Chapter 3
CHECK VALVES

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Introduction

1. Check valves are used in aircraft liquid oxygen systems to limit the delivery of liquid oxygen from a liquid oxygen container to an aircraft oxygen breathing circuit. In certain installations, check valves are also used to release excess pressure in the supply line to the build-up side of the converter system.

2. For details of the location of a liquid check valve in a typical liquid oxygen system, reference should be made to ◀Part 1, Sect. 3.▶ An arrow located on the body of each check valve indicates the direction of flow.

LIQUID OXYGEN CHECK VALVE (Ref. No. 6D/2264)

3. The check valve is normally located at the bottom of a liquid oxygen container and it is essentially a non-return valve, which permits the rapid flow of oxygen in one direction only. It consists of a free-moving, poppet type valve accommodated in a stainless steel and light-alloy casting.

4. Referring to fig. 1 and 2, it will be seen that a hexagonal flange provided with this unit enables

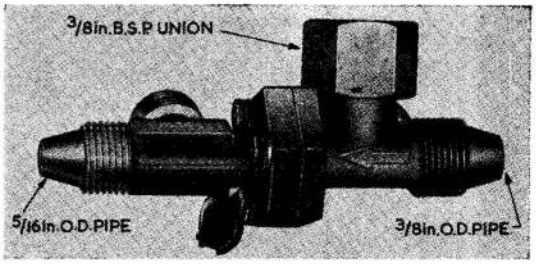

Fig. 1. Liquid oxygen check valve (Ref. No. 6D/2264)

pipe line connectors to be located at intervals of 120 degrees. Two outlet connections are provided, either of which may be used for the build-up or supply circuit connections.

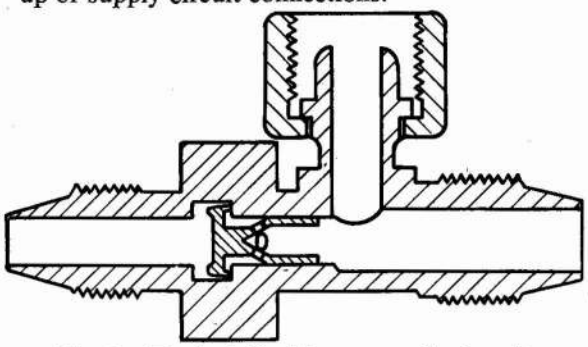

Fig. 2. Typical liquid oxygen check valve, sectional view

Operation

5. The liquid in a liquid oxygen system is prevented from flowing out of a liquid oxygen container by the poppet type check valve. If the gas pressure in a liquid oxygen container drops below a predetermined setting, the pressure closing valve (*Chap.* 5) in the system opens, allowing the gas pressure above and below the liquid oxygen to equalize. There is then an excess pressure due to the head of liquid acting on the liquid check valve, which opens and allows some liquid to trickle through into a pressure raising coil (*Sect.* 1, *Chap.* 3).

LIQUID OXYGEN CHECK VALVE (Ref. No. 6D/2167)

6. The liquid oxygen check valve (*Ref. No.* 6*D*/2167) is a 'T'-type valve assembly incorporating two male cone union connectors and $\frac{3}{8}$ in. B.S.P. union nut. The internal construction of this unit is similar to other liquid oxygen check valves described in this chapter and it is suitable for direct connection to a liquid oxygen container.

Operation

7. The free type poppet valve in this unit functions as a non-return valve in the supply and build-up circuits of a liquid oxygen breathing-system. The non-return valve closes when a pressure greater than that in the liquid oxygen container is built up in those circuits, thus preventing further supply of liquid oxygen.

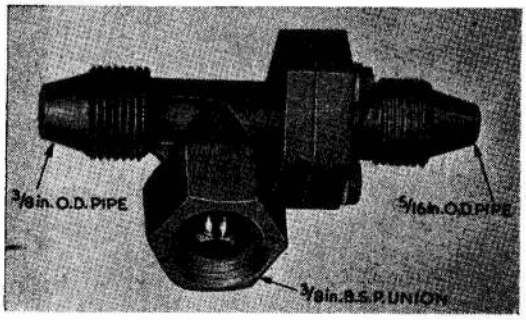

Fig. 3. Liquid oxygen check valve (Ref. No. 6D/2167)

8. A single outlet connection is provided downstream of the non-return valve and an additional external tee-piece is provided to divide the build-up and supply circuits.

LIQUID OXYGEN CHECK VALVE (Ref. No. 6D/2162)

9. The liquid oxygen check valve (*Ref. No.* 6*D*/2162) is similar in function to other type liquid oxygen check valves, i.e. limiting the delivery of liquid oxygen from a liquid oxygen container. This valve is provided with three male cone union connectors and $\frac{3}{8}$ in. B.S.P. union nut. Two external male cone union outlets are connected to $\frac{5}{16}$ in. O.D. pipe lines and the single male cone union connector is provided for connecting $\frac{3}{8}$ in. O.D. pipe line, either of the two outlet connections may be used for build-up or supply circuit connections.

Operation

10. This valve assembly is suitable for direct connection to a liquid oxygen container. As with other types of liquid oxygen check valves, this unit consists of a free-moving poppet valve functioning as a non-return valve into the supply and build-up circuits of a liquid oxygen breathing system. The non-return valve closes when a pressure greater than that in the container is built-up in those circuits, thus preventing further supply of liquid oxygen. Hexagonal flanges of this assembly enable pipe line connectors to be positioned at intervals of 120 degrees.

TWO-WAY CHECK VALVE (Ref. No. 6D/2265)

11. The two-way check valve (*Ref. No.* 6*D*/2265) is used in aircraft liquid oxygen breathing systems using two liquid oxygen containers. It enables the two containers to be linked and provides duplicate safety in the event of one system failure.

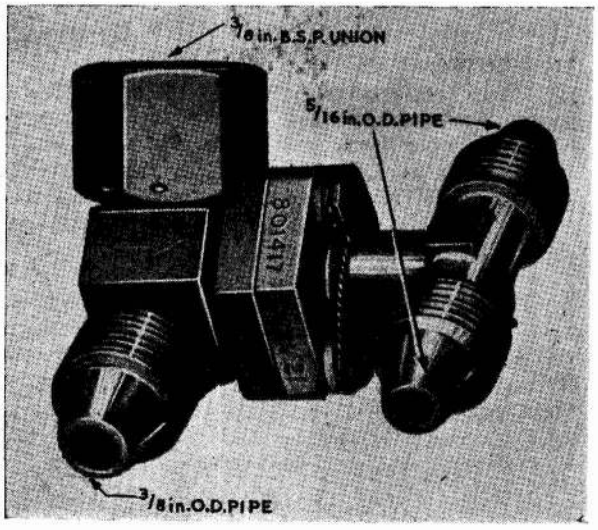

Fig. 4. Liquid oxygen check valve (Ref. No. 6D/2162)

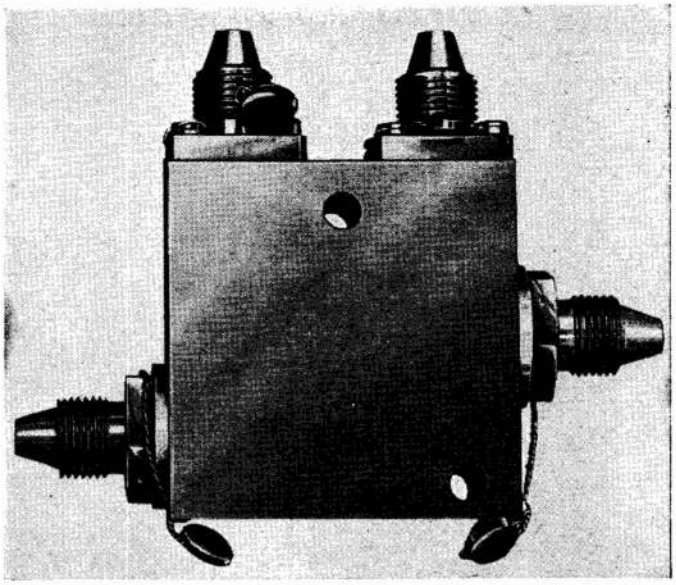

Fig. 5. Two-way liquid oxygen check valve (Ref. No. 6D/2265)

Operation

12. Referring to fig. 5 and 6, this valve has two internal passages with a non-return valve at each inlet, allowing the supply from two container systems to be directed to their respective regulators. These two passages are interconnected by two differential pressure valves, set to open at a pre-determined differential pressure (normally 10 lb/in^2).

13. Under normal operating conditions each container supplies one regulator only. In the event of loss of pressure in one regulator or its system, the non-return valves prevent the loss of the other container contents and the operation of the interconnecting differential pressure valves, enable all crew members to breathe from the remaining container.

TWIN SUPPLY LIQUID OXYGEN CHECK VALVE (Ref. No. 6D/2266)

14. The twin supply liquid oxygen check valve (*Ref. No. 6D/2266*) is for use, one per crew member, in a liquid oxygen system where two liquid oxygen container systems provides breathing oxygen for two or more crew members whose stations are some distance apart. In the event of one container system being damaged, the other container system is safeguarded so that its contents may continue to supply all crew members.

Operation

15. Referring to fig. 8, gaseous oxygen from one container is supplied to the inlet connection (1) and from the other container to the inlet connection (2). Normally the gas flow is through the inlet connection (1), through the non-return valve (A) to the outlet connection (3), from which a short length of pipe leads to the crew member's regulator. Non-return valve (B) remains closed since it is spring-loaded to maintain a differential pressure of 10 lb/in^2.

16. In the event of damage upstream of the inlet connection (1), the non-return valve (A) prevents the loss of oxygen in that direction and the non-return valve (B) functions similarly should there be damage upstream of the connection (2). If the pressure upstream of the connection (1) fails, the non-return valve (B) opens at a differential pressure of 10 lb/in^2 so as to maintain an oxygen supply at connection (3).

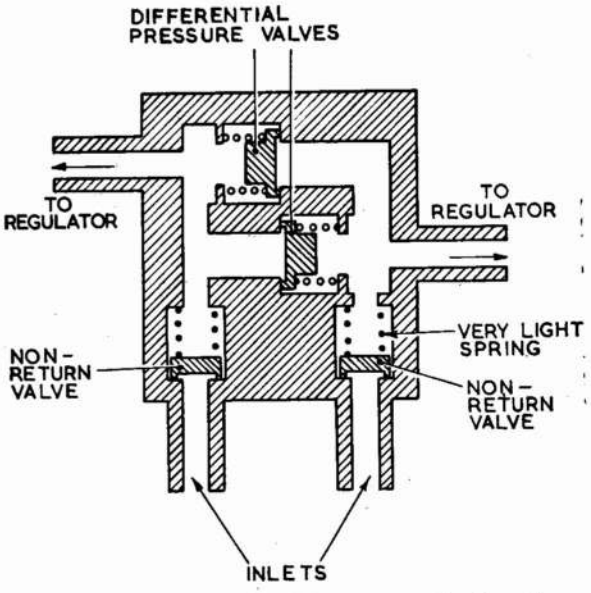

Fig. 6. Two-way liquid oxygen check valve (Ref. No. 6D/2265), sectional view

17. There are three A.G.S. male cone union connections, to suit $\frac{5}{16}$ in. O.D. piping. The method of mounting is by means of two fixing holes for 2 B.A. bolts as shown in fig. 7.

LIQUID OXYGEN CHECK VALVE (Ref. No. 6D/2493)

18. The liquid oxygen check valve (*Ref. No. 6D/2493*) is a simple free-moving poppet type valve suitable for use with liquid oxygen package units. It consists of two assemblies clamped together with three hexagon-headed set screws. It is normally located in the liquid oxygen circuit between the container and the regulator in a single liquid oxygen container system.

TWO-WAY CHECK VALVE (Ref. No. 6D/2672)

19. The two-way check valve (*Ref. No. 6D/2672*) is identical in principle to the check valve (*Ref. No. 6D/2265*). It differs only in the differential pressure setting. Check valve (*Ref. No. 6D/2265*) operates at 10 lb/in², check valve (*Ref. No. 6D/2672*) operates at 25 lb/in².

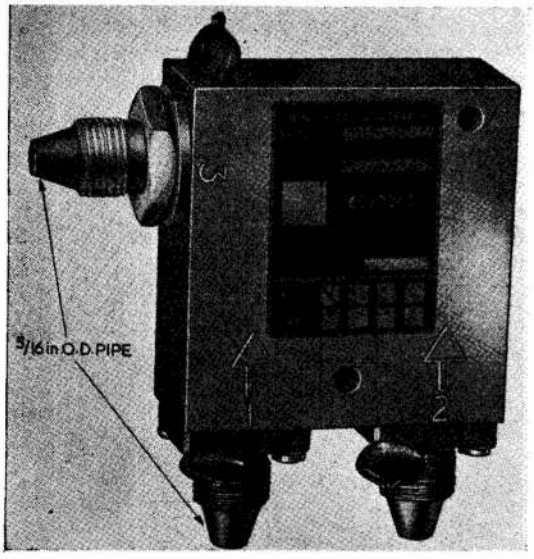

Fig. 7. Twin supply liquid oxygen check valve (Ref. No. 6D/2266)

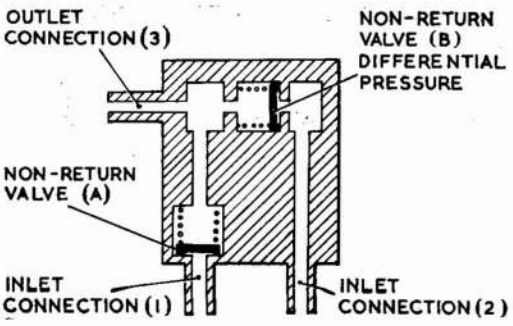

Fig. 8. Sectional view

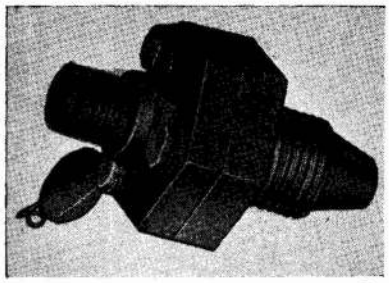

Fig. 9. Liquid oxygen check valve (Ref. No. 6D/2493)

CHECK VALVE (Part No. OP.18630)

20. This valve (fig. 10 and 11) is used in certain package units to limit the flow of liquid oxygen from the liquid oxygen container as described in para. 1. The body of the unit is in two portions, an inlet and an outlet, these being bolted together and sealed by means of an O-ring. A housing formed jointly by the two bodies contains a spring and a square-sectioned stainless steel valve, the head of which is fitted with a silicone rubber seal; the seal is located by a retainer and a special screw.

Operation

21. The valve operates between the build-up and supply circuits of a package unit, preventing the flow of liquid oxygen from the container to the supply line unless the pressure in the supply line falls 5·0 lb/in² below that of the converter system.

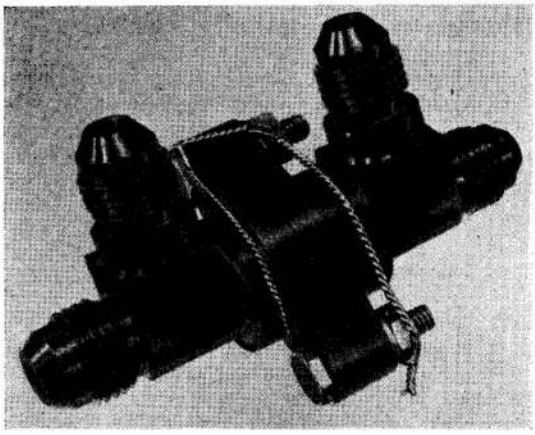

Fig. 10. Check valve (Part No. OP.18630)

CHECK VALVE (Part No. O.P.18631)

22. This check valve (fig. 12 and 13) is incorporated in certain package units to release excess supply pressure to the build-up side of the converter system. The valve consists of a housing, an insert, spring, and a valve assembly identical to that fitted to the valve (Part No. OP.18630) described in para. 20. The insert accommodates

the spring and the valve assembly, and is screwed into the housing, sealing between the insert and the housing being by an O-ring.

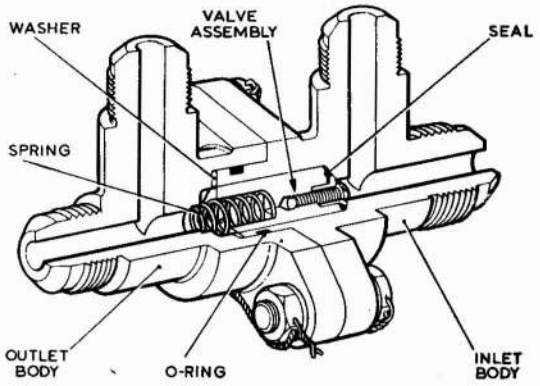

Fig. 11. General arrangement of valve (Part No. 18630)

Operation

23. The valve is incorporated in a pipeline which connects the supply line with the build-up side of the converter. Should the supply pressure exceed the converter pressure by 20 lb/in² the valve opens to release pressure to the build-up side of the converter.

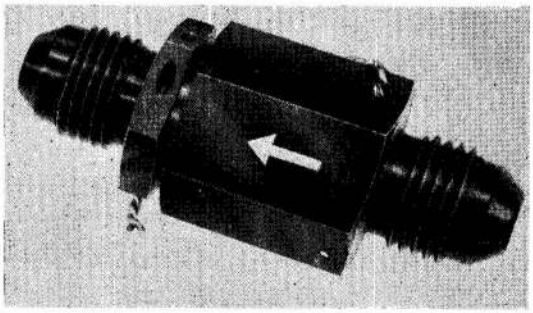

Fig. 12. Check valve (Part No. OP.18631)

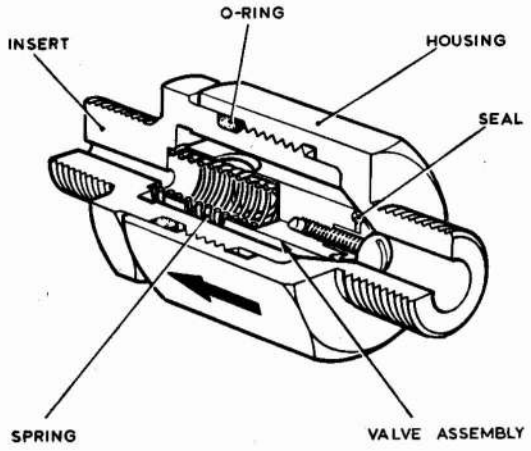

Fig. 13. General arrangement of valve (Part No. OP.18631)

LIQUID OXYGEN CHECK VALVE (Ref. No. 6D/2910)

◀**24.** The liquid oxygen check valve (*Ref. No. 6D/2910*) (803000) is identical in principle and application to other versions of this valve, but differs in the arrangements for pipeline connections. No. 1 connection consists of $\frac{1}{8}$ in. A.N.T.P. tapered screw thread, which screws into a tee-piece integral with the container. No. 2 connection is A.G.S. size "BB" to suit $\frac{5}{16}$ in. O.D. pipe to the supply line. This check valve is similar to that shown in fig. 9.▶

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Appendix 1

STANDARD SERVICEABILITY TEST (R.N.)

for

Check Valve Ref. No. 6D/2162

Check Valve Ref. No. 6D/2167

Check Valve Ref. No. 6D/2264

Two-way Check Valve Ref. No. 6D/2265

Twin Supply Check Valve Ref. No. 6D/2266

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
Gauge pressure 0-250 lb/in²	6C/263	1 off
Oxygen leak tester	6D/1418	1 off
◀Cone cap, $\frac{3}{8}$ in., B.S.P.	28F/15579	1 off▶
◀Sleeve outer, $\frac{3}{8}$ in. B.S.P.	28F/5604	1 off▶
Cone cap $\frac{5}{16}$ in., B.S.P.	28F/15688	2 off
Sleeve, outer, $\frac{5}{16}$ in., B.S.P.	28F/5723	2 off
NA.T.O. air supply or dry gaseous oxygen		As required
Thermometer, 0-200°C	6C/6685-99-943-2934	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.

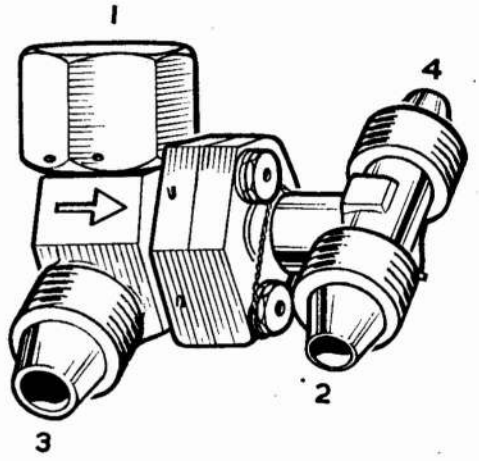

Fig. 1. Check valve, Ref. No. 6D/2162

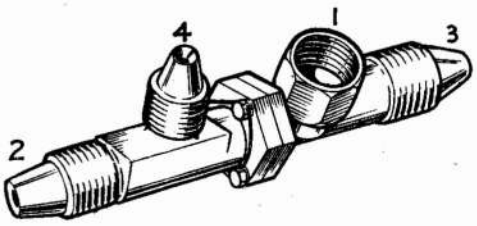

Fig. 2. Check valve, Ref. No. 6D/2264

Check valves, Ref. No. 6D/2162, 6D/2167 and 6D/2264

Visual checks

4. (1) Remove the transit blanks and check the valve for defects and damage.

(2) Examine the retaining bolts for security of attachment and ensure that all locking wire is intact.

Functional tests

5. (1) Blank off connections 3 and 4 (connection 3 when testing valve, Ref. No. 6D/2167).

(2) Connect the air or oxygen supply to connection 2 (*fig.* 2), and slowly increase the pressure. Check that the valve closes at 10lb/in².

(3) Connect the oxygen leak tester to connection 1. Check that the leakage rate does not exceed 2·5 cc/min. (3 bubbles in 10 seconds).

(4) Gradually increase the pressure to 225 lb/in². Check that there is no leakage from connection 1. Reduce the gas pressure to zero.

(5) Disconnect the oxygen leak tester and disconnect the supply.

(6) Remove the blanks from connections 3 and 4.

(7) Place the valve in the drying cabinet at a temperature of 70°C for one hour.

(8) After drying out the valve, fit the transit blanks to all connections.

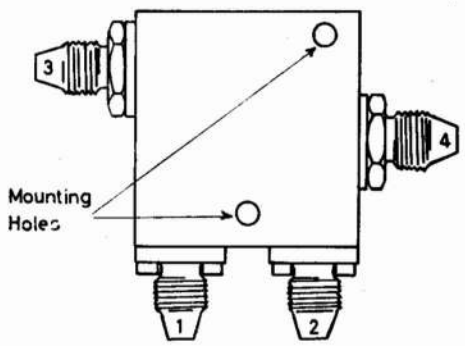

Fig. 3. Two-way check valve, Ref. No. 6D/2265

Two-way check valve, Ref. No. 6D/2265

Visual test

6. (1) Remove the transit blanks and check the valve for defects and damage.

(2) Examine the retaining bolts for security of attachment and ensure that all the wire-locking is intact.

Functional tests

7. (1) Blank off connection 3 (*fig.* 3)

(2) Connect the air or oxygen supply to connection 1. Slowly increase the pressure until gas escapes from connection 4. Check that the supply pressure is 15 lb/in² ± 5 lb/in².

(3) Remove the blank from connection 3 and refit to connection 4.

(4) Reduce the air supply to zero and disconnect it from connection 1. Re-connect the supply to connection 2.

(5) Slowly increase the pressure until gas escapes from connection 3. Check that the supply pressure is 15 lb/in² ± 5 lb/in².

(6) Reduce the supply pressure to zero. Blank off connection 3.

(7) Gradually increase the gas supply to 200 lb/in².

(8) Connect the liquid oxygen tester to connection 1. Check that the leakage rate does not exeed 15 cc/min. (8 bubbles in 10 seconds).

(9) Disconnect the leak tester and reduce the supply pressure to zero.

(10) Disconnect the gas supply from connection 2 and reconnect to connection 1.

(11) Gradually increase the air pressure to 200 lb/in².

(12) Connect the oxygen leak tester to connection 2. Check that the leakage rate does not exceed 15 cc/min. (8 bubbles in 10 seconds).

(13) Reduce the supply pressure to zero and diconnect the leak tester.

(14) Disconnect the supply and remove the blanks from connections 3 and 4.

(15) Place the valve in the drying cabinet at a temperature of 70°C for one hour.

(16) After drying out the valve, refit the transit blanks to all connections.

Twin supply check valve, Ref. No. 6D/2266

Visual checks

8. (1) Remove the transit blanks and check the valves for defects and damage.

(2) Examine the retaining bolts for security of attachment and ensure that all the wire locking is intact.

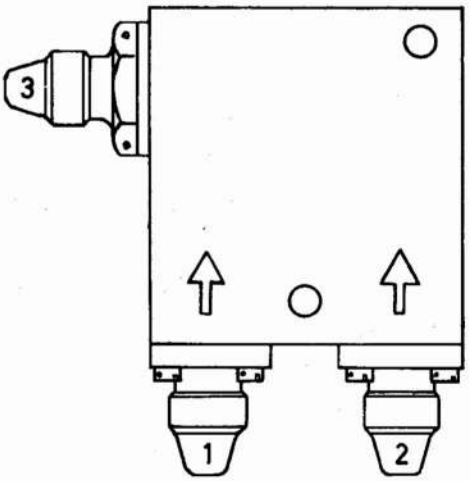

Fig. 4. Twin supply check valve, Ref. No. 6D/2266

Functional tests

9. (1) Connect the air or oxygen supply to connection 3. (*fig.* 3). Slowly increase the supply pressure to 200 lb/in².

(2) Connect the oxygen leak tester to connections 1 and 2 in turn (*fig.* 3). Check that the leakage rate from either connection does not exceed 15cc/min. (8 bubbles in 10 seconds).

(3) Disconnect the leak tester and reduce the supply pressure to zero.

(4) Disconnect the gas supply and reconnect to connection 2.

(5) Connect the oxygen leak tester to connection 3 and increase supply pressure to 10 lb/in^2.

(6) Check that the leakage rate does not exceed ◀50▶cc/min. (8 bubbles in 10 seconds). Disconnect the leak tester.

(7) Increase the supply pressure to 20 lb/in^2 and check that gas flows freely from connection 3.

(8) Reduce the supply pressure to zero and disconnect from the valve.

(9) Place the valve in the drying cabinet at a temperature of 70°C for one hour.

(10) After drying out the valve, fit the transit blanks to all connections.

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Appendix 2

STANDARD SERVICEABILITY TEST (R.A.F.)
for
LIQUID OXYGEN CHECK VALVES
6D/2162, 6D/2167, 6D/2264,
6D/2266, 6D/2265 and 6D/2493
◂ OP.18630 and OP.18631 ▸

Introduction

1. The tests described in this Appendix must be applied prior to installation of check valves in aircraft, whenever the serviceability is suspect and at scheduled intervals. The tolerances specified must not be exceeded.

TEST EQUIPMENT

2. A test rig consisting of the following items is required:—

(1) Control valve, Hale Hamilton, 0-25 lb/in² (CV) Ref. No. 6C/3040

(2) Gauge, pressure, 0-250 lb/in² (G1 and G2), Ref. No. 6C/263

(3) Filter, oxygen, Mk. 1 (F), Ref. No. 6D/1666

(4) Flexible connecting piping, Ref. No. 13C/679

(5) Oxygen valve, Mk. 10 (V1 and V2), Ref. No. 6D/2313

(6) Valve, drallim type (V3), Ref. No. 6C4273

(7) Flowmeter, 2-25 cc/min, Ref. No. 6C/3158

(8) Blanks for check valve connections

(9) Flowmeter, 25-500 cc/min, Ref. No. 6C/3149

(10) Flowmeter, 30-300 cc/min, Ref. No. 6C/3160

Note . . .

The flexible pipes (4) *are to adapt to medium pressure cone unions of different sizes according to the item under test. Tubing (maricon) is suitable and should be fixed to the appropriate adapter with clips, hose, size* 00, *Ref. No.* 28E/10154, *or with Araldite jointing compound where a permanent joint is required.*

CHECK VALVE

6D/2162, 6D/2167 and 6D/2264

3. During any test the valve must not oscillate (Scream).

External leakage test

4. (1) Blank all outlets and inlets except the union nut connection.

(2) Connect to pressure and leak test rig as shown in fig. 1.

(3) Close V2 and V3. Open V1.

(4) Adjust CV until G1 indicates 250 lb/in².

(5) Immerse check valve in water. There is to be no leakage in one minute.

(6) Exhaust the system by closing CV.

(7) Remove the check valve, dry it using a jet of warm, dry air.

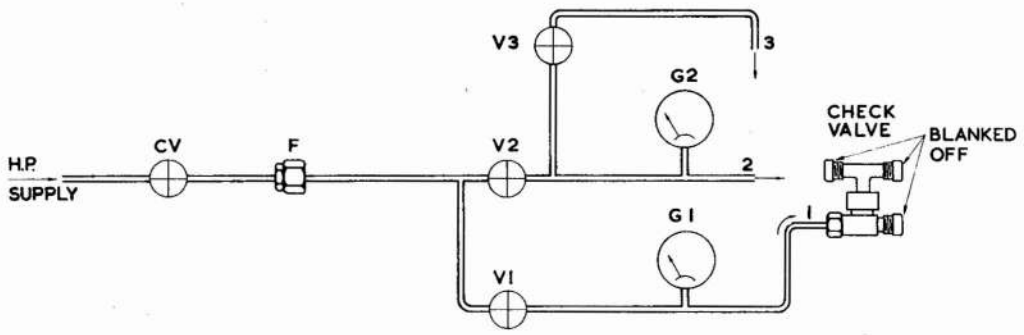

Fig. 1. Test rig, external leakage test, check valves 6D/2162, 6D/2167 and 6D/2264

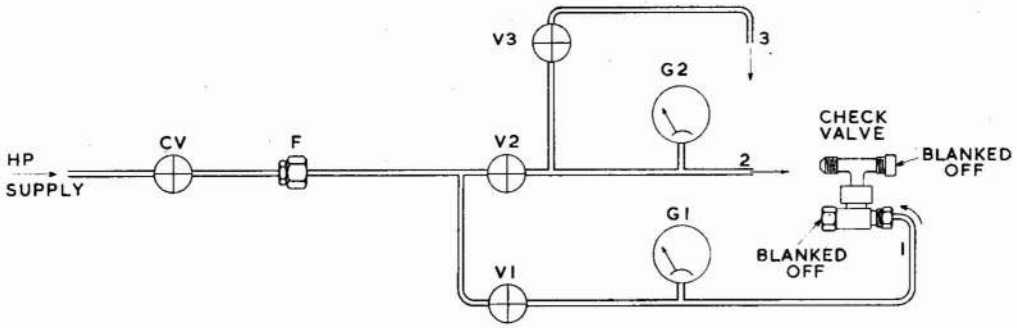

Fig. 2. Test rig, internal leakage test, check valves, 6D/2162, 6D/2167 and 6D/2264

Internal leakage test

5. (1) Blank nut on check valve.

(2) Remove blank from inlet connection and from one only outlet connection.

(3) Connect to pressure and leak test rig as shown in fig. 2.

(4) Connect 25-500 cc/min. flowmeter to inlet connection.

(5) Ensure V1 is open, V2 and V3 are closed.

(6) Adjust CV until G1 indicates 10 lb/in^2.

(7) Flowmeter is to indicate not more than 250 cc/min.

(8) Exhaust the system and remove the flowmeter.

Flow test

6. (1) Reconnect the check valve to pressure and leak test rig as shown in fig. 3.

(2) Connect 30-300 L/min. flowmeter to outlet of check valve.

(3) Ensure V1 is open, V2 and V3 are closed.

(4) Adjust CV until flowmeter indicates 50 L/min.

(5) G1 is to read not more than 10 lb/in^2.

(6) Exhaust the system.

(7) Disconnect the check valve.

TWO-WAY CHECK VALVE
Ref. No. 6D/2265

External leakage test

7. (1) Blank connections 3 and 4 of the two-way check valve.

(2) Connect to pressure and leak test rig as shown in fig. 4.

(3) Open V1 and V2, close V3.

(4) Adjust CV until both gauges indicate 250 lb/in^2.

(5) Immerse check valve in water. There is to be no leakage in one minute.

(6) Exhaust the system by closing CV.

(7) Remove the check valve and dry it using a jet of warm dry air.

Internal leakage test

8. (1) Remove blanks from connections 3 and 4 of check valve.

(2) Reconnect to pressure and leak test rig as shown in fig. 5.

(3) Ensure that V1 and V2 are open, and V3 is closed.

(4) Connect 2-25 cc/min. flowmeter to check valve inlet 2.

(5) Adjust CV until both gauges indicate 200 lb/in^2. Flowmeter must indicate not more than 15 cc/min.

(6) Reconnect the flowmeter to check valve inlet 1. It must indicate not more than 15 cc/min.

(7) Exhaust the system.

Differential pressure valve leakage test

9. (1) Blank inlets 1 and 2 of check valve.

(2) Disconnect flexible pipe 2 from check valve outlet 4.

(3) Connect 2-25 cc/min. flowmeter to check valve outlet 4.

(4) Close V2. Ensure V1 is open, V3 is closed.

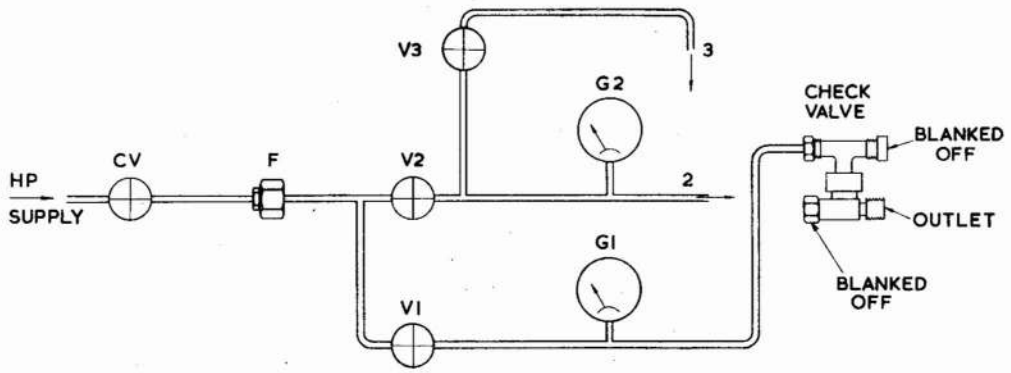

Fig. 3. Test rig, flow test, check valves, 6D/2162, 6D/2167 and 6D/2264

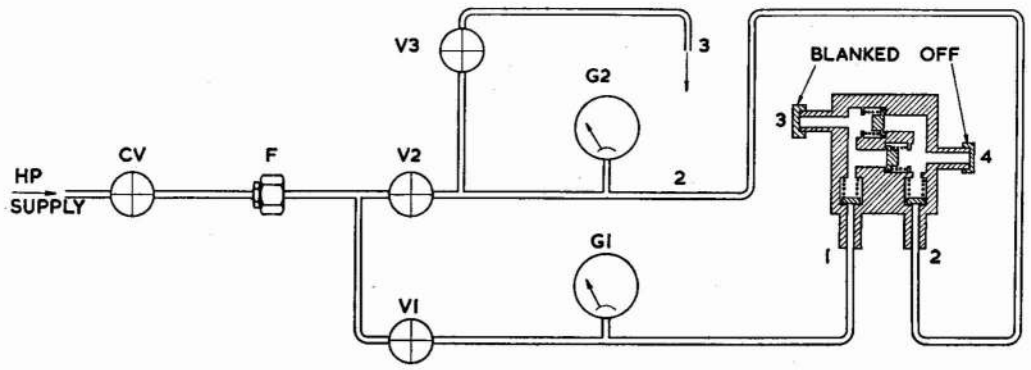

Fig. 4. Test rig, external leakage test, check valve, 6D/2265

(5) Adjust CV until G1 indicates 10 lb/in² flowmeter is to indicate not more than 15 cc/min.

(6) Replace 2-25 cc/min. flowmeter with one whose range is 30-300 L/min.

(7) Adjust CV until G1 indicates 20 lb/in². Flowmeter is to indicate not less than 100 L/min.

(8) Exhaust the system.

(9) Connect flexible pipe 2 to outlet 4 of the check valve, and 2-25 L/min. flowmeter to outlet 3 of the check valve.

(10) Repeat (4), (5), (6) and (7) above.

(11) Exhaust the system and disconnect.

Note . . .

Sub-paragraph (7) is a functional test of the operation of the differential pressure valve. At the present moment the flow rate quoted is arbitrary and will depend, as well as valve characteristics, upon the back pressure characteristics of the test equipment. These at present cannot be predicted. However the important thing is to ensure the correct function of the differential pressure valve by observing a vastly increased flow rate when 20 lb/in² is applied, from that when the valve is closed at 10 lb/in².

TWIN SUPPLY CHECK VALVE
Ref. No. 6D/2266

External leakage test

10. (1) Blank off connection 3 of twin supply check valve.

(2) Connect to pressure and leak test rig as shown in fig. 6.

(3) Open V1 and V2, close V3.

(4) Adjust CV until both gauges indicate 250 lb/in².

(5) Immerse twin supply check valve in water. There is to be no leakage in one minute.

(6) Exhaust the system, dry out the valve and fit transmit blanks.

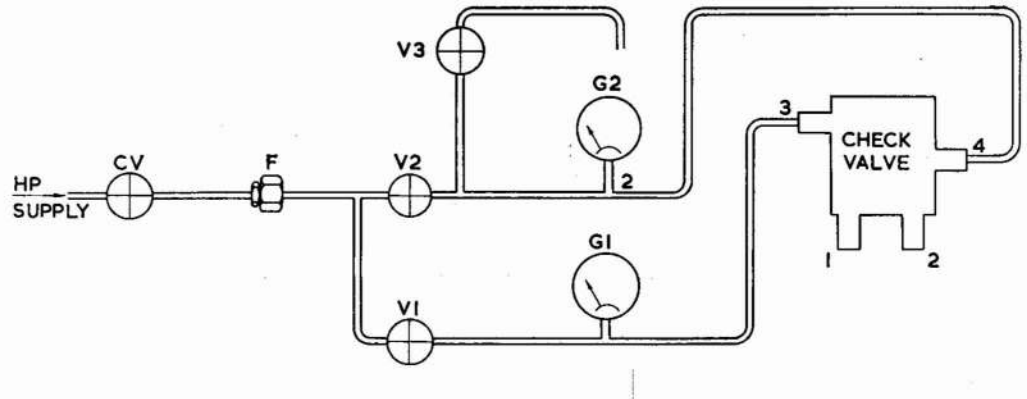

Fig. 5. Test rig, internal leakage test, check valve, 6D/2265

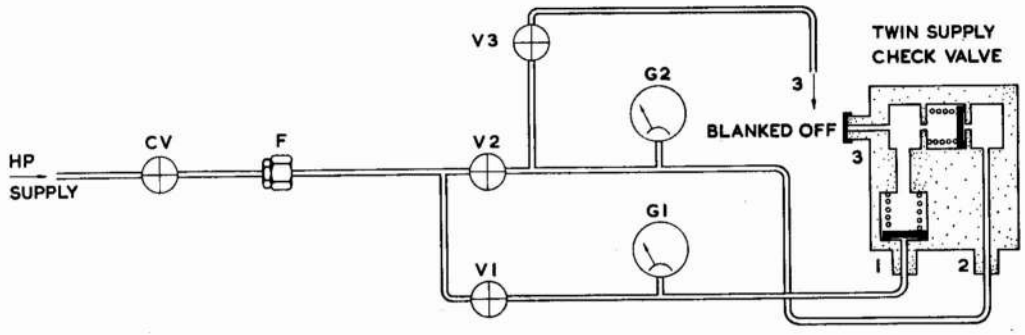

Fig. 6. Test rig, external leakage test, check valve, 6D/2266

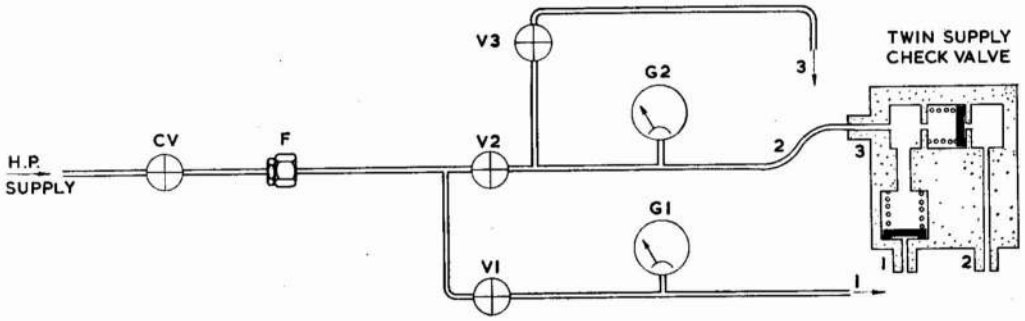

Fig 7. Test rig, internal leakage test, check valve, 6D/2266

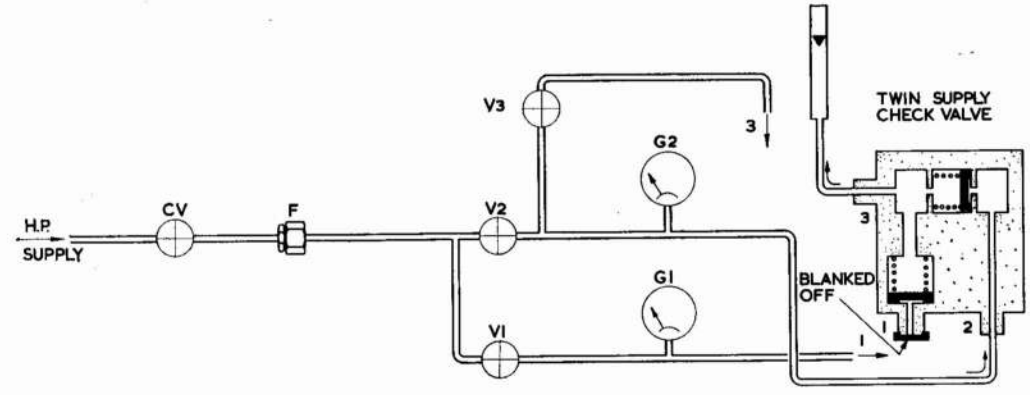

Fig. 8. Test rig, flow test, check valve, 6D/2266

Internal leakage test

11. (1) Remove blank from connection 3 of the twin supply check valve.

(2) Reconnect twin supply check valve as shown in fig. 7.

(3) Ensure that V3 is closed, close V1 and open V2.

(4) Connect 2-25 cc/min. flowmeter to connection 1 of twin supply check valve. Flowmeter is to indicate not more than 15 cc/min.

(5) Remove 2-25 cc/min. flowmeter and connect it to connection 2. It is to indicate not more than 15 cc/min.

(6) Exhaust the system and remove the flowmeter.

(7) Reconnect the twin supply check valve as shown in fig. 8.

(8) Blank off connection 1 of the twin supply check valve.

(9) Ensure that V1 and V3 are closed, V2 is open.

(10) Adjust CV until G2 indicates 10 lb/in².

(11) Flowmeter is to indicate not more than 15 cc/min.

(12) Exhaust the system and remove the flowmeter.

Flow test

12. (1) Connect 30-300 L/min. flowmeter to connection 3 of the twin supply check valve.

(2) Ensure V1 and V3 are closed, V2 is open.

(3) Adjust CV until G2 indicates 20 lb/in².

(4) Flowmeter is to indicate 100 L/min. or more.

(5) Exhaust the system and disconnect the twin supply check valve and fit transit blanks.

Note . . .

Sub-paragraph (4) *is a functional test of the operation of the differential pressure valve. At this stage the flow rate quoted is arbitrary and will depend, as well as valve characteristics, upon the back pressure characteristics of the test equipment. These cannot at present be predicted. However, the important thing is to ensure that the correct function of the differential pressure valve by observing a vastly different flow rate of* 20 *lb/in² is applied, from that when the valve is closed at* 10 *lb/in².*

◂ CHECK VALVE
(Part No. OP.18630)

Leakage

13. Apply a pressure of 10·0 lb/in² in a direction tending to close the valve, and measure the leakage past the valve seat. The leakage should not exceed 50 cm³/min.

Flow/pressure characteristics

14. Apply an inlet pressure of 7·0 lb/in² in the direction which corresponds with the arrow on the valve body, and measure the flow. The flow should be not less than 5·0 litres/min.

15. Operate the valve through a pressure cycle of 4·0, 7·0, 3·0 and 5·0 lb/in² checking the leakage past the seat at a pressure of 3·5 lb/in². The leakage should not exceed 50 cm³/min.

CHECK VALVE
(Part No. OP.18631)

Leakage

16. Apply a pressure of 20·0 lb/in² in a direction tending to close the valve and measure the leakage past the valve seat. The leakage should not exceed 50 cm³/min.

Flow-pressure characteristics

17. Apply an inlet pressure of 20·0 lb/in² in the direction which corresponds with the arrow on the valve body, and measure the flow. The flow should be not less than 70 litres/min.

18. Operate the valve through a pressure cycle of zero, 20·0 lb/in² and zero, and check the leakage past the valve seat as the pressure descends, at a pressure of 0·1 lb/in². The leakage should not exceed 50 cm³/min. ▸