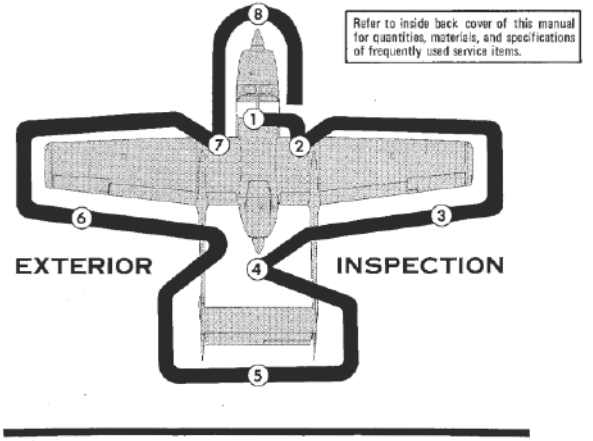
C337H
SKYMASTER II

NORMAL & EMERGENCY PROCEDURES

NORMAL CHECKLIST



Note

Visually check aircraft for general condition during walk-around inspection. In cold weather, remove even small accumulations of frost, ice or snow from wing, tail and control surfaces. Also, make sure that control surfaces contain no internal accumulations of ice or debris. Prior to IFR flight, check that pitot heater is warm to touch within 30 seconds with battery and pitot heat switches on. If night flight is planned, check operation of all lights, and make sure a flashlight is available.

(1)

a. Control Lock -- REMOVE and STOW.
b. Parking Brake -- SET.
c. All Switches -- OFF.
d. Landing Gear Switch -- EXTEND.
e. Battery Switch -- ON.
f. Fuel Gages -- CHECK QUANTITY and OPERATION.
g. Battery Switch -- OFF.
h. Fuel Selectors: Front Engine -- LEFT TANK (feel for detent).
Rear Engine -- RIGHT TANK (feel for detent).
i. Trim Controls (2) -- NEUTRAL.

(2)
a. Main Gear, Doors, and Tire -- CHECK.
b. Fuel Sump(s):
Standard System -- DRAIN sump tank (using sampler cup).
Optional System -- DRAIN wing tank (using sampler cup).
c. Tie Down -- REMOVE.
d. Fuel Quantity -- CHECK and CAP SECURE.

(3)
a. Fuel Vent -- CLEAR.
b. Aileron -- CHECK SECURITY and FREEDOM OF MOVEMENT.
c. Aileron Gap Seal -- CHECK SECURITY and FIT.
d. Flaps -- CHECK SECURITY and ATTACHMENT

(4)
a. Oil Level -- CHECK, minimum 6 quarts.
b. Fuel Strainer -- DRAIN.
c. Engine Compartment General Condition -- CHECK.
d. Cowl Flaps -- SECURE.
e. Propeller and Spinner -- EXAMINE FOR NICKS, SECURITY, and OIL LEAKS.

(5)
a. Tie Down -- REMOVE.
b. Control Surfaces -- CHECK CONDITION, FREEDOM OF MOVEMENT, and TAB POSITION.

(6)
a. Flaps -- CHECK SECURITY and ATTACHMENT.
b. Aileron -- CHECK SECURITY and FREEDOM OF MOVEMENT.
c. Aileron Gap Seal -- CHECK SECURITY and FIT.
d. Fuel Vent -- CLEAR.

(7)
a. Fuel Quantity -- CHECK and CAP SECURE.
b. Tie Down -- REMOVE.
c. Pitot Ports (2 located near top of left wing strut) -- CLEAR.
d. Fuel Sump(s):
Standard System -- DRAIN sump tank (using sampler cup).
Optional System -- DRAIN wing tank (using sampler cup).
e. Rear Propeller Viewing Mirror -- CLEAN.
f. Main Gear, Doors, and Tire -- CHECK.

(8)
a. Static Port (each side of fuselage) -- CLEAR.
b. Oil Level -- CHECK, minimum 6 quarts.
c. Fuel Strainer -- DRAIN.
d. Engine Compartment General Condition -- CHECK.
e. Tie Down -- REMOVE.
f. Nose Gear Strut, Doors, and Tire -- CHECK.
g. Air Inlet Openings -- CLEAR.
h. Propeller and Spinner -- EXAMINE FOR NICKS, SECURITY, and OIL LEAKS.

BEFORE STARTING ENGINES.

(1) Preflight Inspection -- COMPLETE.
(2) Cabin Doors -- CLOSE BOTTOM; LOWER OR CLOSE UPPER.
(3) Cabin Window -- AS DESIRED for ventilation.
(4) Control Lock -- REMOVE.
(5) Brakes -- TEST and SET.
(6) Seats, Belts, Shoulder Harnesses -- ADJUST and SECURE.
(7) Landing Gear Switch -- EXTEND.
(8) Radios, Autopilot, Electrical Equipment -- OFF.
(9) Circuit Breakers -- IN.
(10) Battery and Alternators -- ON.
(11) All Press-to-Test Lights -- CHECK.
(12) Cowl Flaps -- OPEN.
(13) Fuel Selectors: Front Engine -- LEFT TANK.
Rear Engine -- RIGHT TANK.
(14) Fuel Quantity -- CHECK.

STARTING ENGINES.

(1) Mixtures -- RICH.
(2) Propellers -- HIGH RPM.
(3) Throttles -- CLOSED.
(4) Auxiliary Fuel Pump -- HI.
(5) Throttle -- ADVANCE to obtain 60 lbs./hr. fuel flow; then RETARD to IDLE.
(6) Auxiliary Fuel Pump -- OFF.
(7) Propeller Area -- CLEAR.
(8) Ignition Switch -- START.
(9) Throttle -- SLOWLY ADVANCE.
(10) Ignition Switch -- RELEASE when engine starts.

NOTE

The engine should start in two to three revolutions. If it does not continue running, start again at Step (3) above. If the engine does not start, leave the auxiliary fuel pump switch off, set the mixture to idle cut-off, open the throttle, and crank until the engine fires (or for approximately 15 seconds). If still unsuccessful, start again using the normal starting procedure after allowing the starter motor to cool.

(11) Throttle -- 800 to 1000 RPM.
(12) Oil Pressure -- CHECK.
(13) Other Engine -- REPEAT 4 THROUGH 12.

BEFORE TAKE-OFF.

(1) Parking Brake -- SET.
(2) Cabin Doors and Window -- CLOSED and LATCHED.
(3) Flight Controls -- FREE and CORRECT.
(4) Elevator and Rudder Trim -- SET.
(5) Fuel Mixtures, Selectors, and Quantities -- RECHECK -
Front Engine -- LEFT TANK.
Rear Engine -- RIGHT TANK.
(6) Throttles -- 1800 RPM.
a. Magnetos -- CHECK (RPM drop should not exceed 150 RPM on either magneto or 50 RPM differential between magnetos).
b. Propellers -- CHECK feathering to 1200 RPM; return promptly to HIGH RPM (full forward).
c. Alternators -- CHECK.
d. Engine Instruments -- CHECK.
e. Suction Gage -- CHECK (4.6 to 5.4 IN. Hg).
(7) Flight Instruments and Radios -- SET and CHECKED.
(8) Autopilot (optional) -- OFF.
(9) Parking Brake -- RELEASE.
(10) Quadrant Friction Lock -- ADJUST.

TAKE-OFF.

NORMAL TAKE-OFF.

(1) Wing Flaps -- UP to 1/3 DOWN.
(2) Power -- FULL THROTTLE and 2800 RPM (LEAD with REAR engine).

NOTE

Lead with rear engine to verify rear engine operation.

(3) Mixtures -- RICH (below 3000 Ft).
(4) Power Instruments -- CHECK for adequate power from both engines.

(5) Elevator Control -- LIFT NOSE WHEEL at 75-80 MPH.
(6) Brakes -- APPLY momentarily when airborne.
(7) Landing Gear -- RETRACT in climb-out.
(8) Climb Speed -- 100-120 MPH until all obstacles are cleared.
(9) Wing Flaps -- RETRACT (if extended) after obstacles are cleared.

MAXIMUM PERFORMANCE TAKE-OFF.

(1) Wing Flaps -- 1/3 DOWN.
(2) Brakes -- APPLY.
(3) Power -- FULL THROTTLE and 2800 RPM.
(4) Mixtures -- LEAN for field elevation per fuel flow placard.
(5) Brakes -- RELEASE.
(6) Elevator Control -- MAINTAIN SLIGHTLY TAIL LOW.
(7) Climb Speed -- 85 MPH until all obstacles are cleared.
(8) Brakes -- APPLY momentarily when airborne.
(9) Landing Gear and Wing Flaps -- RETRACT (after obstacles are cleared).

ENROUTE CLIMB.

NORMAL CLIMB.

(1) Airspeed -- 120-140 MPH.
(2) Power -- 24 INCHES Hg and 2600 RPM.
(3) Mixtures -- ADJUST to 78 lbs/hr fuel flow.
(4) Cowl Flaps -- AS REQUIRED.

MAXIMUM PERFORMANCE CLIMB.

(1) Airspeed -- 111 MPH (sea level) to 105 MPH (10,000 feet).
(2) Power -- FULL THROTTLE and 2800 RPM.
(3) Mixtures -- LEAN for altitude per fuel flow placard.
(4) Cowl Flaps -- AS REQUIRED.

CRUISE.

(1) Power -- 15-25 INCHES Hg, 2200-2600 RPM (no more than 75% power).
(2) Cowl Flaps -- CLOSED.
(3) Elevator and Rudder Trim -- ADJUST.
(4) Mixtures -- LEAN for cruise fuel flow using the EGT gage, the

Cessna Power Computer or in accordance with the Cruise procedures in Section II.

(5) Fuel Selectors: Normal Operation -
Front Engine -- LEFT TANK.
Rear Engine -- RIGHT TANK.

NOTE

If operating both engines from single tank cease crossfeed when fuel level is within:
50 lbs of empty in tank in use or
50 lbs of full in tank not in use.

LET-DOWN.

(1) Power -- AS REQUIRED.
(2) Mixtures -- ADJUST for smoothness. Use a rich mixture at idle power.
(3) Fuel Selectors: Front Engine -- LEFT TANK.
Rear Engine -- RIGHT TANK.
(4) Cowl Flaps -- CLOSED.

BEFORE LANDING.

(1) Fuel Selectors: Front Engine -- LEFT TANK.
Rear Engine -- RIGHT TANK.
(2) Landing Gear -- DOWN below 160 MPH.

NOTE

Check gear positions visually and green light ON.

(3) Wing Flaps -- UP to 1/3 below 160 MPH.
1/3 to 2/3 below 140 MPH.
2/3 to FULL below 125 MPH.
(4) Mixtures -- RICH.
(5) Propellers -- HIGH RPM.
(6) Airspeed -- 95-105 MPH (flaps UP)
85-95 MPH (flaps DOWN).
(7) Elevator Trim -- ADJUST.

BALKED LANDING.

(1) Power -- FULL THROTTLE and 2800 RPM.
(2) Wing Flaps -- RETRACT to 1/3 DOWN.
(3) Airspeed -- 90 MPH.
(4) Wing Flaps -- RETRACT slowly.
(5) Cowl Flaps -- OPEN.

NOTE

Do not retract landing gear if another landing approach is to be conducted.

LANDING.

(1) Touchdown -- MAIN WHEELS FIRST.
(2) Landing Roll -- LOWER NOSE WHEEL GENTLY.
(3) Braking -- MINIMUM REQUIRED.

AFTER LANDING.

(1) Wing Flaps -- RETRACT.
(2) Cowl Flaps -- OPEN.

SECURING AIRCRAFT.

(1) Parking Brake -- SET.
(2) Idle Speed -- CHECK - Front Engine - 575-625 RPM.
Rear Engine - 625-675 RPM.
(3) Radios and Electrical Equipment -- OFF.
(4) Mixtures -- IDLE CUT-OFF.
(5) Ignition Switches -- OFF.
(6) Battery and Alternators -- OFF.
(7) Control Lock -- INSTALL.

EMERGENCY CHECKLIST

ENGINE FAILURE.

ENGINE FAILURE DURING TAKE-OFF.

An engine-out on take-off presents no difficult directional control problem with the centerline thrust Skymaster, since there is no unbalanced thrust as with a conventional twin-engine aircraft. Therefore, there is no minimum single-engine control speed, as normally defined for conventional twins.

The most critical time for an engine failure in a twin-engine aircraft is a two or three-second period late in the take-off run while the aircraft is accelerating to the single-engine best rate-of-climb speed. The following paragraphs present a detailed discussion of the problems associated with engine failure during take-off.

The aircraft climb performance in the event of an engine-out is at the optimum at the best single-engine rate-of-climb speed. This speed (calibrated airspeed) is marked by a blue line on the airspeed indicator dial. In the event of engine failure, altitude can be maintained more easily at this speed while the propeller is being feathered. Therefore, it is recommended that this speed be obtained as promptly as possible after lift off. Although 104 MPH (indicated airspeed) is the preferred speed, 90 MPH may be used with obstacles immediately ahead.

It is important to note that the aircraft accelerates through the "area

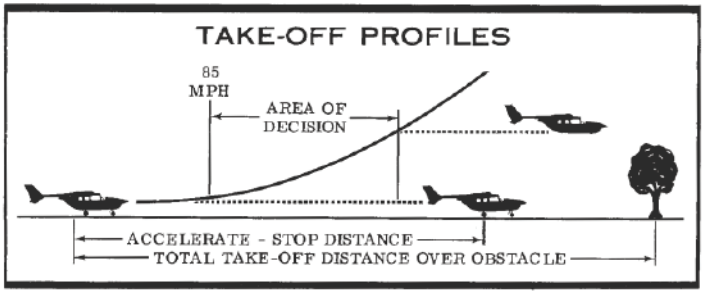


Figure 3-1.

of decision" in a few seconds. However, to assure an intelligent decision in this type of emergency, the field length, obstruction height, field elevation, air temperature, headwind, and the gross weight must be considered. Speed is also considered since a continued take-off is not recommended with an engine failure occurring below the obstacle clearance speed for single-engine operation. Under gross weight conditions this speed is 90 MPH. At reduced weights, where greater climb performance is available and the aforementioned obstacle clearance speed is lowered, a decision to continue the take-off at speeds as low as 85 MPH is acceptable. The flight paths illustrated in Figure 3-1 indicate that the "area of decision" is bounded by: (1) the point at which 85 MPH is reached, and (2) the point where the obstruction altitude is reached. An engine failure in this area requires an immediate decision to either continue the take-off or abort it.

In cases where airspeed and height above the runway at engine failure are great enough, slight deceleration and altitude loss may be accepted while the gear is being retracted and the aircraft is being prepared for a single-engine climb. However, in most cases it is better to discontinue the take-off, since any slight mismanagement of single-engine procedures more than offsets any advantages offered by continuing the take-off.

The following general facts should be used as a guide if an engine failure occurs:

(1) Discontinuing a take-off upon engine failure is advisable under most circumstances.

(2) Altitude is more valuable to safety after take-off than is airspeed in excess of the best single-engine climb speed, since excess airspeed is lost more rapidly than is altitude.
(3) A windmilling propeller causes a severe drag penalty and, therefore, climb or continued level flight may not be possible, depending on weight, altitude and temperature. Prompt identification of the inoperative engine and feathering the propeller is of utmost importance if the take-off is to be continued.
(4) In no case should the airspeed be allowed to fall below 90 MPH (at gross weight) even though altitude is lost since this speed will provide a better chance of climb or a smaller altitude loss than any lesser speed.

Aircraft drag with the landing gear doors opened and the gear partially extended is greater than the drag with the landing gear fully extended. Corresponding rate-of-climb penalties are -240 FPM and -110 FPM respectively. Therefore, since there is a drag increase with the initiation of gear retraction, it should not be attempted unless adequate airspeed and altitude margins exist for sustained flight. This is especially important under the conditions of weight, altitude, and temperature that result in little or no single-engine climb.

DISCONTINUED TAKE-OFF PROCEDURE.

(1) Throttles -- CLOSE IMMEDIATELY.
(2) Brakes -- AS REQUIRED.

NOTE

Total distances required to accelerate to various speeds and then stop are shown in Section VI.

CONTINUED TAKE-OFF WITH ENGINE-OUT.

(1) Throttles -- FULL FORWARD.
(2) Propeller Controls -- FULL FORWARD.
(3) Mixtures -- AS REQUIRED for altitude.
(4) Inoperative Engine -- IDENTIFY (from RPM, fuel flow, and EGT indications).

NOTE

Verify inoperative engine by closing throttle and noting power response to throttle movement.

(5) Windmilling Propeller -- FEATHER.
(6) Wing Flaps -- RETRACT slowly.

SINGLE - ENGINE SPEEDS
— FLAPS UP —

Obstacle Clearance Speed (Gear Down)	90 MPH
Best Rate of Climb (Gear Up)	104 MPH

Figure 3-2.

(7) Airspeed -- 104 MPH (90 MPH with obstacles ahead).
(8) Landing Gear -- RETRACT (after immediate obstacles are cleared
(9) Inoperative Engine -- SECURE.
  a. Mixture -- IDLE CUT-OFF.
  b. Ignition Switch -- OFF.
  c. Alternator Switch -- OFF.
  d. Fuel Selector -- FUEL OFF.
  e. Cowl Flaps -- CLOSE.

ENGINE-OUT DURING FLIGHT.

(1) Power -- INCREASE as required.
(2) Inoperative Engine -- IDENTIFY (check power response to throttle movement).
(3) Cowl Flaps -- AS REQUIRED on operating engine.
(4) Mixture -- ADJUST.
(5) Inoperative Engine -- ATTEMPT RESTART.
  a. Mixture -- FULL RICH (if fuel flow is deficient).
  b. Auxiliary Fuel Pump -- ON (if fuel flow is deficient).

NOTE

If a positive fuel flow indication is not immediately re-established, turn the auxiliary fuel pump switch OFF promptly. The absence of a fuel flow response may be indicative of a damaged fuel supply line in the engine compartment.

  c. Ignition Switch -- CHECK IN BOTH POSITION.

If proper corrective action was taken, engine will restart. If it does not, proceed as follows:

(6) Inoperative Engine -- SECURE.
  a. Mixture -- IDLE CUT-OFF.
  b. Propeller -- FEATHER.

c. Ignition Switch -- OFF.
d. Alternator Switch -- OFF.
e. Fuel Selector -- FUEL OFF.
f. Cowl Flaps -- CLOSED.

SINGLE-ENGINE OPERATION.

SIMULATED ENGINE-OUT EMERGENCY PROCEDURES.

Engine-out procedures should be practiced in anticipation of an emergency. This practice should be commenced at a safe altitude with full power operation on both engines. Practice should be continued until (1) an instinctive failed engine identification procedure is developed, and corrective action is automatic, and (2) airspeed, altitude, and heading can be maintained easily while the aircraft is being prepared for climb. To simulate an engine failure, set both engines at full power operation, and at a chosen speed, pull the throttle of one engine back to the idle position. Then, after several seconds pull the corresponding mixture control into ICO (idle cut-off) and proceed with single-engine emergency procedures.

Simulated single-engine flight can also be practiced by setting the propeller RPM of an idling engine at zero thrust as shown in Figure 3-3. In

PROPELLER RPM FOR ZERO THRUST
AT 104 MPH, IAS

SIMULATED INOPERATIVE ENGINE CONDITIONS
Propeller Control - Full High RPM
Throttle - Adjust For RPM Below

ALTITUDE & TEMPERATURE	FRONT ENGINE RPM	REAR ENGINE RPM
Sea Level & 59° F.	1790	2190
2500 Ft. & 50° F.	1860	2270
5000 Ft. & 41° F.	1930	2360
7500 Ft. & 32° F.	2000	2450
10,000 Ft. & 23° F.	2080	2550

NOTES: 1. When setting up the rear engine for zero thrust, the front engine should be at full throttle and 2800 RPM.
2. Altitude and temperature values shown are for a standard day. Add 50 RPM for each 25° F. above standard, or subtract 50 RPM for each 25° F. below standard.

this case, the mixture should be left at the position required for full power at the operating altitude.

ENGINE RESTARTS IN FLIGHT (AFTER FEATHERING).

(1) Fuel Selector: Front Engine -- LEFT TANK.
Rear Engine -- RIGHT TANK.
(2) Throttle -- ADVANCE as required to silence gear warning horn.
(3) Propeller -- CRUISE RPM position.

NOTE

With the optional propeller unfeathering system installed, the propeller will automatically windmill when the propeller pitch lever is moved to high RPM position, at speeds above 110 MPH.

(4) Auxiliary Fuel Pump -- HI.
(5) Ignition Switch -- START until propeller windmills (without optional unfeathering accumulators).
(6) Mixture -- ADJUST for fuel flow between 10-35 lbs/hr while starting. Then adjust for maximum engine acceleration to 1000 RPM.
(7) Auxiliary Fuel Pump -- OFF.
(8) Throttle -- ADJUST for smooth engine acceleration and to prevent propeller overspeed.
(9) Oil Pressure -- CHECK for 10 PSI minimum within 30 seconds in normal weather or 60 seconds in cold weather. If no indication appears, shut down the engine.
(10) Power -- INCREASE slowly until cylinder head temperature reaches 200°F.

SINGLE-ENGINE APPROACH.

(1) Fuel Selector (Operating Engine) -- GREEN SECTOR.
(2) Landing Gear -- EXTEND on downwind leg.
(3) Inoperative Engine's Throttle -- IDLE to check for gear warning horn.
(4) Wing Flaps -- MINIMUM SETTING necessary (until landing is assured).
(5) Airspeed -- 85 - 95 MPH in approach.

SINGLE-ENGINE GO-AROUND.

(1) Power -- FULL THROTTLE and 2800 RPM.
(2) Wing Flaps -- RETRACT to 1/3 DOWN.

(3) Airspeed -- 90 MPH.
(4) Wing Flaps -- RETRACT after obstacles are cleared and a safe altitude is reached.
(5) Airspeed -- 104 MPH.
(6) Cowl Flaps -- OPEN on operating engine.
(7) Landing Gear -- RETRACT after obstacles are cleared.

FORCED LANDINGS.

FORCED LANDING WITHOUT ENGINE POWER.

In the event both engines are out, maximum gliding distance can be obtained by maintaining indicated airspeeds (with landing gear and wing flaps retracted and propellers feathered) as shown in the Maximum Glide Diagram, Figure 3-4.

If all attempts to restart one or both engines fail and a forced landing is imminent, select a suitable field and prepare for the landing as follows:

(1) Airspeed -- 115 MPH (or as shown in Figure 3-4).
(2) Seat Belts and Shoulder Harnesses -- SECURE.
(3) Propellers -- FEATHERED.
(4) Mixtures -- IDLE CUT-OFF.
(5) Fuel Selectors -- FUEL OFF.
(6) All Switches (except Battery Switch) -- OFF.
(7) Landing Gear -- DOWN (if field is smooth and hard).
(8) Upper Cabin Door Section -- UNLATCHED.
(9) Wing Flaps -- AS REQUIRED (full down recommended).
(10) Airspeed -- 90 MPH with flaps full down.
(11) Battery Switch -- OFF.
(12) Touchdown -- SLIGHTLY TAIL LOW.
(13) Brakes -- APPLY HEAVILY.
(14) If terrain is rough or soft plan a wheels-up landing as follows:
    a. Land in a slightly tail low attitude.
    b. Attempt to hold tail low throughout slide.

PRECAUTIONARY LANDING WITH POWER.

(1) Seat Belts and Shoulder Harnesses -- SECURE.
(2) Drag over selected field with flaps 1/3 and 100 MPH airspeed, noting type of terrain and obstructions.

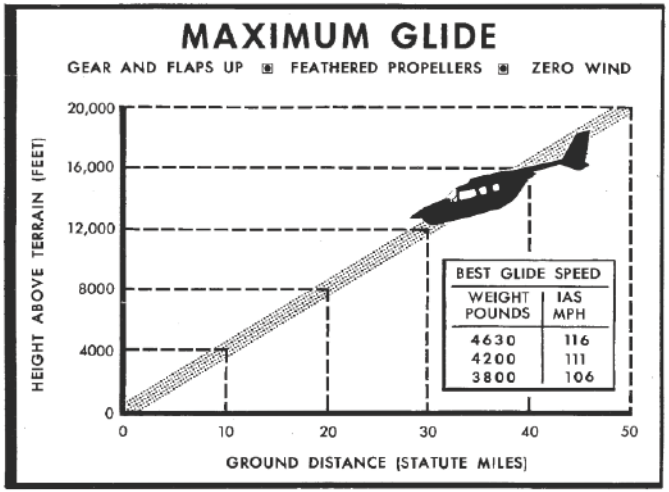


Figure 3-4.

(3) All switches (except Battery and Ignition) -- OFF.
(4) Landing Gear -- DOWN (if surface is smooth and hard).
(5) Wing Flaps -- FULL DOWN.
(6) Airspeed -- 90 MPH.
(7) Battery Switch -- OFF.
(8) Upper Cabin Door Section -- UNLATCH prior to approach.
(9) Touchdown -- Make a normal landing, keeping nose wheel off ground as long as possible.
(10) Ignition Switches -- OFF.
(11) Brakes -- APPLY HEAVILY.
(12) If surface is rough or soft, complete the above procedures as appropriate and plan a wheels-up landing as follows:
    a. Reduce power to a minimum during flare-out.
    b. Prior to contact, turn off ignition switches.
    c. Land in a slightly tail-low attitude.
    d. Attempt to hold the tail low throughout slide.

DITCHING.

Prepare for ditching by securing or jettisoning heavy objects located in the baggage area, and collect folded coats or cushions for protection of occupants face at touchdown. Transmit Mayday message on 121.5 MHz giving location and intentions.

(1) Leave landing gear retracted.
(2) Plan approach into wind if winds are high and seas are heavy. With heavy swells and light wind, land parallel to swells.
(3) Secure seat belts and shoulder harnesses.
(4) Approach with full flaps and sufficient power for a 300 ft/min. rate of descent at 95 MPH.
(5) Open upper cabin door section.
(6) Maintain a continuous descent until touchdown in level attitude. Avoid a landing flare because of difficulty in judging aircraft height over a water surface.
(7) Instruct rear passengers to place folded coat or cushion in front of their face at time of touchdown.

It is expected that the aircraft will skip clear of the water once or twice using the optimum technique outlined. If final contact is made in the desired level attitude, the nose will submerge completely during two or three seconds of moderately abrupt deceleration, and then the aircraft will float for only a short time. Evacuate the aircraft as soon as it has stopped.

FIRES.

ENGINE FIRE IN FLIGHT.

Although engine fires are extremely rare in flight, the following steps should be taken if one is encountered.

(1) Affected Engine
  a. Throttle -- CLOSE.
  b. Propeller -- FEATHER.
  c. Mixture -- IDLE CUT-OFF.
  d. Fuel Selector -- FUEL OFF.
  e. Ignition Switch -- OFF.
  f. Cowl Flaps -- CLOSED.
  g. Alternator Switch -- OFF.

(2) Operating Engine
   a. Power -- AS REQUIRED.
   b. Cowl Flaps -- AS REQUIRED

(3) Cabin Heat/Air -- OFF (except overhead vents).
(4) Electrical Load -- REDUCE.
(5) Airspeed -- 120 MPH. If fire is not extinguished, increase airspeed to find speed which will provide an incombustible mixture.
(6) Land as soon as practical.

NOTE

Refer to engine-out operation and single-engine landing procedures in this section for additional information.

ELECTRICAL FIRE IN FLIGHT.

The initial indication of an electrical fire is usually the odor of burning insulation. The following procedure should then be used:

(1) Alternator and Battery Switches -- OFF.
(2) All Other Switches (except Ignition Switches) -- OFF.
(3) Vents/Cabin Air/Heat -- CLOSED.
(4) Fire Extinguisher -- ACTIVATE (if available).

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

(5) Alternator and Battery Switches -- ON.
(6) Circuit Breakers -- CHECK for faulty circuit; do not reset.
(7) Radio/Electrical Switches -- ON one at a time, with delay after each until short circuit is localized.
(8) Vents/Cabin Air/Heat -- AS DESIRED when it is ascertained that fire is completely extinguished.

ROUGH ENGINE OPERATION OR LOSS OF POWER.

SPARK PLUG FOULING.

An 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 the 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 normal 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 the 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.

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, power should be reduced as a precautionary measure and a landing planned at the next airport having service facilities.

If a total loss of oil pressure is accompanied by a sudden rise in oil temperature, there is reason to suspect an engine failure is imminent. Close throttle and verify faulty engine before feathering the propeller. After reviewing single-engine approach procedures in this section, perform an engine-out landing at the nearest suitable airport.

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 battery switch is on and the GEAR IND and LG MTR circuit breakers are in; reset if necessary. Also, check both landing gear position indicator lights for operation by utilizing the press-to-test feature of the light units. Ro-

tate the lights while they are depressed 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.

A malfunction in either the electrically-driven hydraulic pump or the landing gear system could cause the hydraulic pump to run continuously after gear extension or retraction. A malfunction could also cause the pump to run intermittently. Pump operation at intervals of less than five minutes is considered excessive. Continuous or intermittent pump operation should be stopped by pulling out on the circuit breaker switch labeled LG MTR. This will prevent damage to the pump motor. If continued flight is required, maintain a reduced speed of 160 MPH or less, in the event the landing gear doors are still open. Prior to attempting a landing, push the circuit breaker switch in and extend the landing gear normally. After extension, pull the circuit breaker switch back out.

RETRACTION MALFUNCTIONS.

If the landing gear fails to retract normally or an intermittent amber gear up indicator light is present, check the indicator light for proper operation and attempt to recycle the landing gear.

(1) Battery Switch -- ON.
(2) Landing Gear Switch -- CHECK FULL UP.
(3) Circuit Breakers -- CHECK, GEAR IND and LG MTR breakers IN.
(4) Landing Gear Switch -- EXTEND.
(5) Landing Gear Lights -- CHECK GREEN ON.
(6) Landing Gear Switch -- RECYCLE to RETRACT.

If gear still fails to retract, select gear EXTEND and fly to repair station.

EXTENSION MALFUNCTIONS.

Normal landing gear extension time is approximately 12 seconds. If the landing gear will not extend normally, perform the general checks of circuit breakers and battery switch and repeat the normal extension procedures at a reduced airspeed of 100 MPH. 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 visual check of landing gear position after extension should become

a habit for every pilot. Illumination of the gear-down indicator light is not always a sufficient check of gear position since a damaged or improperly adjusted landing gear system or switching could cause a malfunction which would not be evident unless gear position was checked. As an example of this type of malfunction, an improperly adjusted down-lock switch which actuated before gear extension was complete would allow hydraulic pressure to be diverted prematurely from gear actuation to door closing, resulting in proper gear indicator light operation but leaving one main gear in an intermediate trailing position after the system had shut off. Attempts to retract and then extend the gear again would result in the same condition. Also, use of the emergency hand pump would not permit further extension of the gear since pressure is diverted to the door system in the final phases of gear extension and any additional pressure applied to the system would be recirculated. To relieve the pressure which is holding the doors closed, and complete the extension of the trailing gear, electrical power must be removed from the door control valve solenoid which is trapping pressure to the gear door actuators. Turning off the battery and alternator switches will allow the door control valve to recycle to the gear actuator position, permitting hand pump pressure to be applied to complete extension of the trailing main gear. Once extension is complete, the battery and alternator switches should be turned on again to actuate the door control valve and close the doors.

NOTE

Periods of flight with the battery and alternator switches turned off should be brief since all electrical equipment, including radios and lighting, will be unusable during these times.

MANUAL LANDING GEAR EXTENSION.

The following procedures are necessary for manual landing gear extension.

(1) Battery Switch -- CHECK ON.
(2) Landing Gear Switch -- EXTEND.
(3) Manual Pump Handle -- EXTEND forward and PUMP approximately 95 COMPLETE CYCLES (Stop when resistance becomes very heavy).
(4) Landing Gear Down Light -- GREEN ON.
(5) Main Landing Gear -- VERIFY DOWN visually.

NOTE

To perform periodic practice manual landing gear exten-

sion, it is necessary to first pull the LG MTR circuit breaker prior to performing the above.

LANDING WITHOUT POSITIVE INDICATION OF GEAR LOCKING.

After performing the checks listed under Extension Malfunctions observe that the main gear is extended. If possible, request a tower operator or another aircraft to confirm that the nose gear is extended. In the absence of outside help, a nose wheel shadow can be observed at low altitude in sunlight by banking so as to obtain a side profile of the aircraft. Under the assumption that the nose gear is not down or locked, the landing should be accomplished as follows:

(1) Perform Before Landing checklist.
(2) Make a normal full flap approach.

NOTE

If favorable conditions exist for a single-engine landing, the front engine could be shut down and the propeller feathered. In this case, the propeller should be rotated with the starter to position it horizontally so that damage is minimized if the nose gear collapses. This engine-out landing procedure is recommended only where a long runway is available and there is no possibility of a missed approach.

(3) Maintain landing gear down pressure by allowing the electrically operated hydraulic pump to continue running during the landing.
(4) Land tail-low as smoothly as possible and minimize braking in the landing roll.
(5) Pull mixture controls to idle cut-off when clear of runway.
(6) Before turning off battery switch, have ground personnel depress the tail until the nose gear is off the ground.

NOTE

The nose gear requires hydraulic pressure to hold it in the down position if it is not mechanically locked.

(7) Determine that the nose gear is mechanically locked down BEFORE lowering the nose wheel to the ground.

LANDING WITH DEFECTIVE NOSE GEAR.

If the nose gear does not extend, or only partially extends, and observers verify that it is not down, prepare for a wheels-down landing as follows:

(1) Transfer movable load to baggage area and passengers to rear seats.
(2) Select the longest hard-surfaced or smooth sod runway available.
(3) Extend full flaps.

NOTE

If favorable conditions exist for a single-engine landing, the front engine could be shut down and the propeller feathered. In this case, the propeller should be rotated with the starter to position it horizontally so that damage is minimized if the nose gear collapses. This engine-out landing procedure is recommended only where a long runway is available and there no possibility of a missed approach.

(4) Land in a slightly tail low attitude and keep nose off the ground as long as possible.
(5) Lower nose gently as elevator control decreases.
(6) Turn off battery and alternator switches.
(7) Pull mixture controls to idle cut-off.
(8) Turn fuel selector valves off.
(9) Turn off ignition switches.
(10) Evacuate aircraft as soon as possible.

LANDING WITH PARTIALLY EXTENDED MAIN GEAR.

If the main gear are only partially extended, and all efforts to fully extend them (including manual extension) have failed, the following procedure is recommended:

(1) Select longest hard-surfaced or smooth sod runway available.
(2) Extend full flaps.

NOTE

If favorable conditions exist for a single-engine landing, the rear engine could be shut down and the propeller

feathered. In this case, the propeller should be rotated with the starter to position it horizontally so that damage is minimized if the gear collapses. This engine-out landing procedure is recommended only where a long runway is available and there is no possibility of a missed approach.

(3) Land in a slightly tail-low attitude.
(4) Turn off battery and alternator switches.
(5) Pull mixture controls to idle cut-off.
(6) Turn fuel selector valves off.
(7) Turn off ignition switches.
(8) Evacuate aircraft as soon as possible.

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS.

The following corrective action should be taken when electrical system malfunctions occur.

OVER-VOLTAGE CONDITION(RED VOLTS HIGH AND AMBER ALT NOT CHARGING LIGHTS ILLUMINATED).

In the event of an over-voltage condition, an over-voltage sensor will shut off the faulty alternator, causing the amber ALT NOT CHARGING light for the faulty alternator to come on in addition to the VOLTS HIGH light.

(1) Alternator Switches -- OFF.
(2) Battery Switch -- OFF for 3 seconds; then ON, to reset over-voltage sensor. VOLTS HIGH light will go out and both ALT NOT CHARGING lights and BAT DIS LIGHT will remain on.
(3) Front Alternator Switch -- ON. Front ALT NOT CHARGING light should go out and VOLTS HIGH light should remain out.
(4) Rear Alternator Switch -- ON. Rear ALT NOT CHARGING light should go out and VOLTS HIGH light should remain out.
(5) BAT DIS light -- CHECK OFF.

If the condition is temporary, the above steps will return the electrical system to normal operation. A malfunction in either alternator will cause the ALT NOT CHARGING light for the faulty alternator and the red VOLTS HIGH light to come on as soon as the switch to the faulty alternator

is turned back on. If either ALT NOT CHARGING light comes on accompanied by the VOLTS HIGH light proceed as follows:

(1) Alternator Switches -- OFF.
(2) Battery Switch -- OFF momentarily to reset over-voltage sensor.
(3) Good Alternator Switch -- ON. The ALT NOT CHARGING light for the operating alternator should go out, and VOLTS HIGH light should remain out.

If both alternators are faulty:

(1) Alternator Switches -- OFF.
(2) All Non-Essential Electrical Equipment -- OFF.
(3) Flight -- TERMINATE as soon as practical.

LOW VOLTAGE CONDITION(AMBER ALT NOT CHARGING LIGHT(S) COME ON FOLLOWED BY ILLUMINATION OF BAT DIS LIGHT).

The ALT NOT CHARGING lights indicate a complete loss of alternator output when illuminated.

If only one ALT NOT CHARGING light comes on:

(1) Affected Alternator Switch -- OFF.
(2) BAT DIS light -- CHECK OFF.

If BAT DIS light remains on:

(1) Reduce electrical load.

If both ALT NOT CHARGING lights come on:

(1) Alternator Switches -- OFF.
(2) All Non-Essential Electrical Equipment -- OFF.
(3) Flight -- TERMINATE as soon as practical.

BATTERY DISCHARGE CONDITION (AMBER BAT DIS LIGHT ILLUMINATED).

The amber BAT DIS light does not necessarily indicate a malfunction. Its main function is to indicate current being drawn from the battery.

(1) Check VOLTS HIGH and ALT NOT CHARGING lights for possible alternator-regulator malfunction.

(2) If BAT DIS light is on, or only one ALT NOT CHARGING light is on, reduce electrical load until BAT DIS light goes out.

NOTE

If both ALT NOT CHARGING lights come on, turn off all non-essential electrical equipment and terminate flight as soon as practical.

TOTAL LOSS OF ELECTRICAL POWER.

A complete loss of electrical power is extremely rare, and should be handled in the following manner if it does occur:

(1) Electrical Equipment -- OFF.
(2) Battery Switch -- ON.
(3) Alternator Switches -- ON.
(4) ALT RESTART Switch -- DEPRESS for 1 second and release.
(5) Alternator Operation -- VERIFY. Check indication on fuel and cylinder head temperature gages.
(6) Electrical Equipment -- AS REQUIRED.

SPINS.

Intentional spins are prohibited in this aircraft. Because of the aural stall warning system, it is not probable that an inadvertent spin will be encountered. However, should a spin occur, the following recovery procedures should be employed:

(1) Cut power on both engines.
(2) Apply full rudder against the direction of rotation and neutralize ailerons.
(3) Approximately 1/4 turn after applying rudder, apply full down elevator with control wheel full forward.
(4) Neutralize rudder after rotation stops.
(5) Pull out of the resulting dive with smooth steady control pressure. Approximately 1200 feet of altitude will be lost in a 1 1/2 turn spin and recovery.

FLIGHT IN ICING CONDITIONS.

Intentional flight into known icing conditions is prohibited in this air-

craft regardless of installed ice protection equipment. During instrument flights, however, icing conditions may be encountered inadvertently and therefore some corrective action will be required. Initiation of a climb is usually the best ice avoidance action to take; however, alternatives are descent to warmer air or to reverse course.

If icing is encountered, the following procedures are recommended:

(1) Pitot Heat Switch (Optional) -- ON.
(2) Propeller Anti-Ice Switch (Optional) -- ON.
(3) Windshield Anti-Ice Switch (Optional) -- ON.
(4) Windshield Defroster -- MAXIMUM temperature and air flow.
(5) Wing De-Ice Light (Optional) -- AS REQUIRED.
(6) De-Ice Boots (Optional) -- CYCLE when 1/2 inch of ice builds on wing boots.
(7) Engine RPM -- INCREASE to minimize ice build-up.

NOTE

If excessive vibration is noted, momentarily reduce engine speed to 2200 RPM with the propeller control; then rapidly move the control full forward. Repeating this operation several times should result in a smoother running engine at normal engine operating speeds since flexing of the propeller blades and increased centrifugal force causes ice to shed more readily.

(8) If icing conditions are unavoidable, plan a landing at the nearest suitable airport. With an extremely rapid ice build-up, select a suitable "off airport" landing site.
(9) With 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 longer landing roll.
(10) Open window and, if practical, scrape ice from a portion of the windshield for visibility in the landing approach.
(11) Set wing flaps at 1/3 down for ice accumulation of 1 inch or less. With larger ice formations, approach with flaps retracted to ensure adequate elevator effectiveness in the approach and landing.
(12) Approach at 100 to 110 MPH with 1/3 flaps and 110 to 120 MPH with flaps retracted, depending on the amount of ice accumulation. If ice accumulation is unusually large, decelerate to the planned approach speed while in the approach configuration at an altitude high enough to permit recovery in the event of an inadvertent stall.
(13) Land in level attitude using power as required to control rate of

PERF OMANCE TABLES:

CRUISE PERFORMANCE

EXTENDED RANGE MIXTURE

Standard Conditions — Zero Wind — Gross Weight-4630 Pounds

2500 FEET

RPM	MP	% BHP	TAS MPH	TOTAL LBS/ HOUR	552 LBS (NO RESERVE)		888 LBS (NO RESERVE)	
					ENDR. HOURS	RANGE MILES	ENDR. HOURS	RANGE MILES
2600	24	77	191	140	3.9	750	6.4	1210
	23	72	184	131	4.2	775	6.8	1245
	22	67	177	123	4.5	800	7.2	1285
	21	62	170	114	4.8	825	7.8	1325
2500	25	78	192	142	3.9	745	6.3	1200
	24	73	186	134	4.1	770	6.6	1235
	23	69	179	125	4.4	790	7.1	1270
	22	64	173	117	4.7	815	7.6	1310
2400	25	73	185	133	4.2	770	6.7	1240
	24	69	179	125	4.4	790	7.1	1270
	23	64	173	118	4.7	810	7.5	1305
	22	60	167	110	5.0	835	8.1	1345
2300	25	68	179	125	4.4	790	7.1	1275
	24	64	173	117	4.7	815	7.6	1310
	23	60	167	110	5.0	835	8.1	1345
	22	56	160	103	5.4	860	8.6	1380
2200	25	63	172	116	4.8	820	7.7	1315
	24	60	166	109	5.1	840	8.1	1350
	23	56	160	103	5.4	860	8.7	1385
	22	52	153	96	5.7	880	9.2	1415
	21	48	147	90	6.1	900	9.9	1450
	20	44	139	84	6.6	920	10.6	1475
	19	41	129	77	7.1	925	11.5	1485

CRUISE PERFORMANCE

EXTENDED RANGE MIXTURE

Standard Conditions — Zero Wind — Gross Weight-4630 Pounds

5000 FEET

RPM	MP	% BHP	TAS MPH	TOTAL LBS/ HOUR	552 LBS (NO RESERVE)		888 LBS (NO RESERVE)	
					ENDR. HOURS	RANGE MILES	ENDR. HOURS	RANGE MILES
2600	23	75	194	137	4.0	780	6.5	1255
	22	70	187	129	4.3	805	6.9	1290
	21	66	180	120	4.6	830	7.4	1335
	20	61	173	111	5.0	860	8.0	1380
2500	23	72	189	131	4.2	795	6.8	1280
	22	67	183	123	4.5	820	7.2	1320
	21	63	176	115	4.8	850	7.7	1365
	20	58	169	107	5.2	875	8.3	1410
2400	23	67	183	123	4.5	820	7.2	1320
	22	63	177	116	4.8	845	7.7	1360
	21	59	170	108	5.1	870	8.2	1400
	20	55	164	101	5.5	895	8.8	1440
2300	23	63	177	115	4.8	845	7.7	1360
	22	59	170	108	5.1	870	8.2	1400
	21	55	164	101	5.5	895	8.8	1440
	20	51	157	94	5.9	920	9.4	1480
2200	23	59	170	108	5.1	870	8.2	1400
	22	55	164	101	5.5	895	8.8	1440
	21	51	158	95	5.8	920	9.4	1475
	20	47	150	88	6.2	940	10.0	1510
	19	43	142	82	6.7	955	10.8	1540
	18	39	132	76	7.3	960	11.7	1545

CRUISE PERFORMANCE

EXTENDED RANGE MIXTURE

Standard Conditions — Zero Wind — Gross Weight-4630 Pounds

7500 FEET

RPM	MP	% BHP	TAS MPH	TOTAL LBS/ HOUR	552 LBS (NO RESERVE)		888 LBS (NO RESERVE)	
					ENDR. HOURS	RANGE MILES	ENDR. HOURS	RANGE MILES
2600	21	69	189	126	4.4	830	7.0	1335
	20	64	182	117	4.7	860	7.6	1380
	19	59	175	109	5.1	890	8.2	1430
	18	55	167	100	5.5	920	8.8	1475
2500	21	66	185	121	4.6	845	7.4	1360
	20	61	178	112	4.9	875	7.9	1410
	19	57	171	104	5.3	905	8.5	1455
	18	52	163	96	5.7	935	9.2	1505
2400	21	62	179	113	4.9	870	7.8	1405
	20	58	172	106	5.2	900	8.4	1445
	19	53	165	98	5.6	925	9.0	1490
	18	49	157	91	6.1	950	9.7	1530
2300	21	58	173	106	5.2	895	8.4	1445
	20	54	166	99	5.6	925	9.0	1485
	19	50	158	92	6.0	950	9.6	1525
	18	45	150	85	6.5	970	10.4	1560
2200	21	54	166	100	5.5	920	8.9	1480
	20	50	159	93	5.9	945	9.5	1520
	19	46	151	87	6.4	965	10.3	1555
	18	42	142	80	6.9	985	11.1	1580
	17	38	130	74	7.5	975	12.0	1565

CRUISE PERFORMANCE

EXTENDED RANGE MIXTURE

Standard Conditions — Zero Wind — Gross Weight-4630 Pounds

10,000 FEET

RPM	MP	% BHP	TAS MPH	TOTAL LBS/ HOUR	552 LBS (NO RESERVE)		888 LBS (NO RESERVE)	
					ENDR. HOURS	RANGE MILES	ENDR. HOURS	RANGE MILES
2600	19	63	185	115	4.8	890	7.7	1430
	18	58	177	106	5.2	920	8.4	1480
	17	53	168	98	5.7	950	9.1	1530
	16	48	159	89	6.2	980	10.0	1580
2500	19	60	180	110	5.0	905	8.1	1455
	18	55	172	102	5.4	935	8.7	1505
	17	50	164	93	5.9	965	9.5	1555
	16	45	154	85	6.5	995	10.4	1600
2400	19	56	174	103	5.3	930	8.6	1495
	18	52	166	96	5.8	960	9.3	1540
	17	47	158	88	6.2	985	10.0	1580
	16	43	147	81	6.8	1005	11.0	1615
2300	19	52	167	97	5.7	955	9.2	1535
	18	48	159	90	6.1	980	9.9	1575
	17	44	150	83	6.7	1000	10.7	1610
	16	40	138	76	7.3	1000	11.7	1610
2200	19	49	161	91	6.1	975	9.7	1570
	18	45	153	84	6.5	995	10.5	1605
	17	41	142	78	7.1	1005	11.4	1615

CRUISE PERFORMANCE

EXTENDED RANGE MIXTURE

Standard Conditions → Zero Wind → Gross Weight-4630 Pounds

12,500 FEET

RPM	MP	% BHP	TAS MPH	TOTAL LBS/ HOUR	552 LBS (NO RESERVE)		888 LBS (NO RESERVE)	
					ENDR. HOURS	RANGE MILES	ENDR. HOURS	RANGE MILES
2600	17	56	177	103	5.3	950	8.6	1525
	16	51	168	95	5.8	985	9.4	1580
	15	46	157	86	6.4	1010	10.3	1625
	14	40	142	77	7.1	1015	11.5	1635
2500	17	53	173	99	5.6	970	9.0	1555
	16	49	163	90	6.1	995	9.8	1600
	15	44	151	82	6.7	1020	10.8	1635
	14	38	135	74	7.4	1000	12.0	1610
2400	17	50	166	93	5.9	985	9.5	1590
	16	45	156	85	6.5	1010	10.4	1625
	15	41	143	78	7.1	1015	11.4	1635
	14	36	126	71	7.8	975	12.5	1570
2300	17	47	159	87	6.3	1005	10.2	1620
	16	42	147	80	6.9	1020	11.1	1635
	15	38	132	73	7.5	995	12.1	1600
2200	17	44	151	82	6.7	1020	10.8	1635
	16	39	138	76	7.3	1010	11.7	1620

CRUISE PERFORMANCE

EXTENDED RANGE MIXTURE

Standard Conditions — Zero Wind — Gross Weight-4630 Pounds

15,000 FEET

RPM	MP	% BHP	TAS MPH	TOTAL LBS/ HOUR	552 LBS (NO RESERVE)		888 LBS (NO RESERVE)	
					ENDR. HOURS	RANGE MILES	ENDR. HOURS	RANGE MILES
2600	15	49	167	91	6.1	1015	9.7	1630
	14	43	153	82	6.7	1030	10.8	1660
	13	38	135	73	7.5	1015	12.1	1635
2500	15	46	161	87	6.3	1025	10.2	1645
	14	41	147	79	7.0	1030	11.3	1655
	13	36	129	71	7.8	1005	12.5	1615
2400	15	43	153	82	6.7	1030	10.8	1660
	14	39	138	75	7.4	1020	11.9	1640
2300	15	40	143	77	7.2	1025	11.5	1650
	14	36	126	71	7.8	1000	12.6	1610