OXYGEN GAUGES, INDICATORS AND CONTROL UNITS – ELECTRICAL

GENERAL AND TECHNICAL INFORMATION

BY COMMAND OF THE DEFENCE COUNCIL

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(Ministry of Defence)

FOR USE IN THE

ROYAL NAVY
ROYAL AIR FORCE

Prepared by the Procurement Executive, Ministry of Defence

AMENDMENT RECORD SHEET

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Chapter 1

CONTENTS GAUGE CONTROL UNIT, MK 2 AND CONTROL UNITS, PART No. 801227 AND 802213

Introduction

1. The contents gauge control unit is used in aircraft liquid oxygen systems to convert the capacitance values provided by the quantity of liquid oxygen available in a liquid container for reproduction on a remote indicator. The liquid oxygen container consists of a stainless steel double-walled receptacle with an evacuated annular space for insulation. The inner vessel in which the liquid oxygen is stored forms one of two plates of a variable capacitor, a probe forming the other plate; the two plates are connected in a capacittance bridge which is part of the control unit circuit.

DESCRIPTION

2. The control unit which utilizes the difference in dielectric constant between gaseous and liquid oxygen to measure the quantity of liquid in a container, consists of an amplifier oscillator and a capacitance bridge. Referring to fig. 2, it operates from the aircraft 28V d.c. supply and the oscillator generates 5·6 kc/s to feed the capacitance bridge.

3. A six-pole plug and a three-pole socket are provided with the unit, the three-pole socket for connecting the unit to the oxygen container, the six-pole plug to connect the unit to the contents gauge. Referring to fig. 1 and 2, a control is incorporated to zero the bridge when the liquid oxygen container is empty, i.e., the control sets the contents gauge pointer to zero, whilst a second control adjusts the gauge pointer to full scale reading when the container is full. The second control is necessary to match the gain of the amplifier with the dielectric constant of the liquid oxygen measured.

Note . . .

Initially these control units were marked SET EMPTY *and* SET FULL *for calibration purposes, later versions were marked* SET LOW *and* SET HIGH *respectively.*

OPERATION

4. The inner shell of the liquid oxygen container, which carries a capacitance probe in the form of two electrodes (para. 1) measures the level of the liquid in the container. The capacity readings obtained from the container are converted and amplified by the control unit, to volumetric readings in litres on a remote indicator.

5. Each unit comprises an oscillator, an a.c. bridge and an amplifier. The oscillator produces an a.c. source to operate the bridge (fig. 2). The bridge compares the capacitance of a container and its contents with a standard capacitor, and gives an output proportional to the capacitance of the container and its contents. The a.c. signal from the bridge is amplified, rectified and emerges as a d.c. output. The output is capable of operating up to three remote indicators in series.

INSTALLATION

6. For details of the location of the contents gauge control unit in a typical liquid oxygen system, reference should be made to the relevant chapter in A.P.107D-0001-1.

CONTENTS GAUGE CONTROL UNIT, PART NO. 801227

7. This contents gauge control unit (Ref. No. 6D/2163) is identical in construction and application to the unit described in para. 2 and differs only in the length of cable used between this unit and a liquid oxygen container. The bridge circuit of the control unit is balanced so that with a length of cable of between 5 ft. and 15 ft., the contents gauge indicator may be calibrated to give full scale deflection of the pointer.

CONTENTS GAUGE CONTROL UNIT, PART NO. 802213

8. This contents gauge control unit (Ref. No. 6D/2362) is identical in construction and application to the unit described in para. 2 and differs only in the length of cable used between this unit and a liquid oxygen container. The bridge circuit in the control unit is balanced so that with a length of cable of between 18 in. and 10 ft., the contents gauge indicator may be calibrated to give full scale deflection of the pointer.

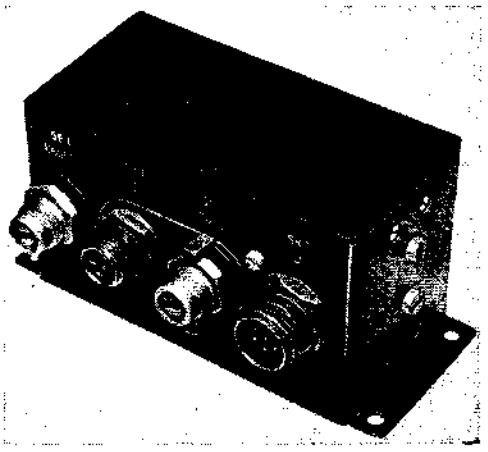

Fig. 1. Contents gauge control unit, Mk. 2

Chapter 1-1

STANDARD SERVICEABILITY TESTS

for

CONTENTS GAUGE CONTROL UNIT, MK 2 AND CONTROL UNITS, PART No. 801227 AND 802213

Introduction

1. The tests laid down in this chapter must be applied to the above-mentioned equipment immediately prior to installation in aircraft, in accordance with the appropriate Servicing Schedule and at any time when serviceability is suspect. The tolerances specified must not be exceeded.

TEST EQUIPMENT

2. The following test equipment is required:—

Description	Ref. No.	Remarks
Multimeter, model 8SX	0577/6625-943-1524	1 off
Sullivan decade air capacitor	5G/3029	1 off
Socket, electrical (free) 6-pole	0568-5935-99-999-8045	1 off
Sextopren sheath, 6	5E/3798	As required
Cable assembly, twin coaxial	6D/2268	1 off
Coaxial extension adaptor		1 off
Resistor, variable, 1A, 100k ohms		1 off
Power supply, 28V d.c., 1A		

Method of test

3. All tests must be in a clean, dry atmosphere.

TEST PROCEDURE

General

4. The SET EMPTY control of these units has a "dip" characteristic. It is essential that the multimeter indication is on the correct side of the "dip"; this will be indicated when, on turning the SET EMPTY control clockwise, the multimeter indication decreases.

Note . . .

Initially these control units were marked SET EMPTY *and* SET FULL *for calibration purposes, later versions were marked* SET LOW *and* SET HIGH *respectively.*

5. The unit is of potted construction and no repairs are to be carried out.

6. Use care when connecting the supply, as reversal will damage the transistors.

7. When setting the Sullivan decade air capacitor to a particular capacitance value, allowance must be made for:—

(1) Initial capacitance of Sullivan capacitor.

(2) Capacitance of co-axial extension adaptor.

(3) Capacitance of extension lead (if quired).

8. The capacitance of the coaxial extension adaptor (fig. 1) has been accurately measured, therefore no further measurement is necessary. Maintain the adaptor in a clean and dry condition.

9. No insulation resistance tests are to be carried out on these units.

Visual checks

10. Check for defects and damage.

Setting up

11. (1) Connect the control unit to the test circuit as shown in fig. 1 (see para. 6).

(2) Remove the covers from the SET EMPTY and SET FULL controls.

(3) Set the multimeter to 1mA, d.c. range. Set the Sullivan capacitor to LOW capacitance value marked on the container (to which the control unit is to be matched), making allowances as in para. 7. Adjust the d.c. supply to 28 volts and switch on.

(4) Adjust the SET EMPTY control to obtain an indication of 0·795mA on the multimeter.

(5) Set the multimeter to the 10mA range and adjust the Sullivan capacitor to the HIGH capacitance valve marked on the container (to which the control unit is to be matched) making allowances as in para. 7.

(6) Adjust the SET FULL control to obtain an indication of 1·77mA on the multimeter.

(7) Owing to the interaction between SET EMPTY and SET FULL controls, operations 3 to 6 inclusive must be repeated alternately until no further adjustment is needed to obtain the correct readings.

(8) When the above adjustments have been satisfactorily completed, slowly reduce the value of the Sullivan capacitor, and ensure that the multimeter reading falls to at least 0·4mA.

(9) Slowly increase the value of the Sullivan capacitor and ensure that the multimeter reading rises to at least 2·0mA.

12. To apply the standard serviceability test on a control unit which is not required to be fitted into an aircraft LOX package unit, the procedure detailed in para. 11 should be carried out with the following changes;

(1) LOW capacitance value should be 259 pf.

(2) HIGH capacitance value should be 306 pf.

WARNING . . .

Before a control unit is issued for fitting in an aircraft LOX package unit, it must be set up as in para. 11, using the capacitance values marked on the container, to which the unit is to be matched.

Regulation

13. (1) With the output current of 2·0mA flowing, lower the supply voltage to 25V. The indication on the multimeter must not vary more than ±0·025mA.

(2) Reset the d.c. supply to 28V.

Open circuit failure

14. (1) Disconnect the capacitor and check that the multimeter indication rises to not less than 3·0mA.

(2) Switch OFF the d.c. supply and disconnect the unit from the test circuit. Replace the covers on the SET EMPTY and SET FULL controls.

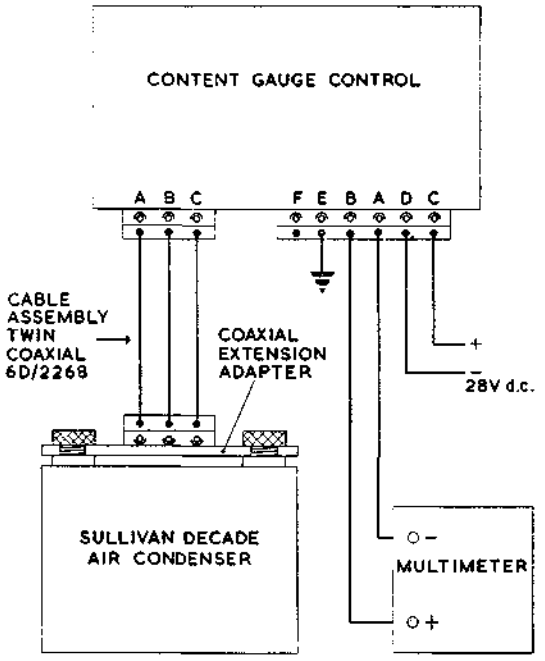

Fig. 1. Test rig, gauging system

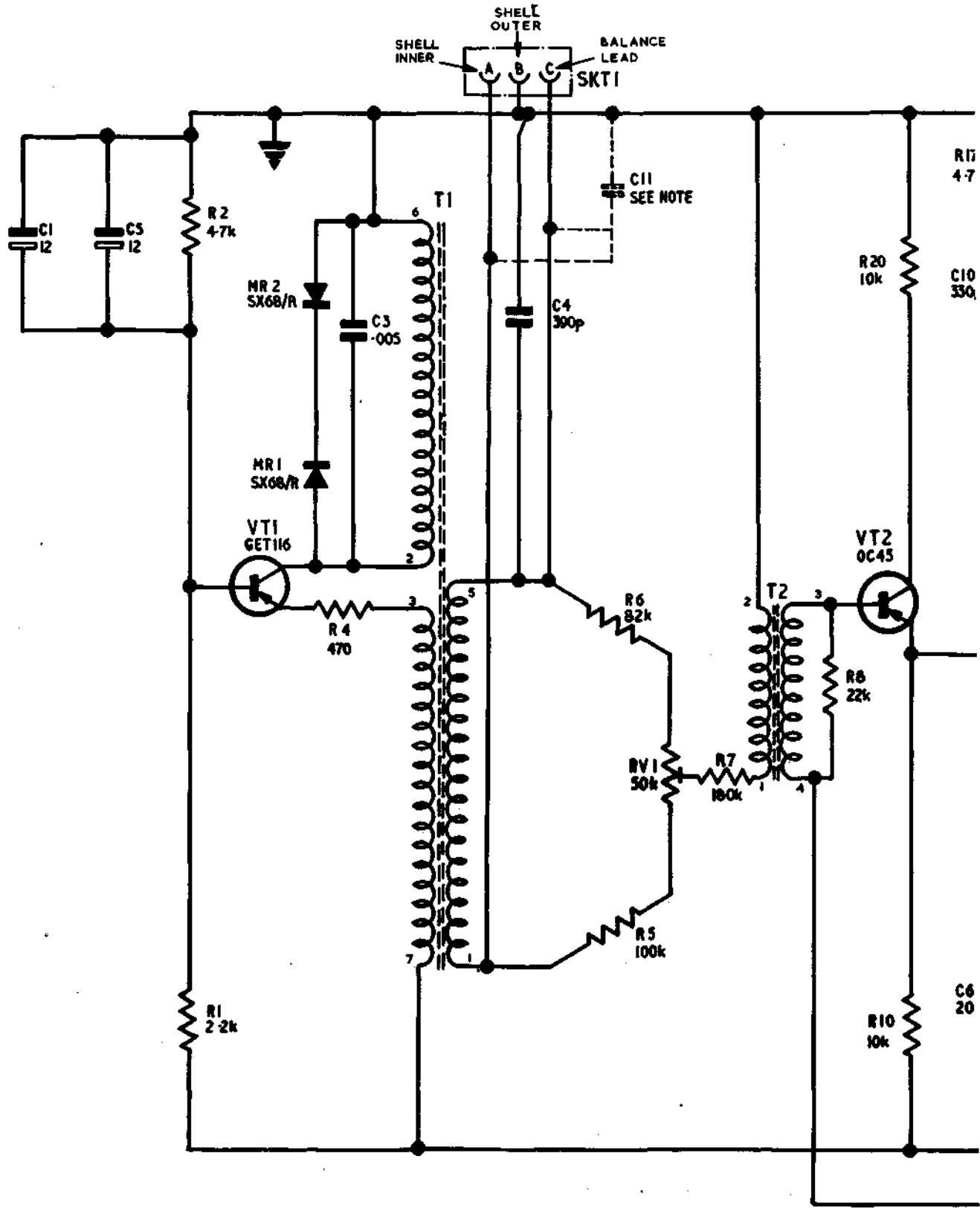

Fig. 2

Circuit dia

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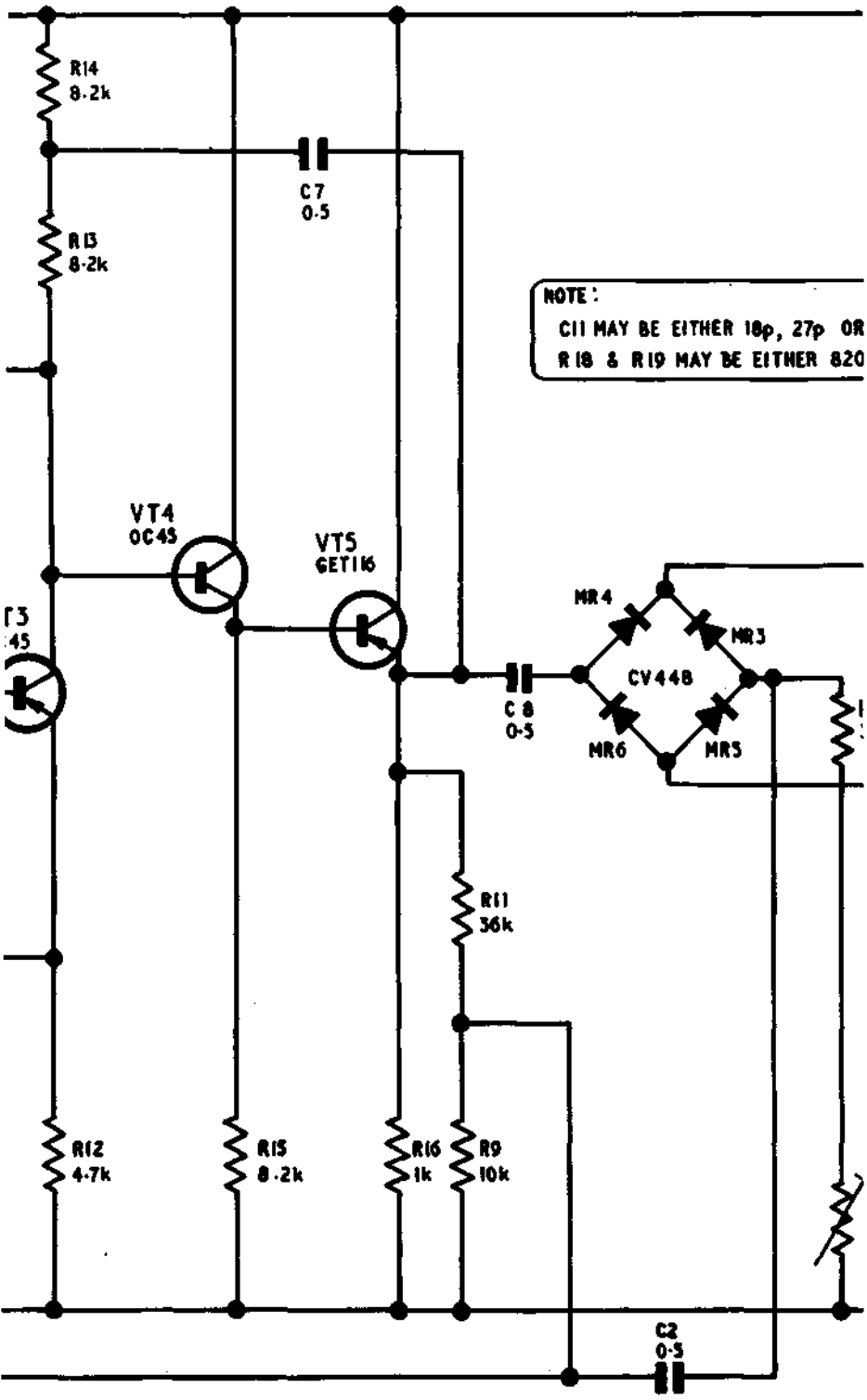

am, contents gauge control unit

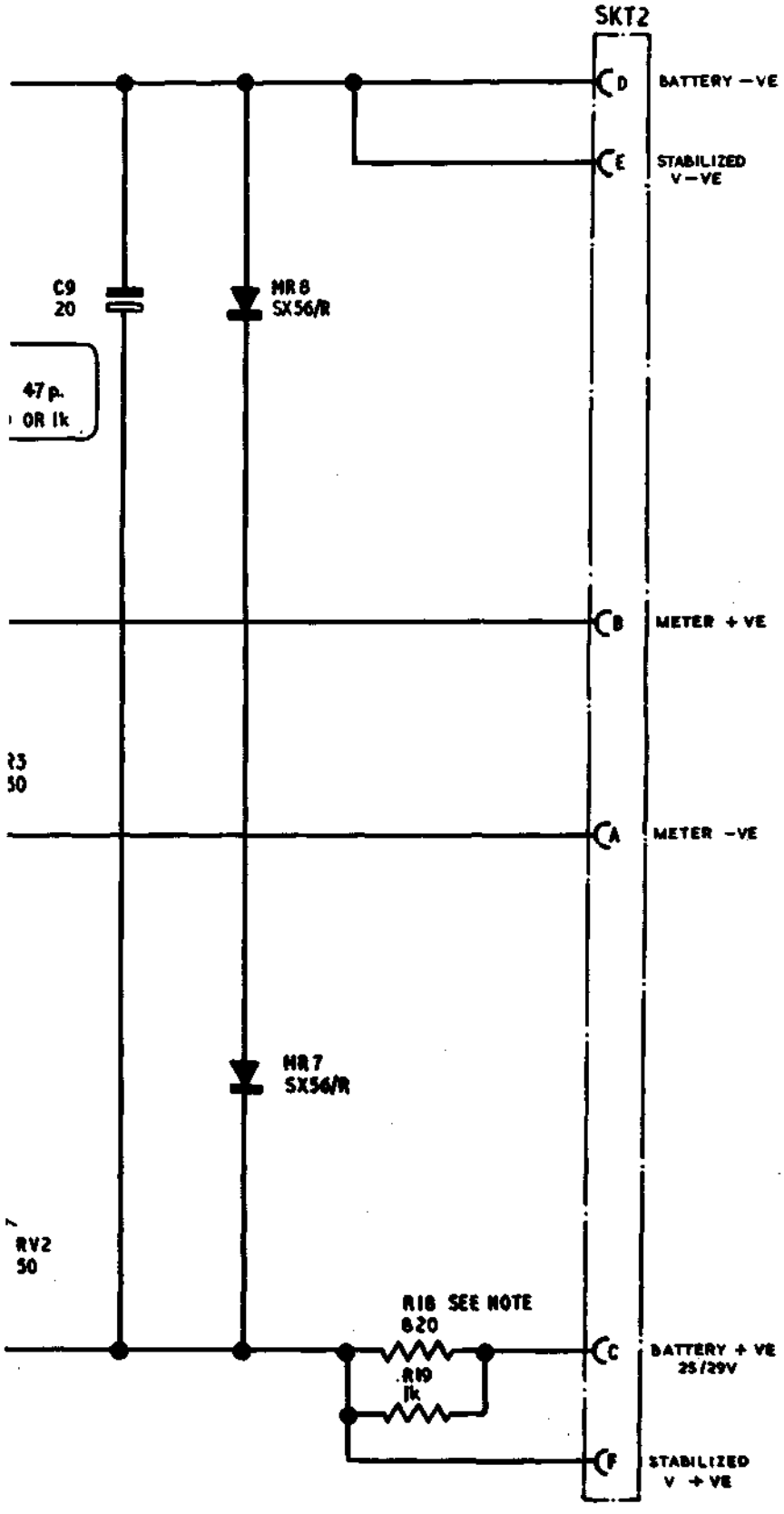
SKT2
D
BATTERY −VE
E
STABILIZED V−VE
C9
20
MR8
SX56/R
47p.
OR 1k
B
METER +VE
A
METER −VE
MR7
SX56/R
RV2
50
R18 SEE NOTE
820
R19
1k
C
BATTERY +VE
25/29V
F
STABILIZED V +VE

Fig.2

Chapter 2

CONTENTS GAUGE INDICATORS, PART No. 802169, 802828, 803161 AND 803426

Introduction

1. These are ratiometer type instruments of the S149 series, and a detailed description of these indicators, together with the test instructions, is given in A.P.112G-0508-1, Chap. 2.

2. Details of these indicators are as follows: —

Part No.	S149 series No.	Ref. No.
802169	S149/3/157	6D/2164
802828	S149/3/340	6D/2495
803161	S149/3/341	6D/2605 or 6D/103-7851
803426	S149/3/373	6D/2675

Chapter 3

OXYGEN CONVERTER PRESSURE GAUGE
(Part No. OP 5750)

Introduction

1. This gauge (Ref. No. 6D/2708) is employed in liquid oxygen systems to indicate the pressure in the supply line from the liquid oxygen converter.

DESCRIPTION

2. The unit consists of a dial-type gauge, the casing of which is suitably threaded at the forward end to enable the gauge to be panel mounted by means of a flange adapter assembly (Ref. No. 6A/4246). The dial is graduated from 0 to 150 lb/in². in increments of 10 lb/in².

3. The gauge operates on the Bourdon tube principle, a $\frac{1}{8}$ in. B.S.P., internal cone seating, pressure connection extending from the rear of the casing.

INSTALLATION

4. Information concerning the installation of the gauge in the aircraft will be found in the relevant aircraft air publication.

WARNING . . .

Many materials, particularly oil and grease, are subject to spontaneous combustion when exposed to undiluted oxygen under pressure. Precautions must, therefore, be taken to exclude oil, grease, dust and metal particles from the unit.

SERVICING

5. The gauge is sealed during manufacture and must not, therefore, be dismantled. If serviceability is suspect, the gauge is to be tested as detailed in Chap. 3-1.

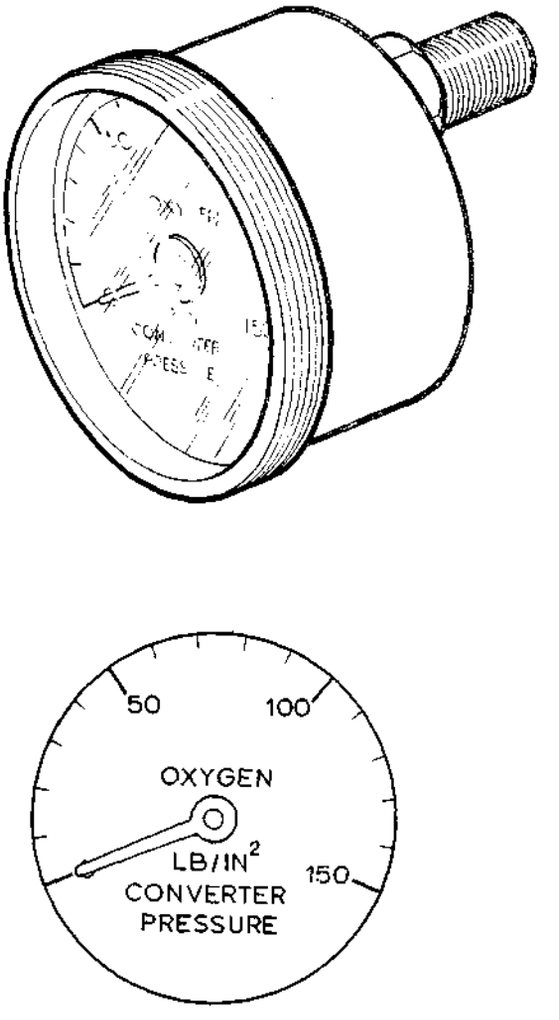

Fig. 1. External view and dial presentation

Chapter 3-1

STANDARD SERVICEABILITY TESTS

for

OXYGEN CONVERTER PRESSURE GAUGE

(Part No. OP 5750)

Introduction

1. The tests described in this chapter should be applied before the gauge is installed in aircraft, when the serviceability of the gauge is in doubt, and at the appropriate examination periods at Equipment Depots.

TEST EQUIPMENT

2. The following test equipment is required:—

(1) Oxygen test gauge (Ref. No. 6C/263)

(2) Breathing oxygen test supply (150 lb/in²)

(3) Differential pressure chamber, Mk. 1 or 1A (Ref. No. 6A/1455 or 6A/1649).

TEST PROCEDURE

WARNING . . .

Many materials, particularly oil and grease, are subject to spontaneous combustion when exposed to undiluted oxygen under pressure. Precautions must be taken, therefore, to exclude oil, grease, dust and metal particles from the unit and the test equipment.

Calibration test

3. The calibration test should be applied using Items 1 and 2 of the test equipment (para. 2). The gauge should be tested in the horizontal and vertical positions with both increasing and decreasing pressures, and should be within the following limits:—

Gauge reading (lb/in².)	True pressure (lb/in².)	
	Min.	Max.
zero	zero	+5
50	46	54
100	94	106
150	142	156

Leak test

4. Connect a breathing oxygen test supply (150 lb/in²) to the gauge inlet, close the supply valve and observe the gauge reading. There should not be any fall in the pressure reading over a period of 2 minutes.

External pressure test

5. Blank the gauge inlet connection and, using the differential pressure chamber, submit the gauge to an external pressure of 9 lb/in². After this test, the gauge glass must be examined for failure and the tests described in para. 3 and 4 repeated.

Chapter 4

PRESSURE INDICATOR, TYPE S149/1/270

Introduction

1. This is a ratiometer type instrument of the S149 series. The indicator (Ref. No. 6D/2710) has a range of from 0 to 300 lb/in^2 and a detailed description of the indicator, together with the test instructions, is given in A.P.112G-0508-1.

Chapter 5

CONTENTS GAUGE INDICATOR, Part No. 802595

Introduction

1. This instrument (Ref. No. 6D/2532) is a twin miniature liquid oxygen contents gauge provided for aircraft liquid oxygen installations.

DESCRIPTION

2. This twin unit consists of two miniature contents indicators for aircraft liquid oxygen systems, mounted together in the form of an assembly. Each instrument consists of the conventional moving coil indicator, where the movement of the moving coil in relation to the field of the permanent magnet, is proportional to the voltage applied to the coil. Empty is indicated by "0" and is equivalent to a current of 0·40mA to 0·52mA. Full is indicated by "F" and is equivalent to a current of 1·94mA and 2·0mA. The sweep between "0" and "F" is approximately 180 deg. and indications of $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ are marked in white. Below "0" there is a red, lower failure arc, above "F" an upper failure arc, also red. The connections to the indicator is by six B.A. terminals mounted on the back of the instrument, connections to instrument 1 being by terminals A and B and to instrument 2 by terminals E and F.

3. The complete assembly is designed for panel mounting via four No. 6, 32 U.N.C. stiffnuts mounted on the front plate.

SERVICING

Insulation resistance test

4. The insulation resistance between pins A, B, E, and F, connected together and the case, measured at 50V d.c., should be not less than 50 megohms. The insulation resistance between terminals A and F, also measured at 50V d.c., should not be less than 100 megohms.

Accuracy test

5. The calibration of the indicator should be within the limits given in Table 1 when checked under the following conditions.

6. The indicator should be mounted on a test panel. The current through the instrument should be increased until the pointer reaches the "F" mark. After 15 minutes the current should be gradually reduced and measured at each calibration point.

TABLE 1

Calibration Check

Calibration point	Current (mA d.c.)	
Start of zero mark	0·40	
End of zero mark	0·52	
$\frac{1}{4}$ full	0·955	
$\frac{1}{2}$ full	1·31	+0·05
$\frac{3}{4}$ full	1·605	
Start of full mark	1·94	
End of full mark	2·00	

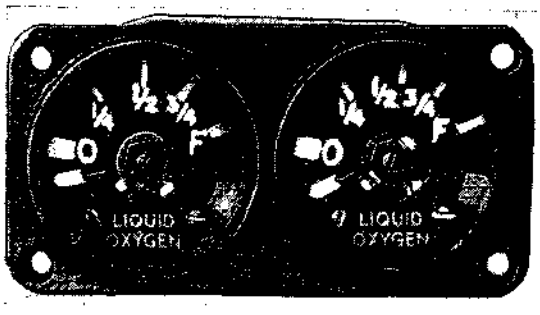

Fig. 1. Dial presentation

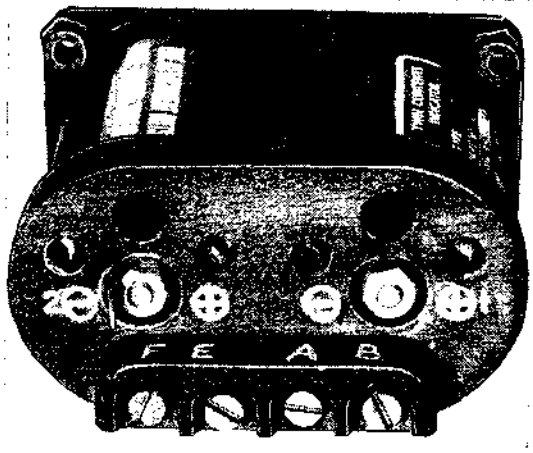

Fig. 2. Rear view

Chapter 6

OXYGEN PRESSURE GAUGE
(Part No. OP. 7600)

Introduction

1. This gauge (Ref. No. 6D/2888) is used in certain aircraft liquid oxygen systems to indicate the gas pressure in the supply line from the liquid oxygen converter.

DESCRIPTION

2. The unit consists of a dial-type gauge, housed in a 2·0 in. S.A.E. rimless case which is suitably threaded at the forward end to enable the gauge to be panel mounted. The dial face is graduated from 0 to 400 lb/in² in increments of 20 lb/in².

3. The gauge operates on the Bourdon tube principle, a $\frac{1}{8}$ in. Bsp internal cone seating, pressure connection extending from the rear of the casing. A gauze disc, located in the back of the gauge case, protects a safety bursting disc.

INSTALLATION

4. Information concerning the installation of the gauge in the aircraft will be found in the relevant air publication.

WARNING . . .

Many materials, particularly oil and grease, are subject to spontaneous combustion when exposed to undiluted oxygen under pressure. Precautions must, therefore, be taken to exclude oil, grease, dust and metal particles from entering the unit.

SERVICING

5. The gauge is sealed during manufacture and must not, therefore, be dismantled. If serviceability is suspect, the gauge is to be tested as detailed in Chap. 6-1.

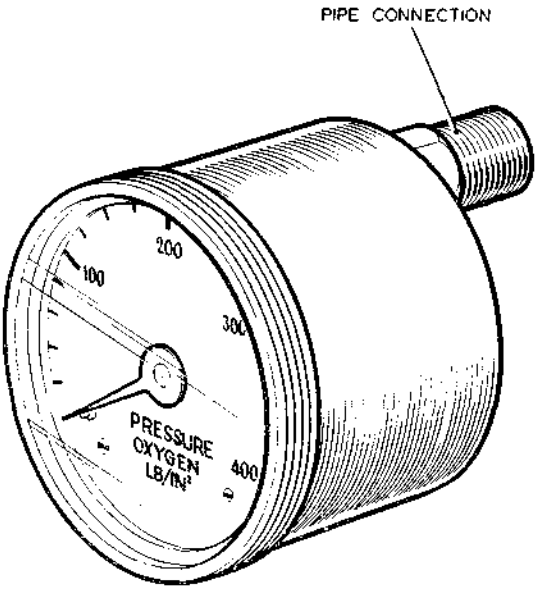

Fig. 1. Oxygen pressure gauge—general view

Chapter 6-1

STANDARD SERVICEABILITY TESTS

for

OXYGEN PRESSURE GAUGE

(Part No. OP. 7600)

Introduction

1. The tests described in this chapter should be applied before the gauge is installed in an aircraft. When the serviceability of the gauge is in doubt and at the appropriate examination periods at Equipment Depots.

Test equipment

2. The following test equipment is required:—

(1) Oxygen pressure gauge (Ref. No. 6C/264)

(2) Breathing oxygen test supply 600 lb/in^2.

Particulars of tests

3. Soap solution for leak testing must be prepared in accordance with the instructions contained in Part 1, Sect. 2, Chap. 1. Precautions must be taken to prevent the solution entering the gauge, and all traces of soap and moisture must be removed when each test is completed.

TEST PROCEDURE

WARNING . . .

Many materials, particularly oil and grease, are subject to spontaneous combustion when exposed to undiluted oxygen under pressure. Precautions must be taken, therefore, to exclude oil, grease, dust and metal particles from the unit and the test equipment.

Calibration test

4. The calibration test should be applied using items (1) and (2) of the test equipment (para. 2). The gauge should be tested in the horizontal and vertical positions with both increasing and decreasing pressures, and should be within the limits given in Table 1.

TABLE 1

Calibration data

Gauge reading (lb/in^2)	True pressure (lb/in^2)	
	Min.	Max.
0	0	+15
100	90	110
200	185	215
300	280	320
400	380	420

Leak test

5. Connect a breathing oxygen test supply (400 lb/in^2) to the gauge inlet, close the supply valve and observe the gauge reading. There should not be any fall in the pressure reading over a period of two minutes.

External pressure test

6. Blank the gauge inlet connection and, using the differential pressure chamber, submit the gauge to an external pressure of 9 lb/in^2. After this test, the gauge glass must be examined for failure, and the tests detailed in para. 4 and 5 repeated.

Chapter 7

CONTENTS GAUGE CONTROL UNIT
(Part No. 1215X000)

CONTENTS

ILLUSTRATIONS

LEADING PARTICULARS

Ref. No.	6*D*/3211
Dimensions (overall)	
Length	4·41 *in.*
Width	2·70 *in.*
Height	2·13 *in.*
Weight	1·0 *lb.*
Connection for co-axial cable ...	... *Amphenol socket, Type TY*27-12
Connection for electrical services ...	*Plessey plug Mk. 6 Type* 681*ET*-10-6*P*
Electrical supply	28*V d.c.*

Introduction

1. The contents gauge control unit is an electronic device which operates in conjunction with a suitably calibrated milliammeter to give indication of the contents of a liquid oxygen container.

DESCRIPTION

2. The unit consists of transistorized electronic circuits enclosed in a silver-plated case which incorporates a baseplate for mounting purposes. Two adjusters, located on the front of the unit and protected by wire-locked covers, permit adjustment when matching the unit to a container. The adjusters are slotted to enable adjustments to be made using a screwdriver, and should not be disturbed unless the matching procedure (para. 15) is being carried out.

3. Interconnection between the liquid oxygen container and the control unit is through a coaxial cable which connects with an Amphenol socket located on the front cover. The remaining electrical connections are taken through a 6-pole plug which is also on the front cover. An on/off switch is not fitted on the unit, hence the control unit is in operation when the aircraft 28V d.c. supply is switched on.

4. The unit is designed for operation with a capacitance of between 360 pF and 390 pF when the converter is empty; this is increased by between 70 pF and 80 pF when the converter is full. The indicator circuit may be of any impedance between 10 ohms and 3K ohms.

OPERATION

5. The circuit (fig. 2), which is in four parts, consists of an oscillator, a.c. amplifier, d.c. amplifier and the power supplies.

Oscillator

6. A simple oscillator circuit, consisting of a transistor VT1, a transformer T1, capacitors C2 and C2(a), and a resistor R4, generates an a.c. signal of constant frequency, and its amplitude is held constant at 4·9V r.m.s. by Zener diodes MR1 and MR2. A centre-tapped, secondary winding of the transformer feeds the a.c. signal to the capacitor in the liquid oxygen container from one end of the winding, and to the capacitors C3 and C4 from the other end. Thus, the capacitors form a bridge, and a balance is obtained at the empty condition of the liquid oxygen container by adjusting capacitor C3. The presence of liquid oxygen increases the capacitance of the container and an out-of-balance state is produced. This results in an a.c. current, proportional to the amount of out-of-balance, flowing from the centre-tap of the transformer; this current is fed to an a.c. pre-amplifier which forms part of an a.c. amplifier.

A.C. amplifier

7. The a.c. amplifier comprises transistors VT4 and VT5 and their associated components, and also incorporates the pre-amplifier consisting of transistors VT2 and VT3, together with their associated components.

8. The pre-amplifier converts the a.c. current input from the capacitor bridge to an output voltage of between 30mV and 200mV (approximately) corresponding to the respective empty and full states of the liquid oxygen container. This voltage is fed to the a.c. amplifier, which has a gain of about 7, and provides an output voltage of between 200mV and 1·4V (approximately) when the converter is empty and full respectively. Adjustment of the gain to obtain the correct output voltage at the full condition is by the variable resistor RV1.

9. Negative a.c. feedback in both parts of the a.c. amplifier ensures stability of the signal gain, and d.c. feedback through the same resistor network ensures stability of the d.c. working points. A positive voltage of 6·2V d.c. is provided by resistor R29 and Zener diode MR3 for the operation of the transistors VT2 and VT4, and for VT7 in the d.c. amplifier. Capacitor C5 prevents oscillation due to interaction between the pre-amplifier and the a.c. amplifier. Two capacitors back to back, C6(a) and C6(b), provide a signal earth while at the same time preventing any possibility of a d.c. flow through the aircraft frame.

D.C. amplifier

10. Signals from the a.c. amplifier are detected by diode MR4, and passed through an input resistor and smoothing network R17, C12 and R18, to the d.c. amplifier consisting of transistors VT6, VT7 and VT8. The output from transistor VT7 must be reduced in voltage before it can be fed to the base of the output transistor VT8, and two voltage dropping Zener diodes, MR5 and MR6, are therefore included in the circuit.

11. The amplifier gain is controlled by the ratio of the value of the negative feedback resistor R23 to the total value of the input resistors R17 and R18; by including the indicator in the negative feedback loop; indicator impedances of between 10 ohms and 3K ohms can be accommodated. Indicator currents range between 0·4mA for empty indication and 2·0mA for full indication. Indications outside this current range give warning of a fault. Temperature compensation is provided by a sensistor SE1 which is arranged to afford compensation for the complete unit.

Power supplies

12. The aircraft 28V d.c. supply is smoothed and stabilized at +16V d.c. by resistors R27 and R28, and a Zener diode MR7. Transient high, positive voltages are eliminated by capacitor C14, and reverse transients are by-passed by diode MR8.

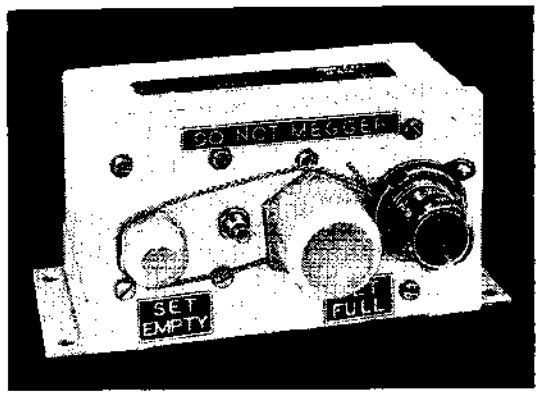

Fig. 1. Contents gauge control unit

INSTALLATION

Caution . . .

Ensure that the liquid oxygen container is completely empty when the 'empty' indication is obtained. In the event of the SET EMPTY *control being incorrectly set to give an empty indication when the container contains liquid oxygen, further emptying of the container will result in an initial decrease in indication below 'empty' which may then be followed by an increase in indication of liquid oxygen contents.*

13. The following instructions are complementary to those given in the relevant aircraft air publication to which reference should be made.

(1) In the event of the control unit and the liquid oxygen container not being matched, the full matching procedure (para. 15) must be applied.

(2) Ensure that the co-axial cable is connected to the control unit, and the 6-pole plug is securely mated with its associated socket.

Post installation checks

14. Ensure that the indicator reads correctly when the liquid oxygen container is empty and full respectively, and that the pointer does not rest against the stops at either end of the scale.

SERVICING

WARNING . . .

Many materials, particularly oil and grease, are subject to spontaneous combustion when exposed to undiluted oxygen under pressure. Precautions must be taken, therefore, to exclude oil, grease, dust and metal particles from the control unit.

Matching the contents gauge control unit to the container

15. The procedure for matching the contents gauge control unit to the container is as follows:—

(1) Connect the co-axial cable to the control unit and connect the other end of the cable by a special adapter (Part No. 1058K000) to a variable air condenser (Ref. No. 6C/3039).

(2) Connect a 28V d.c. supply and a multimeter, Type 1 (Ref. No. 10S/16411) to the control unit as shown in fig. 3.

(3) Set the variable air condenser to a capacitance value equal to the 'empty' capacitance of the container less the capacitance of the special adapter. The capacitance values of the container and the adapter are inscribed on the respective units.

(4) Remove the cover of the SET EMPTY control on the contents gauge control unit, and adjust the control to obtain a reading of 0·4mA (d.c.) on the multimeter. The control unit has a 'dip' characteristic and, when adjusting the SET EMPTY control, the zero must be set on the correct side of the dip. The correct setting can be determined by observing the direction of movement of the gauge pointer when turning the SET EMPTY control clockwise; this should produce a counter-clockwise movement of the gauge pointer.

(5) Set the variable air condenser to the full capacitance value inscribed on the container; less the capacitance of the adapter.

(6) Remove the cover of the SET FULL control. Adjust the control to obtain a reading of 2·0mA (d.c.) on the multimeter.

(7) Reset the variable air condenser to the capacitance value stipulated in sub-para. (3) to obtan a reading of 0·4mA on the multimeter.

(8) Reset the variable air condenser to the capacitance value specified in sub-para. (5) to obtain a reading of 2·0mA on the multimeter.

(9) Repeat the procedures detailed in sub-para. (7) and (8) until the readings are correct for both settings without further adjustment.

(10) Assemble the covers to the SET EMPTY and SET FULL controls and wire-lock using locking wire (Ref. No. 30A/3339). Record the serial number of the container to which the unit has been matched.

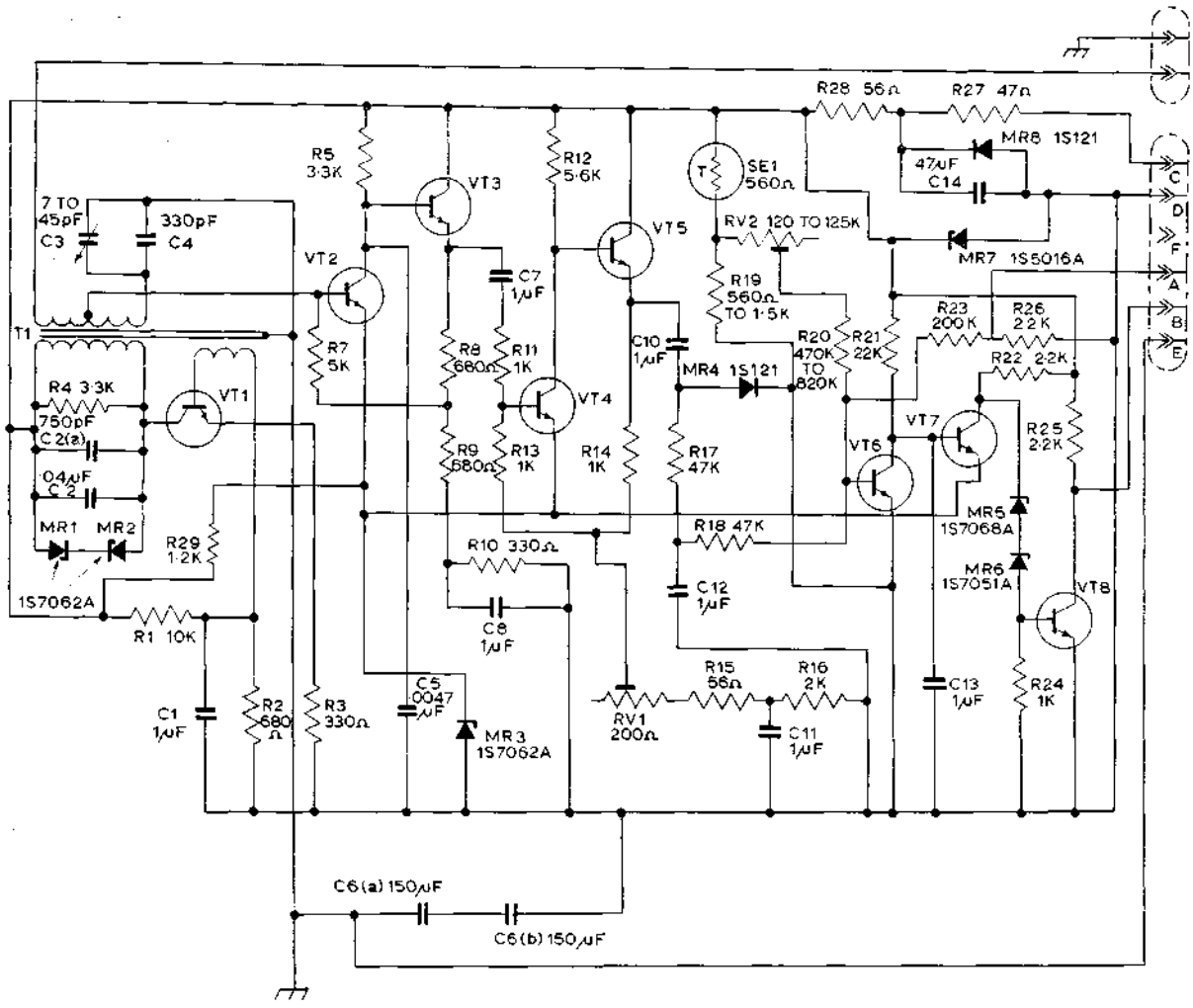

Fig. 2. Circuit diagram

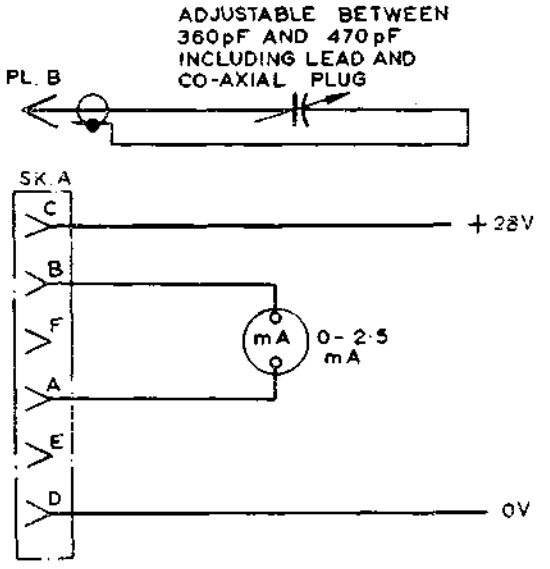

Fig. 3. Circuit diagram for matching procedure

Chapter 7-1

STANDARD SERVICEABILITY TESTS

for

CONTENTS GAUGE CONTROL UNIT

(Part No. 1215X000)

Introduction

1. The tests detailed in this chapter should be applied before the unit is matched to a container prior to installation in an aircraft, when the serviceability of the unit is in doubt and at the appropriate examination periods at Equipment Depots.

TEST EQUIPMENT

2. The test equipment required for the tests is as follows:—

(1) Variable air condenser (Ref. No. 6C/3039), equipped with a special adapter (Part No. 1058K000)

(2) A coaxial cable assembly (Part No. OP.7140) terminating in an Amphenol plug, Type TY27-7

(3) Multimeter, Type 1 (Ref. No. 10S/16411)

(4) Plessey socket, Type 691ET-10-6S

(5) 28V d.c. supply.

PARTICULARS OF TESTS

3. The SET EMPTY control of this unit has a 'dip' characteristic. It is essential that the multimeter indication is on the correct side of the 'dip'; this will be revealed when, on turning the SET EMPTY control clockwise, the multimeter indication decreases.

4. Insulation resistance tests must not be applied to this unit.

TEST PROCEDURE

WARNING . . .

Many materials, particularly oil and grease, are subject to spontaneous combustion when exposed to undiluted oxygen under pressure. Precautions must be taken, therefore, to exclude oil, grease, dust and metal particles from the control unit and test equipment.

Setting

5. (1) Connect the control unit to the test circuit as shown in fig. 1.

Caution . . .

The control unit will be damaged if the polarity of the supply is reversed.

(2) Remove the covers from the SET EMPTY and SET FULL controls.

(3) Set the multimeter to the 1mA (d.c.) range and the variable air condenser to a capacitance value of 375pF. Switch on the 28V d.c. supply.

(4) Adjust the SET EMPTY control as necessary and verify that an indication of 0·4mA can be obtained on the multimeter.

(5) Reset the multimeter to the 10mA (d.c.) range and adjust the variable air condenser to 450pF.

(6) Adjust the SET FULL control as necessary and verify that an indication of 2·0mA can be obtained on the multimeter.

(7) Owing to interaction between the SET EMPTY and SET FULL controls, the instructions detailed in sub-para. (3) to (6) must be repeated alternately until no further adjustment is needed to obtain the readings.

Maximum and minimum inputs

6. (1) Repeat the tests (para. 5(3) to 5(7) inclusive) using 360pF setting on the air condenser for SET EMPTY capacitance, and 430 and 440pF, consecutively, for the SET FULL capacitance. In each instance it must be possible to obtain 0·4mA and 2·0mA.

(2) Repeat tests (para. 5(3) to 5(7) inclusive), using 390pF for SET EMPTY capacitance and 460 and 470pF, consecutively, for the SET FULL capacitance. In each instance it must be possible to obtain 0·4mA and 2·0mA.

(3) Reset the contents gauge control unit to the conditions specified in para. 5(3) to 5(7) inclusive.

Open circuit failure

7. (1) Disconnect the air condenser and check that the multimeter indication rises to not less than 2·5mA.

(2) Switch off the electrical supply and disconnect the unit from the test circuit. Replace the covers on the SET EMPTY and SET FULL controls and wire-lock using locking wire (Ref. No. 30A/3339).

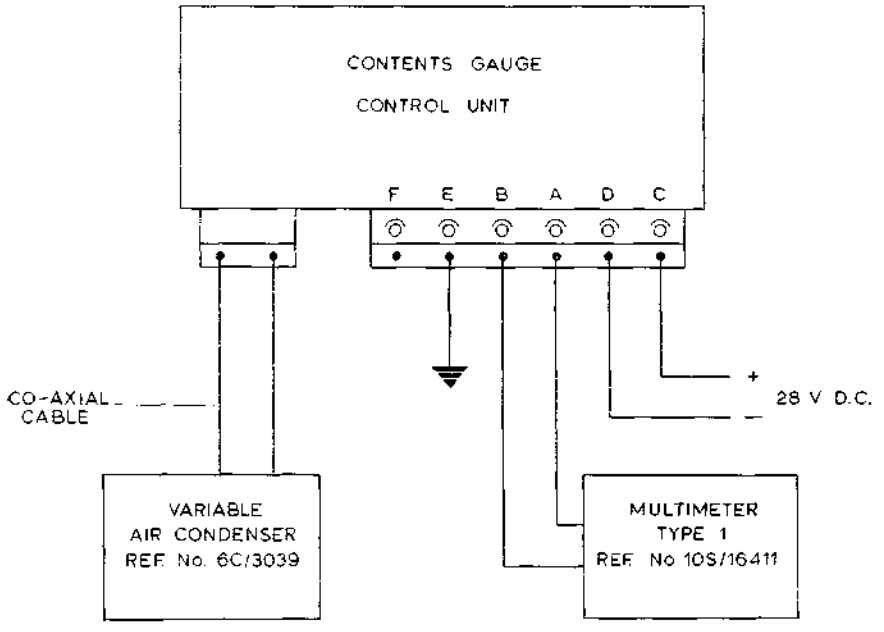

Fig. 1. Test circuit

Chapter 8

LIQUID OXYGEN CONTENTS GAUGING SYSTEM (VC 10)

Introduction

1. This gauging system operates from a 28V d.c. supply, and compares the capacitance of the liquid oxygen converter, which varies as the oxygen contents change, with that of a fixed capacitance.

2. Two d.c. signals, proportional to the two capacitances, are transmitted by an oscillator adjuster unit to a moving coil indicator mounted on the front panel of a master control unit, Type WKA 26865 installed at the flight engineers station.

3. The gauging system consists of the following components:—

(1) Oscillator adjuster unit, Type GP 1032/02—(Chap. 8-1).

(2) Indicator, Type GP 1031/02—(Chap. 8-2).

(3) Liquid oxygen converter (Part No. OP 4780)—(A.P.107D-0701-1).

(4) A coaxial cable connecting components (1) and (3).

Chapter 8-1

OSCILLATOR ADJUSTER UNIT, TYPE GP 1032/02

LEADING PARTICULARS

Ref. No.	6D/3321
Dimensions:—	
Length of base	6·5 *in.*
Width of base	4·875 *in.*
Height of unit	3·125 *in.*
Weight	*Not exceeding* 2 *lb.*
Electrical supply	28*V d.c.*
Electrical connections:—	
For remote capacitance	*Amphenol No.* 27-12
For power supplies	*Plessey UK-AN-FIXED*-16-9*P*
For principal indicator	*Plessey UK-AN-FIXED*-14*S*-13*S*
For demand indicator	*Plessey UK-AN-FIXED*-14*S*-7*SW*

Introduction

1. The oscillator adjuster unit, Type GP 1032/02, is a component of a liquid oxygen contents gauging system comprising:—

(1) an indicator, or indicators,

(2) the oscillator adjuster unit,

(3) a coaxial cable and

(4) a liquid oxygen converter.

The system operates from the aircraft 28V d.c. system.

DESCRIPTION

2. The oscillator adjuster unit (fig. 1) is an electronic device which compares the capacitance of the converter, which varies as the oxygen contents change, with that of a fixed capacitance contained within the unit; and it transmits two d.c. signals, proportional to these capacitances to an indicator having twin moving coils.

3. The unit contains a relay which is used to switch the outputs to an alternative indicator (e.g. at the oxygen filling point instead of at the flight deck); and also has adjusters enabling indicators, oscillator adjuster unit, co-axial cable capacitance and converter capacitance to be matched after installation in the aircraft.

4. The circuits are contained in a rectangular box which has the adjusters mounted on the top to give accessibility in the aircraft. There are EMPTY and FULL adjusters for the outputs to each of the two indicators, one pair marked '1' and the other pair marked '2'. There is also an earth connection on the side of the box.

5. A coaxial receptacle PL1 is provided at one end to connect the unit to the converter, using the co-axial cable; and, at the same end is a 4-pole plug PL2, which accepts the 28 V d.c. power supply and also a 28 V d.c. signal for the operation of the relay. At the other end of the box are two 3-pole sockets SKT1 and 2, one each for the outputs to the two indicators.

OPERATION

Power supplies

6. The circuit is shown in fig. 2. Power is taken directly, at pins A (negative) and B of plug PL2, from the aircraft 28 V d.c. supply to energize the principal circuits and indirectly at pins C (negative) and D for the operation of the relay RL1.

Oscillator

7. The direct power supply energizes a modified Clapp oscillator in which regenerative feedback is applied to the base of VT1. Base bias is provided via R1 and the collector lead via R2. The tuned circuit consists of the capacitors C2 and C3 in parallel with the inductance L1 and the capacitors C4. As the series capacitance of C2 and C3 is large compared with C4, the oscillator frequency is effectively determined by C4 and L1. The inductance L1 is variable but is preset to give a frequency within the range 33·00 to 33·66 Kc/s

Coupling stage

8. The emitter follower circuit centring on VT2 forms a coupling stage connecting the oscillator with the output stage. The sinusoidal output from

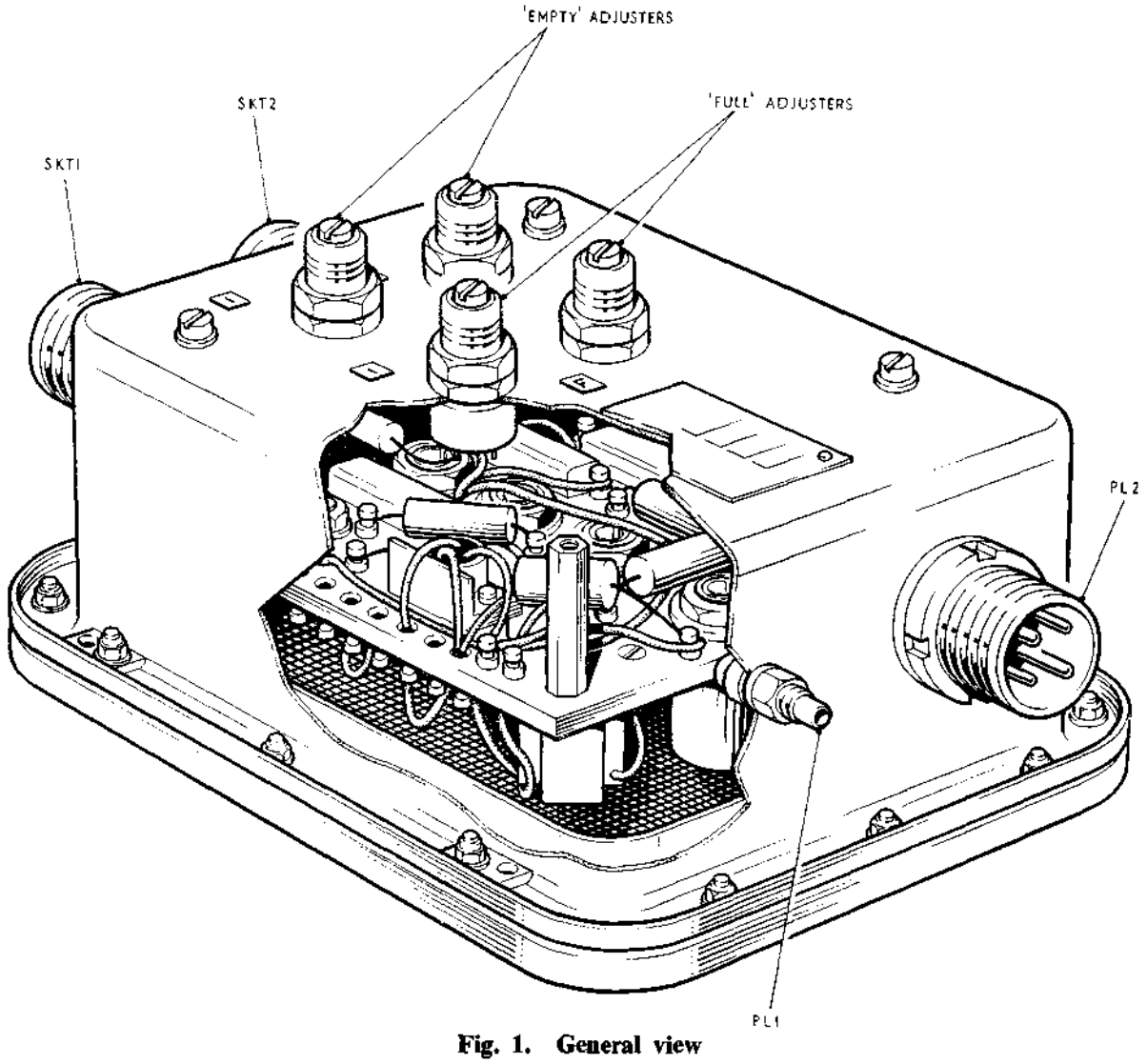

Fig. 1. General view

the collector of VT1 is fed, via the capacitor C5, to the base of VT2; and the output from the emitter of VT2 is fed via the resistor R6 to the phase-splitting transformer T1, which is tuned to give maximum impedance coupling to the output stage.

Output stage

9. The output stage consists of a push-pull amplifier circuit formed by VT3 and VT4. The output from the centre-tapped secondary winding of T1 is fed via capacitors C6 and C7 to the base of VT3 and VT4 respectively during each alternate half cycle. The amplified signal is taken from the collectors of VT3 and VT4 and applied to the centre-tapped primary winding of the transformer T2. The resultant sinusoidal output from the secondary winding is approximately 8 V at a frequency of 33·33 Kc/s and is applied to the rectifier adjuster section.

Control circuit

10. The alternating current output from the oscillator section is applied to the primary winding of the control circuit, matching transformer T3 via C10, which is the control capacitance. The output from the secondary winding of T3 is rectified by the two half-wave rectifiers MR2 and MR3 smoothed by the capacitor C12. The resultant d.c. signal is applied to one or other of the two resistance networks, via the relay RL1, and thence to the control coil of the associated indicator.

Deflection circuit

11. The alternating current output from the oscillator section is also applied to the primary winding of the deflection circuit, matching the transformer T4 with the padding capacitance C11 in parallel with the capacitance of the coaxial cable and the capacitance of the converter, which varies with the change of oxygen content. The output from the secondary winding of T4 is rectified by the two half-wave rectifiers MR4 and MR5 smoothed by C13. The resultant d.c. signal is applied to one or other of the two resistance networks, via the relay RL1, and thence to the deflection coil of the associated indicator.

Relay

12. The relay RL1 is operated by a remote switch and provides the means of shunting the

output from one indicator to the other (e.g. from the flight deck instrument to an instrument positioned at the oxygen filler point).

Adjuster networks

13. Two similar resistance networks are provided, one for the setting up of the system with each of the indicators. In each, a potentiometer RV1 or RV2, in the control circuit is used to set up the system at the EMPTY end of the scale and the potentiometer, RV3 or RV4, in conjunction with a resistor, R13 or R14, is used to adjust the deflection current at the FULL end of the scale. By this arrangement, variation of the resistance value of the FULL adjusters does not affect the setting of the EMPTY adjuster.

INSTALLATION

14. The following instructions are complementary to those given in the relevant aircraft air publication to which reference should be made.

(1) Ensure that all mechanical and electrical connections are securely made.

(2) To ensure the overall accuracy of the system, it is essential to match the converter, the coaxial cable, the oscillator adjuster unit and the indicators in the aircraft. Whenever any of these items are changed, apply the "setting up" procedure prescribed in the relevant aircraft air publication.

(3) Ensure that the type of oscillator adjuster unit and the setting up instructions employed are relevant to the type of aircraft concerned.

SERVICING

15. At pre-flight checks, switch on the system and ensure by the visual indication that the system is operating.

16. At intervals prescribed in the aircraft air publication:—

(1) Check the security of the mounting and the electrical connections.

(2) Apply the "setting up" procedure prescribed in the aircraft air publication.

17. If serviceability of the oscillator adjust unit is suspect, it is to be tested as detailed in Chap. 8-1-1.

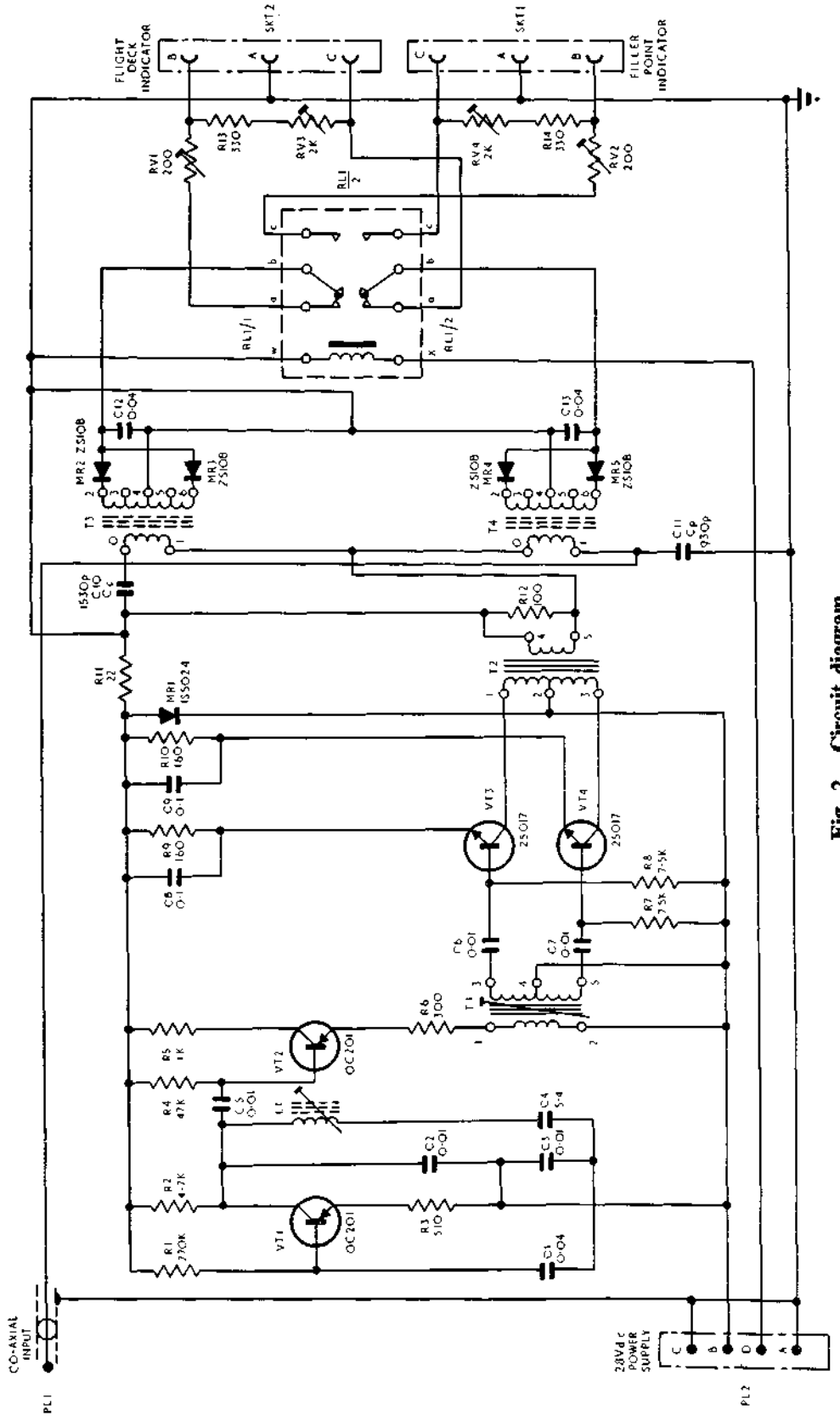

Fig. 2. Circuit diagram

Chapter 8-1-1

STANDARD SERVICEABILITY TESTS

for

OSCILLATOR ADJUSTER UNIT, TYPE GP 1032/02

Introduction

1. The tests detailed in this chapter should be applied before the unit is installed in an aircraft, when the serviceability of a unit is in doubt and at the appropriate examination periods at Equipment Depots.

TEST EQUIPMENT

2. The test equipment required is as follows:—

(1) A multimeter, Type 12889 (Ref. No. 5QP/17447)

(2) A calibrated indicator, Type GP1031/02

(3) A calibrated coaxial cable assembly, Type GP34040/02

(4) A variable capacitance calibrated to an accuracy of ± 1pF over the range 500 to 750 pF.

(5) A capacitance bridge accurate to ± 1 pF in the range 5 to 1000 pF when operating in the frequency range 20 to 34 Kc/s.

(6) Power supply variable over the range 22 to 29 V d.c. at a consumption not exceeding 4 watts.

(7) Connectors as follows:—
Plessey UK-AN-FREE-16-9S
Plessey UK-AN-FREE-14S-13P
Plessey UK-AN-FREE-14S-7PW

(8) A frequency counter, Type CT463 (Ref. No. 10S/9131419).

PARTICULARS OF TESTS

3. The tests comprise bonding tests and a functional test. The functional test, although in the form of a setting up routine, is not intended as the final adjustment of the unit, the principal purpose being to demonstrate that the range of adjustment available is adequate to enable the converter, the coaxial cable, the oscillator adjuster unit and the indicators to be matched in the aircraft. Therefore, it is essential after installation in the aircraft, to apply the setting up routine prescribed in the aircraft air publication.

TEST PROCEDURE

Bonding tests

4. Using the multimeter, check that the resistance is not greater than 0·01 ohms between:—

(1) The shells of the connectors and the case of the unit,

(2) Pin A and the shell of the connector SKT1,

(3) Pin A and the shell of the connector SKT2,

(4) Pin A and C and the shell of the connector PL2 and

(5) The shell of the coaxial receptacle PL1 and the case of the unit.

Functional tests

5. Prepare for the tests as follows:—

(1) Refer to fig. 1 illustrating the connections required for the tests, and make the connections as and when indicated below.

(2) Take the coaxial cable assembly to be used in the tests, and establish the capacitance to within ± 1pF, which shall be 76 ± 10 pF and which shall be called C1.

(3) Deduce the algebraic difference (C2) between C1 and the standard (76 pF) as follows:—

$$C2 = 76 - C1$$

for example:—

$$+ 76 - (+78) = - 2 \text{ pF}$$

Refer to Table 1 and enter the value of the difference (C2) not forgetting the algebraic sign, in Column 5 of Table 1.

(4) Deduce the capacitance values (C3) to be used in the tests (Column 6) by the algebraic summation of the standard converter capacitances (C4) and the cable difference (C2) as follows:—

$$C3 = C4 + C2$$

for example:—

$$+ 540 + (-2) = 538 \text{ pF}$$

(5) Using the coaxial cable assembly, connect the calibrated variable capacitance to the coaxial receptacle PL1.

(6) Connect a 28 V d.c. supply to pin A (positive) and pin B of the 4-pole plug PL2. **DO NOT SWITCH ON.** This shall be called the OSCILLATOR power supply.

(7) Connect a 28 V d.c. supply to pin C (positive) and pin D of the 4-pole plug PL2. **DO NOT SWITCH ON.** This shall be called the RELAY power supply.

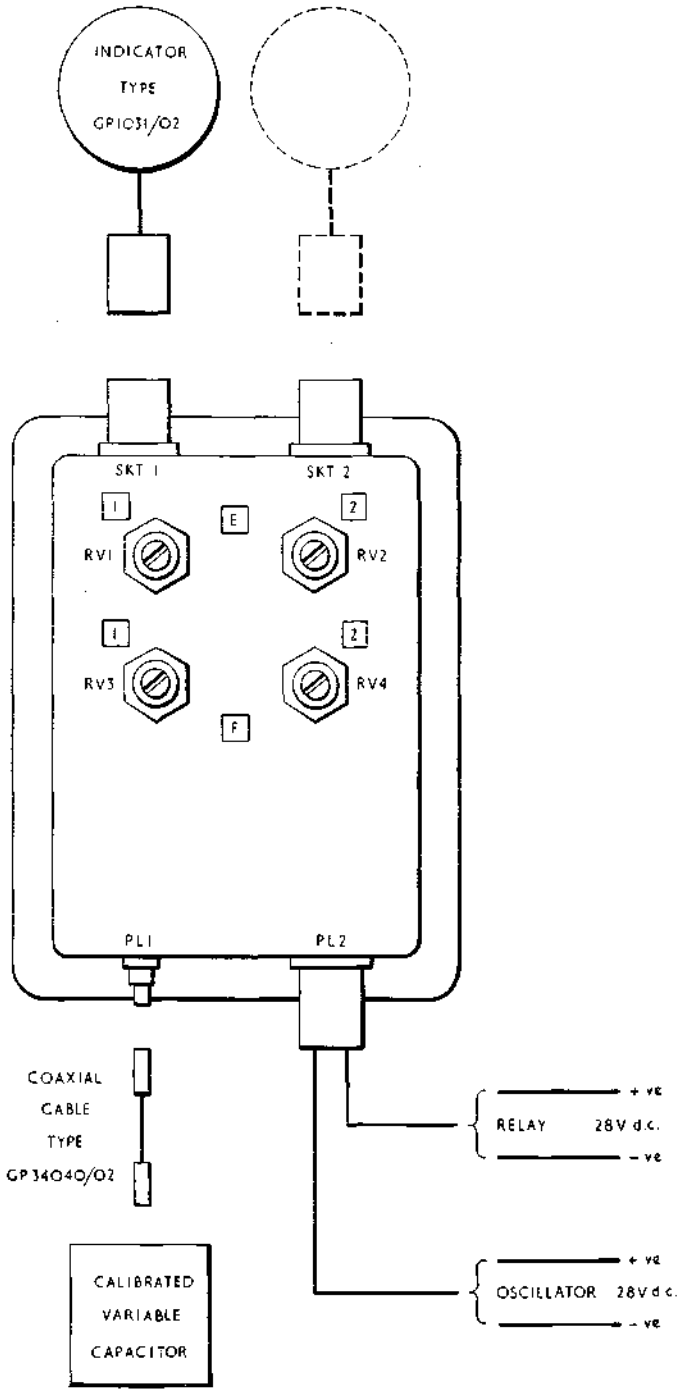

Fig. 1. Test circuit diagram

6. Apply the tests as follows:—

(1) Connect the multimeter, set to the ohms range, across pins B and C of the 3-pole socket SKT2. Switch ON the RELAY power supply.

(2) Turn the FULL adjuster RV3 fully counter-clockwise and note the resistance. Check that the value is between 305 and 355 ohms.

(3) Turn the FULL adjuster RV3 fully clockwise and note the resistance. Check that the value is between 2105 and 2555 ohms.

(4) Set the FULL adjuster RV3 so that the resistance value is the mean of the two readings obtained in (2) and (3). Switch OFF the RELAY power supply and disconnect the testmeter.

(5) Connect the testmeter across pins B and C of the 3-pole socket SKT1. **DO NOT** switch on the relay power supply.

(6) Turn the FULL adjuster RV4 fully counter-clockwise and note the resistance. Check that the value is between 305 and 355 ohms.

(7) Turn the FULL adjuster RV4 fully clockwise and note the resistance. Check that the value is between 2105 and 2555 ohms.

(8) Set the FULL adjuster RV4 so that the resistance value is the mean of the two readings obtained in (6) and (7). Disconnect the testmeter.

(9) Connect a calibrated indicator, Type GP1031/02 to the 3-pole socket SKT2. Switch on the OSCILLATOR power supply. **DO NOT** switch on the relay power supply.

(10) Turn the EMPTY adjuster RV1 fully counter-clockwise and adjust the calibrated variable capacitor until the indicator reads 4 litres (top of RED band). Note the reading of the calibrated variable capacitor, and check that it differs from the value given in Column 6 of Table 1 by not less than 20 pF.

(11) Turn the EMPTY adjuster RV1 fully clockwise and adjust the calibrated variable capacitor until the indicator reads 4 litres. Note the reading of the calibrated variable capacitor and check that it differs from the value given in Column 6 of Table 1 by not less than 20 pF.

(12) Set the calibrated variable capacitor to the figure given in Column 6 of Table 1 for 4 litres and turn EMPTY adjuster RV1 until the indicator reads exactly 4 litres. Turn the FULL adjuster RV3 over the full range of movement and check that the indication does not vary by more than $\pm$ 1% of the full scale deflection. Switch OFF the OSCILLATOR power supply.

(13) Connect a frequency counter across the calibrated variable capacitor and switch ON the OSCILLATOR power supply. Adjust the calibrated variable capacitor until the indicator reads mid-scale (15 litres). Note the frequency reading and check that it is 33·333 $\pm$ 0·333 kc/s. Switch OFF the OSCILLATOR power supply and disconnect the frequency counter.

(14) Switch ON the OSCILLATOR power supply. Check that the indicator is still reading 4 litres for the calibrated variable capacitor setting of Column 6 of Table 1, and then adjust the calibrated variable capacitor

to the FULL setting (30 litres) given in Column 6 of Table 1. Turn the FULL adjuster RV3 until the indicator reads 30 litres.

(15) Progressively reduce the setting of the calibrated variable capacitor over the range of values given in Column 6 of Table 1 and note the indications. Check that the indications do not vary from those given in Columns (1) and (2) by more than ± 3½% of the full scale deflection, except for the 4 litre indication which shall be within the limits + zero − 1½% of full scale deflection.

(16) Adjust the calibrated variable capacitor successively to give indications of 4 litres, ½ and FULL. At each point, vary the OSCILLATOR power supply potential up to 29 V and then down to 24 V. Check that the indication does not vary by more than 1 litre. Reduce the supply to 22 V and check that the indicator continues to function at the 4 litres, ½ and FULL positions. Switch OFF the OSCILLATOR power supply.

(17) Disconnect the indicator from the 3-pole socket SKT2 and connect it to the 3-pole socket SKT1.

(18) Switch ON the RELAY power supply and then repeat the tests of sub-paragraphs (10), (11), (12), (13), (14), (15) and (16), adjusting the EMPTY adjuster RV2 and the FULL adjuster RV4 in the place of RV1 and RV3 respectively.

(19) On completion, switch OFF the RELAY power supply and disconnect both power supplies, the indicator, the calibrated variable capacitor and the coaxial cable.

TABLE 1

Calculation of substitute converter capacitance

Sector colour	Dial indication	Converter contents (litres)	Standard converter capacitance (pF)	Difference in cable capacitance (pF)	Substitute converter capacitance (pF)
(1)	(2)	(3)	(4)	(5)	(6)
RED	EMPTY	NIL	540		
(End of RED sector)		4·0	577		
	¼	7·5	598		
	½	15·0	634		
	¾	22·5	666		
(Start of GREEN sector)			692		
GREEN	FULL	30·0	704		
(Full scale deflection)			726		

Chapter 8-2

INDICATOR, TYPE GP1031/02

LEADING PARTICULARS

Ref. No.	*6D/3319*
Dimensions (overall):—	
Length	3·333 *in.*
Diameter	1·940 *in.*
Flange adapter	$2\frac{3}{4}$ *in.* × $2\frac{3}{4}$ *in.*
Weight (without flange adapter)	$11\frac{1}{4}$ *oz.*
Connection for electrical services	*Cannon socket MC14H-8-3PN*
Electrical supply	*28V d.c.*

Introduction

1. The indicator, Type GP1031/02 is a contents gauge for a liquid oxygen system comprising:—

(1) the indicator, or indicators,

(2) an oscillator adjuster unit,

(3) a coaxial cable and

(4) a liquid oxygen converter.

The system operates from the aircraft 28V d.c. supply.

DESCRIPTION

2. The indicator (fig. 1) has a cylindrical case which is hermetically sealed and which provides a magnetic screen for the movement, which is a moving coil ratiometer. Two separate coils and the pointer are mounted on a comon spindle. The coils are wound in opposite directions and each coil is wired in series with a preset calibration resistor. Each coil moves over a separate core, both cores being mounted in the field of a single magnet.

3. The indicator covers the range 0 to 30 litres of oxygen, the dial having a RED sector covering 0 to 4 litres and a GREEN sector at the FULL end of the scale. Between these sectors the dial is marked $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$.

OPERATION

4. The electrical circuit is shown in fig. 2. The indicator receives two d.c. signals from the oscillator adjuster unit, each of which is applied to one of the moving coil circuits. The two coils, each with its calibration resistor, are balanced electrically; and, being wound in opposite directions, apply opposing torques to the pointer spindle. One of the d.c. signals is a control signal and the other is proportional to the contents of the converter; so that the effect of the two signals is to hold the pointer in a position, dependent upon the ratio of the magnitudes of the signals, indicative of the oxygen content.

5. Because the position of the pointer is governed by the ratio of the strengths of these two signals, the indication is not affected by variations in the aircraft supply voltage in the range 24 to 29V d.c. When the system is not energized, the pointer is returned off-scale by the action of a light coil spring.

INSTALLATION

6. The following instructions are complementary to those given in the relevant aircraft air publication to which reference should be made.

(1) Ensure that all mechanical and electrical connections are securely made.

(2) To ensure the overall accuracy of the system, it is essential to match the converter, the coaxial cable, the oscillator adjuster unit and the indicators in the aircraft. Whenever any of these items are changed, apply the "setting up" procedure prescribed in the relevant aircraft air publication.

(3) Ensure that the type of indicator and the setting up instructions employed are relevant to the type of aircraft concerned.

SERVICING

7. At pre-flight checks, switch on the system and ensure by the visual indication that the system is operating.

8. At intervals prescribed in the aircraft air-publication:—

(1) Check the security of the mounting and the electrical connections.

(2) Check that the glass is sound and the dial not deteriorating.

(3) Apply the setting up procedure prescribed in the aircraft air publication.

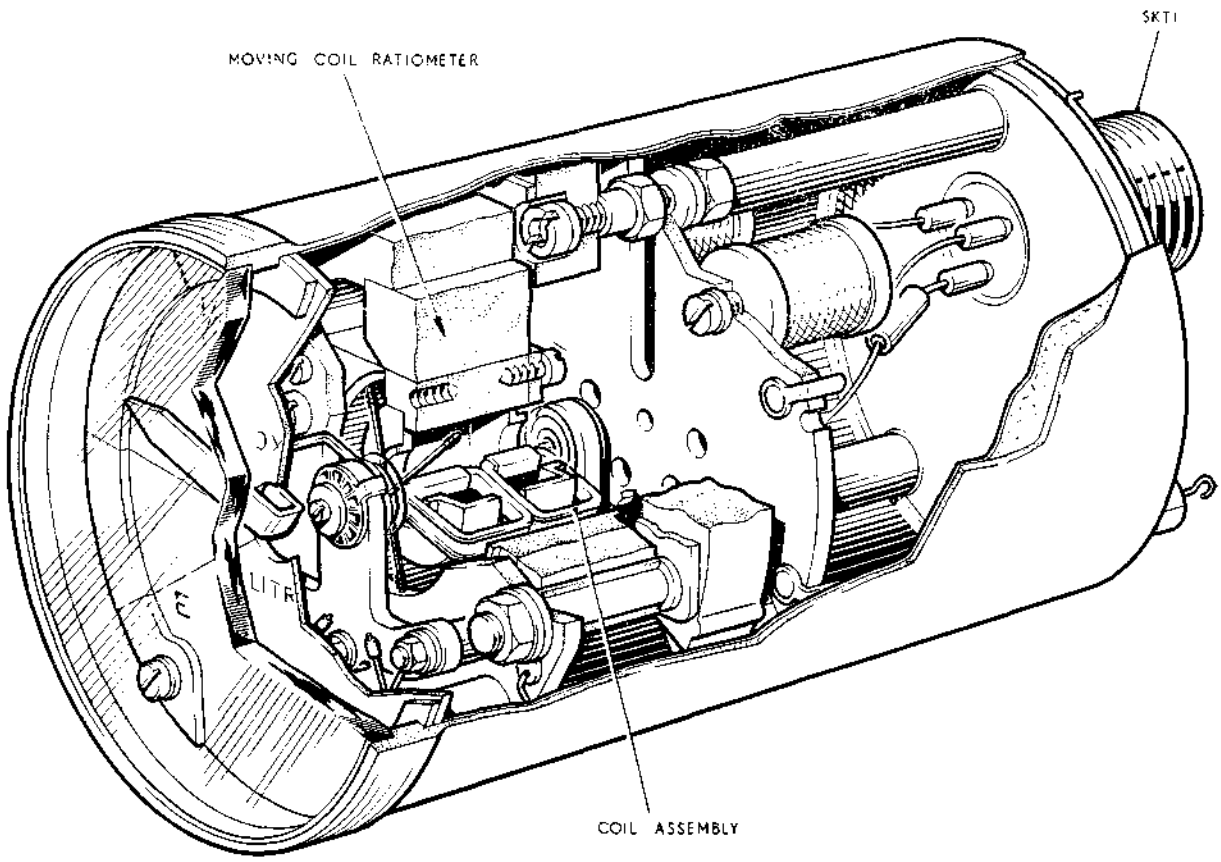

Fig. 1. Sectional view

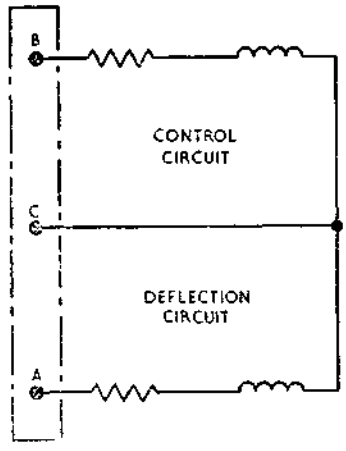

Fig. 2. Circuit diagram

Chapter 8-2-1

STANDARD SERVICEABILITY TESTS

for

INDICATOR, TYPE GP1031/02

Introduction

1. The tests detailed in this chapter should be applied before the unit is installed in an aircraft, when the serviceability of the unit is in doubt and at the appropriate examination periods at Equipment Depots.

TEST EQUIPMENT

2. The test equipment required is as follows:—

(1) Multimeter, Type 12889 (Ref. No. 5QP/17447).

(2) Tester, insulation resistance, Type A (Ref. No. 5G/1621) and for test circuit (see fig. 1).

(3) Power supply variable over the range 22 to 29V d.c. at a consumption not exceeding 4 watts.

(4) Two decade resistors adjustable over the range 0 to 3000 ohms.

PARTICULARS OF TESTS

3. The tests comprise an insulation resistance check, an overall resistance check of each moving coil circuit, and a dial calibration check in terms of ohmic proportions.

4. These checks are sufficient to establish the serviceability of the indicator before installation into the aircraft but they are not sufficient to give complete interchangeability with other indicators. Therefore, after installation in the aircraft, it is essential to apply the "setting up" procedure prescribed in the relevant aircraft air publication, to match the indicator to the other components, the adjustments being made at the oscillator adjuster unit.

TEST PROCEDURE

Insulation resistance check

5. (1) Link together pins A, B and C of the 3-pole socket.

(2) Using the insulation resistance tester, Type A, check that the resistance between the linked pins and the earth connection at the end of the case is not less than 20 megohms at 500V d.c.

(3) Remove the link from pins A, B and C.

Circuits resistance check

6. (1) Using the multimeter, set to the ohms range, measure the resistance between:—

(a) Pin A and pin B of the 3-pole socket

(b) Pin A and pin C of the 3-pole socket

(2) Check that the value is 2660 ± 30 ohms in each instance.

Calibration check

7. (1) Connect the pins of the 3-pole socket to the test network shown in fig. 1.

(2) Set the switch S1 in the OFF position and check that the pointer is held below the zero position by the return spring.

(3) Refer to Table 1

(4) Set the power supply to 28V d.c. and the switch S1 in the ON position.

(5) Set RV1 and RV2 in turn to each of the pairs of values given in columns (4) and (5) of Table 1 and accurately note the actual indications of the indicator. Check that these indications can be obtained within the tolerance given in column 4.

(6) Set RV1 and RV2 to the pairs of values given in columns (4) and (5) of Table 1 for 4 litres (top of RED sector) ½ and FULL. Adjust the power supply to 29 volts and then down to 24 volts at each pair of settings of RV1 and RV2. Check that at each voltage adjustment there is no perceptible difference from the indications noted at subparagraph (5).

(7) Adjust the power supply to 22 volts and check that the indicator continues to function with RV1 and RV2 adjusted to the pairs of values given in columns (4) and (5) of Table 1 for 4 litres (top of RED section), ½ and FULL.

(8) Switch OFF the power supplies and disconnect the test network.

TABLE 1

Calibration Check data

Sector colour	Dial indication	Converter contents (litres)	Resistance RV1 (ohms)	Resistance RV2 (ohms)
(1)	(2)	(3)	(4)	(5)
RED	EMPTY	NIL	3610 ± 30	2250
(top of RED sector)		4·0	3119 ± 32	2250
	¼	7·5	2700 ± 30	2250
	½	15·0	2227 ± 30	2250
	¾	22·5	1890 ± 30	2250
(Start of GREEN sector)			1660 ± 30	2250
GREEN	FULL	30·0	1560 ± 30	2250
(Full scale deflection)			1390 ± 30	2250

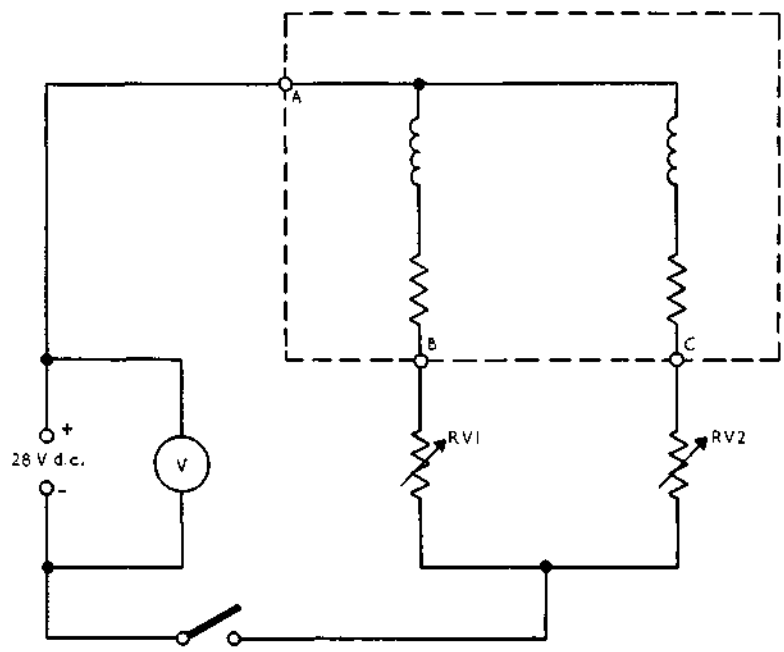

Fig. 1. Test circuit

Chapter 9

OXYGEN PRESSURE GAUGE (PART No. OP4930)

Introduction

1. This gauge (Ref. No. 6D/2924) is used in liquid oxygen systems to indicate the pressure in the supply line from the liquid oxygen converter.

DESCRIPTION

2. The unit consists of a dial-type gauge, the case being threaded at the forward end to accommodate a mounting flange and a gasket; these are secured to the case by a locking ring. The dial is graduated from 0 to 400 lb/in² in increments of 25 lb/in². A segment extending over the range 100 to 160 lb/in² is coloured red, and is marked RESERVE; this is the operating pressure range for a crew reserve system. Another segment coloured green and marked NORMAL indicates the normal operating pressure range 300 to 340 lb/in².

3. The gauge operates on the Bourdon tube principle, a $\frac{1}{8}$ Bsp, internal cone seating, pressure connection extending from the rear of the case. A gauze disc, located in the rear of the case, protects a safety bursting disc.

INSTALLATION

4. If it is required to test the gauge before installation, apply the standard serviceability tests detailed in Chap. 9-1. Information concerning the installation procedure will be found in the relevant aircraft air publication.

WARNING . . .

Many materials, particularly oil and grease, are subject to spontaneous combustion when exposed to undiluted oxygen under pressure. Precaution must therefore be taken to exclude oil, grease, dust and metal particles from entering the unit.

SERVICING

5. The only routine servicing that can be applied is an examination for damage and corrosion, and renewal of the rubber gasket between the case and the mounting flange. To do this, unscrew the locking ring using a suitable peg spanner, then separate the mounting flange from the case.

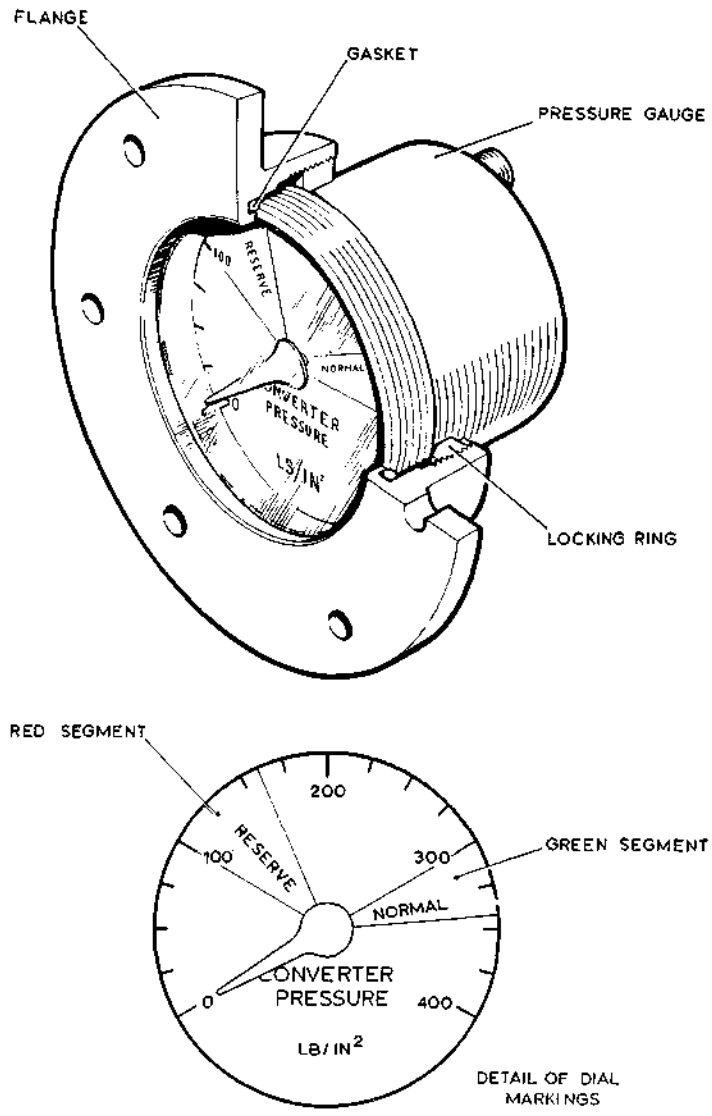

Fig. 1. Sectional view and dial presentation

Chapter 9-1

STANDARD SERVICEABILITY TESTS

for

OXYGEN PRESSURE GAUGE (PART No. OP4930)

Introduction

1. Standard serviceability tests cannot be applied to this gauge until a test pressure gauge, of sufficient range, is available.

Amendment List No.12
to AP 107D-0301-1
Pages 1 and 2 (one leaf).
Chap.11-1 Pages 1 and 2 (one leaf) and SUBSTITUTE this new
REMOVE and DESTROY Chap.11-1 Pages 1 and 2 (one leaf).
RECORD the incorporation of this AL in the Amendment Record Sheet.
MINISTRY OF DEFENCE

Chapter 11-1

STANDARD SERVICEABILITY TESTS FOR OXYGEN FLOW INDICATOR TRANSMITTER (Part No. 1449W000)

Introduction

1. The tests detailed in this chapter should be applied before a transmitter is installed in an aircraft and when the serviceability of a transmitter is in doubt.

TEST EQUIPMENT

2. The test equipment is as follows:-

(1) Test panel for liquid oxygen components (A.P.112T-01197-1) (fig.1).

(2) Adapter pipe to connect transmitter inlet ($\frac{1}{4}$ in. Bsp internal cone) to test panel. Local manufacture.

(3) Adapter pipe to connect transmitter outlet ($\frac{1}{4}$ in. Bsp male cone) to test panel. Local manufacture.

(4) Blanking adapter for transmitter outlet. Local manufacture.

(5) Test chamber approved for use with high-pressure oxygen and maintained specifically for this purpose.

(6) Insulation resistance tester (100V d.c.).

(7) Continuity tester (5V d.c. max).

(8) Electro-magnetic indicator (Ref. No. 5CZ/5003).

◀(9) Multimeter (Ref. No. 5QP/17447 or 5QP/1057049).▶

(10) Electrical supply, 28V d.c.

PARTICULARS OF TESTS

3. The test values specified in these tests are related to conditions of normal room temperature and pressure.

WARNING...

MANY MATERIALS, PARTICULARLY OIL AND GREASE, ARE SUBJECT TO SPONTANEOUS COMBUSTION WHEN EXPOSED TO UNDILUTED OXYGEN UNDER PRESSURE. PRECAUTIONS MUST BE TAKEN, THEREFORE, TO EXCLUDE OIL, GREASE, DUST AND METAL PARTICLES FROM THE TRANSMITTER AND THE TEST EQUIPMENT.

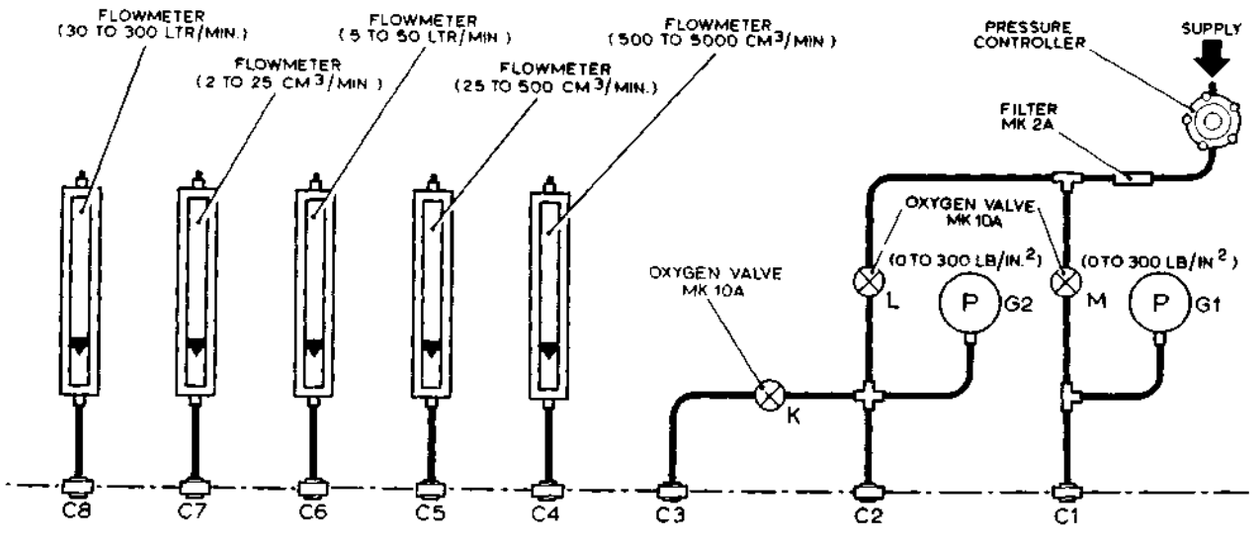

Fig.1. Test panel

TEST PROCEDURE

Insulation resistance

4. Using the 100V d.c. tester, check the insulation resistance between pin A and the case, and between pin B and the case. The test voltage must be applied for a period not exceeding 30 sec and the resistance should be not less than 20 megohms.

5. ◀Using the multimeter set to the appropriate test range (i.e. TO DIVIDE BY 100 SCALE), connect the positive lead to pin B and the negative lead to pin C; the resistance should not exceed 25 ohms. Reverse the leads and check the resistance: the value should be not less than 10 megohms with the multimeter set to OHMS range.▶

Bonding test

6. Using the continuity tester, check the resistance between the switch case and the transmitter unit. The resistance should not exceed 0·01 ohms.

Continuity test

7. (1) Ensure that the pressure controller selector on the test panel is rotated fully counter-clockwise and that all control valves are fully closed.

(2) Using the adapter pipes (para.2(2) and (3)), connect the transmitter inlet to panel connector C1 and the transmitter outlet to panel connector C2.

(3) Interconnect panel connectors C3 and C6.

(4) Open valve M fully, then adjust the pressure controller selector to obtain an inlet pressure of 70 lbf/in^2.

(5) Open valve K slowly until the 5 to 50 litres/min flowmeter indicates

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