Chapter 13 ANTI-G SYSTEM

(Completely revised)

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ILLUSTRATION

WARNING
AIRCRAFT EJECTION SEATS ARE FITTED TO THIS AIRCRAFT
Before attempting to enter the cabin ensure that the instructions detailed on the LETHAL WARNING marker card at the front of this handbook have been complied with. This is very important.

Introduction

1. This chapter contains a description of the anti-G system installed in this aircraft to supply and control the anti-G suits of each pilot, together with details of the servicing necessary to maintain the equipment in an efficient condition. An illustration of the system is also included. The use of an anti-G suit raises the pilot's blackout level, considerably reduces fatigue caused by repeated applications of G and enables the pilot to carry out 'all round' observations at high G. Detailed information on the components used in the system will be found in the Air Publications listed in Table 1.

DESCRIPTION

General

2. The anti-G system installed in this aircraft consists of four high-pressure air bottles which, when brought into use by the operation of an ON/OFF selector valve, automatically supply air to inflate the pilots' anti-G suits when G loads are applied. The air from the bottles is fed via a filter, a selector valve, a pair of pressure reducing valves and a pair of anti-G valves; all of which are interconnected by a system of pipe lines to quick-release connections located on flexible hoses which are clipped to their respective ejection seats. From these connections, further flexible hoses extend one to each pilot's quick-release connection. A pressure gauge is provided to indicate the pressure in the air bottles. The four air bottles, together with the alighting gear

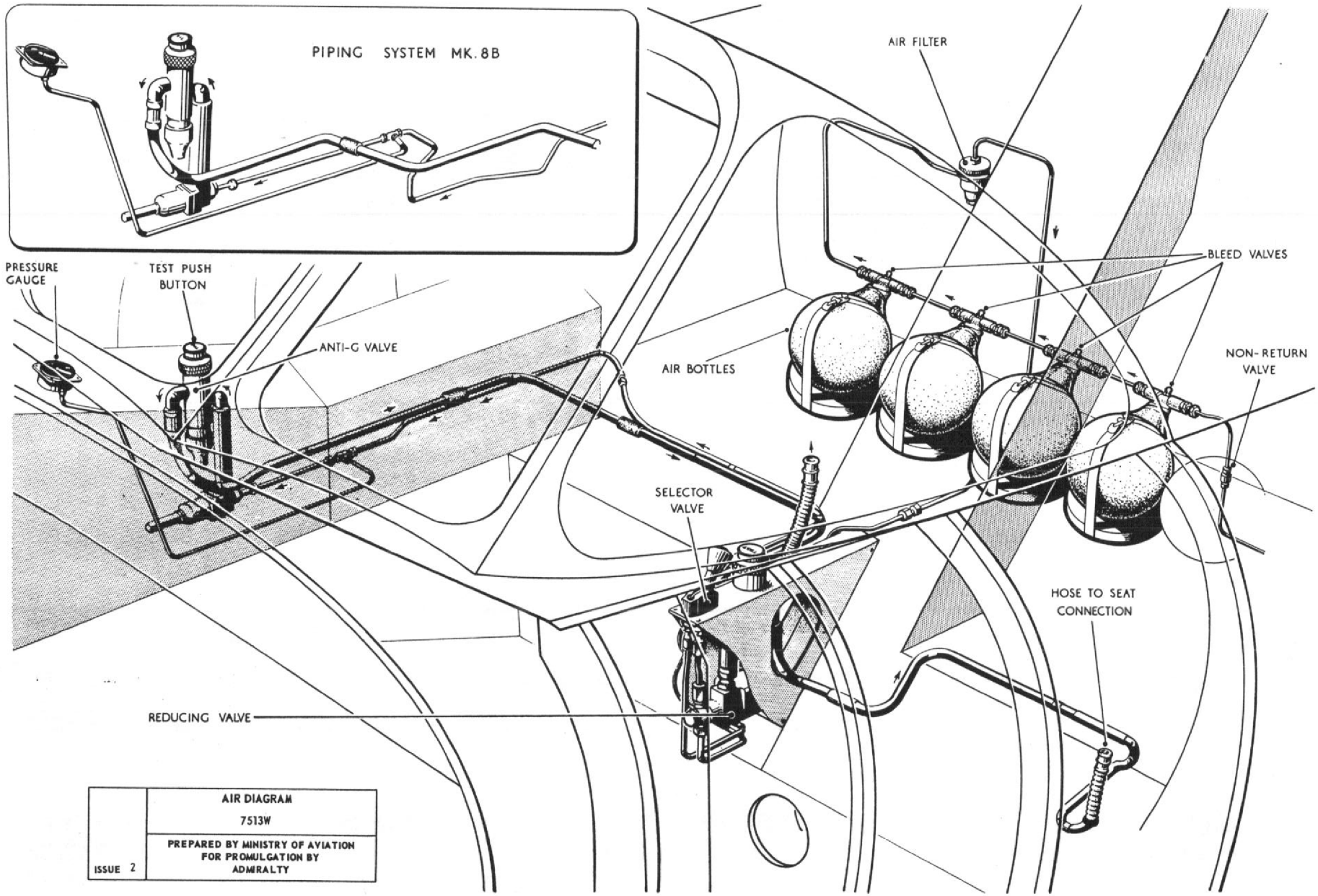

Fig.1 Anti-G System

and flap emergency air bottles, are charged in-situ through a common charging valve.

Air bottles

3. The four anti-G air bottles are mounted together with the two hydraulic emergency air bottles in line laterally across the cabin floor behind the ejection seats. They are clamped by wing nut tensioned straps to support structure just forward of frame 14 with their pipe connections facing upwards and slightly aft.

Charging valve

4. The charging valve is located just aft of frame 16 below the bottom longeron on the port side of the aircraft, and is accessible via the radio bay access doors in the bottom of the fuselage. The four anti-G air bottles, together with the hydraulic emergency air bottles, are charged simultaneously through this valve. A non-return valve in the pipe line between the charging valve and the anti-G air bottles is provided to prevent a return flow from the anti-G system into the hydraulic emergency system.

Air filter

5. The air filter is clamped to the forward face of frame 14 above the air bottles on the starboard side of the aircraft. It is provided to ensure that only clean air is supplied to the sensitive reducing and anti-G valves in the system.

Pressure gauge

6. The pressure gauge, which is tapped into the circuit on the high pressure side of the reducing valves, to indicate the pressure in the air bottles, is located at the forward end of the cabin starboard shelf.

Selector valve

7. The lever operated ON/OFF selector valve, which is used to bring the anti-G system into operation, is located on the anti-G control panel between the two ejection seats.

Pressure reducing valves

8. The pressure reducing valve for the instructor is located in clips bolted to the cabin floor beneath the forward portion of the cabin starboard shelf, while that for the port crew member is beneath the anti-G control panel between the seats. The valves lower the air pressure to the required operating value for the anti-G valves.

Anti-G valves

9. The anti-G valve for the pupil is mounted on the underside of the anti-G control panel between the seats with its test button projecting upwards through the panel while that for the starboard crew member is similarly mounted below the forward portion of the cabin starboard shelf with its test button protruding above the shelf. The valves automatically control the pressure in the pilots' anti-G suits in accordance with the G loads applied perpendicular to the line of flight. Test push-buttons are provided to enable each pilot to manually inflate his suit, either for checking the operation of the system, or as an anti-fatigue measure during flight.

Quick-release connections

10. The airframe portion of the anti-G system terminates in a pair of quick-release sockets, both of which mate with plugs attached to lengths of kinkproof hose, one of which is clipped to the port side of each ejection seat. These latter hoses terminate in quick-release plugs to which, when in use the pilots' anti-G suits are connected. When not in use, the hoses are stowed in blanking sockets, one of which is mounted on the port side of each seat pan. When ejection action is taken, the airframe portions of the system are automatically disconnected at the quick-release connections in the pipes clipped to each seat and, when the pilots leave their seats after ejection, their suits are automatically disconnected at the quick-release connections on the suits.

Operation

11. The operation of the system, when once selected for use, is fully automatic as the pressure applied to each suit is controlled by its respective sensitive anti-G valve which is opened to an extent depending upon the G loads applied. When the anti-G valves open, high-pressure air flows from the bottles through the filter and selector valve to the pressure reducing valves. At these valves, the high-pressure air is suitably reduced and the air then flows via the open anti-G valves to inflate the suits. When normal flight is resumed, the anti-G valves close thus shutting off the supply to the suits, which deflate through exhaust ports in the anti-G valves.

SERVICING

General

12. The servicing necessary to maintain the system in an efficient condition consists of keeping the installation clean,

ensuring that the exhaust ports in the anti-G valves and pressure reducing valves are free from obstruction, together with a check of the pipelines and components for leaks, damage and security. The quick-release connections, in particular, should be examined to ensure that they are correctly assembled to their respective flexible hoses and that the hoses and connections are undamaged. The air filter should be drained and its felt filter pad cleaned as described in the Air Publication referred to in Table 1, and reference should be made to the pressure gauge to ensure that the air bottles are fully charged. The pressure to which the bottles are to be charged is given in the Leading Particulars, the procedure being described in Sect.2, Chap.2. The other servicing necessary is the serviceability and operational tests of the components which will be found in the Air Publications referred to in Table 1.

Draining air filter

13. *The air filter should be drained periodically, while compressed air is present, by unscrewing the drain plug at the bottom of the filter casing one quarter of a turn.* When this is done, oil and water, if present, will be ejected through the drain hole at the bottom of the filter body. The filter should also be dismantled regularly to enable the felt filter element to be cleaned as detailed in the Air Publication referred to in Table 1, but before this is attempted, the pressure in the air bottles must be dissipated by opening the bleed valve at the neck of each bottle.

REMOVAL AND ASSEMBLY

General

14. The procedure for removing the anti-G valves, pressure reducing valves, selector valve, air filter and pressure gauge is obvious once access has been obtained, but care must be taken to ensure that the pressure in the air bottles is dissipated by opening the bleed valve in the neck of each bottle before any pipelines are disconnected. *When any component is removed, or when pipelines are disconnected for any reason, it is essential that the pipe ends and connections on the units are blanked off to prevent the ingress of dirt or other foreign matter.* This is important, as any dirt etc., in the pipelines, or units, will cause damage to the sensitive reducing and anti-G valves. Before reconnecting a component, the pipelines must be blown through with clean dry air to ensure that they are scrupulously clean. During assembly care must be taken to ensure that the components and non-return valves are fitted correctly i.e. arrows point in the direction of flow. Removal and replacement of the pipe elbows of the anti-G valves should be carried out only under conditions of absolute cleanliness. Adhesives between the elbows and the valve body should not be used under any circumstances.

Air bottles

15. Access to the anti-G air bottles, which together with the hydraulic emergency air bottles are located behind the ejection seats, is obtained from within the cabin. The method of removing them is as follows:-

(1) Dissipate the pressure in the air bottles by unlocking and opening the bleed valves located on the neck of each bottle.

(2) Unscrew the pipe couplings at the neck of each bottle and gently ease the pipes away until they are clear of the bottles. Blank off the pipe ends and bottle connections.

(3) Unlock and slacken off the wing nuts tensioning the straps around each bottle.

(4) Disengage the straps and remove the bottles, taking care that they do not foul or damage any pipelines and installations behind the seats.

Note . . .

The method of refitting the bottles is a reversal of the above procedure, ensuring that the bleed valves are fully closed and locked before recharging the system.

Quick release connections and hoses

16. Water may be used as a lubricant when screwing the kinkproof hoses on to the quick release connections. The hose must be screwed on to the full length of the thread on the connection, which is provided with flats so that it can be held with a spanner whilst fitting the hose.

Testing

17. The system is to be tested at the periods specified in the servicing schedule as follows:-

(1) Replenish the air bottles to 2000 lb /in.^{2}. After allowing the charge to cool re-check the air pressure and top up if necessary.

(2) Connect the quick release connections to the ejection seat hoses.

(3) With the selector valve ON momentarily depress the anti-G valve test buttons and ensure that there is a free flow of air from each seat hose.

(4) Connect a suitable pressure gauge (0-10lb/in.^{2}) with a length of hose and a quick release plug to the ◀ seat port hose. ▶

(5) Set the selector valve to ON and depress the port anti-G valve test ◀ button sufficiently to obtain a pressure of 7 lb /in.^{2} on the gauge. ▶ Check the pipe and hose from the anti-G valve for leaks with soapy water and check the inherent leak through the anti-G valve. This should not exceed 100 lb /in.^{2} in 45 minutes.

(6) Set selector valve to OFF and remove pressure gauge.

(7) Repeat operations (4), (5) and (6) on the starboard installation.

(8) Ensure that there is no pressure drop with the selector valves OFF.

(9) Stow the hoses in the seat blanking sockets.

(10) Re-charge the air bottles as in (1) above.

TABLE 1

Component and Air Publication reference

Component	Air Publication
Bottle, Air, spherical Dunlop A.C.M.16782	
Filter, Dunlop A.C.O.7273	4303B, Vol.1, Book 1, Sect.2, Chap.1
Gauge, Pressure Mk.14KK	1275A, Vol.1, Sect.15, Chap.6
Socket, Quick Release Dunlop A.C.O.6580	
Suit, Anti-G	1182E, Vol.1, Sect.1, Chap.10
Valve, Anti-G Type A.G.2	4303C, Vol.1, Sect.4, Chap.14
Valve, Non-return Dowty D.5213Y	
Valve, Reducing Type C.58	4303Z,
Valve, Selector Type S.V.9	4303C, Vol.1, Sect.6, Chap.3, App.1