valve indicator lamp on test panel is OUT.

(iv) No. 4 refuelling valve indicator lamp on test panel is ON.

(j) Operate No. 1 (No. 4) group override switch on panel 36P (37P) and check the following :

(i) No. 4 tank indicator lamp on panel 36P (37P) is OUT.

(ii) No. 5 tank indicator lamp on panel 36P (37P) is ON.

(iii) No. 4 refuelling valve indicator lamp on test panel is OUT.

(iv) No. 5 refuelling valve indicator lamp on test panel is ON.

(k) Operate No. 1 (No. 4) group override switch on panel 36P (37P) and check the following :

(i) No. 5 tank indicator lamp on panel 36P (37P) is OUT.

(ii) No. 7 tank indicator lamp on panel 36P (37P) is ON,

(iii) No. 5 refuelling valve indicator lamp on test panel is OUT.

(iv) No. 7 refuelling valve indicator lamp on test panel is ON.

(l) Operate No. 1 (No. 4) group override switch on panel 36P (37P) and check the following :

(i) Master switch on panel 36P (37P) automatically trips to OFF.

(ii) All indicator lamps on panel 36P (37P) and the test panel are OUT.

(2) No. 2 GROUP (*No. 3 GROUP*)

(a) Switch ON tank group master switches on panel 36P (37P) and check that switches hold in with positive action.

(b) Switch OFF No. 1 group master switch.

(c) Operate start switch on panel 36P (37P) to select No. 2 tank. This will be indicated by No. 2 group and No. 2 tank indicator lamps on panel 36P (37P) and No. 2 refuelling valve indicator lamp on the—test panel coming ON. Check that the milliammeter needle on No. 2 moving coil relay on panel 36P (37P) moves to the extreme left of the scale.

(d) Operate No. 2 (No. 3) override switch on panel 36P (37P) and check the following :

(i) No. 2 tank indicator lamp on panel 36P (37P) is OUT.

(ii) No. 3 tank indicator lamp on panel 36P (37P) is ON.

(iii) No. 2 refuelling valve indicator lamp on test panel is OUT.

(iv) No. 3 refuelling valve indicator lamp on test panel is ON.

(e) Operate No. 2 (No. 3) override switch on panel 36P (37P) and check the following :

(i) No. 3 tank indicator lamp on panel 36P (37P) is OUT.

(ii) No. 6 tank indicator lamp on panel 36P (37P) is ON.

(iii) No. 3 refuelling valve indicator lamp on test panel is OUT.

(iv) No. 6 refuelling valve indicator lamp on test panel is ON.

(f) Operate No. 2 (No. 3) override switch on panel 36P (37P) and check the following :

(i) Master switch on panel 36P (37P) automatically trips to OFF.

(ii) All indicator lamps on panel 36P (37P) and the test panel are OUT.

Ground refuelling—Test 2

22. In this test the refuelling circuit is checked with simulated fuel level switch operation.

Note . . .

When Mods. 847 (*Mk.* 2 *aircraft*) *and* 858 (*Mk.* 1 *aircraft*) *are embodied, the refuelling panel will incorporate an electrical time delay in the change-over circuit for each tank group. A short period will elapse between change-over from one tank to the next, and during this period, the test panel delay indicator appropriate to the tank group will light.* ▶

(1) No. 1 GROUP (*No.* 4 *GROUP*)

(a) Switch ON No. 1 (No. 4) master switch on panel 36P (37P).

(b) Operate start switch on panel 36P (37P) to select No. 1 tank.

(c) Set No. 1 fuel level switch on test panel to TRIP and check the the following :

(i) No. 1 tank and No. 1 refuelling valve indicator lamps are OUT.

(ii) No. 4 tank and No. 4 refuelling valve indicator lamps are ON.

(d) Set No. 4 fuel level switch on test panel to TRIP and check the following :

(i) No. 4 tank and No. 4 refuelling valve indicator lamps are OUT.

(ii) No. 5 tank and No. 5 refuelling valve indicator lamps are ON.

(e) Set No. 5 fuel level switch on test panel to TRIP and check the following :

(i) No. 5 tank and No. 5 refuelling valve indicator lamps are OUT.

(ii) No. 7 tank and No. 7 refuelling valve indicator lamps are ON.

(f) Set No. 7 fuel level switch on test panel to TRIP and check the following :

(i) Master switch on panel 36P (37P) automatically trips to OFF.

(ii) All indicator lamps on panel 36P (37P) and test panel are OUT.

(2) No. 2 GROUP (*No.* 3 *GROUP*)

(a) Switch ON No. 2 (No. 3) master switch on panel 36P (37P).

(b) Operate start switch on panel 36P (37P) to select No. 2 tank.

(c) Set No. 2 fuel level switch on test panel to TRIP and check that :

(i) No. 2 tank and No. 2 refuelling valve indicator lamps are OUT.

(ii) No. 3 tank and No. 3 refuelling valve indicator lamps are ON.

(d) Set No. 3 fuel level switch on test panel to TRIP and check that :

(i) No. 3 tank and No. 3 refuelling valve indicator lamps are OUT.

(ii) No. 6 tank and No. 6 refuelling valve indicator lamps are ON.

(e) Set No. 6 fuel level switch on test panel to TRIP and check that :

(i) Master switch on panel 36P (37P) automatically trips to OFF.

(ii) All indicator lamps on panel 36P (37P) and test panel are OUT.

Ground refuelling—Test 3

23. This test is intended to check moving coil relay operation and correct adjustment of the resistance network.

(1) No. 1 GROUP (*No.* 4 *GROUP*)

(a) Make the following adjustments on the Smiths-Waymouth test set :

(i) Switch ON and check 28 volt input.

(ii) Set the selector switch to No. 3 position for indication on the milliampere scale.

(iii) Set the capacitor selector switch to 1500.

(iv) Set the variable capacitor to 100.

(b) Set all fuel level switches on the test panel to ON.

(c) Select 50% on stabilised voltage power pack.

(d) Set amplifier selector switch on test panel to No. 1.

(e) Set group contents selector switch on test panel to No. 1 and 4.

(f) Set individual group selector switch on test panel to GROUP.

(i) Check that the milliammeters on the test panel and Smiths-Waymouth test set indicate approximately 3·4mA.

(g) Set individual group selector switch to INDIVIDUAL.

(i) Check that the milliammeters indicate approximately 3·4mA.

Note . . .

Simulation of increasing fuel tank contents is achieved by increasing the output of the fuel tank amplifier. The variable capacitor on the Smiths-Waymouth test set is provided for this purpose.
With a selection 50% on the stabilised voltage power pack, it will now be necessary to simulate an increase in tank contents to the 50% level, at which the refuelling of a particular tank should be interrupted by the action of the moving coil relay.

(h) Switch ON No. 1 (No. 4) master switch on panel 36P (37P).

(i) Operate start switch on panel 36P (37P) to select No. 1 tank.

(j) Increase capacitance by means of the variable capacitor on the Smiths-Waymouth test set and, as capacitance is increased, check that :

(i) The readings on the milliammeters increase.

(ii) The milliammeter needle on No. 1 moving coil relay on panel 36P (37P) moves toward the right of the scale.

(k) Increase capacitance until No. 1 tank trips. This will be indicated by No. 1 tank and No. 1 refuelling valve indicator lamps going OUT, and No. 4 tank and No. 4 refuelling valve indicator lamps coming ON.

(i) Check that the moving coil relay needle has moved to extreme right of the scale.

(l) Decrease capacitance.

(m) Set amplifier selector switch on test panel to No. 4.

(n) Repeat operations (j) to (l) inclusive, and check that as No. 4 tank trips No. 5 tank is automatically selected.

(o) Set amplifier selector switch on test panel to No. 5.

(p) Repeat operations (j) to (l) inclusive, and check that as No. 5 tank trips, No. 7 tank is automatically selected.

(q) Set amplifier selector switch on test panel to No. 7.

(r) Repeat operations (j) and (k) and as No. 7 tank trips, check that :

(i) Master switch on panel 36P (37P) automatically trips to OFF.

(ii) All indicator lamps on panel 36P (37P) and test panel are OUT.

(2) No. 2 GROUP (*No. 3 GROUP*)

(a) Repeat operations detailed in para, 23. sub-paras. (1)(a) to (g) inclusive.

(b) Set amplifier selector switch on the test panel to No. 2.

(c) Switch ON No. 2 (No. 3) master switch on panel 36P (37P).

(d) Operate start switch on panel 36P (37P) to select No. 2 tank.

(e) Increase capacitance by means of the variable capacitor on the Smiths-Waymouth test set, and as capacitance is increased check that :

(i) The readings on the milliammeters increase.

(ii) The milliammeter needle on No. 2 coil relay on panel 36P (37P) moves towards the right of the scale.

(f) Increase capacitance until No. 2 tank trips, and No. 3 tank is automatically selected. At position of trip check that :

(i) No. 2 tank and No. 2 refuelling valve indicator lamps are OUT, and No. 3 tank and No. 3 refuelling valve indicator lamps are ON.

(ii) The milliammeter needle on No. 2 moving coil relay on panel 36P (37P) moves to the extreme right of the scale.

(g) Decrease capacitance.

(h) Set amplifier selector switch on test panel to No. 3.

(i) Repeat operations (e) to (g) inclusive, and check that as No. 3 tank trips, No. 6 tank is automatically selected.

(j) Set amplifier selector switch on test panel to No. 6.

(k) Repeat operations (e) and (f) and as No. 6 tank trips check that ;

(i) Master switch on panel 36P (37P) automatically trips to OFF.

(ii) All indicator lamps on panel 36P (37P) and the test panel are OUT.

Ground refuelling—Test 4

24. In this test, the operation of the test controls should set up in the refuelling panel conditions similar to those which would occur during normal refuelling of the aircraft system. Moving coil relay operation is checked in conjunction with fuel tank capacitance.

(1) No. 1 GROUP (*No.* 4 *GROUP*)

(a) Trim the No. 1, 4, 5 and 7 variable trimmers on panel 36P (37P) to the minimum position by turning anticlockwise.

(b) Select 100% on stabilised voltage power pack.

(c) Switch ON No. 1 (No. 4) master switch on panel 36P (37P).

(d) Operate start switch on panel 36P (37P) to select No. 1 tank.

(e) Set amplifier selector switch on test panel to No. 1.

(f) Increase capacitance by means of the Smiths-Waymouth test set until No. 1 tank trips, and carefully note and record the milliammeter reading at which tripping occurs.

(g) Select in turn No. 4, 5, and 7 on the amplifier selector switch, and at each setting, increase capacitance until the subject tank trips and note and record milliameter readings.

(h) Reset the No. 1, 4, 5 and 7 variable trimmers on panel 36P (37P) to the maximum position by turning clockwise and repeat operations (b) to (g) inclusive.

◀ (i) Check that the milliammeter readings at minimum and maximum trim are within the following limits ; subject to the modification status of the panel. ▶

◀ **Pre. Mod. 501**

Tank No.	*Minimum* ±5%	*Maximum* ±5%
1	6·3mA.	7·5mA.
4	6·3mA.	7·5mA.
5	5·7mA.	6·55mA.
7	6·0mA.	7·0mA.

Post Mod. 501

1	6·6mA.	7·9mA.
4	6·6mA.	7·9mA.
5	5·7mA.	6·55mA.
7	6·0mA.	7·0mA. ▶

(j) Reset variable trimmers to minimum position and decrease capacitance.

(k) Disconnect the fuel level override relay connections at 'A' coil of No. 1 moving coil relay on panel 36P (37P) and connect a test lamp and battery to the disconnected leads.

(l) Switch ON No. 1 (No. 4) master switch on panel 36P (37P).

(m) Operate start switch on panel 36P (37P) to select No. 1 tank.

(n) Set amplifier selector switch on test panel to No. 1.

(o) Select 50% on stabilised voltage power pack.

(p) Increase capacitance on Smiths-Waymouth test set until No. 1 tank trips, and check that the test lamp lights at moment of trip.

(q) Set master switch on panel 36P (37P) to OFF.

(r) Switch OFF Smiths-Waymouth test set.

(s) Re-connect the fuel level override relay to 'A' coil of No. 1 moving coil relay.

(t) Set master switch on panel 36P (37P) to ON, and select No. 1 tank.

(u) Switch ON Smiths-Waymouth test set and increase capacitance until No. 1 tank trips.

(v) Set master switch on 36P (37P) to OFF.

(2) No. 2 GROUP (*No.* 3 *GROUP*)

(a) Trim the No. 2, 3 and 6 variable trimmers on panel 36P (37P) to the minimum position by turning anticlockwise.

(b) Select 100% on stabilised voltage power pack.

(c) Switch ON No. 2 (No. 3) master switch on panel 36P (37P).

(d) Operate start switch on panel 36P (37P) to select No. 2 tank.

(e) Set amplifier selector switch on test panel to No. 2.

(f) Increase capacitance by means of the Smiths-Waymouth test set until No. 2 tank trips and carefully note and record the milliammeter readings at which tripping occurs.

(g) Select in turn No. 3 and 6 on the amplifier selector switch, and at each setting, increase capacitance until the subject tank trips and note and record milliammeter readings.

(h) Reset the No. 2, 3 and 6 variable trimmers on panel 36P (37P) to the maximum position by turning clockwise and repeat operations (b) to (g) inclusive.

(i) Check that the milliammeter readings at minimum and maximum trim are within the following limits, subject to the modification status of the panel,

Pre Mod. 501

Tank No.	*Minimum* ±5%	*Maximum* ±5%
2	6·3mA.	7·5mA.
3	5·16mA.	5·75mA.
6	5·7mA.	6·5mA.

Post Mod. 501

2	6·6mA.	7·9mA.
3	5·16mA.	5·75mA.
6	5·75mA.	6·2mA.

(j) Reset variable trimmers to the minimum position and decrease capacitance.

(k) Disconnect the fuel level override relay connections at 'A' coil of No. 2 moving coil relay on panel 36P (37P) and connect a test lamp and battery to the disconnected leads.

(l) Switch ON No. 2 (No. 3) master switch on panel 36P (37P).

(m) Operate start switch on panel 36P (37P) to select No. 2. tank

(n) Select amplifier selector switch on test panel to No. 2.

(o) Select 50% on the stabilised voltage power pack.

(p) Increase capacitance on Smiths-Waymouth test set until No. 2 tank trips, and check that the test lamp lights at moment of trip.

(q) Set master switch on panel 36P (37P) to OFF.

(r) Switch OFF, Smiths-Waymouth test set.

(s) Re-connect the fuel level override relay to 'A' coil of No. 2 moving coil relay.

(t) Set master switch on panel 36P (37P) to ON, and select No. 2 tank.

(u) Switch ON Smiths-Waymouth test set and increase capacitance until No. 2 tank trips.

(v) Set master switch on panel 36P (37P) to OFF.

Checking individual tank contents system

25. This system may be checked as follows:-

(1) No. 1 GROUP (*No. 4 GROUP*)

(a) Set the variable capacitor on Smiths-Waymouth test set to low capacitance position.

(b) Set amplifier selector switch on test panel to No. 1.

(c) Engage No. 1 fuel contents switch on test panel and check that an indication is shown on the milliammeters.

(d) Engage, in turn, No. 4, 5 and 7 fuel contents switches. There should be no indication on the milliammeters.

(e) Set amplifier selector switch to No. 4.

(f) Engage No. 4 fuel contents switch and check that an indication is shown on the milliammeters.

(g) Engage, in turn, No. 1, 5 and 7 fuel contents switches and check that at each selection there is no indication on the milliammeters.

(h) Set amplifier selector switch to No. 5.

(i) Engage No. 5 fuel contents switch and check that an indication is shown on the milliammeters.

(j) Engage, in turn, No. 1, 4 and 7 fuel contents switches and check that at each selection there is no indication on the milliammeters.

(k) Set amplifier selector switch to No. 7.

(l) Engage No. 7 fuel contents switch and check that an indication is shown on the milliammeters.

(m) Engage, in turn, No. 1, 4 and 5 fuel contents switches and check that at each selection there is no indication on the milliammeters.

(2) No. 2 GROUP (*No. 3 GROUP*)

(a) Set the variable capacitor on the Smiths-Waymouth test set to the low capacitance position.

(b) Set amplifier selector switch on test panel to No. 2.

(c) Engage No. 2 fuel contents switch on test panel and check that an indication is shown on the milliammeters.—

(d) Engage, in turn, No. 3 and No. 6 fuel contents switches and check that at each selection there is no indication on the milliammeters. ▶

(e) Set amplifier selector switch on test panel to No. 3.

◀ (f) Engage No. 3 fuel contents switch and check that an indication is shown on the milliammeters.

(g) Engage, in turn, No. 2 and No. 6 fuel contents switches and check that at each selection there is no indication on the milliammeters.

(h) Set amplifier selector switch on test panel to No. 6.

(i) Engage No. 6 fuel contents switch and check that an indication is shown on the milliammeters. ▶

(j) Engage in turn No. 2 and No. 3 fuel contents switches and check that at each selection there is no indication on the milliammeters.

(k) Switch OFF Smiths-Waymouth test set.

Fuel transfer (normal)

26. (1) Set fuel transfer switch on test panel to AFT and check that ;

◀ (a) No. 7 tank indicator lamp on panel 36P (37P) and No. 7 refuelling valve indicator lamp on test panel are ON.

(2) Set fuel transfer switch on test panel to FWD and check that ;

(a) No. 1 tank indicator lamp on panel 36P (37P) and No. 1 refuelling valve indicator lamp on test panel are ON.

Flight refuelling

27. (1) Set master refuelling switch on test panel to ON, and check that all tank indicator lamps on panel 36P (37P) and refuelling valve indicator lamps on test panel are ON.

(2) Set fuel transfer switch on test panel to AFT and check that :

(a) No. 3, 4, 5, 6 and 7 tank and refuelling valve indicator lamps are ON.

(b) No. 1 and 2 tank and refuelling valve indicator lamps are OUT.

(3) Set fuel transfer switch on test panel to FWD and check that :

(a) No. 1 and 2 tank and refuelling valve indicator lamps are ON.

(b) No. 3, 4, 5, 6 and 7 tank and refuelling valve indicator lamps are OUT. ▶

(4) Set all switches on panel 36P (37P) and the test panel to the OFF position.

After test

28. (1) Switch OFF 28 volt d.c. supply.

(2) Disconnect the extension cables.

(3) Disconnect the 6 core and co-axial cables and stow in the Smiths-Waymouth test set.

SERVICING

General

29. The test set will require little servicing other than a periodic check of the lamp filaments for serviceability, the fuses for continuity, and the extension cables for damage to the outer covering and end connections. Cleanliness of the connections and in particular the Pye socket is essential. The milliammeter should be serviced as necessary in accordance with current instructions and calibrated against a master instrument at the periods recommended by the manufacturer.

Test panel proving

30. The serviceability of the test panel can be proved using the following tests. A test lamp or test meter will be required, with a 28 volt d.c. supply connected to the test panel supply plug.

Test No. 1 (Flight Refuelling and Fuel Transfer)

	Test Lamp Connections	*Switch function*	*Indication*
(1)	Plug 448 pin M—Plug 449 pin A.	Refuelling Master Switch ON	Lamp lit
		Refuelling Master Switch OFF.	Lamp extinguished
(2)	Plug 448 pin M—Plug 449 pin B.	Refuelling Master Switch ON.	Lamp lit
		Refuelling Master Switch OFF.	Lamp extinguished
(3)	Plug 448 pin 1—Plug 449 pin A.	Fuel Transfer Switch FWD.	Lamp lit
		Fuel Transfer Switch OFF.	Lamp extinguished
		Fuel Transfer Switch AFT.	Lamp extinguished
(4)	Plug 447 pin 1—Plug 449 pin A.	Fuel Transfer Switch FWD.	
		Refuelling Master Switch ON.	Lamp extinguished
		Refuelling Master Switch OFF.	Lamp lit
		Fuel Transfer Switch OFF.	Lamp extinguished
		Refuelling Master Switch ON.	Lamp extinguished
		Fuel Transfer Switch AFT.	Lamp extinguished
		Refuelling Master Switch OF.	Lamp extinguished
(5)	Plug 448 pin L—Plug 449 pin A.	Fuel Transfer Switch AFT.	Lamp lit
		Fuel Transfer Switch OFF.	Lamp extinguished
		Fuel Transfer Switch FWD.	Lamp extinguished
(6)	Plug 460 pin 2—Plug 449 pin A.	Fuel Transfer Switch AFT.	
		Refuelling Master Switch ON.	Lamp extinguished
		Refuelling Master Switch OFF.	Lamp lit
		Fuel Transfer Switch OFF.	Lamp extinguished
		Refuelling Master Switch ON.	Lamp extinguished
		Fuel Transfer Switch FWD.	Lamp extinguished
		Refuelling Master Switch OFF.	Lamp extinguished

Test No. 2 (Individual Tank contents. No. 1 and No. 4 groups)

(1)	Plug 460 pin D—Plug 449 pin A.	No. 1 Fuel Contents Switch ON.	Lamp lit
		No. 1 Fuel Contents Switch OFF.	Lamp extinguished
(2)	Plug 460 pin E—Plug 449 pin A.	No. 4 Fuel Contents Switch ON.	Lamp lit
		No. 4 Fuel Contents Switch OFF.	Lamp extinguished
(3)	Plug 460 pin F—Plug 449 pin A.	No. 5 Fuel Contents Switch ON.	Lamp lit
		No. 5 Fuel Contents Switch OFF.	Lamp extinguished
(4)	Plug 460 pin G—Plug 449 pin A.	No. 7 Fuel Contents Switch ON.	Lamp lit
		No. 7 Fuel Contents Switch OFF.	Lamp extinguished

Test No. 3 (Individual Tank contents No. 2 and No. 3 groups)

(1)	Plug 460 pin L—Plug 449 pin A.	No. 2 Fuel Contents Switch ON.	Lamp lit
		No. 2 Fuel Contents Switch OFF.	Lamp extinguished
(2)	Plug 460 pin M—Plug 449 pin A.	No. 3 Fuel Contents Switch ON.	Lamp lit
		No. 3 Fuel Contents Switch OFF.	Lamp extinguished
(3)	Plug 460 pin 1—Plug 449 pin A.	No. 6 Fuel Contents Switch ON.	Lamp lit
		No. 6 Fuel Contents Switch OFF.	Lamp extinguished

Test No. 4 (Group Contents No. 1 and No. 4)

Test lamp connections	*Switch function*	*Indication*
(1) Disconnect the lead from the milliammeter negative and temporarily link this lead to the milliammeter positive.		
(2) Plug 460 pin A—Plug 449 pin A.	Indiv. group selector to INDIVIDUAL.	Lamp lit
(3) Plug 460 pin B—Plug 449 pin A.	Group selector to 1 and 4.	Lamp lit
	Group selector to 2 and 3.	Lamp extinguished
	Indiv. group selector to GROUP	
(4) Plug 460 pin C—Plug 449 pin A.	Group selector to 1 and 4.	Lamp lit
	Group selector to 2 and 3.	Lamp extinguished

Test No. 5 (Group contents No. 2 and No. 3)

	Indiv. group selector to INDIVIDUAL.	
(1) Plug 460 pin J—Plug 449 pin A.	Group selector to 2 and 3	Lamp lit
	Group selector to 1 and 4	Lamp extinguished
	Indiv. group selector to GROUP.	
(2) Plug 460 pin K—Plug 449 pin A.	Group selector to 2 and 3	Lamp lit
	Group selector to 1 and 4	Lamp extinguished
(3) Disconnect the temporary link and reconnect the lead to the milliammeter negative.		

Test No. 6 (Amplifier Supply)

Connect temporary link between Amplifier plug pins A and C	Pre-Mod. Switch ON. Group selector to 1 and 4.	
(1) Plug 552 pin 1—Plug 449 pin A.	No. 1 Amplifier Selector Switch to No. 1.	Lamp lit
(2) Plug 552 pin 4—Plug 449 pin A.	No. 1 Amplifier Selector Switch to No. 4.	Lamp lit
(3) Plug 552 pin 5—Plug 449 pin A.	No. 1 Amplifier Selector Switch to No. 5.	Lamp lit
(4) Plug 552 pin 7—Plug 449 pin A.	No. 1 Amplifier Selector Switch to No. 7. Group Selector to 2 and 3.	Lamp lit
(5) Plug 552 pin 2—Plug 449 pin A.	No. 2 Amplifier Selector Switch to No. 2.	Lamp lit
(6) Plug 552 pin 3—Plug 449 pin A.	No. 2 Amplifier Selector Switch to No. 3.	Lamp lit

Test lamp connections	*Switch function*	*Indication*
(7) Plug 552 pin 6—Plug 449 pin A.	No. 2 Amplifier Selector Switch to No. 6.	Lamp lit
(8) At each of the above tests, lamp should be extinguished when PRE-MOD switch is set to OFF.	Pre-Mod. Switch OFF Group Selector to 1 and 4.	
(9) Plug 447 pin E—Plug 449 pin A.	No. 1 Amplifier Selector Switch to No. 1.	Lamp lit
(10) Plug 448 pin D—Plug 449 pin A.	No. 1 Amplifier Selector Switch to No. 4.	Lamp lit
(11) Plug 450 pin 1—Plug 449 pin A.	No. 1 Amplifier Selector Switch to No. 5.	Lamp lit
(12) Plug 450 pin 3—Plug 449 Pin A	No. 1 Amplifier Selector Switch to No. 7 Group Selector to 2 and 3.	Lamp lit
(13) Plug 447 pin J—Plug 449 pin A.	No. 2 Amplifier Selector Switch to No. 2.	Lamp lit
(14) Plug 451 pin D—Plug 449 pin A.	No. 2 Amplifier Selector Switch to No. 3.	Lamp lit
(15) Plug 448 pin E—Plug 449 pin A.	No. 2 Amplifier Selector Switch to No. 6.	Lamp lit
(16) At each of the above tests, lamp should be extinguished when PRE-MOD switch is set to ON. Remove temporary link from Amplifier plug pins A and C.		

Test No. 7 (Panel Selector Switch and Power Pack Supply)

(1) Power Pack Plug pin A and pin B.	Panel Selector Switch to 37P. Panel Selector Switch to 36P.	Lamp lit Lamp extinguished
(2) Set Panel Selector Switch to 36P. (a) Test for continuity between Power Pack Plug pin A and Plug 452 pin A. (b) Test for continuity between Power Pack Plug pin B and Plug 452 pin B.		
(3) Test for continuity between Power Pack plug pin C and Plug 452 Pin C. Test for continuity between Power Pack Plug pin D and Plug 452 pin D.		

Test No. 8 (Fuel level switches and indicators, No. 1 and No. 4 Groups)

(1) Set No. 1 Fuel level switch to TRIP.
Check for continuity between Plug 447 pin L and Plug 447 pin M.

(2) Set No. 4 Fuel level switch to TRIP.
Check for continuity between Plug 448 pin J and Plug 448 pin K.

(3) Set No. 5 Fuel level switch to TRIP.
Check for continuity between Plug 450 pin 5 and Plug 450 pin 7.

Test lamp connections	*Switch function*	*Indication*
(4) Set No. 7 Fuel level switch to TRIP. Check for continuity between plug 450 pin 6 and Plug 450 pin 7.		
(5) Connect temporary link between Amplifier Plug pin A and Plug 447 pin M.		
	(a) Set No. 1 Fuel level switch to ON.	No. 1 indicator lamp should light.
	(b) Set No. 1 Fuel level switch to TRIP.	No. 1 indicator lamp should be extinguished. Delay indicator lamp should light.
(6) Connect temporary link between Amplifier Plug pin A and Plug 448 pin J.		
	(a) Set No. 4 fuel level switch to ON.	No. 4 indicator lamp should light.
	(b) Set No. 4 Fuel level switch to TRIP.	No. 4 indicator lamp should be extinguished.
(7) Connect temporary link between Amplifier Plug pin A and Plug 450 pin 5.		
	(a) Set No. 5 Fuel level switch to ON.	No. 5 indicator lamp should light.
	(b) Set No. 5 Fuel level switch to TRIP.	No. 5 indicator lamp should be extinguished.
(8) Connect temporary link between Amplifier Plug pin A and Plug 450 pin 6.		
	(a) Set No. 7 Fuel level switch to ON.	No. 7 indicator lamp should light.
	(b) Set No. 7 Fuel level switch to TRIP.	No. 7 indicator lamp should be extinguished.

Test No. 9 (Fuel level switches and indicators No. 2 and No. 3 groups)

(1) Set No. 2 Fuel level switch to TRIP. Check for continuity between Plug 447 pin B and Plug 447 pin C.		
(2) Set No. 3 Fuel level switch to TRIP. Check for continuity between Plug 451 pin A and Plug 451 pin B.		
(3) Set No. 6 Fuel level switch to TRIP. Check for continuity between Plug 448 pin A and Plug 448 pin B.		
(4) Connect temporary link between Amplifier plug pin A and plug 447 pin B.		
	(a) Set No. 2 Fuel level switch to ON.	No. 2 indicator lamp should light.
	(b) Set No. 2 Fuel level switch to TRIP.	No. 2 indicator lamp should lie extinguished. Delay indicator lamp should light.
(5) Connect temporary link between Amplifier Plug A and Plug 451 pin B.		
	(a) Set No. 3 Fuel level switch to ON.	No. 3 indicator lamp should light.
	(b) Set No. 3 Fuel level switch to TRIP.	No. 3 indicator lamp should be extinguished.
(6) Connect temporary link between Amplifier Plug A and Plug 448 pin B.		
	(a) Set No. 6 Fuel level switch to ON.	No. 6 indicator lamp should light.
	(b) Set No. 6 Fuel level switch to TRIP.	No. 6 indicator lamp should be extinguished.

(*continued on next leaf*)

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Test No. 10 (Fused through feeders)

(1) Fuse No. 3. Test lamp should light when connected between plug 447 pin A and plug 449 pin A.

(2) Fuse No. 4. Test lamp should light when connected between plug 448 pin H and plug 449 pin A.

(3) Fuse No. 7. Test lamp should light when connected between plug 448 pin G and plug 449 pin A.

(4) Fuse No. 8. Test lamp should light when connected between plug 447 pin 2 and plug 449 pin A.

Table 1

Extension Cable Looms

Part No.	Ident.	Cable	End "A" Test panel	Connections	End "B"	Length
2.Z.9013	460/453	Unipren 6	Socket CZ.71751	A to A B to B C to C D to D E to E F to F G to G H to H J to J K to K L to L M to M 1 to 1 2 to 2	Socket CZ.71751	5′ 0″
3.Z.9103	448/455	Unipren 6	Socket CZ.71751	A to A B to B D to D E to E G to G H to H J to J K to K L to L M to M 1 to 1	Socket CZ.71751	5′ 0″
4.Z.9103	447/454	Unipren 6	Socket CZ.71751	A to A B to B C to C E to E J to J L to L M to M 1 to 1 2 to 2	Socket CZ.71751	5′ 0″
5.Z.9103	450/457	Unipren 6	Socket CZ.56100	1 to 1 3 to 3 5 to 5 6 to 6 7 to 7	Socket CZ.56100	5′ 0″
6.Z.9103	451/458	Unipren 6	Socket CZ.56092	A to A B to B D to D	Socket CZ.56092	5′ 0″
7.Z.9103	449/456	Unipren 6	Socket CZ.56084	A to A B to B	Socket CZ.56084	5′ 0″

Table 1—contd.

Extension Cable Looms

Part No.	Ident.	Cable	End "A" Test panel	Connections	End "B"	Length
8.Z.9103	Amplifier supply	Unipren 6	Plug Mk. 4 2.CZ.84092	A to A B to B C to C	Socket 2.CZ.84104	3′ 9″
9.Z.9103	Power pack supply	Unipren 6	Socket CZ.56092	A to 1 C to 2 D to 3 B to 4	Pye socket and Angle entry cover 734491/730606	3′ 9″
10.Z.9103	Fuel panel 452/459	Unipren 6	Socket CZ.56092	A to A B to B C to C D to D	Socket Z.56088	5′ 0″
21.Z.9103	552/554	Unipren 6	Socket CZ.56100	1 to 1 2 to 2 3 to 3 4 to 4 5 to 5 6 to 6 7 to 7	Socket CZ.56100	5′ 0″
22.Z.9103	Panel supply	Unipren 6	Socket CZ.56084	A to terminal block B to terminal block	2 way terminal block 5C/430	6′ 9″

Table 2

Cable Looms—Internal Wiring

Part No.	Plug Ident.	Cable	End "A"	Connections	End "B"
2Z.9648	447/454	Unipren 6	Plug CZ.28108	A to fuse 3	5H/25
				B to trip switch 2-2	Bare
				C to trip switch 2-3	Bare
				D —	
				E to relay A-8	Bare
				F —	
				G —	
				H —	
				J to relay A-6	Bare
				K —	
				L to trip switch 1-3	Bare
				M to trip switch 1-2	Bare
				1 to relay C-2a	Bare
				2 to fuse 8	5H/25.
3Z.9648	448/455	Unipren 6	Plug CZ.28108	A to trip switch 6-3	Bare
				B to trip switch 6-2	Bare
				C —	
				D to relay A-2	Bare
				E to Relay B-6	Bare
				F —	
				G to fuse 7	5H/25
				H to fuse 4	5H/25
				J to trip switch 4-2	Bare
				K to trip switch 4-3	Bare
				L to relay C-4	Bare
				M to refuelling master switch-1	Bare
				1 to relaying C-2	Bare
				2 —	
4Z.9648	460/453	Unipren 6	Plug CZ.28108	A to milliammeter +	HC/102
				B to group contents switch 1-3	Bare
				C to group contents switch 1-6	Bare
				D to push switch 1-1	Bare
				E to push switch 4-1	Bare
				F to push switch 5-1	Bare
				G to push switch 7-1	Bare
				H to milliammeter +	HC/102
				J to group contents switch 1-1	Bare
				K to group contents switch 1-4	Bare
				L to push switch 2-1	Bare
				M to push switch 3-1	Bare
				1 to push switch 6-1	Bare
				2 to relay C-4a	Bare
5Z.9648	450/457	Unipren 6	Plug CZ.50357	1 to relay B-8	Bare
				2 —	
				3 to relay B-4	Bare
				4	
				5 to trip switch 5-2	Bare
				6 to trip switch 7-2	Bare
				7 to trip switch 7-3	Bare
				8 —	
				9 —	

Table 2—contd.

Cable Looms—Internal Wiring

Part No.	Plug Ident.	Cable	End "A"	Connections	End "B"
6Z.9648	449/456	Unipren 6	Plug CZ.50354	A to terminal block-B B to terminal block-C	Bare Bare
7Z.9648	Amplifier supply	Unipren 6	Socket CZ.49223	A to fuse 10 B to terminal block-D C to group contents switch 2-2 D —	5H/25 Bare Bare
8Z.9648	451/458	Unipren 6	Plug CZ.50356	A to trip switch 3-3 B to trip switch 3-2 C — D to relay A-4 E —	Bare Bare Bare
9Z.9648	Power pack and 452/459	Unipren 6	Plug CZ.50356 Bare Bare	A to panel selector switch-2 B to panel selector switch-5 C to plug 452/459-C D to plug 452/459-D Panel selector switch-6 to B Panel selector switch-3 to A	Bare Bare Plug CZ.50356
10Z.9648	552/554	Unipren 6	Plug CZ.50357	1 to relay A-7a 2 to relay A-5a 3 to relay A-3a 4 to relay A-1a 5 to relay B-7a 6 to relay B-5a 7 to relay B-3a 8 — 9 —	Bare Bare Bare Bare Bare Bare Bare
55Z.9648	Panel supply	Unipren 6	Plug CZ.50354	A to terminal block-A B to terminal block-E	Bare Bare

Table 3

Schedule of Parts

Part No.	Description	Qty.	Manufacturer and/or Sec. & Ref. Nos.
45/Z.9102	Switch	3	5C/4182 (Rotax D.5506).
46/Z.9102	Switch	1	5C/4178 (Rotax D.5403).
47/Z.9102	Warning lamp	7	5C/1069 (Rotax H.2702)
48/Z.9102	Lamp filament	7	5L/9951273
80/Z.9102	Switch	7	N.F.S. 8284/B.4
50/Z.9102	Push switch	7	N.F.S. 8450/B.1
51/Z.9102	Selector switch	1	Sangamo Weston S18-112430
52/Z.9102	Selector switch	1	Sangamo Weston S18-112429
58/Z.9102	Fuse block 12-way Type S.	1	5H/75 (with commoning bar).
59/Z.9102	Indicator 3½"	1	Sangamo Weston No. S37-1-862.
61/Z.9102	Switch	1	5C/936.
66/Z.9102	Commoning bar.	1	5H/93.
69/Z.9102	Terminal block 5-way	1	5CZ/868
70/Z.9102	Relay, Type S2	1	5C/3943
71/Z.9102	Relay, Type S4	2	5C/3945
72/Z.9102	Switch	1	5CW/4184 (Rotax D.5404)
78/Z.9102	Switch	1	5CW/4198 (Rotax D.5504)
2/Z.9103	Cable loom 460/453	1	
3/Z.9103	Cable loom 448/455	1	
4/Z.9103	Cable loom 447/454	1	
5/Z.9103	Cable loom 450/457	1	
6/Z.9103	Cable loom 451/458	1	
7/Z.9103	Cable loom 449/456	1	
8/Z.9103	Cable loom amplifier supply	1	
9/Z.9103	Cable loom power pack supply	1	
10/Z.9103	Cable loom 452/459	1	
21/Z.9103	Cable loom 552/554	1	
22/Z.9103	Cable loom panel supply	1	
CZ.28108	Plug	3	Plessey
CZ.50357	Plug	2	Plessey
CZ.50356	Plug	3	Plessey
CZ.50354	Plug	2	Plessey
CZ.49223	Socket	1	Plessey

Table 1

Extension Cables

Part No.	Cable	Terminations and connections		Length
		Test Set Plug CZ.49180	*Aircraft* Connector Assy. 8U.1339	
19.U.1339	Trisheathground	Red A	Red Top	59 ft.
Starboard	7	Green B Blue C	Green Crocodile clip Blue Bottom	
		Plug CZ.49181	Connector Assy. 8U.1339	
20.U.1339 Port	Trisheathground 7	Red A Green B Blue C	Red Top Green Crocodile clip Blue Bottom	59 ft.

Table 2

Schedule of Parts

Part No.	Description	Qty.	Manufacturer, Sect. & Ref. No.
8/U.1339	Fuse end	2	Made from 5C/1881
26/U.1339	Locking guard	1	Rotax ZA 2402/1
27/U.1339	Free plug	1	Plessey Mk. 4. MIN.CZ49218
28/U.1339	Straight outlet Code 42	1	Plessey CZ.49180
29/U.1339	Cable clamp Code 42	2	Plessey CZ.69733
31/U.1339	Clip crocodile	2	Commercial
33/U.1339	Free plug	1	Plessey Mk. 4. MIN.C249218/5
34/U.1339	Angle outlet Code 42	1	Plessey CZ.49181
37/U.1339	Lamp warning, Type A	1	5 CX/1069
38/U.1339	Lamp warning, Type A	1	5 CX/1635
39/U.1339	Lamp filament	2	5L/9951271
40/U.1339	D.P. switch	1	5 CW/4223
41/U.1339	Circuit breaker, Type A	2	5 C/2559
44/U.1339	Fixed socket	1	Plessey Mk. 4 MIN.CZ.49219
45/U.1339	Fixed socket	1	Plessey Mk. 4 MIN.CZ.49219/5

DN. 2771/250/9.60/B. & S. Ltd./1437