Chapter 13 AIR COOLING SYSTEM FOR ELECTRICAL AND RADAR EQUIPMENT

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LIST OF ILLUSTRATIONS

1. The main concentrations of radar and electrical equipment, for which cooling is required, are in the nose radome and the upper servicing bay. In order to maintain these installations within certain temperature limitations a system of cooling ducts is arranged for each compartment. In addition facilities are provided for cooling the aileron and rudder/elevator power unit motors.

2. During flight, cooling air is obtained from ram air intakes; for ground cooling of the equipment, special connections enable a ground servicing trolley to supply air to the systems in the nose and upper servicing bay. Non-return valves isolate the ram air intakes when the ground servicing trolley is being used. Butterfly valves are fitted in selected ducts in the upper servicing bay, so that the varying airflow requirements for each unit of equipment can be determined. When these requirements have been established the valves are locked in the optimum position and no adjustment is necessary.

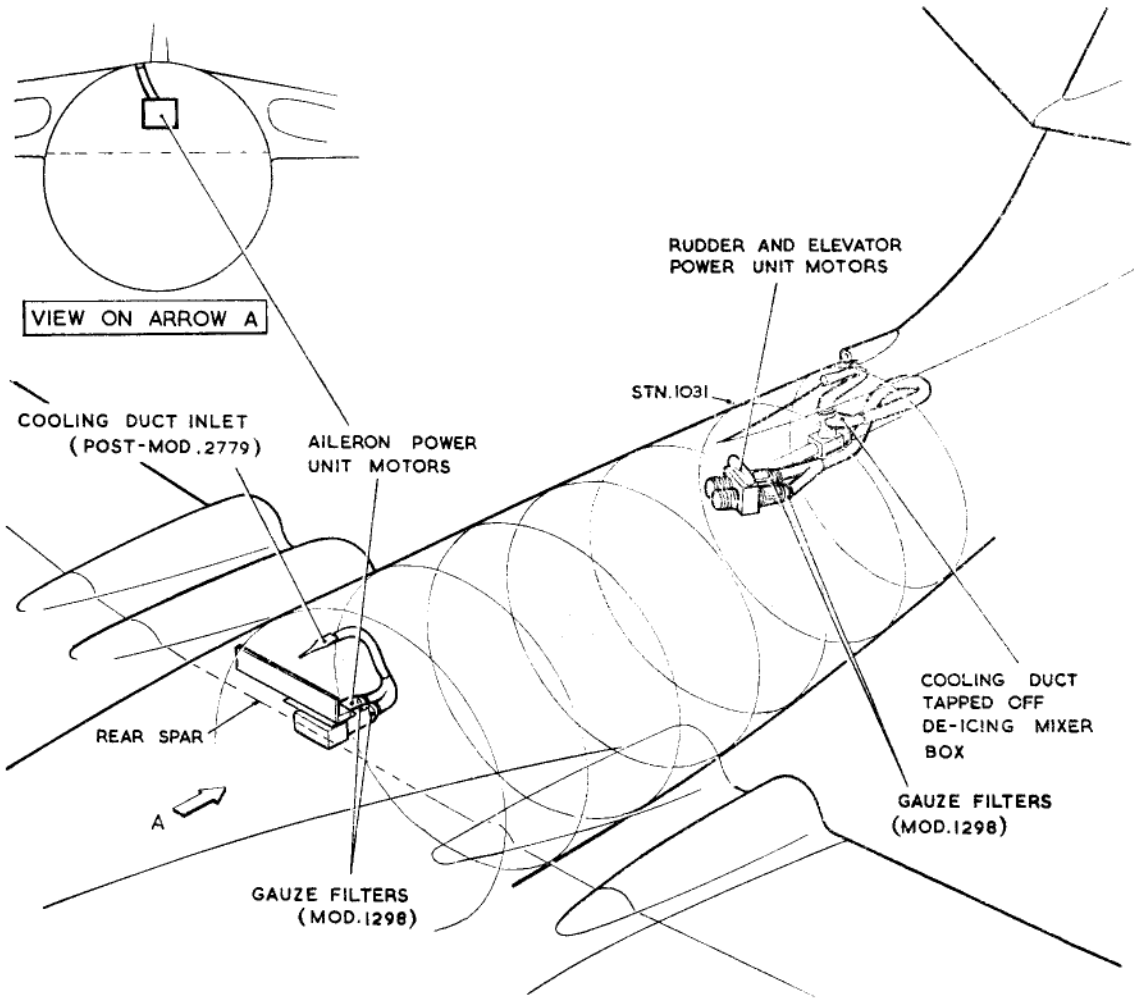

Fig. 1. Power unit motors cooling system

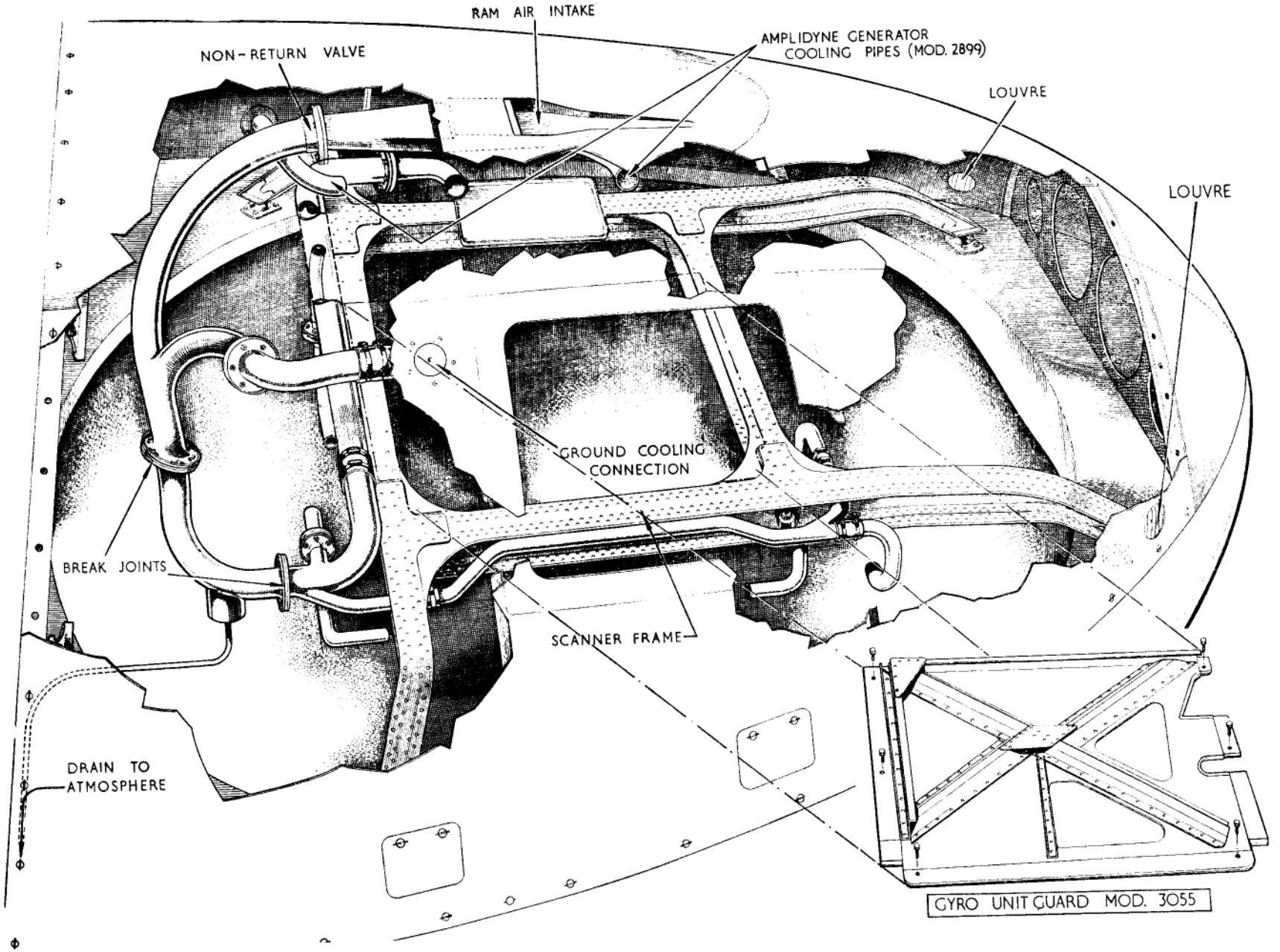

Fig. 2 Scanner cooling system

◀Gyro unit guard added▶

POWER UNIT MOTOR COOLING (*fig.* 1)

3. The cooling air supply to the elevator/rudder power unit motors is directed through a bifurcated duct leading from an intake in the base of the dorsal fin; the intake for the duct carrying the cooling air to the aileron power unit motors is situated in the fuselage port side, beneath the wing. Mod. 2779 entails repositioning the aileron power unit cooling air-intake to the upper starboard side of the centre fuselage, thus preventing the power unit motor from becoming fouled with " Window " chaff. Mod. 2948 introduces a bung for the repositioned intake to prevent the ingress of foreign matter when the aircraft is on the ground. Additional protection to the aileron, rudder and elevator power unit motors is given by gauze filters (Mod. 1298) fitted at each point where the cooling ducts connect with the motors.

SCANNER COOLING (*fig.* 2)

4. The scanner equipment is suspended from a special mounting frame and hangs into the bottom half of the nose radome. ◀To prevent accidental damage to the N.B.S. gyro unit, the central area between the frame members is covered, post-Mod. 3055, by a guard plate attached to the frame.▶ Around the frame is arranged a series of interconnected cooling ducts and blast pipes. The cooling air, derived from the ram air intake or the ground servicing trolley, exhausts to atmosphere through two louvres, one port and one starboard in the scanner bonnet. An additional independent system, introduced by Mod. 2899, cools the amplidyne generator through two ducts which connect the inlet and outlet orifices on the port side of the scanner bonnet.

Flush air intake

5. Ram air is obtained from the flush air intake during flight only. This intake is built into the scanner bonnet just above the radome entrance hatch on the starboard side.

Ground cooling connection

6. This fitting, which enables a ground servicing trolley to be coupled into the scanner cooling system, is located behind the rear upper corner of the radome entrance hatch and has a cast alloy body, fitting flush with the skin line from the inside and having an inlet and outlet connection. The inlet orifice is sealed by a spring-loaded plate valve which is, in effect, a non-return valve; the outlet connects via a short length of hose to the ducting.

7. The end fitting on the supply hose from the servicing trolley consists of a tubular member ridged externally at one end to take a hose connection, and with a thick rubber sealing collar and three spring claws at the other. This end is formed into a blunt nose with three radial ports (*A.P.* 2306R, *Vol.* 1 and 6, *Sect.* 1). The blunt nose of the hose end fitting depresses the plate valve, and the spring-loaded claws, after passing through the orifice, spring back so that the claw shoulders bear on the plate valve seating and hold the two components firmly together, the rubber collar effecting a seal; they can be disengaged by a sharp strong pull.

Non-return valve

8. This valve, which prevents loss of air through the open flush air-intake when using the ground servicing trolley, is fitted at the first flanged joint in the ducting leading from the flush air-intake. A circular flanged casting contains an annular seating and two flaps which are hinged about a central pin; a stop tube parallel to the hinge pin prevents the flaps from coming together in the centre. In the closed position the flaps are held on their seating by the airflow from the ground cooling connection. Conversely air from the ram air intake blows the flaps open as far as the stop tube permits, allowing air to pass into the ducting.

Ducting

9. Cooling air is distributed via light alloy ducting of varying diameters arranged round the scanner frame, and terminating in a series of nozzles which are directed onto or attached to the appropriate unit. Joints are either by flange or hose and clip. To facilitate bonnet removal, quick-release fasteners are provided at a convenient flange break joint between the scanner bonnet and the frame ducting. A water drain line is arranged to connect with a drain valve at a point on the fuselage nose joint on the lower starboard side.

Outlet louvres

10. Two outlet louvres vent the radome and are located near the bonnet forward end, just above the horizontal joint.

UPPER SERVICING BAY COOLING (*fig.* 3)

11. The main radar and electrical power supply units are housed in the upper servicing bay, and a system of ducts and blast pipes is arranged around this equipment. Cooling air can be derived from one of two sources; two ram air intakes in flight or a ground cooling connection when using a servicing trolley.

Ram air intakes

12. Cooling air is provided from these sources in flight only. One intake, in the starboard wing leading edge between the inboard engine air-intake and the fuselage, provides cooling air to the main radar and electrical power supply units with the exception of the Type 350 inverters. The other intake (Mod. 1292), positioned between Stn. 341 and 350 on the fuselage port side, ducts cooling air to the three inverters.

Ground cooling connection

13. This fitting, which enables a ground servicing trolley to be connected to the upper servicing bay ducting is installed above the rear access panel of the starboard servicing bay forward of Stn. 350; it is riveted to the skin from the inside and lies flush with the skin line.

14. The valve comprises a circular light alloy casting carrying a hinged valve flap,

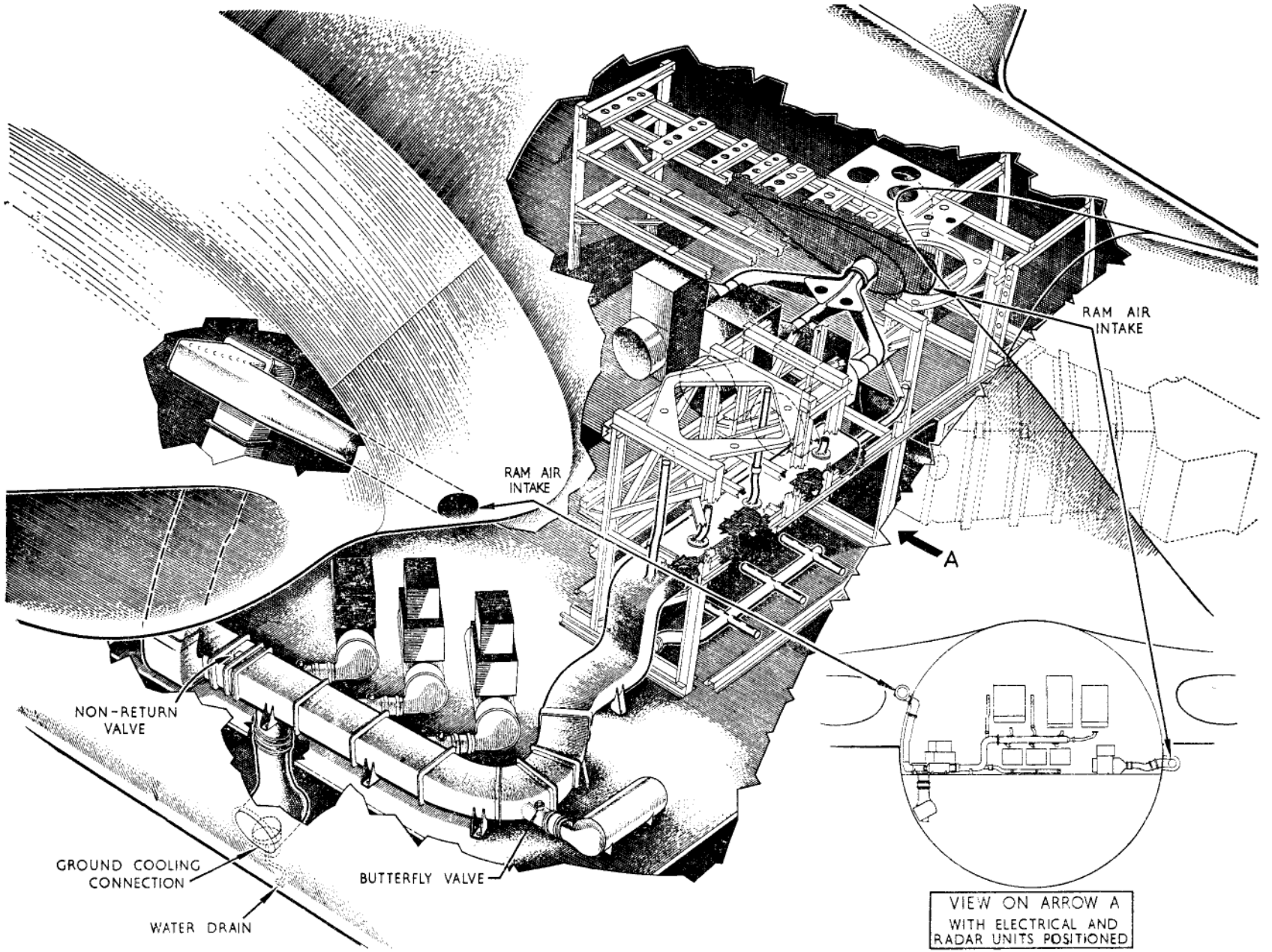

Fig. 3. Cooling ducts in upper servicing bay

which, in the closed position, bears on a rubber seal held in the body. An over-centre spring holds the valve flap open or closed but it must be positioned manually. A metal door completes the assembly and aligns with the contour of the skin. At the centre it carries a locking screw which engages a threaded block mounted on the centre of the sealing flap. When tightened, the screw has the double effect of locking down the door and pulling the sealing flap firmly on to its seat. Thus the inner flap must be closed manually, before the external door can be closed. The ground servicing hose adapter is fitted with four hooked latches which engage four diametrically-opposed pins in the mouth of the valve (*A.P.* 2306R, *Vol.* 1 and 6, *Sect.* 1). Connection is made by a push in and turn movement.

Non-return valve

15. This valve is fitted to prevent loss of air through the ram air-intake when using a ground servicing trolley. The valve is positioned in the rectangular ducting, in the upper servicing bay, upstream of the ground cooling connection and on the starboard side at floor level; at this point the ducting changes from a vertical run down the side of the fuselage to a horizontal fore-and-aft run. The valve can be located by the open end of the stop tube, which is clearly visible on the top surface of the ducting. The valve is similar in operation to that described in para. 9 differing only in that it is larger, is fabricated from light alloy sheet and is rectangular in section.

Ducting

16. The upper servicing bay ducting is mainly rectangular. After entering the fuselage at Stn. 350 from the ram air-intake it drops to floor level, and passes forward along the starboard side. In this section is the non-return valve (*para.* 15) and the junction of the ground cooling connection duct which comes up through the floor. The ducting passes forward to approximately Stn. 310 where it curves inboard towards the radar crate, rises half way up the crate and passes through it to the port side. Another right angle turn directs it parallel to the port side back as far as Stn. 350. Branches are taken from the main duct throughout its length and some of the branches are provided with preset butterfly valves to cater for varying airflow requirements and connect to rotary transformers and inverters by hose and clip joints. Other branches among the radar crate equipment are open ended or terminate in louvred blast pipes.

Water drain

17. A water drain is provided from a point in the ducting immediately inside the ground cooling connection and drains at a point in the skin just below this connection.

Venting

18. The considerable volume of air released into the upper servicing bay, from the ducting and from the combined valve unit of pressurization system, exhausts to atmosphere via ports in the rear fuselage access door (Stn. 933) after passing through the port and starboard servicing bays.

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