

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 standard avionics, the ELT, or any optional systems can be found in the Supplements, Section 9.

AIRSPEEDS

AIRSPEEDS FOR EMERGENCY OPERATION

Engine Failure After Takeoff:	
Wing Flaps Up	70 KIAS
Wing Flaps Down	65 KIAS
Maneuvering Speed:	
2550 Lbs	105 KIAS
2200 Lbs	98 KIAS
1900 Lbs	90 KIAS
Maximum Glide	68 KIAS
Precautionary Landing With Engine Power	65 KIAS
Landing Without Engine Power:	
Wing Flaps Up	70 KIAS
Wing Flaps Down	65 KIAS

EMERGENCY PROCEDURES CHECKLIST

Procedures in the Emergency Procedures Checklist 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 -- 70 KIAS (flaps UP).**
65 KIAS (flaps DOWN).
2. Mixture -- IDLE CUT OFF.
3. Fuel Shutoff Valve -- OFF (Pull Full Out).
4. Ignition Switch -- OFF.
5. Wing Flaps -- AS REQUIRED.
6. Master Switch -- OFF.
7. Cabin Door -- UNLATCH.
8. Land -- STRAIGHT AHEAD.

ENGINE FAILURE DURING FLIGHT (Restart Procedures)

1. **Airspeed -- 68 KIAS.**
2. **Fuel Shutoff Valve -- ON (push full in).**
3. **Fuel Selector Valve -- BOTH.**
4. **Auxiliary Fuel Pump Switch -- ON.**
5. **Mixture -- RICH (if restart has not occurred).**
6. **Ignition Switch -- BOTH (or START if propeller is stopped).**

NOTE

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

7. **Auxiliary Fuel Pump Switch -- OFF.**

NOTE

If the fuel flow indicator immediately drops to zero (indicating an engine-driven fuel pump failure), return the Auxiliary Fuel Pump Switch to the ON position.

FORCED LANDINGS

EMERGENCY LANDING WITHOUT ENGINE POWER

1. **Passenger Seat Backs -- MOST UPRIGHT POSITION.**
2. **Seats and Seat Belts -- SECURE.**
3. **Airspeed -- 70 KIAS (flaps UP),
65 KIAS (flaps DOWN).**
4. **Mixture -- IDLE CUT OFF.**
5. **Fuel Shutoff Valve -- OFF (Pull Full Out).**
6. **Ignition Switch -- OFF.**
7. **Wing Flaps -- AS REQUIRED (30° recommended).**
8. **Master Switch -- OFF (when landing is assured).**
9. **Doors -- UNLATCH PRIOR TO TOUCHDOWN.**
10. **Touchdown -- SLIGHTLY TAIL LOW.**
11. **Brakes -- APPLY HEAVILY.**

PRECAUTIONARY LANDING WITH ENGINE POWER

1. Passenger Seat Backs -- MOST UPRIGHT POSITION.
2. Seats and Seat Belts -- SECURE.
3. Airspeed -- 65 KIAS.
4. Wing Flaps -- 20°.
5. Selected Field -- FLY OVER, noting terrain and obstructions, then retract flaps upon reaching a safe altitude and airspeed.
6. Avionics Master Switch and Electrical Switches -- OFF.
7. Wing Flaps -- 30° (on final approach).
8. Airspeed -- 65 KIAS.
9. Master Switch -- OFF.
10. Doors -- UNLATCH PRIOR TO TOUCHDOWN.
11. Touchdown -- SLIGHTLY TAIL LOW.
12. Ignition Switch -- OFF.
13. Brakes -- APPLY HEAVILY.

DITCHING

1. Radio -- TRANSMIT MAYDAY on 121.5 MHz, giving location and intentions and SQUAWK 7700.
2. Heavy Objects (in baggage area) -- SECURE OR JETTISON (if possible).
3. Passenger Seat Backs -- MOST UPRIGHT POSITION.
4. Seats and Seat Belts -- SECURE.
5. Wing Flaps -- 20° to 30°.
6. Power -- ESTABLISH 300 FT/MIN DESCENT AT 55 KIAS.

NOTE

If no power is available, approach at 70 KIAS with flaps up or at 65 KIAS with 10° flaps.

7. Approach -- High Winds, Heavy Seas -- INTO THE WIND.
Light Winds, Heavy Swells -- PARALLEL TO SWELLS.
8. Cabin Doors -- UNLATCH.
9. Touchdown -- LEVEL ATTITUDE AT ESTABLISHED RATE OF DESCENT.
10. Face -- CUSHION at touchdown with folded coat.
11. ELT -- Activate.
12. Airplane -- EVACUATE through cabin doors. If necessary, open window and flood cabin to equalize pressure so doors can be opened.
13. Life Vests and Raft -- INFLATE WHEN CLEAR OF AIRPLANE.

FIRES

DURING START ON GROUND

1. **Ignition Switch -- START, Continue Cranking** to get a start which would suck the flames and accumulated fuel into the engine.

If engine starts:

2. Power -- 1800 RPM for a few minutes.
3. Engine -- SHUTDOWN and inspect for damage.

If engine fails to start:

4. **Throttle -- FULL OPEN.**
5. **Mixture -- IDLE CUT OFF.**
6. **Cranking -- CONTINUE.**
7. **Fuel Shutoff Valve -- OFF (Pull Full Out).**
8. **Auxiliary Fuel Pump Switch -- OFF.**
9. Fire Extinguisher -- ACTIVATE.
10. Engine -- SECURE.
 - a. Master Switch -- OFF.
 - b. Ignition Switch -- OFF
11. Parking Brake -- RELEASE.
12. Airplane -- EVACUATE.
13. Fire -- EXTINGUISH using fire extinguisher, wool blanket, or dirt.
14. 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 Shutoff Valve -- Pull Out (OFF).**
3. **Auxiliary Fuel Pump Switch -- OFF.**
4. **Master Switch -- OFF.**
5. Cabin Heat and Air -- OFF (except overhead vents).
6. Airspeed -- 100 KIAS (If fire is not extinguished, increase glide speed to find an airspeed - within airspeed limitations - which will provide an incombustible mixture).
7. Forced Landing -- EXECUTE (as described in Emergency Landing Without Engine Power).

ELECTRICAL FIRE IN FLIGHT

1. **Master Switch -- OFF.**
2. **Vents, Cabin Air, Heat -- CLOSED.**
3. **Fire Extinguisher -- ACTIVATE.**
4. Avionics Master Switch -- OFF.
5. All Other Switches (except ignition switch) -- OFF.

WARNING

AFTER DISCHARGING FIRE EXTINGUISHER AND ASCERTAINING THAT FIRE HAS BEEN EXTINGUISHED, VENTILATE THE CABIN.

6. Vents/Cabin Air/Heat -- OPEN when it is ascertained that fire is completely extinguished.

If fire has been extinguished and electrical power is necessary for continuance of flight to nearest suitable airport or landing area:

7. Master Switch -- ON.
8. Circuit Breakers -- CHECK for faulty circuit, do not reset.
9. Radio Switches -- OFF.
10. Avionics Master Switch -- ON.
11. Radio/Electrical Switches -- ON one at a time, with delay after each until short circuit is localized.

CABIN FIRE

1. **Master Switch -- OFF.**
2. **Vents/Cabin Air/Heat -- CLOSED** (to avoid drafts).
3. **Fire Extinguisher -- ACTIVATE.**

WARNING

AFTER DISCHARGING FIRE EXTINGUISHER AND ASCERTAINING THAT FIRE HAS BEEN EXTINGUISHED, VENTILATE THE CABIN.

4. Vents/Cabin Air/Heat -- Open when it is ascertained that fire is completely extinguished.
5. Land the airplane as soon as possible to inspect for damage.

WING FIRE

1. **Landing/Taxi Light Switches -- OFF.**
2. **Navigation Light Switch -- OFF.**
3. **Strobe Light Switch -- OFF.**
4. **Pitot Heat Switch -- OFF.**

NOTE

Perform a sideslip to keep the flames away from the fuel tank and cabin. Land as soon as possible using flaps only as required for final approach and touchdown.

ICING

INADVERTENT ICING ENCOUNTER

1. **Turn pitot heat switch ON.**
2. **Turn back or change altitude** to obtain an outside air temperature that is less conducive to icing.
3. **Pull cabin heat control full out and open defroster outlets** to obtain maximum windshield defroster airflow. Adjust cabin air control to get maximum defroster heat and airflow.
4. Watch for signs of engine-related icing conditions. An unexplained loss in engine speed could be caused by ice blocking the air intake filter, or, in extremely rare instances, ice completely blocking the fuel injection air reference tubes. Change the throttle position to obtain maximum RPM. This may require either advancing or retarding the throttle, dependent on where ice has accumulated in the system. Adjust mixture, as required, for maximum RPM.
5. Plan a landing at the nearest airport. With an extremely rapid ice build up, select a suitable "off airport" landing site.
6. With an ice accumulation of 1/4 inch or more on the wing leading edges, be prepared for significantly higher stall speed and a longer landing roll.
7. Leave wing flaps retracted. With a severe ice build up on the horizontal tail, the change in wing wake airflow direction caused by wing flap extension could result in a loss of elevator effectiveness.
8. Open left window and, if practical, scrape ice from a portion of the windshield for visibility in the landing approach.
9. Perform a landing approach using a forward slip, if necessary, for improved visibility.

10. Approach at 65 to 75 KIAS depending upon the amount of the accumulation.
11. Perform a landing in level attitude.

STATIC SOURCE BLOCKAGE (Erroneous Instrument Reading Suspected)

1. **Static Pressure Alternate Source Valve -- PULL ON.**
2. Airspeed -- Consult appropriate calibration tables in Section 5.

LANDING WITH A FLAT MAIN TIRE

1. Approach -- NORMAL.
2. Wing Flaps -- 30°.
3. Touchdown -- GOOD MAIN 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.

LANDING WITH A FLAT NOSE TIRE

1. Approach -- NORMAL.
2. Flaps -- AS REQUIRED.
3. Touchdown -- ON MAINS, hold nose wheel off the ground as long as possible.
4. When nose wheel touches down, maintain full up elevator as airplane slows to stop.

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

AMMETER SHOWS EXCESSIVE RATE OF CHARGE (Full Scale Deflection)

1. Alternator -- OFF.

CAUTION

WITH THE ALTERNATOR SIDE OF THE MASTER SWITCH OFF, COMPASS DEVIATIONS OF AS MUCH AS 25° MAY OCCUR.

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

LOW VOLTAGE ANNUNCIATOR (VOLTS) ILLUMINATES DURING FLIGHT (Ammeter Indicates Discharge)

NOTE

Illumination of "VOLTS" on the annunciator panel may occur during low RPM conditions with an electrical load on the system such as during a low RPM taxi. Under these conditions, the annunciator will go out at higher RPM. The master switch need not be recycled since an overvoltage condition has not occurred to deactivate the alternator system.

1. Avionics Master Switch -- OFF.
2. Alternator Circuit Breaker (ALT FLD) -- CHECK IN.
3. Master Switch -- OFF (both sides).
4. Master Switch -- ON.
5. Low Voltage Annunciator (VOLTS) -- CHECK OFF.
6. Avionics Master Switch -- ON.

If low voltage annunciator (VOLTS) illuminates again:

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

VACUUM SYSTEM FAILURE

Left Vacuum (L VAC) Annunciator or Right Vacuum (VAC R) Annunciator Illuminates.

CAUTION

IF VACUUM IS NOT WITHIN NORMAL OPERATING LIMITS, A FAILURE HAS OCCURRED IN THE VACUUM SYSTEM AND PARTIAL PANEL PROCEDURES MAY BE REQUIRED FOR CONTINUED FLIGHT.

1. **Vacuum Gage** -- **CHECK** to ensure vacuum within normal operating limits.

AMPLIFIED EMERGENCY PROCEDURES

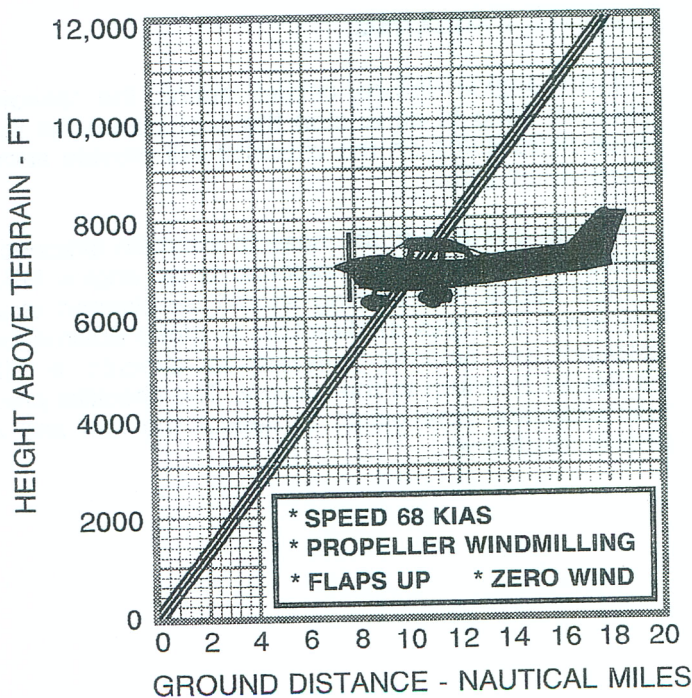
The following Amplified Emergency Procedures elaborate upon information contained in the Emergency Procedures Checklist portion of this section. These procedures also include information not readily adaptable to a checklist format, and material to which a pilot could not be expected to refer in resolution of a specific emergency. This information should be reviewed in detail prior to flying the airplane, as well as reviewed on a regular basis to keep pilot's knowledge of procedures fresh.

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.

After an engine failure in flight, the most important course of action is to continue flying the airplane. 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.



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Figure 3-1. Maximum Glide

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. Transmit Mayday message on 121.5 MHz giving location and intentions and squawk 7700.

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 or jettisoning heavy objects located in the baggage area 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. Avoid a landing flare because of difficulty in judging height over a water surface. The checklist assumes the availability of power to make a precautionary water landing. If power is not available, use of the airspeeds noted with minimum flap extension will provide a more favorable attitude for a power off ditching.

In a forced landing situation, do not set the AVIONICS MASTER switch or the airplane MASTER switch to the OFF position until a landing is assured. When these switches are in the OFF position, the airplane electrical systems are de-energized.

Before performing a forced landing, especially in remote and mountainous areas, activate the ELT transmitter by positioning the cockpit-mounted switch to the ON position. For complete information on ELT operation, refer to the Supplements, Section 9.

LANDING WITHOUT ELEVATOR CONTROL

Trim for horizontal flight (with an airspeed of approximately 65 KIAS and flaps set to 20°) by using throttle and elevator trim controls. Then **do not change the elevator trim control setting;** control the glide angle by adjusting power exclusively.

At the landing flare (round-out), the nose down moment resulting from power reduction is an adverse factor and the airplane may land on the nose wheel. Consequently, at flare, the elevator trim control should be adjusted toward the 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

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 (Total Vacuum System Failure)

If both the vacuum pumps fail in flight, the directional indicator and attitude indicator will be disabled, and the pilot will have to rely on the turn coordinator if he inadvertently flies into clouds. If an autopilot is installed, it too may be affected. Refer to Section 9, Supplements, for additional details concerning autopilot operation. The following instructions assume that only the electrically powered turn coordinator 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. Using the clock, 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.

3. Check accuracy of the turn by observing the compass heading which should be the reciprocal of the original heading.
4. If necessary, adjust heading primarily with skidding motions rather than rolling motions so that the compass will read more accurately.
5. Maintain altitude and airspeed by cautious application of elevator control. Avoid over controlling by keeping the hands off the control wheel as much as possible and steering only with rudder.

EMERGENCY DESCENT THROUGH CLOUDS

If conditions prevent return to 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 letdown condition as follows:

1. Apply full rich mixture.
2. Reduce power to set up a 500 to 800 ft/min rate of descent.
3. Adjust the elevator trim for a stabilized descent at 70-80 KIAS.
4. Keep hands off the control wheel.
5. Monitor turn coordinator and make corrections by rudder alone.
6. Check trend of compass card movement and make cautious corrections with rudder to stop the turn.
7. Upon breaking out of clouds, resume normal cruising flight.

RECOVERY FROM SPIRAL DIVE IN THE CLOUDS

If a spiral is encountered in the clouds, proceed as follows:

1. Retard throttle to idle position.
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 elevator back pressure to slowly reduce the airspeed to 80 KIAS.
4. Adjust the elevator trim control to maintain an 80 KIAS glide.
5. Keep hands off the control wheel, using rudder control to hold a straight heading.
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** and extremely dangerous. 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.

During these encounters, an unexplained loss in engine speed could be caused by ice blocking the air intake filter, or, in extremely rare instances, ice completely blocking the fuel injection air reference tubes. In either case, the throttle should be positioned to obtain maximum RPM (in some instances, the throttle may need to be retarded for maximum power). The mixture should then be adjusted, as required, to obtain maximum RPM.

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 cabin.

When using the alternate static source, refer to the Alternate Static Source Airspeed Calibration table in Section 5, Performance, for additional information.

Maximum airspeed and altimeter variation from normal is 4 knots and 30 feet over the normal operating range with the window(s) closed. See Section 5, Performance, for additional airspeed calibration data.

SPINS

Should an inadvertent spin occur, the following recovery procedure should 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 may be referred to for this information.

For additional information on spins and spin recovery, see the discussion under SPINS in Normal Procedures (Section 4).

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 possible. 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 result in an immediate loss of engine power, similar to fuel exhaustion or starvation, but while operating from a fuel tank containing adequate fuel. A sudden reduction in indicated fuel flow will occur just before loss of engine power.

If the engine-driven fuel pump fails, immediately set the auxiliary fuel pump switch (FUEL PUMP) to the ON position to restore engine power. The flight should be terminated as soon as practical and the engine-driven fuel pump repaired.

EXCESSIVE FUEL VAPOR INDICATIONS

Excessive fuel vapor is most likely to be generated during ground operations when operating at higher altitudes, in unusually warm temperatures or with more volatile fuel blends. Operation at or near idle RPM (low fuel flow) for extended periods will increase the chances of fuel vapor generation. (See "Leaning For Ground Operations", Section 4.)

Indicated fuel flow that is not stable (sudden changes greater than 1 gal/hr) is a sign that fuel vapor may be present in the system. Fuel flow indications that become less stable (increasing changes) may lead to power surges and power loss if not corrected.

If in-flight vapor is suspected, smoother engine operation may result from making the following changes (singly or together): set the auxiliary fuel pump to the ON position, lean the mixture for smooth engine operation and select another fuel tank. Increasing the airspeed to provide more air flow through the cowling will aid in cooling the engine and fuel system components.

LOW OIL PRESSURE

If the low oil pressure annunciator (OIL PRESS) illuminates and oil temperature remains normal, the oil pressure sending unit or relief valve may be malfunctioning. Land at the nearest airport 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.

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

Malfunctions in the electrical power supply system can be detected by periodic monitoring of the ammeter and low voltage annunciator (VOLTS); 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 following paragraphs 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 can be adversely affected by higher than normal voltage. The alternator control unit includes an overvoltage sensor which normally will automatically shut down the alternator if the charge voltage reaches approximately 31.5 volts. If the overvoltage sensor malfunctions, as evidenced by an excessive rate of charge shown on the ammeter, the alternator should be turned off, nonessential electrical equipment turned off and the flight terminated as soon as practical.

INSUFFICIENT RATE OF CHARGE

NOTE

The low voltage annunciator (VOLTS) may come on 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 annunciator will go out at higher RPM.

If the overvoltage sensor should shut down the alternator and trip the alternator circuit breaker (ALT FLD), or if the alternator output is low, a discharge rate will be shown on the ammeter followed by illumination of the low voltage annunciator (VOLTS). Since this may be a "nuisance" trip out, an attempt should be made to reactivate the alternator system. To reactivate, set the avionics master switch to the OFF position, check that the alternator circuit breaker (ALT FLD) is in, then set both sides of the master switch to the OFF position and then to the ON position. If the problem no longer exists, normal alternator charging will resume and the low voltage annunciator (VOLTS) will go off. The avionics master switch may then be returned to the ON position.

If the annunciator 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 wing flaps and, if the emergency occurs at night, for possible use of the landing lights during landing.

OTHER EMERGENCIES

WINDSHIELD DAMAGE

If a bird strike or other incident should damage the windshield in flight to the point of creating an opening, a significant loss in performance may be expected. This loss may be minimized in some cases (depending on amount of damage, altitude, etc.) by opening the side windows while the airplane is maneuvered for a landing at the nearest airport. If airplane performance or other adverse conditions preclude landing at an airport, prepare for an "off airport" landing in accordance with the Precautionary Landing With Engine Power or Ditching checklists.

