PART 4

EMERGENCIES

List of Chapters

PART 4

CHAPTER 1 — EMERGENCIES INDEX

◀ (*Re-issued at AL*15) ▶

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1 General

Table 1 shows the location of all emergency procedures covered in the Flight Reference Cards and in the text of these Notes.

Table 1 — Malfunctions and Emergencies

Emergency	*Text* Pt Ch Para	*FRC*
ABANDONING		
Ejection	1—12—21	25(R)
Manual separation	1—12—21	25(R)
AUTOPILOT AND AUTOSTABILISATION		
Autopilot and autostabilisation malfunctions	1—14—26	31
CANOPY		
Emergency operation on the ground	1—9—2	—
Canopy jettison	1—9—3	25
AIR CONDITIONING		
Excessive cockpit heating or cooling	1—10—9	31
Loss of pressurisation	1—10—8	30(R)
Overpressurisation	1—10—2	30(R)
Toxic fumes or mist in cockpit	1—10—11	30(R)

(*continued*)

Emergency	*Text* Pt Ch Para	*FRC*
ELECTRICAL		
AC supply failure	1—1—16	29
Generator failure	1—1—17	29
Generator overvolting	1—1—18	29
DC failure	1—1—17	29
AC and DC failure	—	29
DC and battery failure	—	29
Air turbine malfunctions	1—1—19	29
Instrument supply changeover	1—1—20	29
ENGINES		
Engine failure on take-off	3—1—4	20
Reheat failure on take-off	3—1—4	20
Engine failure in flight	—	20(R)
Reheat relighting	3—2—3	20
Engine relighting	3—4—4	20(R)
Oil pressure warning	1—3—14	21
FIRE		
Engine fire	4—2—2	18
Single reheat warning	4—2—2	19
Double reheat warning	4—2—2	19(R)
FUEL		
Fuel pressure warning	1—2—23	21(R)
Fuel tank vent valve failure	1—2—27	22(R)
Fuel transfer cock failure	1—2—24	22(R)
Ventral and flap tank fuel transfer failures	1—2—26	23
Fuel contents gauge failure	1—2—25	—
HYDRAULICS		
Services failure	1—5—7	24
Hydraulic feel failure	—	24
Single flying controls failure	1—6—12	24(R)
Double flying controls failure	1—6—12	24(R)
Trimmer malfunctions	1—6—13	31

(*continued*)

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PART 4

CHAPTER 2 — EMERGENCY PROCEDURES

Contents

AL 17

1 General

Although systems malfunctions are covered in the appropriate chapters of these Notes and in the Flight Reference Cards, considerations to be borne in mind and background information on certain emergencies are given in this chapter.

2 Fire in the Air

(*a*) *Damage to Elevator Control Rods*

A fire of sufficient severity in a reheat or engine zone can affect the elevator control rods so that elevator control is reduced or lost. The most likely result is control stiffening caused either by structural distortion or by grease carbonisation in the control system bearings; it is stressed that in this condition the aircraft can still be manoeuvred. All evidence available suggests that it is most unlikely that complete loss of control will occur from fire causes alone, before other significant occurrences which would necessitate ejection; these malfunctions are total electrical failure, fuel system warnings, hydraulic problems and loss of rudder control. Even with these associated failures the aircraft is likely to be fully controllable until the point of ejection. There is also evidence to suggest that the symptoms of fire damage to the controls are progressive and, provided they are not accompanied by warnings of other system failures or malfunctions, it is likely that the aircraft will remain flyable. No additional danger is placed on the pilot by staying with the aircraft until it is either deemed to be recoverable or ejection is necessary for reasons of fuel state, operational necessity or danger to

civilian population. It is advisable, therefore, to fly at a low IAS turning where necessary at a low rate, not attempting to look for external signs of fire which, in any case, may be indiscernable. Although the steel control rods are resistant to the most severe fire, the surrounding structure could fail with similar results to control rod failure. Symptoms of fire damage are

(i) Increase in friction or stiffening of elevator control.

(ii) Loss of effectiveness about the centre position of the control column.

(iii) Loss of feel.

To detect the symptoms, make small fore and aft movements of the control column. Investigation has shown that in the case of a persistent fire, it is very likely that the symptoms will appear within 5 minutes.

(*b*) *Fire Warning at Low Level*

The rate at which control damage can arise is such that there may be insufficient time to land safely even though the warning occurs at low level near an airfield. Unless a warning occurs during the last stages of an approach, from which position a landing is likely to be safer than an overshoot, the pilot's primary considerations should be to shut down the affected engine and to attain a minimum safe height of 5000 feet AGL.

(*c*) *Minimum Safe Height*

The recommended minimum safe height at which to perform subsequent actions is 5000 feet AGL. This height assumes automatic parachute deployment and caters for:

(i) All aircraft attitudes.

(ii) A rate of descent of 20,000 feet/minute.

(iii) The time interval between a pilot deciding to eject and initiating the ejection sequence.

(*d*) *Persistent Warning*

If the fire drill extinguishes the fire, the firewire should cool and the warning should go out; a persistent warning indicates either a continuing fire or a spurious warning. As stated in para 2 (*a*), if elevator control is going to be lost, it is most likely to occur within 5 minutes. If loss of control has not occurred at the end of 15 minutes it is virtually certain that the warning is spurious. Thus, to diagnose whether a persistent warning is real or spurious,

a minimum of 5 minutes should be spent above 5000 feet and longer than this if the fuel state permits. A continued double warning must be taken initially as an indication of persistent fire. However, if after carrying out the drills listed in the FRC and waiting for the recommended period no further symptoms occur, the warning may be assumed to be spurious. If considered practicable, the aircraft may be landed using the minimum power required. A continued single warning without any other signs of fire or system(s) malfunctioning can be assumed to be spurious. The decision to land whether the symptoms remain or go out, must be taken individually and will depend on what other symptoms have occurred.

(*e*) *Firewire Reset Times*

Dependent on the type of overheating experienced by the firewire, and the level beyond the warning threshold to which the firewire has been heated, a certain time is required for the system to fall to the reset level. In many cases this reset time could extend up to 2 minutes and even beyond.

(*f*) *Engine Fire*

The importance of immediately shutting down an engine following a fire warning cannot be overstressed. This action quickly lowers the temperature of the engine and its surrounds, and cuts off supplies of inflammable fluids. A speed reduction is recommended before discharging the extinguisher. However, the pilot should not wait deliberately for speed to reduce but rather effect the speed reduction as circumstances permit whilst carrying out the actions which precede operating the extinguisher. It should be noted that optimum cooling of the external surfaces of a live engine is obtained at flight idle. Whenever possible the live engine should be brought back to this condition at the time of shut down of the affected engine.

(*g*) *Reheat Fire*

Present data suggests that a double reheat fire warning will result in the loss of the aircraft. However, it is stressed that even in this condition, immediate ejection is not essential. In all cases the No 1 engine should be shut down immediately and a controlled climb initiated to at least 5000 feet AGL. The aircraft may then be manoeuvred

into the most suitable area for an ejection, unless further symptoms necessitate otherwise. In the case of a single reheat warning it is possible for the warning to originate from either engine and the drill requires shut down of the engine associated with the warning while minimum practicable RPM is used on the other (the drill represents minimum practicable RPM as 250 knots). It is also possible for only one warning to be given when, but for some unusual circumstances or malfunction, two warnings would have appeared. Thus, even though a single reheat warning goes out, a safe height should be maintained for at least 5 minutes.

(*h*) *Titanium Fires*

Under certain conditions, mechanical failure in the compressor may result in a titanium fire. Furthermore, in isolated instances the fire has not been contained within the engine casing. In the event of the fire breaking out into the engine bay there is a possibility that the FFFD firewire could be burned through and disabled so quickly that no fire warning would be given. Consequently, the only indications within the cockpit would probably be falling RPM accompanied by rapidly rising JPT. Therefore, if a flame-out is characterised by rapidly rising JPT in the absence of compressor stall or mechanical failure symptoms, the possibility of a titanium fire rendering the fire warning system inoperative should be considered. If this is suspected action should be taken as for 'Engine Fire — *if light remains on*' notwithstanding the absence of a fire warning light.

(*j*) *Fire Drills*

Engine and reheat fire drills are given in the Flight Reference Cards. These drills recommend that a similar pattern be followed involving immediate shut-down of the affected engine (No 1 engine in the case of a double reheat warning), a climb to a minimum safe altitude of 5000 feet AGL, gentle manoeuvres only without negative g, operation of the extinguisher followed by checks (both from a visual source and functional) to try to establish the seriousness of the fire. If fuel permits, flying may be continued until the real situation can be established so as to permit landing, or until the aircraft is in the most suitable position for abandonment.

3 Loss of Rudder in Flight

If the rudder becomes detached in flight the aircraft should be recovered to a runway with less than 10 knots crosswind. However, if this is not possible, evidence suggests that a landing in crosswinds up to 20 knots should not present any serious difficulty.

4 Engine/Fuel Management During Diversion

To realise maximum range with critical fuel reserves remaining, the best engine/fuel handling technique to adopt during a low level diversion (50 to 70 NM) has been investigated. Results indicate that fuel should initially be transferred using the fueldraulic system (preferably from the No 2 side since this produces the higher transfer rates) while flying in the 2-engine cruise condition; on completion of transfer, revert to single-engine cruise. No advantage is gained by increasing an engine speed to assist transfer. This technique is only valid with critical fuel reserves; wing-to-wing transfer using DC pumps alone during level flight becomes the more efficient method with high fuel contents.

◀5 Failure to Obtain Three Green Undercarriage Lights

If one or more undercarriage position lights remain out after a down selection (ie no green or red), the failure is probably an electrical fault in the indicating circuitry. This can be assumed if all red lights appeared on the down selection and if the distinctive noise of each leg locking down is heard. If one or more lights fail to appear, proceed as follows:

(*a*) Check bulb changeover.

(*b*) If the light(s) still fail to appear, obtain a visual check if possible.

(*c*) If the undercarriage appears abnormal carry out the **Undercarriage Fails to Lower** drill in the FRC.

(*d*) If the undercarriage appears down and locked, the nature of the electrical fault can be determined by the number of red lights which appeared on initial down ▶

selection (if the red lights were not checked the undercarriage should be recycled to establish the number of red lights which appear). If three reds appeared, the likely fault is a break in the circuit downstream of the microswitch, since the red light is extinguished by the operation of the locking plunger. The undercarriage can be taken to be locked down if the red light comes on and then goes out. If a leg has no green and no red appeared either, an electrical fault upstream of both microswitches is likely; in this case the undercarriage is still probably down and locked.

(*e*) Before landing, operate the emergency undercarriage lowering handle.