Chapter 1

LIQUID OXYGEN CONTAINERS

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Introduction

1. Referring to fig. 1 and 2, the liquid oxygen container is stainless steel double-walled with an evacuated annular space for insulation. The space is permanently sealed and should remain hard throughout the life of the container.

DESCRIPTION

2. The inner shell in which the oxygen is stored is mounted in an annular metal ring (fig. 1 and 2) through the medium of two concave rings and six stay rods. One end of each stay rod is secured to one annular ring, the other end is located in one of the concave rings and is secured by means of a hexagon-headed nut. Three connector assemblies located in the periphery of the annular ring are provided for connecting the filler and vent valve assembly, check valve and contents gauge control unit. There is also a blanking cap on the annular ring which encloses a crimped pipe connection. This connection is used for evacuating the insulation space during the manufacture of the containers. The contents of the container are measured electrically by means of a content gauge control unit and a content gauge, details of which are given in Sect. 2, Chap. 1 and 2 respectively.

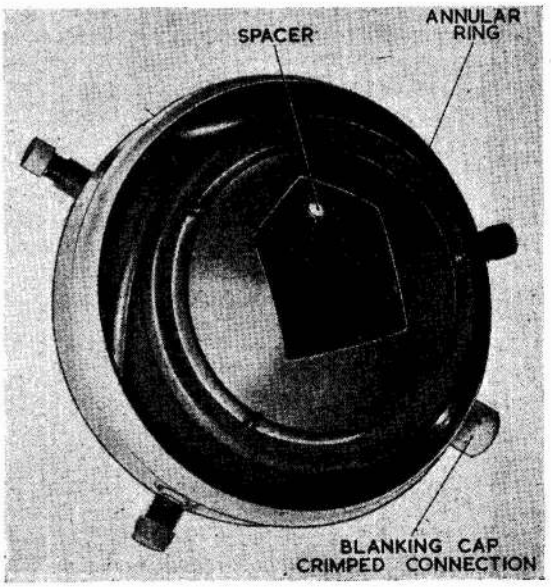

Fig. 1. Typical 3½ litre spherical liquid oxygen container, general arrangement of construction

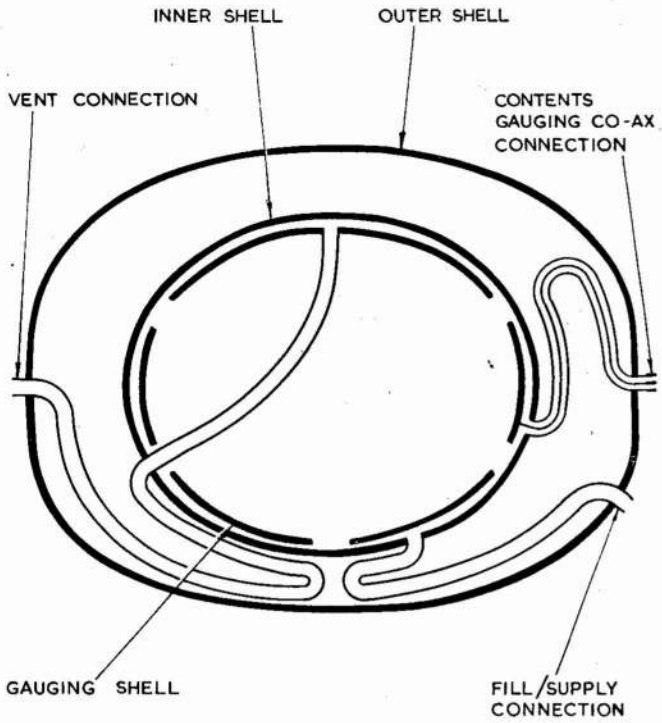

Fig. 2. Typical 3½ litre spherical liquid oxygen container (schematic)

3. The inner shell of the container and a perforated gauging shell form the two plates of a variable capacitor in a capacitance bridge to measure the level of the liquid oxygen. The capacitance is converted by the gauge control unit to give a contents reading on the contents gauge. The fundamental principle used in this type of gauge system is that the capacity of a capacitor depends on the dielectric content of the substance between the plates. In this instance the inner shell of the container is concentric with the perforated gauging shell and separated by an air gap which is filled with liquid oxygen gas or both. As the liquid in the container rises it displaces the gas in the gap, thus serving as a variable capacitor, the capacitance varying as the level of the liquid oxygen rises and falls. To convert this measure of capacitance for reproduction on a remote indicator, an a.c. circuit is used with the variable capacitor controlling the current in the bridge circuits. The signal is fed into an a.c. bridge and the current passing through it, after amplification and rectification passes through a moving coil type contents gauge.

INSTALLATION

4. For details of the location of the liquid oxygen container in a typical liquid oxygen system, reference should be made to Part 1, Sect. 3, Chap. 2 of this publication. The container should be mounted vertically with the vent position uppermost, when the aircraft is in its normal attitude on the ground. The container may be tilted only if it is essential and then the inclination from the vertical must not exceed the angle shown in fig. 3. Any deviation from the vertical will cause a deterioration in the performance of the container.

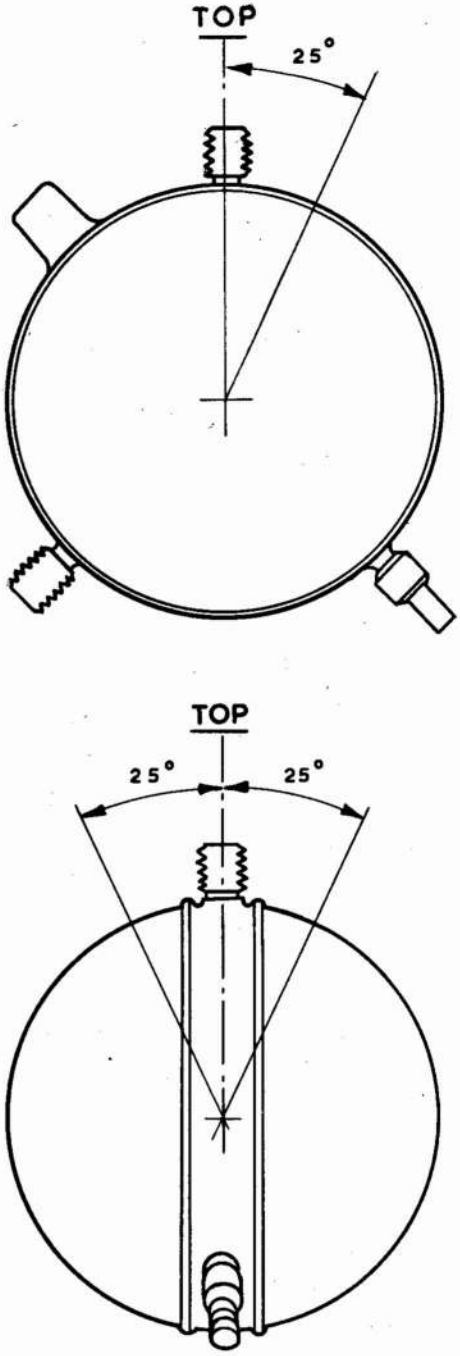

Fig. 3. Normal operating position of spherical container

LIQUID OXYGEN CONTAINER, Mk. 6 (801423) 3½ LITRES, Ref. No. 6D/2159

5. This unit is a vacuum insulated steel container, the application and operation of which is identical to other 3½ litre liquid oxygen containers. It differs only in shape and the method of mounting it in a liquid oxygen system. The shape of this unit conforms to an oblate spheroid to facilitate its location in a particular liquid oxygen installation. It is mounted with its major axis horizontal.

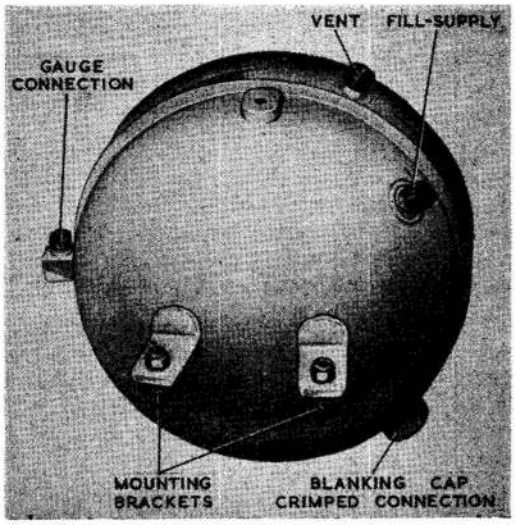

Fig. 4. Liquid oxygen container (801423), Ref. No. 6D/2159

6. It is scaled as a 3½ litre capacity container and when used in a suitable external circuit it provides 2960 litres of gaseous oxygen at 20 deg. C and 760 mm. Hg shortly after filling.

7. Capacitance elements for liquid oxygen contents measurements are incorporated in the container, the electrical signal from the element being fed to a gauge control unit, via a coaxial cable.

8. An alternate version (802872) of this container, which is scaled under Ref. No. 6D/2584, differs from the container Ref. No. 6D/2159, in that the mounting lugs are not provided.

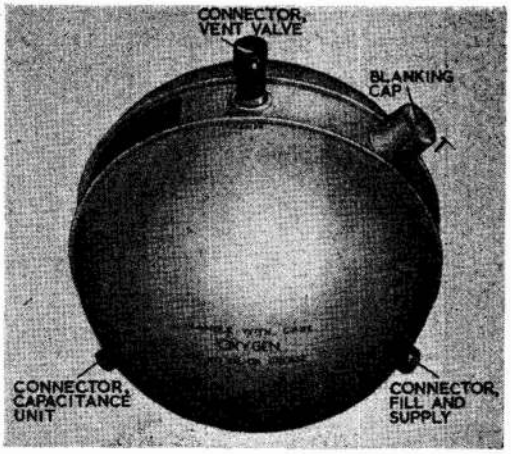

Fig. 5. Liquid oxygen container (800872) Ref. No. 6D/2165

LIQUID OXYGEN CONTAINER (800872) (Ref. No. 6D/2165

9. This unit is a vacuum insulated steel container, the application and capacity of which is identical to the container, Ref. No. 6D/2159. It differs in construction only in respect of its spherical shape and the method of mounting it in a particular liquid oxygen installation.

10. It is scaled for issue as a 3½ litre capacity container and when used in a suitable external circuit it provides 2960 litres of gaseous oxygen at 20 deg. C and 760 mm. Hg shortly after filling.

11. Capacitance elements for controlled measurements are incorporated in this container, the electrical signal from the element being fed into a gauge control unit via a coaxial cable.

LIQUID OXYGEN CONTAINER (802349) Ref. No. 6D/2492

12. The liquid oxygen container (802349), Ref. No. 6D/2492 is a 25-litre capacity spherical container which is provided for transport type aircraft This unit is normally included in a liquid oxygen package unit (Sect. 4, Chap. 1 and 2).

13. The container (fig. 6) is a stainless steel double-walled vacuum insulated unit and incorporates a capacitance probe of a liquid oxygen contents gauging system. The container is supported on three mountings and fitted into a cylindrical-shaped frame which carries the FILL, GAS, BUILD-UP, VENT and SUPPLY connectors.

14. The container is replenished via a fill and vent valve assembly (Sect. 1, Chap. 1) and the level of the liquid oxygen is measured by the contents

Fig. 6. Liquid oxygen container (802349) Ref. No. 6D/2492

gauging system. This system incorporates a control unit which consists of an oscillator, capacitance bridge and an amplifier.

15. The oscillator produces 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 one, two or three indicators connected in series.

16. The contents gauge control unit used with this equipment is described in Sect. 2, Chap. 1, but a padder unit is provided to enable it to be used with this type of container, so that the control unit and the probe will be matched to suit individual installations. Further details of the padder unit are given in Sect. 4, Chap. 1 and 2.

◂ LIQUID OXYGEN CONTAINER (OP.18629)

17. This container has a capacity of 10 litres and is normally incorporated in a liquid oxygen package. The container assembly is spherical and comprises an electrical shell, an inner container and an outer container, the intervening space between the two containers being evacuated for the purpose of thermal insulation.

18. The electrical shell is the innermost of the three components and consists of a light-alloy perforated sphere manufactured in two halves riveted together. The inner and outer containers are of stainless steel, the exterior of the inner container being silver plated. This surface and the interior of the outer container are polished to obtain maximum thermal efficiency. The inner container is located within the outer container by top and bottom thermal insulators, these being housed within plugs screwed into the outer container and soldered in position. A resilient mounting is obtained by interposing two springs between the top insulator and an additional insulator located in a fitting welded to the inner container.

19. To obviate the possibility of the container bursting under excessive pressure, a removable disc assembly is screwed into the outer container and soft soldered in position. This assembly consists of a blow-out disc assembly and a blade, these being welded to a threaded fitting and housed within a cover. The blow-out disc assembly comprises a blow-out disc, a disc and a ring; the components are welded together and located over an aperture in the fitting. The blade is arranged diametrically across the disc assembly and the ends are welded to the fitting. The cover is spot-welded to the fitting and has a series of vent holes round its side.

20. A Pyrotenax coaxial cable connects the electrical shell and inner container to an Amphenol receptacle fitted to a termination shell which is soldered to the outer container. A trimming capacitor is also housed in the shell and the whole is sealed in an electrical potting compound.

21. Two pipe fittings welded to the outer container connect with fittings in the inner container and provide the inlet and outlet connections of the assembly. An evacuation cap soldered to the outer container covers the sealed end of the evacuation tube. ▸

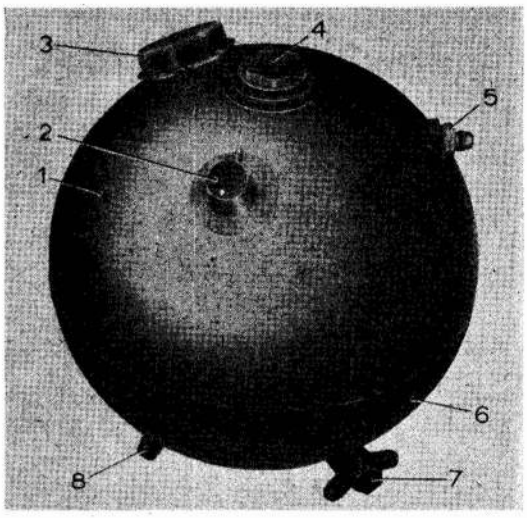

Fig. 7. Liquid oxygen container (O.P.18629)

1 TOP OUTER CONTAINER ASSEMBLY
2 TERMINATION SHELL
3 REMOVABLE DISC ASSEMBLY
4 TOP PLUG
5 GAS AND VENT CONNECTION (NOT SUPPLIED WITH CONTAINER)
6 BOTTOM OUTER CONTAINER ASSEMBLY
7 FILL AND OUTLET CONNECTION (NOT SUPPLIED WITH CONTAINER)
8 EVACUATION CAP

Appendix 1

STANDARD SERVICEABILITY TESTS (R.N.)

for

LIQUID OXYGEN CONTAINER

◀Ref. No. 6D/2165 and 6D/2837▶

Introduction

1. The tests laid down in this Appendix must be applied to the above-mentioned equipment immediatey prior to installation in aircraft, in accordance with the appropriate Servicing Schedule and at any time serviceability is suspect. The tolerances specified must not be exceeded.

TEST EQUIPMENT

2. The following test equipment is required:—

Description	Ref. No.	Remarks
Multimeter model 8SX	0557/6625-99-943-1524	1 off

TESTS

3. All tests must be carried out in a clean, dry atmosphere.

WARNING . . .

The presence of oil or grease in contact with oxygen at high pressure is dangerous since it introduces a grave risk of explosion.

Visual check

4. Check the container for defects and damage.

Continuity check

5. With a multimeter set to OHMS, check:—

(1) That the resistance between pin B and the case is zero.

(2) That infinity exists between the following:—

(a) Pin A to pin C.

Pin A and C to the case of the container.

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