Chapter 8 AIR CONDITIONING SYSTEM

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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 windscreen panel, quarter-lights the sides of the hood and at the pilot's feet.

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

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 3½ lb/in² 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/in² 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.)*

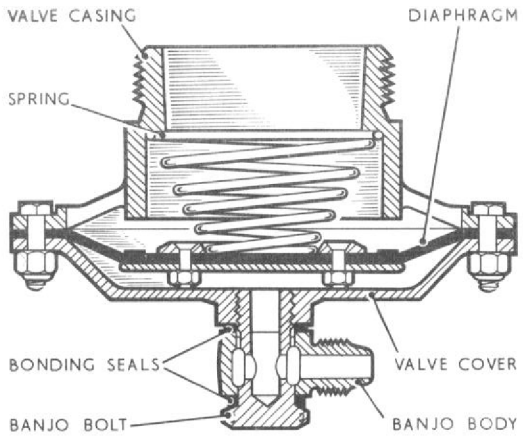


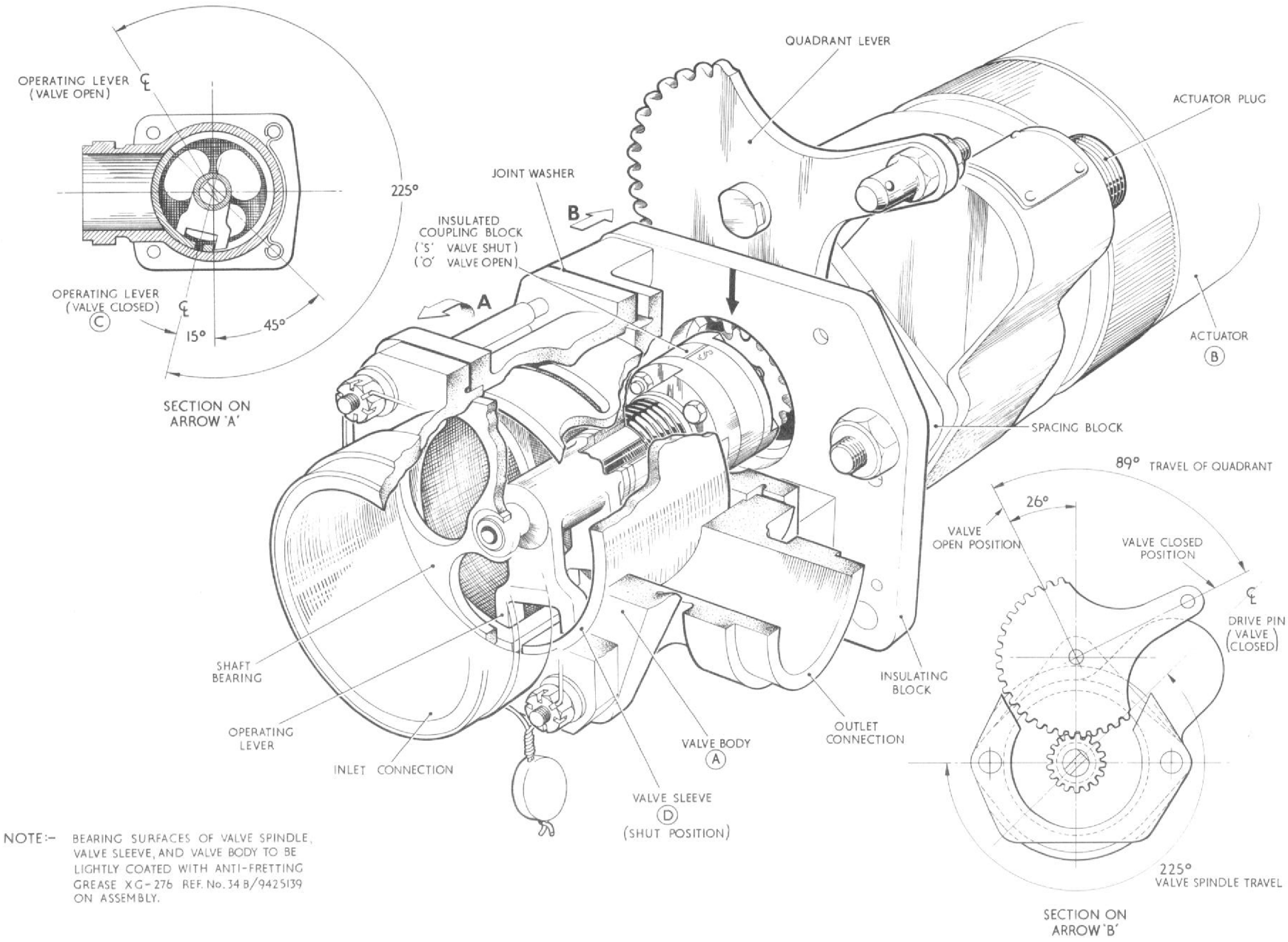
Fig. 1 Air extraction valve

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, hrough linkage, a follow-up resistor. The resistor is a component of the temperature controller *(para. 13)*.



NOTE:– BEARING SURFACES OF VALVE SPINDLE, VALVE SLEEVE, AND VALVE BODY TO BE LIGHTLY COATED WITH ANTI-FRETTING GREASE XG-276 REF. No. 34B/9425139 ON ASSEMBLY.

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Fig.2 Temperature control valve

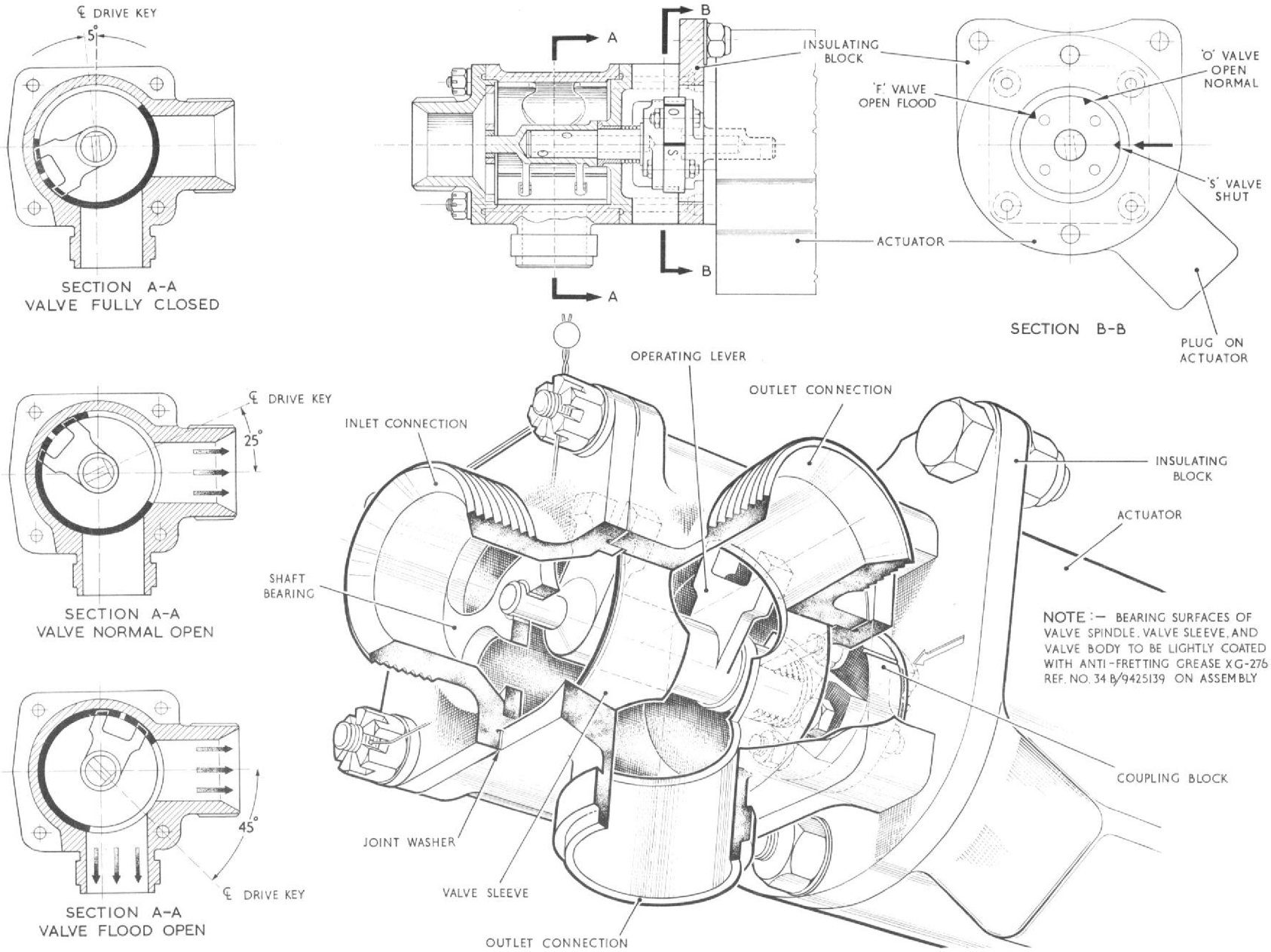

Fig. 3 Air supply valve

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 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.

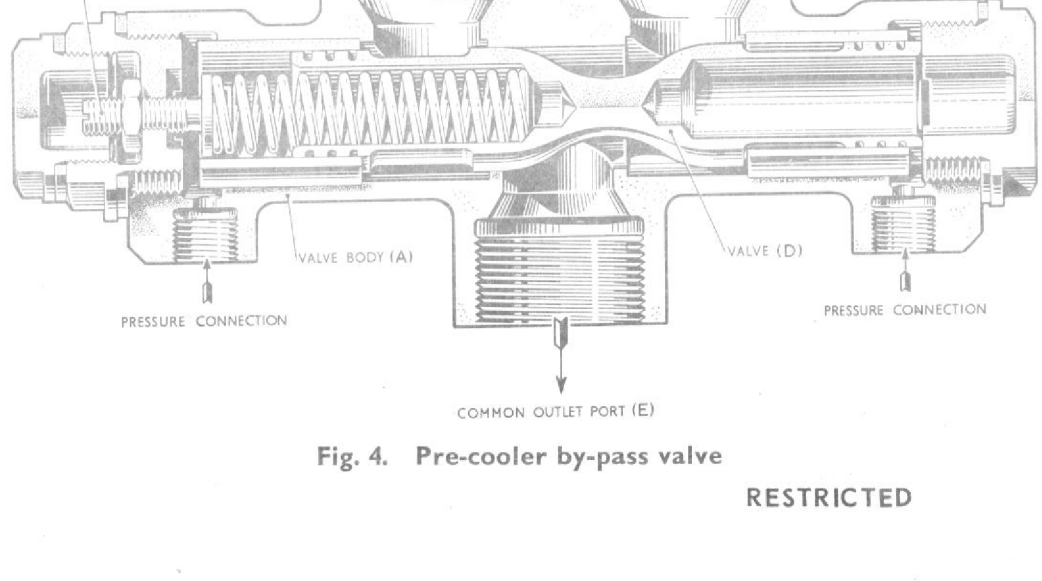

Fig. 4. Pre-cooler by-pass valve

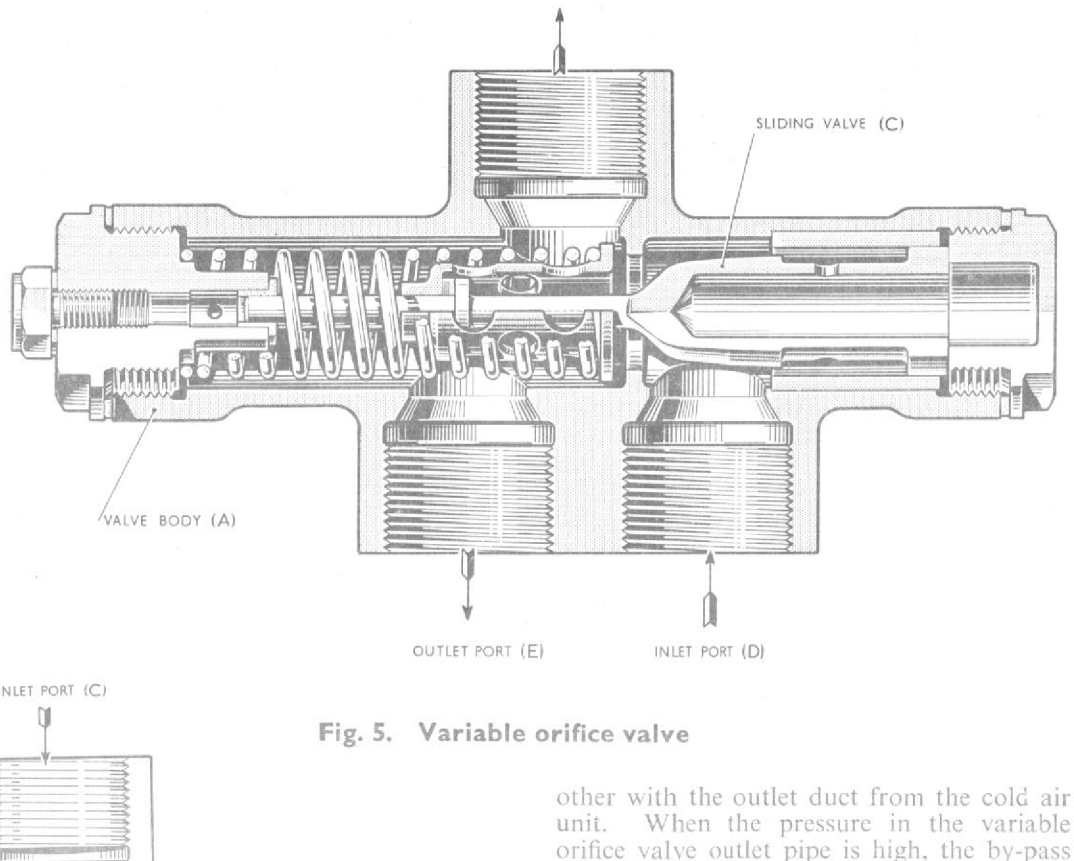

Fig. 5. Variable orifice valve

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.^{2} 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 B.201552 C.201553/12	Pipe, coupling to coupling Pipe, pre-cooler to connection Pipe, coupling to engine	Shown in red, on fig. 8

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
B.233539/5 B.233539/6 B.233539/12 A.241951	Camera heating system pipes	

The procedure for the removal of these pipes is described in para. 31 and 32.

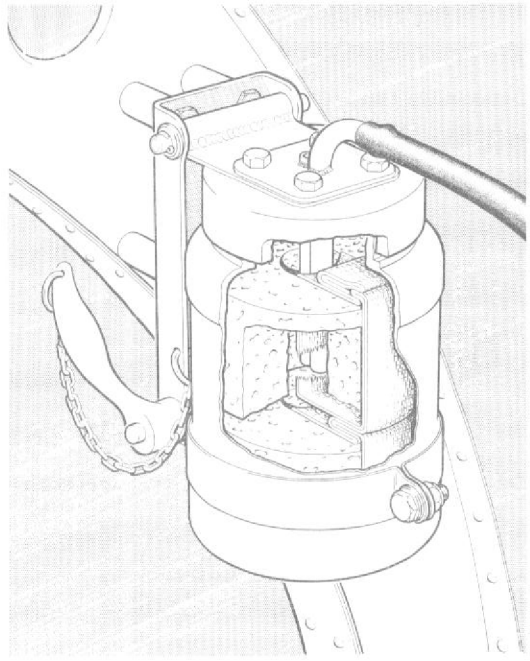

Fig. 6 Hood and Windscreen spray drain collector bottle

Hood and windscreen spray drain collector bottles (fig. 6)

19. The polythene bottles, into which water drains from the windscreen and hood side galleries (*para. 2*) should be removed and the sponge elements in the bottles squeezed dry at the periodicities specified in the relevant Servicing Schedules. The procedure is as follows : —

(1) Remove the pip pins and unscrew the bottles complete with securing straps from their respective caps.

(2) By means of the tapes, remove the sponge elements and squeeze dry. Empty any water that may have remained in the bottles.

(3) Replace the sponge elements and screw the bottles back into their respective caps, ensure that the bottles are screwed fully home in the caps so that the securing strap aligns with the mounting bracket and fit pip pins to secure the bottles.

(4) Ensure that the vent holes in the caps are clear.

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 $\frac{3}{8}$ of an inch from the joint in all directions

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/in². 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 $3\frac{1}{2}$ lb/in² in the cabin. The trolley blow-off setting should not exceed about 5 lb/in². 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 $3\frac{1}{2}$ to $1\frac{3}{4}$ lb/in² in not less than 30 seconds after disconnecting the external supply, with the hood seal pressure maintained at 8 lb/in². 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/in². Disconnect the foot pump and check that the seal pressure does not fall below $6\frac{1}{2}$ lb/in² 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.

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(2) Disconnect the five-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/in²) 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 (120lb /in², 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/in² 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.

(2) With the valves closed, apply an air pressure of about 75 lb/in² to the end inlet connection of the temperature control valve and about 135 lb/in² 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. When fitting the spray drains they are to be clamped to the spray pipes using Hermetal Double Bond Cream (D.T.D. 900/4572) between the spray drain and the spray pipe. The spray drain tubing must be inserted over the drain pipe at least 0·50 in. To facilitate assembly of the tubing the ends may be immersed in hot water.

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 $24\frac{7}{8}$ 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 ½ 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 3½ 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

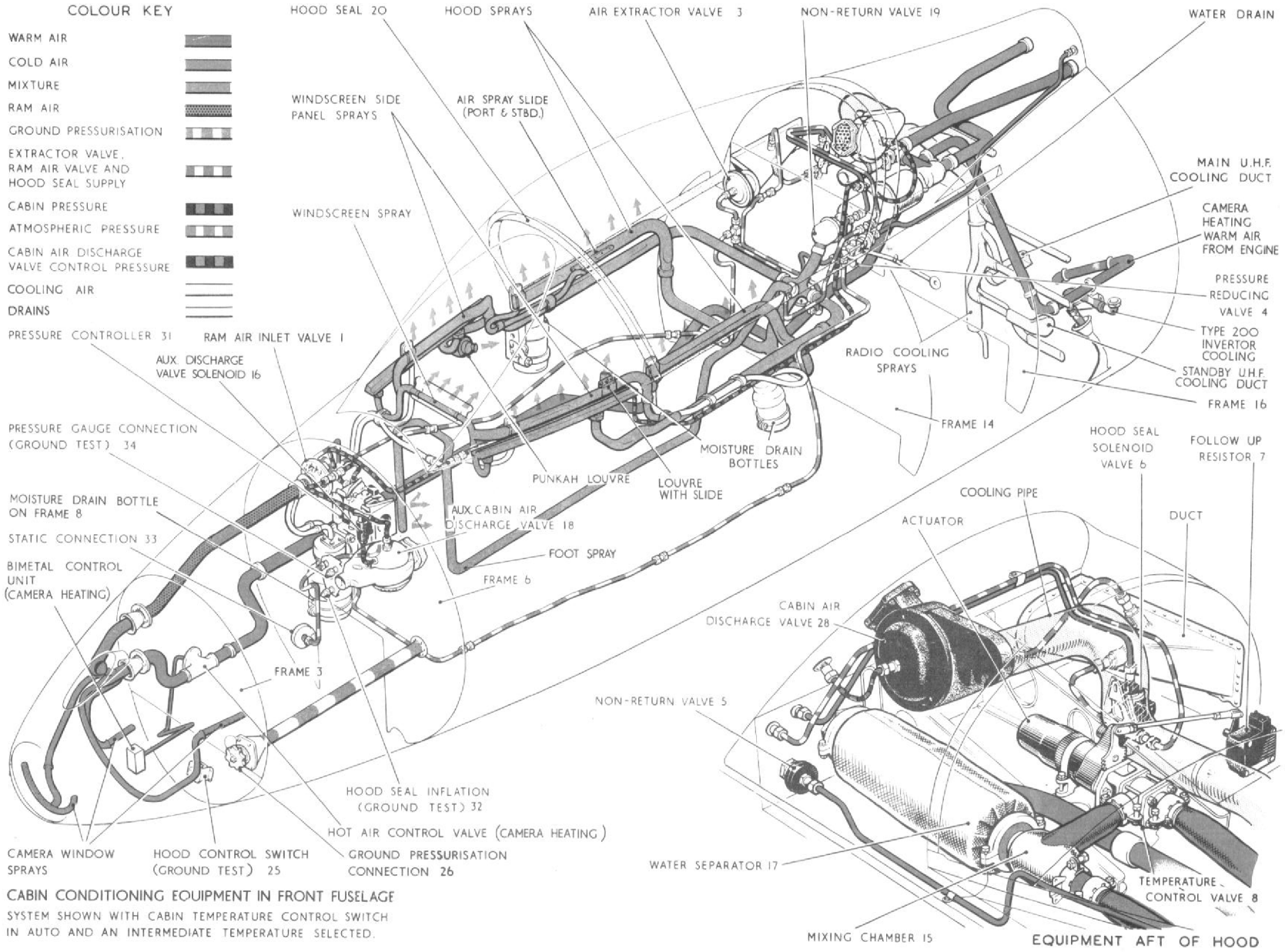
32 HOOD SEAL INFLATION CONNECTION (EXTERNAL SUPPLY)
Used for ground pressure testing

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

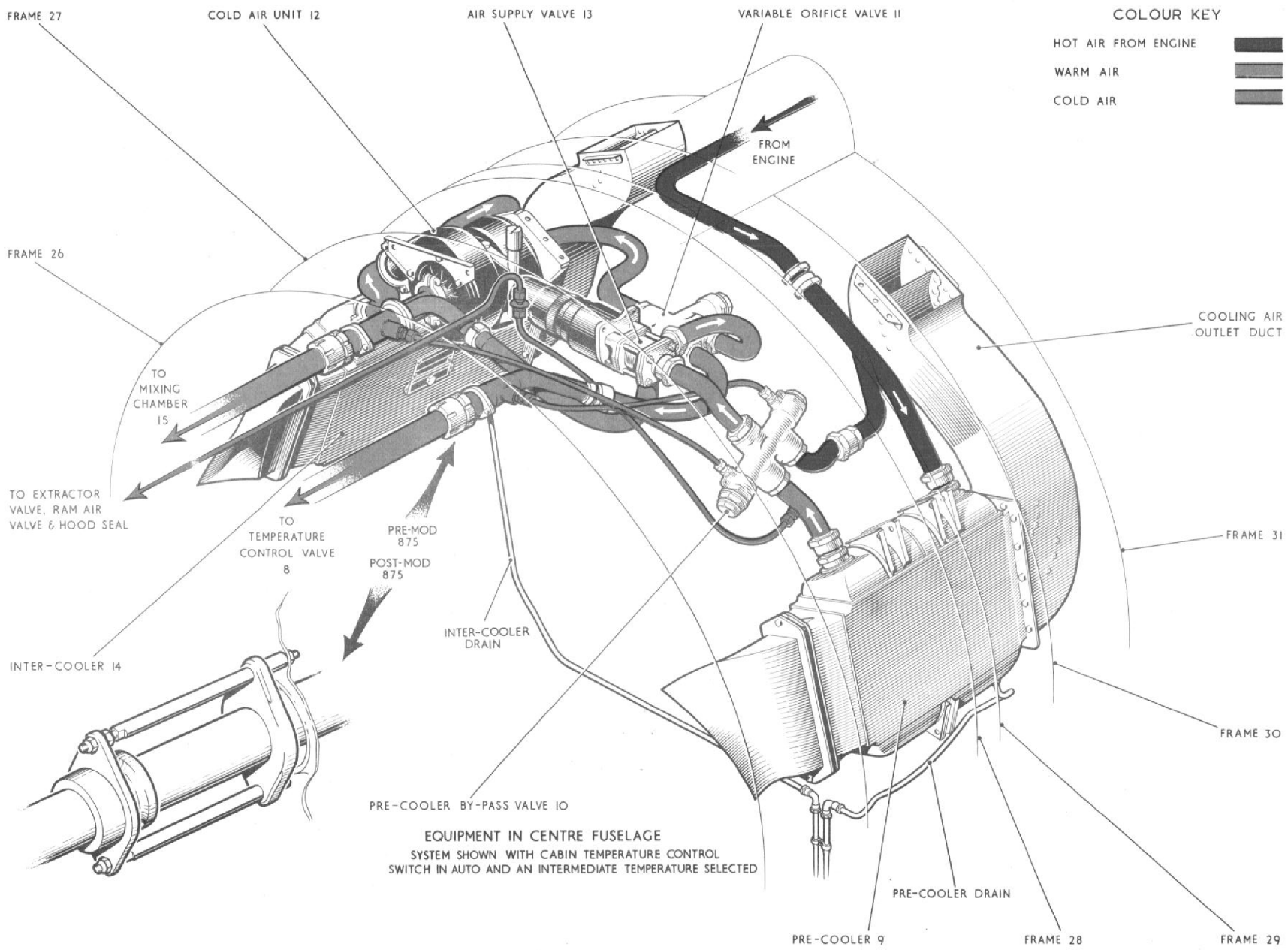


CABIN CONDITIONING EQUIPMENT IN FRONT FUSELAGE

SYSTEM SHOWN WITH CABIN TEMPERATURE CONTROL SWITCH IN AUTO AND AN INTERMEDIATE TEMPERATURE SELECTED.

Fig. 7 Air Conditioning System Installation (1)

T.P.15333



EQUIPMENT IN CENTRE FUSELAGE

SYSTEM SHOWN WITH CABIN TEMPERATURE CONTROL SWITCH IN AUTO AND AN INTERMEDIATE TEMPERATURE SELECTED

Fig. 8 Air conditioning system installation (2)

T.P.14477

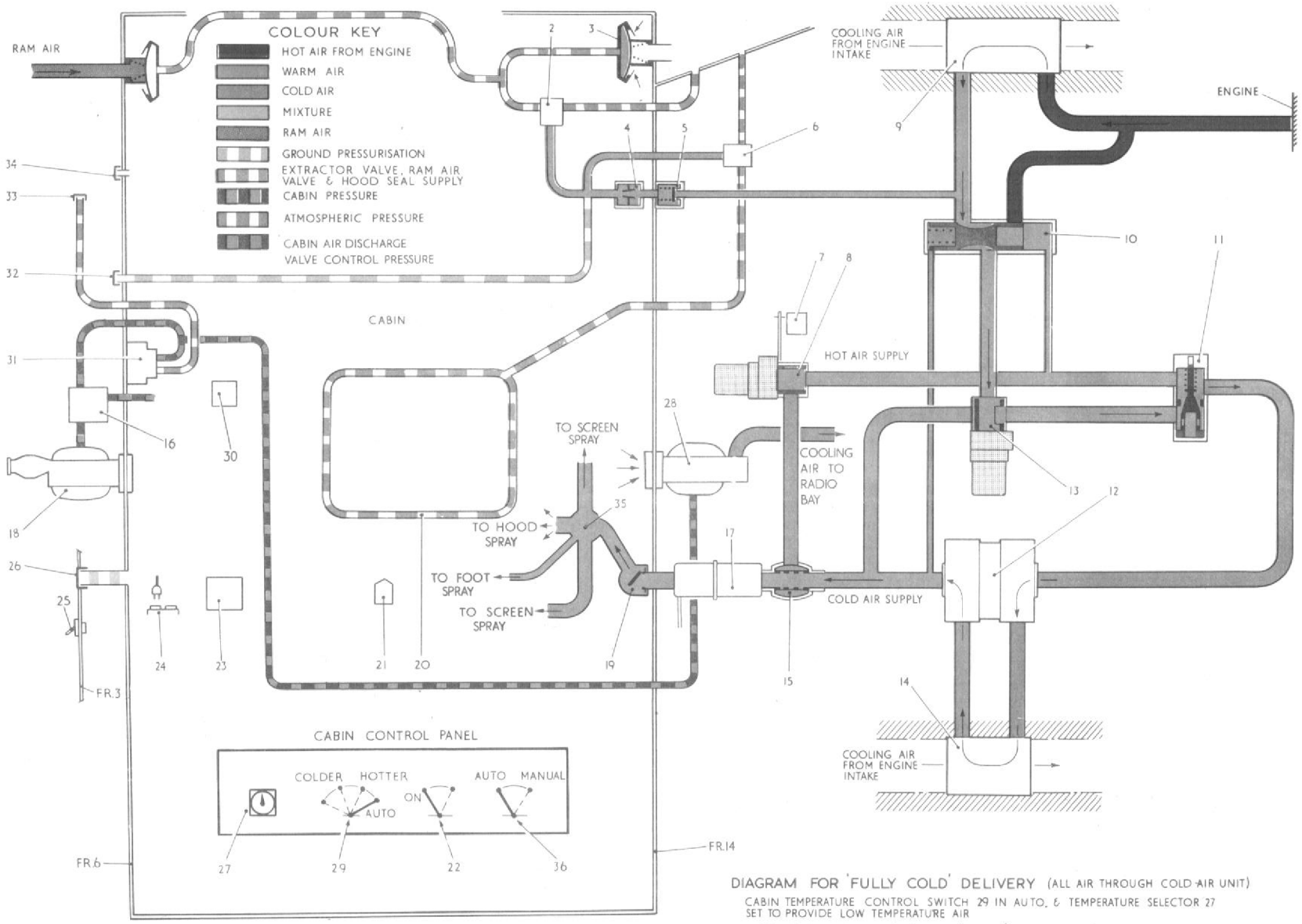


DIAGRAM FOR 'FULLY COLD' DELIVERY (ALL AIR THROUGH COLD AIR UNIT)
CABIN TEMPERATURE CONTROL SWITCH 29 IN AUTO. & TEMPERATURE SELECTOR 27 SET TO PROVIDE LOW TEMPERATURE AIR
ALTERNATIVELY FOR MANUAL SETTING 'COLDER' ON SWITCH 29

Fig. 9 Air conditioning system diagram (2)

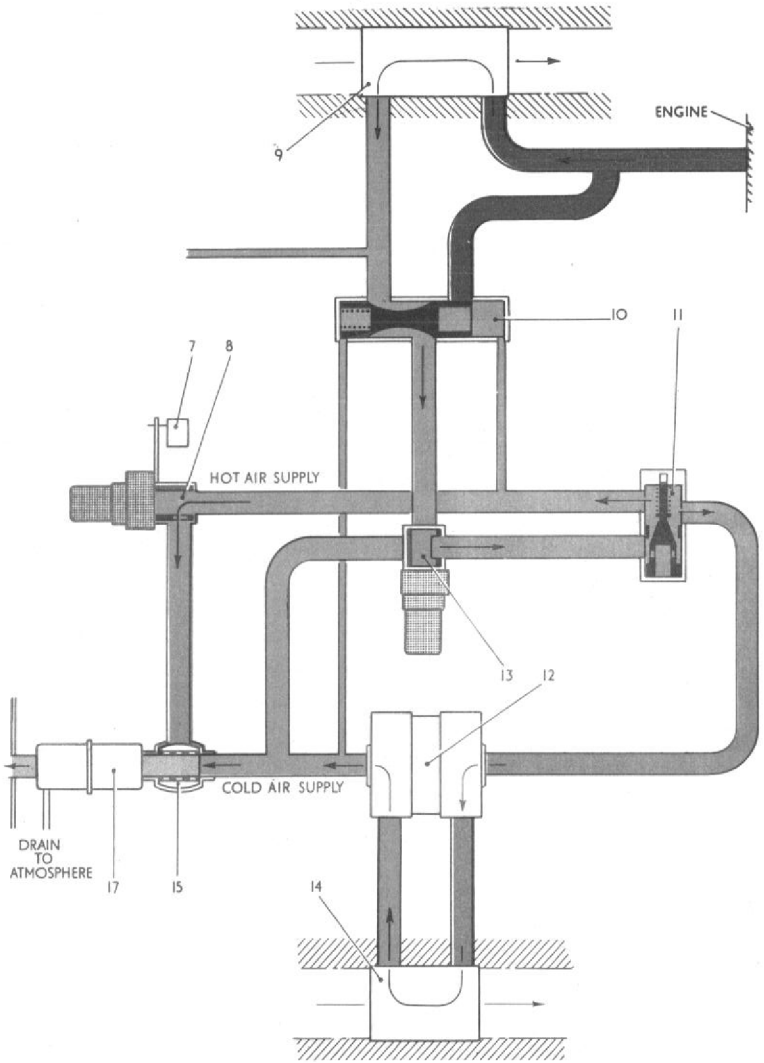


DIAGRAM FOR INTERMEDIATE TEMPERATURES (MIXTURE OF HOT & COLD AIR)

CABIN TEMPERATURE CONTROL SWITCH 29 IN AUTO. & TEMPERATURE SELECTOR 27 SET TO PROVIDE REQUIRED TEMPERATURE OF AIR

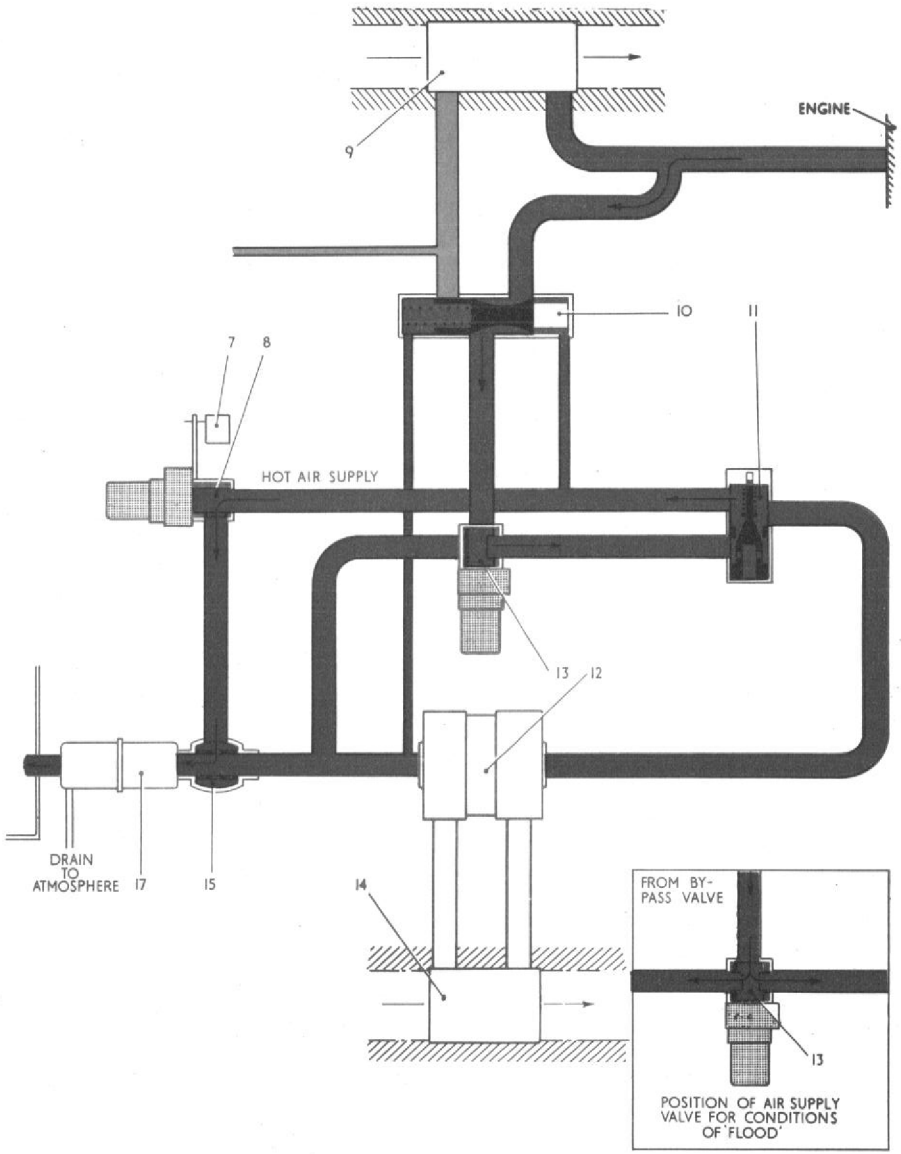


DIAGRAM FOR 'FULLY HOT' DELIVERY (COLD AIR UNIT BY-PASSED)

CABIN TEMPERATURE CONTROL SWITCH 29 IN AUTO. & TEMPERATURE SELECTOR 27 SET TO PROVIDE HIGH TEMPERATURE AIR

ALTERNATIVELY FOR MANUAL SETTING 'HOTTER' ON SWITCH 29

Fig. 10. Air conditioning system diagram (2)

RESTRICTED

T.P.14479

◀ **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*).

Removal and assembly of camera heating pipes (frames 3 to 6 and frames 11 to 14)

32. The procedure for removing and assembling the pipes is as follows :—
Pipes between frames 3 and 6.

Note . . .

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

(1) Render the aircraft electrically safe (*Sect. 5, Chap. 1*).

(2) Gaining access through the nose wheel bay, disconnect the bonding wires on the pipes.

(3) Disconnect the pipe from the hot air valve to the bi-metal control unit at the hot air valve (*Sect. 3, Chap. 1*).

(4) Remove the pipe clamps and sealing rings connecting the air pipes to the hot air valve and remove the valve.

(5) Disconnect the coupling aft of frame 3 and remove the pipe.

(6) Remove the pipe clip on frame 5. Remove the locking wire and disconnect the coupling forward of frame 6 and remove the pipe.

Pipes between frames 11 and 14.

(7) Remove the hood (*Sect. 3, Chap. 1*).

(8) Remove the pilot's seat (*A.P.4288*).

(9) Remove the gun pack (*Sect. 7, Chap. 2*).

(10) Disconnect and remove the radio compass R.F. amplifier (*Sect. 6, Chap. 1*).

(11) Remove the R.F. amplifier mounting plate.

(12) Disconnect the cable assembly from the five-way piece.

(13) Disconnect the clips and sleeves securing the pipes to the five-way piece and remove the five-way piece.

(14) Remove the bolts securing the camera heating pipe just below the non-return valve (*item 19, fig. 7*) to the forward face of frame 14. (*The bolts are accessible from the gun pack bay*).

(15) Disconnect the coupling adjacent to frame 14 and remove the pipe.

(16) Disconnect the bolts securing the flanged coupling to the cockpit floor on the starboard side.

(17) Remove the bracelet securing the flanged coupling to the pipe just above the cockpit floor and remove the flanged coupling.

(18) Remove the pipe from behind the flying control casing.

The fitting of the replacement pipes is, in general, a reversal of the removal procedure. After replacement, pressure test the camera heating pipes between the hot air valve and the engine, with an air pressure of 50 lb/in^2 connected at the engine end for 5 minutes, before refitting the cabin air conditioning five-way piece. After assembly of the five-way piece, carry out a pressure test in accordance with para. 24, then refit all equipment removed. (*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
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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