

RESTRICTED

PART 1 : SECTION 5

CHAPTER 5

EJECTION SEAT EQUIPMENT

DESCRIPTION

Introduction

1. Escape from disabled aircraft has become more difficult as the speeds of aircraft have increased, and as the needs of survival have demanded the carrying of bulky personal equipment. The principle has therefore been adopted of ejecting a pilot or other crew member together with his seat, parachute, and survival equipment. The ejection seat is operated by a cartridge-fired gun. On ejection the seat structure slides on four rollers in a guide rail bolted to the aircraft structure, and is propelled by the gun which is located within the hollow guide rail. The rail is so inclined that the occupant clears all obstructions during ejection, which is initiated by the seat occupant pulling a blind down over his face. The tendency for the seat to rotate after ejection is reduced by fitting a drogue which steadies the seat before the parachute is opened.

Types of Ejection Seats

2. There are three types of ejection seats : Mk. 1, Mk. 2, and Mk. 3.

(a) The Mk. 1 seat is so equipped that upon ejection the occupant is required to unfasten his seat harness, separate himself from the seat, and make a normal parachute descent by operating his parachute rip-cord. A standard ejection gun of 42-inch stroke, giving an ejection velocity of 60 ft. per sec., is used.

(b) The Mk. 2 seat provides for automatic separation from the seat and deployment of the parachute to cater for cases of battle injury, unconsciousness brought on by the effects of ejection at very high altitude, or the lack of time available when ejected at very low altitude. A standard or special ejection gun of 42-inch or 39-inch stroke, giving an ejection velocity of 60 or 50 ft. per sec. respectively, is used.

(c) The Mk. 3 seat is fitted with a square seat pan, and automatic leg-restraining gear takes the place of thigh-guards and footrests. A telescopic ejection gun of 72-inch stroke, giving an ejection velocity of 80 ft. per sec., is used.

3. The design features of various aircraft may necessitate slight modification to the seat details. A suffix letter is used to denote the aircraft type to which the seat is fitted, *e.g.* the suffix letter E on Mk. 2E indicates a Mk. 2 seat fitted in Meteor aircraft. The principal differences in detail between the various seats when fitted in different aircraft are shown in the following tables. Pilot's Notes for the type should also be studied, as only the major differences are given in the tables.

Seat Structure

4. The seat structure is a frame made of two side beams with cross members top and bottom. The drogue container is mounted at the top, providing attachment for the headrest pad, the firing handle, and stowage for the blind. The seat pan is supported on seat-raising levers attached to the bottom of the frame. The seat is raised or lowered by means of an adjusting handle, the weight of the occupant being counter-balanced by two compensating springs to ensure ease of adjustment in flight.

5. A container, hinged at its lower edge to brackets attached to the side beams, supports the parachute pack during flight and restrains it when an acceleration load is imposed during ejection. A lever, on the starboard side of the seat, controls forward and backward movement of the container, enabling the occupant to bring cockpit facilities within easy reach.

Ejection Gun

6. The ejection gun, located within the hollow guide rail, uses cartridges giving an ejection velocity of 50 ft./sec., 60 ft./sec., or 80 ft./sec., as required. One cartridge, known as the primary cartridge, is initiated by the firing mechanism, while the other secondary cartridges are ignited by the flame from the primary one. This occurs during the extension of the gun on ejection, as ports in the cylinder wall become exposed.

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TABLE 1
MARK 1 SEATS

After ejection, the occupant of the seat releases himself from it and makes a normal parachute descent.

<i>Aircraft</i>	<i>Type</i>	<i>Dinghy</i>	<i>Parachute</i>	<i>Life S. Waistcoat</i>	<i>Harness</i>	<i>Principal Differences</i>
Attacker ...	Mk. 1A	K Dinghy Pack Type J	Mk. 3A Back Type	Mk. 2 or Mk. 3	Z.D.	Seat-raising handle hinged.
Wyvern ...	Mk. 1B	K Dinghy Pack Type J	Mk. 3A Back Type	Mk. 2 or Mk. 3	Z.D.	Headrest tilted forward. Bungees fitted to seat pan to keep harness clear of aircraft equipment. Slots in thigh-guards for aircraft control-locking device. Clip embodied for sanitary tube. No footrests.
Canberra ...	Mk. 1C	K Dinghy Pack Type M in seat pan	Mk. 5 Seat Type	Mk. 2 or Mk. 3	Z.A.	Hinged starboard thigh-guard. Wedge-shaped headrest. Cable type harness release.
Sea Hawk ...	Mk. 1D	K Dinghy Pack Type J	Mk. 3A Back Type	Mk. 2 or Mk. 3	Z.D.	Retractable thigh-guards, automatically- and manually-operated. Mk. 1B type headrest.
Meteor (later types)	Mk. 1E	K Dinghy Pack Type J	Mk. 3A Back Type	Mk. 2 or Mk. 3	Z.D.	Fixed thigh-guards.
Venom ...	Mk. 1F	K Dinghy Pack Type J	Mk. 3A Back Type	Mk. 2 or Mk. 3	Z.D.	Ejection gun with one cartridge only. Special drogue gun. Smaller guide-rail. Headrest extended forward and firing handle tilted downwards. No footrests.

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EJECTION SEAT EQUIPMENT

TABLE 2
MARK 2 SEATS

Fully automatic facilities are provided to separate the occupant from the seat and to open his parachute after ejection.

<i>Aircraft</i>	<i>Type</i>	<i>Dinghy</i>	<i>Parachute</i>	<i>Life S. Waistcoat</i>	<i>Harness</i>	<i>Principal Differences</i>
Attacker ...	Mk. 2A	K Dinghy Pack Type J	Mk. 8A Back Type	Mk. 2 or Mk. 3	Z.F.	Mk. 1A seat modified by application of automatic conversion set.
Wyvern ...	Mk. 2B	K Dinghy Pack Type J	Mk. 8A Back Type	Mk. 2 or Mk. 3	Z.F.	Mk. 1B seat modified by application of automatic conversion set.
Sea Hawk ...	Mk. 2D	K Dinghy Pack Type J	Mk. 8A Back Type	Mk. 2 or Mk. 3	Z.F.	Mk. 1D seat modified by application of automatic conversion set.
Meteor ...	Mk. 2E	K Dinghy Pack Type J	Mk. 8 or Mk. 13 Back Type	Mk. 2 or Mk. 3	Z.F.	Fixed thigh-guards. Mk. 1E seat modified by application of automatic conversion set.
Venom ...	Mk. 2F	K Dinghy Pack Type J	Mk. 8 or Mk. 13 Back Type	Mk. 2 or Mk. 3	Z.F.	Mk. 1F seat modified by application of automatic conversion set.
Swift ...	Mk. 2G	K Dinghy Pack Type J	Mk. 8 or Mk. 13 Back Type	Mk. 2 or Mk. 3	Z.F.	Hinged seat-raising handle. Basically a Mk. 2A seat modified.
Hunter ...	Mk. 2H	K Dinghy Pack Type J	Mk. 8 or Mk. 13 Back Type	Mk. 2 or Mk. 3	Z.F.	Basically a Mk. 2E seat with a Mk. 1B headrest.

TABLE 3
MARK 3 SEATS

Fully automatic facilities are provided to separate the occupant from the seat and to open his parachute after ejection.

<i>Aircraft</i>	<i>Type</i>	<i>Dinghy</i>	<i>Parachute</i>	<i>Life S. Waistcoat</i>	<i>Harness</i>	<i>Principal Differences</i>
Valiant ...	Mk. 3A	O.R.856 ...	Mk. 9 Back Type	Mk. 3 or Mk. 4	Z.F.	Seat-raising handle hinged. Telescopic 80-ft./sec. ejection gun. Leg restraint by nylon cords and snubbing units.
Vulcan ...	Mk. 3K	O.R.856 ...	Mk. 9 Back Type	Mk. 3 or Mk. 4	Z.F.	Similar to Mk. 3A seat. Modified parachute container.
Victor ...	Mk. 3L	O.R.856 ...	Mk. 9 Back Type	Mk. 3 or Mk. 4	Z.F.	Similar to Mk. 3A seat.
Vampire T.11	Mk. 3B	O.R.856 ...	Mk. 9 Back Type	Mk. 3 or Mk. 4	Z.F.	Basically a modified Mk. 2F seat. Leg restraint by nylon cords and snubbing units.

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7. The gun is designed so that a high acceleration is reached comparatively gradually and, to avoid possible injury to the crew member owing to shock load, this high value of acceleration is maintained practically throughout the stroke of the gun.

Note: Safe ejection from aircraft such as the Venom, which has a twin-boom structure and low fins, is achieved with only one cartridge. The resulting ejection velocity of about 50 ft./sec. causes no adverse physiological effects. Aircraft such as the Valiant, with a high central fin, necessitate ejection velocities of about 80 ft./sec. To achieve this velocity without undesirable physiological effects, a telescopic ejection gun, using five cartridges, is necessary.

Firing Control

8. The ejection gun is fired by the pulling out of a horizontal red handle, situated immediately above the headrest, which draws a blind out of the headrest. The blind covers the crew member's face against the air stream and holds his head against the headrest to prevent it jerking forward on ejection. Attached to the blind is a cable which is connected to the sear in the firing body of the gun. A fabric strap attached to the front of the drogue container is passed through the firing handle and secured to two lugs by a spring safety pin to prevent inadvertent operation. A warning disc is attached to the pin. Before flight this pin must be withdrawn and stowed in its stowage on the seat. On completion of the flight the strap and safety pin must be replaced to lock the firing handle. In some aircraft the canopy will be jettisoned automatically by operation of the firing control of ejection seats.

Drogue Gun

9. A drogue gun, fitted to the side of the seat, fires a piston which pulls the drogue from its container and streams it well clear of the seat. It is fired on ejection by a spring-loaded firing pin which is released by the removal of a sear connected to a static line. The length of static line (24 ft.) in the Mk. 1 seat provides some delay before the gun is fired. In the Mk. 2 and 3 seats a short static line is used, the delay being provided by a time mechanism which operates the firing pin.

Drogue

10. The drogue is 2 ft. in diameter in the developed state and has a 7-inch diameter vent. Twelve nylon shroud lines are united 4 ft. from the edge of the canopy and are then plaited into a rope which is attached to a shackle on the top cross beam in Mk. 1 seats. In Mk. 2 and 3 seats,

this shackle engages with the scissor shackle (Fig. 1) on the top member of the seat structure. A nylon cord extends from the apex of the drogue to the drogue gun piston. The shroud lines and rope are stowed in the container behind the headrest and covered by four canvas flaps retained in position by a quick-release gun.

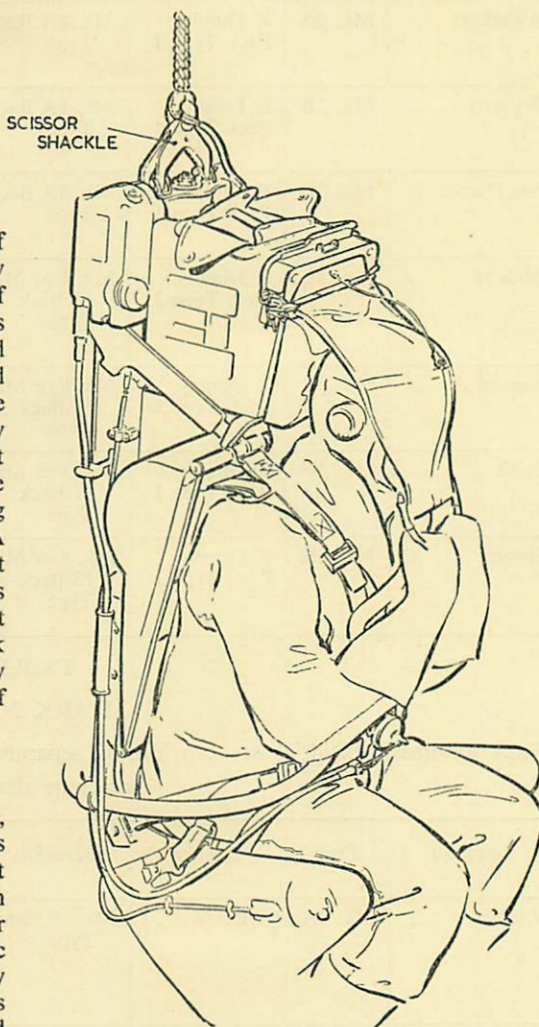


Fig. 1. Automatic Operation—First Stage

Apron (Mks. 2 and 3 Seats)

11. After ejection, the drogue initially stabilizes the seat; it is then freed from its shackle attachment at the top of the seat and then, through a

further attachment, straightens the apron (Figs. 2 and 3) to pitch the occupant forward out of the seat. A withdrawal line attached to the apron then opens his parachute. The apron is made of canvas; the upper end is attached to the headrest pad and the lower to two clips which secure it to the parachute container. After the occupant has left the seat and the apron has straightened, the weight of the seat frees the clips and the seat drops clear. Two lifting lines and the parachute withdrawal line, all of which are integral, are secured to the rear of the apron at the top, and the parachute withdrawal line emerges from a slot approximately in the centre. The lifting lines are attached to the drogue nylon rope by a shackle, thus forming a continuous line from the drogue gun connection to the parachute withdrawal line. Full instructions for securing the disconnect slide-pin at the end of this line are given in A.P.1182A, Vol. 1, Sect. 4. The emergency oxygen bottle is stowed in the dinghy pack and held in position by the parachute harness. If the harness is not tightly adjusted and the

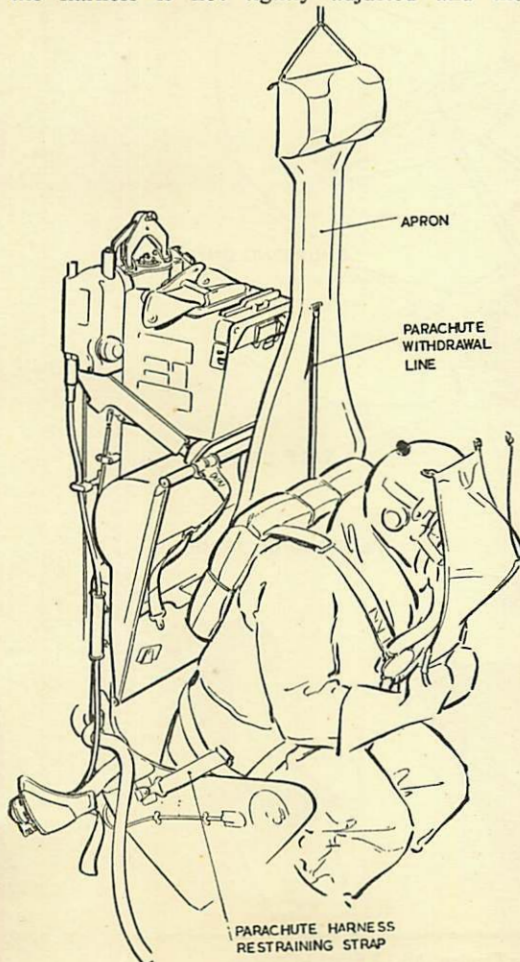


Fig. 2. Automatic Operation—Second Stage

EJECTION SEAT EQUIPMENT

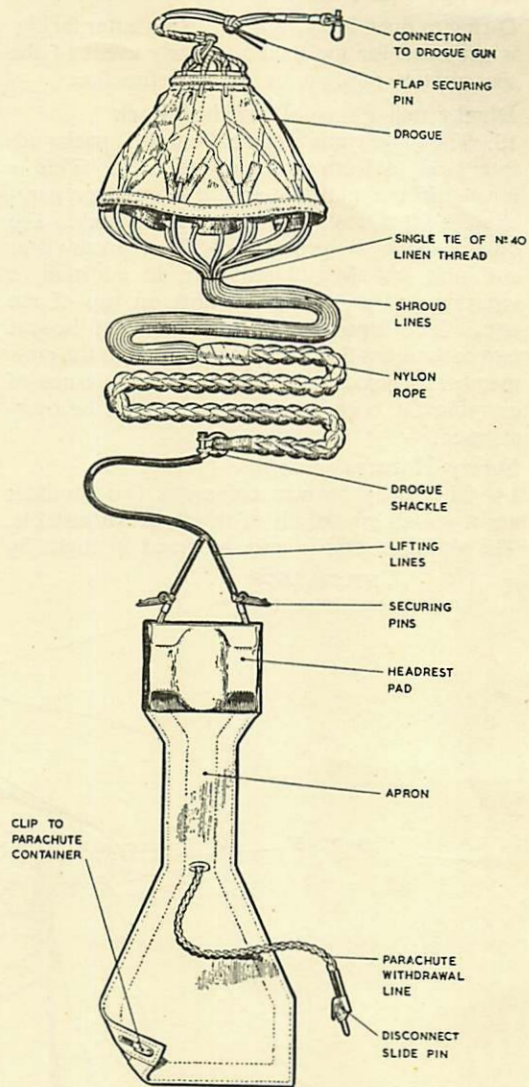


Fig. 3. Drogue and Apron

shoulder straps are loose, there is a danger of the bottle protruding over the lip of the seat pan and preventing full rearward movement of the control column.

Parachute

12. A seat or back-type parachute is fitted according to the mark and series of seat. For Mk. 2 or 3 seats the parachute is modified for either automatic or manual release. Automatic release is effected by means of a parachute withdrawal line attached to the drogue plaited rope which pulls the rip-cord and extracts the canopy from the pack. A manual override is coupled to an additional D-ring on the harness and, when used, discards the automatic attachment and enables the occupant to leave the seat and make a normal descent using the standard

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D-ring to open his parachute. This latter facility is provided for use in the unlikely event of the seat ejection mechanism failing to function.

Dinghy and Personal Survival Pack

13. The dinghy and personal survival packs are interlaced to form a composite pack. This is located in the seat pan, and, if a seat-type parachute is fitted, rests on the parachute pack. The dinghy pack is provided with a fresh-water cushion; the Mk. 3 seat has, in addition, a separate pad and thigh support on top of the pack. The disposition of the contents of the seat pan determines the forces transmitted to the crew member on ejection; hence the importance of carrying the correct equipment cannot be overstressed.

Safety Harness

14. The safety harness comprises two shoulder and two lap straps, all of which are adjustable. The shoulder straps may be freed in flight by

movement of a lever projecting from the starboard thigh-guard; this enables the wearer to bend forward in the seat. On some seats the shoulder straps can be locked in an intermediate or *alert* position. All harnesses relock when the normal position is resumed, either to the alert position on seats where provision is made for this setting, or fully back.

15. Ejection in the alert position is satisfactory, and no difficulty should be experienced in reaching the blind, but ejection in the fully-back position is recommended.

Footrests

16. Footrests are fitted to most Mk. 1 and 2 seats. They are hinged to the seat frame and spring-loaded so that they remain at floor level regardless of the seat pan adjustment. However, they are not fitted to Mk. 3 seats as the legs are held in position by the leg-restraining device.

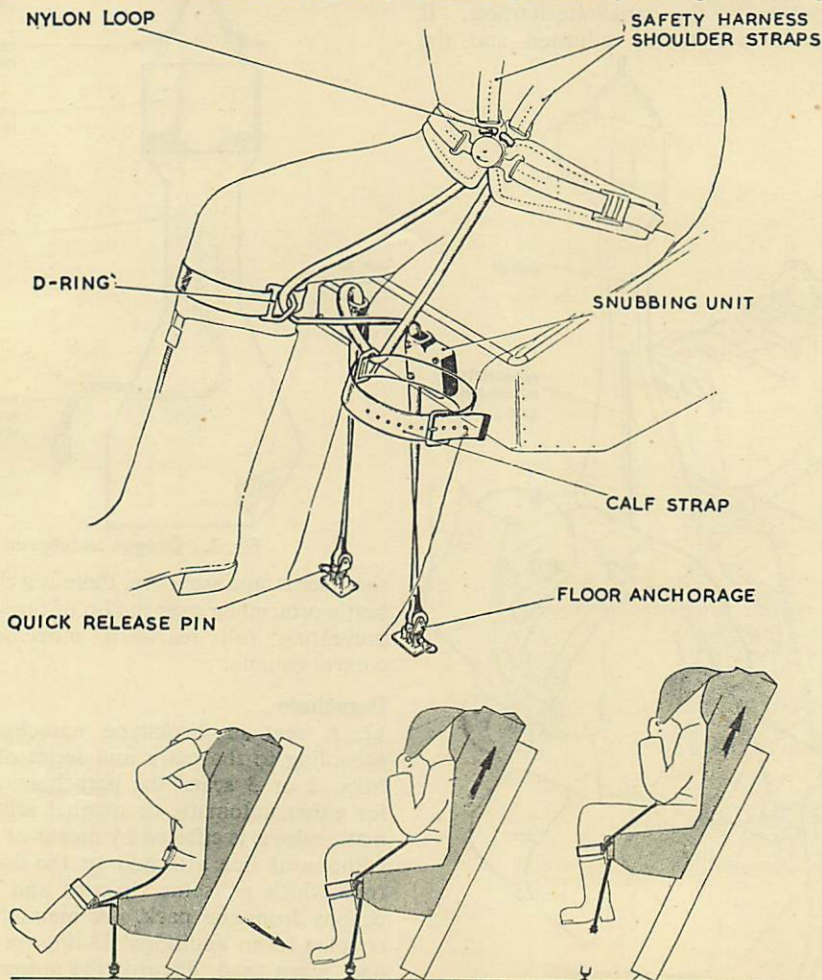


Fig. 4. Leg-Restraining Device (Mk. 3 Seat)

Leg-Restraining Device (Mk. 3 Seats)

17. A leg-restraining device (Figs. 4 and 5) is incorporated in Mk. 3 ejection seats to ensure that the occupant's legs are drawn back automatically and restrained close to the seat pan with the knees about six inches apart when clear of the aircraft. This provides leg clearance on ejection and prevents the legs being blown apart after ejection. The device consists of two calf straps with D-rings attached, and two nylon cords which are fixed to the aircraft floor by shear rivets. The cords pass through a pair of snubbing units attached to the front of the seat pan, the other ends being looped to permit insertion of the safety harness shoulder straps.

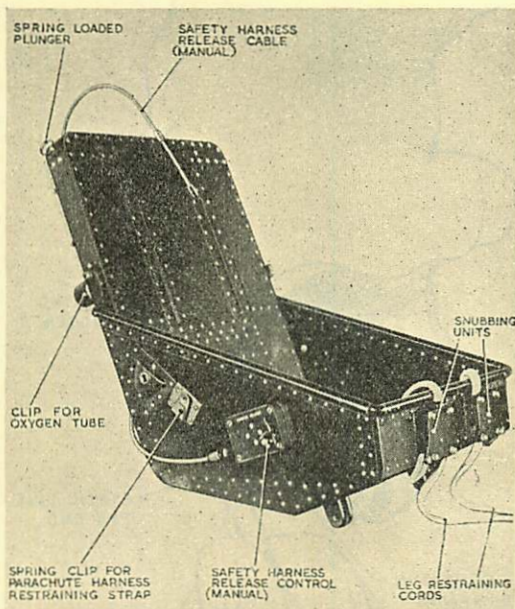


Fig. 5. Seat Pan (Mk. 3 Seat)

18. The snubbing units (Fig. 6) are similar, but are "handed" (i.e. right-handed and left-handed). The object of the snubbing unit is to allow the nylon cord to pass freely down through the unit, but to lock the cord against any upward movement. During ejection they pull the seat-occupant's legs backwards and together before the light alloy rivets shear. Since the cords cannot pass upward through the snubbing units, the occupant's legs are restrained in this position until the safety harness is released. A release button on the snubbing unit permits adjustment of the cords to give free leg movement during flight.

Oxygen

19. Oxygen is supplied to the crew member through an adjustable supply pipe attached to the starboard lap strap and connected to the aircraft supply at the starboard base of the seat. Both connections are of the quick-release type.

Emergency Oxygen

20. An emergency oxygen supply bottle is in or near the dinghy pack, except in the Mk. 3 seat where it is in the seat cushion. In all cases it is turned on automatically on ejection. The outer casing of the operating cable is engaged with a similar union on the starboard side of the seat; and the snaphook end of this cable engages with the manual release cable which is attached to the aircraft. (See Pilot's Notes for details regarding attachment.) *This emergency supply can be made available, in the event of failure of the aircraft oxygen system, by pulling on the manual release cable or operating a control.*

Intercommunication

21. A short tele-mic lead on the port shoulder strap of the seat harness connects with the occupant's helmet. This socket and the main aircraft circuit connection at the rear of the seat are of the quick-release type.

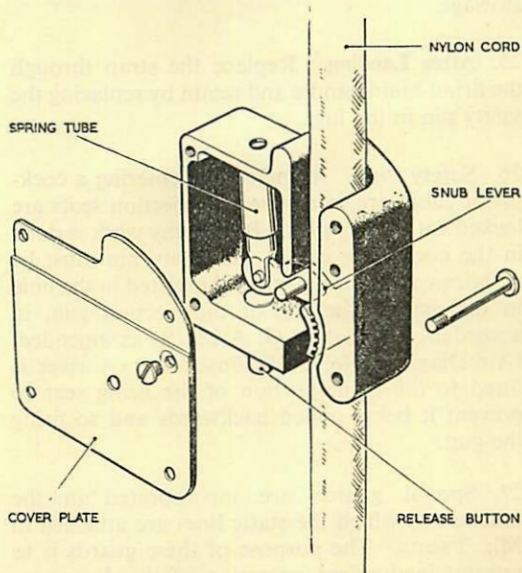


Fig. 6. Details of Snubbing Unit (Mk. 3 Seat)

Barostat-Controlled Time-Release Mechanism (Mks. 2 and 3 Seats)

22. This unit is at the top of the starboard side beam of the seat. It is designed to disconnect the drogue from the seat and to unlock the safety harness automatically after ejection on the Mks. 2 and 3 seats. It consists of spring-loaded plungers (which operate the harness release and drogue scissor shackle), controlled and operated by a rack in engagement with gears regulated by an escapement and star wheel. A barostat control engages the star wheel at heights above 10,000 feet, delaying operation of the mechanism until that height is reached; but below this height the mechanism is free to function immediately ejection occurs. The barostat is usually set at 10,000 feet, but barostats set to control at other heights above mean sea level can be provided. The height at which the barostat is set to operate is engraved on the barostat case.

Safety Precautions—All Marks of Seats

23. **Clearance.** The occupant of an ejection seat should ensure that there is adequate clearance between himself, when fully equipped for flight, and the aircraft structure along the ejection path. Reference to the appropriate Pilot's Notes will give details of any special limitations such as knee clearance, thigh length, and sitting height.

24. **Before Take-Off.** Remove the safety pin which guards the firing handle and stow in stowage.

25. **After Landing.** Replace the strap through the firing-blind handle and retain by replacing the safety pin in the lugs.

26. **Safety Pins.** All personnel entering a cockpit or cabin are to ensure that ejection seats are locked with safety pins. Before any work is done in the cockpit or cabin, the safety pin must be withdrawn from the strap and inserted in the hole in the seat at the top of the ejection gun, in accordance with A.M.O. A.284/50 as amended. (Air Diagram No. 5037 illustrates.) A rivet is fitted to the front portion of the firing sear to prevent it being pulled backwards and so firing the gun.

27. Special guards are incorporated in the brackets to which the static lines are attached in Mk. 3 seats. The purpose of these guards is to prevent inadvertent operation of the drogue or barostatic time-release units by personnel moving between seats on the flight deck of the aircraft.

28. Rendering the Drogue Gun Safe.

(a) Disconnect the static line by raising the locking trigger (Fig. 7) and lifting the eye end out of the slot (Mk. 1 seat).

(b) Disconnect the static line by withdrawing the quick-release pin (Fig. 8). Render the gun safe by inserting the pin in the safety lock (Mks. 2 and 3 seats).

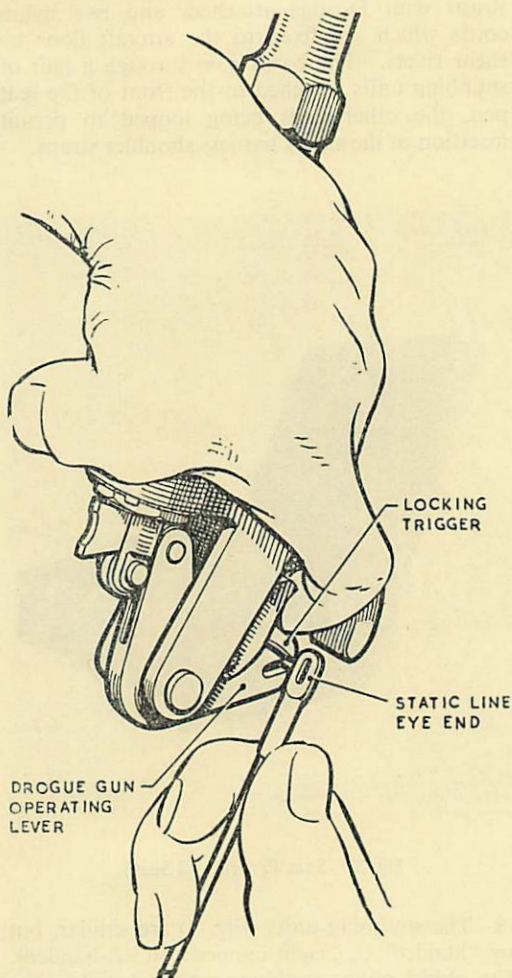


Fig. 7. Rendering the Drogue Gun Safe (Mk. 1 Seat)

OPERATION**Ejecting**

29. Place the feet on the footrests and grasp the firing handle with both hands, backs of the hands facing forward and elbows as close together as possible. Pull the firing handle smartly downwards, drawing the blind over the face, thus firing the ejection gun.

30. When the firing handle is pulled, a cable attached to the face blind extracts a wedge-shaped sear from the firing head. The movement of the sear first compresses a firing spring and then releases the firing pin to strike the percussion cap of the primary cartridge. The resultant gas pressure drives the release piston downwards, freeing the piston tube from the cylinder tube. As the gas pressure rises it propels the piston tube upwards, exposing the ports in the cylinder wall. The flame passes through the port to ignite the secondary cartridge and continue the propulsion. This ejects the occupant and seat from the aircraft.



Fig. 8.
Rendering the Drogue Gun Safe (Mks. 2 and 3 Seats)

Ejection Sequence

31. On ejection the aircraft intercom, the oxygen services, and the anti-*g* suit disengage automatically at the quick-release connections. Further quick-release connections disengage these services when the occupant leaves the seat after ejection. Quick-release connections are provided to operate the emergency oxygen bottle on ejection and then to disengage. The emergency oxygen connection to the mask tube has a quick-release connection but this is not automatic.

32. **Mk. 1 Seat.** The drogue-gun static line removes the drogue gun sear and the cartridge is fired, propelling the piston upwards and in doing so withdraws the drogue. The drogue stabilizes the seat, and the occupant, in his own time, lets go of the firing handle, unfastens his safety harness, falls forward out of the seat, and operates his own parachute in the normal way.

33. **Mks. 2 and 3 Seats.** On ejection two short-line connections attached to the guide rail or aircraft structure withdraw wedge-shaped sears, setting off the drogue gun mechanism and the barostatically-controlled time release which then function in this order :—

(a) The drogue gun, through its time-delay mechanism, is fired after a one-second delay. This propels a tubular piston upwards and in doing so extracts the drogue from its container. As the drogue emerges it draws out the shroud lines and a nylon rope which is attached to the scissor shackle on the top of the seat. The drogue, when developed, reduces the speed, stabilizes the seat and puts it into a convenient attitude for separation.

(b) The main time-release mechanism is actuated on ejection by the withdrawal of a sear from the release plunger. The mechanism is then set in motion and after five seconds accomplishes the following :—

(i) It removes restraint imposed by a cross plunger on the scissor shackle. This opens, releasing the drogue shackle and freeing the drogue from the seat.

(ii) It unlocks the harness-release plunger which rises under spring pressure, and, by means of a cable connection to the harness release box, releases the safety harness.

Barostatic Control (Mks. 2 and 3 Seats)

34. Provided that ejection occurs below 10,000 feet, the time-release mechanism will operate unimpeded from the moment of ejection; and five seconds later will automatically release the drogue from the seat and unlock the safety harness (Fig. 2). Above 10,000 feet a barostat prevents the release mechanism from operating until the seat and occupant have fallen to about 10,000 feet. This reduces prolonged exposure to low temperature and rarified air, and enables the occupant to ride down in the seat, controlled by the drogue and supplied automatically with emergency oxygen, to a more tolerable altitude.

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35. When the drogue is released from the seat it pulls on a lifting line which in turn disconnects the face blind and headrest pad from the seat. By extending the apron, which is attached to the seat by spring-loaded clips and passes round the back of the parachute pack, the drogue forces the parachute pack from its container and presses the occupant forward out of the seat. Two restraining straps (Fig. 2) clipped to the seat pan delay his separation from the seat until an extension of the lifting line draws his parachute from its pack and its subsequent development lifts him clear of the seat to descend in the normal way. This arrangement eliminates the possibility of a collision between the seat and the occupant after separation.

Manual Override (Mks. 2 and 3 Seats)

36. If for some reason the seat does not eject when the ejection control is operated or, when ejected, the automatic gear does not operate, the occupant can use the manual override (Fig. 9) to disconnect the parachute pack from the seat and then operate the parachute manually.



Fig. 9. Manual Override Device (Mks. 2 and 3 Seats)

37. To do this the occupant must first pull the manual override D-ring. This action disconnects the parachute from the seat and uncovers the inner (parachute rip-cord) D-ring (Fig. 10) which is used to open the parachute. This arrangement ensures that the controls are operated in the correct sequence and that there is no danger of the parachute rip-cord being pulled manually while the parachute is still connected to the seat.

38. The occupant then manually unfastens the seat safety harness and leaves the seat, later opening his parachute by pulling the rip-cord D-ring.

USE OF EQUIPMENT

Note: Refer to Pilot's Notes for the aircraft type for precise details.

Fitting and Adjusting

39. Adjustments for correct fitting must be made in the aircraft, as it is not possible to enter the aircraft wearing the equipment. Aircrew should be familiar with the adjustments needed to ensure a well-fitting harness.

Pre-Flight Actions

40. The following actions should be carried out before flight:—

(a) Ensure that the firing handle of the ejection seat is locked by the safety pin.

(b) Check that the parachute and survival pack are in their correct compartments, and that the emergency oxygen bottle, when fitted in the seat, does not overlap the front of the seat pan, thereby causing obstruction to control movements.

(c) Ensure that the disconnect slide-pin on the end of the parachute withdrawal line is attached to the parachute static line, and that the red safety thread is intact. A small flap on the end of the parachute pack must be lifted to verify this. (Mks. 2 and 3 seats.)

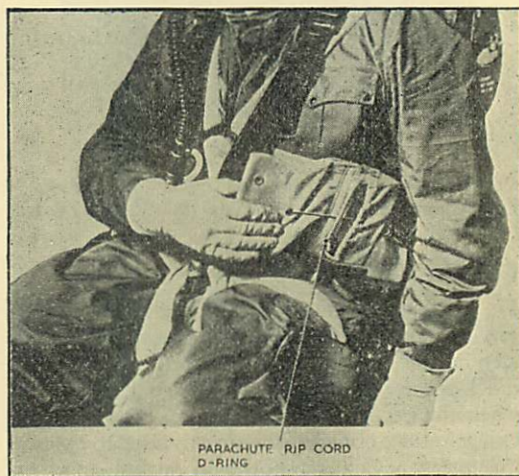


Fig. 10. Parachute Rip-Cord D-Ring (Uncovered)

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EJECTION SEAT EQUIPMENT

- (d) Check that the two seat-restraining straps of the parachute harness are in their spring clips on the seat pan. (Mks. 2 and 3 seats.)
- (e) Check that the two restraining straps of the parachute pack are in their spring clips on the parachute container. (Mks. 2 and 3 seats.)
- (f) Check that the emergency oxygen supply operating cable is connected to its appropriate position. Ensure that the safety pin has been removed from the emergency oxygen bottle and that the tell-tale wire is intact.
- (g) Ensure that the main oxygen and the intercom. connections to the seat are made.
- (h) Ensure that the static line to the drogue gun is connected.
- (j) Ensure that the barostat time-release static line is connected. (Mks. 2 and 3 seats.)

Actions on Entering Cockpit

1. The pilot should seat himself and carry out the following actions :—

- (a) Adjust seat height.
- (b) Connect the dinghy lanyard to the life-saving waistcoat and connect the survival pack to the waistcoat. (*Mk. 3 seat*, the dinghy lanyard is tied to the right-hand loop of the life-saving waistcoat.)
- (c) Secure the parachute harness. (*Mk. 3 seat*, pass the metal fitting on the end of the dinghy lanyard over one of the straps before inserting in the quick-release box.)
- (d) *Mk. 3 Seats Only*. Secure the leg-restraining straps below the knees, D-rings to the rear. Pass the nylon cords through the D-rings, making sure that they are crossed between the snubbing units and the leg-restraining straps (Fig. 4).
- (e) Secure and adjust the safety harness. (For *Mk. 3 seats* insert the metal fittings at the end of the shoulder straps through the loops at the end of the leg-restraining cords.)

Note : To prevent possible entanglement, ensure that the emergency oxygen supply tube and the dinghy lanyard are not connected through the harness.

- (f) Connect the main oxygen and emergency oxygen supply tubes to the oxygen mask tube, and the locating chain to the life-saving waistcoat.
- (g) Connect the intercom. lead.
- (h) Check that the firing handle can be reached with both hands together, particularly when protective helmets are worn.
- (j) See that the ejection-seat safety pin is removed and stowed in its housing.

After-Flight Actions

42. After flight :—
- (a) Secure the firing handle with the safety pin.

- (b) Disconnect the intercom. lead.
- (c) Disconnect the main oxygen supply.
- (d) Release the safety harness.
- (e) Release the parachute harness.
- (f) Disconnect the emergency oxygen supply.
- (g) Disconnect the dinghy lanyard and personal survival pack.

Pre-Ejection Actions

43. Before ejection :—

- (a) Reduce speed.
- (b) Jettison the canopy or hatch.
- (c) Retract the gun-sight.
- (d) Ensure that the ejection path out of the cockpit is clear.
- (e) Lock the safety harness in the fully-back position.

Ejection Drill

44. The following ejection drill is recommended :—

- (a) Place the feet on the footrests or, if no footrests are provided, draw the feet back to the base of the seat.
- (b) Press the base of the spine against the seat-back and the head against the headrest.
- (c) Centre the flying controls if possible or operate the control column snatch device where applicable.
- (d) Raise the hands above the head and grasp the firing handle, with the backs of the hands facing forward and the elbows close together.
- (e) Pull the firing handle smartly downwards, drawing the blind over the face. It is essential that it is drawn down to the fullest extent. When wearing a protective helmet there is a possibility that the blind handle may foul the helmet when the handle is operated, and pull the head forward. This applies particularly to tall pilots. It is essential to make a conscious effort to keep the head pressed hard back against the headrest. If necessary the blind handle can be slightly raised initially to clear the top of the helmet.

Use of Manual Release (Mks. 2 and 3 Seats)

45. If after ejection the automatic system fails for any reason, proceed as follows :—

- (a) After the forward speed has been checked by the drogue, discard the firing handle and blind.
- (b) Pull the override D-ring to isolate the automatic parachute-opening device (Fig. 9).

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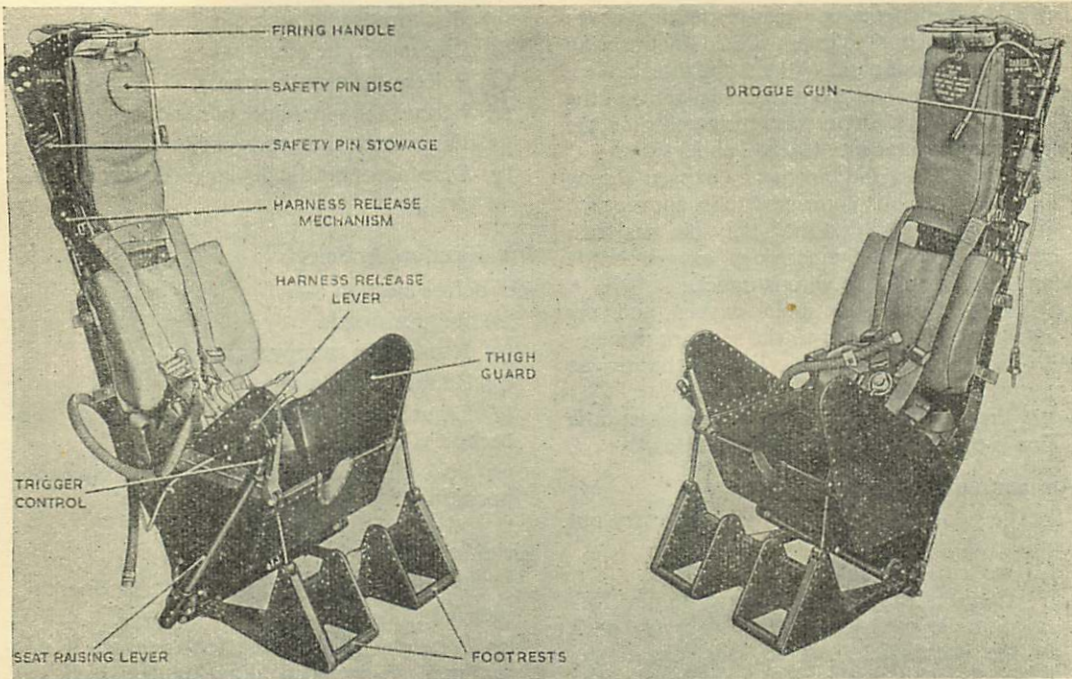


Fig. 11. Ejection Seat, Mk. 1C—Canberra Aircraft

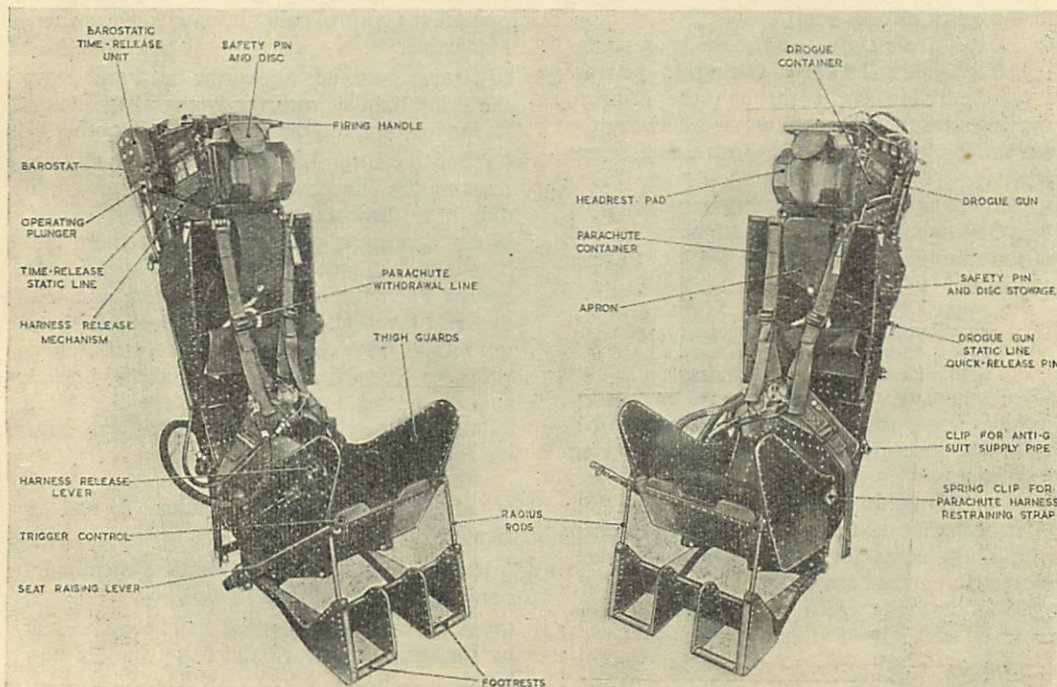


Fig. 12. Ejection Seat, Mk. 2E—Meteor Aircraft

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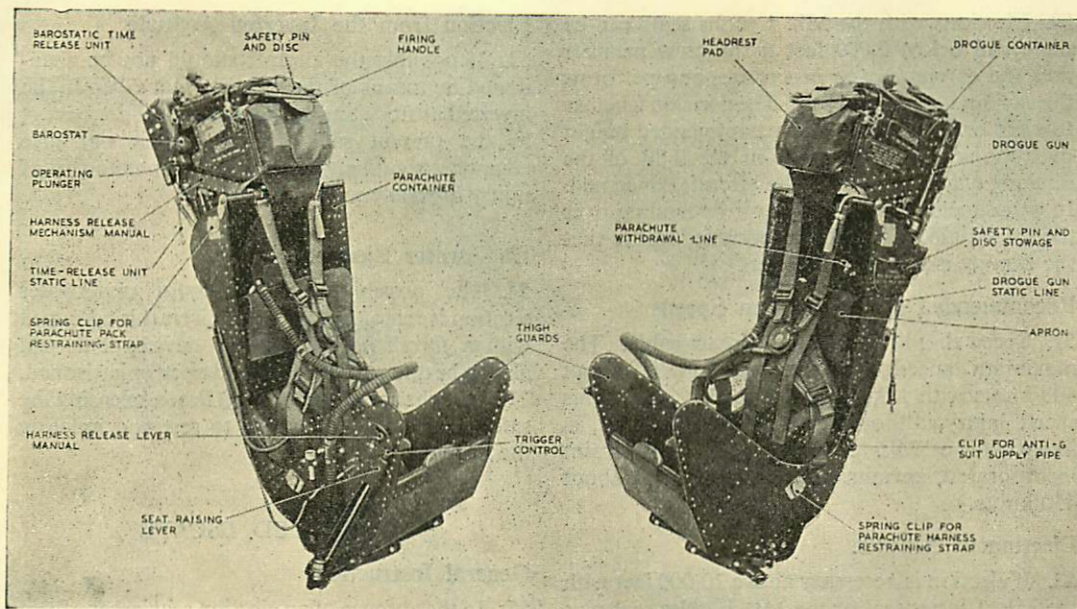


Fig. 13. Ejection Seat, Mk. 2F—Venom Aircraft

(c) At a safe height release the safety harness—operate the lever in a clockwise direction.

Note : It is vital to concentrate all the faculties on reaching and operating the harness release, as the seat will probably be spinning and the occupant confused.

(d) Disengage the seat-restraining straps of the parachute harness.

(e) Lift the top flap (Fig. 10) and grasp the rip-cord D-ring.

(f) Fall clear of the seat and pull the parachute rip-cord to make a normal parachute descent.

Abandoning Without the Use of Ejection Seat

46. Carry out the following drill :—

- (a) Reduce speed and jettison the cockpit cover.
- (b) Operate the parachute manual override in Mk. 2 and 3 seats.
- (c) Release the safety harness.
- (d) Abandon the aircraft as recommended in Pilot's Notes for the type.

The action of leaving the seat will automatically operate the emergency oxygen system. This requires a pull force of 15 lb., and it may be operated manually before leaving the seat. The main oxygen, intercom., and anti-g suit connections will part automatically on leaving the cockpit.

Ejection Through the Canopy

47. It may be possible for ejection to be made through the canopy if this fails to jettison ; this emergency course of action has the greatest chance of success when the canopy is of the plastic bubble type. (The use of the protective helmet considerably reduces the risk of head injury in these circumstances.) This course of action is not recommended if the cockpit canopy is strengthened by metal members.

Crash Landing

48. The ejection seat is a source of danger to unskilled persons. After a crash landing the crew member should, if possible, make the seat safe by inserting the safety pin in the firing handle. An appropriate warning should be given to the authority on the spot.

RECOMMENDATIONS FOR USE The Minimum Height Recommended for Ejection

49. The minimum heights recommended for ejection apply only when the aircraft is in straight and level flight :—

- | | | | |
|---|-----|-----|------------|
| (a) Mk. 1 series seats | ... | ... | 2,000 feet |
| (b) Mk. 1 series seats with M.L. attachment | ... | ... | 1,000 feet |
| (c) Mk. 2 series seats | ... | ... | 500 feet |
| (d) Mk. 3 series seats | ... | ... | 100 feet |

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50. Ejections with the Mk. 1 series seats can be successful below 2,000 feet if the crew member uses the correct escape procedure, and performs the various actions quickly. The decision whether to eject or ditch below the recommended height over the sea must be made in the light of the ditching characteristics of the aircraft concerned. In consequence pilots taking off or landing over the sea should, whenever practicable, ensure that the canopy is locked fully open.

Recommended and Maximum Speeds

51. Speed should be as slow as practicable. The maximum speed for safe ejection is about 400 knots with Mk. 1 and 2 seats. Above this speed injury, although not necessarily fatal, is likely. The Mk. 3 seat, with leg-restraint incorporated, permits safe ejection up to about 450 knots.

Ejection at Altitude

52. If ejection is necessary above 20,000 feet with the Mk. 1 series seat or the Mk. 1 series seat plus M.L. attachment, the parachute should not be streamed until below this height. Similarly, if it is decided to stream the parachute of the Mk. 2 or Mk. 3 seat manually, this should not be done above 20,000 feet.

Ejection from the Inverted Attitude

53. If possible the aircraft should not be abandoned by means of the ejection seat when in the inverted attitude and in the presence of negative g , as the present safety harness does not give adequate negative g restraint to eliminate risk of injury in such conditions.

Underwater Ejection

54. The possibility of successful underwater ejection is remote. Unless an aircraft is equipped with a *forced hood-jettisoning* device, it should always be ditched with the hood open or jettisoned. The best chance of escape then lies in releasing the safety harness after coming to rest and inflating the life-saving waistcoat.

UNASSISTED ESCAPE

General Instructions

55. In the absence of an ejection seat, escape from an aircraft flying at speeds much above 200 knots is not easy. To ensure the best chance of leaving the aircraft successfully at these speeds, Pilot's Notes or Flying Orders give the procedures applicable to each type of aircraft.

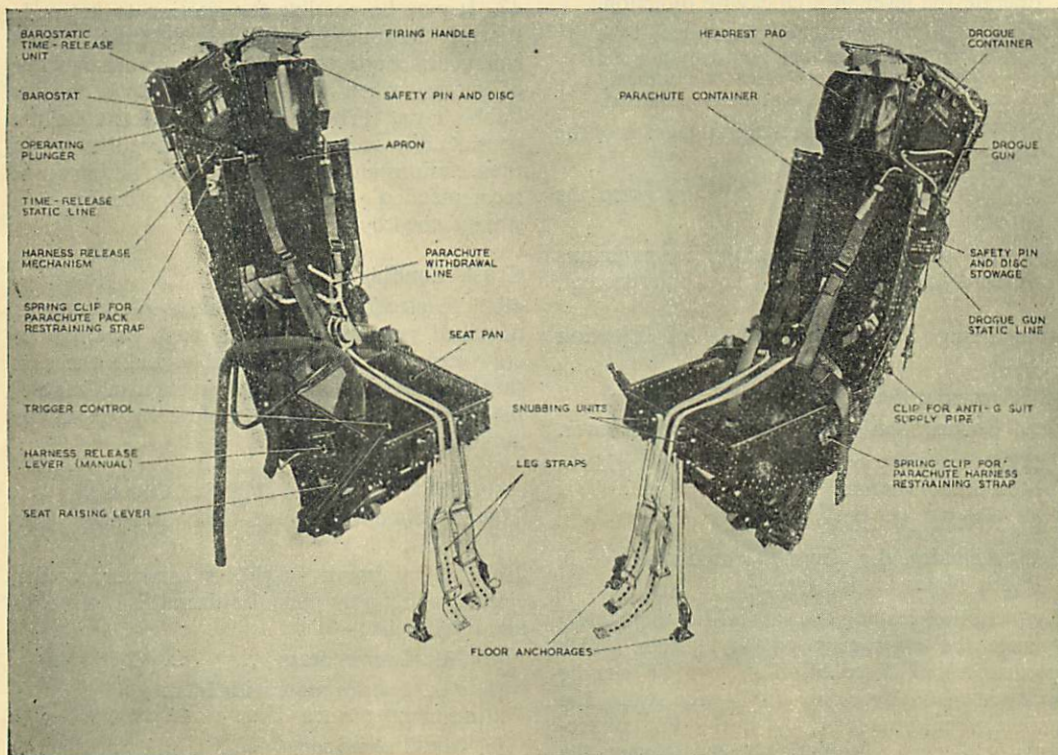


Fig. 14. Ejection Seat, Mk. 3A—Valiant Aircraft

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(A.L. 3, Jan. '55)

56. When abandoning an aircraft without the aid of an ejection seat it is vital to succeed that all possible self-control is used and that only reasoned and calculated actions are made. The possibly violent buffeting of the airflow and the effects of *g* can cause extreme mental confusion which can only be minimized by concentrating all the mental powers on the immediate task.

57. The best method of abandoning depends largely on the configuration of the aircraft. For example, in some aircraft it is best to invert the aircraft and fall out, while in others this might entail the risk of being struck by the fin and rudder. Whatever method is recommended, the drill for abandoning must be thoroughly memorized, and adhered to should the emergency arise.

58. Before jettisoning the canopy, the pilot must check that his helmet is securely fastened. If the chinstrap is not used there is every possibility of the helmet and oxygen mask being torn off by the air stream.

59. When jettisoning the canopy the head should be lowered as much as possible before operating the jettison mechanism.

60. If a crew or passenger is carried the pilot must give the order to abandon the aircraft and as far as possible facilitate their escape.

Abandoning a Controllable Aircraft

61. The procedure for abandoning a controllable aircraft is as follows :—

(a) The most important consideration with a controllable aircraft is to reduce speed as much as possible, by all possible means, before leaving the aircraft; with certain types the air brakes must be closed before abandoning, to reduce risk of injury. On twin and multi-engined types, when on asymmetric power, the live engine should be stopped, if possible, and the remaining forces trimmed out.

(b) At high altitude, turn on the emergency oxygen supply.

(c) Disconnect all unnecessary leads.

(d) Lower the goggles or visor, and jettison the canopy at the recommended air speed.

(e) When the speed has fallen to a suitable value, or when circumstances dictate, release the harness and leave the aircraft as recommended in Pilot's Notes.

(f) When it is recommended that the aircraft should be inverted to enable the pilot to fall out, it should first be trimmed nose heavy, then inverted, and finally the harness released.

Abandoning an Uncontrollable Aircraft

62. As soon as it is clear that control cannot be regained, every effort should be made to abandon before the speed becomes excessive. This consideration does not apply in the case of a spinning aircraft (see para. 63). Depending on the cause and nature of the out-of-control condition, the *g* loads will vary but may become high, acting in any direction. The following drill should be attempted :—

(a) Limit the speed by all possible methods, including stopping the engine. The remarks of para. 61 (a) concerning air brakes should be borne in mind.

(b) Turn on the emergency oxygen if at high altitude.

(c) Disconnect all unnecessary leads and jettison the canopy.

(d) Release the harness and leave the aircraft as quickly and cleanly as possible. The utmost physical effort will be necessary to leave the aircraft while at high speed and/or *g* loads. If possible, the control column should be pushed or kicked forward, or the aircraft suitably trimmed, in an attempt to impose negative *g*. If the elevators are ineffective, the ailerons may roll the aircraft into an inverted attitude, so helping the pilot to fall clear. Since the effort that can be exerted by the legs is much greater than that of the arms, the legs should be braced against some part of the aircraft where the maximum effort can be obtained to push the body out of the cockpit.

Escape from a Spinning Aircraft

63. If the aircraft is spinning out of control the following recommendations apply :—

(a) After disconnecting all unnecessary leads the canopy should be jettisoned and, finally, the harness released.

(b) Leave the aircraft over the side opposite to the direction of the spin, e.g. if spinning to starboard escape over the port side of the cockpit, on the *outside* of the spin; if escape is made over the same side as the direction of spin there is a chance of being struck by the aircraft. This risk may have to be taken when escaping from an aircraft with side-by-side seats.

(c) If the spinning characteristics are such that the aircraft hesitates between turns, leave the aircraft at the moment when the spin is slowest.

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