PART 1

CHAPTER 12—PILOT EQUIPMENT AND ASSOCIATED SYSTEMS

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EJECTION SEAT

ANTI-g AND AVS SYSTEMS

continued

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EJECTION SEAT

CONTROLS AND INDICATORS

WARNING: The aircraft assisted escape system is a potential source of danger and inadvertent operation can cause fatal injuries. On completion of a landing and before departing from the aircraft, the pilot is to ensure that the ejection seat (and the canopy in the T Mk 5) is left in the 'Safe for Parking' condition, that is, safety pins fitted to the face-screen firing handle, to the seat pan firing handle and, in the case of the T Mk 5, to the canopy sear.

1. The features of the Type 4BSB Mk 2 and Type 4BSC Mk 2 ejection seats are shown in Fig 1 and Fig 2.

DESCRIPTION OF THE SYSTEM

General

2. In the F Mk 3 and F Mk 6, a Type 4BSC Mk 2 ejection seat is fitted. In the T Mk 5, two Type 4BSB Mk 2 ejection seats are fitted. The associated parachute assembly is a Back Type Mk 45 which embodies a horseshoe parachute pack and a combined parachute

and safety harness fastened by a quick-release fitting (QRF), the pack being held in position by two restraining straps at the upper end. A back pad and lumbar cushion are included in the harness for comfort and support. A Type V personal survival pack (PSP), complete with cushion and containing a liferaft and survival equipment, is housed in the seat pan. Two leg restraint cords are fitted to the front of the seat pan. Emergency oxygen is provided. A guillotine unit is incorporated to assist in manual separation.

3. A pack restraint spreader system is incorporated. This consists of two arms mounted just beneath the parachute support arch which swivel forward giving quicker release of the parachute pack restraining straps during separation after ejection.

4. At the rear of the seat is an 80 ft/sec ejection gun. The seat has two firing handles, both of which are provided with safety pins. One, which has an integral face screen, projects from the front of the drogue container; the other is positioned centrally on the front of the seat pan.

5. A drogue gun is mounted on the left seat beam. For high speed ejections below 10,000 feet a g-switch control is fitted. This delays operation of the baro-static time release mechanism until the forward speed of the seat and pilot has been sufficiently reduced to ensure a safe parachute deployment. The seat has a ground-level ejection capability provided the aircraft's flight path is parallel to the ground with a minimum forward speed of 90 knots.

Seat Height Adjustment

6. The seat height is adjusted by an electric motor. In the F Mk 3 and F Mk 6, the motor is operated by a switch on the left console marked SEAT—UP/off/DOWN. In the T Mk 5, the seat height is adjusted appropriately by a SEAT — RAISE / off / LOWER switch under the left and right instrument panel shroud. The switches are spring-loaded to off.

7. The seat pan moves relative to the headrest to accommodate different body lengths and to ensure the pilot's head is correctly located.

Inertia-Reel Harness

8. An inertia-reel, go-forward, shoulder harness system is fitted. It is controlled by a 3-position spring-loaded lever on the left side of the seat pan. When the lever is moved fully forward and then allowed to return to the central position under the action of the spring, the occupant may move forwards or backwards at will. An automatic inertia device locks the harness during an ejection or if more than 2·5g in the forward plane is experienced. Moving the lever to the rear position brings into action the snubbing unit in the top harness lock, thus preventing further forward movement. As the wearer leans back the harness is locked in the rearward position.

Quick Release Fitting (QRF)

9. The QRF, when fastened, secures the combined restraint and parachute harness and therefore secures the pilot to the seat in flight and to the parachute after ejection. *On no account is the QRF to be operated when carrying out a manual separation since its operation frees the pilot from both seat and parachute.*

Personal Equipment Connector (PEC)

10. A PEC on the right side of the seat pan enables main oxygen, emergency oxygen, mic-tel, the air ventilated suit and the anti-g system to be connected or disconnected in one action. It consists of three components: a seat portion which is fitted permanently to the right side of the seat pan, a man portion which is attached to the flying clothing, and an aircraft portion which disconnects automatically on ejection. The man portion is separated from the seat portion when the harness release mechanism operates.

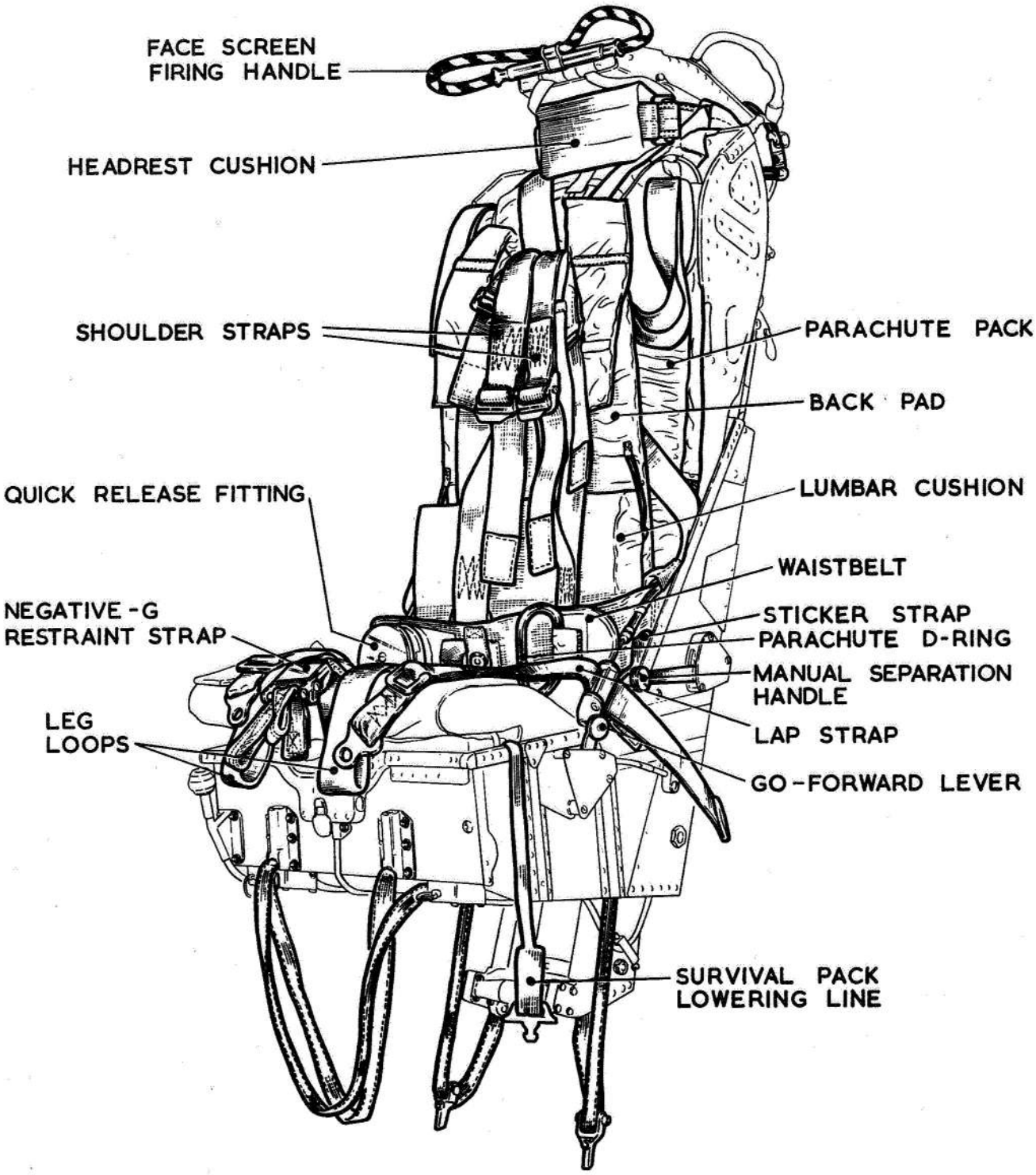
Leg Restraint System

11. The two leg restraint cords ensure that the pilot's legs are drawn back automatically and restrained close to the seat pan during ejection to prevent injury to the legs by flailing. The cords are connected to the aircraft structure at their lower ends by a shear rivet, and pass through snubbing units beneath the front of the seat pan, which allows the cords to pass freely down through the units but prevents them passing upwards. An adjusting ring on each snubbing unit, when pulled forwards, allows the pilot to adjust the cords to give sufficient leg movement for the application of full rudder. The upper ends of the cords are passed through the leg-restraint garter D-rings and plugged into units on the forward face of the seat pan.

12. During ejection the cords operate to restrain the legs until drawn tight, when the shear rivets allow the cords to separate from the aircraft structure. The legs are held in position until automatic or manual separation occurs, the cords then being free to pull through the garter D-rings.

Ripcord D-Ring

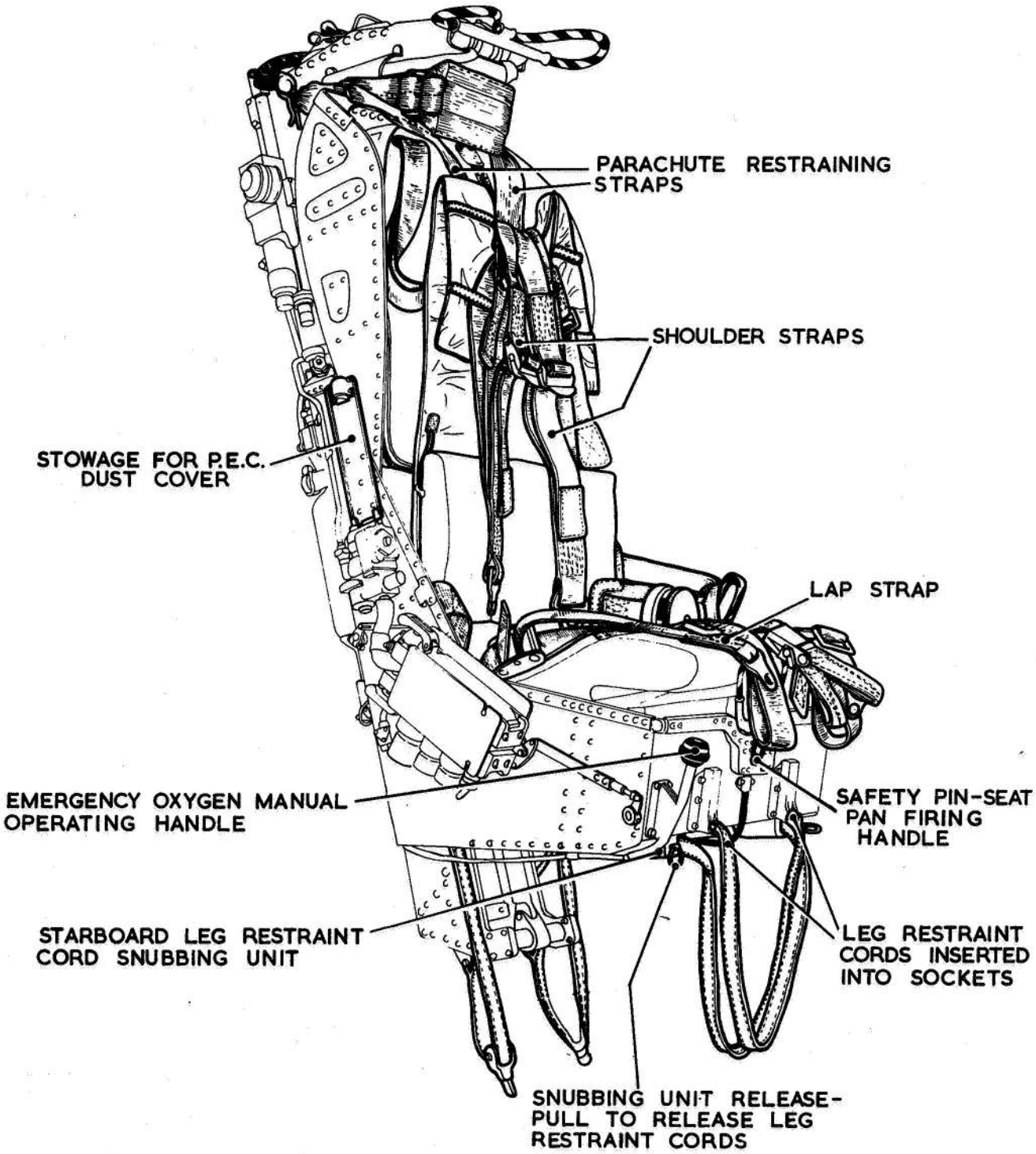
13. The ripcord D-ring, on the left lap strap, is provided for manual operation of the parachute after a manual separation or manual bale-out.



1—12 Fig 1 — 4BSB and 4BSC Mk 2 Ejection Seats—Left Side

Ejection Sequence

14. When either firing handle is pulled, the canopy immediately jettisons, thus removing an attached interdictor from the time-delay firing unit. Continued force on the firing handle is necessary, however, to remove the sear on the time-delay firing unit and start the ejection. The 'double pull' effect is unlikely to be noticed if the system operates normally. The main purpose of the interdictor system is to ensure that the seat is not in a 'live but unfired' condition if the canopy



1—12 Fig 2 — Type 4BSB and 4BSC Mk 2 Ejection Seats—Right Side

fails to jettison: the seat cannot eject while the canopy is on.

15. After the canopy has removed the interdictor a delay of 0·6 seconds occurs before the seat is fired. As the seat rises the drogue gun sear and the barostatic time-release mechanism sear are withdrawn by static rods. The aircraft portion of the PEC is disconnected, emergency oxygen is supplied to the pilot, and the IFF/SSR transponder replies with emergency codes

provided it has warmed up (see Chapter 13). The legs are restrained by the leg restraint cords.

16. The drogue gun fires 0·5 seconds after the withdrawal of its sear and the stabilising drogues are deployed. Removal of the sear from the barostatic time-release mechanism puts it into an 'armed' condition. When the seat has descended to 10,000 feet (or 5000 metres, depending on the modification state) the barostatic time-release mechanism operates to release the combined harness from the seat, to separate the man portion of the PEC and to free the leg restraint cords. The drogues are also released from the seat to allow them to deploy the main parachute. The pilot may momentarily be prevented from leaving the seat by two sticker straps until deployment of the parachute lifts him clear.

17. If ejection takes place below 10,000 feet (or 5000 metres) the barostatic time-release mechanism operates after a 1·25 second delay. However, a g-stop mechanism prevents the start of the 1·25 second sequence until the forward speed has been sufficiently reduced to permit the main parachute to be deployed without the danger of its bursting.

Manual Separation

18. A manual separation lever is on the left side of the seat pan. When pulled out of its gate and upwards, the combined harness is released from the seat, the parachute restraining straps are freed, the man portion of the PEC separates, and the leg restraint cords are released. As the occupant moves forward in the seat the guillotine operates. When clear of the seat it is necessary to pull the parachute ripcord D-ring to deploy the parachute.

19. The guillotine unit fires as a result of forward movement of the parachute pack during manual separation, to sever the parachute withdrawal line, thus making the final separation of the pilot and his parachute from the seat. The unit, positioned on the left side of the drogue container, has a sear safety pin for use during servicing.

NORMAL USE OR MANAGEMENT

Pre-Flight Checks

20. Carry out the **Aircraft Safe For Parking** and **Ejection Seat Checks** given in FRC.

Strapping-In

21. When seated, strap in using the following procedures:

a. Remove the dust cover from the seat portion of the PEC and fit into the stowage on the right-hand side of the seat pan. Connect the man portion to the seat portion, ensuring it is locked.

b. Connect the survival pack lanyard to life preserver or pressure jerkin ensuring that it passes outside the left leg.

c. Pass the left-hand leg restraint cord through the right leg garter D-ring and plug into the socket above left-hand snubbing unit. Pass the right-hand leg restraint cord through the left leg garter D-ring and plug into the socket above the right-hand snubbing unit. It is not important which cord is secured first provided they are not interlaced. Pull sharply on each cord to ensure it is securely locked (the leg restraint cords cannot be secured unless the PEC is locked to the seat portion). If the cords are too short, pull the ring of each snubbing unit and ease the cord forward. Take up any slack by pulling the cords backwards through the snubbing units.

d. Pull up the parachute back pad and adjust the height of the lumbar cushion. Pass the looped ends of the blue 'Y' section of the negative-g strap over their respective lap strap lugs and connect the lugs to the harness QRF. Tighten the straps and tighten the adjustable part of the negative-g strap.

Note: The lap straps must be as tight as possible.

e. Pass the left leg loop upwards over the inside of the thigh and through the D-ring on the left strap (from the inside of the ring towards the outside of the leg). Bring the end of the leg loop over towards the QRF and pass the lug of the left shoulder strap through the leg loop (from the top downwards) and insert the lug into its appropriate slot in the QRF. Snug the loop over the lug. Repeat these operations with the right leg loop and shoulder strap.

f. Adjust the sitting height to the desired position.

g. Ensure the shoulder straps pass under the lobes of the life preserver or pressure jerkin stole. Tighten the inner (blue) straps and then the outer (khaki) straps.

Note: It is not desirable to tighten these straps excessively since this action may arch the back and lead to spinal injury if ejection becomes necessary. The inner straps should not press down unduly on the shoulders but equally there should be no slack. The outer straps should be adjusted similarly to provide a comfortable fit.

h. Operate the go-forward lever and lean forward. Move the lever fully back, lean fully back and re-tighten the khaki straps. Failure of the harness to re-engage and lock back indicates that the harness is not secure.

i. Don helmet and connect oxygen supply and mic-tel lead.

j. Check that the face screen firing handle is resting on top of the protective helmet. Check that the firing handle can be reached with both hands.

k. Have the face screen and seat pan firing handle safety pins removed and placed in their stowages.

Leaving the Aircraft After Landing

22. Proceed as follows to leave the aircraft:

a. Have the ejection seat made Safe for Parking.

b. Unlock the QRF, free the straps and return the QRF to the locked position.

c. Disconnect the man portion of the PEC and replace the dust cover.

d. Free the leg restraint cords from the garter D-rings.

e. Disconnect the PSP lanyard.

Abandoning the Aircraft in Flight

23. If a premeditated ejection is to be made, consider and plan for the area of parachute landing and aircraft impact, and complete as much of the following drill as time and conditions permit:

T Mk 5	...	Alert other crew member
Height	...	Below 40,000 feet (ideal height 9000 feet)
Speed	...	250 knots
IFF/SSR	...	EMGY
Harness	...	Tight and locked. Leg restraints, PSP and lanyard connected
Visor	...	Down
Trims	...	Pitch trim—level Roll trim—slight roll
Radio	...	Mayday call
Throttles	...	Idle/fast idle

EJECT (T Mk 5, pupil first)

24. The seat pan handle is the primary handle. Adopt the correct posture leaving the feet on the rudder pedals, grasp the firing handle and pull it to its full extent. This action jettisons the canopy and ejects the seat. When the parachute has developed and the seat has fallen away, release the PSP leaving the lowering line attached to the life preserver. If descending into water, inflate the life preserver. Once safely down, operate the QRF to free the occupant from the parachute. If in water, trace the PSP lowering line to the operating handle of the CO_2 cylinder, and pull the handle to inflate the liferaft.

Note: When the seat pan handle is used to operate the ejection system, release the handle before separation from the seat since the handle does not come free. If the face screen firing handle is used, the handle and screen fall free on separation.

MALFUNCTIONS OF THE SYSTEM

Failure to Eject

WARNING: If, in the event of a failure of the automatic ejection sequence, the canopy has to be jettisoned manually, either firing handle must be pulled again to eject the seat.

25. If the canopy fails to jettison on the automatic sequence, pull up the canopy unlock handle to remove the canopy, and then pull the firing handle again.

26. If the canopy has left the aircraft and the seat still fails to eject, operate the manual separation lever, push free of the seat and bale out. When clear of the aircraft, pull the parachute ripcord D-ring.

Failure of Auto-Separation

27. If the auto-separation fails, operate the manual separation lever, push free of the seat and then pull the parachute ripcord D-ring.

ANTI-g AND AVS SYSTEMS

CONTROLS AND INDICATORS

28. *F Mk* 3 *and F Mk* 6. In the single-seat aircraft, the anti-g stop valve and control lever unit is mounted on the inboard face of the right console; a spring-loaded catch retains the control lever in either the OFF (forward) or ON (aft) position. The barometric/anti-g valve, which incorporates a high (H) and low (L) gradient selector and test button, is situated aft of the anti-g stop valve. The AVS rotary control knob, which is turned counter-clockwise to OPEN, is positioned forward of the anti-g stop valve.

29. *T Mk* 5. In the T Mk 5, the instructor's anti-g and AVS controls are similar in position and operation to those in the F Mk 3 and F Mk 6. The pupil's anti-g stop valve is on the inboard face of the left console but the barometric/anti-g valve, incorporating the gradient and test functions, and the AVS rotary control knob are between the seats.

DESCRIPTION OF THE SYSTEMS

General

30. Both the anti-g and AVS systems take partially-cooled air drawn from a tapping in the refrigeration unit of the cabin pressurisation and air conditioning system. Therefore, neither system operates unless the CABIN AIR switch is on and an engine is running, although air can be fed to the systems from a break-away ground cooling connection in the fuselage skin for the AVS when the aircraft is on the ground.

31. The common, partially-refrigerated air supply passes through a heat exchanger, a water trap and a non-return valve before dividing into the separate anti-g and AVS systems. The heat exchanger adjusts the temperature of the air depending on the setting of the cockpit temperature controller. Eventually, air from the two systems is fed to the pilot's clothing through PEC connections.

Note: In the T Mk 5, the pupil's and instructor's systems are entirely separate after the original tapping from the refrigeration unit.

Anti-g System

32. With CABIN AIR selected on, the engines running and the anti-g stop valve selected ON, the barometric/anti-g valve automatically provides protection to the lower abdomen and legs under positive g and after cabin depressurisation at high altitude.

33. *Positive-g Protection.* Under positive g the barometric/anti-g valve applies pressurised air to the anti-g suit proportional to the g force experienced. With the gradient selector set to H, pressure is supplied at 1·25 PSI/g when more than +1·9g is experienced. When set to L, pressure is applied at 1·05 PSI/g when more than +2·25g is pulled.

34. *Depressurisation Protection.* If loss of cabin pressure occurs at altitudes above 35,000 feet, the barometric/anti-g valve applies pressure to the g-suit at a value approximately 0·5 PSI greater than the oxygen system applies pressure to the lungs.

35. *Test Button.* With the system selected ON and an engine running, the system is checked by pressing the test button on the barometric/anti-g valve, thus inflating the g-suit. The suit deflates when the button is released.

36. *Not used.*

AVS System

37. With CABIN AIR selected on, the engines running and the AVS rotary control knob turned to OPEN, air is supplied to the AVS via a pressure control valve which functions to maintain the air at 4·5 to 6·5 PSI above the prevailing cockpit pressure at any cabin altitude. A relief valve, set at 11·0 to 11·5 PSI, is incorporated. The temperature of the air is controlled by the cockpit temperature controller.

MANAGEMENT OF THE SYSTEMS

Anti-g System

38. Before flight, ensure that the anti-g stop valve control is to ON. The OFF position is for emergency use only and ON is normally selected at all times. If the control is left at OFF, there is no protection for the lower part of the body after depressurisation nor during positive-g accelerations.

39. Set the gradient selector to H or L as desired. The setting is decided by individual requirements; it should not be necessary to change the setting in the air.

40. When the engines are running, press the test button to check the operation of the system.

AVS System

41. Control the quantity of the air supplied to the AVS by adjusting the position of the rotary control knob. Adjust the temperature of the air by use of the cockpit temperature controller.

MALFUNCTION OF THE SYSTEMS

Anti-g System

42. In the event of failure of the barometric/anti-g valve giving an abnormal build-up in pressure in the anti-g suit, select the stop valve to OFF to deflate the suit. No further lower body protection is then available.

AVS System

43. If the temperature of the air to the AVS becomes uncontrollable because of a temperature control runaway in the pressurisation and air conditioning system, turn off the AVS rotary control knob to cut off the supply of air.

OXYGEN SYSTEM—F MK 3 AND F MK 6

CONTROLS AND INDICATORS

44. The controls and indicators of the main and emergency oxygen systems in the F Mk 3 and F Mk 6 consist of a Mk 17F regulator and an oxygen contents gauge on the right console, and the emergency oxygen knob, striped yellow and black, on the right front of the seat pan of the ejection seat. There is an oxygen flow MI at top left on the instrument coaming to repeat the flow indication on the regulator. There is an OXY warning caption on the SWP.

DESCRIPTION OF THE SYSTEM

General

45. The main oxygen system consists of a 3·5 litre liquid oxygen container and associated evaporator and stabilising system, housed in the equipment bay, and a Mk 17F pressure demand regulator. Gaseous oxygen is fed to the pilot via the regulator and the PEC. A type P or Q oxygen mask is used.

46. The system provides normal protection against hypoxia at cabin altitudes up to 42,000 feet and affords

the pilot 'get down' protection from a maximum cabin altitude of 50,000 feet without the aid of pressure garments. At cabin altitudes below approximately 11,000 feet, oxygen is delivered at cabin pressure; above this altitude and up to 40,000 feet, oxygen is delivered at a slight safety pressure to ensure that any mask leakage is outward. Between 40,000 and 50,000 feet, after depressurisation, pressure oxygen is delivered to maintain an adequate level of oxygen in the lungs to enable a safe descent to be made to a more normal environment.

Mk 17F Regulator

47. The Mk 17F pressure demand regulator has the following controls and indicators:

a. *ON/OFF Cock.* An OXYGEN SUPPLY—ON/OFF cock, wired to ON, controls the flow of oxygen entering the regulator.

b. *Pressure Gauge.* A pressure gauge, in the centre of the regulator panel, indicates the input pressure to the regulator. When the OXYGEN SUPPLY cock is ON, the gauge normally indicates 150 to 215 PSI but may increase to 270 PSI following a high demand.

c. *Flow Indication.* The OXYGEN FLOW INDICATOR is an MI which shows a white vertical bar when oxygen is being drawn from the regulator on breathing in, and black when no flow is taken on breathing out or if there is no electrical supply to the regulator. A repeater MI, marked OXY FLOW, is positioned on the upper left coaming.

d. *Air Mix.* The NORMAL OXYGEN/100% OXYGEN switch, in the NORMAL position, conserves oxygen at low cabin altitudes by mixing air and oxygen in appropriate quantities, but makes recognition of low oxygen delivery difficult. With the switch at 100% OXYGEN, neat oxygen is delivered to the mask. Above a cabin altitude of 32,000 feet, 100% oxygen is supplied irrespective of the switch position.

e. *Test Button.* A button marked EMERGENCY —PRESS TO TEST MASK is used to test delivery pressures to the mask. Moving the button to the left or right delivers oxygen at approximately safety pressure up to 11,000 feet cabin altitude and at double safety pressure above this height. Pressing the button down allows a pressure test of the oxygen mask (with the mask toggle down).

Contents Indication

48. Liquid oxygen (LOX) is stored within the inner shell of a double-walled container. The inner shell and a perforated gauging shell form the two plates of a variable capacitor in a capacitance bridge to measure the level of LOX. The capacitance is converted by a gauge control unit to give a reading on the contents gauge.

49. The contents gauge is calibrated in fractions of tank capacity from 0 (zero) to F (full). The dial has two sectors which are failure arcs. When energised, the pointer reads between 0 and F depending on the contents. If the pointer remains in the red arc below 0, a power failure is indicated; if the pointer moves towards or into the arc above F, a capacitance gauging failure has occurred.

OXY Caption

50. The OXY caption on the SWP is triggered by a low pressure switch in the oxygen delivery line to the regulator when the pressure drops below 125 to 128 PSI.

Oxygen Masks

51. The Mk 17F regulator is only to be used with a type P or Q oxygen mask; other types of mask are not compatible, even at low altitudes. The masks have a harness toggle system which, when moved down, tightens the mask-to-face fit to allow pressure breathing without leaks round the sides of the masks.

Limitations

52. The protection afforded by the Mk 17F regulator and P or Q mask is subject to a limitation of 50,000 feet, provided descent is initiated within 30 seconds of depressurisation and a cabin altitude of 40,000 feet is attained within two minutes.

Note: If the canopy is lost, aerodynamic suck causes the cabin altitude to exceed aircraft altitude by up to 8000 feet.

Power Supplies

53. The two MI and the contents gauge are powered by the main 28V DC busbar.

Emergency Oxygen

54. The emergency oxygen system has a gaseous oxygen storage bottle fitted to the back of the ejection seat which feeds its supply through an emergency oxygen demand regulator to the rear of the seat portion of the PEC and thence into the oxygen mask tube. Emergency oxygen is selected manually by pulling the emergency oxygen knob, or automatically on ejection as the seat rides up the rails. When the pilot separates from the seat after ejection, the separation of the man

and seat portions of the PEC breaks the emergency oxygen supply and allows air to be breathed at ambient pressure.

55. The emergency oxygen demand regulator controls and regulates the delivery of oxygen to the pilot according to altitude. A pressure/contents gauge is fitted to the right rear of the ejection seat; the reading on the gauge should be in the white sector before flight.

MANAGEMENT OF THE SYSTEM

General

56. During the **Ejection Seat Checks** ensure that the emergency oxygen contents gauge pointer is in the white sector. Check that the OXYGEN SUPPLY cock is wired to ON.

Pre-Flight Checks

Note: Comprehensive checks of all personal equipment should be carried out on a Godfrey Test Cabinet with the assistance of a safety equipment worker, prior to flight. The following checks verify the serviceability of the aircraft equipment.

57. During the **Internal Checks:**

a. Check that the contents gauge shows sufficient oxygen is available.

b. Check that the OXYGEN SUPPLY cock is ON and wired.

c. Check that the pressure gauge indicates between 150 and 215 PSI.

d. Set the air mix control to NORMAL.

e. Check that the oxygen flow indicator and the OXY FLOW MI both annunciate during breathing.

f. Deflect the EMERGENCY — PRESS TO TEST MASK button sideways (left or right) and check that increased safety pressure is felt. Check the flow indicators show black when the breath is held. Move the mask harness toggle down and press the button: oxygen is fed to the mask under pressure; hold the breath and again check that the flow indicators show black. Return both mask toggle and button to their normal positions.

MALFUNCTIONS OF THE SYSTEM

58. The drills for pressurisation failure, toxic fumes in the cockpit, suspected hypoxia and oxygen equipment malfunctions are given in the FRC.

OXYGEN SYSTEM—T MK 5

CONTROLS AND INDICATORS

59. The controls and indicators for the oxygen system in the T Mk 5 are listed in Table 1. A schematic diagram of the T Mk 5 oxygen system is at Fig 3.

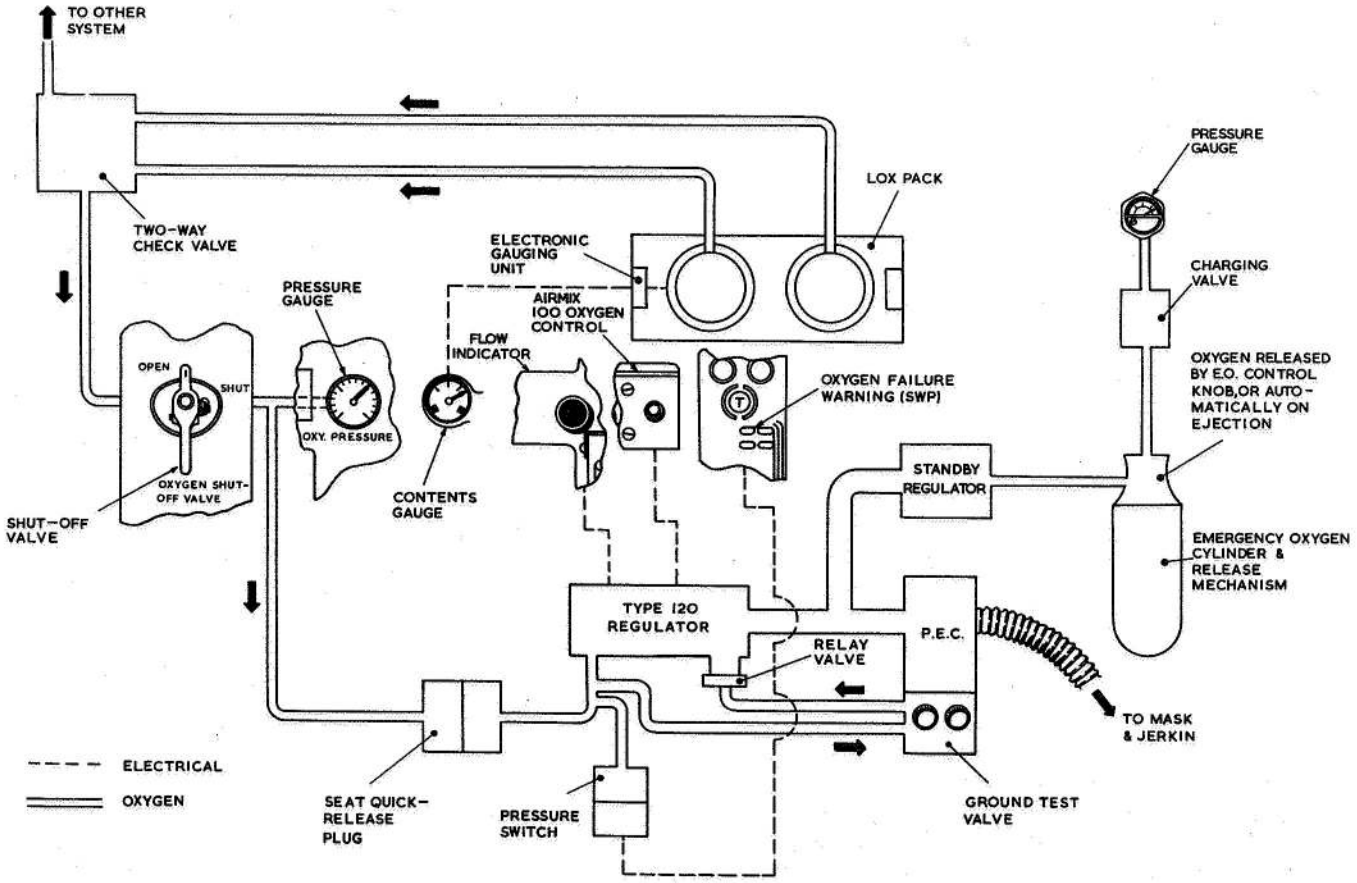
DESCRIPTION OF THE SYSTEM

General

60. In the T Mk 5 there are two separate main oxygen systems and two emergency oxygen systems. In the main systems, two 3·5 litre liquid oxygen (LOX) containers and their associated evaporators and stabilising systems are housed in the main equipment bay behind the cockpit aft pressure bulkhead. Gaseous oxygen is fed to the cockpit through the bulkhead to

Table 1—Controls and Indicators

Item	*Location*	*Markings*	*Remarks*
Contents gauges (2)	Panel A5		—
Shut-off valves (2)	a. Panel A2 extension b. Panel A6	OXYGEN SHUT OFF VALVE—OPEN/SHUT	—
Pressure gauges (2)	Panel A1	OXY PRESSURE	—
Flow indicators (2)	a. Panel A1 left b. Panel A1 right	OXY FLOW	—
Warning captions (2)	SWP	OXY 1/OXY 2	—
Airmix controls (2)	a. Left shroud b. Right shroud	PULL OXYGEN 100% AIRMIX PUSH	Integral light
Emergency oxygen knobs (2)	Right front of each seat pan	—	Black and yellow striped
Test buttons (2 for each)	Front of each PEC	—	One button guarded



1—12 Fig 3 — Oxygen System Schematic—T Mk 5

two Type 120 regulators mounted on the right side of each ejection seat whence oxygen is fed to the pilots via their PEC. A type P or Q mask is used.

61. Each main oxygen system provides normal protection against hypoxia at cabin altitudes up to 40,000 feet and affords pilots 'get down' protection from a maximum altitude of 43,000 feet without the aid of a pressure jerkin. At cabin altitudes below approximately 14,000 feet, oxygen is delivered at cabin pressure; above that altitude and up to 40,000 feet, oxygen is delivered at a slight safety pressure to ensure any mask leakage is outward. Between 40,000 feet and the limiting altitude without a pressure jerkin of 43,000 feet, oxygen is delivered under pressure to maintain an adequate level of oxygen in the lungs to enable a safe descent to be made to a more normal environment.

Two-Way Valve

62. The supply to each main system and its associated regulator passes through a two-way check valve which links the two systems. In the event of one system failing, the valve operates automatically to supply both regulators from the serviceable system; it also prevents leakage from the serviceable to the failed system.

63. In some circumstances it is possible for both crew members to be supplied from one system until it is empty and then from the other system, or be

supplied from each system alternately rather than simultaneously. This may be caused either by pressure difference between the two systems greater than 10 PSI, or by a pressure drop in a system during manoeuvring flight if the system is not fully stabilised. In these conditions no action is necessary since the oxygen from both systems is available provided all other indications are normal.

Main Oxygen Equipment

64. The Type 120 pressure demand regulators and their associated cockpit equipment have the following controls and indicators:

a. *Shut-Off Valves.* Two isolating valves, one for each system, are controlled by two switches marked OXYGEN SHUT OFF VALVE; they are held in the OPEN position by spring-loaded safety flaps. Each control enables the supply to its associated regulator to be turned off when SHUT is selected. Thereafter only emergency oxygen is available to that crew position, the shut-off valve being downstream of the two-way valve. The controls are always set to SHUT on the ground unless DC power is available, otherwise leakage of oxygen under safety pressure occurs.

b. *Pressure Gauges.* In each system, a tapping downstream of the two-way valve and shut-off valve leads to an OXY PRESSURE gauge. When the OXYGEN SHUT OFF VALVE is OPEN, each gauge normally reads 60 to 100 PSI when static or 50 to 100 PSI when working; a gauge may read up to 115 PSI for a short period following a high demand.

c. *Flow Indications.* Two diaphragm-operated microswitches in the regulators control two remote OXY FLOW MI on the left and right side of panel A1 which correspond to the left and right seat systems. Each MI shows a white vertical bar when oxygen is being drawn from the regulator, and black when no flow is taken on breathing out. The MI also shows black after electrical power failure.

d. *Oxygen Warning Captions.* Another tapping between each shut-off valve and regulator serves a pressure-operated switch. The switch makes if supply pressure falls below approximately 50 PSI, bringing on the appropriate OXY 1 or OXY 2 caption on the SWP, the warnings corresponding to the left and right systems respectively.

e. *Air Mix.* Two air dilution controls, one each for each system, are both marked PULL OXYGEN 100%/AIRMIX PUSH. When pushed in to the AIRMIX position, oxygen is conserved at low cabin altitudes by mixing air and oxygen in appropriate quantities, but recognition of low oxygen delivery is difficult. With the switch pulled out to the OXYGEN 100% position, neat oxygen is delivered and an integral light in the control comes on. Above a cabin altitude of 34,000 feet or after an electrical failure, 100% oxygen is delivered irrespective of the position of this switch.

f. *Test Buttons.* A tapping from each main supply to the regulator is fed to a ground test valve, with two buttons, fitted at the forward end of each PEC. The unguarded button is used for normal mask leak testing; the guarded button was used for testing when a pressure jerkin was worn, both buttons being pressed for a jerkin test.

Contents Indications

65. The method used in each LOX system to determine oxygen contents is described in para 48. In the T Mk 5, two contents indicators on panel A5 are calibrated in fractions of tank capacity from 0 (zero) to F (full). The dial has two sectors which are failure arcs. When energised, the pointers read between 0 and F depending on the contents of each system. If a pointer moves towards or into the arc above F, a capacitance gauging failure has occurred; if a pointer remains in the red arc below 0, a power failure is indicated.

Oxygen Masks

66. The Type 120 regulator is only to be used with a P or Q mask; other types of mask are not compatible, even at low altitudes. The masks have a harness toggle system which, when moved down, tightens the mask-to-face fit to allow pressure breathing without leaks round the sides of the masks.

Limitations

67. The protection afforded by the Type 120 regulator and P or Q mask is subject to a limitation of 43,000 feet, provided descent is initiated within 30 seconds of depressurisation and a cabin altitude of 40,000 feet is attained within two minutes. At cabin altitudes above 43,000 feet the pressure delivered by the regulator is too great for the lungs without a pressure jerkin to compensate for the high pressure.

Note: If the canopy is lost, aerodynamic suck causes the cabin altitude to exceed aircraft altitude by up to 11,000 feet.

Power Supplies

68. The oxygen contents gauges, flow indications, failure captions and the airmix valves are all powered from the 28V DC busbar.

Emergency Oxygen

69. The two separate emergency oxygen systems in the T Mk 5 are each identical to that described for the F Mk 3 and F Mk 6 in para 54 and 55.

MANAGEMENT OF THE SYSTEM

Pre-Flight Checks

Note: Comprehensive checks of all personal equipment should be carried out on a Godfrey Test Cabinet with the assistance of a safety equipment worker prior to flight. The following checks verify the serviceability of the aircraft equipment.

70. During the **Ejection Seat Checks** ensure that the emergency oxygen contents gauge pointers are in the white sectors.

71. During the **Internal Checks:**

a. Check that the contents gauges show sufficient oxygen is available.

b. Select both OXYGEN SHUT OFF VALVE switches to OPEN and guarded, and check that the OXY 1 and OXY 2 captions go out.

c. Check the pressure gauges indicate between 60 and 100 PSI.

d. Set the airmix controls to the AIRMIX position (in) and check the integral lights are out.

e. Check that both OXY FLOW indicators annunciate during breathing.

f. Press the unguarded test button and check that an increase in safety pressure is felt in the mask. Check that the flow indications show black when the breath is held.

MALFUNCTIONS OF THE SYSTEM

72. The drills for pressurisation failure, toxic fumes in the cockpit, suspected hypoxia and oxygen equipment malfunctions are given in FRC.

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