Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

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Section 3

EMERGENCY/MALFUNCTION PROCEDURES

3-1. INTRODUCTION

Following procedures contain indications of equipment or system failure or malfunction, use of emergency features of primary and backup systems, and appropriate warnings, cautions, and explanatory notes. Table 3-1 lists fault conditions and corrective actions required for illumination of red warning lights. Table 3-2 addresses malfunction procedures associated with yellow caution lights.

Corrective action procedures listed herein assume pilot gives first priority to helicopter control and a safe flight path.

Helicopter should not be operated following any precautionary landing until cause of malfunction has been determined and corrective maintenance action taken.

3-2. DEFINITIONS

Following terms indicate degree of urgency in landing helicopter.

LAND AS SOON AS POSSIBLE — Land without delay at nearest suitable area (i.e., open field) at which a safe approach and landing is reasonably assured.

LAND AS SOON AS PRACTICAL — Duration of flight and landing site are at discretion of pilot. Extended flight beyond nearest approved landing area is not recommended.

Following terms are used to describe operating condition of a system, subsystem, assembly, or component:

AFFECTED — Fails to operate in intended or usual manner.

NORMAL — Operates in intended or usual manner.

3-3. ENGINE

3-3-A. SINGLE ENGINE FAILURE

ENG RPM (N_2) of operating engine is allowed to droop to 97% during transition from twin engine operation to single engine operation. When best rate of climb airspeed (58 KIAS) is attained, N_2 RPM should be increased to 100% if possible.

Flight can be continued on remaining engine until a desirable landing site is available. There are certain combinations of GW, altitude, and ambient air temperatures that will result in OEI torque limit being exceeded. A run-on landing at 20 to 30 knots is recommended.

Loss of an engine while hovering at high GW and extremely cold conditions is likely to result in exceeding OEI torque limit. If an overtorque is observed or suspected, an entry shall be made in log book. Refer to performance charts in Section 4.

NOTE

Refer to ENGINE RESTART if an engine restart is to be attempted.

INDICATIONS:

ENG 1 OUT or ENG 2 OUT warning light illuminated.

GAS PROD RPM (N_I) below 61 ± 1% and decreasing.

ENG RPM (N_2) below 85% and decreasing.

ITT below 400 °C and decreasing.

ENG 1 or ENG 2 OIL PRESSURE, DC GENERATOR, and PART SEP OFF caution lights illuminated.

PROCEDURES:

WARNING

DO NOT ALLOW ROTOR RPM (N_R) TO DECAY BELOW MINIMUM LIMITS.

CAUTION

DURING COLD WEATHER OPERATIONS, MONITOR TORQUE OF OPERATING ENGINE WHEN ONE ENGINE FAILS OR IS SHUT DOWN IN FLIGHT.

Shut down affected engine as follows:

Collective — Reduce as required to maintain ROTOR RPM (N_R) within limits and power within OEI limits.

NOTE

Airspeed — 55 to 65 KIAS for Minimum Power for level flight.

RPM INCR DECR switch — INCR, set remaining ENG RPM (N_2) at 100% if possible.

Throttle — Closed.

Fuel Crossfeed switch — Override Close.

Fuel Interconnect switch — OPEN.

ENGINE (1 or 2) BOOST PUMP switch — OFF.

Verify FUEL BOOST caution light and FUEL switch to be turned off are all for affected engine.

ENGINE (1 or 2) FUEL switch — OFF.

GEN (1 or 2) switch — OFF.

MASTER CAUTION light — Reset.

Land as soon as practical.

If no. 2 engine failed:

INV 3 to DC BUS 1 (if installed).

BATTERY BUS 2 switch — OFF.

BATTERY BUS 1 switch — ON.

MASTER CAUTION light — Reset.

Land as soon as practical.

3-3-B. ENGINE RESTART IN FLIGHT

Conditions which would warrant an attempt to restart an engine would probably be a flameout, caused by a malfunction of automatic mode of fuel control unit. Decision to attempt an engine restart during flight is pilot responsibility. If an engine restart is to be made, proceed as follows:

CAUTION

MONITOR ITT WHEN RESTARTING ENGINE IN MANUAL FUEL CONTROL MODE.

ENGINE RESTART:

ENGINE RESTART NO. 1:

Engine 1 throttle — Closed.

ENGINE 1 BOOST PUMP switch — ON.

Fuel Crossfeed switch — Normal.

ENGINE 1 FUEL switch — ON.

ENGINE NO. 1 GOV switch — MANUAL.

BATTERY BUS 2 switch — OFF.

BATTERY BUS 1 switch — ON.

INV 1 and INV 2 switches — ON.

INV 3 switch (if equipped) — ON DC BUS 1.

START switch — ENG 1.

After 12% GAS PROD RPM (N_I) is attained and oil pressure is indicating, slowly open throttle until a rise is seen in ITT which indicates engine is self-sustaining. Do not open throttle farther until GAS PROD RPM (N_I) and

ITT are stabilized. Continue to open throttle slowly to complete start. Center START switch after 55% GAS PROD RPM (N_1) is attained. Adjust engine to desired power level. Care must be taken to make small adjustments with throttle as compressor stall may result.

GEN 1 switch — ON.

BATTERY BUS 1 switch — OFF.

BATTERY BUS 2 switch — ON.

ENGINE RESTART (NO. 2):

Engine 2 throttle — Closed.

ENGINE 2 BOOST PUMP switch — ON.

Fuel Crossfeed switch — Normal.

ENGINE 2 FUEL switch — ON.

ENGINE NO. 2 GOV switch — MANUAL.

BATTERY BUS 1 switch — OFF.

BATTERY BUS 2 switch — ON.

INV 1 and 2 switches — ON.

INV 3 switch (if equipped) — ON DC BUS 2.

START switch — ENG 2.

After 12% GAS PROD RPM (N_1) is attained and oil pressure is indicating, slowly open throttle until a rise is seen in ITT which indicates engine is self sustaining. Do not open throttle farther until GAS PROD RPM (N_1) and ITT are stabilized. Continue to open throttle slowly to complete start. Center START switch after 55% GAS PROD RPM (N_1) is attained. Adjust engine to desired power level. Care must be taken to make small adjustments with throttle as compressor stall may result.

GEN 2 switch — ON.

3-3-C. DUAL ENGINE FAILURE

INDICATIONS:

ENG 1 OUT and ENG 2 OUT warning lights illuminated.

RPM caution light illuminated.

ROTOR RPM audio on.

GAS PROD RPM (N_1) below 61 ± 1% RPM and decreasing (both engines).

ENG RPM (N_2) below 85% and decreasing (both engines).

ITT below 400 °C and decreasing (both engines).

ENG 1 and ENG 2 OIL PRESSURE, DC GENERATOR, and PART SEP OFF caution lights illuminated.

PROCEDURES:

WARNING

DO NOT ALLOW ROTOR RPM TO DECAY BELOW MINIMUM LIMITS.

Collective — Reduce, establish autorotative glide. Minimum rate of descent (65 KIAS) or maximum glide (90 KIAS).

Autorotative landing — Accomplish.

If time permits before landing and a restart will not be attempted, proceed as follows:

Throttles — Closed.

ENGINE 1 and ENGINE 2 FUEL switches — OFF.

ENGINE 1 and ENGINE 2 BOOST PUMP switches — OFF.

After landing:

Engine shutdown — Complete.

Helicopter — Exit.

3-3-D. ENGINE UNDERSPEED

NOTE

Normal deviations of ROTOR RPM (N_R) from the governed setting may occur when large collective changes are made but should not be confused with fuel control failure, unless a large steady-state TORQUE split occurs.

If there is a low power demand (less than single engine power available) at time of low side failure, ROTOR RPM (N_R) and ENG RPM (N_2) of affected engine will decrease and stabilize, at or slightly below governed value. TORQUE, ITT, and GAS PROD RPM (N_1) of affected engine will also decrease. As ROTOR RPM (N_R) decreases, normal engine will increase TORQUE output to assume load. If power demand is near zero, there might not be a significant TORQUE split.

If there is a high power demand (greater than single engine power available) at time of low side failure, ROTOR RPM (N_R) will decrease along with ENG RPM (N_2), TORQUE, ITT, and GAS PROD RPM (N_1) of affected engine. As ROTOR RPM (N_R) decreases, normal engine will increase to maximum power to assume load, causing significant increases in TORQUE, ITT, and GAS PROD RPM (N_1) while ENG RPM (N_2) will remain below governed value.

INDICATIONS:

Low ENG RPM (N_2) and ROTOR RPM (N_R) (possibly with RPM caution light and audio if power demand is in excess of single engine power available).

TORQUE split (proportional to power demand).

Low GAS PROD RPM (N_1), ITT, and TORQUE on affected engine.

PROCEDURES:

WARNING

ROTOR RPM CAN DECAY EXCESSIVELY IF CORRECTIVE ACTION IS NOT IMMEDIATELY INITIATED.

Collective — Adjust as necessary to maintain ROTOR RPM (N_R).

Airspeed — 55 to 65 KIAS for Minimum Power for level flight.

Affected engine — Identify.

Throttle friction — Tighten on normal engine, reduce on affected engine.

Throttle (affected engine) — Reduce to idle.

GOV switch (affected engine) — MANUAL.

CAUTION

WHEN OPERATING IN MANUAL FUEL CONTROL MODE, MAKE SLOW, SMOOTH THROTTLE MOVEMENTS TO AVOID COMPRESSOR STALL, OVERTEMPERATURE, OVER-SPEED, AND POSSIBLE DRIVETRAIN DAMAGE.

COORDINATE THROTTLE AND COLLECTIVE CHANGES TO AVOID OVERLOADING NORMAL ENGINE.

Throttle (affected engine) — Increase slowly. Adjust throttle and collective as required to maintain TORQUE of affected

engine slightly below TORQUE of normal engine.

MASTER CAUTION light — Reset.

Land as soon as practical.

3-3-E. ENGINE OVERSPEED — FUEL CONTROL/GOVERNOR FAILURE

NOTE

Normal deviations of ROTOR RPM (N_R) from the governed setting may occur when large collective changes are made but should not be confused with fuel control failure, unless a large steady-state TORQUE split occurs.

If there is a low power demand (less than single engine power available) at time of high side failure, ROTOR RPM (N_R) and ENG RPM (N_2) of affected engine will increase considerably above governed value. TORQUE, ITT, and GAS PROD RPM (N_1) of affected engine will also increase. As ENG RPM (N_2) and ROTOR RPM (N_R) increase above governed value, normal engine will reduce power to keep itself from overspeeding and will indicate significantly lower TORQUE, ITT, and GAS PROD RPM (N_1) than affected engine.

If there is a high power demand (greater than single engine power available) at time of high side failure, ROTOR RPM (N_R) and ENG RPM (N_2) (of affected engine will surge initially along with TORQUE, ITT, and GAS PROD RPM (N_1). As ENG RPM (N_2) and ROTOR RPM (N_R) increase, normal engine will reduce power to keep itself from overspeeding. Affected engine then tries to assume all of load, which is beyond its capability due to high power demand. ENG RPM (N_2) of affected engine and ROTOR RPM (N_R) will then decrease and rejoin ENG RPM (N_2) of normal engine, stabilizing at or slightly above governed value as normal engine adjusts power output to share load.

INDICATIONS:

High ENG RPM (N_2) and ROTOR RPM (N_R) ,possibly with RPM caution light.

Definite TORQUE split (proportional to power demand).

High GAS PROD RPM (N_1), ITT, and TORQUE on affected engine.

Return of ENG RPM (N_2) and ROTOR RPM (N_R) to governed value (if power demand is very high).

PROCEDURES:

CAUTION

ROTOR RPM CAN OVERSPEED EXCESSIVELY IF CORRECTIVE ACTION IS NOT IMMEDIATELY INITIATED.

Collective — Adjust as necessary to maintain ROTOR RPM (N_R).

Affected engine — Identify.

Throttle (affected engine) — Reduce to maintain TORQUE at or slightly below TORQUE of normal engine.

Throttle friction — Tighten on normal engine, reduce on affected engine.

Throttle (affected engine) — Reduce to idle.

GOV switch (affected engine) — MANUAL.

CAUTION

WHEN OPERATING IN MANUAL FUEL CONTROL MODE, MAKE SLOW, SMOOTH THROTTLE MOVEMENTS TO AVOID

COMPRESSOR STALL, OVERTEMPERATURE, OVERSPEED, AND POSSIBLE DRIVETRAIN DAMAGE.

COORDINATE THROTTLE AND COLLECTIVE CHANGES TO AVOID OVERLOADING NORMAL ENGINE.

Throttle (affected engine) — Increase slowly. Adjust throttle and collective, as required, to maintain torque of affected engine slightly below torque of normal engine.

MASTER CAUTION light — Reset.

NOTE

If values of overspeed parameters are unknown, or if N_R exceeds 110%, or if transmission torque exceeds 104%, land as soon as possible.

Land as soon as practical.

ENGINE OVERSPEED — GOVERNOR ACTUATOR FAILURE

- **INDICATIONS:**

  ENG RPM (N_2) and ROTOR RPM (N_R) increase to approximately 101%.

  RPM INCR DECR switch inoperative.

- **PROCEDURE:**

  If this failure occurs during takeoff or landing, no immediate corrective action is necessary to complete either maneuver.

  As soon as practical, roll back both throttles to maintain 97 to 100% ENG RPM (N_2). Further adjustment of collective and throttles simultaneously will allow full power at pilot discretion.

  Land as soon as practical.

3-3-F. ENGINE OVERSPEED — DRIVESHAFT FAILURE

WARNING

FAILURE OF MAIN DRIVESHAFT TO TRANSMISSION WILL RESULT IN COMPLETE LOSS OF POWER TO MAIN ROTOR. ALTHOUGH COCKPIT INDICATIONS FOR A DRIVESHAFT FAILURE ARE SOMEWHAT COMPARABLE TO A DUAL ENGINE FAILURE, IT IS IMPERATIVE THAT AUTOROTATIVE FLIGHT PROCEDURES BE ESTABLISHED IMMEDIATELY. FAILURE TO REACT IMMEDIATELY TO LOW ROTOR RPM (N_R) AUDIO SIGNAL, CAUTION LIGHT, AND TACHOMETER WILL RESULT IN LOSS OF CONTROL.

This is a situation involving a break in drive system, such as a severed main driveshaft to transmission. A failure of this type in powered flight will result in nose of helicopter swinging to left (right side slip) and usually a roll of fuselage. Nose down attitude may also be present. Severity of initial reaction will be affected by airspeed, H_D, GW, CG, and power being used.

- **INDICATIONS:**

  Left yaw.

  Rapid decrease in ROTOR RPM (N_R).

  Rapid increase in ENG RPM (N_2).

  Illumination of ROTOR RPM (N_R) caution light with audio.

  Possible increase in noise due to:

  - **Overspeeding engine turbines**
  - **Overspeeding combining gearbox**
  - **Driveshaft breakage**

- **PROCEDURE:**

  Collective — As required to establish autorotative descent.

Airspeed — Establish for minimum rate of descent (65 KIAS) or maximum glide (90 KIAS).

Throttles — Close, if time permits.

Flight controls — As required for autorotative landing.

3-3-G. ENGINE COMPRESSOR STALL

• INDICATIONS:

Engine 'pops'.

High or erratic ITT.

Decreasing or erratic N_1 and N_2 RPM.

Torque oscillations.

• PROCEDURE:

Collective — Reduce; maintain slow cruise flight.

HEATER switch — ON.

ITT and N_1 — Check for normal indications.

SEAT BELT and no smoking signs — ON.

If an audible compressor stall is noted, refer to Maintenance Manual to determine cause.

3-3-H. ENGINE HOT START/SHUTDOWN

A hot start is caused by a combination of excessive fuel in combustion chamber and delayed fuel ignition.

• INDICATIONS:

Rapid rise in ITT.

Flames emitting from exhaust.

• PROCEDURE:

Abort start of affected engine as follows:

Throttle — Closed, keep START switch engaged.

ENGINE (1 or 2) FUEL switch — OFF.

ENGINE (1 or 2) BOOST PUMP switch — OFF.

START switch — Engaged until ITT decreases to within limits.

Engine shutdown — Complete.

Helicopter — Exit, check for damage.

If ITT limits for starting were exceeded, refer to engine Maintenance Manual for inspection requirements.

3-3-I. ENGINE OIL HOT

• INDICATIONS:

Engine oil temperature above limit of 115°C.

• PROCEDURE:

Collective, airspeed — As required.

Throttle (affected engine) — Idle.

ENG switch — INCR; set ENG RPM (N_2) at 100% if possible.

If condition persists:

Throttle (affected engine) — Close.

Complete engine shutdown.

Land as soon as practical.

3-4. FIRE

3-4-A. ENGINE FIRE

3-4-A-1. DURING START

• INDICATIONS:

FIRE 1 PULL and/or FIRE 2 PULL handle illuminated.

• PROCEDURE:

Abort start of affected engine as follows:

Throttle — Closed.

FIRE PULL handle — PULL.

FIRE EXT switch — MAIN.

Fuel pump crossfeed switch — Override close.

Fuel INTCON switch — OPEN.

ENGINE (1 or 2) BOOST PUMP switch — OFF.

ENGINE (1 or 2) FUEL switch — OFF.

Starter switch — Disengage.

If FIRE warning light remains illuminated for more than 10 seconds:

FIRE EXT switch — RESERVE.

Engine(s) shutdown — Complete.

Helicopter — Exit.

3-4-A-2. ENGINE FIRE DURING TAKEOFF OR APPROACH

- INDICATIONS:

  FIRE 1 PULL and/or FIRE 2 PULL handle illuminated.

- PROCEDURE:

  If a landing site is available, begin descent and approach. If landing sight is not available, continue takeoff/approach. Proceed as follows:

  Airspeed — 45 KIAS minimum.

  Collective — Reduce, if possible.

  Appropriate FIRE PULL handle — Pull.

  FIRE EXT switch — MAIN.

If FIRE warning light remains illuminated for more than 10 seconds:

FIRE EXT switch — RESERVE.

ENG RPM (N_2) (remaining engine) — Set at 100%.

Land as soon as possible.

Engine shutdown — Complete.

Helicopter — Exit.

3-4-A-3. ENGINE FIRE IN FLIGHT

- INDICATIONS:

  FIRE 1 and/or FIRE 2 PULL handle illuminated.

- PROCEDURE:

  Immediately initiate emergency descent, if possible.

  Shut down affected engine (1 or 2) as follows:

  FIRE PULL handle — Pull.

  FIRE EXT switch — Main.

  Throttle — Closed.

  Fuel Crossfeed switch — Override close.

  Fuel interconnect switch — OPEN.

  Engine BOOST PUMP — OFF.

  Verify FIRE handle light, FUEL BOOST caution light, and FUEL switch to be turned off are all for affected engine.

  Engine FUEL switch — OFF.

If FIRE warning light remains illuminated:

FIRE EXT switch — RESERVE.

ENG RPM (N_2) (remaining engine) — Set at 100%.

Land as soon as possible.

If a landing site is not readily available, proceed as follows:

FIRE PULL handle — In.

GEN (1 or 2) switch — OFF.

If No. 2 engine was shut down:

INV 3 to DC BUS 1 (if installed).

BATTERY BUS 2 switch — OFF.

BATTERY BUS 1 switch — ON.

After landing:

Engine shutdown — Complete.

Helicopter — Exit.

3-4-B. CABIN SMOKE OR FUMES

• INDICATIONS:

Smoke, toxic fumes, etc. in cabin.

• PROCEDURE:

VENT BLOWER switch — ON.

Vents and accessible windows — Open.

If additional ventilation is required:

Airspeed — Reduce to 60 KIAS or less.

Passenger doors, windows, vents — Open.

If time and altitude permit and source is suspected to be electrical:

Affected system — Attempt to identify and isolate.

Land as soon as possible.

3-4-C. BAGGAGE COMPARTMENT FIRE

• INDICATIONS:

BAGGAGE FIRE warning light illuminated.

• PROCEDURE:

Reduce power to minimum required.

Land as soon as possible.

Inspect tailboom area for damage.

3-5. TAIL ROTOR

NOTE

The key to successful handling of a tail rotor emergency lies in pilot ability to quickly recognize type of malfunction and to select proper emergency procedure. Following is a discussion of some types of tail rotor malfunctions and their probable effects.

3-5-A. COMPLETE LOSS OF TAIL ROTOR THRUST

• INDICATIONS:

This is a situation involving a break in drive system, such as a severed driveshaft, wherein tail rotor stops turning and delivers no thrust. A failure of this type in powered flight will result in nose of helicopter swinging to right (left side slip) and usually a roll of fuselage. Nose down attitude may also be present. Severity of initial reaction will be affected by airspeed, H_D, GW, CG, and power being used.

3-5-B. LOSS OF TAIL ROTOR THRUST AT HOVER

• PROCEDURE:

Close throttles immediately and make a hovering autorotation landing. Yawing can be expected on touchdown.

3-5-C. LOSS OF TAIL ROTOR THRUST IN CLIMB

Degree of right yaw upon failure will be greater than that expected in level flight due to higher power and anti-torque settings.

• PROCEDURE:

Close throttles and lower collective immediately. Establish a glide speed slightly above normal autorotation approach speed.

If a turn is required to reach a more desirable place to land or to align into wind, make it to the right if possible. A turn to right can be more nearly streamlined by use of a little power.

Once aligned for landing, yaw can be controlled in following manner:

- Right Yaw

  If nose yaws right with power off, a pulse of up collective will produce more friction in mast thrust bearings, creating a left moment. The greater the input of pulse, the more the response will be.

WARNING

DO NOT ALLOW *ROTOR* RPM TO DECAY BELOW MINIMUM LIMITS.

Moving collective upward abruptly increases rotor loading. Do not hold collective up as rotor rpm will decrease lower than desirable. It is essential that collective be returned to down position for autorotation. This cycle is one pulse. Pulse should be rapid (up and down) but should not be used at low altitudes.

- Left Yaw

  If nose yaws left with power off, a slight addition of power should arrest it. Further increase in power results in more right yaw increase.

- Landing

  During final stages of approach, a mild flare should be executed and all power to rotor should be off. Maintain helicopter in a slight flare and use collective smoothly to execute a soft, slightly nose high landing. Landing on aft portion of skids will tend to correct side drift. If helicopter starts to turn, move cyclic as necessary to follow turn until helicopter comes to a complete stop. This technique will, in most cases, result in a run on type landing.

CAUTION

FOR ZERO GROUND SPEED LANDING, FLARE AND ABRUPT USE OF COLLECTIVE MAY CAUSE NOSE TO YAW LEFT. DO NOT CORRECT WITH THROTTLE. ALTHOUGH APPLICATION OF THROTTLE WILL RESULT IN YAWING TO RIGHT, ADDITION OF POWER IS A VERY STRONG RESPONSE MEASURE AND IS TOO SENSITIVE FOR PILOT TO MANAGE PROPERLY. DO NOT ADD POWER AT THIS TIME. SLIGHT YAWING UPON TOUCHDOWN AT ZERO GROUND SPEED MAY BE EXPECTED.

3-5-D. LOSS OF TAIL ROTOR THRUST IN LEVEL FLIGHT OR DESCENT

PROCEDURES:

Close throttles and reduce collective immediately. Attain an airspeed slightly above normal autorotative glide speed.

If altitude permits with AIRSPEED above 60 KIAS, throttle and collective may be gently applied to determine if some degree of powered flight can be resumed. If unacceptable yawing is experienced, re-enter autorotation and continue descent to a landing.

Landing technique is same as prescribed for climb condition above.

3-5-E. LOSS OF TAIL ROTOR COMPONENTS

Loss of any tail rotor component will result in a forward CG shift. Other than additional nose down pitching, this situation would be quite similar to complete loss of tail rotor thrust as discussed above.

3-5-F. TAIL ROTOR FIXED PITCH FAILURES

INDICATIONS:

Tail rotor pitch change control failures are characterized either by a lack of directional response when a pedal is pushed or by locked pedals. If pedals can not be moved with a moderate amount of force, do not attempt to apply a maximum

effort since a more serious malfunction could result.

3-5-G. FIXED PITCH FAILURE AT A HOVER

PROCEDURES:

Do not close throttles unless a severe right yaw occurs. If pedals lock in any position at a hover, landing from a hover can be accomplished with greater safety under power controlled flight rather than by closing throttles and entering autorotation.

3-5-H. FIXED PITCH FAILURE IN FLIGHT

If tail rotor fixed pitch failure occurs during climb (left pedal applied), cruise (approximately neutral pedals), and descent (right pedal applied), a descent and landing can be effected safely by use of power and throttle changes.

PROCEDURES:

If helicopter is in a trimmed condition when malfunction is discovered, engine power and airspeed should be noted and helicopter flown to a suitable landing area.

Combinations of ENG TORQUE, ROTOR RPM (N_R), and AIRSPEED will correct or aggravate yaw attitude and these should be adjusted as required to control yaw during landing.

- Right Pedal Locked Forward of Neutral

  Power should be reduced and ENG RPM (N_2) maintained within green arc. This will help streamline helicopter in flight. Right turns are easier than left turns. AIRSPEED should be maintained at or above 60 KIAS.

  Execute a normal to steep approach adjusting power as necessary to minimize or prevent right yaw. Maintain ENG RPM (N_2) and an AIRSPEED of 60 KIAS during initial part of approach.

  At 60 to 75 feet AGL and when landing area can be made, start a slow deceleration to arrive at intended landing point with AIRSPEED at about 25 KIAS.

  At 2 to 5 feet AGL, slowly reduce throttle to overcome yaw effect and allow helicopter to settle. When aligned with landing area, allow helicopter to touch down.

  After ground contact, use collective and throttle as necessary to maintain alignment with landing strip, and to minimize forward speed. If helicopter starts to turn, move cyclic as necessary to follow turn until helicopter comes to a complete stop.

- Left Pedal Locked Forward of Neutral

  Reduce power and maintain ENG RPM (N_2) within green arc. Normal turns can be safely made under these conditions, although helicopter nose may be displaced to left.

  On final approach, begin a slow deceleration so as to arrive at a point about four to five feet above intended touchdown area as effective translational lift is lost.

  Apply collective to stop rate of descent and forward speed, and to align helicopter with intended landing path. Allow helicopter to touch down at near zero ground speed, maintaining alignment with throttle.

- Pedals Locked in Neutral

  Reduce power and maintain ENG RPM (N_2) within green arc. Normal turns can be safely made under these conditions.

  Execute a normal to shallow approach, holding AIRSPEED at 60 KIAS during initial part of approach. Adjust power

as necessary to minimize or prevent right yaw.

At 50 to 75 feet AGL and when landing area can be made, start a deceleration to arrive at intended landing point with AIRSPEED at 25 KIAS.

At 2 to 5 feet AGL, use throttle slowly as necessary to maintain alignment with landing area and to control yaw; do not allow helicopter to settle until alignment is assured, then touch down.

After ground contact, use collective and throttle as necessary to minimize forward speed and to maintain alignment. Move cyclic as necessary to follow turn until helicopter has come to a complete stop.

3-5-J. LOSS OF PITCH CHANGE CONTROL LINKAGE

INDICATIONS:

In this type of failure, pitch change mechanism is broken at some point and tail rotor will assume a blade angle determined by aerodynamic and counterbalance forces.

PROCEDURES:

Corrective action procedures are described in FIXED PITCH FAILURES above. Specific procedure to be used depends on yaw change experienced.

3-6. HYDRAULIC SYSTEM

The helicopter has two hydraulic powered flight control systems (1 and 2). Both systems supply power to collective and cyclic but tail rotor is powered only by system 1.

If system pressure or temperature exceeds limits, affected system should be turned off. Continued flight and normal maneuvers can be accomplished on remaining system. Land as soon as practical. If system no. 1 fails and is turned off, tail rotor control forces will increase but no change in limitations result.

3-7. ELECTRICAL SYSTEM

3-7-A. DC FAILURE TO PRODUCE POWER

If either generator has not failed but circuit is open, reset generator by moving generator switch to RESET, then ON.

For single generator operation, nonessential busses may be restored by moving NON ESS BUS switch from NORMAL to MANUAL. Monitor to ensure loads are within limits.

3-7-B. AC - FAILURE TO PRODUCE POWER

If any inverter fails to produce power, check appropriate AC circuit breakers in.

3-8. FUEL SYSTEM

3-8-A. FUEL BOOST PUMP FAILURE

INDICATION:

NO. 1 or NO. 2 FUEL BOOST Caution Light illuminates.

PROCEDURE:

CAUTION

IF EITHER BOOST PUMP FAILS, FUEL EXHAUSTION COULD OCCUR AT 60 POUNDS INDICATED ON FUEL QUANTITY GAGE.

If practical, descend below 5000 feet H_P to prevent possible fuel starvation in the event remaining boost pump fails.

Fuel interconnect switch — OPEN.

NOTE

If fuel crossfeed switch is in NORM position, crossfeed valve will be automatically opened allowing remaining pump to supply fuel to both engines.

Land as soon as practical.

3-8-B. FUEL FILTER PARTIALLY BLOCKED

Land as soon as practical.

3-8-C. FUEL QUANTITY INDICATION MALFUNCTIONS

INDICATION:

Fuel quantity indication freezes in place. (Possible power failure to the fuel quantity indicator system.)

PROCEDURE:

FUEL QTY circuit breaker — Recycle.

Fuel interconnect switch — OPEN.

NOTE

A failure in the fuel quantity indicating system will have no effect on fuel low caution light, fuel interconect, fuel crossfeed, fuel boost, or fuel valve and indications.

3-9. AUTOMATIC FLIGHT CONTROLS SYSTEM

Not applicable to VFR helicopter.

3-10. COMMUNICATION SYSTEM

3-10-A. NAVIGATION RADIO FAILURE

NAV AC switch — BUS NO. 2.

3-10-B. INTERCOM FAILURE

INDICATION:

Weak or no reception in headsets.

PROCEDURE:

Check headset connection.

Verify volume and ICS controls set properly.

Cycle ICS circuit breaker out and in.

3-11. CABIN HEATER

NOTE

A malfunction in the bleed air heater controls may or may not cause heater to become inoperative.

INDICATION:

HEATER AIR LINE caution light illuminates.

Heated airflow does not shut off when thermostat knob is turned to full cold position.

PROCEDURE:

HEATER switch — OFF immediately.

CABIN HTR circuit breaker — Check; if out, do not reset.

Check prior to next flight.

3-12. LANDING GEAR

Not applicable to skid gear helicopters.

3-13. STATIC PORT OBSTRUCTION

Erratic readings from airspeed indicator, vertical speed indicator, and altimeter may occur when operating in rain with STATIC SOURCE switch (if installed) in PRI.

If this occurs, proceed as follows:

Windows and vents — Close.

Heater SYSTEM SELECTOR switch (if installed) — OFF.

STATIC SOURCE switch (if installed) — ALTN.

NOTE

This procedure selects an alternate static source (cabin air) for pilot instruments only.

Table 3-1. WARNING LIGHTS

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
FIRE 1 PULL/ FIRE 2 PULL	Fire in engine compartment.	Pull FIRE PULL handle, position FIRE EXT switch to MAIN, close throttle, position FIRE EXT switch to RESERVE, if necessary. Land as soon as possible.
ENG 1 OUT/ENG 2 OUT	Engine GAS PROD RPM (N_1) below 53 $\pm$ 2%.	Check engine torque, GAS PROD (N_1) RPM, ENG (N_2) RPM, and ITT. Adjust power and airspeed. Reset remaining ENG (N_2) RPM to 100% if possible. Close throttle of affected engine. Refer to ENGINE FAILURE and ENGINE RESTART. Land as soon as practical.
BAGGAGE FIRE	Smoke in baggage compartment.	Reduce power to minimum required. Land as soon as possible. Inspect tailboom area for damage.
XMSN OIL PRESS	Transmission oil pressure below limit.	Reduce power. Land as soon as possible.
XMSN OIL TEMP	Transmission oil temperature above limit.	Reduce power. Check XMSN OIL temperature. If not within limits, land as soon as possible.
C BOX OIL PRESS	Combining gearbox oil pressure below limit.	Reduce power. Land as soon as possible.
C BOX OIL TEMP	Combining gearbox oil temperature above limit.	Reduce power. Check GEAR BOX temperature. If not within limits, land as soon as possible.
BATTERY TEMP (If installed)	Battery temperature above limit.	Position BATTERY switches to OFF. Land as soon as practical. If BATTERY caution segment does not illumninate, turn GEN 2 OFF. Land as soon as possible.

Table 3-1. WARNING LIGHTS (Cont)

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
		WARNING BATTERY SHALL NOT BE USED FOR ENGINE START AFTER ILLUMINATION OF BATTERY TEMP LIGHT. BATTERY SHALL BE REMOVED AND SERVICED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS PRIOR TO RETURN TO SERVICE.
ROTOR BK (if installed)	Rotor brake linings not retracted.	Check rotor brake handle in detent. If light remains illuminated, land as soon as possible.

Table 3-2. CAUTION LIGHTS

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
ENG 1 OIL PRESSURE	Engine oil pressure below limit.	Shut down no. 1 engine. SN 30554 and sub.,- Position INV 3 switch to ON DC BUS 2.
ENG 2 OIL PRESSURE	Engine oil pressure below limit.	Shut down no. 2 engine. SN 30554 and sub. -, Position INV 3 switch to ON DC BUS 1 and BATTERY BUS 2 switch to OFF. Position BATTERY BUS 1 switch to ON.
ENG 1 DC GENERATOR	Failure of DC generator.	Position GEN 1 switch to RESET then ON. Position to OFF if reset not possible. SN 30554 and sub.- position INV 3 switch to ON DC BUS 2.
ENG 2 DC GENERATOR	Failure of DC generator.	Position GEN 2 switch to RESET then ON. Position to OFF if reset not possible. SN 30554 and subsequent- Position INV 3 switch to ON DC BUS 1 and BATTERY BUS 2 switch to OFF. Position BATTERY BUS 1 switch to ON.
ENG 1 PART SEP OFF/ENG 2 PART SEP OFF	Separator bypass door closed. Ice and dust protection system inoperative.	Check RPM WARN and PART SEP circuit breakers in. Position PART SEP switch to OVRD ON. If PART SEP OFF light remains illuminated, correct malfunction prior to next flight.
ENG 1 FUEL BOOST/ ENG 2 FUEL BOOST	Applicable pump pressure is low or pump has failed.	If practical, descend to 5000 feet H_P or below for remainder of flight due to possible fuel starvation of engine if remaining boost pump fails. If either fuel boost pump fails, crossfeed valve is opened by a flow switch, allowing remaining pump to furnish pressure to both engine fuel systems. Above sequence is possible with fuel pump crossfeed switch in normal position.

Table 3-2. CAUTION LIGHTS (Cont)

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
		If this automatic function is not desired, fuel pump crossfeed switch should be positioned to override close position and interconnect switch to open.
ENG 1 FUEL FILTER/ ENG 2 FUEL FILTER	Filter and/or heater is partially clogged.	Land as soon as practical. Correct malfunction prior to next flight
ENG 1 FUEL LOW/ ENG 2 FUEL LOW	Fuel remaining is approximately 140 pounds.	Fuel interconnect switch in normal position (closed) separates two lower fuel cells. When either FUEL LOW light illuminates, interconnect switch should be positioned to OPEN. This will allow fuel quantity in lower tanks to equalize. In event a fuel boost failure has occurred, or occurs after interconnect switch is positioned to OPEN, fuel in lower tanks will be available to both engines, through either boost pump.
ENG 1 GOV MANUAL/ENG 2 GOV MANUAL	GOV switch in MANUAL.	ENG RPM, TORQUE, and ITT must be controlled manually by throttle and collective.
ENG 1 CHIP/ENG 2 CHIP	Metal particles in engine oil.	Reduce power and shut down engine as soon as practical to preclude engine damage. Land as soon as practical.
ENG 1 FUEL VALVE/ ENG 2 FUEL VALVE (SN 30597 and subsequent)	Fuel valve not properly seated or circuit breaker open.	Check FUEL VALVE circuit breakers in. Land as soon as practical. If on ground, position FUEL switch to OFF then ON.
ENG 1 GEN OVHT/ ENG 2 GEN OVHT (SN 30597 and subsequent)	Generator overheating.	Position GEN switch to OFF. Correct malfunction prior to next flight.
CAUTION PANEL (SN 30597 and subsequent)	Caution panel inoperative.	Check MASTER CAUTION circuit breaker in. Monitor instruments. Land as soon as practical.
INVERTER #1	Failure of no. 1 inverter.	SN 30504 through 30553 - Check INV 1 PWR and INV 1 CONT circuit breakers in. Position INV 1 switch to OFF.

Table 3-2. CAUTION LIGHTS (Cont)

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
		SN 30554 and subsequent - Check no. 1 AC voltmeter to determine that no. 3 inverter has automatically assumed no. 1 inverter load.
INVERTER #2	Failure of no. 2 inverter.	SN prior to 30554 - Check INV 2 PWR and INV 2 CONT circuit breakers in. Position INV 2 switch to OFF.
		SN 30554 and subsequent - Check no. 2 AC voltmeter to determine that no. 3 inverter has automatically assumed no. 2 inverter load.
INVERTER #3 (SN 30554 and subsequent)	Failure of no. 3 inverter.	Position INV 3 switch to other DC BUS. If light stays illuminated, position INV 3 switch to OFF.
EXTERNAL POWER	External power connected to helicopter or external power door not closed properly.	Disconnect external power if still applied, close and latch external power door.
DOOR LOCK	Cabin aft door(s) or baggage compartment door not locked.	Check doors closed and latched.
BATTERY	Battery relay open or both battery switches in same position.	Position both BATTERY switches to OFF. Position BATTERY switch to ON DC BUS 1. If light does not extinguish, position switch to OFF, and position other switch to ON DC BUS 2. If light does not extinguish, position switch to OFF.
CHIP C BOX	Metal particles in combining gearbox oil.	Reduce power. Land as soon as practical.
CHIP XMSN	Metal particles in transmission oil.	Reduce power. Land as soon as practical.
CHIP 42° BOX (SN 30504 through 30596)	Metal particles in intermediate gearbox oil.	Land as soon as practical.
CHIP 90° BOX (SN 30504 through 30596)	Metal particles in tail rotor gearbox.	Land as soon as practical.

Table 3-2. CAUTION LIGHTS (Cont)

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
CHIP 42°/90° BOX (SN 30597 and subsequent)	Metal particles in intermediate and/or tail rotor gearbox.	Land as soon as practical.
HYDRAULIC (SN 30554 and subsequent)	Hydraulic pressure low or temperature above limit.	Verify fault from gage readings. If pressure is low or temperature is high, turn affected system off. Land as soon as practical.
FUEL XFEED (SN 30597 and subsequent)	Fuel crossfeed valve not fully open or closed, or FUEL XFEED circuit breaker open.	Check FUEL XFEED circuit breakers in. Cycle FUEL XFEED switch.
HEATER AIR LINE	Heater mixing valve malfunction.	Turn heater off immediately.
RPM	ROTOR (N_R) RPM above or below operating limits.	Adjust collective and/or RPM INCR DECR switch as required.
FDR SYS FAIL (if installed)	Flight data recorder inoperative.	Refer to applicable regulations for operation with flight data recorder inoperative.