SECTION 3
EMERGENCY PROCEDURES

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INTRODUCTION

Section 3 provides checklist and amplified procedures for coping with emergencies that may occur. Emergencies caused by airplane or engine malfunctions are extremely rare if proper preflight inspections and maintenance are practiced. Enroute weather emergencies can be minimized or eliminated by careful flight planning and good judgment when unexpected weather is encountered. However, should an emergency arise, the basic guidelines described in this section should be considered and applied as necessary to correct the problem. Emergency procedures associated with ELT and other optional systems can be found in Section 9.

AIRSPEEDS FOR EMERGENCY OPERATION

Engine Failure After Takeoff:	
Wing Flaps Up	85 KIAS
Wing Flaps Down	80 KIAS
Maneuvering Speed:	
4000 Lbs	130 KIAS
3350 Lbs	119 KIAS
2700 Lbs	106 KIAS
Maximum Glide:	
4000 Lbs	91 KIAS
3350 Lbs	83 KIAS
2700 Lbs	74 KIAS
Precautionary Landing With Engine Power	75 KIAS
Landing Without Engine Power:	
Wing Flaps Up	90 KIAS
Wing Flaps Down	80 KIAS
Emergency Descent:	
Smooth Air	200 KIAS
Rough Air:	
4000 Lbs	130 KIAS
3350 Lbs	119 KIAS
2700 Lbs	106 KIAS

OPERATIONAL CHECKLISTS

Procedures in the Operational Checklists portion of this section shown in **bold-faced** type are immediate-action items which should be committed to memory.

ENGINE FAILURES

ENGINE FAILURE DURING TAKEOFF ROLL

1. **Throttle -- IDLE.**
2. **Brakes -- APPLY.**
3. Wing Flaps -- RETRACT.
4. Mixture -- IDLE CUT-OFF.
5. Ignition Switch -- OFF.
6. Master Switch -- OFF.

ENGINE FAILURE IMMEDIATELY AFTER TAKEOFF

1. **Airspeed -- 85 KIAS.**
2. Mixture -- IDLE CUT-OFF.
3. Fuel On-Off Valve -- OFF (pull out).
4. Wing Flaps -- AS REQUIRED (30° recommended).
5. Ignition Switch -- OFF.
6. Master Switch -- OFF.
7. Cabin Door Safety Lock -- UNLOCK (pull out).

ENGINE FAILURE DURING FLIGHT (RESTART PROCEDURES)

1. **Airspeed -- 85 KIAS.**
2. **Fuel Selector Valve -- BOTH ON.**
3. **Auxiliary Fuel Pump -- ON.**
4. Throttle -- HALF OPEN.
5. Mixture -- LEAN from full rich until restart occurs.

NOTE

If propeller is windmilling, engine will restart automatically within a few seconds. If propeller has stopped (possible at low speeds), turn ignition switch to START, advance throttle slowly from idle, and (at higher altitudes) lean the mixture from full rich.

6. Mixture -- ADJUST as required as power is restored.
7. Throttle -- ADJUST power as required (slowly at higher altitudes).
8. Auxiliary Fuel Pump -- OFF.

NOTE

If the fuel flow indication immediately drops to zero, signifying an engine-driven fuel pump failure, return the auxiliary fuel pump switch to ON.

9. Mixture -- ADJUST.
10. Fuel Selector Valve -- AS DESIRED after fuel flow is stabilized.

FORCED LANDINGS

EMERGENCY LANDING WITHOUT ENGINE POWER

1. Airspeed -- 90 KIAS (flaps UP).
   80 KIAS (flaps DOWN).
2. Seat Belts and Shoulder Harnesses -- SECURE.
3. Mixture -- IDLE CUT-OFF.
4. Fuel On-Off Valve -- OFF (pull out).
5. Ignition Switch -- OFF.
6. Landing Gear -- DOWN (UP if terrain is rough or soft).
7. Wing Flaps -- AS REQUIRED (30° recommended).
8. Door -- UNLATCH PRIOR TO TOUCHDOWN.
9. Master Switch -- OFF when landing is assured.
10. Touchdown -- SLIGHTLY TAIL LOW.
11. Brakes -- APPLY HEAVILY.

PRECAUTIONARY LANDING WITH ENGINE POWER

1. Seat Belts and Shoulder Harnesses -- SECURE.
2. Airspeed -- 85 KIAS.
3. Wing Flaps -- 10°.
4. Selected Field -- FLY OVER, noting terrain and obstructions.
5. All Switches (except avionics power, master and ignition) -- OFF.
6. Dump Valve Control Handle -- PULL OUT.
7. Landing Gear -- DOWN (UP if terrain is rough or soft).
8. Wing Flaps -- 30° (on final approach).
9. Airspeed -- 75 KIAS.
10. Door -- UNLATCH PRIOR TO TOUCHDOWN.
11. Avionics Power and Master Switches -- OFF when landing is assured.
12. Touchdown -- SLIGHTLY TAIL LOW.
13. Ignition Switch -- OFF.
14. Brakes -- APPLY HEAVILY.

DITCHING

1. Radio -- TRANSMIT MAYDAY on 121.5 MHz, giving location and intentions and SQUAWK 7700 if transponder is installed.
2. Heavy Objects -- SECURE.
3. Landing Gear -- UP.
4. Wing Flaps -- 30°.
5. Power -- ESTABLISH 300 FT/MIN DESCENT AT 75 KIAS.
6. Approach -- High Winds, Heavy Seas -- INTO THE WIND.
   Light Winds, Heavy Swells -- PARALLEL TO SWELLS.

NOTE

If no power is available, approach at 85 KIAS with flaps up or at 80 KIAS with 10° flaps.

7. Seat Belts and Shoulder Harnesses -- SECURE.
8. Cabin Pressurization Switch -- OFF.
9. Cabin Door -- UNLATCH.
10. Touchdown -- LEVEL ATTITUDE AT 300 FT/MIN DESCENT.
11. Face -- CUSHION at touchdown with folded coat.
12. Airplane -- EVACUATE through cabin door and emergency exit. If necessary, open the openable window and flood cabin to equalize pressure so cabin door and emergency exit can be opened.
13. Life Vests and Raft -- INFLATE.

FIRES

DURING START ON GROUND

1. **Ignition Switch -- START** (continue cranking to obtain start).
2. **Auxiliary Fuel Pump -- OFF.**

If engine starts:

3. Power -- 1700 RPM for a few minutes.
4. Engine -- SHUTDOWN and inspect for damage.

If engine fails to start:

3. **Cranking -- CONTINUE** (ignition switch in START).
4. **Throttle -- FULL OPEN.**
5. **Mixture -- IDLE CUT-OFF.**
6. Fire Extinguisher -- OBTAIN (have ground attendants obtain if not installed).
7. Engine -- SECURE.
   a. Ignition Switch -- OFF.
   b. Master Switch -- OFF.
   c. Fuel On-Off Valve -- OFF (pull out).
8. Airplane -- EVACUATE.
9. Fire -- EXTINGUISH using fire extinguisher, wool blanket or dirt.

NOTE

If sufficient ground personnel are available (and fire is on ground and not too dangerous) move airplane away from the fire by pushing rearward on the leading edge of the horizontal tail.

10. Fire Damage -- INSPECT, repair damage or replace damaged components or wiring before conducting another flight.

ENGINE FIRE IN FLIGHT

1. **Mixture -- IDLE CUT-OFF.**
2. **Fuel On-Off Valve -- OFF (pull out).**
3. Dump Valve Control Handle -- PULL OUT.
4. Electrical Load -- REDUCE.
5. Airspeed -- 120 KIAS (If fire is not extinguished, increase glide speed to find an airspeed which will provide an incombustible mixture).
6. Forced Landing -- EXECUTE (as described in Emergency Landing Without Engine Power).

ELECTRICAL FIRE IN FLIGHT

1. **Master Switch -- OFF.**

NOTE

If operating in unpressurized flight, the dump valve control handle should be pulled to the dump position prior to shutting off all electrical power, to avoid the possibility of sudden pressurization of the cabin.

2. **Avionics Power Switch -- OFF.**
3. **All Other Switches (except ignition switch, and if pressurized, cabin pressurization switch) -- OFF.**
4. **Overhead Vents -- CLOSED** (to avoid drafts).

NOTE

If pressurized, reduce manifold pressure to minimum required for pressurization (i.e., to maintain a zero cabin R/C) to reduce airflow into the cabin.

5. **Fire Extinguisher -- ACTIVATE** (if available).

WARNING

If an oxygen system is available, occupants should use oxygen masks until smoke and discharged dry powder clears. After discharging an extinguisher within a closed cabin, ventilate the cabin. If pressurized, increase power to increase bleed airflow into cabin. If unpressurized, also open overhead vents, and if necessary, openable window.

If fire appears out and electrical power is necessary for continuance of flight:

6. Pressurization Switch -- ON (if in pressurized flight).
7. Master Switch -- ON.
8. Circuit Breakers -- CHECK for faulty circuit; do not reset.
9. Radio Switches -- OFF.
10. Avionics Power Switch -- ON.
11. Radio and Electrical Switches -- ON one at a time, with delay after each until short circuit is localized.
12. Vents/Cabin Air/Heat -- AS DESIRED when it is ascertained that fire is completely extinguished.

CABIN FIRE

1. **Master Switch -- OFF.**

NOTE

If operating in unpressurized flight, the dump valve control handle should be pulled to the dump position prior to shutting off all electrical power, to avoid the possibility of sudden pressurization of the cabin.

2. **Overhead Vents -- CLOSED** (to avoid drafts).

NOTE

If pressurized, reduce manifold pressure to minimum required for pressurization (i.e., to maintain zero cabin R/C) to reduce airflow into the cabin.

3. **Fire Extinguisher -- ACTIVATE** (if available).

WARNING

If an oxygen system is available, occupants should use oxygen masks until smoke and discharged dry powder clears. After discharging an extinguisher within a closed cabin, ventilate the cabin. If pressurized, increase power to increase bleed airflow into cabin. If unpressurized, also open overhead vents, and if necessary, openable window.

4. Land the airplane as soon as possible to inspect for damage. Use electrical power as required until landing is assured.

WING FIRE

1. **Radar Altimeter (if installed) -- OFF.**
2. **Navigation Light Switch -- OFF.**
3. **Strobe Light Switch (if installed) -- OFF.**
4. **Pitot Heat Switch (if installed) -- OFF.**
5. **Radar (if installed) -- OFF.**

NOTE

Perform a sideslip to keep the flames away from the fuel tank and cabin, and land as soon as possible.

ICING

INADVERTENT ICING ENCOUNTER

1. **Turn pitot heat, propeller anti-ice, and windshield anti-ice switches ON** (if installed).
2. **Turn back or change altitude** to obtain an outside air temperature that is less conducive to icing.
3. **Pull cabin heat and defrost controls full out** to obtain maximum windshield defroster effectiveness.
4. Increase engine speed to minimize ice build-up on propeller blades. If excessive vibration is noted, momentarily reduce engine speed to 2200 RPM with the propeller control, and then rapidly move the control full forward.

NOTE

Cycling the RPM flexes the propeller blades and high RPM increases centrifugal force, causing ice to shed more readily.

5. Watch for signs of induction air filter ice and regain manifold pressure by increasing the throttle setting.

NOTE

If ice accumulates on the intake filter (causing the alternate air valve to open), a decrease of up to 10 inches of full throttle manifold pressure will be experienced.

6. If icing conditions are unavoidable, plan a landing at the nearest airport. With an extremely rapid ice build-up, select a suitable "off airport" landing site.
7. With an ice accumulation of 1/4 inch or more on the wing leading edges, be prepared for a significantly higher power requirement,

approach speed, stall speed, and landing roll.

8. Open the window and, if practical, scrape ice from a portion of the windshield for visibility in the landing approach.
9. Use a 10° to 20° landing flap setting for ice accumulations of 1 inch or less. With heavier ice accumulations, approach with flaps retracted to ensure adequate elevator effectiveness in the approach and landing.
10. Approach at 85 to 95 KIAS with 20° flaps and 95 to 105 KIAS with 0° to 10° flaps, depending upon the amount of ice accumulation. If ice accumulation is unusually large, decelerate to the planned approach speed while in the approach configuration (landing gear and flaps down) at a high enough altitude which would permit recovery in the event that a stall buffet is encountered.
11. Land on the main wheels first, avoiding the slow and high type of flare-out.
12. Missed approaches should be avoided whenever possible because of severely reduced climb capability. However, if a go-around is mandatory, make the decision much earlier in the approach than normal. Apply maximum power and maintain 95 KIAS while retracting the flaps slowly in 10° increments. Retract the landing gear after immediate obstacles are cleared.

STATIC SOURCE BLOCKAGE
(Erroneous Instrument Reading Suspected)

1. **Static Pressure Alternate Source Valve -- PULL ON.**
2. Airspeed -- Climb 3 knots faster and approach 7 knots faster than normal or consult appropriate table in Section 5.
3. Altitude -- Cruise 70 feet higher and approach 50 feet higher than normal.

EXCESSIVE FUEL VAPOR

FUEL FLOW STABILIZATION PROCEDURES
(If Fuel Flow Fluctuations Of 5 PPH Or More Or Power Surges Occur)

1. Auxiliary Fuel Pump -- ON.
2. Mixture -- RESET as required.
3. Fuel Selector Valve -- SELECT BOTH ON if vapor symptoms continue.

NOTE

If vapor indications persist, select the fullest single tank. If the symptoms still continue, select the opposite tank for a minimum of 30 seconds; then switch to the fullest tank again.

4. Auxiliary Fuel Pump -- OFF after fuel flow has stabilized.
5. Mixture -- RESET as required.
6. Fuel Selector Valve -- AS DESIRED after fuel flow has stabilized for one minute, provided there is fuel in any single tank selected.

LANDING GEAR MALFUNCTION PROCEDURES

LANDING GEAR FAILS TO RETRACT

1. Master Switch -- ON.
2. Landing Gear Lever -- CHECK (lever full up).
3. Landing Gear and Gear Pump Circuit Breakers -- IN.
4. Gear Up Light -- CHECK.
5. Landing Gear Lever -- RECYCLE.
6. Gear Motor -- CHECK operation (ammeter and noise).

LANDING GEAR FAILS TO EXTEND

1. Landing Gear Lever -- DOWN.
2. Emergency Hand Pump -- EXTEND HANDLE, and PUMP (perpendicular to handle until resistance becomes heavy -- about 35 cycles).
3. Gear Down Light -- ON (master switch on).
4. Pump Handle -- STOW.

GEAR UP LANDING

1. Seats, Seat Belts and Shoulder Harnesses -- SECURE.
2. Landing Gear Lever -- UP.
3. Landing Gear and Gear Pump Circuit Breakers -- IN.
4. Runway -- SELECT longest hard surface or smooth sod runway available.
5. Wing Flaps -- 30° (on final approach).
6. Airspeed -- 75 KIAS.
7. Cabin Door -- UNLATCH PRIOR TO TOUCHDOWN.
8. Avionics Power and Master Switches -- OFF when landing is assured.
9. Touchdown -- SLIGHTLY TAIL LOW.
10. Mixture -- IDLE CUT-OFF.
11. Ignition Switch -- OFF.
12. Fuel On-Off Valve -- OFF (pull out).
13. Airplane -- EVACUATE.

LANDING WITHOUT POSITIVE INDICATION OF GEAR LOCKING

1. Before Landing Check -- COMPLETE.
2. Approach -- NORMAL (full flap).
3. Landing Gear and Gear Pump Circuit Breakers -- IN.
4. Landing -- TAIL LOW as smoothly as possible.
5. Braking -- MINIMUM necessary.
6. Taxi -- SLOWLY.
7. Engine -- SHUTDOWN before inspecting gear.

LANDING WITH A DEFECTIVE NOSE GEAR (Or Flat Nose Tire)

1. Movable Load -- TRANSFER to rear seat.
2. Passenger -- MOVE to rear seat.
3. Before Landing Checklist -- COMPLETE.
4. Runway -- SELECT LONGEST, HARD SURFACE or SMOOTH SOD available.
5. Wing Flaps -- 30°.
6. Cabin Door -- UNLATCH PRIOR TO TOUCHDOWN.
7. Avionics Power and Master Switches -- OFF when landing is assured.
8. Land -- SLIGHTLY TAIL LOW.
9. Mixture -- IDLE CUT-OFF.
10. Ignition Switch -- OFF.
11. Fuel On-Off Valve -- OFF (pull out).
12. Elevator Control -- HOLD NOSE OFF GROUND as long as possible.
13. Airplane -- EVACUATE as soon as it stops.

LANDING WITH A FLAT MAIN TIRE

1. Before Landing Check -- COMPLETE.
2. Approach -- NORMAL (full flap).
3. Touchdown -- GOOD TIRE FIRST, hold airplane off flat tire as long as possible with aileron control.
4. Directional Control -- MAINTAIN using brake on good wheel as required.

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

AMMETER SHOWS EXCESSIVE RATE OF CHARGE (Full Scale Deflection)

1. Alternator -- OFF.
2. Alternator Circuit Breaker -- PULL.

3. Nonessential Electrical Equipment -- OFF.
4. Flight -- TERMINATE as soon as practical.

LOW-VOLTAGE LIGHT ILLUMINATES DURING FLIGHT (Ammeter Indicates Discharge)

NOTE

Illumination of the low-voltage light may occur during low RPM conditions with an electrical load on the system such as during a low RPM taxi. Under these conditions, the light will go out at higher RPM. The master switch need not be recycled since an over-voltage condition has not occurred to de-activate the alternator system. Momentary illumination and/or ammeter needle deflection may also occur during startup of the landing gear system hydraulic pump motor.

1. Avionics Power Switch -- OFF.
2. Alternator Circuit Breaker -- CHECK IN.
3. Master Switch -- OFF (both sides).

NOTE

If operating in unpressurized flight, the dump valve control handle should be pulled to the dump position prior to shutting off all electrical power, to avoid the possibility of sudden pressurization of the cabin.

4. Master Switch -- ON.
5. Low-Voltage Light -- CHECK OFF.
6. Avionics Power Switch -- ON.

If low-voltage light illuminates again:

7. Alternator -- OFF.
8. Nonessential Radio and Electrical Equipment -- OFF.
9. Flight -- TERMINATE as soon as practical.

PRESSURIZATION SYSTEM EMERGENCIES

PRESSURIZED AIR CONTAMINATION - CABIN HEAT ON

1. Cabin Heat Control -- PUSH OFF.

PRESSURIZED AIR CONTAMINATION - CABIN HEAT OFF

Use the following procedure only in the event that pressurized air

contamination is severe enough to require immediate dumping of the pressurized air while above 12,500 feet rather than minor enough to allow a pressurized descent to 12,500 feet or less first.

1. Oxygen (if installed) -- USE.
2. Dump Valve Control Handle -- PULL OUT.
3. Cabin Pressurization Switch -- OFF.
4. Overhead Vents/Openable Window -- ON/OPEN as required to ventilate the cabin.
5. Emergency Descent -- PERFORM as outlined in this section.
6. Flight -- TERMINATE as soon as practical.

IMPENDING FAILURE OF WINDOW OR DOOR, OR CABIN OVER-PRESSURE (ABOVE 3.5 PSI)

1. Cabin Pressurization Switch -- OFF.
2. Dump Valve Control Handle -- PULL OUT.
3. If above 12,500 feet without supplemental oxygen, perform an emergency descent as outlined in this section.
4. If supplemental oxygen is available, check that each occupant is using oxygen in accordance with the appropriate procedures in Section 9.
5. Descend to 12,500 feet or below, prior to exhaustion of oxygen supply.
6. Dump Valve Control Handle -- PUSH IN (if cabin heating is required after cabin is depressurized).
7. Flight -- TERMINATE as soon as practical.

EMERGENCY DESCENT PROCEDURES

SMOOTH AIR

1. Seat Belts and Shoulder Harnesses -- SECURE.
2. Throttle -- IDLE.
3. Propeller -- HIGH RPM.
4. Mixture -- FULL RICH.
5. Landing Gear -- EXTEND.
6. Wing Flaps -- UP.
7. Airspeed:
   a. During landing gear extension -- 165 KIAS.
   b. After landing gear is fully extended -- 200 KIAS.

ROUGH AIR

1. Seat Belts and Shoulder Harnesses -- SECURE.
2. Throttle -- IDLE.

3. Propeller -- HIGH RPM.
4. Mixture -- FULL RICH.
5. Landing Gear -- EXTEND.
6. Wing Flaps -- UP.
7. Airspeeds:
   4000 Lbs -- 130 KIAS
   3350 Lbs -- 119 KIAS
   2700 Lbs -- 106 KIAS

INADVERTENT OPENING OF CABIN DOOR IN FLIGHT

1. Altitude -- CLIMB (after takeoff) or DESCEND (if above 12,500 feet) to a safe altitude. Do not exceed 167 KIAS with cabin door open.
2. Airspeed -- MAINTAIN 100 KIAS while closing door.
3. Pilot's Seat -- SLIDE AFT slightly at a safe altitude.
4. Openable Window -- OPEN inward (but not aft).
5. Door Handle -- POSITION (in detent at approximately the 1 o'clock position).
6. Door -- CLOSE and LATCH.
7. Door Handle Safety Lock -- LOCK.
8. Landing -- Make normal approach and landing if door fails to close and latch.

INADVERTENT OPENING OF EMERGENCY EXIT IN FLIGHT

1. Seat Belts and Shoulder Harnesses -- SECURE.
2. Altitude -- CLIMB (after takeoff) or DESCEND (if above 12,500 feet) to a safe altitude. Do not exceed 167 KIAS with emergency exit open.
3. Openable Window -- OPEN (to reduce buffeting).
4. Airspeed -- MAINTAIN 100 KIAS while closing exit.
5. Copilot's Seat -- SLIDE AFT.
6. Emergency Exit -- CLOSE and LOCK.
7. Landing -- Make normal approach and landing if emergency exit cannot be closed and locked.

AMPLIFIED PROCEDURES

The following Amplified Procedures elaborate upon information contained in the Operational Checklists portion of this section. These procedures also include information not readily adaptable to a checklist format, and material to which a pilot could not be expected to refer in resolution of a specific emergency.

ENGINE FAILURE

If an engine failure occurs during the takeoff roll, the most important thing to do is stop the airplane on the remaining runway. Those extra items on the checklist will provide added safety after a failure of this type.

Prompt lowering of the nose to maintain airspeed and establish a glide attitude is the first response to an engine failure after takeoff. In most cases, the landing should be planned straight ahead with only small changes in direction to avoid obstructions. Altitude and airspeed are seldom sufficient to execute a 180° gliding turn necessary to return to the runway. The checklist procedures assume that adequate time exists to secure the fuel and ignition systems prior to touchdown.

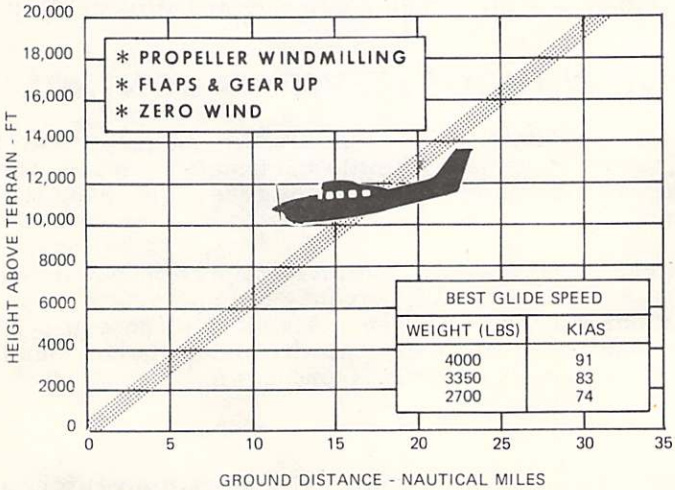

Figure 3-1. Maximum Glide

After an engine failure in flight, the best glide speed as shown in figure 3-1 should be established as quickly as possible. While gliding toward a suitable landing area, an effort should be made to identify the cause of the failure. If time permits, an engine restart should be attempted as shown in the checklist. If the engine cannot be restarted, a forced landing without power must be completed.

FORCED LANDINGS

If all attempts to restart the engine fail and a forced landing is imminent, select a suitable field and prepare for the landing as discussed under the Emergency Landing Without Engine Power checklist.

Before attempting an "off airport" landing with engine power available, one should fly over the landing area at a safe but low altitude to inspect the terrain for obstructions and surface conditions, proceeding as discussed under the Precautionary Landing With Engine Power checklist.

Prepare for ditching by securing heavy objects and collect folded coats for protection of occupants' face at touchdown. Transmit Mayday message on 121.5 MHz giving location and intentions and squawk 7700 if a transponder is installed. Avoid a landing flare because of difficulty in judging height over a water surface.

In a forced landing situation, do not turn off the avionics power and master switches until a landing is assured. Premature deactivation of the switches will disable the encoding altimeter and airplane electrical systems.

LANDING WITHOUT ELEVATOR CONTROL

Trim for horizontal flight (with an airspeed of approximately 80 KIAS and flaps set to 20°) by using throttle and trim tab controls. **Then do not change the trim tab setting** and control the glide angle by adjusting power exclusively.

At flareout, the nose-down moment resulting from power reduction is an adverse factor and the airplane may hit on the nose wheel. Consequently, at flareout, the trim tab should be set at full nose-up position and the power adjusted so that the airplane will rotate to the horizontal attitude for touchdown. Close the throttle at touchdown.

FIRES

Improper starting procedures involving the excessive use of auxiliary fuel pump operation can cause engine flooding and subsequent collection of fuel on the parking ramp as the excess fuel drains overboard from the

intake manifolds. This is sometimes experienced in difficult starts in cold weather where engine pre-heat service is not available. If this occurs, the airplane should be pushed away from the fuel puddle before another engine start is attempted. Otherwise, there is a possibility of raw fuel accumulations in the exhaust system igniting during an engine start, causing a long flame from the tailpipe, and possibly igniting the collected fuel on the pavement. If a fire occurs, proceed according to the checklist.

Although engine fires are extremely rare in flight, the steps of the appropriate checklist should be followed if one is encountered. After completion of this procedure, execute a forced landing. Do not attempt to restart the engine.

The initial indication of an electrical fire is usually the odor of burning insulation. The checklist for this problem should result in elimination of the fire.

EMERGENCY OPERATION IN CLOUDS (Vacuum System Failure)

In the event of a complete vacuum system failure during flight, the directional indicator and attitude indicator will be disabled, and the pilot will have to rely on the turn coordinator or the turn and bank indicator if he inadvertently flies into clouds. The following instructions assume that only the electrically-powered turn coordinator or the turn and bank indicator is operative, and that the pilot is not completely proficient in instrument flying.

EXECUTING A 180° TURN IN CLOUDS

Upon inadvertently entering the clouds, an immediate plan should be made to turn back as follows:

1. Note the compass heading.
2. Note the time of the minute hand and observe the position of the sweep second hand on the clock (use timer mode with digital clock).
3. When the sweep second hand (or timer) indicates the nearest half-minute, initiate a standard rate left turn, holding the turn coordinator symbolic airplane wing opposite the lower left index mark for 60 seconds. Then roll back to level flight by leveling the miniature airplane.
4. Check accuracy of the turn by observing the compass heading which should be the reciprocal of the original heading.
5. If necessary, adjust heading primarily with skidding motions rather than rolling motions so that the compass will read more accurately.

6. Maintain altitude and airspeed by cautious application of elevator control. Avoid overcontrolling by keeping hands off the control wheel as much as possible and steering only with rudder.

EMERGENCY DESCENT THROUGH CLOUDS

If conditions preclude reestablishment of VFR flight by a 180° turn, a descent through a cloud deck to VFR conditions may be appropriate. If possible, obtain radio clearance for an emergency descent through clouds. To guard against a spiral dive, choose an easterly or westerly heading to minimize compass card swings due to changing bank angles. In addition, keep hands off the control wheel and steer a straight course with rudder control by monitoring the turn coordinator. Occasionally check the compass heading and make minor corrections to hold an approximate course. Before descending into the clouds, set up a stabilized let-down condition as follows:

1. Extend landing gear.
2. Reduce power to set up a 500 to 800 ft./min. rate of descent.
3. Adjust mixture for smooth operation.
4. Adjust the elevator and rudder trim control wheels for a stabilized descent at 105 KIAS.
5. Keep hands off the control wheel.
6. Monitor turn coordinator and make corrections by rudder alone.
7. Adjust rudder trim to relieve unbalanced rudder force.
8. Check trend of compass card movement and make cautious corrections with rudder to stop turn.
9. Upon breaking out of clouds, resume normal cruising flight.

RECOVERY FROM A SPIRAL DIVE

If a spiral is encountered, proceed as follows:

1. Close the throttle.
2. Stop the turn by using coordinated aileron and rudder control to align the symbolic airplane in the turn coordinator with the horizon reference line.
3. Cautiously apply control wheel back pressure to slowly reduce the airspeed to 105 KIAS.
4. Adjust the elevator trim control to maintain a 105 KIAS glide.
5. Keep hands off the control wheel, using rudder control to hold a straight heading. Adjust the rudder trim to relieve unbalanced rudder force.
6. Clear engine occasionally, but avoid using enough power to disturb the trimmed glide.
7. Upon breaking out of clouds, resume normal cruising flight.

INADVERTENT FLIGHT INTO ICING CONDITIONS

Flight into icing conditions is prohibited. An inadvertent encounter

with these conditions can best be handled using the checklist procedures. The best procedure, of course, is to turn back or change altitude to escape icing conditions.

STATIC SOURCE BLOCKED

If erroneous readings of the static source instruments (airspeed, altimeter and vertical speed) are suspected, the static pressure alternate source valve should be pulled on, thereby supplying static pressure to these instruments from the baggage compartment.

Baggage compartment pressures will be affected by pressurization, open window and varying airspeeds, and this will affect the readings.

With the cabin pressurized, maximum airspeed and altimeter variation from normal reaches 3 knots and 70 feet respectively at maximum cruise (instruments read high). At climb speeds, typical variations are 2 knots and 20 feet respectively (reads high).

With the cabin unpressurized , dump valve open, vents closed, and the window closed, variations up to 10 knots and 60 feet occur near stall (reads high) and 5 knots and 80 feet at maximum cruise (reads high). During approach, typical variations are 10 knots and 80 feet (reads high).

With the cabin unpressurized, dump valve closed, vents open, and the window closed, variations up to 4 knots and 20 feet occur near stall (reads high) and 2 knots and 30 feet at maximum cruise (reads high). During approach, typical variations are 4 knots and 30 feet, respectively (reads high).

With the cabin unpressurized and the window open, variations up to 7 knots and 40 feet occur near stall (reads high) and 6 knots and 100 feet at maximum cruise (reads high). During approach, typical variations are 7 knots and 55 feet (reads high).

With the alternate static source on, fly the airplane at airspeeds and altitudes which compensate for the variations from normal indications. For more exact airspeed correction, refer to the alternate static source airspeed calibration table in Section 5, appropriate to the pressurization and window configuration.

Installation of the Cessna Air Conditioning System described in Section 9 will also affect the alternate static source indications. With an air conditioner equipped airplane, fly 30 feet lower and 3 knots less than noted above or in the Section 5 alternate airspeed tables in order to more exactly compensate for the variations from normal indications.

SPINS

Intentional spins are prohibited in this airplane. Should an inadvertent spin occur, the following recovery technique may be used:

1. RETARD THROTTLE TO IDLE POSITION.
2. PLACE AILERONS IN NEUTRAL POSITION.
3. APPLY AND **HOLD** FULL RUDDER OPPOSITE TO THE DIRECTION OF ROTATION.
4. JUST **AFTER** THE RUDDER REACHES THE STOP, MOVE THE CONTROL WHEEL **BRISKLY** FORWARD FAR ENOUGH TO BREAK THE STALL. Full down elevator may be required at aft center of gravity loadings to assure optimum recoveries.
5. **HOLD** THESE CONTROL INPUTS UNTIL ROTATION STOPS. Premature relaxation of the control inputs may extend the recovery.
6. AS ROTATION STOPS, NEUTRALIZE RUDDER, AND MAKE A SMOOTH RECOVERY FROM THE RESULTING DIVE.

NOTE

If disorientation precludes a visual determination of the direction of rotation, the symbolic airplane in the turn coordinator or the needle of the turn and bank indicator may be referred to for this information.

ROUGH ENGINE OPERATION OR LOSS OF POWER

SPARK PLUG FOULING

A slight engine roughness in flight may be caused by one or more spark plugs becoming fouled by carbon or lead deposits. This may be verified by turning the ignition switch momentarily from BOTH to either L or R position. An obvious power loss in single ignition operation is evidence of spark plug or magneto trouble. Assuming that spark plugs are the more likely cause, lean the mixture to the recommended lean setting for cruising flight. If the problem does not clear up in several minutes, determine if a richer mixture setting will produce smoother operation. If not, proceed to the nearest airport for repairs using the BOTH position of the ignition switch unless extreme roughness dictates the use of a single ignition position.

MAGNETO MALFUNCTION

A sudden engine roughness or misfiring is usually evidence of

magneto problems. Switching from BOTH to either L or R ignition switch position will identify which magneto is malfunctioning. Select different power settings and enrichen the mixture to determine if continued operation on BOTH magnetos is practicable. If not, switch to the good magneto and proceed to the nearest airport for repairs.

ENGINE-DRIVEN FUEL PUMP FAILURE

Failure of the engine-driven fuel pump will be evidenced by a sudden reduction in the fuel flow indication **prior to a loss of power**, while operating from a fuel tank containing adequate fuel.

In the event of an engine-driven fuel pump failure during takeoff, immediately hold the left half of the auxiliary fuel pump switch in the HI position until the airplane is well clear of all obstacles. Upon reaching a safe altitude, reduce the power settings to give cruise power. Then release the HI side of the switch, allowing the right side of the switch to remain in the ON position for level flight.

This ON position provides a reduced fuel flow which results in lean mixtures at two portions of the manifold pressure range. For example, at 2500 RPM, excessively lean mixtures with resulting roughness and/or power drop off are experienced at approximately 22 inches (just before the throttle switch activates) and again at 28 or more inches of manifold pressure.

To avoid these areas of rough engine operation, select 2200 RPM and sufficient manifold pressure within the green arc range for the flight condition at hand. If more power is required, use progressively more RPM and select a manifold pressure where smooth engine operation and normal airspeed can be obtained.

The landing approach should be planned so that approximately 15 inches of manifold pressure can be used. If the throttle is brought back to idle position, the mixture becomes very rich. This could cause a sluggish power response if the throttle had to be advanced rapidly during landing.

EXCESSIVE FUEL VAPOR INDICATIONS

Excessive fuel vapor indications are most likely to appear during climb and the first hour of cruise on each tank, especially when operating at higher altitudes or in unusually warm temperatures.

Indications of excessive fuel vapor accumulation are fuel flow gage fluctuations greater than 5 PPH. This condition with leaner mixtures or with larger fluctuations may result in power surges, and if not corrected, may cause power loss.

To eliminate vapor and stabilize fuel flows, turn the auxiliary fuel pump on and reset the mixture as required. If vapor symptoms persist, follow the checklist procedures. When fuel flow stabilizes, turn off the auxiliary fuel pump and reset the mixture as desired.

LOW OIL PRESSURE

If low oil pressure is accompanied by normal oil temperature, there is a possibility the oil pressure gage or relief valve is malfunctioning. A leak in the line to the gage is not necessarily cause for an immediate precautionary landing because an orifice in this line will prevent a sudden loss of oil from the engine sump. However, a landing at the nearest airport would be advisable to inspect the source of trouble.

If a total loss of oil pressure is accompanied by a rise in oil temperature, there is good reason to suspect an engine failure is imminent. Reduce engine power immediately and select a suitable forced landing field. Use only the minimum power required to reach the desired touchdown spot.

LANDING GEAR MALFUNCTION PROCEDURES

In the event of possible landing gear retraction or extension malfunctions, there are several general checks that should be made prior to initiating the steps outlined in the following paragraphs.

In analyzing a landing gear malfunction, first check that the master switch is ON and the LDG GEAR and GEAR PUMP circuit breakers are in; reset if necessary. Also, check both landing gear position indicator lights for operation by "pressing-to-test" the light units and rotating them at the same time to check for open dimming shutters. A burned-out bulb can be replaced in flight by using the bulb from the remaining gear position indicator light.

RETRACTION MALFUNCTIONS

Normal landing gear retraction time is approximately 8 seconds. If the landing gear fails to retract normally or an intermittent GEAR UP indicator light is present, check the indicator light for proper operation and attempt to recycle the landing gear. Place the landing gear lever in the GEAR DOWN position. When the GEAR DOWN light illuminates, reposition the gear lever in the GEAR UP position for another retraction attempt. If the GEAR UP light still fails to illuminate, the flight may be continued to an airport having maintenance facilities, if practical. If gear motor operation is audible after a period of one minute following gear lever retraction actuation, pull the GEAR PUMP circuit breaker to prevent the electric motor from overheating. In this event, remember to re-engage the circuit breaker just prior to landing. Intermittent gear motor operation

may also be detected by momentary fluctuations of the ammeter needle.

EXTENSION MALFUNCTIONS

Normal landing gear extension time is approximately 6 seconds. If the landing gear will not extend normally, perform the general checks of circuit breakers and master switch and repeat the normal extension procedures at a reduced airspeed of 100 KIAS. The landing gear lever must be in the down position with the detent engaged. If efforts to extend and lock the gear through the normal landing gear system fail, the gear can be manually extended (as long as hydraulic system fluid has not been completely lost) by use of the emergency hand pump. The hand pump is located between the front seats.

A checklist is provided for step-by-step instructions for a manual gear extension.

If gear motor operation is audible after a period of one minute following gear lever extension actuation, pull the GEAR PUMP circuit breaker to prevent the electric motor from overheating. In this event, remember to re-engage the circuit breaker just prior to landing.

GEAR UP LANDING

If the landing gear remains retracted or is only partially extended, and all efforts to fully extend it (including manual extension) have failed, plan a wheels up landing. In preparation for landing, reposition the landing gear lever to GEAR UP and push the LDG GEAR and GEAR PUMP circuit breakers in to allow the landing gear to swing into the gear wells at touchdown. Then proceed in accordance with the checklist.

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

Malfunctions in the electrical power supply system can be detected by periodic monitoring of the ammeter and low-voltage warning light; however, the cause of these malfunctions is usually difficult to determine. A broken alternator drive belt or wiring is most likely the cause of alternator failures, although other factors could cause the problem. A defective alternator control unit can also cause malfunctions. Problems of this nature constitute an electrical emergency and should be dealt with immediately. Electrical power malfunctions usually fall into two categories: excessive rate of charge and insufficient rate of charge. The paragraphs below describe the recommended remedy for each situation.

EXCESSIVE RATE OF CHARGE

After engine starting and heavy electrical usage at low engine speeds (such as extended taxiing) the battery condition will be low enough to accept above normal charging during the initial part of a flight. However, after thirty minutes of cruising flight, the ammeter should be indicating less than two needle widths of charging current. If the charging rate were to remain above this value on a long flight, the battery would overheat and evaporate the electrolyte at an excessive rate.

Electronic components in the electrical system could be adversely affected by higher than normal voltage. The alternator control unit includes an over-voltage sensor which normally will automatically shut down the alternator if the charge voltage reaches approximately 31.5 volts. If the over-voltage sensor malfunctions, as evidenced by an excessive rate of charge shown on the ammeter, the alternator should be turned off, the alternator circuit breaker pulled, nonessential electrical equipment turned off and the flight terminated as soon as practical.

INSUFFICIENT RATE OF CHARGE

NOTE

> Illumination of the low-voltage light and ammeter discharge indications may occur during low RPM conditions with an electrical load on the system, such as during a low RPM taxi. Under these conditions, the light will go out at higher RPM. The master switch need not be recycled since an over-voltage condition has not occurred to de-activate the alternator system. Momentary illumination and/or ammeter needle deflection may also occur during startup of the landing gear system hydraulic pump motor.

If the over-voltage sensor should shut down the alternator, or if the alternator output is low, a discharge rate will be shown on the ammeter followed by illumination of the low-voltage warning light. Since this may be a "nuisance" trip-out, an attempt should be made to reactivate the alternator system.

NOTE

> If operating in unpressurized flight, the dump valve control handle should be pulled to the dump position prior to shutting off all electrical power, to avoid the possibility of sudden pressurization of the cabin.

To do this, turn the avionics power switch off, check that the alternator

circuit breaker is in, then turn both sides of the master switch off and then on again. If the problem no longer exists, normal alternator charging will resume and the low-voltage light will go off. The avionics power switch may then be turned back on. If the light illuminates again, a malfunction is confirmed. In this event, the flight should be terminated and/or the current drain on the battery minimized because the battery can supply the electrical system for only a limited period of time. Battery power must be conserved for later operation of the landing gear and wing flaps and, if the emergency occurs at night, for possible use of the landing lights during landing.

PRESSURIZATION AIR CONTAMINATION

Strong fumes (smoke or odors) coming from the pressurization air outlets when the heater is turned on high and which go away when the heater is turned off, indicate oil contamination, either from recent ground pressurization system maintenance or from a malfunction in the turbocharger lubricating system. Inspect and repair, if needed, at the earliest opportunity.

If fumes occur or do not clear up with the heater off, determine if the contamination is severe enough to require an immediate depressurization and an emergency descent rather than minor enough to allow a pressurized descent to 12,500 feet or less before depressurizing and ventilating the cabin. In this case, the flight should be terminated as soon as practical and the pressurization system, engine induction and exhaust components should be inspected and repaired.

INADVERTENT OPENING OF CABIN DOOR IN FLIGHT

If the cabin door should inadvertently open in flight while unpressurized or while just beginning to pressurize due to probable improper latching or locking procedure, turn the cabin pressurization switch off, and if desired, attempt to close the door in flight at a safe altitude following the checklist in this section. To facilitate closing the door, open the openable window inward (but not aft) to relieve cabin pressure, and slide the seat aft slightly (so as to retain control of the airplane) to obtain a better grasp of the door grip. It is important that the door handle be in the detent at approximately the 1 o'clock position prior to pulling the door closed, followed immediately by rotating the handle forward to latch.

If the cabin door inadvertently opens when locked closed, the flight should be terminated as soon as practical and repairs made.

Flight characteristics are normal in any flap position with the cabin door open.

INADVERTENT OPENING OF EMERGENCY EXIT IN FLIGHT

If the emergency exit should inadvertently open in flight while unpressurized or when just beginning to pressurize due to probable improper latching or locking procedure, the flight may be continued after closing the emergency exit following the checklist in this section.

If the emergency exit inadvertently opens when locked closed, the flight should be terminated as soon as practical and repairs made.

Flight characteristics are normal in any flap position with the emergency exit open, although a moderately strong buffet exists in the cabin due to air pressure fluctuations. This buffet can be minimized by opening the openable window.