Group D MISCELLANEOUS INSTRUMENTS

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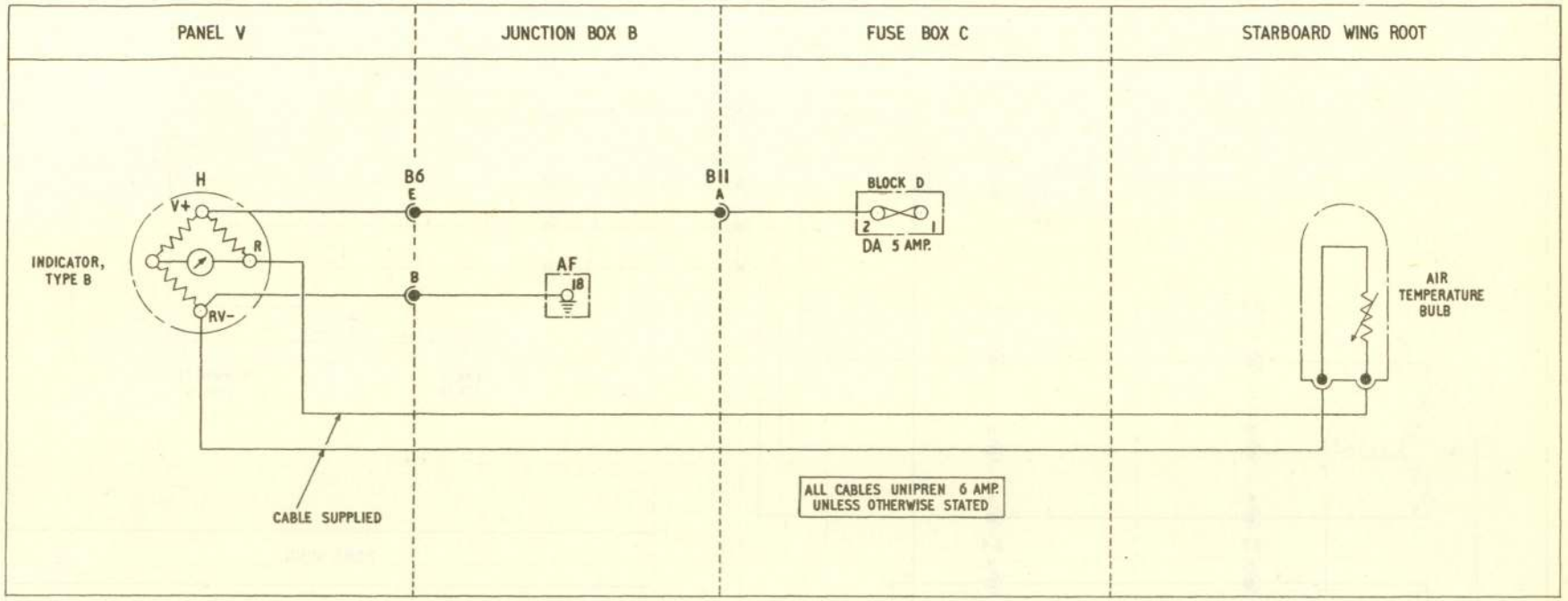

Fig. 1. Air temperature thermometer-DA

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INTRODUCTION

1. The instruments described in this group have not been included in the other groups of this chapter and as such, are classed as miscellaneous. Each instrument is described briefly with regard to its location in the aircraft, its principle of operation and servicing together with a reference to the specialist Air Publication where further information may be found.

DESCRIPTION

Air Thermometer

2. This instrument is mounted in the cockpit on panel V and is electrically-operated by a resistance bulb fitted in the starboard wing root by the nose fairing. The indicator is of the transmitting type operating on the ratiometer principle and is calibrated from -80 to +80 deg. C.

3. The transmitting unit, or resistance bulb, consists of a platinum element whose resistance varies with temperature. The resistance bulb is filled with hydrogen; the use of this gas gives a substantial improvement in response time, permitting heat exchange to pass more quickly between the surrounding air and the sensitive element.

4. Connection to the indicator is by means of a terminal block on the rear of the casing. The lettering "P. T. LAW" on the rear case indicates that the instrument operates on the platinum law and is therefore unsuitable for use with Mk.1 or Mk.2 resistance bulbs which operate on the nickel law. Further information concerning this instrument will be published in A. P. 1275A, Sect. 4, at a later date.

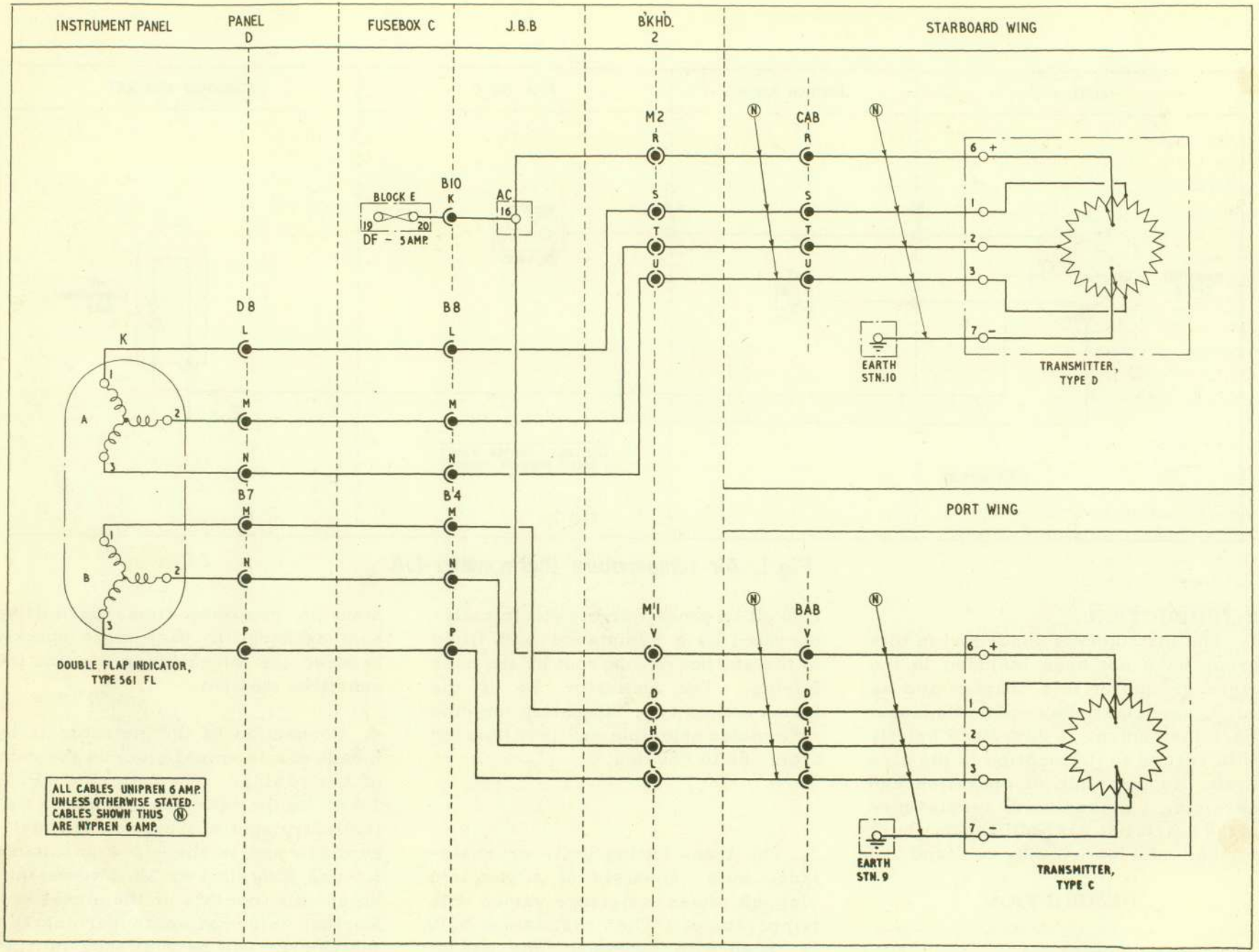

Fig. 2. Flap position indicator – DF

Brake pressure gauge

5. The brake pressure gauge is located on panel G below the main instrument panel, port side. This instrument is hydraulically operated and measures the pressure available in the main supply of the brake system and also the pressure applied to each brake, port and starboard. The gauge gives indication of each pressure on a single dial which has three scales; the centre scale being that for the air supply. Reference should be made to A.P.1275A, Vol.1, Sect.3, for further information.

Flaps position indicator

6. The flaps position indicator Smiths Type 561 FL has two indicator dials and is mounted to the left of the instrument panel. Port and starboard synchronous flap movement is shown on the two fluorescent dials of the instrument. Operating on the Desynn principle, each indicating pointer is actuated by signals received from independent transmitters, one attached to the port flap mechanism and the other to the starboard flap mechanism.

7. The port transmitter is a Type C while that on the starboard is a Type D. A description of the Desynn system is given in A.P.1275A, Vol.1, Sect.1.

Fuel contents

8. The location of the fuel contents equipment throughout the aircraft is shown in fig.3 and the interconnection of units is shown in fig.4. The operation of the equipment is based on the principle that the electrical value of a capacitor depends on the nature of the dielectric between the plates. Each tank unit is a capacitor and consists of two concentric cylindrical tubes arranged vertically in the tank, the tubes being separated by a small air gap which is filled with fuel, air, or both.

9. As the fuel in the tank rises, it replaces the air in the gap between the tubes, thus each tank unit serves as a variable capacitor, the electrical value of which changes as the level of the fuel rises or falls.

10. The tank units are so connected to give an indication of the aircraft fuel contents on a single gauge mounted on the upper starboard side of the instrument panel. A push-switch (totalised/fuselage), adjacent to the gauge, enables the pilot to check the contents of the main fuselage tank. For this purpose the gauge has an inner scale calibrated from 0 to 708 lb.; while the outer scale is calibrated from 0 to 2,410 lb. to represent the totalised fuel contents. The gauge reading calibrated in lb. (mass units), must be multiplied by ten to obtain the true weight of fuel on board. The Mk.5A fuel contents equipment is described in A.P.1275A, Vol.1, Sect.18.

11. The fuel contents installation in this aircraft comprises essentially the following equipment :-

Power unit	Type G.P.512/002
Rectifier unit	Type G.P.640/004
Relay and adjuster unit	Type G.P.814/008
Indicator gauge	Type G.P.250/009
Tank units	Type G.P.352/119 (main tank) G.P.384/040 (port and starboard wing tanks)

12. There is also a facility for checking, under non-flying conditions, the presence of water in the bottom of the fuselage tank. A toggle switch on the relay and adjuster unit switches in the water detector probe and if there is water present, the fuel contents indicator needle will drop below zero into the red sector of the dial.

13. Briefly, the water detector probe is a short metal rod, with an insulated sheath which only partly covers the electrode surface, passing through the hollow bolt forming the drain plug at the base of the fuselage tank. It takes the place of the sealing plug normally fitted.

Oxygen pressure gauge

14. The oxygen pressure gauge, Mk.3, mounted in the cabin on panel V is a direct reading instrument (0-1800 lb. per sq. in.) with a fluorescent scale and indicates the air pressure in the two oxygen cylinders.

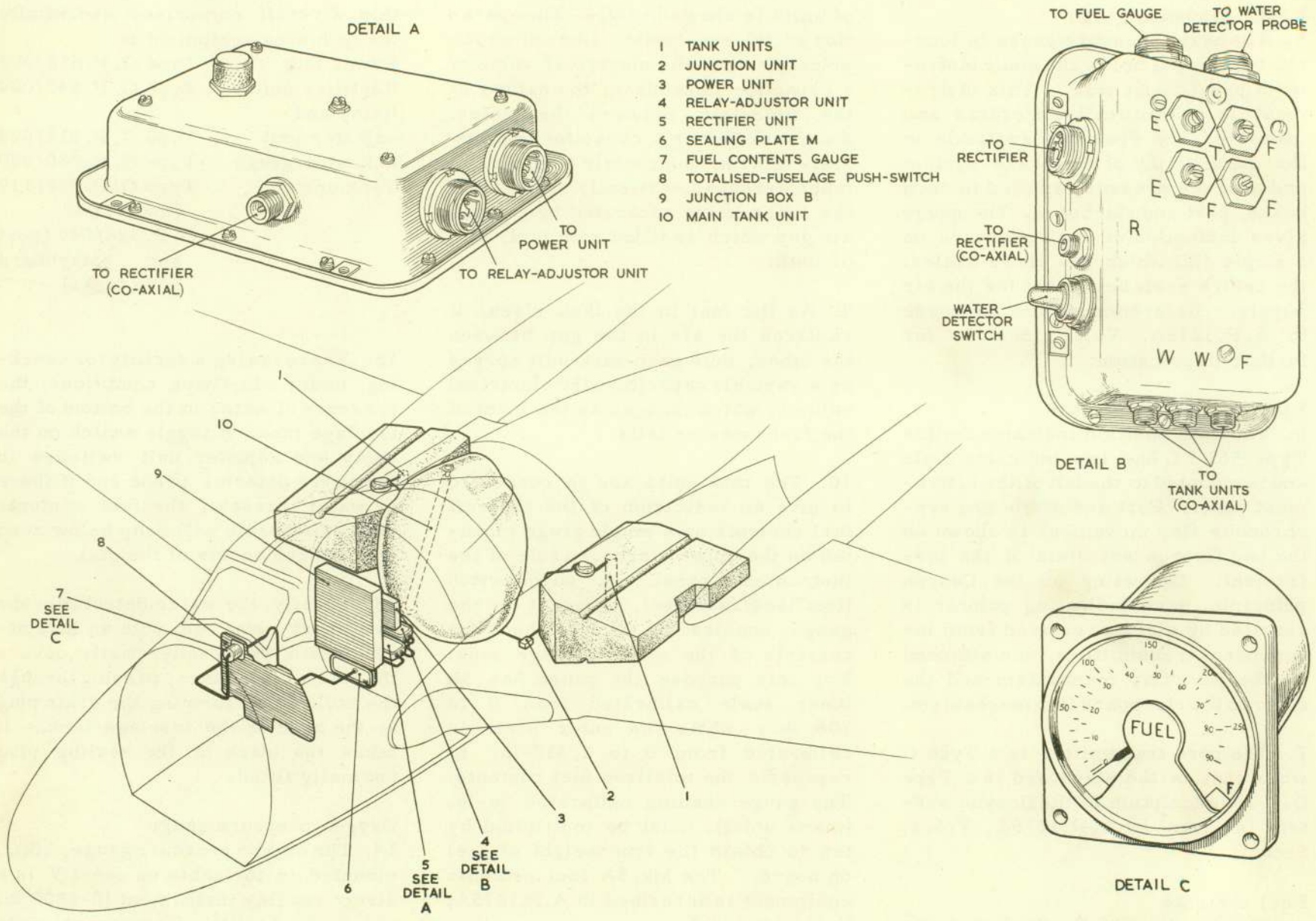

Fig. 3 Fuel contents installation

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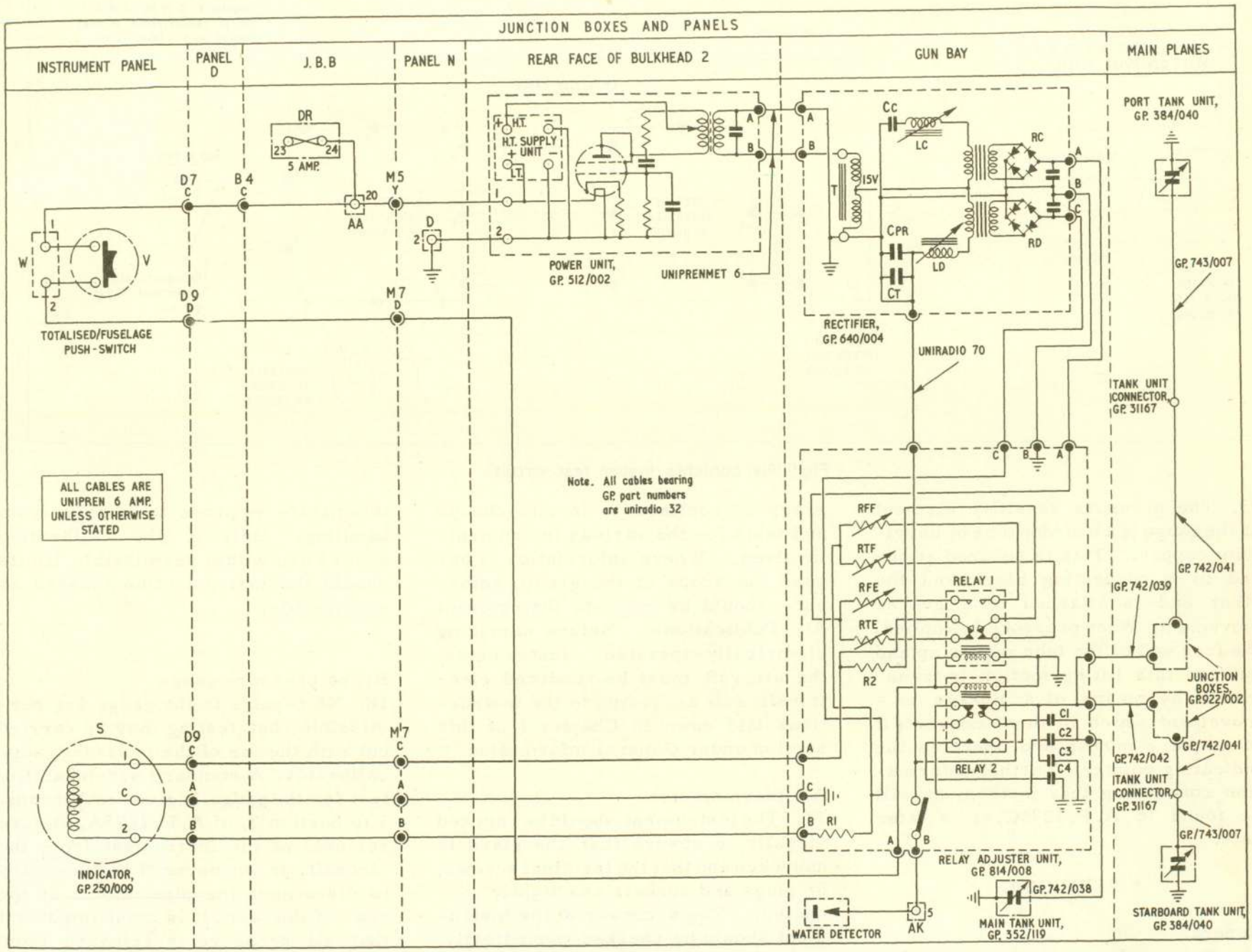

Fig.4 Fuel contents wiring (DR)

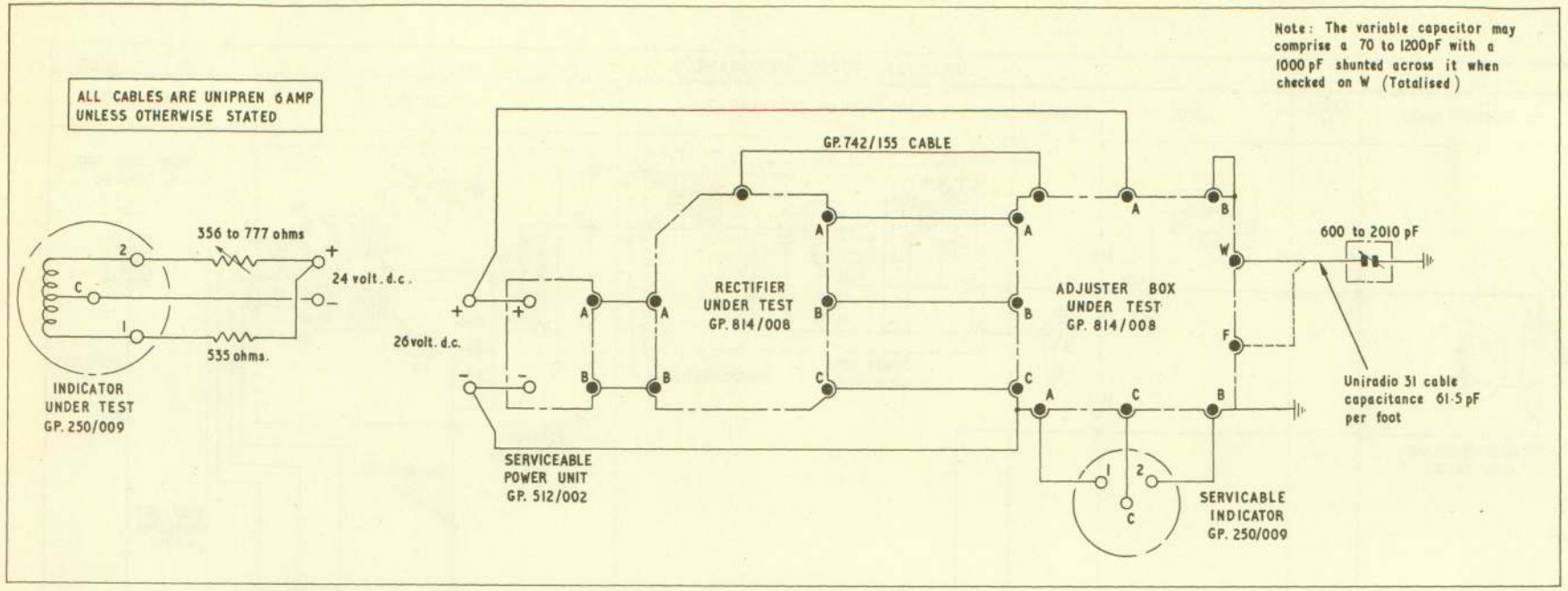

Fig.5 Fuel contents system test circuits

15. The pressure sensitive element of the gauge is a bourdon tube of beryllium copper. This is secured at one end to a connecting block and the other end is attached to a geared movement. When pressure is applied, the free end of the tube moves up and out and this lifting motion is transmitted by means of a linkage to a movement which in turn, converts it to a rotary motion and operates the indicating pointer. Further information concerning this instrument will be found in A.P.1275G, at a later date.

SERVICING

General

16. The servicing information in this group is confined to in-situ checks and tests for the various instruments involved. Where information is beyond the scope of the group, reference should be made to the relevant Air Publications. Before servicing electrically-operated instruments, the aircraft must be rendered electrically safe according to the instructions laid down in Chapter 1 of this section under General Information.

Air thermometer

17. The instrument should be checked visually to ensure that the glass is unbroken and that the terminal screws, or plugs and sockets are tightly connected. The accuracy of the instrument should be checked periodically, preferably "in-situ", as apparatus of this nature is prone to damage from handling. Only if the calibration errors are within permissible limits should the instrument be classed as serviceable.

Brake pressure gauge

18. No repairs to the gauge are permissible, but testing may be carried out with the use of the pressure gauge calibrator. A standard serviceability test for the gauge is given in Appendix 1 to Section 3, of A.P.1275A. Before removal of the instrument from the aircraft, or whenever it is necessary to disconnect the pipe unions at the rear of the case, it is most important that all pressure is released from the accumulators. The method of

doing this is described in Sect. 3, Chap. 6 of this publication.

Flaps position indicator

19. Both the transmitters and the indicator maybe tested for accuracy, without removing any unit from the aircraft, by using the Desynn tester. This tester and its method of application is described in A.P. 1275T, Vol. 1, Sect. 5.

Fuel contents system

20. The components, as shown in Fig. 3, are easily accessible. The indicator and selector push-switch are accessible in the cabin while the rectifier, relay adjuster box and main tank unit are positioned in the gun bay. The power unit is accessible via the port ammunition bay door while the wing tank units are reached via access panels in the upper surface of the wings.

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Note...

The co-axial cable must at no point have a bend radius of LESS than 4 in.

Setting up the indicator

21. Instructions on the method of setting up the indicator will be found in A.P. 1275A, Vol. 1, Sect. 18.

Water detector test

22. The water detector circuit may be tested in situ as follows :-

(1) With fuel in the main tank and power switched ON, operate the toggle switch on the relay adjuster box and check that the indicator pointer just flickers.

(2) Pour water into a bright metal canister which is bonded to the airframe, remove the detector from the base plate of the main fuel tank, ensuring that a suitable receptacle is placed immediately underneath to collect the draining fuel, and place the detector in the water. Switch ON, depress the toggle switch and check that the indicator pointer swings hard into the red zone at the empty end of the scale.

(3) After satisfactory completion of this test, re-fit the detector and again check for presence of water to ensure that the circuit is serviceable.

Fault location tests

23. The following tables are a general form of fault location based upon the reading obtained at the indicator.

24. A more detailed procedure may be carried out, as follows, to locate any fault, using the test set, Stores Ref. 6C/964. This test set is a navalised version of that described in A.P. 1275T, Vol. 1, Sect. 5, Chap. 3.

25. Power unit

(1) With an external supply of 26 to 28 volts d.c. connected to the aircraft, disconnect the d.c. connections to the power unit and connect them to the D.C. IN terminals of the test set using extra unipren 6 amp. cable if necessary, ensuring the connections are of the correct polarity.

(2) Using cable GP.30900 supplied with the test set, connect the D.C. OUT terminal block on the test set to the d.c. terminal block of the power unit. Now interconnect the a.c. output socket of the power unit and the A.C. IN socket of the test set with cable GP.30978/2.

(3) Set test set switch C to FREQ, EXT. P.U.

(4) Set switch A to VOLTS D.C. and check that the pointer of meter B lies within the arc marked VOLTS D.C.

(5) Set switch A to AMPS D.C. and check that the pointer of meter B lies within the arc marked AMPS. D.C.

(6) Set switch A to volts A.C. and check that the pointer of meter B lies within the arc marked VOLTS A.C.

(7) Operate the FREQUENCY AND CAPACITANCE toggle switch and check that the pointer on meter A lies within the orange coloured sector.

(8) If all these checks prove satis-

factory then the power unit is serviceable. Switch OFF the external supply, remove the test set and reconnect the aircraft wiring to the power unit.

26. Indicator :

(1) Disconnect the three pole indicator socket from the relay adjuster box in the gun bay and connect the adapter GP. 30729 to this socket. Now connect cable GP. 30978/3 to the adapter and to the three pole plug on the test set marked EXT. INDICATOR.

(2) Remove fuse DR from fuse block F in fuse-box C. Using unipren 6 amp. cable, connect the test set D.C. IN positive to the socket of the gun bay inspection lamp supplied from its terminal 1 connection. Now connect the test set negative to the remaining socket of the lamp. This correct polarity is important. Switch ON the external supply.

(3) Set switch A on the test set to its EMPTY R position and check that the aircraft indicator reads ZERO.

(4) Set switch A to FULL R and check that the indicator now reads FULL.

Note...

If it is suspected that the indicator pointer is sticking over its scale range, turn switch A to SLOW and rotate the SLOW CHECK AND OHMMETER ZERO knob slowly so that the indicator pointer traverses from 0 to FULL. If the pointer jumps, the indicator movement is sticking and the indicator should be replaced. The readings on the indicator should be within 2 per cent of its full scale reading.

(5) Switch OFF the external supply, remove the unipren 6 amp. cable from the gun bay inspection lamp and replace fuse DR. If the indicator has passed this check satisfactorily then it is serviceable. Remove the test set and re-connect the indicator three pole socket to the relay adjuster box.

27. Rectifier :

(1) Totalised FULL adjuster :

(a) Disconnect all aircraft wiring from the relay adjuster box, except the rectifier co-axial cable located adjacent to the water detector switch.

(b) Connect the three pin adapter GP.31655/2 to the vacated indicator plug at the end of the relay adjuster box, the two pin adapter GP.31655 to the vacated water detector probe plug at the end of the relay adjuster box and the three pin adapter GP. 31655/1 to the vacated rectifier output plug on the side of the relay adjuster box.

(c) Connect both cables GP. 30980 to the three pin adapters.

(d) Connect cable GP.742/074/1 to the RECTIFIER co-axial plug on the test set and to any of the co-axial plugs marked W or F on the relay adjuster box.

(e) Connect cable GP. 30967 to the test set, i.e. the plug to the OHMS socket and the spade terminal to the black D.C. IN terminal.

(f) Set switch A to 300-950 OHMS and switch B to TOTALISE SEA VENOM.

(g) Connect a 26 to 28 volt d.c. supply to the test set as detailed in operation 26(2).

(h) Zero the test set ohmmeter by shorting the probe and clip of cable GP. 30967 together and turning the SLOW CHECK AND OHMMETER ZERO knob until meter B reads maximum.

(j) Connect the probe of cable GP. 30967 to the red lead of cable GP. 30980 connected to the rectifier output plug of the relay adjuster box. Connect the clip of cable GP. 30967 to the blue lead of cable GP. 30980 connected to the indicator plug of the relay adjuster box. Vary the FT adjuster on the relay adjuster box until meter B reads 600 OHMS.

(2) Totalised EMPTY adjuster :-

(a) Set switch A to 20-60 OHMS and again zero the ohmmeter by short-

ing the probe and clip of cable GP. 30967 together and turning the SLOW CHECK AND OHMMETER ZERO knob until meter B reads maximum.

(b) Connect the probe of cable GP. 30967 to the blue lead of cable GP. 30980 connected to the rectifier output plug of the relay adjuster box. Connect the clip of cable GP. 30967 to the blue lead of cable GP. 30980 connected to the indicator plug of the relay adjuster box.

(c) Vary the ET adjuster on the adjuster box until meter B reads 50 OHMS.

(3) Fuselage FULL adjuster :

(a) Set switch A to 300-950 OHMS and switch B to FUSELAGE SEA VENOM.

(b) Connect cable GP. 30978/2 to RELAY SUPPLY on test set and to adapter GP. 31655 connected to the water detector plug on the end of the relay adjuster box.

(c) Zero the ohmmeter as in operation (1)(h).

(d) Connect cable GP. 30967 to each cable GP. 30980 as detailed in operation (1)(j). Vary the FF adjuster on the relay adjuster box until meter B reads 600 ohms.

(4) Fuselage EMPTY adjuster :

(a) Make connections as detailed in operation (2)(a) and (2)(b).

(b) Vary the EF adjuster on the relay adjuster box until meter B reads 50 ohms.

(c) Switch OFF external supply and disconnect all test cables from adjuster box and test set.

(5) Rectifier FUSELAGE

(a) Disconnect all aircraft cables from the rectifier, ensuring that this is also the case for the relay adjuster box, except for the co-axial cable coupling the rectifier and relay adjuster box together.

(b) Set switch A to INNER SCALE, switch B to SEA VENOM FUSELAGE and switch C to E. CAP.

(c) Couple cable GP. 742/074/1 from co-axial plug marked F on the relay adjuster box to co-axial plug marked RECTIFIER on the test set.

(d) Connect cable GP. 30978/3 to IND. IN on test set, couple adapter GP. 31655/2 to it and connect the adapter to the three pin plug on the end of the adjuster box vacated by the indicator socket.

(e) Inter-connect the rectifier, using cable GP. 30979/3, and the vacated rectifier output plug of the relay adjuster box, using adapter GP. 31655/1, by coupling this cable to the adapter.

(f) Connect cable GP. 30978/2 to A. C. OUT on the test set, connect cable GP. 30979/2 to the rectifier and couple these cables using adapter GP. 30927.

(g) Connect adapter GP. 31655 to the adjuster box, connect cable GP. 30978/2 to the RELAY SUPPLY on the test set and couple these cables together.

(h) Connect the external 26 to 28 volt d. c. supply to the test set as detailed in operation 26(2) and switch ON.

(j) Allow five minutes for the equipment to warm up and turn the SET INDICATOR POINTER knob on the test set to bring the pointer to zero.

(k) Set switch C to F. CAP. and wait for two to three minutes. Set switch C to E. CAP, again allow two to three minutes to elapse then vary the EF adjuster on the relay adjuster box to zero the indicator pointer.

(l) Set switch C back to F. CAP. and vary the FF adjuster on the relay adjuster box to bring the pointer of the indicator onto the yellow line at the end of the capacitance scale, i.e. 500 position.

(6) Rectifier TOTALISE :

(a) Switch OFF the external supply. Set switch A to OUTER

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TABLE 1

Fault - Indicator does not read for any tank contents

Probable fault	Test	Remedy
Blown fuse in supply to power unit.	Check input volts to power unit.	Replace unit.
Failure of valve, vibrator, or other component in the power unit.	When vibrator is working, vibration can be felt and heard. Test valve by checking output at output-plug. This should be 70 ± 5 volts at approx. 19.1 kc/s.	Replace valve, vibrator or complete power unit.
Open-circuit in two or three core connecting cables to rectifier unit or relay adjuster unit.	Check continuity of each cable.	Replace cable.
Open-circuit or short-circuit in co-axial cable between rectifier unit and relay adjuster unit.	Check continuity, or measure capacitance.	Replace cable.
Open-circuit or short-circuit in co-axial cable to co-axial plug marked "W" on relay and adjuster unit when under totalised conditions.	Examine junction units, check continuity or measure capacitance of cables.	Replace cable or junction units as necessary.
Open-circuit or short-circuit in co-axial cable to tank unit of fuselage tank, when reading under fuselage conditions.	Examine cable, check continuity or check capacitance.	Replace cable as necessary.
Fuselage tank unit disconnected when selector switch is set to read fuselage tanks.	Check capacitance.	Examine tank unit connector.
Short-circuit in any wing tank unit when reading totalized tanks.	Check insulation.	Drain tank to remove water, or fit a serviceable tank unit.

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TABLE 1 continued

Probable fault	Test	Remedy
Rectifier or relay adjuster unit defective.	Measure voltages with a testmeter, Type 8S (Stores Ref. 10S/16411) across indicator terminals 1-C and 2-C. These should be approximately 2.2 volts d.c. and 1.6 volts d.c. respectively when the gauge reads EMPTY and 2.4 volts d.c. and 3.3 volts d.c. when the gauge reads FULL.	Replace rectifier unit or relay adjuster unit with serviceable unit.
Indicator faulty.	Check continuity between terminals 2-C or check on approved test set.	Fit a serviceable indicator.

TABLE 2

Fault - Indicator reads beyond full for any tank contents

Probable fault	Test	Remedy
Open-circuit in lead to No. 1 terminal of indicator.	Check that voltage across terminals 1-C is approximately 2-4 volts.	Check and secure connections or replace cable with new.
Open-circuit in indicator control coil.	Check continuity between terminals 1-C of indicator.	Fit a serviceable indicator.
Defect in rectifier unit or relay adjuster unit.	Measure voltage across terminals 1-C of indicator.	Fit serviceable rectifier or relay adjuster unit.
Short-circuit in co-axial cable to fuselage tank when reading under totalised conditions.	Examine cable, check continuity or capacitance.	Fit new cable as necessary.
Short-circuit on fuselage tank unit under totalised conditions.	Check insulation.	Drain tank to remove water, or fit serviceable tank unit.

TABLE 3

Fault - Gauge reads inaccurately

Probable fault	Test	Remedy
Incorrect setting of empty adjusters on relay adjuster unit.	Check totalised and fuselage readings at EMPTY.	Re-set empty adjuster as required.
Incorrect setting of full adjuster on relay adjuster unit.	Check totalised and fuselage readings at FULL.	Re-set full adjuster, as required.

TABLE 3 continued

Probable fault	Test	Remedy
Faulty rectifier unit or relay adjuster unit.	Substitute an alternative unit, or check on test rig.	Replace with new if necessary.
Power unit, low output voltage, or incorrect frequency.	Check output volts and frequency. (1) Voltage 70 + 5 a.c. (2) Frequency 19.1 kc/s on standard load of .08 mF. in series with a 500-ohm, 2-watt resistor across output terminals of power unit. The voltmeter used should be a thermocouple type consuming not more than 5mA. at 70 volts. Alternatively, a testmeter, Type F (Stores Ref. 10S/1) which has been calibrated by testing a serviceable power unit beforehand, may be used.	Fit serviceable valve or unit.
Low insulation on a tank unit or cable assembly.	Check the insulation resistance with a 250-volt insulation resistance tester; this should not be less than 3 megohms.	(1) Drain tanks to remove water. (2) Replace any faulty tank unit. (3) Replace faulty cable or junction unit.
A tank unit disconnected.	Examine co-axial cables at relay adjuster unit and co-axial terminals at junction units. Check with approved test set or a capacitance meter. Values of capacitance should be as given on the aircraft schematic drawings. The amount of error will indicate position of fault in cable or tank unit.	Check connection between cable and tank unit connector or drop-in type tank unit.

SCALE, switch B to SEA VENOM TOTALISE and switch C to E. CAP.

(b) Disconnect cable GP.742/074/1 from plug marked F on relay adjuster box and connect it to plug marked W.

(c) Disconnect the cables connected in operation (5)(g). Switch external supply ON and allow five minutes to elapse.

(d) Turn SET INDICATOR POINTER knob to zero pointer.

(e) Set switch C to F. CAP. and allow two to three minutes to elapse.

(f) Set switch C to E. CAP. and allow two to three minutes to elapse before varying the ET adjuster on the relay adjuster box to zero the pointer.

(g) Set switch C to F. CAP. and vary the FT adjuster to bring the pointer onto the yellow line at the end of the capacitance scale, i.e. 500 position.

(h) Switch OFF the external supply, disconnect all test cables and reconnect all aircraft cables to both rectifier and relay adjuster box.

28. Cables and tank units: For these tests reference should be made to Table 4.

TABLE 4

Tank units and cable capacitances

Part Nos.		pF values
Tank units	GP.384/040	185-171
	GP.352/119	525-505
Cable assemblies	GP.743/007	45-40
	GP.742/155	24-21
	GP.742/042	202-192
	GP.742/041	116-110
	GP.742/039	215-203
	GP.742/038	75-71

(1) The unipren 6 amp. cables should be interconnected between the test set and gun bay inspection lamp as detailed in operation 26(2). The following connections are made using the cables at the relay adjuster box.

(2) Main tank: Connect junction unit GP.30694 to the co-axial plug marked CAPACITY on the test set. Plug aircraft cable GP.742/038 to junction unit GP,30694 and set switch C to the nearest value below 576. Switch ON the external supply, press the FREQ. CAP. switch and note the reading on meter A. Add this reading to 576, the result should be within the limits of 576 and 600 pF. Switch OFF the external supply.

(3) Starboard tank: Disconnect aircraft cable GP.742/038 from the junction GP.30694 and connect aircraft cable GP.742/042 to it. Switch ON the external supply. Set switch C to the nearest value below 513. Press the FREQ. CAP. switch and note the reading on meter A. Add this reading to 513; the result should be within the limits of 548 and 513 pF. Switch OFF the external supply.

(4) Port tank: Disconnect aircraft cable GP.742/042 from the junction GP.30694 and connect aircraft cable GP.742/039 to it. Switch ON the external supply. Set switch C to the nearest value below 524, press the FREQ. CAP. switch and note the reading on meter A. Add this 524, the result should be within the limits of 561 and 524 pF. Switch OFF the external supply.

(5) If these three tests have proved satisfactory, all cables and tank units are serviceable. The test set may then be removed from the aircraft and all aircraft cables re-connected to the relay adjuster box. If any test has proved faulty reference should be made to Fig.1 and each cable tested separately, being disconnected at each end for this purpose. Their capacitance is shown in Table 4.

29. Calibration of indicator and rectifier: The following table is included to facilitate complete range testing on the bench of the indicator and the rectifier and relay adjuster box :-

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(1) Indicator: Connect an external test circuit, as shown in Fig. 5, between the suspected indicator and a stable 24 volt d.c. supply. Adjust the variable resistor to the values shown in Table 5 and check that the indicator reads, over inner (fuselage) and outer (totalised) scales, the lb. content for the resistance value inserted. If the indicator fails this test, it should be replaced.

(2) Rectifier and relay adjuster box: Connect an external test circuit, as shown on Fig. 5. The power unit and indicator must be of tested serviceability. Adjust the variable capacitor to the values shown in Table 5, taking into account the capacitance of the connecting uniradio 31 cable, and check that the indicator reads over its complete range the lb. content for the capacitance value inserted. If these readings are not obtained the rectifier or relay adjuster box must be replaced.

Note...

The EF, ET, FF and FT adjusters must be set to their mid-position before calibrating as above. The variable capacitor must be connected to the W co-axial socket of the relay adjuster box when checking on the outer scale of the indicator, and to the F co-axial socket when checking on the inner scale. The tolerance on the indicator in both the foregoing checks is ± 2 per cent of the full scale reading.

Oxygen pressure gauge

30. This instrument requires no routine servicing. Check the glass for cleanliness, cracks and security, also check the fluorescent markings for discolouration and flecking.

REMOVAL AND INSTALLATION

General

31. No definite procedure is considered necessary for the removal of instruments described in this group. Providing due care is taken, little difficulty should be experienced.

32. The removal and refitting of tank units for the fuel contents system is fully described in Sect. 4, Chap. 2 of this publication. The method of connections to the tank units is shown in fig. 3.

Table 5 overleaf

TABLE 5

Rectifier and indicator calibration values (mass units)

lb. x 10		Capacitance (pF)		Resistance (ohms)	
Totalised	Fuselage	Totalised	Fuselage	Totalised	Fuselage
0	0	1483	601	777	777
10	5	1490	612	764	764
20	10	1537	638	724	743
30	15	1577	675	685	705
40	20	1623	723	645	662
50	25	1658	764	612	626
60	30	1692	791	582	603
70	35	1719	828	559	574
80	40	1739	868	546	540
90	45	1758	912	532	507
100	50	1774	948	517	481
110	55	1791	983	504	457
120	60	1809	1028	492	427
130	65	1822	1067	478	402
140	70	1843	1123	466	368
150	FULL	1860	1147	454	356
160		1874		443	
170		1891		432	
180		1905		422	
190		1920		411	
200		1933		399	
210		1947		388	
220		1964		378	
230		1981		368	
FULL		2008		356	

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