### Chapter 9 MISCELLANEOUS (GENERAL)

(Completely revised)

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### Introduction

1. This chapter describes the liquid oxygen system's contents and flow indication circuits, including their installation and operation. Brief descriptions of the standby compass and the clock are also included. Detailed information regarding the systems and components is in the Air

Publications referred to in Chap. 1 of this Section: the same Chapter also illustrates the location and means of access to the components.

### Modification standard

2. This Chapter includes Mod 18.

#### LIQUID OXYGEN TANKS CONTENTS INDICATION

### General

3. A continuous indication of the contents of the liquid oxygen container incorporated in each crew member's individual oxygen system is shown by two indicators, one at the appropriate crew member's

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station and the other in the radio bay adjacent to the liquid oxygen charging point of the respective system. Depression of a push-switch adjacent to the indicator at the pilot's station causes the contents of the container incorporated in the observer's system to be shown by the pilot's indicator. Detailed information regarding the liquid oxygen system is contained in Book 1, Cover 2, Sect. 3, Chap. 10 of this publication.

### Description

### System principle

4. The contents indication system relies on a capacitance gauging principle. In this case the dielectric elements between the plates are liquid and gaseous oxygen.

### Container capacitors

5. The two liquid oxygen containers, one to each crew member's oxygen system, are located on the aft face of frame 534.5. An inner vessel and a perforated gauging shell incorporated in each container form the two plates of a variable capacitor, the capacitance of which is dependent upon the volume of liquid oxygen within the container. To facilitate the calibration of the indication circuits, the capacitor values for empty and full conditions are endorsed on the outer shell of each container.

### Control units

6. The control unit of each crew member's oxygen contents indication circuit is mounted adjacent to the associated liquid oxygen container (para 5), and incorporates two controls for calibration purposes. One control is marked SET LOW (or EMPTY), and the other is marked SET HIGH (or FULL).

### Contents indicators

7. Four indicators, one on the pilot's starboard console panel C-F/2, one on the

observer's starboard console panel C-M, and one at each liquid oxygen charging point, indicate the contents of their associated oxygen containers. The scale of each instrument, which is calibrated in litres from 0 to 3.75, is extended by a short red band appended to each end and if, during operation, a pointer moves to either of these positions, a circuit fault is indicated.

## Contents indication push-switch

8. The contents of the observer's liquid oxygen system's container is shown by the indicator at the pilot's station when a pushswitch, located adjacent to the indicator, is held depressed.

## Operation (fig 1 and 2)

### Normal contents indication

**9.** A 28V d.c. supply from fuse A2 (panel C-Q) is fed to both control units. When a container's capacitance value is affected by variations in the volume of liquid oxygen between the plates, a resistance capacitance bridge, within the associated control unit, becomes unbalanced. Resulting from the operation of the bridge, an output proportional to the capacitance of the container is relayed to the appropriate cockpit and charging point indicators.

### Note ...

If an indicator's pointer coincides with the red band at the beginning of the scale, a failure of the d.c. supply is indicated. Should the pointer move to the red band at the end of the scale, a faulty control unit, or an open-circuit between control unit and container gauging shell, is indicated.

## Changeover contents indication

10. When the push-switch C on the pilot's starboard console panel C-F/2 is held

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depressed, a d.c. supply is fed from fuse A2, in panel C-Q, to the solenoid of relay E on panel C-S. The contacts of the energized relay switch the contents indication system as follows:-

- Contacts 4a-4 and 8-8a isolate the d.c. output supply of control unit R-FJ from the indicators R-FL and D of the pilot's circuit.
- (2) Contacts 2-2a and 6-6a isolate the indicator R-FM of the observer's circuit.
- (3) Contacts 1-1a, 3a-3, 7-7a and 5a-5 connect the d.c. output supply of control unit R-FK, via the indicator B, to indicator D on the pilot's starboard console.

In this way the switched circuit, while maintaining the indication at the observer's station, causes an indication of the contents of the container in the observer's liquid oxygen system to be shown by the indicator D on the pilot's starboard console.

## Servicing

### Calibration checks

11. Periodically it is necessary to ensure that each of the liquid oxygen tank contents indication systems is properly calibrated. The recommended method is detailed in the following sequence of operations. A decade air capacitor (Ref No. 5G/3209) is required, together with, if possible, a capacitor/aircraft adapter socket.

- (1) Disconnect the screened cable from the liquid oxygen container and connect it, via the adapter, to the decade air capacitor.
- (2) Ensure that d.c. power is on the aircraft busbars.









- (3) Set the capacitor to the container's EMPTY capacitance value (endorsed on the container shell) making due allowance for the inherent capacitance of the test equipment.
- (4) Check that the pointer of each of the associated indicators registers with the zero mark at the lower end of the instrument scale.
- (5) Set the capacitor, as in operation (3),

to the container's FULL capacitance value.

- (6) Check that the pointer of each of the associated indicators registers with the full mark, F, at the upper end of the instrument scale.
- (7) Disconnect the d.c. power supplies and the decade air capacitor; reconnect the screened cable to the liquid oxygen container.

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12. Should any inaccuracies be evident during the calibration check, the affected contents indication system circuit must be set up in accordance with the subsequent instructions. If any discrepancies exist between the contents indicators, the suspected indicator(s) must be removed for individual calibration before proceeding any further.

Setting up the contents indication circuits 13. Each liquid oxygen system contents



indication circuit is set up by two controls on the outside of the respective control unit. These controls are marked, respectively, SET LOW (EMPTY) and SET HIGH (FULL). As the indicators can be adjusted to either of two zero settingsone true and the other false-it is most important that the true setting is established before the following sequence of operations is finalized. The true setting is indicated when a clockwise movement of the SET LOW (EMPTY) control moves the pointers of the associated indicators in an anti-clockwise direction.

14. The procedure for setting up the circuit is as follows:-

- Disconnect the screened cable from the liquid oxygen container and connect it, via an adapter, to a decade air capacitor. Use the equipment specified for the calibration check.
- (2) Ensure that d.c. power is available at the aircraft busbars.
- (3) Set the capacitor to the liquid oxygen container's EMPTY capacitance value (endorsed on the container shell) making allowance for the capacitance of the test equipment.
- (4) Adjust the SET LOW (EMPTY) control so that the pointer of each of the associated indicators coincides with the ZERO mark at the lower end of the instrument scale.
- (5) Set the decade capacitor as in operation (3) to the containers FULL capacitance value.
- (6) Adjust the SET HIGH (FULL) control so that the pointer of each of the associated indicators coincides with the FULL mark, F, at the upper end of the instrument scale.

- (7) To prove the setting of the circuits repeat operations (3) to (6) inclusive, until no further adjustment is necessary.
- (8) Disconnect the d.c. power supplies and the decade air capacitor; reconnect the screened cable to the liquid oxygen container.

### OXYGEN FLOW INDICATORS

### General

15. Two electro-magnetic indicators, one to each crew member, are located at each member's station to indicate when either of them is breathing oxygen. The indicators at the pilot's station are located on the port side of the instrument panel C-B and those at the observer's station on the auxiliary port console panel C-Y. The two indicators showing the pilot's use of the oxygen system are controlled by a pair of diaphragm-operated contacts incorporated in an oxygen demand regulator on the pilot's starboard console. The two indicators showing the observer's use of the oxygen system are similarly controlled by another regulator on the observer's starboard console.

### Function

16. When the oxygen system is in use each crew member's inhalations and exhalations open and close the diaphragm contacts of their respective regulators, thereby transmitting an intermittent d.c. supply to the appropriate indicator at each crew station. When oxygen is being consumed the indicators are energized and show a vertical white stripe on a black background. When there is no flow of oxygen the indicators are de-energized and show black.

### Note...

Each oxygen demand regulator embodies a similar electro-magnetic indicator which

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operates simultaneously with its respective pair of panel-mounted indicators.

# Operation (fig 3)

17. As the pilot's and observer's oxygen flow indication circuits are similar, the operation of the pilot's circuit only is described with the identification letters of the corresponding components of the observer's circuit in brackets. A d.c. supply is fed from fuse E10 (E11), in the normal fuse panel C-Q, to the contacts of the oxygen regulator A on panel C-F/5 (C-M). As the pilot inhales oxygen, the diaphragm of the regulator closes the switch contacts thereby transmitting a d.c. supply to the indicators AA on panel C-B and S on panel C-Y (T on panel C-Y and AB on panel C-B). When the pilot exhales, the diaphragm contacts of the regulator disconnect the supply to the indicators, causing them to be de-energized.

### STANDBY COMPASS

18. A Type E2B miniature magnetic compass, mounted centrally on the windscreen frame, is employed as a standby compass in the event of a failure of the Mk. 1 navigation display system (Chap. 3, this Section). A non-magnetic miniature lamp is incorporated at the base of the compass to provide direct lighting of the compass bowl. The operation of the lamp is controlled by the pilot's instrument lighting circuit (Cover 1, Sect. 6, Chap. 9).

### CLOCK

19. Provision is made for an elapsed time dashboard clock on the observer's starboard console panel C-M.

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# Appendix 1 LIQUID OXYGEN TANKS CONTENTS INDICATION (Mod 713)

# ILLUSTRATION

## Fig

Liquid oxygen tanks contents indication ... 1

1. Mod 713 introduces screened cables between the indicators and control units of the liquid oxygen tanks contents system as shown in fig 1. To prevent the capacitance of the screened cables affecting the accuracy of the system, STI/Bucc/96A removes the earth connections to the cable screens.

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# Appendix 2 LIQUID OXYGEN TANKS CONTENTS INDICATION (Mod 731)

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### General

1. Mod 731 introduces liquid oxygen contents indicators Type S149/3/341 (Ref No. 6D/2605) which are calibrated in fractions of tank capacity from O-F (full), in lieu of the type calibrated in litres. The scale of each instrument includes two red sectors for fault indication, described in the basic Chapter, and two yellow marks denoting, respectively, SET LOW and SET HIGH, are provided for calibration purposes (para 3).

2. To simplify the liquid oxygen charging procedure (Book 1, Cover 1, Sect. 2, Chap. 2) a cursor, in the form of a circlip with a white tongue, is fitted in the bezel of each of the two indicators at the servicing point.

#### Servicing

Calibration checks and setting up procedure 3. Instructions for checking the calibration of the liquid oxygen tanks contents indication system, together with setting up details, are in the basic Chapter.

### Note...

With modification Inst/GL10 incorporated, the capacitor values endorsed on the outer shell of each container are those for low and high conditions; the calibration procedure must therefore be performed using the lower and upper yellow marks, respectively, on the indicator scale, in lieu of the empty and full marks.

### Resetting the cursor

4. If the position of a cursor requires resetting, proceed as follows:-

- (1) Disconnect the electrical connections at the indicator.
- (2) Connect the indicator to the test circuit (fig 1).
- (3) Set R1 to approximately mid-way position.
- (4) Set the supply switch to ON, and **RESTRICTED**

adjust R1 to give an ammeter reading of 1.65mA.

- (5) Adjust the cursor until the tip of the indicator pointer appears in the centre of the hole in the tongue of the cursor.
- (6) Disconnect the test circuit and reconnect the aircraft cables to the indicator.



Fig. 1. Indicator test circuit

# Appendix 3 LIQUID OXYGEN TANK CONTENTS INDICATION (Mod 917)

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### ILLUSTRATION

### Fig

Liquid oxygen tank contents indication ... 1

#### General

1. On aircraft with Mod 917 embodied, a removable liquid oxygen package unit, Type C9/10 (Ref No. 6D/2836), is carried in lieu of the two fixed storage containers and associated control units. The package unit, R-FH, is located in the radio bay immediately above and behind the access aperture, and incorporates a single container and a control unit. Information on the Type C9/10 liquid oxygen package unit is in A.P. 1275G, Vol. 1, Part 3, Sect. 4.

2. Only two indicators, calibrated in fractions of tank capacity (post-Mod 731), are retained in the revised tank contents indication system (fig 1); one indicator is at the pilot's station, and the other, R-FM, is repositioned close to the servicing point in the radio bay. To prevent the capacitance of the screened cables between the indicators and control unit

affecting the accuracy of the system, STI/Bucc/96A removes the earth connections to the cable screens.

3. The cursor fitted in the contents indicator at the servicing point by Mod 731 is discarded, and the start of the F mark on the instrument is used to indicate the point at which charging must be discontinued (*Book* 1, *Cover* 1, *Sect.* 2, *Chap.* 2). The two yellow marks on the scale of each indicator denoting, respectively, SET LOW and SET HIGH, are used during calibration checks (*para* 4).

### Servicing

### Calibration checks

4. Periodically it is necessary to ensure that the liquid oxygen tank contents indication system is properly calibrated. The recommended method is detailed in the following sequence of operations. A decade

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air capacitor (Ref No. 5G/3209) is required, together with, if possible, a capacitor/ aircraft adapter socket.

- Disconnect the screened cable from the liquid oxygen container and connect it, via the adapter, to the decade air capacitor.
- (2) Ensure that d.c. power is available at the aircraft busbars.
- (3) Set the capacitor to the container's LOW capacitance value (endorsed on the container shell) making due allowance for the inherent capacitance of the test equipment.
- (4) Check that the pointer of each indicator (*fig* 1) registers with the yellow line at the lower end of the instrument scale.
- (5) Set the capacitor, as in operation (3), to the container's HIGH capacitance value.

- (6) Check that the pointer of each indicator (fig 1) registers with the yellow line at the upper end of the instrument scale.
- (7) Disconnect the d.c. power supplies and the decade air capacitor; reconnect the screened cable to the liquid oxygen container.

5. Should any inaccuracies be evident during the calibration check, the contents indication system circuit must be set up in accordance with the subsequent instructions. If any discrepancies exist between the contents indicators, the suspect indicator(s) must be removed for individual calibration before proceeding any further.

### Setting up the contents indication circuit

6. The contents indication circuit of the liquid oxygen system is set up by two adjusting controls on the outside of the control unit. These controls are identified, respectively, SET LOW and SET HIGH. As the indicators can be adjusted to either of two zero settings — one true and the other false — it is most important that the true setting is established before the following sequence of operations is finalized. The true setting is indicated when a clockwise movement of the SET LOW control moves the pointers of the indicators in an anti-clockwise direction.

7. The procedure for setting up the circuit is as follows:-

- Disconnect the screened cable from the liquid oxygen container and connect it, via an adapter, to a decade air capacitor. Use the equipment specified for the calibration check.
- (2) Ensure that d.c. power is available at the aircraft busbars.





- (3) Set the capacitor to the container's LOW capacitance value (endorsed on the container shell) making due allowance for the inherent capacitance of the test equipment.
- (4) Adjust the SET LOW control so that the pointer of each indicator (fig 1) coincides with the yellow mark at the lower end of the instrument scale.
- (5) Set the capacitor, as in operation (3), to the container's HIGH capacitance value.

# (6) Adjust the SET HIGH control so that the pointer of each indicator (fig 1) coincides with the yellow mark at the upper end of the instrument scale.

- (7) To prove the setting of the circuit, repeat operations (3) to (6) until no further adjustment of the SET LOW and SET HIGH controls is necessary.
- (8) Disconnect the d.c. power supplies and the decade air capacitor; reconnect the screened cable to the liquid oxygen container.

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# Appendix 4 LIQUID OXYGEN TANK CONTENTS INDICATION (Mod 994)

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#### General

1. On aircraft with Mod 994 embodied, a liquid oxygen package unit, Type CP14/10 (Ref No. 6D/3130), incorporating a stabilizing container in addition to the main container, is fitted in lieu of the package unit introduced by Mod 917.

2. When replenishing the liquid oxygen system, a volume equal to the capacity of stabilizing container must be left unfilled in the main container. To simplify the charging procedure (Book 1, Cover 1, Sect. 2, Chap. 2) a cursor, in the form of a circlip with a white tongue, is fitted in the bezel of the contents indicator at the servicing point. The white tongue of the

cursor indicates the point at which charging must be discontinued.

### Servicing

3. If the position of the cursor requires resetting, proceed as follows:-

- (1) Disconnect the electrical connections at the indicator.
- (2) Connect the indicator to the test circuit (fig 1).
- (3) Set R1 to approximately mid-way position.
- (4) Set the supply switch to ON, and adjust R1 to give an ammeter reading of 1.675 mA.
- (5) Adjust the cursor until the tip of the indicator pointer appears in the centre of the hole in the tongue of the cursor.

(6) Disconnect the test circuit and reconnect the aircraft cables to the indicator.



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