

PART 1

Chapter 8 — AIRCREW EQUIPMENT
ASSEMBLY AND OXYGEN SYSTEM

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WARNING: The aircraft is 'safe for parking' when safety pins are inserted in:

- Both face-screen firing handles
- Both seat-pan firing handles
- The canopy jettison firing unit sear
- Both guillotine firing units

1 General

The aircrew equipment assembly (AEA) consists of the two ejection seats, the flying and survival clothing and associated equipment including oxygen connections.

Ejection Seat

2 Ejection seat type 4HA

(a) *General*

Each seat has a combined safety and parachute harness which is fastened by a single quick-release box (QRB). A back-type B Mk 41 parachute pack of the horse-shoe type is fitted. The pack is secured by two restraining straps which are attached to the headrest cushion. The seat well accommodates a personal survival pack type R containing a life-raft and seat cushion. Two leg restraint cords are fitted at the front of the seat pan. An emergency oxygen bottle is fitted at the rear of the seat pan. A negative G strap with a downward-pull tightening action, is fitted. The seat height may be adjusted by a lever on the starboard side of the seat. A lean-forward facility is controlled by a lever on the port side of the seat pan. To assist in manual separation from the seat, a guillotine unit is fitted.

(b) *Combined harness quick-release box*

The quick-release box, when fastened, secures the occupant to the seat. The box must not be operated when carrying out manual separation after ejection since this will free the occupant from both seat and parachute.

(c) *Ejection gun and firing handles*

(i) An 80 ft/second ejection gun is fitted. The ejection gun is fired by pulling either the face-screen firing handle or the seat-pan firing handle attached to the forward edge of the seat pan between the pilot's legs. When either firing handle is operated, the canopy is jettisoned immediately by gas pressure from the canopy jettison cartridge; at the same time the seat is withdrawn from the time delay firing unit of the seat. The mechanism runs for 0.5 second at the end of which time the seat cartridge is fired and ejection takes place. If conditions necessitate using the seat-pan firing handle, the pilot must sit firmly in the seat and press his head firmly against the headrest to minimise the risk of spinal injury on ejection. *Leave the feet on the rudder pedals*; drawing the feet back could lead to injury. As no face protection is available the visor should be lowered and the eyes tightly closed when using this handle.

(ii) All leads incorporate quick releases which are automatically broken on ejection.

(iii) After a further 0.5 second the drogue gun fires deploying two drogues to stabilise and retard the seat which falls in a near vertical attitude.

(d) *Barostat/G-stop time delay*

(i) After ejection, at heights of 10000 feet and below, a barostat causes an automatic cycle to commence. After $1\frac{1}{4}$ seconds if the G-stop has not operated (see (ii) below) the safety harness is released, as are the firing handle, face screen and headrest pad. The drogues, which are attached to the parachute withdrawal line, are freed from the seat by the action of the barostatic time release unit and withdraw the parachute from its pack.

(ii) A G-stop is incorporated to prevent the opening of the main parachute if the speed of the seat after ejection is too high for safe deployment. The stop prevents the operation of the barostatic time release unit until the speed of the seat has fallen to a safe figure. The seat has a ground level ejection capability provided that the aircraft's flight path is parallel to the ground and the speed is a minimum of 90 knots. If the aircraft is descending or nose-down, more than the minimum altitude will be required.

(e) *Manual separation handle and guillotine unit*

(i) A handle at the port side of the seat pan, when pulled up, releases the combined harness from its three attachment points and releases the leg restraint cords. To prevent the immediate deployment of the parachute as the pilot leaves the seat the parachute withdrawal line is severed by the guillotine unit. The guillotine is fired by a static line attached to the rear of the parachute pack. During an automatic separation the withdrawal line is pulled out of the guillotine unit by the drogues before the guillotine is fired.

(ii) A thumb-operated catch on the handle must first be pressed before the handle can be pulled up.

(iii) The guillotine unit is positioned on the port side of the seat forward of the drogue gun and incorporates a sear safety pin for use when servicing.

(iv) After separating from the seat the parachute is deployed by pulling the rip-cord D ring.

(f) *Leg restraint cords*

(i) The leg restraint cords ensure that the occupant's legs are drawn back automatically and restrained close to the seat pan during ejection, keeping them clear of the aircraft and preventing them from flailing when exposed to the airstream. The lower ends of the cords are attached to the aircraft structure by shear pins; they then pass through snubbing units on the front of the seat pan, through D-rings of the leg restraint garters and plug into locking units on the forward face of the seat pan.

(ii) The snubbing units allow the cords to pass freely *down* through the units but prevent them passing upwards. Adjusting rings below the snubbing units allow the occupant to adjust the cords to give sufficient leg movement for application of full rudder.

(iii) The cords are released from the locking units by operation of the release lever on the starboard side of the seat pan or the manual separation handle on the port side of the seat pan. They are released automatically as part of the automatic sequence following ejection from the aircraft.

(g) *Lean-forward harness release*

The inertia-reel lean-forward harness release is controlled by a lever on the port side of the seat. With the lever in the rear position the harness is locked. When the lever is moved fully forward and then allowed to return to the central position, the pilot can lean forward or backward as desired; with the lever thus set, in the event of a crash landing or if an ejection is made, an inertia mechanism locks the harness in whatever position it happens to be at the time.

(h) *Harness restraint apron*

An apron, stowed in a box in the nosewheel bay when the aircraft is being flown dual, secures the instructor's seat harness, PSP and parachute pack when the aircraft is being flown solo. It does not secure the leg restraint cords.

Anti-G Suit System

3 Anti-G suit system

(a) The purpose of the system is to provide air at low pressure for the pilots' anti-G suits, the connections for which are on the port sides of the ejection seats.

(b) Air under pressure is stored in four air bottles, the pressure in which is indicated by a pressure gauge on the starboard shelf, provided the ON/OFF cock between the seats is on. When the cock is on and G in excess of approximately $1\frac{1}{2}$ is applied, a spring-loaded valve operates and allows air to pass to and inflate the anti-G suits. The amount of inflation depends on the amount of G applied.

(c) The system may be tested, with the cock on, by pressing the ANTI-G TEST button adjacent to the on/off cock, as gently as possible to avoid severe discomfort due to too rapid inflation. A second test button on the starboard shelf is provided for the instructor's use.

Oxygen System

4 Oxygen system — general

(a) Oxygen is carried in four Mk 5D cylinders. A Mk 17E demand regulator on the centre panel and another on the starboard shelf control the supply to each pilot. A contents gauge above the centre panel regulator, gives an indication of pressure in the cylinders, but is calibrated in fractions of full contents.

(b) The oxygen mask is connected into the system by an inlet warning connector, which permits easy breathing only when fully connected. At other times it offers resistance to inhalation.

5 Regulators

(a) Each regulator has an ON/OFF valve which controls the flow of oxygen, an air inlet NORMAL/100% OXYGEN switch, an EMERGENCY three-position switch and a magnetic indicator which shows black when oxygen is not being used or when electrical power is not available and a vertical white line when oxygen is being demanded. A duplicate indicator for the instructor is on the starboard instrument panel.

(b) When the on/off valve is on and the inlet switch is at NORMAL, an air/oxygen mixture is fed to the pilot's mask, up to 30000 feet cockpit altitude at which height 100% oxygen is automatically delivered. When the inlet switch is at 100% OXYGEN, no air is added, irrespective of the height. Except in emergency, NORMAL should always be

used. The emergency switch when moved right or left, admits oxygen under greater pressure.

(c) The mask may be tested before flight by firmly pressing in the emergency switch, when in the central position. Oxygen is then supplied under pressure; the firmer the switch is pressed the greater the pressure (up to 5 times that obtained with the switch in either side position). The mask can then be adjusted until there are no leaks.

(d) To check for leaks in the system from the regulator to the mask, deflect the emergency switch; the flow magnetic indicator should show black when the breath is held.

(e) The regulator pressure gauge measures the pressure between the cylinders and the regulator and should normally read between 250 and 400 PSI when the regulator is switched on.

NOTE: The maximum safe cockpit altitude with Mk 17 regulators is 50000 feet. If the canopy is lost, aerodynamic suck will cause the cockpit altitude to exceed the aircraft altitude by up to 8000 feet. For this reason the maximum safe operating altitude is 42000 feet.

6 Emergency bottles

(a) A manual control on the front of each seat pan is pulled up to turn on the emergency oxygen bottle (provided that the safety pin on the emergency bottle is withdrawn) in conditions where ejection is not contemplated. The emergency oxygen is automatically turned on at ejection.

(b) The bottle is attached to the seat and is not, therefore, available to the occupant after separation.

Emergency use of the Oxygen System

7 Fumes

If the cockpit becomes contaminated with fumes, set the air inlet switch on the regulator to 100% OXYGEN and deflect the EMERGENCY switch to either side, to prevent inward leaks at the mask. Descend to below 35000 feet ASL and depressurise.

8 Regulator indicator failure

(a) If the magnetic indicator ceases to operate, check that the main hose is correctly connected and set the air inlet switch to 100% OXYGEN. If it is impossible to breathe in freely, the regulator is faulty (see para 9).

(b) If breathing is normal check that the pressure on the regulator gauge is fluctuating when breathing in and that the main oxygen contents gauge is indicating that oxygen is still available.

(c) If the above indications are satisfactory depress the regulator EMERGENCY switch, when in the central position. A supply of oxygen under increased pressure indicates that the regulator is serviceable but that the indicator is defective.

9 Regulator failure

If the regulator is unserviceable, as indicated by no flow, operate the emergency bottle and descend immediately to an altitude where oxygen is not required (corresponding to a cockpit altitude not above 10000 feet) and return to base.

10 Use of the emergency bottle

(a) If it is necessary to use the emergency oxygen bottle through failure of the regulator or because of exhaustion of the main supply, pull up the emergency control on the front of the seat-pan and disconnect the mask hose from the main supply point.

(b) The duration of supply from the emergency bottle is 8 to 10 minutes only: the descent to 10000 feet cockpit altitude must therefore be completed within this time. When the bottle is empty, breathing becomes difficult and the mask should be slackened or removed.

(c) On ejection, the main supply hose is automatically released and the emergency bottle is brought into use. In all high altitude ejections the supply is adequate until 10000 feet is reached and separation occurs. The bottle remains with the seat and the emergency oxygen tube connection to the pilot is automatically broken. The pilot then breathes air through the inlet warning connector against the warning back pressure which it produces. To overcome this difficulty, *and always when descending into water*, the oxygen mask should be removed.

Use of the Aircrew Equipment Assembly

11 Strapping-in procedure

(a) Ensure that the safety pins have been removed from the ejection gun sear, canopy jettison sear and guillotine sear and that safety pins are fitted through the face-screen and seat-pan firing handles. Ensure that the parachute withdrawal line is held under the guillotine flap. If the aircraft is being flown solo ensure that the harness restraint apron is fitted to the unoccupied seat.

(b) Check that the face-screen firing handle cable is connected to the canopy jettison cross shaft and to the time-delay firing unit sear. Check that the ring of the seat-pan firing cable is threaded over the cable to the time-delay firing unit sear.

(c) Check that the drogue withdrawal line is routed over all other lines and is connected to the top of the drogue gun piston by shackle pin. Check that the scissor shackle is closed and flat. Check that the drogue gun and time release mechanism trip rods are connected to their brackets and that the drogue gun safety pin is removed.

(d) Check that the centre pin of the top latch plunger is flush with the latch housing.

(e) Grasp each leg strap and shoulder strap in turn and tug smartly to check for security. Check that the emergency oxygen control has not been pulled.

(f) Sit in the seat and adjust its height to approximately the mid position.

(g) Connect the PSP lowering line to the life preserver ensuring that the line passes outside the left leg.

(h) Pass the left-hand leg restraint cord through the right leg garter D-ring and plug it into the socket above the left-hand snubbing unit. Pass the right-hand leg restraint cord through the left leg garter D-ring, ensuring that it does not pass through the loop formed by the left-hand cord, and plug it into the socket above the right-hand snubbing unit. Pull sharply on each cord to check that it is locked securely.

(i) Adjust the leg restraint cords in the snubbing units to give freedom for application of full rudder.

- (j) Connect the anti-G suit air supply hose to the suit.
- (k) Adjust the back pad and lumbar cushion to the most comfortable position.
- (l) Bring the negative G strap up, ensuring that it does not pass through the seat-pan firing handle. Pass the lap strap lugs through the looped ends of the negative G strap and insert the lugs into the QRB. Tighten the lap straps as much as possible and then tighten the negative G strap.
- (m) Pass the left leg loop upwards over the inside of the thigh and through the D-ring on the left lap strap (from the inside of the ring towards the outside of the leg). Bring the end of the leg loop over towards the quick release box 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 quick-release box. Snug the loop over the lug. Repeat these operations with the right leg loop and shoulder strap.
- (n) Ensure that the shoulder straps pass under the folds of the life preserver. Tighten the inner (blue) straps and then the outer (khaki) straps. The shoulder straps should not be over tightened as this may lead to an arched back and possible spinal injury during ejection.
- (o) Move the lean-forward lever to the forward position and allow it to return to the central position; check full freedom of movement. Move the lever to the rear position, lean back, and check that the harness is locked.
- (p) Put on helmet, fasten chin strap and fit the oxygen mask. Connect the oxygen mask to the main supply hose ensuring that the hose is outside the harness. Connect the mask hose clip to the D ring on the life preserver.
- (q) Pass the emergency oxygen tube between the body and the main oxygen hose, pass it under the right shoulder strap and connect it to the mask hose.
- (r) Connect the mic/tel lead.
- (s) Check that the face-screen firing handle can be reached with both hands together.

(t) Remove and stow the seat-pan firing handle safety pin and have the face-screen firing handle safety pin removed and stowed by the ground crew.

NOTE: If a ground crew member is not available, the pilot must remove and stow the face screen safety pin prior to strapping-in.

12 Normal exit procedure

- (a) Have the aircraft made 'safe for parking'.
- (b) Disconnect the main oxygen hose and emergency oxygen tube from the oxygen mask hose.
- (c) Operate the QRB, free the straps and then lock the QRB.
- (d) Free the leg restraint cords by operating the lever on the starboard side of the seat.
- (e) Disconnect the anti-G hose and fit the blanking plug.
- (f) Disconnect the PSP lowering line from the life preserver.
- (g) Disconnect the mic-tel lead.

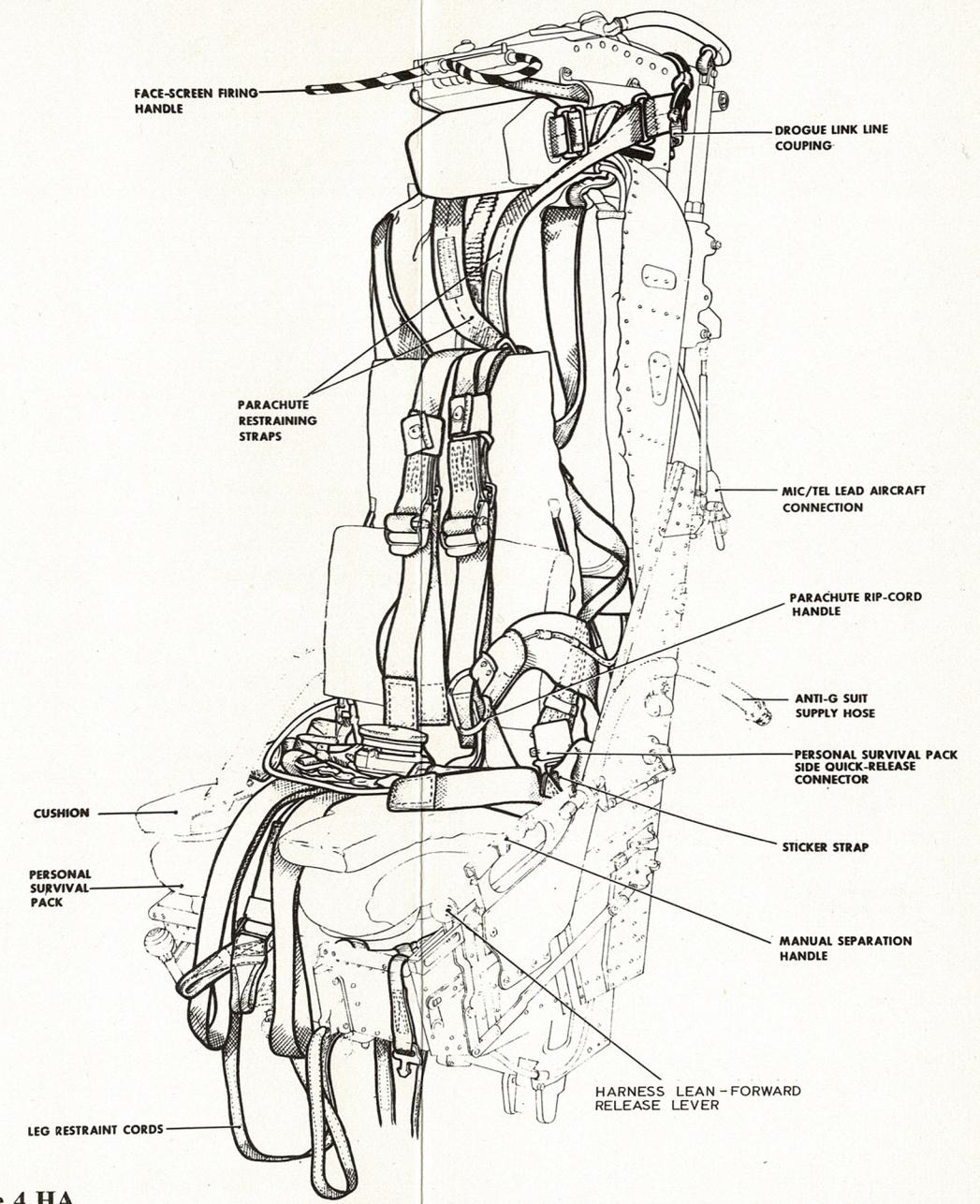
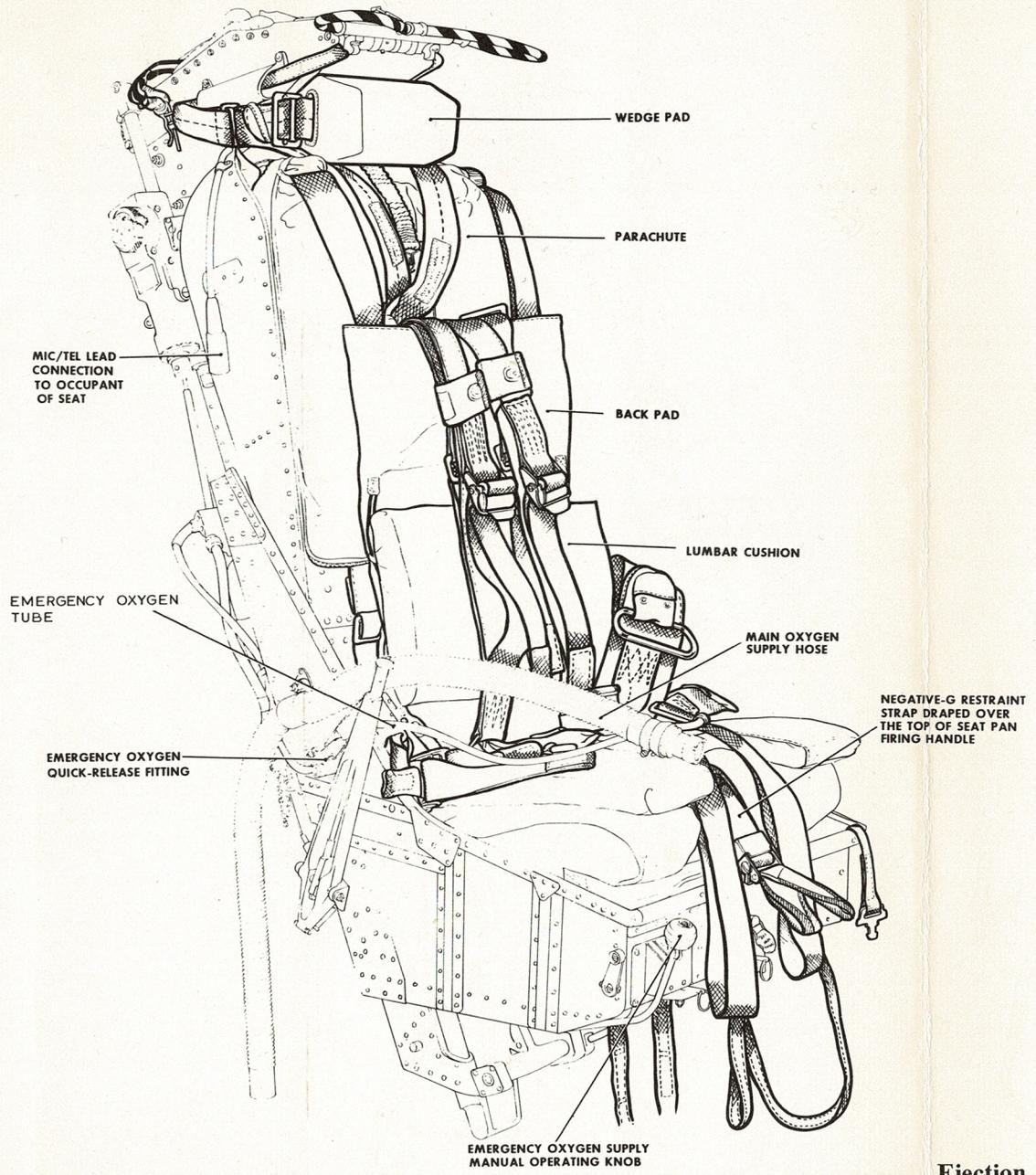
13 Forced landing

If it has been decided not to eject, or if the seat has failed to operate and manual bale-out is considered inadvisable the following actions should be taken prior to landing.

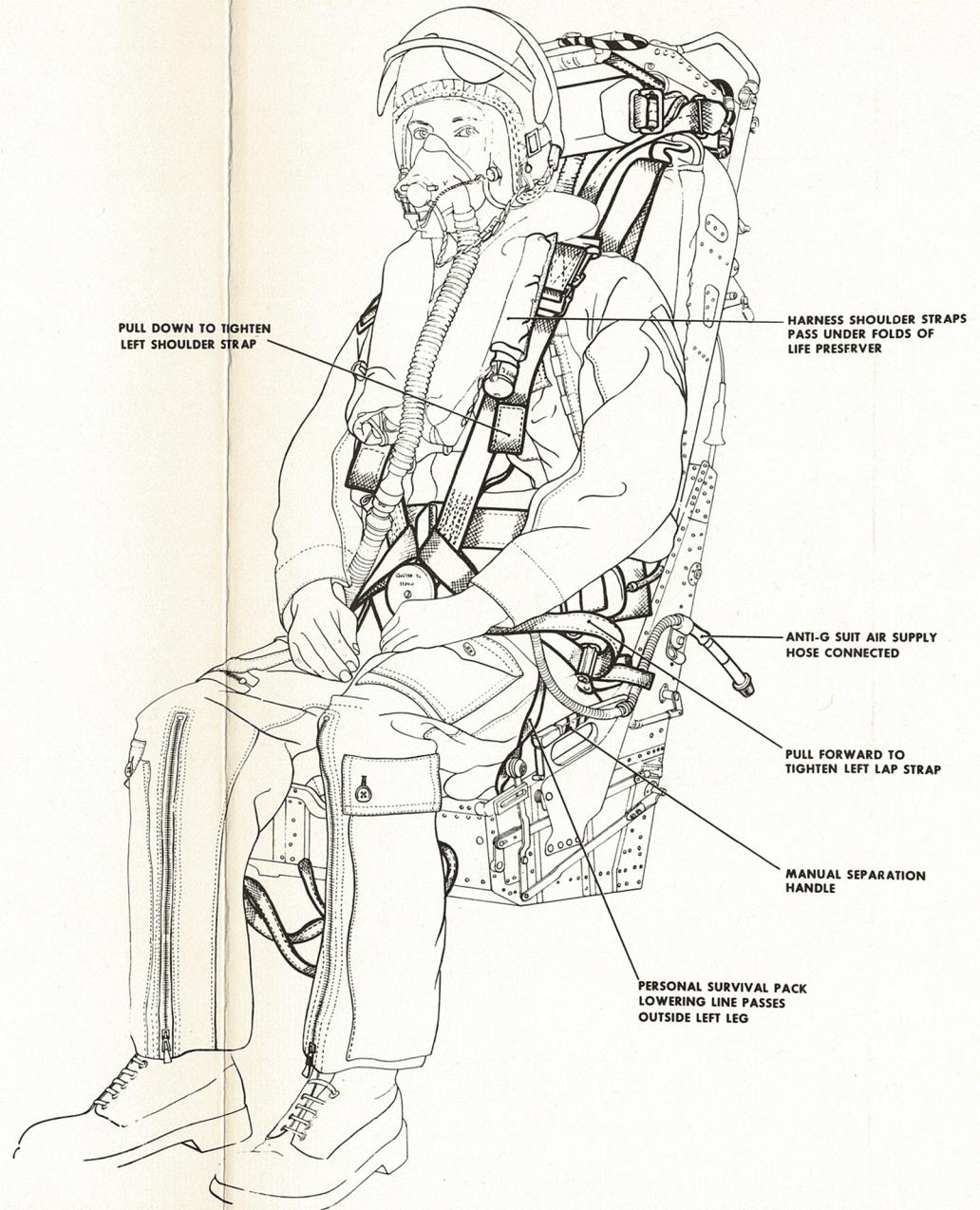
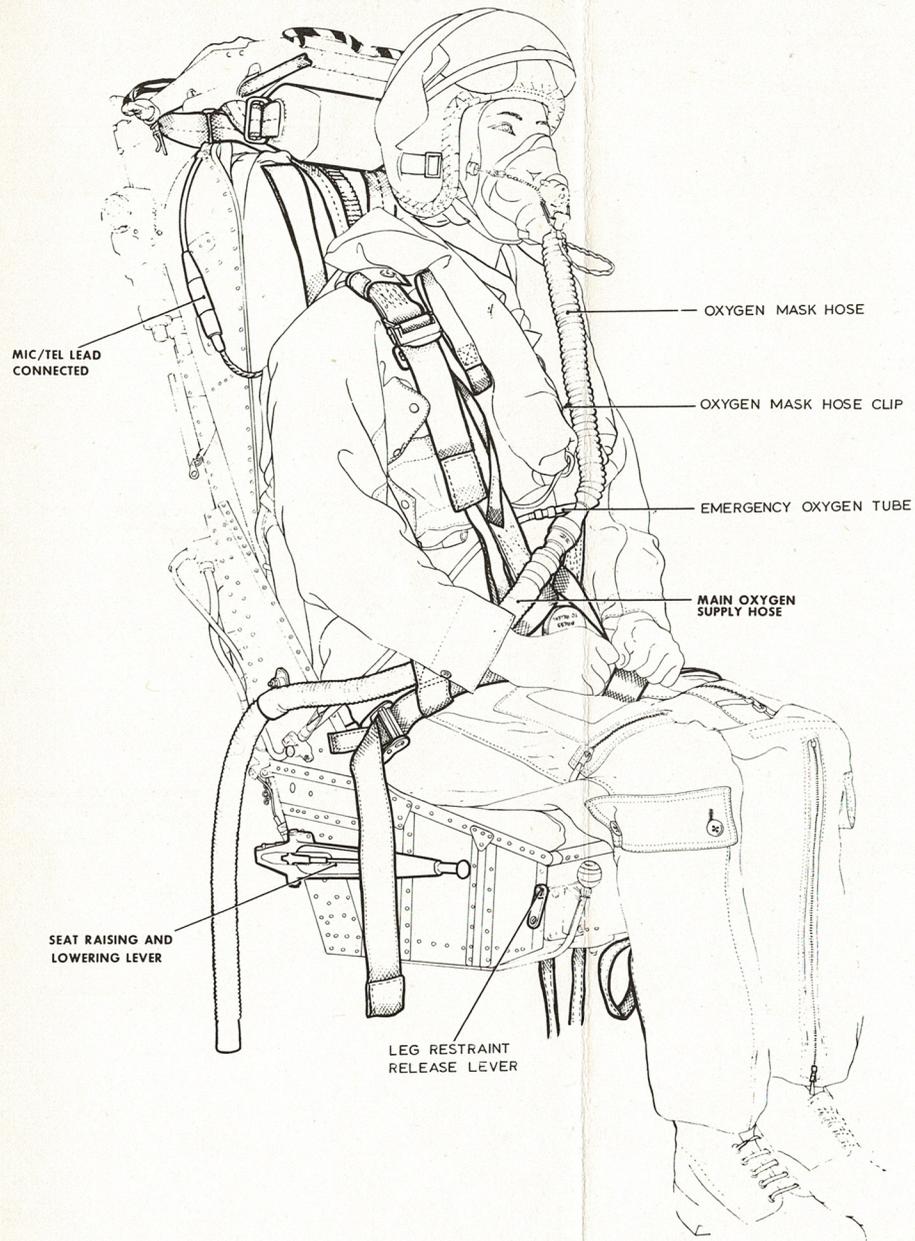
- (a) Disconnect the PSP from the life preserver.
- (b) Disconnect the emergency oxygen tube, below 10000 feet.
- (c) Disconnect the anti-G suit hose.
- (d) Disconnect the leg restraint.
- (e) Lean back and ensure that the safety harness is locked in the rear position. Re-tighten safety straps as necessary.
- (f) After landing, disconnect the main oxygen hose, release the combined harness and leave the aircraft as soon as possible.
- (g) After a reasonable time, if there are no signs of fire, return and make the aircraft 'safe for parking'.

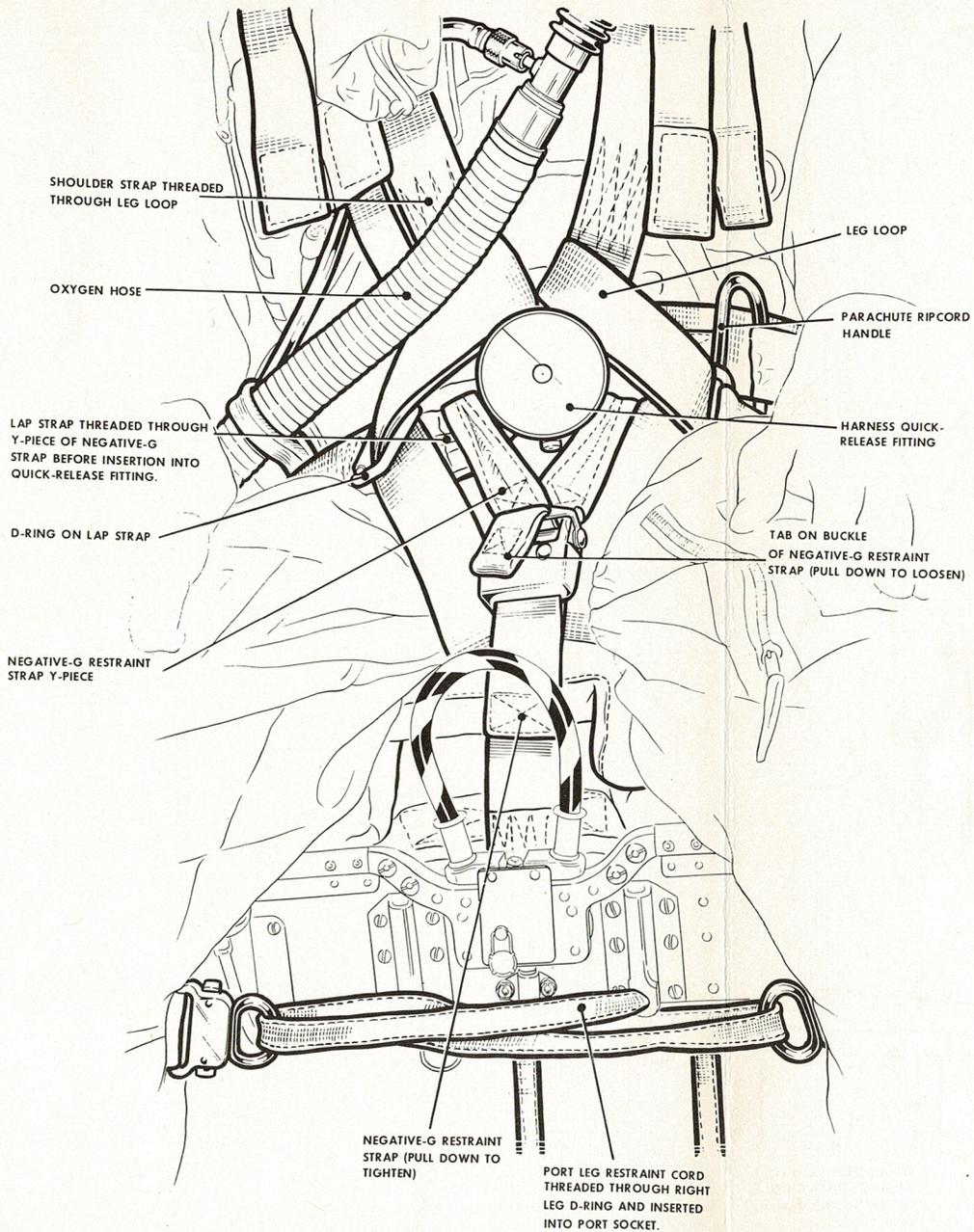
14 Abandoning and ditching

These are fully covered in Part 4, Emergency Procedures. (See Part 4, Chapter 3.)



Ejection Seat Type 4 HA





Combined Harness and Leg Restraint

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