

PART IV

EMERGENCY HANDLING

98. Engine failure in flight

- (i) If the engine fails in flight, feather the propellers by closing the H.P. cock and pressing the starting pitch button until rotation ceases. In aircraft with the reverse torque unit operative, the propellers will be coarsened off to the near feather position automatically. (See para. 99.)
- (ii) It is recommended that as soon as any possibility of engine failure is suspected, the F.F.P.S. switch be set to EMERGENCY and speed reduced to 160 knots. This will prevent any possibility of the engine overspeeding in aircraft having the reverse torque unit inoperative. If time is available, and except when ditching, MANŒUVRE flap should also be selected while hydraulic power is still available from the engine.
- (iii) In the case of suspected mechanical failure in the engine, the engine should be stopped by closing the H.P. cock and pressing the feathering button.
- (iv) In aircraft with the reverse torque switch inoperative, if the engine should fail while the stop is withdrawn (e.g. on the approach), close the H.P. cock immediately, otherwise loss of elevator power will occur.

99. Engine stalling

- (i) If due to mishandling of the engine, or in icing conditions, the compressor stalls, complete loss of power will occur. It may in most cases be possible to re-establish

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the airflow through the engine by *immediately* closing the throttle to the Flight Idle gate. If on gently reopening the throttle there is a rapid rise in J.P.T., with no increase in torque, or if the J.P.T. remains substantially above the limits in spite of throttling back, there is no alternative but to stop the engine and relight it.

- (ii) In aircraft fitted with a reverse torque unit, the propellers will not necessarily auto-feather if the engine stalls because the residual thrust from a stalled engine is probably large enough to prevent this. In these conditions the drag will be high, and diving may be necessary to maintain airspeed which should be kept above 160 knots while the attempt is being made to unstick the engine.
- (iii) If, in aircraft with the reverse torque unit inoperative, the engine stalls on the approach, i.e., with the F.F.P.S. disengaged, it is probable that the propeller will fine off to the 8° position, in which case the H.P. cock must be closed to feather the propeller and recover elevator control. If time allows it may be possible to engage the F.F.P.S. before the propeller fines off past the 28° position. Once it has gone beyond the 28° position, the F.F.P.S. cannot be engaged.

100. P.C.U. failures in flight

(i) Suspected failure

- (a) Should a P.C.U. failure be suspected in flight, or should the oil pressure drop below 30 lb./sq. in. reduce airspeed and select power to maintain 160 knots. Select EMERGENCY on the F.F.P.S. switch.
- (b) The approach and landing should be made with EMERGENCY still selected. As speed is reduced on the approach, the r.p.m. may fall below 7,800.
- (c) After touchdown the H.P. cock must be closed immediately or the F.F.P.S. disengaged, to prevent engine stalling. This is particularly important on a "stop engaged" deck landing. (See para. 81, sub-para (iv).)

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(ii) Actual failure

- (a) Select EMERGENCY on the F.F.P.S. switch.
- (b) Throttle back immediately to the Flight Idle gate.
- (c) Reduce airspeed and select power to maintain 8,000 r.p.m. and carry out the procedure as in (i) (b) (c).

NOTE.—(1) Should flame-out follow P.C.U. failure, carry out the normal relighting drill.

(2) If it is impossible to feather the propeller before a relight is initiated, the windmilling r.p.m. may be above the ignition throw-out speed. The ignition switch must therefore be held at START until the engine is relit, or the start is abandoned.

(3) If the P.C.U. has failed, the power obtainable from the engine should be sufficient to maintain height. The best speed to maintain in the circumstances, at maximum landing weight, is 130 knots. If the speed is allowed to fall below this, the drag increases and the rate of climb will be reduced. Likewise, the use of flap is not recommended.

101. Restarting the engine in flight

NOTE.—(a) Normally only one attempt to relight should be made. Should this be unsuccessful there is a risk of fire if a further relight is attempted.

(b) Restarting the engine in flight is by windmilling only.

(i) If the engine failure is due to flame extinction close the H.P. cock immediately, and close the throttle to the GROUND IDLE gate.

(ii) Switch off all non-essential electrically-operated services, then:—

(a) Check throttle is at GROUND IDLE.

- (b) Set the F.F.P.S. switch to EMERGENCY. This is to ensure that the F.F.P.S. remains engaged whether the undercarriage is lowered or not.
- (c) Trip on the ignition switch and see that the green light is showing.
- (d) Maintain an airspeed of 130-150 knots. There may be a better chance of a relight at the lower speed, but drag will be high while the propeller is wind-milling, and elevator power may be marginal if the speed is allowed to fall much below 150 knots.
- (e) Open the H.P. cock and press the starting pitch button.
- (f) Release the starting pitch button directly the engine speed has risen by 500 r.p.m. Engine acceleration is rapid and the ignition throw-out speed of 2,700 r.p.m. should be attained within 3-5 seconds. If the engine fails to accelerate when the starting pitch button is released, press it again for about 1 second only to assist the r.p.m. to increase.
- (g) Evidence that a relight has occurred will be slight and no initial indication of this will be forthcoming from the J.P.T. gauge as this does not register below 400°C. However, cautious movements of the throttle may be made provided the r.p.m. are above 2,700; if the r.p.m. follow the throttle movement, a relight has taken place. Drag will normally be high before the relight, but should decrease once a relight has occurred. White vapour from either jet pipe may mean that the engine has not relit. Reverse torque, if operative, should die out as the throttle is opened, provided a relight has occurred.
- (iii) If a relight has not occurred by the time the engine speed is above about 3,000 r.p.m. the H.P. cock must be closed and the propeller feathered.
- (iv) A relight should not be attempted above 15,000 ft., or below 2,500 ft.
- (v) Relighting should be undertaken within a short time of flame out, as the chances are better with a warm engine.
- (vi) If the engine fails to relight, a second attempt may be made at a lower altitude to enable the engine to dry out.
- (vii) The average height lost during relighting from the time of initiating the relight to selecting climb power is about 2,000 ft.

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102. Action in the event of fire

NOTE. (a) There are two separate fire detection systems. The ENGINE fire warning light is connected to a mixture of resetting and non-resetting flame detectors. The JET PIPE fire warning light is connected only to non-resetting flame detectors. Either warning light will remain on irrespective of any action taken.

- (b) When Mod. 451 is incorporated, resetting type flame detectors are installed throughout both systems. The appropriate light should go out if the fire is successfully extinguished.
- (i) If fire occurs, and if the circumstances and origin of the fire allow an attempt to be made to extinguish it rather than to abandon the aircraft, the extinguisher should be operated after closing the H.P. cock.
- (ii) If the ENGINE fire warning light comes on and there is no other evidence that a fire has occurred, power should be reduced at once. (If with Mod. 451 fitted the warning light goes out within ten seconds of throttling back, a hot gas leakage may be the cause.) The flight should then be continued at reduced power until actual evidence of a fire exists, or until the earliest time at which a landing can be made.
- (iii) If the JET PIPE fire warning light comes on, it should normally be assumed that an actual fire exists, whether it can be seen or not, for the jet pipes are in close proximity to the fuel tanks.
- (iv) Once either extinguisher system has been used, it should be borne in mind that on restarting the engine, no further fire protection for that zone will be available. Thus, if the fire restarts with the use of the engine, the aircraft must be abandoned.

103. Hood jettisoning

Before jettisoning the hood, the seat should be lowered fully and the pilot should keep his head well down. Speed should be between 130 and 300 knots, or, if Mod. 349 is embodied, between 140 and 280 knots.

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104. Gyro gunsight emergency lowering

The sight may be lowered manually by striking the knob to the right of the sight a blow with the hand. The sight is automatically retracted on jettisoning the hood, but only if electrical power is available.

105. Abandoning the aircraft

- (i) Reduce speed as much as possible.
- (ii) Jettison the hood, retract the gunsight, and set parachute container fully back.
- (iii) Place the feet in the footrests and at the same time grasp the handle of the blind.
- (iv) Press the head against the headrest and draw the handle and face screen firmly over the face. It is not necessary to jerk the handle and in no circumstances should the blind be pulled outwards away from the face as it may not be possible to fire the cartridge.
- (v) After ejection, the static line will automatically fire the drogue gun.
- (vi) In aircraft fitted with the Mk. 2B seat automatic separation will take place at heights below 10,000 ft., but in aircraft with the Mk. 1 seat, when falling freely, and if below 20,000 ft., the pilot must disconnect his seat harness and when clear of the seat should open his parachute in the normal way.
- (vii) *Action should the automatic mechanism of the Mk. 2 seat fail*
If, after ejection, the pilot for any reason doubts the serviceability of the automatic parachute releasing mechanism he should operate the parachute manually as follows:—
 - (a) Pull the first "D" ring on the parachute harness.
 - (b) Release the restraining straps from the seat.
 - (c) Release the safety harness.

- (d) After falling clear of the seat pull the second "D" ring to develop the parachute canopy.

(viii) *Action should the Mk. 2 seat fail to eject*

- (a) Pull first "D" ring on parachute harness.
- (b) Proceed as on aircraft not fitted with an ejection seat. (Under these circumstances the parachute will not be opened automatically.)

106. Undercarriage and flaps emergency operation

If the hydraulic system fails, the undercarriage and flaps may be lowered by operating the emergency controls irrespective of the position of the normal controls. The flaps may be selected fully down only; no intermediate position is available.

107. Arrestor hook emergency operation

When no hydraulic power is available, either from the handpump or the engine driven pump, the normal control will operate the system down and up, once only. There is no separate emergency control.

108. Airbrakes emergency operation

If no hydraulic power is available the airbrakes must be closed by handpump. In aircraft subsequent to WL 885, which incorporates the new type airbrakes, they should retract due to air loads following an up-selection.

109. Flapless landing

A speed of 160 knots minimum should be maintained while manœuvring in the circuit. The final approach should be begun at 130 knots. Little power is required and the approach is flat. The airfield boundary should be crossed at 120-125 knots, at which speed the aircraft will be in the three point attitude. The landing run will

be approximately 50 per cent. longer than a landing with flaps down.

110. Forced landing

NOTE.—(a) "Windmilling" is defined as being when the engine is "dead", and is caused to revolve solely by the airstream.

(b) A forced landing must not be attempted with the propeller windmilling unless it is impossible to feather it (see note (d) below).

(c) When the propeller is feathered, drag is considerably less than that expected and the gliding angle, particularly with the flaps up, is remarkably flat.

(d) Should a landing be attempted with the propeller windmilling in the 28° position, the propeller drag and rate of descent will be very high.

(e) If the propeller is windmilling at a finer angle than 28°, i.e., F.F.P.S. disengaged, longitudinal control will not be possible at speeds below 160 knots. (This speed may not, in fact, be attained even in a steep dive.) Close the H.P. cock immediately and feather the propeller. Longitudinal control will then return. If, due to P.C.U. failure it is not possible to feather, or nearly feather, the propeller, the aircraft should be abandoned by parachute.

(i) Engage the F.F.P.S. if the engine is still turning.

(ii) If no engine power is available the propeller must be feathered by closing the H.P. cock and pressing the starting pitch button.

(iii) Initiate distress procedure.

(iv) Jettison the cockpit hood and all external stores and fuel.

(v) Tighten and lock the harness in the rear position and lower the seat fully.

(vi) Maintain a speed of 160 knots while manoeuvring.

(vii) Lower the flaps on the emergency system when a landing is certain.

(viii) Once full flap has been lowered, carry out a normal glide landing, rounding out at a speed of not less than 130 knots.

(ix) Emergency undercarriage lowering is very rapid, and if circumstances are favourable, this may be safely left until the aircraft is over the airfield boundary. It should *only* be lowered once a landing is *certain on a runway*. Once it is lowered it cannot be raised again. The gliding angle with flaps and wheels down, propeller feathered, is very steep. Because of this, the wheels must never be lowered if the propeller is windmilling as the glide angle may then be excessively steep.

111. Ditching

NOTE.—Model tests indicate that the ditching characteristics are poor. The chances of a successful ditching are reduced if there is any swell, if the sea is "glassy" calm (making height judgment difficult), or if the sea conditions are not otherwise ideal.

(i) If ditching is inevitable, the following procedure should be adopted:—

(a) Feather the propeller whether power is available or not. This will ensure a flatter glide angle and avoid the possibility of the engine blowing-up due to the sudden ingress of water while it is turning fast.

(b) Initiate distress procedure.

(c) Lower the seat fully and jettison the hood, all stores and drop tanks. (A successful ditching has, however, been done with a torpedo, but there is as

yet no evidence whether the drop tanks will improve the ditching characteristics.)

- (d) Release the parachute harness and check the dinghy attachments.
 - (e) Tighten the harness and lock in the rear position.
 - (f) *Do not lower the flaps.* This, together with propeller feathering, will ensure a flat glide angle and the minimum rate of descent at touchdown.
 - (g) Maintain a speed of 160 knots while manoeuvring.
 - (h) Flatten out, as near the water as possible, keeping the rate of descent at touchdown as small as possible. Allow the speed to drop off to 130 knots before touchdown. The touchdown attitude should *not* be nose-up, otherwise the aircraft may hit tail first with a consequent risk of porpoising. The minimum speed at touchdown should therefore be as near 130 knots as possible.
- (ii) Ditching should be along the swell, or into wind if no swell is discernible from the air.

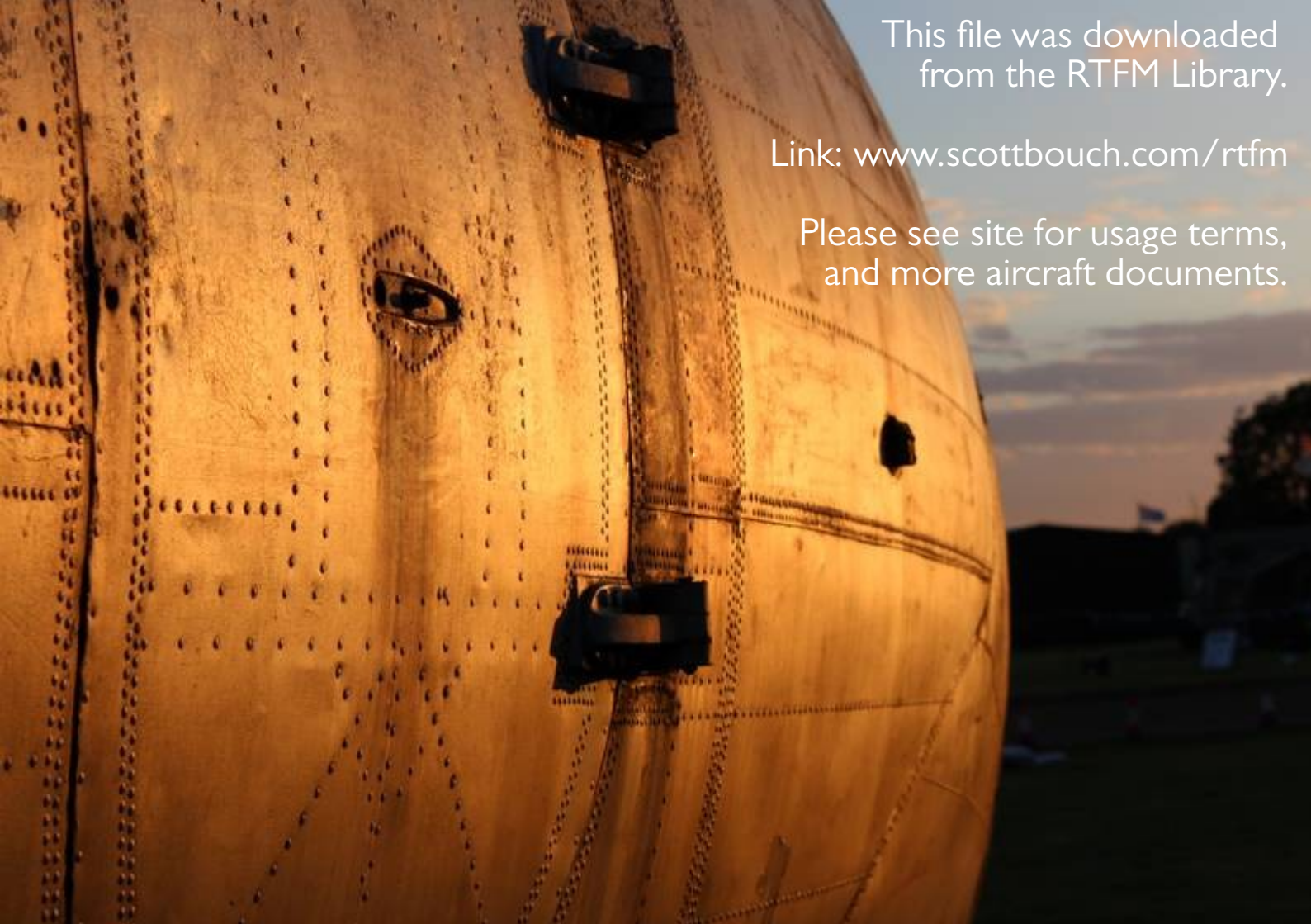
111A. Flying in icing conditions

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Engine icing is known to occur in the same conditions which give airframe icing. The first sign of engine icing is a reduction in shaft horsepower, followed by a rise in j.p.t. Should these symptoms be evident, reduce power and endeavour to fly out of icing conditions. If the engine limitations are likely to be exceeded, or if there is vibration, reduce power still further.

111B. Electrical failures

The trimmer controls, booster and transfer pumps and electrical instruments will become unserviceable. Electrical selection of the undercarriage will not be possible, necessitating use of the emergency system. The reverse torque system (see para. 10) will become inoperative and the F.F.P.S. will auto-engage regardless of the switch position. A false excessively high j.p.t. reading will result.



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