Chapter 8

LIQUID OXYGEN PACKAGE UNIT (806168) TYPE CP. 14/10

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LIST OF ILLUSTRATIONS

Introduction

1. This liquid oxygen package unit is a 10-litre capacity stabilized system which maintains a specified oxygen pressure. This is the conventional liquid oxygen system with a stabilizing container and an automatic change-over valve incorporated in the installation. This package unit is designed to facilitate quick release and may be removed from aircraft after dismantling, vent and supply connections, 6-pole plug connection and two bolts located in slots at the front of the cradle base.

DESCRIPTION

2. If liquid oxygen is agitated (such as filling the system or by manoeuvring of aircraft in flight) cold layers of liquid comes into contact with the pressurizing gas, cooling it, causing it to contract and some to condense so that the supply pressure falls. The supply pressure remains low until it can be raised by the normal build up process. To overcome this pressure failure a stabilized system is used, which introduces an auxiliary container and an automatic changeover valve into the package unit.

3. The complete system consists of the following :—

(1) Container (806168)
(2) Stabilizing container (806136)
(3) Pressure control valve (801427)
(4) Automatic change-over valve (801919)
(5) Contents gauge control unit
(6) Contents gauge (ex-package unit)
(7) Quick release connectors. SUPPLY
(8) Quick release connectors. VENT
(9) Cradle
(10) Heat exchanger (803827)
(11) Bursting disc assembly (802259)
(12) Cable and plug assembly (804846)
(13) Fill and vent valve (804846).

Container

4. The container is mounted on rubber lined shoes. fixed to the base of a light-alloy cradle. Security of attachment of the container is by means of harness consisting of three strap and strainer bolt assemblies fastened to the cradle. The main container is surrounded by a cylindrical type heat exchanger, with the stabilizing con-

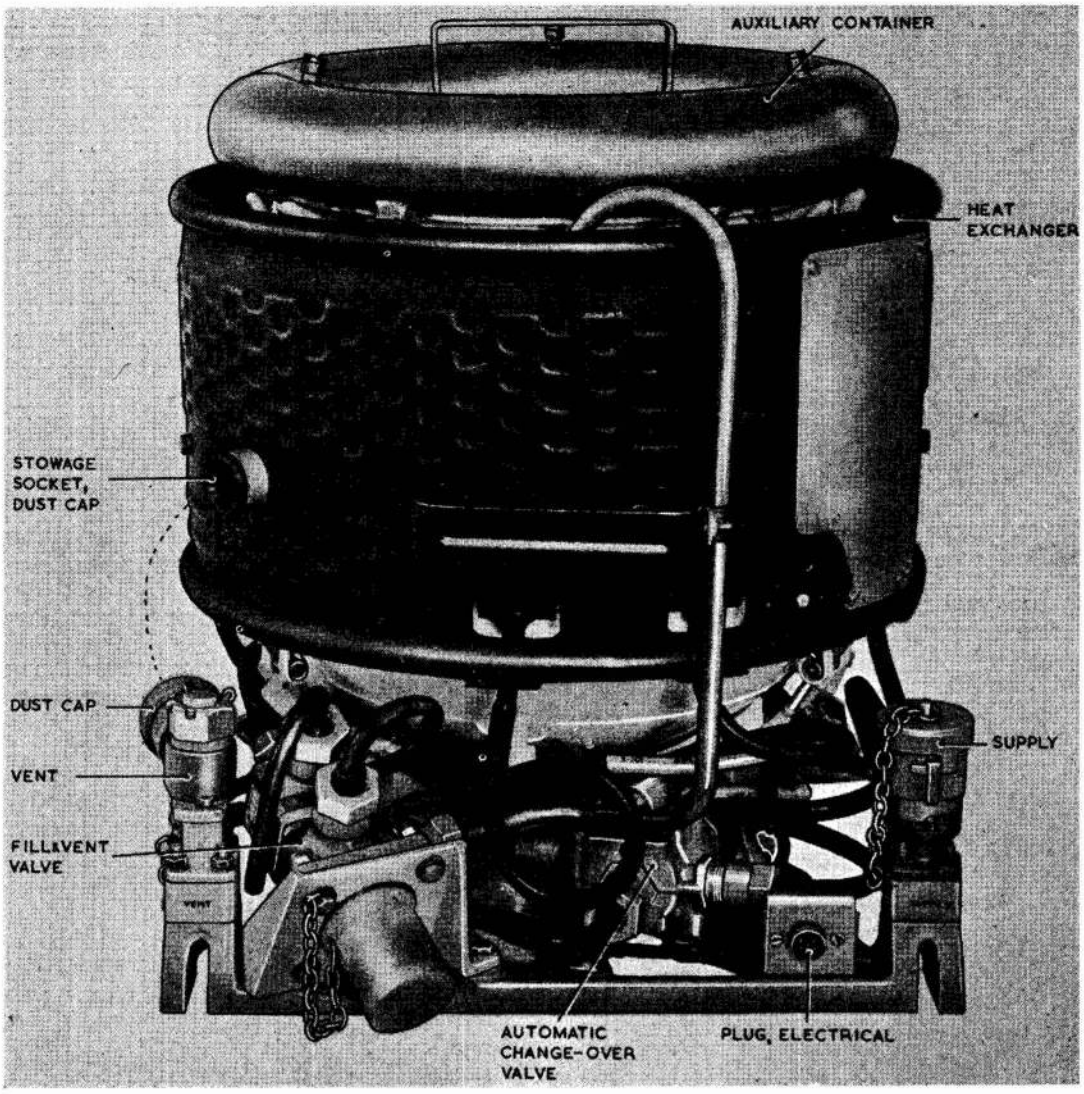

Fig. 1. Liquid oxygen package unit (806168), Type CP 14/10

tainer mounted immediately above the main container. This is the conventional spherical type container, details of which are given in Sect. 3.

Auxiliary container

5. The auxiliary container takes the form of a ring-shaped annular component with a capacity of approximately 1·5 litres. To facilitate installation it is fitted immediately above the main container and is easily accessible when the complete package unit is withdrawn from aircraft. Two pipes of different length are fitted inside the auxiliary containers (fig. 1). One pipe is connected to the automatic change-over valve, the other pipe is connected into the heat exchanger and the fill and vent valve. This container which is not thermally insulated, is filled during the replenishing of the main container. As soon as filling is completed the oxygen in the auxiliary container boils and the pressure generated forces liquid through the heat exchanger where it is evaporated, bubbles through the liquid in the main container and condenses again.

Fill and vent valve (fig. 1 and 2)

6. This is the standard FVB6 series fill and vent valve mounted on an angle bracket at the base of the cradle. It has four conical type pipeline connectors which connect with auxiliary and heat exchanger pressure control valve and vent connector. The principle of operation of this valve is common to all FVB type valves, but they differ only in the disposition of the pipeline connector, to suit individual liquid oxygen installations. This is referred to in Sect 1, Chapter 1.

Pressure control valve

7. The pressure control valve used in an appropriate circuit controls the system working pressure provides an economiser circuit and limits the maximum working pressure. The spring - loaded pressure control valve closes when the working pressure is reached and prevents further quantity of oxygen passing into the gas space of the liquid oxygen container. This valve is described in Sect. 1, Chap. 2.

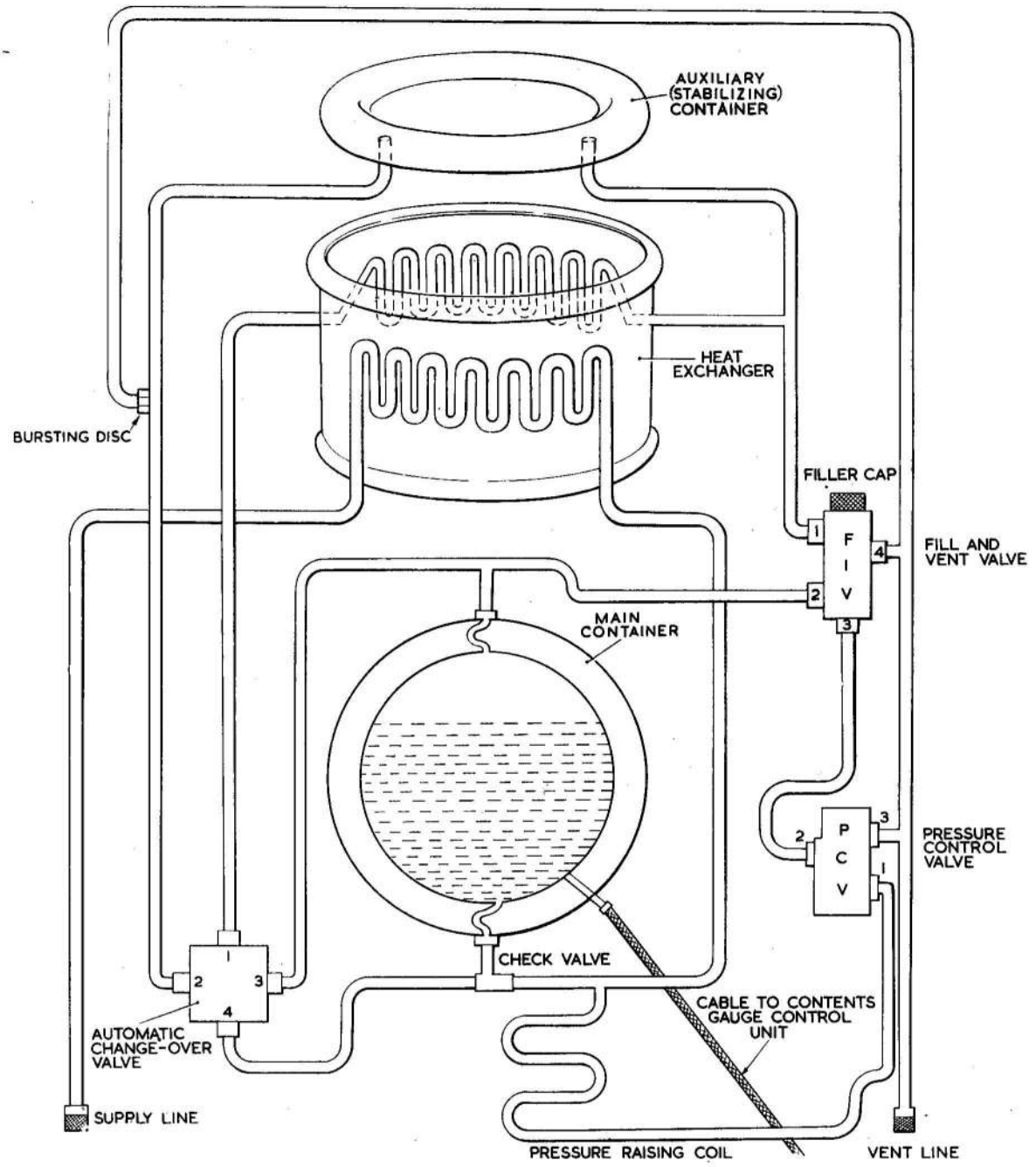

Fig. 2. Layout of system (schematic)

Automatic change-over valve

8. As mentioned in Para. 2 this valve is provided when a liquid oxygen system is fitted with a stabilizing container to control the operation of stability. It consists of a light-alloy body accommodating a spring-loaded valve and bellows assembly. Four conical type pipe line connectors are provided in the body for connecting to heat exchanger, stabilizing container, gas line and liquid oxygen line and are numbered 1, 2, 3 and 4 respectively.

9. During the operation of filling the main liquid oxygen container, a pressure difference exists between the filling line where the automatic change-over valve is sited, and the container gas line to which port 3 is connected by the sensing line. This pressure difference compresses the bellows inside the valve and moves the poppet. When the pressure in ports 1, 2 and 4 exceeds the pressure in port 3 by 25 lb/in^2 the valve allows liquid oxygen to pass from port 2, connected to the auxiliary liquid oxygen container, to port 4 which is connected to the main liquid oxygen container and seals off port 1, which is connected to the heat exchanger. With no pressure difference between ports 1, 2 and 4 and port 3, the valve

allows flow from port 1 to port 4, and seals off port 2. This valve is described in Sect. 1, Chap. 4.

Contents gauge control unit

10. The contents gauge control unit is used in aircraft liquid oxygen systems to convert capacitance values (provided by the quantity of liquid oxygen in a liquid oxygen container) for reproduction on a remote indicator. This unit which employs an amplifier oscillator and capacitance bridge, utilizes the difference in dielectric constant between gaseous and liquid oxygen in the container. It operates from the aircraft 28-volt d.c. supply and the oscillator generates a 5·6 kc/s signal to feed the capacitance bridge. The front panel embodies 3-pole socket, 6-pole plug and two adjustable controls (SET EMPTY and SET FULL) for calibration purposes. One control is used to zero the bridge when the container is empty, the other control adjusts the contents gauge pointer to full scale reading when the container is full. This unit is described in Sect. 2, Chap. 1.

Note . . .

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

Contents gauge (ex package unit)

11. These gauges employ two basic principles, i.e. one employs the ratiometer movement which measures the ratio of two currents, the other operates on the standard moving coil voltmeter or ammeter principle depending upon the use to which it is applied. For contents gauges, current is supplied from a capacitance bridge system which depends for its action on the difference in dielectric constant between gaseous and liquid oxygen (Para. 10). This gauge is not included in the package unit but located at the aircraft liquid oxygen replenishing station and in the cockpit. For further details of the instrument reference should be made to Sect. 2, Chap. 2.

Quick release connectors

12. To facilitate quick removal of this package unit two quick release connectors are provided. One is used for the VENT pipeline, the other connector is for oxygen SUPPLY line to the oxygen regulators. The flexible pipe for the VENT enters the quick release connector horizontally, and the lateral position of this connector is preset to suit the vent pipeline for individual aircraft installation. This package unit CP 14/10 also introduces stowage nipples (fig. 1) for retaining the VENT and SUPPLY dust covers. When the dust covers are removed for connecting up the SUPPLY and VENT pipelines, the covers are secured to two nipples fixed externally on the heat exchanger.

Cradle

13. The cradle is a simple light-alloy casting, triangular in shape, with three fixing points. The triangular wedge-shaped base is accommodated in a corresponding frame and secured with two bolts and nuts located at the front end. With the exception of the auxiliary container, main container, and heat exchanger, all other components are mounted on the base of the cradle.

Heat exchanger

14. The heat exchanger consists of an inner and outer cylindrical sheet metal shell, joined (cold welded) together at the top and bottom seams and embodying gas passages which form a multi-block honeycomb. Pipeline connections of the heat exchanger are as follows :—

(1) Check valve to heat exchanger to supply line.

(2) Fill and vent valve through heat exchanger to automatic change-over valve.

Bursting disc

15. A bursting disc provided in the liquid oxygen system, serves as a safety device to protect the auxiliary container. It is a fully annealed aluminium disc which will function under excessive pressure, and its failure is generally due to excessive pressure resulting from malfunctioning of the pressure control valve. This disc is designed to fail at pressures in excess of 335 lb/in^{2}g and not more than 380 lb/in^{2}g over ambient range. Once the disc has failed it will be necessary to locate the reason for failure before fitting a new disc.

Cable and plug assembly

16. This co-axial cable and plug assembly is connected between the probe at the bottom of the container and the content gauge control unit. For details of the circuit reference should be made to the relevant aircraft handbook.

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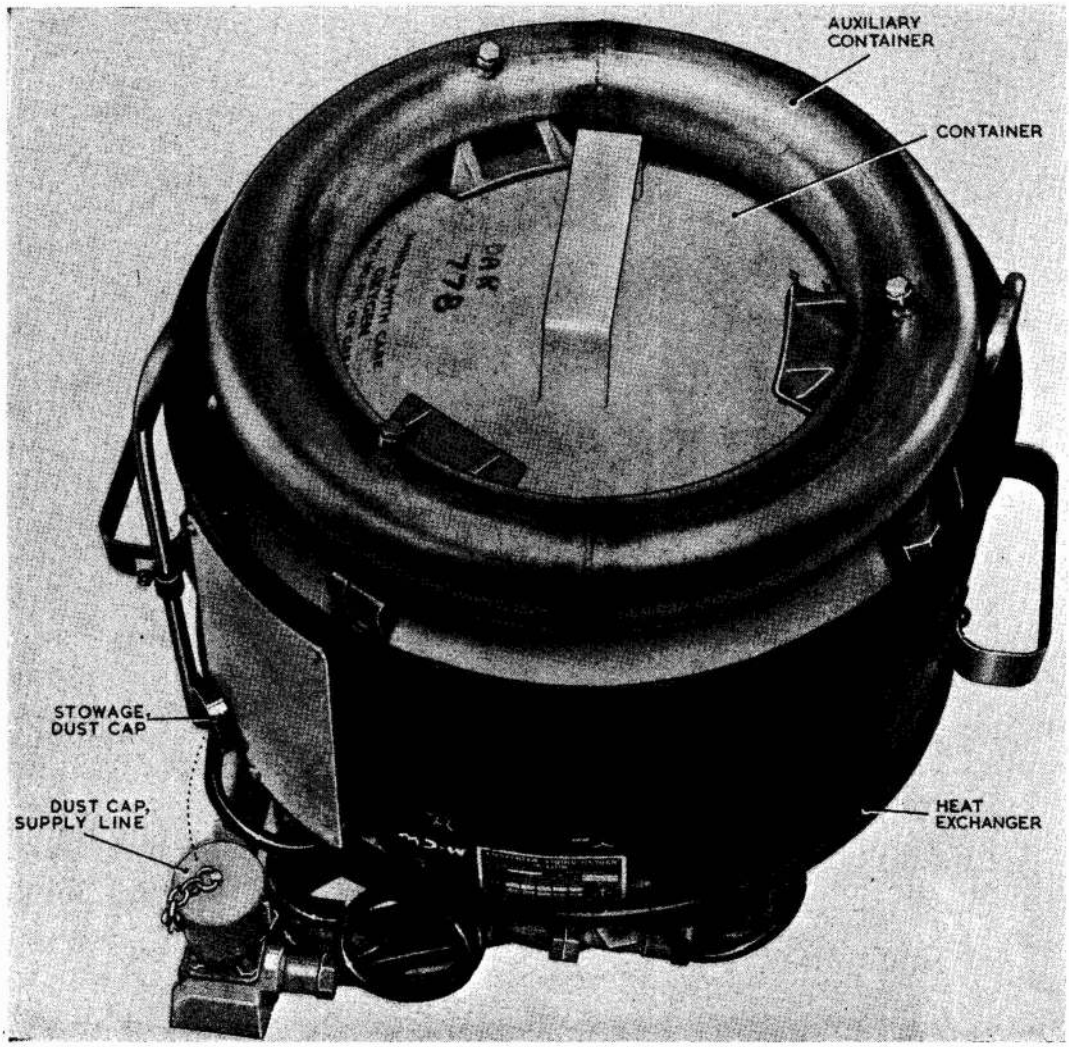

Fig. 3. View showing auxiliary container

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