Chapter 2

STABILIZING CONTAINERS

LIST OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

Introduction

1. In ground dispensers liquid oxygen is normally stored at atmospheric pressure patterned under such conditions its temperature is approximately 183 deg. C. In a standard aircraft system that has recently been filled gaseous oxygen pressure is soon raised to 150 lb/in², and the liquid is pressurized to the same value, at which its boiling point is −150 deg. C. The temperature of the thin surface layer of the liquid is then raised to −153 deg. C. by heat transfer from the gas. In this condition the system operates, with all the liquid beneath the thin surface layer still at −183 deg. C, and the liquid is drawn off at the normal applied pressure of 150 lb/in².

2. If the liquid is agitated the cold lower layers of liquid come 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 then remains low until it can be re-established by the normal build-up process.

3. These pressure drops are generally met with in systems in highly manoeuvreable aircraft, being most severe when a nearly full container is subject to zero or negative "g" conditions and after six to twelve hours the normal heat inleak into a full container raises the temperature of the whole liquid mass to −153 deg. C, so that the pressure drop no longer occurs.

4. To overcome this difficulty an auxiliary oxygen stabilizing container (fig. 1) which is not thermally insulated, is added to the system, together with various other components. During the filling of the main container, the auxiliary container is also filled. 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 and bubbled through the liquid in the main container and condenses again. In becoming liquified it gives up its latent heat of vaporization to the main mass of liquid, the whole of which is thus heated to about −153 deg. C.

DESCRIPTION

5. The auxiliary container consists of a cylindrical-shaped receptacle (fig. 1) with two unions located at the bottom end. Two pipes of different lengths are fitted inside the container. One pipe is connected to the automatic change-over valve, the other pipe is connected into the system between the filler and vent valve and the stabilizing heat exchanger coil. For details of the layout of a typical single container stabilized oxygen system, reference should be made to fig. 2 and Air Diagram 7315.

Bursting disc assembly

6. In certain liquid oxygen systems a bursting disc assembly (fig. 2) is incorporated in a connection on the auxiliary container. This is provided as a means for releasing pressure due to the malfunctioning of the change-over valve or ice blockage in the stabilizing container. Once the bursting disc has functioned, it is necessary to locate the reason for failure before a new disc is fitted. The disc (fig. 3) consists of 45 s.w.g. aluminium, 0·395 in. diameter. A list of stabilizing containers is given in Table 1.

OPERATION

7. Referring to fig. 2, during the normal filling operation a differential pressure exists between port 4 of the automatic change-over valve leading to the container and the main liquid oxygen container gas line. This differential pressure is applied across the bellows change-over valve via the sensing line and port 3, causing port 1 to be sealed and port 2 to communicate with port 4.

8. Liquid oxygen thus flows through the auxiliary container after filling it to the top of the internal stack pipe and on into the main liquid oxygen container. This process is continued until the main container holds $2{\cdot}6 \pm 0{\cdot}2$ litres of liquid oxygen as shown on the contents indicator when the replenishing hose is disconnected.

9. As soon as the liquid oxygen replenishing hose coupling is disconnected, the pressures throughout the system become approximately equal and the poppet valve of the automatic change-over valve operates due to spring action so as to seal port 2 and allow port 1 to communicate with port 4.

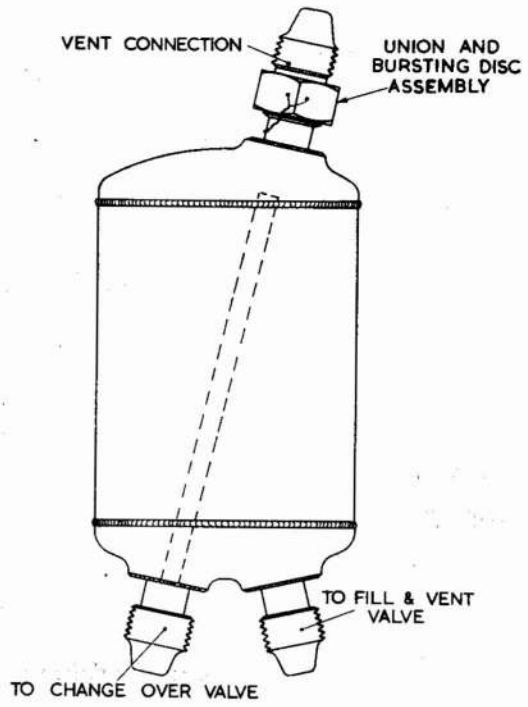

Fig. 1. Stabilizing container (802802) Ref. No. 6D/2618

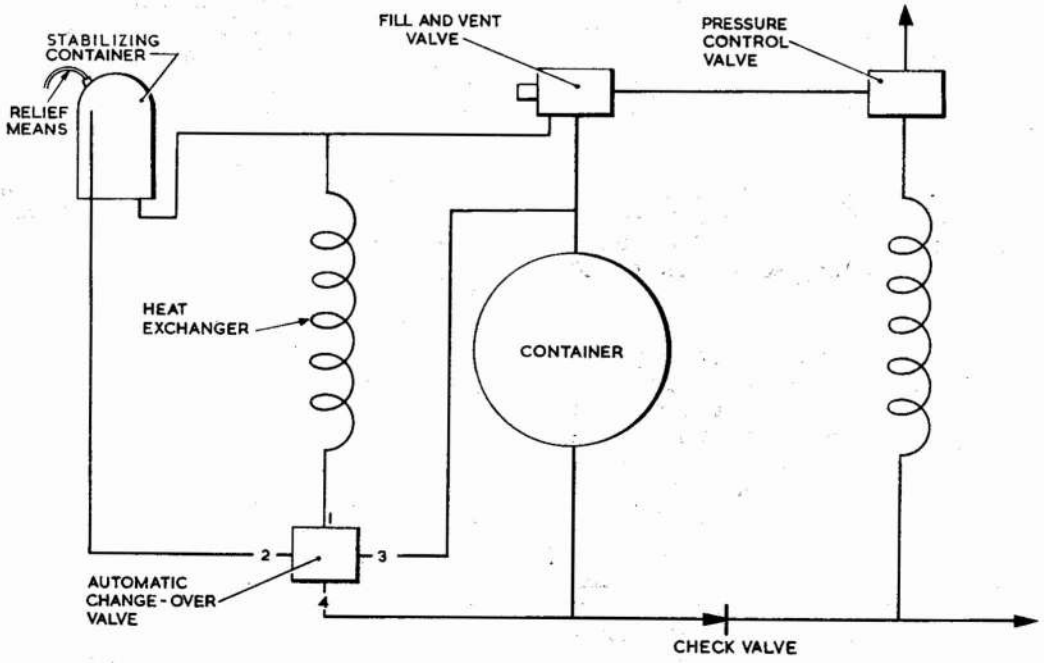

Fig. 2. Stabilizing container in a single container system (schematic)

TABLE 1

List of stabilizing containers

Stabilizing container	Capacity	Bursting disc assembly	Bursting disc Part No.	Bursting disc Ref. No.
802782	0·6 litre	802259	802194	6D/2554
802840	0·6 litre	—	802194	6D/2554
802564	0·5 litre	802259	802194	6D/2554
802802	0·5 litre	—	802194	6D/2554

10. The liquid held in the auxiliary stabilizing container immediately starts to boil off due to the natural heat inleak, and the pressure thus generated forces liquid back off the filling line and into the heat exchanger coil where it is evaporated. Oxygen gas then passes via the automatic change-over valve into the main liquid oxygen container where it is condensed back into liquid form and gives up its latent heat of vaporization so as to raise the temperature of the whole mass of the liquid in the main container to approximately —153 deg. C.

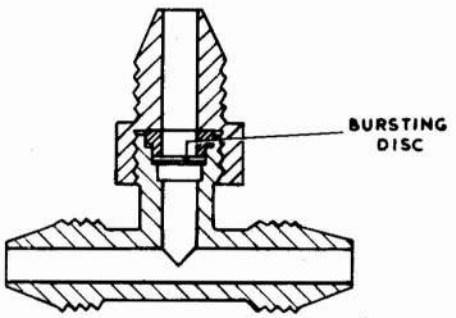

Fig. 3. Tee piece and bursting disc assembly

Printed for H M Stationery Office by Chorley & Pickersgill Ltd Leeds
P32970/470052/1410 1500 11/64 Gp 375