PART 1

CHAPTER 10—AIR SYSTEMS

Contents

INTRODUCTION

Sources of Air

1. With the exception of some cooling air, the main air system takes air from two 15th-stage engine compressor tappings, one from each engine. Non-return valves close to each tapping ensure that an air supply is maintained after an engine fails or is shut down. After passing the non-return valves, the compressor air from both engines enters a common duct which feeds the main air system.

2. Compressor tappings, separate from the main air system, supply the reheat pumps (Chapter 3), the guided weapons pack (Aircrew Manual, Weapon System), the hydraulic reservoirs (Chapter 4) and the fuel system (Chapter 2). Ram air is used for equipment cooling and, when selected by the pilot, for cockpit ventilation.

Air Systems

3. The air systems described in this Chapter are:
Cockpit pressurisation and air conditioning
Canopy sealing

4. The location of information on other systems supplied from the main air system is as follows:

Subject	*Location*
Main air turbine	Chapter 1
Standby generator turbine	Chapter 1
Reheat nozzle system	Chapters 1 and 3
Anti-icing systems	Chapter 3
Hot air demisting	Chapter 11
Canopy demisting	Chapter 11
Rain dispersal	Chapter 11
Anti-g system	Chapter 12
Air ventilated suit	Chapter 12
Radar head pressurisation	Aircrew Manual, Weapon System (AP 101B-1003, 5 & 6-15B)

PRESSURISATION AND AIR CONDITIONING CONTROLS AND INDICATORS

5. The controls and indicators in the cabin pressurisation and air conditioning system for all marks are listed in Table 1. The locations of controls in the F Mk 3 and F Mk 6 are shown in Fig 1, and for the T Mk 5 in Fig 2.

DESCRIPTION OF THE SYSTEM

General

6. Air tapped from the 15th-stage of both engine compressors is used to pressurise the cockpit and regulate the cockpit temperature. An electrically-operated shut-off valve in the main hot air supply duct, controlled by the CABIN AIR switch on the starter panel, controls the supply of air. It takes its power from the 28V DC busbar.

7. With the shut-off valve open, temperature control is effected by passing the bulk of the airflow through a refrigeration system and routeing the remainder to by-pass the refrigeration system, the latter flow being controlled by a variable-position, electrically-operated valve connected to the cockpit temperature controller. The regulated hot air from the by-pass is then mixed with the refrigerated air and delivered to the cockpit via a water extractor.

8. In the F Mk 3 and F Mk 6, conditioned air is delivered to the cockpit through two perforated spray nozzles and two ducts on either side of the control column pedestal. In the T Mk 5, conditioned air is delivered to the cockpit through a perforated spray nozzle and two diffusers on panels A3 and A5. Cockpit differential pressure is controlled by the pressure controller (para 15).

9. Partially-cooled air from the cabin pressurisation and air conditioning system is used for the anti-g and AVS systems, and to pressurise the radar head.

10. A manually-operated RAM AIR valve in the left cockpit wall allows air at ambient temperature and pressure into the cockpit when OPEN is selected. The valve is normally in the CLOSED position.

Refrigeration System

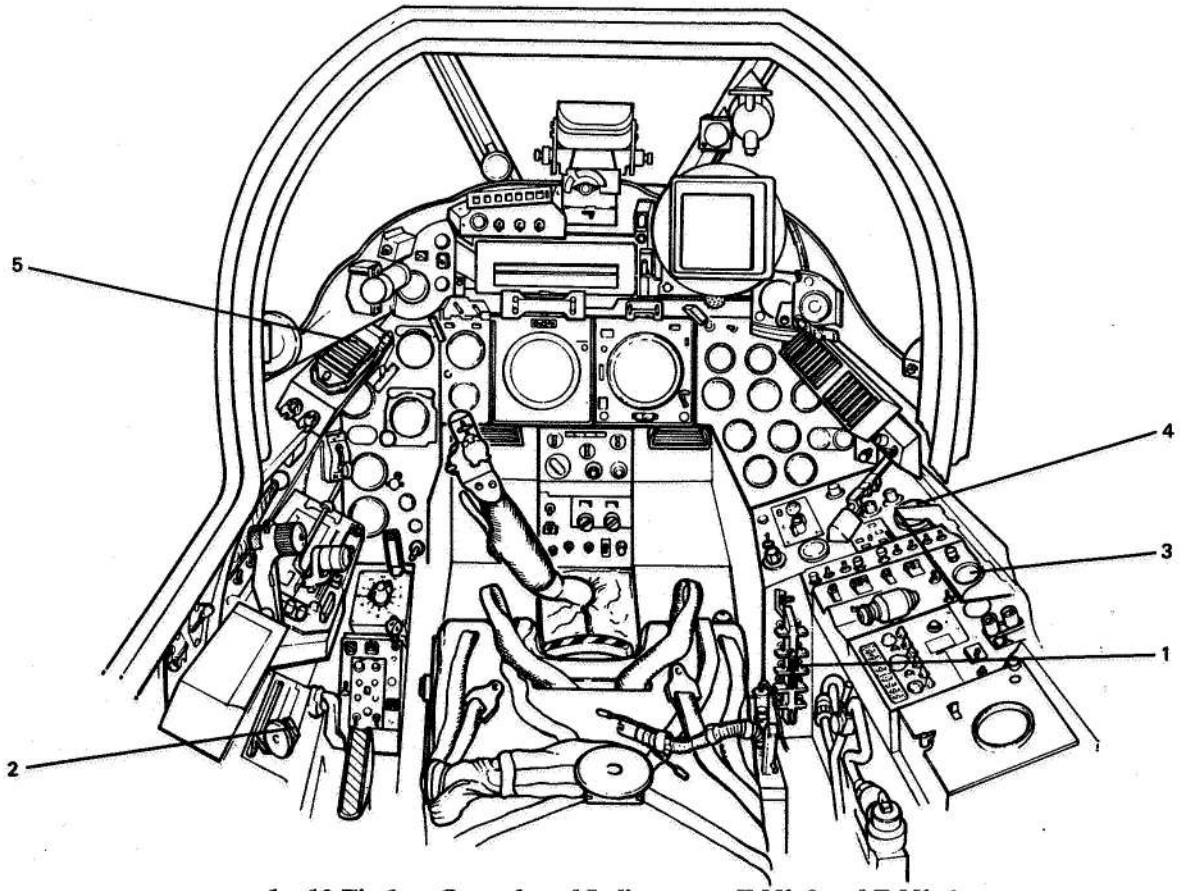
11. The refrigeration system consists of a pre-cooler which uses ram air as a cooling medium, a water boiler and a cold air unit.

Cabin Altimeter

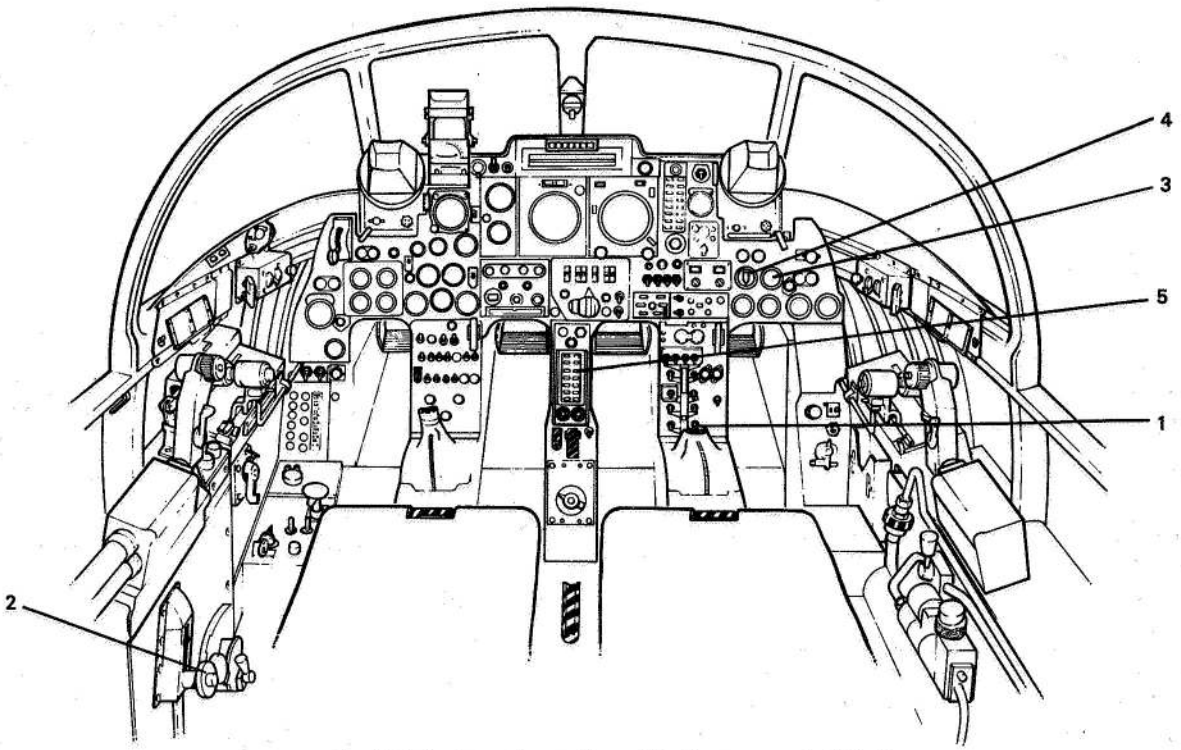
12. The Mk 21A cabin altimeter indicates the cockpit pressure in terms of altitude.

Table 1 — Controls and Indicators

Item No	*Item*	*Markings*	*Remarks*
1	Cabin air switch	CABIN AIR	Up for on
2	Ram air selector	RAM AIR — OPEN/CLOSED	—
3	Cabin altimeter	—	—
4	Cockpit temperature controller	MANUAL/AUTO — COOL/FIXED/WARM	—
5	Pressurisation failure warning	CPR caption (SWP)	—



1—10 Fig 1 — Controls and Indicators — F Mk 3 and F Mk 6



1—10 Fig 2 — Controls and Indicators — T Mk 5

Temperature Controller

13. The temperature controller regulates the by-pass airflow to allow the adjustment of the temperature of pressurised air. The controller is divided into two sectors, AUTO (black) and MANUAL (red). In the AUTO sector the temperature control valve is operated by 115V, 3-phase AC from the Essential instrument busbar and it therefore takes standby inverter power after AC failure; in the manual sector the valve is operated by 28V DC.

14. When the temperature controller is in the AUTO sector, the knob remains at the position selected and the cockpit temperature is automatically regulated by the temperature control valve. In the MANUAL sector, the control is self-centring to a FIXED position. The control is held against a spring to either WARM or COOL until the desired temperature is attained. In MANUAL the valve takes approximately 20 seconds to move from fully WARM to fully COOL (and vice versa) and a time delay of approximately one minute elapses before the full effect of a temperature change is felt.

Pressure Controller

15. A pressure controller on the forward pressure bulkhead automatically controls cockpit pressure by regulating the action of an air discharge valve. When the aircraft climbs through approximately 7500 feet the unit starts to control the discharge of air from the cockpit and, as altitude increases, the cockpit pressure in relation to ambient pressure builds up until the full differential of 4 PSI is reached at approximately 32,000 feet, above which altitude the differential remains constant.

16. Severe overpressurisation is normally prevented by relief valves, built into the discharge valve, which open if the cabin pressure/ambient pressure differential exceeds approximately 4·5 PSI. Aircraft operation is limited if differential pressure approaches or exceeds 6 PSI (para 24). Corresponding values of aircraft altitude and cabin altitude are as follows:

Aircraft Altitude (feet)	*Cabin Altitude (feet) at 4 PSI*	*Cabin Altitude (feet) at 6 PSI*
35,000	17,750	11,500
45,000	22,500	15,500
55,000	26,500	18,000

Note: The cabin altitude above 32,000 feet at 4 PSI differential is approximately half the aircraft altitude; at 6 PSI differential the cabin altitude is approximately one-third of the aircraft altitude.

Canopy Seal

17. When the canopy is closed, the final movement of either the internal or external canopy locking handle mechanically operates a pneumatic valve to allow air at a reduced pressure from the main 15th-stage air system to inflate the canopy seal. Similarly, the initial movement of either handle when unlocking, deflates the seal. If the canopy handle is not fully home after locking, the canopy seal may not inflate fully, causing loss of cockpit pressurisation.

18. In the canopy seal system there is an air storage bottle which is charged either from the main air system or from a ground charging point. The storage bottle holds sufficient air to inflate the seal several times and it also compensates for slight leakages in the system.

Pressure Failure Warning

19. A serious failure of cockpit pressurisation is indicated by the CPR caption on the SWP.

MANAGEMENT OF THE SYSTEM

Cabin Pressurisation and Temperature Control

20. Set the CABIN AIR switch to on (up) before engine start, using the starter bar. The switch is normally left in this position for the duration of the flight.

21. Before take-off ensure that the RAM AIR valve is CLOSED and the canopy seal is inflated.

22. Set the temperature controller into the AUTO sector as required. Although automatically controlled, variations in the selected temperature can be expected with large changes of speed or altitude. If a new temperature datum is selected, there is a delay of approximately one minute before it is attained.

23. The MANUAL sector of the temperature controller is not normally used. However, if the AUTO facility fails, move the control to the MANUAL sector, hold it momentarily to COOL or WARM as desired and then release it to the FIXED position. Again there is a delay of approximately one minute between selecting and experiencing a new temperature.

MALFUNCTIONS OF THE SYSTEM

Overpressurisation

24. If the cabin altimeter indicates that the differential pressure is between 4 and 6 PSI, restrict speed to a maximum of 500 knots/1·3M. If the differential is greater than 6 PSI, restrict speed to 500 knots/1·3M and land as soon as practicable.

Pressurisation Failure

25. *Indications.* Pressurisation failure is indicated by the CPR caption on the SWP accompanied by the attention-getters; the failure is confirmed by the cabin altimeter indication.

26. *Actions.* If the failure occurs at high altitude, make an immediate descent to 40,000 feet cabin altitude having set the oxygen mask toggle down. Set the oxygen regulator to 100% and EMERGENCY, and the DEMIST lever to ALL ON (OPEN, T Mk 5). To avoid decompression sickness continue the descent to below 25,000 feet cabin altitude and fly as low as practicable. Use ram air ventilation as necessary.

Temperature Control Failure

27. If overheating or overcooling occurs, select the temperature controller to MANUAL and hold at COOL or WARM, as appropriate, for 10 to 15 seconds. If the temperature responds, leave the controller in the FIXED position but make manual adjustments as necessary. If the overheating or overcooling persists, select the CABIN AIR switch off (down) and proceed as for a pressurisation failure.

Smoke in Cockpit

28. If smoke enters the cockpit through the diffusers, select the CABIN AIR switch off until the smoke disappears. If the smoke is coming from any other source, select the RAM AIR valve OPEN. Select 100% and EMERGENCY on the oxygen regulator while the smoke persists. In both cases cockpit pressurisation is lost; take pressurisation failure actions.

Emergency Decompression

29. If it is necessary to depressurise the cockpit, set the CABIN AIR switch to off (down) and set the RAM AIR valve OPEN.

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