Chapter 3-0

LIQUID OXYGEN CONTENTS INDICATORS, TYPE S149 SERIES

CONTENTS

Introduction

1 The information contained within this chapter deals with the Type S149 liquid oxygen contents level indicators. Each indicator (Fig 1) has a manufacturer's code number which is made up of three parts. A typical code is S149.3.341 where S149 is the model number, 3 is the 'form' and 341 the suffix number which varies according to the application to which the indicator is adapted. Each indicator will have a different number if used for a different purpose. The relevant information is contained in the sub-chapters. It should be noted that where the indicator has been supplied by the aircraft manufacturer, the relevant indicator provided by Service Stores will bear a different suffix number.

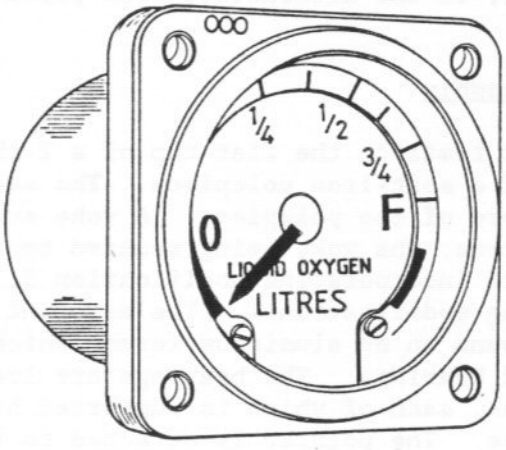

Fig 1 Contents indicator, Type S149.3 series

2 A standard serviceability test (SST) for the indicator is detailed in Chap 1-1; dial presentation, circuit diagram and calibration test for a particular variant are contained in the relevant chapter.

3 Three forms of the Type S149 indicator are in Service use; all liquid oxygen contents indicators are form 3.

4 The current to the indicator is provided from a measuring system which depends for its action upon the difference between the dielectric constant of gaseous and liquid oxygen. The dielectric constant varies according to the level of liquid in the container and this variation is measured as a change in capacitance. Suitable electronic equipment interprets this change in capacitance as a change in dc current. These current-changes control the moving coil of the contents indicator.

DESCRIPTION

5 The indicator (Fig 2) consists of the following assemblies.

5.1 Case.

5.2 Back plate.

5.3 Magnet and movement assembly.

5.4 Scales.

Case

6 The case is of 2-inch diameter; a flange adapter for conversion to SAE pattern may be fitted to the front of the case. After assembly of the indicator, the case is sealed by soldering the back plate to the rear of the case.

Back plate

7 The back plate incorporates three pillars which support the moulded ring on which the movement is mounted. Connections to the instrument are made via a terminal block or, if the alternative back plate is fitted, via a 3-pole Cannon plug.

Magnet and movement assembly

8 The permanent magnet rests on the flat top of a T-shaped spacer which is assembled in the gap of a soft-iron polepiece. The stem of the spacer fits into the slot in the core of the polepiece. A yoke encloses the magnet, spacer, core and polepiece, the yoke being secured to the front plate by two screws on indicators incorporating modification J, or by four screws on indicators incorporating modification T. The movement consists of a coil of fine copper wire, wound on an aluminium former which is pivoted in spring-loaded, jewelled bearings. The bearings are located in the front and rear bearing bridges, each of which is supported by three pillars secured to the polepiece. The pointer is attached to the base of the coil former pivots. Balance of the pointer is maintained by weights, and the travel of the pointer, in both directions, is limited by spring stops. The coil rotates in the gap between the core and the polepiece, this movement being controlled by the interaction of the magnetic flux, due to the permanent magnet, with the field produced by the current in the coil. Connections to the moving coil are made by one cable connected to the rear bearing bridge and a second cable which is earthed to the front-plate by a tag and securing screw. Final connection to the coil is made via the two hairsprings which provide the torque necessary to return the pointer to the 'set-zero' position when the indicator is not energized.

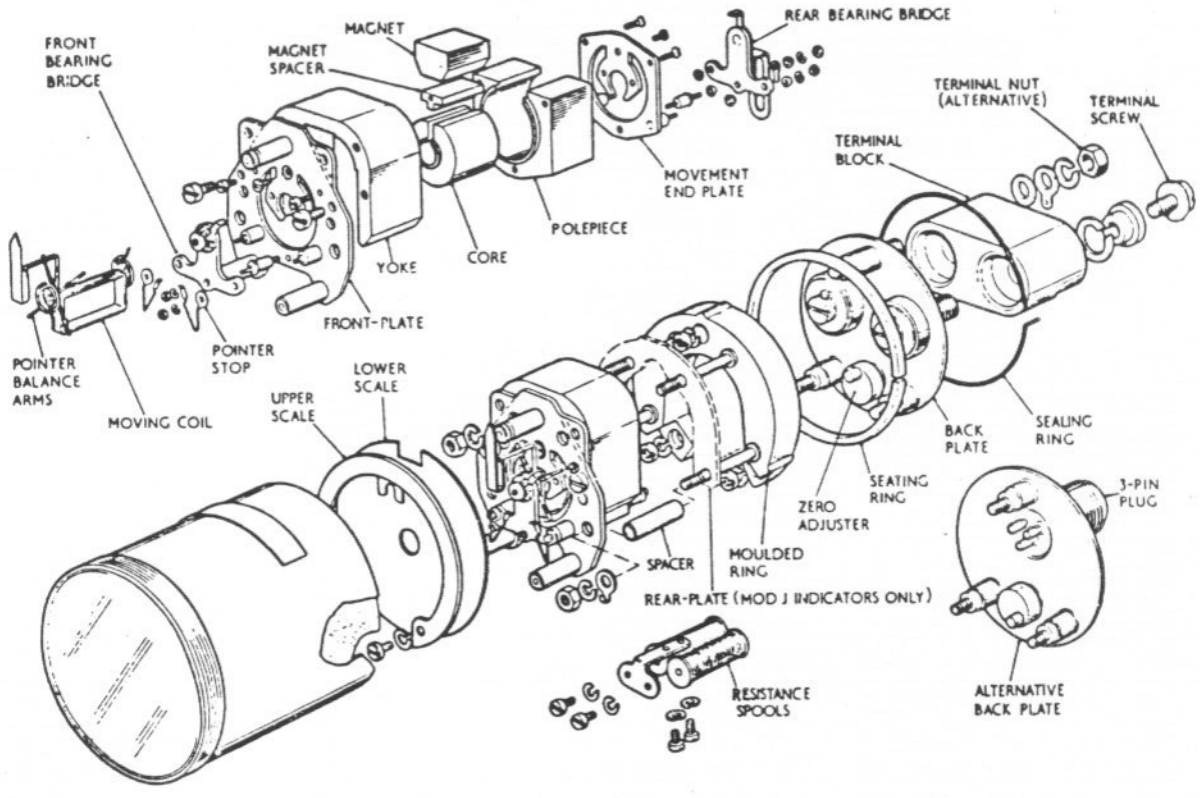

Fig 2 Indicator, Type S149 form 3

9 On indicators which do not incorporate modification T (mod J indicators) the magnet and movement assembly is held rigidly between the front and rear-plates and is mounted on pillars which project from the moulded ring; the moulded ring is secured to three mounting pillars on the back plate. The rear-plate (shown dotted in Fig 2) is omitted on indicators which incorporate modification T and the spacer on each pillar of the moulded ring is of sufficient length to compensate for the thickness of the rear-plate.

Scales

10 The scales are mounted on the three pillars fitted to the front-plate. Two screws passing through the bottom of both scales secure them to the two bottom pillars. A clip in the underside of the upper scale engages in a groove on the top pillar; the lower scale is, therefore, clamped in position when both scales are fitted.

OPERATION

11 In form 3, the principle is that of the normal voltmeter or ammeter where the movement of the moving coil in relation to the field of the permanent magnet is proportional to the voltage or current applied to the coil. For currents or voltages in excess of the rating of the indicator, resistances in shunt or series-connection are mounted internally.

Chapter 3-1

LIQUID OXYGEN CONTENTS INDICATOR, TYPE S149 SERIES

STANDARD SERVICEABILITY TEST

CONTENTS

INTRODUCTION

1 The following tests are to be applied to an indicator, Type S149.3 series immediately prior to installation in an aircraft and at any time the serviceability is suspect. The tolerances stated are not to be exceeded.

TEST EQUIPMENT

2 The following test equipment is required.

2.1 Insulation resistance tester, Type C, (Ref No 5G/9156675).

2.2 Multi-range test set, No 1 (Ref No 5QP/6625-99-105-7049).

2.3 Resistor, Type 321, variable, 15 ohms, (Ref No 10W/9846).

2.4 Resistor, fixed, composition, Grade 1, 10 kilohms. (Ref No 10W/0219185).

POWER SUPPLY

3 A 28 V dc power supply is required.

TESTING

Insulation resistance

4 Using the insulation resistance tester set to the 250 V range, measure the resistance between each terminal and the case of the indicator. In each case the insulation resistance is to be not less than 0.5 megohm.

Functional test

5 Perform the functional test as detailed in the relevant chapter for the indicator under test.

Chapter 3-2

INDICATOR, TYPE S149.3.341 OR 374

CONTENTS

DIAL PRESENTATION

1 The liquid oxygen contents indicator, Type S149.3.341 (Fig 1) and Type S194.3.374 is calibrated in fractions of tank-capacity from 0 (empty) to F (full).

2 The dial has two red sectors known as failure arcs. When the indicator circuit is energized, the pointer registers between the limits of 0 and F according to the level of liquid in the container. Failure of the contents-measuring system can cause the applied current to reduce and the pointer then remains in the red sector below zero; alternatively, failure of the system can produce sufficient current to move the pointer into the red sector beyond the full position. A thin black line is positioned at the centre of each red sector.

3 Two versions of each indicator are in use in the Services and different versions are a identified by a modification letter, adjacent to the indicator coding, which is printed on the dial; indicators with identical coding but different mod. letters, still bear the same reference number. Indicators marked with mod. letter X have wider bands on the dial at 0 and F than those indicators marked with the mod. letter V; they also are marked with a black line at the centres of the red sectors.

4 The indicator, Type S149.3.341 is fitted with a flange with a unified thread to adapt the instrument to SAE pattern; the indicator, Type S149.3.374 is identical in construction and calibration to the Type S149.3.341 with the exception that it has a flangeless housing. The resistance of each indicator is 70 ohms $\pm$1 ohm at 20 deg C.

CIRCUIT AND CONNECTIONS

5 The circuit of the instrument is shown in Fig 2. Connections are made via the 2-pole terminal block at the rear of the instrument.

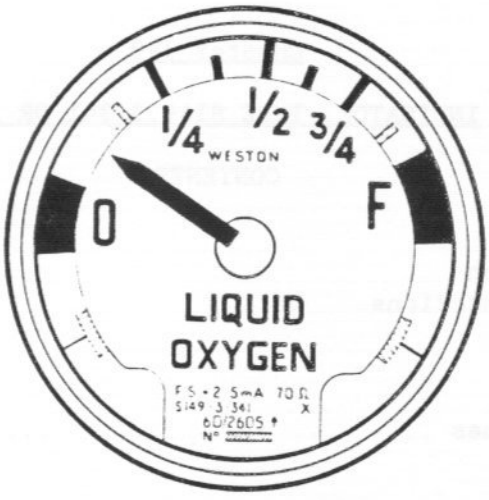

Fig 1 Indicator, Type S149.3.341

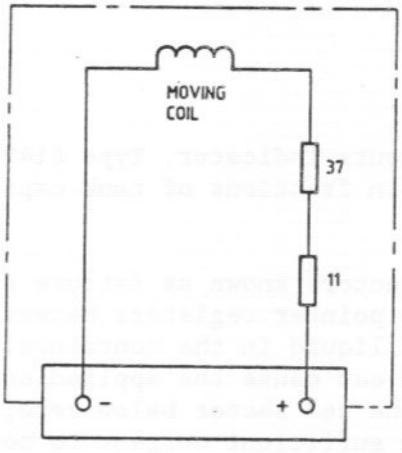

Fig 2 Circuit diagram

TESTING

6 The method of test is the same for both versions of the Type S149.3.341 indicator, and for the Type S149.3.374 indicator. The current values for the pointer positions are shown in Table 1. Proceed as follows.

6.1 Mount the indicator with dial upright and in a vertical plane.

6.2 Using the zero-adjusting screw at the rear of the indicator housing, adjust the indicator pointer to the black line of the left-hand red sector for Type S149.3.341X ad Type S149.3.374X; adjust to start of left-hand red sector for Type S149.3.341V and S149.3.374V.

6.3 Connect the indicator into the test circuit shown in Fig 3.

6.4 Adjust R1 so that the pointer indicates in turn each of the scale marks shown in Table 1. Tap the indicator lightly at each position and check that at each scale mark, for both increasing and decreasing values, the multimeter indicates as shown in the relevant section of Table 1.

Note ...

To obtain the negative value for the start of the left-hand red sector, change-over the connections to the indicator and then, if necessary, readjust R1.

6.5 Disconnect the indicator from the test circuit.

TABLE 1 CALIBRATION VALUES

Scale mark on dial	Multimeter reading (mA) S149.3.341X S149.3.374X	Multimeter reading (mA) S149.3.341V S149.3.374V
End of right-hand red sector	2.53 to 2.63	2.45 to 2.55
Right-hand black line	2.45 to 2.55	-
Start at right-hand red sector	2.37 to 2.47	-
End of 'F' mark	2.11 to 2.21	1.95 to 2.05
Start of 'F' mark	1.83 to 1.93	1.89 to 1.99
Yellow mark	1.72 to 1.82	1.72 to 1.82
3/4	1.55 to 1.65	1.55 to 1.65
5/8	1.39 to 1.49	1.39 to 1.49
1/2	1.26 to 1.36	1.26 to 1.36
3/8	1.09 to 1.19	1.09 to 1.19
1/4	0.90 to 1.00	0.90 to 1.00
Yellow mark	0.74 to 0.84	0.74 to 0.84
End of '0' mark	0.47 to 0.57	0.47 to 0.57
Start of '0' mark	0.23 to 0.33	0.35 to 0.45
End of left-hand red sector	0.03 to 0.13	-
Left-hand black line	0.00	-
Start of left-hand red sector	-0.03 to -0.13	0.00

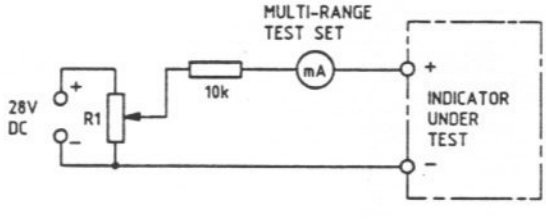

Fig 3 Test circuit

Chapter 3-4

INDICATOR, TYPE S149.3.157

CONTENTS

DIAL PRESENTATION

1 The liquid oxygen contents indicator, Type S149.3.157 (Fig 1) is calibrated in litres of liquid.

2 The dial has two red sectors known as "failure arcs". When the indicator is energized, the pointer indicates between the limits of 0 (empty) and F (full) according to the level of the liquid in the container. Failure of the contents-measuring system can cause the applied current to reduce and the pointer then remains in the left-hand red sector, below zero; alternatively, failure of the system can produce sufficient current to move the pointer past the F position and into the right-hand red sector.

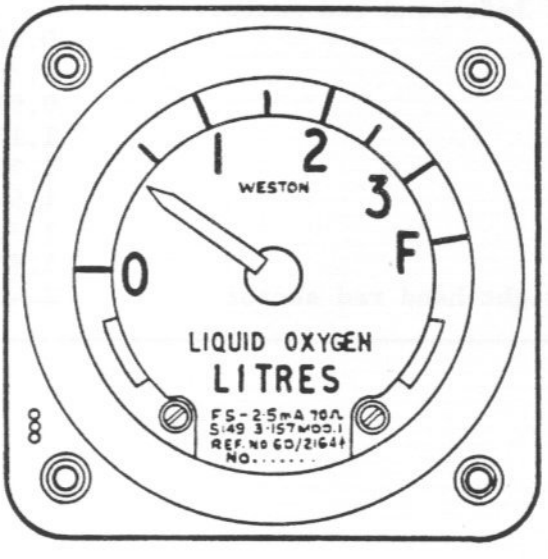

Fig 1 Indicator, Type S149.3.157

GENERAL

3 The indicator is fitted with a flange (unified thread) to adapt the instrument to SAE pattern.

CIRCUIT AND CONNECTIONS

4 The circuit diagram is shown in Chap 3-2, Fig 2. Connections to the indicator are made via the 2-pole terminal block at the rear of the case. The resistance of the indicator is 69 to 71 ohms at 20 deg C.

TESTING

5 Set the indicator pointer to the start of the left-hand red sector (Fig 1) by means of the zero-adjuster screw at the rear of the case.

6 Connect the indicator to the test circuit (Chap 3-2, Fig 3). Mount the indicator with the dial upright and in a vertical plane.

7 Adjust R1 so that the pointer indicates in turn each of the scale marks shown in Table 1. Tap the indicator lightly at each position and check that at each scale mark, for both increasing and decreasing values, the multimeter indicates as shown in Table 1.

8 Disconnect the indicator from the test circuit.

TABLE 1 CALIBRATION VALUES

Scale mark on dial	Multimeter reading (mA)
Start of left-hand red sector	0 to 0.05
0	0.35 to 0.45
0.5	0.76 to 0.86
1	0.975 to 1.075
1.5	1.18 to 1.28
2	1.375 to 1.475
2.5	1.54 to 1.64
3	1.72 to 1.82
F	1.95 to 2.05
End of right-hand red sector	2.45 to 2.55