PART 4

EMERGENCY PROCEDURES

Chapter 1

ENGINE AND FUEL SYSTEM EMERGENCY PROCEDURES

CONTENTS

1. Engine failure on take-off

a. At or below the V STOP speed

(i) Action. Abandon the take-off: proceed as follows:—
Move the THROTTLE/s to idle/idle
Stream the brake parachute (refer Part 3, Chap. 5, para 4(c))
Employ maximum wheel braking technique
Use hook if required.
Make appropriate R/T call.

(ii) Considerations. Provided that the services hydraulic pump on the running engine is serviceable, no loss of brake pressure will occur. Failure of the pump will not be indicated on the services system pressure gauge since AC is off-line. In this case the wheel brakes accumulator will usually meet the braking requirements of the aircraft but, particularly if frequent 'maxaretting', and/or differential braking occurs, its capabilities may be marginal.

b. Above the V STOP speed

(i) Immediate action
Continue the take-off
Leave both throttles at maximum reheat
Delay unstick to 185 kts.

(ii) Subsequent actions
Raise the undercarriage as soon as the aircraft is safely airborne
Raise the flaps, preventing any loss of height with stick movement
Select the failed engine throttle to HP COCK OFF
Select the appropriate LP ENG COCK switch off
Land as soon as practicable.

2. Reheat failure on take-off (TTC warning remains on AWP)

a. At or below the V STOP speed cancel the failed reheat and reselect below 90 kts.
If unsuccessful, abandon the take-off.
In operational necessity, take-off can be achieved with one failed reheat, but care should be taken to check that the nozzle on the failed reheat is closed (see (b) below).

b. Above the V STOP speed. Continue the take-off: proceed as follows:—
Leave both throttles at maximum reheat
Check that the nozzle closes on the failed reheat: if not, cancel manually and leave the throttle at the maximum cold thrust position.
Raise the undercarriage when the aircraft is safely airborne, and the flaps above 190 kts.
Return the appropriate throttle to the maximum cold thrust position.

3. Engine failure in flight

a. Mechanical. If an engine fails owing to mechanical causes, carry out the following drill immediately:—
Select the failed engine THROTTLE to HP COCK OFF.
Select the appropriate LP ENG fuel COCK and DC FUEL PUMP switches to off.

If it is necessary to transfer fuel in order to recover, select the DC PUMP switch to ON.

Do not attempt to relight the failed engine.

Land as soon as practicable.

b. Flame out

(i) If an engine flames-out in normal operating altitudes, an immediate attempt to relight may be made at any speed and altitude (refer to Part 3, Chap. 6, para. 3(a)). If this attempt fails, select the appropriate THROTTLE/HP cock to HP COCK OFF, wait 1½ minutes and carry out the relighting drill given in Part 3, Chap. 6, para.3(b).

(ii) If an engine flames-out during zoom climbs to altitudes above 60,000 ft select the appropriate THROTTLE to HP COCK OFF, descend to within the relighting envelope and relight as given in Part 3, Chap. 6, para.3(b).

c. Double flame-out

(i) Within normal operating altitudes. Immediately attempt to relight: if this fails proceed as follows:—

Select both THROTTLES to HP COCK OFF

Maintain speed above 250 kts (to ensure that windmilling RPM provide hydraulic power for the operation of the power controls)

Make a fast rate descent to the relighting altitude (below 40,000 ft)

Restrict flying control movements to a minimum

Switch off all non-essential DC loads as quickly as possible

When the relighting altitude is reached:—

Carry out the relighting drill on one engine

When the engine has relit (or failed to relight), relight the other engine. The danger of repeated relight attempts may be unavoidable. Further attempts to relight are permissible, if necessary.

If neither engine can be relit, glide to a suitable area and abandon the aircraft.

(ii) Above the normal operating altitude. Select both THROTTLE/s to HP COCK OFF.

Descend at the maximum rate possible, using minimum control movements, to the relighting altitude

Do not attempt to relight until within the relighting envelope.

4. Oil pressure warning

a. Indication. OIL 1 or OIL 2 on AWP in positive g conditions.

b. Actions. Throttle the affected engine to idle.

Transfer fuel from the affected side.

Land as soon as practicable.

c. Subsequent actions

(i) If there is any vibration or other evidence of malfunction, the engine should be shut down and a single-engine landing carried out.

(ii) If there is no evidence of malfunction other than the oil warning, the throttle may be left at idle for the services the engine provides or, if desired, the engine may be shut down and subsequently relit and maintained at idle for landing.

(iii) If it is essential in the interests of aircraft safety (e.g. undercarriage emergency lowering) the engine may be operated at up to 85% RPM.

5. Engine or reheat fires in flight

a. General considerations

(i) Damage to elevator control rods. A fire of sufficient severity in an engine or reheat zone can damage the elevator control rods to the extent that control is either reduced or lost. The most likely result is a stiffening of the controls caused by either structural distortion or grease carbonization in the system bearings; but it is stressed that, even in this condition, the aircraft can still be manoeuvred. All evidence available suggests it is most unlikely that complete loss of control will occur from fire causes alone before other hazardous events (also a result of the fire) which would necessitate ejection. These are: total electrical failure, fuel system warnings, hydraulic problems, and loss of rudder control. Nevertheless, even with these associated failures, the aircraft is likely to remain fully controllable up to 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 will be placed on the pilot by staying with the aircraft until it is deemed to be recoverable or ejection is necessary for reasons of fuel state, operational necessity, or the later possibility of endangering populated areas. 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:

Increase in friction or stiffening of elevator control.

Loss of effectiveness about the centre position of the control column.

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.

(ii) 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 ft AGL. This is the recommended minimum safe height at which to assess possible fire damage and to perform any subsequent actions. Should ejection become necessary, provided the seat operates correctly, this height allows for the time delay between the decision to eject and the ejection, all aircraft attitudes, and a rate of descent of 20,000 ft/min.

(iii) Persistent warnings. If the fire drill extinguishes the fire, the firewire should cool and the warning should go out. A certain time will be required for the firewire to cool depending on the degree to which it has been heated, and the fire warning light may stay on for up to two minutes or even longer. A persistent warning would indicate either a continuing fire or a spurious warning. As stated in (i) above, 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. Therefore, after remaining for as long as the fuel state and other circumstances permit, and in any case for a minimum of 5 minutes, above 5000 ft, a persistent warning without any other signs of fire damage can be assumed to be spurious. This also applies to a continued double reheat fire warning, but a continued double engine fire warning, if for no other

reason than that the proper drill cannot be carried out, must be treated as a persistent fire and the aircraft should not be landed. However, the decision to land, even if all warnings go out, will depend on the nature of any other symptoms that may have occurred.

(b) Engine fire warnings. The importance of immediately shutting down an engine following a fire warning cannot be overstressed. This quickly lowers the temperature of the engine and its surrounds, and cuts off supplies of inflammable fluids. A speed reduction is recommended before the extinguisher is discharged but discharge should not be deliberately delayed for this purpose. Thus, when practicable, immediately the fire warning is triggered off the throttles should be closed to flight idle and the speed reduced by climbing while the affected engine is shut down preparatory to discharging the fire extinguisher. Where practicable (even when already above 5000 ft AGL), a climb should be initiated and the throttles closed to flight idle immediately the warning is triggered off; thereby effecting some speed reduction whilst shutting down the affected engine preparatory to discharging the extinguisher. It should also be noted that optimum cooling of the external surfaces of an engine is attained at flight idle, hence the added necessity to throttle back the unaffected engine to this setting wherever possible

(i) Indications. FIRE 1 or FIRE 2 on SWP and the associated extinguisher button.

(ii) Immediate actions. Cancel both reheats and throttle back to flight idle where practicable, whilst pulling up into a climb. The climb will result in speed reduction and attain a safe height (5000 ft AGL) for likely ejection. Avoid negative g.

Move the THROTTLE of the affected engine to the HP COCK OFF position, ensuring that the other throttle (if at or near idle) is not carried with it.

Select the appropriate LP ENG COCK and DC FUEL PUMP switches off, and select the FLIGHT REFUEL switch to ON.

Press the appropriate extinguisher button.

(iii) Subsequent actions if warning remains. Set the minimum practicable RPM (the power setting for 250 kts IAS) on the unaffected engine.

Remain above 5000 ft AGL for as long as possible and for at least 5 minutes.

Make preparations to eject and head for a suitable area.

Monitor flight and engine instruments and warning panels for further signs of fire.

Monitor flying controls for symptoms of fire damage.

If possible have a visual check made by a chase aircraft which should fly at a safe distance, preferably below and behind and not in close formation.

If the fire is confirmed, eject when forced to or over a suitable area.

If there are no signs of fire, land when the fuel state dictates having adopted the range speed, if necessary, meanwhile. Use the minimum necessary power.

(iv) Subsequent actions if warning goes out. Land as soon as practicable, using the minimum necessary power.

(Should the warning recur, suspect a persistent fire and proceed as in (iii) above).

c. Single reheat fire warnings. In the case of a single reheat warning, it is possible for the warning to originate from either engine and not necessarily from the one indicated. The drill, therefore, requires shutdown of the engine associated with the warning whilst, at the same time, setting minimum practicable RPM on the other (this being represented by power to maintain 250 kts IAS). It is also possible for only one warning to be given when, but for some unusual circumstance or malfunction, two warnings should have been given. Accordingly, even though a single reheat warning goes out, a safe height should be maintained for at least 5 minutes and a watch kept for symptoms of fire damage.

(i) Indications. RHT 1 or RHT 2 on SWP

(ii) Immediate actions. Proceed as for an engine fire warning (b (ii) above), remembering that the engine fire extinguisher has no effect on the reheat section and must NOT be used in case an engine fire should later develop.

(iii) Subsequent actions – whether or not the warning goes out. Proceed as for a persistent engine fire warning ((iii) above) observing the full waiting period.

d. Double reheat fire warnings. Present data suggests that a double reheat fire warning will result in the loss of the aircraft. However, it is stressed that, even though the condition may exist, immediate ejection is not vitally essential. First, in all cases, No. 1 engine should be shut down immediately whilst a controlled climb to at least 5000 ft AGL is initiated. The aircraft can then be manoeuvred into the most suitable area for ejection (unless further symptoms indicate continued delay to be hazardous) during which time the situation can be investigated, and, if there are no signs of fire, a landing may be contemplated.

(i) Immediate actions. Proceed initially as for a single warning – cancel reheat, select flight idle, and climb – being particularly careful to avoid negative g.

Regardless of other considerations, shut down No. 1 engine (HP COCK OFF, LP ENG COCK and DC PUMP off), select the FLIGHT REFUEL switch to ON, and maintain the No. 2 engine at the minimum practicable power.

(ii) Subsequent actions – whether or not one or both warnings go out. Proceed as for a persistent single warning, landing finally if there are no signs of fire. The assistance of a chase aircraft should be considered essential.

e. Further considerations. After the fire drill has been completed following an engine or reheat fire warning:

(i) Do not attempt to relight the engine; the LP COCK must remain closed.

(ii) Transfer fuel (DC PUMP ON) from the affected engine's tanks only if it is essential to recovery. 400 lb of that fuel will not be available.

(iii) Should AC change-over to the standby inverter occur (for instance, through low RPM on the remaining engine) while the original fire warning is still present, the attention getters will function again due to the momentary interruption of AC supplies.

6. Fuel warnings. The appearance of a FUEL warning indicates that there is no output from the associated fueldraulic booster pump. Loss of booster pump output may be caused by either a failure of the fueldraulic system or an empty collector box. Exceptionally, either of these conditions may be the result of a fractured fuel supply pipe. More usually, an empty collector box results from descending or decelerating flight when there is no gravity flow into the box, combined with a failed leading edge DC pump and the rear DC pump uncovered. Refer also to Part 1, Chap. 2, para. 25(c).

a. Indication. FUEL 1 or FUEL 2 on the AWP

Reheat, if in use, cancels automatically: TTC 1 or TTC 2 on the AWP.

b. Immediate action. Throttle affected engine to idle and establish aircraft attitude 7° nose-up for at least 15 seconds in order to refill the collector box, if empty, thus prevent possible flame-out through fuel starvation.

c. Subsequent actions if the warning persists. Although in all probability a failure of the fueldraulic pump has occurred, it cannot be ruled out that a fuel supply pipe has fractured with the consequent hazard of a large scale leak. Therefore:

Recover immediately

Do not exceed 40,000 ft, 0.9 M and 85% (affected engine), to avoid possible damage to the HP pump

If fuel balancing becomes necessary during the cruise, throttle the affected engine to idling before selecting fuel transfer and leave at idling during the transfer operation.

If the engine flames out:

Do not relight
HP COCK — OFF

Land as soon as practicable

NOTE. . .

Even in the case of combined fueldraulic and DC pump failure, the engine should run successfully on gravity feed provided:

The altitude is below 12,000 ft
The RPM is 85% or less
The collector box is kept full
There are no blockages in the fuel lines

d. Subsequent actions if the warning goes out. Assume DC pump failure and:

Recover using range (slow-rate) descent if possible (0.9M/250 kts, airbrake in, throttles idle/idle but maintaining No. 2 engine at 60% RPM)

Avoid nose-down attitude as much as possible

Increase the aircraft attitude to 7 nose-up for 15 seconds:

immediately if the FUEL warning recurs
every 15,000 ft down the descent

Land as soon as practicable

It the engine flames out, adopt a nose-up attitude and attempt a relight. If the relight is unsuccessful, select the HP COCK OFF, transfer fuel to the live engine, adopt a 7° nose-up attitude for 15 seconds every 15,000 ft down the descent and carry out a single-engined recovery and landing.

7. Ventral tank fuel transfer failures

a. Slow transfer (AC failure or AC pump failure)

(i) Indications. Either AC warning on AWP or, at high engine power or with reheat, wing tank contents decrease markedly while ventral contents decrease slowly.

(ii) Actions. Reduce power and speed to economic cruise. Select EMERG at the ventral tank emergency transfer switch to supplement the pump by-pass valve by opening the emergency transfer valve. Fuel transfer on air pressure alone will normally meet optimum cruise conditions. If power in excess of subsonic cruise is used, monitor the wing tank gauges and do not allow wing tank contents to decrease below 1200 lb/side whilst fuel remains in the ventral pack. With fuel in the ventral tank and wing tank fuel decreasing normal accelerations should be kept to a minimum until ventral tank fuel has transferred.

b. Failure to transfer (REFUEL selected or pump transfer valve shut)

(i) Indication. Ventral tank contents do not decrease.

(ii) Actions. Ensure FLIGHT REFUEL switch is selected to OFF

Select EMERG on the ventral tank emergency transfer switch

Monitor the fuel gauge

If fuel still fails to transfer Reduce speed; do not exceed 250 kts

Keep within +lg to +2g and 60° bank

Perform all manoeuvres gently (pitch control forces will be lighter than normal), and once lowered, leave the undercarriage down since a subsequent malfunction may require harder manoeuvres than normal.

An instrument type approach is recommended.

8. Fuel leak. Should a major fuel leak occur, indicated by the fuel gauge contents decreasing rapidly, and possibly by external streaming or venting of fuel, a serious fire risk exists and the aircraft should be landed without delay. The action to be taken while recovering is described in the Flight Reference Cards.

Chapter 2

ELECTRICAL EMERGENCY PROCEDURES

CONTENTS

1. General information

a. DC power is provided by a generator; if this fails all the aircraft services can be operated by the standby generator. Only if both generators fail does an emergency condition arise because all loads which cannot be switched off have to be supplied by the battery.

b. Should the AC generation or control system fail, all AC services are lost except for the standby artificial horizon and direction indicator system and those essential services which have a standby supply via the standby inverter. In these conditions the standby ASI and standby altimeter must be used throughout the recovery and the aircraft can only be used operationally in visual attacks because of the loss of the AI.

c. In the event of failure of the governor system of the main air turbine resulting in overspeeding, the air turbine is automatically shut-down as a safety measure, thus stopping the main generator and alternator. The battery provides for DC services until the standby generator is switched into use, and the essential AC services are provided by the standby inverter which starts up automatically.

2. Main generator failure

a. Indications. GEN warning on the SWP and AWP with generator switch selected to NORMAL: voltmeters indicate battery voltage.

b. Immediate action. Press the GEN RESET button

If the warnings remain
Select the GEN switch to ST'BY

Check that the GEN warning on the SWP disappears and the voltmeters indications are approximately 28 volts.

3. Double generator failure

a. Indications. GEN warning on the SWP and AWP irrespective of the selection made on the generator switch: voltmeters indicate battery voltage.

b. Immediate actions. Commence recovery to the nearest suitable airfield

Switch off all non-essential DC loads as quickly as possible

Select Tacan channel for recovery, subsequent channel changing should not be attempted.

c. Subsequent actions. Select the UHF SET switch to STANDBY

Select the UHF POWER switch to STANDBY

When communication is established, select the function switch on the main UHF controller to OFF.

(i) Range not critical. Descend to below cloud if position is known and it is safe to do so.

(ii) Range critical. Cruise at optimum altitude for 25 minutes or until the voltmeter indicate 23-volts, then descend to below cloud if it is safe to do so. If the flight instruments appear to be unreliable, a descent through cloud may be extremely hazardous and ejection must be considered before commencing the descent. If the fuel state permits, select the undercarriage down early and check three green lights obtained.

d. Considerations

(i) Guide to load shedding

		amps
DC pumps (4)	(total)	44
Main VHF/UHF	UHF TX	14
	V/UHF RX	10.4
	VHF TX	12.4
ILS		11
Pitot heaters (on standby power)		10
AI 23S		3
Navigation lights		2.5
Camera heaters		2
IFF		2
Cockpit lighting		2
FCS		1.5
Master armament selector		1

(ii) Switching off the DC pumps will reduce the electrical load considerably. If the pumps are switched off they should not be switched on again as the starting load will impose a very heavy discharge on the battery. Depending on prevailing circumstances consideration should be given to switching off DC pumps on one side.

(iii) With the DC pumps switched off, replenishment of the fuel collector boxes will depend entirely on gravity feed therefore the aircraft attitude must be maintained nose-up whenever practicable. Approximately every 15,000 ft down the descent the aircraft attitude should be increased to 7° nose-up for not less than 15 seconds to fill the collector boxes, thus preventing possible flame-out through fuel starvation.

(iv) Switching off the main radio and using the standby set on standby power is a total saving as the standby set will be connected to the emergency battery.

(v) The pitot heaters normally use AC power and would only be selected to standby (DC) power in AC failure conditions.

4. Battery failure (total DC failure following double generator failure)

a. Indication. Voltmeters indicating in the left-hand red sector.

b. Actions. Fly below cloud and in visual conditions. Use the standby flight instruments but do not attempt to fly in instrument weather conditions (e.g. to descend through cloud).

Abandon the aircraft before entering those conditions.

Select emergency cockpit lighting if required

Where practicable, maintain nose-up flight attitude to ensure fuel in the collector boxes

Be prepared to lower the undercarriage on the emergency system: the green lights may not be visible

Set up approach for flapless landing

Land as soon as possible.

c. Considerations

(i) The following instruments will still be available, even with a discharged battery:— standby compass: standby altimeter: standby ASI: slip indicator: RPM and JPT indicators, standby artificial horizon and standby direction indicator for as long as the emergency battery lasts.

(ii) With a failing battery the relay controlling 115-volt AC supplies will drop out, resulting in loss of the following services:— height and rate-of-climb display: strip speed

display: attitude indicator: navigation display: fuel gauges: fire detection system: cockpit temperature control and JPT control. Missile jettisoning is possible down to a very low battery voltage.

(iii) The nozzles will move to, and remain in, the cruise position irrespective of RPM.

(iv) The brake accumulator pressure gauge will indicate 4000 PSI, the real pressure will not be known.

(v) The brake parachute can be streamed but it cannot be jettisoned.

(vi) Services lost in addition to those above include:— Fuel cocks and DC pumps: engine relighting: warnings on the SWP and AWP: undercarriage normal selection and indicators: flaps and airbrakes selectors and indicators: trim motors and indicators: oxygen contents gauge: canopy (normal) opening

(vii) The oxygen airmix facility will be inoperative, the regulator will deliver 100% oxygen.

5. AC supplies failure

a. Indications. AC warning on AWP: Standby inverter indicator changes to white/ON: AP warning on SWP if MASTER is selected on the FCS controller.

b. Immediate action. Press the AC reset button.

c. Subsequent actions if power is restored. The autopilot will remain tripped – switch off and reselect any mode required using the correct switching sequence. Cross-check the main altimeter with the standby altimeter for error (The AI will not be operational for 5 minutes).

d. Subsequent actions if the warning remains. While reducing to subsonic speed if necessary:

Select the INVerter switch to STANDBY
Select STANDBY on the PITOT HEATER switch
Select FCS MASTER switch OFF (A/P warning off)
Select the VENT TANK EMERGY T'FER switch to EMERG if fuel remains in ventral pack, and cruise at 85% RPM to aid ventral fuel transfer
Select the AI on/off switch off
Use the standby ASI and standby altimeter for recovery (the AAL is 500 ft indicated)

e. Considerations. The services lost are as follows:— Air data system (strip speed and height and rate-of-climb displays): AI 23S: Tacan: IFF and SIF: autopilot and flight director: pitot heaters (normal): fuel vent valve heaters: ventral fuel transfer pump: windscreen heaters: canopy blower: JPT controller: services hydraulic pressure gauge: spraymat anti-icing: 4-volt instrument lighting. Should the automatic change-over to the standby inverter fail, the MRG will be lost and consequently the attitude indicator and the gyro magnetic compass, even though the inverter is subsequently brought on line by selection of the INVerter switch to STANDBY. It will still however be possible to synchronise the compass with the aircraft heading in order to check the direction indicator.

6. Air turbine failure or burst air duct. The following drill is based on the assumption that the pilot is unable to assess whether the air turbine has failed or the air duct has burst from the initial indications. If, however, the initial indications include a CPR warning or loss of nozzle control (i.e., nozzles fully open in cold power), the generator switch should be selected to EMERG and action taken for a burst air duct (see (d) and (e) below). The electrical accessories drive system diagram in Part 1, Chap. 1 should be consulted throughout this paragraph.

a. Indications

GEN warning on SWP

TURB AC and GEN warnings on AWP

b. Immediate actions

Cancel reheat if in use, and throttle back smoothly

Select GEN switch to STBY

c. Subsequent actions

(i) If the GEN warning on the SWP goes out, indicating a turbine failure with the standby generator on line: Take action for AC failure but without attempting to reset AC.

(ii) If the warnings remain, indicating a turbine failure with standby generator failure, or a burst air duct: Ensure both engines are running above 60% and select the GEN switch to EMERG.

(iii) If the warnings still remain, indicating a turbine failure and standby generator failure: Take action for double generator and AC failure. Reselect GEN switch to STBY.

(iv) If GEN on SWP goes out with EMERG selected, indicating a burst air duct: Take action according to the remaining indications as described in (d) and (e) below.

d. Burst air duct between No. 1 engine and the isolating cock

(i) Indications

CPR warning on SWP if at altitude

GEN warning on AWP

(ii) Actions

Take action for pressurization failure

Maintain fast idle or above on No. 2 engine

e. Burst air duct between No. 2 engine and the isolating cock

(i) Indications

TURB AC and GEN warnings on AWP

Loss of nozzle control (nozzles indicating fully open)

(ii) Actions

Take action for AC failure

Allow for loss of thrust.

f. Considerations. A 40% reduction of full cold thrust will occur if air for nozzle control is completely lost. Therefore if the No. 2 engine is shut down with the GEN switch set to EMERG, the loss of No. 1 engine nozzle control will probably require the use of reheat during the recovery.

Chapter 3

AIRFRAME EMERGENCY PROCEDURES

CONTENTS

TABLES

1. Service hydraulic system failure

a. Total pressure failure

(i) Indications. Services pressure gauge indicates persistent loss of pressure when no service is being operated (e.g. needle in the red sector – needle in the white sector indicates AC electrical failure to the gauge). Services fail to operate when selected.

(ii) Actions. Select the FCS – MASTER switch OFF

Check position of the airbrakes and then check that the selector is in agreement with airbrakes position

Land as soon as practicable

When preparing to land select FLAPS down just before lowering the undercarriage as return fluid may lower the flaps

Lower the undercarriage by the emergency lowering selector (refer to para. 4(d))

If the flaps remain up, plan the approach for a flapless landing

Immediately after touchdown select both HP COCKS OFF

Supplement the drag of the brake parachute by a continuous steady application of wheel brakes; avoid maxaretting if possible.

(iii) Considerations. Hydraulic fluid is extremely flammable – leaking fluid will create a serious fire hazard.

If exhaustion of the feel unit accumulator occurs, only spring feel remains on the tailplane and rudder

The aircraft should be landed on a long runway (not less than 7500 ft) equipped with an arrester barrier or wire.

The following services will be inoperative:—

Undercarriage operation (normal system)
Flaps
Airbrakes
Guided missiles and rocket launchers

The following services will become inoperative when the accumulators from which they are operated become exhausted:—

Wheelbrakes
Nosewheel centring
Autostabs
Canopy operation
Feel and feel simulator

b. Partial failure

(i) Services pressure gauge indicating fluctuating pressure or slowly reducing pressure when no service is being operated.

(ii) Actions. Select the missile ARMED/SAFE switch to SAFE – to prevent damage to the weapons system

Reduce speed to below 400 kts

Select the FCS – MASTER switch OFF – to prevent intermittent operation

Select the FEEL switch OFF – to avoid varying feel forces

Land as soon as practicable.

NOTE. . .

Total and partial hydraulic failures appear as a combined drill in the FRC.

2. Hydraulic feel failure

a. Indication. Marked lightening of the tailplane and rudder control forces.

b. Action

Reduce speed to below 400 kts

Restrict handling to gentle manoeuvres.

c. Considerations

(i) The spring control forces remaining are adequate at low speeds, but at high speeds are low enough to make overstressing of the airframe easy.

(ii) If the fault is caused by pilot pressure failure, malfunctioning of the flight instruments associated with the air data system is likely.

3. Flying controls hydraulic system failure

a. Failure of one controls system

(i) Indications

Either HYD 1 or HYD 2 warning on AWP.

(ii) Actions

Disengage any autopilot mode engaged

Do not exceed 2g

Land as soon as practicable.

(iii) Considerations. It is prudent to restrict speed and control movements to those necessary for recovery

With a No. 1 controls system failure (HYD 1), the undercarriage emerency lowering system will be inoperative, but if the HYD 1 is due to No. 1 engine failure, windmilling RPM should provide sufficient power for the undercarriage emergency system should it be required

Accumulator pressure may be available for streaming the brake parachute but it should not be relied upon, and the precautionary landing technique, as described in Part 3, Chap. 5, para. 2 should be used.

b. Failure of both control systems

(i) Indications

HYD warning on SWP

HYD 1 and HYD 2 warnings on AWP

Flying controls will stiffen and finally become inoperative as the accumulators become exhausted.

(ii) Actions

If failure caused by double engine flame out:—

Take the appropriate action for double flame-out (Part 4, Chap. 1, para. 3(c)).

If failure not caused by double engine flame-out:—

The most likely cause of a double flying controls hydraulic warning, not associated with a double flame-out, is aeration of the system followed by pump cavitation usually after negative 'g' flight. A period of straight and level flight is likely to restore hydraulic

power; this has been known to take eight minutes. The following procedure is recommended when a double controls hydraulic warning is indicated:

Restrict control movement to a minimum. Establish 1 'g' flight at or above 5,000 ft. Select autopilot, if serviceable and if flying conditions are such that use of the autopilot would be less demanding on the power controls hydraulic supply. In general terms, hydraulic demands will be less if autopilot is used in all but turbulent conditions. Fly at as high a power setting as is practicable towards a suitable ejection area. Power settings above 70/70% should be maintained whenever possible.

Maintain these conditions until operational reasons or fuel shortage necessitate ejection or one HYD warning is cleared, when the drill for the failure of one controls system should be followed (see (a) above).

(iii) Whilst pressure within the accumulators is reducing and the pumps are passing air through the system, some control stiffening and restrictions may occur. The pilot must eject if the attitude of the aircraft reaches the stage where control is being lost and delay may jeopardize safe ejection.

4. Undercarriage emergencies. If the undercarriage malfunctions because of services pressure failure, it should be locked down if necessary, by use of the emergency lowering system and the aircraft landed. In the case of other malfunctions, a fuel state of 800 lb/side should allow sufficient time to carry out the drills outlined below.

a. Undercarriage fails to retract (on take-off or overshoot)

(i) Indications. One or more U/C red lights.

(ii) Immediate actions. Maintain speed below 250 kts. Reselect U/C down.

(iii) Subsequent actions. If three green lights obtained:
Make no further U/C selections
Land when down to normal landing weight

If three green lights not obtained:
Proceed as for (b) below.

b. Undercarriage fails to lower – unlocks but fails to lock down

(i) Indications. One or more U/C red lights

(ii) Actions. Attempt several reselections

Ascertain from other aircraft or the control tower the position of the undercarriage legs.

If a main undercarriage leg is within approximately 20° of fully down, yaw the aircraft away from that leg for periods of at least 20 seconds (i.e. yaw to starboard to lock the port leg) increasing speed into the range 270-280 kts. In this speed band the maximum benefit of yaw is obtained. If the leg is more than 20° from fully down, use roll first then yaw. If still unsuccessful, use the UC emergency lowering selector.

If the undercarriage nose leg is partially down, increase speed to 270-280 kts and apply positive and negative g to the buffet limit.

c. Undercarriage fails to unlock

(i) Indications. All U/C lights out.

(ii) Actions. Attempt several reselections

If unsuccessful, use the U/C emergency lowering selector

If the undercarriage remains locked up, abandon the aircraft (for the nosewheel locked up drill, see Chap. 4, para. 3(b)).

d. Undercarriage lowering using the emergency system

Maintain 200 kts in level or climbing flight with minimum use of the flying controls

Maintain No. 1 engine above 70% RPM

If the services hydraulic system has failed, select flaps down before operating emergency lowering selector

Ensure that the normal undercarriage selector is in the DOWN position to isolate the armament circuits

Push in the button on the top of the UC emergency lowering handle and firmly pull the handle up to the positive stop with the ankle above the guide tube

If still unsuccessful after 15 seconds, pull the handle vertically up again and hold it at its maximum extension.

5. Oxygen emergencies

WARNING . . .

HYPOXIA IS HARD TO DETECT AND DEADLY. ITS SYMPTOMS ARE VARIABLE, ILL-DEFINED AND UNRELIABLE. OF ITS VERY NATURE IT MAKES OXYGEN SYSTEM FAULT DIAGNOSIS DANGEROUS UNLESS IT IS CARRIED OUT BELOW 10,000 FT. THEREFORE, WHEN FLYING AT ALTITUDE, IF EITHER CREW MEMBER SUSPECTS HYPOXIA OR DOUBTS THE OXYGEN EQUIPMENT—PULL THE EMERGENCY OXYGEN KNOB IMMEDIATELY AND DESCEND BELOW 10,000 FT, SETTING THE OXYGEN SHUT OFF VALVE TO SHUT.

The procedures which follow should only be used when it is operationally necessary to do so and normally only when it is certain that oxygen is flowing to the mask or when flying below 10,000 ft.

(a) Indication. OXY 1 or 2 warning on SWP (indicating low pressure).

Actions. Check associated OXY PRESSURE gauge. If pressure above 25 PSI. Descend to 40,000 ft aircraft altitude or below. Continue the sortie and monitor the oxygen pressure.

(b) Indication. OXY FLOW indicator remains black (indicating no oxygen flow).

Actions. Check mask, hose and PEC connections, OXYGEN SHUT OF VALVE TO OPEN, oxygen contents and pressure. Select OXYGEN 100%.

If breathing unrestricted:

Assume an OXY FLOW indicator failure. Continue sortie and carefully monitor the oxygen equipment.

(c) Indication. OXY FLOW indicator remains white (indicating continuous oxygen flow).

Actions. Check oxygen contents and oxygen regulator pressure when breathing.

If contents show no sudden fall and the regulator shows a regular drop in pressure:

Assume a sticking OXY FLOW indicator. Continue sortie and carefully monitor the oxygen equipment.

6. Cockpit pressure failure

a. Indication. CPR warning on SWP.

b. Actions. Move the mask toggles to the high pressure (down) position
Descend rapidly to 40,000 ft cockpit altitude
Select 100% OXYGEN at both crew stations
Select the DE-MISTER control to ON—CPR caption may go out
Switch off the AI 23S
Continue descent, at reduced rate if range is critical, to 25,000 ft cockpit altitude or below.
Return to base at the lowest altitude that the fuel state will safely permit
Use ram air as necessary for ventilation.

7. Overpressurization

a. Indication. Cabin altitude less than the 4 PSI differential value corresponding to the altitude of the aircraft.

TABLE 1 – AIRCRAFT/CABIN ALTITUDES

Aircraft altitude	Cabin altitude at 4 PSI	Cabin altitude at 6 PSI
35,000 ft	17,750 ft	11,500 ft
45,000 ft	22,500 ft	15,500 ft
55,000 ft	25,000 ft	18,000 ft

b. Actions

(i) If cabin differential is above 4 PSI but below 6 PSI, restrict speed to 1.3M/500 kts.

(ii) If cabin differential is 6 PSI or above reduce speed to below 1.3M/500 kts, return to base and land.

8. Smoke, noxious fumes or mist in the cockpit

a. Smoke or noxious fumes

(i) Immediate actions. Proceed as for Cockpit Pressure Failure.

(ii) Subsequent actions. Select the CABIN AIR switch off
Select the RAMAIR valve to OPEN.

b. Mist

(i) Immediate action. Select the DE-MISTER control – ON.

(ii) Subsequent action. When the mist clears select OFF or BLEED.

9. Cockpit temperature control failure

a. Indications. Cockpit too hot or very cold.

b. Actions. Select MANUAL on the temperature controller and hold at COOL or WARM for 15 seconds.

If there is no worsening of the condition

Use MANUAL temperature control for the remainder of the flight.

If the condition worsens

Proceed as for Cockpit Pressure Failure and switch the CABIN AIR switch off.

c. Considerations. If the system responds to manual control, there will be no worsening of the condition after 15 seconds but it will take about 1 minute until a change of temperature for the better is felt.

10. Missile jettisoning

Position over a safe area if possible

Fly the aircraft below the missile jettisoning limits, i.e. 300 kts/0.7 M between 1 and 2g (250 kts with undercarriage down).

Minimize sideslip

Press the STORES JETTISON button

11. Canopy jettisoning

Reduce speed to between 200-300 kts, if possible, with flaps up

Lower the seats

Keep heads down

Pull the CANOPY JETTISON handle to its full extent.

If the canopy fails to jettison

Operate the CANOPY JACK RELEASE handle.

Pull up the normal CANOPY unlocking handle.

WARNING 1 . . .

IF THE CANOPY HAS TO BE JETTISONED MANUALLY BY THE ABOVE METHODS AFTER AN EJECTION SEAT HANDLE HAS BEEN PULLED, EITHER HANDLE MUST BE PULLED AGAIN BEFORE THAT SEAT WILL FIRE.

WARNING 2 . . .

DO NOT PULL A FIRING HANDLE ON THE SECOND SEAT UNTIL BOTH THE CANOPY AND FIRST SEAT HAVE LEFT THE AIRCRAFT, OTHERWISE THE SEATS WOULD EJECT SIMULTANEOUSLY AFTER THE CANOPY HAS BEEN RELEASED.

12. Autostabilizer/autopilot malfunction

a. Indication. A/P warning on SWP.

b. Actions. Immediately correct aircraft response by appropriate control application. If an oscillatory malfunction is recognised, do not chase it

Select the FCS – MASTER switch OFF (A/P warning out)

Re-trim the flying controls

Select the STAB switch and the control column engage switch OFF.

c. Considerations. It is recommended that the system is not used again during the flight.

Chapter 4

ABANDONING AND EMERGENCY LANDING PROCEDURES

CONTENTS

1. Abandoning the aircraft. Ejection may be initiated at any height from ground level upwards. However, runway ejections should be made only when the aircraft speed is above 90 kts or the circumstances dictate that ejection is the only reasonable solution. In flight, if the aircraft is descending or turning the minimum height required for a successful ejection is increased and in the worst case is several thousand feet. Ejections should not normally be made in negative g conditions.

It should be remembered (see Chap. 11, para. 2(c)) that when the firing handle is pulled, first the canopy is jettisoned and then the seat is fired, but that this double-pull action should not normally be noticeable.

a. Actions

(i) The Captain warns the other occupant 'Prepare to eject'. Reduce speed to 250 kts or below in straight and level flight. Descend to 40,000 ft or below, if possible. The Captain orders 'Eject, eject', the other occupant pulls the face-screen or seat-pan firing handle, preferably the latter (refer to Chap. 11, para. 20(d)). After canopy jettison and the first ejection the Captain ejects.

(ii) Controlled ejection

Fly towards a suitable ejection area

Height	14,000 ft
Speed	250 kts
Altitude	Straight and level
IFF	EMERG
Harnesses	Tight and locked
	leg restraints. PSP and Lanyard connected
Visor	Down
Trims	Pitch-level
	Aileron-slight roll
Radio	Mayday call
THROTTLES	Idle/fast idle

When the other occupant has ejected, the captain releases the controls and ejects.

b. Failure of auto-separation after ejection. Operate the manual separation lever on the left side of the seat pan.

Fall clear of the seat and pull the parachute rip-cord D-ring.

c. Failure of the seat to eject. Pull the firing handle again, if this fails pull the other firing handle. If the face-screen handle has been used first, retain a hold on it while pulling the seat-pan handle then, if possible, return to a two handed grip.

It the seat still fails to eject (canopy fails to jettison)

Unlock and free the canopy using the normal opening handle, then pull either the face-screen or the seat-pan firing handle again.

If a seat still fails to eject (canopy gone)

Operate the manual separation handle on the left side of the seat pan.

Move out of the seat and when the guillotine unit fires, bale out. In this case emergency oxygen will not be available after separation.

d. Action during parachute descent. When the parachute has developed, disconnect the survival pack side quick-release couplings and allow the pack to hang on its lowering line. If descending into water, remove the oxygen mask.

2. Landing on an unprepared surface

a. A crash landing will be extremely hazardous and, if circumstances permit, the aircraft should always be abandoned.

b. Action if a crash landing is inevitable. Extend the airbrakes and lower the undercarriage.

Jettison the canopy at a speed above 200 kts whilst the flaps are up

Lower the flaps and carry out a normal approach

After touchdown, stream the brake parachute and close both HP cocks.

3. Landing with the undercarriage in abnormal positions

a. One or both main wheels not locked down. Do not attempt to land. Abandon the aircraft.

b. Both main wheels locked down, but nose-wheel unlocked

Raise the flaps

Jettison missiles

Call for the barrier to be lowered

Jettison the canopy at a speed above 200 kts

Lower the flaps and carry out a normal approach

After touchdown, stream the brake parachute

After the parachute has streamed, establish a nose-up attitude for maximum aerodynamic braking

Close the HP cocks

Lower the nose to the runway before tailplane effectiveness is lost

Apply the wheel brakes to keep straight.

CAUTION . . .

It is essential that the runway arrester barrier is lowered for a landing with the canopy jettisoned, otherwise the top cable may enter the cockpit.

4. Landing with a burst tyre. Experience indicates that landing with a burst tyre is not hazardous. The aircraft can usually be kept straight by judicious use of the rudder and wheelbrakes.

5. Engaging a runway arrester barrier. Jettison the missiles if they have motors and/or warheads fitted while airborne, but never after touchdown.

KEEP THE CANOPY CLOSED and ensure harness locked and tight

Apply wheel-brakes, if available

Aim to engage centre of barrier between the vertical ropes

Ensure the nose wheel is firmly on the ground and, immediately before engaging the barrier, release the wheel-brakes. If time permits switch the battery switch off.

At the moment of entry duck heads forward

Allow wheels to run over the bottom cable and then apply steady wheel braking

Set the parking brake on when the aircraft comes to rest in order to prevent the aircraft rolling back and sustaining further damage

Select the HP cocks off

Vacate the aircraft (there is a risk of fire after engagement).

6. Engaging a runway arrester wire

Keep the canopy closed and ensure that the harness is locked and tight

Ensure that the nose-wheel is on the ground

Pull the hook release handle when about 200 yards from the wire, check the hook green light comes on

Aim to engage the approximate centre of the wire at 90° but avoid the runway centre line markings

After engagement do not use the brakes except to keep straight

If the pull-back from the wire is violent, use engine power to stop the aircraft

Vacate the aircraft.