

## Chapter 8

## AIR CONDITIONING SYSTEM

## LIST OF CONTENTS

	Para.		Para.		Para.	
<b>Description and operation</b>			<b>Servicing</b>		<b>Assembly of components</b>	
Introduction	1		Cold air unit—servicing before installation	16	Air supply valve and temperature control valve	25
Engine air pressure system	2		Cold air unit—topping-up	17	Cabin air extraction valve	26
Ram air supply	6		Drains	18	Windscreens and hood spray drains	27
Hood seal	7		Examination of pipes (S.I./Hunter/76 & Pre-Mod. 1073)	18A	Pipe clamps—intercooler and cold air unit	28
Cabin air extractor valve	8		Hood and windscreens spray drains	19	Hood spray pipes	29
Temperature control valve	9		Maintenance of cabin pressure and structural sealing		Lubrication	30
Air supply valve	10		Sealing cabin structure	20	Removal of air conditioning pipes—engine to pre-cooler and by-pass valve	31
Pre-cooler by-pass valve	11					
Variable orifice valve	12					
Controls	13					

## Fig.

Air extraction valve	1
Temperature control valve	2
Air supply valve	3

## LIST OF ILLUSTRATIONS

## Fig.

Pre-cooler by-pass valve	4
Variable orifice valve	5
Hood and windscreens spray drain collector bottle	6
Air conditioning system installation (1)	7

## Fig.

Air conditioning system installation (2)	8
Air conditioning system diagram (1)	9
Air conditioning system diagram (2)	10

## TABLE

Component and Air Publication reference	1
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## DESCRIPTION AND OPERATION

## Introduction

1. The aircraft is provided with an air conditioned and pressurized cabin, pressure air being obtained from the engine compressor. A switch in the cabin is provided to select pressurization, the OFF position enabling ram air, received from an air scoop in the nose of the aircraft, to be used in lieu of engine pressure air if desired. Temperature control is effected by means of a temperature control switch, which is gated for hotter or colder air selections in manual, an intermediate position maintaining the selected condition. A fourth position provides for control in auto, temperature selection then being made by means of a temperature selector and maintained by a temperature controller. The cabin hood is equipped with a rubber seal which is automatically inflated from the engine supply when the hood is closed, and

automatically deflated when the hood OPEN selection is made, partial deflation occurring before the hood actuation gear operates. Detailed information on the components used in the system will be found in the Air Publications listed in Table 1 and in Sect. 5, Chap. 1.

## Engine air pressure system

2. The air supply for cabin pressurization is taken from a restricted tapping on the engine compressor and is conveyed to a pre-cooler located on the port side of the fuselage. The pre-cooler reduces the temperature of the air to a permissible value. A by-pass valve (para. 11), piped to the air supply and the pre-cooler, permits the air to by-pass the pre-cooler under certain conditions of flight. From the by-pass valve, the air passes to a motorized air supply valve (para. 10) for normal supply or for flood supply (para. 4). For normal (or main) feed, the air leaves the air supply valve

to continue to a variable orifice valve (para. 12), from which it is conveyed either to a motorized temperature control valve (para. 9) or to the cold air unit. The cold air unit consists of a free-running compressor and a turbine mounted on one shaft, with an intercooler ducted in between them, the air passing to the compressor and thence via the intercooler to the turbine. The resulting cold air output from the turbine is piped forward to rejoin the air from the temperature control valve at a mixing chamber and the combined flow is delivered through a water separator and a non-return valve to the cabin ventilation ducts. These ducts feed the sprays at the windscreens panel, quarter-lights and at the sides of the hood.

3. Spent ventilation air is expelled from the cabin through a combined valve unit mounted on the front face of frame 6. Piping in

the nose of the aircraft permits the waste air to circulate in jackets around the radar equipment for cooling purposes before it is finally discharged to atmosphere.

## WARNING

It is imperative that nothing covers, or even partially covers, the protective grid of the combined valve unit or discharge valve, thereby preventing free access of spent ventilation air to the outer bodies of the valve. Failure to observe this precaution may lead to an excessive build-up of pressure in the cabin resulting in a structural failure.

4. Flood air from the air supply valve is fed into the outlet duct from the cold air unit. The feed is automatically obtained whenever the cabin altitude exceeds 38,000 feet by the operation of an altitude switch (*Sect. 5, Chap. 1*) which opens the air supply valve to the 'flood' position to prevent low cabin pressure at this altitude. Flood air may also be obtained manually to provide hot air for demisting purposes, by placing the flood switch in the cabin to the manual position.

5. A cabin pressure controller is installed in the cabin on the rear face of frame 6. The controller, which operates the combined valve unit, commences pressurization at 10,000 feet and the full  $3\frac{1}{2}$  lb/in<sup>2</sup> differential is built up at 25,000 feet and above.

### Ram air supply

6. An alternative air supply for emergency cabin ventilation is provided from a forward facing air scoop situated in the camera gun vision cone in the front fuselage nose piece. From the scoop, the air passes through a ram air shut-off valve, mounted on the rear face of frame 6, and thence into the cabin.

The shut-off valve is pneumatically-operated via a solenoid from a tapping off the main supply from the pre-cooler to the by-pass valve. In circumstances which entail positive isolation of the engine air pressurization supply, ram air induction is further assisted by a pneumatically-operated extractor valve, mounted on the forward face of frame 14, which operates in conjunction with the ram air shut-off valve and directs outflow of spent air to a region of low pressure. This condition is obtained by placing the cabin pressure switch to OFF, thus closing the air supply valve and allowing the extractor valve to open. The hood seal is kept inflated to prevent the noise of air leakage.

### Hood seal

7. A pneumatic rubber seal is mounted on the perimeter members of the cabin hood. A common air supply for the seal, the ram air valve and extractor valve is taken from a tapping downstream of the pre-cooler. The air passes to a combination of non-return valve and reducing valve, incorporating a

safety blow-off, which are located on frame 14 and maintain the supply to the seal at a pressure of 8 lb/in<sup>2</sup> above cabin datum pressure. From the reducing valve, the supply is branched off via solenoid valves to the ram air and extractor valves and to the hood seal. The closing of the air supply valve does not affect the seal. The hood seal solenoid and hood winding motor are activated from a common control switch. The circuit embodies a time-delay to achieve deflation of the seal before the hood commences to open, deflation exhaust being bled to atmosphere. The hood seal solenoid valve admits air to the hood seal when the hood is closed and maintains the seal inflated in the event of electrical failure. It incorporates a mechanical override which, operating in conjunction with the hood jettison gear, provides for seal deflation prior to jettisoning the hood. (*It is recommended that the cabin pressure switch is set to 'OFF' before jettisoning the hood.*)

### Cabin air extractor valve (fig. 1)

8. This valve is fitted on frame 14. It is operated pneumatically via a solenoid from a tapping off the pipe between the pre-cooler and by-pass valve and is automatically opened when the air supply valve is closed. If the electrical power fails, the extractor valve remains closed. The valve operates in conjunction with the ram air shut-off valve (*para. 6*).

### Temperature control valve (fig. 2)

9. The temperature control valve, which is located adjacent to the mixing chamber consists of a valve body (A) which contains a spindle carrying the operating levers (C) which, in turn, engage with the split sleeve (D). The sleeve incorporates a specially shaped port giving a progressive opening of the valve. The actuator (B) is arranged to engage with the valve spindle for operation of the valve. A pinion on the valve spindle meshes with a separately mounted quadrant which operates, through linkage, a follow-up resistor. The resistor is a component of the temperature controller (*para. 13*).

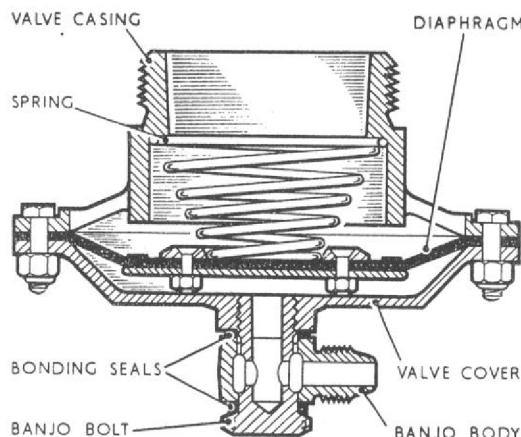


Fig. 1 Air extraction valve

## LUBRICATION ON ASSEMBLY

BEARING SURFACES OF VALVE SLEEVE AND VALVE BODY TO BE LIGHTLY COATED WITH ANTI-FRETTER GREASE XG-276 AND BEARING SURFACE OF VALVE SPINDLE KEPT DRY

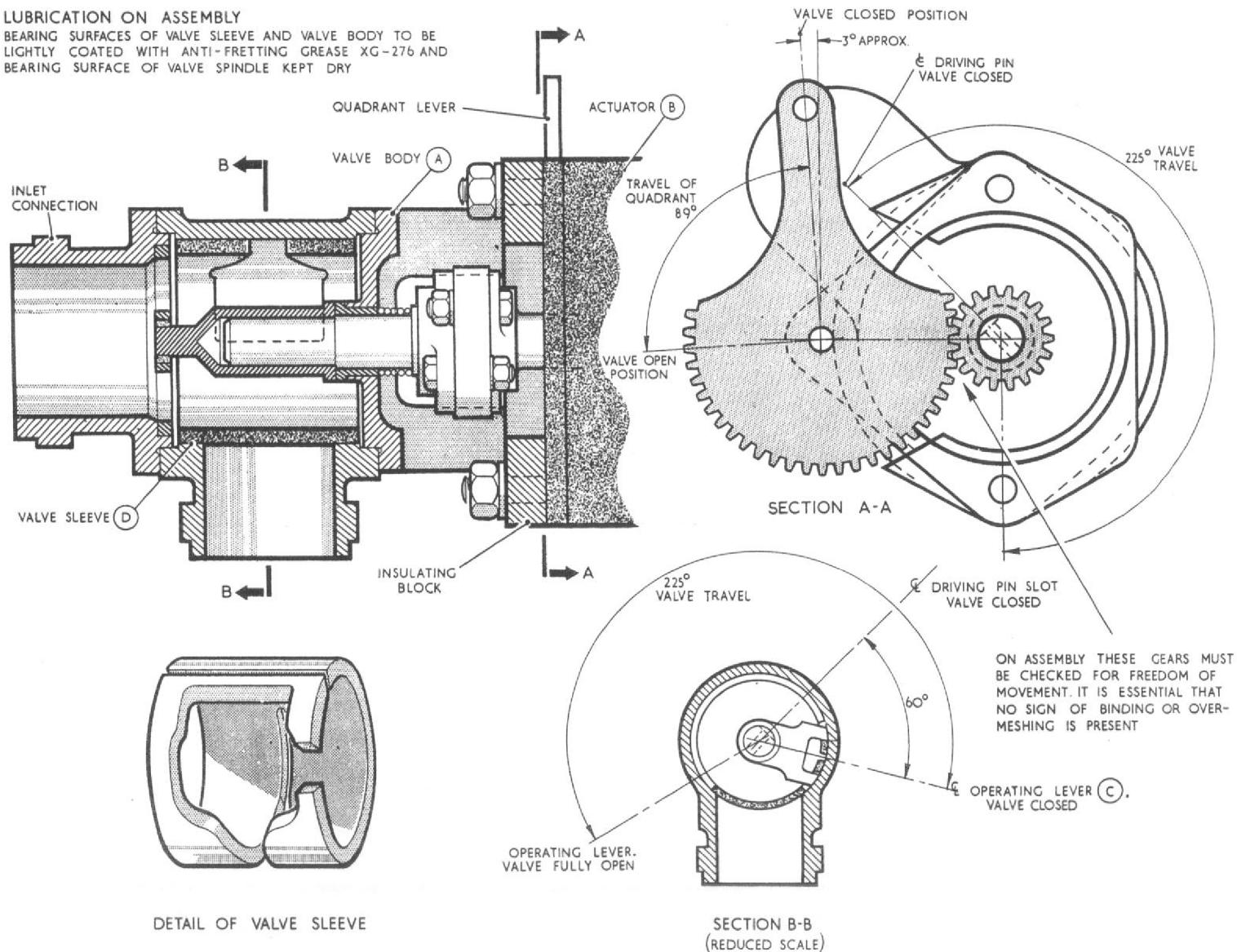
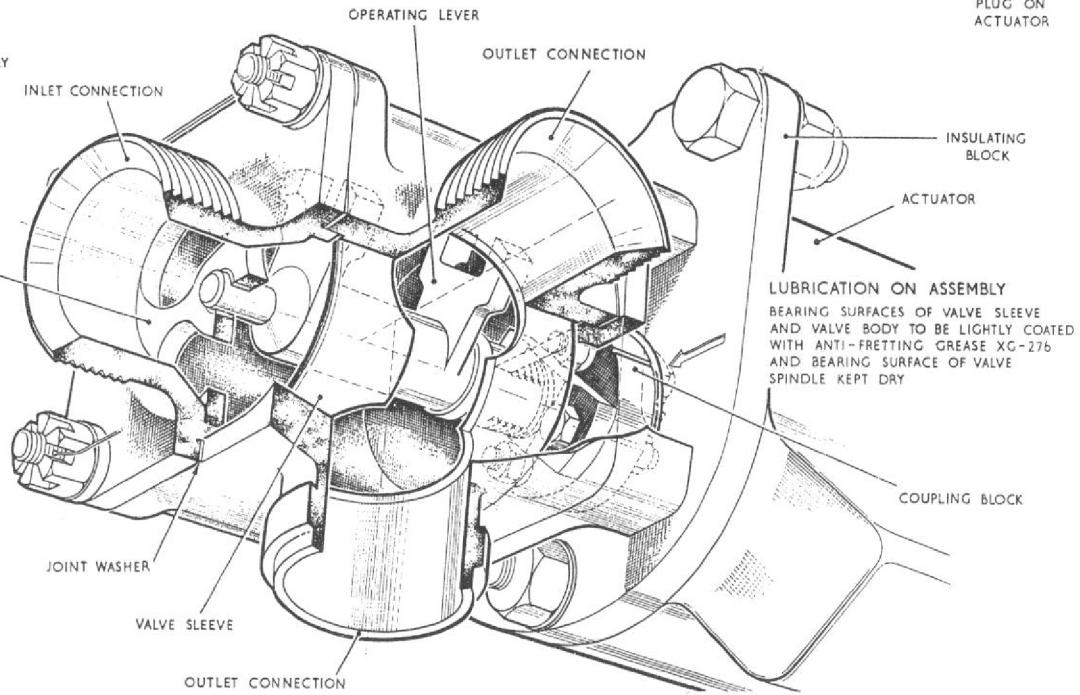
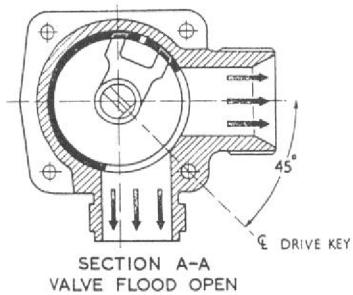
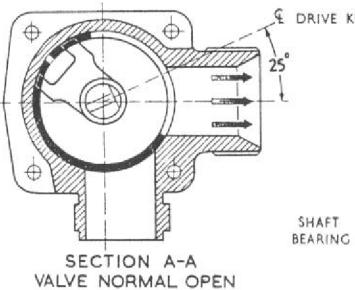
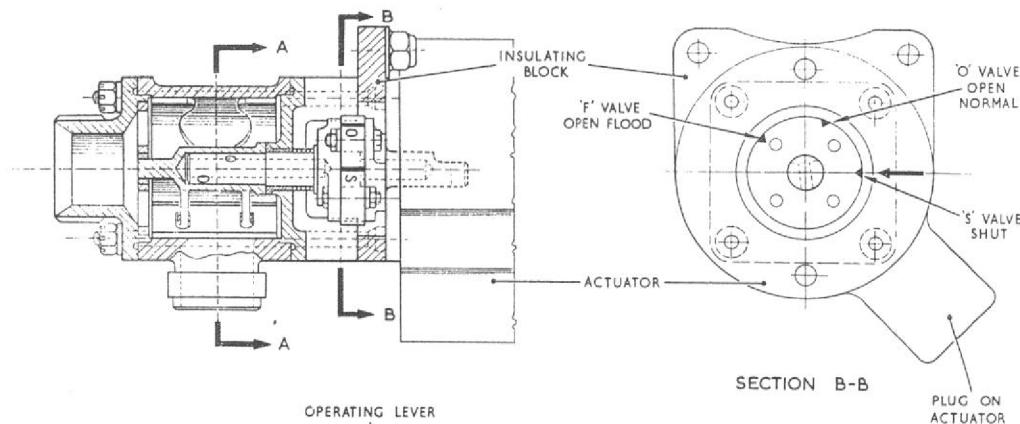
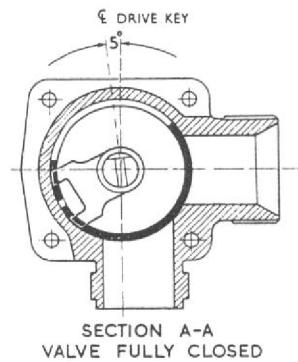


Fig.2 Temperature control valve

◀ Lubrication change assembly note added ▶

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**Fig. 3 Air supply valve**

◀ Lubrication change ▶

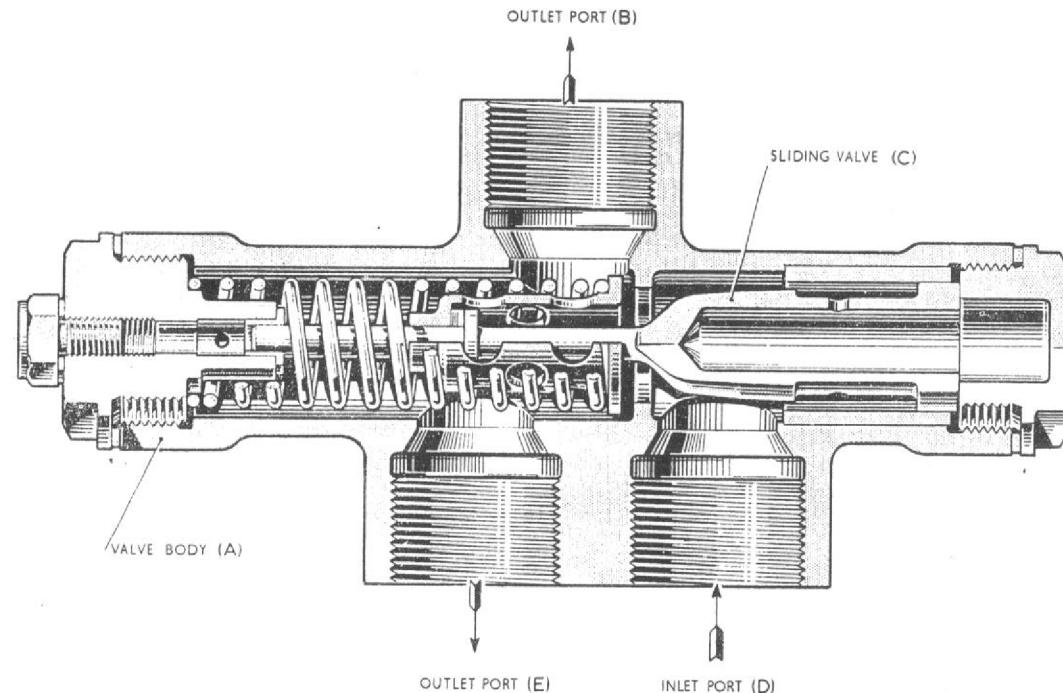
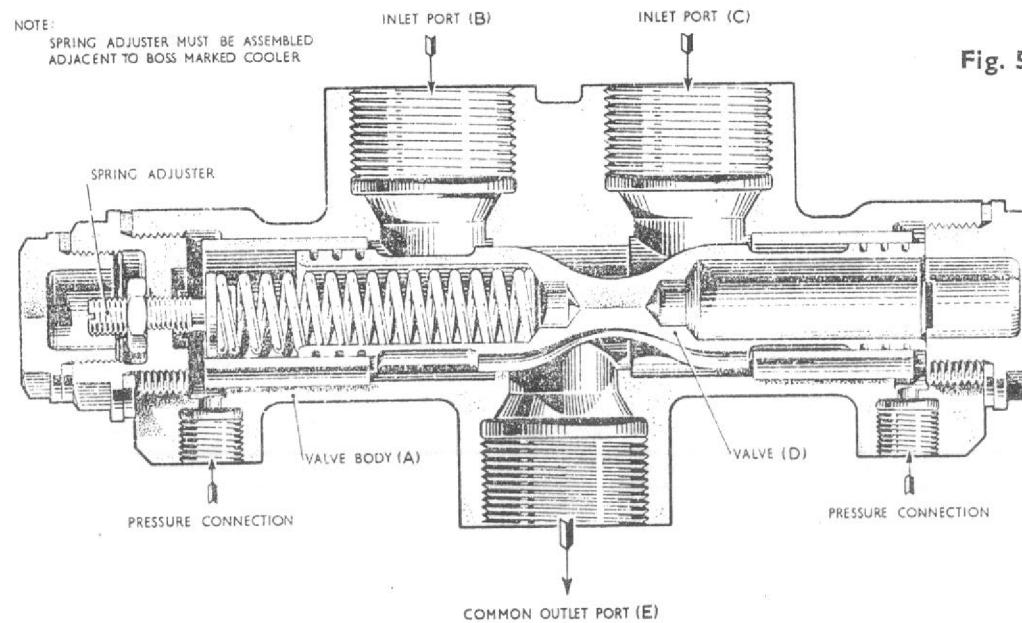
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**Air supply valve (fig. 3)**

10. The air supply valve is similar in construction to the temperature control valve (para. 9), except that an additional outlet port is provided for flood air. The valve is driven by an actuator which is operated by the control in the cabin for pressure 'ON' or 'OFF' and, for flood air, by an altitude switch or a manually-operated flood switch.

**Pre-cooler by-pass valve (fig. 4)**

11. This unit consists of a valve body (A) containing a spring-loaded sliding valve (D). The valve body incorporates two inlet ports (B and C), port (B) being connected to a pipe from the pre-cooler and port (C) to a pipe by-passing the pre-cooler. There is a common outlet port (E). According to the position of the sliding valve, the pressure air is either fed into the system direct or is by-passed through the pre-cooler. The position of the valve is dependent upon the pressure difference at the two ends of the valve body, one end being connected with the hot air outlet pipe from the variable orifice valve (para. 12) and the

**Fig. 5. Variable orifice valve****Fig. 4. Pre-cooler by-pass valve**

other with the outlet duct from the cold air unit. When the pressure in the variable orifice valve outlet pipe is high, the by-pass valve is positioned so that the air supply is passed through the pre-cooler.

**Variable orifice valve (fig. 5)**

12. The variable orifice valve consists of a body (A) which contains a sliding spring-loaded valve (C). Its purpose is to control the flow of air to the cold air unit or direct to the cabin through the hot air by-pass. Movement of the valve is effected by the pressure difference across it, the profile of the valve being forced into a circular orifice in order to provide the required flow. The inlet port (D) is in connection with the normal outlet port of the air supply valve, the outlet port (E) with the hot air by-pass to the temperature control valve and the outlet port (B) with the inlet of the cold air unit.

**Controls**

**13.** The cabin pressurization and air conditioning controls are grouped together in the cabin. The controls comprise a cabin pressure control switch, which is marked OFF/ON; a flood air flow switch, marked AUTO/MANUAL; a cabin temperature control switch, marked AUTO / COLDER / EMERGENCY/HOTTER and a cabin temperature selector, marked COOL/NORMAL/ WARM. The cabin pressure switch controls the air supply valve actuator, the air extractor valve solenoid located on the diaphragm aft of the hood, and the temperature control valve actuator. The air supply valve actuator is also controlled by the flood air flow switch, which gives manual control of flood operation irrespective of cabin altitude. The action of the cabin temperature control switch is such that, when it is in either the COLDER or the HOTTER position, the temperature control valve actuator closes or opens the valve, thus permitting manual control of the cabin temperature. The intermediate EMERGENCY position is used to maintain the temperature control valve in any chosen condition. With the switch placed in the AUTO position, temperature is selected by means of the cabin temperature selector. The selected temperature is then automatically controlled by a magnetic amplifier temperature controller to within  $\pm 2\frac{1}{2}$  deg. C. at any selection in the range of +5 deg. C. to +30 deg. C., so that progressive alterations in temperature control valve opening are timed to damp out or suppress deviations in cabin temperature from the selected setting. The magnetic amplifier and cabin element of the controller are located in the cabin; the follow-up resistor is installed outboard of the temperature control valve, and the duct stat is fitted in a pipe forward of frame 14. When 'hood open' is selected, provision is made for overriding the cabin pressure control switch, to close the air supply valve, and energize the solenoid to open the cabin air extractor valve. At the same time, the temperature control valve is closed.

*It is recommended that the 'cabin pressure' switch is operated to OFF before jettisoning the hood. For further information on the*

operation, electrical interconnection, relays, etc., reference should be made to Sect. 5, Chap. 1.

**Visual warning of loss of pressure**

**14.** Warning of loss of cabin pressure is given visually by means of a warning lamp in the cabin. The lamp is operated by electrical contacts in the pressure controller (para. 5), whenever the cabin pressure differential falls by approximately 1 lb./in.<sup>2</sup> below nominal datum. A cabin pressure warning switch, marked TEST/NORMAL, is provided to test the warning lamp and flood circuits. For further information on the warning system, reference should be made to Sect. 5, Chap. 1, Group D6.

**Ground test connections**

**15.** Provision is made for ground testing the system using an external supply. The equipment consists of the following:—

- (1) A connection, for ground pressurization of the cabin and a switch for external operation of the hood, both of which are accessible after removal of the nose piece (Sect. 3, Chap. 1).
- (2) A connection for hood seal inflation from an external source and a connection for a pressure gauge, both of which are accessible via the nose wheel bay.

**SERVICING****WARNING**

Only personnel certified as medically fit for servicing duties inside pressure cabins are permitted inside the aircraft when tests are carried out at ground level. Personnel with colds must have further medical approval.

**Note . . .**

◀ (1) The precautions detailed in A.P.3158, Vol. 2, Section H leaflet must be complied with during cabin pressure tests on the ground.

(2) The detachable hood fairing must be fitted at all times when ground pressurization tests are being carried out.

**Cold air unit—servicing before installation**

**16.** At all times, care must be taken to exclude dirt, oil or foreign matter from entry into this assembly. Before installation, all connecting pipe flanges should be examined for damage and distortion and it should be ensured that they are clean, and free from obstruction or oil. If the unit has been inoperative for an appreciable time (e.g., as in storage), it should be primed as detailed in A.P.4340, Vol. 1.

**Cold air unit—topping up**

**17.** When the unit is subsequently serviced on the aircraft, it should be topped up daily (Sect. 2, Chap. 2). The oil and the containers must be absolutely clean. Avoid overfilling the unit as excess oil may seep past the labyrinth seals when the unit is stationary.

**Drains**

**18.** The water separator is provided with a restricted drain which terminates outside the fuselage skin. The drain should be periodically examined to ensure that it is not blocked. The pre-cooler and the inter-cooler are each provided with a drain pipe. The plugs sealing the drain pipes should be removed periodically and any water that may have collected should be drained off. The plugs are accessible through the gear-box access door. (Sect. 2, Chap. 4.)

**Examination of pipes (S.I./Hunter/76 & Pre-Mod. 1073)**

**18A.** Whenever the engine is removed, examine the following cabin air conditioning pipes for dark brown discolouration of the lagging material this discolouration is evidence of chemical corrosion of the tungum piping due to the lagging :—

Part No.	Description	Reference
C.201553/11	Pipe, coupling to coupling	Shown in red, on fig. 8
B.201552	Pipe, pre-cooler to connection	
C.201553/12	Pipe, coupling to engine	

If the lagging material is discoloured these pipes and the following pipes must be renewed :—

Part No.	Description	Reference
C.201553/9	Pipe, coupling to by-pass valve	Shown in red, on fig. 8
C.201553/7	Pipe, by-pass valve to air supply valve	Shown in yellow, on fig. 8

The procedure for the removal of these pipes is described in para. 31.

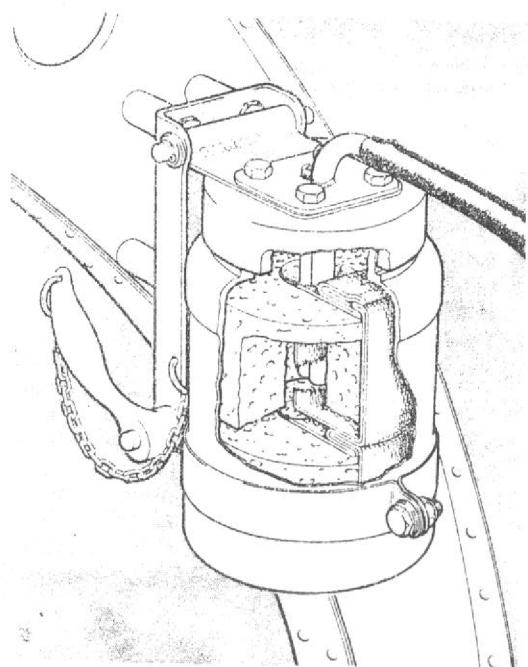


Fig. 6. Hood and Windscreen spray drain collector bottle

**MAINTENANCE OF CABIN PRESSURE  
AND STRUCTURAL SEALING**

**Sealing cabin structure**

20. The maintenance of cabin pressure at high altitude is essential and all sources of

leakage must be sealed in accordance with the instructions given in the following paragraphs, using the approved materials listed :—

- (1) Bostik pressurizing plastic No. 1751. This is a liquid used as a primer and sealant. It is applied with a brush.
- (2) Bostik pressurizing plastic No. 1790. This is a stopper extruded from a tube, or pressure applicator, to form a bead around the edges of mating parts and for filling spaces too large for Bostik 1751.
- (3) Soft rubber rectangular strip (*Commercial*) or Prestik pressure plastic. This is for a preliminary filling of spaces too large for Bostik 1790.

**Note . . .**

*As Bostik sealants are highly inflammable the usual fire precautions applicable when using inflammable materials must be observed. It is important that no sealing compound or jointing compound is permitted to come into contact with Perspex or laminated glass.*

**Application of sealants**

21. The method of application of the sealants is as follows :—

- (1) Parts to be assembled or rectified for leakage should be coated with Bostik 1751 in the detail stage.
- (2) All joints in the pressure cabin must be sealed and for an effective seal, the surfaces to be sealed must be scrupulously clean. If necessary, the surface to which the sealant is to be applied can be cleaned with white spirit but the spirit must be used sparingly.
- (3) Make all the joints between mating parts (e.g., skin to frame), with Bostik 1751 applied with a 1 inch medium soft bristle brush, the application to extend for  $\frac{1}{2}$  of an inch from the joint in all directions.

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on the pressure side of the joint. Allow between 30 and 60 minutes drying time before bringing the joint faces together. After riveting, apply a liberal coat of Bostik 1751 over all rivet heads. Dip bolts in Bostik 1751 before assembly. Coat any large apertures (above 0.10 in. approx. dia.) in corners with Bostik 1751 and fill with Prestik coated with Bostik 1751 immediately prior to insertion. Fill tooling holes with "Chekaleke" plugs applied as above. Fill pop rivets with Bostik 1790 and coat with Bostik 1751 on the pressure side. Allow to dry for 2 hours.

- (4) Apply a fillet of Bostik 1790 as necessary along the edges of mating parts and in jointed corners. Allow to dry for 24 hours.
- (5) Apply a further coat of Bostik 1751, extending over the whole area treated in sub-para. (3). Allow to dry for 24 hours before pressure testing.
- (6) Pressurize the cabin in accordance with the requirements laid down in para. 22 and 23.
- (7) Stop any leaks shown in the above test with a further application of Bostik 1790 and 1751 over pressure side of the leak. Alternatively, a mixture of half and half of each, by volume, may be applied to the leak with a brush. Allow to dry for 6 hours before re-testing.
- (8) Allow 12 hours from the last application of sealant before painting.
- (9) Re-test in accordance with the requirements laid down in para. 22 and 23.

**Note . . .**

Bostik 1790 may be thinned down by thinner Bostik 6846 if required. Experience has shown that a suitable mixture of Bostik 1790

and 1751 may be satisfactorily used in the pressure applicator and also applied with a brush. After using the pressure applicator, accessories should be thoroughly cleaned with Bostik cleaner 6307 if they are likely to be out of use for a period in excess of 24 hours.

**Cabin pressure tests**

22. The following equipment will be required:—

- (1) Test trolley—Ref. No. 4F/1714.
- (2) Hood seal inflator—Ref. No. 4F/1812. (incorporating Schrader valve).
- (3) Connection adapter for cabin pressure gauge—2 off—Ref. No. 4F/1810.
- (4) Hood seal pressure gauge—Ref. No. 6A/1582.
- (5) Cabin pressure gauge—Ref. No. 6A/1582.
- (6) A length of rubber hose to suit adapters (3) above.
- (7) Foot pump for hood seal inflation (car type).
- (8) An external electrical supply.
- (9) Blank for cabin pressure control valve.

23. To pressure test the cabin, proceed as follows:—

- (1) Check for correct adjustment of the hood seal micro-switch and connect the equipment listed in para. 22 to the aircraft. With the cabin pressure control switch ON close the hood by means of the external switch and gradually apply pressure with the foot pump to the hood seal and the ram air and extractor valves. Note the pressure at which the valves close and continue pumping until the hood seal pressure builds up to 8 lb/in<sup>2</sup>. Check for leaks in the seal and valves systems.

- (2) Blank the static vent of the type 'A' pressure controller and run the test trolley with the blow-off set to produce a pressure of 3½ lb/in<sup>2</sup> in the cabin. The trolley blow-off setting should not exceed about 5 lb/in<sup>2</sup>. Carry out checks for leakages from various points, particularly the following:—

- (a) Ram air and extractor valves.
- (b) Type 7/20 combined valve units.
- (c) Non-return valve in the main supply line.
- (d) Access holes for flying controls, Teleflex controls, etc.

- (3) Operate the various flying controls to ensure that their movement does not increase leakage. Check the rate of cabin pressure drop. The required rate is for the pressure to drop from 3½ to 1½ lb/in<sup>2</sup> in not less than 30 seconds after disconnecting the external supply, with the hood seal pressure maintained at 8 lb/in<sup>2</sup>. At the end of these tests, unblank the static vent of the pressure controller.
- (4) With the hood closed and cabin pressure 'ON', build up the hood seal pressure to 8 lb/in<sup>2</sup>. Disconnect the foot pump and check that the seal pressure does not fall below 6½ lb/in<sup>2</sup> over a period of 5 minutes. At the end of all tests, disconnect the ground equipment.

24. The piping system should be pressure tested as follows:—

- (1) Connect a high-pressure air supply, control valve and pressure gauge at the main engine air supply connection.

- (2) Disconnect the four-way air supply pipe at the rear of the cabin, blank off the outlet of the non-return valve and fit a pressure gauge (0-50 lb/in<sup>2</sup>) at this point.
- (3) Disconnect the  $\frac{1}{4}$  in. dia. control lines on the pre-cooler by-pass valve and blank connections on valve.
- (4) Blank drain connection on water extractor.

Proceed with the test as follows:—

- (a) With the air supply valve closed, i.e., Cabin Pressure Control Switch at OFF, and with the hood open, increase pressure at the main air supply connection gradually up to the maximum obtainable (120 lb/in<sup>2</sup>, if possible).
- (b) Check that no leakage occurs from ducts, joints and all components up to the air supply valve. (A small leakage flow through the air supply valve may occur.)
- (c) Remove blanks from control line connections on by-pass valve and reconnect all pipes.
- (d) Turn off the air supply, close the hood and open the air supply valve by selecting cabin pressure ON. Increase the pressure gradually to 20 lb/in<sup>2</sup> and check that the remainder of the system is free from leakage. (A certain amount of flow from the vents of the cold air unit cannot be avoided.)
- (e) On completion of these tests, turn off the air supply, remove all test equipment and restore the system to normal by removing blanks and remaking connections.

#### ASSEMBLY OF COMPONENTS

##### Air supply valve and temperature control valve

25. The following should be observed when it becomes necessary to change either the actuator or the valve in any of the above assemblies:—

- (1) When fitting the actuator to the valve, care should be taken to see that the actuator driving pin engages correctly with the valve spindle. The two components should slide together freely without force being applied to the driving spindle, due to malalignment. Malalignment may cause damage to the actuator and increase the valve gland leakage. After fitting the quadrant lever of the temperature control valve the gears must be checked for freedom of movement, there must be no sign of binding or over-meshing of the gears.
- (2) With the valves closed, apply an air pressure of about 75 lb/in<sup>2</sup> to the end inlet connection of the temperature control valve and about 135 lb/in<sup>2</sup> to the inlet connection of the air supply valve. This should be carried out before and after assembly to the actuators to check that gland leakage has not increased.
- (3) With a suitable Breeze plug and switch, connect the actuator to a 24 volt supply. With pressure applied, open and close the valve over its full range by means of the actuator.

##### Cabin air extraction valve

26. When fitting a new cabin air extraction valve, the mounting flange may be filed locally, if necessary, to enable it to clear the bend in the frame diaphragm.

##### Windscreen and hood spray drains

27. The spray drains are permanently attached to the spray pipes with Hermetal Double Bond Cream (D.T.D. 900/4572) be-

tween the spray drain and the spray pipe. The spray drain tubing must pass over the drain pipe at least 0.50 in. To facilitate assembly of the tubing, the ends may be immersed in hot water. The tubes attached to the drain bottle on frame 8 must run one on each side of the oxygen pipe adjacent to the bottle, and the oxygen pipe union must be wrapped with  $1\frac{1}{2}$  in. dia. P.V.C. tubing tied in position with cord.

##### Pipe clamps—Intercooler and cold air units

28. The sealing ring is to be cemented to the pipe core and allowed to dry prior to assembly of the clamp (Part No. A.190174).

##### Hood spray pipes

29. Care should be taken at all times when entering the cabin to avoid damage to the hood spray pipes (*usually caused by stepping on the hood rails*). Any displacement of the starboard hood spray pipe may cause fouling of the seat raising handle of Mk. 2H ejection seats on removal of the seat. When such fouling does occur, the following points should be checked before replacement of the seat:—

- (a) Ensure that none of the hood spray pipes securing screws are missing and that all are tight.
- (b) The inboard face of the starboard hood spray pipe should be a minimum of 24 $\frac{1}{8}$  in. from the centre line of the port hood rail, as measured from a point approximately 5 in. aft of the forward end and at right angles to the hood rail. This clearance may be obtained by local dressing (*with hammer*) of the spray pipe, as necessary.

##### Lubrication

30. All threaded fittings are to be lubricated with ZX-28.

KEY TO FIG. 7, 8, 9 & 10

(Air Conditioning System Installation and Diagram)

1 RAM AIR VALVE  
Controls entry of fresh air into cabin through ram air duct in conjunction with AIR EXTRACTOR VALVE (3)

2 EXTRACTOR SOLENOID VALVE  
Controlled by CABIN PRESSURE CONTROL SWITCH (22) and operates AIR EXTRACTOR VALVE (3)

3 AIR EXTRACTOR VALVE  
Controlled by CABIN PRESSURE CONTROL SWITCH (22) and EXTRACTOR SOLENOID VALVE (2). Extracts air from cabin and assists entry of fresh air through ram air duct in nose of aircraft

4 PRESSURE REDUCING VALVE  
Maintains cabin hood seal pressure at 8 lb. per sq. in. above that of cabin pressure

5 NON-RETURN VALVE  
Prevents back flow

6 HOOD SEAL SOLENOID VALVE  
Admits air to hood seal when hood is closed and maintains seal inflated in event of electrical failure. Mechanical override deflates seal if jettison lever is pulled or 'HOOD FREE' is selected on HOOD CONTROL SWITCH. Is not affected by movement of CABIN PRESSURE CONTROL SWITCH (22)

7 FOLLOW-UP RESISTOR  
Controls TEMPERATURE CONTROL VALVE (8) in conjunction with DUCTSTAT (35)

8 TEMPERATURE CONTROL VALVE  
Controlled by CABIN PRESSURE CONTROL SWITCH (22), CABIN TEMPERATURE CONTROL SWITCH (29), CABIN ELEMENT (30), DUCTSTAT (35), TEMPERATURE SELECTOR (27), AMPLIFIER (23) and FOLLOW-UP RESISTOR (7). Also controlled by hood movement. Operated by slow-acting rotary electric actuator. Closes automatically when hood is opened or CABIN PRESSURE CONTROL SWITCH (22) is moved to the OFF position

9 PRE-COOLER  
Reduces the temperature of the air from the engine compressor to a permissible value for cabin pressurization purposes

10 PRE-COOLER BY-PASS VALVE  
Opens pre-cooler delivery duct and closes by-pass, when difference between the hot and cold air supply pressures rises above a pre-determined value

11 VARIABLE ORIFICE VALVE  
Safeguards COLD AIR UNIT (12) against overspeeding and controls a flow of air to the cabin

12 COLD AIR UNIT  
Consists of a free-running centrifugal compressor and turbine on a common shaft. Air is compressed, cooled through INTER-COOLER (14) and expanded through the turbine to a low temperature

13 AIR SUPPLY VALVE  
Controlled by CABIN PRESSURE CONTROL SWITCH (22), ALTITUDE SWITCH (21), FLOOD CONTROL SWITCH (36) and limit switch on hood. The valve has three positions, 'closed', 'open' and 'flood', and is operated by an electric rotary actuator. The valve opens automatically when the hood is closed, if CABIN PRESSURE CONTROL SWITCH (22) is in the ON position and FLOOD CONTROL SWITCH (36) is in the AUTO position. ALTITUDE SWITCH (21) moves the valve to the 'flood' position at cabin altitudes above 38,000 ft. For demisting purposes, the FLOOD CONTROL SWITCH (36) is moved to 'MANUAL', when 'flood' is again obtained. With the valve in the 'flood' position, the VARIABLE ORIFICE VALVE (11), COLD AIR UNIT (12) and INTER-COOLER (14) are by-passed, but piping to them is not closed

14 INTER-COOLER  
Reduces temperature of air delivered from compressor section of COLD AIR UNIT (12) prior to expansion through turbine section of unit

15 MIXING CHAMBER  
Where hot and cold air are mixed before being passed through WATER SEPARATOR (17)

16 AUXILIARY DISCHARGE VALVE SOLENOID  
Operates AUXILIARY CABIN AIR DISCHARGE VALVE (18) to obtain additional discharge in conjunction with CABIN AIR DISCHARGE VALVE (28) when 'flood' is operated for demisting purposes

17 WATER SEPARATOR  
Removes water from pressure air to cabin and drains it via a pipe to atmosphere

18 AUXILIARY CABIN AIR DISCHARGE VALVE  
Operated by AUXILIARY DISCHARGE VALVE SOLENOID (16). Discharges air from cabin in conjunction with CABIN AIR DISCHARGE VALVE (28)

19 NON-RETURN VALVE  
Prevents back flow

20 HOOD SEAL  
A pneumatic rubber seal around the perimeter of the cabin hood joint. Seal is maintained at a pressure of 8 lb. per sq. in. above cabin datum pressure when hood is closed. Is deflated prior to hood opening or jettisoning

21 ALTITUDE SWITCH (FLOOD CONTROL)  
Moves AIR SUPPLY VALVE (13) to 'flood' position if cabin altitude exceeds 38,000 ft., with FLOOD CONTROL SWITCH (36) in AUTO

22 CABIN PRESSURE CONTROL SWITCH  
Controls AIR SUPPLY VALVE (13), TEMPERATURE CONTROL VALVE (8) and EXTRACTOR SOLENOID VALVE (2). Must be left in the ON position, except in emergency. In the OFF position, it closes the AIR SUPPLY VALVE (13) and TEMPERATURE CONTROL VALVE (8), opens AIR EXTRACTOR VALVE (3), but does not deflate the hood seal

23 AMPLIFIER  
Controls TEMPERATURE CONTROL VALVE (8)

24 PLUG AND SOCKET (HOOD CONTROL)  
Separate couplings are provided in the cabin for internal and external operation of hood circuit. Normally plugged in appropriate socket for internal control, but plugged into other socket for external control, as required, during servicing and ground pressure testing of cabin. Must be placed in socket for internal control before flight

25 SWITCH (HOOD CONTROL)  
For external operation of hood when servicing and ground pressure testing of cabin. Mounted on forward face of frame 3 and accessible only after removal of nose piece from the remaining structure of the aircraft. Appropriate connection on PLUG AND SOCKET (24) must be made before switch can be used

26 GROUND PRESSURIZATION CONNECTION  
Located on forward face of frame 3, adjacent to SWITCH (25). Used for connection to an external air pressure supply when ground pressure testing the cabin

27 TEMPERATURE SELECTOR  
Controls TEMPERATURE CONTROL VALVE (8)

28 CABIN AIR DISCHARGE VALVE  
Incorporates relief valve and shroud connecting discharge of air to radar cooling ducts. Relief valves in shroud limit back-pressure on unit to  $\frac{1}{2}$  lb. per sq. in. max.

29 CABIN TEMPERATURE CONTROL SWITCH  
Controls TEMPERATURE CONTROL VALVE (8). Switch normally in AUTO position, when temperature is then controlled by (30), (35), (27), (23) and (7). In emergency position, the switch operates TEMPERATURE CONTROL VALVE (8) direct, opening the valve when switch is in HOTTER position and closing it when in COLDER position. TEMPERATURE CONTROL VALVE (8) remains stationary when switch lever is in the emergency gate

30 CABIN ELEMENT  
Controls TEMPERATURE CONTROL VALVE (8)

31 PRESSURE CONTROLLER  
Commences pressurization at 10,000 ft. Full differential of  $\frac{3}{4}$  lb. per sq. in. is built up at 25,000 ft. and above. In the event of excessive pressure drop, a warning lamp in the cabin is automatically switched on

32 HOOD SEAL INFLATION CONNECTION (EXTERNAL SUPPLY)  
Used for ground pressure testing

33 STATIC CONNECTION  
Static line from PRESSURE CONTROLLER (31)

34 PRESSURE GAUGE CONNECTION (EXTERNAL)  
Used for ground pressure testing

35 DUCTSTAT  
Controls TEMPERATURE CONTROL VALVE (8)

36 FLOOD CONTROL SWITCH  
Switched to MANUAL, enables 'flood' air to be obtained for demisting purposes

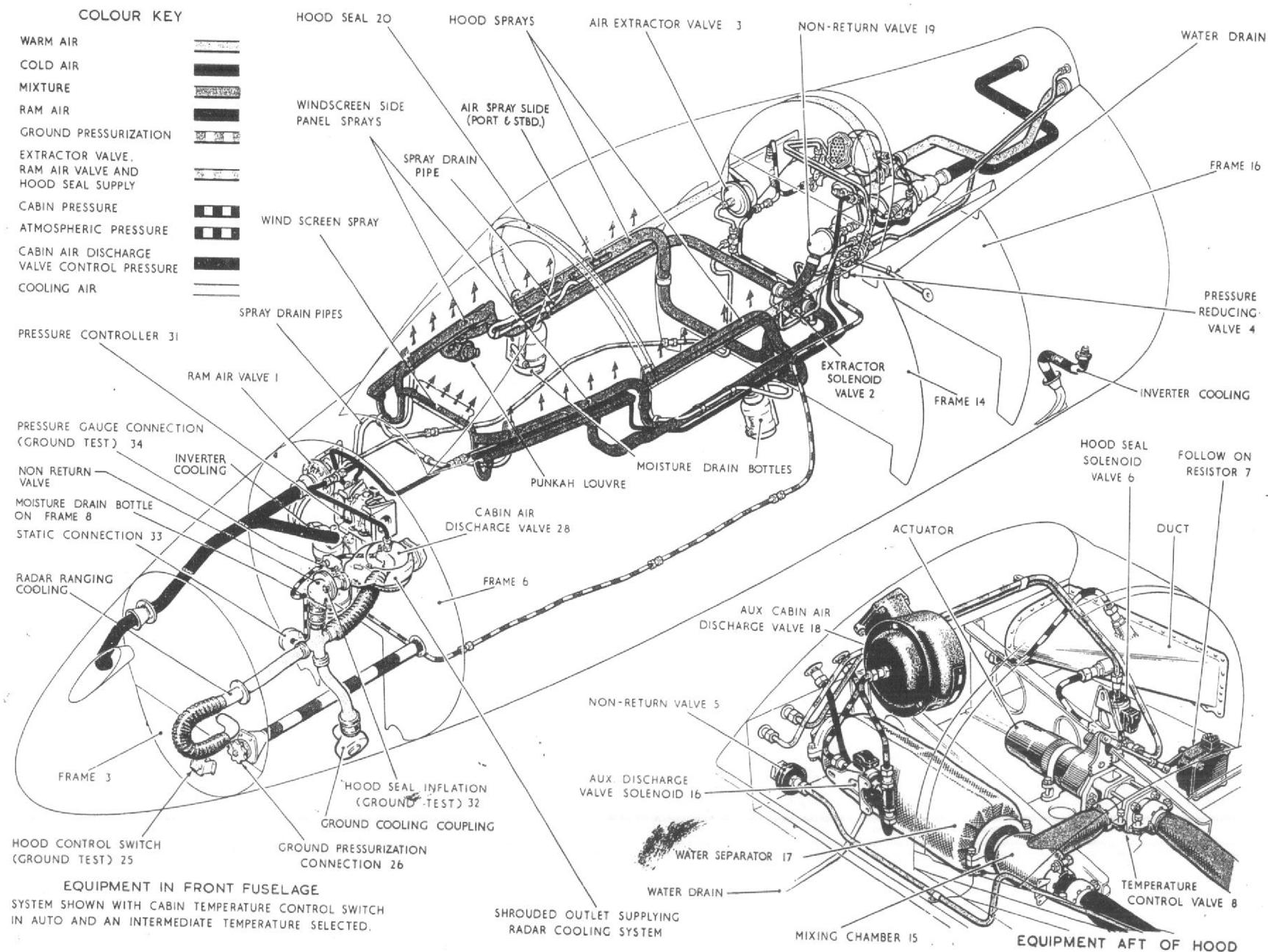


Fig 7. Air Conditioning System Installation (1)

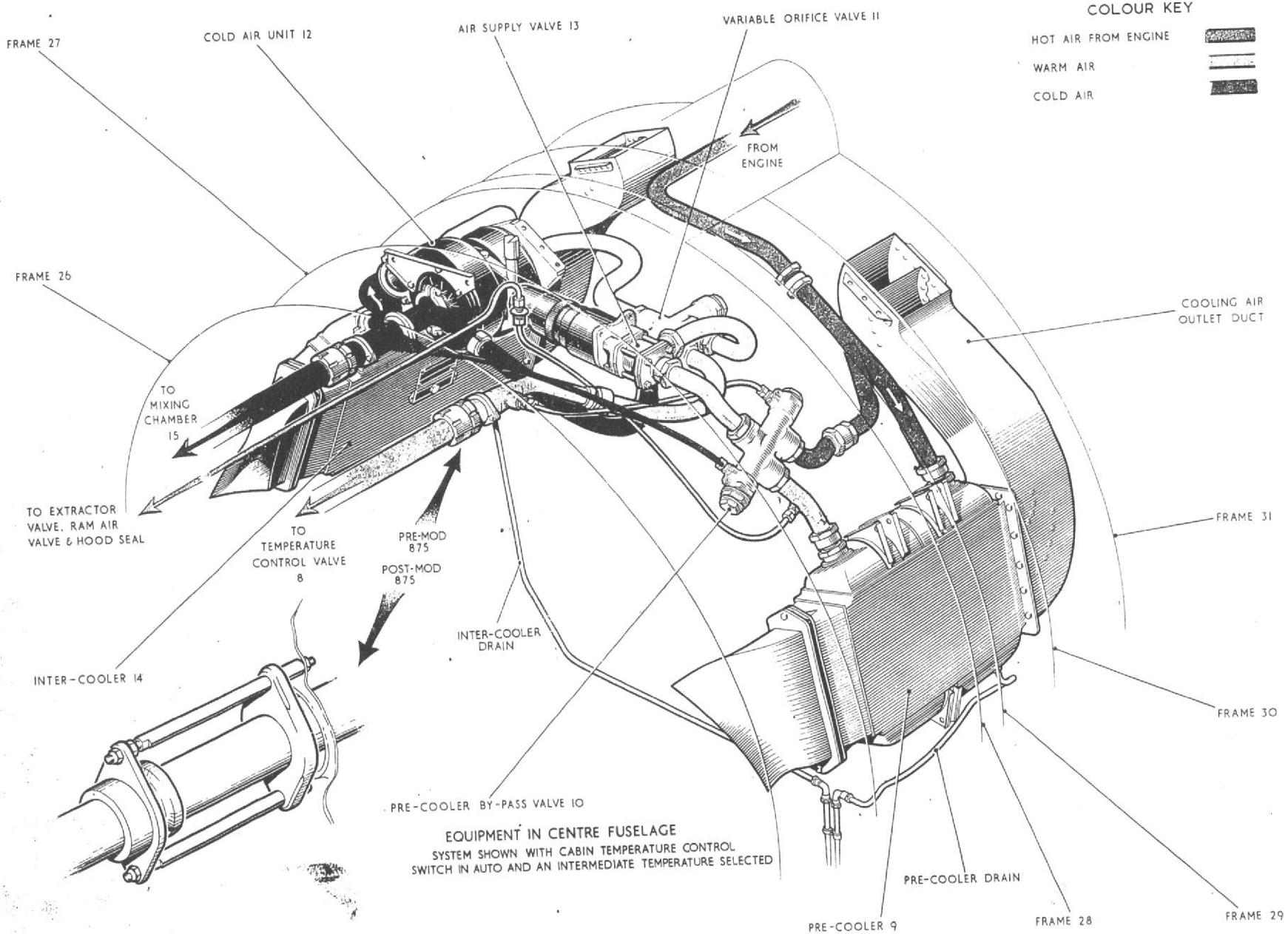


Fig 8 Air Conditioning System Installation (2)

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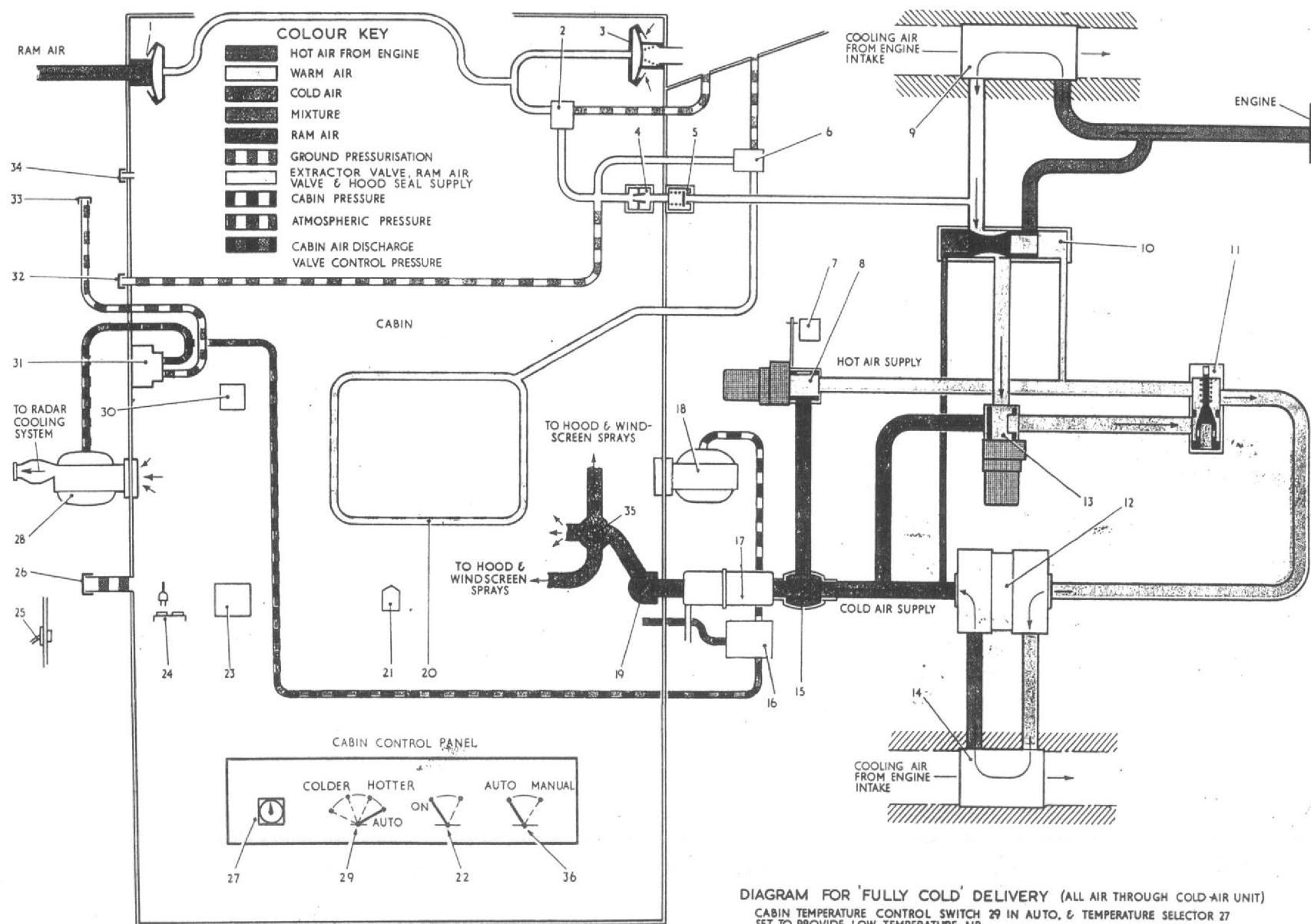


Fig. 9. Air conditioning system diagram (I)

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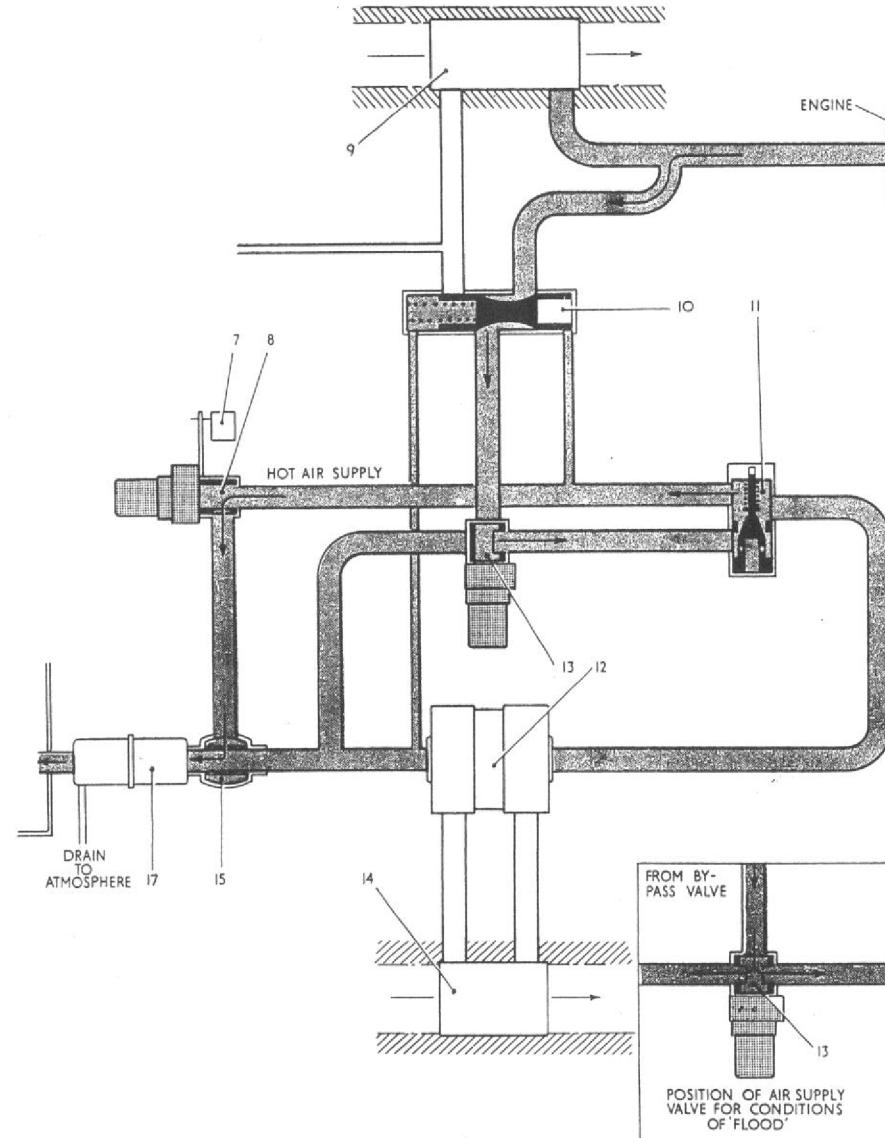
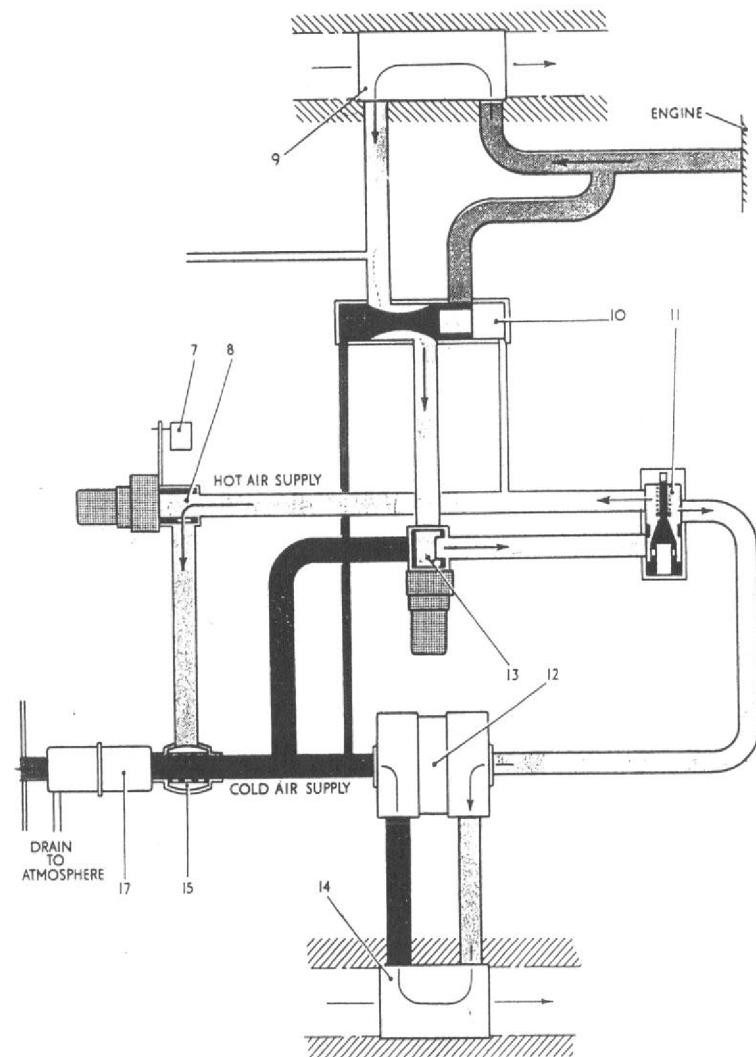


Fig. 10. Air conditioning system diagram (2)

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◀ Removal and assembly of air conditioning pipes—  
engine to pre-cooler and by-pass valve

31. The procedure for removing the pipes detailed in para. 18A is as follows:—

- (1) Render the aircraft electrically safe (Sect. 5, Chap. 1).
- (2) Remove the engine in accordance with Sect. 4, Chap. 1.

**Note . . .**

*Blank off all pipes and valves, etc., as the pipes are disconnected.*

- (3) Gaining access through the panel above the pre-cooler by-pass valve, and referring to fig. 8, remove the locking wires and disconnect the couplings to

enable the yellow pipe between the air supply valve and the by-pass valve, and the red pipe from the by-pass valve to be removed.

- (4) Working aft of frame 29, remove the four bolts securing the sealing plates adjacent to the pre-cooler to the frame and remove the plates.
- (5) Referring to fig. 8, remove the locking wire from the coupling joining the red pipe to the pre-cooler and disconnect the coupling.
- (6) In a similar manner disconnect the coupling forward of frame 30 and the coupling aft of frame 31 and remove

the pipes (shown red on fig. 8).

- (7) Disconnect the coupling (aft of frame 31) to the metallic hose assembly.
- (8) Disconnect the four clips supporting the pipe between frames 31 to 36 and remove the clips and pipe.

The assembly of the pipes is, in general, a reversal of the removal procedure, but when fitting the replacement pipe, between frames 31-36, ensure that the pipe in the way of the brackets is wrapped with varnished, cambric insulating tape, reference 5F/9401212. After assembly carry out a pressure test in accordance with para. 24. (The part numbers of replacement pipes are given in Vol. 3). ►

**TABLE I**  
**Component and Air Publication reference**

Component	Manufacturer	Part No. or Ref.	Air Publication
Cabin pressure controller	Normalair	509930 embodying Mod. N.146	A.P.1275A, Vol. 1, Sect. 20
Cold air unit	Sir George Godfrey (Mk. 6W)	23407	A.P.4340, Vol. 1, Book 1, Sect. 2, Chap. 4
Combined valve unit	Normalair	510250	A.P.1275A, Vol. 1, Sect. 20, Chap. 7
“ “ “	“	509920	
Inter-cooler	Marston D.1137/2A Modified	26FX/10056	
Pre-cooler	Marston D.1137/1A Modified	26FX/10055	
Valve, non-return	Hymatic NR.9, Mk. 6	D.9205	A.P.4303C, Vol. 1, Sect. 4, Chap. 18
Valve, reducing	Hymatic P.S.29/4	D.9206	A.P.4303C, Vol. 1, Sect. 4, Chap. 15

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