AIRPLANE FLIGHT MANUAL

MODEL 112

SERIAL NO. 126 AND SUBSEQUENT

FOR COORDINATION WITH SALES AND SERVICE INFORMATION, SERIAL NO. 126 AND SUBSEQUENT ARE REFERRED TO AS MODEL 112A

Commander Aircraft Division
Rockwell International

5001 North Rockwell Avenue
Bethany, Oklahoma 73008

FAA APPROVED

AIRPLANE FLIGHT MANUAL

MODEL 112

SERIAL NO. 126 AND SUBSEQUENT

NOTE

This airplane must be operated in compliance with the OPERATING LIMITS set forth herein.

Mfrs. Serial No. 441

Registration No. N1441J

FAA Approved by: Glen W. Welsh

Glen W. Welsh, Chief
Engineering & Manufacturing Branch
FAA Southwest Region
Fort Worth, Texas 76101

Date of Approval: January 14, 1974 Manual No. _____

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LOG OF REVISIONS

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Approved: November 5, 1975

Larry L. McHughes

Delegation Option PC-203

SECTION I
LIMITATIONS

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LIMITATIONS

POWER PLANT

ENGINE

One Lycoming IO-360-C1D6

Engine Operation Limitations:

Power Limits (Full Throttle): 200 BHP @ 2700 RPM
Do not exceed 24 In. Hg. manifold pressure when below 2400 RPM

Oil Temperature:	Maximum	245°F
Oil Pressure:	Minimum	25 PSI
	Maximum	90 PSI
Cylinder Head Temp:	Maximum	475°F

Fuel: 100/130 Octane Aviation Gasoline
Useable Capacity - Standard, 48 U.S. Gal.
- Optional, 68 U.S. gal.
Fuel Pressure Maximum: 12 PSI

Cowl Flaps: Should be open for takeoff and all ground operations.
Do not open cowl flaps above 130 KCAS.

PROPELLER

One Hartzell HC-E2YR-1B/7666A or HC-E2YR-1BF/F7666A.
Pitch Settings at 30 inch station: Low Pitch 13 Degrees - High Pitch 28 to 30 Degrees.

INSTRUMENT MARKINGS

See Figure 1-1.

AIRSPEED LIMITATIONS

Never Exceed Speed (V_{NE})	180 KTS (207 MPH) CAS
Maximum Structural Cruising (V_{NO})	143 KTS (165 MPH) CAS
Maneuvering Speed (V_A)	
Normal Category (2650 LBS)	113 KTS (130 MPH) CAS
Utility Category (2488 LBS)	118 KTS (136 MPH) CAS
Flap Extended Speed (V_{FE})	
0 Degrees - 20 Degrees	130 KTS (150 MPH) CAS
20 Degrees - 35 Degrees	109 KTS (125 MPH) CAS
Maximum Landing Gear Extended Speed (V_{LE})	130 KTS (150 MPH) CAS
Maximum Landing Gear Operation Speed (V_{LO})	130 KTS (150 MPH) CAS
Maximum Speed, Cowl Flaps Open	130 KTS (150 MPH) CAS
Maximum Speed, Side Window Open	130 KTS (150 MPH) CAS

FLIGHT LOAD FACTORS

	Normal Category	Utility Category
Limit Load Factors (Flaps Up)	+3.8 to -1.52 G's	+4.4 to -1.76 G's
Limit Load Factors (Flaps Down/ 35 Degrees)	+2.0 to 0.0 G's	+2.0 to 0.0 G's

WEIGHT AND CENTER OF GRAVITY

See Weight and Balance Section for Loading Schedule. See Figure 1-2 for Flight Envelope.

Normal Category
Maximum Takeoff Weight - 2650 lbs.
Maximum Landing Weight - 2550 lbs.

Utility Category
Maximum Takeoff Weight - 2488 lbs.
Maximum Landing Weight - 2488 lbs.
Maximum Zero Fuel Weight - 2300 lbs.

C.G. Limits - Normal Category

Forward: 103.5 Inches Aft of Datum (18.8% MAC) at 2650 lbs.
101.4 Inches Aft of Datum (15.0% MAC) at 2550 lbs.
97.0 Inches Aft of Datum (7.0% MAC) at 2100 lbs.
97.0 Inches Aft of Datum (7.0% MAC) at 1600 lbs.

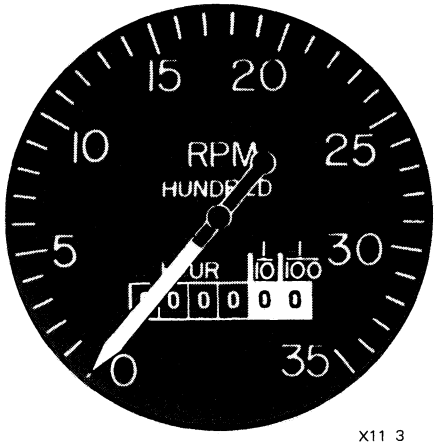
Aft: 110.5 Inches Aft of Datum (31.5% MAC) at 2650 lbs.
110.5 Inches Aft of Datum (31.5% MAC) at 1600 lbs.

C.G. Limits - Utility Category

Forward: 100.8 Inches Aft of Datum (13.9% MAC) at 2488 lbs.
97.0 Inches Aft of Datum (7.0% MAC) at 2100 lbs.
97.0 Inches Aft of Datum (7.0% MAC) at 1600 lbs.

Aft: 106.5 Inches Aft of Datum (24.25% MAC) at 2488 lbs.
106.5 Inches Aft of Datum (24.25% MAC) at 1600 lbs.

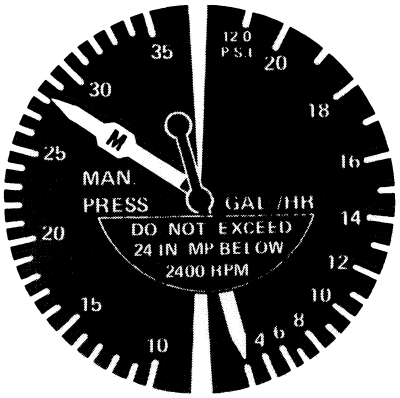
Straight line variations between points.



X11 3

ENGINE TACHOMETER

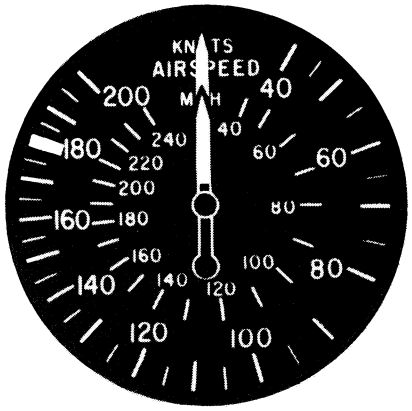
500 - 2700 RPM	Green Arc	NORMAL OPERATING RANGE
2700 RPM	Red Line	MAXIMUM



X11 4

FUEL PRESSURE

12 PSI At 20.5 GPH	Red Line	MAXIMUM



X11 5

AIRSPEED

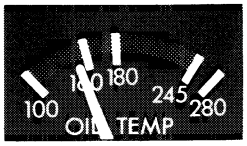
54-109 KCAS	White Arc	FLAP OPERATING RANGE (20 Deg. to 35 Deg.)
61-143 KCAS	Green Arc	NORMAL OPERATING RANGE
143-180 KCAS	Yellow Arc	CAUTION RANGE (Smooth Air Only)
180 KCAS	Red Line	NEVER EXCEED

Figure 1-1. Instrument Markings (Sheet 1 of 2)

X11 6

VACUUM (Optional)

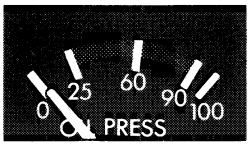
4.5 IN.Hg.	Red Line	MINIMUM
4.5 - 5.2 IN.Hg.	Green Arc	NORMAL
5.2 IN.Hg.	Red Line	MAXIMUM



X11 7

OIL TEMPERATURE

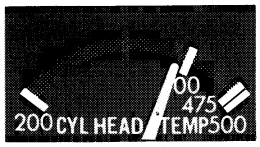
100 - 160°F	Yellow Arc	CAUTION
160 - 245°F	Green Arc	NORMAL
245°F	Red Line	MAXIMUM



X11 8

OIL PRESSURE

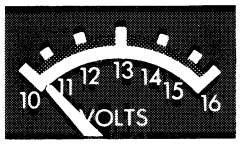
25 PSI	Red Line	MINIMUM
25 - 60 PSI	Yellow Arc	CAUTION
60 - 90 PSI	Green Arc	NORMAL
90 PSI	Red Line	MAXIMUM



X11 9

CYLINDER HEAD TEMPERATURE

200 - 475°F	Green Arc	NORMAL
475°F	Red Line	MAXIMUM



X11 10

VOLTMETER

10.0 - 11.3 Volts	Red Arc	MINIMUM
11.3 - 12.0 Volts	Yellow Arc	CAUTION
12.0 - 15.3 Volts	Green Arc	NORMAL
15.3 - 16.0 Volts	Red Arc	MAXIMUM

Figure 1-1. Instrument Markings (Sheet 2 of 2)

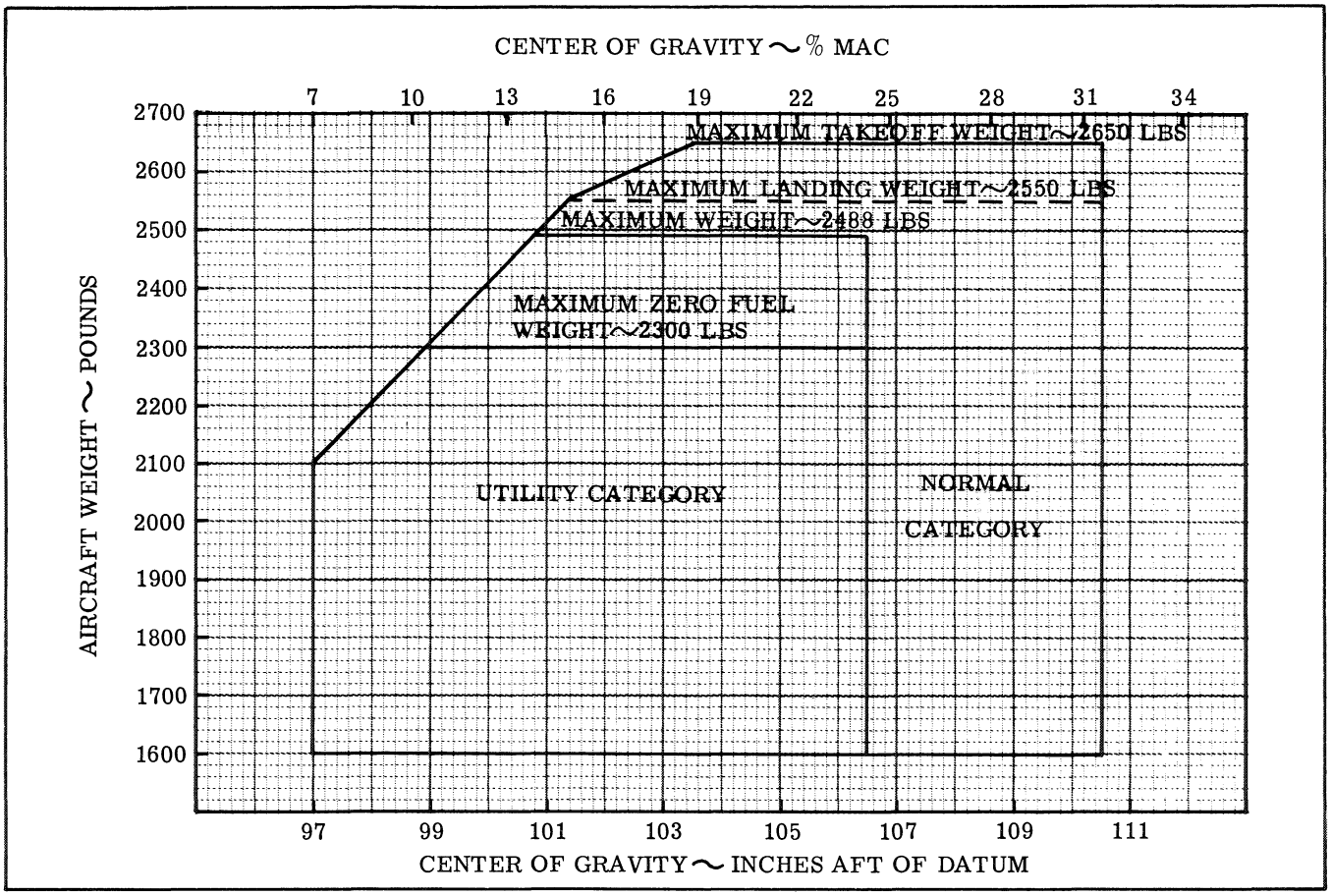


Figure 1-2. Flight Envelope

MANEUVERS

NORMAL CATEGORY

Normal category flight maneuvers include steep turns, chandelles and lazy-eights in which bank angles do not exceed 60 degrees and in which pitch angles do not exceed 30 degrees. Stalls (except whip stalls) are also approved for Normal Category operation. No inverted maneuvers permitted. Intentional spins are prohibited.

UTILITY CATEGORY

The Rockwell Commander Model 112 may be operated in the Utility Category when Utility Category limitations are observed. No inverted maneuvers permitted. Intentional spins are prohibited. Utility Category maneuvers which are approved include Normal Category Maneuvers in addition to the following:

Maneuver	Recommended Entry Speed
STEEP TURNS (over 60 Deg. Bank)	118 KTS (136 MPH) CAS
LAZY EIGHTS (over 60 Deg. Bank and/or 30 Deg. Pitch)	118 KTS (136 MPH) CAS
CHANDELLES (over 60 Deg. Bank and/or 30 Deg. Pitch)	118 KTS (136 MPH) CAS

TYPES OF OPERATION

The Rockwell Commander Model 112 is approved for flight in day or night, VFR or IFR conditions when equipped in accordance with FAR Part 91. Flight into known icing conditions is prohibited.

PLACARDS

See Figure 1-3.

X11 13

Near Airspeed Indicator

X11 17

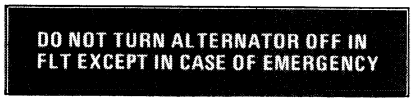
Main Instrument Panel Below Flap Gage.

X11 14

Overhead Windshield Frame or Windshield Centerpost.

X11 18

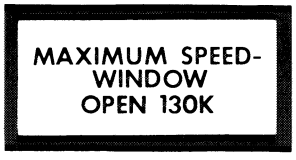
Side Panel, AFT, RH Side.



(On Instrument Sub-Panel below Master Switch)

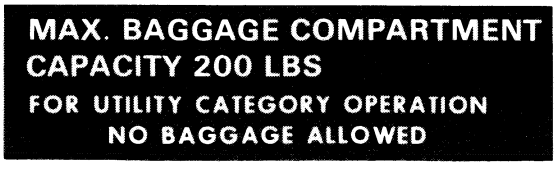
X11 15

Lower Half of Manifold Press. Gage.



X11 16

On Cabin Door Below Window.



X11 19

Baggage Door Upper Left Corner.

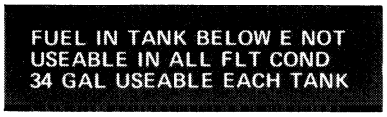
NOTE Dimensions of placards may vary due to panel configuration.

Figure 1-3. Placards (Sheet 1 of 2)

(Standard on Serial No. 126 thru 155)

(Optional on Serial No. 156 thru 380)

(Standard on Serial No. 156 thru 380)



(Optional on Serial No. 381 and Subs)

(Standard on Serial No. 381 and Subs)

Center Console At Fuel Selector

Center Console at Fuel Selector

NOTE Dimensions of placards may vary due to panel configuration.

Figure 1-3. Placards (Sheet 2 of 2)

SECTION II
NORMAL PROCEDURES

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NORMAL PROCEDURES

DEFINITIONS

WARNING - Operating procedures, techniques, etc., which could result in personal injury or loss of life if not carefully followed.

CAUTION - Operating procedures, techniques, etc., which could result in damage to equipment if not carefully followed.

NOTE - An operating procedure, technique, etc., which is considered essential to emphasize.

AIRSPEEDS - All airspeeds in Section II and III are indicated airspeeds in knots (KIAS), assuming zero instrument error.

VISUAL INSPECTION

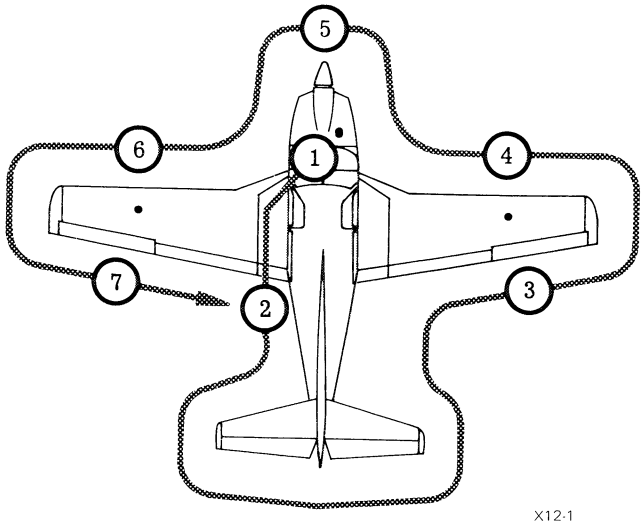
(1) INTERIOR

1. Parking Brake - SET.
2. Control Wheel Lock - REMOVE.
3. Landing Gear Position Handle - DOWN.
4. Master Switch - ON.

NOTE

If night flight is planned, check operation of all night lighting equipment.

5. Fuel Quantity Gages - CHECK.
6. Master Switch - OFF.
7. Fuel Selector Valve - BOTH.
8. Selector Valve Drain - OPEN. Pull up for 4 seconds. Then OFF.



(2) LEFT SIDE OF FUSELAGE & EMPENNAGE

9. Baggage Compartment Door - LOCK.
10. Left Side of Fuselage - INSPECT.
11. Static Port - CHECK for obstruction.
12. Rudder Gust Lock - REMOVE. If installed.
13. Tail Tiedown - REMOVE. If installed.
14. Control Surfaces - CHECK. Rudder and elevator for freedom and movement.
15. Tail Navigation Light - CHECK. Security and condition.

(3) RIGHT SIDE OF FUSELAGE & RIGHT WING TRAILING EDGE

16. Right Side of Fuselage - CHECK.
17. Static Port - CHECK for obstruction.
18. Right Wing Flap - INSPECT.
19. Right Aileron - CHECK. Security, freedom and movement.
20. Right Wing Tip - INSPECT.
21. Navigation Light - CHECK. Security and condition.

(4) RIGHT WING FORWARD EDGE

22. Right Fuel Tank Vent - UNOBSTRUCTED.
23. Right Wing Tie-Down - REMOVE. If installed.
24. Fuel Quantity - CHECK.

NOTE

A reduced fuel load indicator is located in the filler neck of the optional fuel installation. This indicator is used to indicate a useable fuel capacity of 24 U.S. gallons.

25. Fuel Tank Cap - SECURE.
26. Right Main Gear/Wheel Well - INSPECT.
27. Squat Switch - CHECK CONDITION.
28. Landing Gear Limit Switches - CHECK CONDITION.
29. Fuel Tank Sump - DRAIN SAMPLE. Check that valve is CLOSED.
30. Fuel Selector Drain Valve - CHECK CLOSED.

(5) ENGINE SECTION

31. Engine Oil Level - CHECK - 6 Qts. Min. (fill to 8 Qts. for extended flight).
32. Cowling Interior - INSPECT. Secure access door.
33. Cowling Fasteners - SECURE.
34. Nose Wheel/Wheel Well - INSPECT.
35. Landing Gear Limit Switches - CHECK CONDITION.
36. Propeller and Spinner - INSPECT.

NOTE

Operation from a gravel or cinder field will require extra attention to propeller tips for evidence of abrasion. Gravel or stone damage to the blade surfaces, particularily near the tips will seriously reduce the fatigue life of the blades.

(6) LEFT WING FORWARD EDGE

37. Left Main Gear/Wheel Well - INSPECT.
38. Landing Gear Limit Switches - CHECK CONDITION.
39. Fuel Tank Sump - DRAIN SAMPLE. Check that valve is CLOSED.
40. Fuel Quantity - CHECK.

NOTE

A reduced fuel load indicator is located in the filler neck of the optional fuel installation. This indicator is used to indicate a useable fuel capacity of 24 U.S. gallons.

41. Fuel Tank Cap - SECURE.
42. Stall Warning Vane - CHECK for freedom of movement and horn actuation.

NOTE

Master switch must be on to check stall warner circuit. For Serial Numbers 335, 372, 381 and Subsequent the spring-loaded test switch located in the left main gear wheel well and labeled STALL CKT must be moved from the NORM position to the TEST position while the stall warner is checked. Use a gentle upward motion of the vane to actuate the stall warner horn.

43. Left Wing Tie-Down - REMOVE. If installed.
44. Pitot Tube - CHECK. Cover removed and tube unobstructed.
45. Left Fuel Tank Vent - UNOBSTRUCTED.
46. Left Wing Tip - INSPECT.
47. Navigation Light - CHECK. Security and condition.

(7) LEFT WING TRAILING EDGE

48. Left Aileron - CHECK. Security, freedom and movement.
49. Left Wing Flap - INSPECT.

BEFORE STARTING ENGINE

1. Exterior Inspection - COMPLETE.
2. Emergency Locator Transmitter - ARM.
3. Seats, Seat Belts and Shoulder Harness - ADJUST AND SECURE.
4. Fuel Selector Valve - (Serial Numbers 126 thru 380) - RIGHT or LEFT (fullest tank).
5. Fuel Selector Valve - (Serial Numbers 381 and Subs) - BOTH.
6. Avionics Master Switch - OFF (Serial Numbers 381 and Subs.).
7. Radios and Electrical Equipment - OFF.
8. Circuit Breakers - CHECK.
9. Cowl Flaps - FULL OPEN.
10. Landing Gear Control Lever - DOWN.
11. Parking Brake - SET.

STARTING ENGINE (COLD)

1. Mixture Control - FORWARD/FULL RICH.
2. Propeller Control - FORWARD/HIGH RPM.
3. Throttle Control - FORWARD 1/4 INCH.
4. Induction Air Heat Control - OFF.
5. Master Switch - ON (ALT side OFF if External Power is used).
6. Auxiliary Fuel Pump Switch - ON MOMENTARILY - THEN OFF.
7. Propeller Area - CLEAR.
8. Ignition Switch - START/TO BOTH WHEN ENGINE STARTS.

NOTE

Cranking should be limited to 30 seconds, and several minutes allowed between cranking periods to permit the starter to cool.

9. Throttle - DESIRED IDLE SPEED.
10. Oil Pressure - CHECK.

NOTE

During the ground run-up, turn the auxiliary fuel pump ON and note a slight rise in fuel flow. Then turn auxiliary fuel pump OFF.

11. Alternator - ON and CHARGING.

NOTE

The BATT switch should be left ON for alternator turn-on and stabilization.

12. Voltage - CHECK for indication in Green Arc.

STARTING ENGINE (HOT)

1. Mixture Control - AFT/FULL LEAN.
2. Propeller Control - FORWARD/HIGH RPM.
3. Throttle Control - FORWARD FULL.
4. Induction Air Heat Control - OFF.
5. Master Switch - ON (ALT side OFF if External Power is used).
6. Propeller Area - CLEAR.
7. Ignition Switch - START/TO BOTH WHEN ENGINE STARTS.

NOTE

Cranking should be limited to 30 seconds, and several minutes allowed between cranking periods to permit the starter to cool.

8. Mixture - FORWARD/FULL RICH.
9. Throttle - DESIRED IDLE SPEED.
10. Oil Pressure - CHECK.

NOTE

During the ground run-up, turn the auxiliary fuel pump ON and note a slight rise in fuel flow. Then turn auxiliary fuel pump OFF.

11. Alternator - ON and CHARGING.

NOTE

The BATT switch should be left ON for alternator turn-on and stabilization.

12. Voltage - CHECK for indication in Green Arc.

BEFORE TAKEOFF

1. Parking Brake - SET.
2. Controls - CHECK FREE AND CORRECT MOVEMENT.
3. Avionics Master Switch - ON (Serial Numbers 381 and Subs.).
4. Instruments and Radios - CHECK AND SET AS DESIRED.
5. Fuel Selector Valve - (Serial Numbers 126 thru 380) - RIGHT or LEFT (fullest tank).

NOTE

Use of the BOTH position on Serial Numbers 126 thru 380 is not recommended in flight due to potential fuel imbalance and spillage.

6. Fuel Selector Valve - (Serial Numbers 381 and Subs) - BOTH.
7. Elevator and Rudder Trim - TAKEOFF SETTINGS.
8. Throttle - 2000 RPM.
9. Magnetos - CHECK. Make magneto check at 2000 RPM, as follows:
   a. Ignition Switch - BOTH to R. Note RPM.
   b. Ignition Switch - BOTH. Allow time for plugs to clear.
   c. Ignition Switch - L. Note RPM.
   d. Ignition Switch - BOTH. The RPM drop should not exceed 175 RPM on either magneto or indicate greater than a 50 RPM differential between magnetos.

NOTE

An absence of RPM drop may be an indication of faulty magneto grounding or improper timing. If there is doubt concerning ignition system operation, RPM checks at a leaner mixture setting or higher engine speed will usually confirm whether a deficiency exists.

10. Propeller Control - CYCLE/RETURN TO HIGH RPM.
11. Induction Air Heat Control - CYCLE/RETURN TO OFF.
12. Optional Suction Gage - CHECK (4.5 to 5.2 In. Hg.).
13. Throttle - IDLE RPM.
14. Cabin Doors - LOCK.

NOTE

Full throttle checks on the ground are not recommended unless the pilot has good reason to suspect that the engine is not operating properly, or desires to adjust the mixture for high altitude or hot weather conditions. If a full throttle run-up is necessary, monitor oil temperature and cylinder head temperature gages to maintain temperatures within limits.

TAKEOFF

NOTE

Proper full throttle engine operation should be checked early in the takeoff roll. Any significient indication of rough or sluggish engine response is reason to discontinue the takeoff.

When takeoff must be made over a gravel surface, it is important that the throttle be applied slowly. This will allow the aircraft to start rolling before a high RPM is developed, and gravel or loose material will be blown back from the prop area instead of being pulled into it.

NORMAL TAKEOFF

1. Auxiliary Fuel Pump - ON, at start of takeoff roll.
2. Wing Flaps - 10 DEGREES.

NOTE

Flap extension settings of greater than 20 degrees are not recommended for takeoff.

3. Power - FULL THROTTLE AND 2700 RPM.
4. Aircraft Attitude - LIFT NOSEWHEEL AT 50 KTS (58 MPH) IAS.
5. Climb Speed - 90 KTS (104 MPH) IAS.
6. Landing Gear - RETRACT IN CLIMB.
7. Wing Flap - RETRACT.

NOTE

Takeoffs preceded by a rapid taxi turn are not recommended with less than 9.5 gallons of fuel in tank if either LEFT or RIGHT tank is selected.

NOTE

Landing gear retraction should be avoided until well clear of the runway, and after a positive rate of climb has been established. On long runways, gear retraction should be delayed until reaching a point over the runway where a gear down forced landing on that runway could no longer be made. Before retraction of the landing gear, the brakes may be applied momentarily to stop tire rotation. Completion of the landing gear retraction cycle is indicated by all position lights being out.

CLIMB

For cruise climb, establish a power configuration of 26 inches Hg. manifold pressure or full throttle (use lower of the two) and 2600 RPM, with an airspeed of approximately 85-90 Kts (98 to 104 MPH) IAS. Adjust cowl flaps to maintain engine temperature within limits.

For maximum climb, establish a power configuration of full throttle and 2700 RPM, with an airspeed of approximately 80-90 Kts (92-104 MPH) IAS. Adjust cowl flaps to maintain engine temperature within limits.

CRUISE

1. Power - SET.

Normal cruising is made between 65 percent and 75 percent power. Observe all engine operations limitations.

For maximum engine service life, cylinder head temperatures should be maintained below 435°F during high performance cruise operation and 400°F for economy cruise settings.

To obtain greater cruising range at a specified throttle setting, select the lowest engine RPM in the green arc range on the tachometer that will give smooth engine operation.

When changing power settings, it is advisable to always increase RPM (with the propeller control) before increasing manifold pressure, and to reduce manifold pressure (with the throttle) before reducing RPM. Always remain within the established operating limits and operate throttle and propeller controls slowly and smoothly.

NOTE

Do not exceed 24 In. Hg. manifold pressure when below 2400 RPM.

Fuel injector impact ice, which may form under certain atmospheric conditions causing an unexplained loss of power, can be removed by application of full induction heat. Upon regaining the original power indication, return the induction air control to the COLD position. Induction filter ice can also form, as indicated by a drop in manifold pressure. Full induction heat should be applied in this situation to regain the original manifold pressure indication.

2. Elevator and Rudder Trim - ADJUST as required.
3. Mixture Control - ADJUST, Best Power or Best Economy.
4. Cowl Flaps - ADJUST. Close above 130 KTS (150 MPH) IAS.
5. Fuel Selector Valve - (Serial Numbers 126 thru 380) - RIGHT or LEFT as required to maintain lateral trim.
6. Fuel Selector Valve - (Serial Numbers 381 and Subs) - BOTH.

NOTE

If use of BOTH position of fuel selector valve results in uneven fuel feeding, maintain lateral trim by selecting LEFT or RIGHT as required.

7. Auxiliary Fuel Pump - OFF.

DESCENT

1. Mixture - RICH/OR LEAN FOR SMOOTH OPERATION.
2. Power - AS DESIRED.
3. Cowl Flaps - CLOSED ABOVE 130 KTS (150 MPH) IAS.

NOTE

Let-down should be initiated far enough in advance of the destination to allow a gradual planned rate of descent at cruising speed. Rate of descent should be approximately 500 FPM for passenger comfort, using sufficient power to maintain engine temperatures.

BEFORE LANDING

1. Seats, Seat Belts and Shoulder Harnesses - ADJUST AND SECURE.
2. Landing Gear - EXTEND/BELOW 130 KTS (150 MPH) IAS.
3. Mixture Control - FULL RICH.
4. Fuel Selector Valve - (Serial Numbers 126 thru 380) - LEFT or RIGHT (fullest tank).
5. Fuel Selector Valve - (Serial Numbers 381 and Subs) - BOTH.
6. Propeller Control - HIGH RPM.
7. Wing Flaps - AS DESIRED BELOW 109 KTS (125 MPH) IAS. UP TO 20 DEGREES MAY BE USED BELOW 130 KTS (150 MPH) IAS.
8. Elevator and Rudder Trim - ADJUST, as necessary.
9. Auxiliary Fuel Pump - ON.

NOTE

Landing gear extension may be verified by illumination of the three gear down position lights and the absence of a gear warn light and bell when the throttle is reduced below approximately 14 inches manifold pressure, or when wing flaps are extended 25 degrees or more regardless of power setting.

GO-AROUND

1. Power - FULL THROTTLE AND 2700 RPM.
2. Flaps - RETRACT TO 0 DEGREES WHILE MAINTAINING ALTITUDE.
3. Gear - RETRACT AFTER CLIMB IS ESTABLISHED.
4. Cowl Flaps - FULL OPEN.

LANDING

NORMAL LANDING

1. Airspeed on Final - 75 KTS (86 MPH) IAS WITH FULL FLAPS.
2. Touchdown - MAIN WHEELS FIRST.
3. Landing Roll - LOWER NOSE WHEEL GENTLY.
4. Brakes - MINIMUM REQUIRED.
5. Cowl Flaps - FULL OPEN.
6. Wing Flaps - RETRACT AFTER CLEARING RUNWAY.
7. Auxiliary Fuel Pump - OFF AFTER CLEARING RUNWAY.

NOTE

Improved lateral and directional stability may be obtained during instrument approaches by lowering 20 degrees of flaps below 130 KIAS. Recommended approach speed with 20 degrees flaps is 80-85 KIAS. The maximum demonstrated crosswind velocity is 12 knots.

SECURING THE AIRCRAFT

1. Parking Brake - SET.
2. Avionics Master Switch - OFF (Serial Numbers 381 and Subs.).
3. Radios and Electrical Equipment - OFF.
4. Mixture Control - IDLE CUTOFF.
5. Ignition and Master Switch - OFF.
6. Control Wheel Lock - INSTALLED.
7. Fuel Selector Valve - OFF.
8. Parking Brake - RELEASE AND INSTALL WHEEL CHOCKS.
9. Control Locks, Tie-Downs, Pitot Covers - INSTALL.

COLD WEATHER OPERATIONS

The starting procedure for cold weather operation is basically the same as that presented in the Normal Procedures.

NOTE

Before performing the External Inspection, remove any accumulations of frost, ice, or snow from wings, tail and all flight control surfaces.

CAUTION

Before pulling a propeller through by hand, check ignition switch OFF, and visually check the security of magneto ground wire attachment to prevent inadvertent engine firing.

In extremely cold weather, the use of external preheaters and the availability of an external power unit (if your aircraft is equipped with the optional ground service receptacle) are recommended to reduce wear and abuse to the engine and to conserve battery energy. Also, caution should be exercised to prevent inadvertent forward movement of the aircraft when started on icy or snow-packed surfaces. The position of the Master Switch is important in starting operations using external power. Before connecting external power to the aircraft, the BATT half of the split Master Switch should be turned ON, and the ALT portion of the Master Switch left OFF. After the engine has started, disconnect the external power. The ALT half of the Master Switch should then be turned ON to allow normal electrical system charging.

NOTE

The beacon or optional strobe light should not be used when flying through clouds or overcast; the flash effect reflected from water particles in the atmosphere, particularly at night, could produce vertigo (loss of orientation). Also, as a consideration to other pilots, the strobe light should be left OFF during taxi near other occupied aircraft.

IFR OPERATIONS

IFR operations of the aircraft are normal. Improved lateral and directional stability may be obtained during instrument approaches by lowering 20° of flaps below 130 KIAS. Recommended approach speed with 20° flaps is 80-85 KIAS.

NOTE

Engine operation at 2700 RPM during ILS approach may result in unreliable localizer display due to propeller modulation effects. The autopilot may also be adversely affected in the roll axis, if coupled to the localizer. Engine speed reduction to 2600 RPM (or less) will eliminate localizer interference.

SECTION III
EMERGENCY PROCEDURES

Table of Contents

ENGINE FIRE IN FLIGHT

1. Cowl Flaps - CLOSE.
2. Mixture Control - IDLE CUTOFF.
3. Fuel Selector Valve - OFF.
4. Cabin Ventilation and Defroster Controls - CLOSED.
5. Landing Gear - EXTEND-WHEN LANDING IS ASSURED.
6. Wing Flaps - EXTEND. As Necessary.

NOTE

If fire is not extinguished, attempt to increase airflow over the engine by increasing glide speed. Plan a forced landing as described in this section. Do not attempt an engine restart.

ELECTRICAL FIRE IN FLIGHT

1. Master Switch - OFF.
2. Cabin Ventilation and Defroster Controls - CLOSED.
3. Circuit Breakers - CHECK. To identify faulty circuit if possible.

If electrical power is essential for the flight, attempt to identify and isolate the faulty circuit as follows:

1. Master Switch - ON.
2. Select essential switches ON one at a time, and permit a short time to elapse before activating an additional circuit.

WARNING

Stall warning is not available with master switch OFF.

ROUGH ENGINE OR LOSS OF POWER

Immediately upon noting any condition that could eventually lead to an engine failure (loss of oil or fuel system pressure, or rough engine operation), perform the following checks if time and altitude permit.

1. Low Fuel Quantity - FUEL SELECTOR TO BOTH.
2. Low Fuel Pressure - AUX. FUEL PUMP ON - OFF IF NO IMPROVEMENT NOTED.
3. Mixture Control - ADJUST.
4. Selector Valve Drain - OFF (FULL DOWN).
5. Induction Air - HOT.
6. Ignition - Starter Switch - BOTH.
7. Induction Air - COLD - After Power Resumption.

SPINS

INTENTIONAL SPINS ARE PROHIBITED. In the event of an inadvertent spin, the following recovery technique should be used:

1. Throttle - RETARD TO IDLE.
2. Rudder - Apply FULL RUDDER opposite the direction of spin.
3. Control Wheel - FORWARD of neutral in a brisk motion.

As Rotation Stops:

4. Rudder - NEUTRALIZE and smoothly recover from dive.
5. Flaps - If extended, RETRACT during recovery.

FORCED LANDING

If an engine failure occurs, establish a flaps-up glide at 85 Kts (97 MPH) IAS. If all attempts to restart the engine prove unsuccessful, prepare for a landing as follows:

1. Emergency Locator Transmitter - ARM, As Required.
2. Seat Belts and Shoulder Harnesses - SECURE.
3. Mixture Control - IDLE CUTOFF.
4. Fuel Selector Valve - OFF.
5. Ignition Starter Switch - OFF.
6. Wing Flaps - EXTEND, As Necessary.
7. Landing Gear - EXTEND WHEN LANDING IS ASSURED.
8. Approach Speed - 75 Kts to 85 Kts IAS DEPENDING ON FLAP POSITION.
9. Master Switch - OFF, Prior To Landing.

SYSTEM FAILURES

ELECTRICAL SYSTEM

Excessive Charge: After periods of heavy electrical usage, such as prolonged cold weather starts or extended periods of taxiing, the battery charge level will have dropped low enough to accept higher than normal charge rates during the initial part of the flight. However, after a reasonable length of time (approximately thirty minutes), the ammeter indication should decrease steadily to a point of less than two needle-widths on the charge side of zero, and the voltmeter should indicate within the green arc (12 - 15 volts). If the charging rate remains above this value for an extended period of time, there is a possibility that the battery may overheat and evaporate electrolyte at an excessive rate. To preclude the possibility of an overcharging condition affecting the battery, the ALT half of the master switch should be turned OFF and the flight terminated, or electrical load reduced to an essential minimum if landing is impractical.

Insufficient Charge: A continuous discharge rate, noted on the ammeter during flight, generally indicates either an alternator system malfunction or an accidental turn-off of the ALT half of the master switch. When continuous discharge is noted, perform the following procedure:

1. Check ALT half of master switch and,

   A. If OFF, turn it ON. Turn off all non-essential electrical equipment as required to allow battery to recharge in minimum time.

NOTE

The BATT switch should be left ON for alternator turn-on and stabilization.

   B. If ON, cycle ALT switch to bring the alternator back on the line. If alternator does not come back on the line, turn ALT switch OFF and turn off all non-essential electrical equipment to reduce discharge rate of the battery.

LANDING GEAR

There are several general checks that should be made before attempting further corrective action in the event of a landing gear malfunction. Check LANDING GEAR circuit breakers IN; reset if necessary. Check gear position indicator lights for a possible burned-out bulb by pressing to test. A burned-out bulb can be replaced in flight by using the bulb from the magnetic compass. The magnetic compass bulb is accessible by sliding the socket cover, at the top of the compass bezel up, and removing the bulb.

Retraction Malfunction: If the landing gear fails to retract normally, as indicated by continual gear motor operation or failure of the GEAR WARN light to go out, attempt to recycle the gear. If recycling attempts fail to produce a positive indication of proper retraction (all gear indicator lights out, landing gear motor off), the landing gear should be extended until maintenance can be obtained to correct the problem.

Extension Malfunction: If a positive "gear down and locked" indication cannot be obtained with normal extension procedures, operate press-to-test feature of indicator lights, and if still no indication, recycle the landing gear. If a recycling attempt does not provide positive indication (gear down lights on, absence of the GEAR WARN lights and warning bell with flaps extended or power reduced) proceed with manual gear extension as follows:

1. Gear Position Handle - DOWN.
2. Reduce Airspeed to 75 KTS (86 MPH) IAS.
3. Throttle - RETARD, To Idle.
4. Rudder Trim - NEUTRAL.
5. Emergency Extension Valve Knob - PULL OUT AND DOWN.
   (The red emergency extension valve knob is located on the extreme forward left side of the center console).
6. Nose Gear Fails to Lock Down - CYCLE RUDDER PEDALS FORE AND AFT.
7. Gear Position Lights - VERIFY GEAR DOWN.

SECTION IV
PERFORMANCE

TABLE OF CONTENTS

INTRODUCTION

The information in this section is presented in compliance with the appropriate performance criteria and certification requirements of FAR Part 23.

PERFORMANCE DEFINITIONS

AIRSPEED TERMINOLOGY

The airspeed terminology is presented below in what is called the Normal Airspeed Sequence. This sequence begins with the airspeed actually seen by the pilot and progresses through the several airspeeds which can be derived from the airspeed indicator and other information. All airspeed values presented in terms of Indicated Airspeed assume a zero instrument error and the primary static source. CAUTION: When alternate static source is utilized, the appropriate calibration curve must be used.

1. INDICATED AIRSPEED (IAS), is the number actually read from an airspeed indicator which has a zero instrument error.

2. CALIBRATED AIRSPEED (CAS), is the result of further correcting the Indicated Airspeed for error of the pressure inputs to the airspeed indicator, which are termed position error.

3. TRUE AIRSPEED (TAS), is the result of correcting the Calibrated Airspeed for instrument scale errors in compressibility and air density. These errors result from the fact that the actual air temperature and density is usually different from the values assumed in the instrument calibration equation to which the instrument is built. Most flight computers can execute the conversion from Calibrated Airspeed to True Airspeed.

PRESSURE ALTITUDE TERMINOLOGY

The pressure altitude terminology is presented below in what is called the Normal Altitude Sequence. This sequence begins with setting the altimeter barometric scale and the number actually read from the altimeter and progresses to Pressure Altitude.

1. INDICATED PRESSURE ALTITUDE (IPA), is the number actually read from an altimeter which has a zero instrument error and when the barometric scale (Kollsman Window) has been set to 29.92 Inches of Mercury (1013 Millibars).

2. PRESSURE ALTITUDE (PA), is the result of further correcting Indicated Pressure Altitude for error of the pressure input to the instrument, which is termed the position error.

AIR TEMPERATURE TERMINOLOGY

Air Temperature measurement is presented below primarily for purposes of clarification, since all performance data is presented directly in terms of the instrument corrected reading of the Scott Aerotherm Indicator, which is provided for the pilot.

1. INDICATED OUTSIDE AIR TEMPERATURE (IOAT), is the number actually read from a Scott Aerotherm Indicator which has zero instrument error. In flight a moving temperature sensor will measure a higher temperature than a stationary (static) sensor because of the higher energy of the air relative to a moving vehicle. This temperature rise varies with, and increases with, both airplane Mach Number and the Static Air Temperature itself. A chart to correct IOAT to OAT is presented in the Manufacturers Data Section of this manual.

2. OUTSIDE AIR TEMPERATURE (OAT), is the result of correcting the Indicated Outside Air Temperature for the temperature rise due to the relative motion of the airplane to the air. When the airplane is at rest relative to the wind, IOAT and OAT are the same.

MISCELLANEOUS

International Standard Atmosphere (ISA), for the purposes of this Flight Manual, the International Standard Atmosphere is defined to correspond to the atmosphere properties standard published under the title U.S. STANDARD ATMOSPHERE, 1962. This document was prepared under the sponsorship of The National Aeronautics and Space Administration, The United States Air Force, and The United States Weather Bureau. At altitudes applicable to the Model 112, this standard is virtually identical to the older standard of The International Civil Aviation Organization (ICAO).

True Tapeline Rates: The altimeter is calibrated for standard atmospheric conditions and when flying under non-standard conditions, the height change read on the altimeter must be corrected to the actual flight conditions. To obtain true tapeline rates, use the following equation:

$$\text{True Tapeline Rates} = \text{Observed Rate} \times \frac{\text{Observed OAT (DEG C)} + 273}{\text{Standard OAT (DEG C)} + 273}$$

ALTITUDE LOSS DURING STALL RECOVERY

The maximum altitude lost in wings level stall recovery is 320 feet for the Model 112.

USEABLE FUEL

The full amount of usable fuel in each tank can be used in all normal and utility category flight maneuvers.

AIRSPEED CALIBRATION (PRIMARY STATIC SOURCE)

The variation of Calibrated Airspeed with Indicated Airspeed is shown in Figure 4-1 for Gear UP, Flaps UP and Gear DOWN, Flaps DOWN configurations. It applies only when the Primary Static Pressure Source has been selected.

ASSOCIATED CONDITIONS

Power	SUFFICIENT FOR LEVEL FLIGHT (Nominal)	
Configuration	CLEAN	LANDING
Wing Flaps	0 DEG	35 DEG
Landing Gear	UP	DOWN

TECHNIQUE

Select the Primary Static Pressure Source. Read the Airspeed Indicator and determine the Calibrated Airspeed from the chart. Note that this technique assumes Zero Instrument Error for the Airspeed Indicator.

EXAMPLE

A.	GIVEN:	Indicated Airspeed		145 KIAS
		Configuration		CLEAN
	FIND:	Calibrated Airspeed,	Fig 4-1	146.5 KCAS
B.	GIVEN:	Indicated Airspeed		85 KIAS
		Configuration		LANDING
	FIND:	Calibrated Airspeed,	Fig 4-1	82.5 KCAS

NOTE: If the actual Airspeed Indicator Instrument mechanical errors are known, apply these to the Indicated Airspeed before entering the chart.

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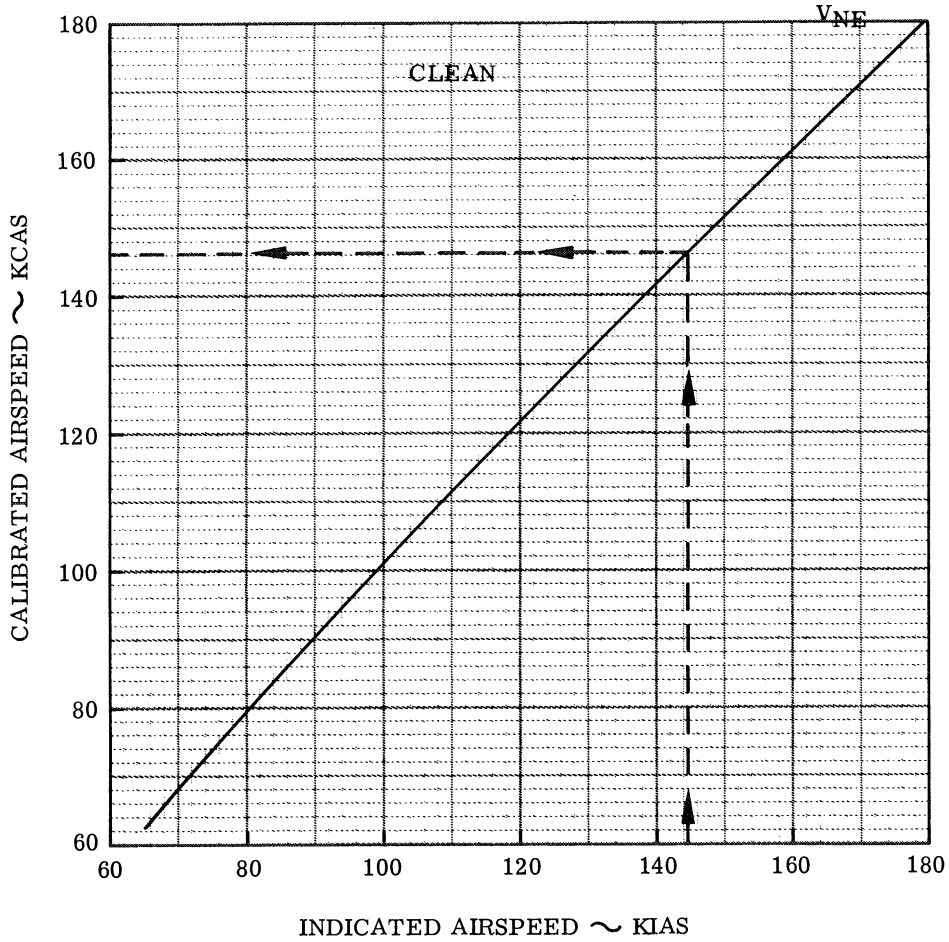
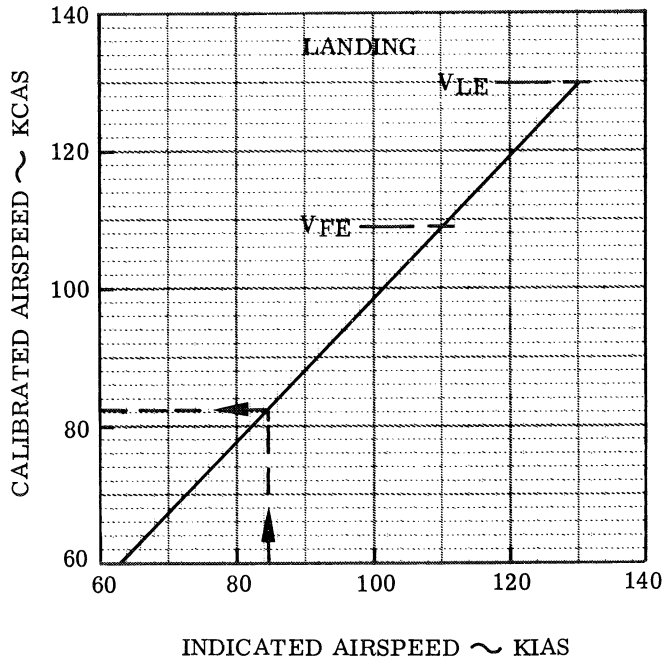
PRIMARY SYSTEM AIRSPEED CALIBRATION

NOTE: IAS ASSUMES ZERO INSTRUMENT ERROR





AIRSPEED CALIBRATION (ALTERNATE STATIC SOURCE)

The Alternate Static Source should be selected in the event that the Normal Static Source system becomes inoperative, due to obstructed static ports, broken static lines, etc. When using the alternate static source it is impossible to obtain higher indicated airspeeds and altitudes than would be obtained with the normal static source: Therefore it is not recommended that the alternate source be relied upon for normal operations and that any problems with the normal static source be corrected as soon as practical.

Whenever the Alternate Static Source is selected, means are provided to correct the indicated airspeed and altimeter readings for the resulting position error. An airspeed/altitude correction card, located on the upper left corner of the instrument panel, presents corrections to be applied when the alternate static source is in use and the side window is OPEN. This configuration results in the largest position correction to be applied to airspeed and altitude.

ASSOCIATED CONDITIONS

Power	SUFFICIENT FOR LEVEL FLIGHT (Nominal)
Configuration	ALL
Wing Flaps	0 or 35 DEG
Landing Gear	UP or DOWN

TECHNIQUE

Select the Alternate Static Pressure Source. Read the Indicated Airspeed and Altitude and determine corrections from card. Note that the technique assumes Zero Instrument Error.

EXAMPLE

A. Airspeed Correction

GIVEN:	Indicated Airspeed	90 KTS
FIND:	Calibrated Airspeed	85 KTS

B. Altitude Correction

GIVEN:	Indicated Airspeed	90 KTS
	Indicated Altitude	1000 FT
FIND:	Altitude Correction	-60 FT
	Calibrated Pressure Altitude	940 FT

The correction card illustrated below is an EXAMPLE ONLY.
USE THE CORRECTION CARD IN THE AIRPLANE.

Alternate Static Source
Correction Card (See AFM)

Indicated Airspeed Kts		Calibrated Airspeed Kts		Altitude Correction Ft
70		63		-40
80		73		-50
90	(1)	85	(2)	-60
100		95		-70
110		104		-80
120		104		-90
130		104		-100

NOTES:

1. Altimeter must be at the proper setting.
2. Instrument error taken to be zero.
3. For calibrated airspeeds not shown, either interpolate between the values above and below, or use the next higher calibrated airspeed given.
4. When two side windows are installed, both must be open.
5. If the actual Airspeed Indicator Instrument mechanical errors are known, apply these to the Indicated Airspeed before entering the chart.

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LOG OF SUPPLEMENTS

Supplement No.	Title	FAA Approved	Date
1	Narco CLC-60 Area Navigation System (Page 1-1)	John F. Vogel Chief, Engineering and Manufacturing Branch Southern Region	6/1/72
2	King KN-74 Area Navigation System (Page 2-1)	John F. Vogel Chief, Engineering and Manufacturing Branch Southern Region	6/1/72
3	Oil Cooler Winterization Kit (Page 3-1)	John F. Vogel Chief, Engineering and Manufacturing Branch Southern Region	5/18/73
4	Emergency Locator Transmitter (ELT) (SHARC-7) (Pages 1 of 2 and 2 of 2)	Jack E. Owens	4/12/74

LOG OF REVISIONS TO SUPPLEMENTS

Revision Number	Revised Supplement Number	Description of Revision	FAA Approved	Date
1	1	Revised Page 1-1		4/12/74
1	2	Revised Page 2-1		4/12/74
1	3	Revised Page 3-1	Jack E Owen	4/12/74

SUPPLEMENT I

NARCO CLC-60 AREA NAVIGATION SYSTEM

INTRODUCTION

This Supplement must be attached to the FAA Approved Rockwell Commander 112 Airplane Flight Manual when the NARCO CLC-60 Area Navigation System is installed in accordance with approved Rockwell Commander Drawing Number 48711, 48763, and 48765. The information contained herein supplements the basic Airplane Flight Manual. For limitations, procedures, and performance data not contained in this supplement consult the basic Airplane Flight Manual.

SECTION I

LIMITATIONS

1. The NARCO CLC-60 should not be used as a primary source of navigation information since its accuracy has not been verified.

Placard - Located adjacent to CLC-60 indicator: AREA NAVIGATION USE LIMITED TO VFR ONLY.

SECTION II

NORMAL OPERATIONS

1. For instrument's use refer to the Pilots Guide, supplied by Narco Avionics.

SECTION III

EMERGENCY PROCEDURES

No Change.

SECTION IV

PERFORMANCE

No Change.

SUPPLEMENT 2

KING KN-74 AREA NAVIGATION SYSTEM

INTRODUCTION

This Supplement must be attached to the FAA Approved Rockwell Commander 112 Airplane Flight Manual when the King KN-74 Area Navigation System is installed in accordance with approved Rockwell Commander Drawing Number 48710, 48746, and 48764. The information contained herein supplements the basic Airplane Flight Manual. For limitations, procedures, and performance data not contained in this supplement consult the basic Airplane Flight Manual.

SECTION I

LIMITATIONS

1. The King KN-74 should not be used as a primary source of navigation information since its accuracy has not been verified.

Placard - Located adjacent to KN-74 indicator: AREA NAVIGATION USE LIMITED TO VFR ONLY.

SECTION II

NORMAL OPERATIONS

1. For instrument's use, refer to the Pilots Guide, Supplied by King Radio.

SECTION III

EMERGENCY PROCEDURES

No Change.

SECTION IV

PERFORMANCE

No Change.

SUPPLEMENT 3

OIL COOLER WINTERIZATION KIT

INTRODUCTION

This Supplement must be attached to the FAA Approved Rockwell Commander 112 Airplane Flight Manual when the Oil Cooler Winterization Kit is installed in accordance with approved Rockwell Commander Drawing Number 46237 and ECN49005 and 49307. The information contained herein supplements the basic Airplane Flight Manual. For limitations, procedures, and performance data not contained in this supplement consult the basic Airplane Flight Manual.

SECTION I

LIMITATIONS

1. The Oil Cooler Winterization Kit must be removed when outside air temperature exceeds 50°F.

Placard - Located above Cowl Flap Control and on Winterization Plate: DO NOT OPERATE AIRCRAFT WITH WINTERIZATION KIT INSTALLED IF O.A.T. IS GREATER THAN 50°F.

SECTION II

NORMAL OPERATIONS

1. During normal operations with the Oil Cooler Winterization Kit, the cowl flaps should remain closed. If, during operation with the kit installed the engine temperatures approach their limits, open the cowl flaps as necessary to maintain the temperatures within their limits.

SECTION III

EMERGENCY PROCEDURES

No Change.

SECTION IV

PERFORMANCE

No Change.

FAA APPROVED SUPPLEMENT 4

EMERGENCY LOCATOR TRANSMITTER (ELT)(SHARC-7)

INTRODUCTION

This Supplement must be attached to the FAA Approved Rockwell Commander 112 Airplane Flight Manual dated 1/14/74 when the SHARC-7 Emergency Locator Transmitter (ELT) is installed in the airplane in accordance with approved Rockwell Commander data. The information contained herein supplements the basic Airplane Flight Manual. For limitations, procedures, and performance information not contained in this Supplement consult the basic Airplane Flight Manual.

SECTION I

LIMITATIONS

No Change

SECTION II

NORMAL PROCDURES

Before Takeoff

1. Emergency Locator Transmitter Control Switch - ARM.

SYSTEMS OPERATION

The ELT is a self-contained transmitter mounted on floor adjacent to pilot's seat. Its purpose is to automatically transmit a sweeping audio signal on 121.5 MH_Z when subjected to a 5 (+2, -0) G deceleration for a duration of 11 (+5, -0) ms, or more, along the airplane line of flight. The transmitter may be controlled from the pilot cockpit location. With the control switch in the ARM position, the ELT is armed for transmitting when the "G" switch in the transmitter is activated. With the control switch in the ON position, signals can be manually transmitted regardless of the "G" switch position.

It is recommended that the transmitter be checked, following landing by turning the aircraft VHF communication receiver to 121.5 MH_Z and listening for ELT audio sweeps. The control switch must be placed in ON position to accomplish ground test. After this check the control switch should be placed in the ARM position.

The ELT may be tested following maintenance or repair but certain precautions must be observed, as follows:

1. Tests should be no longer than three audio sweeps.
2. Tests should be conducted only within the time period made up of the first five minutes after any hour.
3. If the operational test must be made at a time not included within the first five minutes after the hour, the test(s) should be coordinated with the closest FAA tower or flight service station.

SECTION III

EMERGENCY PROCEDURES

Inadvertent Actuation of ELT "G" Switch:

Should the ELT "G" switch be inadvertently triggered proceed as follows:

1. Emergency Locator Transmitter Control Switch - ON, momentarily
   then
2. Emergency Locator Transmitter Control Switch - ARM. This will reset the "G" switch.

SECTION IV

PERFORMANCE

No Change.

FAA Approved 4/12/74

Jack E. Owens

For Chief, Engineering and Manufacturing Branch
Federal Aviation Administration
Southwest Region, Fort Worth, Texas

Table Of Contents

LOG OF PAGES

112
MANUFACTURERS DATA

PART II
FLIGHT PLANNING DATA

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TEMPERATURE CONVERSION

Temperatures in Degrees Celsius is presented in Figure 2-1 for varying temperature in Degrees Fahrenheit.

EXAMPLE

GIVEN:	Temperature Deg C		$-20^{o}C$
FIND:	Temperature Deg F	Fig. 2-1	$-4^{o}C$

PART I

WEIGHT AND BALANCE INSTRUCTIONS

TABLE OF CONTENTS

GENERAL

The attached data will enable you to operate your Rockwell Commander Model 112 within the prescribed weight and balance limitations for normal and utility category operation.

To compute accurate weight and balance for your particular aircraft; the Sample problem, Loading Graph and Center of Gravity Moment Envelope should be used as follows:

Obtain the Licensed Empty Weight and Moment from the Aircraft Weight and Balance Report, Form AC 1476, (or values noted on FAA Form 337, if applicable), and enter these figures on the appropriate line in the Sample Loading Problem. The Aircraft Weight and Balance Report also contains a Licensed Empty Weight C.G. Arm figure which should be disregarded for Sample Loading Problem calculations. Using the Loading Graph, Figure 1-1, determine the moment for each additional item remaining in the Sample Loading Problem and compute the total loaded aircraft weight and moment. Enter these two values on the Center of Gravity Moment Envelope, Figure 1-2, to determine if the load and moment are within balance limitations. If operations within the UTILITY CATEGORY are to be made, consult all weight and balance information for notations pertaining to gross weight, rear seat passengers and baggage area limitations.

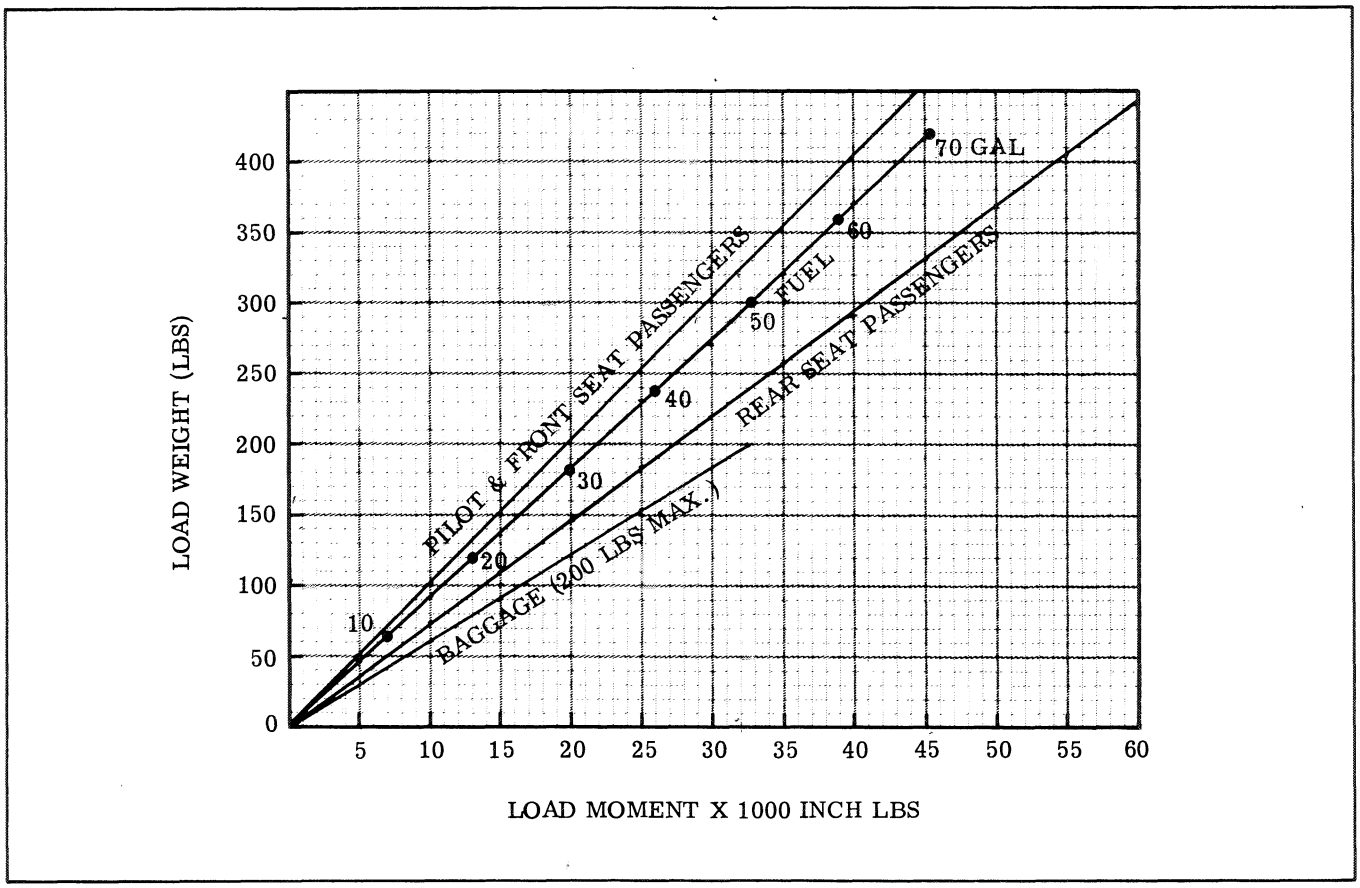


Figure 1-1. Loading Graph

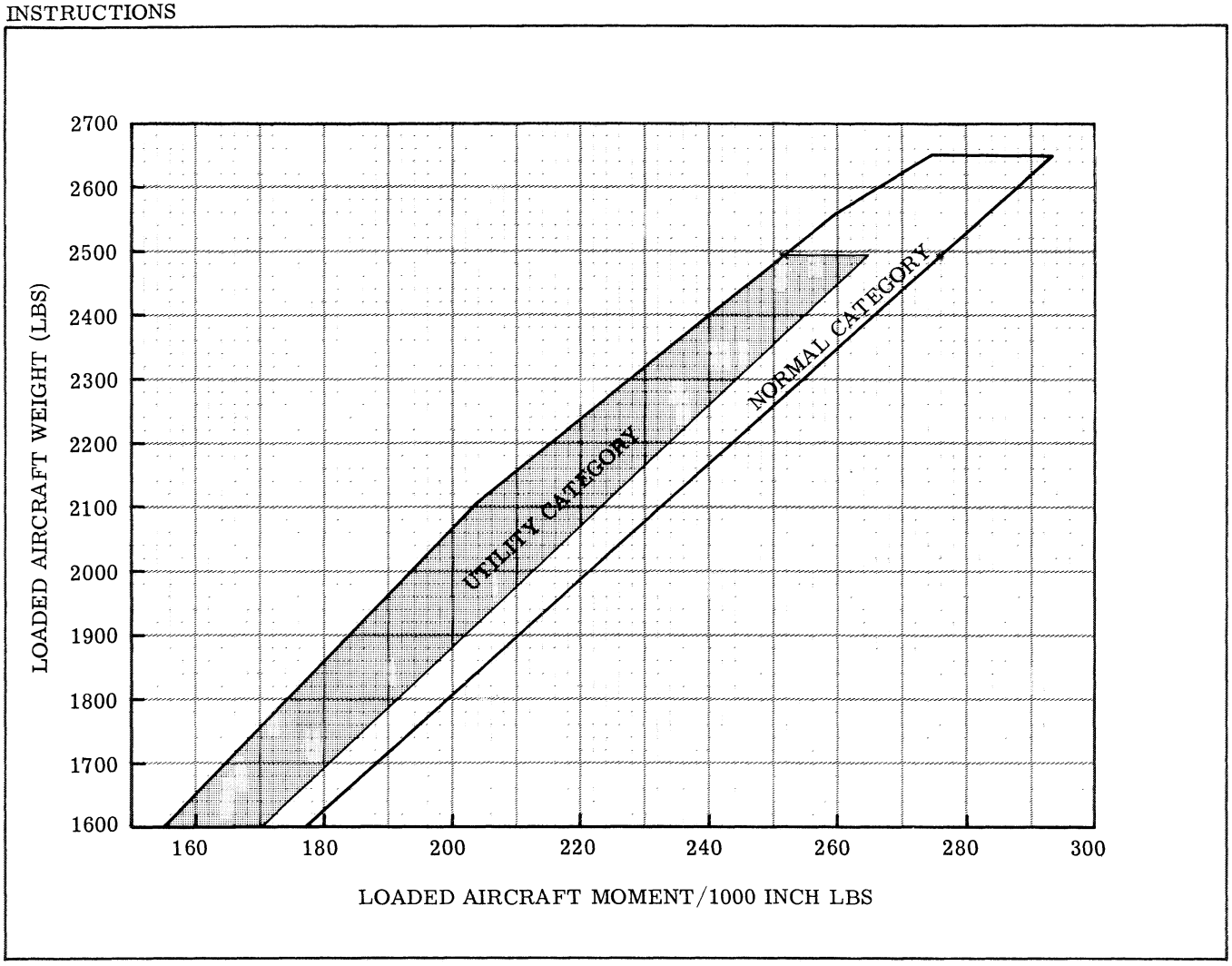


Figure 1-2. Center of Gravity Moment Envelope

TEMPERATURE CONVERSION

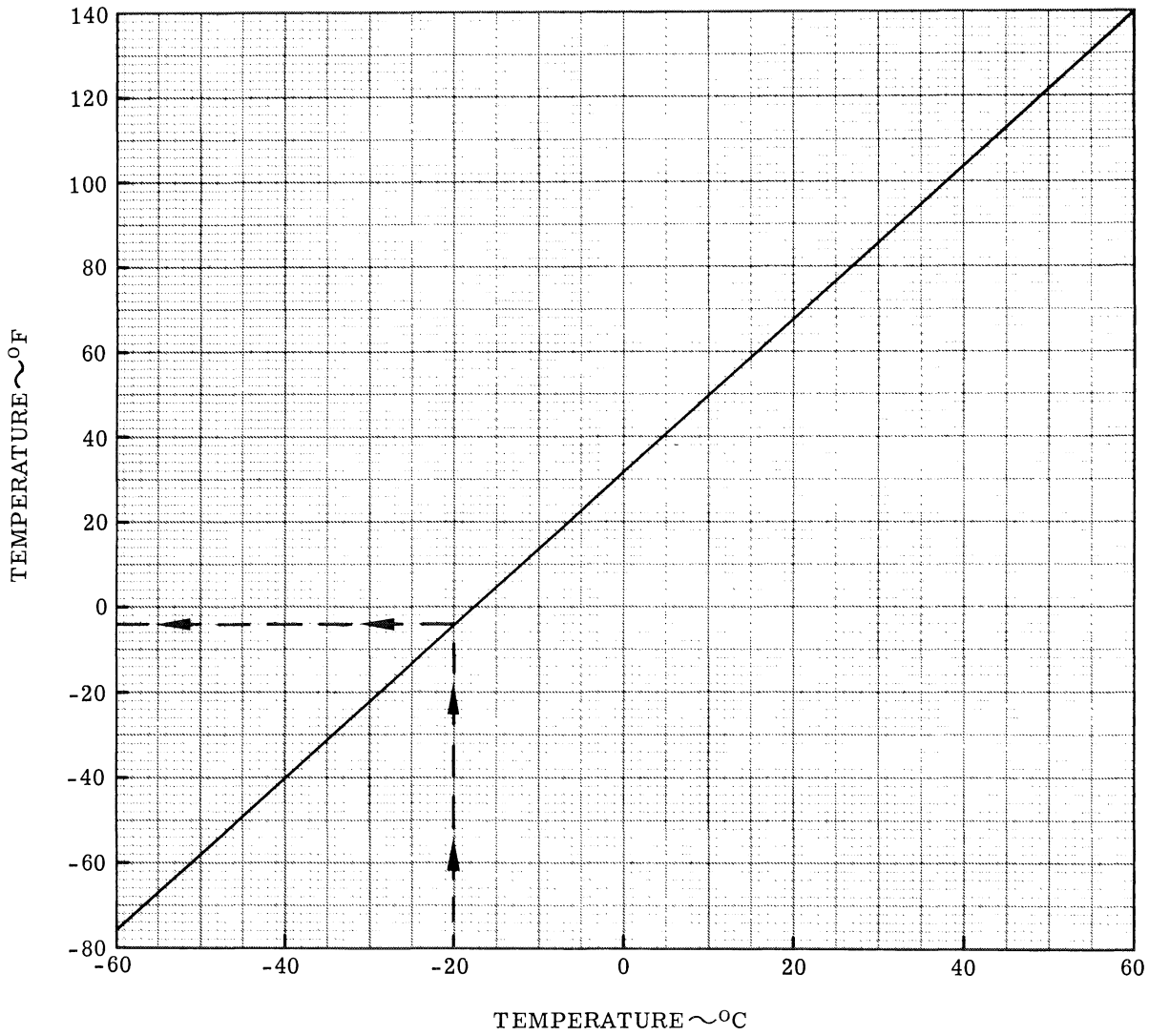


Figure 2-1.

POWER OFF STALL SPEEDS

The variation of Power Off Stall Speeds with Bank Angle, Flight Configuration, and Airplane Weight is shown in Figure 2-2 for Cruise, Takeoff, and Landing Configurations.

ASSOCIATED CONDITIONS

Power	OFF		
Configuration	CRUISE	TAKEOFF	LANDING
Wing Flaps	0 DEG	10 DEG	40 DEG
Landing Gear	UP	DOWN	DOWN
Trim Speed	140 PERCENT OF STALL SPEED		
Stall Entry Rate	UNIFORMLY DECREASING AT 1 KT/SEC		

EXAMPLE

GIVEN:	Gross Weight	2100 LB
	Configuration	CRUISE
	Bank Angle	30 DEG
FIND:	Stall Speed Fig. 2-2	62 KTS (CAS)

TAKEOFF DISTANCE TO 50-FT HEIGHT
(10 DEG FLAPS) PAVED, DRY, LEVEL RUNWAYS

SCHEDULED LIFTOFF SPEED : 67 KTS (IAS)
SCHEDULED 50-FT HEIGHT SPEED : 71 KTS (IAS)

NOTES:
1. IAS ASSUMES ZERO INSTRUMENT ERROR.
2. IT MAY NOT BE POSSIBLE TO CLIMB AFTER TAKEOFF WHEN ALTITUDE AND TEMPERATURE CONDITIONS FALL WITHIN THE SHADED SECTION OF THIS GRAPH.

NOTE: GUIDELINES NOT APPLICABLE FOR INTERMEDIATE OBSTACLE HEIGHTS

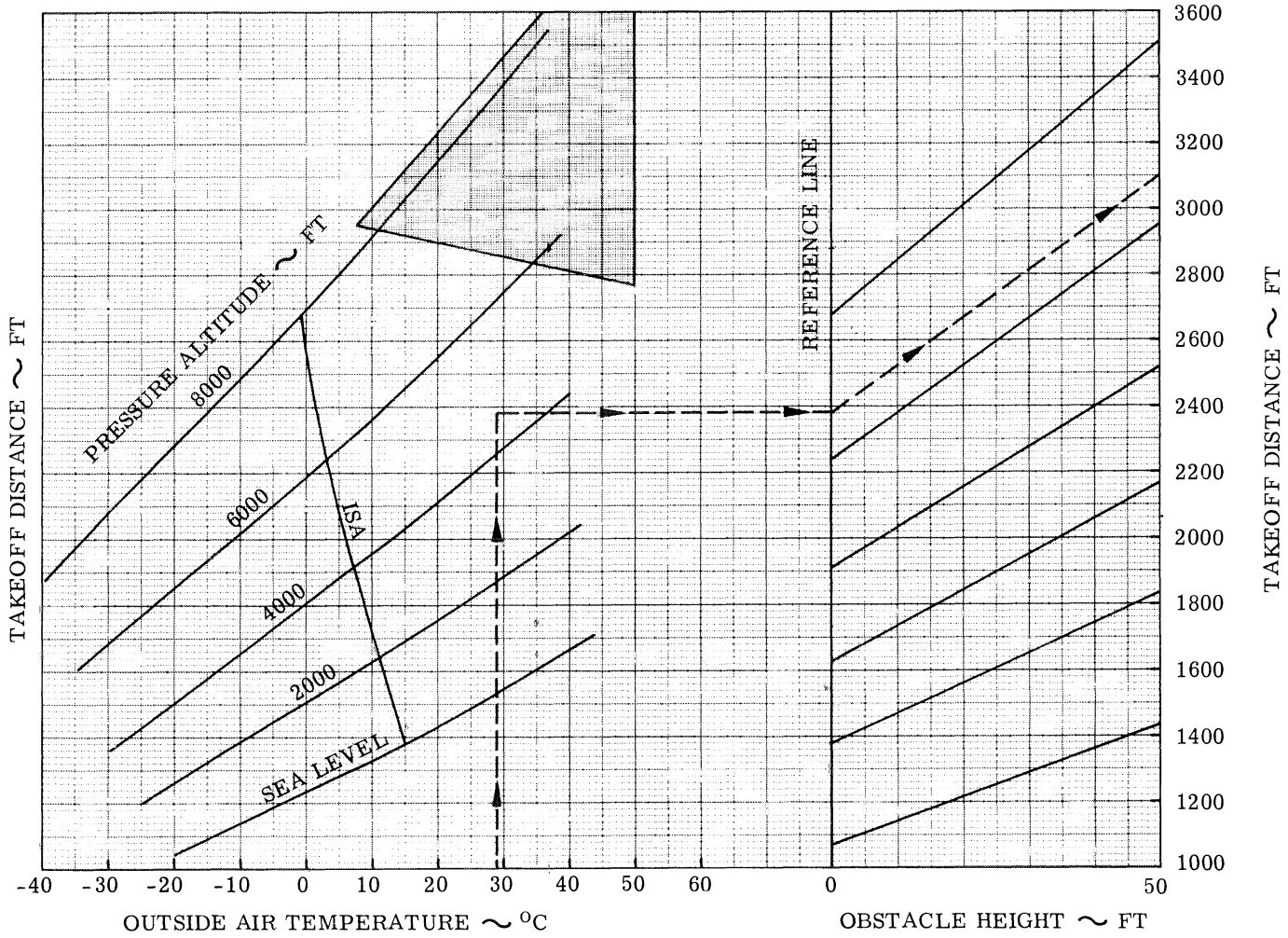


Figure 2-5.

TAKEOFF DISTANCE TO 50-FT HEIGHT (20 DEG FLAPS)

The Takeoff Distance to 50-Ft Height with 20 Degree Flaps is shown in Figure 2-6 for varying outside air temperature and pressure altitude at a gross weight of 2650 Lbs. and Zero Wind.

ASSOCIATED CONDITIONS

Power	TAKEOFF (FULL THROTTLES, 2700 RPM)
Wing Flaps	20 DEG
Landing Gear	DOWN
Cowl Flaps	OPEN
Runway Conditions	PAVED, DRY, LEVEL

TECHNIQUE

Obtain takeoff power prior to brake release. Release the brakes and accelerate. Liftoff at 62 KIAS and accelerate to 66 KIAS at 50-Ft Height.

EXAMPLE

GIVEN:	Gross Weight	2650 LBS
	Outside Air Temperature	23°C
	Pressure Altitude	3000 FT
FIND:	Ground Roll	1675 FT
	Distance to 50-Ft Height	2225 FT

NOTES:
1. IAS assumes zero instrument error.
2. Allowance must be made for wet runways, grass or sod runways, or other actual associated conditions which may differ from those above.

TAKEOFF DISTANCE TO 50-FT HEIGHT
(20 DEG FLAPS) PAVED, DRY, LEVEL RUNWAYS

SCHEDULED LIFTOFF SPEED : 62 KTS (IAS)
SCHEDULED 50-FT HEIGHT SPEED : 66 KTS (IAS)

NOTES:
1. IAS ASSUMES ZERO INSTRUMENT ERROR.
2. IT MAY NOT BE POSSIBLE TO CLIMB AFTER TAKEOFF WHEN ALTITUDE AND TEMPERATURE CONDITIONS FALL WITHIN THE SHADED SECTION OF THIS GRAPH.

NOTE: GUIDELINES NOT APPLICABLE FOR INTERMEDIATE OBSTACLE HEIGHTS.

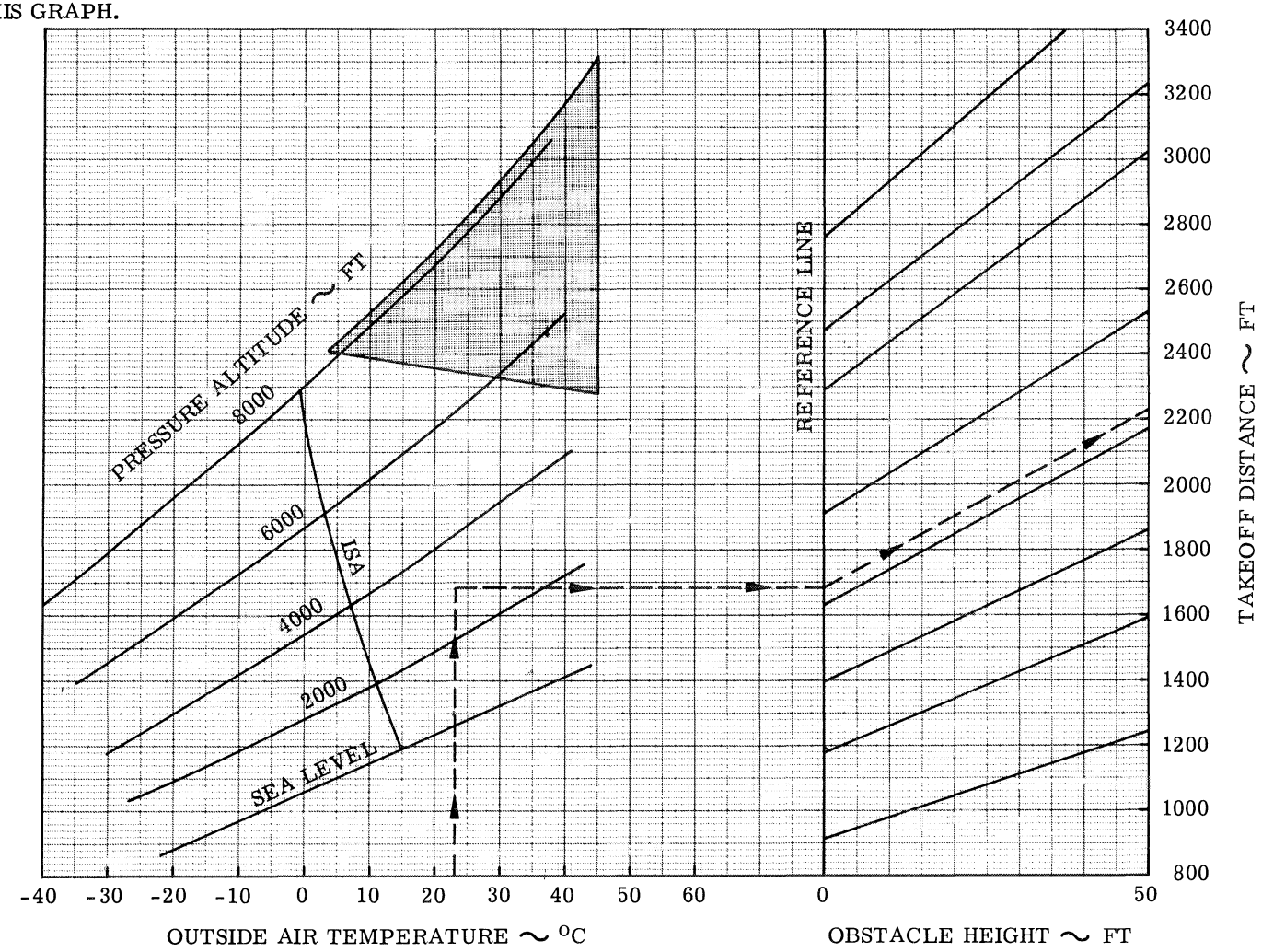


Figure 2-6.

RATE OF CLIMB, CLEAN CONFIGURATION

The Rate of Climb for the Clean Configuration is shown in Figure 2-7 for varying outside air temperature and pressure altitude at 2650 Lb gross weight. A table of Scheduled Climb Speeds versus Pressure Altitude is presented in the upper right hand corner of the chart.

ASSOCIATED CONDITIONS

Power	MAXIMUM CONTINUOUS
Wing Flaps	0 DEG
Landing Gear	UP
Cowl Flaps	OPEN

TECHNIQUE

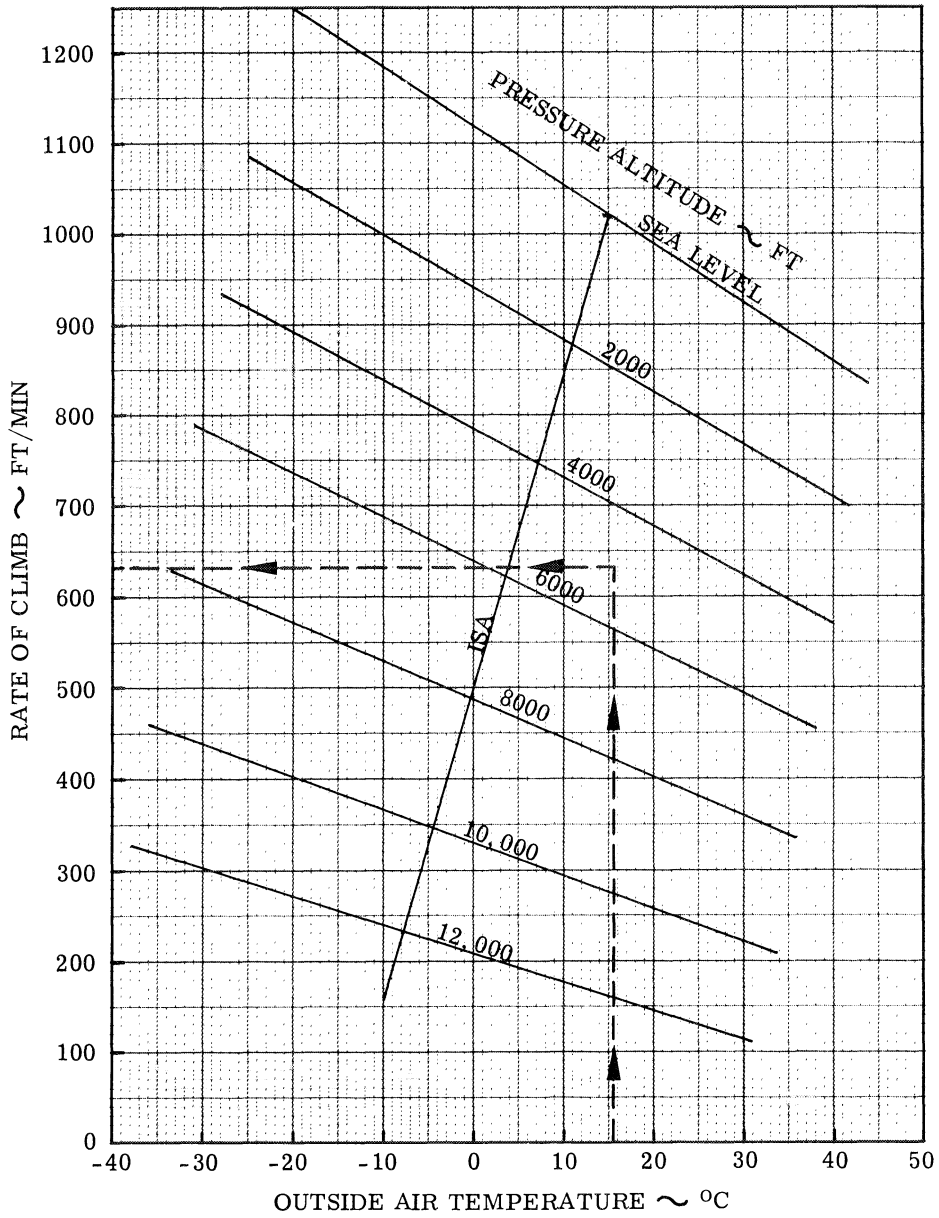
Establish the airplane in a steady climb at the scheduled climb speed and obtain maximum continuous power. Follow the climb speed versus pressure altitude table as the climb progresses.

EXAMPLE

GIVEN:	Gross Weight	2650 LB
	Outside Air Temperature	15.5°C
	Pressure Altitude	5000 FT
FIND:	Rate of Climb	635 FT/MIN

NOTES:
1. IAS assumes zero instrument error.
2. The rate of climb is a true tapeline rate obtained in smooth air and allowance must be made for actual conditions which may differ.

RATE OF CLIMB
CLEAN CONFIGURATION



NOTE: IAS ASSUMES ZERO INSTRUMENT ERROR.

SCHEDULED CLIMB SPEEDS	
PRESSURE ALTITUDE FT	CLIMB SPEED KIAS
SEA LEVEL	90
2000	88
4000	87
6000	85
8000	83
10,000	82
12,000	80

Figure 2-7.

TIME, DISTANCE AND FUEL REQUIRED IN CLIMB

The Time, Distance and Fuel Required in Climb for the clean configuration is shown in Figure 2-8 for varying outside air temperature and pressure altitude at 2650 Lb. gross weight. A table of Scheduled Climb Speeds versus Pressure Altitude is presented in the upper right hand corner of the chart.

ASSOCIATED CONDITIONS

Power	MAXIMUM CONTINUOUS
Wing Flaps	0 DEG
Landing Gear	UP
Cowl Flaps	OPEN

TECHNIQUE

Establish the airplane in a steady climb at the scheduled climb speed and obtain maximum continuous power. Follow the climb speed schedule versus pressure altitude table as the climb progresses.

EXAMPLE

GIVEN:	Gross Weight	2650 LB
	Outside Air Temperature	ISA
	Takeoff Altitude	1000 FT
	Final Altitude	6000 FT
FIND:	Time In Climb	7.5 - 1.0 = 6.5 MIN
	Distance In Climb	11.5 - 1.5 = 10.0 NM
	Fuel In Climb	1.7 - 0.2 = 1.5 GAL

NOTE: IAS assumes zero instrument error.

POWER OFF STALL SPEEDS

CALIBRATED AIRSPEED - KNOTS

HOLDING ALTITUDE ANGLE OF BANK DEGREES	GROSS WEIGHT 2650 LBS.			GROSS WEIGHT 2100 LBS.		
	Gear Up Flaps 0^{o}	Gear Down Flaps 10^{o}	Gear Down Flaps 35^{o}	Gear Up Flaps 0^{o}	Gear Down Flaps 10^{o}	Gear Down Flaps 35^{o}
0	61	59	54	57	56	51
30	66	63	58	62	60	55
60	86	83	76	81	79	72

POWER SETTING CHARTS

The following charts are based on Lycoming IO-360-C engine curve, best power mixture, Model 112 installation.

ASSOCIATED CONDITIONS

Power	SEE BELOW
Wing Flaps	ALL POSITIONS
Landing Gear	UP or DOWN
Cowl Flaps	AS REQUIRED

TECHNIQUE

To obtain the desired percent BHP, set manifold pressure for desired engine speed at pressure altitude and outside air temperature required.

EXAMPLE:

GIVEN:	Engine Speed	2700 RPM
	Pressure Altitude	4000 FT
	Outside Air Temperature	STD
	Percent Power	65 PERCENT
FIND:	Manifold Pressure	19.9 IN. HG

S.L. Press. Alt.		+10	STD +15	+20	+26	+31	+37
RPM	% BHP	MP at OAT (°C) Shown Above					
2700	75	23.0	23.1	23.3	23.5	23.6	23.8
	65	20.7	20.8	20.9	21.1	21.2	21.3
	55	18.4	18.5	18.6	18.7	18.8	18.9
2600	75	23.7	23.8	24.0	24.2	24.3	24.5
	65	21.4	21.4	21.6	21.8	21.9	22.0
	55	19.0	19.1	19.2	19.3	19.5	19.5
2500	75	24.5	24.6	24.8	25.0	25.2	25.3
	65	22.0	22.1	22.3	22.5	22.6	22.8
	55	19.7	19.7	19.8	20.0	20.1	20.2
2400	75	25.5	25.7	25.9	26.0	26.2	26.4
	65	22.9	23.0	23.2	23.4	23.6	23.7
	55	20.4	20.5	20.6	20.8	20.9	21.0
2300	65	23.8	23.9	----	----	----	----
	55	21.1	21.2	21.3	21.5	21.6	21.8
2200	55	22.0	22.2	22.3	22.4	22.5	22.7

NOTE: Do not exceed 24 In. Manifold Pressure below 2400 RPM.

2000 Ft. Press. Alt.		0	+5	STD +11	+17	+23	+28
RPM	% BHP	MP at OAT (°C) Shown Above					
2700	75	22.3	22.5	22.6	22.8	22.9	23.1
	65	20.1	20.2	20.4	20.5	20.6	20.7
	55	17.8	17.9	18.1	18.2	18.3	18.4
2600	75	23.0	23.2	23.3	23.5	23.7	23.8
	65	20.7	20.9	21.0	21.1	21.2	21.4
	55	18.4	18.5	18.7	18.8	18.9	19.0
2500	75	23.7	23.9	24.1	24.2	24.5	24.6
	65	21.4	21.5	21.7	21.8	21.9	22.1
	55	19.0	19.1	19.2	19.3	19.5	19.6
2400	75	24.7	25.0	25.1	25.3	25.5	25.7
	65	22.2	22.4	22.5	22.7	22.8	23.0
	55	19.7	19.8	20.0	20.1	20.3	20.4
2300	65	23.1	23.2	23.4	23.5	23.7	23.9
	55	20.4	20.6	20.7	20.8	21.0	21.1
2200	55	21.3	21.4	21.6	21.7	21.9	22.0

NOTE: Do not exceed 24 In. Manifold Pressure below 2400 RPM.

Figure 2-3.

4000 Ft. Press. Alt		-4	+2	STD +7	+13	+18	+24
RPM	% BHP	MP at OAT (°C) Shown Above					
2700	75	21.8	21.9	22.1	22.3	22.4	22.6
	65	19.6	19.8	19.9	20.0	20.2	20.3
	55	17.4	17.5	17.7	17.8	17.9	18.0
2600	75	22.4	22.6	22.8	23.0	23.5	23.3
	65	20.2	20.4	20.5	20.7	20.9	21.0
	55	17.9	18.1	18.2	18.3	18.5	18.6
2500	75	23.2	23.4	23.6	23.8	23.9	24.1
	65	20.9	21.0	21.2	21.3	21.5	21.7
	55	18.5	18.6	18.8	18.9	19.1	19.2
2400	75	24.2	24.3	24.5	24.7	Full Throttle	
	65	21.7	21.9	22.9	22.2	22.4	22.5
	55	19.2	19.3	19.5	19.6	19.7	19.9
2300	65	22.5	22.7	22.9	23.0	23.2	23.4
	55	20.0	20.2	20.3	20.5	20.6	20.7
2200	55	20.8	21.0	21.2	21.3	21.5	21.6

NOTE: Do not exceed 24 In. Manifold Pressure below 2400 RPM.

6000 Ft. Press. Alt.		-8	-2	STD +4	+9	+14	+20
RPM	% BHP	MP at OAT (°C) Shown Above					
2700	75	21.3	21.5	21.6	21.8	21.9	22.1
	65	19.2	19.3	19.5	19.6	19.8	19.9
	55	16.9	17.1	17.2	17.3	17.4	17.6
2600	75	22.0	22.1	22.3	22.5	22.6	22.8
	65	19.8	19.9	20.2	20.2	20.4	20.6
	55	17.5	17.6	17.7	17.9	18.0	18.2
2500	75	22.7	22.9	Full Throttle			
	65	20.4	20.6	20.7	20.9	21.0	21.2
	55	18.0	18.2	18.3	18.4	18.5	18.7
2400	65	21.2	21.4	21.5	21.7	21.9	22.0
	55	18.9	19.0	19.1	19.3	19.4	19.6
2300	65	22.0	22.2	22.3	22.5	22.7	22.9
	55	19.5	19.7	19.8	19.9	20.1	20.3
2200	55	20.4	20.5	20.6	20.8	21.0	21.1

NOTE: Do not exceed 24 In. Manifold Pressure below 2400 RPM.

8000 Ft. Press. Alt.		-12	-6	STD -1	+5	+11	+16
RPM	% BHP	MP at OAT (°C) Shown Above					
2700	75	21.0	21.1	Full Throttle			
	65	18.7	18.9	19.1	19.2	19.4	19.5
	55	16.7	16.8	16.9	17.0	17.2	17.3
2600	65	19.3	19.5	19.7	19.8	19.9	20.1
	55	17.3	17.4	17.5	17.7	17.8	17.9
2500	65	20.0	20.1	20.3	20.4	20.6	20.8
	55	17.8	17.9	18.0	18.2	18.3	18.4
2400	65	20.7	20.9	21.1	21.3	Full Throttle	
	55	18.4	18.6	18.8	18.9	19.0	19.1
2300	55	19.0	19.3	19.4	19.5	19.7	19.8
2200	55	19.8	20.0	20.2	20.3	20.5	20.6

NOTE: Do not exceed 24 In. Manifold Pressure below 2400 RPM.

10,000 Ft. Press. Alt.	-15	-10	STD -5	+1	+6	+12
RPM	% BHP	MP at OAT (°C) Shown Above				
2700	65	18.4	18.5	18.6	18.8	19.0	19.1
	55	16.4	16.5	16.6	16.7	16.8	16.9
2600	65	19.0	19.1	19.3	19.4	19.6	Full Throttle
	55	16.9	17.0	17.2	17.3	17.5	17.6
2500	65	19.6	Full Throttle				
	55	17.4	17.5	17.7	17.8	18.0	18.1
2400	55	18.1	18.2	18.3	18.4	18.6	18.7
2300	55	18.7	18.8	18.9	19.0	19.2	19.3
2200	55	19.4	19.5	Full Throttle			

NOTE: Do not exceed 24 In. Manifold Pressure below 2400 RPM.

Figure 2-4.

TAKEOFF DISTANCE TO 50-FT HEIGHT (10 DEG FLAPS)

The Takeoff Distance to 50-Ft Height with 10 Degree Flaps is shown in Figure 2-5 for varying Outside Air Temperature and Pressure Altitude at a Gross Weight of 2650 Lbs. and Zero Wind.

ASSOCIATED CONDITIONS

Power	TAKEOFF (FULL THROTTLE, 2700 RPM)
Wing Flaps	10 DEG
Landing Gear	DOWN
Cowl Flaps	OPEN
Runway Condition	PAVED, DRY, LEVEL

TECHNIQUE

Obtain takeoff power prior to brake release. Release the brakes and accelerate. Liftoff at 67 KIAS and accelerate to 71 KIAS at 50-Ft Height.

EXAMPLE

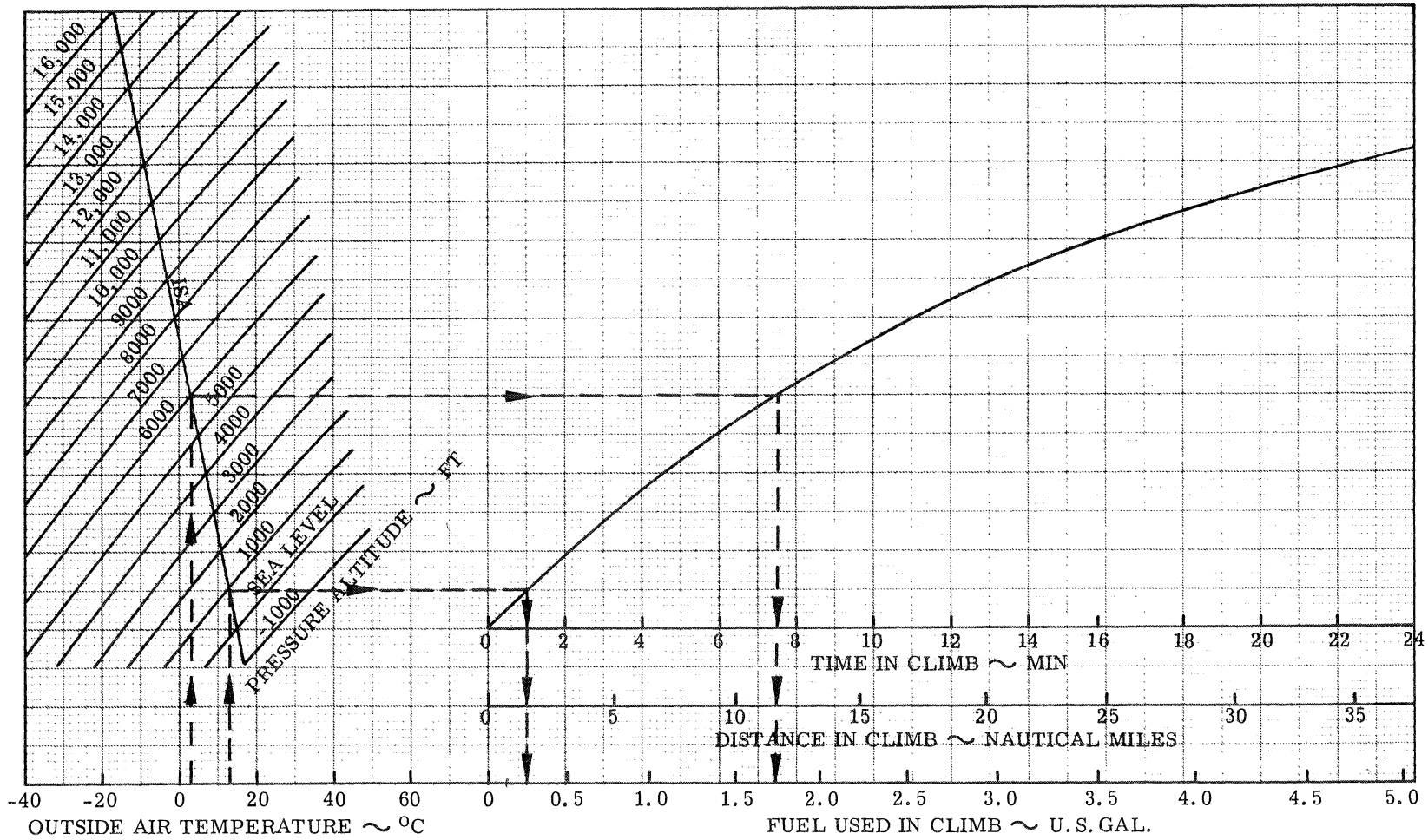
GIVEN:	Gross Weight	2650 LBS
	Outside Air Temperature	29°C
	Pressure Altitude	4500 FT
FIND:	Ground Roll	2380 FT
	Distance to 50-Ft Height	3100 FT

NOTES:
1. IAS assumes zero instrument error.
2. Allowance must be made for wet runways, grass or sod runways, or other actual associated conditions which may differ from those above.

TIME, DISTANCE, AND FUEL REQUIRED IN CLIMB

SCHEDULED CLIMB SPEEDS	
PRESSURE ALTITUDE FT	CLIMB SPEED KIAS
SEA LEVEL	90
2000	88
4000	87
6000	85
8000	83
10,000	82
12,000	80

NOTE: IAS ASSUMES ZERO INSTRUMENT ERROR.



RANGE

The Range is presented in Figure 2-9 for varying outside air temperature, pressure altitude, and power settings at an average gross weight. A table of Fuel Flow Settings is shown in the upper right hand corner of the chart.

ASSOCIATED CONDITIONS

Power	AS DESIRED
Wing Flaps	0 DEG
Landing Gear	UP
Cowl Flaps	CLOSED
Wind	0 KTS

Fuel Allowances

1. Start, Run-up, and Taxi (1.5 Gal).
2. Climb to Cruising Altitude at Maximum Continuous Power and Best Speed.
3. Cruise at Best Economy Fuel Flow.
4. 45 Minute Reserve based on a power setting of 45 percent MCP at 2500 RPM (6.0 Gal).

TECHNIQUE

See Individual Climb and Cruise Speed charts for discussion of techniques.

EXAMPLE

GIVEN:	Outside Air Temperature	10°C
	Pressure Altitude	2000 FT
	Power Setting	55 PERCENT MCP
	Usable Fuel Capacity	68 U.S. GAL
FIND:	Range	838 NM

RANGE

BEST ECONOMY FUEL FLOW - GPH			
RPM	75 PERCENT MCP	65 PERCENT MCP	55 PERCENT MCP
2700	10.9	9.8	8.7
2600	10.6	9.6	8.5
2500		9.5	8.5
2400		9.4	8.2

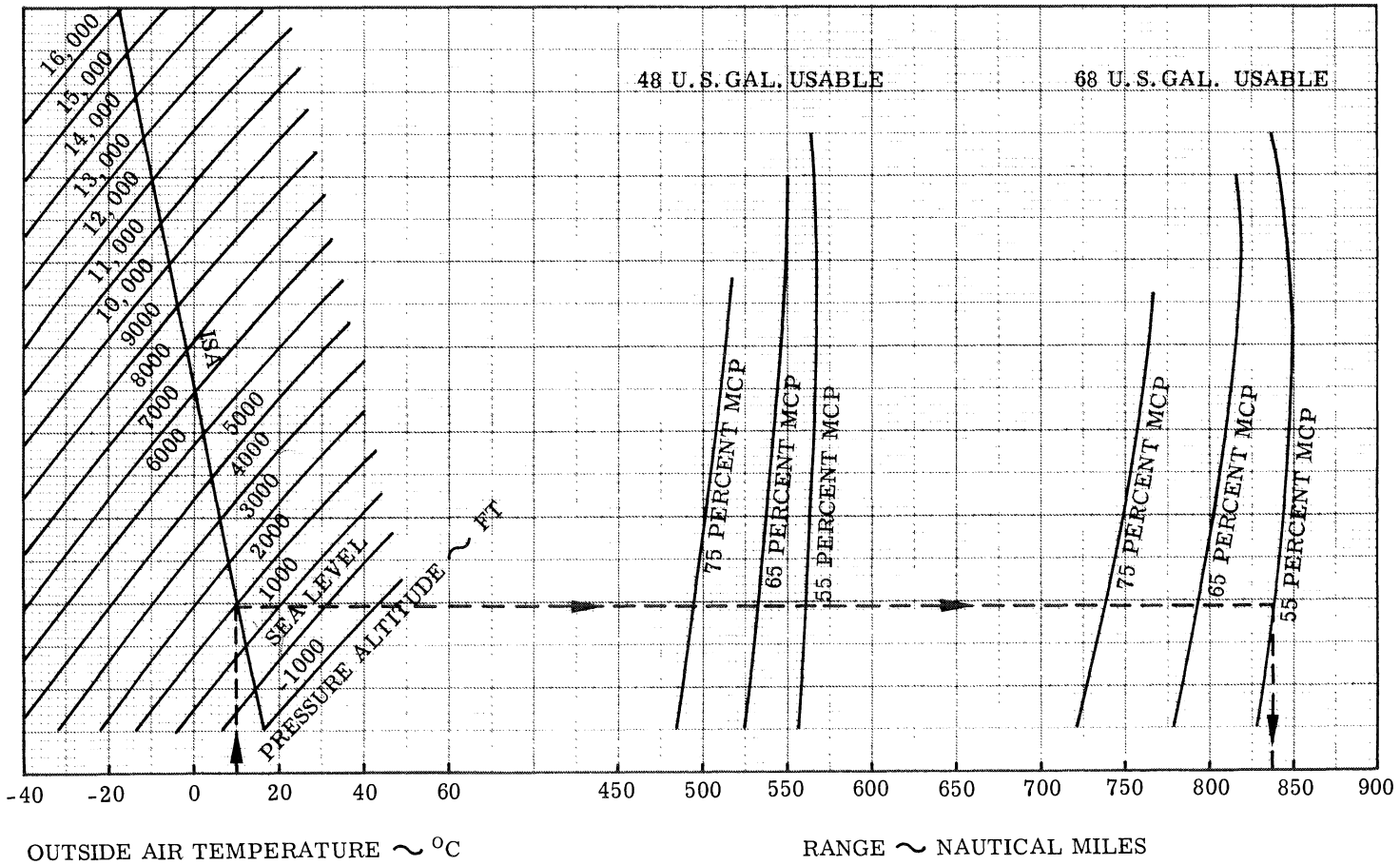


Figure 2-9.

CRUISE TRUE AIRSPEED

The Cruise True Airspeed is presented in Figure 2-10 for varying outside air temperature, pressure altitude, and power setting at an average gross weight. A table of Fuel Flow Settings is shown in the upper right hand corner of the chart.

ASSOCIATED CONDITIONS

Power	AS REQUIRED
Wing Flaps	0 DEG
Landing Gear	UP
Cowl Flaps	CLOSED

TECHNIQUE

Obtain and maintain power setting desired. Approach the cruise altitude from a slightly higher altitude with a shallow dive. Trim the airplane in a stabilized condition with zero rate of climb.

EXAMPLE

GIVEN:	Outside Air Temperature	20°C
	Pressure Altitude	5000 FT
	Power Setting	65 PERCENT MCP
FIND:	True Airspeed	129.5 KTS (TAS)

CRUISE TRUE AIRSPEED

CONDITIONS: BEST POWER FUEL FLOW (If equipped with EGT, lean until EGT peaks, then enrich mixture for a 75°F drop).

BEST POWER FUEL FLOW - GPH			
RPM	75 PERCENT MCP	65 PERCENT MCP	55 PERCENT MCP
2700	12.6	11.5	10.2
2600	12.5	11.2	10.0
2500	12.3	11.1	9.8
2400		10.9	9.7

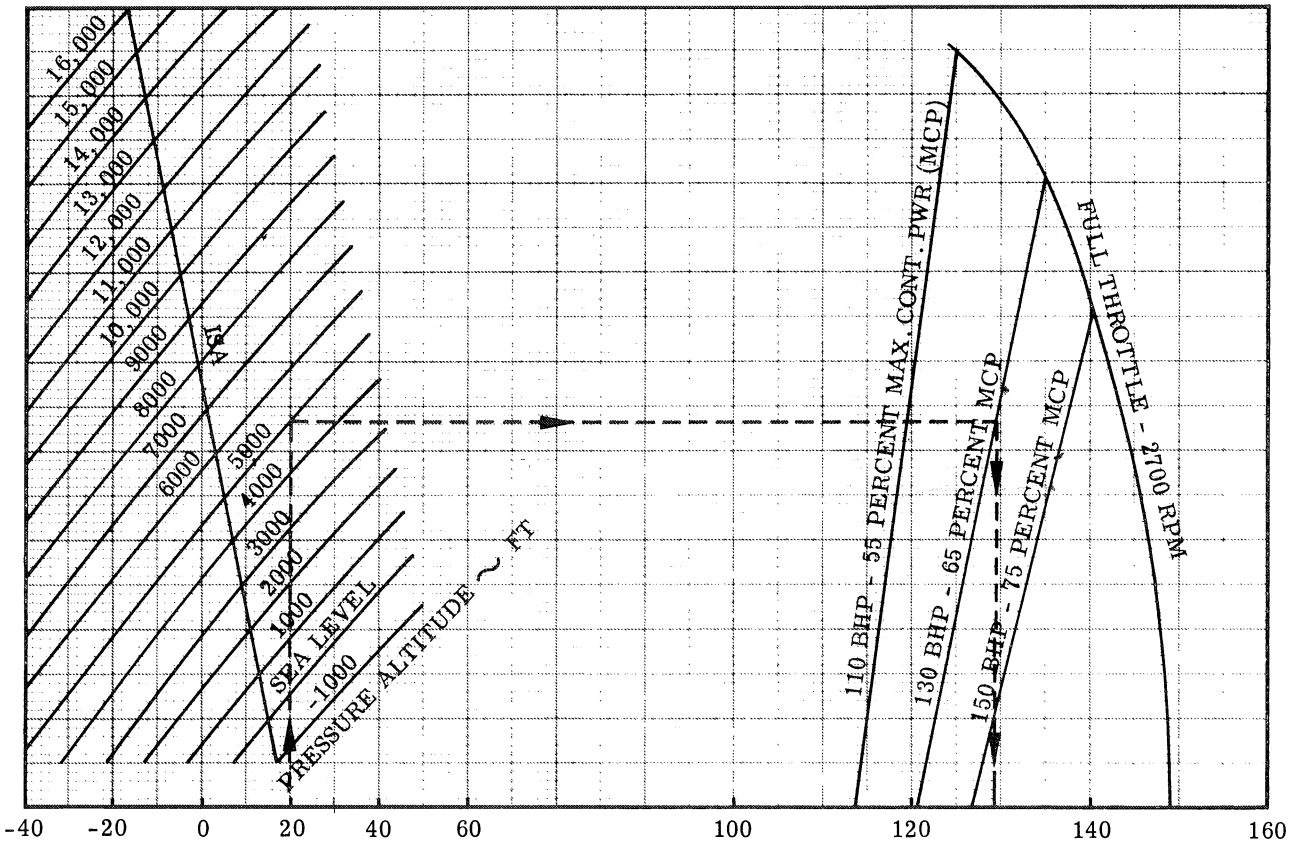


Figure 2-10.

LANDING DISTANCE FROM 50-FT HEIGHT, SHORT FIELD

The Landing Distance from 50-Ft Height to rest is shown in Figure 2-11 for varying conditions of outside air temperature and pressure altitude at a gross weight of 2550 Lb. and zero wind.

ASSOCIATED CONDITIONS

Power	SEE TECHNIQUE BELOW
Wing Flaps	35 DEG
Landing Gear	DOWN
Cowl Flaps	FULL OPEN
Runway Conditions	PAVED, DRY, LEVEL

TECHNIQUE

Make the final approach with the landing gear extended and the wing flaps at 35 degrees arriving at the 50-ft height at 68 KIAS. Touchdown should be made on the main wheels first, with the nose wheel being lowered smoothly during the landing roll. Close throttles, and apply heavy braking. Do not retract wing flaps.

EXAMPLE

GIVEN:	Gross Weight	2550 LB
	Outside Air Temperature	26°C
	Pressure Altitude	3500 FT
FIND:	Ground Roll	717 FT
	Total Distance from 50-Ft	1500 FT

NOTES:
1. IAS assumes zero instrument error.
2. Allowance must be made for wet runways, grass or sod runways, or other associated conditions which may differ from those above.

SHORT FIELD LANDING DISTANCE FROM 50-FT HEIGHT

SCHEDULED APPROACH SPEED : 68 KTS (IAS)

NOTE: IAS ASSUMES ZERO INSTRUMENT ERROR.

NOTE: GUIDELINES NOT APPLICABLE FOR INTERMEDIATE OBSTACLE HEIGHTS.

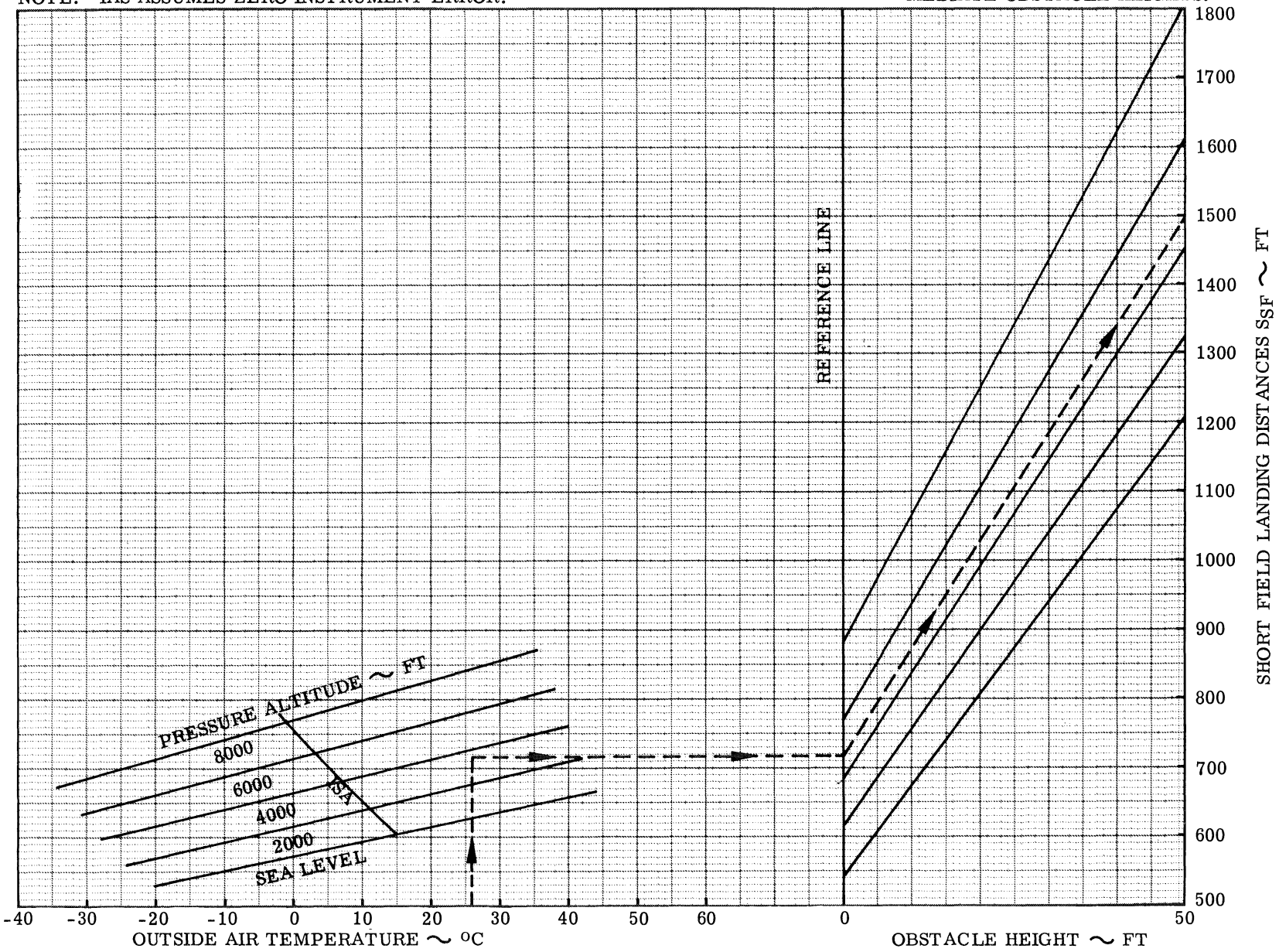
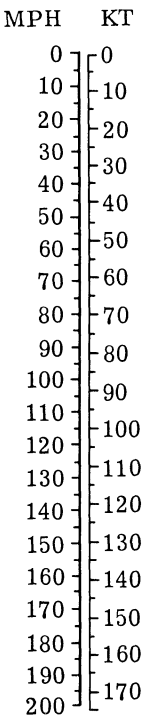


Figure 2-11.

MILES PER HOUR/KNOTS



NAUTICAL MILES/STATUTE MILES

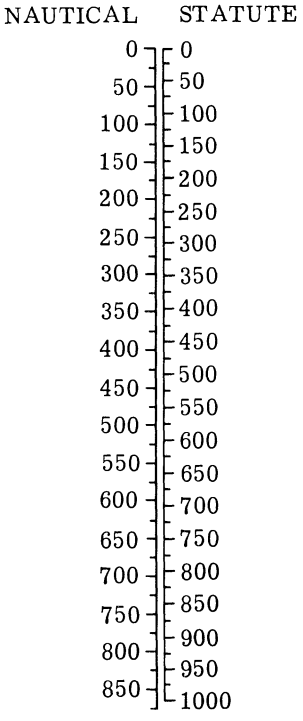


Figure 2-12.

PART III
SYSTEMS

TABLE OF CONTENTS

GENERAL

The Model 112 is a four-place, low-wing, all-metal retractable gear aircraft powered by a four-cylinder, fuel-injected Lycoming engine that is equipped with a Hartzell #HC-E2YR-1BF/F7666A all-metal constant speed propeller. Access to the spacious cabin interior is through two lockable cabin doors, one on each side of the aircraft. The cabin interior is sectioned into four distinctive seating areas by a functional center console which houses engine/propeller controls, elevator trim control wheel and passenger convenience items.

Standard overhead console equipment includes separately adjustable ventilation outlets, and two front reading lights. All primary and supporting flight instruments are located on the left side of the main panel; engine and fuel system indicators are located in the left instrument subpanel. Avionics packages, ventilation controls and electrical system circuit breakers are grouped on the right side of the main instrument and sub panels.

The aircraft is equipped with a retractable tricycle landing gear system, and incorporates a steerable nose wheel and toe-operated hydraulic disc brakes.

FLIGHT CONTROLS

AILERON CONTROL SYSTEM -- The aileron control system consists of mechanical linkage and cables connecting the ailerons to the control column. The control wheel is connected to the control column, and to sprockets on each end of the horizontal control column, with tubes. A chain is wrapped around the end sprockets, under the center idler sprocket, and around the double sprocket on the vertical control column. Direct cables connect to chain-ends through a series of pulleys to the aileron bellcranks. A carry-through cable "closes" the system. Turnbuckles are used on the direct and carry-through cables to set cable tension. The bellcranks are connected to the ailerons with adjustable push-pull rods.

ELEVATOR CONTROL SYSTEM -- The elevator controls consist of cables connected to elevator arms on the control column and routed through a series of pulleys to the elevator bellcrank. The bellcrank is connected to the elevator horn with a push-pull rod. When the control wheel is moved forward or aft, the cables move in opposite directions, turning the bellcrank, which in turn pushes or pulls the control rod, causing the elevators to move up or down.

ELEVATOR TRIM SYSTEM -- An elevator trim control wheel, labeled ELEVATOR TRIM, which is located in the left forward edge of the center console, provides manual pitch control through mechanical linkage to the elevator trim tabs. Rotating the wheel forward toward the NOSE DOWN indicator will provide nose-down trim, rotation in the opposite direction produces nose-up trim.

RUDDER CONTROL SYSTEM -- The rudder control system consists of mechanical linkage and cables connecting the rudder pedals to the rudder. The rudder pedals are connected to rudder bars, which in turn are connected to the rudder bellcrank with push-pull rods. Cables are attached to the bellcrank and are routed aft through a series of pulleys to the rudder horn. When force is applied to one rudder pedal, the cables move in opposite directions, turning the rudder horn and rudder. The pedals are also connected to the nose wheel steering with cables and bungee assemblies which act as return springs for the rudder pedals.

RUDDER TRIM SYSTEM -- A rudder trim control knob, labeled RUDDER TRIM, is mounted to the left of the console, below the lower edge of the instrument panel, and provides manual control of trim around the vertical axis. Rotation of the knob clockwise will yaw the aircraft to the right, opposite rotation will yaw the aircraft to the left. A scale is incorporated to the right of the knob to indicate direction of trim.

WING FLAPS -- The wing flaps are electrically operated by a flap motor located under the rear seat floor assembly. Flap position is controlled by a switch labeled WING FLAPS and is mounted directly to the right of the accessory electrical switches. Flap position is electrically indicated by a gage mounted above, and to the right of, the flap switch.

To extend the wing flaps, the wing flap switch must be depressed and held DOWN until the desired degree of extension is reached by pilot reference to the flap position indicator. After the desired flap extension is obtained, releasing the switch allows it to return to the center OFF position. When flap retraction is necessary, place the switch UP. The switch will remain in the UP position without manual assistance due to an over-center design within the switch. With the flaps extended in flight, placing the flap switch UP will retract the flaps in approximately 6 seconds. Gradual flap retraction can be accomplished by intermittent operation of the flap switch to UP. Normal full flap extension in flight will require approximately 9 seconds. After the flaps reach maximum extension or retraction, limit switches will automatically shut off the flap motor; however, when the flaps reach the fully retracted position, the wing flap switch should be manually returned to the center-off position. An additional limit switch is installed on the flap motor drive to activate the gear warning system when flaps are extended 25 degrees or more with the landing gear retracted.

For further flight controls information refer to the Maintenance Manual.

HYDRAULIC SYSTEMS

LANDING GEAR EXTENSION/RETRACTION SYSTEM -- Refer to Figure 3-1. The hydraulic power supply is an integrated pack containing an electric motor-driven hydraulic pump, reservoir, pressure control and thermal relief valves. The power pack is located in the left forward area of the fuselage tailcone. A landing gear selector switch, mounted on the instrument panel, controls the direction of fluid flow from the pump to permit gear retraction or extension. A hydraulic manifold serves as the mounting base for attaching the power pack to the airframe.

When the landing gear selector switch is pulled out slightly to clear a detent, and placed in the UP position, pressurized hydraulic fluid at 1600 to 2000 psi is directed through the manifold to the actuators. As a pressure of 75 psi is reached in the up side of the individual actuator, the piston lock is withdrawn and the cylinder begins to retract the gear. Fluid on the opposite side of the cylinder piston flows back through the manifold into the power pack. When all three gears are retracted and their respective limit switches actuated, the pump is shut off and the gears are held up by hydraulic lock. Any loss of pressure or internal leakage which allows the gears to partially extend is sensed by the limit switches which will automatically re-energize the hydraulic pump to reposition the gears to the up position.

When the landing gear selector switch is placed in the DOWN position, pressurized hydraulic fluid at 500 to 800 psi is directed through the manifold to the down side of the actuators. When all three gear-down limit switches, and gear lock limit switches are actuated, the hydraulic pump is shut off and the gear is held down and locked by the lock cylinders engaging the piston of each actuator.

The emergency dump valve by-passes fluid from the "up" side of the actuators (which form the hydraulic up-lock) directly to the reservoir. The gears then drop by gravity, assisted by down springs, and the piston locks mechanically engage. Note that with the emergency dump valve in the down position, the gear cannot be raised, nor can the piston down lock become disengaged.

POSITION INDICATOR LIGHTS AND GEAR WARNING LIGHT -- Three green indicator lights, mounted directly above the landing gear position handle, provide an electrical indication that nose and main gears are down and locked. These gear down lights are the "press-to-test" type.

A red GEAR WARN light is installed in the glareshield surface to indicate that the gear is not fully up, or not down and locked. Gear up is indicated by the GEAR WARN and all position lights being out.

As a reminder that the gear is retracted, the gear warning bell and red GEAR WARN light will actuate whenever the throttle is retarded below approximately 14 inches of manifold pressure (Master Switch - ON) with the gear retracted, or flaps extended 25 degrees or more with the gear retracted.

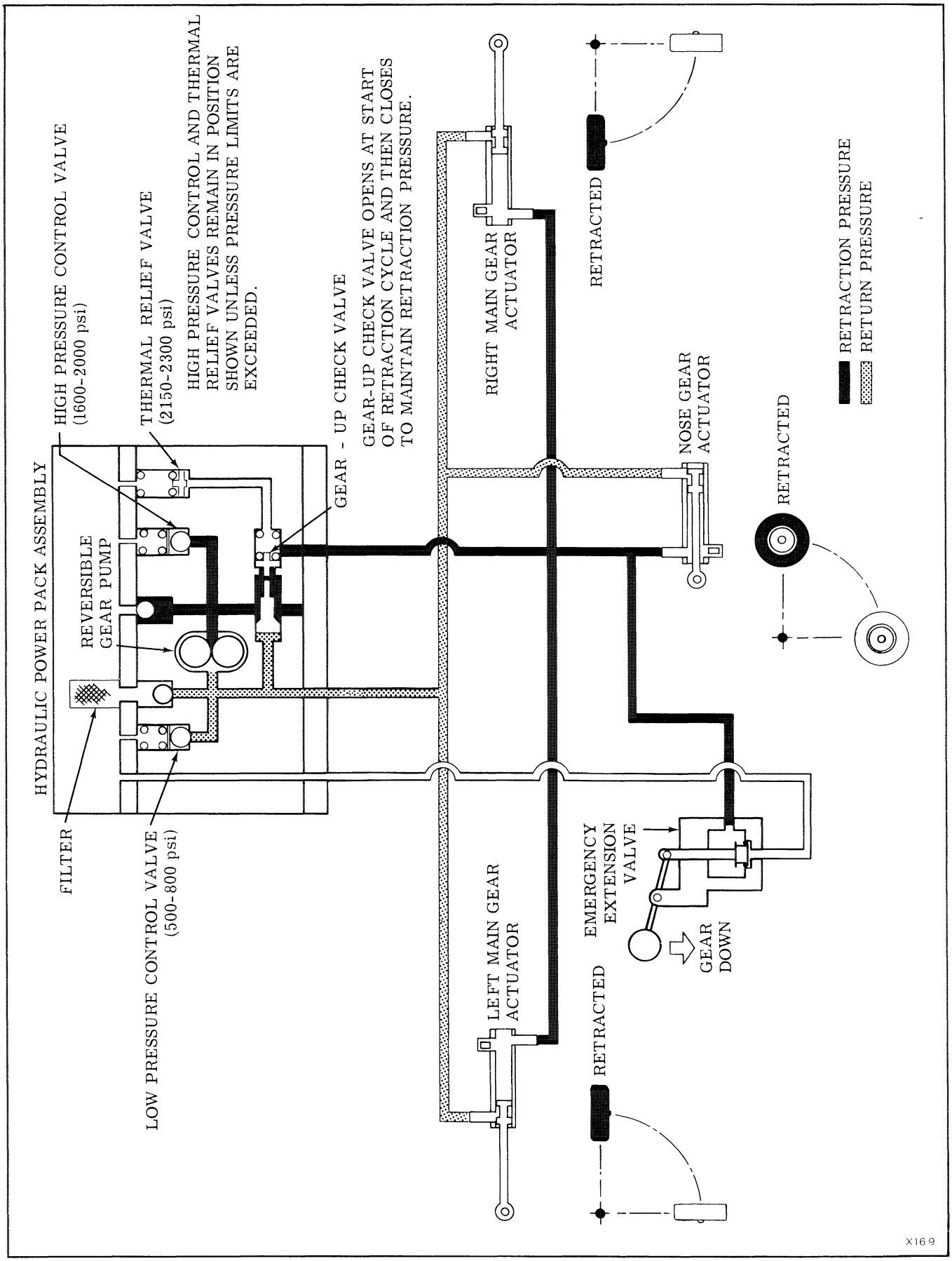


Figure 3-1. Hydraulic System Schematic-(Gear Retracted)

LANDING GEAR POSITION HANDLE -- The wheel-shaped landing gear handle is mounted to the left of the accessory electrical switches and moves vertically through two positions - above center for gear UP and below center for gear DOWN. From the DOWN position, the gear handle must be pulled out slightly to clear a detent before it can be repositioned to UP. After the gear handle is placed in the desired position, hydraulic pressure is directed within the gear system to retract or extend the gear to the position selected. Gear DOWN is indicated by illumination of the three (green) gear-down indicator lights, and absence of the gear warning bell and GEAR WARN light. Gear UP is indicated by the GEAR WARN light being out. If a position indicator light fails to illuminate, check bulb condition by pressing to test. A burned out bulb may be replaced in flight with the bulb from the magnetic compass.

EMERGENCY GEAR EXTENSION VALVE -- A red pressure relief valve knob (installed in the forward left side of the center console) is provided for use in the event of a total electrical system failure. The valve will allow relief of pressure which normally retains the landing gear in the up position.

HYDRAULIC BRAKE SYSTEM -- The two main wheels are equipped with self-adjusting, single-disc hydraulic brakes which are actuated by individual master cylinders attached to the rudder pedals. The brake master cylinders are attached to the pilot's rudder pedals only. Both pilot master cylinders incorporate reservoirs to supply system fluid to respective wheel brake cylinders. Since the co-pilot's brakes lack reservoirs, they are hydraulically inter-connected to the pilot's master cylinders. The brakes are actuated by applying toe pressure to the tops of the rudder pedals.

The parking brake system uses a panel mounted control knob and cable connected to a dual park brake valve. To apply the parking brakes, depress the tops of the rudder pedals and pull the control knob (labeled PARK BRAKE) straight out, thereby captivating hydraulic pressure to the brakes. Toe pressure may then be released. To release the parking brake, depress the rudder pedals and push control knob to the full-in position releasing hydraulic pressure. For further Hydraulic Systems information refer to the Maintenance Manual.

POWER PLANT

The aircraft is equipped with a fuel-injected Lycoming IO-360-C1D6, horizontally-opposed, 4-cylinder engine. This engine incorporates its own oil supply and distribution system and utilizes a separate oil cooler assembly. The engine is certified to operate on a minimum of 100/130 octane aviation fuel, and is rated to produce 200 BHP at 2700 RPM. A Lycoming Engine Operator's Manual is supplied with each aircraft, and should be consulted for complete engine specifications.

ENGINE COWLING -- The cowling consists of two moulded fiberglass assemblies containing scoop inlets for oil cooling and induction air intake, including landing light and cowl flap/nose gear door components. The upper half of the cowling is secured by two Camloc fasteners (aft of the propeller spinner) and four over-center side latches. The lower portion is secured by machine screws to a fuselage/firewall flange. Two external cowlflaps are controlled mechanically from the instrument panel by a push-pull control knob labeled COWL FLAPS-PULL OPEN. Cowl flaps should be full open for ground operations and takeoff; and adjusted if necessary during climb to maintain cylinder head temperature within the proper green arc range. Cowl flaps should be closed below 100 knots in transition from climb to cruise. Maximum speed with cowl flaps full open is 130 knots.

EXHAUST SYSTEM -- Stainless steel exhaust pipes are flange-mounted to each cylinder exhaust port and connected individually to the muffler assembly. A single exhaust stack extends through the right lower side of the cowling to direct exhaust gases overboard.

INDUCTION AIR SYSTEM -- The external scoop on the left side of the cowling serves as the ram air source for the induction air system. Intake air is directed through an oil-impregnated filter element and flexible ducts for delivery to the induction manifold assembly. The manifold then directs the filtered air to the Bendix fuel injector unit for the fuel/air mixing process. A second (heated) air source is connected to the induction heat outlet of the muffler assembly and routed to the induction air manifold. This provides an alternate source of intake air in the event of fuel injector nozzle impact icing, or icing of the external filter element. This heated airflow source is controlled by the INDUCTION AIR control lever (Black, half-round in shape) on the engine controls pedestal.

BAFFLES INSTALLATION -- Sheetmetal baffles are installed on the engine to provide optimum cooling airflow around the engine cylinders and accessory components. These baffles incorporate rubber-asbestos composition seals at points of contact with the engine cowling to confine and direct intake air to the desired areas. The baffles, air blast tubes and scoops are carefully positioned to maintain proper cooling efficiency; their alteration or damage will cause improper air circulation and engine overheating.

ENGINE AND NOSE LANDING GEAR MOUNT -- A welded tubular structure attached to the firewall by five bolts serves as a mount for the engine and nose landing gear.

STARTER -- A Bendix-type starter is installed on the lower left side of the front of the engine. The starter drive pinion engages the engine flywheel ring gear to provide direct cranking of the engine. The starter relay, installed on the battery box in the tailcone, is energized by a key operated, spring-loaded, ignition-starter switch. When starting the engine, avoid energizing the starter for more than 10-15 seconds, and allow several minutes for the starter unit to cool between starting attempts.

ENGINE LUBRICATION -- The oil supply and distribution system is integral with the basic engine except for an independent oil cooler assembly mounted on the right side of the firewall. The amount of oil directed through the cooler is regulated by a thermostatic flow control valve that assures constant oil temperature relative to engine heat and ambient air temperature.

The oil pump draws oil through the oil sump pick-up screen, and directs it to the oil cooler through a flexible line. Cooled oil is then routed to the oil pressure relief valve installed in the upper-right side of the engine, just aft of the number 3 cylinder.

ENGINE OIL SCREENS -- An engine oil suction screen is installed in the oil sump to filter out any sizeable metal particles or heavy sludge from the oil before it is directed through the oil pump. An oil pressure screen is installed in the thermostatic/oil pressure screen housing located on the upper-center section of the accessory case. The oil pressure screen filters any small solid particles that may have passed through the oil suction screen to the oil sump.

OIL PRESSURE INDICATOR -- The oil pressure gage, mounted on the engine gage cluster on the instrument sub-panel, is a direct reading instrument. A small oil line is connected to one end of the oil pressure outlet housing on the accessory case. The opposite end is connected to the rear of the gage case.

OIL TEMPERATURE GAGE -- The oil temperature indicator is electrically connected to a temperature sensing bulb installed on the oil pressure/oil cooler bypass valve. Changes in oil temperature are sensed by the bulb and transmitted to the oil temp. indicator. Temperature variations are registered as changes in electrical current flow to the indicator.

ENGINE CONTROLS -- The power plant controls are located on the forward end of the center console and rotate in fore and aft movements. The control levers are color and shape-coded to assist in identification.

Function of the control levers are, proceeding from left to right: Induction Air (black/half-round shaped), controls heating of intake air to the fuel injector: Throttle (black/round), controlling manifold pressure: Propeller Control (blue/crowned) which regulates engine RPM: and the Mixture Control (red/hexagonal), which manually controls the fuel/air ratio. A cam type friction control lever is mounted on the right side of the control quadrant to permit locking the control levers at a desired setting. For further Power Plant information refer to the Maintenance Manual.

PROPELLER

The Model 112 is equipped with a Hartzell # HC-E2YR-1BF/F7666A all-metal constant speed propeller. Maximum diameter is 76-inches, minimum diameter is 74-inches.

The constant speed propeller used on this aircraft is a single-acting type in which oil pressure from the engine, boosted and regulated by a governor, is used to increase blade pitch. The natural centrifugal twisting moment of the rotating blades and the force of a spring are used to decrease blade pitch. Pitch setting at 30-inch station Low Pitch - 13 Deg, High Pitch 28-30 Deg.

NOTE

Federal Aviation Regulations, Part 43 (FAR 43) defines major and minor repairs and alterations and who may accomplish them. Federal Aviation Regulations and the propeller manufacturer's instructions must be observed.

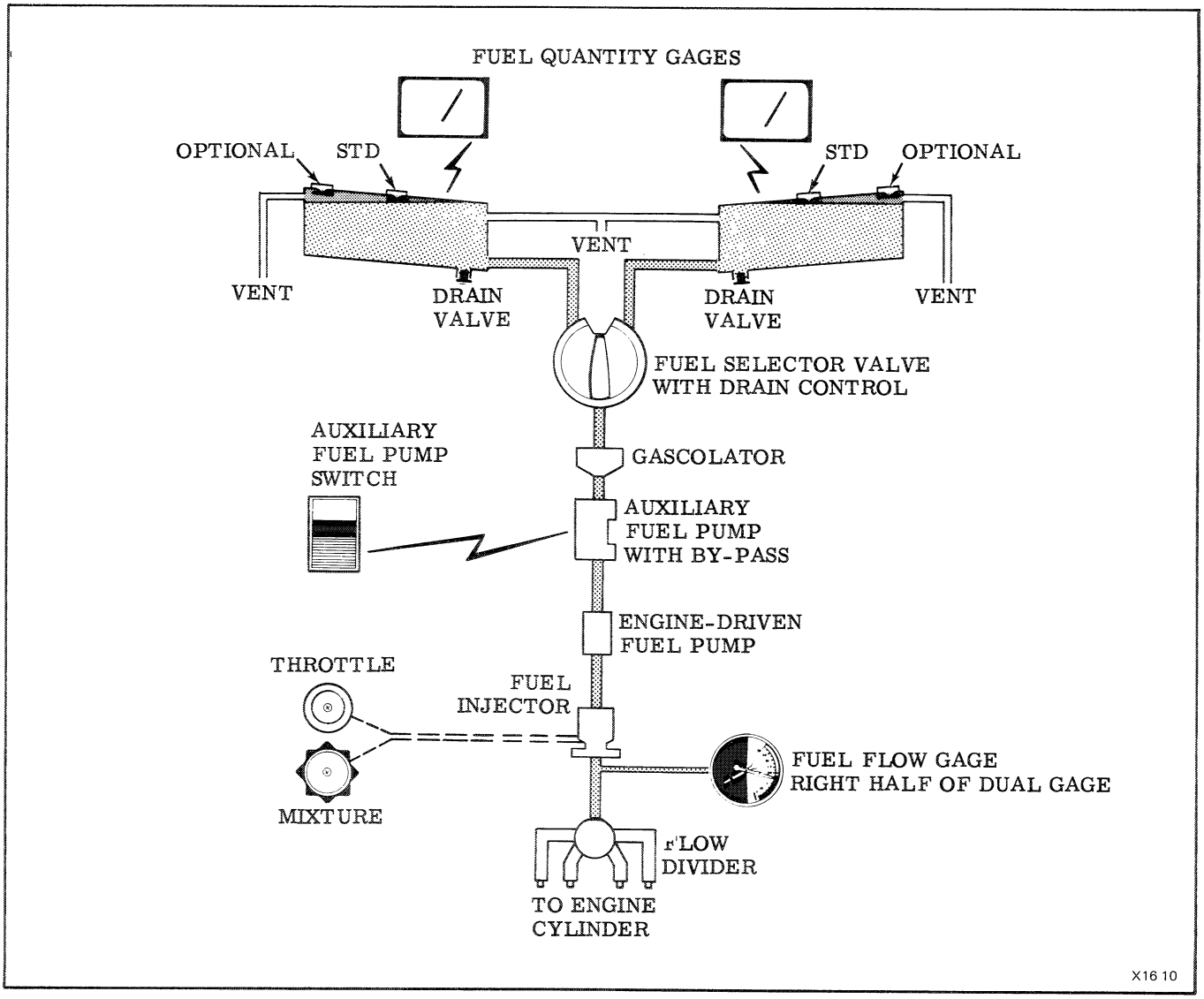


Figure 3-2. Fuel System Schematic

PROPELLER GOVERNOR -- The propeller governor is a single-acting, centrifugal type, which boosts oil pressure from the engine and directs it to the propeller where the oil is used to increase blade pitch. A single-acting governor uses oil pressure to effect a pitch change in one direction only; a pitch change in the opposite direction results from a combination of centrifugal twisting moment of rotating blades and compressed springs. Oil pressure is boosted in the governor by a gear type oil pump. A pilot valve, flyweights, and a speeder-spring act together to open and close governor oil passages as required to maintain a constant engine speed. For further Propeller information refer to the Maintenance Manual.

FUEL SYSTEM

Aviation fuel (100/130 minimum octane) is supplied to the engine by two integral fuel tanks, one in the forward center section of each wing. Normal fuel tank capacity is 25 U.S. gallons for each wing tank, 24 gallons of which are considered usable, see Figure 3-2. Optional fuel filler caps are available that give a total fuel capacity of 35 U.S. gallons, 34 gallons of which are considered usable. A reduced fuel load indicator is located in the filler neck of the optional installation. This indicator is used to indicate a usage fuel capacity of 24 U.S. gallons. From the wing tanks, fuel flow is directed through a selector valve, gascolator, electric fuel pump (with by-pass), and engine-driven fuel pump for delivery to the fuel-injector unit.

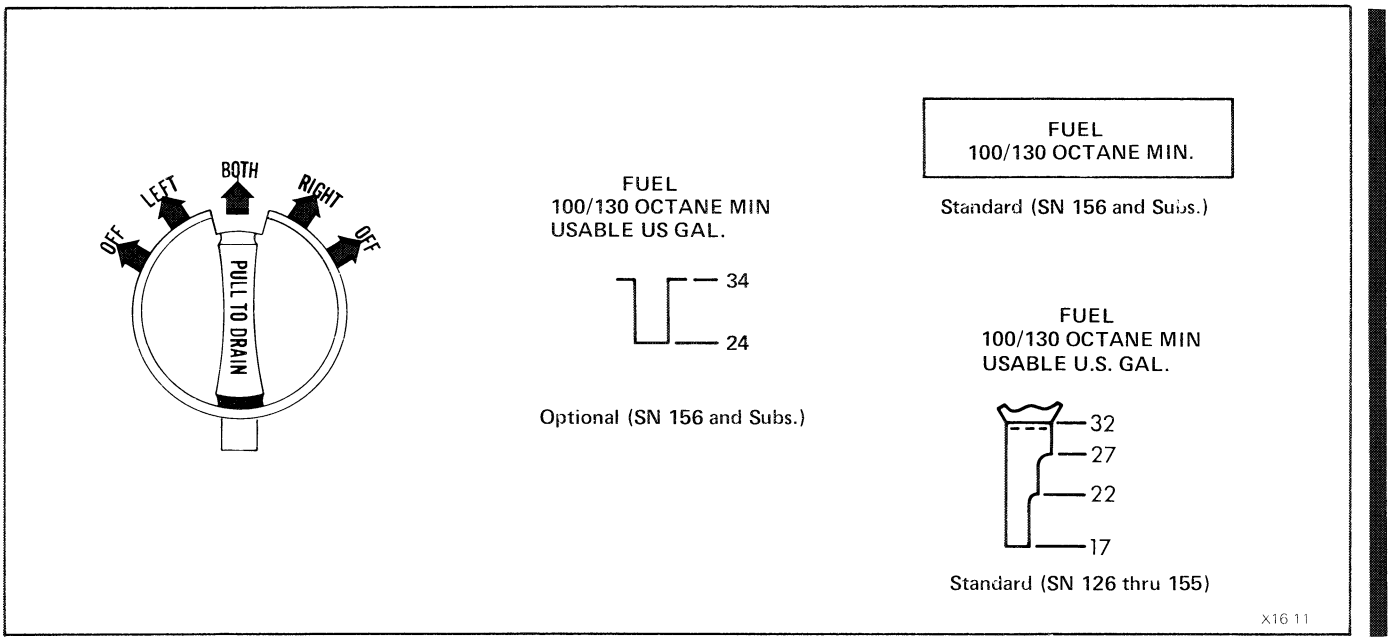


Figure 3-3. Fuel Selector Valve & Fuel Tank Placard

FUEL FILLER CAPS -- The filler necks of each wing fuel tank incorporate an anti-siphoning, flapper valve to prevent loss of fuel if a cap is inadvertently left off or improperly secured. The caps are secured to the valve plates by a quarter turn, spring-loaded plunger. To remove the cap, simply depress the fastener in the center of the cap and rotate one quarter turn. To replace the cap depress the fastener, rotate counterclockwise one quarter turn (until the unit clicks) then rotate clockwise one quarter turn.

FUEL FILTERS AND DRAIN VALVES -- Fuel filters are located in the outlet line of each wing fuel tank, firewall mounted gascolator, and fuel injector inlet fitting. Prior to the first flight of the day the wing tank sumps and fuel selector valve should be drained to check for the presence of water or sediment in the fuel system. There is a possibility that the wing tank sumps may contain water. Therefore, the wing tank sumps and fuel selector valve should be redrained as necessary. For fuel system servicing information, refer to Servicing.

FUEL SELECTOR VALVE -- A five-position fuel selector valve (see Figure 3-3.) is installed in the forward section of the center console. The valve handle controls selection of: OFF, LEFT tank, BOTH tanks, RIGHT tank and a second OFF position.

The fuel selector valve handle provides a remote control for draining fuel samples from the wing tanks individually, or both tanks simultaneously, through a drain on the bottom of the fuel selector valve.

Placing the valve handle in either LEFT or RIGHT position, and pulling up on the valve handle, will drain fuel from that particular tank only; the BOTH position will provide simultaneous drain from both tanks.

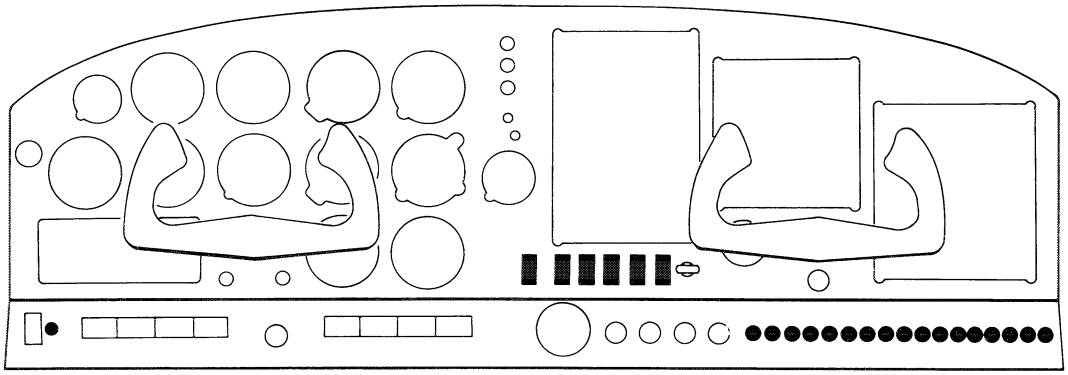
Prior to the first flight of the day, and after each refueling operation, set the selector valve on BOTH and pull the selector handle up to drain for approximately four seconds. Visually check that drain valve closes when the handle is released. Depress red tab to rear of fuel selector to select OFF.

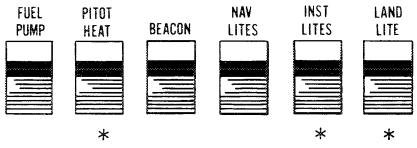
NOTE

Place fuel selector valve handle in the RIGHT or LEFT position while aircraft is parked to prevent fuel from flowing out of tank vent line.

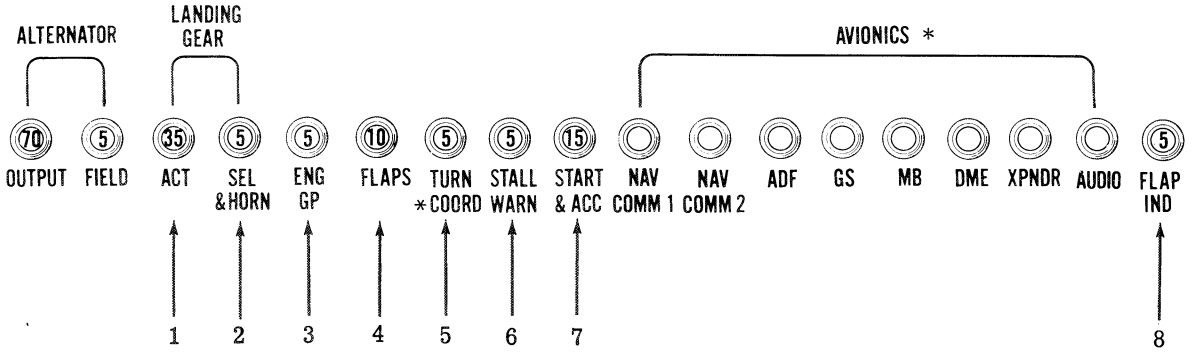
AUXILIARY FUEL PUMP -- The electric auxiliary fuel pump is located on the right forward side of the firewall, and is controlled by a two-position rocker switch labeled FUEL PUMP in the row of accessory electrical switches. The auxiliary fuel pump is used as a boost in starting and in the event of engine-driven fuel pump failure.

For further Fuel System information refer to the Maintenance Manual.





*OPTIONAL EQUIPMENT



1. LNDG GEAR UP-DOWN RELAYS
   HYDRAULIC POWER PACK
2. GEAR POSITION IND. LIGHTS
   GEAR WARN LIGHT & BELL
   LNDG GEAR POSITION SWITCH
   THROTTLE & SQUAT SWITCH
   FLAP ACTUATED GEAR WARN SWITCH
3. AMMETER
   OIL TEMPERATURE IND.
   FUEL QUANTITY IND.
   CYL. HEAD TEMPERATURE
4. WING FLAP MOTOR
   WING FLAP POSITION SWITCHES
5. TURN COORDINATOR OR TURN & BANK IND.
6. STALL WARNING HORN
7. STARTER
   COURTESY & OVERHEAD LIGHTS (opt.)
8. FLAP POSITION INDICATOR

X16 12

Figure 3-4. Circuit Breakers

ELECTRICAL SYSTEM

Electrical power is supplied by a 12-volt, direct-current system powered by an engine-driven 70 amp alternator. The 12-volt battery is located in the aft tailcone structure and is accessible through the baggage compartment. Electrical power is supplied to all accessory circuits through a single bus bar, incorporating an over-voltage relay to protect avionics equipment from harmful transient voltages.

Wiring and circuit breaker provisions are provided to accommodate optional communications and navigational equipment.

MASTER SWITCH -- A split-rocker type master switch, which controls all accessory electrical systems is located in the extreme left lower portion of the instrument sub-panel. This switch, labeled MASTER, is ON when the upper half of both sides of the switch are depressed. The left half of the switch (Labeled BATT), controls all battery power to the aircraft and the right half (ALT) controls alternator output. For all normal operations, both sides of the master switch should be ON, however, the BATT side can be turned ON separately to check the operation of equipment during preflight.

With the ALT side turned OFF, the entire accessory electrical load is placed on the battery, and all non-essential electrical equipment should be turned off to reduce battery discharge rate.

AMMETER -- The panel mounted ammeter indicates current flow, in amperes, from the alternator to the battery, or from the battery to the electrical system. With the engine operating and both halves of the master switch ON, the ammeter indicates the rate of charge being applied to the battery. In the event of an alternator malfunction, or if the electrical load demand exceeds the alternator output, the ammeter will indicate the discharge rate of the battery.

VOLTMETER -- A voltmeter, located in the lower left instrument sub-panel, allows the pilot to monitor bus bar voltage. When the voltmeter is used in combination with the ammeter; alternator output, battery charge or discharge rate and accurate bus bar voltage can be determined. Normal voltmeter readings should be within the green arc (12-15 volts). See Flight Manual for details concerning over-charging or insufficient voltage problems (as indicated by two red arcs on the voltmeter scale: yellow arc indicates possible failure.)

CIRCUIT BREAKERS -- Push-to-reset, push-pull, or rocker switch circuit breakers are used to protect all electrical circuits in the aircraft. Circuit breakers automatically open to break the electrical current flow if the system receives an overload, thus preventing damage to electrical system components.

The main circuit breaker panel is contained within the lower right instrument sub-panel. All general system and avionics circuit breakers contained in this panel are the push-to-reset type. All accessory lighting equipment, pitot heat and the auxiliary fuel pump circuits are protected by circuit breakers built directly into the back of the individual rocker switch.

ALTERNATOR -- A 12-volt, 70-amp alternator is installed on the forward lower right side of the engines. The alternator employs a 3-phase stator winding in which the phase windings are electrically 120 degrees apart. The rotor consists of a field coil encased between two, 4-poled interleaved sections, producing an 8-pole magnetic field with alternate North and South poles. When the rotor rotates inside the stator, an alternating current is induced in the stator windings. This ac current is rectified, i.e., changed to dc, by silicon diode rectifiers and delivered to the output terminal of the alternator. A ram air blast tube extending from the slip ring cover of the alternator to the forward engine baffle supplies cooling air to the alternator. A belt from the alternator pulley, to a pulley which is integral with the aft propeller flange, drives the alternator at 3.25 times the speed of the engine.

EXTERIOR LIGHTING -- Three conventional navigation lights are installed on the wing tips and aft end of the tailcone. The lights are operated by the NAV LITE rocker switch (located in the accessory electrical section of the lower instrument panel). A single-beam landing light is mounted in the lower center area of the nose cowl for night operations. The light is controlled by the LAND LITE rocker switch.

A unique independent set of exterior courtesy lights are provided. One light is mounted on each lower side of the aft fuselage to illuminate the baggage area and wing steps. This light system is "independent" in the sense that it can receive its power directly from the battery (without the master switch being on), and operates through a time-delay circuit to automatically turn the lights off after night boarding and deplaneing operations.

The lights are activated by a remote switch button on the left entrance step attach plate. Depressing the switch within the step plate activates the lights and a holding relay to provide approximately three minutes of illumination before the lights go off automatically. Lights can be reset if additional time is needed. Also, whenever the baggage door is opened, the baggage compartment courtesy light illuminates, and remains illuminated until the baggage door is closed.

A series of strobe-type anti-collision light systems are available for installation on the aircraft. The aircraft comes standard with the strobe light installed on the lower surface of the fuselage. Optional strobe lights may be wing-tip mounted, and/or installed on the tip of the vertical stabilizer. The strobe light installation provides superior identification lighting, as compared with conventional rotating beacon lights.

NOTE

Beacon or strobe lights should not be used when flying through clouds or overcast; the flash effect reflected from water particles in the atmosphere, particularly at night, could produce vertigo (loss of orientation). Also, as a consideration to other pilots, the strobe light should be left OFF during taxi near other occupied aircraft.

INTERIOR LIGHTING -- Standard interior lighting systems include two individual overhead reading lights for passengers (two aft reading lights are optional) baggage compartment, left control wheel, map reading light (right control wheel and reading light optional), and instrument panel lighting.

The individual reading lights are controlled by a circular wheel type switch on each light unit. Rotate the switch forward to turn on the light and to adjust the position of the light beam. To turn the light off, rotate the switch in the opposite direction. The baggage compartment light, located in the ceiling aft of the rear seats, is controlled automatically by a plunger-type switch in the baggage door. Lamp bulb replacement access in these units is gained by carefully prying off the translucent lens cover.

A map light may be installed on the bottom edge of the pilot's control wheel to provide convenient chart illumination during night operation. The light is turned on and off by a slide-type switch on the underside of the control wheel.

Instrument panel illumination is provided by blue-white flood light units installed on the underside of the anti-glare shield. The magnetic compass and radio installations contain integral lighting. Instrument panel lighting intensity is controlled by a rheostat control knob labeled INSTR; radio and engine instrument light intensity is controlled by a second rheostat knob labeled AVIONICS. Rotating either rheostat control clockwise will increase light intensity. Both rheostat controls are located on the instrument panel directly below the pilot's control column

INSTRUMENTS

The standard equipment instrument installation provides all instruments necessary for safe and efficient operation of the aircraft. With the exception of the magnetic compass and optional outside air temperature gage, all instruments are installed in the main instrument panel and sub-panel areas, and are grouped according to function and ease of surveillance. Instruments are divided into three groups for discussion in this section: Flight Instruments, Engine Instruments and Miscellaneous Instruments.

All primary flight and gyro instruments are installed in the left side of the main instrument panel. Manifold pressure and tachometer gages are mounted in the lower center area of the main panel and the remaining engine instruments are grouped horizontally across the left instrument sub-panel.

Optional navigation and communications equipment is located in the center and right side of the main instrument panel. The lower right instrument sub-panel contains electrical system circuit breakers and heating-ventilation control knobs.

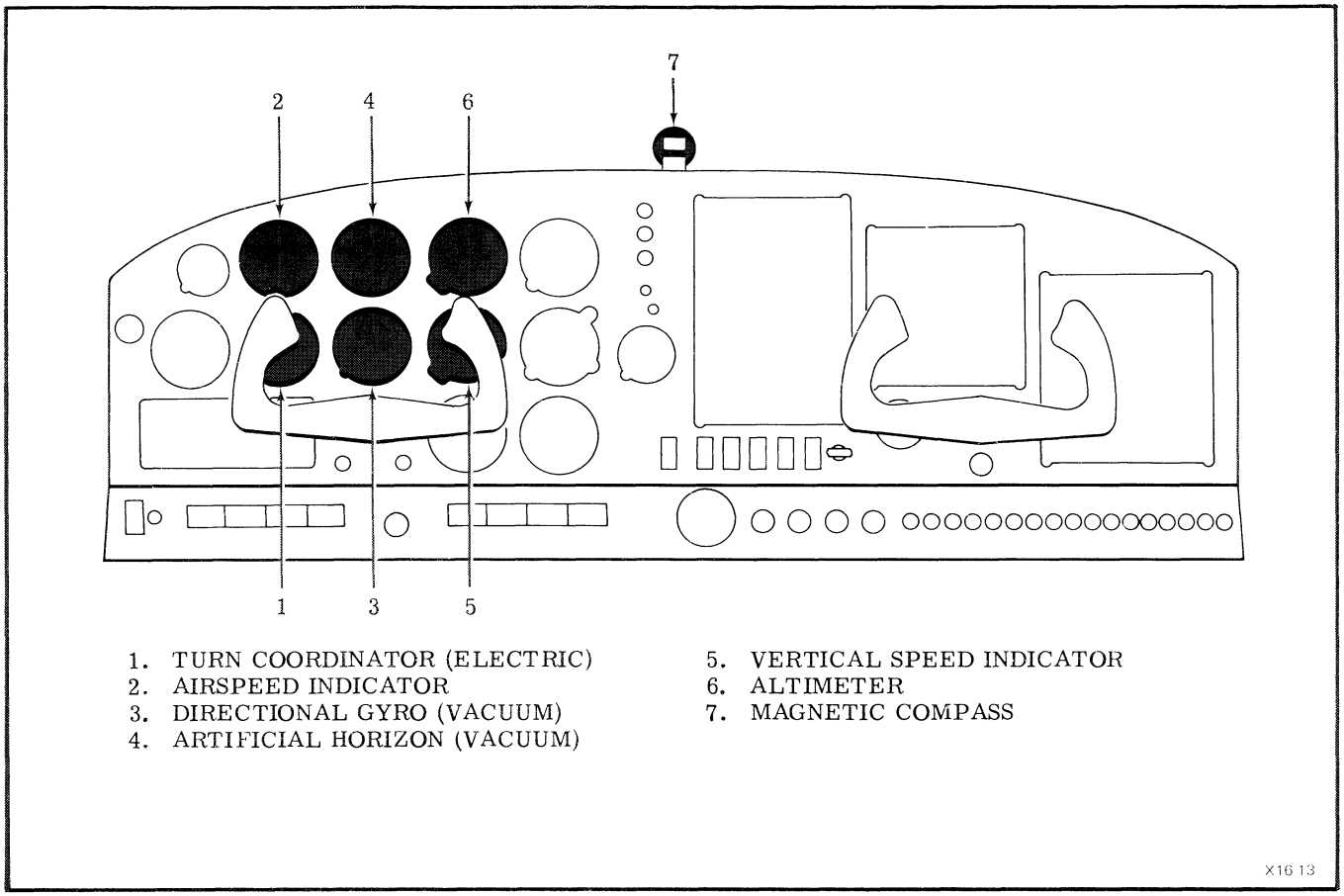


Figure 3-5. Flight Intruments

FLIGHT INSTRUMENTS -- Flight instruments consist of the magnetic compass, airspeed indicator, altimeter and, optional vacuum driven attitude and directional gyro. An electrically-driven turn coordinator is also available. A vertical speed indicator is also available as part of the pitot-static instrument system. Refer to Figure 3-5. The pitot-static system provides pitot (impact) and static (atmospheric) air pressure to the airspeed indicator, and static air pressure to the altimeter and vertical speed indicator.

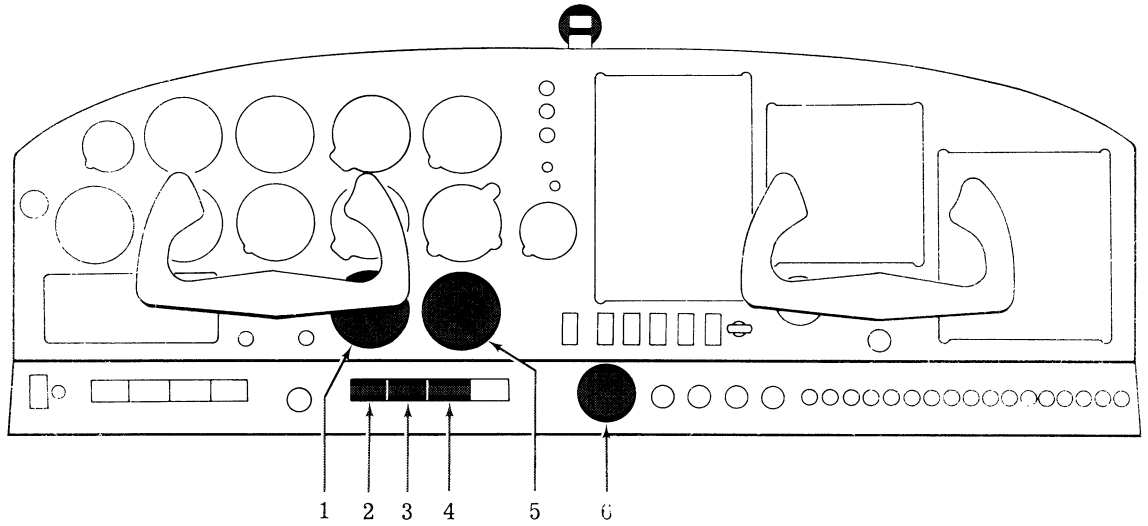
The vacuum system gyros are driven by ambient air drawn into the instrument case to replace the air evacuated by the vacuum pump. The inlet air for the gyro instruments is filtered through the instrument vacuum air filter. Refer to the end of this section for vacuum system trouble shooting procedures.

TURN-AND-BANK INDICATOR -- The turn-and-bank indicator is an electrically operated instrument. It is powered by the aircraft electrical system and, therefore, operates only when the master switch is on.

MAGNETIC COMPASS -- The magnetic compass is liquid-filled, with expansion provisions to compensate for temperature changes. It is equipped with compensating magnets adjustable from the front of the case. Access to the compass light and the compensating magnets is provided by pivoted covers. No maintenance is required on the compass except an occasional check on a compass rose with adjustment of the compensation, if necessary; and replacement of the lamp.

ENGINE INSTRUMENTS -- Refer to Figure 3-6.

TACHOMETER -- The tachometer is a mechanical indicator driven at half crankshaft speed by a flexible shaft. Most tachometer difficulties will be found in the driveshaft. To function properly, the shaft housing must be free of kinks, dents and sharp bends. There should be no bend on a radius shorter than six inches, and no bend within three inches of either terminal.



1. MANIFOLD PRESSURE/FUEL FLOW GAGE
2. CYLINDER HEAD TEMPERATURE GAGE
3. OIL PRESSURE GAGE
4. OIL TEMPERATURE GAGE
5. TACHOMETER
6. EXHAUST GAS TEMPERATURE

X16 14

Figure 3-6. Engine Instruments

OIL TEMPERATURE GAGE -- The oil temperature gage is a Bourdon-tube type pressure instrument connected by armored capillary tubing to a temperature bulb in the engine. The temperature bulb, capillary tube, and gage are filled with fluid and sealed. Expansion and contraction of the fluid in the bulb with temperature changes operates the gage.

OIL PRESSURE GAGE -- The Bourdon-tube type oil pressure gage is a direct-reading gage, operated by a pressure pickup line connected to the engine main oil galley.

FUEL FLOW INDICATOR -- The indicator is a fuel pressure gage calibrated to indicate gallons hour of fuel flow. It is operated by a pressure line from a fitting on the fuel injector flow divider.

MANIFOLD PRESSURE -- The manifold pressure/fuel flow gage is mounted to the left of the engine tachometer. The manifold pressure half of the gage is calibrated in inches of mercury and indicates the pressure in the induction air manifold.

CYLINDER HEAD TEMPERATURE -- The cylinder head temperature indications are controlled by an electrical resistance type temperature probe installed in the number four cylinder, and receives power from the aircraft electrical system.

EXHAUST GAS TEMPERATURE (EGT) GAGE -- An optional (EGT) gage may be installed in the instrument subpanel, directly above the engine control levers. The gage is used to aid the pilot in selecting various fuel-air mixtures for cruising flight at less than 75% power. Temperature indications for the EGT gage are provided by a temperature probe installed in the exhaust manifold.

SUCTION GAGE -- The suction gage, installed as part of the optional vacuum system, is mounted to the extreme left side of the main instrument panel. The gage indicates suction available for operation of the attitude and directional gyros.

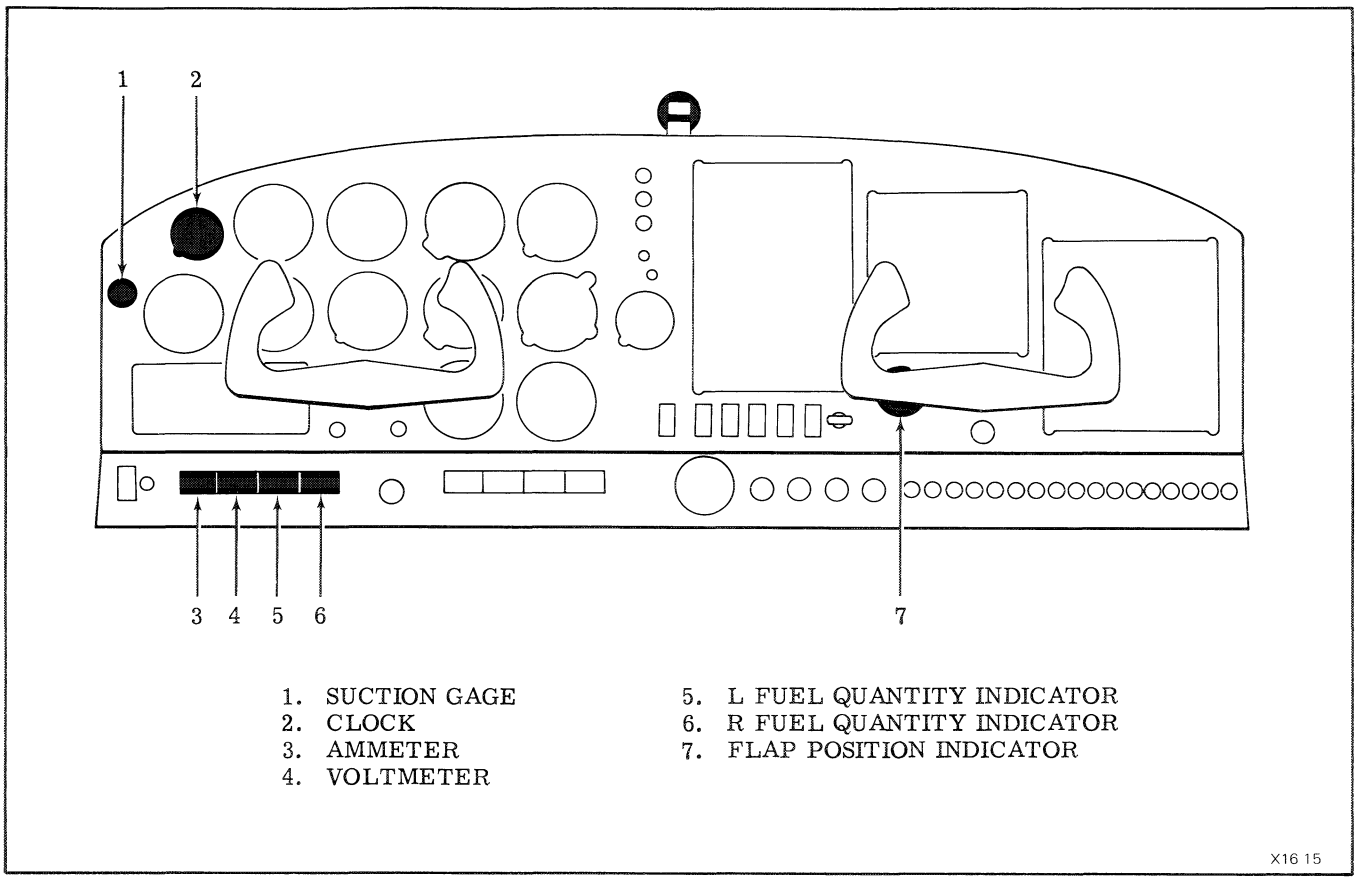


Figure 3-7. Miscellaneous Instruments

CLOCK -- The optional clock is an eight-day, stemwound stop clock, and provides a winding and time set knob on the lower left area of the dial.

AMMETER -- The sub-panel mounted ammeter indicates current flow, in amperes, from the alternator to the battery, or from the battery to the electrical system. With the engine operating, and both halves of the split master switch "ON", the ammeter indicates the rate of charge being applied to the battery. In the event of an alternator malfunction, or if the electrical load demand exceeds the alternator output, the ammeter will indicate the discharge rate of the battery.

VOLTMETER -- A voltmeter, located in the lower left instrument sub-panel, allows the pilot to monitor bus bar voltage. When the voltmeter is used in combination with the ammeter; alternator output, battery charge or discharge rate and accurate bus bar voltage can be determined. Normal voltmeter readings should be within the green arc (12-15 volts).

FUEL QUANTITY INDICATORS -- The fuel quantity indicators are used in conjunction with a float-operated variable-resistance transmitter in each fuel tank. The tank-full position of the transmitter float produces a minimum resistance through the transmitter, permitting maximum current flow through fuel quantity indicator and maximum pointer deflection.

FLAP POSITION INDICATOR -- Wing flap position is electrically indicated by a gage mounted directly to the right of the flap switch. Position indications are transmitted by a sender unit which is actuated by the flap motor jackscrew in the fuselage.

STALL WARNING SYSTEM -- The electrical stall warning system uses a vane-actuated switch installed in the left wing leading edge, to energize a stall warning horn located in the cabin. The stall warning switch is adjusted to provide aural warning at 5 to 10 MPH before the actual stall is reached and will remain on until the aircraft flight attitude is changed.

NOTE

With the master switch OFF, the stall and gear warning system are inoperative.

PITOT-STATIC SYSTEM

Pitot pressure is provided by the pitot tube installed near the center of the left wing lower surface. Pitot system tubing is routed from the pitot head, aft of the spar structure inboard to the wing root. A drain is located eight inches left of aircraft centerline immediately aft of the spar. From the drain, the tubing routes forward through the center console, to the instrument panel where pitot pressure is coupled to the airspeed indicator.

The static pressure points are located on both sides of the aft fuselage at station 205.00. Tube routing from static pressure points is up to a tee at aircraft centerline then forward through the upper cabin upholstery to windshield area. Line is then routed down the pilots side windshield post to the alternate static valve (which doubles as a drain) then to instrument panel where it is coupled to the altimeter, airspeed and vertical speed indicator.

ALTERNATE STATIC SOURCE VALVE -- A toggle-type alternate static source valve is installed in the instrument sub-panel directly below the landing gear position handle. In the event that the normal external static ports become obstructed, causing erroneous static pressure instrument readings, the alternate static source valve should be placed in the ALT position to provide an alternate (cabin) source of static pressure. When the alternate source valve is in the ALT position, the normal exterior static port lines are isolated and static pressure for the airspeed indicator, altimeter and vertical speed indicator is supplied strictly from inside the cabin.

Due to inside cabin pressure differential, operation with the static source valve on ALT will cause slight variations in the pitot-static system instruments. For detailed corrections consult the Correction Card installed in this airplane.

HEATING & VENTILATION SYSTEM

Three ventilation systems provide interior comfort control which can be suited to individual pilot and passenger preference.

The cabin heating system consists of an intake, within the nose cowl landing light housing, an exhaust shroud to heat the incoming air, and an air box assembly containing four separate outlets to direct heated air to two windshield defroster outlets or four cabin floor side outlets for interior heating.

Four separate knobs control adjustment and routing of the heated air; two labeled DEFROSTER control windshield defrosting, and two labeled CABIN HEAT control cabin heating. The heat and ventilation control knobs are located above the engine controls on the instrument sub-panel. Pulling the control knobs out to full extension will provide the maximum amount of heated airflow, intermediate settings will provide an adjustment in air temperature for individual requirements.

Two separate systems provide maximum air intake for cabin ventilation. The four individually adjustable outlets in the overhead console utilize an intake in the vertical fin leading edge. Each outlet port contains two knurled position wheels to control the amount and direction of airflow. The second system utilizes one intake in the inboard leading edge of each wing to supply four adjustable outlets at cabin floor level. The floor level system is tied into the cabin heating system through a series of cables to provide balanced airflow when the heating system is in operation.

SHOULDER HARNESSES

Inertia reel-type shoulder harnesses are installed in the pilot's and front passenger seats (rear seats are optional). The inertia restraint system provides optimum pilot and passenger mobility without undue restriction or constant adjustment of the harness. After the harness strap is extended from the seat back and secured to the seat belt, the inertia reel will permit free movement, so long as a sudden forward movement is not attempted. Sudden forward movement will automatically lock the inertia reel and shoulder harness to provide restraint. Relaxing forward pressure will unlock the inertia reel.

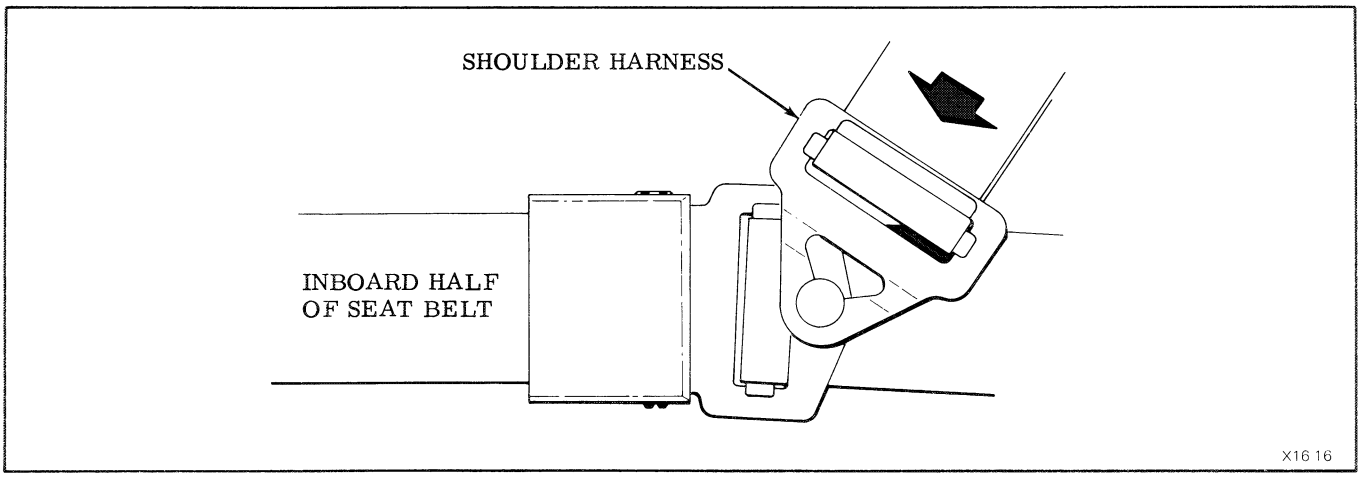


Figure 3-8. Shoulder Harness Secured

To secure the shoulder harness, refer to Figure 3-8, fasten the seat belt first. Extend the harness strap over the shoulder and lengthen sufficiently to allow the harness end to reach the seat belt. Secure by snapping the harness end plate over the metal stud located on the slotted half of the seat belt. To release the harness assembly quickly, simply unlatch the seat belt and allow the reel to retain the harness and seat belt portion against the seat back.

EMERGENCY LOCATOR TRANSMITTER (ELT) (SHARC-7)

The emergency locator transmitter (ELT) is installed on the left side of the floor console adjacent to the pilot's seat. As the name implies, this device is intended for EMERGENCY use only - in the event of a forced landing. Activating the ELT for other than emergencies should be limited to testing only. When properly armed, the ELT operates automatically upon impact, emitting a sweeping audio signal on 121.5 MH_Z. This signal provides electronic guidance for search aircraft to more easily determine the location of the downed aircraft.

Pilot/owner attention to the ELT consists mainly of periodic battery life inspection, testing of the unit, and insuring that the function switch on the ELT is placed in the ARM position prior to flight. Placing the function switch in ARM will allow the unit to be activated automatically by G force. Whenever the ELT function switch is placed in the ON position the transmitter will operate. Occasionally, during preflight operations, you should test the ELT to verify proper operation.

The following precautions must be observed:

1. Tests should be no longer than three audio sweeps.
2. Tests should be conducted only within the time period made up of the first five minutes after any hour.
3. If the operational test must be made at a time not included within the first five minutes after the hour, the test(s) should be coordinated with the closest FAA Tower or Flight Service Station.

To test the ELT transmitter, proceed as follows:

1. Aircraft master switch - ON.
2. Aircraft radio transceiver - ON, tune 121.5 MH_Z.
3. ELT antenna cable - DISCONNECT by depressing antenna connector and rotating one quarter turn.
4. ELT function switch - ON (for 3 AUDIO SWEEPS). This should provide a sufficient signal to be audible on your aircraft's transceiver, yet it will not disrupt surrounding communications.
5. ELT function switch - ARM.
6. ELT antenna cable - RECONNECT.

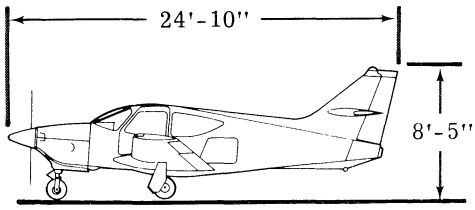
NOTE

ELT batteries must be replaced on or before the date stamped on the battery service life placard attached to the transmitter.

PART IV
SERVICING

TABLE OF CONTENTS

Some general procedures covering ground handling, servicing, and lubrication should be included in the pilots general knowledge of his aircraft. Those procedures most apt to be encountered or accomplished by a pilot are included in this section. When servicing or maintenance other than that outlined in this section, is required, refer to the applicable section of the Maintenance Manual.

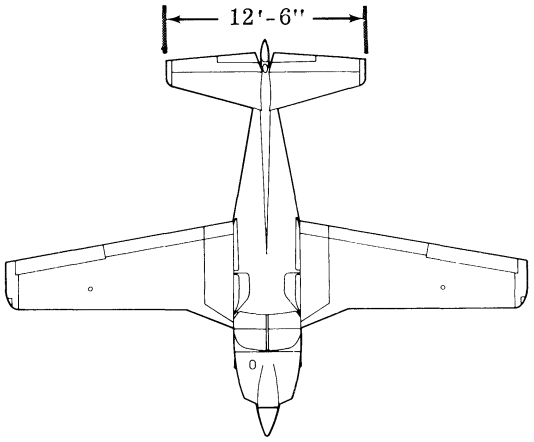


Type-Four Place, All-Metal, Low Wing, Retractable Gear Monoplane.

Engine-Lycoming IO-360-C1D6, 200 HP, Four Cylinder, Fuel Injected Engine.

Propeller-Hartzell #HC-E2YR-1BF/F7666A Constant Speed, All Metal Propeller.

Gross Weight	2650 LBS
Normal Fuel Capacity, Usable (100/130 Octane Min)	48 GAL
Add. Fuel Capacity, Usable	20 GAL
Total Oil Capacity	8 QTS
Main Gear Tires	6.00 x 6, 6 PLY
Pressure	29 PSI
Nose Gear Tire	5.00 x 5, 4 PLY
Pressure	31 PSI
Nose Strut Pressure	90 PSI
Main Strut Pressure	150 PSI



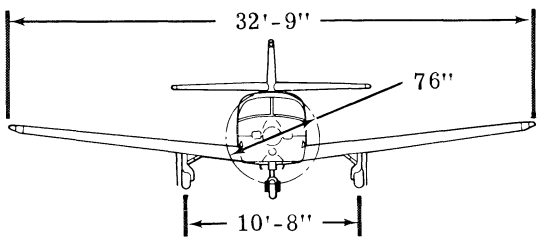


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Figure 4-1. Specifications

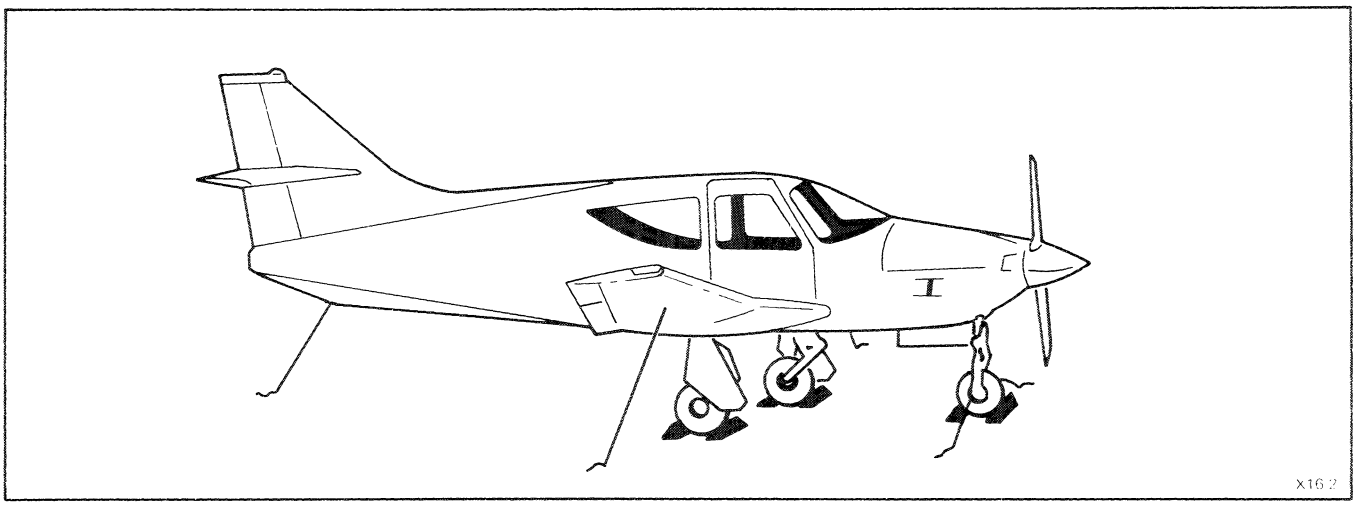

Figure 4-2. Typical Aircraft Tie-Down

GROUND HANDLING

PRECAUTIONS -- The following precautionary measures should be taken when handling the aircraft on the ground:

1. Do not set parking brake lever if brakes are overheated.
2. Do not set parking brake lever if brakes are wet and ambient air is 0°C or less as there is a possibility of moisture accumulation freezing in the brake assembly.
3. When operating the engine, remove all towing equipment and observe the following:
   a. Head aircraft into wind and chock wheels.
   b. Remove all control locks.
   c. All personnel, work stands, and equipment shall be clear of danger areas.
   d. Set parking brake.
   e. Position nose wheel straight ahead and hold rudder pedals in neutral position when operating engine at high power.
   f. Perform engine ground run in clear area to prevent foreign object damage to engine and propeller.

TOWING -- Movement of the aircraft on the ground may be accomplished by pulling and guiding aircraft with a tow bar. The nose gear will turn 30 degrees to each side of center for ordinary turning.

NOTE

Do not exceed nose wheel turning angle of 30 degrees either side of center, or damage to the nose gear will result.

MOORING -- It is recommended that the aircraft be hangared when not in use to minimize the deteriorating effect of weather and high wind. The aircraft may be secured in outside tie-down by nylon or manila rope. If manila rope is used for tie-down, allow enough slack to compensate for contraction of the rope fiber. Tie-down procedures are as follows:

1. Turn aircraft into wind, if possible, and install control wheel lock.
2. Chock both sides of each wheel and tie chocks together.
3. Place a rope around the nose gear strut near the base and, using a half-hitch, allow the two ends of the rope to extend an equal distance on each side of the nose wheel. Secure the ropes to tie-down points.
4. Secure a rope to the tailcone tie-down ring and secure to a point aft of the tail.

It is strongly recommended that exterior control surface locks be locally fabricated and installed at any time the aircraft is tied down. Also, soft foam rubber intake opening plugs will prevent foreign matter from accumulating inside the engine cowling.

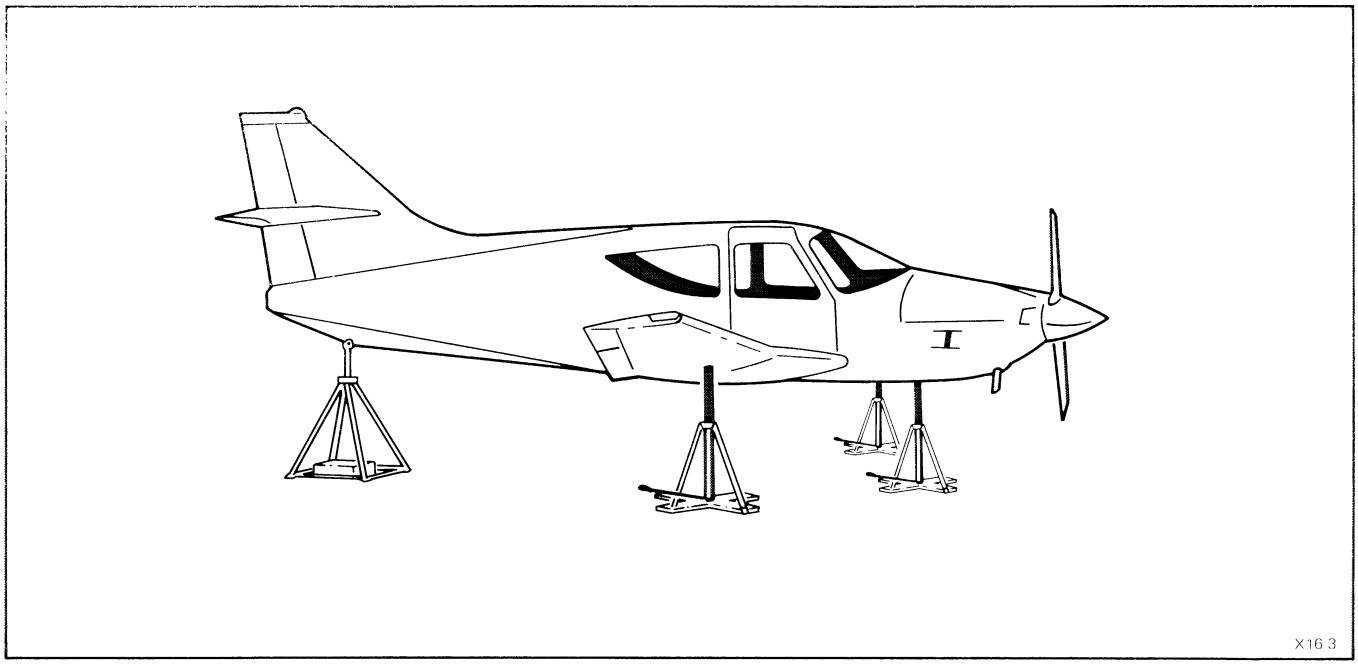

Figure 4-3. Jacking Arrangement

JACKING -- To jack the aircraft for landing gear maintenance, etc., refer to Figure 4-3 and proceed as follows:

1. Place jacks under jack pads on the underside of both wings and nose jack pad near the nose gear wheel well.
2. Attach a tail support stand to the tail tie-down fitting, and ballast as required.
3. Raise nose and wing jacks evenly until all three wheels are clear of the floor and struts have fully extended. Provide adequate clearance from floor surface if landing gear cycle tests are to be made.

CAUTION

Check that parking brake is released prior to lowering the aircraft after maintenance.

LEVELING -- To level the aircraft for weighing procedures, etc., proceed as follows:

1. Place aircraft in an enclosed hangar. If weighing is to be made, retract flaps if extended, install control wheel lock, remove all loose equipment from the aircraft and position adjustable seats in the forward position.
2. Place scales under jack stands at wing and nose jacking points. If scales are equipped with caster wheels, block wheels to prevent inadvertent movement.
3. Raise all three jacks evenly until aircraft is high enough to permit fore and aft leveling by adjustment of the nose jack.
4. Place a level on the exterior surface of the fuselage floor pan just aft of the nose wheel well. Minor lateral leveling adjustments can then be made by adjusting an individual wing jack.
5. Longitudinal leveling can now be made by placing a level in a fore and aft direction on the exterior floor pan surface and adjusting the nose jack as necessary.

STORAGE -- The aircraft is constructed of corrosion resistant alclad aluminum, however it is subject to oxidation, and must be periodically checked for signs of corrosion. The first indications of corrosion is the formation of white deposits or spots on unpainted surfaces. Painted surfaces will discolor or blister. The aircraft should be stored in a dry hangar for good preservation.

SHORT TERM (LESS THAN 28 DAYS). Special preservation measures are not required for airframe and system components if the aircraft is to be stored for 28 days or less. However, the following procedures should be accomplished before the aircraft is placed in storage.

1. Service fuel, engine oil and hydraulic systems.
2. Place fuel selector valve in the OFF position.
3. All electrical equipment OFF.
4. Install pitot cover, rubber intake plugs, gust locks and tie-down the aircraft if stored outside.
5. Clean and rotate tires regularly to prevent flat-spotting.
6. Remove and store battery during cold weather.
7. Rotate propeller through several revolutions by hand once every seven days after checking ignition switch 'OFF'.
8. Start engine and run-up to operating temperatures each 14 days.

LONG TERM (MORE THAN 28 DAYS). When the aircraft is to be stored for periods greater than 28 days, the general steps under Short Term should be followed to prepare the airframe for storage. In addition the engine must be prepared and stored in accordance with INSTALLATION AND STORAGE details contained in the Lycoming Operator's Manual.

RETURNING AIRCRAFT TO SERVICE. If proper procedures have been observed during storage, very little preparation will be necessary to reactivate the aircraft. Install a fully charged battery and perform a thorough inspection and preflight check. If the engine has been preserved, comply with the procedures for returning the engine to operation as detailed in the Lycoming Operator's Manual.

SERVICING

BATTERY -- The 12-volt battery is installed in the left side of the tailcone, and is accessible through the baggage compartment. Loosen and remove the fiberglas battery box cover for battery inspection and electrolyte level checks. A built-in plastic carry strap is provided for convenience in handling the battery if it becomes necessary to remove it from the battery box.

Check the battery electrolyte level frequently, especially during hot weather. If visual check shows low cell level, and no electrolyte is available at this time add distilled water to bring the cell(s) up to proper level. However, addition of water may result in as much as 15 point difference in specific gravity reading between cells not serviced and those receiving water in place of electrolyte.

LANDING GEAR

TIRES -- The nose and main gear tires and struts should be checked periodically for proper inflation.

	TIRE PRESSURE	STRUT PRESSURE
Nose Gear (5.00 x 5, 4 Ply)	31 PSI	90 PSI
Main Gear (6.00 x 6, 6 Ply)	29 PSI	150 PSI

The wheels and tires are balanced assemblies and the red dot on tire must align with yellow mark on tube. If tires are suspected of being out of balance, they may be balanced on automotive type balancing equipment.

When cleaning the tires, use only soap and water. Do not use solvents for cleaning, as they may produce harmful effects on sidewall rubber, etc. Tires should be rotated frequently whenever the aircraft is stored for extended periods to prevent flat-spotting.

SHOCK STRUT SERVICING -- Maintain nose strut air pressure at 90 PSI and main strut pressures at 150 PSI. Check the landing gear daily for general cleanliness, security of mounting, and hydraulic leaks. Keep machined surfaces of strut piston wiped free of dirt and dust, with a clean lint-free cloth saturated with MIL-H-5606 hydraulic fluid. Surfaces should be wiped free of excessive hydraulic fluid.

ENGINE OIL SYSTEM -- The oil level should be checked prior to each flight. Maintain a minimum of 6 quarts and fill to 8 quarts for extended duration flight. The oil may be changed every 100 hours of operation, provided that the filter element is changed each 50 hours. Oil that becomes dirty and contains sludge deposits should be changed regardless of time since last oil change.

When preflight check indicates low oil level, service with aviation grade engine oil as follows:

TEMPERATURE	GRADE
Below 10^{O}F	SAE 20W30 or SAE 20
0^{O}F to 70^{O}F	SAE 20W30 or SAE 30
30^{O}F to 90^{O}F	SAE 40
Above 60^{O}F	SAE 50

Detergent or "ashless-dispersant" oil, conforming to current Lycoming Service Instruction #1014 must be used.

NOTE

To promote faster ring seating and improved oil control, this aircraft was delivered from the factory with a mineral-type (non detergent) oil installed.

This type of "break-in" oil should be used for the FIRST 50 HOURS ONLY, at which time it should be drained and replaced with detergent oil.

After THE FIRST 25 HOURS of operation, drain engine oil, clean suction and oil pressure screens and replace the filter element. Refill the sump with non-detergent oil and use until the 50 HOUR mark is reached or oil consumption has stabilized, then change to detergent oil conforming to specifications.

FUEL SYSTEM -- The fuel tank filler caps are located on the upper outboard surface of each wing tank and contain anti-siphoning flapper valves. Do not service the aircraft with an octane rated lower than 100/130.

WARNING

Ground aircraft and fuel servicing equipment to the aircraft prior to servicing. Smoking in, or around the aircraft during refueling is strictly prohibited.

Service the aircraft from fuel facilities that utilize proper grounding equipment and filter systems to remove impurities and water accumulations from the bulk fuel. If filtering facilities are not available, filter the fuel through a quality grade chamois. Fuel tanks should be serviced after the last flight of each day to reduce condensation and allow any entrapped water accumulations to settle to the fuel system drains prior to the next flight.

TO REFUEL THE AIRCRAFT PROCEED AS FOLLOWS:

1. Verify battery switch OFF.
2. Remove filler cap and service with 100/130 octane fuel until level rises to filler opening.
3. Replace filler cap and check it for security.
4. Wash any spilled fuel from wings with clean water.
5. Repeat for opposite fuel tank.

FUEL DRAINS -- After servicing, all fuel drains should be checked for the presence of water or other impurities in the fuel system. Drain check the fuel system as follows:

1. Drain a fuel sample from the wing tank sumps on the inboard underside area of each tank.
2. Place fuel selector valve on interior center console on BOTH and pull to drain selector valve through bottom of fuselage. An outside assistant will be needed to obtain fuel sample.

NOTE

The fuel selector remote drain valve will also permit draining of the individual tank lines by switching to either RIGHT or LEFT and pulling up on valve handle. Return fuel selector valve to RIGHT or LEFT position to prevent fuel from flowing out of tank vent line.

3. Visually check that all drain valves close after draining.

If water is observed in the drain samples, there is a possibility that the tank sumps and lines contain additional water. Therefore, a complete re-draining check should be made.

HYDRAULIC SYSTEMS

LANDING GEAR POWER PACK -- To check the hydraulic power unit fluid level, remove the left side baggage compartment sidewall by releasing Velcro fastener. Remove the vent screw from the top of the power unit, and check fluid level. Service with MIL-H-5606 hydraulic fluid.

HYDRAULIC BRAKES -- The hydraulic brake system utilizes two fluid reservoirs incorporated on the pilot's rudder pedal cylinders. Each reservoir contains a plastic filler plug for inspection and servicing the system with MIL-H-5606 hydraulic fluid. Before removing a filler plug, wipe the top of the master cylinders to prevent dirt from entering the brake reservoir. Reservoir level should be maintained to the bottom of the filler plug opening.

The co-pilot's brakes are hydraulically interconnected to the pilot's master cylinders. If bleeding of brakes is required, refer to the Maintenance Manual.

LUBRICATION. See Figure 4-4.

AIRCRAFT FINISH CARE

EXTERIOR CLEANING -- Climate and operating conditions will determine the extent and frequency of cleaning required. Frequent washings when operating near salt water areas will help to minimize corrosion. Use a mild commercial soap to wash the aircraft and rinse with clean water. The exterior surfaces may be waxed with a quality grade automotive paste wax after allowing adequate curing time.

Inspection of propeller blades for nicks, and wiping them occasionally with an oil cloth to clean off stains, will assure long trouble-free operation. Small nicks, particularly near the prop tips and on the leading edges, should be dressed out as soon as practical since these nicks can produce stress concentrations. Never use an alkaline cleaner on the blade surfaces; remove dirt with carbon tetrachloride or equivalent solvent.

INTERIOR CLEANING -- Clean the aircraft interior with commercial cleaning compounds designated for plastic, vinyls and rug materials. Before applying any cleaner, carefully read the directions and test the cleaner on an obscure piece of material to check its compatibility and cleaning reaction.

APPLICATION SYMBOL	SPECIFICATIONS AND TYPE OF LUBRICATION
HAND PACK	MIL-G-3545 HIGH TEMPERATURE AIRCRAFT GREASE
(HF) CLOTH WIPE	MIL-H-5606 HYDRAULIC FLUID
OIL CAN	MIL-L-7870 LOW TEMPERATURE GENERAL PURPOSE LUBRICATING OIL.
50 HRS. / 100 HRS. / AS REQD	

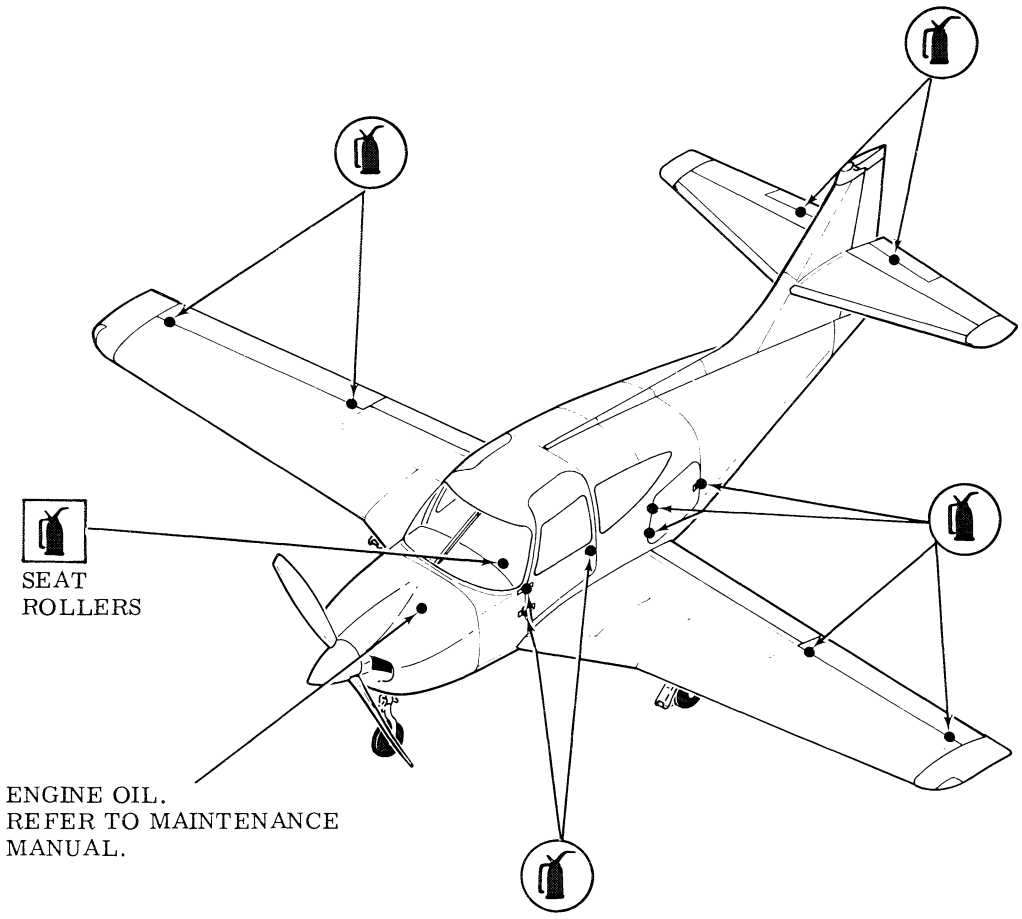

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Figure 4-4. Lubrication Chart (Sheet 1 of 2)

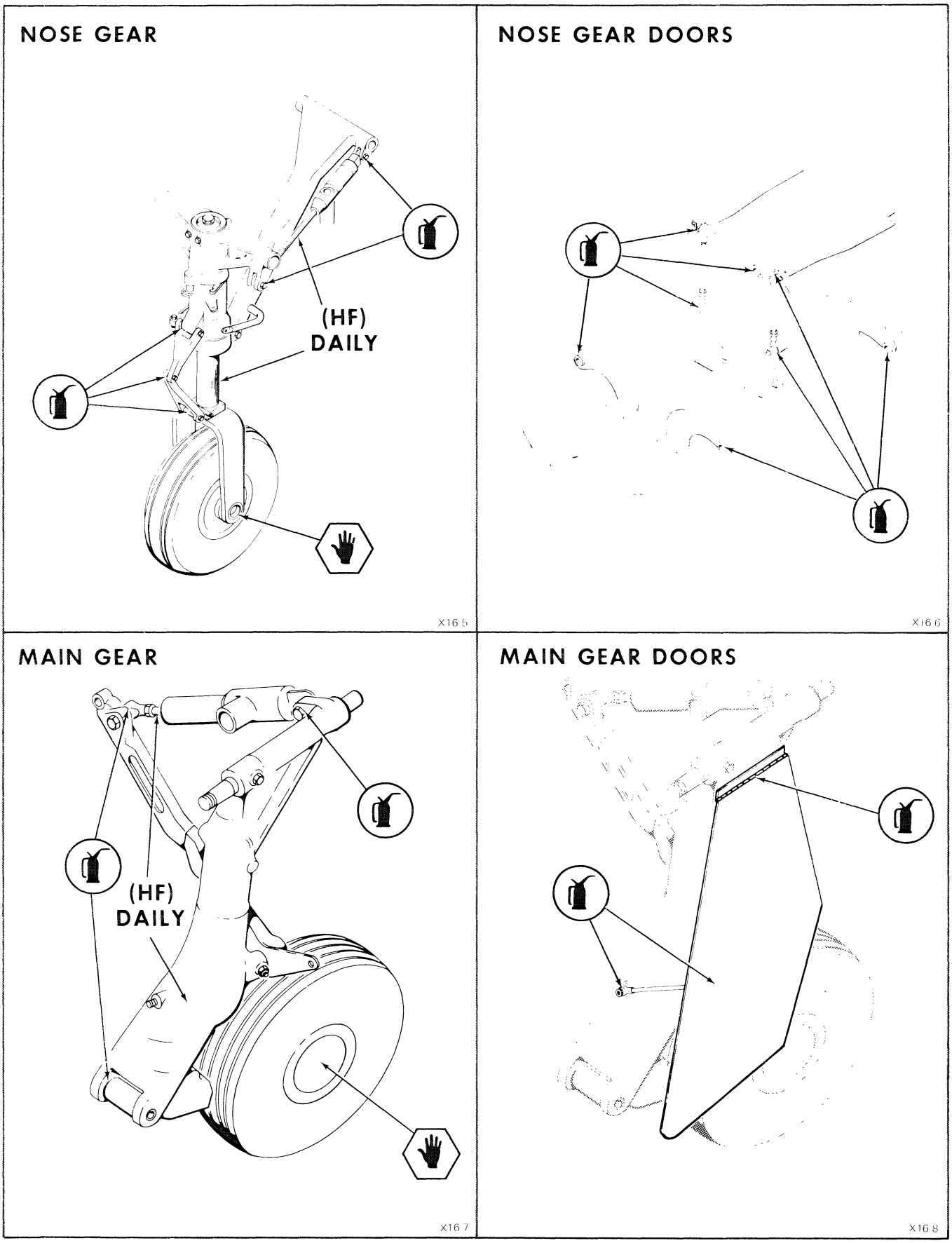

Figure 4-4. Lubrication Chart (Sheet 2 of 2)

Service Information

Rockwell International
General Aviation Division
5001 North Rockwell Avenue
Bethany, Oklahoma 73008

SERVICE INFORMATION NO. SI-101B
(Supersedes and Replaces Service Information No. SI-101A in its entirety.)

DATE: 19 September 1975

ATTENTION

With the exception of the Restricted Category Model S-2R you cannot fly your aircraft legally without a current Flight Manual on board. Read this Service Information letter carefully.

The General Aviation Division of Rockwell International delivers with each aircraft a Maintenance Manual and an FAA Approved Flight Manual. All revisions to the initially furnished Flight Manual and Maintenance Manual will be provided to the aircraft owners free of charge. The aircraft owner will also receive, on a continuing basis, free of charge, Service Releases (which include Service Bulletins, Service Letters, Service Information and Custom Kit Sales Sheets).

Approved Aircraft Distributors will receive one (1) copy of each applicable Technical Manual, and Revisions and five (5) copies of each Service Release (Service Bulletin, Service Letter, Service Information and Custom Kit), and their Revisions at no charge.

Technical Manuals and Service Releases are available, for purchase from the Aircraft Manufacturer. Revisions to purchased manuals will be provided, free of charge, as long as the General Aviation Division, Publications Department has a valid address on file.

NOTE

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Prices of Technical Manuals with continuing Revisions are as follows:

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PARTS CATALOGS

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A Technical Manual Order Form (applicable to your aircraft) is attached. The Order Forms will also be made available to all Distributors and Dealers, and a copy included in all Technical Manuals.

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ROCKWELL COMMANDER TWIN ENGINE TECHNICAL MANUAL ORDER FORM

FLIGHT MANUALS

MODEL	PRICE	QTY	$ TOTAL
500	$50.00	____	_____
500A		____	_____
500B		____	_____
500S		____	_____
500U		____	_____
520		____	_____
560		____	_____
560A		____	_____
560E		____	_____
560F		____	_____
680		____	_____
680E		____	_____
680F		____	_____
680FL (8000 lb)		____	_____
680FL (8500 lb)		____	_____
680FL(P)		____	_____
680F(P)		____	_____
680T		____	_____
680V		____	_____
680W		____	_____
681		____	_____
685		____	_____
720	$50.00	____	_____
690	$75.00	____	_____
690A	$75.00	____	_____
	TOTAL	====	====

MAINTENANCE MANUALS

MODEL	PRICE	QTY	$ TOTAL
500	$25.00	____	_____
500A		____	_____
500B		____	_____
500S		____	_____
500U		____	_____
520/560		____	_____
560A		____	_____
560E		____	_____
560F		____	_____
680/680E		____	_____
680F		____	_____
680FL/680FL(P)		____	_____
680F(P)		____	_____
680T/680V		____	_____
680W		____	_____
681		____	_____
685		____	_____
690		____	_____
690A		____	_____
720	$25.00	____	_____
	TOTAL	====	====

SERVICE RELEASES

One Set	$50.00	____	_____

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VOLUME III - Model 680FL, 680FL(P)		____	_____
VOLUME IV - Model 680T, 680V, 680W,681		____	_____
VOLUME V - Model 500S	$25.00	____	_____
	TOTAL	____	_____

MODEL	PRICE	QTY	$ TOTAL
685	$25.00	____	_____
690		____	_____
690A	$25.00	____	_____
	TOTAL	____	_____

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