

PART V

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122. Engine failure on take-off

- (a) The safety speed is between 150 and 190 knots (see para. 103).
- (b) Corrective action must be taken quickly for control to be maintained, particularly at the higher weights. From the safety speed the aircraft will accelerate and climb away providing the undercarriage is up. At take-off weights above 50,000 lb. the tip tanks (and pylon bombs (B.(I)6) must be jettisoned.
- (c) Having raised the undercarriage, trim as necessary and climb away at 180 knots.
- (d) Carry out the appropriate drill at para. 123 below.

123. Engine failure in flight

If an engine fails in flight and depending on the type of failure, carry out one of the following drills without delay.

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(a) *Flame-out*

A relight may be attempted immediately as described in para. 120 (a). If this is not possible or if the attempt fails:—

Throttle and H.P. cock	Closed
No. 5 inverter	Off
Generator	Off (if possible)
L.P. cocks and pumps	Off

Leave the generator off and keep the electrical consumption to a minimum until the engine is relit.

(b) *Mechanical failure*

Throttle and H.P. cock	Closed
No. 5 inverter	Off
Generator	Off (if possible)
L.P. cocks and pumps	Off
Engine air switch	Off

Do not relight and keep the electrical consumption to a minimum.

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(c) *Engine fire*

H.P. and L.P. cocks	Closed
Engine air switch	Off, to prevent toxic fumes entering cabin
Speed	Reduce as much as possible
Fire-extinguisher pushbutton	Press
No. 5 inverter	Off
Generator	Off (if possible)

The warning light should go out when the fire is extinguished. Do not relight the engine as the fire-extinguisher(s) will be exhausted. Reduce the electrical consumption to a minimum.

124. Double flame-out

- (a) If a double flame-out occurs a relight on one engine may be attempted immediately, while the r.p.m. are decreasing, by pressing the relight button for 2 seconds and then releasing it, leaving the throttle at its set position. A successful relight will be indicated by the r.p.m. stabilising and then commencing to rise. Ensure that the maximum allowable j.p.t., by throttling back if necessary, is not exceeded. The likelihood of obtaining a successful relight is increased if the height and airspeed are below the permitted maxima.
- (b) If an attempt to relight an engine as above is unsuccessful, carry out on both engines the flame-out drill at para. 123(a) and reduce electrical consumption to an absolute minimum. Descend as rapidly as possible, commensurate with the need to avoid trimming, to the relight height, and carry out *on one engine only* the relighting drill at para. 120. When that engine has relit, switch on its generator and relight the other engine.

NOTE.—The battery should last approximately 20 minutes with a flight instruments inverter running, one V.H.F. set on and several applications of trim.

125. Action in the event of cabin fire

Should an electrical fire occur in the cabin, the following drill is recommended:—

Oxygen	To emergency (switch to right or left).
Electrical	All non-essential services off.
Fire-extinguisher	Use if source of fire can be identified and fire is persistent.
Cabin pressurisation	Maintain pressure.

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If the fumes persist descend to below 13,000 feet, reduce speed to 150 knots and jettison the navigator's hatch to improve ventilation, keeping the engine air switches ON. If the fire spreads or the fumes become dangerously overpowering abandon the aircraft.

NOTE.—If a fire develops which cannot be quickly controlled, there is a risk that damage may occur to the ejection seat, parachute and jettison circuits, rendering subsequent escape impossible.

126. Jettisoning the wing tip tanks

- (a) The wing tip tanks may be jettisoned at any speed, full or empty, up to the limitations imposed when carrying wing tip tanks.
- (b) Always jettison the wing tip tanks if, in the opinion of the captain, their retention will jeopardise the safety of the aircraft.
- (c) The tip tanks must always be jettisoned when making a forced landing or a landing with an undercarriage mainwheel not locked down.
- (d) If one wing tip tank is full and the other is empty, a safe landing is possible (see para. 112), but if the circumstances are such that the captain has any doubts of his ability to land the aircraft safely, the tanks must be jettisoned.
- (e) If an engine fails before safety speed has been attained on take-off, and it is decided to continue with the take-off, jettisoning the tip tanks reduces the safety speed, and therefore greatly improves the chances of recovery.

127. Jettisoning internal and external stores

- (a) To jettison both internal and external stores in an emergency switch ON the EMERG. BOMB JETTISON switch and after the internal stores have been jettisoned, switch it OFF; this will close the bomb/flare doors provided that the normal selector is set to SHUT.
- (b) To jettison the external stores only in an emergency, switch on the WING CLEARING switch.

128. Emergency operation of the bomb/flare doors

- (a) If the bomb/flare doors fail to open either when selected normally or when the EMERG. BOMB JETTISON switch is set ON, the failure may be hydraulic or electrical. To determine which check the hydraulic pressure. If this is less than 2,200 lb./sq. in. the failure is probably hydraulic and can be confirmed by selecting another hydraulic service: otherwise the failure is probably electrical.

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- (b) Depending on the type of failure proceed as follows:—

(i) Hydraulic failure

With either the normal selector at OPEN or the EMERG. BOMB JETTISON switch ON, open the bomb/flare doors by means of the handpump; they may be closed in the same way with the normal selector at SHUT and the emergency switch OFF.

NOTE.—If the handpump is used to operate the bomb/flare doors lack of hydraulic fluid may make subsequent lowering of the undercarriage impossible.

(ii) Electrical failure

1. Check and if necessary change the fuse (No. 24 on the electrical control panel) for the bomb/flare doors selector valve, before selecting bomb/flare doors OPEN.
2. If the bomb/flare doors still fail to open, operate the bomb/flare doors emergency lever: however, the doors should only be opened in this way if it is vital as they cannot be closed again until serviced.

129. Emergency operation of the undercarriage

- (a) Failure of the undercarriage to lower normally may be caused through a hydraulic, electric or mechanical failure.

(b) Hydraulic failure

A hydraulic failure may be assumed if the reading on the hydraulic pressure gauge falls below 2,200 lb./sq. in. and can be confirmed by operating another hydraulic service. If a hydraulic failure has occurred adopt the following procedure:

- (i) Select undercarriage DOWN.
- (ii) Operate the handpump until the undercarriage is locked down.

(c) Electrical failure

If the hydraulic system is serviceable, an electrical failure at the selector valve is the probable cause. In this case adopt the following procedure:

- (i) Check and, if necessary, change the fuse (No. 52 on the electrical control panel) for the undercarriage control circuit before selecting undercarriage DOWN.
- (ii) If the selector valve still fails to operate, move it to the "down" position by pulling out the undercarriage

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emergency toggle handle. However, if the undercarriage is lowered in this way, it will not be possible to raise it again until it is serviced.

(d) *Indicator or mechanical failure*

If the undercarriage position indicator shows that either the nosewheel or a main wheel has failed to lower, the failure may be either at the indicator or mechanical within the undercarriage unit itself. In this event carry out the following procedure:—

- (i) Check the changeover lights on the undercarriage position indicator.
- (ii) Check and, if necessary, change the fuse (No. 53 on the electrical control panel) for the undercarriage indicator circuit.
- (iii) If there is still no evidence of correct functioning, reselect undercarriage UP and DOWN several times to overcome any slight sticking of the sequence valves, doors or latches.
- (iv) Use the handpump, which may overcome the failure and achieve a successful lowering because of the greater hydraulic pressure exerted.

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(e) *Raising the undercarriage in emergency*

- (i) To raise the undercarriage on the ground in an emergency, ensure that the undercarriage master safety switch (if fitted) is set to LIVE and then rotate the metal collar of the UP selector button clockwise through 90° before selecting UP. It must not be used in this way to retract the undercarriage when airborne.
- (ii) If the UP button cannot be pressed in normally either after take-off or at any other time after lowering the undercarriage in flight, the undercarriage must be left down and the aircraft landed when weight permits.

130. Landing with an undercarriage unit not locked down

(a) *Both main wheels only locked down*

- (i) Use as much fuel as possible and in such a way as to achieve a C.G. as near the aft design limit as possible, *e.g.*, the C.G. will be on the appropriate aft limit (with light series carriers fitted but no bombs carried) when *only* No. 3 tank contains fuel as follows—fully without tip tanks fitted and 3,300 lb. with wing tip tanks fitted. Unless circumstances dictate otherwise land on a runway.
- (ii) Jettison internal and external stores.
- (iii) Jettison the cabin roof hatch.
- (iv) Check harnesses tight and locked.

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- (v) Make a normal approach and landing and maintain a moderate nose-up attitude after touch down, using rudder only to keep straight.

- (vi) Close the throttles and shut the H.P. cocks.

- (vii) Use the tail trimmer to assist in holding the nose off as long as possible, but, at the lowest speed possible and while elevator control is still available, lower the nose smoothly and positively on to the runway; use the brakes gently to keep straight.

(b) *Nosewheel and one main wheel locked down*

The aircraft can be successfully landed as follows:—

- (i) Reduce weight as much as possible and have fuel only in No. 2 tank.
- (ii) Jettison internal and external stores and wing tip tanks.
- (iii) Check harnesses tight and locked.
- (iv) Make a normal landing and hold the wings level for as long as possible after touch-down.
- (v) Close the throttles and shut the H.P. cocks.
- (vi) The landing will need an area of about 250 yards in width at the side of the landing path in the direction of the expected swing.

131. Landing with a defective hydraulic system or wheel brakes

- (a) If the handpump has had to be used to lower the undercarriage for landing, it may be found that the wheel brake hydraulic pressure is low and shows no signs of building up. Should this occur, or at any other time that the brake pressure remains low, an attempt must be made to raise it by means of the handpump. If it remains low, the brakes must not be applied until after touchdown.
- (b) If little or no pressure is available reduce weight as much as practicable. It is an advantage to empty No. 1 tank as far as possible so that the landing is carried out at an aft C. of G.
 - (i) Touchdown at as low a speed as possible.
 - (ii) Close the H.P. cocks immediately.
 - (iii) Use the tail trimmer to assist in holding the nose-wheel off for as long as possible.
- (c) If some pressure is available do not use the brakes until the maximum aerodynamic braking has been obtained from the aircraft and the nose wheel can no longer be held off. If possible have another crew member operate the handpump while the brakes are in use.

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132. Cabin pressurisation and oxygen failure at altitude

(a) Pressurisation failure

If pressurisation failure occurs at heights above 40,000 ft. the following emergency drill is recommended:

- (i) Pilot warns crew "Immediate Descent" and orders "~~Emergency Oxygen~~", crew acknowledge.
- (ii) Throttles fully closed.
- (iii) Airbrakes OUT.
- (iv) Bomb/flare doors open.
- (v) Descend at 0.79 M.
- (vi) Below 40,000 feet switch OFF the engine air switches; continue descent to 30,000 feet or below.
- (vii) If the pressurisation failure was caused by damage to the canopy or cabin, depending on the degree of damage and fuel state, return to base or land at the nearest airfield. Except for the initial descent do not exceed a speed of 0.70 M. or 300 knots.

(b) Oxygen failure

If symptoms of annoxia are felt indicating lack of oxygen or if oxygen failure occurs at altitude, operate the emergency oxygen supply and descend to a safe altitude. With the emergency supply in use the oxygen main connection will have to be disconnected to allow free breathing.

133. Abandoning the aircraft in flight

- (a) The minimum height recommended for ejection in straight and level flight is 1,000 feet.
- (b) The navigator and bomb aimer should occupy their ejection seats at all times unless engaged at the nose station, as they may find it difficult or even impossible to regain their ejection seats if the aircraft goes out of control.

- (c) The recommended method of escape for the pilot is by ejection through the canopy after operating the control column snatch unit. In aircraft not fully modified the navigator and bomb-aimer must jettison the hatch (above 150 knots) before ejecting. If it fails to jettison, they may eject through it although serious injury may result. When the aircraft and seats are fully modified (see NOTE to para. 80 (a)) the recommended method is for the navigator and bomb-aimer to eject through the hatch.

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- (d) The following escape drill is recommended:—

- (i) Reduce speed if possible.
- (ii) Pilot checks jettison master switch ON.
- (iii) Navigator and bomb-aimer—unmodified seats
Jettison cabin roof hatch and eject, one after the other.
- (iv) Navigator and bomb-aimer—modified seats and frangible hatch
Eject through hatch one after the other. Whoever ejects last must grasp the blind firing handle and cover his face with his forearms before the first crew member ejects.
- (v) Pilot
Pilot operates the control column snatch unit and ejects through the canopy.

NOTE.—The ejection seats should be adjusted to their lowest position before ejecting.

(e) Sequence on ejection

- (i) The harness release delay mechanism is armed by the initial travel of the seat.
- (ii) The drogue gun fires automatically and the drogue stabilises the seat and slows it down.
- (iii) $2 \pm \frac{1}{2}$ seconds after ejection, the seat harness is released automatically.
- (iv) Kick the seat away.
- (v) The barometric release will stream the parachute at 13,000 feet, or after $2\frac{1}{2}$ – $4\frac{1}{2}$ seconds if ejection is below 13,000 feet. If the barometric control fails to operate, or if it is necessary to stream the parachute instantaneously, ensure that the seat is well clear, then pull the manual override knob.

(f) If the automatic harness release fails after ejection:—

- (i) Operate the seat harness manual quick release (if height permits, the main oxygen tube should be disconnected before releasing the harness).
- (ii) Kick the seat away.
- (iii) The parachute will be streamed automatically at 13,000 feet or when the manual override knob is pulled (see (e) (v) above).

(g) If the ejection seat fails to fire:—

- (i) Post-Mod. parachute 114
 1. Disconnect the main oxygen tube.
 2. Operate the brass key on the static line to disconnect the barometric control.

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3. Operate the seat harness quick release.
4. Abandon the aircraft through an escape hatch.
5. Pull the manual override knob to stream the parachute.

(ii) *Pre-Mod. parachute 114*

1. Disconnect the main oxygen tube.
2. Operate the seat harness quick release.
3. Abandon the aircraft through an escape hatch.
4. Above 13,000 feet, the barometric control will operate to stream the parachute at 13,000 feet, unless the manual override knob is used.
5. At 13,000 feet or below, the barometric control will stream the parachute only $2\frac{1}{2}$ – $4\frac{1}{2}$ seconds after leaving the seat, with the consequent danger of the parachute becoming entangled in the aircraft. Therefore a suction escape through the canopy aperture and navigators' hatch aperture may be the only means of clearing the aircraft safely.

134. Forced landing

- (a) If a forced landing has to be made, jettison the cabin roof hatch above 150 knots while electrical power is still available.
- (b) *With engine power available*
 - (i) Reduce weight as much as is practicable aiming to land if possible with fuel in No. 2 tank only.
 - (ii) Jettison the wing tip tanks if using AVTAG.
 - (iii) Jettison internal and external stores.
 - (iv) Check harnesses tight and locked.
 - (v) Make a normal approach and landing (see NOTE under (c) below).
 - (vi) Switch off the battery isolating switch and close the H.P. cocks before touchdown.
- (c) *With no engine power available*
 - (i) Glide at 165 knots.
 - (ii) Jettison the wing tip tanks if using AVTAG.
 - (iii) Jettison internal and external stores.

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- (iv) Check harnesses tight and locked.
- (v) While positioning for a landing reduce speed to 140 knots and maintain this speed until the final approach is commenced.
- (vi) Use flap, if possible and reduce speed to 95–105 knots (see also NOTE below).
- (vii) Before touchdown switch OFF the battery isolating switch.

NOTE.—It may be advantageous when making a forced landing to have the undercarriage down and pilots should carefully consider the probable advantages, in most cases, of reducing impact load by this means.

- (d) After the landing run is complete, leave the aircraft either through the cabin roof hatch or the normal entrance door without delay and stand well clear of the aircraft. When it is apparent that there is no risk of explosion or fire return to the aircraft and fit the ejection seat safety pins.

135. Ditching

- (a) The ditching qualities are expected to be poor and it is recommended that the aircraft be abandoned in flight rather than ditched.
- (b) Should ditching be unavoidable, the bomb/flare doors must be closed and the entrance door must not be jettisoned. Jettison the cabin roof hatch above 150 knots. Make the final approach with the flaps lowered and touchdown in a nose-up attitude at the lowest practical forward speed and rate of descent. After touchdown lose no time in escaping through the hatch aperture.

NOTE.—The demand oxygen system makes a fairly good under-water breathing set if the mask fit is good, the air inlet switch is set to 100% OXYGEN and the emergency switch is set to either side. However, it is imperative that the use of the demand system as under-water breathing equipment is clearly understood. This is covered in A.P.129.