GROUP 2.A

FUEL CONTENT GAUGES AND FUEL PRESSURE WARNING

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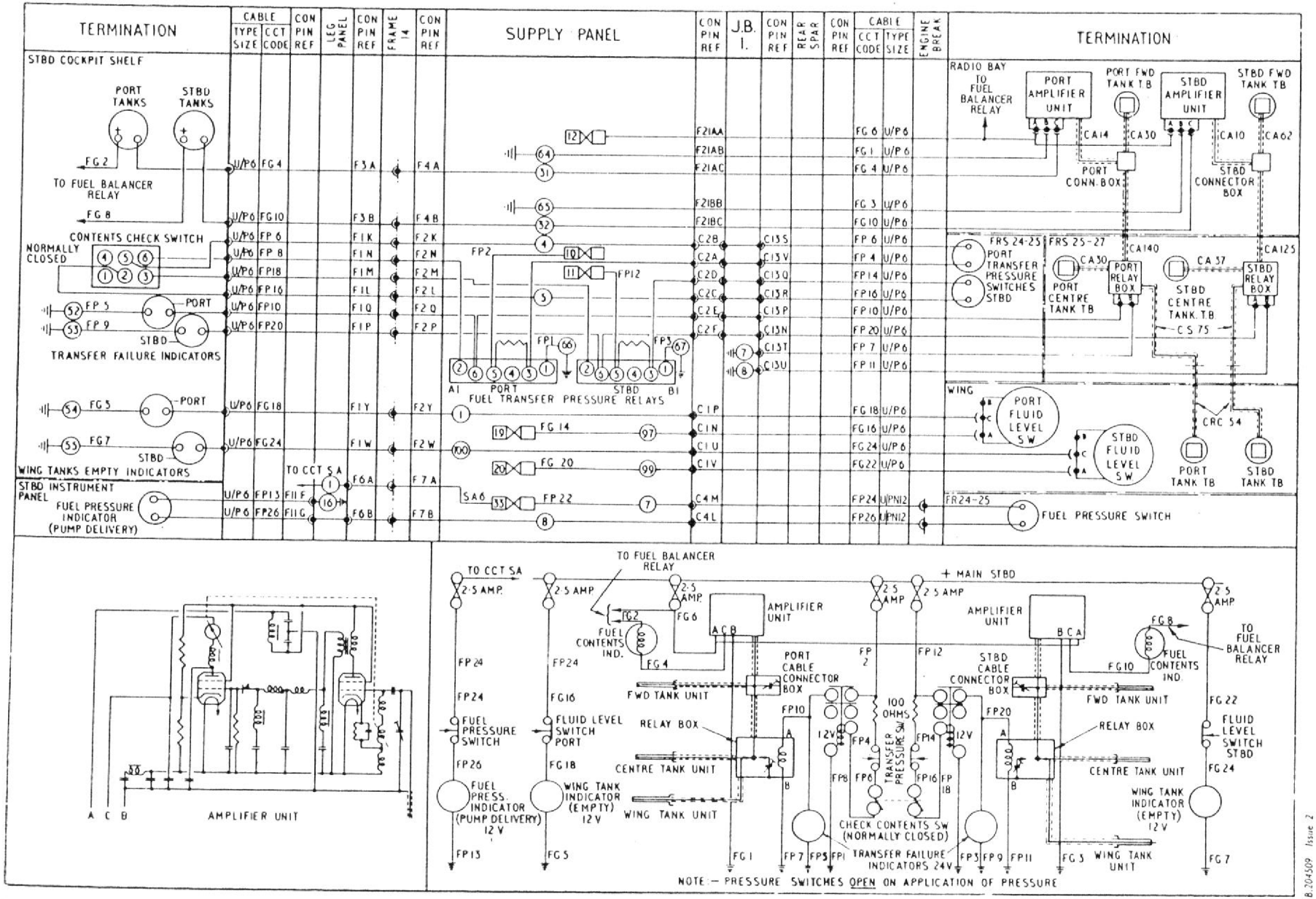

Fig. 1. Fuel contents gauges and fuel pressure warning (routing and theoretical)

Equipment employed

1. The fuel contents and fuel pressure warning equipment employed in this aircraft are listed below, together with the relevant Air Publications to which reference should be made for a detailed description and the necessary servicing required to maintain them in an efficient condition.

Fuel contents indicator, Type AG.38 *(port)*	*A.P.1275A, Vol. 1, Sect. 18*
Fuel contents indicator, Type AG.39 *(stbd.)*	
Amplifier, Type FAB/03	
Connector box, Type JX.12	
Connector box, Type JX.14	
Relay and connector box, Type JX.13 *(port)*	
Relay and connector box, Type JX.15 *(stbd.)*	
Tumbler switch, D.P./C.O., Type XD.493/1	*A.P.4343C, Vol. 1, Book 1, Sect. 1*
Magnetic indicators, Mk. 1 or Type A2 *(transfer failure and wing tanks empty)*	*A.P.4343E, Vol. 1, Sect. 18*
Warning lamp, Smith's CFP/24/43 or Rotax H.2805 *(engine pump failure)*	
Relay, Type Q, No. 2	*A.P.4343C, Vol. 1, Book 2, Sect. 3*
Resistor, 100 ohm, Type TG.214	—
Pressure switch, Mk. 1E *(transfer pressure)*	*A.P.1275A, Vol. 1, Sect. 24*
Pressure switch, Type T.P.5266/1 *(engine pump failure)* ...	
Fluid level switches, Type D.3504100/1 & /2 *(wing tanks empty)*	

Introduction

2. This Group contains a description including the method of operation, of the fuel contents and fuel pressure warning circuits installed in this aircraft, together with the necessary servicing information required to maintain the equipment in an efficient condition. Routing and theoretical diagrams of the installations are also included. For a general description of the aircraft instrument installation as a whole, reference should be made to Group 1.A. Detailed information on the standard components used, will be found in the relevant Air Publications *(listed in para. 1)*.

DESCRIPTION

Fuel content gauges (code FG)

General

3. This is a 28-volt electronic installation. The gauges, one for the port and another for the starboard fuel tanks, are located on the cabin starboard shelf. They give a continuous summated indication of the front, centre and wing fuel tank contents irrespective of the aircraft attitude. The port and starboard tank systems are entirely independent except for their connection with the fuel balancing relay circuit *(described in Group C.1)*. The fuel gauging systems share a common d.c. supply and differ only in that the port centre tank contains a few more gallons than the starboard. The gauges, which are engraved in pounds (*mass*), are actuated by strap type capacitor gauge units fitted within each tank, via two amplifier units, located on the port side of the fuselage between frames 17B and 18A. The gauge units are connected to the amplifiers, via connector boxes located below the amplifiers, while those in the centre and wing tanks are, in addition, connected to relay boxes, which are mounted on the rear face of frame 25. These relay boxes are energized by the operation of two fuel transfer pressure relays located on the supply panel and controlled by two transfer pressure switches mounted between frames 24 and 25 in the centre fuselage.

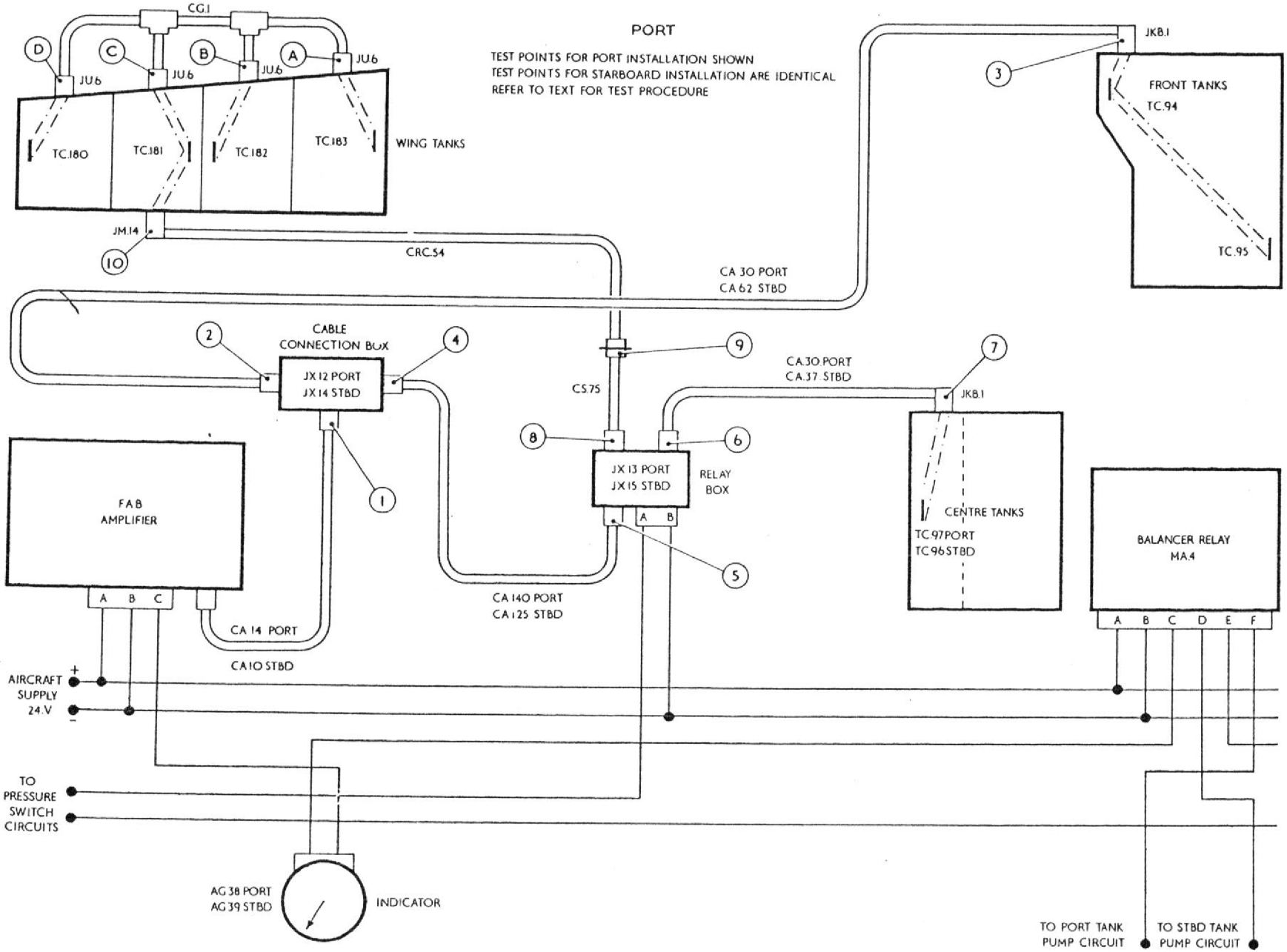

Fig. 2. Fuel content gauge tank test points

4. Apart from energizing the relay boxes the transfer pressure relays also energize two transfer failure indicators located on the cabin starboard shelf. Two magnetic indicators are provided on the forward portion of the cabin starboard shelf adjacent to the fuel gauges to indicate when the wing tanks are empty. These indicators are controlled by Flight Refuelling fluid level switches located one in each inboard wing tank. Since the drop fuel tanks are ungauged and feed into the wing tanks, it should be appreciated that the fuel gauges will show "full contents" until such time as the drop tanks are empty. A switch for use when it is required to check the fuel content while the engine is not running is also provided on the starboard shelf. A warning lamp, mounted on the starboard instrument panel and controlled by a fuel pressure switch situated on the engine, is provided to indicate low fuel pump delivery pressure.

5. Routing and theoretical diagrams of the circuits are given in fig. 1, while the fuel system as a whole is covered in Sect. 4, Chap. 2. For a detailed description of the gauges and the operation of the system, reference should be made to the relevant Air Publications *(listed in para. 1)*.

Operation

6. As each fuel gauge and its associated amplifier is separately fused and provided with independent control equipment, it is only necessary to follow the operation of one gauge to fully understand the circuit. The gauge and amplifier are both energized from the main positive supply and commence operation immediately the battery master switch is placed in the ON position. With transfer pressure in the tanks, the gauge will indicate the content of the front, centre and wing tanks, but if the fuel transfer pressure fails so preventing fuel from being transferred from the centre and wing tanks to the forward tank, the transfer pressure switch will close. This will, in turn, energize the transfer pressure relay, which will energize the fuel gauge relay box and the transfer failure indicator. The indicator will thus give warning of transfer failure and the relay box will disconnect the centre and wing tank gauge units from the amplifier and insert a fixed capacitor into circuit the value of which, corresponds to that obtained when the centre and wing tanks are empty. The gauge will, therefore, only indicate the fuel content of the front tank, as this is the only fuel available to the engine under conditions of fuel transfer pressure failure.

7. The contents check switch, which is marked ENGINE ON and ENGINE OFF is normally closed to complete the supply from the transfer pressure switch to the transfer pressure relay. This switch is used to check the total fuel content when the engine is not running, as under this condition the required transfer pressure may not be available to open the transfer pressure switch and the centre and wing fuel tank gauge units will therefore be out of circuit *(para. 6)*. When the switch is opened by placing it in the ENGINE OFF position, the supply to the transfer pressure relay is broken and this in turn de-energizes the fuel gauge relay box, which will reconnect the centre and wing fuel tank gauge units to the amplifier, as during normal conditions.

Fuel pressure warning (code FP)

8. The operation of the fuel pressure warning circuit is such that when the engine pump delivery pressure falls below 3-3½ p.s.i., the engine fuel pressure switch contacts close and make the supply to energize the indicator lamp *(mounted on starboard instrument panel)* which will show to give warning of this condition. The circuit is shown in fig. 1.

SERVICING

General

9. Apart from the servicing information given in the following paragraphs, all other servicing and the standard serviceability tests, together with the equipment to be used and the method of conducting the tests are contained in the appropriate sections of A.P. 1275A and T, Vol. 1. Before servicing or removing any of the electrically-operated instruments the aircraft must be rendered electrically safe *(described in Sect. 5, Chap, 1, Group A.1)*

Fuel content gauges

Data and tolerances on units

10. These figures are given in order that the units may be checked individually. The following equipment should be used for carrying out the tests and must be of at least the accuracy stated:—

(1) *Variable capacitor*—
Range 100 to 2300 pF
Accuracy ± 1 pF at any point on its range

(2) *Milliammeter**—
Range 0 to 7.5 mA, 0 to 15 mA, 0 to 30 mA
Accuracy to BS.89 precision grade

(3) *Voltmeter*—
Range 0 to 40 volts.
Accuracy to BS.89 first grade

(4) *FAB/18 amplifier*—
Tested using the above instruments for conformation to the limits given in para. 17

(5) *250 volt d.c. insulation resistance meter*

*Alternatively, a d.c. potentiometer and standard resistance may be used.

Tank units

11. The initial capacitance *(quoted in Table 1)* is measured with the tank unit moist, but thoroughly drained of all kerosene fuel. The range of a unit is the increase in capacitance when totally immersed, at a temperature between 15 deg. C. and 25 deg. C., in a kerosene fuel, having a permittivity of 2·10 at the temperature of test. Measurements must be carried out with the units well clear of all metal objects, and with the leads a minimum of three inches apart. A resistance of at least 20 megohms should be obtained

for a new or replacement unit, dry before installation. *To avoid any risk of an explosion, insulation resistance tests of installed tank units should not be made under any circumstances.*

Tank terminals

12. The capacitance of the tank terminals is as follows:—

Code JM14 - Capacitance 23±3 pF.
Code JU6 - Capacitance 23±3 pF.
Code JKB1—
mod 01 - Capacitance 17±3 pF.

The terminals should have an insulation resistance of at least 20 megohms.

Complete tank with tank terminal

13. The capacitance values for the tanks complete with terminals is given in Tables 2 and 3. The insulation resistance of a complete tank installation, measured at the tank terminal coaxial socket should not be less than 1 megohm. *Tanks should be completely drained of all fuel before carrying out the above check.*

TABLE 1

Tank units

Code	Initial capacitance (pF)	Range (pF)	Tank
TC.94	227±3	243±3	Front
TC.95	287±3	304±3	Front
TC.96	181±3	184±3	Stbd. centre
TC.97	188±3	193±3	Port centre
TC.180	50±3	53±3	Wing
TC.181	74±3	77±3	Wing
TC.182	74±3	77±3	Wing
TC.183	118±3	120±3	Wing

Coaxial cables

14. Coaxial cables should have insulation resistance of at least 20 megohms whether new or installed. Cable details are given in Table 4.

Cable boxes (*code JX13 and JX15*)

15. The capacitance figures given in Table 5 for both these cable boxes are box values measured at the output socket, and with all tank system coaxial cables disconnected. The box capacitance with the relay open should be 15±5 pF in each case. The JX13 *(Mod. 01 and 02)* and JX15 *(Mod. 01 and 02)* cable boxes should have an insulation resistance of at least 20 megohms between the following points:—

(1) Pin A or B and earth with the relay unenergized.
(2) Output socket and earth with the relay unenergized.
(3) Output socket and earth with the relay energized.

Note . . .

The tank circuit should be disconnected during the check.

TABLE 2

Fuselage tanks
(*Port and Starboard*)

Tank	Empty, out of aircraft	Installed, wet and pressurized
Front	587±20 pF	632±25 pF
Centre Port	240±15 pF	249±15 pF
Centre (Stbd.)	234±15 pF	245±15 pF

TABLE 3

Wing tanks (*Port and Starboard*)

Tank	Empty, out of aircraft	Installed dry	Installed, wet and pressurized
No. 1	158 ± 15 pF	172 ± 15 pF	187 ± 19 pF
No. 2	116 ± 15 pF	133 ± 15 pF	148 ± 19 pF
No. 3	149 ± 20 pF	173 ± 20 pF	194 ± 32 pF
No. 4	88 ± 15 pF	102 ± 15 pF	110 ± 15 pF

TABLE 4

Coaxial cables

Code	Length (in.)	Capacitance (pF.)
CA.10	10	18±3
CA.14	14	26±3
CA.30	30	54±3
CA.37	37	67±3
CA.62	62	111±3
CA.125	125	225±5
CA.140	140	252±5
CRC.54	54	97±3
CS.75	75	135±3

TABLE 5

Cable boxes, JX13 and JX15

Code	Box capacitance (relay closed) Trimmer at min. not more than	Trimmer at max. not less than
JX13 *(Mod. 01)*	1157 pF	1349 pF
(Mod. 02)	1160 pF	1398 pF
JX15 *(Mod. 01)*	1166 pF	1358 pF
(Mod. 02)	1169 pF	1407 pF

Cable boxes (*code JX12 and JX14*)

16. Before checking a cable box in accordance with the range values given in Tables 6 or 7, the trimmers must be adjusted to their nominal value *(mid-setting)*. The range into, and out of, the box is the increase in capacitance above 2 mA. It will be seen in each table that the capacitance out of the box figure is the tanks empty capacitance of the amplifier less the capacitance of the connecting cable. The full testing procedure is described in A.P.1275T, Vol. 1. As each cable box contains a coil connected to earth, it is useless to subject them to an insulation resistance test. These units may be considered serviceable if they conform to the capacitance figures given in the Tables.

Amplifiers (*code FAB*)

17. The relationship between the indicator current and capacitance with a power supply of 28 volts is given in Table 8. The amplifiers contain a 150-volts working condenser, which would be damaged by the higher Megger voltage, thus an insulation resistance test must not be carried out on these units. They may be considered serviceable if they conform to the capacitance/indicator current test figures given in the Table using the accurate test equipment referred to in para. 10.

Power supply—
Nominal voltage 28 volts.
Current at 28 volts 0·7 amps. *(approx.)*

Capacitance—
Initial *(or tanks empty)* 750 pF.
Tanks full 1250 pF.
Range 500 pF.

Coaxial harness (*code CGI*)

18. The capacitance of the coaxial harness is 136±5 pF and it should have an insulation resistance of at least 20 megohms.

Indicators

19. An insulation resistance test should not be carried out on the indicators. These may be considered serviceable if they conform to the figures given in Table 9.

Accuracy of the fuel gauge installation

20. It will be realised from the nature of the system that its accuracy depends on the supply voltage being maintained at the required figure and the physical properties of the fuel conforming to specification. Any small inaccuracies which may exist will usually stem from these two sources. The calibration of this gauge is based on a kerosene fuel having a permittivity of 2·10 and a specific gravity of 0·779 at a temperature of 20 deg. C.

TABLE 6

Cable boxes, JX12

'Tanks empty' capacitance into box at input socket					
Trimmer at min. not less than	Box input nominal value	Trimmer at max. not more than	'Tanks empty' capacitance out of box	Range out of box	Range into box
2351 pF	2217 pF	2083 pF	724 pF	500 pF	1105 pF

TABLE 7

Cable boxes, JX14

'Tanks empty' capacitance into box at input socket					
Trimmer at min. not less than	Box input nominal value	Trimmer at max. not more than	'Tanks empty' capacitance out of box	Range out of box	Range into box
2390 pF	2256 pF	2122 pF	732 pF	500 pF	1090 pF

TABLE 8

Amplifier capacitance/indicator current

Capacitance (pF)	Indicator current (mA)
750	2·0±·03
823	3·0±·05
908	4·0±·05
1005	5·0±·05
1120	6·0±·05
1250	7·0±·05

TABLE 9

Indicators

Code AG.38		Code AG.39	
Indication (pounds x 100)	Indicator current (mA)	Indication (pounds x 100)	Indicator current (mA)
0	2·00	0	2·00
1	2·35	1	2·33
2	2·73	2	2·73
3	3·14	3	3·16
4	3·53	4	3·57
5	3·92	5	3·95
6	4·25	6	4·28
7	4·58	7	4·59
8	4·90	8	4·93
9	5·22	9	5·25
10	5·50	10	5·55
11	5·78	11	5·84
12	6·04	12	6·10
13	6·29	13	6·34
14	6·50	14	6·57
15	*6·72	15	6·81
16	6·96	16·05(F)	7·00
16·28(F)	7·00		

**Actual figure is 6·725. A reading of 6·72 or 6·73—therefore, acceptable.*

Errors of the fuel gauge in normal flight

21. The following Tables will enable an operator to obtain an approximate error from true reading caused by system inaccuracies and by various conditions of temperature, supply voltage, fuel permittivity and density. All errors are expressed as a percentage of the total indication, with the exception of fuel temperature errors, which are expressed as a percentage of indicated fuel contents per degree Centigrade.

TABLE 10

Temperature

Temperature	−35°C	−10°C	+15°C	+40°C
Tank empty	+0·8	+0·4	0	−0·4
1/10	+1·0	+0·5	0	−0·5
1/3	+1·4	+0.7	0	−0·7
2/3	+2·0	+1·0	0	−1·0
Full	+2·6	+1·3	0	−1·3

TABLE 11

Supply voltage

Supply voltage	24V	28V	29V
All fuel levels	−1·5	0	+0·8

Note . . .

(a) The fuel contents gauge is calibrated for a supply voltage of 28 volts d.c. To obtain maximum accuracy the voltage must be adjusted to this figure.

(b) The figures given in Table 12 will enable an operator to calculate errors when using fuels differing in permittivity and density to those for which the gauge is calibrated (para. 20), It should be borne in mind that

TABLE 12

Fuel variations

(1) Fuel	(2) Permittivity k	(3) gm./gal. d	Density Tank Empty	(4) % Errors 1/10	1/3	2/3	Tank full
			BRITISH				
AVTAG/DERD2486	2·035	0·739	0	−0·08	−0·3	−0·6	−0·8
(J.P.4B or F-40)	2·180	0·825	0	+0·1	+0·4	+0·8	+1·3
AVTUR/DERD2482	2·035	0·780	0	−0·6	−2·0	−4·0	−6·0
(J.P.1B or F-33)	2·165	0·810	0	+0·2	+0·6	+1·2	+1·8
AVCAT/DERD2488	2·156	0·817	0	0	0	0	0
(J.P.5B or F-42)	2·161	0·817	0	+0·05	+0·17	+0·33	+0·5
			AMERICAN				
J.P.1 (MIL-F-5616	2·093	0·8030	0	−0·4	−1·2	−2·4	−3·7
or F-33)	2·186	0·8479	0	−0·09	−0·3	−0·6	−0·9
J.P.3 (MIL-F-5624C)	1·997	0·7434	0	−0·5	−1·6	−3·2	−5·0
	2·270	0·8300	0	+0·8	+2·8	+5·6	+8·3
J.P.4 (MIL-F-5624C	2·020	0·7467	0	−0·3	−1·1	−2·1	−3·2
or F-40)	2·106	0·8251	0	−0·5	−1·7	−3·4	−5·1

the errors given in column (4) of Table 12 are not extreme errors to be expected when using the fuels defined in column (1). The errors given are those which may be present when using fuels conforming to the permittivities and densities quoted in columns (2) and (3). The errors given have been calculated from the 'highest' and 'lowest' values obtained by laboratory measurement of fuel samples.

(c) Since fuel permittivity does not always vary exactly in relation to density, an error may exceed that quoted or the sign of an error may reverse. Should a fuel be employed which differs to that defined on columns (2) and (3), the mass indication for that fuel will be in error by a factor equal to $\frac{k-1}{d}\cdot\frac{do}{ko-1}$; *that is to say, the capacitance index of the fuel divided by that for the standard.*

(d) The correction is to be made to the indicator reading to indicate true contents, is equal in magnetic but opposite in sign to the error given.

(e) Each unit of the fuel gauge is manufactured to a desired capacitance with an associated tolerance. It is, therefore, possible, although unlikely, for all to these be either high or low in tolerance. For this reason Table 14 quoting the maximum system errors is given.

Setting up fuel content gauges

22. Before commencing to set-up the fuel gauges, ensure that the power supply to the amplifier is switched on for at least 15 minutes, by placing the battery master switch to the ON position or by connecting an external supply to the aircraft electrical system. The recommended setting-up instructions are as follows:—

(1) The supply voltage is to be 28±0·5 volts.
(2) Fill and then drain the complete fuel system to the unusable fuel level.
(3) Pressurize the fuel system to the normal working pressure.
(4) Trim summation circuits to zero, using the three trimmers marked TRIM SUM in the cable boxes JX.12 and JX.14.
(5) Depressurize the fuel system.
(6) Trim the wing and centre matching circuits to zero, using the three trimmers marked TRIM O/C in the relay boxes JX.13 and JX.15.

TABLE 13

Temperature variations acting on the fuel

Condition	% Error
Temperatures above +20 deg.C	−0·028/°C
Temperatures below +20 deg.C	+0·028/°C
For 50 deg.C fall in temperature	+1·40
For 50 deg.C rise in temperature	−1·40

Checking the fuel gauge installation

23. Apart from the normal inspection for physical damage, the installation on this aircraft requires no maintenance during service other than the functional *(or tanks drained)* check. The fault location checks should be carried out, using the code QAA test set, which is described in A.P.1275T, Vol. 1. The figures quoted for these checks should only be employed as a guide when using the QAA test set, the necessary standard of accuracy not being obtainable with this instrument. If, however, a unit appears to deviate greatly from the figures quoted, it should be removed from the aircraft and checked, using the accurate test equipment referred to in para. 20 or alternatively, replaced by a new unit and the fault location test repeated. On no account should a unit be rejected solely on the evidence of the test set.

TABLE 14

System error

(includes 0·3 per cent readability error)	
Tank empty	±0·3
1/10	±0·8
1/3	±2·0
2/3	±3·7
Full	±5·7

24. It is permissible to change a valve in an amplifier, but this must be replaced only by a Code ZAA valve supplied by Smiths Aircraft Instruments, Ltd. After a valve replacement has been carried out the amplifier must pass a capacitance indicator current test *(para. 17)*, again using the accurate equipment referred to previously.

Functional check

25. This check should be carried out at the times quoted in the aircraft Servicing Schedule or after any major unit of the installation is changed. The check ensures a correct reading on the indicators when the tanks are drained of all normally usable fuel, and thus acts as a guide to the correct operation of the gauge. Each side of the system must be checked separately and, therefore, the following procedure must be followed out on each in turn.

26. Before commencing this test, the system should be pressurized to the normal working pressure, the tanks must also have been recently filled and then drained of all normally usable fuel. It is important to note that 15 minutes should be allowed to elapse to enable the tank units to completely drain, otherwise the tank units will have a higher capacitance than that quoted. In addition, the power supply to the amplifier must be switched on at least five minutes before the check is carried out.

27. If these conditions obtain, the indicator should read zero contents. If not, the trimmers in either JX.12 or JX.14 cable box must be revolved until the indicators give a satisfactory reading.

28. The systems should now be depressurized. The CHECK CONTENTS switch set to ENGINE ON so that the dummy capacitances for the wing and centre tanks are now connected to their respective amplifiers. The indicator should still show zero contents, but if not, the trimmers in the JX.13 or JX.15 cable box should be used to obtain the desired reading. Whilst it is immaterial which trimmers are used to effect adjustment, under

certain conditions difficulty may be experienced in setting the indicator to zero contents, in either the pressurized or unpressurized state. If such is the case, it will be necessary to adjust the trimmers of the cable box involved to the maximum capacitance setting utilising the QAA test set for the purpose.

29. The QAA test set should not be connected to any part of the circuit whilst carrying out a zero contents check. It must be realised that this check in no way guarantees the accuracy of the system throughout the range and that if this is suspect the units should be individually tested with the equipment listed in para. 10.

Insulation resistance check

30. An insulation resistance check should be carried out periodically with at least the same frequency as this check is made on the remainder of the aircraft electrical system. Using a 250 volt insulation resistance tester, the individual units should conform to the tolerances laid down in paras. 11 to 19. It is important to note that insulation resistance checks should not be carried out on amplifiers, cable boxes, tank units and indicators for the reasons stated previously, and that it is preferable that the tanks are completely drained of all fuel before the checks are commenced.

WARNING

A 250-volt insulation tester only should be used as the application of voltages above 300 may cause a tank explosion, if there is a distorted or otherwise damaged tank unit present.

Fault location checks

General

31. Apart from a failure in the 28 volt supply, a fault in the installation will only affect one indicator and, therefore, in most instances, it will only be necessary to carry out a check on the one system. The method of testing each system is identical, but the test values differ slightly owing to certain cable dissimilarities. These necessitate Tables 15 and 16 found in this Group.

TABLE 15

Test points (port system)

Test point	A Test capacitance (pF)	B Test capacitance (pF)	Adaptors and cables used	Approximate reading on Aircraft indicator	Test set meter
1	724±3	570±8	CC3 and CE1	Zero contents	2 mA
2	686±28	536±31	CE1	,, ,,	,,
3	632±25	478±30	CC3 and CE1	,, ,,	,,
4	1585±127	1435±130	CE1	,, ,,	,,
5	1333±122	1179±127	CC3 and CE1	,, ,,	,,
6	303±23	153±26	CE1	,, ,,	,,
7	249±20	95±25	CC3 and CE1	,, ,,	,,
8	1030±99	880±102	CE1	,, ,,	,,
9	895±96	737±101	CC1 and CE1	,, ,,	,,
10	798±93	640±98	CC1 and CE1	,, ,,	,,

Check on amplifier and indicator

32. The first part of a fault location check is carried out by connecting the test set between an amplifier and its power supply, as described in A.P.1275T, Vol. 1. Move the test set selector switch first to position 1 and then to position 2, thereby checking the power supply and current respectively into the amplifier by noting the test set meter reading: this procedure is explained in greater detail in the above Air Publication. If an unsatisfactory result is obtained, check back to the source of the power supply.

33. To test the circuit between an amplifier and indicator, turn the test set selector switch to position 3. As the output of the FAB amplifier varies between approximately 2 and 7 mA over the range of 'tanks empty' to 'tanks full', it follows that the test set meter reading should lie between these two limits, depending on the amount of fuel on board. If a satisfactory reading is not obtained, the fault could lie either with the amplifier and associated tank circuit or with the indicator and its circuit. To check which of these two is at fault, move the selector switch to position 4. This cuts out the circuit to the indicator, and if a satisfactory result is still not obtained, the fault must lie in the amplifier or in the tank circuit. If a satisfactory reading is obtained, the fault lies in the indicator circuit. The foregoing procedure is explained, at greater length in A.P.1275T, Vol. 1; a table that summarises it appears in that publication and on the lid of the test set itself.

34. Disconnect the tank circuit coaxial cable from the amplifier and substitute the coaxial cable supplied with the test set, connecting the other end of the cable to either of the test set two coaxial sockets. This arrangement is also shown in A.P.1275T, Vol. 1. As the test set cable has a capacitance of 150 pF, if the variable capacitor on the set is adjusted to 600 pF, a capacitance of 750 pF will be fed into the amplifier. Thus, if the selector switch is placed at position 3 or 4 the test set meter should read about 2 mA. This procedure should be repeated for each of the settings given in Table 8 and the amplifier checked for approximate accordance with the values given.

Check on tank circuits

35. It will be seen in fig. 2 that every connection or test point is numbered, starting at the cable box and working to the tanks. These numbers will be found in Tables 15

TABLE 16

Test points (starboard system)

Test point	A Test capacitance (pF)	B Test capacitance (pF)	Adaptors and cables used	Approximate reading on Aircraft indicator	Test set meter
1	732±3	578±8	CC3 and CE1	Zero contents	2 mA
2	743±28	593±31	CE1	,, ,,	,,
3	632±25	478±30	CC3 and CE1	,, ,,	,,
4	1562±127	1412±130	CE1	,, ,,	,,
5	1337±122	1183±127	CC3 and CE1	,, ,,	,,
6	307±23	157±26	CE1	,, ,,	,,
7	245±20	91±25	CC3 and CE1	,, ,,	,,
8	1030±99	880±102	CE1	,, ,,	,,
9	895±96	737±101	CC1 and CE1	,, ,,	,,
10	798±93	640±98	CC1 and CE1	,, ,,	,,

and 16, together with the capacitance that must be connected at each point to give an indication of approximately 2 mA on the test set meter and therefore a reading of zero contents on the indicator.

36. When testing at beyond points 3, 7 and 10 it is essential that the tanks be drained of all normally usable fuel and the system pressurized. If the amplifier has proved serviceable, reconnect the aircraft coaxial cable to the amplifier and disconnect it at point 1 of the associated system. The test set coaxial cable must now be connected to the aircraft cable, employing the double socket clipped to the inside of the test set lid.

37. The variable capacitor should now be set to 750 pF, less the capacitance of the aircraft CA10 or CA14 cable, test set cable and the socket; the resultant value is the figure given in the table. The indicator should now read approximately zero contents and the test set meter about 2 mA. This process is repeated at each of the remaining points throughout the sytem, the variable capacitor value being set to the figures given in the appropriate table as each unit is connected back into the installation until a complete check has been made.

38. The capacitance values given have the total tolerance at each particular point quoted alongside. The desired meter reading of 2mA should, therefore, be obtainable with the variable capacitor setting within these limits, provided that the system trimmers are correctly adjusted. On no account should the cable box trimmer settings be altered; these settings should only be adjusted during a functional check.

39. The method of checking the units installed in the port and starboard wing tanks is a little different to that described in paras. 35 to 38, and is therefore described in paras. 40 to 42.

40. Disconnect the coaxial harness CG1 at points A, B, C and D *(fig. 2)* and connect the QAA test set to the amplifier as described in A.P.1275T, Vol. 1. Using a suitable length of coaxial cable and a Pye Waymouth adaptor join the spare coaxial socket to any point of the harness. The variable capacitor should now be set to give a milliammeter reading of, say, 5 mA, and the harness disconnected, leaving the coaxial cable and adaptor all connected to the test set socket. Having noted the variable capacitor reading, it should be readjusted until the same milliammeter reading is again recorded. The capacitance of the CG1 harness is obtained by subtracting the first variable capacitor reading from the second, and should be within the limits quoted in para. 18, plus ten per cent allowance for test set inaccuracies. This method is described in greater detail in A.P.1275T, Vol. 1.

41. Assuming that the harness is serviceable, leave it disconnected and also disconnect the coaxial cable CRC.54 from the JM.14 tank terminal. Employing the method detailed for the CG1 harness, now check each tank at points A, B, C and D for accordance with the capacitance values given in Table 17.

TABLE 17

Test points (wing system)

Point into which test capacitance is connected	Value of tank unit, plus internal wiring, measured at tank terminal
A	187±19
B	148±19
C	194±32
D	110±15

42. The values quoted in column A of Tables 15 and 16 are the true capacitances to be connected at each point, whilst those in column B are the true capacitances less the capacitance of the connecting cables and/or sockets. In other words, the values in column B are the actual test set variable capacitor settings, and the values in column A are the theoretical values. Both are given so that an operator may make allowances accordingly should he use a different method of connection.

Additional equipment required for checking wing tank system

43. The equipment issued with the standard QAA Mod. 01 or Mod. 02 test sets is insufficient when checking aircraft and/or components fitted with Pye coaxial plugs and sockets. On this particular aircraft, the wing tank system is so equipped. To meet this requirement, the following additional items with capacitance values given may be obtained through the usual channels:

(1) Double Pye coaxial cable, Code CR4, Capacitance 10±2 pF *(Mod. 01)*.

(2) Pye Waymouth adaptor, Code CC1, Capacitance 8±2 pF *(Mod. 01 and Mod. 02)*.

Note . . .

When the QAA Mod. 04 test set is employed. no additional equipment will be required, as this set contains the Pye Waymouth adaptor.

REMOVAL AND ASSEMBLY

General

44. The removal of the instrument panels and cabin shelves carrying the fuel content gauges, contents check switch, pressure warning lamp, and transfer pressure indicators, is covered in Group 1.B. Illustrations showing the location of all the components will be found in Group 1C. Once access has been obtained, the removal of the remaining items of equipment should present no difficulties.