Chapter 1

LIQUID OXYGEN PACKAGE UNIT (802314)

Ref. No. 6D/2555

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LIST OF ILLUSTRATIONS

Introduction

1. The liquid oxygen package unit contains the aircraft supply of breathing oxygen in liquid form. It converts the liquid as and when required, into gas at pressures suitable for the supply of demand regulators, at flow rates to meet requirements of transport type aircraft. A contents gauging system, with the exception of indicating gauges is built into this unit.

WARNING . . .

Under no circumstances must oil or grease be used on liquid oxygen equipment owing to the risk of explosion in the presence of undiluted oxygen.

DESCRIPTION

2. The liquid oxygen package unit consists of a 25-litre capacity liquid oxygen container, liquid oxygen check valve, heat exchanger, contents gauge control unit, a padder unit and pressure control valve.

3. Referring to fig. 1 and 2, the container is spherical, vacuum insulated, and contains the sensing probe of the contents gauging system. The lower half of the container is encircled by and has attached to it the tubing plate heat exchanger (12), the contents gauge controls units (16) and the pressure control valve (7) are mounted on a panel which is itself attached to the heat exchanger. This group of components is supported upon three flexible mountings which are bolted directly to the aircraft structure. The aircraft side of two of the mountings carries between them a bracket on which are grouped five pipeline connectors. The three mountings together carry a drip tray. Each pipeline connection (SUPPLY, VENT, BUILD-UP, FILL and GAS) differs from the others, to prevent a misconnection and the pipelines connecting these to the appropriate components are coiled for flexibility.

OPERATION

4. The container is replenished via a fill and vent valve assembly (2). Engagement of the replenishing hose with the latter pushes open a vent valve (3), closes a build-up valve (4) and opens a filler valve (1). Liquid oxygen is then free to flow into the bottom of the container (14) whilst the top of the container is vented to atmosphere. When replenishing has been completed, removal of the replenishing hose allows spring pressure to close the fill and vent valve and to reopen the build-up valve. Under gravity a small amount of liquid oxygen trickles past the liquid check valve (13). This is evaporated in the heat exchanger (12), by heat inleak from the atmosphere, causing a build-up of pressure to both the supply lines, the pressure control valve (7), the fill and vent valve and the container itself.

5. At the normal operating pressure of 150 lb/in^2 (later raised to 160 lb/in^2, Mod. G.L.3) the bellows (5) is sufficiently compressed to allow the pressure closing valve (9) to close. A further rise in pressure takes place between check and control valves until the head of liquid is balanced and there is no further flow of liquid. Under normal operating conditions a demand for oxygen causes a slight drop in pressure in the supply lines and more liquid passes through the check valve to make good the gas extracted. Breathing oxygen is taken off downstream of the check valve and absorbs heat to an acceptable temperature in the heat exchanger before passing out of the container at the supply connection.

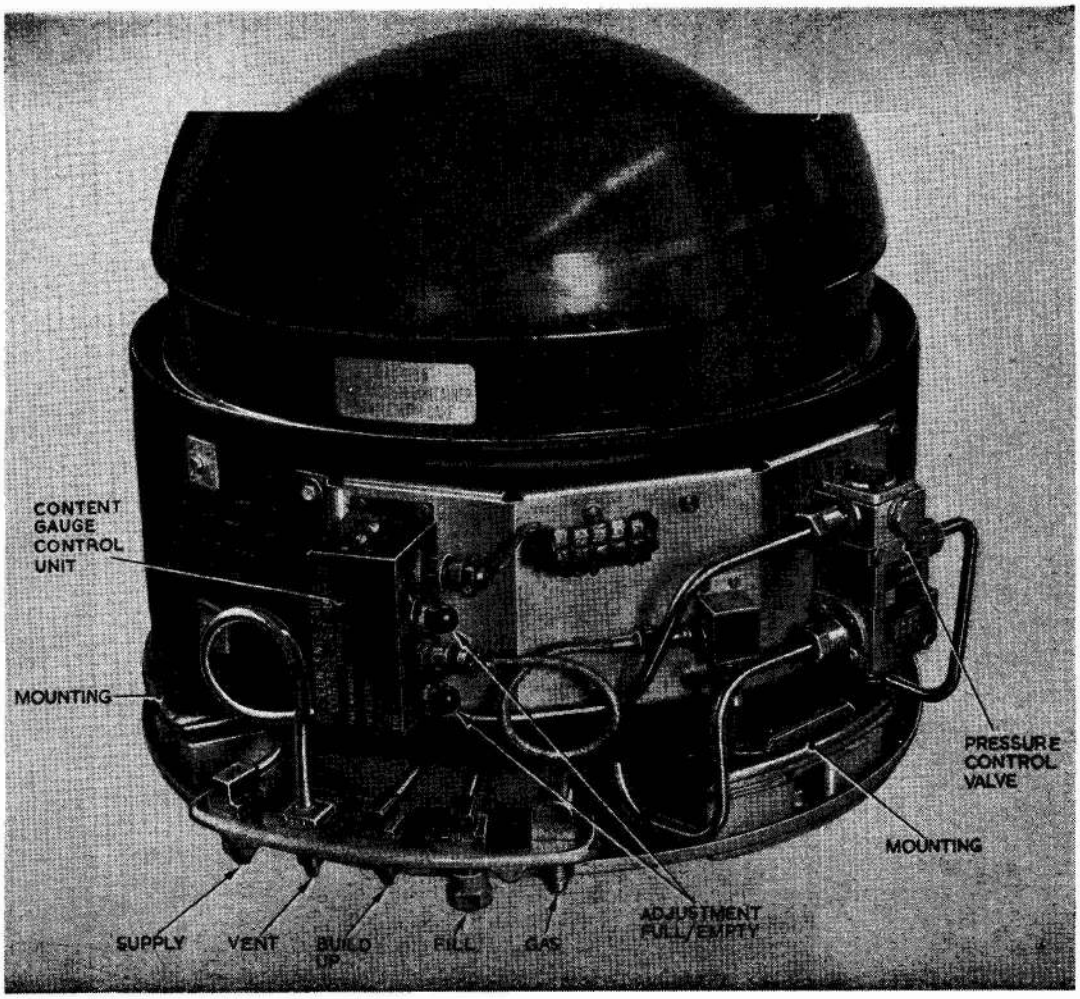


Fig. 1. 25-litre liquid oxygen package unit (802314), Ref. No. 6D/2555

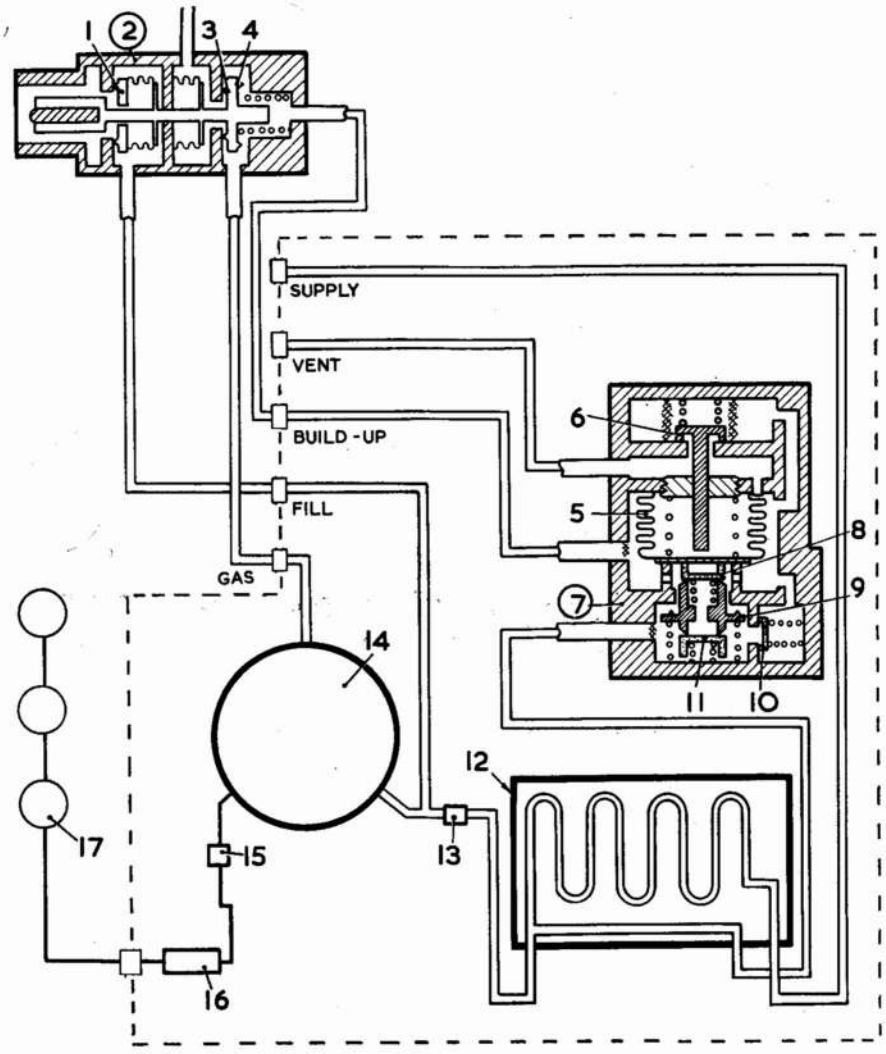
6. Heat inleak into the container causes a slight evaporation and, unless there is a demand for oxygen, pressure builds up throughout the system. At 170 lb/in² the bellows (5) is compressed sufficiently for the pressure-opening valve (8) to operate and allow gas from the top of the container to be economically used in the supply lines, a non-return valve (11) prevents a flow in the reverse direction. At 200 lb/in² the continued movement of the bellows opens a relief valve (6), venting to atmosphere. The differential pressure valve (10) opens at 50 lb/in².

7. In operation, frost forms on some of the components and drops of water formed when this melts are caught in a drip tray.

8. Within the container there is a capacitor gauging probe, consisting of five tubes located concentrically with the containers vertical axis. As this capacitor is more or less immersed in liquid, so its capacitance varies in relation with the level of liquid oxygen and measurements of this variation provides an indication of the liquid level.

9. The measurement is made by the contents gauging control unit (Sect. 2, Chap. 1) which consists of an oscillator, resistance capacitance bridge and an amplifier. The oscillator provides alternating current to operate the bridge, the bridge compares the capacitance of the probe with that of a fixed capacitor and gives an output proportional to the difference between them. This output is amplified, rectified and transmitted as direct current to 1, 2 or 3 indicators connected in series. This control unit is scaled as a standard item and incorporates the two adjustments for "empty and full" positions of the indicator, so that corrections can be made for the control unit, associated cables, and the probe to be matched to suit a particular installation.

10. To enable the standard control unit to be used with this container a padder unit comprising additional capacitance (fig. 4) is connected in parallel with the control unit's fixed capacitor, this increases the latter until it approximately balances that of the probe. A second capacitor within the



1 FILLER VALVE
2 FILL AND VENT VALVE ASSEMBLY
3 VENT VALVE
4 BUILD-UP VALVE
5 BELLOWS
6 RELIEF VALVE
7 PRESSURE CONTROL VALVE
8 PRESSURE OPENING VALVE
9 PRESSURE CLOSING VALVE
10 DIFFERENTIAL PRESSURE VALVE
11 NON-RETURN VALVE
12 HEAT EXCHANGER
13 CHECK VALVE
14 CONTAINER
15 PADDER UNIT
16 CONTENTS GAUGE CONTROL UNIT
17 CONTENTS INDICATORS

Fig. 2. 25-litre oxygen package unit (schematic)

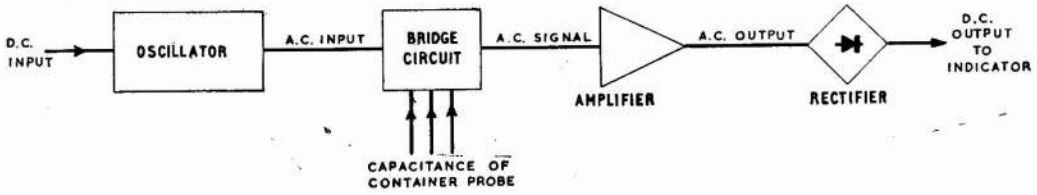


Fig. 3. Gauging system (schematic)

padder unit is connected in series with the probe to correct the capacitance variation of the probe between "full and empty" to a value within the limits of the control unit.

Electrical supply

11. An electrical supply of 14 amps. (nominal) 25-29 volts d.c. is required. All electrical connections from the Cannon type connectors on the control unit are made through the medium of a Plessy terminal block adjacent to the contents gauge control box. The cables to the terminal block terminate in forked type connectors.

SERVICING

12. With the exception of general inspection for cleanliness and security of attachment of pipeline connections, very little servicing is required. The removal of the complete unit for Bay Servicing will only be necessary when its function is suspect or at periods specified in the appropriate Aircraft Servicing Schedule.

INSTALLATION

13. During the installation of this equipment it is necessary to have access to the five pipeline connections and the electrical junction box. Scrupulous cleanliness must be observed and all connections should remain blanked off until immediately prior to the connecting up of the pipelines.

14. If the package unit is removed from the aircraft its connections must be sealed immediately, as must the aircraft pipelines. The complete system must be leak tested and functional checks applied after installation and also after the replacement of components. To avoid abnormally high losses from the system, all pipes, joints, etc., must be leak free, this is particularly important in pipelines carrying liquid oxygen.

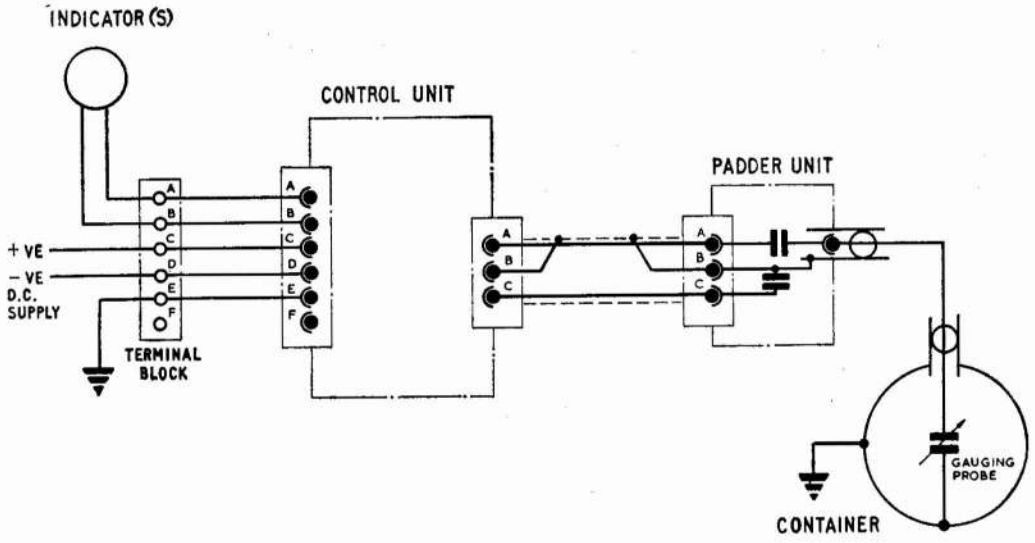


Fig. 4. Inter-units wiring diagram