

Chapter 1

CONTENTS GAUGE CONTROL UNIT

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Introduction

1. The contents gauge control unit is used in aircraft liquid oxygen systems to convert the capacitive 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 capacitance 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 28-volt 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

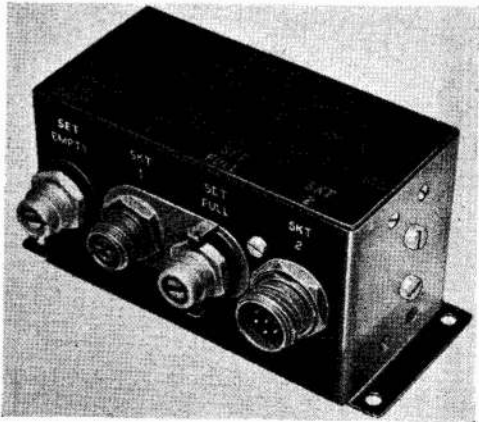


Fig. 1. Contents gauge control unit, Mk. 2

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 Part 1, Sect. 3, Chap. 2 of this publication.

CONTENTS GAUGE CONTROL UNIT (801227) Ref. No. 6D/2163

7. The 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 (802213) Ref. No. 6D/2362

8. The 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.

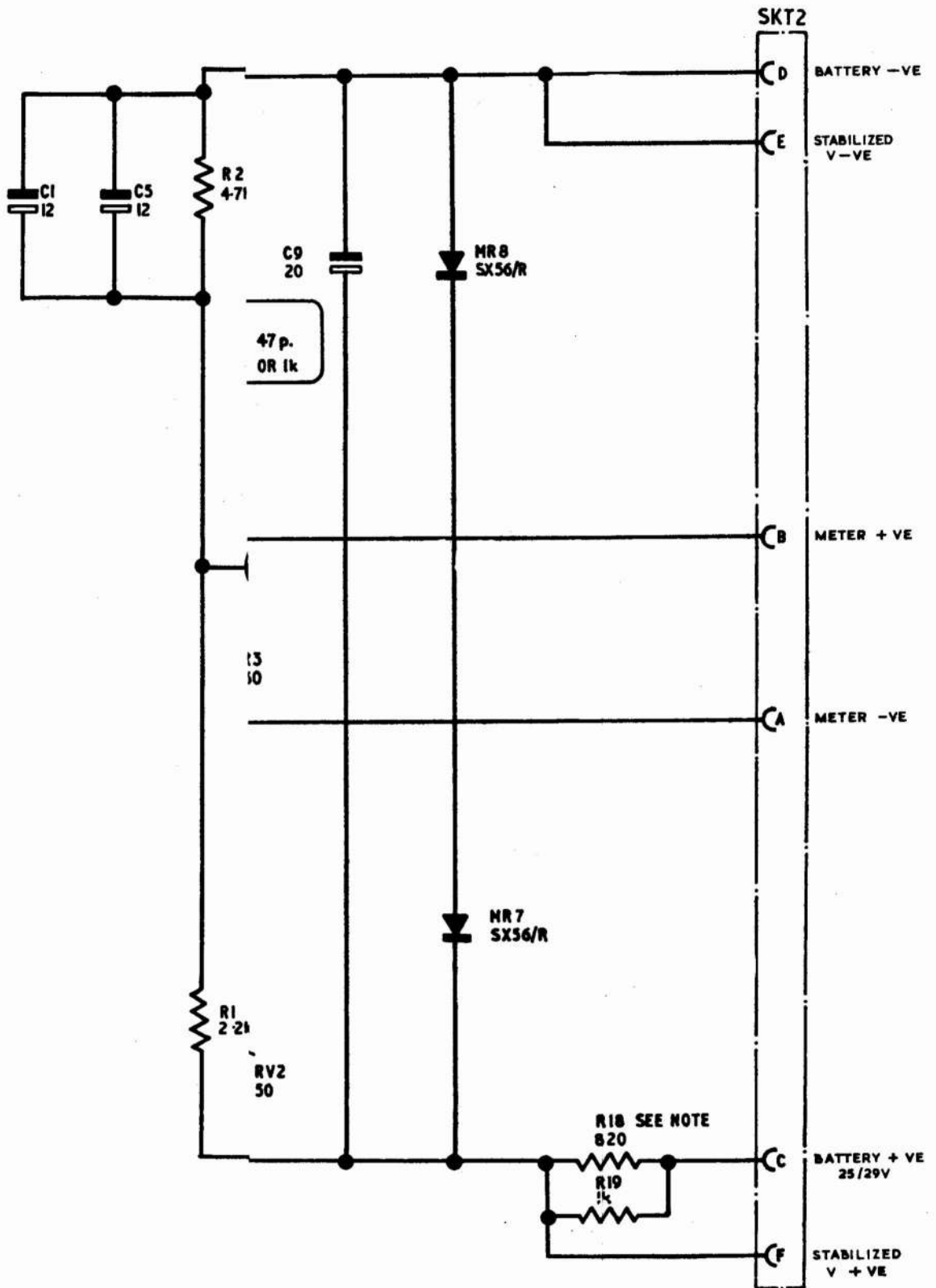


Fig. 2

Fig. 2

Appendix 1

STANDARD SERVICEABILITY TEST (R.N.)

for

CONTENTS GAUGE CONTROL UNIT, Mk. 1 and 2

Ref. No. 6D/2163 and Ref. No. 6D/2362

1. The tests laid down in this Appendix 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		

TESTS

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

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. Care must be taken 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 required)▶

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 0.795 mA on the multimeter.

(5) Set the multimeter to the 10mA range and adjust the Sullivan capacitor to the HIGH capacitance value 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 1.77 mA 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.

RESTRICTED

(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 0.4 mA.

(9) Slowly increase the value of the Sullivan capacitor and ensure that the multimeter reading rises to at least 2.0 mA.▶

◀12. If it is required to carry out 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 ± 0.025 mA.

(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.

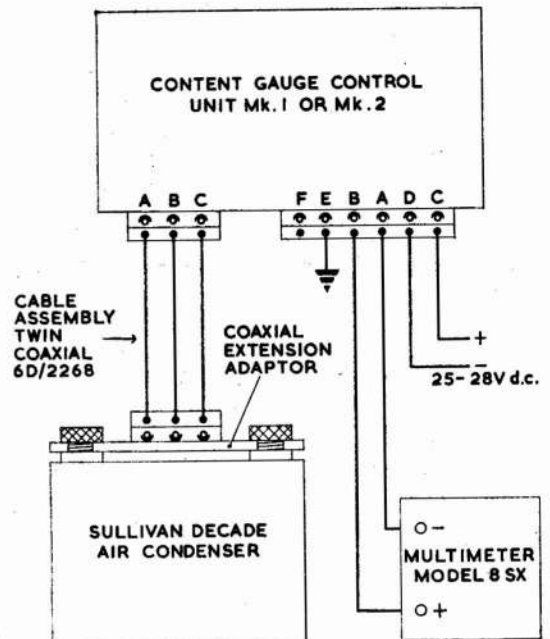


Fig. 1. Test rig, gauging system



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