Part I

Chapter 9—Air Conditioning System

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Description, Controls and Indicators

1 General

Air for pressurising and conditioning the cabin is tapped from each engine compressor. All components of the system are installed beneath the cabin floor. Two pressure controllers are mounted in the cabin. On top of each is a ground test lever, which must be set fully down for flight conditions.

2 Controls and indicators

The controls and indicators for the system with the exception of circuit breakers on panel AV are all on the 2nd pilot's side panel AD as follows:

(*a*) Four OPEN-CLOSE ENGINE BLEED ISOLATION VALVES switches one for each engine, control the supply of air for the system and for the anti-icing system.

(*b*) Two OPEN-CLOSE PORT and STBD. CABIN AIR ISOL. COCKS, one for each pair of engines control the supply to the pressure ratio control valve and the temperature control valve and thence to the cabin.

(*c*) The CABIN PRESSURE control switch has three positions, CRUISE—COMBAT—UNPRESS. With it set to CRUISE the pressure controllers, one of which has two different settings, maintain a constant cabin altitude of 8,000 feet at all altitudes above 8,000 feet until a maximum differential pressure of 9 PSI is reached (47,000 feet approximately). Above that height the pressure differential remains constant and the cabin altitude will increase. With the switch at COMBAT the variable controller is set to maintain 8,000 feet cabin altitude until a maximum differential of 4 PSI is reached (19,500 feet). When set to UNPRESS a discharge valve is opened to dump cabin pressure.

(*d*) The temperature of the cabin air is controlled by two switches, the CABIN TEMPERATURE MASTER and SETTING switches. The Master switch permits the selection of off (central), MANUAL COOL or WARM (down), or AUTO (up). The SETTING switch, which is for use with the MASTER switch at AUTO, automatically varies the temperature between COOL, NORMAL and WARM. The MANUAL COOL and WARM positions may be used for manual control of cabin temperature. The switch must be held to either position ; when released it reverts to the off position. Above the MASTER switch is an indicator which shows the position of the temperature control valve between WARM and COOL. Above the SETTING switch are two warning lights, an amber one marked MAX HEAT and a red one marked OVERHEAT.

(*e*) A CAU BYPASS—CAU IN switch, adjacent to the ISOLATION VALVES switches enables the cold air unit to be completely by-passed by setting the switch to CAU BYPASS.

(*f*) A cabin altimeter is provided on the second pilot's instrument panel AB. A warning light on the 1st pilot's side panel comes on if cabin pressure falls by approximately $\frac{1}{2}$ PSI from the selected value. Red warning lights are at each crew station except the 2nd pilot's and prone bomb aimer's.

(*g*) In addition to the warning light a warning horn sounds if cabin altitude exceeds 42,000 feet. The warning can be silenced by operation of the HORN OVERRIDE switch on the 2nd pilot's side panel AD.

(*h*) Mod. 3816 introduces a cabin differential pressure gauge on panel BCB to provide an indication to rear crew members.

3 Flood flow control

(*a*) The MASTER FLOOD FLOW AUTO-MANUAL switch controls the flood flow system. The switch is held at AUTO by a spring-loaded gate. With the switch at AUTO flood flow is automatically selected should cabin altitude rise above 27,000 feet. When the gate is raised the switch may be set to OFF (central). The MANUAL setting of the switch is either to FLOOD (left) or LESS AIR (right). By judicious use of these two positions the cabin pressure can be maintained to a reasonable degree. The switch must be held to either position, if released it springs to the off position.

(*b*) A magnetic indicator shows white whenever the flood flow system is in operation.

(*c*) A guarded RESET switch is provided to reset the flood flow control after use, with the flood flow switch OFF.

4 Ram air ventilation—unpressurised flight

The starboard ram air intake nostril supplies air for ventilation in unpressurised flight at low altitude. The ram air valve may be opened by a bowden-cable, operated by a lever at the Nav./Radar operator's station.

5 Cabin decompression

In an emergency, and if the aircraft is to be abandoned, cabin pressure can be released by any one of the following controls:

(*a*) The EMERGENCY DECOMPRESSION switch on the 1st pilot's panel AC when moved upwards.

(*b*) The cabin pressure control switch when set to UNPRESS.

(*c*) The crew dump control above the main entrance door when pulled downwards.

(*d*) The ABANDON AIRCRAFT warning switch when set ON.

6 Circuit breakers

Circuit breakers for the cabin ventilation control, cabin temperature control, cabin temperature overheat warning, air-conditioning isolation and ram air valve circuits are positioned on panel AV. On the 2nd pilot's console are two test switches for testing the cabin temperature balance bridges.

7 Windscreen de-icing and demisting

(*a*) The pilot's windscreen panels are heated electrically by gold film inlays. A switch on panel AC, marked WINDSCREEN HEATING PO & SI/OFF/DE-MIST controls the electrical supplies to the port outer and starboard inner panels. On the right of panel AZ is a second WINDSCREEN HEATING PI & SO/OFF/DE-MIST switch, controlling the supplies to the port inner and starboard outer panels. A magnetic indicator beside each switch shows the condition of the system. Mod. 3698 introduces a DE-ICE position to both switches.

(*b*) *Demisting*

A WINDSCREEN DEMISTING OPEN/SHUT control lever on panel AB can be used to supply demisting air either to the pilots' centre windscreens (up) or to the downward observation windows (down) and provides reduced supplies to both in the HALF OPEN position.

(*c*) *Windscreen wipers*

A windscreen wiper is on each pilot's front panel. Each wiper is actuated by a hydraulic pump driven by an electric motor, through suitable reduction gears. The speed of each electric motor is controlled by its associated OFF-SLOW-FAST switch, one on 2nd pilot's console, AF and one on 1st pilot's side panel.

8 Bomb-bay heating system

(*a*) *General*

The bomb-bay heating system is designed to maintain a temperature of +20°C but provision is made to allow manual control within variable limits dependent upon the type of store carried. The system will operate only if the starboard ENGINE BLEED ISOLATION COCKS switches are set to OPEN.

(*b*) *Controls and indicators*

The controls are mounted on the navigator's side panel and consist off:

(i) An OFF/AUTO/MANUAL switch.

(ii) A COOL/OFF/WARM control switch.

(iii) A COOL/NORMAL/WARM rotary TEMP. SETTING CONTROL switch.

(iv) A bomb-bay TEMPERATURE INDICATOR.

(v) A bomb-bay OVERHEAT RESET switch.

(vi) An OVERHEAT warning light.

(vii) A TAIL ANTI-ICING, BOMB-BAY HEATING/BOMB-BAY ISOLATED switch. The switch must be selected to TAIL ANTI-ICING, BOMB-BAY HEATING. With the switch set to BOMB-BAY ISOLATED the starboard isolation cock is closed, bomb-bay heating is inoperative and tail anti-icing is fed from the port engines only.

(*c*) *Carriage of Blue Steel*

When Blue Steel is carried the bomb-bay heating must not be switched on. Prior to Mod. 3167 the warm air supply to the missile must not be switched on below 35,000 feet.

Normal Management of the System

9 Before flight

(*a*) Before starting the engines, in accordance with the check list, carry out the following checks and selections:

Nos. 1 and 2 pressure controller levers	Down and flush
Cabin pressure dump valve	Up and wired
Circuit breakers at panel AV	Closed
Crew door accumulator pressure	Normal
Hatch seal pressures	Normal (both sides)
Hatch seal clips	In position
CABIN TEMP. BRIDGE TEST switches	Both central
Bomb-aimer's demist selector	OFF
Ram air valve	CLOSE
ENGINE BLEED ISOLATION VALVES	CLOSE (4)
MASTER FLOOD FLOW switch	AUTO
Flood flow reset switch	Central
Flood flow indicator	Black
Warning HORN OVERRIDE switch	Up
CAU selector switch	CAU IN
CABIN AIR ISOL. COCKS	CLOSE PORT & STBD.
CABIN PRESSURE selector	CRUISE or as required
MAX. HEAT and OVERHEAT warning lights	Out: push to test
CABIN TEMPERATURE control switch	AUTO
CABIN TEMPERATURE SETTING selector	As required

(*b*) When the engines are started and the entrance door closed, set:

AIR CROSS-FEED cock	CLOSE
ENGINE BLEED ISOLATION VALVES	All to OPEN (RPM below 60%)
DV windows	Closed before take-off

(*c*) After take-off select the CABIN AIR ISOL. COCKS switches OPEN in turn with a minimum 10-second interval.

10 Control of cabin temperature

(*a*) The cold-air unit should be selected IN prior to engine starting and remain so until airborne. During flight the CAU should be selected to BYPASS, so as to give increased CAU life, and only selected IN if the cabin temperature becomes excessively hot. It should be selected IN prior to landing.

(*b*) The cold air unit control switch must be selected to CAU IN if cabin air conditioning is required on the ground. Select the CABIN AIR ISOL. COCKS open at 10 second intervals, but ensure that the ENGINE BLEED ISOLATION VALVES are open first or overspeeding of the cold air unit turbine may result. At least one engine should be at 70—75% RPM. The CABIN AIR ISOL. COCKS should be closed for take-off.

(*c*) With the CABIN TEMPERATURE control switch set to AUTO the temperature may be adjusted by means of the SETTING selector. If the red OVERHEAT warning light illuminates, the temperature control valve will automatically move to the fully cold position (indicated on the WARM-COOL indicator). Subsequent cooling of the thermal switch will allow the temperature control valve to open and a small movement of the SETTING selector towards COOL may help to prevent further overheating. If the OVERHEAT warning light illuminates again, a failure of the automatic temperature control system is indicated and all subsequent control must be made by manual selection.

(*d*) Manual control is achieved by judicious use of the control switch between the COOL and WARM positions. Movement of the temperature control valve is indicated on the COOL—WARM indicator when the switch is at COOL or WARM, and movement ceases when the switch is released. If the amber MAX HEAT warning light comes on, the temperature should be reduced by holding the control switch at COOL until the amber light goes out. If, when the amber light is on, further overheating occurs, the red OVERHEAT warning light will illuminate and the system will automatically go to fully cold. When the OVERHEAT warning light goes out, further manual selections may be made.

(*e*) Only sufficient hot air should be allowed on to the windscreen panels to prevent misting. Surplus air should be directed to the pilots' feet heating by setting the windscren demisting control to BOMB AIMER OPEN. Particular care must be taken to avoid excessive heating of the panels whenever the anti-flash screens are fitted.

(*f*) At low altitudes the RAM AIR VALVE may be selected OPEN to assist in cabin cooling.

(*g*) Air conditioning is marginal in conditions of high humidity where the OAT is above +25°C. Before descent to low level the cabin should be refrigerated for about 20 minutes using the CAU. During the descent close the cabin air isolation cocks at 10,000 ft. to trap the cold air. Resume normal cabin conditioning after about $\frac{1}{2}$ hour of low level flight.

11 Control of cabin pressure

The pressure control selector should normally be set to CRUISE or COMBAT as required. If air conditioning only is required, select UNPRESS. Periodic checks of the cabin altimeter should be made throughout flight to ensure that cabin altitude is correct for the pressure selection in operation. When the selector is set from CRUISE to COMBAT or vice versa the times to stabilise the new condition are as follows:

CRUISE to COMBAT . . .	36 seconds
COMBAT to CRUISE . . .	$5\frac{1}{2}$ to $6\frac{1}{4}$ minutes

Some internal misting may occur when selecting COMBAT from CRUISE.

12 Control of gold film windscreen heating

(*a*) Both heater switches should be selected to DE-MIST before take-off and maintained there throughout flight. DE-ICE (Mod. 3698) should only be selected when it is required to clear ice or heavy misting.

(*b*) To avoid delamination of windscreen panels, DE-ICE should never be selected without having first selected DE-MIST, nor should the aircraft be flown with the system OFF.

Malfunctioning of the System

13 Loss of cabin pressure

(*a*) If the cabin pressure falls below the correct pressure for the selection in use, red LOSS OF CABIN PRESSURE warning lights on the 1st pilot's coaming and at the 3 rear crew stations will illuminate. The cabin pressure warning horn will sound if the cabin pressure falls to that equivalent to 42,000 ft. cabin altitude.

(*b*) With the MASTER FLOOD FLOW switch selected to AUTO, the flood flow system should automatically operate if the cabin altitude reaches 27,000 ft. and the indicator will show white (OPEN) when the flood flow valve is fully open. The mass-flow valve will remain fully open until the cabin altitude is reduced to

26,500 ft. and will cycle open and closed to maintain these conditions while the switch is selected to AUTO. This cycling effect may be prevented by assuming manual control of the mass-flow valve. Move the MASTER FLOOD FLOW SWITCH to the mid (OFF) position, and then increase or decrease the mass flow by judicious selection between the FLOOD and LESS AIR positions until comfortable conditions exist in the cabin.

(*c*) When flood flow is no longer required select the flood-flow reset switch to RESET until the indicator goes black.

14 Emergency de-pressurisation of the cabin

(*a*) In an emergency the cabin can be depressurised by any of the following selections:

1st pilot's ABANDON AIRCRAFT switch . . .	ABANDON AIRCRAFT
1st pilot's EMERGENCY DECOMPRESSION switch .	EMERGENCY DECOMPRESSION
CABIN PRESSURE selector .	UNPRESS
Rear crew dump valve operating handle	Break wire and pull down

(*b*) The time taken to depressurise the cabin will vary according to the aircraft's altitude and the pressure differential selected. Above 12,000 ft. and with CRUISE selected, the appropriate time must elapse between selecting depressurisation of the cabin and opening the door. (See Part IV, Chap. 3, para. 1). All crew members should be strapped in their seats before the door is opened.