P/N M114001-1

COMMANDER 114
OPERATING HANDBOOK

Print Date. 10/1/98

GULFSTREAM COMMANDER

114

PILOTS
OPERATING HANDBOOK

ISSUED: 21 FEBRUARY 1976
REVISED: 16 JULY 1986

MANUFACTURERS SERIAL NO.______________________

REGISTRATION NO.______________________________

FAA Approved in Normal Category based on FAR 23. This document must be carried in the airplane at all times.

This Handbook includes the material required to be furnished to the pilot by FAR 23 and constitutes the Approved Airplane Flight Manual. This Handbook should not be used for operation purposes unless it is maintained in a current status.

FAA Approved A.C. Jackson
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DEL OP PC-203

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P/N M114001-1

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FAA Approved: 16 July 1986

Delegation Option PC-203

Revision 1	5-18-76
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Revision 3	10-01-76
Revision 4	3-03-77
Revision 5	4-06-77
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SECTION I

GENERAL

TABLE OF CONTENTS

INTRODUCTION

This handbook must be read carefully by the owner and operator in order to become familiar with the operation of the Rockwell Commander 114. This handbook includes the material required to be furnished to the pilot by FAR Part 23 and constitutes the Approved Airplane Flight Manual. It also contains additional data supplied by the airframe manufacturer. The FAA Approved data is identified by the notation "Data on this page is F.A.A. Approved" at the bottom of each page, as applicable.

CONTENTS OF HANDBOOK

The Pilot's Operating Handbook is designed to contain information necessary for safe and efficient operation of the Rockwell Commander 114. The handbook is divided into nine sections as follows:

- Section I General
- Section II Limitations
- Section III Emergency Procedures
- Section IV Normal Procedures
- Section V Performance
- Section VI Weight and Balance/Equipment List
- Section VII Airplane and Systems Description
- Section VIII Airplane Handling, Service and Maintenance
- Section IX Supplements

NOTE

Since a large number of Rockwell Commander 114's are equipped with different varieties of optional equipment, the illustrations shown in this handbook will not be typical of every airplane.

REVISING THE HANDBOOK

The "List of Effective Pages" contains a list of all pages in the Pilot's Operating Handbook and their issue date. When a page of the handbook is revised or changed, the "List of Effective Pages" will reflect the revision number and date of that revision. Upon receipt of revised pages from Rockwell International, the revised pages must be inserted in the handbook and the obsoleted pages removed and destroyed.

NOTE

It is the responsibility of the pilot to assure this handbook is current when using it to operate the Rockwell Commander 114.

AIRPLANE DIMENSIONS

See Figure 1-1.

DESCRIPTIVE DATA

ENGINE

One Lycoming IO-540-T4A5D (Serial Numbers 14000 thru 14149)
IO-540-T4B5D (Serial Number 14150 and Subs.)

Engine Type: Reciprocating, normally-aspirated, fuel injected, direct-drive, air-cooled, horizontally-opposed, six-cylinder, 541.5 cubic inch displacement.

Maximum Horsepower Rating: 260 BHP at 2700 RPM.

PROPELLER

One constant speed, hydraulically actuated, two-bladed Hartzell propeller, Model Number HC-C2YR-1BF/F8467-7R. Diameter: 77 inches. Pitch Change: 14.2° (low pitch) to 30° (high pitch) at Propeller Station 30.0.

FUEL

Approved Fuel Grade (Color): 100/130 Aviation Fuel (Green). 100 LL Aviation Fuel (Blue) is an approved alternate.
Total Fuel Capacity: 70 Gallons.
Usable Fuel Capacity: 68 Gallons.

OIL

TYPES (Specifications)	MINERAL (MIL-L-6082B)	ASHLESS DISPERSANT (MIL-L-22851)

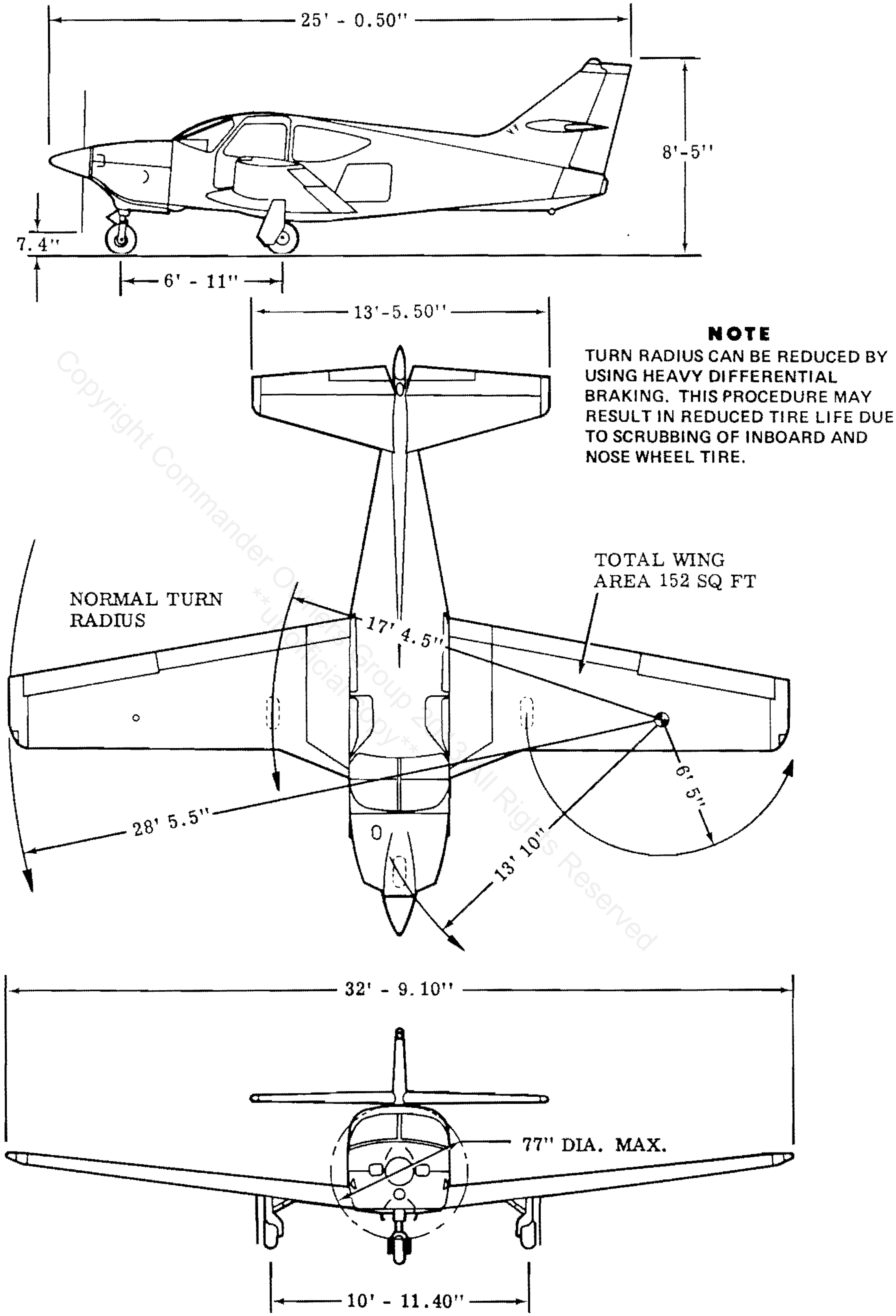


Figure 1-1. Airplane Dimensions

Grades and Recommended Operating Temperatures:

MINERAL (MIL-L-6082B)	AMBIENT AIR TEMP.
SAE 50	Above 60°F
SAE 40	30° to 90°F
SAE 30	0° to 70°F
SAE 20	Below 10°F

ASHLESS DISPERSANT (MIL-L-22851)	AMBIENT AIR TEMP.
SAE 50 or 40	Above 60°F
SAE 40	30° to 90°F
SAE 40 or SAE 30	0° to 70°F
SAE 30	Below 10°F

NOTE

For more detailed information concerning oil servicing, refer to the airplane maintenance manual.

Total Oil Capacity: 8 Quarts
Minimum Safe Oil Quantity: 2 Quarts

Normal Oil Quantity Operating Range: 6 to 8 Quarts

MAXIMUM CERTIFICATED WEIGHTS

NOTE

Utility Category applicable to Serial Numbers 14000 thru 14254 with Custom Kit No. CK-114-1 installed, and Serial Numbers 14255 and Subs.

Maximum Takeoff Weight:
- Normal Category 3140 lbs.
- Utility Category 2800 lbs.

Maximum Landing Weight: 3140 lbs

Maximum Weight in Baggage Compartment: 200 lbs.

Maximum Zero Fuel Weight for Normal Category: 2852 lbs from 24.7% MAC to 31.5% MAC 2250 lbs at 12% MAC varying linearly to 2852 lbs at 24.7% MAC.

Maximum Zero Fuel Weight for Utility Category: 2500 lbs from 17.27% MAC to 26.0% MAC 2250 lbs at 12% MAC varying linearly to 2500 lbs at 17.27% MAC.

MINIMUM CERTIFICATED WEIGHTS

Minimum Weight - Normal Category
2023 lbs at 12.00% MAC to
2028 lbs at 14.70% MAC to
2266 lbs at 26.00% MAC to
2503 lbs at 31.50% MAC.

Minimum Weight - Utility Category
2023 lbs at 12.00% MAC to
2028 lbs at 14.70% MAC to
2266 lbs at 26.00% MAC.

NOTE

Straight line variation between points.

STANDARD AIRPLANE WEIGHTS

Standard Airplane Weight for Serial Numbers 14000 thru 14149:	1840 lbs	Standard Useful Load for Serial Numbers 14000 thru 14149:	1300 lbs
Standard Empty Weight for Serial Numbers 14150 and Subs:	1885 lbs	Standard Useful Load for Serial Numbers 14150 and Subs:	1255 lbs

CABIN AND ENTRY DIMENSIONS

Maximum Cabin Width:	47 in.	Minimum Entry Width:	18 in.
Maximum Cabin Length:	75 in.	Minimum Entry Height:	34 in.
Maximum Compartment Height:	49 in.	Minimum Door Sill Height:	11 in.

BAGGAGE SPACE AND ENTRY DIMENSIONS

Compartment Width:	44 in. Front 40 in. Rear	Compartment Volume:	22 cu.ft.
		Minimum Entry Width:	21 in.
Compartment Length:	28 in.	Minimum Entry Height:	18 in.
Compartment Height:	36 in.		

SPECIFIC LOADINGS

Wing Loading: 20.7 lbs/sq.ft. Power Loading: 12.1 lbs/hp.

SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

GENERAL AIRSPEED TERMINOLOGY AND SYMBOLS

CAS — Calibrated Airspeed means the indicated speed of an aircraft, corrected for position and instrument error. Calibrated airspeed is equal to True Airspeed in a standard atmosphere at sea level.

KCAS — Calibrated Airspeed expressed in "Knots".

GS — Ground Speed is the speed of the aircraft relative to the ground.

IAS — Indicated Airspeed is the speed of an aircraft as shown in the airspeed indicator when corrected for instrument error. IAS values published in this handbook assumes zero instrument error.

KIAS — Indicated Airspeed expressed in "Knots".

TAS — True Airspeed is the airspeed of an airplane relative to undisturbed air and is the CAS corrected for altitude, temperature and compressibility.

V_A — Maneuvering Speed is the maximum speed at which application of maximum available aerodynamic control will not overstress the airplane.

V_{FE} — Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a prescribed extended position.

V_{LE} — Maximum Landing Gear Extended Speed is the maximum speed at which an aircraft can be safely flown with the landing gear extended.

V_{LO} — Maximum Landing Gear Operating Speed is the maximum speed at which the landing gear can be safely extended or retracted.

V_{NE} / M_{NE} — Never Exceed Speed or mach number is the speed limit that may not be exceeded at any time.

V_{NO} / M_{NO} — Maximum Structural Cruising Speed or Mach Number is the speed that should not be exceeded except in smooth air and then only with caution.

V_S — Stalling Speed or the minimum steady flight speed at which the aircraft is controllable.

V_{SO} — Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration.

V_X — Best Angle of Climb Speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.

V_Y — Best Rate-of-Climb Speed is the airspeed which delivers the greatest gain in altitude in the shortest possible time.

METEOROLOGICAL TERMINOLOGY

ISA — International Standard Atmosphere in which
(1) The air is a dry perfect gas;
(2) The temperature at Sea Level is 15° Celsius (59° Fahrenheit);
(3) The pressure at Sea Level is 29.92 inches Hg. (1013.2 Millibars);
(4) The temperature gradient from sea level to the altitude at which the temperature is -56.6°C (-69.7°F) is -0.00198°C (-0.003566°F) per foot and Zero above that altitude.

OAT — Outside Air Temperature is the free air static temperature obtained either from inflight temperature indications or ground meteorological sources, corrected for instrument error and compressibility effects.

Indicated Pressure Altitude — The number actually read from an altimeter when the barometric subscale has been set to 29.92 inches Hg. (1013.2 Millibars).

Pressure Altitude — Altitude measured from standard sea level pressure (29.92 In.Hg.) by a pressure or barometric altimeter. It is the indicated pressure altitude corrected for position and instrument error. In this handbook, altimeter instrument errors are assumed to be zero.

Station Pressure — Actual atmospheric pressure at field elevation.

Wind — The wind velocities recorded as variables on the charts of this handbook are to be understood as the headwind or tailwind components of the reported winds.

POWER TERMINOLOGY

MCP — Maximum Continuous Power (MCP) is the maximum power rating not limited by time. It is obtained by setting full throttle at 2700 RPM, full rich mixture setting. For this airplane, the takeoff power limitation is the same as maximum continious power.

Leaning Procedure

Above 75%: Full rich only.

75% and Below: BEST POWER: This mixture guarantees, for a given manifold pressure and engine speed setting that maximum power is obtained from the engine. It is recommended that the best power mixture be determined by using the EGT gauge to determine the peak temperatures and then enrichening the fuel mixture until the EGT decreases by 100 degrees Fahrenheit from peak.

BEST ECONOMY: This mixture guarantees for a given manifold pressure and engine speed setting the minimum acceptable fuel flow rates for a particular power level. It is recommended that the best economy mixture be determined by setting peak EGT. For flight planning purposes use schedules on fuel flow rates found in Section V.

ENGINE CONTROLS AND INSTRUMENTS

Throttle — A control in the cockpit that enables the pilot to control manifold pressure.

Propeller Control — A control in the cockpit that enables the pilot to adjust propeller speed.

Mixture Control — A control in the cockpit that enables the pilot to control the fuel/air ratio.

Alternate Air Control — A control in the cockpit that enables the pilot to select induction air from an alternate sheltered source.

EGT — Exhaust Gas Temperature is the temperature of the exhaust gases measured in the exhaust riser of cylinder No.2. As a direct relationship exists between EGT and fuel/air ratio, leaning is often accomplished with reference to the peak EGT.

Tachometer — An instrument that indicates engine speed.

Manifold Pressure Gage — An instrument that indicates the pressure in the induction air manifold.

Propeller Governor — An engine component located on the engine which maintains a selected propeller RPM, and is set by the propeller control.

AIRPLANE PERFORMANCE AND FLIGHT PLANNING TERMINOLOGY

Climb Gradient — The ratio of the height gained during some period of a climb, to the horizontal distance traversed in the same time interval.

Demonstrated Crosswind Velocity	The demonstrated crosswind velocity (19kts) is the velocity of the crosswind component for which adequate control of the airplane during takeoff and landing was actually demonstrated during certification tests. The value shown is not considered to be limiting.
MEA	Minimum enroute IFR altitude.
Route Segment	A part of a route. Each end of that part is identified by: (1) a geographical location; or (2) a point at which a definite radio fix can be established.

WEIGHT AND BALANCE

Reference Datum	An imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Fuselage Station	A location along the airplane fuselage given in terms of distance from the reference datum.
Arm	The horizontal distance from the reference datum to the center of gravity (C.G.) of an item.
Moment	The product of the weight of an item multiplied by its arm. (For convenience, moment is sometimes quoted in 1000's of In-Lbs to reduce the number of digits.)
Tare	The weight of chocks, blocks, stands, etc., that were on the scales when the airplane was weighed. The weight of these items or other items present during weighing which will not be present during flight has to be subtracted from the scale reading(s) to determine the actual weight of the airplane.
Center of Gravity (C.G.)	The datum station about which an airplane would balance, if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the airplane.
C.G. Arm	The arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.
C.G. Limits	The extreme center of gravity locations within which the airplane must be operated at a given weight. (See Section II, Limitations.)
Usable Fuel	Fuel available for flight planning (68 U.S. gallons).
Unusable Fuel	Fuel remaining after a runout test has been completed in accordance with governmental regulations.
Payload	Weight of occupants, cargo and baggage.
Maximum Takeoff Weight	Maximum weight approved for start of takeoff run.
Maximum Landing Weight	Maximum weight approved for landing touchdown.
Maximum Zero Fuel Weight	Maximum weight exclusive of usable fuel.
Minimum Flying Weight	Minimum weight approved for all operations.

The following terms apply to Serial Numbers 14000 thru 14149:

Airplane as Weighed	The airplane as specified per Sales Order plus full oil, full operating fluids and no fuel.

Corrected Empty Weight	Standard airplane weight plus optional equipment, unusable fuel and minus drainable oil.
Standard Airplane Weight	Corrected empty weight minus optional equipment.
Loading Sub-total	Corrected empty weight plus drainable oil and 170 pound pilot.
Useful Load	Difference between takeoff weight, or ramp weight if applicable, and corrected empty weight.
Standard Useful Load	Difference between takeoff weight, or ramp weight it applicable, and standard airplane weight.

The following terms apply to Serial Number 14150 and Subs:

Standard Empty Weight	Standard airplane with unusable fuel, full oil, full hydraulic and operating fluids, standard interior, seating, instruments, accessories and all other standard equipment. No optional avionics or miscellaneous equipment.
Airplane As Weighed	The airplane as specified per sales order, plus full oil, full hydraulic and operating fluids and unusable fuel.
Basic Empty Weight	Airplane as weighed plus ballast for optional equipment, if required.
Dry Empty Weight	Basic empty weight minus all oil, all unusable fuel and all hydraulic and operating fluids.
Empty Weight	Basic empty weight minus drainable oil.
Standard Dry Empty Weight	Dry empty weight of a standard airplane (no optional equipment or associated ballast).
Standard Useful Load	Difference between takeoff weight, or ramp weight if applicable, and standard empty weight.
Useful Load	Difference between takeoff weight, or ramp weight if applicable, and basic empty weight.

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.

SECTION II

LIMITATIONS

TABLE OF CONTENTS

INTRODUCTION

This section of the Pilot's Operating Handbook presents the various operating limitations, the significance of such limitations, instrument markings, color coding and basic placards necessary for the safe operation of the airplane, its powerplant, standard systems and standard equipment.

The Limitations included in this section have been approved by the Federal Aviation Administration. For additional limitations refer to FAA Type Certificate Data Sheet # A12S0.

AIRSPEED LIMITATIONS

NOTE

Utility Category is applicable to Serial Numbers 14000 thru 14254 with Custom Kit No. CK-114-1 installed, and Serial Numbers 14255 and Subs.

SPEED	KCAS	KIAS	REMARKS
Maneuvering V_A	Normal Category		Do not make full or abrupt control movements above this speed.
	118 (3140 lbs)	116	
	109 (2658 lbs)	107	
	95 (2023 lbs)	93	
	Utility Category		
	120 (2800 lbs)	118	
	107 (2250 lbs)	105	
	102 (2023 lbs)	100	

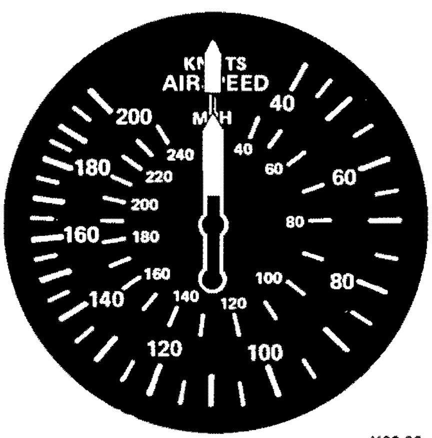
Figure 2-1. Airspeed Limitations (Sheet 1 of 2)

SPEED	KCAS	KIAS	REMARKS
Maximum Flap Extended V_{FE}	150 (0-20°) 120 (20-25°) 109 (25-35°)	150 120 109	Do not exceed this speed with a given flap setting.
Maximum Landing Gear Operating V_{LO}	130	129	Do not extend or retract landing gear above this speed.
Maximum Landing Gear Extended V_{LE}	186	187	Do not exceed this speed with landing gear extended. Do not exceed V_{NE}.
Never Exceed V_{NE}	186* (SL-12,500 ft) 175 (16,000 ft) 161 (20,000 ft) 147 (24,000 ft)	187 175 160 145	Do not exceed this speed in any operation.
Maximum Structural Cruising V_{NO}	148* (SL-12,500 ft) 139 (16,000 ft) 128 (20,000 ft) 117 (24,000 ft)	147 137 126 115	Do not exceed this speed except in smooth air and then only with caution.
Maximum Cowl Flaps Open**	130	129	Do not exceed this speed with the cowl flaps open.
Maximum Side Window Open	130	129	Do not exceed this speed with the side window open.

*Straight Line Variation between points. **Serial Numbers 14000 thru 14149 only.

Figure 2-1. Airspeed Limitations (Sheet 2 of 2)

AIRSPEED INDICATOR MARKINGS



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MARKING	KCAS	KIAS	SIGNIFICANCE
White Arc	53-109	58-108	Full Flap Operating Range. Lower limit is maximum weight stalling speed in landing configuration. Upper limit is maximum speed allowable with flaps fully extended.
Green Arc	60-148	65-147	Normal Operating Range. Lower limit is maximum weight stalling speed with flaps and landing gear retracted. Upper limit is maximum structural cruising speed.
Yellow Arc	148-186	147-187	Operations must be conducted with caution.
Red Line	186	187	Maximum Speed for ALL operations.
NOTE: Airspeed indicator markings are based on Calibrated Airspeeds.			

Figure 2-2. Airspeed Indicator Markings

POWER PLANT LIMITATIONS

ENGINE

Lycoming IO-540-T4A5D (Serial Numbers 14000 thru 14149
IO-540-T4B5D (Serial Numbers 14150 and Subs.).

Engine Operating Limits for Takeoff and Continuous Operations:

Maximum BHP	-	260
Maximum RPM	-	2700
Maximum Cylinder Head Temp.	-	500°F
Maximum Oil Temperature	-	245°F
Minimum Oil Pressure	-	25 PSI
Maximum Oil Pressure		
S/N 14000 thru 14349	-	90 PSI
S/N 14350 and Subs	-	100 PSI
Minimum Fuel Injector Inlet Pressure	-	14 PSI
Maximum Fuel Injector Inlet Pressure	-	45 PSI
Maximum Fuel Nozzle Pressure	-	9.5 PSI

POWERPLANT INSTRUMENT MARKINGS

INSTRUMENTS	RED LINE MINIMUM LIMIT	YELLOW ARC CAUTION RANGE	GREEN ARC NORMAL OPERATING	YELLOW ARC CAUTION RANGE	RED LINE MAXIMUM LIMIT
TACHOMETER (RPM)	—	—	2200-2700	—	2700
OIL TEMPERATURE (°F)	—	100-160	160-245	—	245
CYLINDER HEAD TEMPERATURE (°F)	—	—	200-500	—	500
OIL PRESSURE (PSI)					
S/N 14000 thru 14349	25	25-60	60-90	—	90
S/N 14350 and Subs	25	25-60	60-90	90-100	100
FUEL FLOW (GPH)	—	—	—	—	9.5 PSI (27.5 GPH)
FUEL PRESSURE (PSI)	14	—	14-45	—	45

Figure 2-3. Power Plant Instrument Markings

ELECTRICAL SYSTEM LIMITS

Maximum allowable voltmeter reading (red line) is 16.0 volts.

SEATS

Front seats must be in upright position for takeoff and landing.

No passengers allowed in the rear seat during utility category operations.

WEIGHT LIMITS

NOTE

Utility Category applicable to Serial Numbers 14000 thru 14254 with Custom Kit No. CK-114-1 installed, and 14255 and Subs.

Maximum Takeoff Weight:	
Normal Category	3140 lbs.
Utility Category	2800 lbs.
Maximum Landing Weight:	3140 lbs.
Maximum Weight in Baggage Compartment:	200 lbs.

Maximum Zero Fuel Weight for Normal Category	2852 lbs from 24.7% MAC to 31.5% MAC 2250 lbs at 12% MAC varying linearly to 2852 lbs at 24.7% MAC.
Maximum Zero Fuel Weight for Utility Category	2500 lbs from 17.27% MAC to 26.0% MAC 2250 lbs at 12% MAC varying linearly to 2500 lbs at 17.27% MAC.

Minimum Weight:

Normal Category
2023 lbs at 12.00% MAC to
2028 lbs at 14.70% MAC to
2266 lbs at 26.00% MAC to
2503 lbs at 31.50% MAC.

Utility Category
2023 lbs at 12.00% MAC to
2028 lbs at 14.70% MAC to
2266 lbs at 26.00% MAC.

NOTE

Straight line variation between points.

CENTER OF GRAVITY LIMITS

NORMAL CATEGORY

Forward:
106.91 Inches Aft of Datum (25.0% MAC) at 3140 lbs.
101.11 Inches Aft of Datum (14.5% MAC) at 2658 lbs.
99.75 Inches Aft of Datum (12.0% MAC) at 2250 lbs.
99.75 Inches Aft of Datum (12.0% MAC) at 2023 lbs.

Aft:
110.50 Inches Aft of Datum (31.5% MAC) at 3140 lbs.
110.50 Inches Aft of Datum (31.5% MAC) at 2503 lbs.

Maximum Zero Fuel Weight

106.74 Inches (24.7% MAC) to 110.50 Inches (31.5% MAC) at 2852 lbs.
99.75 Inches (12.0% MAC) at 2250 lbs. to 106.74 Inches (24.7% MAC) at 2852 lbs.

UTILITY CATEGORY

Forward:
102.82 Inches Aft of Datum (17.57% MAC) at 2800 lbs.
101.11 Inches Aft of Datum (14.5% MAC) at 2658 lbs.
99.75 Inches Aft of Datum (12.0% MAC) at 2250 lbs.
99.75 Inches Aft of Datum (12.0% MAC) at 2023 lbs.

Aft:
107.46 Inches Aft of Datum (26.0% MAC) at 2800 lbs.
107.46 Inches Aft of Datum (26.0% MAC) at 2266 lbs.

Maximum Zero Fuel Weight

102.66 Inches (17.27% MAC) to 107.46 Inches (26.0% MAC) at 2500 lbs.
99.75 Inches (12.0% MAC) at 2250 lbs. to 102.66 Inches (17.27% MAC) at 2500 lbs.

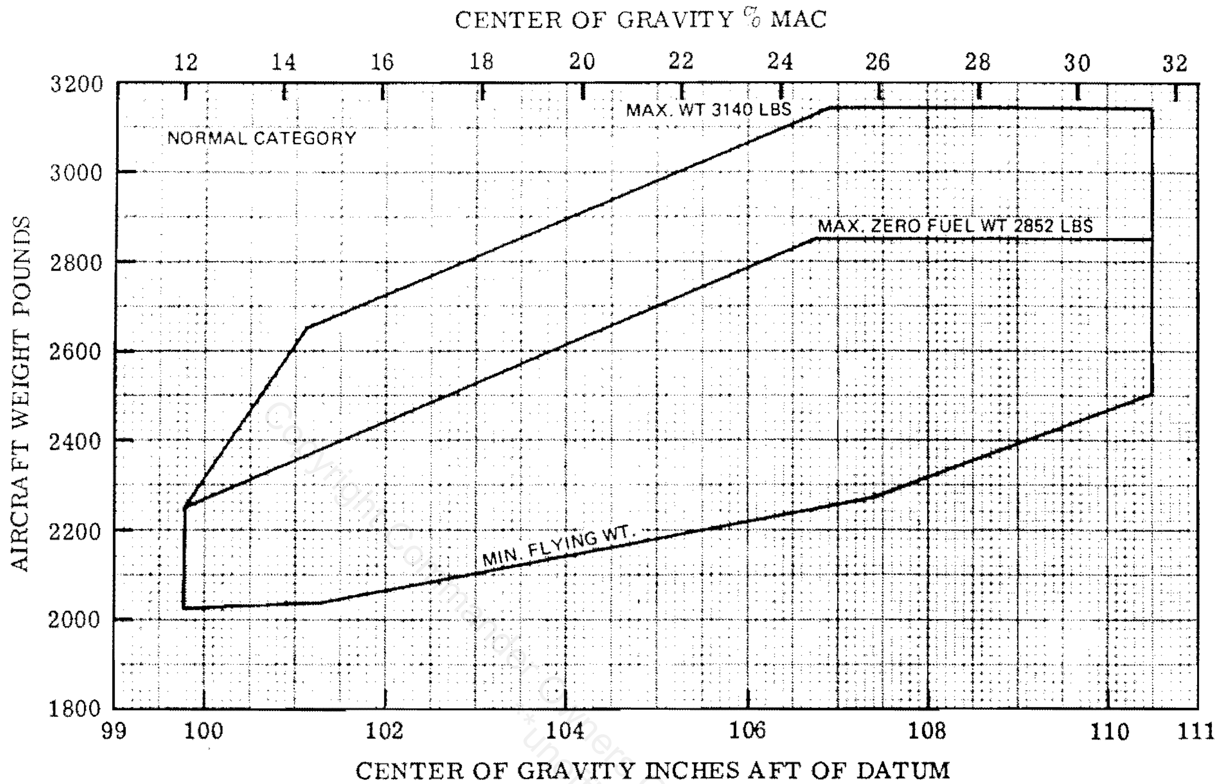
NOTE

Straight line variation between points.

Datum Location:	Fuselage Station 0.0 Inches.
Mean Aerodynamic Chord:	55.05 Inches.
L.E. of Mean Aerodynamic Chord:	Fuselage Station 93.15 Inches.

BAGGAGE COMPARTMENT

No baggage allowed in baggage compartment during Utility Category operation.



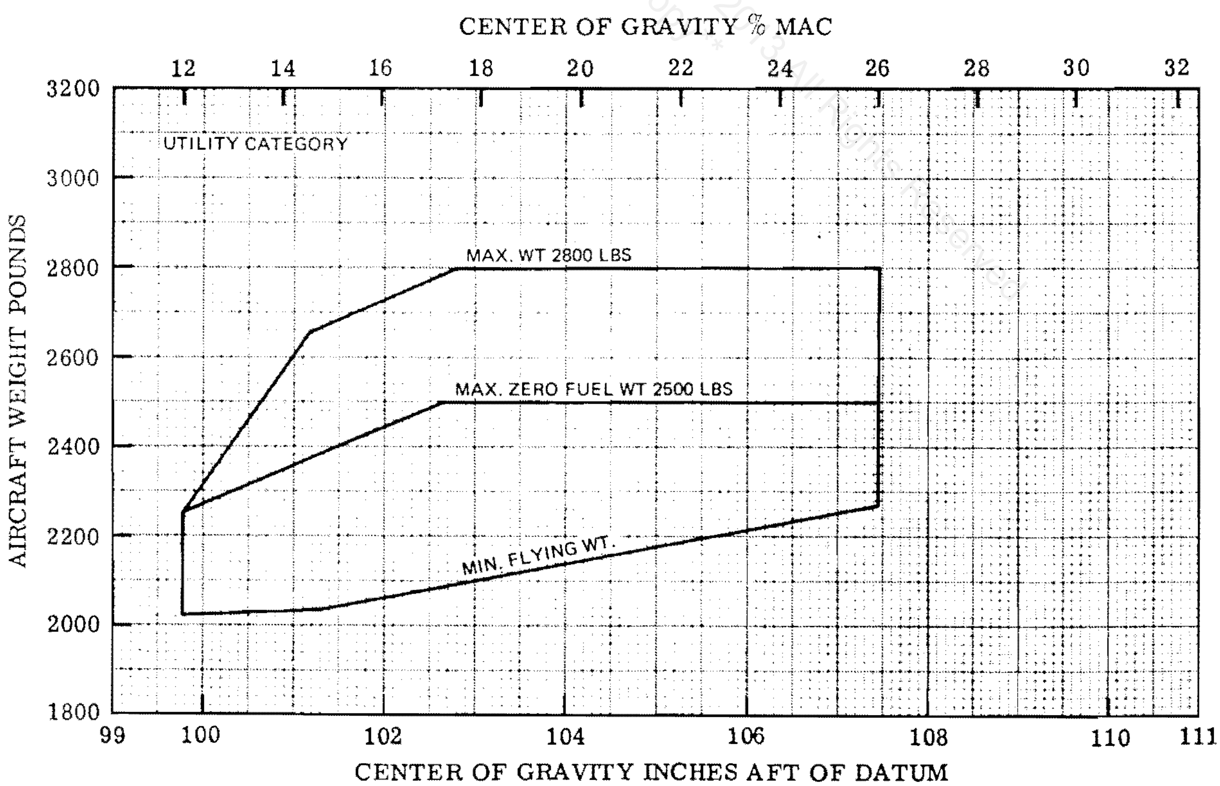


Figure 2-4. Flight Envelope

MANEUVER LIMITS

This airplane is certified in the Normal Category. When operated within a reduced weight and C.G. envelope (see Weight & Center of Gravity Limitations), the airplane is also certified in the Utility Category. The following maneuvers are either authorized or unauthorized as indicated.

NORMAL CATEGORY

AUTHORIZED MANEUVERS

Maneuver	Recommended Entry Speeds (KCAS)
Lazy Eights (Angle of Bank Not to Exceed 60°.)	118 Knots at 3140 lbs. 109 Knots at 2658 lbs. 95 Knots at 2023 lbs.
Chandelles (Angle of Bank Not to Exceed 60°.)	118 Knots at 3140 lbs. 109 Knots at 2658 lbs. 95 Knots at 2023 lbs.
Steep Turns (Angle of Bank Not to Exceed 60°.)	118 Knots at 3140 lbs. 109 Knots at 2658 lbs. 95 Knots at 2023 lbs.
Stalls (Except Whip Stalls)	Slow Entry Rate Only

NOTE

Maximum altitude loss during a wings level stall recovery is 400 feet.

Any other maneuver incidental to normal flying.

Unauthorized Maneuvers

Any other intentional maneuver which involves an abrupt change in the airplanes attitude, an abnormal attitude, or abnormal acceleration not necessary for normal flight.

Intentional spins are prohibited.
Inverted maneuvers are prohibited.

UTILITY CATEGORY

AUTHORIZED MANEUVERS

Maneuver	Recommended Entry Speeds (KCAS)
Lazy Eights (Angle of Bank in Excess of 60°.)	120 Knots at 2800 lbs. 107 Knots at 2250 lbs. 102 Knots at 2023 lbs.
Chandelles (Angle of Bank in Excess of 60°.)	120 Knots at 2800 lbs. 107 Knots at 2250 lbs. 102 Knots at 2023 lbs.
Steep Turns (Angle of Bank in Excess of 60°.)	120 Knots at 2800 lbs. 107 Knots at 2250 lbs. 102 Knots at 2023 lbs.

In addition, all maneuvers approved for Normal Category Operation.

Unauthorized Maneuvers

Intentional spins and inverted maneuvers are prohibited.

FLIGHT LOAD FACTOR LIMITS

NORMAL CATEGORY

Limit Load Factors: Flaps Retracted: +3.8 G's to -1.52 G's
Flaps at 35°: +2.0 G's to 0.0 G's

UTILITY CATEGORY

Limit Load Factors: Flaps Retracted: +4.4 G's to -1.76 G's.
Flaps at 35°: +2.0 G's to 0.0 G's

TYPES OF OPERATION

This aircraft has been certificated in accordance with FAR Part 23, Amendment 7 for day and night VFR operation. When the instruments, systems and equipment are installed in accordance with FAR 91.33, the aircraft is certificated for day and night IFR.

Flight into known icing conditions is prohibited.

The following list summarizes many of the instruments, systems and equipment that, depending upon the type of operation desired, determine the basic airworthiness of the aircraft. If an instrument, system or item of equipment is inoperative, this list should be consulted for the kind of operation intended. Should the particular item be required, a flight should not be undertaken until suitable repairs have been made.

This list addresses only operations conducted under FAR Part 91. For other types of operations, consult the appropriate regulations.

INSTRUMENT, SYSTEM OR EQUIPMENT	KINDS OF OPERATION			
	DAY VFR	NIGHT VFR	DAY IFR	NIGHT IFR
Airspeed Indicator	Reqd	Reqd	Reqd	Reqd
Altimeter	Reqd	Reqd	Sensitive Altimeter	Sensitive Altimeter
Altimeter - Sensitive	Not Reqd	Not Reqd	Reqd	Reqd
Altimeter - Encoding	Reqd above 12,500 MSL Reqd in all TCA's	Reqd above 12,500 MSL Reqd in all TCA's	Reqd above 12,500 MSL Reqd in all TCA's	Reqd above 12,500 MSL Reqd in all TCA's
Magnetic Direction Indicator	Reqd	Reqd	Reqd	Reqd
Fuel Quantity Indicators	Reqd	Reqd	Reqd	Reqd
Oil Pressure Indicator	Reqd	Reqd	Reqd	Reqd
Oil Temperature Indicator	Reqd	Reqd	Reqd	Reqd
Tachometer	Reqd	Reqd	Reqd	Reqd
Cylinder Head Temperature Indicator	Reqd	Reqd	Reqd	Reqd
Manifold Pressure Indicator	Reqd	Reqd	Reqd	Reqd
Master Switch	Reqd	Reqd	Reqd	Reqd
Alternator	Reqd	Reqd	Reqd	Reqd
All Circuit Breakers	Reqd	Reqd	Reqd	Reqd
Seat Belts for Each Occupant	Reqd	Reqd	Reqd	Reqd
Ammeter	Reqd	Reqd	Reqd	Reqd
Position Light System	Not Reqd	Reqd	Not Reqd	Reqd
Anti-Collision Light	Not Reqd	Reqd	Not Reqd	Reqd
Alternate Air System	Reqd	Reqd	Reqd	Reqd
Alternate Static Source	Reqd	Reqd	Reqd	Reqd
Cowl Flaps	Reqd	Reqd	Reqd	Reqd
Flap Position Indicator	Reqd	Reqd	Reqd	Reqd
Elevator Trim	Reqd	Reqd	Reqd	Reqd
Elevator Trim Indicator	Reqd	Reqd	Reqd	Reqd
Emergency Gear System	Reqd	Reqd	Reqd	Reqd
Auxiliary Fuel Pump	Reqd	Reqd	Reqd	Reqd
Gear Position Lights	Reqd	Reqd	Reqd	Reqd
Gear Warning Bell or Horn	Reqd	Reqd	Reqd	Reqd

INSTRUMENT, SYSTEM OR EQUIPMENT	KINDS OF OPERATION			
	DAY VFR	NIGHT VFR	DAY IFR	NIGHT IFR
Gear Warning Light	Reqd	Reqd	Reqd	Reqd
Nose Wheel Steering	Reqd	Reqd	Reqd	Reqd
Rudder Trim System	Reqd	Reqd	Reqd	Reqd
Stall Warning System	Reqd	Reqd	Reqd	Reqd
Propeller Governor	Reqd	Reqd	Reqd	Reqd
Voltmeter	Reqd	Reqd	Reqd	Reqd
Battery	Reqd	Reqd	Reqd	Reqd
Spinner	Reqd	Reqd	Reqd	Reqd
Voltage Regulator	Reqd	Reqd	Reqd	Reqd
Instrument Panel Light	Reqd	Reqd	Reqd	Reqd
Fuel Pressure Indicator	Reqd	Reqd	Reqd	Reqd
Gyro, Artificial Horizon	Not Reqd	Not Reqd	Reqd	Reqd
Gyro, Directional	Not Reqd	Not Reqd	Reqd	Reqd
Clock with Sweep Second Hand	Not Reqd	Not Reqd	Reqd	Reqd
OAT Gage	Not Reqd	Not Reqd	Reqd	Reqd
Turn-and-Bank Indicator	Not Reqd	Not Reqd	Reqd	Reqd
Oxygen System	Flights in excess of 30 minutes at altitudes between 12,500 and 14,000 ft. MSL require the pilot to utilize supplemental O_2. Flights in excess of 14,000 ft. require the pilot to utilize supplemental O_2. Flights in excess of 15,000 ft. MSL require that all occupants be provided with supplemental O_2.			
Emergency Locator Beacon	Emergency Locator Beacons are required to be installed for all operations except ferrying an aircraft to location where the locator can be installed or fixed or training flights that do not exceed a radius of 20 miles from the originating airport.			

FUEL LIMITATIONS

Capacity	-	70 Gallons
Unusable	-	2 Gallons
Usable	-	68 Gallons

EXHAUST GAS TEMPERATURE LIMITATIONS

Leaning with reference to peak Exhaust Gas Temperature (EGT) is prohibited above 75% Maximum Continuous Power (MCP).

Operation on the lean side of peak EGT is prohibited, except momentarily to establish peak EGT.

PLACARDS - See Figure 2-5.

MAX. BAGGAGE COMPARTMENT CAPACITY 200 LBS

Baggage Door Upper Left Corner

MAXIMUM SPEED-WINDOW OPEN 130K

Near Vent Window

MANEUVERING SPEED (3140 LBS) ....118 KCAS
MAX GEAR OPERATING SPEED ....130 KCAS
MAX SPEED 20° FLAP ....150 KCAS
MAX SPEED 25° FLAP ....120 KCAS
MAX SPEED COWL FLAP OPEN ....130 KCAS

Near Airspeed Indicator
Serial Numbers 14000 thru 14149

ALT. (FT)	V_{NE} (KCAS)	V_{NO} (KCAS)
SL-12,500	186	148
16,000	175	139
20,000	161	128
24,000	147	117

Above Altimeter

MANEUVERING SPEED (3140 LBS) ....118 KCAS
MAX GEAR OPERATING SPEED ....130 KCAS
MAX SPEED 20° FLAP ....150 KCAS
MAX SPEED 25° FLAP ....120 KCAS

Near Airspeed Indicator
Serial Number 14150 and Subs.

34 GAL. USEABLE EACH TANK
USE BOTH FOR T.O. & LANDING

Center Console at Fuel Selector

ON
OFF
BAT - ALT MASTER
PITCH TRIM
DO NOT TURN ALTERNATOR OFF IN FLT EXCEPT IN CASE OF EMERGENCY
ALTERNATOR CAPACITY 60 AMPS

On Instrument Sub-panel Below Master Switch
Serial Numbers 14000 thru 14149

FLAPS
USE 10° TO 20° FOR TAKEOFF

Under Flap Indicator

ON
OFF
BAT - ALT MASTER
PITCH TRIM
DO NOT TURN ALTERNATOR OFF IN FLT EXCEPT IN CASE OF EMERGENCY

On Instrument Sub-panel Below Master Switch
Serial Number 14150 and Subs.

Figure 2-5. Placards (Sheet 1 of 2)

ALTERNATE STATIC SOURCE CORRECTION CARD MODEL 114

- PILOT'S SIDE WINDOW OPEN
- OPTIONAL RIGHT SIDE WINDOW MUST BE CLOSED

AIRSPEED		ALTITUDE CORRECTION	
INDICATED	CALIBRATED	IPA: S.L.	IPA: 15K FT.
KIAS	KCAS	FT.	FT.
70	64	-38	-60
80	75	-38	-60
90	85	-42	-66
100	95	-48	-77
110	104	-57	-91
120	114	-70	-111
130	122	-87	-137
138	130	103	-164

- AIRSPEED LIMITS: SEE SECT. II - PILOT'S OPERATING HANDBOOK
- DO NOT OPEN WINDOW ABOVE 130 KCAS

SEE OTHER SIDE FOR PILOT'S SIDE WINDOW CLOSED

ALTERNATE STATIC SOURCE CORRECTION CARD MODEL 114

- PILOT'S SIDE WINDOW CLOSED
- OPTIONAL RIGHT SIDE WINDOW MUST BE CLOSED

AIRSPEED			ALTITUDE CORRECTION			
KIAS	KCAS		IPA S.L.		IPA: 15K FT.	
	BOTH GEAR AND FLAPS					
	RET	EXT	RET	EXT	RET	EXT
70	71	73	7	18	11	29
80	81	83	9	18	15	29
90	91	92	12	15	19	24
100	102	101	15	9	23	15
110	112	110	18	0	28	0
120	122	119	21	-14	33	-22
130	132	127	25	-33	39	-52
140	142	136	29	-57	46	-91
158	160	150	37	-118	58	-190
160	163		38		60	
180	183		48			
183	186		50			

- AIRSPEED LIMITS: SEE SECT. II - PILOT'S OPERATING HANDBOOK

SEE OTHER SIDE FOR PILOT'S SIDE WINDOW OPEN

In Pocket on Pilot's Map Case

HEADREST TO BE IN PLACE DURING TAKEOFF & LANDING

On Top of Pilot and Front Passenger Seat Back Beneath Headrest.

OPERATING LIMITATIONS

THIS AIRPLANE MUST BE OPERATED AS A NORMAL CATEGORY AIRPLANE IN COMPLIANCE WITH OPERATING LIMITATIONS STATED IN THE AIRPLANE FLIGHT MANUAL.

NO ACROBATIC MANEUVERS ARE APPROVED. INTENTIONAL SPINS ARE PROHIBITED.

THIS AIRPLANE IS APPROVED FOR FLIGHT IN DAY/NIGHT VFR/IFR WHEN EQUIPPED IN ACCORDANCE WITH FAR 91. FLIGHT INTO KNOWN ICING CONDITIONS IS PROHIBITED.

Windshield Center Frame
NORMAL CATEGORY

OPERATING LIMITATIONS

THIS AIRPLANE MUST BE OPERATED AS A NORMAL OR UTILITY CATEGORY AIRPLANE IN COMPLIANCE WITH OPERATING LIMITATIONS STATED IN PILOTS OPERATING HANDBOOK.

ALL MARKINGS AND PLACARDS ON THE AIRPLANE APPLY TO ITS OPERATION AS A NORMAL CATEGORY AIRPLANE. FOR UTILITY CATEGORY OPERATION REFER TO THE PILOTS OPERATING HANDBOOK.

THIS AIRPLANE IS APPROVED FOR FLIGHT IN DAY/NIGHT VFR/IFR WHEN EQUIPPED IN ACCORDANCE WITH FAR 91. FLIGHT INTO KNOWN ICING CONDITIONS IS PROHIBITED.

Windshield Center Frame
UTILITY CATEGORY

Figure 2-5. Placards (Sheet 2 of 2)

SECTION III

EMERGENCY PROCEDURES

TABLE OF CONTENTS

INTRODUCTION

Emergencies caused by aircraft or engine malfunctions are extremely rare if proper pre-flight inspections and maintenance are practiced. Weather associated emergencies are rarely encountered when adequate pre-flight planning and good judgement are used.

The following information is presented to enable the pilot to form, in advance, a definite plan of action for coping with the most probable emergency situations which could occur in the operation of the airplane. Where practicable, the emergencies requiring immediate corrective action are shown in checklist form for easy reference. Amplified procedures are also presented as required to provide the pilot with a more complete understanding of the procedures.

Emergency procedures associated with the Emergency Locator Transmitter (ELT) and other optional systems can be found in Section IX.

AIRSPEEDS FOR SAFE OPERATIONS

OPERATION	KIAS	CONFIGURATION
Emergency Descent *	187 - SL to 12,500 Ft 175 - 16,000 Ft 160 - 20,000 Ft 145 - 24,000 Ft	Gear Down, Flaps Up
Power Off Glide (Best Glide Angle)	82 - 3140 Lbs ** 74 - 2600 Lbs 65 - 2023 Lbs	Gear Up, Flaps Up Cowl Flaps Closed
Power Off Approach	71* - 86	Gear Down, Flaps 35^{o}
Extreme Turbulence Encounter	116 - 3140 Lbs ** 107 - 2658 Lbs 93 - 2023 Lbs	Gear Up, Flaps Up
* Smooth Air Only ** Straight Line Variation between points		

Figure 3-1. Airspeeds for Safe Operations

EMERGENCY PROCEDURES CHECKLIST

ENGINE FAILURE

DURING TAKEOFF ROLL

1. Throttle - RETARD.
2. Brakes - APPLY.
3. Flaps - RETRACT.
4. Mixture - IDLE CUTOFF.
5. Fuel Selector - OFF.
6. Master Switch - OFF.

IN FLIGHT

1. Airspeed - 82 KIAS.
2. Auxiliary Fuel Pump - ON.
3. Alternate Induction Air - HOT.
4. Mixture - FULL RICH.
5. Fuel Selector - FULLEST TANK (check other two positions).
6. Fuel Selector Drain Valve - CHECK CLOSED (handle fully down).
7. Ignition Switch - BOTH (check right and left).

AIRSTART

1. Airspeed - 82 KIAS, minimum for windmilling propeller.

NOTE

If propeller stops windmilling, use normal starting procedures as outlined in Section IV.

2. Fuel Selector - FULLER TANK.

NOTE

To minimize restart time, select the fuller tank. Do not use the BOTH position.

3. Mixture - RICH.
4. Throttle - AT LEAST 1/2 OPEN.
5. Ignition Switch - BOTH.
6. Auxiliary Fuel Pump - ON.

After engine has started:

7. Throttle - ADJUST.
8. Mixture - LEAN as required.
9. Auxiliary Fuel Pump - OFF.

EMERGENCY LANDINGS

CAUTION

The final approach speeds shown under Emergency Landings were determined in a no wind condition. This approach speed should be increased as required (typically 5 to 15 KIAS) if turbulence or wind shear conditions exist.

POWER OFF

Approach

1. Airspeed - 82 KIAS.
2. Mixture - IDLE CUTOFF.
3. Ignition Switch - OFF.
4. Fuel Selector - OFF.
5. Flaps - UP.
6. Landing Gear - RETRACTED.
7. Cowl Flaps - CLOSED.
8. Emergency Locator Transmitter (if installed) - ON.
9. Transponder (if installed) - CODE 7700.
10. Seats, Seat Belts and Shoulder Straps - SECURE (front seats in upright position).
11. Loose Objects - SECURE.
12. Ground Controller Briefing - ACCOMPLISH, if circumstances permit.

On Final Approach

13. Landing Gear - DOWN.

NOTE

If the landing site has an extremely soft surface or if a ditching is to be accomplished, it is recommended that the landing gear remain retracted.

14. Flaps - 35 DEGREES.
15. Airspeed - 71 KIAS MINIMUM.

PRECAUTIONARY OFF-AIRPORT LANDING WITH POWER

Approach

1. Seats, Seat Belts and Shoulder Straps - SECURE (front seats in upright position).
2. Loose Objects - SECURE.
3. Emergency Locator Transmitter (if installed) - ON.
4. Ground Controller Briefing - ACCOMPLISH, if circumstances permit.
5. Mixture - FULL RICH.
6. Landing Gear - DOWN.
7. Flaps - AS REQUIRED.
8. Power - AS REQUIRED.

On Final Approach

9. Flaps - 35 DEGREES.
10. Airspeed - 71 KIAS MINIMUM.
11. Propeller - HIGH RPM.

After Touchdown

12. Mixture - IDLE CUTOFF.
13. Fuel Selector - OFF.

LANDING WITH A FLAT MAIN GEAR TIRE

Approach

1. Seats, Seat Belts and Shoulder Straps - SECURE (front seats in upright position).
2. Loose Objects - SECURE.
3. Mixture - FULL RICH.
4. Landing Gear - EXTEND.

NOTE

If it is known that a tire is defective, it is advisable to leave the gear extended.

5. Flaps - AS REQUIRED.
6. Power - AS REQUIRED.

NOTE

Select a runway with a crosswind from the same side as the good main gear tire, if practical.

On Final Approach

7. Flaps - 35 DEGREES.
8. Airspeed - 71 KIAS MINIMUM.
9. Propeller - HIGH RPM.

Touchdown

10. Touchdown - ON GOOD TIRE.
11. Rollout - Utilize aileron to keep affected tire off runway as long as possible. Maintain direction using nose gear steering and braking as required.

LANDING WITH A FLAT NOSE GEAR TIRE

Approach

1. Seats, Seat Belts and Shoulder Straps - SECURE (front seats in upright position).
2. Loose Objects - SECURE.
3. Mixture - FULL RICH.
4. Landing Gear - EXTEND.

NOTE

If it is known that a tire is defective, it is advisable to leave the gear extended.

5. Flaps - AS REQUIRED.
6. Power - AS REQUIRED.

On Final Approach

7. Flaps - 35 DEGREES.
8. Airspeed - 71 KIAS MINIMUM.
9. Propeller - HIGH RPM.

Touchdown and Rollout

10. Touchdown - MAIN GEAR FIRST.
11. Mixture - IDLE CUTOFF.
12. Rollout - NOSE GEAR HIGH.

LANDING WITH ONE RETRACTED OR UNLOCKED MAIN GEAR

Approach

1. Seats, Seat Belts and Shoulder Straps - SECURE (front seats in upright position).
2. Loose Objects - SECURE.
3. Mixture - FULL RICH.
4. Landing Gear - EXTEND.

NOTE

Select a runway with a crosswind from the same side as the good main gear, if practical.

On Final Approach

5. Flaps - 35 DEGREES.
6. Airspeed - 71 KIAS MINIMUM.
7. Propeller - HIGH RPM.

Touchdown and Rollout

8. Touchdown - ON EXTENDED GEAR FIRST.
9. Aileron - Bank away from affected gear.
10. Mixture - IDLE CUTOFF.
11. Fuel Selector - OFF.

LANDING WITH A DEFECTIVE NOSE GEAR

Approach

1. Seats, Seat Belts and Shoulder Straps - SECURE (front seats in upright position).
2. Loose Objects - SECURE.

3. Mixture - FULL RICH.
4. Landing Gear - EXTEND.

On Final Approach

5. Flaps - 35 DEGREES.
6. Airspeed - 71 KIAS MINIMUM
7. Propeller - HIGH RPM.

Touchdown and Rollout

8. Touchdown - MAIN GEAR FIRST.
9. Elevator Control - AFT.

NOTE

During the rollout, the nose should be held off the runway as long as possible.

10. Mixture - IDLE CUTOFF.
11. Fuel Selector - OFF.

LANDING WITH POWER AND WITH LANDING GEAR RETRACTED

NOTE

If possible, choose a smooth sod runway.

Approach

1. Seats, Seat Belts and Shoulder Straps - SECURE (front seats in upright position).
2. Loose Objects - SECURE.
3. Mixture - FULL RICH.
4. Landing Gear - RETRACTED.
5. Power - AS REQUIRED.

On Final Approach

6. Flaps - 20 DEGREES.
7. Airspeed - 74 KIAS MINIMUM.
8. Propeller - HIGH RPM.

Touchdown and Slide

9. Elevator Control - AFT.
10. Mixture - IDLE CUTOFF.
11. Fuel Selector - OFF.

LANDING WITHOUT POWER AND WITH LANDING GEAR RETRACTED

Approach

1. Airspeed - 82 KIAS.
2. Mixture - IDLE CUTOFF.
3. Ignition Switch - OFF.
4. Fuel Selector - OFF.
5. Flaps - UP.
6. Cowl Flaps - CLOSED.
7. Emergency Locator Transmitter (if installed) - ON.
8. Transponder (if installed) - CODE 7700.

9. Ground Controller Briefing - ACCOMPLISH, if circumstances permit.
10. Seats, Seat Belts and Shoulder Straps - SECURE (front seats in upright position).
11. Loose Objects - SECURE.

On Final Approach

12. Flaps - 20 DEGREES.
13. Airspeed - 74 KIAS MINIMUM.

Touchdown and Slide

14. Elevator Control - FULL AFT.

DITCHING

Approach

1. Airspeed - 82 KIAS.
2. Transponder (if installed) - CODE 7700.
3. MAYDAY Transmission - TRANSMIT information which may expedite search and rescue AS REQUIRED.

NOTE

See Airman's Information Manual for transmitted information which may be valuable if time permits its transmission.

4. Emergency Locator Transmitter (if installed) - ON.
5. Seats, Seat Belts and Shoulder Straps - SECURE (front seats in upright position).
6. Loose Objects - SECURE.
7. Flotation Equipment (for occupants) - DON.
8. Flaps - UP.
9. Landing Gear - RETRACTED.
10. Cowl Flaps - CLOSED.

On Final Approach

NOTE

See Airman's Information Manual for additional details regarding ditching procedures.

11. Flaps - 20 DEGREES.
12. Airspeed - 74 KIAS MINIMUM.
13. Landing Gear - RETRACTED.
14. Propeller - HIGH RPM.

Touchdown

15. Elevator Control - FULL AFT.
16. Fuel Selector - OFF.

SMOKE AND FIRE

ELECTRICAL FIRE ON THE GROUND

1. Master Switch - OFF.
2. All Electrical Switches - OFF.

3. Mixture - IDLE CUTOFF.
4. Fuel Selector - OFF.
5. Fire Extinguisher (if installed) - DISCHARGE.

WARNING

Do not attempt to fly the airplane again until the source of the fire has been located and corrective action has been taken.

ENGINE FIRE ON THE GROUND

Should a fire occur in the engine induction system during engine start, it is advisable to continue cranking the engine for several seconds. If the fire persists, proceed as follows:

1. Mixture - IDLE CUTOFF.
2. Fuel Selector - OFF.
3. Ignition Switch - OFF.
4. Master Switch - OFF.
5. Cowl Flaps - CLOSED.

WARNING

Do not attempt to fly the airplane until the source of the fire has been located and corrective action has been taken.

6. Fire Extinguisher (if installed) - DISCHARGE as required.

FIRE DURING TAKEOFF

1. Throttle - IDLE.
2. Brakes - APPLY.
3. Mixture - IDLE CUTOFF.
4. Master Switch - OFF.
5. Fuel Selector - OFF.
6. All Electrical Switches - OFF.
7. Fire Extinguisher (if installed) - DISCHARGE as required.

ELECTRICAL FIRE IN FLIGHT

1. Master Switch - OFF.
2. All Electrical Switches - OFF.
3. Cabin Heat and Defrost Controls - OFF.
4. Air Vents - OFF.
5. Fire Extinguisher (if installed) - DISCHARGE, if fire persists.

If smoke and fire persists, proceed as follows:

6. Oxygen Masks (if installed) - DON.
7. Oxygen System (if installed) - EMERG.
8. Emergency Descent Procedure - PERFORM.

If the fire has been extinguished and continued flight is essential, proceed as follows:

9. Master Switch - ON.
10. Essential Electrical Equipment - ON, one switch at a time.
11. Cabin Heat and Defrost Controls - AS DESIRED.
12. Air Vents - AS DESIRED.
13. Storm Window - OPEN (to clear cabin of smoke).

ENGINE FIRE IN FLIGHT

1. Mixture - IDLE CUTOFF.
2. Fuel Selector - OFF.
3. Master Switch - OFF.
4. Cabin Heat and Defrost Controls - OFF.
5. Airspeed - INCREASE as required without exceeding V_{NE}.

If fire persists, execute a power-off landing as outlined under Landing Emergencies. Momentarily activate the master switch to extend the landing gear and/or the flaps, if they are required.

CABIN FIRE

1. Cabin Heat and Defrost Controls - OFF.
2. Air Vents - CLOSED.
3. Fire Extinguisher (if installed) - DISCHARGE.

If smoke and fire persist, proceed as follows:

4. Oxygen Masks (if installed) - DON.
5. Oxygen System (if installed) - EMERG.
6. Emergency Descent Procedure - PERFORM.

If the fire has been extinguished and continued flight is essential, proceed as follows:

7. Cabin Heat and Defrost Controls - AS DESIRED.
8. Air Vents - AS DESIRED.
9. Storm Window - OPEN.

EMERGENCY DESCENT

1. Landing Gear - SELECT DOWN below 128 KIAS.
2. Flaps - UP.
3. Throttle - IDLE.
4. Propeller Control - HIGH RPM.
5. Bank - APPROXIMATELY 45 DEGREES, if practical.
6. Airspeed - 187 KIAS below 12,500 ft.

CAUTION

Do not exceed V_{NO} unless in smooth air. See Section II for reduced speed limits above 12,500 feet.

MAXIMUM GLIDING DISTANCE - Refer to Figure 3-2.

LANDING GEAR SYSTEM EMERGENCIES

FAILURE TO RETRACT

1. Circuit Breaker - CHECK.
2. Emergency Gear Extension Valve Knob - CHECK for full up position.
3. Landing Gear Switch - CYCLE.

If unsafe indication persists, proceed as follows:

4. Landing Gear Switch - DOWN.
5. Gear Position Lights - VERIFY GEAR DOWN.
6. Landing - PERFORM as soon as practical.

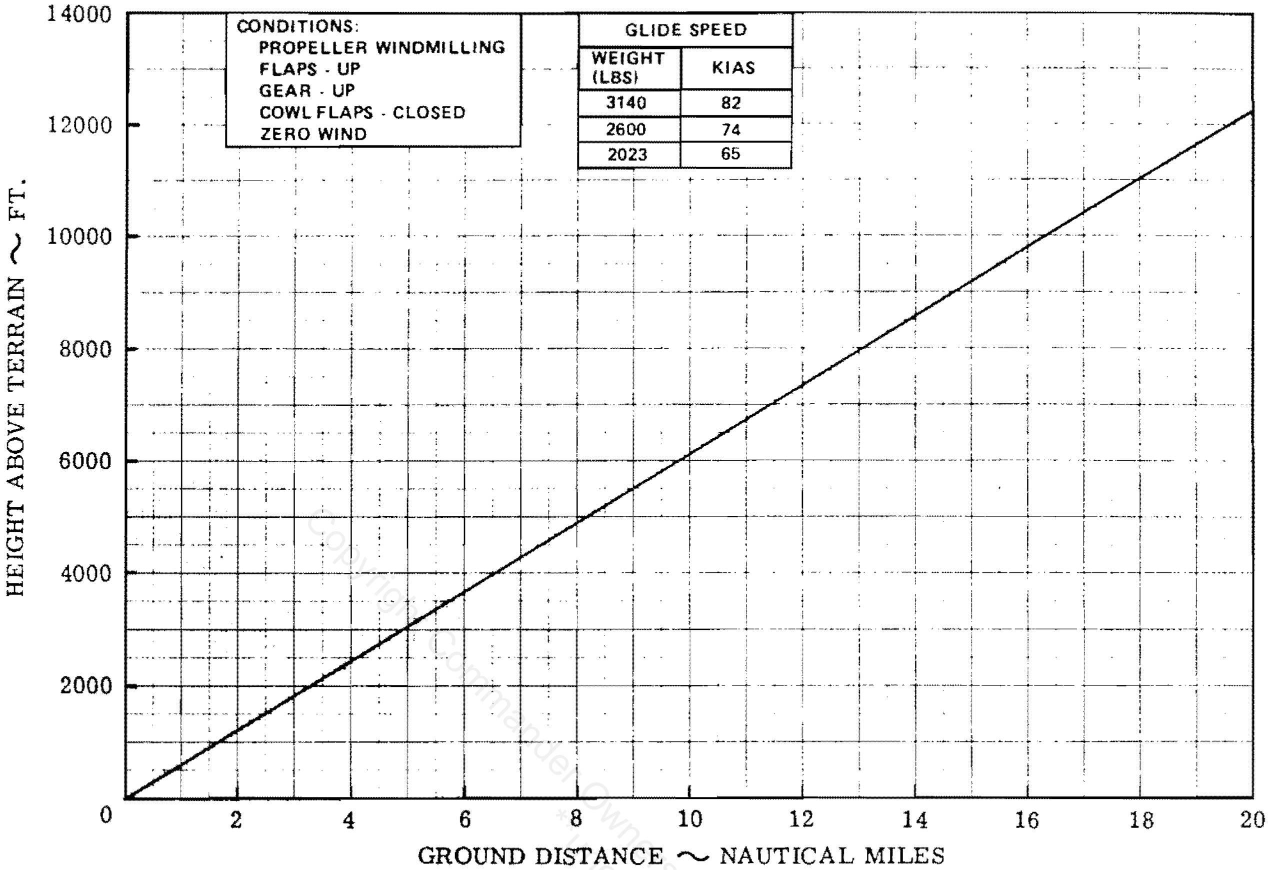


Figure 3-2. Maximum Gliding Distance

FAILURE TO EXTEND

1. Circuit Breaker - CHECK.
2. Landing Gear Switch - CYCLE.
3. Gear Down Position Lights - PRESS-TO-TEST.

If an unsafe indication persists, proceed as follows:

4. Landing Gear Switch - DOWN.
5. Throttle - MINIMIZE POWER.
6. Airspeed - 80 KIAS MAXIMUM.
7. Rudder Trim - NEUTRAL.
8. Emergency Extension Valve Knob - PULL OUT and DOWN.

NOTE

If the gear fails to extend, it may be necessary to cycle the rudder pedals, reduce power, and/or reduce airspeed.

9. Gear Down Position Lights - VERIFY GEAR DOWN.

ELECTRICAL SYSTEM EMERGENCIES

EXCESSIVE BATTERY CHARGING INDICATED ON AMMETER

1. Alternator Switch - OFF.
2. All Non-essential Electrical Equipment - OFF.

ALTERNATOR FAILURE

1. Alternator Switch - CYCLE.

NOTE

Battery power may be required to excite alternator. Keep battery portion of master switch ON.

2. Circuit Breakers - CHECK.

If the alternator fails to come on the line, proceed as follows:

3. Alternator Switch - OFF.
4. All Non-essential Electrical Equipment - OFF.

CIRCUIT BREAKER TRIPPING

1. Affected Circuit Breaker - RESET.

If the circuit breaker continues to trip, proceed as follows:

2. Leave Circuit Breaker in TRIP position.
3. Affected Electrical Equipment - OFF.

AVIONICS MASTER SWITCH/CIRCUIT BREAKER TRIPPING

NOTE

In the event that a radio should have a short circuit, the individual circuit breaker for that radio will open as evidenced by it's button popping out. The individual circuit breakers are located in the lower right side of the instrument panel.

1. Reset Avionics Master Switch - ON.

If unable to keep it in the ON position:

2. All Individual Avionics Switches - OFF.
3. Avionics Master Switch-type Circuit Breaker - ON.

If unable to keep it reset, turn it off, otherwise proceed to step 4.

4. Individual Avionics Switches - ON, one at a time (the most essential radios first).

NOTE

When the radio at fault is turned on, the Avionics master switch may open again.

5. Faulty Radio Switch - OFF (leave off).

NOTE

Repeat Steps 3. and 4. until all avionics (except the faulty unit(s)) are on.

POWER PLANT EMERGENCIES

LOSS OF OIL PRESSURE INDICATION

1. Engine Power - REDUCE.
2. Engine RPM - REDUCE.
3. Oil Temperature - CHECK.

CAUTION

Loss of oil pressure is usually accompanied by a high oil temperature indication. If this condition exists, plan a landing immediately. If a normal oil temperature exists, proceed to the nearest practical airport.

EXCESSIVE OIL PRESSURE

1. Engine RPM - REDUCE.
2. Engine Oil Temperature - ALLOW TO STABILIZE.

CAUTION

If high oil pressure persists, proceed to the nearest practical airport.

EXCESSIVE OIL/CYLINDER HEAD TEMPERATURE

1. Cowl Flaps - OPEN.
2. Airspeed - INCREASE.
3. Mixture - FULL RICH.
4. Power - REDUCE.

CAUTION

If excessive oil/cylinder head temperature persists, proceed to the nearest practical airport.

ROUGH RUNNING ENGINE OR LOSS OF POWER

1. Mixture - RICH.
2. Alternate Induction Air - HOT, if no change is evident, position to COLD.
3. Magnetos - BOTH (check right and left).

NOTE

Should the engine smooth out on one magneto, continue operation on that magneto.

4. Auxiliary Fuel Pump - ON, if no change is evident, turn to OFF.
5. Mixture - LEAN, if no change, ENRICHEN.

PROPELLER OVERSPEED

1. Throttle - CLOSE IMMEDIATELY (to reduce rpm).
2. Airspeed - REDUCE.
3. RPM Limit - OBSERVE.

CAUTION

Proceed to the nearest practical airport at reduced power and reduced airspeed.

MISCELLANEOUS EMERGENCIES

INADVERTENT ICING ENCOUNTER

1. Pitot Heat - ON.
2. Windshield Defrost - PULL ON.
3. Engine RPM - INCREASE.

WARNING

Evasive action should be initiated immediately when icing conditions are first encountered.

4. Altitude - CHANGE to an altitude less conducive to icing.

NOTE

A climb is usually preferred, if practical.

5. Course - ALTER or REVERSE as required, to avoid icing.

NOTE

The likelihood of the induction air system icing is very remote; however, should icing occur, as evidenced by loss of manifold pressure, the alternate induction air control should be placed in the HOT position.

6. Mixture - ADJUST, as required.
7. Approach Airspeed - INCREASE 5 to 20 KIAS depending on ice accumulation.

EXTREME TURBULENCE ENCOUNTER

1. Airspeed - MANEUVERING SPEED (observe airspeed for appropriate weight).
2. Flaps - UP.
3. Landing Gear - RETRACTED.
4. Seat Belts and Shoulder Straps - SECURE FIRMLY.
5. Loose Objects - SECURE.

NOTE

Avoid large excursions in pitch attitude.

OBSTRUCTED STATIC SOURCE

1. Alternate Static Source - ON.
2. Heat and Defrost Controls - ON.
3. Overhead Air Vents - OFF.

NOTE

Refer to alternate static source correction card for corrections to apply to altimeter and airspeed readings.

OBSTRUCTED PITOT

1. Pitot Heat - ON.

NOTE

Use familiar pitch attitude and power settings to achieve desired airspeeds if airspeed indicator readings appear to be unreliable.

CABIN DOOR OPENING IN FLIGHT

NOTE

If a door comes open in flight on airplanes S/N 14000 thru 14349, observe a maximum airspeed of 100 KIAS and return for a normal approach and landing. If an immediate landing is impractical, to close the cabin door in flight proceed as outlined below.

1. Airspeed - 80 KIAS.
2. Storm Window - OPEN.
3. Affected Door - OPEN approximately 4-inches and THEN SLAM SHUT.
4. Main Door Latch - CHECK for free play (no more than 1/8 to 1/4-inch).
5. Upper Door Latch - SECURE.

S/N 14350 and Subs.

1. Airspeed - 130 KIAS or below.
2. Cabin Door - PULL CLOSE, then RELATCH.

AIR PIRACY

1. Transponder (if installed) - CODE 7500, OR ANY CODE 7500 TO 7577.
2. Ground Controller Briefing - PERFORM as circumstances permit.

NOTE

See Airman's Information Manual for additional details for special emergencies, such as air piracy, and for current codes.

INADVERTENT SPINS

1. Throttle - IDLE.
2. Rudder - FULL OPPOSITE DIRECTION OF ROTATION.
3. Control Wheel - FULL FORWARD BRISKLY and HOLD against the forward stop UNTIL A DEFINITE NOSE DOWN PITCHING MOTION IS OBSERVED AND ROTATION STOPS.

NOTE

As sufficient nose down pitching motion is developed for a spin recovery, the pilot will become noticeably light in his seat or thrown against the seat belt.

As rotation stops,

4. Rudder - NEUTRAL.
5. Flaps - RETRACT, if extended.

Recover smoothly from the resulting dive.

AMPLIFIED EMERGENCY PROCEDURES

LANDING GEAR MALFUNCTIONS

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 bezel, up and removing the bulb.

Retraction Malfunction: If the landing gear fails to retract normally, as indicated by continuous gear motor operation or failure of the gear warning light to go out, attempt to recycle the gear. If recycling attempt fails 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 warning lights and warning bell or horn with flaps extended or power reduced), proceed with emergency gear extension.

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 toward zero indication on the ammeter, and the voltmeter should indicate between 12 and 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, and electrical load reduced to an essential minimum if an immediate landing is impractical.

Insufficient Charge: A continuous discharge rate, noted on the ammeter during flight, generally indicates:

a. Alternator and/or voltage regulator malfunction, or
b. Excessive load on the electrical system.

First the electrical load must be reduced. If ammeter continues to show discharge, the ALT half of the master switch should be turned OFF to isolate the alternator from the electrical system. With the ALT half of the master switch OFF, the entire accessory electrical load is placed on the battery, and all non-essential electrical equipment should be turned off to reduce the discharge rate of the battery.

Operation With Master Switch OFF: When the master switch is OFF, it should be remembered that certain electrical equipment will be inoperative, such as:

1. Wing Flaps.
2. Landing Gear Retraction System (except emergency extension system).
3. Fuel Gages.
4. Engine Temperature Gages.
5. Stall Warner
6. Turn Coordinator
7. All Lights (interior and exterior).
8. All Radios (except optional ELT).

SECTION IV

NORMAL PROCEDURES

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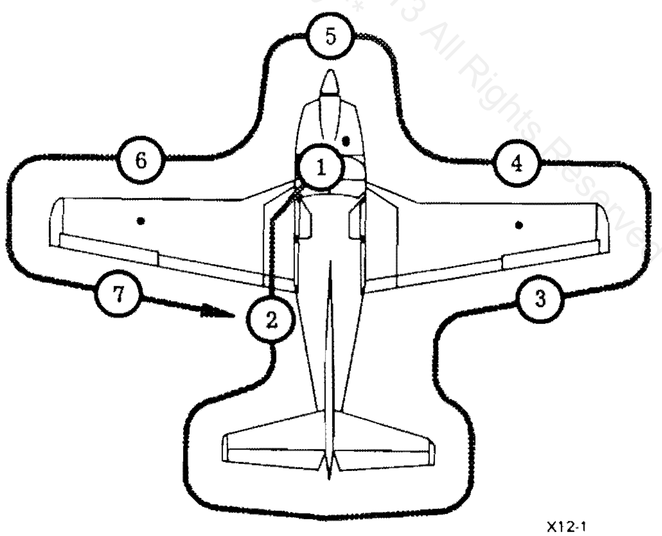

Figure 4-1. Pre-Flight Inspection Stations

NORMAL PROCEDURES CHECKLIST

PRE-FLIGHT INSPECTION

WARNING

Remove any accumulation of ice, snow or frost from aircraft prior to flight.

NOTE

If a night flight is planned check the operation of all lights and ensure a flashlight is available.

(1) INTERIOR

1. Controls Lock - REMOVE.
2. Ignition Switch - OFF.
3. All Circuit Breakers - SET.
4. Landing Gear Position Switch - DOWN.
5. All Switches - OFF or NORMAL.
6. Master Switch - ON.
7. Landing Gear Position Lights - CHECK/SAFE.
8. Fuel Selector - BOTH.
9. Elevator Trim Tab - NEUTRAL.
10. Fuel Quantity Gages - CHECK.

NOTE

Useable fuel quantities above approximately 27 U.S. gallons are not gageable.

11. Fuel Selector Drain - PULL for four seconds, then OFF. (S/N 14000 thru 14149 only.)

WARNING

Do not lift fuel selector disk when draining fuel or selecting tanks. Use only the center handle marked "PULL TO DRAIN". Failure to do so can result in undetectable fuel draining.

12. Oxygen (if installed) - CHECK QUANTITY and AVAILABILITY OF MASKS.

(2) LEFT SIDE OF FUSELAGE AND EMPENNAGE

13. Baggage Door - CLOSED and LOCKED.
14. Side of Fuselage - INSPECT.
15. Static Port - UNOBSTRUCTED.
16. Horizontal Stabilizer and Elevator - INSPECT.
17. Elevator - CHECK for freedom of movement.
18. Elevator Trim Tab - CHECK for excessive free play, security, condition, and neutral position.
19. Rudder Gust Lock (if installed) - REMOVE.
20. Vertical Stabilizer and Rudder - INSPECT.
21. Rudder - CHECK for freedom of movement.
22. Navigation Light - CHECK.
23. Flashing Beacon - CHECK condition.

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

24. Side of Fuselage - INSPECT.
25. Static Port - UNOBSTRUCTED.
26. Wing Flap - INSPECT.
27. Aileron - CHECK for security and freedom of movement.
28. Wing Tip - INSPECT.
29. Navigation Light - CHECK.

(4) RIGHT WING LEADING EDGE

30. Wing Leading Edge - CHECK condition.
31. Fuel Vent - UNOBSTRUCTED.
32. Fuel Quantity - CHECK.

NOTE

A reduced fuel quantity indicator is located in the fuel filler neck. This indicator is used to indicate a useable fuel quantity of 24 gallons.

33. Fuel Filler Cap - SECURE.
34. Wing Tie-down - REMOVE.
35. Fuel Tank Sump - DRAIN SAMPLE. Check valve closed.
36. Right Main Gear and Wheel Weel - INSPECT.
37. Main Gear Tire - CHECK inflation and wear.
38. Squat Switch - INSPECT.
39. Landing Gear Limit Switches (2) - CHECK condition.
40. Wheel Well Fuel Drain - DRAIN SAMPLE. Check valve closed. (S/N 14150 and Subs.)
41. Fuel Selector Drain Valve - VERIFY CLOSED (S/N 14000 thru 14149 only).

(5) ENGINE SECTION

42. Fuel Gascolator - DRAIN SAMPLE. Check valve closed.
43. Engine Accessory Section - INSPECT.
44. Cowl Fasteners - SECURED.
45. Oil Cooler Inlet - UNOBSTRUCTED.
46. Lower Cowl and Cowl Flap - INSPECT and SECURE.
47. Nose Gear Assembly and Strut - CHECK condition and proper inflation.
48. Nose Gear Tire - CHECK proper inflation and wear.
49. Landing Gear Limit Switches (2) - CHECK condition.
50. Engine Inlets - UNOBSTRUCTED.
51. Propeller and Spinner - INSPECT.
52. Oil Quantity - CHECK, minimum 6 quarts.

(6) LEFT WING LEADING EDGE

53. Left Main Gear and Wheel Well - INSPECT.
54. Wheel Well Fuel Drain - DRAIN SAMPLE. Check valve closed. (S/N 14150 and Subs.)
55. Landing Gear Limit Switches (2) - CHECK condition.
56. Fuel Tank Sump - DRAIN SAMPLE. Check valve closed.
57. Fuel Quantity - CHECK.

NOTE

A reduced fuel quantity indicator is located in the fuel filler neck. This indicator is used to indicate a useable fuel quantity of 24 gallons.

58. Fuel Filler Cap - SECURE.
59. Wing Leading Edge - CHECK condition.
60. Stall Warning Vane - CHECK freedom of movement and horn actuation.

NOTE

The master switch must be ON to check stall warner circuit. 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.

61. Wing Tie-down - REMOVE.
62. Pitot Mast - UNOBSTRUCTED.

NOTE

If flight into rain or conditions conducive to possible icing is anticipated, pitot heat should be checked. The pitot heat can be checked by lightly touching the pitot probe after the heating element has been turned on. The pitot should become warm to the touch after the heater has been on for 35 seconds.

63. Fuel Vent - UNOBSTRUCTED.
64. Wing Tip - INSPECT.

(7) LEFT WING TRAILING EDGE

65. Navigation Light - CHECK.
66. Aileron - CHECK security and freedom of movement.
67. Wing Flap - INSPECT.

BEFORE STARTING ENGINE

1. Exterior Inspection - COMPLETE.
2. Seats, Seat Belts and Shoulder Straps - ADJUST and SECURE (front seats in upright position for takeoff).
3. Fuel Selector Valve - BOTH.
4. Avionics Master Switch - OFF.
5. All Electrical Equipment - OFF.
6. Circuit Breakers - CHECK.
7. Cowl Flaps - FULL OPEN.
8. Landing Gear Position Switch - DOWN.
9. Landing Gear Emergency Extension Valve Knob - UP.
10. Parking Brake - SET.

NOTE

If a start is to be made at night, turn ON the navigation lights prior to starting.

STARTING ENGINE

1. Mixture - IDLE CUTOFF.
2. Propeller - HIGH RPM.
3. Throttle - CRACKED 1/4 INCH.
4. Alternate Induction Air - COLD.
5. Master Switch - ON.

NOTE

ALT side of master switch should be OFF, if external power is used.

6. Voltmeter - CHECK.
7. Fuel Pump Switch - ON.

NOTE

Verify that auxiliary fuel pump operates by observing a rise in the fuel pressure indication.

8. Mixture - ADVANCE MOMENTARILY, then back to IDLE CUTOFF.
9. Fuel Pump Switch - OFF.
10. Propeller Area - CLEAR.
11. Ignition Switch - START then 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.

12. Mixture - FULL RICH after engine starts.
13. Throttle - 800 to 1000 RPM.
14. Oil Pressure - CHECK for indication within 30 seconds.
15. Alternator Switch - ON.

NOTE

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

16. Ammeter - CHECK for charging indication.
17. Voltmeter - CHECK for 13-16 Volts.

STARTING ENGINE (FLOODED START PROCEDURE)

1. Mixture - IDLE CUT-OFF.
2. Propeller Control - HIGH RPM.
3. Throttle - FULL OPEN.
4. Alternate Induction Air Control - COLD.
5. Master Switch - ON.

NOTE

The ALT side of the master switch should be OFF if external power is used.

6. Propeller Area - CLEAR.
7. Ignition Switch - START then to BOTH.

NOTE

Cranking should be limited to 30 seconds. Allow at least five (5) minutes between cranking periods to permit the starter to cool.

As engine fires:

8. Throttle - RETARD.
9. Mixture - FULL RICH.
10. Throttle - 800 to 1000 RPM.
11. Oil Pressure - CHECK for indication within 30 seconds.
12. Alternator - ON and CHARGING.

NOTE

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

13. Ammeter - CHECK for charging indication.
14. Voltmeter - CHECK for 13-16 Volts.

BEFORE TAXIING

1. Flashing Beacon - ON.

CAUTION

If the engine is started with the flashing beacon ON, it may be necessary to cycle the beacon switch to reestablish the flashing mode.

2. Strobe Lights (if installed) - OFF.
3. Instruments and Radios - SET.
4. Parking Brake - RELEASE.

TAXIING

1. Brakes - CHECK during initial taxi.
2. Nose Wheel Steering - CHECK.
3. Compass - CHECK against known taxiway heading.

BEFORE TAKEOFF

1. Parking Brake - SET.
2. Controls - CHECK for freedom of movement and proper direction.
3. Flaps - CYCLE. Check operation and symmetry.
4. Rudder Trim - NEUTRAL.
5. Elevator Trim Tab - TAKEOFF RANGE.
6. Throttle - 2000 RPM.
7. Magnetos - CHECK. Right then both. Left then both.

NOTE

The RPM drop should not exceed 175 RPM on either magneto or greater than a 50 RPM differential between the two magnetos. An absence of an RPM drop may be an indication of faulty magneto grounding or improper timing. Magneto checks at a high power setting will usually confirm that a deficiency exists. 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 density altitude operation. No leaning is allowed below 5000 ft. density altitude. Above 5000 ft. density altitude, lean only as required for smooth engine operation. If a full throttle runup is necessary, monitor oil temperature and cylinder head temperature to assure that their limits are not exceeded.

8. Propeller Control - CYCLE and RETURN TO HIGH RPM.
9. Alternate Induction Air Control - FULL HOT and RETURN TO FULL COLD.

NOTE

A slight reduction in engine RPM should be noted when the alternate induction air control is placed in the FULL HOT position.

10. Gyro Suction Gage (if installed) - 4.5 to 5.2 IN.HG.
11. Alternate Static Source Valve - NORMAL.
12. Throttle - CHECK for proper IDLE RPM, should be 600 to 700 RPM.
13. Instruments and Radios - CHECK and SET.
14. Fuel Selector Valve - BOTH.
15. Cabin Doors (S/N 14000 thru 14349) - LATCHED.

NOTE

If freeplay in lower inside cabin door latches exceeds approximately 1/4-inch, then the lower and/or aft cabin door hooks are not properly engaged.

16. Cabin Doors (S/N 14350 and Subs) - CLOSED and LATCHED.
17. Parking Brake - RELEASE.

OPERATION		KIAS	CONFIGURATION
Maximum Performance Takeoffs:	Short Field	Initial Climb 69* MINIMUM	Gear DOWN, Flaps - 20°
	Soft Field	Initial Climb 69* MINIMUM	Gear DOWN, Flaps - 20°
Maximum Performance Landings:	Short Field	Approach 71* MINIMUM	Gear DOWN, Flaps - 35°
	Soft Field	Approach 71* MINIMUM	Gear DOWN, Flaps - 35°
Best Rate-of-Climb V_y		91 - S.L. ** 89 - 5000 Ft. 85 - 10,000 Ft.	Gear UP, Flaps UP
Best Angle of Climb V_x		79 - S.L. ** 80 - 5000 Ft. 81 - 10,000 Ft.	Gear UP, Flaps UP

* Smooth Air Only, increase as required for turbulence.
** Straight Line Variation Between Altitudes.

Figure 4-2. Airspeeds For Normal Operations

TAKEOFFS

NOTE

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

CAUTION

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 propeller area instead of being pulled into it.

WARNING

Takeoffs with less than 11 gallons of usable fuel are not recommended.

NORMAL TAKEOFF

1. Fuel Pump Switch - ON.
2. Mixture - FULL RICH.
3. Wing Flaps - 10 DEGREES.

NOTE

Takeoff flap setting in excess of 20 degrees is not recommended.

4. Power - FULL THROTTLE AND 2700 RPM.

NOTE

Takeoffs at density altitudes greater than 5000 feet may require leaning in order to obtain smooth engine operation.

5. Elevator Control - SLIGHTLY AFT OF NEUTRAL.
6. Rotate - 69 KIAS.
7. Climb Speed - 72 KIAS.
8. Landing Gear - RETRACT, when safely airborne.
9. Wing Flaps - RETRACT after obstacle clearance is assured.

CROSSWIND TAKEOFF

NOTE

Maximum demonstrated crosswind is 19 knots.

1. Fuel Pump Switch - ON.
2. Mixture - FULL RICH.
3. Wing Flaps - 10 DEGREES.
4. Power - FULL THROTTLE and 2700 RPM.
5. Aileron Control - FULL AILERON, into the wind. Reduce aileron deflection as speed is increased.
6. Elevator Control - SLIGHTLY FORWARD OF NEUTRAL.
7. Rotate - 75 KIAS.

NOTE

The aircraft should be positively rotated to preclude the possibility of skidding the main gear tires as might be encountered during a gradual rotation. Make a coordinated turn to maintain track.

8. Climb Speed - 80 KIAS.
9. Landing Gear - RETRACT, when safely airborne.
10. Wing Flaps - RETRACT.

SHORT FIELD TAKEOFF

1. Fuel Pump Switch - ON.
2. Mixture - FULL RICH.
3. Wing Flaps - 20 DEGREES.
4. Brakes - HOLD.
5. Power - FULL THROTTLE and 2700 RPM.
6. Brakes - RELEASE.
7. Elevator Control - SLIGHTLY AFT OF NEUTRAL.
8. Rotate - 66 KIAS.
9. Climb Speed - 69 KIAS.
10. Landing Gear - RETRACT, when safely airborne.
11. Wing Flaps - RETRACT when obstacles are safely cleared and airspeed has increased to 80 KIAS.
12. Climb Speed - Best Rate of Climb Speed or As Required.

SOFT FIELD TAKEOFF - NO OBSTACLES

1. Fuel Pump Switch - ON.
2. Mixture - FULL RICH.
3. Wing Flaps - 20 DEGREES.
4. Power - FULL THROTTLE and 2700 RPM.
5. Elevator Control - FULL AFT.

CAUTION

As the nose gear lifts off the runway, the elevator control will have to be readjusted to maintain a constant nose high attitude during the takeoff roll without dragging the tail skid.

6. Takeoff Roll/Liftoff - NOSE HIGH.

NOTE

Nose gear should be just clear of the runway during the takeoff roll and subsequent liftoff.

7. Climb - 69 KIAS.
8. Landing Gear - RETRACT, when safely airborne.
9. Wing Flaps - RETRACT after increasing airspeed to 80 KIAS.

SOFT FIELD TAKEOFF - OBSTACLES AHEAD

1. Fuel Pump Switch - ON.
2. Mixture - FULL RICH.
3. Wing Flaps - 20 DEGREES.
4. Power - FULL THROTTLE and 2700 RPM.
5. Elevator Control - FULL AFT.

NOTE

As the nose gear lifts off the runway, the elevator control will have to be adjusted to maintain a constant nose high attitude during the takeoff roll.

6. Takeoff Roll/Liftoff - NOSE HIGH.

NOTE

Nose wheel should be just clear of the runway.

7. Climb - 69 KIAS.
8. Landing Gear - RETRACT, when safely airborne.
9. Wing Flaps - RETRACT when obstacles are safely cleared and airspeed has increased to 80 KIAS.

NORMAL CLIMB

1. Airspeed - 100 to 120 KIAS.
2. Manifold Pressure - FULL THROTTLE or 25 IN.HG., whichever is less.
3. Engine Speed - 2500 RPM.
4. Mixture - FULL RICH below 5000 feet density altitude and LEAN as required for smooth engine operation above 5000 feet density altitude.
5. Cowl Flaps - AS REQUIRED.
6. Strobe Lights (if installed) - ON, unless flying through fog, clouds, or haze.

NOTE

Using strobe lights during flight through fog, clouds, or dense haze conditions can be unnecessarily distracting to the pilot, possibly resulting in disorientation.

MAXIMUM PERFORMANCE CLIMB

1. Airspeed - 91 KIAS at SEA LEVEL and 85 KIAS at 10,000 feet.
2. Manifold Pressure - MAXIMUM (Full throttle).
3. Engine Speed - 2700 RPM.
4. Mixture - FULL RICH below 5000 feet density altitude and LEAN as required for smooth engine operation above 5000 feet density altitude.
5. Cowl Flaps - AS REQUIRED.

CRUISE

CAUTION

Sudden or abrupt throttle movement may result in an engine overspeed condition. Should an overspeed condition be observed, contact Lycoming Service Representative for instructions.

1. Cowl Flaps - AS RFQUIRFD, to maintain proper operating temperatures.
2. Manifold Pressure - 15 to 24 IN.HG.
3. Engine Speed - 2200 to 2700 RPM.
4. Power - 75% MCP OR LESS.

NOTE

For more detailed information concerning cruise power settings, refer to Section V of this handbook.

5. Fuel Pump Switch - OFF.
6. Mixture - BEST POWER or BEST ECONOMY.

NOTE

Leaning should be accomplished using the Exhaust Gas Temperature (EGT) indicating system when practical. If it should be impractical to do so, leaning can be accomplished by utilizing the cruise performance fuel flow data presented in Section V of this handbook. For a best power mixture, lean to peak EGT and enrichen until the EGT decreases by 100°F. For best economy mixture, lean to peak EGT. Enrichen mixture prior to increasing engine power.

CAUTION

Do not lean to peak EGT when operating above approximately 75% MCP.

7. Fuel Selector Valve - AS REQUIRED to maintain lateral trim.

DESCENT

CAUTION

Sudden or abrupt throttle movement may result in an engine overspeed condition. Should an overspeed condition be observed, contact Lycoming Service Representative for instructions.

1. Mixture - FULL RICH.

NOTE

If engine is rough with full rich mixture lean for smoothness as required.

2. Throttle - AS REQUIRED.
3. Engine Speed - AS REQUIRED.

NOTE

Adjust manifold pressure and RPM to maintain cylinder head and oil temperature in their normal operating range.

4. Cowl Flaps - CLOSED.

BEFORE LANDING

1. Seats, Seat Belts and Shoulder Straps - ADJUST and SECURE (front seats in upright position).
2. Fuel Selector - BOTH.
3. Fuel Pump Switch - ON.
4. Landing Gear - EXTEND.
5. Flaps - 20 DEGREES.
6. Mixture - FULL RICH.

NOTE

Maximum demonstrated crosswind is 19 knots.

BALKED LANDING

1. Power - FULL THROTTLE and 2700 RPM.
2. Landing Gear - RETRACT.
3. Flaps - 20 DEGREES.
4. Airspeed - 69 KIAS MINIMUM.
5. Cowl Flaps - OPEN.

When a positive rate-of-climb has been established:

6. Airspeed - 80 KIAS.
7. Flaps - RETRACT.

NORMAL LANDING

1. Propeller Control - FULL FORWARD.
2. Power - AS REQUIRED.
3. Flaps - 35 DEGREES.
4. Airspeed - 80 KIAS.
5. Touchdown - MAIN WHEELS FIRST.
6. Braking - MINIMUM required.

SHORT FIELD LANDING

1. Propeller Control - FULL FORWARD.
2. Flaps - 35 DEGREES.
3. Power - IDLE.
4. Airspeed - 71 KIAS MINIMUM.

CAUTION

This final approach speed is a minimum speed for a smooth air condition. This approach speed should be increased as required (typically 5 to 15 KIAS), if turbulence or wind shear conditions exist.

5. Touchdown - MAIN WHEELS FIRST.
6. Flaps - RETRACT.
7. Braking - MAXIMUM.
8. Elevator Control - FULL AFT during braked roll-out.

SOFT FIELD LANDING

FINAL APPROACH

1. Propeller Control - FULL FORWARD.
2. Flaps - 35 DEGREES.
3. Manifold Pressure - 12 to 14 IN.HG.
4. Airspeed - 71 KIAS. MINIMUM.

CAUTION

This final approach speed is a minimum speed for a smooth air condition. This approach speed should be increased as required (typically 5 to 15 KIAS) if turbulence or wind shear conditions exist.

5. Touchdown - MAIN WHEELS FIRST.
6. Rollout - NOSE HIGH with nose wheel just clear of the runway.

NOTE

A slight amount of power should be maintained during touchdown. Close the throttle during the roll-out.

AFTER LANDING

1. Flaps - RETRACT.
2. Cowl Flaps - OPEN.
3. Fuel Pump Switch - OFF.
4. Strobe Lights (if installed) - OFF.

SHUTDOWN

1. Parking Brake - SET.
2. Radio Master Switch - OFF.
3. Electrical Equipment - OFF.
4. Mixture - IDLE CUTOFF.
5. Ignition Switch - OFF.
6. Master Switch - OFF.
7. Controls Lock - INSTALL.
8. Fuel Selector - OFF.
9. Tie-Downs - SECURE

NOISE CHARACTERISTICS

Certified maximum noise level for the Rockwell Commander 114 per Federal Aviation Regulation Procedures is 78.47 DB(A).

"No determination has been made by the Federal Aviation Administration that the noise levels of this airplane are or should be acceptable or unacceptable for operation at, into, or out of, any airport."

Despite the fact that the Rockwell Commander 114 noise level is below established noise level limits, all pilots can demonstrate a concern for environmental improvement by application of the following flight procedures:

1. Even though flights below 2000 feet may be consistent with Federal Aviation Regulations under VFR conditions, pilots should make an effort to avoid such flights over recreational areas or outdoor assemblies of people in order to minimize the effect of airplane noise on the public.

2. During departure or approach over public areas, every effort should be made to avoid prolonged flight at low altitude.

SECTION V

PERFORMANCE

TABLE OF CONTENTS

INTRODUCTION

The graphs and tables in this section present performance information for flight planning at various weights, powers, altitudes and temperatures. Examples of the use of each graph is shown on the graphs.

VARIABLE FACTORS AFFECTING PERFORMANCE

The effects of temperature, gross weight, pressure altitude, airspeed and airplane configuration have been accounted for in this data. Variable factors that have not been accounted for include the following: Humidity, Runway Slopes or Wet Runways.

FLIGHT PLANNING

The flight planning data presented on the following pages provides accurate and complete information from brake release to final stop. Descriptive text explains the use of each chart. The data presented is for normal operation and when combined with the "FAA APPROVED" information will provide the necessary background for flight planning. Most flight planning information is based on flight tests and is consistent with the operating procedures and limitations set forth in the "FAA APPROVED" information.

The flight planning example presented here uses the figures for airplane S/N 14150 & Subs. For flight planning information on airplane S/N 14000 thru 14149, the procedure is the same except use the charts applicable to those serial numbers.

The flight planning example presents procedures which utilize takeoff, climb, cruise, descent and landing performance charts. The sample flight log on page 5-6 will aid in following each step of the procedure. It should be noted that this example does not necessarily correspond to the example shown on each individual chart.

FLIGHT PLANNING EXAMPLE

A flight from Oklahoma City (OKC) to Houston (HOU) is presented in this example.

Runway Data at (OKC)	
Outside Air Temperature	20°C (68°F) *
Available Runway Length	9500 FT
Field Pressure Altitude	1100 FT
Reported Wind	120 DEG (MAG)/14 KT
Runway Direction	170 DEG (MAG)
Airplane Ramp Weight	3140 LB
Cruise Data	
Outside Air Temperature	5°C
Cruise Pressure Altitude to (HOU)	5000 FT
Reported Wind Aloft: (OKC to HOU)	230 DEG (TRUE)/15 KT
Course to (HOU)	160 DEG (TRUE) (151 DEG MAG)
Distance (OKC) to (HOU)	351 NM (DIRECT)
Runway Data at (HOU)	
Outside Air Temperature	25°C (77°F) *
Available Runway Length	7600 FT
Field Pressure Altitude	200 FT
Reported Wind	320 DEG (MAG)/6 KT
Runway Direction	210 DEG (MAG)
Assume fuel required for start and taxi at 9 LB. Therefore; Airplane Takeoff Weight	3131 LB

TAKEOFF

Takeoff performance can be obtained for flap deflections of 10 and 20 DEG.

From Figure 5-11 for 10 DEG Flaps: NORMAL TAKEOFF,	
Lift-Off Speed	69 KIAS
50-FT Height Speed	72 KIAS
From Figure 5-9, using 15 KT wind at 50 DEG from left of runway	
Headwind Component	10 KT
From Figure 5-10	
Ground Roll Distance	1460 FT
From Figure 5-11	
Takeoff Distance to 50 FT	2480 FT

* The airport tower and weather bureau normally give surface temperatures in DEG F.

FLIGHT PLANNING (CONTD)

CLIMB

A climb at Maximum Continuous Power is assumed; Enter Figure 5-17 at 1100 FT field pressure altitude and 20 DEG C and determine Time, Distance and Fuel; then using the cruise altitude of 5000 FT and 5 DEG C again determine Time, Distance and Fuel. The difference between these two sets of data is the Time, Distance and Fuel required to climb from field pressure altitude to cruise pressure altitude.

	Sea Level To Cruise Altitude		Sea Level To Field Pressure Altitude		Field Pressure Altitude To Cruise Altitude
Time	5.5 MIN	minus	1.2 MIN	equals	4.3 MIN
Zero Wind Distance	9.0 NM	minus	2.0 NM	equals	7.0 NM
Fuel	1.8 U.S.Gal	minus	0.4 U.S.Gal	equals	1.4 U.S.Gal (8.4 LB)

From Figure 5-9, using a wind velocity of 15 KT from 230 DEG, 70 DEG to right of true course, read:

Headwind Component . . . . . . 5 KT

The distance in climb with wind is computed as follows:

$$\text{Distance} = 7.0\text{ NM} - \left[\left(5 \frac{\text{NM}}{\text{HR}}\right) \times \left(\frac{4.3\text{ MIN}}{60\text{ MIN/HR}} \right) \right] = 6.6\text{ NM}$$

Weight at level off (including 9 LB start and taxi allowance) is 3123 LB.

CRUISE

Select the cruise type desired: 55 percent of MCP at 2300 RPM. At a pressure altitude of 5000 FT and an average cruise weight of 3000 LB, determine the Cruise True Airspeed from Figure 5-27.

Cruise True Airspeed = 131 KTAS *

To determine Level Flight Cruise performance use the Cruise Power Setting Charts, Figures 5-20 and 5-21, a portion of which is reproduced below.

PRESSURE ALTITUDE	ENGINE SPEED	% BHP	IOAT	MANIFOLD PRESSURE	FUEL FLOW
FT	RPM	PERCENT	DEG C	IN HG	U.S.GAL/HR
4000	2300	55	0	19.9	11.2
6000	2300	55	0	19.6	11.2
4000	2300	55	10	20.4	11.2
6000	2300	55	10	20.1	11.2

From the table interpolate for 5000 FT and 5 DEG C to find:

Fuel Flow . . . . 11.2 U.S. GAL/HR

Manifold Pressure . . . . 21.8 IN.HG.

The distance to Houston from level off is 351 NM less the climb distance of 7 NM or 344 NM. Enter Figure 5-9 using a wind velocity of 15 KT from 230 DEG, 70 DEG to right of true course and read:

Headwind Component . . . . 5 KT

* Figure 5-27 is presented for 3140 LBS. Therefore, the actual cruise speed will be slightly higher. This will result in a small increase in range.

FLIGHT PLANNING (CONTD)

CRUISE (Continued)

Compute the ground speed as true airspeed minus the wind or (131 KTAS - 5 KT) 126 KTAS. Time and fuel can be computed as:

Time = 344/126 = 2.73 HR *
Fuel = 11.2 x 2.73 = 30.58 U.S.GAL (183.5 LB) *

* These are intermediate calculations which do not include the descent distance allowance The final calculation is presented later.

DESCENT

To compute the descent performance, enter Figure 5-34 and read:

	Cruise Altitude To Sea Level		Field Pressure Altitude To Sea Level		Cruise Altitude To Field Pressure Altitude
Time	5.0 MIN	minus	0.2 MIN	equals	4.8 MIN
Zero Wind Distance	13.9 NM	minus	1.2 NM	equals	12.7 NM
Fuel	0.55 U.S.Gal	minus	0.03 U.S.Gal	equals	0.52 U.S.Gal (3.1 LB)

The distance in descent with the wind is:

$$\text{Distance} = 12.7\ \text{NM} - \left[(5\ \frac{\text{NM}}{\text{HR}}) \times (\frac{4.8\ \text{MIN}}{60\ \text{MIN/HR}})\right] = 12.3\ \text{NM}$$

The distance from Houston to begin letdown point is 12 NM.

The total cruise time and fuel consumption can now be calculated:

Time = (344 - 12)/126 = 2.635 HR = 2 HR 38 MIN

Fuel = 11.2 x 2.635 = 29.51 U.S. GAL (177.1 LB)

LANDING

The weight at touchdown is:

Weight = 3140 LB - 9.0 LB - 8.4 LB - 177.1 LB - 3.1 LB = 2942.4 LB.

The landing performance can be obtained from Figure 5-36. It should be noted that the data in this figure is presented for 3140 LB only, therefore the data will be conservative for 2942 LB.

To get the landing distance, first enter Figure 5-9 with a wind velocity of 6 KT at 110 DEG relative to the runway direction, and read:

Tailwind Component . . . . 2 KT

Then with a Pressure Altitude of 200 FT, a Wind Component of 2 KT and Indicated Outside Air Temperature of 25 DEG C:

From Figure 5-35
Final Approach Speed . . . . 71 KIAS
Landing Ground Roll . . . . 790 FT
and From Figure 5-36
Landing Distance From 50 FT . . . . 1322 FT

SAMPLE FLIGHT LOG

LEG	DISTANCE	TRUE AIRSPEED	WIND COMP *	GROUND SPEED	TIME LEG/TOTAL	AVERAGE FUEL FLOW	FUEL LEG/TOTAL	INITIAL WEIGHT
-	SEE BELOW	KTAS	KT	KT	HR:MIN	LB/HR	LB	LB
RAMP	--	--	--	--	--	--	--	3140
TAKEOFF (OKC)	2480 FT	--	+10	--	0:10/0:10	54.0	9.0/9.0	3131
CLIMB	7 NM	84	+ 5	79	0:05/0:15	100.8	8.4/17.4	3123
CRUISE	332 NM	131	+ 5	126	2:38/2:53	67.2	177.1/194.5	2946
DESCENT	12 NM	144	+ 5	139	0:05/2:58	37.2	3.1/197.6	2942
LANDING (HOU)	1322 FT	--	- 2	--	0:00/2:58	--	0.0/197.6	2942

* (+) Indicates a Headwind
(-) Indicates a Tailwind

THROTTLE CLOSED STALL SPEEDS

The variation of Throttle Closed Stall Speeds with Bank Angle, Flight Configuration, and Airplane Weight is shown in Figure 5-1 for Cruise, Takeoff, and Landing Configurations.

ASSOCIATED CONDITIONS

Power	THROTTLE CLOSED				
Configuration	CRUISE	TAKEOFF	TAKEOFF	TAKEOFF	LANDING
Wing Flaps	0 DEG	0 DEG	10 DEG	20 DEG	35 DEG
Landing Gear	RETRACTED	EXTENDED	EXTENDED	EXTENDED	EXTENDED
Cowl Flaps	CLOSED	OPEN	OPEN	OPEN	CLOSED
Trim Speed	150 PERCENT OF STALL SPEED				
Stall Entry Rate	UNIFORMLY DECREASING AT 1 KT/SEC.				

EXAMPLE

GIVEN:	Gross Weight	3140 LB
	Configuration	CRUISE (Gear: Retracted, Flaps: 0 Deg.)
	Bank Angle	0 DEG
FIND:	Stall Speed Fig. 5-1	60 KCAS

THROTTLE CLOSED STALL SPEEDS - CALIBRATED AIRSPEED, KNOTS

ANGLE OF BANK ~ DEGREES	GROSS WEIGHT - 3140 LBS					GROSS WEIGHT - 2500 LBS				
	GEAR RET. FLAPS 0°	GEAR EXT. FLAPS 0°	GEAR EXT. FLAPS 10°	GEAR EXT. FLAPS 20°	GEAR EXT. FLAPS 35°	GEAR RET. FLAPS 0°	GEAR EXT. FLAPS 0°	GEAR EXT. FLAPS 10°	GEAR EXT. FLAPS 20°	GEAR EXT. FLAPS 35°
0	60	63	60	58	55	54	56	54	52	49
15	61	64	61	59	56	55	57	55	52	50
30	64	67	64	61	59	57	59	57	55	52
45	72	75	72	69	66	64	66	64	61	58
60	85	89	85	82	78	76	79	76	73	70

Figure 5-1.

AIRSPEED CALIBRATION (PRIMARY STATIC SOURCE)

The variation of Calibrated Airspeed with Indicated Airspeed is shown in Figure 5-2 for Takeoff, Cruise and Landing Configurations. It applies only when the Primary Static Pressure Source has been selected.

ASSOCIATED CONDITIONS

Power	SUFFICIENT FOR LEVEL FLIGHT (Nominal)		
Configuration	TAKEOFF	CRUISE	LANDING
Wing Flaps	10 or 20 DEG	0 DEG	35 DEG
Landing Gear	EXTENDED	RETRACTED	EXTENDED
Cowl Flaps	OPEN	CLOSED	CLOSED

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

GIVEN:	Configuration	CRUISE
	Indicated Airspeed	121 KIAS
FIND:	Calibrated Airspeed Fig. 5-2	123 KCAS

NOTE: If the particular airspeed indicator instrument mechanical errors are known, apply these to the Indicated Airspeed before entering the chart.

PRIMARY AIRSPEED SYSTEM CALIBRATION

NOTE: INDICATED AIRSPEED ASSUMES ZERO INSTRUMENT ERROR

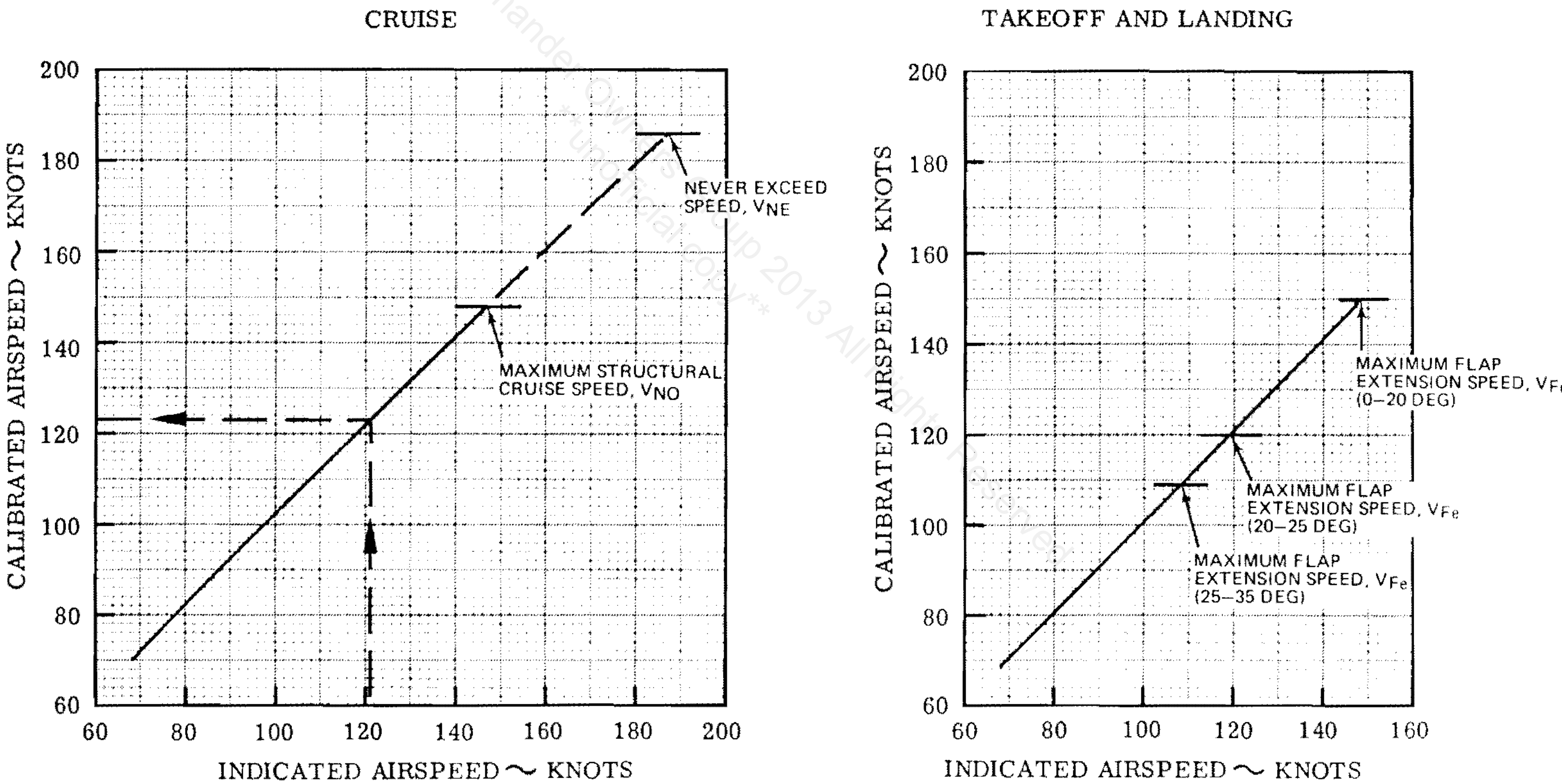

Figure 5-2.

AIRSPEED CALIBRATION (ALTERNATE STATIC SOURCE) PILOT'S SIDE WINDOW ONLY-OPEN

The variation of Calibrated Airspeed with Indicated Airspeed is shown in Figure 5-3 for Takeoff, Cruise, and Landing Configurations. It applies only when the Alternate Static Pressure Source has been selected. Only the Pilot's side window may be open.

ASSOCIATED CONDITIONS

Power: SUFFICIENT FOR LEVEL FLIGHT (Nominal)

Configuration	TAKEOFF	CRUISE	LANDING
Wing Flaps	10 or 20 DEG	0 DEG	35 DEG
Landing Gear	EXTENDED	RETRACTED	EXTENDED
Cowl Flaps	OPEN	CLOSED	CLOSED
Cabin Vent Control	OFF	OFF	OFF
Overhead Air Outlets	OFF	OFF	OFF
Heater	ON	ON	ON
Defroster	ON	ON	ON

TECHNIQUE

Select the Alternate 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. Only the Pilot's side window may be open.

EXAMPLE

GIVEN:	Configuration	CRUISE
	Indicated Airspeed	121 KIAS
FIND:	Calibrated Airspeed Fig.5-3	114 KCAS

NOTES:
1. If the particular airspeed indicator instrument mechanical errors are known, apply these to the Indicated Airspeed before entering the chart.
2. If optional right side window is installed, it must be closed.
3. A conveniently located plasticized card is provided in the cockpit, which tabulates the Airspeed Calibration information presented in Figure 5-3.

ALTERNATE AIRSPEED SYSTEM CALIBRATION

NOTE: 1. INDICATED AIRSPEED ASSUMES ZERO INSTRUMENT FRROR
2. PILOT'S SIDE WINDOW ONLY-OPEN
3. HEATER AND DEFROSTER ON

TAKEOFF, CRUISE, AND LANDING

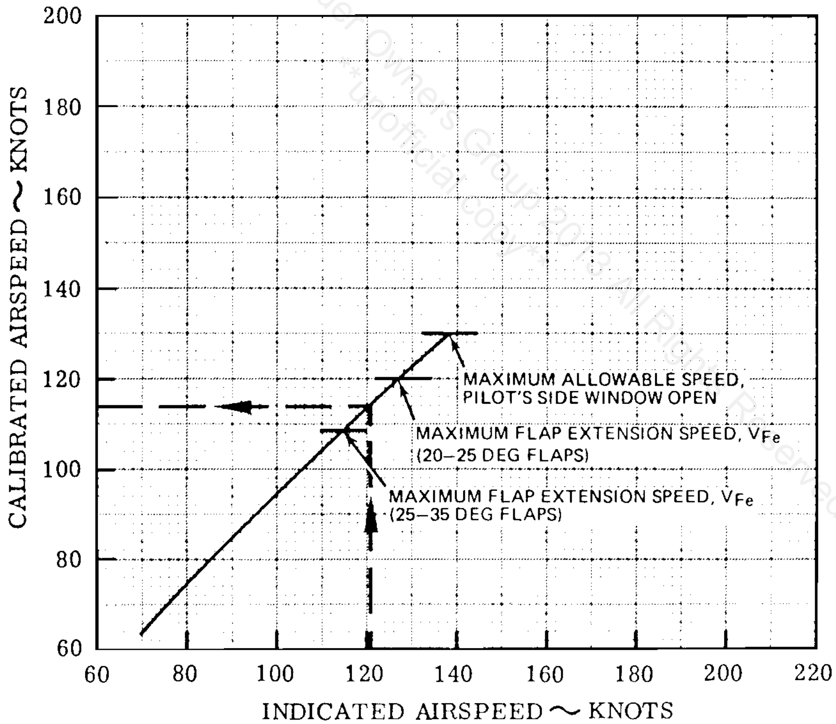

Figure 5-3.

AIRSPEED CALIBRATION (ALTERNATE STATIC SOURCE) ALL SIDE WINDOWS CLOSED

The variation of Calibrated Airspeed with Indicated Airspeed is shown in Figure 5-4 for Takeoff, Cruise, and Landing Configurations. It applies only when the Alternate Static Pressure Source has been selected, and all side windows are CLOSED.

ASSOCIATED CONDITIONS

Power	SUFFICIENT FOR LEVEL FLIGHT (Nominal)		
Configuration	TAKEOFF	CRUISE	LANDING
Wing Flaps	10 or 20 DEG	0 DEG	35 DEG
Landing Gear	EXTENDED	RETRACTED	EXTENDED
Cowl Flaps	OPEN	CLOSED	CLOSED
Cabin Vent Control	OFF	OFF	OFF
Overhead Air Outlets	OFF	OFF	OFF
Heater	ON	ON	ON
Defroster	ON	ON	ON
Vent Windows	CLOSED	CLOSED	CLOSED

TECHNIQUE

Select the Alternate 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. All side windows must be CLOSED.

EXAMPLE

GIVEN:	Configuration		CRUISE
	Indicated Airspeed		121 KIAS
FIND:	Calibrated Airspeed	Fig.5-4	123 KCAS

NOTES: 1. If the particular airspeed indicator instrument mechanical errors are known, apply these to the Indicated Airspeed before entering the chart.
2. If optional side window is installed, it must be closed.
3. A conveniently located plasticized card is provided in the cockpit, which tabulates the Airspeed Calibration information presented in Figure 5-4.

ALTERNATE AIRSPEED SYSTEM CALIBRATION

NOTE: INDICATED AIRSPEED ASSUMES ZERO INSTRUMENT ERROR

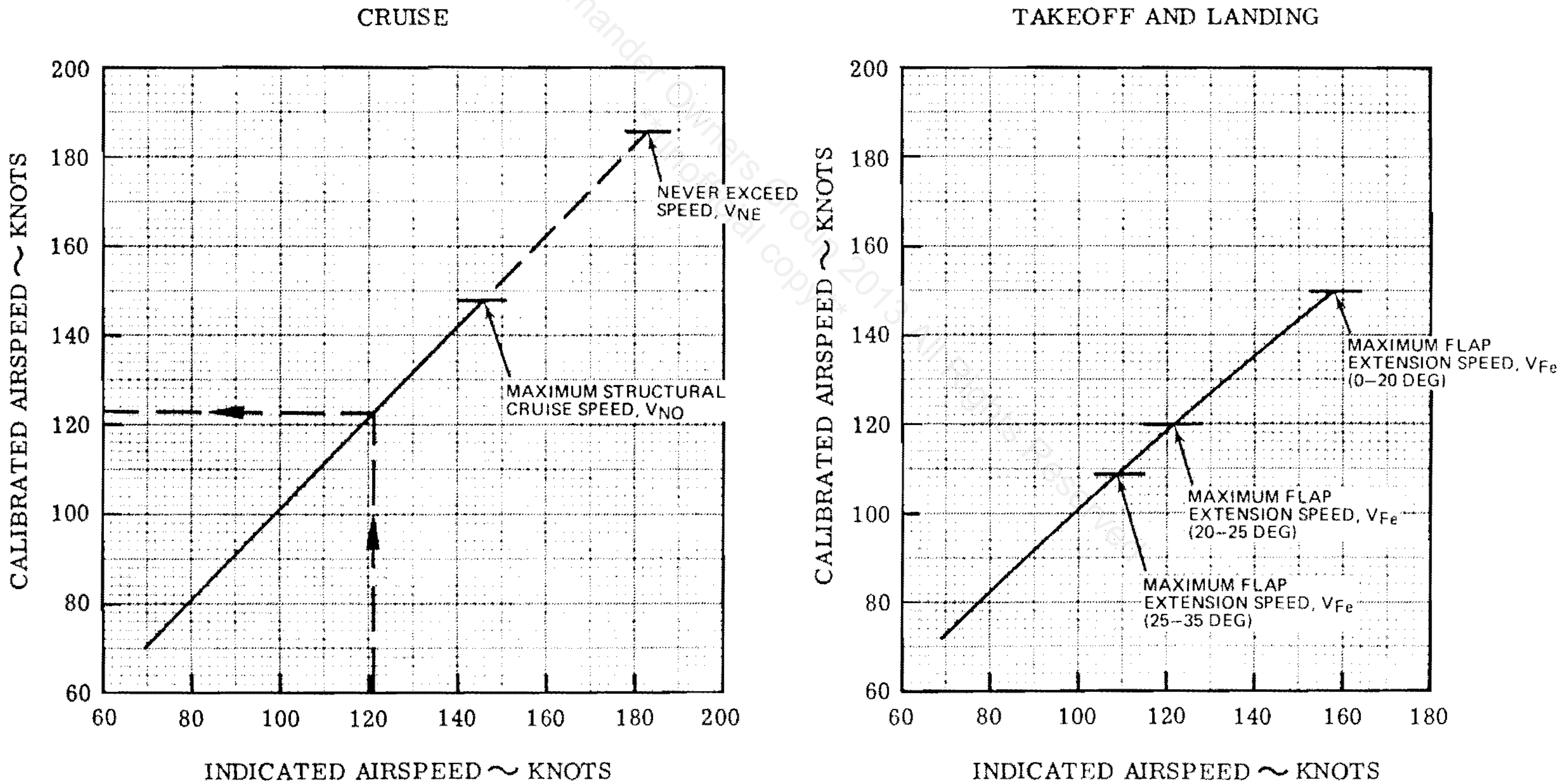

Figure 5-4.

ALTIMETER CORRECTION (PRIMARY STATIC SOURCE)

The variation of Altimeter Correction with Indicated Airspeed and Indicated Pressure Altitude is shown in Figure 5-5 for Takeoff, Cruise and Landing configurations. They apply only when the Primary Static Pressure Source has been selected.

ASSOCIATED CONDITIONS

Power	SUFFICIENT FOR LEVEL FLIGHT (Nominal)		
Configuration	TAKEOFF	CRUISE	LANDING
Wing Flaps	10 or 20 DEG	0 DEG	35 DEG
Landing Gear	EXTENDED	RETRACTED	EXTENDED
Cowl Flaps	OPEN	CLOSED	CLOSED

TECHNIQUE

DETERMINATION OF PRESSURE ALTITUDE (For use on performance charts)

Select the Primary Static Pressure Source and set the barometric scale (Kollsman Window) of the altimeter to 29.92 inches of mercury. Read the airspeed indicator and altimeter and determine the Altimeter Correction from the chart. To the Indicated Pressure Altitude reading add the Altimeter Correction as noted on the chart. Note that this technique assumes zero instrument error. After pressure altitude has been determined, the altimeter should be re-adjusted to local barometric pressure.

EXAMPLE A

GIVEN:	Configuration	TAKEOFF (10 DEG FLAPS)
	Indicated Pressure Altitude	S.L. = 0 FT
	Indicated Airspeed	70 KIAS
FIND:	Altimeter Correction Fig. 5-5	10 FT
	Calibrated Pressure Altitude	0 +10 = 10 FT

DETERMINATION OF FLIGHT ALTITUDE

With the altimeter set to the local barometric pressure, flight altitude can be determined by adding the altimeter correction found on the chart to the indicated altitude. This technique assumes zero instrument error.

EXAMPLE B

GIVEN:	Configuration	CRUISE
	Indicated Pressure Altitude	5000 FT
	Indicated Airspeed	121 KIAS
FIND:	Altimeter Correction Fig. 5-5	25 FT
	Flight Altitude	5000 +25 = 5025 FT

NOTE: If the particular airspeed indicator and altimeter instrument mechanical errors are known, apply them to the Indicated Airspeed and Indicated Pressure Altitude before entering the chart.

PRIMARY SYSTEM ALTIMETER CORRECTION

NOTE: INDICATED AIRSPEED AND PRESSURE ALTITUDE ASSUMES ZERO INSTRUMENT ERROR

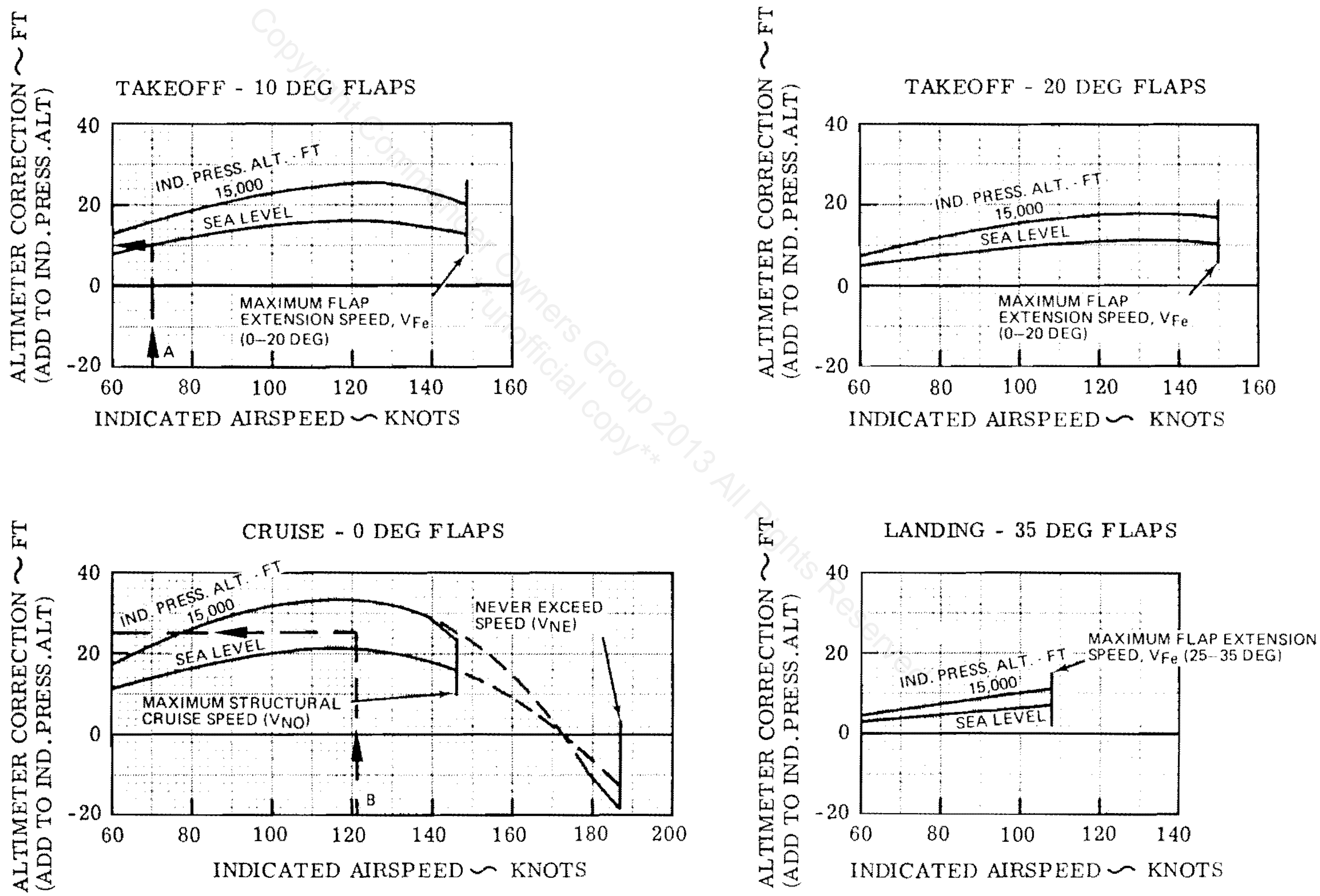

Figure 5-5.

ALTIMETER CORRECTION (ALTERNATE STATIC SOURCE) PILOT'S SIDE WINDOW -OPEN

The variation of Altimeter Correction with Indicated Airspeed and Indicated Pressure Altitude is shown in Figure 5-6 for Takeoff, Cruise, and Landing configurations. They apply only when the Alternate Static Pressure Source has been selected; only the Pilot's side window may be open.

ASSOCIATED CONDITIONS

Power	SUFFICIENT FOR LEVEL FLIGHT (Nominal)		
Configuration	TAKEOFF	CRUISE	LANDING
Wing Flaps	10 or 20 DEG	0 DEG	35 DEG
Landing Gear	EXTENDED	RETRACTED	EXTENDED
Cowl Flaps	OPEN	CLOSED	CLOSED
Heater	ON	ON	ON
Defroster	ON	ON	ON

TECHNIQUE

DETERMINATION OF PRESSURE ALTITUDE (For use on performance charts)

Select the Alternate Static Pressure Source and set the barometric scale (Kollsman Window) of the altimeter to 29.92 inches of mercury. Read the airspeed indicator and altimeter and determine the Altimeter Correction from the chart. To the Indicated Pressure Altitude reading add the Altimeter Correction as noted on the chart. Note that this technique assumes zero instrument error. Only the Pilot's side window may be open. After pressure altitude has been determined, the altimeter should be re-adjusted to local barometric pressure.

EXAMPLE A

GIVEN:	Configuration	CRUISE
	Indicated Pressure Altitude	1100 FT
	Indicated Airspeed	90 KIAS
FIND:	Altimeter Correction Fig. 5-6	-42 FT
	Calibrated Pressure Altitude	1100 -42 = 1058 FT

DETERMINATION OF FLIGHT ALTITUDE

With the altimeter set to the local barometric pressure, flight altitude can be determined by adding the altimeter correction found on the chart to the indicated altitude. This technique assumes zero instrument error.

EXAMPLE B

GIVEN:	Configuration	CRUISE
	Indicated Pressure Altitude	5000 FT
	Indicated Airspeed	121 KIAS
FIND:	Altimeter Correction Fig. 5-6	-84 FT
	Flight Altitude	5000 -84 = 4916 FT

NOTES:
1. If the particular airspeed indicator and altimeter instrument mechanical errors are known, apply them to the Indicated Airspeed and Indicated Pressure Altitude before entering the chart.
2. If optional right side window is installed, it must be closed.
3. A conveniently located plasticized card is provided in the cockpit which tabulates the Altimeter Correction presented in Figure 5-6.

ALTIMETER CORRECTION (ALTERNATE STATIC SOURCE) PILOT'S SIDE WINDOW -OPEN

The variation of Altimeter Correction with Indicated Airspeed and Indicated Pressure Altitude is shown in Figure 5-6 for Takeoff, Cruise, and Landing configurations. They apply only when the Alternate Static Pressure Source has been selected; only the Pilot's side window may be open.

ASSOCIATED CONDITIONS

Power	SUFFICIENT FOR LEVEL FLIGHT (Nominal)		
Configuration	TAKEOFF	CRUISE	LANDING
Wing Flaps	10 or 20 DEG	0 DEG	35 DEG
Landing Gear	EXTENDED	RETRACTED	EXTENDED
Cowl Flaps	OPEN	CLOSED	CLOSED
Heater	ON	ON	ON
Defroster	ON	ON	ON

TECHNIQUE

DETERMINATION OF PRESSURE ALTITUDE (For use on performance charts)

Select the Alternate Static Pressure Source and set the barometric scale (Kollsman Window) of the altimeter to 29.92 inches of mercury. Read the airspeed indicator and altimeter and determine the Altimeter Correction from the chart. To the Indicated Pressure Altitude reading add the Altimeter Correction as noted on the chart. Note that this technique assumes zero instrument error. Only the Pilot's side window may be open. After pressure altitude has been determined, the altimeter should be re-adjusted to local barometric pressure.

EXAMPLE A

GIVEN:	Configuration	CRUISE
	Indicated Pressure Altitude	1100 FT
	Indicated Airspeed	90 KIAS
FIND:	Altimeter Correction Fig. 5-6	-42 FT
	Calibrated Pressure Altitude	1100 -42 = 1058 FT

DETERMINATION OF FLIGHT ALTITUDE

With the altimeter set to the local barometric pressure, flight altitude can be determined by adding the altimeter correction found on the chart to the indicated altitude. This technique assumes zero instrument error.

EXAMPLE B

GIVEN:	Configuration	CRUISE
	Indicated Pressure Altitude	5000 FT
	Indicated Airspeed	121 KIAS
FIND:	Altimeter Correction Fig. 5-6	-84 FT
	Flight Altitude	5000 -84 = 4916 FT

NOTES:
1. If the particular airspeed indicator and altimeter instrument mechanical errors are known, apply them to the Indicated Airspeed and Indicated Pressure Altitude before entering the chart.
2. If optional right side window is installed, it must be closed.
3. A conveniently located plasticized card is provided in the cockpit which tabulates the Altimeter Correction presented in Figure 5-6.

ALTERNATE SYSTEM ALTIMETER CORRECTION

TAKEOFF, CRUISE, AND LANDING

NOTE: 1. INDICATED AIRSPEED AND PRESSURE ALTITUDE ASSUMES ZERO INSTRUMENT ERROR
2. PILOT'S SIDE WINDOW ONLY-OPEN
3. HEATER AND DEFROSTER ON

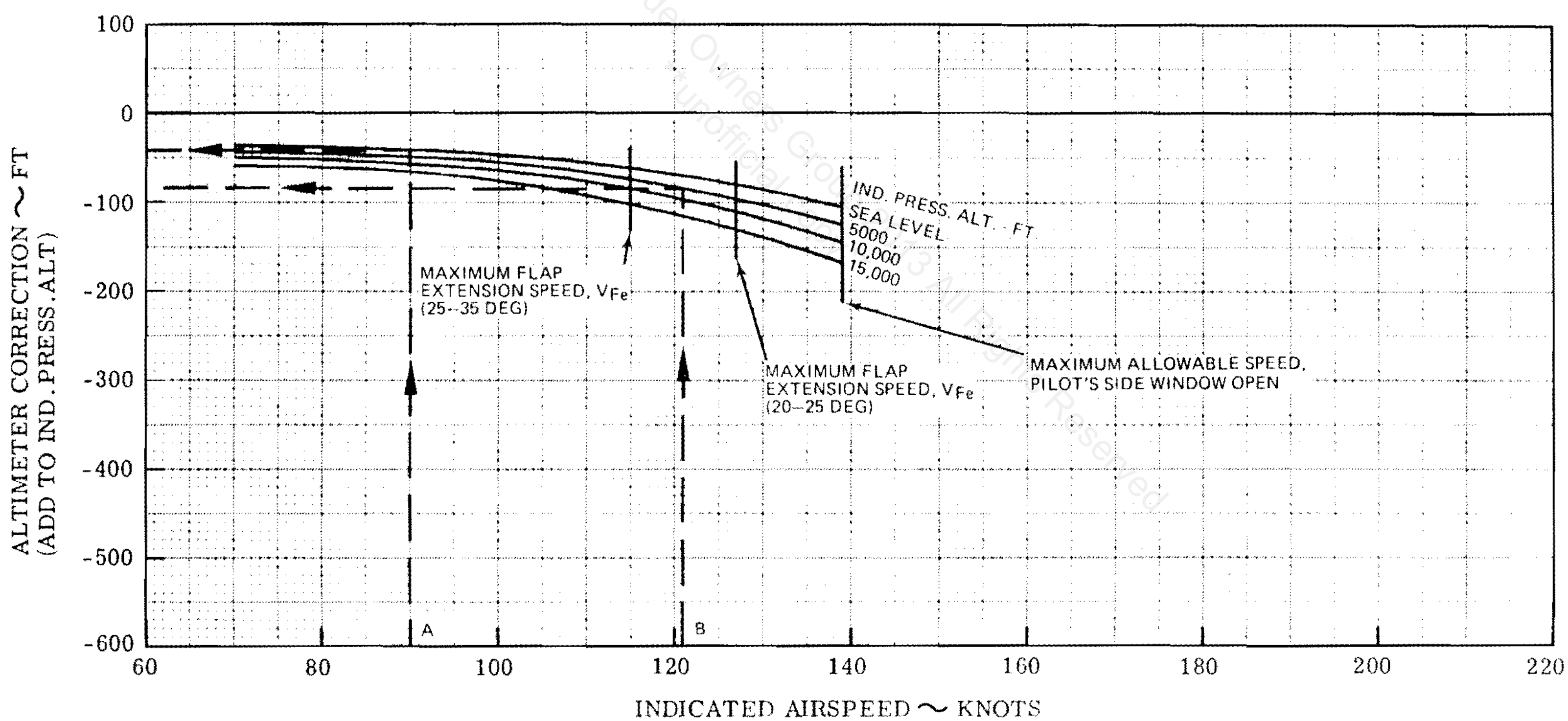

Figure 5-6.

ALTIMETER CORRECTION (ALTERNATE STATIC SOURCE) ALL SIDE WINDOWS CLOSED

The variation of Altimeter Correction with Indicated Airspeed and Indicated Pressure Altitude is shown in Figure 5-7 for Takeoff, Cruise, and Landing configurations. They apply only when the Alternate Static Pressure Source has been selected, and all side windows are CLOSED.

ASSOCIATED CONDITIONS

Power	SUFFICIENT FOR LEVEL FLIGHT (Nominal)		
Configuration	TAKEOFF	CRUISE	LANDING
Wing Flaps	10 or 20 DEG	0 DEG	35 DEG
Landing Gear	EXTENDED	RETRACTED	EXTENDED
Cowl Flaps	OPEN	CLOSED	CLOSED
Heater	ON	ON	ON
Defroster	ON	ON	ON

TECHNIQUE

DETERMINATION OF PRESSURE ALTITUDE (For use on performance charts)

Select the Alternate Static Pressure Source and set the barometric scale (Kollsman Window) of the altimeter to 29.92 inches of mercury. Read the airspeed indicator and altimeter and determine the Altimeter Correction from the chart. To the indicated Pressure Altitude reading add the Altimeter Correction as noted on the chart. Note that this technique assumes zero instrument error. All side windows must be CLOSED. After pressure altitude has been determined, the altimeter should be re-adjusted to local barometric pressure.

EXAMPLE A

GIVEN:	Configuration	CRUISE
	Indicated Pressure Altitude	1100 FT
	Indicated Airspeed	90 KIAS
FIND:	Altimeter Correction Fig. 5-7	13 FT
	Calibrated Pressure Altitude	1100 +13 = 1113 FT

EXAMPLE B

GIVEN:	Configuration	TAKEOFF
	Indicated Pressure Altitude	SEA LEVEL
	Indicated Airspeed	130 KIAS
FIND:	Altimeter Correction Fig. 5-7	-33 FT
	Calibrated Pressure Altitude	S.L. -33 FT = -33 FT

DETERMINATION OF FLIGHT ALTITUDE

With the altimeter set to the local barometric pressure, flight altitude can be determined by adding the altimeter correction found on the chart to the indicated altitude. This technique assumes zero instrument error.

EXAMPLE C

GIVEN:	Configuration	CRUISE
	Indicated Pressure Altitude	5000 FT
	Indicated Airspeed	121 KIAS
FIND:	Altimeter Correction Fig. 5-7	26 FT
	Flight Altitude	5000 + 26 = 5026 FT

NOTES: 1. If the particular airspeed indicator and altimeter instrument mechanical errors are known, apply them to the Indicated Airspeed and Indicated Pressure Altitude before entering the chart.
2. If optional right side window is installed, it must be closed.
3. A conveniently located plasticized card is provided in the cockpit, which tabulates the Altimeter Correction presented in Figure 5-7.

ALTERNATE SYSTEM ALTIMETER CORRECTION

NOTES:
1. INDICATED AIRSPEED AND PRESSURE ALTITUDE ASSUMES ZERO INSTRUMENT ERROR
2. SIDE WINDOW OR WINDOWS-CLOSED
3. HEATER AND DEFROSTER ON

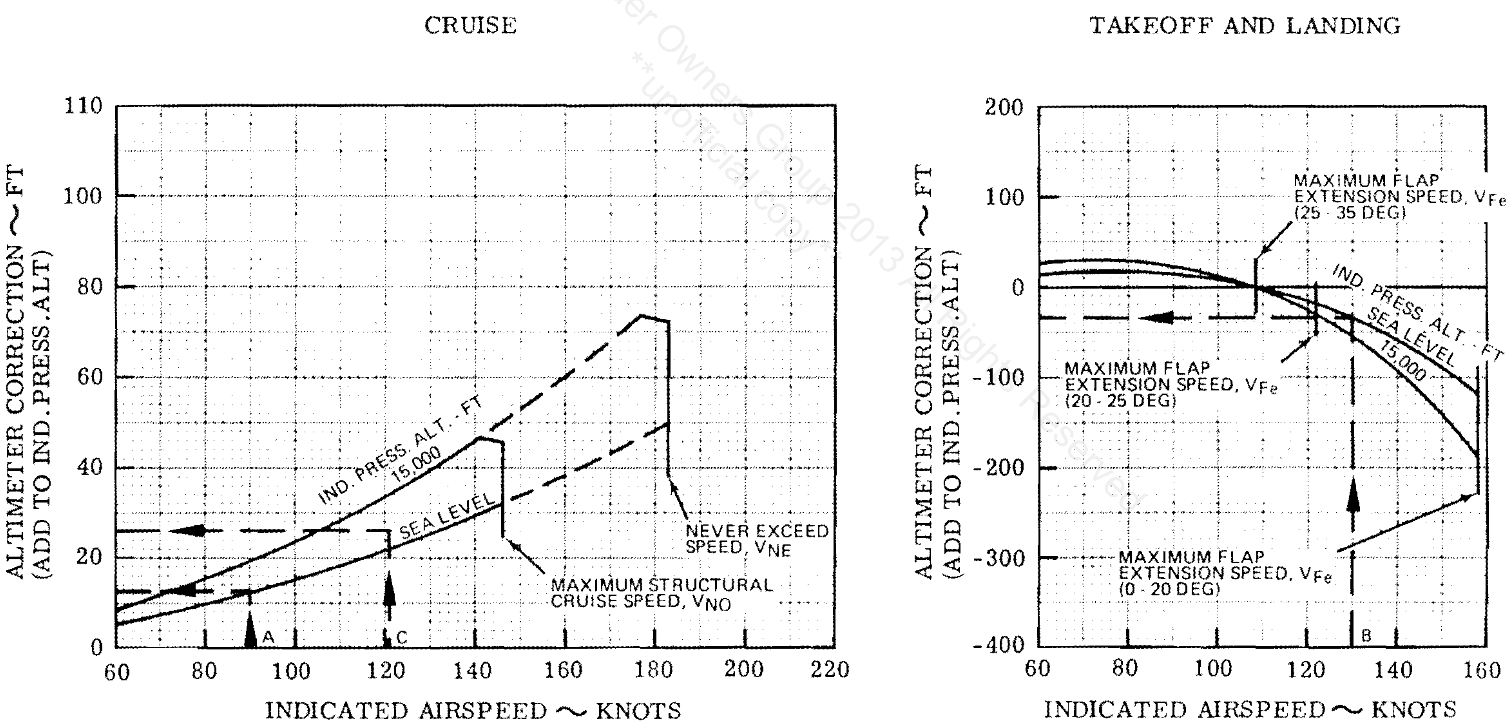

Figure 5-7.

ALTERNATE SYSTEM ALTIMETER CORRECTION

NOTES:
1. INDICATED AIRSPEED AND PRESSURE ALTITUDE ASSUMES ZERO INSTRUMENT ERROR
2. SIDE WINDOW OR WINDOWS-CLOSED
3. HEATER AND DEFROSTER ON

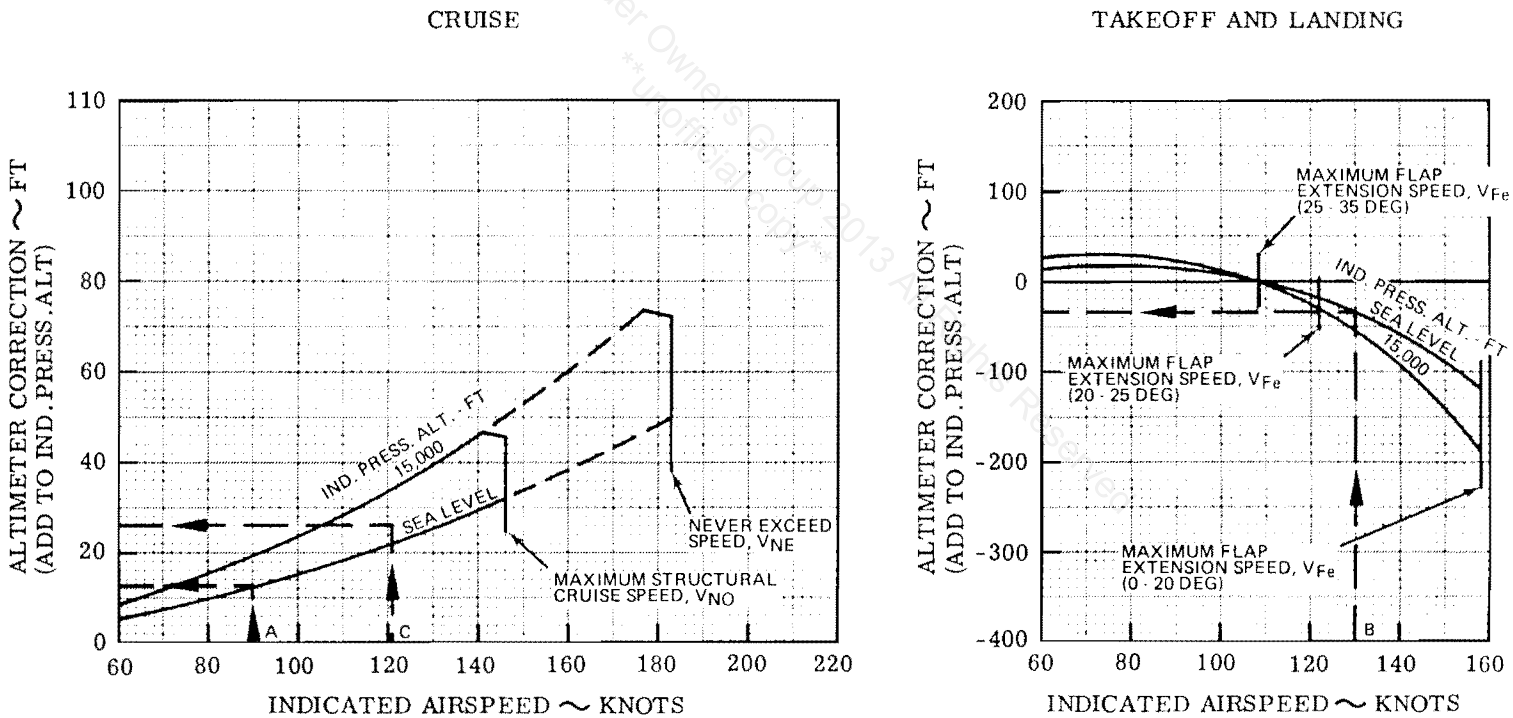

Figure 5-7.

TEMPERATURE CONVERSION

Temperature in Degrees Celsius is presented in Figure 5-8 for varying temperature in Degrees Fahrenheit.

EXAMPLE

GIVEN:	Temperature Deg C	20 DEG C
FIND:	Temperature Deg F, Fig. 5-8	68 DEG F

TEMPERATURE CONVERSION

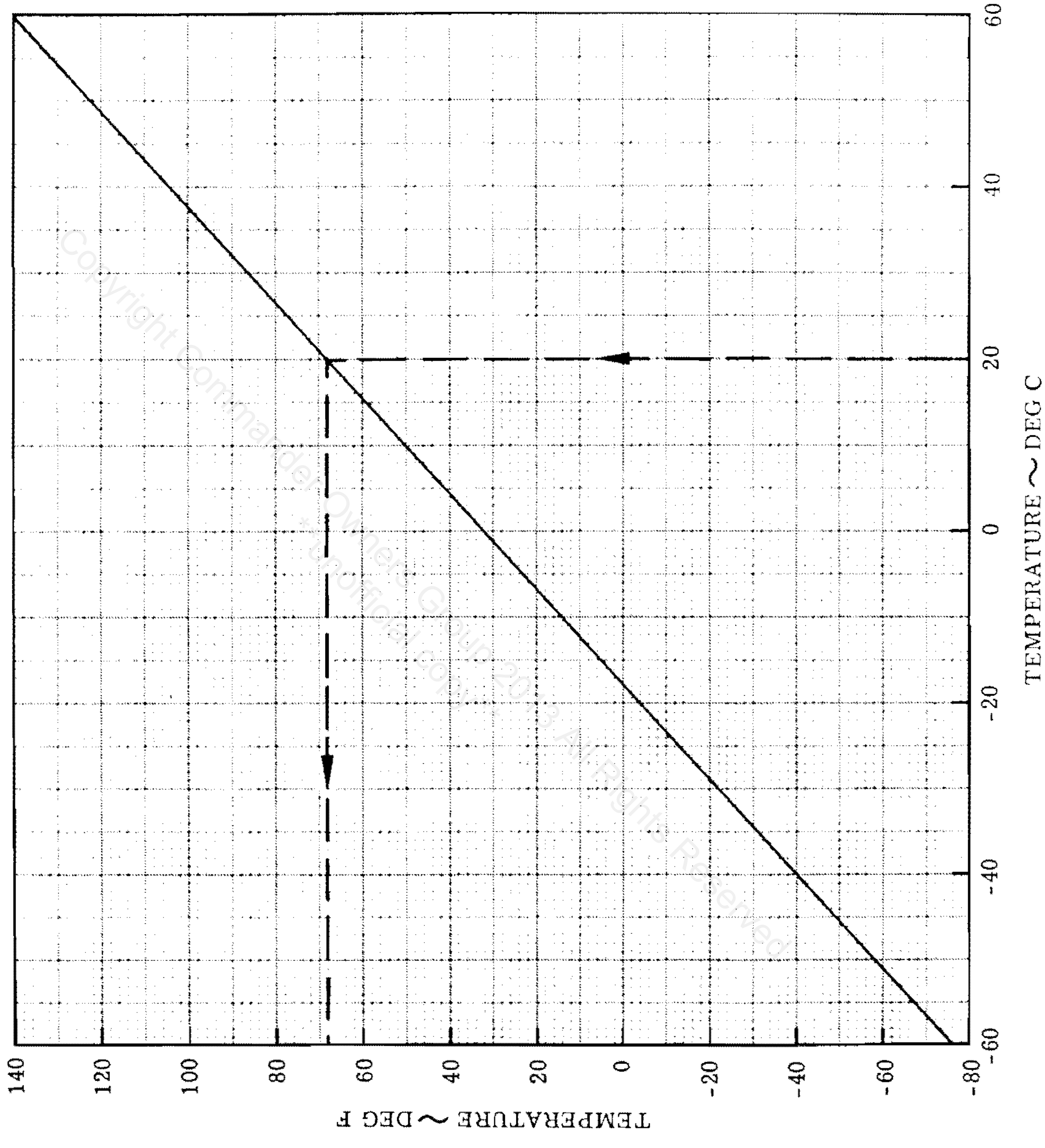

Figure 5-8.

TEMPERATURE CONVERSION

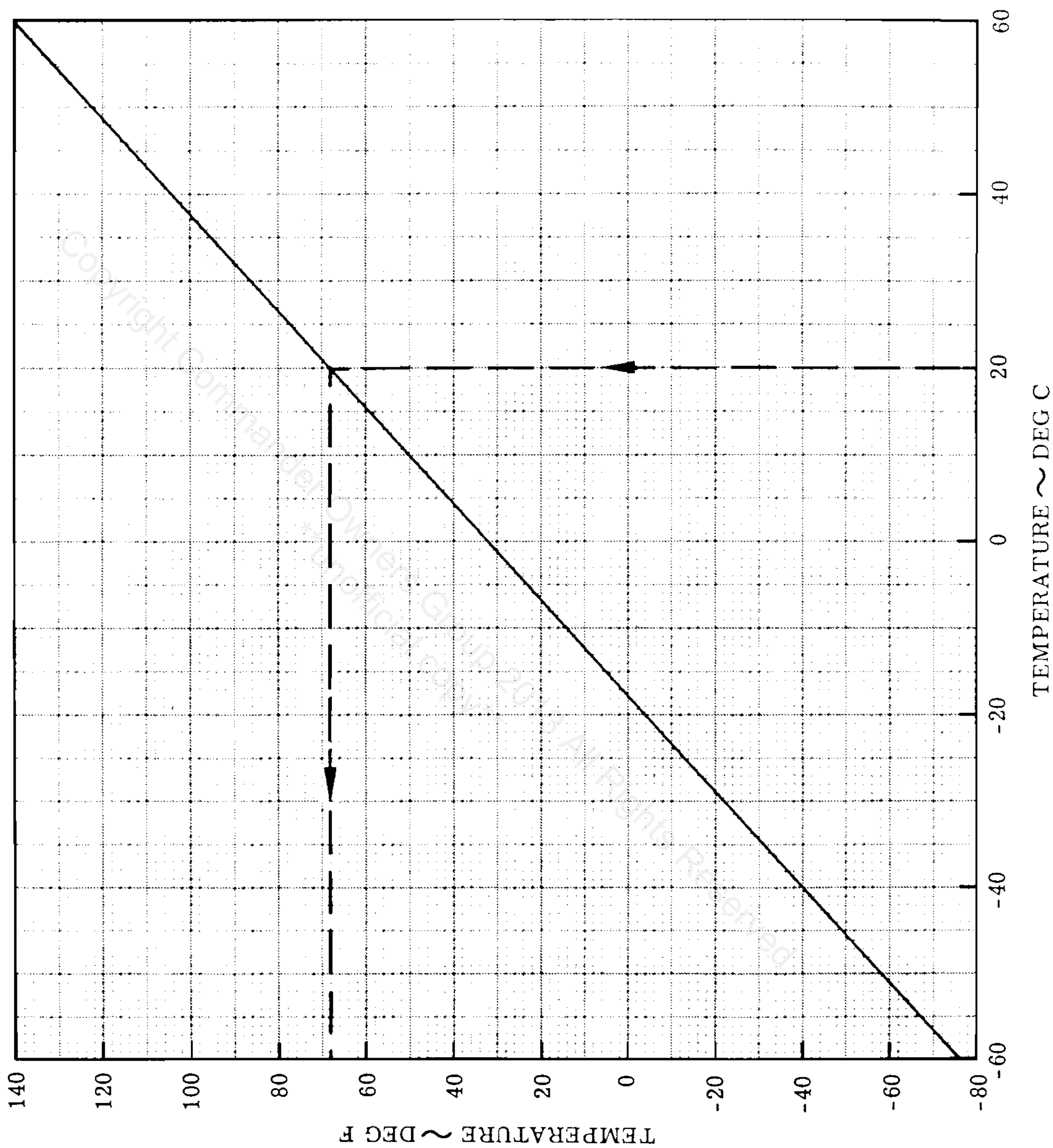

Figure 5-8.

WIND COMPONENTS

Wind Components are presented in Figure 5-9 for varying reported wind velocities and angles between the heading and the reported wind.

EXAMPLE

GIVEN:	Reported Wind Velocity	14 KT
	Angle between Heading and Wind	45 DEG
FIND:	Headwind Component, Fig. 5-9	10 KT
	Crosswind Component, Fig. 5-9	10 KT

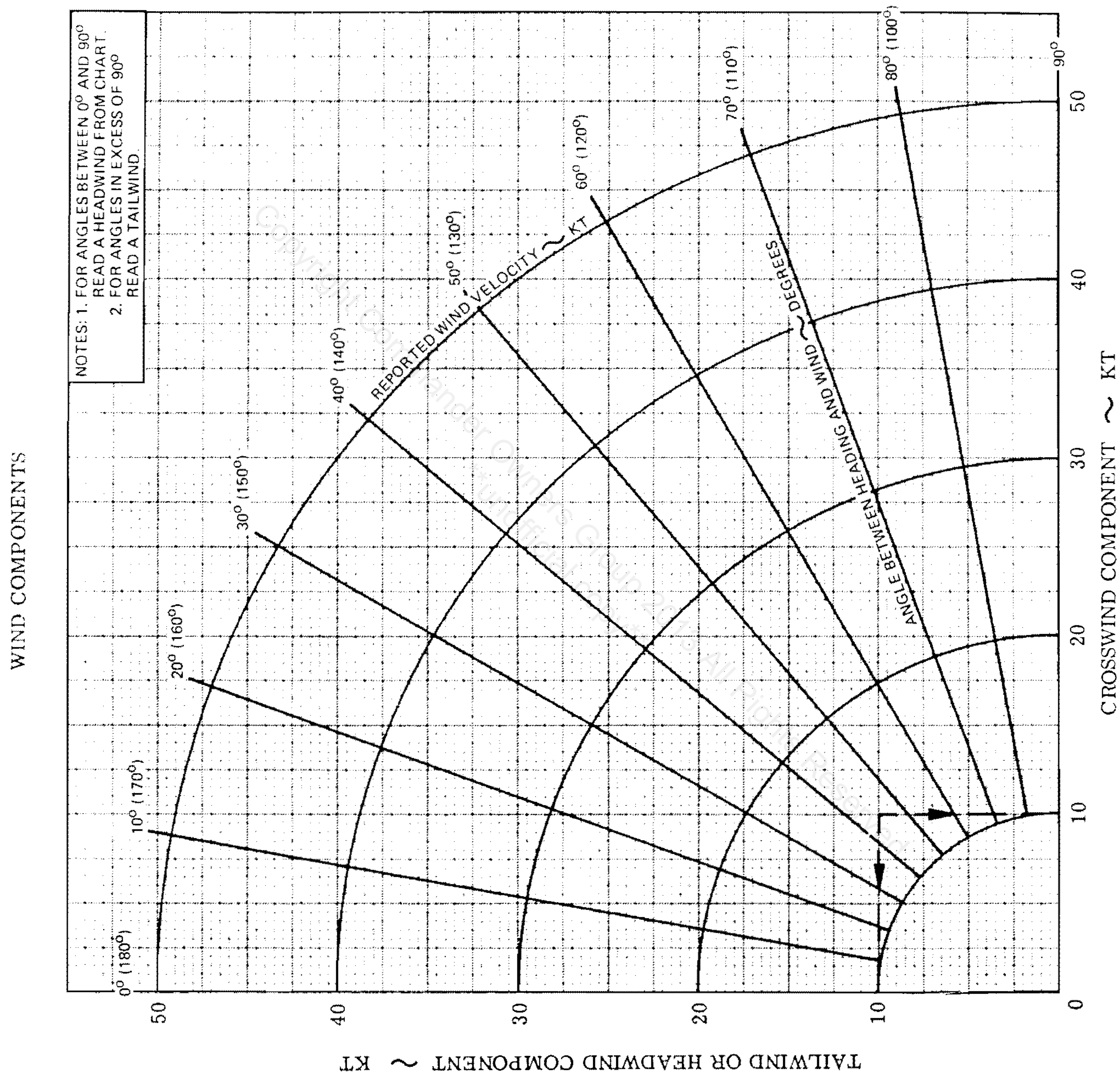
WIND COMPONENTS
NOTES: 1. FOR ANGLES BETWEEN 0° AND 90° READ A HEADWIND FROM CHART.
2. FOR ANGLES IN EXCESS OF 90° READ A TAILWIND.
REPORTED WIND VELOCITY ~ KT
ANGLE BETWEEN HEADING AND WIND ~ DEGREES
0° (180°)
10° (170°)
20° (160°)
30° (150°)
40° (140°)
50° (130°)
60° (120°)
70° (110°)
80° (100°)
90°
CROSSWIND COMPONENT ~ KT
TAILWIND OR HEADWIND COMPONENT ~ KT
0
10
20
30
40
50

Figure 5-9.

TAKEOFF GROUND ROLL DISTANCE, NORMAL (WING FLAPS 10 DEG)

The Takeoff Ground Roll Distance with 10 Deg Flaps is shown in Figure 5-10 for varying outside air temperature, pressure altitude and wind speed at a gross weight of 3140 lbs.

ASSOCIATED CONDITIONS

Power	TAKEOFF (FULL THROTTLE, 2700 RPM)
Wing Flaps	10 DEG
Landing Gear	EXTENDED
Cowl Flaps	OPEN
Runway Conditions	PAVED*, DRY, LEVEL
Mixture	See NOTE 3 below

TECHNIQUE

Obtain Takeoff Power prior to brake release. Release the brakes and accelerate to liftoff at 69 KIAS.

EXAMPLE

GIVEN:	Gross Weight	3140 LB
	Outside Air Temperature	20 DEG C
	Pressure Altitude	1100 FT
	Wind Component	10 KTS (HEADWIND)
FIND:	Distance to Liftoff, Fig. 5-10	1460 FT

NOTES: 1. IAS assumes zero instrument error.
2.* For short, dry grass runways, increase the ground roll distance by 28% at Sea Level linearly increasing to 61% at 8000 feet.
3. Mixture setting should be set according to the existing pressure altitude and outside air temperature: Below 5000 feet, FULL RICH. 5000 feet to 8000 feet; LEAN for smooth engine operation, as required. Above 8000 feet; LEAN for best power mixture (peak EGT, then enrich 100 Deg.F.). These altitudes should be reduced approximately 2000 feet for outside air temperatures of ISA +20°C.

NORMAL TAKEOFF GROUND ROLL DISTANCE
(10 DEG FLAPS)

DRY, LEVEL, PAVED* RUNWAYS   TAKEOFF GROSS WEIGHT = 3140 LB

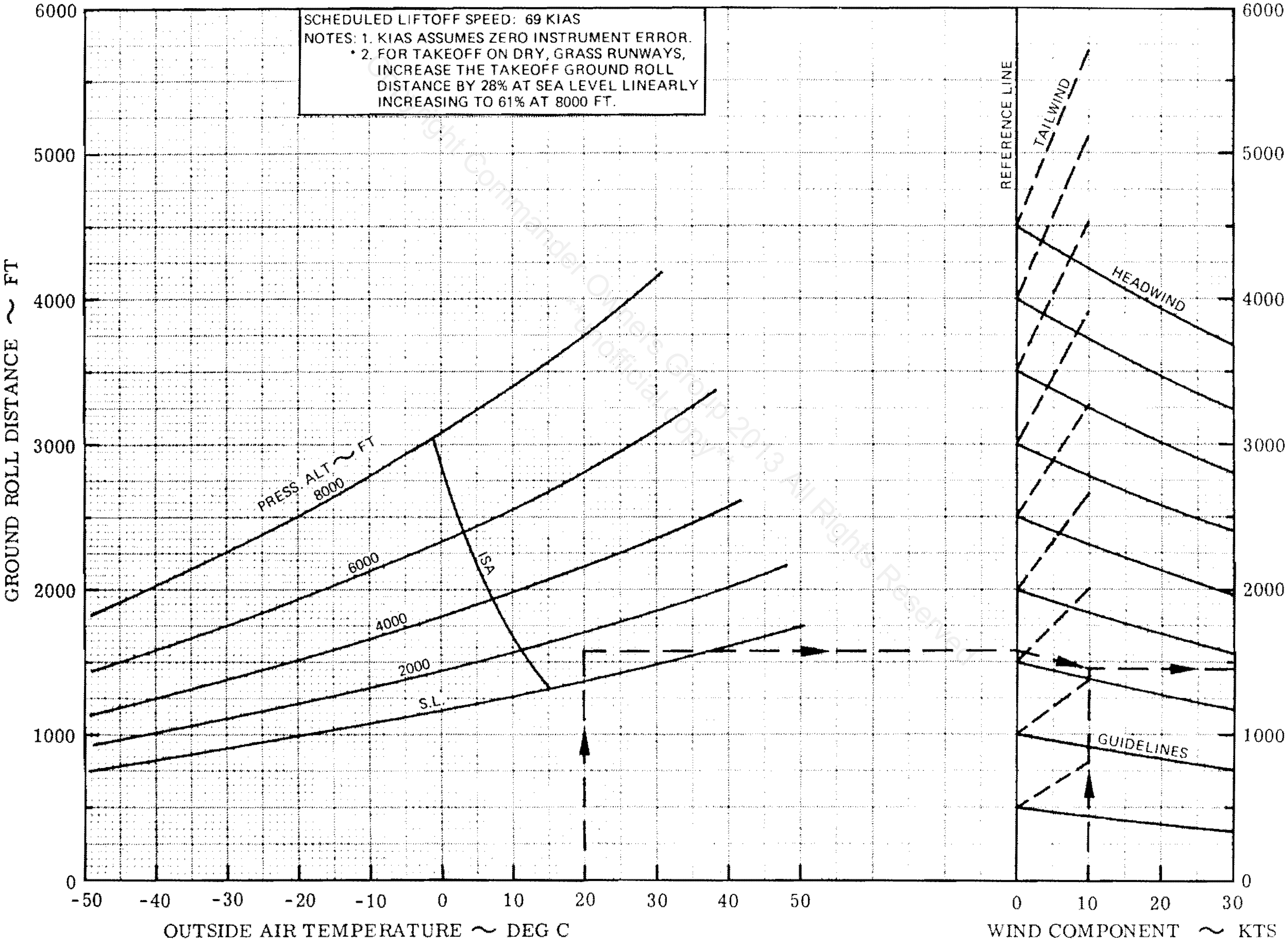

Figure 5-10.

TOTAL TAKEOFF DISTANCE, NORMAL (WING FLAPS 10 DEG)

The Takeoff Distances to 50-Ft Height with 10 Degree Flaps are shown in Figure 5-11 for varying Outside Air Temperature, Pressure Altitude and Wind Speed at a Gross Weight of 3140 lbs.

ASSOCIATED CONDITIONS

Power	TAKEOFF (FULL THROTTLE, 2700 RPM)
Wing Flaps	10 DEG
Landing Gear	EXTENDED
Cowl Flaps	OPEN
Runway Condition	PAVED*, DRY, LEVEL
Mixture	See NOTE 3 below

TECHNIQUE

Obtain takeoff power prior to brake release. Release the brakes and accelerate. Liftoff at 69 KIAS and accelerate to 72 KIAS at 50-Ft Height.

EXAMPLE

GIVEN:	Gross Weight		3140 LBS
	Outside Air Temperature		20 DEG C
	Pressure Altitude		1100 FT
	Wind Component		10 KTS (HEADWIND)
FIND:	Distance To 50-Ft Height		
		Fig. 5-11	2480 FT

NOTES: 1. IAS assumes zero instrument error.
2.* For short, dry grass runways, increase the takeoff distance by 17%.
3. Mixture setting should be set according to the existing pressure altitude and outside air temperature: Below 5000 feet, FULL RICH. 5000 feet to 8000 feet; LEAN for smooth engine operation, as required. Above 8000 feet; LEAN for best power mixture (peak EGT, then enrich 100 DEG. F.). These altitudes should be reduced approximately 2000 feet for outside air temperature of ISA +20°C.

NORMAL TOTAL TAKEOFF DISTANCE
(10 DEG FLAPS)

DRY, LEVEL, PAVED* RUNWAYS TAKEOFF GROSS WEIGHT = 3140 LB

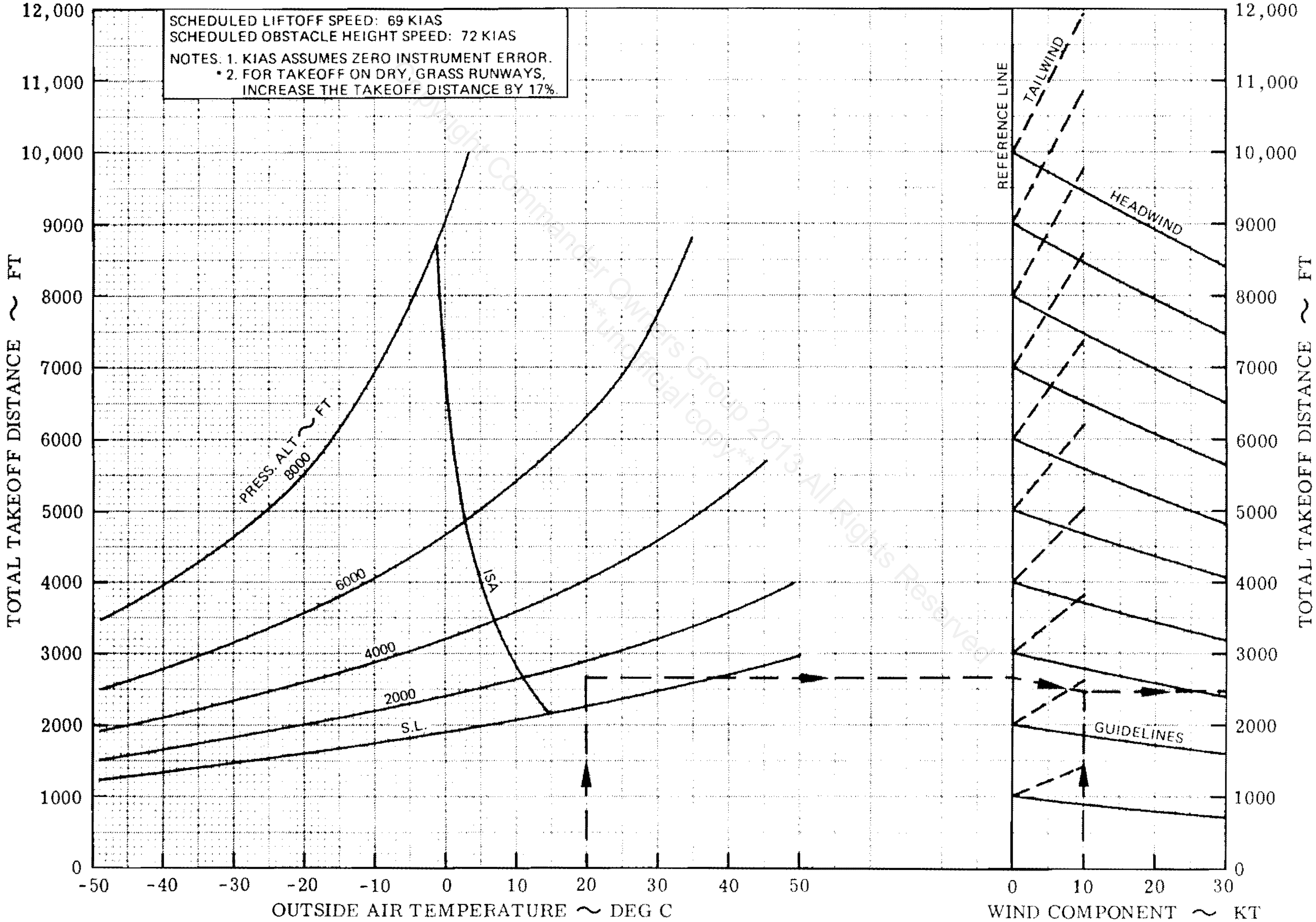

Figure 5-11.

TAKEOFF GROUND ROLL DISTANCE, SHORT FIELD (WING FLAPS 20 DEG)

The Short Field Takeoff Ground Roll Distance with 20 Deg. Flaps is shown in Figure 5-12 for varying outside air temperature, pressure altitude, and wind speed at a gross weight of 3140 lbs.

ASSOCIATED CONDITIONS

Power	TAKEOFF (FULL THROTTLE, 2700 RPM)
Wing Flaps	20 DEG
Landing Gear	EXTENDED
Cowl Flaps	OPEN
Runway Conditions	PAVED*, DRY, LEVEL
Mixture	See NOTE 3 below

TECHNIQUE

Obtain Takeoff Power prior to brake release. Release the brakes and accelerate to liftoff at 66 KIAS.

EXAMPLE

GIVEN:	Gross Weight	3140 LB
	Outside Air Temperature	20 DEG C
	Pressure Altitude	1100 FT
	Wind Component	10 KTS HEADWIND
FIND:	Distance to Liftoff Fig. 5-12	1229 FT

NOTES: 1. IAS assumes zero instrument error.

2.* For short, dry grass runways, increase the ground roll distance by 27% at Sea Level linearly increasing to 65% increase at 8000 feet.

3. Mixture setting should be set according to the existing pressure altitude and outside air temperature: Below 5000 feet, FULL RICH. 5000 feet to 8000 feet; LEAN for smooth engine operation, as required. Above 8000 feet; LEAN for best power mixture (peak EGT, then enrich 100 DEG F.). These altitudes should be reduced approximately 2000 feet for outside air temperatures of ISA +20°C.

SHORT FIELD TAKEOFF GROUND ROLL DISTANCE (20 DEG FLAPS)

DRY, LEVEL, PAVED* RUNWAYS TAKEOFF GROSS WEIGHT = 3140 LB

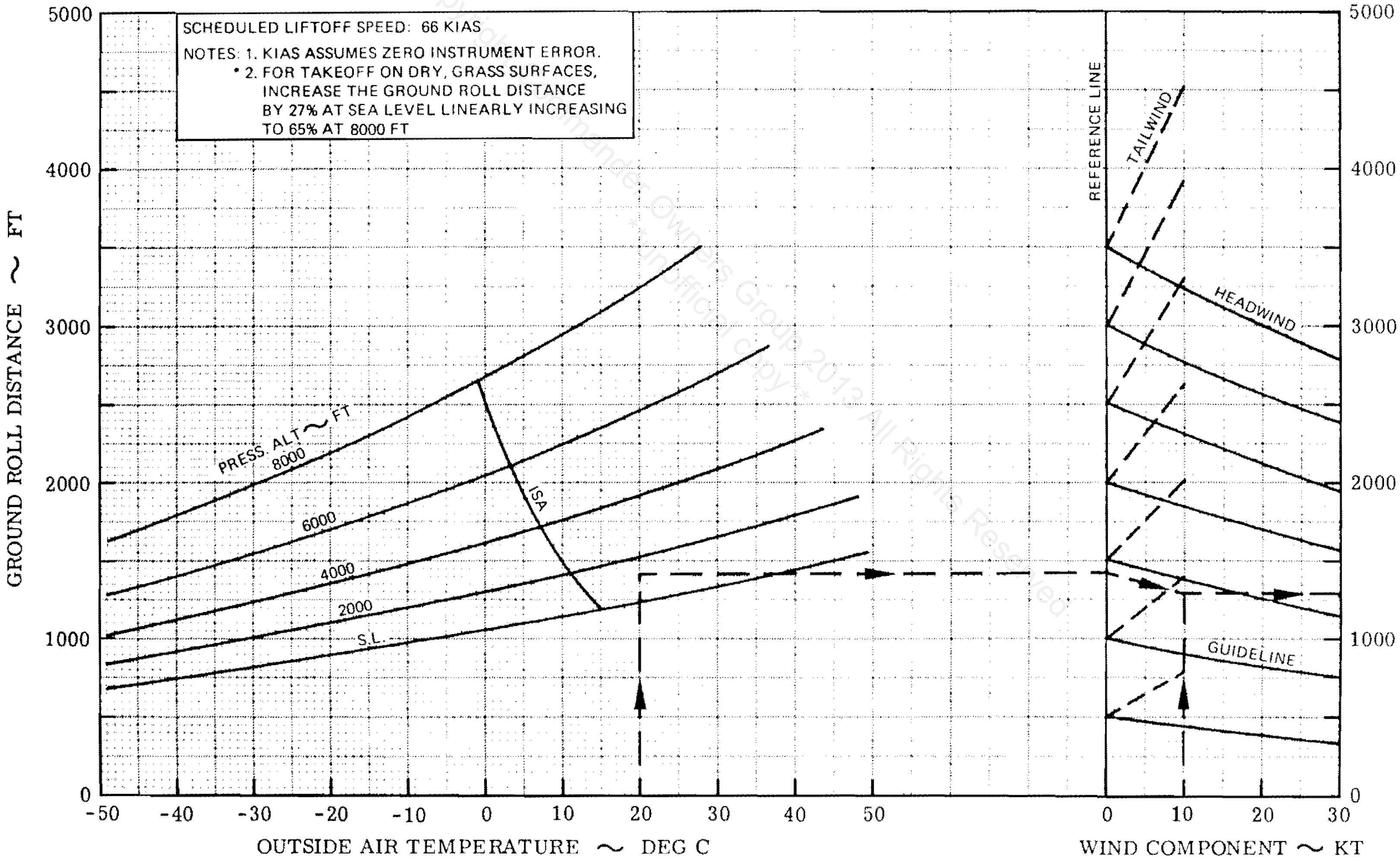

Figure 5-12.

TOTAL TAKEOFF DISTANCE, SHORT FIELD (WING FLAPS 20 DEG)

The Takeoff Distances to 50-Ft Height with 20 Degree Flaps are shown in Figure 5-13 for varying Outside Air Temperature, Pressure Altitude, and Wind Speed at a Gross Weight of 3140 lbs.

ASSOCIATED CONDITIONS

Power	TAKEOFF (FULL THROTTLE, 2700 RPM)
Wing Flaps	20 DEG
Landing Gear	EXTENDED
Cowl Flaps	OPEN
Runway Condition	PAVED*, DRY,LEVEL
Mixture	See NOTE 3 below

TECHNIQUE

Obtain takeoff power prior to brake release. Release the brakes and accelerate. Liftoff at 66 KIAS and accelerate to 69 KIAS at 50-Ft Height.

EXAMPLE

GIVEN:	Gross Weight	3140 LBS
	Outside Air Temperature	20 DEG C
	Pressure Altitude	1100 FT
	Wind Component	10 KTS (HEADWIND)
FIND:	Distance to 50-Ft Height	
	Fig. 5-13	2200 FT

NOTES: 1. IAS assumes zero instrument error.
2.* For short, dry grass runways, increase the takeoff distance by 16%.
3. Mixture setting should be set according to the existing pressure altitude and outside air temperature: Below 5000 feet, FULL RICH. 5000 feet to 8000 feet: LEAN for smooth engine operation, as required. Above 8000 feet: LEAN for best power mixture (peak EGT, then enrich 100 Deg. F.). These altitudes should be reduced approximately 2000 feet for outside air temperatures of ISA +20°C.

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Revised: 22 April 1977

SHORT FIELD TOTAL TAKEOFF DISTANCE
(20 DEG FLAPS)

DRY, LEVEL, PAVED* RUNWAYS   TAKEOFF GROSS WEIGHT - 3140 LB

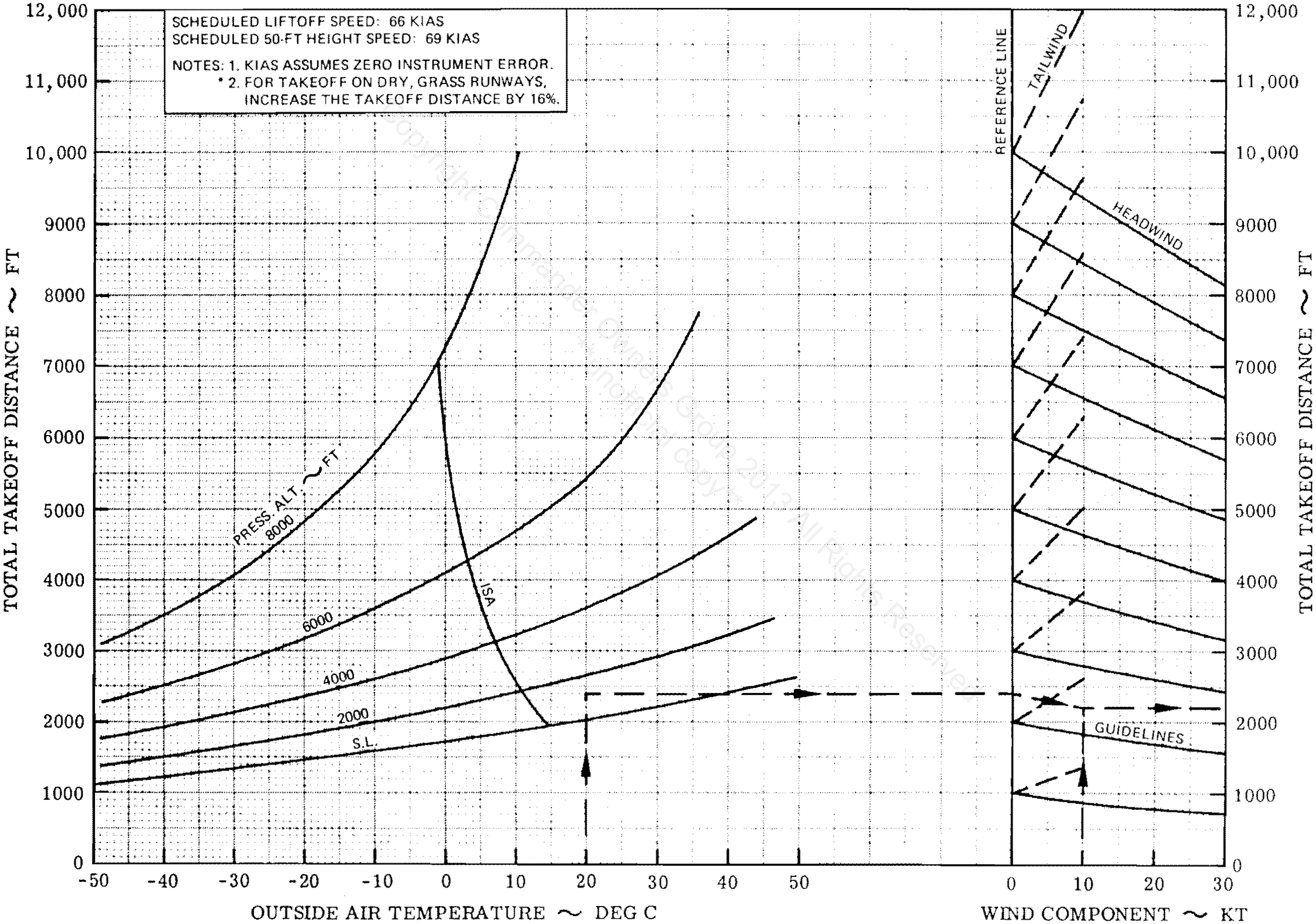


Figure 5-13.

RATE OF CLIMB, CLEAN CONFIGURATION (S/N 14000 THRU 14149)

The Rate of Climb for the Clean Configuration is shown in Figure 5-14 for varying outside air temperature, pressure altitude, and airplane weight. A table of Scheduled Climb Speeds versus Pressure Altitude is presented on the chart.

ASSOCIATED CONDITIONS

Power	MAXIMUM CONTINUOUS
Wing Flaps	0 DEG
Landing Gear	RETRACTED
Cowl Flaps	FULL OPEN
Mixture	See NOTE 3 below

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 A

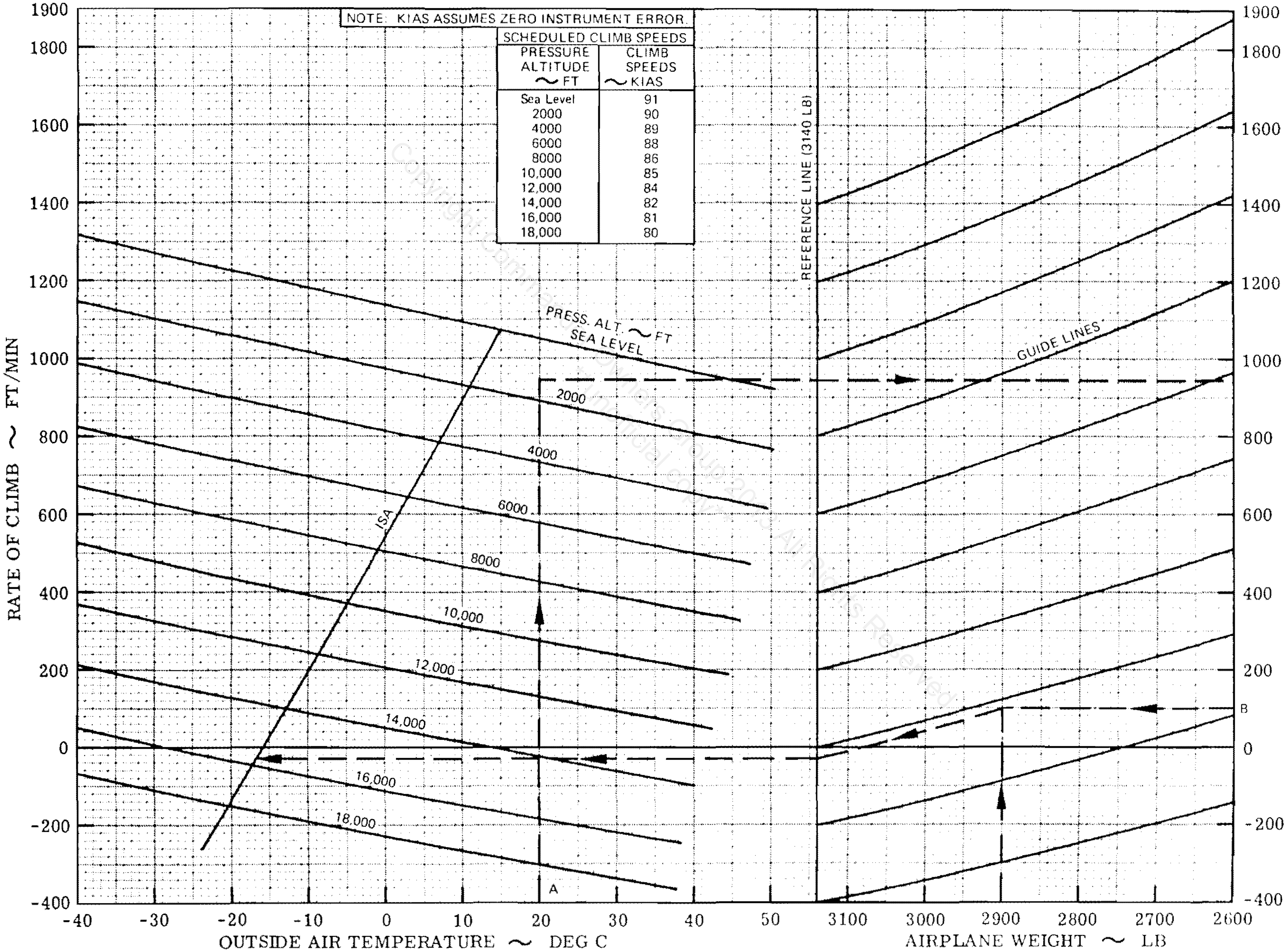
GIVEN:	Airplane Weight	3140 LB
	Outside Air Temperature	20 DEG C
	Pressure Altitude	1100 FT
FIND:	Rate of Climb, Fig. 5-14	950 FT/MIN
	Scheduled Climb Speed, Fig. 5-14	90 KIAS

EXAMPLE B

GIVEN:	Airplane Weight	2900 LB
	Rate of Climb	100 FT/MIN
	Outside Air Temperature	ISA (-15 DEG C)
FIND:	Service Ceiling, Fig. 5-14	15,800 FT

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.
3. Mixture setting should be set according to the existing pressure altitude and outside air temperature: Below 5000 feet, FULL RICH. 5000 feet to 8000 feet; LEAN for smooth engine operation, as required. Above 8000 feet; LEAN for best power mixture (peak EGT, then enrich 100 Deg. F.). These altitudes should be reduced approximately 2000 feet for outside air temperatures of ISA +20°C.

RATE OF CLIMB, CLEAN CONFIGURATION (S/N 14000 THRU 14149)



SCHEDULED CLIMB SPEEDS	
PRESSURE ALTITUDE ~ FT	CLIMB SPEEDS ~ KIAS
Sea Level	91
2000	90
4000	89
6000	88
8000	86
10,000	85
12,000	84
14,000	82
16,000	81
18,000	80

Figure 5-14.

RATE OF CLIMB, CLEAN CONFIGURATION (S/N 14150 AND SUBS)

The Rate of Climb for the Clean Configuration is shown in Figure 5-15 for varying outside air temperature, pressure altitude, and airplane weight. A table of Scheduled Best Rate of Climb Speeds versus Pressure Altitude is presented on the chart.

ASSOCIATED CONDITIONS

Power	MAXIMUM CONTINUOUS
Wing Flaps	0 DEG
Landing Gear	RETRACTED
Cowl Flaps	FULL OPEN
Mixture	See NOTE 3 below

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 A

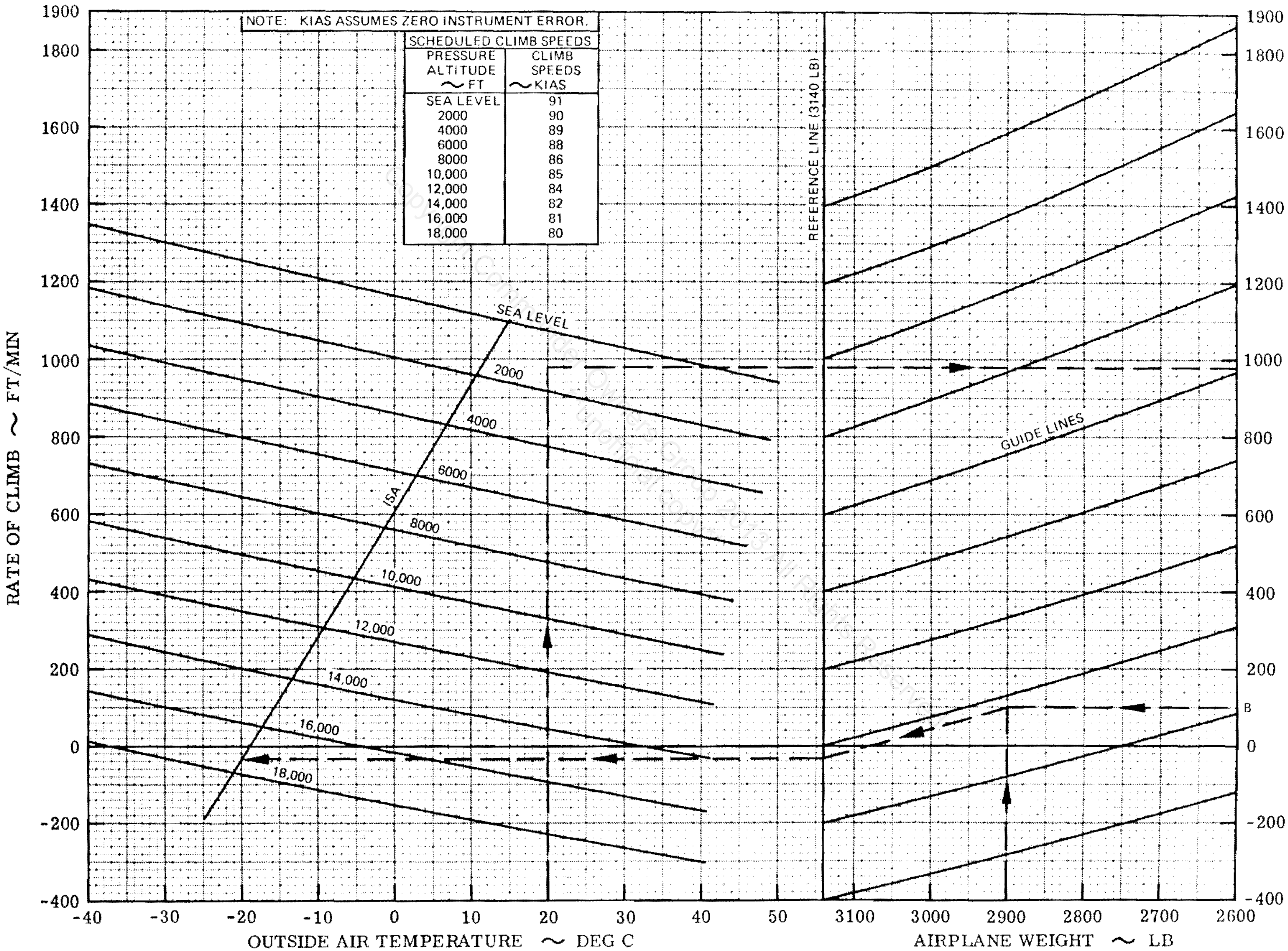
GIVEN:	Airplane Weight	3140 LB
	Outside Air Temperature	20 DEG C
	Pressure Altitude	1100 FT
FIND:	Rate of Climb, Fig. 5-15	980 FT/MIN
	Scheduled Climb Speed, Fig. 5-15	90 KIAS

EXAMPLE B

GIVEN:	Airplane Weight	2900 LB
	Rate of Climb	100 FT/MIN
	Outside Air Temperature	ISA (-19.5 DEG C)
FIND:	Service Ceiling, Fig. 5-15	17,200 FT

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.
3. Mixture setting should be: Below 5000 feet; FULL RICH. 5000 feet to 8000 feet; LEAN for smooth engine operation, as required. Above 8000 feet; LEAN for best power mixture (peak EGT, then enrich 100 Deg. F.).

RATE OF CLIMB, CLEAN CONFIGURATION (S/N 14150 AND SUBSEQUENT)



SCHEDULED CLIMB SPEEDS	
PRESSURE ALTITUDE ~ FT	CLIMB SPEEDS ~ KIAS
SEA LEVEL	91
2000	90
4000	89
6000	88
8000	86
10,000	85
12,000	84
14,000	82
16,000	81
18,000	80

Figure 5-15.

TIME, DISTANCE AND FUEL REQUIRED IN CLIMB (S/N 14000 THRU 14149)

The Time, Distance and Fuel Required in Climb for the clean configuration is shown in Figure 5-16 for varying outside air temperature and pressure altitude at 3140 Lb takeoff gross weight. A table of Scheduled Best Rate of Climb Speeds versus Pressure Altitude is presented on the chart.

ASSOCIATED CONDITIONS

Power	MAXIMUM CONTINUOUS
Wing Flaps	0 DEG
Landing Gear	RETRACTED
Cowl Flaps	FULL OPEN
Mixture	See NOTE 2 below

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:	Takeoff Gross Weight	3140 LB
	Outside Air Temperature	20 DEG C At Takeoff Altitude
		5 DEG C At Final Altitude
	Takeoff Altitude	1100 FT
	Final Altitude	5000 FT

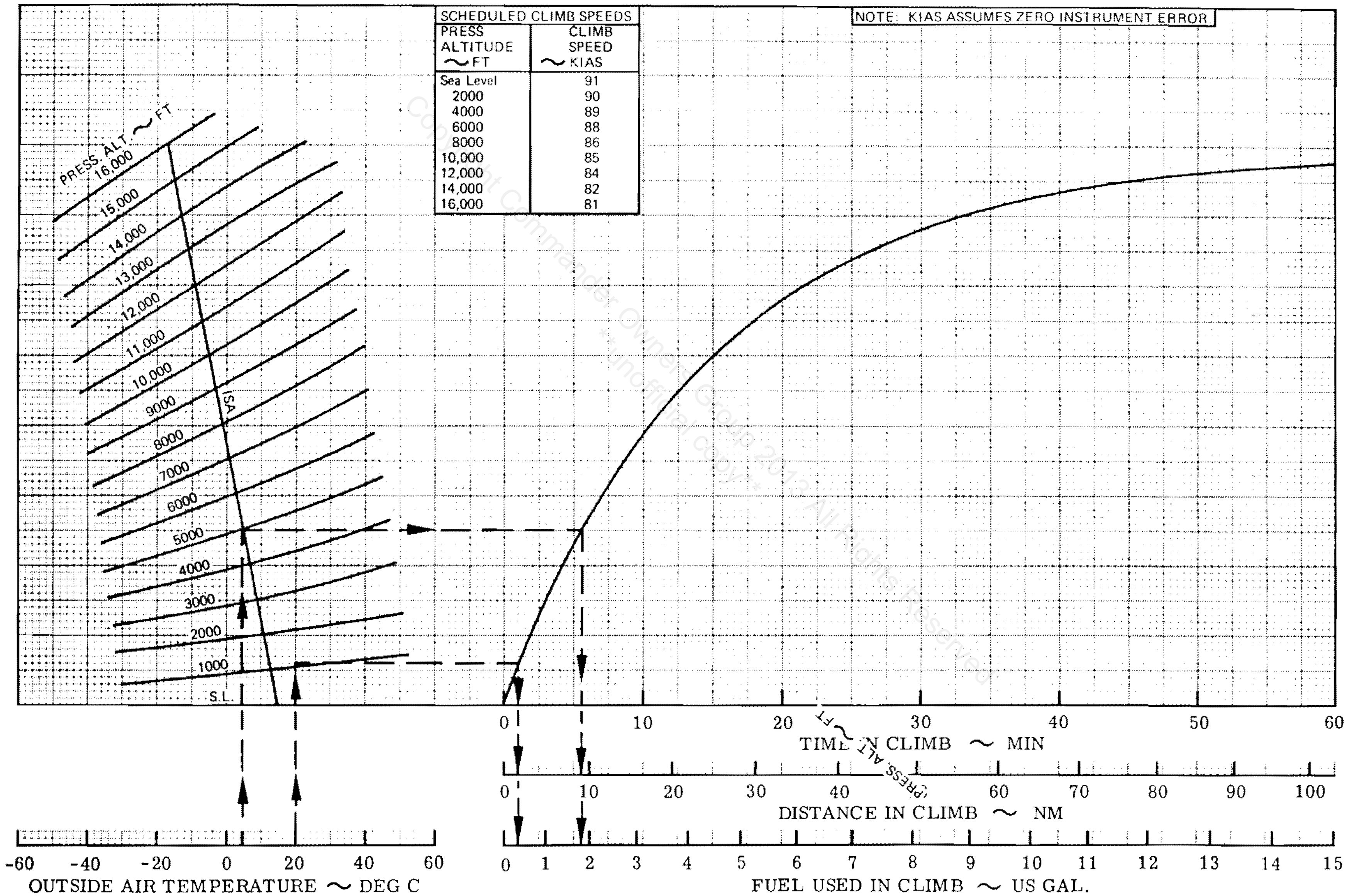
FIND: The total time, distance and fuel to climb from 1100 FT to 5000 FT from Fig. 5-16.

	FINAL ALTITUDE		INITIAL ALTITUDE		NET
Time	6.0 MIN	minus	1.0 MIN	equals	5.0 MIN
Distance	9.0 NAM	minus	2.0 NAM	equals	7.0 NAM
Fuel	1.8 U.S.Gal	minus	0.4 U.S.Gal	equals	1.4 U.S.Gal (8.4 LB)

NOTES:
1. IAS assumes zero instrument error.
2. Mixture setting should be set according to the existing pressure altitude and outside air temperature: Below 5000 feet, FULL RICH. 5000 feet to 8000 feet; LEAN for smooth engine operation, as required. Above 8000 feet; LEAN for best power mixture (peak EGT, then enrich 100 Deg. F.). These altitudes should be reduced approximately 2000 feet for outside air temperatures of ISA +20°C.

TIME, DISTANCE, AND FUEL REQUIRED IN CLIMB (S/N 14000 THRU 14149)

TAKEOFF GROSS WEIGHT = 3140 LB



SCHEDULED CLIMB SPEEDS	
PRESS ALTITUDE ~ FT	CLIMB SPEED ~ KIAS
Sea Level	91
2000	90
4000	89
6000	88
8000	86
10,000	85
12,000	84
14,000	82
16,000	81

Figure 5-16.

TIME, DISTANCE AND FUEL REQUIRED IN CLIMB (S/N 14150 AND SUBS)

The Time, Distance and Fuel Required in Climb for the clean configuration is shown in Figure 5-17 for varying outside air temperature and pressure altitude at 3140 Lb. takeoff gross weight. A table of Scheduled Best Rate of Climb Speeds versus Pressure Altitude is presented on the chart.

ASSOCIATED CONDITIONS

Power	MAXIMUM CONTINUOUS
Wing Flaps	0 DEG
Landing Gear	RETRACTED
Cowl Flaps	FULL OPEN
Mixture	See NOTE 2 below

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

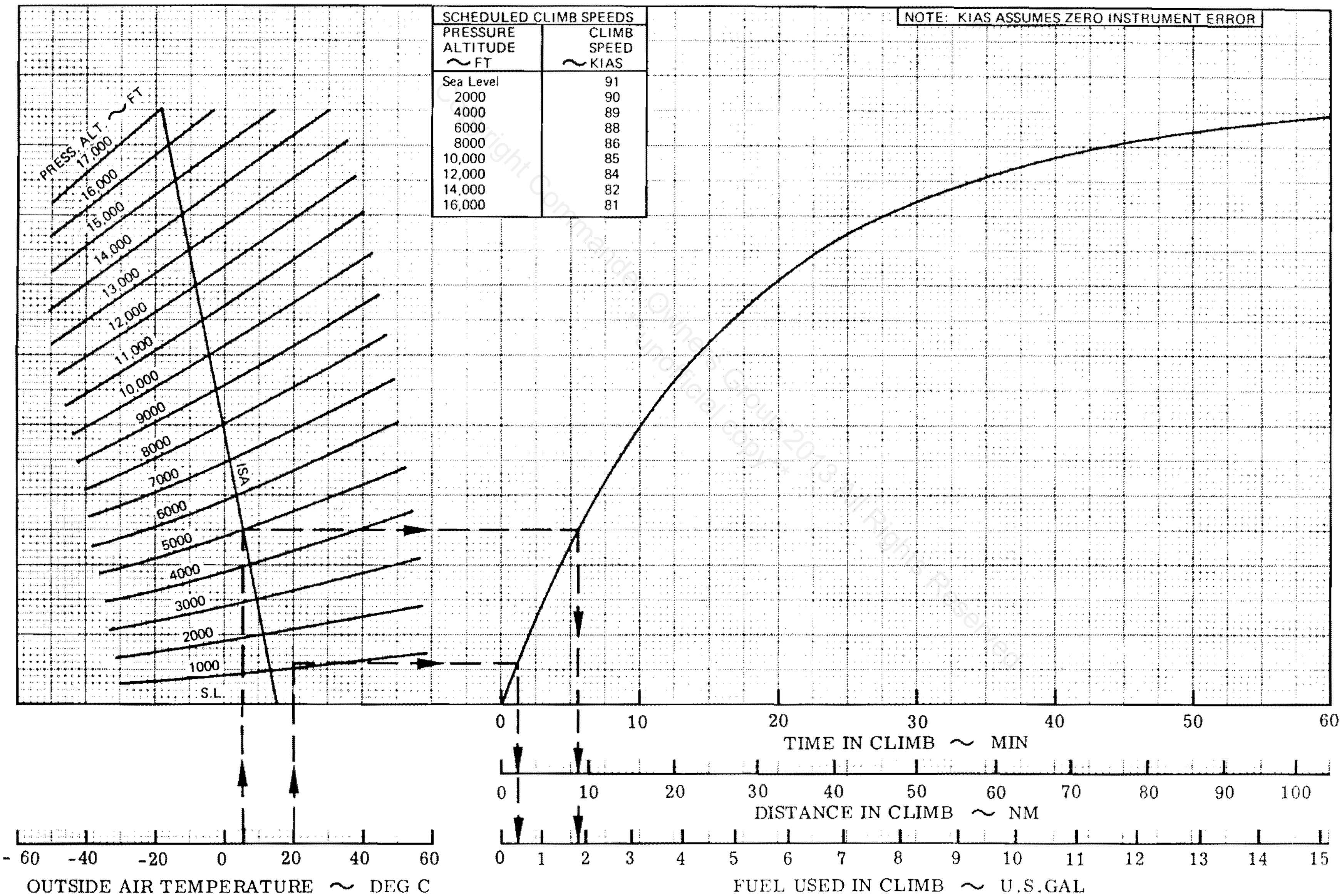
GIVEN:	Takeoff Gross Weight	3140 LB
	Outside Air Temperature	20 DEG C At Takeoff Altitude
		5 DEG C At Final Altitude
	Takeoff Altitude	1100 FT
	Final Altitude	5000 FT

FIND: The total time, distance and fuel to climb from 1100 Ft to 5000 Ft from Figure 5-17.

	FINAL ALTITUDE		INITIAL ALTITUDE		NET
Time	5.5 MIN	minus	1.2 MIN	equals	4.3 MIN
Distance	9.0 NAM	minus	2.0 NAM	equals	7.0 NAM
Fuel	1.8 U.S.Gal	minus	0.4 U.S.Gal	equals	1.4 U.S.Gal (8.4 LB)

NOTES: 1. IAS assumes zero instrument error.
2. Mixture setting should be: Below 5000 feet; FULL RICH. 5000 feet to 8000 feet; LEAN for smooth engine operation, as required. Above 8000 feet; LEAN for best power mixture (peak EGT, then enrich 100 Deg. F.).

TIME, DISTANCE AND FUEL REQUIRED IN CLIMB (S/N 14150 & SUBS)
TAKEOFF GROSS WEIGHT = 3140 LB



SCHEDULED CLIMB SPEEDS	
PRESSURE ALTITUDE ~ FT	CLIMB SPEED ~ KIAS
Sea Level	91
2000	90
4000	89
6000	88
8000	86
10,000	85
12,000	84
14,000	82
16,000	81

Figure 5-17.

CRUISE POWER SETTING TABLES

The following tables are based on Lycoming IO-540-T4A5D or IO-540-T4B5D engine charts.

TECHNIQUE

To obtain the desired percent power, set manifold pressure and fuel flow for desired engine speed at the appropriate pressure altitude and outside air temperature.

EXAMPLE

GIVEN:	Percent Power	55 PERCENT
	Engine Speed	2300 RPM
	Pressure Altitude	6000 FT
	Outside Air Temperature	5.0 DEG C
FIND:	Manifold Pressure, Fig. 5-21	19.6 IN.HG.
	Fuel Flow, Fig. 5-21	11.2 U.S. GAL/HR

NOTES: 1. Fuel flows are presented for BEST ECONOMY; if BEST POWER mixture is selected, the fuel flow will increase 14%. BEST POWER mixture can be obtained by following the procedure described on Page 1-6, "Power Terminology", GENERAL Section.
2. Normal interpolation techniques can be used to determine fuel flow and manifold pressure data for non-tabulated values of altitude, OAT, % BHP and RPM.

SEA LEVEL PRESSURE ALTITUDE

		OUTSIDE AIR TEMPERATURE ~ DEG C																			
		-40		-30		-20		-10		0		10		20		30		40		50	
RPM	% BHP	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF
2500	75	21.2	14.3	21.9	14.3	22.5	14.3	23.2	14.3	23.9	14.3	24.5	14.3	25.1	14.3	25.8	14.3	26.4	14.3	27.1	14.3
	65	19.2	12.9	19.7	12.9	20.3	12.9	20.9	12.9	21.4	12.9	22.0	12.9	22.5	12.9	23.1	12.9	23.7	12.9	24.3	12.9
	55	17.1	11.6	17.6	11.6	18.0	11.6	18.5	11.6	19.0	11.6	19.5	11.6	20.0	11.6	20.5	11.6	20.9	11.6	21.4	11.6
	45	14.9	10.3	15.4	10.3	15.8	10.3	16.2	10.3	16.6	10.3	17.0	10.3	17.4	10.3	17.8	10.3	18.1	10.3	18.6	10.3
2400	75	21.9	14.0	22.6	14.0	23.3	14.0	23.9	14.0	24.6	14.0	25.3	14.0	25.9	14.0	26.6	14.0	27.3	14.0	28.0	14.0
	65	19.8	12.6	20.4	12.6	21.0	12.6	21.6	12.6	22.2	12.6	22.7	12.6	23.3	12.6	23.9	12.6	24.5	12.6	25.0	12.6
	55	17.6	11.4	18.1	11.4	18.6	11.4	19.2	11.4	19.7	11.4	20.2	11.4	20.7	11.4	21.1	11.4	21.6	11.4	22.1	11.4
	45	15.5	10.1	15.9	10.1	16.3	10.1	16.7	10.1	17.1	10.1	17.5	10.1	17.9	10.1	18.3	10.1	18.8	10.1	19.2	10.1
2300	65	20.6	12.4	21.2	12.4	21.8	12.4	22.5	12.4	23.1	12.4	23.7	12.4	24.3	12.4	24.8	12.4	25.4	12.4	26.0	12.4
	55	18.4	11.2	18.9	11.2	19.4	11.2	19.9	11.2	20.5	11.2	21.0	11.2	21.5	11.2	22.0	11.2	22.5	11.2	23.0	11.2
	45	16.2	9.9	16.6	9.9	17.0	9.9	17.5	9.9	17.9	9.9	18.3	9.9	18.7	9.9	19.1	9.9	19.6	9.9	20.0	9.9
2200	55	19.2	10.9	19.7	10.9	20.3	10.9	20.8	10.9	21.3	10.9	21.9	10.9	22.4	10.9	22.9	10.9	23.4	10.9	23.9	10.9
	45	16.9	9.7	17.3	9.7	17.7	9.7	18.2	9.7	18.6	9.7	19.0	9.7	19.5	9.7	19.9	9.7	20.4	9.7	20.8	9.7

NOTES:
1. Manifold Pressure (MP) ~ IN.HG.
2. Fuel Flow (FF) ~ U.S.GAL/Hr.
3. Fuel flows are presented for BEST ECONOMY. If BEST POWER mixture is selected, the fuel flow will increase 14%. BEST POWER mixture can be obtained by following the procedure described on page 1-6, "Power Terminology", GENERAL Section.

Figure 5-18.

2000 FEET PRESSURE ALTITUDE

		OUTSIDE AIR TEMPERATURE ~ DEG C																			
		-40		-30		-20		-10		0		10		20		30		40		50	
RPM	% BHP	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF
2500	75	21.0	14.3	21.6	14.3	22.3	14.3	22.9	14.3	23.6	14.3	24.3	14.3	24.9	14.3	25.6	14.3	-	-	-	-
	65	18.9	12.9	19.5	12.9	20.0	12.9	20.6	12.9	21.1	12.9	21.7	12.9	22.3	12.9	22.9	12.9	23.4	12.9	24.0	12.9
	55	16.8	11.6	17.3	11.6	17.7	11.6	18.2	11.6	18.7	11.6	19.2	11.6	19.7	11.6	20.2	11.6	20.7	11.6	21.1	11.6
	45	14.6	10.3	15.1	10.3	15.4	10.3	15.8	10.3	16.3	10.3	16.7	10.3	17.1	10.3	17.5	10.3	17.9	10.3	18.3	10.3
2400	75	21.6	14.0	22.3	14.0	23.0	14.0	23.7	14.0	24.4	14.0	25.0	14.0	25.7	14.0	26.6	14.0	-	-	-	-
	65	19.5	12.6	20.1	12.6	20.7	12.6	21.3	12.6	21.8	12.6	22.4	12.6	23.0	12.6	23.6	12.6	24.2	12.6	24.8	12.6
	55	17.3	11.4	17.8	11.4	18.3	11.4	18.8	11.4	19.4	11.4	19.9	11.4	20.4	11.4	20.8	11.4	21.3	11.4	21.8	11.4
	45	15.2	10.1	15.6	10.1	16.0	10.1	16.4	10.1	16.8	10.1	17.2	10.1	17.6	10.1	18.0	10.1	18.5	10.1	18.9	10.1
2300	65	20.3	12.4	20.9	12.4	21.5	12.4	22.1	12.4	22.8	12.4	23.4	12.4	24.0	12.4	24.6	12.4	25.1	12.4	25.7	12.4
	55	18.1	11.2	18.6	11.2	19.1	11.2	19.6	11.2	20.2	11.2	20.7	11.2	21.2	11.2	21.7	11.2	22.2	11.2	22.7	11.2
	45	15.8	9.9	16.3	9.9	16.7	9.9	17.1	9.9	17.5	9.9	18.0	9.9	18.4	9.9	18.8	9.9	19.2	9.9	19.7	9.9
2200	55	18.9	10.9	19.4	10.9	19.9	10.9	20.5	10.9	21.0	10.9	21.5	10.9	22.1	10.9	22.6	10.9	23.1	10.9	23.6	10.9
	45	16.5	9.7	16.9	9.7	17.4	9.7	17.8	9.7	18.3	9.7	18.7	9.7	19.2	9.7	19.6	9.7	20.1	9.7	20.5	9.7

NOTES:
1. Manifold Pressure (MP) ~ IN.Hg.
2. Fuel Flow (FF) ~ U.S. GAL/HR.
3. Fuel flows are presented for BEST ECONOMY. If BEST POWER mixture is selected, the fuel flow will increase 14%. BEST POWER mixture can be obtained by following the procedure described on page 1-6, "Power Terminology", GENERAL Section.
4. Dashed lines indicate that manifold pressure at those outside air temperatures are either unobtainable, or not authorized because of manifold pressure/RPM limitations.

Figure 5-19.

4000 FEET PRESSURE ALTITUDE

		OUTSIDE AIR TEMPERATURE ~ DEG C																			
		-40		-30		-20		-10		0		10		20		30		40		50	
RPM	% BHP	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF
2500	75	20.7	14.3	21.4	14.3	22.0	14.3	22.7	14.3	23.4	14.3	24.0	14.3	-	-	-	-	-	-	-	-
	65	18.6	12.9	19.2	12.9	19.8	12.9	20.4	12.9	20.9	12.9	21.5	12.9	22.0	12.9	22.6	12.9	23.2	12.9	23.8	12.9
	55	16.5	11.6	17.0	11.6	17.5	11.6	18.0	11.6	18.5	11.6	19.0	11.6	19.5	11.6	19.9	11.6	20.4	11.6	20.9	11.6
	45	14.4	10.3	14.8	10.3	15.2	10.3	15.6	10.3	16.0	10.3	16.4	10.3	16.8	10.3	17.2	10.3	17.6	10.3	18.0	10.3
2400	75	21.4	14.1	22.0	14.1	22.7	14.1	23.5	14.1	24.1	14.1	-	-	-	-	-	-	-	-	-	-
	65	19.2	12.6	19.9	12.6	20.4	12.6	21.0	12.6	21.6	12.6	22.2	12.6	22.8	12.6	23.4	12.6	24.0	12.6	-	-
	55	17.1	11.4	17.5	11.4	18.1	11.4	18.6	11.4	19.1	11.4	19.6	11.4	20.1	11.4	20.6	11.4	21.1	11.4	21.5	11.4
	45	14.9	10.1	15.3	10.1	15.7	10.1	16.1	10.1	16.5	10.1	16.9	10.1	17.4	10.1	17.8	10.1	18.2	10.1	18.6	10.1
2300	65	20.0	12.4	20.6	12.4	21.2	12.4	21.8	12.4	22.5	12.4	23.1	12.4	23.8	12.4	24.3	12.4	-	-	-	-
	55	17.8	11.2	18.3	11.2	18.8	11.2	19.4	11.2	19.9	11.2	20.4	11.2	20.9	11.2	21.4	11.2	21.9	11.2	22.5	11.2
	45	15.5	9.9	16.0	9.9	16.4	9.9	16.8	9.9	17.2	9.9	17.7	9.9	18.1	9.9	18.5	9.9	18.9	9.9	19.4	9.9
2200	55	18.6	10.9	19.1	10.9	19.7	10.9	20.2	10.9	20.7	10.9	21.2	10.9	21.8	10.9	22.3	10.9	22.8	10.9	23.4	10.9
	45	16.2	9.7	16.6	9.7	17.0	9.7	17.5	9.7	18.0	9.7	18.4	9.7	18.9	9.7	19.3	9.7	19.8	9.7	20.2	9.7

NOTES:
1. Manifold Pressure (MP) ~ IN.Hg.
2. Fuel Flow (FF) ~ U.S.GAL/Hr.
3. Fuel flows are presented for BEST ECONOMY. If BEST POWER mixture is selected, the fuel flow will increase 14%. BEST POWER mixture can be obtained by following the procedure described on page 1-6, "Power Terminology", GENERAL Section.
4. Dashed lines indicate that manifold pressure at those outside air temperatures are either unobtainable, or not authorized because of manifold pressure/RPM limitations.

Figure 5-20.

6000 FEET PRESSURE ALTITUDE

		OUTSIDE AIR TEMPERATURE ~ DEG C																			
		-40		-30		-20		-10		0		10		20		30		40		50	
RPM	% BHP	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF
2500	75	20.5	14.3	21.2	14.3	21.8	14.3	22.5	14.3	-	-	-	-	-	-	-	-	-	-	-	-
	65	18.4	12.9	19.0	12.9	19.6	12.9	20.1	12.9	20.7	12.9	21.3	12.9	21.8	12.9	22.4	12.9	-	-	-	-
	55	16.3	11.6	16.8	11.6	17.2	11.6	17.7	11.6	18.2	11.6	18.7	11.6	19.2	11.6	19.7	11.6	20.2	11.6	20.7	11.6
	45	14.1	10.3	14.5	10.3	14.9	10.3	15.3	10.3	15.7	10.3	16.1	10.3	16.5	10.3	16.7	10.3	17.4	10.3	17.8	10.3
2400	75	20.9	14.0	21.8	14.0	22.5	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	65	19.0	12.6	19.6	12.6	20.2	12.6	20.8	12.6	21.3	12.6	21.9	12.6	22.5	12.6	-	-	-	-	-	-
	55	16.8	11.4	17.3	11.4	17.8	11.4	18.3	11.4	18.9	11.4	19.4	11.4	19.9	11.4	20.3	11.4	20.8	11.4	21.3	11.4
	45	14.7	10.1	15.1	10.1	15.5	10.1	15.9	10.1	16.3	10.1	16.7	10.1	17.1	10.1	17.5	10.1	17.9	10.1	18.4	10.1
2300	65	19.8	12.4	20.4	12.4	21.0	12.4	21.6	12.4	22.2	12.4	-	-	-	-	-	-	-	-	-	-
	55	17.5	11.2	18.0	11.2	18.6	11.2	19.1	11.2	19.6	11.2	20.1	11.2	20.6	11.2	21.1	11.2	21.6	11.2	22.2	11.2
	45	15.2	9.9	15.7	9.9	16.1	9.9	16.5	9.9	16.9	9.9	17.4	9.9	17.8	9.9	18.2	9.9	18.7	9.9	19.1	9.9
2200	55	18.3	10.9	18.8	10.9	19.4	10.9	20.0	10.9	20.5	10.9	21.0	10.9	21.5	10.9	22.0	10.9	22.6	10.9	-	-
	45	15.8	9.7	16.3	9.7	16.7	9.7	17.2	9.7	17.7	9.7	18.1	9.7	18.6	9.7	19.1	9.7	19.5	9.7	20.0	9.7

NOTES:
1. Manifold Pressure (MP) ~ IN.Hg.
2. Fuel Flow (FF) ~ U.S.GAL/Hr.
3. Fuel flows are presented for BEST ECONOMY. If BEST POWER mixture is selected, the fuel flow will increase 14%. BEST POWER mixture can be obtained by following the procedure described on page 1-6, "Power Terminology", GENERAL Section.
4. Dashed lines indicate that manifold pressure at those outside air temperatures are either unobtainable, or not authorized because of manifold pressure/RPM limitations.

Figure 5-21.

8000 FEET PRESSURE ALTITUDE

		OUTSIDE AIR TEMPERATURE ~ DEG C																			
		-40		-30		-20		-10		0		10		20		30		40		50	
RPM	% BHP	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF
2500	75	20.3	14.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	65	18.2	12.9	18.8	12.9	19.4	12.9	20.0	12.9	20.5	12.9	-	-	-	-	-	-	-	-	-	-
	55	16.0	11.6	16.5	11.6	17.0	11.6	17.5	11.6	18.0	11.6	18.5	11.6	19.0	11.6	19.5	11.6	20.0	11.6	20.5	11.6
	45	13.9	10.3	14.3	10.3	14.7	10.3	15.1	10.3	15.5	10.3	15.9	10.3	16.3	10.3	16.7	10.3	17.2	10.3	17.6	10.3
2400	75	20.9	14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	65	18.8	12.6	19.4	12.6	20.0	12.6	20.6	12.6	-	-	-	-	-	-	-	-	-	-	-	-
	55	16.6	11.4	17.1	11.4	17.6	11.4	18.1	11.4	18.6	11.4	19.2	11.4	19.7	11.4	20.2	11.4	20.6	11.4	-	-
	45	14.4	10.1	14.8	10.1	15.2	10.1	15.7	10.1	16.1	10.1	16.5	10.1	16.9	10.1	17.3	10.1	17.7	10.1	18.1	10.1
2300	65	19.6	12.4	20.2	12.4	20.8	12.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	55	17.2	11.2	17.8	11.2	18.3	11.2	18.9	11.2	19.4	11.2	19.9	11.2	20.4	11.2	20.9	11.2	-	-	-	-
	45	15.0	9.9	15.4	9.9	15.9	9.9	16.3	9.9	16.7	9.9	17.1	9.9	17.6	9.9	18.0	9.9	18.4	9.9	18.9	9.9
2200	55	18.0	10.9	18.6	10.9	19.2	10.9	19.7	10.9	20.3	10.9	20.8	10.9	-	-	-	-	-	-	-	-
	45	15.5	9.7	16.0	9.7	16.5	9.7	17.0	9.7	17.4	9.7	17.9	9.7	18.4	9.7	18.8	9.7	19.3	9.7	19.8	9.7

NOTES:
1. Manifold Pressure (MP) ~ IN.Hg.
2. Fuel Flow (FF) ~ U.S.GAL/Hr.
3. Fuel flows are presented for BEST ECONOMY. If BEST POWER mixture is selected, the fuel flow will increase 14%. BEST POWER mixture can be obtained by following the procedure described on page 1-6, "Power Terminology", GENERAL Section.
4. Dashed lines indicate that manifold pressure at those outside air temperatures are either unobtainable, or not authorized because of manifold pressure/RPM limitations.

Figure 5-22.

10,000 FEET PRESSURE ALTITUDE

		OUTSIDE AIR TEMPERATURE ~ DEG C																			
		-40		-30		-20		-10		0		10		20		30		40		50	
RPM	% BHP	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF
2500	65	18.0	12.9	18.6	12.9	19.2	12.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	55	15.9	11.6	16.4	11.6	16.9	11.6	17.4	11.6	17.9	11.6	18.4	11.6	18.9	11.6	-	-	-	-	-	-
	45	13.7	10.3	14.1	10.3	14.5	10.3	14.9	10.3	15.3	10.3	15.7	10.3	16.1	10.3	16.7	10.3	17.0	10.3	-	-
2400	65	18.6	12.6	19.2	12.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	55	16.4	11.4	16.9	11.4	17.4	11.4	17.9	11.4	18.5	11.4	19.0	11.4	-	-	-	-	-	-	-	-
	45	14.2	10.1	14.6	10.1	15.0	10.1	15.5	10.1	15.9	10.1	16.3	10.1	16.7	10.1	17.1	10.1	17.5	10.1	-	-
2300	65	19.4	12.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	55	17.0	11.2	17.6	11.2	18.1	11.2	18.7	11.2	19.2	11.2	-	-	-	-	-	-	-	-	-	-
	45	14.7	9.9	15.2	9.9	15.6	9.9	16.1	9.9	16.5	9.9	16.9	9.9	17.3	9.9	17.8	9.9	-	-	-	-
2200	55	17.8	10.9	18.4	10.9	19.0	10.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	45	15.3	9.7	15.8	9.7	16.2	9.7	16.7	9.7	17.2	9.7	17.7	9.7	18.1	9.7	18.6	9.7	-	-	-	-

NOTES:
1. Manifold Pressure (MP) ~ IN.Hg.
2. Fuel Flow (FF) ~ U.S. GAL/Hr.
3. Fuel flows are presented for BEST ECONOMY. If BEST POWER mixture is selected, the fuel flow will increase 14%. BEST POWER mixture can be obtained by following the procedure described on page 1-6, "Power Terminology", GENERAL Section.
4. Dashed lines indicate that manifold pressure at those outside air temperatures are either unobtainable, or not authorized because of manifold pressure/RPM limitations.

Figure 5-23.

12,000 FEET PRESSURE ALTITUDE

		OUTSIDE AIR TEMPERATURE ~ DEG C																			
		-40		-30		-20		-10		0		10		20		30		40		50	
RPM	% BHP	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF
2500	55	15.7	11.6	16.2	11.6	16.7	11.6	17.2	11.6	17.7	11.6	-	-	-	-	-	-	-	-	-	-
	45	13.6	10.3	14.0	10.3	14.4	10.3	14.8	10.3	15.2	10.3	15.6	10.3	16.0	10.3	-	-	-	-	-	-
2400	55	16.2	11.4	16.7	11.4	17.3	11.4	17.8	11.4	-	-	-	-	-	-	-	-	-	-	-	-
	45	14.0	10.1	14.4	10.1	14.9	10.1	15.3	10.1	15.7	10.1	16.1	10.1	16.5	10.1	-	-	-	-	-	-
2300	55	16.8	11.2	17.4	11.2	17.9	11.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	45	14.5	9.9	15.0	9.9	15.4	9.9	15.9	9.9	16.3	9.9	16.7	9.9	-	-	-	-	-	-	-	-
2200	55	17.6	10.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	45	15.1	9.7	15.6	9.7	16.0	9.7	16.5	9.7	17.0	9.7	-	-	-	-	-	-	-	-	-	-

NOTES:
1. Manifold Pressure (MP) ~ IN.Hg.
2. Fuel Flow (FF) ~ U.S. GAL/Hr.
3. Fuel flows are presented for BEST ECONOMY. If BEST POWER mixture is selected, the fuel flow will increase 14%. BEST POWER mixture can be obtained by following the procedure described on page 1-6, "Power Terminology", GENERAL Section.
4. Dashed lines indicate that manifold pressure at those outside air temperatures are either unobtainable, or not authorized because of manifold pressure/RPM limitations.

Figure 5-24.

14,000 FEET PRESSURE ALTITUDE

		OUTSIDE AIR TEMPERATURE ~ DEG C																			
		-40		-30		-20		-10		0		10		20		30		40		50	
RPM	% BHP	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF
2500	55	15.6	11.6	16.1	11.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	45	13.4	10.3	13.8	10.3	14.2	10.3	14.6	10.3	15.0	10.3	-	-	-	-	-	-	-	-	-	-
2400	55	16.1	11.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	45	13.8	10.1	14.2	10.1	14.7	10.1	15.1	10.1	-	-	-	-	-	-	-	-	-	-	-	-
2300	45	14.4	9.9	14.8	9.9	15.3	9.9	15.7	9.9	-	-	-	-	-	-	-	-	-	-	-	-
2200	45	14.9	9.7	15.4	9.7	15.8	9.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-

15,000 FEET PRESSURE ALTITUDE

		OUTSIDE AIR TEMPERATURE ~ DEG C																			
		-40		-30		-20		-10		0		10		20		30		40		50	
RPM	% BHP	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF	MP	FF
2500	55	15.5	11.6	16.1	11.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	45	13.4	10.3	13.8	10.3	14.2	10.3	14.6	10.3	-	-	-	-	-	-	-	-	-	-	-	-
2400	45	13.7	10.1	14.2	10.1	14.6	10.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2300	45	14.3	9.9	14.7	9.9	15.2	9.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2200	45	14.8	9.7	15.3	9.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

NOTES:
1. Manifold Pressure (MP) ~ IN.Hg.
2. Fuel Flow (FF) ~ U.S. GAL/Hr.
3. Fuel flows are presented for BEST ECONOMY. If BEST POWER mixture is selected, the fuel flow will increase 14%. BEST POWER mixture can be obtained by following the procedure described on page 1-6, "Power Terminology", GENERAL Section.
4. Dashed lines indicate that manifold pressure at those outside air temperatures are either unobtainable, or not authorized because of manifold pressure/RPM limitations.

Figure 5-25.

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CRUISE TRUE AIRSPEED (S/N 14000 THRU 14149)

The Cruise True Airspeed is presented in Figure 5-26 for varying outside air temperature, pressure altitude and power setting at maximum gross weight of 3140 Lbs.

ASSOCIATED CONDITIONS

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

TECHNIQUE

After establishing the desired percentage of power from the power tables presented in this section, trim the airplane in a stabilized condition with zero rate of climb.

EXAMPLE

GIVEN:	Outside Air Temperature	5 DEG C
	Pressure Altitude	5000 FT
	Power Setting	55 PERCENT (2300 RPM)
FIND:	True Airspeed, Fig. 5-26	128 KTS (TAS)

NOTE: The cruise true airspeeds presented here are for BEST ECONOMY mixture. If BEST POWER mixture is selected, the true airspeed will increase 1%. BEST POWER can be obtained by following the procedure described under "Power Terminology", GENERAL Section, Page 1-6.

CRUISE TRUE AIRSPEED (S/N 14000 THRU 14149)
AT BEST ECONOMY
AIRPLANE WEIGHT = 3140 LB

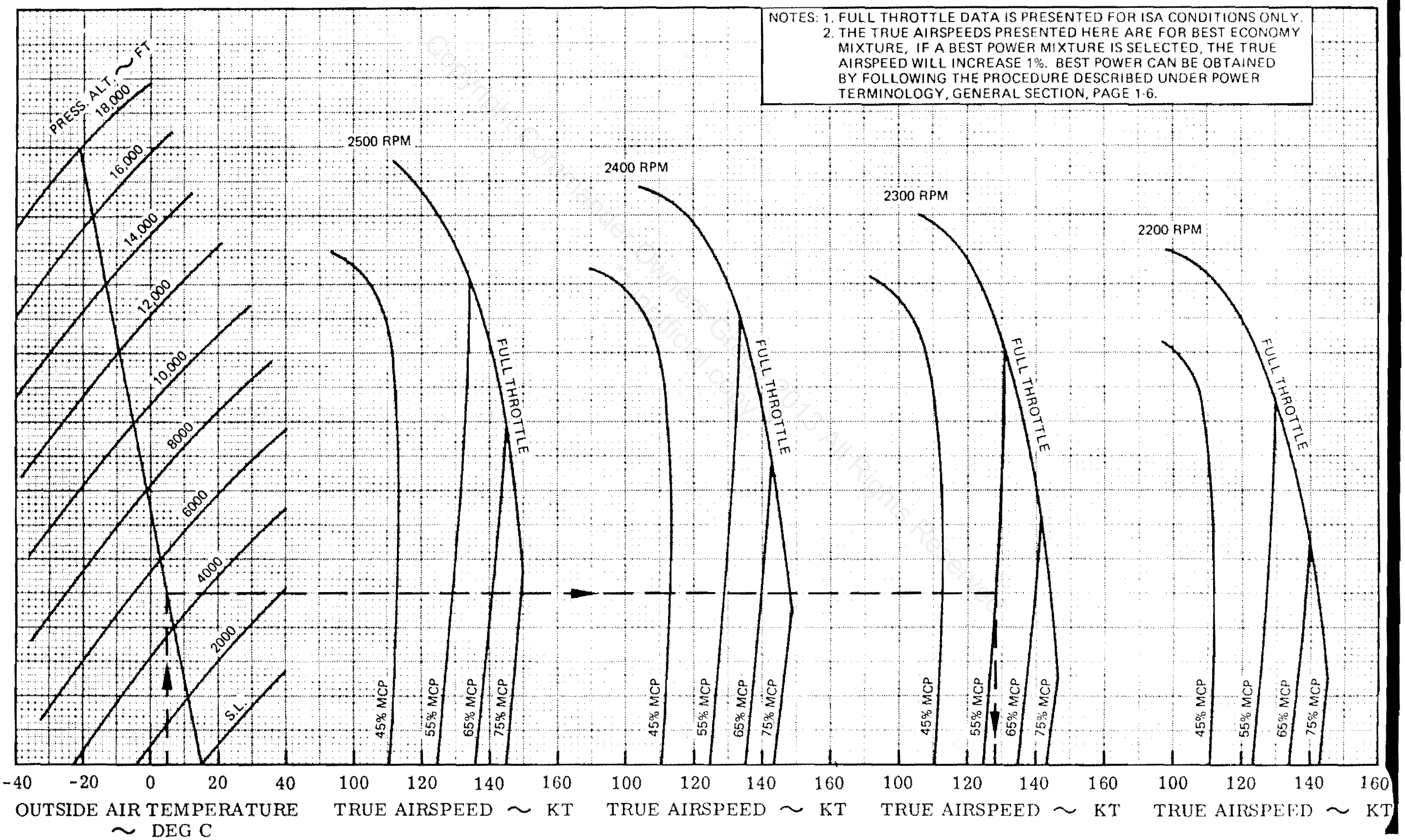


Figure 5-26.

CRUISE TRUE AIRSPEED (S/N 14150 AND SUBS)

The Cruise True Airspeed is presented in Figure 5-27 for varying outside air temperature, pressure altitude, and power setting at maximum gross weight of 3140 Lbs.

ASSOCIATED CONDITIONS

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

TECHNIQUE

After establishing the desired percentage of power from the power tables presented in this section, trim the airplane in a stabilized condition with zero rate of climb.

EXAMPLE

GIVEN:	Outside Air Temperature	5 DEG C
	Pressure Altitude	5000 FT
	Power Setting	55 PERCENT (2300 RPM)
FIND:	True Airspeed, Fig. 5-27	131 KTS

NOTE: The cruise true airspeeds are presented here for a BEST ECONOMY mixture. If BEST POWER mixture is selected, the true airspeed will increase 1%. BEST POWER can be obtained by following the procedure described under "Power Terminology", GENERAL Section, Page 1-6.

CRUISE TRUE AIRSPEED (S/N 14150 & SUBS)
AT BEST ECONOMY
AIRPLANE WEIGHT = 3140 LB

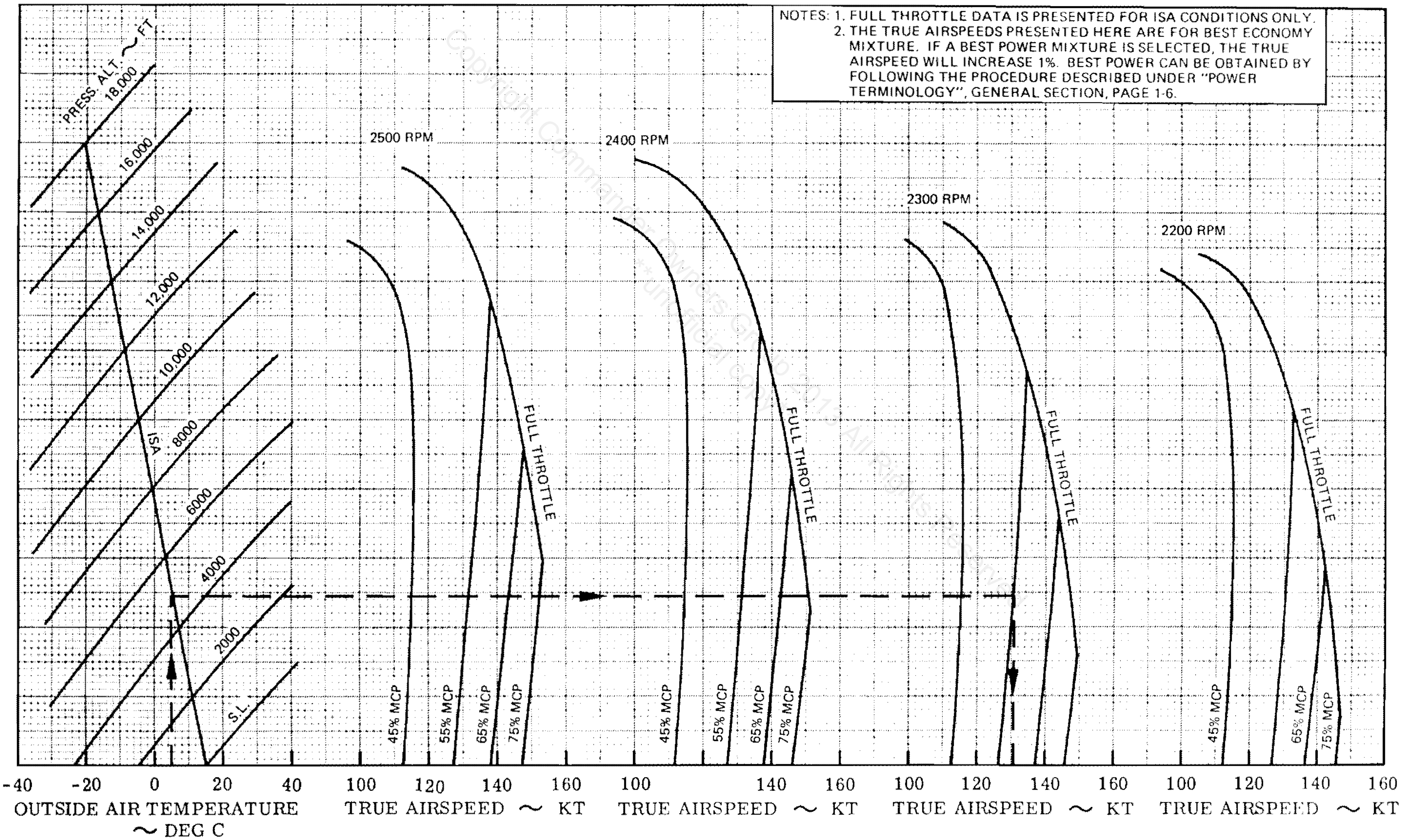


Figure 5-27.

RANGE (S/N 14000 THRU 14149)

The Range is presented in Figure 5-28 for standard day conditions with varying pressure altitude and power settings at an average cruise gross weight. Cruise power tables of fuel flow and manifold pressure are presented in Figures 5-18 thru 5-23.

ASSOCIATED CONDITIONS

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

Fuel Allowances

1. Start, Run-up and Taxi (1.5 Gal).
2. Climb from S.L. to Cruising Altitude at Maximum Continuous Power and Best Rate of Climb Speed.
3. Cruise at Best Economy Mixture.
4. 45 Minute Reserve based on a power setting of 45 percent MCP at 2200 RPM (7.3 Gal).
5. Descent from Cruise Altitude to Sea Level at 1000 FT/Min (2400 RPM and 16 IN.HG.).

TECHNIQUE

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

EXAMPLE

GIVEN:	Outside Air Temperature	ISA
	Pressure Altitude	5000 FT
	Power Setting	55 PERCENT MCP (2300 RPM)
	Usable Fuel Capacity	68 U.S. GAL (408 LB at 6.0 LB/U.S.GAL)
FIND:	Range, Fig. 5-28	676 NM

NOTE: The range data is presented for BEST ECONOMY mixture. If a BEST POWER mixture is selected, the range will decrease 15%. BEST POWER can be obtained by following the procedure described under "Power Terminology", GENERAL Section, Page 1-6.

RANGE PROFILES (S/N 14000 THRU 14149) AT BEST ECONOMY MIXTURE

INTERNATIONAL STANDARD ATMOSPHERE

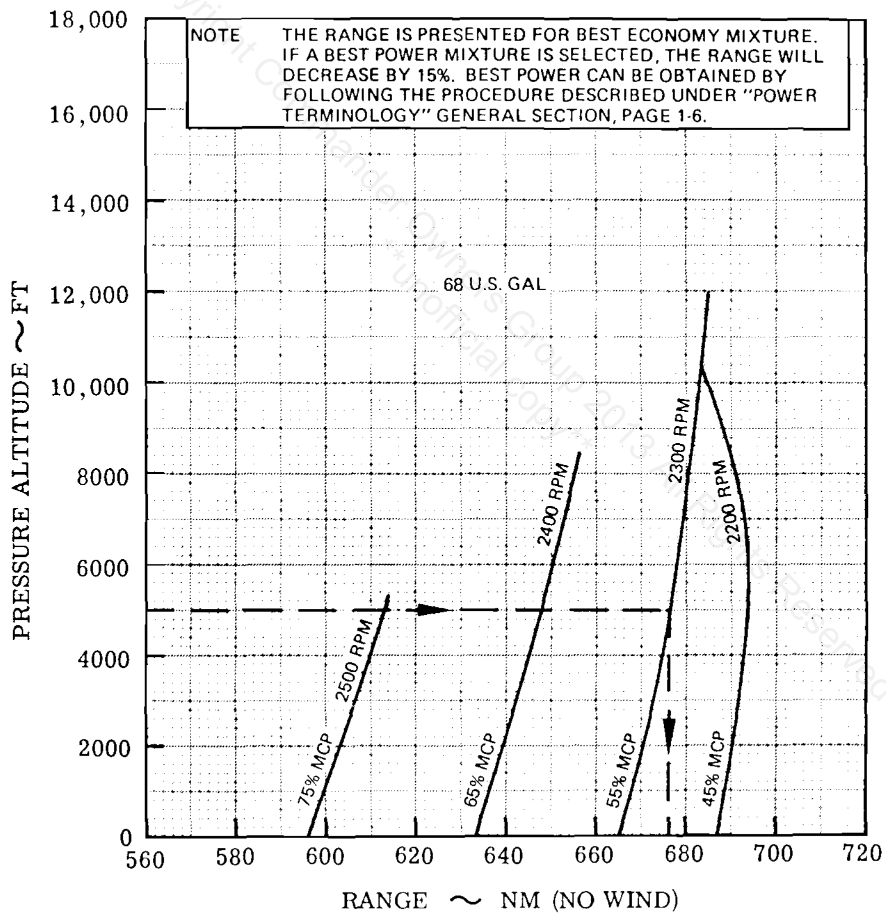


Figure 5-28.

RANGE (S/N 14150 AND SUBS)

The Range is presented in Figure 5-29 for standard day conditions with varying pressure altitude and power settings at an average cruise gross weight. Cruise power tables of fuel flow and manifold pressure are presented in Figures 5-18 thru 5-25.

ASSOCIATED CONDITIONS

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

Fuel Allowances

1. Start, Run-up and Taxi (1.5 Gal).
2. Climb from S.L. to Cruising Altitude at Maximum Continuous Power and Best Rate of Climb Speed.
3. Cruise at Best Economy Mixture.
4. 45 Minute Reserve based on a power setting of 45 percent MCP at 2200 RPM (7.3 Gal).
5. Descent from Cruise Altitude to Sea Level at 1000 FT/MIN (2200 RPM and 16 IN.HG.).

TECHNIQUE

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

EXAMPLE

GIVEN:	Outside Air Temperature	ISA
	Pressure Altitude	5000 FT
	Power Setting	55 PERCENT MCP (2300 RPM)
	Usable Fuel Capacity	68 U.S. GAL (408 LB AT 6.0 LB/U.S.GAL)
FIND:	Range, Fig. 5-29	708 NM

NOTE: The range data is presented for BEST ECONOMY mixture. If a BEST POWER mixture is selected, the range will decrease 15%. BEST POWER can be obtained by following the procedure described under "Power Terminology", GENERAL Section, Page 1-6.

RANGE PROFILES (S/N 14150 & SUBS)
AT BEST ECONOMY MIXTURE
INTERNATIONAL STANDARD ATMOSPHERE

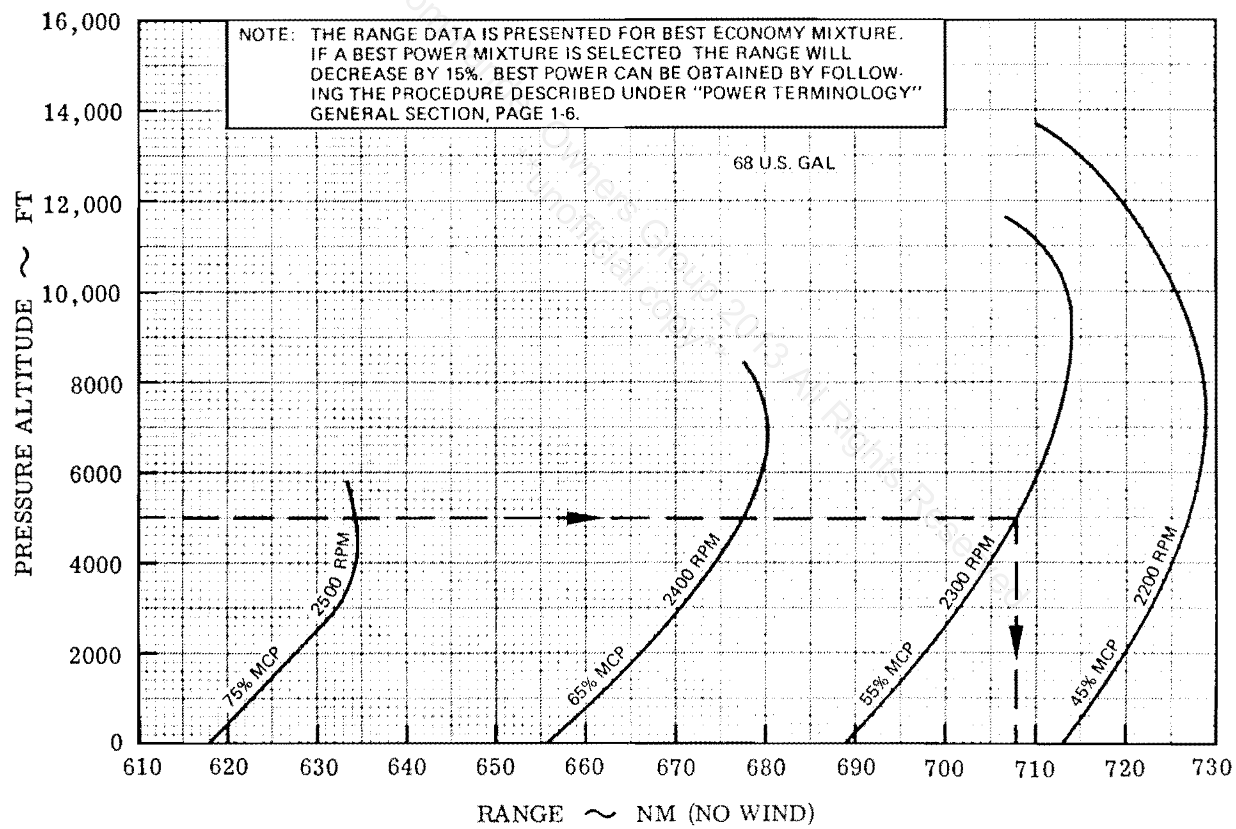


Figure 5-29.

ENDURANCE PROFILE (S/N 14000 THRU 14149)

Figure 5-30 presents the maximum endurance for standard day conditions with varying pressure altitude and percent power.

ASSOCIATED CONDITIONS

Power	AS REQUIRED
Wing Flaps	0 DEG
Landing Gear	RETRACTED
Cowl Flaps	CLOSED
Mixture	BEST ECONOMY

Fuel Allowances

1. Start, warm up and taxi out, (1.5 Gal, 10 MIN, and 0 NM).
2. Climb from S.L. to cruise altitude at maximum continuous power and best rate of climb speed.
3. Cruise at maximum range power at cruise altitude, Best Economy mixture.
4. Descent from cruise altitude to sea level at 1000 ft/min (2400 RPM and 16 IN.Hg.).
5. 45 minute reserve* based on a power setting of 45% MCP at 2200 RPM (7.3 U.S. GAL).

TECHNIQUE

See individual climb and cruise speed charts for discussion of techniques.

EXAMPLE A

GIVEN:	Pressure Altitude	5000 FT
	Power Setting	55% MCP (2300 RPM)
FIND:	Endurance, Fig. 5-30	5.33 HRS = 5 HR 20 MIN

EXAMPLE B

GIVEN:	Pressure Altitude	4000 FT
	Power Setting	75% MCP (2500 RPM)
FIND:	Endurance, Fig. 5-30	4.24 HRS = 4 HR 14 MIN

NOTES: 1.* Reserve time is not included in the total endurance time.
2. The endurance data is presented for BEST ECONOMY mixture. If a BEST POWER mixture is selected, the endurance will decrease 17%. BEST POWER can be obtained by following the procedure described under "Power Terminology", GENERAL Section, Page 1-6.

ENDURANCE PROFILES (S/N 14000 THRU 14149)
BEST ECONOMY MIXTURE
INTERNATIONAL STANDARD ATMOSPHERE

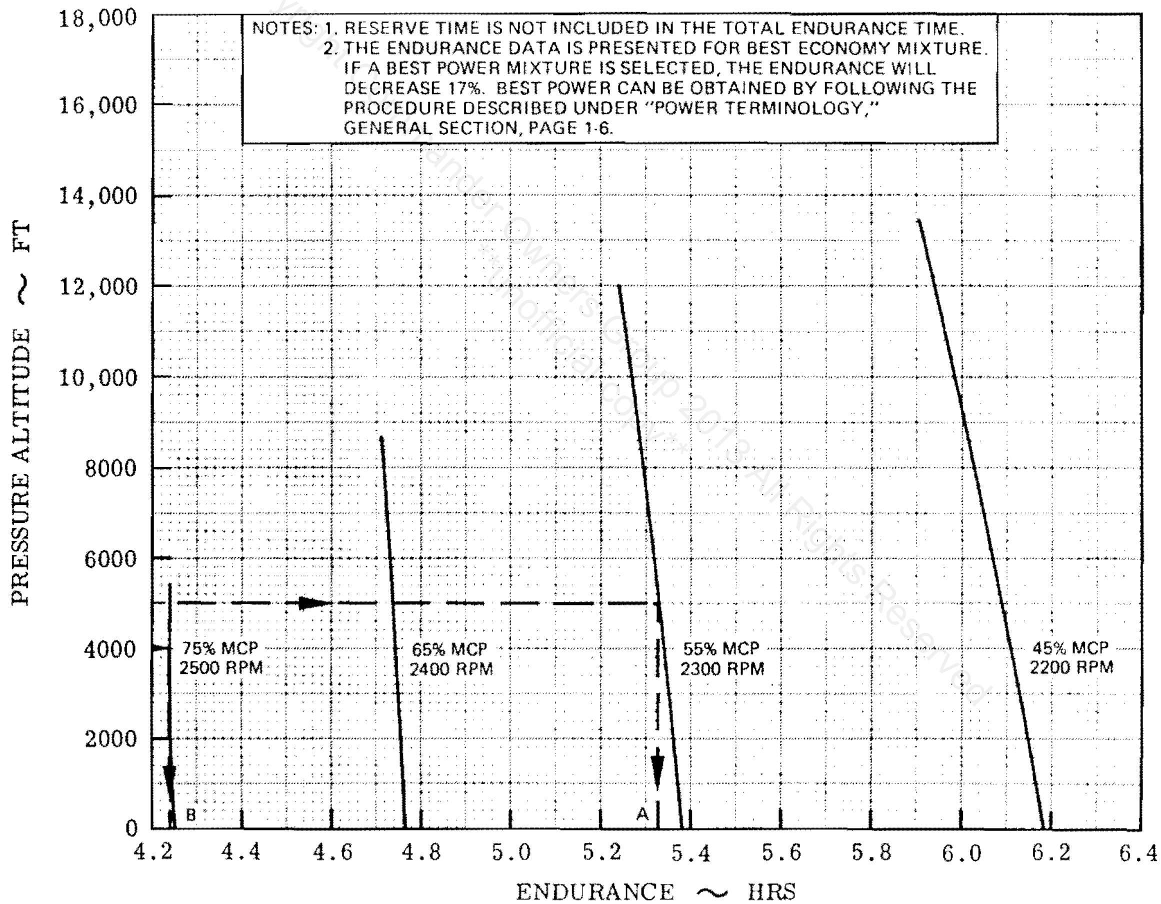


Figure 5-30.

ENDURANCE PROFILES (S/N 14150 AND SUBS)

Figure 5-31 presents the maximum endurance for standard day conditions with varying pressure altitude and percent power.

ASSOCIATED CONDITIONS

Power	AS REQUIRED
Wing Flaps	0 DEG
Landing Gear	RETRACTED
Cowl Flaps	CLOSED
Mixture	BEST ECOMONY

Fuel Allowances

1. Start, warm up and taxi out (1.5 U.S. Gal, 10 MIN and 0 NM).
2. Climb from S.L. to cruise altitude at maximum continuous power and best rate of climb speed.
3. Cruise at maximum range power at cruise altitude, Best Economy Mixture.
4. Descent from cruise altitude to sea level at 1000 FT/MIN (2200 RPM and 16 IN.Hg).
5. 45 minute reserve* based on a power setting of 45% MCP at 2200 RPM (7.3 U.S. Gal).

TECHNIQUE

See Individual climb and cruise speed charts for discussion of techniques.

EXAMPLE A

GIVEN:	Pressure Altitude	5000 FT
	Power Setting	55% MCP (2300 RPM)
FIND:	Endurance, Fig. 5-31	5.47 HRS = 5 HR 28 MIN

EXAMPLE B

GIVEN:	Pressure Altitude	4000 FT
	Power Setting	75% MCP (2500 RPM)
FIND:	Endurance, Fig. 5-31	4.35 HRS = 4 HR 22 MIN

NOTES: 1.* Reserve time is not included in the total endurance time.
2. The endurance data is presented for BEST ECONOMY mixture. If a BEST POWER mixture is selected, the endurance will decrease 17%. BEST POWER can be obtained by following the procedure described under "Power Terminology", GENERAL Section, Page 1-6.

ENDURANCE PROFILES (S/N 14150 & SUBS)
BEST ECONOMY MIXTURE
INTERNATIONAL STANDARD ATMOSPHERE

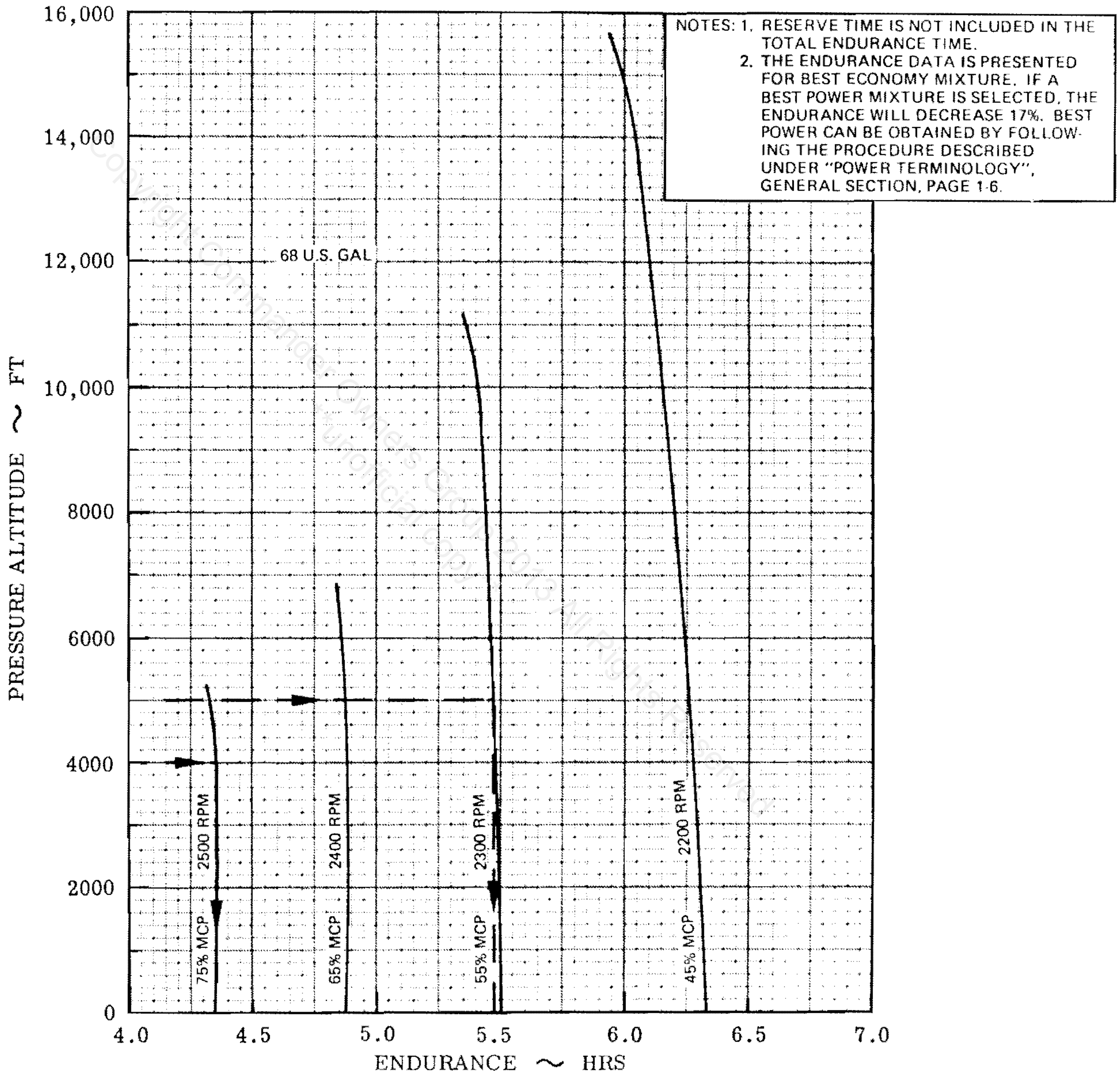


Figure 5-31.

HOLDING TIME

The Holding Time is presented in Figure 5-32 for varying Holding Fuel.

ASSOCIATED CONDITIONS

Power	45% (2200 RPM)
Wing Flaps	0 DEG
Landing Gear	RETRACTED
Cowl Flaps	CLOSED
Mixture	BEST ECONOMY

TECHNIQUE

Obtain 45 percent power at 2200 RPM. Trim the airplane for level flight at the holding altitude.

EXAMPLE A

GIVEN:	Holding Time	0.75 HR (0 HR:45 MIN)
FIND:	Holding Fuel, Fig. 5-32	44 LB

EXAMPLE B

GIVEN:	Holding Fuel	240 LB
FIND:	Holding Time, Fig. 5-32	4.16 HR (4 HR:10 MIN)

NOTES: 1. See cruise power setting charts for manifold pressure schedule.
2. This chart is applicable for 45 percent power only. When 45 percent power can not be obtained due to high temperature and/or high altitude conditions, increase the RPM and refer to the Power Setting Tables for fuel flow information. Holding time can then be determined by dividing holding fuel by the fuel flow from the table.

HOLDING TIME
AT 45% MCP (2200 RPM)

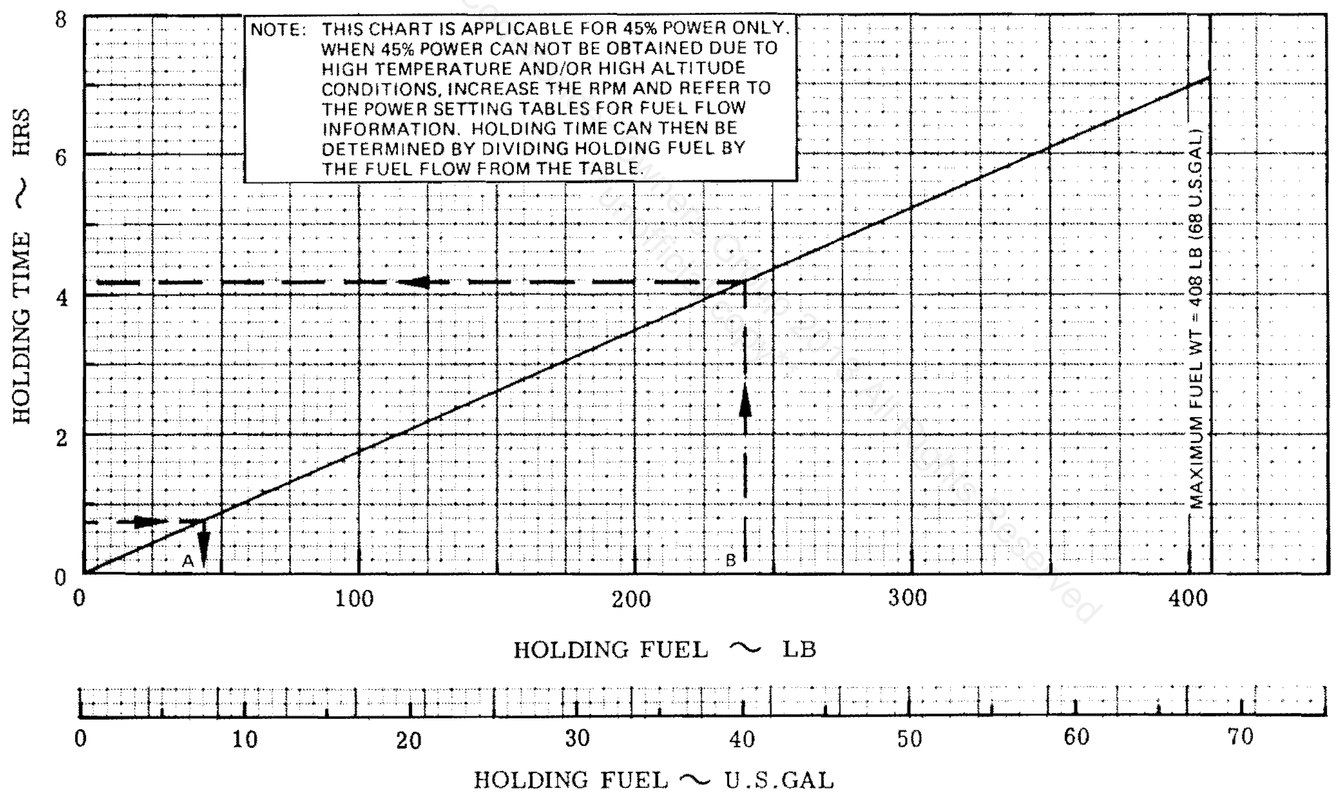


Figure 5-32.

TIME, DISTANCE AND FUEL USED IN DESCENT (S/N 14000 THRU 14149)

The Time, Distance and Fuel used in Descent are presented in Figure 5-33 for varying Pressure Altitude at 1000 FT/MIN Rate of Descent. A table of approximate Descent Speed versus Pressure Altitude is presented in the upper left hand corner of the chart.

ASSOCIATED CONDITIONS

Power	2400 RPM, 16 IN.HG. MP.
Wing Flaps	0 DEG
Landing Gear	RETRACTED
Cowl Flaps	CLOSED

TECHNIQUE

Follow the Scheduled Descent Speed versus Pressure Altitude as the descent progresses, maintaining sufficient power for 1000 FT/MIN Rate of Descent.

EXAMPLE

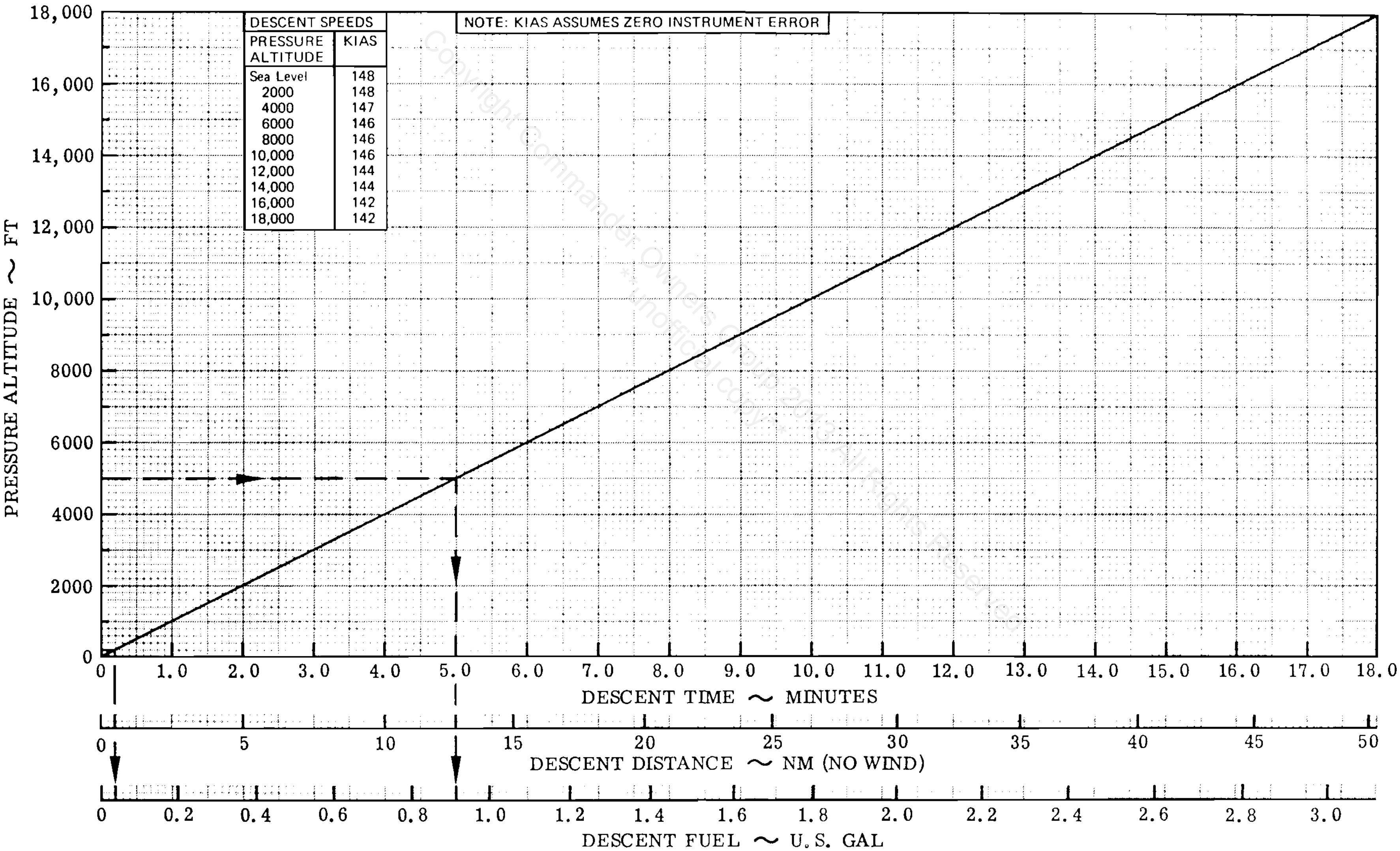
GIVEN: Initial Pressure Altitude 5000 FT
Final Pressure Altitude 200 FT

FIND: The total time, distance and fuel to descend from 5000 FT to 200 FT from Figure 5-33.

	INITIAL ALTITUDE		FINAL ALTITUDE		NET
Time	5.0 MIN	minus	0.2 MIN	equals	5 MIN
Distance	13.0 NAM	minus	1.0 NAM	equals	12 NAM
Fuel	0.9 U.S.Gal	minus	0.04 U.S.Gal	equals	0.86 U.S. Gal (5.2 LB)

NOTES: 1. Descent data is presented for zero wind conditions only.
2. The chart applies for outside air temperatures between -40 and +40 Degree C and for airplane weights between 3140 and 2740 lbs.

TIME, DISTANCE, FUEL USED IN DESCENT (S/N 14000 THRU 14149)
RATE OF DESCENT - 1000 FT/ MIN



DESCENT SPEEDS	
PRESSURE ALTITUDE	KIAS
Sea Level	148
2000	148
4000	147
6000	146
8000	146
10,000	146
12,000	144
14,000	144
16,000	142
18,000	142

Figure 5-33.

TIME, DISTANCE AND FUEL USED IN DESCENT (S/N 14150 AND SUBS)

The Time, Distance and Fuel used in Descent are presented in Figure 5-34 for varying pressure altitude at 1000 FT/MIN rate of descent. A table of Scheduled Descent Speed versus Pressure Altitude is presented in the upper left hand corner of the chart.

ASSOCIATED CONDITIONS

Power	2200 RPM (16 IN HG)
Wing Flaps	0 DEG
Landing Gear	RETRACTED
Cowl Flaps	CLOSED

TECHNIQUE

Follow the Scheduled Descent Speed versus Pressure Altitude as the descent progresses, maintaining sufficient power for 1000 FT/MIN rate of descent.

EXAMPLE

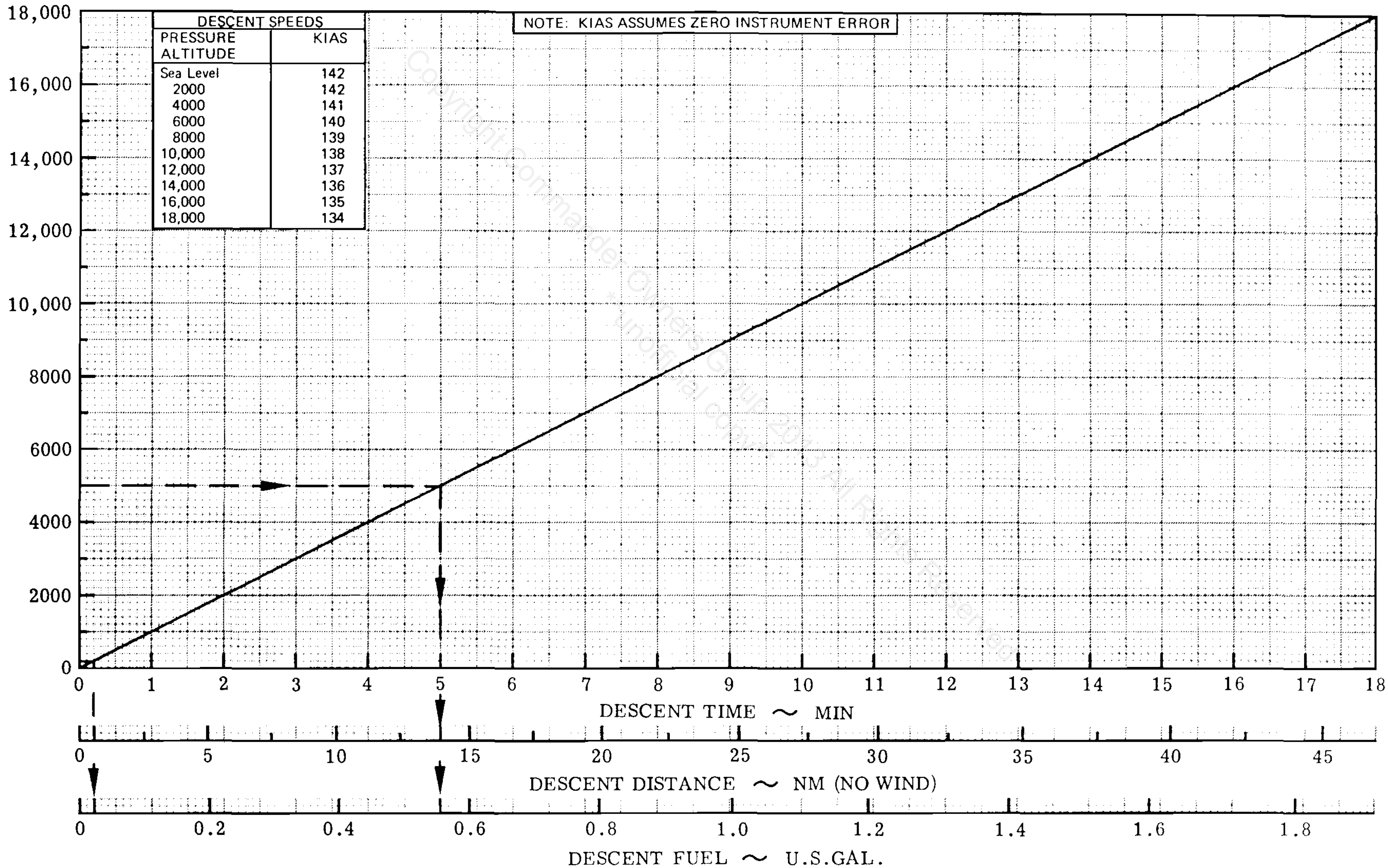
GIVEN:	Initial Pressure Altitude	5000 FT
	Final Pressure Altitude	200 FT

FIND: The total time, distance and fuel to descend from 5000 FT to 200 FT from Figure 5-34.

	INITIAL ALTITUDE		FINAL ALTITUDE		NET
Time	5.0 MIN	minus	0.2 MIN	equals	4.8 MIN
Distance	13.9 NAM	minus	1.2 NAM	equals	12.7 NAM
Fuel	0.55 U.S.Gal	minus	0.03 U.S.Gal	equals	0.52 U.S.Gal (3.1 LB)

NOTES: 1. Descent data is presented for zero wind conditions only.
2. The chart applies for outside air temperatures between -40 and +40 Deg C and for airplane weights between 3140 and 2740 Lbs.

TIME, DISTANCE, FUEL USED IN DESCENT (S/N 14150 & SUBS)
RATE OF DESCENT - 1000 FT/MIN



DESCENT SPEEDS	
PRESSURE ALTITUDE	KIAS
Sea Level	142
2000	142
4000	141
6000	140
8000	139
10,000	138
12,000	137
14,000	136
16,000	135
18,000	134

Figure 5-34.

LANDING GROUND ROLL DISTANCE, SHORT FIELD

The Short Field Landing Ground Roll Distance is shown in Figure 5-35 for varying conditions of Outside Air Temperatures, Pressure Altitudes, and Wind Speeds at a gross weight of 3140 Lbs.

ASSOCIATED CONDITIONS

Power	IDLE
Wing Flaps	35 DEG
Landing Gear	EXTENDED
Cowl Flaps	CLOSED
Runway Conditions	DRY, LEVEL, PAVED*

TECHNIQUE

Make the final approach with the landing gear extended and the wing flaps at 35 degrees arriving at the 50 FT height at 71 KIAS. Touchdown on the main wheels first, lower the nose wheel and apply maximum braking.

EXAMPLE

GIVEN:	Gross Weight	3140 LB
	Outside Air Temperature	25 DEG C
	Pressure Altitude	200 FT
	Wind Component	2 KT (TAILWIND)
FIND:	Ground Distance, Fig. 5-35	790 FT

NOTES: 1. IAS assumes zero instrument error.
2. Allowance must be made for wet runways or other associated conditions which may differ from those above.
*3. For landing on dry grass surfaces, increase ground roll distances by 25%.

CAUTION: The final approach speed is a minimum for smooth air conditions. It should be increased as required (typically 5 to 15 KIAS), if turbulence or wind shear conditions exist.

SHORT FIELD LANDING GROUND ROLL DISTANCE
GROSS WEIGHT = 3140 LB

DRY, LEVEL, PAVED* RUNWAYS 50 FT HEIGHT SPEED = 71 KIAS

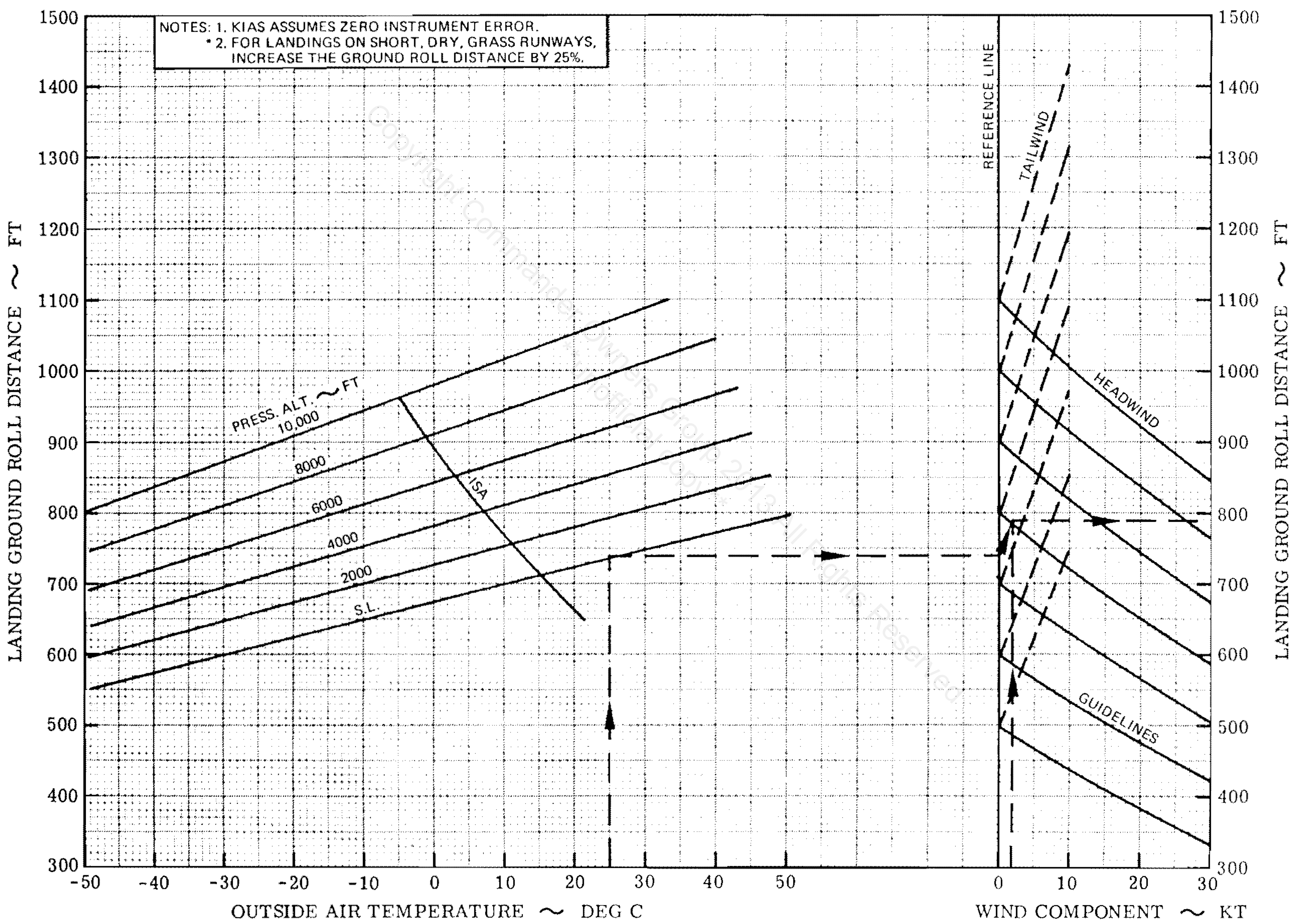


Figure 5-35.

TOTAL LANDING DISTANCE, SHORT FIELD

The Short Field Total Landing Distance from 50 Ft. height is shown in Figure 5-36 for varying conditions of outside air temperatures, pressure altitudes, and wind speeds at a gross weight of 3140 Lbs.

ASSOCIATED CONDITIONS

Power	IDLE
Wing Flaps	35 DEG
Landing Gear	EXTENDED
Cowl Flaps	CLOSED
Runway Conditions	DRY, LEVEL, PAVED*

TECHNIQUE

Make the final approach with the landing gear extended and the wing flaps at 35 degrees arriving at the 50 Ft height at 71 KIAS. Touchdown on the main wheels first, lower the nose wheel and apply maximum braking.

EXAMPLE

GIVEN:	Gross Weight	3140 LB
	Outside Air Temperature	25 DEG C
	Pressure Altitude	200 FT
	Wind Component	2 KT (TAILWIND)
FIND:	Total Landing Distance	
	Fig. 5-36	1322 FT

NOTES: 1. IAS assumes zero instrument error.
2. Allowance must be made for wet runways or other associated conditions which may differ from those above.
*3. For landing on dry grass surfaces, increase ground roll distances by 25%.

CAUTION: The final approach speed is a minimum for smooth air conditions. It should be increased as required (typically 5 to 15 KIAS), if turbulence or wind shear conditions exist.

SHORT FIELD TOTAL LANDING DISTANCE
GROSS WEIGHT = 3140 LB

DRY, LEVEL, PAVED* RUNWAYS 50 FT HEIGHT SPEED = 71 KIAS

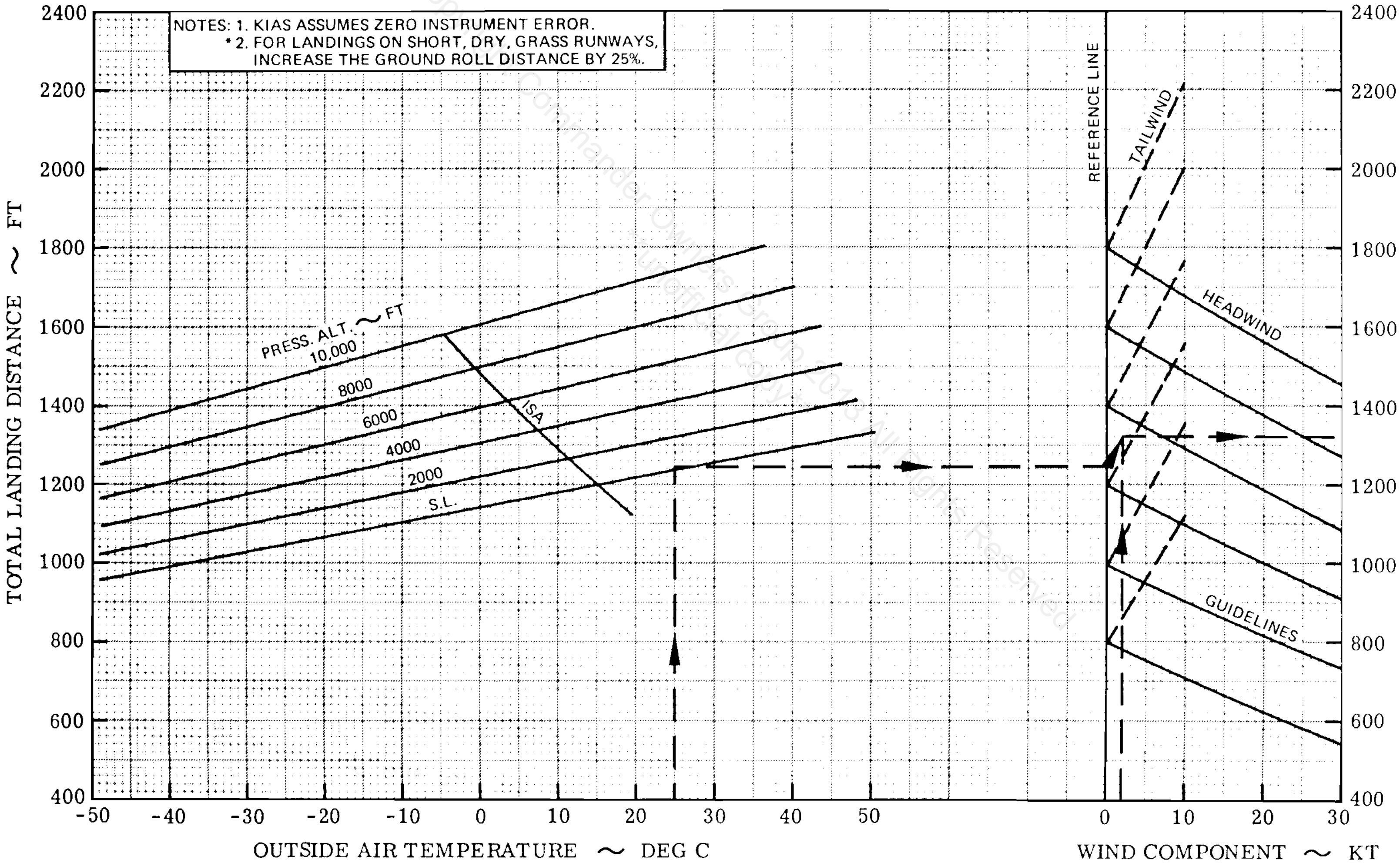


Figure 5-36.

MILES PER HOUR/KNOTS

NAUTICAL MILES/STATUTE MILES

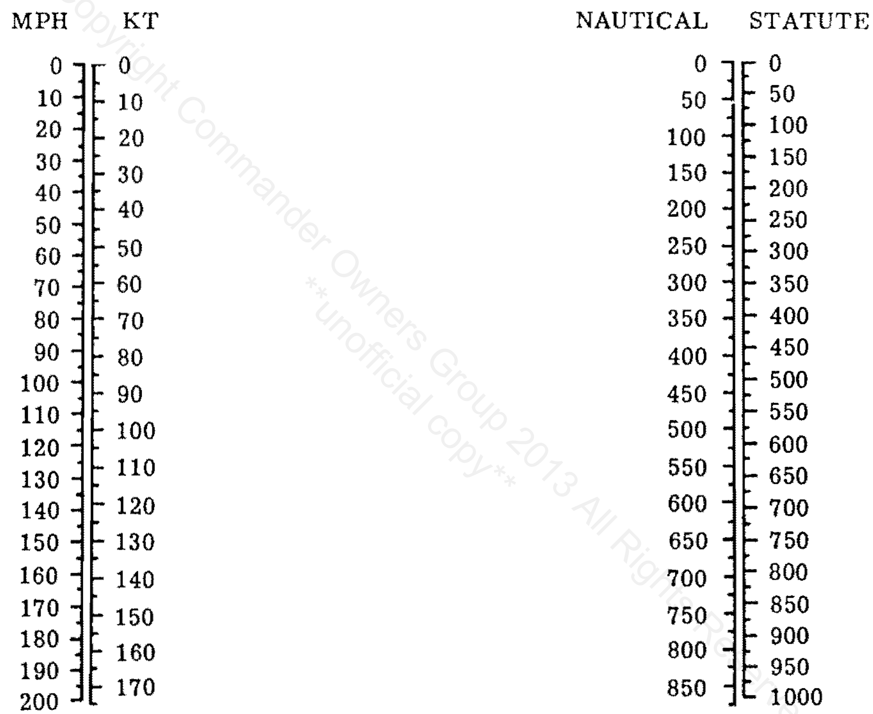


Figure 5-37.

SECTION VI

WEIGHT AND BALANCE/EQUIPMENT LIST

The following information is applicable to Serial Numbers 14000 thru 14149.

TABLE OF CONTENTS

INTRODUCTION

This section describes the procedure for establishing the aircraft Weight, Moment and Center of Gravity (C.G.). Procedures for calculating Weight, Moment and C.G. for various operations are also included in this section.

A list of optional equipment for your specific aircraft can be found in the Weight and Balance Report (Form AC 1678). This list consists of optional equipment, the weight, moment and center of gravity for items installed at the time of factory certification.

AIRCRAFT WEIGHING

PROCEDURES

1. Preparation:
   a. Inflate struts and tires to recommended pressures.
   b. Remove all drainable fuel from wing fuel tanks.
   c. With aircraft in ground attitude, fill sump to 8 quart level.
   d. Move forward seats to the full forward position and place all seat backs in vertical position.
   e. Install control lock to position all controls in neutral.
   f. Fully retract wing flaps and close cabin doors.

2. Leveling:
   a. Place scale under each wheel (500 lbs nose, 1000 lbs each main, minimum weight capacity).
   b. Deflate nose tire to level aircraft as necessary.
   c. Level datum is the forward floorboard.

3. Weighing:
   With the aircraft level and brakes released, record the weight shown on each scale. Deduct the tare, if any, from each reading.

4. Measuring:
Stretch a line between the centers of the main gear. Measure directly fore and aft along the aircraft centerline from the main gear centerline to each side of the nose gear centerline and average the measurements. This is the Distance L used in the Aircraft Weight and Balance Report.

5. Using the weights from step 3. and the measurements from step 4. the aircraft weight and C.G. can be determined. The factory Weight and Balance Report (Form AC 1678) may be followed as an example.

WEIGHT AND BALANCE INSTRUCTIONS

The following information will enable you to operate your Rockwell Commander 114 within the prescribed weight and balance limitations.

To compute accurate Weight and Balance for your particular aircraft, use the Loading Schedule Example, Aircraft Weight and Moment Tables and the Weight and Moment Allowables Envelope included in the Aircraft Weight and Balance Report (Form AC 1678) provided with each individual aircraft.

Using the Loading Sub-Total Weight and Moment from the Weight and Balance Report (Form AC 1678), add the additional Weight and Moment of passengers and baggage. Enter these two values to the Weight and Moment Allowables limitations (Page 3 of Weight and Balance Report) to determine if the aircraft falls within the Weight and Balance Envelope for the Zero Fuel Weight condition. Add the additional Weight and Moment of fuel and enter these two values to the Weight and Moment Allowables Limitations to determine if the loaded aircraft falls within the Weight and Balance Envelope.

NOTE

The loading sub-total and loading schedule (example) assumes an occupant weight of 170 lbs. Allowance must be made for occupant weight variation.

WEIGHT AND BALANCE REPORT - To be inserted by Quality Control for each individual aircraft

The following information is applicable to Serial Numbers 14150 and Subsequent.

TABLE OF CONTENTS

INTRODUCTION

This section provides procedures for establishing the airplane's basic empty weight, moment and center of gravity (C.G.). Procedures for determining the weight and balance for flight are included.

This section includes weight and balance information on all items of equipment installed on the airplane as it was delivered from the factory. Required and optional equipment items are identified as such.

A sample Weight and Balance Record form is included for easily keeping track of changes to the airplane which affect weight and balance (such as installation or removal of optional equipment).

AIRPLANE WEIGHING PROCEDURES

It may be necessary to occasionally weigh the airplane to keep the Basic Empty Weight current. All changes to the airplane affecting weight and balance are the responsibility of the airplane's operator.

Configuration

The airplane must be weighed in the following configuration:

1. Oil
   Oil tanks should be full. Total engine oil is 19 pounds at an ARM of 44.18 inches. A small portion of this oil is undrainable (4 pounds at an ARM of 48.6 inches).

2. Fuel
   The unusable fuel quantity should be in the fuel tanks. This amounts to 12 pounds at an ARM of 112.2 inches.

3. Hydraulic Fluids
   Check for full hydraulic fluids. Service as required.

4. Wing Flaps
   The wing flaps should be retracted.

5. Doors
   All doors closed.

The following information is applicable to Serial Numbers 14150 and Subsequent.

TABLE OF CONTENTS

INTRODUCTION

This section provides procedures for establishing the airplane's basic empty weight, moment and center of gravity (C.G.). Procedures for determining the weight and balance for flight are included.

This section includes weight and balance information on all items of equipment installed on the airplane as it was delivered from the factory. Required and optional equipment items are identified as such.

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1. Oil
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2. Fuel
   The unusable fuel quantity should be in the fuel tanks. This amounts to 12 pounds at an ARM of 112.2 inches.

3. Hydraulic Fluids
   Check for full hydraulic fluids. Service as required.

4. Wing Flaps
   The wing flaps should be retracted.

5. Doors
   All doors closed.

6. Parking Brake
The parking brake should be released.

7. Gust Locks
Any external gust locks should be removed from the control surfaces. The control lock must be installed in order to keep the elevator streamlined.

8. Pilot and Front Passenger Seat Position
Seats should be located per Weight and Balance Statement (Form No. AC 1751) with the seat backs in a vertical position (see Figure 6-2).

9. Installed Equipment
Installed equipment should be checked against the airplane equipment list and/or superseding forms. All installed equipment must be in its proper place during weighing.

Fuel Draining

Drain fuel system in accordance with the Airplane Maintenance Manual.

After the airplane fuel tanks have drained, 12 pounds (1 Gal. per tank) of fuel must be added for the weighing.

Leveling

Leveling can be accomplished as follows:

1. Lateral
Lateral leveling is accomplished by placing a spirit level across the lower outside surface of the fuselage between station 62.50 and 97.60 and deflating the tire or strut on the high side of the airplane until the bubble in the spirit level is centered.

2. Longitudinal
Longitudinal leveling is accomplished by placing a spirit level on the lower fuselage between stations 62.50 and 97.60 in a fore and aft position. Inflating or deflating the nose tire or strut raises or lowers the nose of the airplane as required until the bubble of the spirit level is centered.

Scale Capacity

A scale with a minimum capacity of 1000 pounds is required under each main landing gear wheel. A scale with at least a 500 pound capacity should be used under the nose wheel.

The scales should be properly calibrated and certified.

Scale Location

Weighings should always be made in an enclosed area, free of air currents.

Measuring

Stretch a line between the centers of the main gear (from centerline of left axle to centerline of right axle). Measure directly fore and aft along the airplane centerline to each side of the nose gear centerline and average the measurements. This is the distance "L" used in the Airplane Weight and Balance Statement (Form No. AC 1751).

SECTION VI

WEIGHT AND BALANCE/EQUIPMENT LIST

The following information is applicable to Serial Numbers 14000 thru 14149.

TABLE OF CONTENTS

INTRODUCTION

This section describes the procedure for establishing the aircraft Weight, Moment and Center of Gravity (C.G.). Procedures for calculating Weight, Moment and C.G. for various operations are also included in this section.

A list of optional equipment for your specific aircraft can be found in the Weight and Balance Report (Form AC 1678). This list consists of optional equipment, the weight, moment and center of gravity for items installed at the time of factory certification.

AIRCRAFT WEIGHING

PROCEDURES

1. Preparation:
   a. Inflate struts and tires to recommended pressures.
   b. Remove all drainable fuel from wing fuel tanks.
   c. With aircraft in ground attitude, fill sump to 8 quart level.
   d. Move forward seats to the full forward position and place all seat backs in vertical position.
   e. Install control lock to position all controls in neutral.
   f. Fully retract wing flaps and close cabin doors.

2. Leveling:
   a. Place scale under each wheel (500 lbs nose, 1000 lbs each main, minimum weight capacity).
   b. Deflate nose tire to level aircraft as necessary.
   c. Level datum is the forward floorboard.

3. Weighing:
   With the aircraft level and brakes released, record the weight shown on each scale. Deduct the tare, if any, from each reading.

4. Measuring:
Stretch a line between the centers of the main gear. Measure directly fore and aft along the aircraft centerline from the main gear centerline to each side of the nose gear centerline and average the measurements. This is the Distance L used in the Aircraft Weight and Balance Report.

5. Using the weights from step 3. and the measurements from step 4. the aircraft weight and C.G. can be determined. The factory Weight and Balance Report (Form AC 1678) may be followed as an example.

WEIGHT AND BALANCE INSTRUCTIONS

The following information will enable you to operate your Rockwell Commander 114 within the prescribed weight and balance limitations.

To compute accurate Weight and Balance for your particular aircraft, use the Loading Schedule Example, Aircraft Weight and Moment Tables and the Weight and Moment Allowables Envelope included in the Aircraft Weight and Balance Report (Form AC 1678) provided with each individual aircraft.

Using the Loading Sub-Total Weight and Moment from the Weight and Balance Report (Form AC 1678), add the additional Weight and Moment of passengers and baggage. Enter these two values to the Weight and Moment Allowables limitations (Page 3 of Weight and Balance Report) to determine if the aircraft falls within the Weight and Balance Envelope for the Zero Fuel Weight condition. Add the additional Weight and Moment of fuel and enter these two values to the Weight and Moment Allowables Limitations to determine if the loaded aircraft falls within the Weight and Balance Envelope.

NOTE

The loading sub-total and loading schedule (example) assumes an occupant weight of 170 lbs. Allowance must be made for occupant weight variation.

WEIGHT AND BALANCE REPORT - To be inserted by Quality Control for each individual aircraft

The following information is applicable to Serial Numbers 14150 and Subsequent.

TABLE OF CONTENTS

INTRODUCTION

This section provides procedures for establishing the airplane's basic empty weight, moment and center of gravity (C.G.). Procedures for determining the weight and balance for flight are included.

This section includes weight and balance information on all items of equipment installed on the airplane as it was delivered from the factory. Required and optional equipment items are identified as such.

A sample Weight and Balance Record form is included for easily keeping track of changes to the airplane which affect weight and balance (such as installation or removal of optional equipment).

AIRPLANE WEIGHING PROCEDURES

It may be necessary to occasionally weigh the airplane to keep the Basic Empty Weight current. All changes to the airplane affecting weight and balance are the responsibility of the airplane's operator.

Configuration

The airplane must be weighed in the following configuration:

1. Oil
   Oil tanks should be full. Total engine oil is 19 pounds at an ARM of 44.18 inches. A small portion of this oil is undrainable (4 pounds at an ARM of 48.6 inches).

2. Fuel
   The unusable fuel quantity should be in the fuel tanks. This amounts to 12 pounds at an ARM of 112.2 inches.

3. Hydraulic Fluids
   Check for full hydraulic fluids. Service as required.

4. Wing Flaps
   The wing flaps should be retracted.

5. Doors
   All doors closed.

6. Parking Brake
The parking brake should be released.

7. Gust Locks
Any external gust locks should be removed from the control surfaces. The control lock must be installed in order to keep the elevator streamlined.

8. Pilot and Front Passenger Seat Position
Seats should be located per Weight and Balance Statement (Form No. AC 1751) with the seat backs in a vertical position (see Figure 6-2).

9. Installed Equipment
Installed equipment should be checked against the airplane equipment list and/or superseding forms. All installed equipment must be in its proper place during weighing.

Fuel Draining

Drain fuel system in accordance with the Airplane Maintenance Manual.

After the airplane fuel tanks have drained, 12 pounds (1 Gal. per tank) of fuel must be added for the weighing.

Leveling

Leveling can be accomplished as follows:

1. Lateral
Lateral leveling is accomplished by placing a spirit level across the lower outside surface of the fuselage between station 62.50 and 97.60 and deflating the tire or strut on the high side of the airplane until the bubble in the spirit level is centered.

2. Longitudinal
Longitudinal leveling is accomplished by placing a spirit level on the lower fuselage between stations 62.50 and 97.60 in a fore and aft position. Inflating or deflating the nose tire or strut raises or lowers the nose of the airplane as required until the bubble of the spirit level is centered.

Scale Capacity

A scale with a minimum capacity of 1000 pounds is required under each main landing gear wheel. A scale with at least a 500 pound capacity should be used under the nose wheel.

The scales should be properly calibrated and certified.

Scale Location

Weighings should always be made in an enclosed area, free of air currents.

Measuring

Stretch a line between the centers of the main gear (from centerline of left axle to centerline of right axle). Measure directly fore and aft along the airplane centerline to each side of the nose gear centerline and average the measurements. This is the distance "L" used in the Airplane Weight and Balance Statement (Form No. AC 1751).

Weighing

1. Note the weights indicated on each scale and record them under the scale reading column of the Airplane Weight and Balance Statement (Form No. AC 1751).

2. Determine any scale error (if known) and/or tare and record them in the appropriate columns.

3. Scale error and/or tare should be added or subtracted from their respective scale readings to determine net weights. The net weights are then totaled to arrive at the aircraft's total weight.

Basic Empty Weight and C. G. Calculations

1. Add measurement L (Distance between main gear and nose gear) to 39.00 inches. This distance determines the arm of the main gears and becomes distance D of the Airplane Weight and Balance Statement (Form No. AC 1751).

NOTE

All measurements are in inches.

2. Formula:

$$C.G. = D - \frac{(F \times L)}{W}$$

WHERE: F = Nose Gear Net Weight
L = Distance between Main Gear and Nose Gear
D = Distance between Main Gear and Datum (39.0 + L)
W = Total Airplane Weight

3. After the total airplane weight and C. G. have been determined, enter these figures in the airplane (as weighed) row and under the Weight and C. G. Arm column of the Airplane Weight and Balance Statement.

4. The total airplane moment is determined by multiplying the total airplane weight by its C.G. arm. Enter this number in the airplane (as weighed) row under the moment column.

5. The Basic Empty Weight, C. G. and moment are determined from the Airplane as weighed by addition of the Weight and Moment of any ballast, if required.

WEIGHT AND BALANCE RECORD

At the time of delivery, Rockwell International provides the necessary weight and balance data to compute individual loadings. All subsequent changes in airplane weight and balance are the responsibility of the airplane owner and/or operator.

The ballast requirements are determined from the airplane as weighed condition. If ballast is required, due to factory installed optional equipment, it will be included in the basic empty weight. Any changes in equipment which are made by the owner should be entered on the Weight and Balance Records of the airplane and ballast requirements checked to assure that the airplane is still within the C.G. Envelope.

SAMPLE WEIGHT AND BALANCE RECORD

AIRPLANE MODEL				SERIAL NUMBER						PAGE NUMBER	
DATE	ITEM NO.		DESCRIPTION OF ARTICLE OR MODIFICATION	WEIGHT CHANGE						RUNNING BASIC EMPTY WEIGHT	
				ADDED (+)			REMOVED (−)				
	IN	OUT		WT. (lb.)	ARM (In.)	MOMENT /1000	WT. (lb.)	ARM (In.)	MOMENT /1000	WT. (lb.)	MOMENT /1000

WEIGHT AND BALANCE DETERMINATION FOR FLIGHT

To assure acceptable stability, control, performance and adherence to structural limitations, it is essential that the aircraft be loaded within the limits defined by the flight envelope. This is the pilot's responsibility and should be accomplished prior to each flight.

This section will present information and procedures appropriate to the determination of the aircraft's weight and center of gravity for flight.

The procedure presented will center around a sample loading schedule example (Page 2 of Airplane Weight and Balance Statement (Form No. AC 1751) composed of a seven-step process. The steps will be explained in the same order as they appear on the Airplane Weight and Balance Statement (Form No. AC 1751). For the Weight and Balance calculations, the flight envelope in this section is defined in terms of weight and moment/1000.

Procedure

1. Airplane Basic Empty Weight

   Determine the airplanes basic empty weight and moment/1000. This information should be available from the Weight and Balance Records. Enter these numbers in the Item 1 row under the appropriate columns of the Airplane Weight and Balance Statement (Form No. AC 1751).

2. Pilot and Front Passenger

   Determine the weight of the pilot, then refer to the loading graph (Figure 6-1) to determine the moment/1000 value. Enter these numbers in the Item 2 row under the appropriate columns of the Airplane Weight and Balance Statement.

NOTE

The moment/1000 values for the pilot and front passenger depicted on the loading graph are based on a nominal front seat location of 99.0 inches. This location should be representative of most loadings; however, if it is known that the front seat(s) will be located at some other position, the moment/1000 can be calculated as follows:

a. Determine the front seat(s) location with respect to a Fuselage Station. (Front seat F.S. travels are depicted in Figure 6-2).

b. The moment/1000 value is determined by multiplying the total weight to be placed on these seats by the F.S. location of the seat(s) and then dividing by 1000.

c. Enter the weight and moment/1000 in the Item 2 row under the appropriate columns of the Airplane Weight and Balance Statement.

3. Rear Seat Passengers

   Determine the weight of the passengers then refer to the loading graph (Figure 6-1) to determine the moment/1000 value, using the proper loading lines. Enter the weight and the moment/1000 under the appropriate columns of the Item 3 row of the Airplane Weight and Balance Statement.

4. Cargo and/or Baggage

   Determine the weight of cargo and/or baggage to be carried, then refer to the loading graph (Figure 6-1) to determine the moment/1000 value. It must be noted that the loading graph for the baggage assumes a fixed fuselage station location of 164.0 inches; however, at times it might be desirable to carry baggage in different areas of the baggage compartment or the cabin. Should this be the case, refer to Figure 6-2 to determine the fuselage station location, then calculate the moment/1000 by using the same procedure explained in Step No. 2. Enter the weights and moment/1000 values in Row 4 under the appropriate columns of the Airplane Weight and Balance Statement.

5. Zero Fuel Weight

   Add the columns of Rows 1-4 of the Airplane Weight and Balance Statement. These subtotals become the zero fuel weight and moment. Refer to the flight envelope (Figure 6-3) to determine that these weight and moment limitations have not been exceeded. Any weight carried above the maximum zero fuel weight must be in the form of fuel. Should your calculations at this point show that you have exceeded the zero fuel weight limitations, the load must be redistributed or removed to stay within the maximum limits. Passengers and baggage can be added as long as their combined weights and moments do not exceed the zero fuel weight limits.

   Remember: Zero Fuel Weight = Aircraft Basic Empty Weight + Pilot, Passengers, and Baggage.

6. Fuel Load

Determine the fuel requirements for flight in pounds (assume 6.0 Lbs/Gal for aviation type fuel), then refer to the loading graph to determine the moment/1000 value. Enter these values under the appropriate columns of the Item Number 6 row of the Weight and Balance Statement.

NOTE

The maximum gross weight will dictate the amount of fuel that can be carried.

7. Takeoff Weight

Total (the columns of) Items 5 and 6 of the Airplane Weight and Balance Statement to get takeoff weight and moment/1000. Check to assure that the gross weight and the moment/1000 values are contained within the flight envelope (See Figure 6-3).

WARNING

TAKEOFFS WITH THE WEIGHT AND/OR MOMENT/1000 OUTSIDE THE FLIGHT OR ZERO FUEL ENVELOPES ARE PROHIBITED.

LOADING GRAPH

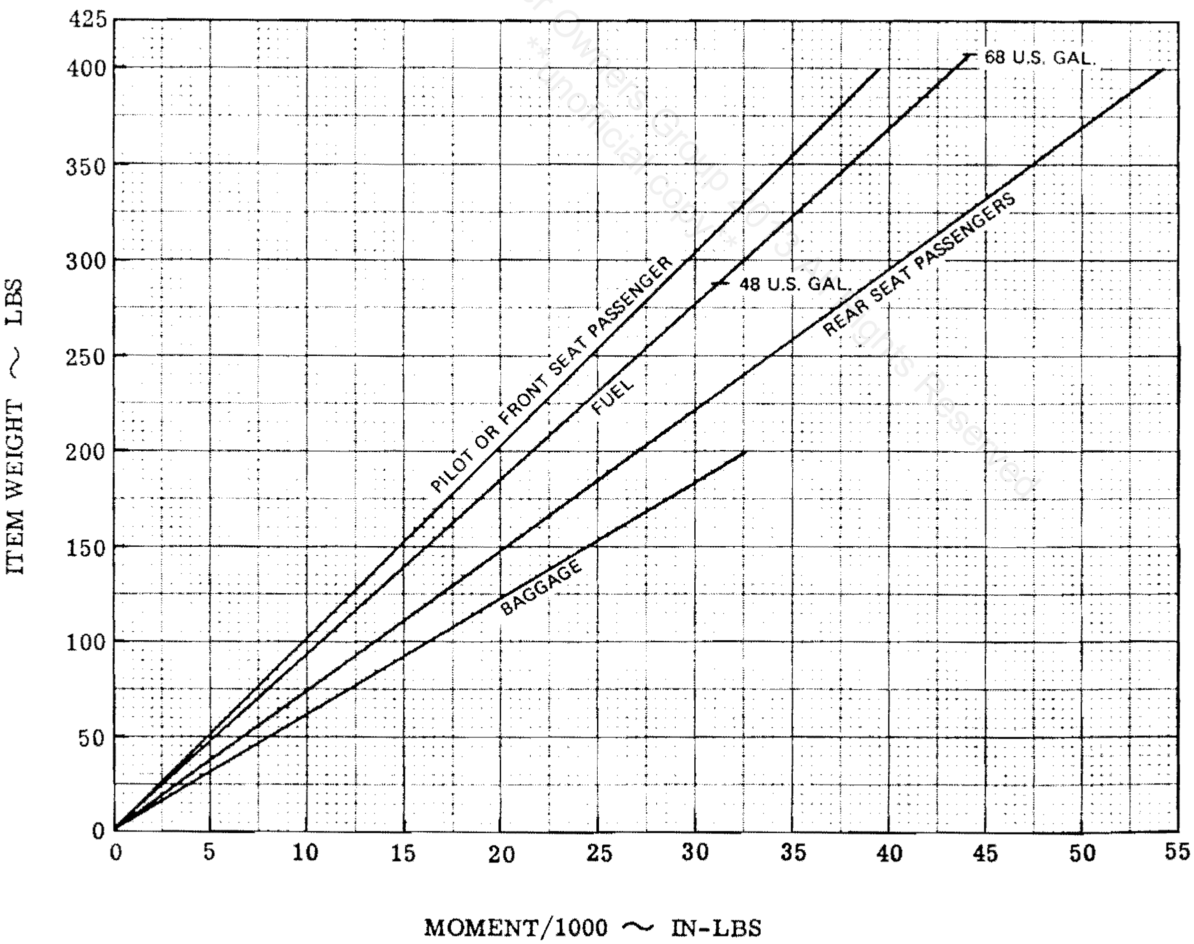


Figure 6-1. Loading Graph

CABIN STATION DIAGRAM

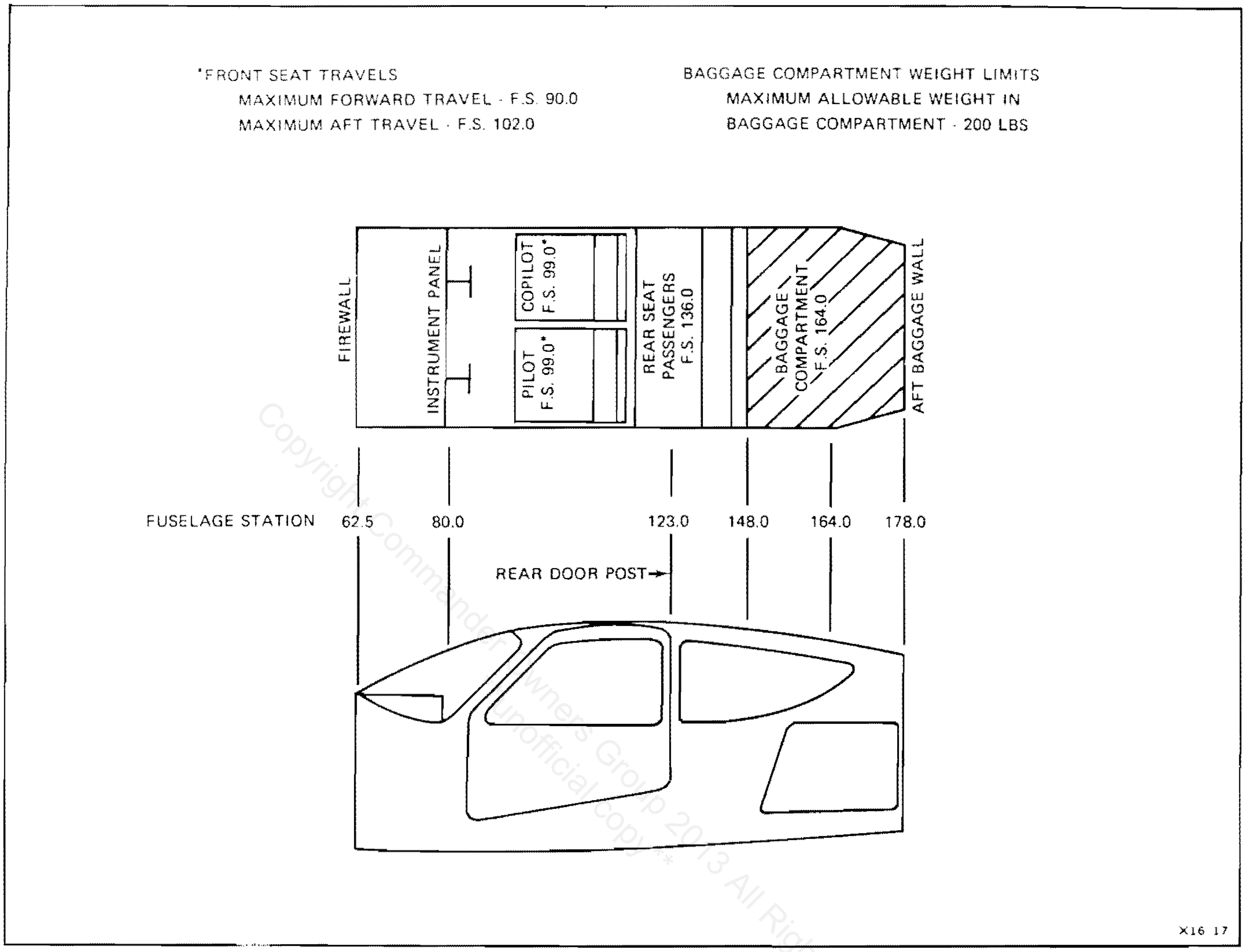


Figure 6-2. Cabin Station Diagram

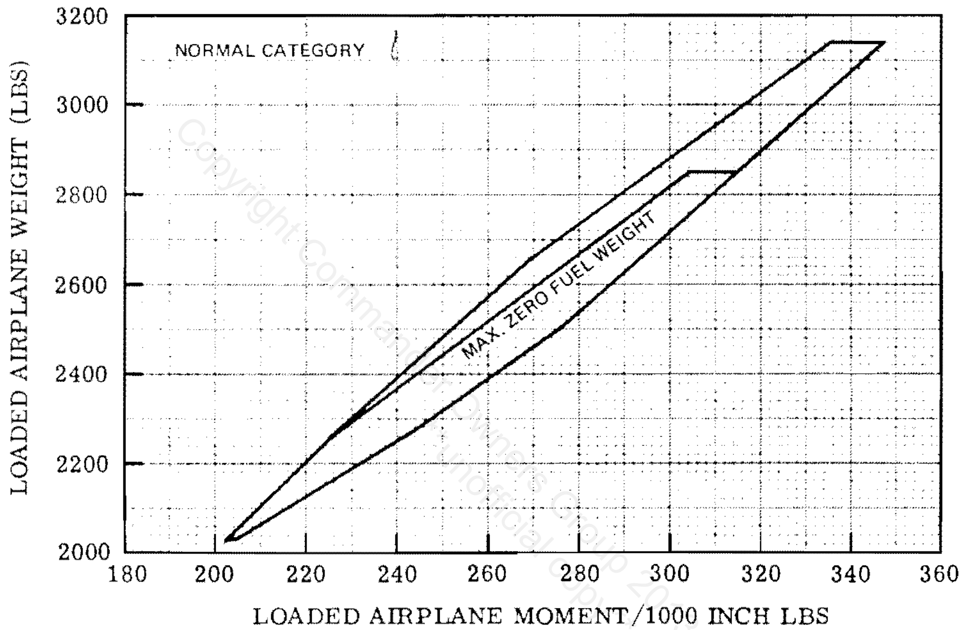
AIRCRAFT OPERATIONAL LIMITATIONS - See Figure 6-3.

WEIGHT AND BALANCE STATEMENT - To be inserted by Quality Control for each individual airplane.

AIRCRAFT OPERATIONAL LIMITATIONS

WEIGHT AND MOMENT ALLOWABLES
(OPERATION OUTSIDE MIN. AND MAX. VALUES IS PROHIBITED)
(GEAR RETRACTION MOMENT ACCOUNTED FOR)

NOTE: UTILITY CATEGORY APPLICABLE TO SERIAL NUMBERS 14000 THRU 14254 WITH CUSTOM KIT NO. CK-114-1 INSTALLED, AND SERIAL NUMBERS 14255 AND SUBS.



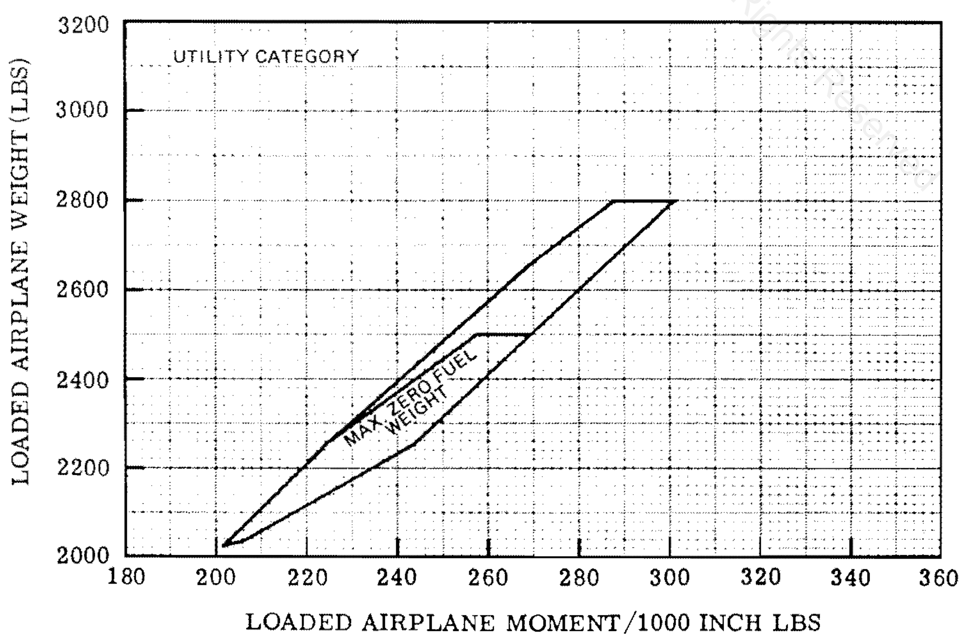


Figure 6-3. Airplane Operational Limitations

SECTION VII

AIRPLANE AND SYSTEMS DESCRIPTIONS

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GENERAL

The Model 114 is a four-place, low-wing, all-metal retractable gear aircraft powered by a six cylinder, normally aspirated Lycoming engine that is equipped with a Hartzell all metal constant-speed two-bladed propeller. Access to the cabin interior is through two lockable cabin doors, one in each side of the aircraft. The cabin interior is sectioned into four seating areas by a center console which houses engine and propeller controls, elevator trim control wheel and passenger convenience items.

Standard overhead console equipment includes separately adjustable ventilation outlets, and four 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.

AIRFRAME

FUSELAGE

The fuselage consists of the nose section, center section and aft section. The nose section, extending from fuselage station 22.00 to 62.50, houses the power plant and retractable nose landing gear. Nose landing gear doors, which open and close as the gear is extended or retracted, form an aerodynamically smooth nose section during flight. The nose section is joined to the center fuselage section at fuselage station 62.50, which is also the location of the engine firewall. The center fuselage, which contains the main cabin area and baggage compartment, extends from fuselage station 62.50 to 178.00 where it is joined to the aft fuselage section. The center fuselage section houses the seats for pilot and three passengers, and has two doors that afford easy access to entering the aircraft from either side. The pilots area is equipped with a wide-vision windshield and large door windows to assure maximum pilot visibility during flight. The aft fuselage section, extending from fuselage station 178.00 to 263.00, is permanently secured to the center fuselage section and provides structural attachment points for the empennage flight surfaces and controls. This section houses the battery, hydraulic power pack unit and various control surface cables. The entire fuselage is designed to assure a strong safety margin for all flight conditions and to provide attaching structures for the wing and empennage. Sturdy aluminum flooring supported by longitudinal beams and bulkheads extends from the firewall aft through the baggage compartment. The center wing structure is attached to the fuselage so that a part of the wing torque is absorbed by the fuselage structure. The aft tail cone is capped by a fiberglass stinger containing mounts for a tail navigation light and lens assembly, and a tail tie-down ring mounted in the vertical fin portion of the cap.

CABIN DOORS (S/N 14000 thru 14349)

The aircraft is equipped with two all-metal cabin doors. Each door has three (3) latch points, the center and lower latches are slam-type with spring-loaded, over-center mechanisms, and these engage when doors are closed. The upper latch is a cam-actuated over-center latch, and the handle must be rotated aft to engage the latch, after door has been closed. If lower door handle has more than 1/8 to 1/4-inch free play, door is not adequately latched. Locks are incorporated into the exterior cabin door handles, and doors may be securely locked when aircraft is parked. The pilot's door has a key lock, the passenger door has a plunger-type lock and either door may be locked before it is closed. The pilot's cabin door has a vent window (passenger vent window is optional) which may be opened in flight, however airspeed is restricted to 130K with vent window open.

CLOSING DOOR IN FLIGHT (S/N 14000 thru 14349)

The following procedure should be followed when attempting to close door in flight:

1. Slow airspeed to 80 knots.
2. Unlatch upper door latch.
3. Open vent window (if installed).
4. Force door open approximately four (4) inches and slam door shut.
5. Verify door is closed.

NOTE

> If lower door handle has more than 1/8 to 1/4-inch free play, door is not adequately latched. Repeat steps 1. thru 5.

6. Secure upper door latch.

CABIN DOORS (S/N 14350 and SUBS)

These airplanes are equipped with two all-metal cabin doors. Each door has three latch points. The center and lower latches are bayonet-type pins which extend into receptacles in the door frame in the latched position. These pins are extended and retracted by a lever operated, over-center, cam type mechanism. The upper latch is a cam-actuated over-center latch, and the latch handle must be rotated aft to engage the latch.

Exterior door handles are recessed and must be lifted out and rotated up to retract the pins. When opening the door, unlatch the upper latch before releasing the lower latches; when closing the door, engage the lower pins first, before engaging the upper latch.

To close the doors from the inside, pull door closed using built in armrest, hold door in closed position, and rotate black lever arm forward and down to engage the pins. It is not necessary to slam the door. With lower pins engaged, rotate the upper latch handle to the CLOSE position.

A sliding metal pin, located at the aft end of the armrest on both entrance doors, may be used to lock the doors from the inside. Sliding the metal pin aft with the door closed and latched, mechanically locks both the inner and outer door handles in the closed position. The pin must be in the forward position for the door to be opened. Recommend the pin be left in the forward (unlocked) position during all ground operation and during takeoff and landing.

To open the doors from the inside, rotate upper latch handle to the OPEN position; slide the metal pin forward to unlock the door mechanism, if necessary, and rotate the black lever up to release the door pins.

A locking mechanism, controlled by a spring-loaded plunger type pin, prevents moving the exterior door handle, or the interior lever, to the latched position when the door is open. The plunger releases the locking mechanism when the door is closed.

A key operated lock is located in the pilot's entrance door. The right entrance door must be locked from the inside using the sliding pin.

SEATS

Pilot and passenger seats are bucket type with individually adjustable backrests. The recliner control handle is located on the lower, aft, outboard corner of each seat. To reposition backrests, lift handle and simultaneously move backrest to desired position, then release handle. In addition to the adjustable backrests the pilot and front passenger seats are adjustable fore and aft, and rise slightly when moved forward. To reposition seats, lift handle, which is located in the center of and just below each seat, move seat to desired position, and release handle. When repositioning seats and/or backrests always check to ascertain that locking mechanisms have properly engaged after adjustments have been completed.

SEAT BELTS AND SHOULDER HARNESSES

Lap belts incorporate quick release metal to metal buckles and length adjustments on both inboard and outboard halves of belt. Belts should be adjusted to position buckle over inboard hip of wearer (see Figure 7-1). Lap belts may be released by lifting upper half of buckle.

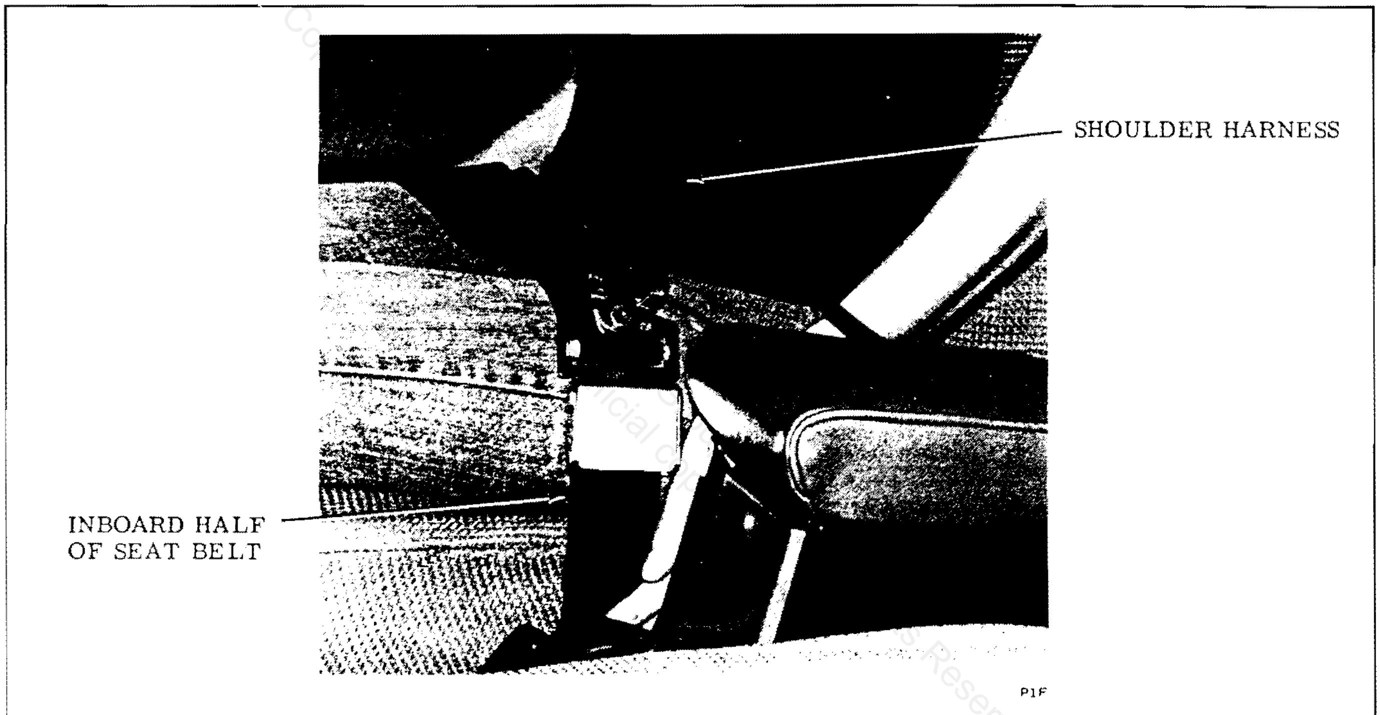


Figure 7-1. Shoulder Harness Secured

Inertia reel-type shoulder harnesses are installed on the pilot's and front passenger seats (installation for rear seats is optional). The inertia restraint system provides pilot and passenger mobility without undue restriction or constant adjustment of the harnesses. 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. To check the inertia reel locking device, give the shoulder harness a quick jerk. Relaxing forward pressure will unlock the inertia reel.

To secure the shoulder harness, refer to Figure 7-1, 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.

BAGGAGE DOOR

The baggage door is of all-metal construction, and is located aft of the wing on the left side of the aircraft. Serial Numbers 14000 thru 14149 - the door is equipped with a keyed rotary-type lock, and must be opened and closed using the key. Serial Numbers 14150 and Subsequent - the door is equipped with a spring-loaded latch assembly in addition to the keyed rotary-type lock. The key can be removed in either the locked or unlocked position.

NOTE

If the baggage door is to remain open for an extended period of time, the baggage door light circuit breaker should be pulled to prevent depleting the battery.

BAGGAGE COMPARTMENT

The baggage compartment is located in the aft most portion of the cabin area of the aircraft. Access is through the baggage door on the left side of the aircraft, or through the cabin area behind the rear passenger seats. Volume of the baggage compartment is twenty two (22) cubic feet and maximum baggage is restricted to two hundred (200) pounds. When loading the aircraft, refer to the Weight and Balance section of the Pilots Operating Handbook to assure that aircraft loading meets all requirements and restrictions. All loads should be securely fastened using the cargo net and the tie-down rings (4) located in the corners of the baggage compartment, thus preventing inadvertent movement during aircraft operations.

WARNING

Passengers should not be allowed to ride in the baggage compartment under any circumstances.

Do not carry hazardous material.

WING

Each wing is of an all-metal stressed-skin construction incorporating spars, formed ribs and an integral fuel tank contained in a three-rib section, forward of the main spar. The main spar of each wing is joined together at the center of the fuselage with spar cap splices. The wing is installed in the lower center fuselage section. It is secured to the fuselage load-bearing frames and fittings by bolts and nuts at stations 85.00, 123.00 and forward of station 148.00. Access plates located at various points on the lower skin of the wing provide access for inspection and repair of the fuel system and the flight control cabling. Landing gear fitting/retraction mechanisms are installed in the basic wing structures to provide attachment points for the main landing gear. An opening in the inboard leading edge of each wing serves as a ram air intake for the lower cabin ventilation system. An electrically operated wing flap is installed between the fuselage and aileron on each wing. The flaps are attached to the aft wing spar by hinge assemblies. Extension and retraction of the wing flaps is controlled by an electrically operated jackscrew and torque tube arrangement. Metal ailerons, extending outboard from the flaps to wing station 189.00, are attached to the aft wing spar by hinge assemblies.

EMPENNAGE

The empennage consists of the vertical and horizontal stabilizers. The vertical fin assembly is made of two separate components; an upper assembly which is mated at the horizontal stabilizer, and a lower stub assembly which is integral with the aft tailcone structure. A rudder control surface is attached to the vertical stabilizer at two hinge points. A fiberglass fin cap contains provisions for mounting the VHF navigation antenna and the flashing beacon. A ram air intake, recessed into the center of the vertical stabilizer, provides maximum cool air for in-flight cabin ventilation. The horizontal stabilizer, consisting of a fixed stabilizer and movable elevator surface, is attached to the lower vertical stabilizer stub assembly. The horizontal and vertical stabilizers both utilize stressed and beaded skin construction to provide maximum strength with minimum structural components. The horizontal tail is of single unit construction with a fixed forward surface and a hinged elevator control surface. The elevator provides mounting attachment for a fiberglass tip-fairing at each outboard end for streamlined appearance.

FLIGHT CONTROLS

CONTROL LOCK

A control lock is provided on the pilot's control column. The control lock pin and flag assembly should be inserted through instrument panel control column mount and control column, after holes have been aligned. When properly installed, the flag on the control lock will cover the starter switch. The control lock should be removed before the key is inserted in starter switch, and no attempt should be made to defeat the purpose of the flag.

FLAP CONTROL SYSTEM

Wing 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. Power from the electric motor is transmitted to the flaps through a jackscrew connected to a torque tube, and from the torque tube to the flaps with push-pull rods. 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. No appreciable change in trim is required over the full flap extension range, however minor changes in trim can be made depending on airspeed and aircraft loading. Normally there will be a slight nose down trim change.

AILERON CONTROL SYSTEM

The aileron control wheels are mechanically interconnected through a series of control chains, sprockets and cables. Control cables extend aft from the control column passing under the floor structure and through idler pulleys to a bracket assembly. The cables are then routed through the bracket assembly and out through the wing to the aileron bellcranks. Adjustable push-pull rods connect the aileron bellcranks to the ailerons. An aileron balance assembly is mounted on the outboard end of each aileron. The aileron and rudder control systems are interconnected by the use of a spring thus providing improved stability by aiding the coordinated application of aileron and rudder control movements.

AILERON TRIM TAB

A fixed-position trim tab is attached to the left aileron. A left wing high attitude may be corrected by bending the trim tab down. Bending the tab up will correct a left wing low attitude. Use forming block when bending tab, and do not bend more than 0.50-inch tab deflection in either direction.

ELEVATOR CONTROL SYSTEM

Each elevator is of all-metal construction, and is hinged at three places and attached to the aft spar of the horizontal stabilizer. The elevators are operated by the fore and aft movement of the control column. Elevator arms, attached to the control column in the console tunnel, are connected to control cables which are 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. Two turnbuckles, installed in the elevator control system between fuselage stations 205.00 and 230.50, permit control cable tension adjustment.

ELEVATOR TRIM SYSTEM

Controllable trim tabs, located on the inboard trailing edge of each elevator, are operated by an elevator trim tab control wheel installed in the center console. A portion of the trim tab control wheel extends through the center console, and when rotated, actuates the trim tab through a mechanical linkage consisting of cables, chains, jackscrew assembly and push rods that attaches to the trim tab. Turnbuckles are utilized for rigging and adjusting cable tensions. An indicator strip, visible through a slot in the console, indicates neutral, nose up or nose down positions. 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

Dual rudder-brake control pedals enable the pilot or copilot to control the rudder, brakes, and nose wheel steering. 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 connected to the nose wheel steering with cables and bungee assemblies which act as return springs for the rudder pedals. The rudder pedals are interconnected to the aileron controls as outlined in the aileron control system.

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 knob clockwise will yaw the aircraft to the right, opposite rotation will yaw the aircraft to the left. An indicator is incorporated in the right side of the lower instrument cluster to indicate rudder trim position.

GROUND CONTROL

The nose wheel steering system is tied in with the rudder trim systems and is controlled by movement of the rudder/brake pedals. A combination of cables, bungees, bellcranks, turnbuckles and pulleys operate the nose wheel steering and give the aircraft a minimum turn radius of 21' 10.25". Nose steering limit ± 30°.

LANDING GEAR

The aircraft is equipped with a hydraulically operated tricycle landing gear that includes a steerable nose wheel and self-adjusting disc brakes for the main landing gear wheels. Landing shocks are absorbed in the nose gear by a conventional oleo strut assembly and by an oleo strut connecting rod arrangement connected to the trailing arm of the main landing gear. Nose wheel steering is controlled by a cable-pulley system attached to the nose gear and to the rudder/brake pedal and actuated by depressing the rudder/brake pedals from either pilot's position. The single-disc, dual piston hydraulic brakes are operated by individual master brake cylinders attached to the rudder/brake pedals. The brakes are actuated by applying toe pressure to the top of the rudder/brake pedals. The aircraft is also equipped with a parking brake system which operates from the master brake cylinders and is actuated by a parking brake control knob. A shimmy dampener is attached to the fixed and movable portions of the nose gear strut to provide a dampening action on the gear. The emergency extension valve, located on the left side of center console, is used for emergency extension of the gear. This valve by-passes hydraulic fluid directly to the reservoir, allowing the gear to drop by gravity; gear extension is assisted by down springs. The emergency gear extension knob is spring-loaded to prevent accidental operation and must be pulled out and then pushed down to operate. The main landing gear retracts inward and upward into the wheel wells in the lower side of the wing. The nose landing gear retracts aft and upward into the wheel well. Mechanically operated doors, connected to the landing gear by link assemblies, open and close during the extension and retraction cycle. A flat surface on the fixed portion of the nose gear keeps the landing gear centered when the gear is retracted. Retraction and extension of the landing gear is controlled by an electro-hydraulic power pack that is actuated by the position of the landing gear selector switch mounted on the instrument panel. When the landing gear selector switch is placed in the UP position, the landing gear retracts until the gear up pressure switch is actuated. When the gear up pressure switch is actuated, the hydraulic power pack pump is shutoff and all three gear are retained in the uplock position by a hydraulic pressure lock. A loss of 250 psi hydraulic pressure will energize the hydraulic power pack and buildup pressure to the pressure switch setting. When the landing gear selector switch is placed in the DOWN position, the hydraulic pressure lock is released and hydraulic fluid is directed to the down side of the landing gear actuator cylinders extending the gear until the pressure switch is actuated. When the pressure switch is actuated, the hydraulic power pack pump is shutoff and all three gear are held in the downlock position by overcenter braces assisted by trapped hydraulic pressure. A ground contact switch, on the right main gear, will prevent landing gear retraction while on the ground caused by an unintentional positioning of the landing gear selector switch to the UP position. Landing gear position indicators and a warning bell or horn system are provided to alert the pilot when the landing gear is in the up, or down and locked position. Position indicators, both red and green, are installed in front of the pilot. The green lights are installed in the instrument panel and the red light is installed on the glareshield. The gear down position is indicated by three green lights above the gear selector switch. The unsafe red (GEAR WARN) light, on the glareshield, indicates the gear is intransit or not fully down and locked. There is no electrical indication of gear being fully retracted other than all indicator lights being extinguished. When the landing gear extends to the full down position, three landing gear down switches are actuated causing the green lights to illuminate, indicating the gear is down and locked.

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 (see Figure 7-2). 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.

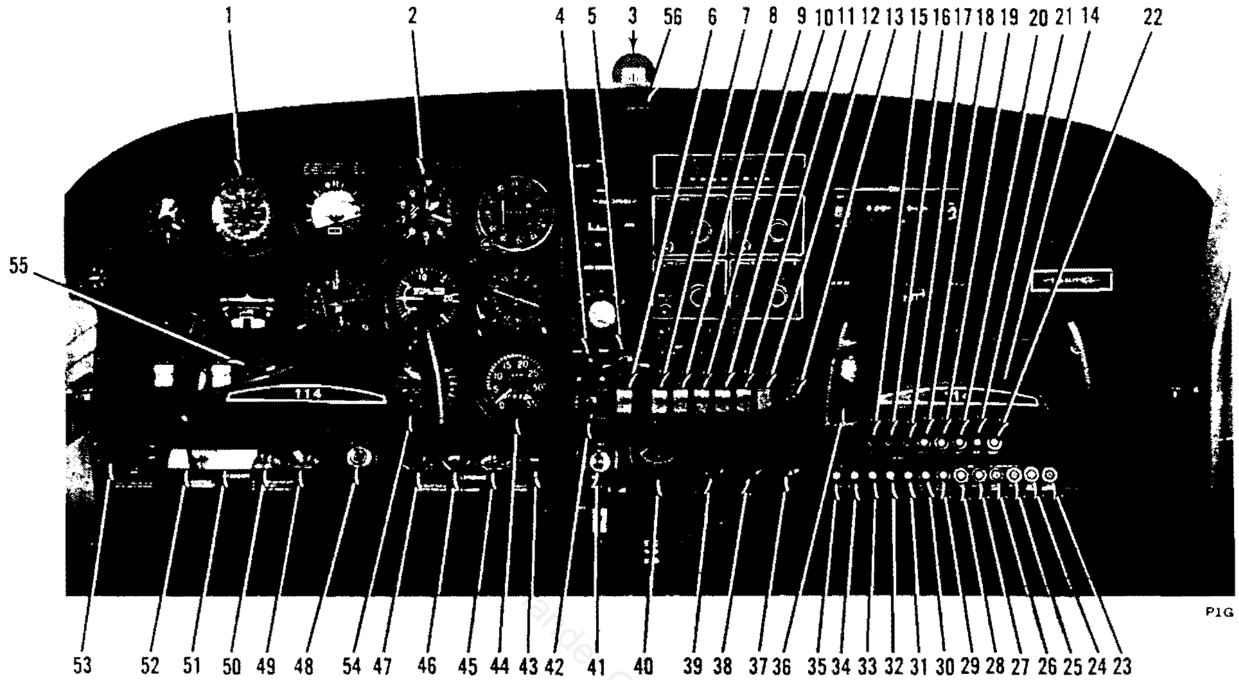
FLIGHT INSTRUMENTS

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 7-3. 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.

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.

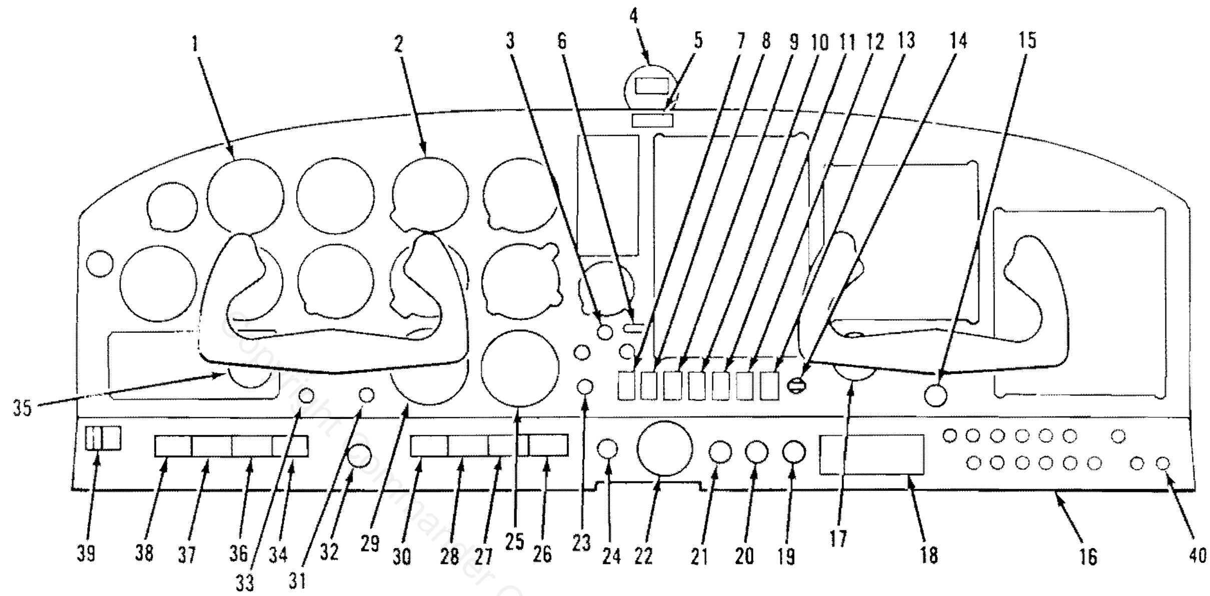
S/N 14000 thru 14149



1. AIRSPEED INDICATOR
2. ALTIMETER
3. MAGNETIC COMPASS
4. LANDING GEAR SAFE LIGHT
5. COWL FLAPS CONTROL
6. FUEL PUMP SWITCH/CKT BKR
7. PITOT HEAT SWITCH/CKT BKR
8. ANTI-COLLISION BEACON SWITCH/CKT BKR
9. NAVIGATION LIGHTS SWITCH/CKT BKR
10. INSTRUMENT LIGHTS SWITCH/CKT BKR
11. LANDING LIGHT SWITCH/CKT BKR
12. AVIONICS MASTER SWITCH/CKT BKR
13. FLAP ACTUATOR
14. CIGAR LIGHTER
15. DME CKT BKR
16. COM-NAV. 1 CKT BKR
17. COM-NAV. 2 CKT BKR
18. TRANSPONDER CKT BKR
19. GLIDE SLOPE CKT BKR
20. ADF CKT BKR
21. MARKER BEACON CKT BKR
22. AUDIO CKT BKR
23. ALTERNATOR OUTPUT CKT BKR
24. ALTERNATOR FIELD CKT BKR
25. LANDING GEAR ACTUATOR CKT BKR
26. LANDING GEAR SELECTOR AND HORN CKT BKR
27. FLAP MOTOR CKT BKR
28. FLAP INDICATOR CKT BKR
29. STARTER AND ACCESSORIES CKT BKR
30. STALL WARNING CKT BKR
31. TURN COORDINATOR CKT BKR
32. OIL TEMPERATURE CKT BKR
33. CYLINDER HEAD TEMPERATURE CKT BKR
34. RIGHT FUEL QUANTITY CKT BKR
35. LEFT FUEL QUANTITY CKT BKR
36. FLAP POSITION INDICATOR
37. DEFROSTER CONTROL
38. CABIN HEAT CONTROL
39. CABIN VENTILATION CONTROL
40. EXHAUST GAS TEMPERATURE GAGE
41. STATIC SOURCE SELECTOR VALVE
42. LANDING GEAR SELECTOR
43. RUDDER TRIM INDICATOR
44. TACHOMETER
45. OIL TEMPERATURE INDICATOR
46. OIL PRESSURE GAGE
47. CYLINDER HEAD TEMPERATURE GAGE
48. IGNITION SWITCH
49. RIGHT FUEL QUANTITY INDICATOR
50. LEFT FUEL QUANTITY INDICATOR
51. VOLTMETER
52. AMMETER
53. MASTER SWITCH
54. MANIFOLD PRESSURE/FUEL FLOW GAGE
55. FUEL PRESSURE GAGE
56. LANDING GEAR WARNING LIGHT

Figure 7-2. Instrument Panel (Sheet 1 of 3)

S/N 14150 thru 14349



1. AIRSPEED INDICATOR
2. ALTIMETER
3. LANDING GEAR SAFE LIGHTS
4. MAGNETIC COMPASS
5. LANDING GEAR WARNING LIGHT
6. COWL FLAPS CONTROL
7. FUEL PUMP SWITCH/CKT BKR
8. PITOT HEAT SWITCH/CKT BKR
9. ANTI-COLLISION BEACON SWITCH/CKT BKR
10. NAVIGATION LIGHTS SWITCH/CKT BKR
11. INSTRUMENT LIGHTS SWITCH/CKT BKR
12. LANDING LIGHT SWITCH/CKT BKR
13. STROBE LIGHTS SWITCH/CKT BKR
14. FLAP ACTUATOR
15. CIGAR LIGHTER
16. CIRCUIT BREAKER PANEL
17. FLAP POSITION INDICATOR
18. RADIO CIRCUIT BREAKER PANEL
19. DEFROSTER CONTROL
20. CABIN HEAT CONTROL
21. CABIN VENTILATION CONTROL
22. EXHAUST GAS TEMPERATURE GAGE
23. LANDING GEAR SELECTOR
24. STATIC SOURCE SELECTOR VALVE
25. TACHOMETER
26. RUDDER TRIM INDICATOR
27. OIL TEMPERATURE INDICATOR
28. OIL PRESSURE GAGE
29. MANIFOLD PRESS./FUEL FLOW GAGE
30. CYLINDER HEAD TEMPERATURE GAGE
31. DIMMER CONTROL - AVIONICS
32. IGNITION SWITCH
33. DIMMER CONTROL - INSTRUMENTS
34. RIGHT FUEL QUANTITY INDICATOR
35. FUEL PRESSURE GAGE
36. LEFT FUEL QUANTITY INDICATOR
37. VOLTMETER
38. AMMETER
39. MASTER SWITCH
40. DIMMER CONTROL-CIRCUIT BREAKERS

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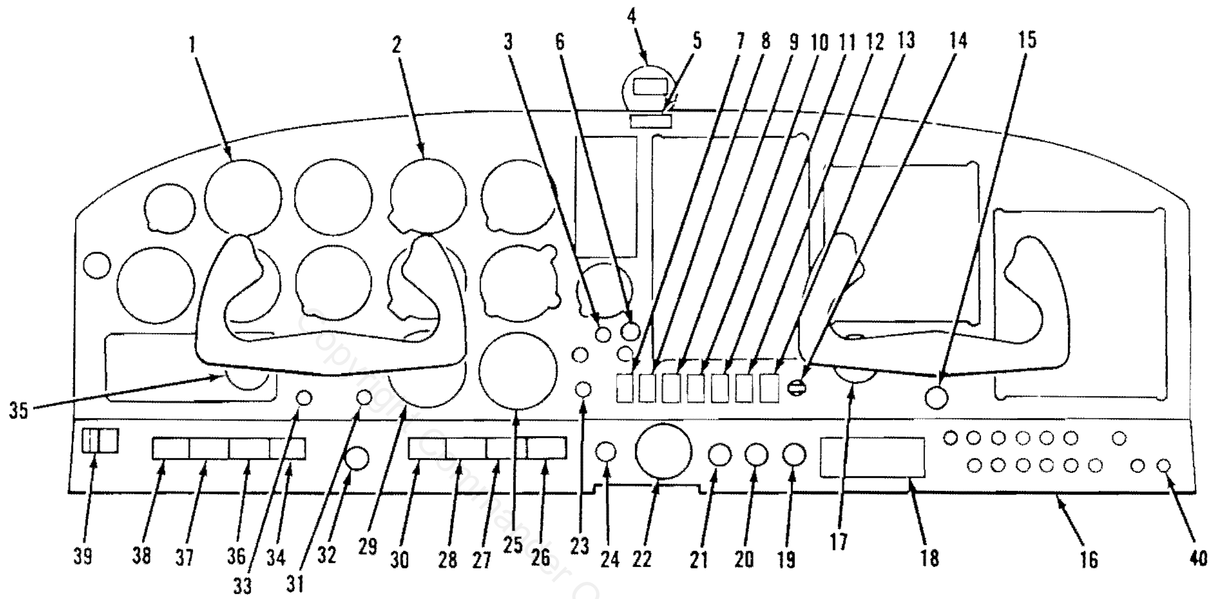
Figure 7-2. Instrument Panel (Sheet 2 of 3)

S/N 14350 & Subs



NOTE: Effective S/N 14350 and subs., the electrically operated instruments, oil temperature (27), cylinder head temp. (30), right fuel quantity (34), left fuel quantity (36), voltmeter (37) and ammeter (38) will indicate at zero, or at dot, on low end of instrument scale upon complete loss of electrical power.

1. AIRSPEED INDICATOR
2. ALTIMETER
3. LANDING GEAR SAFE LIGHTS
4. MAGNETIC COMPASS
5. LANDING GEAR WARNING LIGHT
6. ALTERNATE INDUCTION AIR
7. FUEL PUMP SWITCH/CKT BKR
8. PITOT HEAT SWITCH/CKT BKR
9. ANTI-COLLISION BEACON SWITCH/CKT BKR
10. NAVIGATION LIGHTS SWITCH/CKT BKR
11. INSTRUMENT LIGHTS SWITCH/CKT BKR
12. LANDING LIGHT SWITCH/CKT BKR
13. STROBE LIGHTS SWITCH/CKT BKR
14. FLAP ACTUATOR
15. CIGAR LIGHTER
16. CIRCUIT BREAKER PANEL
17. FLAP POSITION INDICATOR
18. RADIO CIRCUIT BREAKER PANEL
19. DEFROSTER CONTROL
20. CABIN HEAT CONTROL
21. CABIN VENTILATION CONTROL
22. EXHAUST GAS TEMPERATURE GAGE
23. LANDING GEAR SELECTOR
24. STATIC SOURCE SELECTOR VALVE
25. TACHOMETER
26. RUDDER TRIM INDICATOR
27. OIL TEMPERATURE INDICATOR
28. OIL PRESSURE GAGE
29. MANIFOLD PRESS./FUEL FLOW GAGE
30. CYLINDER HEAD TEMPERATURE GAGE
31. DIMMER CONTROL - AVIONICS
32. IGNITION SWITCH
33. DIMMER CONTROL - INSTRUMENTS
34. RIGHT FUEL QUANTITY INDICATOR
35. FUEL PRESSURE GAGE
36. LEFT FUEL QUANTITY INDICATOR
37. VOLTMETER
38. AMMETER
39. MASTER SWITCH
40. DIMMER CONTROL-CIRCUIT BREAKERS

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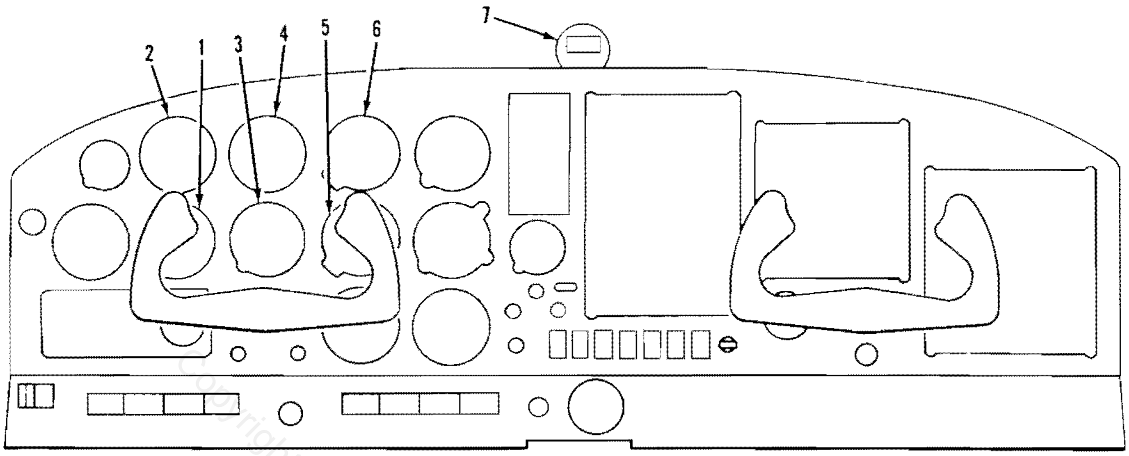
Figure 7-2. Instrument Panel (Sheet 3 of 3)



1. TURN COORDINATOR (ELECTRIC) (OPTIONAL)
2. AIRSPEED INDICATOR
3. DIRECTIONAL GYRO (VACUUM) (OPTIONAL)
4. ARTIFICIAL HORIZON (VACUUM) (OPTIONAL)
5. VERTICAL SPEED INDICATOR (OPTIONAL)
6. ALTIMETER
7. MAGNETIC COMPASS

X210 10A6

Figure 7-3. Flight Instruments

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 periodic checks on a compass rose with possible adjustment of the compensating magnets.

PITOT PRESSURE SYSTEM

Impact pressure (pitot pressure) is sampled by the pitot tube installed near the center of the left wing on the lower surface. Pitot system tubing is routed from the pitot head, aft of the spar structure inboard to the wing root and into the cabin. 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 transmitted to the airspeed indicator.

STATIC PRESSURE SYSTEM

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

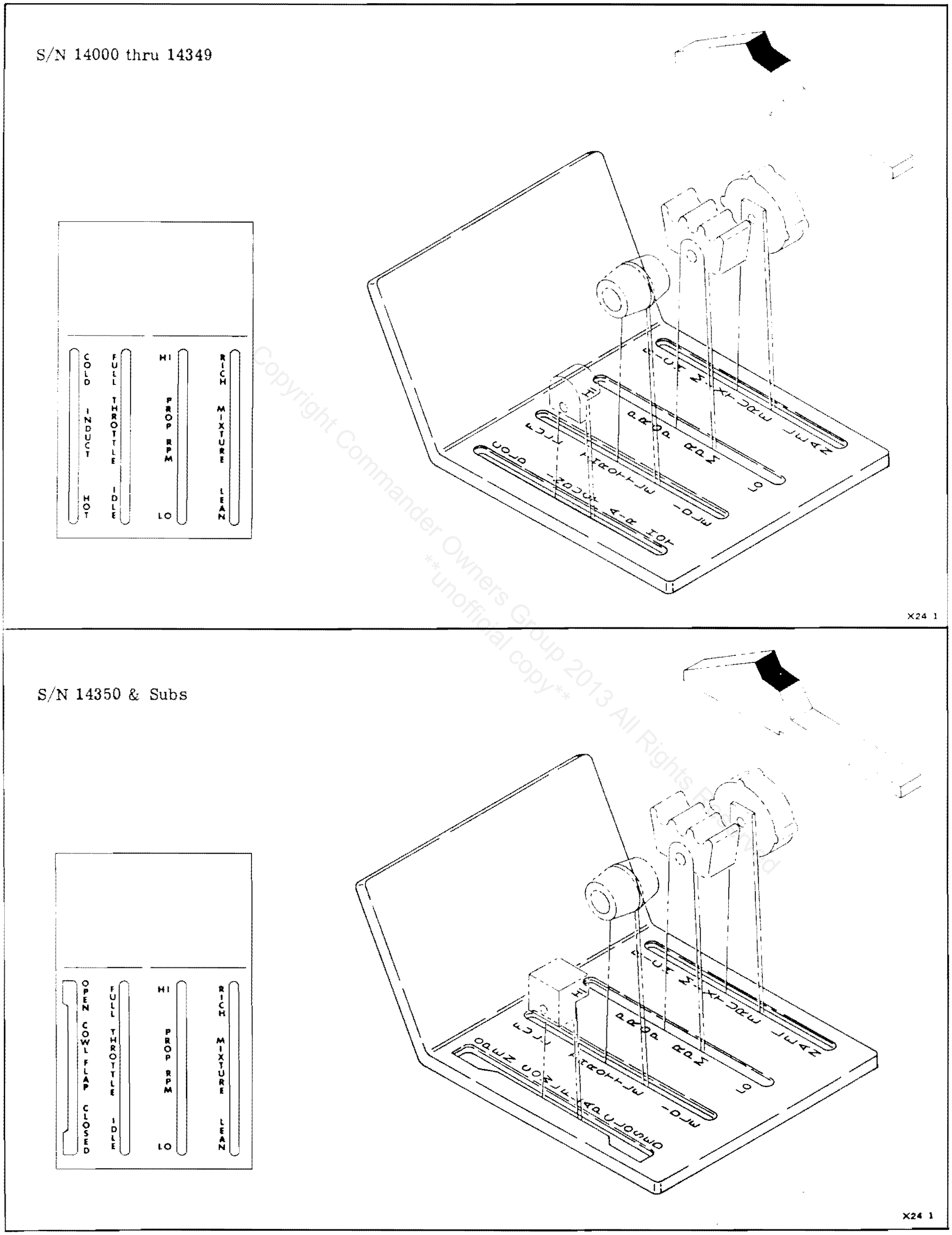


Figure 7-3A. Engine Control Pedestal

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 the inside cabin pressure differential, operation with the static source valve on ALT will cause the airspeed and altimeter to read approximately nine (9) knots and 100 feet higher than normal. For detailed corrections, consult the correction card installed in the aircraft.

STALL WARNING SYSTEM

NOTE

With the master switch OFF, the stall warning system is inoperative.

A stall warning lift detector switch is located in the leading edge of the left wing. The lift detector switch is set to close the circuit and sound the stall warning horn at 5 to 10 knots above aircraft stall speed. The stall warning horn is located on the firewall in the cabin area. The stall warning lift detector switch is interconnected to the ground contact switch to prevent inadvertent actuation of the stall warning horn with aircraft on the ground.

ENGINE

The aircraft is equipped with a fuel-injected Lycoming IO-540-T4A5D, (Serial Numbers 14000 thru 14149 or a Lycoming IO-540-T4B5D (Serial Numbers 14150 and Subs) horizontally-opposed, 6 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 100/130 octane (green) aviation fuel and is rated to produce 260 BHP at 2700 RPM. Aviation fuel 100 LL (blue color) is an approved alternate fuel. A Lycoming Engine Operator's Manual is supplied with each airplane and should be consulted for complete engine specifications.

ENGINE CONTROLS

The power plant controls are located on the forward end of the center console (see Figure 7-3A) and rotate in fore and aft movements. The control levers are color and shape-coded to assist in identification. Functions 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 (S/N 14000 thru 14349); Cowl Flap (white/cube shaped), controls position of cowl flaps (S/N 14350 and Subs); 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.

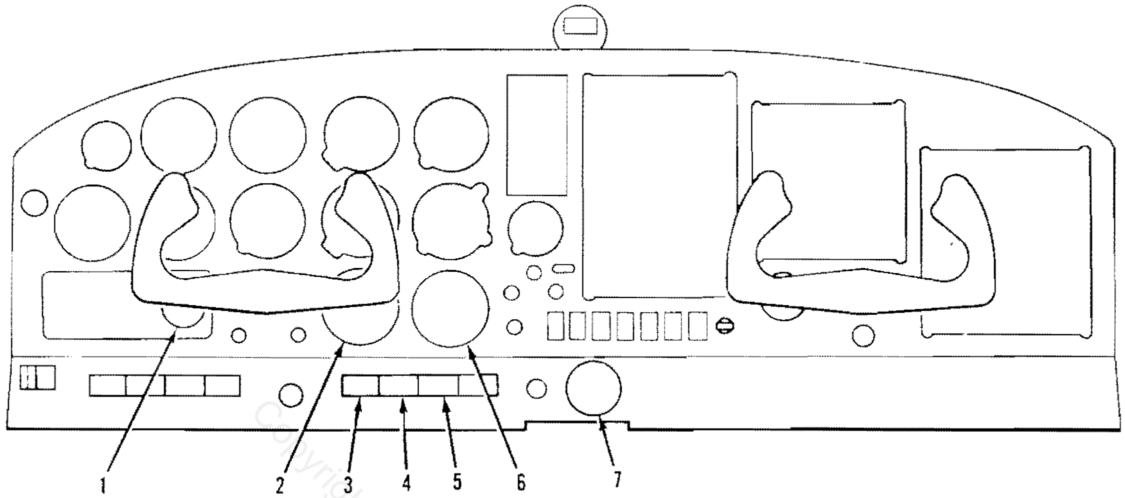
ENGINE INSTRUMENTS - Refer to Figure 7-4.

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. Maximum indication on tachometer should not exceed 2700 RPM (red line).

OIL TEMPERATURE INDICATOR

The oil temperature indicator is electrically connected to a temperature sensing bulb installed on the engine. Changes in oil temperature are sensed by the bulb and transmitted to the oil temperature indicator. The master switch must be on for this indicator to function. Normal operating range for the oil temperature indicator is $160^{\circ}F$ to $245^{\circ}F$ (green arc), and temperature should not exceed $245^{\circ}F$ (red line).



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

Figure 7-4. Engine Instruments

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. The engine should not be operated when less than 25 PSI (red line) is indicated on gage. Caution should be used when operating between 25 PSI and 60 PSI (yellow arc), and normal operating range is from 60 PSI to 90 PSI (green arc). Oil pressure should not exceed 90 PSI (red line) on airplanes S/N 14000 thru 14349 or 100 PSI (red line) on airplanes S/N 14350 and subs.

MANIFOLD PRESSURE/FUEL FLOW GAGE

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. The fuel flow half 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. A red line at 27.5 gallons per hour and 9.5 PSI indicates the allowable maximum fuel flow and pressure respectively.

FUEL PRESSURE GAGE

A fuel pressure gage, installed in the left side of the instrument panel, is connected by tubing to a port on the forward side of the fuel injector and indicates the engine fuel pump pressure. Minimum and maximum allowable operating fuel pressures are marked by red radial lines at 14 and 45 PSI.

CYLINDER HEAD TEMPERATURE

The cylinder head temperature indications are controlled by an electrical resistance type temperature probe that receives power from the aircraft electrical system. The probe is installed in the hottest cylinder head and indicates the temperature of that cylinder head. During normal operations temperatures should remain between 200° and 500°F (green arc) and temperatures should never be allowed to exceed 500°F (red line).

EXHAUST GAS TEMPERATURE (EGT) GAGE

An EGT gage is installed in the instrument sub-panel, directly above the engine control levers. The gage is used to aid the pilot in selecting various fuel-air mixtures for cruising flight with 75 percent power or less. Temperature indications for the EGT gage are provided by a temperature probe installed in the exhaust manifold. For best power mixture, lean to peak EGT, then enrichen 100°F. For best economy mixture, lean to and operate at peak EGT.

PROPER OPERATION AND CARE OF ENGINE

BREAK-IN

All new engines have been tested and run-in before leaving the Avco Lycoming factory, and require no further break-in period.

To promote faster ring seating and improved oil control, this aircraft was delivered from the factory with a mineral-type (non detergent) oil installed. Mineral-type oil should be used for the first fifty (50) hours only, at which time it must be drained and replaced with detergent oil.

After the first twenty five (25) hours of operation, drain engine oil, clean suction and oil filter screens and replace filter elements. Refill the sump with non-detergent oil and use until the fifty (50) hour mark is reached, or oil consumption has stabilized, then change to detergent oil conforming to specification. Also after first twenty five (25) hours of operation the normal fifty (50) hour inspection should be performed on the engine.

ON GOING

When operating the aircraft, the engine should never be allowed to exceed the speed and power ranges specified in this manual. This will prolong engine life and ensure reliability.

In addition to proper operation, pre-flight and periodic inspections should be performed, and any indications of leaks or malfunctions should be corrected before they can develop into major problems. Careful attention should be given when checking oil and fuel systems, and any problems should be corrected before next flight. When servicing aircraft, the proper fuels and lubricating oils should always be used. Aviation Grade Fuel with a minimum octane rating of 100/130 (green color) or 100 LL aviation fuel (blue color) must be used. Under no circumstances should automotive fuel (regardless of octane rating) be used. When pre-flight check indicates low oil level, service with aviation grade engine oil as follows:

TEMPERATURE	SAE GRADE	
	MIL-L-6082-B	MIL-L-22851
Below 10°F	20	30
0°F to 70°F	30	40 or 30
30°F to 90°F	40	40
Above 60°F	50	40 or 50

Single or multi viscosity aviation grade oils conforming to current Lycoming Service Instruction #1014 must be used.

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 regulates 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 5 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 pump.

OIL PRESSURE GAGE

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 INDICATOR

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. The master switch must be on for this indicator to function.

IGNITION SYSTEM

The engine is equipped with one Bendix Type D6LN-2031 (impulse coupling) magneto. This is a dual magneto system utilizing one housing. There are two complete ignition systems on the engine, and these are completely independent of each other. Each ignition system has a shielded harness assembly and a set of radio shielded spark plugs. Each cylinder utilizes two (2) spark plugs. The left magneto fires the bottom plugs in cylinders one (1) three (3) and five (5), and the top plugs in cylinders two (2) four (4) and six (6). The right magneto provides spark for the opposite spark plugs.

INDUCTION AIR SYSTEM

The external scoop on the left side of the lower cowl serves as the ram air source for the induction air system. Intake air is directed through a dry paper 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 taken downstream of the engine near the left muffler 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 on airplanes S/N 14000 thru 14349, and by a round pull-to-operate control adjacent to the landing gear indicator lights on airplanes S/N 14350 and Susequent.

EXHAUST SYSTEM

The engine is equipped with two (2) exhaust muffler systems. One system for each bank of three (3) cylinders. Stainless steel exhaust pipes are flange-mounted to each cylinder exhaust port and connected individually to the muffler assembly. A single stack extends through the lower cowl from each of the muffler assemblies to direct exhaust gases overboard. A heat shroud is fitted around the right muffler assembly to provide a source of heated air for the cabin heat and defroster system.

FUEL INJECTION SYSTEM

Filtered air is introduced into the engine through the servo regulator body, then flows into an air intake riser where it is distributed to each cylinder by individual intake pipes. The amount of air entering the engine is controlled by a throttle valve (butterfly) contained in the body of the fuel injection servo regulator. Fuel is metered and distributed to the individual cylinders by the servo regulator and fuel flow divider valve. The fuel-air ratio is determined by the position of the throttle valve and air sensing functions of the servo regulator. Fuel and air are mixed within the cylinder. The fuel injection system consists of the air flow sensing and fuel control sub-systems. Components of the injection system are: the servo valve, fuel control unit, fuel flow divider valve, and air bleeder nozzles. The servo valve and fuel control unit are contained within the throttle body casting, installed on the engine intake manifold air inlet. Priming is provided by the fuel injection system. A separate priming system is not required.

ENGINE COWLING

The cowling consists of two molded 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 cowl flaps 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 as required during climb and cruise to maintain cylinder head temperature and oil temperature within the proper green arc range.

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.

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 30 seconds, and allow at least 5 minutes between cranking periods to permit the starter to cool.

ACCESSORIES

FUEL PUMP

A diaphragm type, self-regulated pressure pump is installed on the aft lower left side of the engine accessory housing. This engine operated pump provides a continuous flow of fuel to the engine without pressure variations. The pump design allows the auxiliary pump to move fuel through it to the engine in the event it becomes inoperative and also for the purpose of initial engine priming and starting.

VACUUM PUMP

Suction to operate directional and attitude gyro instruments is provided by an engine-driven vane-type vacuum pump. The vacuum pump, installed on the engine accessory housing, is gear-driven through a spline-type coupling. A vacuum regulator is used to control system pressure.

ENGINE MOUNT

The engine mount is a welded tubular structure attached to the firewall at five (5) different locations. The structure serves as an engine mount and nose gear mount. The mount has four (4) points that the engine attaches to and uses two rubber shockmounts at each point. The bonded rubber and metal shockmounts are designed to reduce the transmission of engine vibrations to the airframe.

PROPELLER

The Model 114 is equipped with a Hartzell, all metal HC-C2YR-1BF/F8467-7R, constant speed, two-blade propeller. Maximum diameter is 77 inches, no cutoff is allowed.

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.

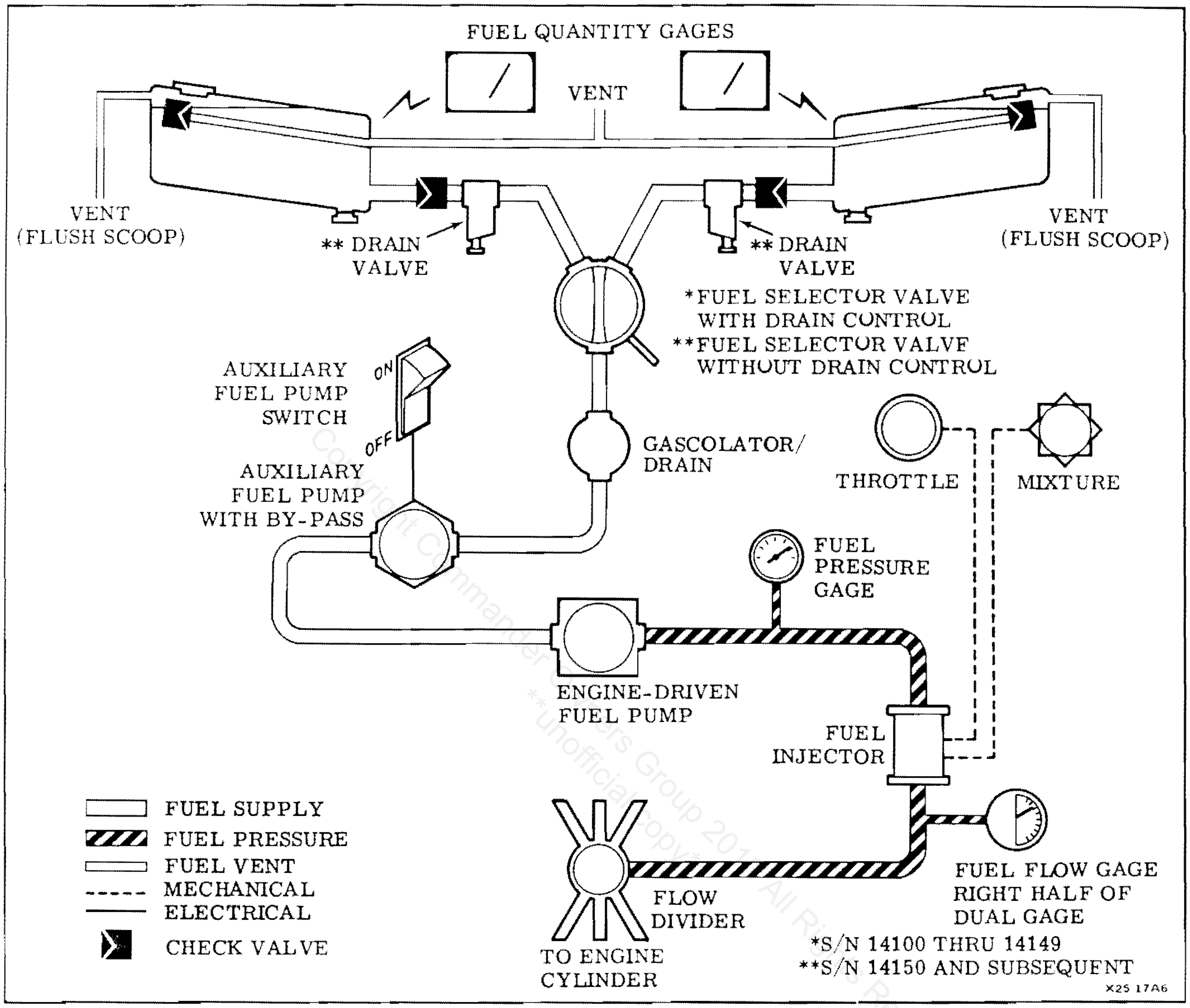


Figure 7-5. Fuel System Schematic

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 only one direction; a pitch change in the opposite direction results from a combination of centrifugal twisting moment of rotating blades and compressed springs.

FUEL SYSTEM

Aviation fuel (100/130 minimum octane, green color or 100 LL, blue color) is supplied to the engine by two (2) integral fuel tanks, one in the forward center section of each wing. The fuel capacity is 35 U.S. gallons for each wing tank, 34 of which are considered usable. A reduced fuel load indicator is located in the filler neck. This indicator is used to indicate a usable fuel capacity of 24 U.S. gallons with aircraft in normal flight attitude. 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.

FUEL FILLER CAPS

The filler necks of each wing fuel tank incorporate an anti-siphoning flapper valve to prevent loss of fuel in flight 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, the firewall mounted gascolator and the fuel injector inlet fitting. Drain valves are located in the wing tanks sumps, gascolator and fuel selector valve in Serial Numbers 14000 thru 14149, and in the wing tank sumps, gascolator and wheel wells in Serial Numbers 14150 and subsequent.

FUEL SELECTOR VALVE

A five-position fuel selector valve (see Figure 7-6) 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 (Serial Numbers 14000 thru 14149) 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, on Serial Numbers 14000 thru 14149 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.

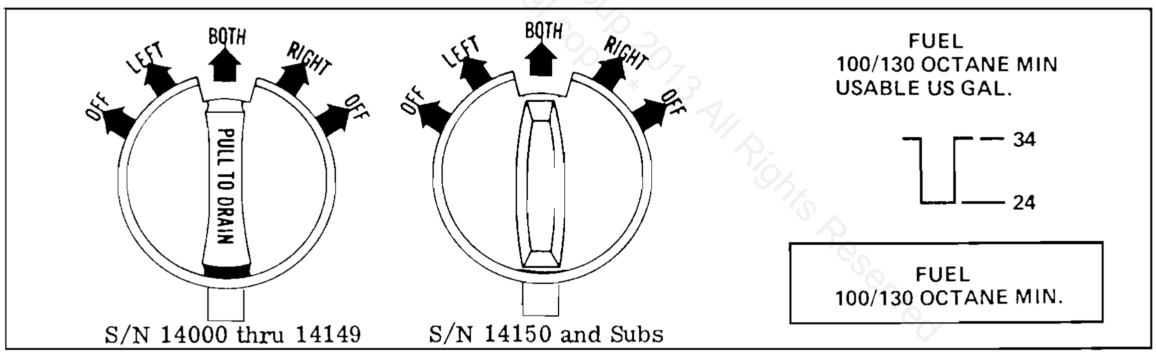


Figure 7-6. Fuel Selector Valve and Fuel Tank Placard

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.

FUEL MANAGEMENT

It is the pilot's responsibility to ascertain that there is sufficient fuel on board the aircraft to safely complete any flight. A visual check of each fuel tank should be made, and this should be compared with quantity indicated on the fuel tank gages. When fuel quantities are checked, the aircraft should be level to assure that any fuel quantity indications, either visual or electrical, will be accurate. During cruise, alternate fuel tanks to maintain lateral trim. When planning flight allow enough reserve fuel for safe completion of flight.

FUEL CONTAMINATION

To avoid fuel contamination always service the aircraft from fuel facilities that utilize proper 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. Prior to the first flight of the day, the wing tank sumps, gascolator, and fuel selector valve (S/N 14000 thru 14149) or wheel well drains (S/N 14150 and subsequent) should be drained to check for the presence of water or sediment in the fuel system. If water or sediment is present in the fuel sample, continue to drain fuel until all traces of water or sediment are removed from system.

FUEL TANK VENT SYSTEM

The fuel tanks are vented to atmosphere through vent scoops on the lower outboard wing surfaces and under the center fuselage. These vents must be free of obstructions and should be checked prior to the first flight of the day. Should a vent become obstructed it could result in fuel starvation of the engine, and possible engine stoppage.

FUEL QUANTITY INDICATORS

The fuel quantity indicating system consists of fuel quantity indicators, (right and left) installed in the instrument sub-panel and electrically connected to the fuel quantity transmitters installed in each fuel tank. The fuel quantity indicating circuit is provided with two dampening resistors within the transmitter. These resistors dampen indicator needle oscillations, caused by irregular movement of the transmitter float during flight through rough air. The fuel quantity transmitters and indicators have been calibrated at the factory and should not require recalibration; however, if for some reason the system requires recalibration this should be done by a licensed A & P mechanic in accord with a current Maintenance Manual.

Effective on S/N 14350 and subs., at 3/4 indication on fuel quantity indicators, the tanks contain 26-1/2 gallons of fuel. Ungaugeable fuel begins at 27 gallons and fuel in the tank in excess of 27 gallons is indicated with the pointer at the high side of the 3/4 mark.

HYDRAULIC SYSTEM

LANDING GEAR EXTENSION/RETRACTION SYSTEM

Refer to Figure 7-7. The hydraulic power supply is an integrated pack containing a reversible electric motor-driven hydraulic pump, reservoir, pressure control valves, thermal relief valve and a gear up check valve. 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 1650 (± 50) psi is directed through the manifold to the actuators. Fluid on the opposite side of the cylinder piston flows back through the manifold into the power pack. When all three gears are retracted, the pump is shutoff and the gears are held up by hydraulic lock. The hydraulic pressure switch controls the pump by removing power to the pump when the pressure reaches 1650 (± 50) psi. A loss of hydraulic pressure is sensed by the pressure switch and turns on the power pack to build up additional pressure. When the landing gear selector switch is placed in the DOWN position, pressurized hydraulic fluid at 500 (± 50) psi is directed through the hydraulic manifold to the down side of the actuator cylinders. When the gear are all down and locked (drag brace over center) the power pack is turned off by a gear down pressure switch set at 500 (± 50) psi. Hydraulic pressure is maintained in the gear down system by a pilot operated check valve. The emergency dump valve bypasses fluid from the up side of the hydraulic actuators (which form the hydraulic uplock) directly to the reservoir, the gears then drop by gravity, assisted by down springs. With the emergency dump valve in the down position, the gear will not retract because the pressure is being relieved through the dump valve back to the reservoir and not to the hydraulic cylinders.

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, and incorporate dimming shutters.

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.

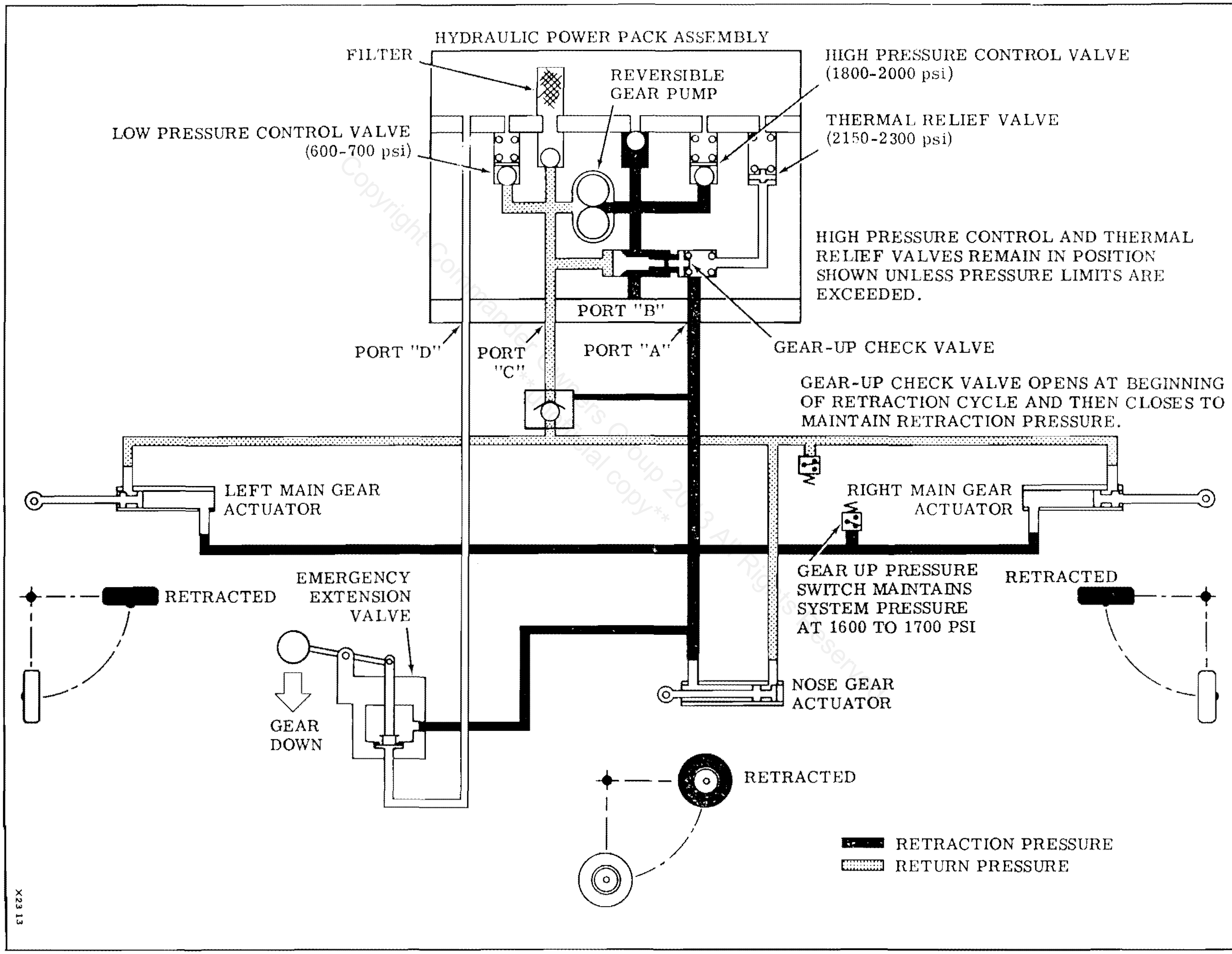


Figure 7-7. Hydraulic System Schematic (Gear Retracted)

As a reminder that the gear is retracted, the gear warning bell, or horn, will actuate whenever the throttle is retarded below approximately 14 inches of manifold pressure with the gear retracted, or flaps extended 25 degrees or more with the gear retracted (regardless of throttle position). Master switch must be on for gear warning. On some airplanes a red GEAR WARN light will also illuminate when the gear warning bell or horn is actuated.

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 or horn 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.

GEAR DOWN GROUND CONTACT (SQUAT) SWITCH

The gear down ground contact (squat) switch is located on the right main landing gear trunnion. This switch is adjusted so that the switch is actuated within the last quarter of an inch of gear extension. The function of the gear down contact (squat) switch is to prevent inadvertent retraction of landing gear when aircraft is on the ground.

EMERGENCY GEAR EXTENSION VALVE

A red emergency gear extension 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, thereby allowing spring assisted gravity free fall to extend the gear.

BRAKE SYSTEM

HYDRAULIC BRAKE SYSTEM

The two main wheels are equipped with self-adjusting, single-disc, dual piston hydraulic brakes which are actuated by individual master cylinders attached to the rudder pedals. On Serial Numbers 14000 thru 14149 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-pilots brakes lack reservoirs, they are hydraulically interconnected to the pilot's master cylinders. On Serial Numbers 14150 and Subsequent, a brake fluid reservoir located in the engine compartment, supplies system fluid to the pilot's master cylinders. The pilot's master brake cylinders supply fluid to the co-pilot's brakes. The brakes are actuated by applying toe pressure to the tops of the rudder pedals.

PARKING BRAKE SYSTEM

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.

ELECTRICAL SYSTEM

Electrical power is supplied by a 12-volt, direct-current system powered by an engine-driven 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. Alternator capacity is limited to 60 amperes on Serial Numbers 14000 thru 14149. Alternator capacity is 70 amperes on Serial Number 14150 and subs.

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 (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 pre-flight.

With the ALT side turned OFF, the entire accessory electrical load is placed on the battery; therefore, all non-essential electrical equipment should be turned off.

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 should indicate on the charge side. In the event of an alternator malfunction, or if the electrical load demand exceeds the alternator output, the ammeter will indicate on the discharge side. When the ammeter continues to display on discharge side, electrical load must be reduced as necessary.

VOLTMETER

A voltmeter, located in the lower left instrument sub-panel, allows the pilot to monitor bus bar voltage. See Section III for details concerning over-charging or insufficient voltage problems. Maximum allowable voltage is indicated by a red radial at 16.0 volts.

CIRCUIT BREAKERS

Push-to-reset, push-pull, or rocker switch circuit breakers are used to protect all electrical circuits in the aircraft.

The main circuit breaker panel is contained within the lower right instrument sub-panel (see Figure 7-8). 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. A convenience circuit breaker is installed near the battery for overhead reading light, electric clock, baggage compartment light and step light circuits. Fuses are also installed to protect some of the circuits. See Airplane Maintenance Manual for details on circuits and their protection.

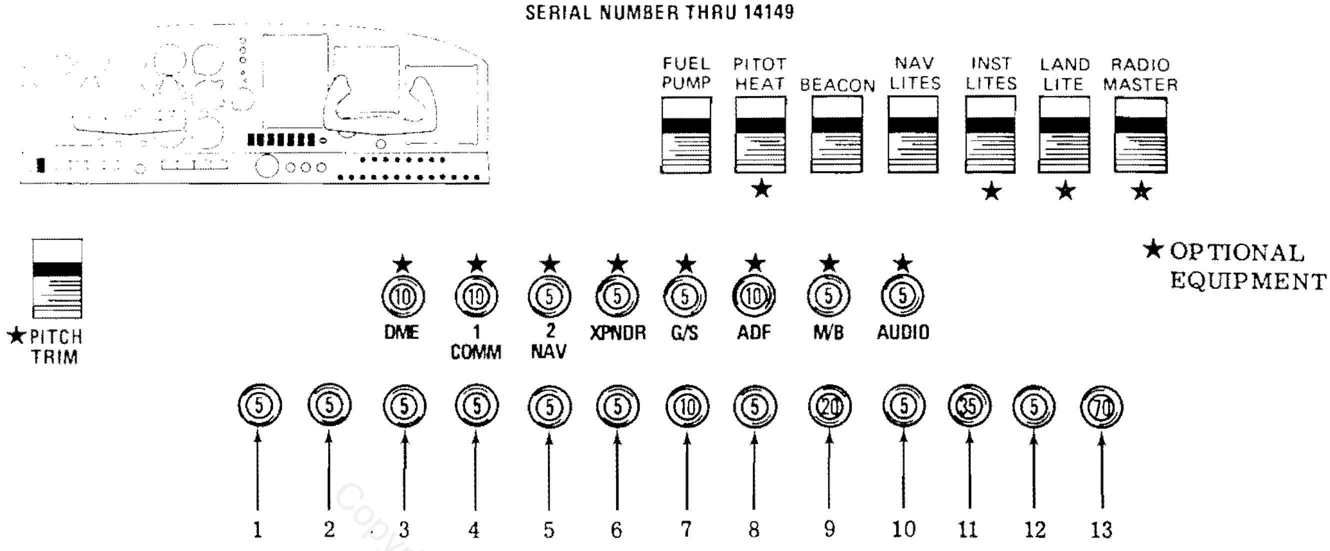
ALTERNATOR

A 14-volt, aircraft type alternator is installed on the forward lower right side of the engine. 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.

EXTERNAL POWER

A dc power receptacle, located aft of the battery on the left side of the fuselage, provides a means for connecting external power to the aircraft electrical system. To conserve battery life, external power should always be used for starting a cold soaked engine when ambient temperature is below 40°F or when performing maintenance requiring electrical power. Voltage setting on external power should not exceed 14.0 volts.

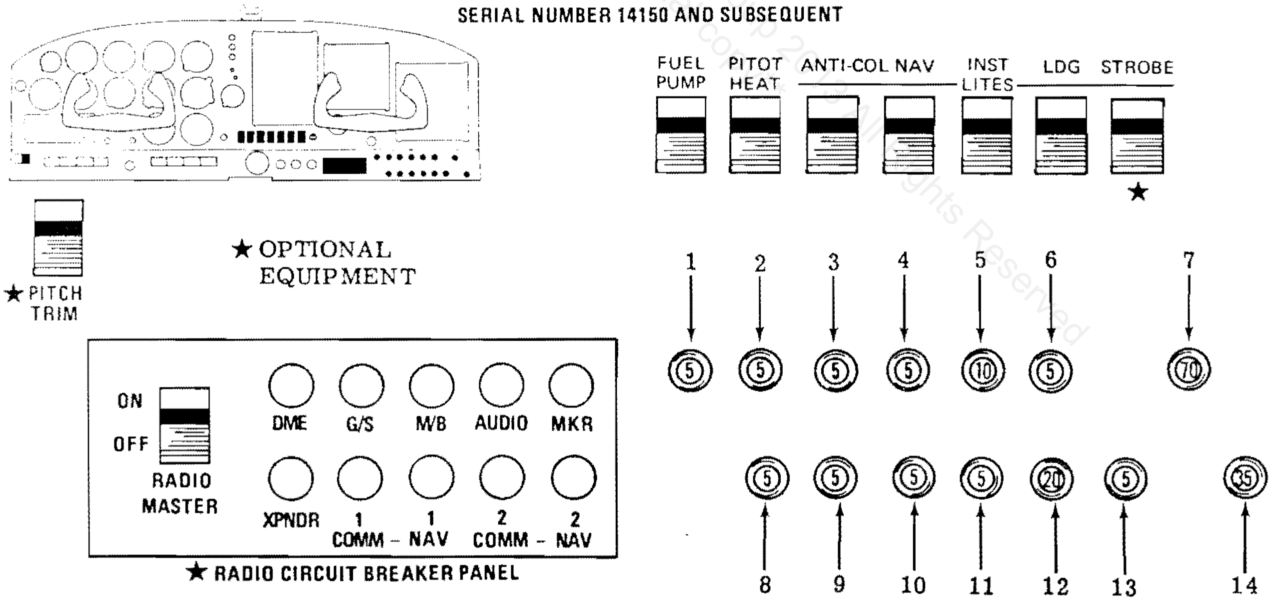
SERIAL NUMBER THRU 14149



1. LEFT FUEL QUANTITY IND. AND VOLTMETER
2. RIGHT FUEL QUANTITY IND.
3. CYL. HEAD TEMPERATURE
4. OIL TEMPERATURE IND.
5. TURN COORDINATOR OR TURN & BANK IND.
6. STALL WARNING HORN
7. STARTER
   COURTESY & OVERHEAD LIGHTS (opt)
8. FLAP POSITION INDICATOR
9. WING FLAP MOTOR
10. GEAR POSITION IND. LIGHTS
    GEAR WARN LIGHT & BELL
    LNDG GEAR POSITION SWITCH
    FLAP ACTUATED GEAR WARN SWITCH
    THROTTLE & SQUAT SWITCH
11. LNDG GEAR UP-DOWN RELAYS
    HYDRAULIC POWER PACK
12. ALTERNATOR FIELD
13. ALTERNATOR OUTPUT

X210 7

SERIAL NUMBER 14150 AND SUBSEQUENT



1. COURTESY & OVERHEAD LIGHTS
2. STALL WARNING HORN
3. CYLINDER HEAD TEMPERATURE
4. OIL TEMPERATURE IND.
5. STARTER
6. ALTERNATOR FIELD
7. ALTERNATOR OUTPUT
8. LEFT FUEL QUANTITY IND. AND VOLTMETER
9. RIGHT FUEL QUANTITY IND.
10. TURN COORDINATOR
11. FLAP POSITION INDICATOR
12. WING FLAP MOTOR
13. LANDING GEAR SELECTOR
    LANDING GEAR WARNING HORN
14. LANDING GEAR ACTUATOR
    - HYDRAULIC POWER PACK

X210 10

Figure 7-8. Circuit Breakers

The position of the master switch is important in a starting operation using external power. Before connecting external power to the aircraft the BATT half of the split master switch should be turned OFF, and the ALT portion of the master switch left OFF. Turn the battery switch ON to apply external power to ac electrical system. 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. It is not recommended to use external power cart to charge aircraft battery. See Airplane Maintenance Manual.

LIGHTING SYSTEMS

EXTERIOR LIGHTING

Three conventional navigational 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 system 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 three (3) minute time-delay circuit to automatically turn the lights off after night boarding and deplaning operations. The left forward cabin reading light also operates off this three (3) minute time delay circuit. 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 three strobe-type anti-collision lights are available for installation on the aircraft. Optional strobe lights will be wing-tip mounted, and installed on the tail stinger. The strobe light installation provides superior identification lighting, as compared with conventional flashing 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 four individual overhead reading lights for passengers, baggage compartment, left control wheel map reading light (right control wheel and map light is optional), and instrument panel lighting.

The individual reading lights are controlled by a push button on/off type switch. Lamp bulb removal is accomplished by inserting a pencil in lamp unit and pressing pencil eraser on bayonet type bulb, while turning counterclockwise. 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 this unit is gained by carefully prying off the translucent lens cover.

A map light is 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 under side of the control wheel. Move left for off and right for on.

Instrument panel illumination is provided by blue-white flood light units installed on the under side of the glareshield. 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.

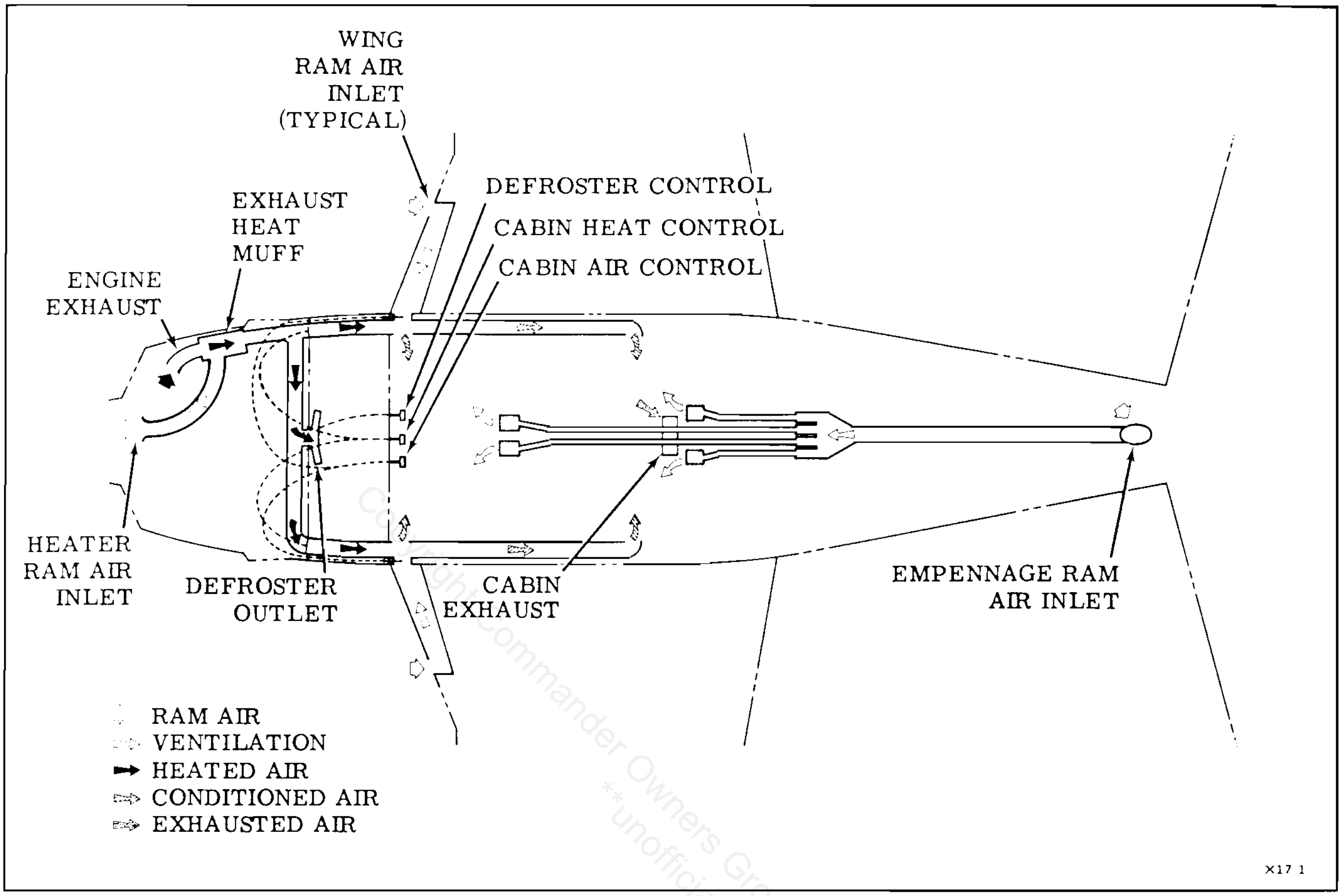


Figure 7-9. Cabin Heat and Ventilation Schematic

ENVIRONMENTAL SYSTEM

CABIN HEAT AND VENTILATION SCHEMATIC - Refer to Figure 7-9.

HEATING AND 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 three (3) air box assemblies to direct heated air to two (2) windshield defroster outlets or four cabin floor side outlets for interior heating.

Two separate knobs control adjustment and routing of the heated air; one labeled DEFROSTER, controls windshield defrosting and one labeled CABIN HEAT controls cabin heating. The heat and ventilation control knobs are located above and to the right of 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 the air temperature for the 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. The second system utilizes one intake in the inboard leading edge of each wing to supply four adjustable outlets at cabin floor level. Ventilation airflow is controlled by a knob labeled VENT, located adjacent to the CABIN HEAT and DEFROSTER controls. Pulling knob to full extension provides maximum ventilation airflow.

SECTION VIII

HANDLING, SERVICING AND MAINTENANCE

TABLE OF CONTENTS

INTRODUCTION

Some general procedures covering ground handling, servicing, and lubrication should be included in the pilots general knowledge of his aircraft. Those procedures most likely to be encountered or accomplished by a pilot are included in this section. Adherence to the procedures outlined in this section can save many hours of maintenance and down time.

It is recommended that service or maintenance required on the aircraft, that cannot be accomplished by a certificated pilot, be taken to an authorized Rockwell Commander Aircraft Dealer or certified service station. Your authorized dealer will have available all service publications and FAA Airworthiness Directives pertaining to your aircraft, as well as trained personnel, thus ensuring maximum utility and safety from your aircraft.

It is the responsibility of the owner and/or operator of the aircraft to ensure that the aircraft is maintained by qualified mechanics and conforms to all airworthiness requirements established for this aircraft.

To ensure a prompt reply, and correct information from Rockwell International, General Aviation Division, Customer Service Department, it is important to include the aircraft serial number in any correspondence concerning service or maintenance on this aircraft. The serial number appears on the General Aviation Manufacturers Association Plate attached to the left side of the ventral fin adjacent to the tailcone tie-down ring.

3. When operating the engine, remove all towing equipment and observe the following:
   a. Head aircraft into the 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 runup in clear area to prevent foreign object damage to engine and propeller.

TOWING

Movement of the aircraft on the ground may be accomplished by the following methods:

1. Pulling and guiding with nose gear tow bar. The nose wheel may be turned a maximum of 30 degrees to the left or right of center. Nose wheel tow limits must be strictly observed to prevent nose gear damage.
2. Rotating aircraft overcenter on main landing gear to clear nose gear of ground and towing backwards. The main wheels are near the center of balance, and two men can lower the tail and move the aircraft with little effort.
3. Attaching rope harness to main landing gear. This method is to be used when towing aircraft forward through snow and over soft or muddy ground. Use tow bar to steer aircraft.

TOWING PRECAUTIONS

1. Never push, pull, or lift aircraft by use of control surfaces.
2. Never use nose gear strut body or tail cone tie-down ring as an attach point for towing.
3. Never place undue strain on aircraft when towing, and avoid jerky motions.
4. Do not use ropes attached to main gear for towing aircraft backward through mud or snow.

PARKING

Head aircraft into wind and set parking brake. Do not set parking brake if brakes are overheated or if brakes are wet and ambient air is 32°F (0°C) or less as there is a possibility of moisture accumulation freezing brake assembly. Close cowl flaps, install internal control lock, place chocks under wheels, and release parking brake.

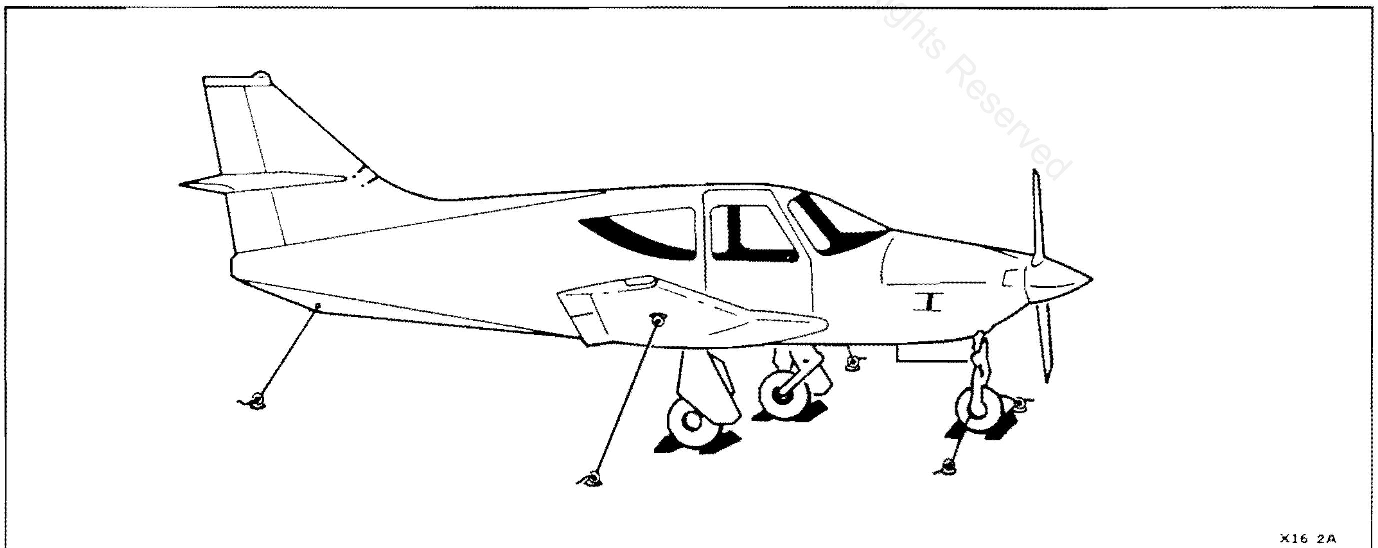


Figure 8-1. Mooring

PUBLICATIONS

The General Aviation Division of Rockwell International delivers with each aircraft a Maintenance Manual and an FAA Approved Pilot's Operating Handbook. All revisions to the initially furnished Pilot's Operating Handbook and Maintenance Manual will be provided to the aircraft owner. The aircraft owner will also receive, on a continuing basis, Service Releases (which include Service Bulletins, Service Letters, Service Information and Custom Kit Sales Sheets). An Illustrated Parts Catalog may be purchased from Rockwell International, General Aviation Division, and once purchased, subsequent revisions will be furnished.

NOTE

It is the responsibility of the aircraft owner, upon receipt of his aircraft, to notify the General Aviation Division Publications Department, in writing, his complete mailing address and any subsequent changes thereto.

Change of address cards are provided in all copies of technical manuals, and a "Publication Change Request" form is also provided in all copies of technical manuals for the purpose of recommended changes to the manuals. For more information on service publications see Service Information No. SI-101.

AIRPLANE INSPECTION PERIOD

1. FAA Required Annual Inspections
2. See "Servicing" section of Maintenance Manual.

PREVENTATIVE MAINTENANCE THAT MAY BE ACCOMPLISHED BY A CERTIFIED PILOT

Those items of maintenance which may be performed by a certificated pilot are listed in Part 43 of Federal Aviation Regulations. Before attempting to perform any maintenance refer to Regulation, Part 43. All other maintenance must be performed by properly licensed personnel.

NOTE

All maintenance must be accomplished in accord with current Maintenance Manual.

ALTERATIONS OR REPAIRS TO AIRCRAFT

All alterations or repairs to aircraft must be accomplished by licensed personnel. The FAA should be contacted prior to any unapproved alterations on the airplane to ensure the airworthiness of the airplane is not inadvertently violated.

GROUND HANDLING

PRECAUTIONS

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

1. Do not use parking brake to hold unattended aircraft.
2. Do not set parking brake lever if brakes are wet and ambient air is 32°F (0°C) or less as there is a possibility of moisture accumulation freezing in brake assembly.

MOORING

It is recommended that the aircraft be hangared when not in use to minimize the deteriorating effect of weather and high winds. 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 tail cone 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.

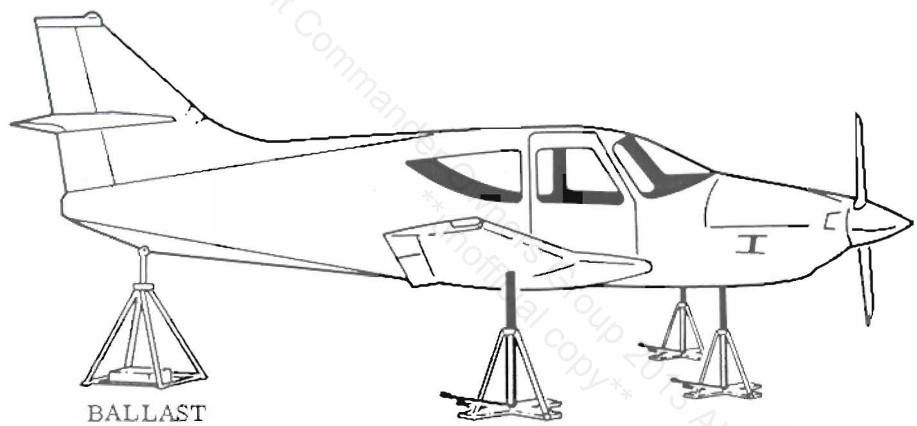


Figure 8-2. Jacking

JACKING

Aircraft jacking should be accomplished in a hangar unless wind is calm. To jack the aircraft for landing gear maintenance, etc., refer to Figure 8-2 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 planned.

CAUTION

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

The nose gear may be raised without the use of jacks, by lowering aft fuselage and securing with weighted tail stand.

PROLONGED OUT OF SERVICE CARE

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 rubber intake plugs, gust locks and tie-down the aircraft if stored outside.
5. Clean and rotate tires weekly to prevent flat-spotting.
6. Remove and store battery during cold weather.
7. Rotate propeller through several revolutions by hand once every seven (7) days after checking ignition switch 'OFF'.
8. Start engine and run-up to operating temperatures each seven (7) days.

LONG TERM (more than 28 days)

When the aircraft is to be stored for periods greater than 28 days, the general steps under the period of 28 days or less, plus cleaning and polishing of the aircraft, 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 tail cone, and is accessible through the baggage compartment. Loosen and remove the thermoplastic 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, add distilled water to bring the cell(s) up to proper level. Periodic hydrometer check for proper specific gravity of electrolyte is recommended. Battery charging and specific gravity requirements are defined in the Maintenance Manual.

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, 6 Ply)	50 PSI	120 PSI
Main Gear (7.00 x 6, 6 Ply)	38 PSI	405 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 120 PSI and main strut pressures at 405 PSI. Check the landing gear daily for general cleanliness, security of mounting, and hydraulic leaks. Keep machined surfaces of strut piston 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 every 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	SAE GRADE	
	MIL-L-6082-B	MIL-L-22851
Below 10°F	20	30
0°F to 70°F	30	40 or 30
30°F to 90°F	40	40
Above 60°F	50	40 or 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 mineral type oil and use until the 50 Hour mark is reached or oil consumption has stabilized, then change to detergent oil conforming to specifications, listed above.

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 fuel lower than 100/130 (green). Aviation fuel 100 LL (blue) is an approved alternate.

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 AIRCRAFT PROCEED AS FOLLOWS:

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

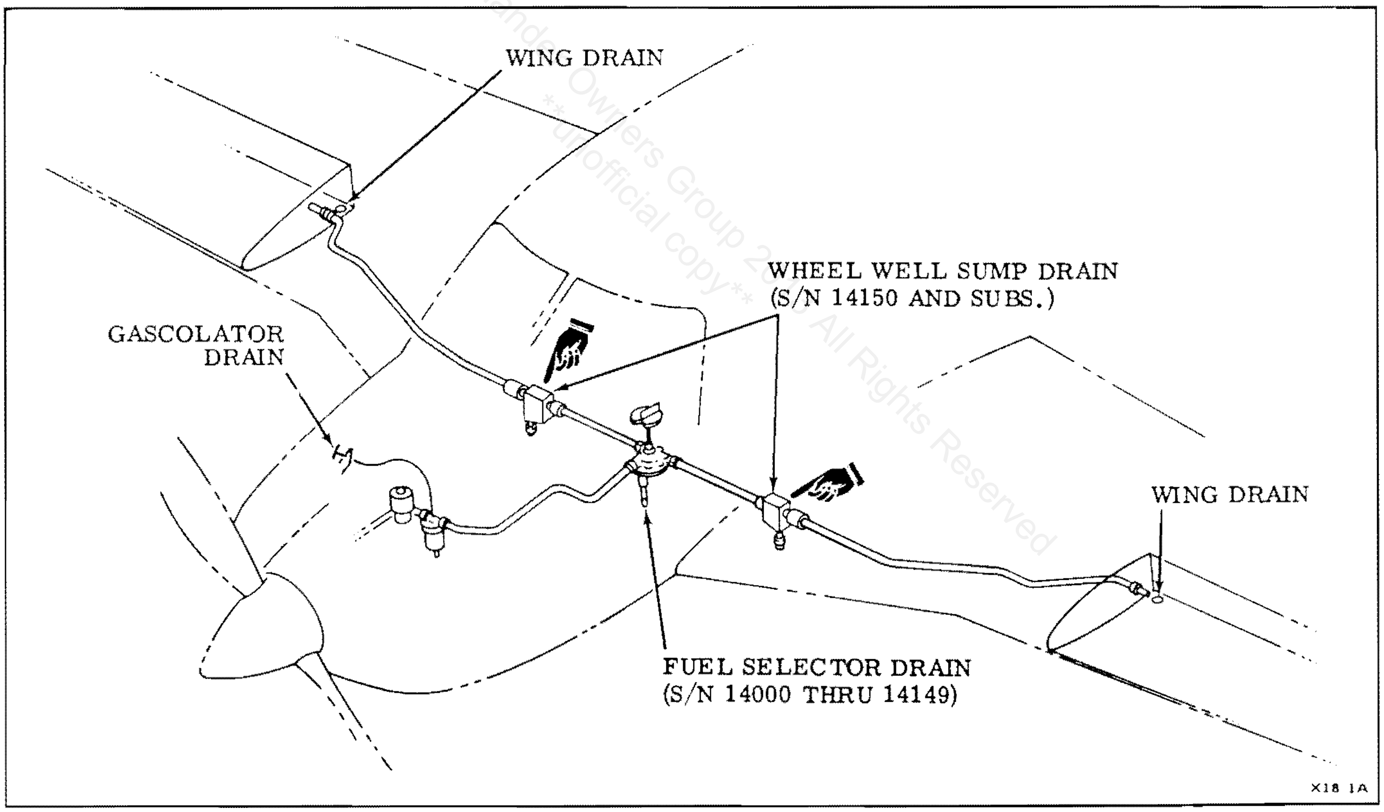


Figure 8-3. Fuel Drains

FUEL DRAINS

After servicing, all fuel drains (see Figure 8-3) 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. (S/N 14000 thru 14149) Place fuel selector valve, located 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 LEFT or RIGHT and pulling up on valve handle.

3. (S/N 14150 and Subsequent) Drain a fuel sample from drain located in each main gear wheel well.
4. Drain fuel from gascolator by pulling tee handle fuel release.
5. 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 SYSTEM

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

(S/N 14000 thru 14149) 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 at the bottom of the filler plug opening. The co-pilot's brakes are hydraulically interconnected to the pilot's master cylinders.

(S/N 14150 and Subsequent) The pilot's and co-pilot's brake cylinders are supplied fluid from a separate fluid reservoir, located on the left forward side of the firewall. Before removing the filler plug, clean the top of the reservoir to prevent dirt from entering the reservoir. Service reservoir to the bottom of the filler plug opening with MIL-H-5606 hydraulic fluid.

If bleeding of brakes is required, refer to the Maintenance Manual.

LUBRICATION - See Figure 8-4.

AIRCRAFT FINISH CARE

Exterior Cleaning - Climate and operating conditions will determine the extent and frequency of cleaning required. Frequent washing when operating near salt water areas will help to minimize corrosion. Prior to cleaning the exterior of the aircraft cover the wheels, making certain the brake discs are covered. Securely install plugs or mask off all openings. Be particularly careful to mask off both static air sources before washing or waxing. Do not apply wax or polish to the exterior surface of the aircraft for a period of 90 days after delivery, as waxes and polishes seal the paint from the air and prevent curing. If it is necessary to clean the painted surfaces before the expiration of the 90-day curing period, use cold or luke warm water and a mild soap. Never use hot water or detergents. Any rubbing of the painted surface should be gentle and held to a minimum to avoid damaging the paint film. Use a mild commercial soap to wash the aircraft and rinse with clean water. Loose dirt should be flushed away with clean water before soap is applied. Harsh or abrasive soaps or detergents may cause corrosion or scratches and should never be used. Soft cleaning clothes or a chamois should be used to prevent scratches when cleaning and polishing. The exterior surfaces may be waxed with a quality grade automotive paste wax after allowing adequate curing time.

The windshield and cabin side windows are made from plastic; therefore, care must be exercised when servicing the aircraft to prevent scratching or otherwise damaging the window surfaces. The windshield and cabin windows may be cleaned by carefully washing with a mild commercial soap and clean water.

APPLICATION SYMBOL	SPECIFICATIONS AND TYPE OF LUBRICATION
HAND PACK	MIL-G-3545 HIGH TEMPERATURE AIRCRAFT GREASE MIL-G-23827 AIRCRAFT GREASE (TOP OF NOSE GEAR TRUNNION ONLY)
(HF) CLOTH WIPE	MIL-H-5606 HYDRAULIC FLUID
OIL CAN	MIL-L-7870 LOW TEMPERATURE GENERAL PURPOSE LUBRICATING OIL.
ZERK GUN	MIL-G-81322 AIRCRAFT GREASE
	50 HRS. 100 HRS. AS REQD

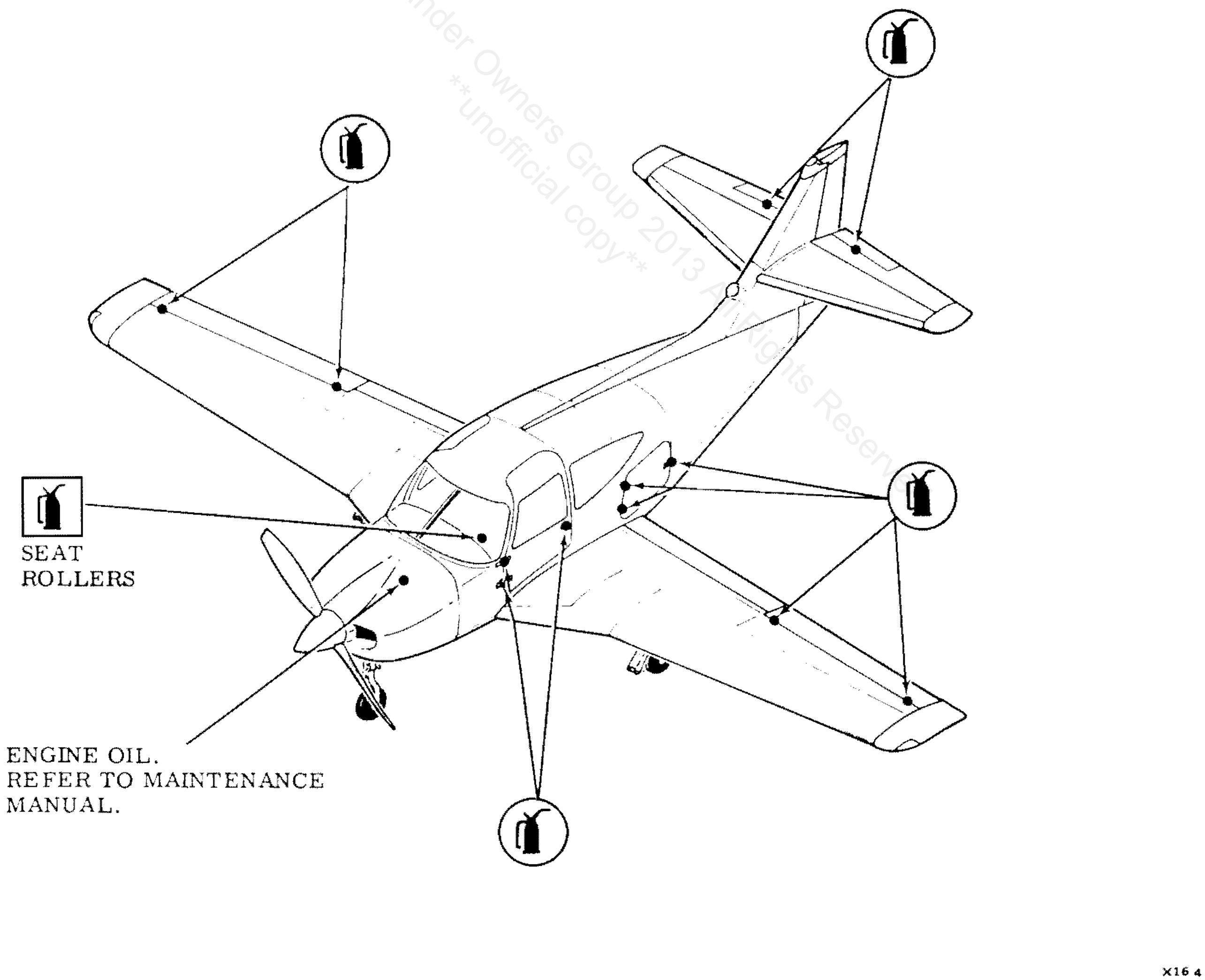


Figure 8-4. Lubrication Chart (Sheet 1 of 2)

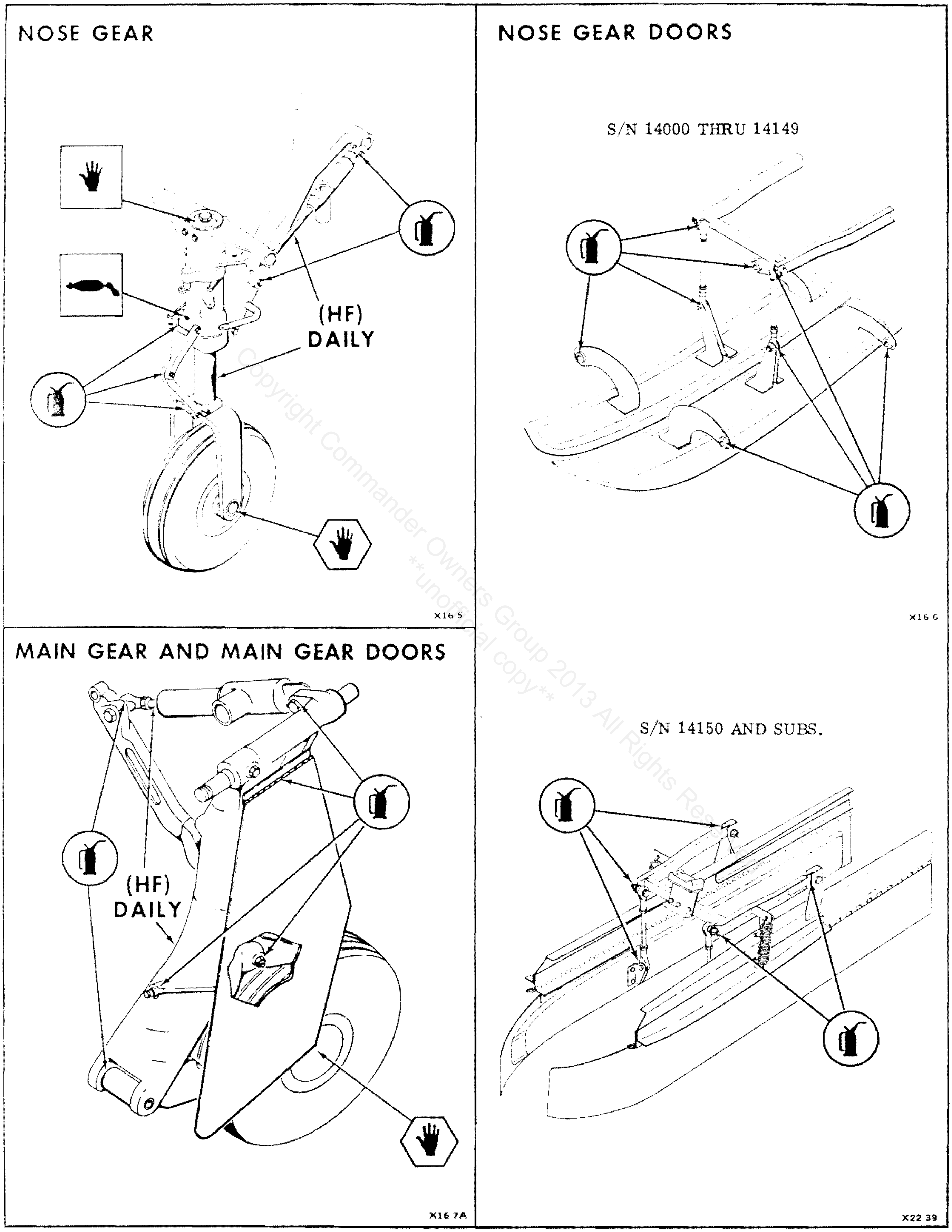


Figure 8-4. Lubrication Chart (Sheet 2 of 2)

CAUTION

Do not use gasoline, alcohol, benzene, acetone, carbon tetrachloride, deicer fluids or glass cleaning components on plastic surfaces as they will soften the plastic and cause crazing.

Avoid rubbing the plastic surface with a dry cloth since this can cause scratches and build up an electric static charge that will attract dust particles. If scratches are visible after removing dirt accumulations, finish the plastic with a quality grade of commercial wax. Apply wax in a thin even coat and carefully buff out with a soft cloth. Do not buff or polish in one area for more than a brief period of time; heat generated by rubbing the surface may soften the plastic and produce visual distortion.

ENGINE CLEANING

Engine and cowling may be cleaned with any standard engine solvent approved for this purpose. Prior to cleaning engine, cover all openings to prevent solvent from entering engine. Spray or brush solvent over engine and wipe dry. Blow excess cleaning solution from engine with compressed air.

CAUTION

Do not allow commercial cleaning solvents to enter magnetos, starter, alternator or any primary component housing. Protect engine components by wrapping in suitable plastic or otherwise covering areas to prevent solvent contact.

LANDING GEAR AND WHEEL WELLS

Clean landing gear and wheel wells with a compound containing an emulsifying agent to remove oil, grease, and surface dirt. The emulsion is removed by rinsing with water or spraying with a petroleum solvent. Cover the wheel and brake during landing gear and wheel well cleaning. If a water rinse is used in cold weather, blow all water from wheel well with an air hose, to prevent freezing. Emulsion type cleaners usually contain solvents which are injurious to rubber if allowed to remain in contact for any length of time; therefore, rinse affected area immediately with water. After cleaning landing gear, wipe exposed strut piston with a clean cloth moistened with MIL-H-5606 hydraulic fluid. To clean tires, rinse with water and scrub with a brush. Tire surface may be brightened after washing by rubbing with glycerene or applying a brush coat of commercial tire paint.

NOTE

Assure that ground contact (squat) switch and all landing gear limit switches are dry prior to flight.

PROPELLER

Check propeller blades and hub periodically for oxidation, corrosion, cracks and nicks. Brush oxidized or corroded area with a phosphating agent to remove superficial corrosion, then remove etched and pitted area by buffing smooth with an aluminum polish. 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 concentration.

NOTE

Any repairs of metal propellers involves evaluating the damage and determining whether the repair will be a major or minor one. Federal Aviation Regulations, Part 43 (FAR 43) defines major and minor repairs and alterations and who may accomplish them. Federal Aviation Regulations and the Hartzell manufacturer's instructions must be observed.

Never use an alkaline cleaner on the propeller blade surfaces. Remove dirt with a petroleum base solvent. After cleaning, wiping propeller blades and hubs occasionally with an oily cloth to clean off stains, will assure long trouble-free operation. When cleaning propeller, take the following precautions:

a. Check that ignition switch is OFF.
b. Make sure engine has cooled completely.
c. When moving propeller, do not stand in line of blades.
d. Avoid using excessive amounts of liquid cleaner as it may splatter or run down blade and enter propeller hub or engine.
e. After cleaning, check area around propeller hub to be sure all cleaning solution is removed.

INTERIOR CLEANING

Seats, rugs, upholstery panels, and instrument panels should be vacuumed frequently to remove surface dust. Spots and stains should be removed with products specifically manufactured for this purpose. Clean the aircraft interior with commercial cleaning compounds designated for plastic, vinyls and rug materials. Such products can be purchased locally. Do not use water to clean fabric surfaces, since it will spot upholstery and remove the flame-resistant chemical impregnated in the cloth. 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.

SECTION IX

SUPPLEMENTS

LOG OF SUPPLEMENTS

Supplement No.	Title	FAA Approved	Date
1	Puritan "Altitude Traveler" Portable Oxygen System (Pages 1 of 4 thru 4 of 4)	DEL OP PC-203	2/21/76
2	Winterization Kit (Pages 1 of 2 and 2 of 2)	DEL OP PC-203	6/21/76
3	Emergency Locator Transmitter (ELT) (SHARC 7H-2A and SHARC 7K) (Pages 1 of 2 and 2 of 2)	DEL OP PC-203	10/1/76
4	Narco CP 136 Audio Panel (Pages 1 of 2 and 2 of 2)	DEL OP PC-203	12/16/77
5	Narco COM 120 Transceiver (Pages 1 of 2 and 2 of 2)	DEL OP PC-203	12/16/77
6	Narco NAV 121 Navigation Unit (Pages 1 of 4 thru 4 of 4)	DEL OP PC-203	12/16/77
7	Narco NAV 124 Navigation Receiver (With Narco HSI-100S Horizontal Situation Indicator) (Pages 1 of 7 thru 7 of 7)	DEL OP PC-203	12/16/77
8	Narco ADF 141 (Pages 1 of 4 thru 4 of 4)	DEL OP PC-203	12/16/77
9	Narco AT 150 Transponder (Pages 1 of 3 thru 3 of 3)	DEL OP PC-203	12/16/77
10	Narco DME 195 (Pages 1 of 3 thru 3 of 3)	DEL OP PC-203	12/16/77

LOG OF REVISIONS TO SUPPLEMENTS

Revision Number	Revised Supplement Number	Description of Revision	FAA Approved	Date
1	1	Revised pages 1 of 4 and 3 of 4	[signature] DEL OP PC-203	5/18/76

SUPPLEMENT 1

PURITAN "ALTITUDE TRAVELER" PORTABLE OXYGEN SYSTEM

SECTION I

GENERAL

The purpose of this Pilot's Operating Handbook Supplement is to provide additional information appropriate to the operation of the Puritan "Altitude Traveler" Portable Oxygen System. When an aircraft is equipped with the Puritan Portable Oxygen System, this Supplement must be included in the Pilot's Operating Handbook.

DESCRIPTION

The Puritan "Altitude Traveler" Portable Oxygen System consists of 1800 PSI oxygen cylinder, a manual regulator, four oxygen outlets, four oxygen masks and hoses and a protective carrying case. The manual regulator provides a means of varying the oxygen flow rate, thus giving the system a wide selection of operating altitudes. The system meets the flow rate requirements set forth in FAR 23.1443 and is authorized for use at altitudes up to 30,000 feet. The oxygen system is installed in the center of the rear seat and is easily removable for servicing.

To operate the system, the manual regulator should be adjusted to the altitude range bracketing the intended operating altitude. Plug in the number of oxygen masks desired, verify that there is flow to each mask by noting that the oxygen flow indicators, located in each delivery hose, have changed from Red to Green, place the mask over the nose and mouth, adjust the retaining strap and breath normally. Never plug in more masks than are necessary as this will result in a needless use of oxygen. Any time a flight altitude change is made, a readjustment of the manual regulator may be necessary to assure that its altitude range brackets the newly selected flight altitude. If this is not accomplished, inadequate flow rates would result if the flight altitude selected is higher than the altitude range selected on the manual regulator, while excessive and wasteful flow rates would result if the flight altitude selected is lower than the altitude range selected on the manual controller. An emergency position is available on the manual regulator. When this position is selected, an oxygen flow rate of 6 liters per minute at Sea Level is established.

Oxygen duration is a function of the manual regulator setting and the number of occupants utilizing the system. The following table depicts that relationship.

Altitude Setting on Regulator	NUMBER OF MASKS IN USE			
	1	2	3	4
8 - 12	6:10	2:50	1:56	1:30
12 - 16	4:56	2:28	1:35	1:08
16 - 20	3:53	1:50	1:16	0:54
20 - 25	3:06	1:30	0:58	0:42
25 - 30	2:30	1:12	0:48	0:36

OXYGEN DURATION - HOURS:MINUTES

NOTE: The above chart is based on 1800 PSI, starting at noted altitude.

The oxygen duration chart only shows average durations and assumes that the oxygen bottle has been filled to maximum capacity prior to use. As these durations are approximate, it is advisable to periodically check the oxygen level to preclude the possibility of unexpectedly exhausting the oxygen supply. It is also advisable to periodically check the oxygen flow indicators to each mask to assure that each occupant utilizing the system is receiving oxygen. Should the oxygen supply become exhausted or should the flow to any mask cease (and flow cannot be restored), a descent should be made immediately to an altitude that would not require the use of supplemental oxygen.

Oxygen capacity is a direct function of oxygen bottle pressure. 1800 psi at 70°F represents a fully charged bottle, while 75% capacity represents 1350 psi, 50% capacity represents 900 psi and 25% capacity represents 450 psi. These pressure values vary slightly with temperature but have no significant effect on oxygen duration. For more detailed information concerning this temperature/pressure relationship and for servicing instructions refer to the "Altitude Traveler" Owner's Instruction Manual provided with each unit.

Oxygen Cylinder

Rating - 1800 PSI, steel cylinder with DOT3AA - 1800 Rating

Capacity - 22 Cubic Ft. (625 Liters) when charged to 1800 PSI at 70°F.

Oxygen

Type - Aviators Breathing Oxygen per MIL-O-27210, Type I or equivalent.

Weight

Approximate total weight of cylinder and masks - 17.5 Lbs.

SECTION II

LIMITATIONS

There are no changes to the operating limitations when this equipment is installed.

SECTION III

EMERGENCY PROCEDURES

Oxygen Flow Interruption

1. Oxygen Regulator - EMERGENCY .

If oxygen flow is re-established:

2. Oxygen Regulator - RESET TO DESIRED ALTITUDE RANGE.

If oxygen flow is not restored:

3. Descent - DESCEND TO AN ALTITUDE THAT DOES NOT REQUIRE THE USE OF SUPPLEMENTAL OXYGEN.

WARNING

An insufficient supply of oxygen can severely limit a pilot's ability to effectively fly his aircraft.

SUPPLEMENT 1 (CONTD)

SECTION IV

NORMAL PROCEDURES

Pre-Flight Inspection

Interior

1. Oxygen Quantity - CHECK.
2. Oxygen Masks - CHECK CONDITION and AVAILABILITY.
3. Oxygen Bottle and Case - SECURELY TIED DOWN.

Before Starting

1. Oxygen Masks - CONNECT TO BOTTLE.

NOTE

Connect only those masks which will be used in flight.

2. Oxygen Regulator - SET ANTICIPATED CRUISING ALTITUDE RANGE.
3. Oxygen Flow Indicator - CHECK GREEN ON ALL MASKS ANTICIPATED FOR USE.
4. Oxygen Regulator - OFF.

Normal Climb

1. Oxygen Masks - DON.

WARNING

All smoking materials must be extinguished when oxygen is being used.

2. Oxygen Regulator - SET DESIRED ALTITUDE RANGE.

NOTE

FAR 91.32 requires that the pilot use supplemental oxygen between 12,500 Ft. MSL and 14,000 Ft. MSL when that portion of the flight exceeds 30 minutes. It further requires that the pilot use supplemental oxygen at altitudes in excess of 14,000 Ft. MSL and that all occupants are provided with supplemental oxygen at altitudes in excess of 15,000 Ft. MSL.

It is recommended; however, that all occupants use supplemental oxygen at altitudes in excess of 10,000 Ft. MSL and that the pilot use supplemental oxygen when flying at altitudes in excess of 5,000 Ft. MSL at night.

3. Oxygen Flow Indicators - CHECK GREEN ON ALL MASKS IN USE.

Cruise

1. Oxygen Flow Indicators - PERIODICALLY CHECK ALL MASKS IN USE.
2. Oxygen Capacity - PERIODICALLY CHECK.

Descent

1. Oxygen Regulator - READJUST AS NECESSARY.

When aircraft has descended below an altitude where supplemental oxygen is no longer required:

2. Oxygen Regulator - OFF.
3. Oxygen Masks - STOW.

SECTION V

PERFORMANCE

There are no changes to the operating performance data when this equipment is installed.

SUPPLEMENT 2

WINTERIZATION KIT

SECTION I

GENERAL

The purpose of this Pilot's Operating Handbook Supplement is to provide additional information appropriate to aircraft operation when the Winterization Kit is installed. When an aircraft is equipped with a Winterization Kit, this Supplement must be included in the Pilot's Operating Handbook.

DESCRIPTION

The Winterization Kit consists of a partial blocking plate, which is inserted over the front face of the oil cooler. The blocking plate reduces the cooling surface area of the oil cooler by approximately fifty percent, thereby providing a means of increasing oil and engine operating temperatures.

As oil and engine operating temperatures are a function of outside air temperature, it will become increasingly more difficult, (especially at low power settings) to maintain oil and engine operating temperatures within their normal operating ranges during cold weather operation. For this reason, it is recommended that the Winterization Kit be installed if prolonged cold weather operation is anticipated.

SECTION II

LIMITATIONS

Outside Air Temperature Limitation

1. Winterization kit must be removed when the OAT exceeds 50°F.

2. Placards

DO NOT OPERATE AIRCRAFT WITH WINTERIZATION KIT INSTALLED IF O.A.T. IS GREATER THAN 50°F.

ABOVE AND TO THE RIGHT OF ALTIMETER

SECTION III

EMERGENCY PROCEDURES

There are no changes to the Emergency Procedures Section when this equipment is installed.

SECTION IV

NORMAL PROCEDURES

Normal Climb

1. Cowl Flaps - CLOSED.

NOTE

Engine temperatures should be monitored closely during the climb. Should any temperature exceed its respective limit, the cowl flaps should be opened enough to reduce and then to maintain temperatures within their normal operating ranges.

SECTION V

PERFORMANCE

There are no changes to the Performance Section when this equipment is installed.

SUPPLEMENT 3

EMERGENCY LOCATOR TRANSMITTER (ELT) (SHARC 7H-2A AND SHARC 7K)

SECTION I

GENERAL

The purpose of this Pilot's Operating Handbook Supplement is to provide additional information appropriate to the operation of the SHARC-7 Emergency Locator Transmitter (ELT). When an aircraft is equipped with a SHARC-7 Emergency Locator Transmitter, this Supplement must be included in the Pilot's Operating Handbook.

DESCRIPTION

The ELT is a self-contained battery powered transmitter. It is colored bright orange and located on the left side of the tail cone behind the aft baggage wall or on the aft mounted avionics shelf (if installed) and is accessible thru the removable panel just inside the baggage door. A placard located on the removable panel shows battery replacement date.

Its purpose is to automatically transmit a sweeping audio signal on the international distress frequencies of 121.5 MH_Z with the SHARC 7K, or 121.5 MH_Z and 243.0 MH_Z with the SHARC 7H-2A, after being subjected to a 5 "g" deceleration for a short period of time, along the airplane line of flight. The transmitter may be controlled from the cockpit by actuation of the switch on the upper right instrument panel. 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 are manually transmitted regardless of the "g" switch position.

General aviation and commercial aircraft, the FAA, and CAP monitor 121.5 MH_Z. The military monitor 243.0 MH_Z.

Following a crash landing, the ELT will provide line-of-sight transmission up to 100 miles at 10,000 feet.

The duration of ELT transmissions is affected by ambient temperature. At temperature of +21° to +54°C (+70 to +130°F) continuous transmission for 115 hours can be expected; a temperature of -40°C (-40°F) will shorten the duration to 70 hours.

SECTION II

LIMITATIONS

There are no changes to the operating limitations when this equipment is installed.

SECTION III

EMERGENCY PROCEDURES

Forced Landing Procedures

ELT procedures prior to a forced landing are included in Section III of the Pilots Operating Handbook for the specific emergency involved.

Immediately after a forced landing where emergency assistance is required, the ELT should be utilized as follows:

1. ENSURE ELT ACTIVATION: Turn a radio transceiver ON and select 121.5 MH_Z. If the ELT can be heard transmitting, it was activated by the "g" switch and is functioning properly. If no emergency tone is audible, gain access to the ELT and place the function selector switch in the ON position.

2. PRIOR TO SIGHTING RESCUE AIRCRAFT: Conserve airplane battery. Do not activate radio transceiver.

3. AFTER SIGHTING RESCUE AIRCRAFT: Place ELT function selector switch in the OFF position, preventing radio interference. Attempt contact with rescue aircraft with the radio transceiver set to a frequency of 121.5 MH_Z. If no contact is established, return the function selector switch to ON immediately.

4. FOLLOWING RESCUE: Place ELT function selector switch in the OFF position, terminating emergency transmissions.

Inadvertent Actuation of ELT "g" Switch

It is recommended that the transmitter be checked, following a lightning strike or an exceptionally hard landing by turning the aircraft VHF communication receiver to 121.5 MH_Z and listening for ELT audio sweeps.

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

NORMAL PROCEDURES

Before Takeoff

1. Emergency Locator Transmitter Control Switch - ARM.

   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 ELT may be tested, but certain precautions must be observed, as follows:

1. Test 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 V

PERFORMANCE

There is no change to the operating performance data when this equipment is installed.

SUPPLEMENT 4

NARCO CP 136 AUDIO PANEL

SECTION I

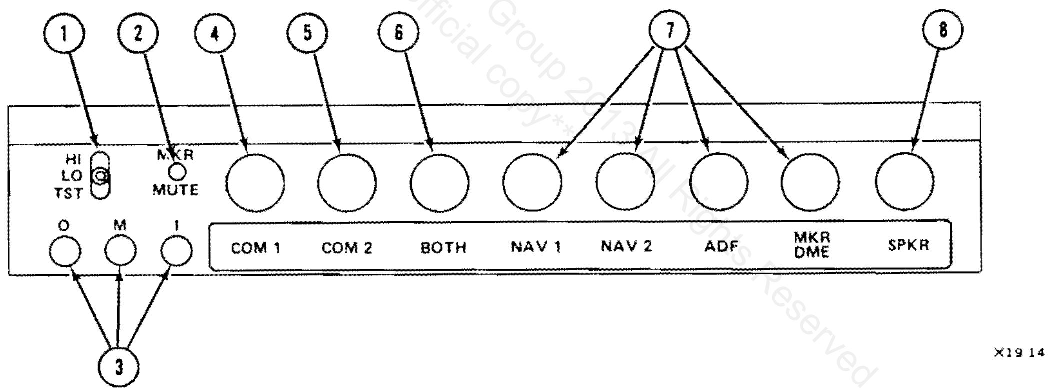
GENERAL

The purpose of this Supplement is to provide information necessary for the operation of the NARCO CP 136 Audio Panel. When an airplane is equipped with the CP 136 Audio Panel, this Supplement must be included in the Pilot's Operating Handbook.

DESCRIPTION

The NARCO CP 136 Audio Panel provides central push-button control, for all airplane communications and navigation audio signals. As many as seven audio inputs may be combined for routing to the cabin speaker and headphones. The panel also contains Marker Beacon indicator lights and audio controls.

CONTROL PANEL



(1) HI-LO-TST SWITCH - Selects Marker Beacon sensitivity. Placing switch in HI enlarges the area in which the marker beacon can be received. The momentary TST position lights the O-M-I lamps. When the DME/MKR and SPKR pushbuttons are selected and the TST switch is depressed, a steady tone will be heard on the speaker and headphones. The marker beacon receiver will be on any time power is on the airplane and marker beacon circuit breaker is set.

(2) MKR MUTE SWITCH - Allows the pilot to mute or disable MKR audio output for a period of 10 to 14 seconds. This is long enough to allow the MKR audio to remain muted as the airplane passes over a marker beacon transmitter, yet permits reactivation of the MKR audio before next Marker Beacon is reached. The switch is spring-loaded and requires only momentary contact.

(3) O-M-I LAMPS - Outer, Middle and Inner Marker Beacon identifiers. The appropriate lamp will light upon receipt of a signal from the Marker Beacon receiver.

Pushbutton Operation

Pushing a button IN closes that circuit and lights that button. The button is locked in the IN position. A second push releases the lock and allows the button to pop out and open the circuit and extinguish the light.

(4) & (5) COM 1 and COM 2 Pushbuttons - The COM 1 and COM 2 pushbuttons are the only two pushbuttons that are interlocked. Depressing one button causes the other to release. Depressing either COM 1 or COM 2 button allows that particular COM transceiver to be used for transmit and receive modes.

(6) BOTH Pushbutton - Depressing the BOTH button permits the audio from both COM receivers to be heard on the speaker and/or headphones simultaneously. It does not void the selection of the COM transmitter selected by the COM 1 or COM 2 button.

(7) NAVIGATION RECEIVER SELECTION Pushbuttons - Four pushbuttons provide navigation receiver selection. Depressing one or more of these pushbuttons permits the audio signal from the selected unit(s) (NAV 1, NAV 2, ADF and DME/MKR) to be routed to the isolation combining circuits of the audio panel.

(8) SPKR Pushbutton - Depressing the SPKR button connects the combined audio signals from all the selected units to the input of the cabin speaker amplifier.

SECTION II

LIMITATIONS

There are no changes to the airplane operating limitations when this equipment is installed.

SECTION III

EMERGENCY PROCEDURES

There are no changes to the emergency procedures when this equipment is installed.

SECTION IV

NORMAL PROCEDURES

1. Comm Transceivers - ON and TUNED as desired.
2. COM 1 or COM 2 Button - SELECT desired transceiver.
3. BOTH Pushbutton - AS DESIRED.
4. Navigation Receiver Selectors - AS DESIRED.
5. SPKR Pushbutton - AS DESIRED.

SECTION V

PERFORMANCE

There are no changes in airplane performance when this equipment is installed.

SUPPLEMENT 5

NARCO COM 120 TRANSCEIVER

SECTION I

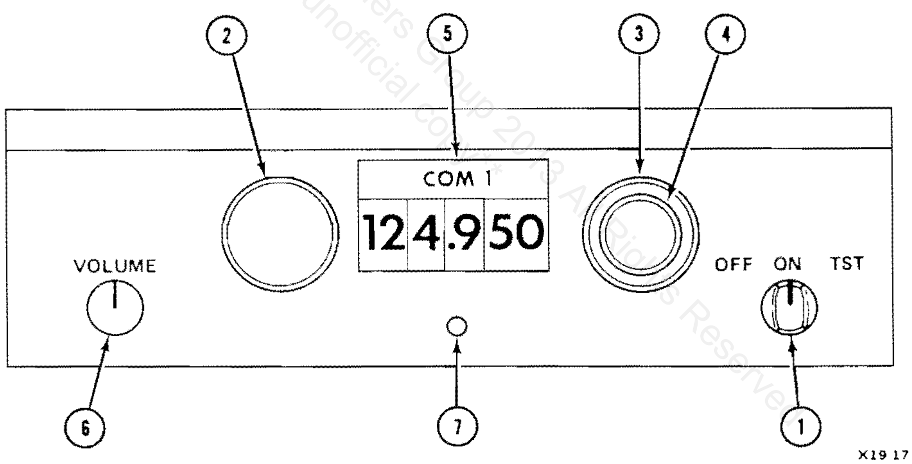
GENERAL

The purpose of this Supplement is to provide information necessary for the operation of the NARCO COM 120 Transceiver. When an airplane is equipped with a COM 120, this Supplement must be included in the Pilot's Operating Handbook.

DESCRIPTION

The NARCO COM 120 is a 720 channel VHF transceiver which operates in the frequency range of 118.000 to 135.975 MHz with 25 kHz spacing. The unit operates on airplane DC power. In a dual installation the units will be labeled COM 1 and COM 2.

CONTROLS



1. OFF-ON-TST Switch - Turning the switch clockwise past the click to the ON position energizes the unit. Continued clockwise rotation to TST position will deactivate the automatic squelch feature.
2. FREQUENCY SELECTOR Knob - Selects frequency in the MHz range.
3. FREQUENCY SELECTOR Knob - Larger knob selects hundreds of kHz.
4. FREQUENCY SELECTOR Knob - Smaller knob selects tens of kHz.
5. FREQUENCY DISPLAY - Displays transmit/receive frequency selected.
6. VOLUME CONTROL - Controls audio volume. Turn clockwise to increase volume.
7. TRANSMIT LIGHT - Lights when transmitter is keyed by push-to-talk switch on the microphone or airplane control wheel.

SECTION II

LIMITATIONS

There are no changes to the airplane operating limitations when this equipment is installed.

SECTION III

EMERGENCY PROCEDURES

There are no changes in the emergency procedures when this equipment is installed.

SECTION IV

NORMAL PROCEDURES

1. Radio Master Switch - ON.
2. Appropriate COMM Circuit Breaker - CHECK IN.
3. OFF-ON-TST Switch - ON.
4. Audio Control Panel - SET as desired.
5. Communications Frequency - TUNE.
6. Volume - AS DESIRED.
7. Transmit Light - MONITOR for proper transmitter operation.

SECTION V

PERFORMANCE

There are no changes in airplane performance when this equipment is installed.

SUPPLEMENT 6

NARCO NAV 121 NAVIGATION UNIT

SECTION I

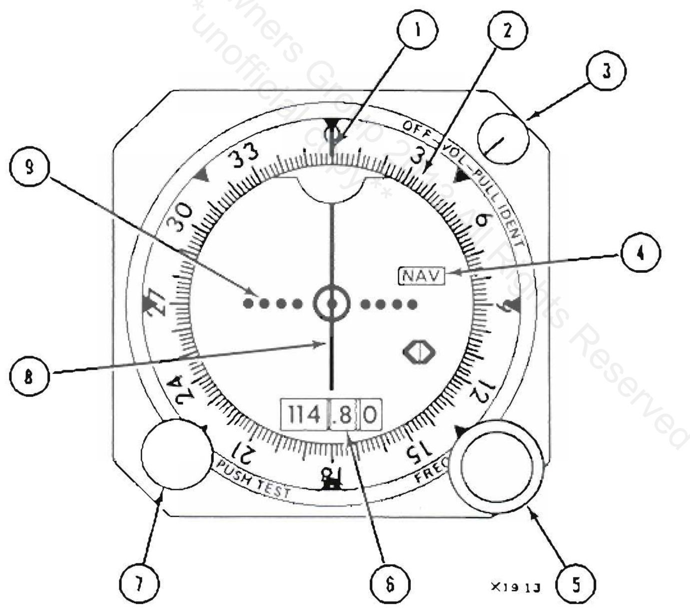
GENERAL

The purpose of this supplement is to provide information necessary for the operation of the NARCO NAV 121 Navigation Unit. When an airplane is equipped with the NAV 121, this supplement must be included in the Pilot's Operating Handbook.

DESCRIPTION

The NAV 121 is a VOR/LOC Receiver, a receiver control head and course deviation indicator combined in a single unit. The NAV 121 operates on airplane DC power.

INDICATOR AND CONTROLS



(1) SELECTED BEARING INDICATOR - A fixed yellow marker which indicates the selected radio bearing on the OMNI BEARING CARD.

(2) OMNI BEARING CARD - A manually rotated compass card used to select the desired OMNI bearing. Controlled by the OBS knob.

(3) OFF-VOL-PULL INDENT - Rotating the knob clockwise, past the "click", applies power to the NAV circuits; continued clockwise rotation increases the audio volume. Pulling the knob out allows the 1020 Hz station identification code to be heard on the airplane audio system. A detent holds the knob in the "pulled" position. Push to return.

(4) TO-FROM-OFF FLAG - A red OFF flag will appear alerting the pilot to either the loss of a signal or inadequate signal level.

A TO or FROM flag will appear indicating whether the selected VOR radial is a bearing TO the station or FROM the station.

(5) RECEIVER FREQUENCY CONTROLS - Receiver frequency is selected by the concentric knobs. Whole megahertz frequencies are selected by the large knob while fractional megahertz frequencies are selected by the small knob. Clockwise rotation of either knob increases selected frequency. If airplane is DME equipped, DME/VOR frequencies are tuned simultaneously when VORTAC transmitting frequencies are selected.

(6) FREQUENCY READOUT WINDOW - Displays frequency selected by Receiver Frequency Controls.

(7) OMNI BEARING SELECTOR (OBS) - A desired OMNI bearing is obtained by turning the OBS knob to set that bearing, read on the Omni Bearing Card, under the yellow Selected Bearing Indicator.

Pushing the OBS knob activates the Self Test Function. With a VOR signal (of any bearing) applied to the receiver, rotate the OBS knob to set a 0° bearing under the selected bearing indicator, then push in the OBS knob. If the unit is operating properly, the VOR/LOC Deviation Indicator will center and VOR/LOC Flag will show TO.

(8) VOR/LOC DEVIATION INDICATOR - In VOR mode, the indicator needle moves left or right to indicate location of the selected VOR bearing relative to the actual airplane position; when centered, the indicator shows on-course condition.

In LOC mode, the indicator needle moves left or right to locate the center of the horizontal component of an ILS glidepath relative to actual airplane position.

(9) VOR/LOC DEVIATION SCALE - When tuned to a VOR frequency each dot represents 2-degrees of deviation left or right of course. The inner circle represents one dot. When tuned to a localizer, the deviation is approximately 1/2-degree per dot.

SECTION II

LIMITATIONS

There are no changes to the airplane operating limitations when this equipment is installed.

SECTION III

EMERGENCY PROCEDURES

There are no changes to the emergency procedures when this equipment is installed.

SECTION IV

NORMAL PROCEDURES

Before Taxi

1. Radio Master Switch - ON.
2. Appropriate NAV Circuit Breaker - CHECK IN.
3. OFF-VOL-PULL IDENT Switch - ON.
4. Receiver - TUNE to local VOR frequency.
5. Audio Control Panel - SELECT APPROPRIATE NAV.

6. Volume - INCREASE until NAV receiver noise is heard. No coded IDENT signal should be heard.
7. OFF-VOL-PULL IDENT Switch - PULL. Check coded IDENT and push switch in.
8. OBS Knob - SET 0° bearing under Selected Bearing Indicator. Depress OBS knob and note VOR/LOC Deviation Indicator centers and TO flag appears.

In Flight Operations

The NAV 121 will allow the pilot to track a selected VOR radial, will provide a TO/FROM indication relative to the station and will provide an indication of VOR station passage. When used as NAV-2, the system does not provide an autopilot coupled capability if airplane is equipped with a slaved compass system, and does not provide computed steering commands for intercept or correction for wind drift. The indicator provides a "FLY TO THE NEEDLE" indication during VOR operation.

The NAV 121 also provides the data necessary to track the localizer portion of an ILS glidepath. It does not provide glideslope information and the TO/FROM flag does not operate when tuned to a localizer frequency.

The indicator displays the location of the localizer centerline relative to the airplane position. When executing a "front course" ILS localizer approach the indicator presents a "FLY TO THE NEEDLE" indication. During a "back course" approach the indications are reversed and the indicator presents a "FLY AWAY FROM THE NEEDLE" indication.

VOR Navigation

To establish the airplane on a desired VOR radial, proceed as follows:

1. Tune receiver to desired VOR frequency.
2. Identify VOR station.
3. Use OBS knob to set desired VOR radial under the selected bearing indicator.
4. Check TO/FROM flag.
5. Turn the airplane to the desired intercept heading.
6. Airplane is on the selected radial when the deviation indicator centers.
7. At station passage, the deviation indicator and the TO-FROM flag may oscillate and the warning flag may appear. Station passage occurs when the TO-FROM flag makes the first positive change to FROM.

LOC Approach

To establish the airplane on a localizer course, proceed as follows:

1. Tune receiver to LOC frequency.
2. Identify LOC station.
3. Intercept inbound localizer course.

NOTE

Use of the OBS knob does not affect the LOC course. Recommend that the published localizer course be set under the selected bearing indicator to help maintain pilot orientation.

WARNING

When executing a "back course" LOC approach, course deviation indications are reversed. Course corrections are made away from the needle during "back course" approaches.

VOR Approach

The procedure for a VOR approach is the same as for VOR navigation. Course deviation remains at 2° per dot.

SECTION V

PERFORMANCE

There are no changes to airplane performance when this equipment is installed.

SUPPLEMENT 7

NARCO NAV 124 NAVIGATION RECEIVER

(WITH NARCO HSI-100S HORIZONTAL SITUATION INDICATOR)

SECTION I

GENERAL

The purpose of this Supplement is to provide information necessary for the operation of the NARCO NAV 124 with an HSI-100S Horizontal Situation Indicator. When an airplane is equipped with a NAV 124 and an HSI-100S, this supplement must be included in the Pilot's Operating Handbook.

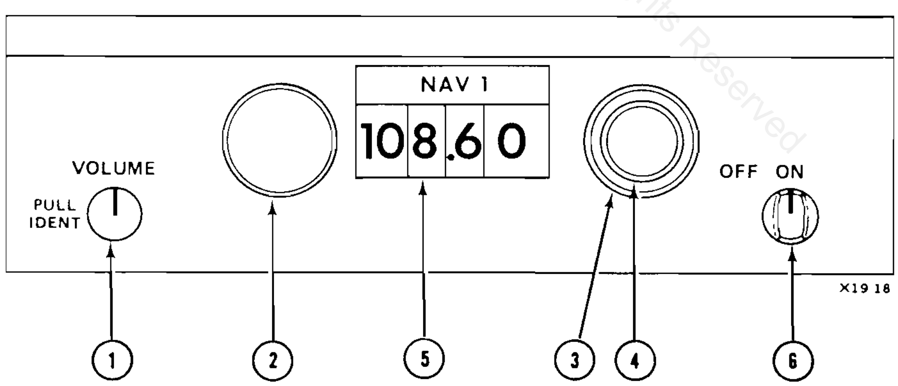
DESCRIPTION

The NARCO NAV 124 is a 200 channel VOR/ILS Receiver with a frequency range of 108.00 to 117.95 MHz, plus a time multiplexed 40 channel Glideslope Receiver and a Marker Beacon Receiver. The NAV 124 also automatically channels the DME system when tuned to a VORTAC frequency. The receiver operates on airplane DC power.

The HSI-100S is a Horizontal Situation Indicator (HSI) which displays airplane heading, VOR and LOC course deviation, glideslope deviation and VOR TO/FROM indications. The directional gyro is slaved to a NARCO compass system. Radio navigation signals are provided by the NAV 124 receiver. If the airplane is equipped with an Area Navigation System and the RNAV mode is selected, the HSI receives its navigation data from the RNAV computer. The HSI-100S will provide error signals to an autopilot for coupled autopilot operation. The HSI operates on airplane DC power.

INDICATORS AND CONTROLS

NAV 124 RECEIVER



(1) VOLUME-IDENT KNOB - Rotating the knob clockwise increases audio volume. Pulling out on the knob allows the 1020 Hz station IDENT tone to be heard. The knob is spring-loaded and must be held in the IDENT position.

The NAV 124 is a time-sharing receiver. When the receiver is tuned to a localizer frequency which is paired with an operating glideslope frequency, the receiver automatically switches back and forth between the localizer frequency and the glideslope frequency 15 times per second. When the VOLUME-IDENT knob is held in IDENT position, time-sharing is defeated, the glideslope signal is blocked out and the receiver is in LOC mode. This will cause the GS indicator on the HSI to slowly rise and the GS alarm flag to come into view. Releasing the spring-loaded knob allows normal LOC/GS time-sharing to resume.

NOTE

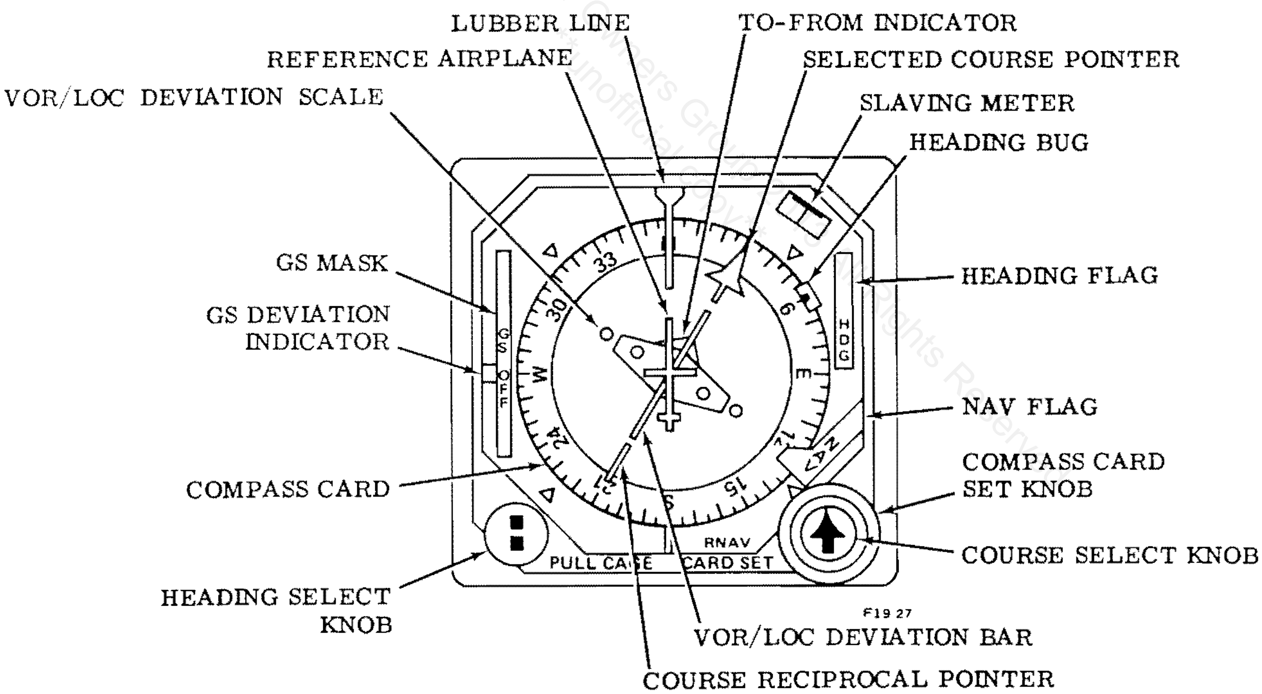
If the VOLUME-IDENT knob is held in the IDENT position during a coupled ILS approach, after the glideslope has been captured, the autopilot will cause the airplane to fly up in an attempt to satisfy the false climb indication.

(2) (3) (4) - RECEIVER FREQUENCY CHANNELING. - The single knob, 2 , selects whole megahertz frequencies. The concentric knobs, 3 and 4 , select fractional MHz frequencies. Clockwise rotation of the knobs increases the selected frequency.

(5) FREQUENCY READOUT WINDOW - Displays selected frequency.

(6) OFF-ON KNOB - Power is applied to the NAV receiver and the HSI-100S Horizontal Situation Indicator when the knob is placed in the ON position.

HSI-100S HORIZONTAL SITUATION INDICATOR



REFERENCE AIRPLANE - A fixed, symbolic representation of the actual airplane, aligned with the lubber line.

LUBBER LINE - An orange line, at top of display, which indicates airplane magnetic heading on the Compass Card.

COMPASS CARD - A rotating card which indicates, beneath the lubber line, the airplane current magnetic heading. The card is driven by the slaved directional gyro (DG). The card is also mechanically coupled to the COMPASS CARD SET KNOB and may be manually aligned with the standby magnetic compass if the gyro slaving system is inoperative.

COMPASS CARD SET KNOB - Used to manually rotate the compass card to set the magnetic heading under the lubber line.

HEADING BUG - The orange Heading Bug is used to select a desired magnetic heading. As the airplane heading varies, the Bug rotates with the Compass Card. When coupled to an Autopilot, heading error signals are generated to acquire and/or maintain a selected heading.

HEADING SELECT KNOB - Used to rotate the Heading Bug to a desired point on the Compass Card. Pulling the Knob out will erect the gyro if it tumbles.

HDG FLAG - Red flag indicates loss of power to the gyro. Heading information is unusable with flag in view, however, radio navigation information remains valid.

SELECTED COURSE POINTER - On this two part arrow, the "head" indicates the desired VOR, Localizer or RNAV course, and the "tail" indicates the course reciprocal. The Course Pointer rotates with the Compass Card. When coupled to the Autopilot, off course error signals will be generated to acquire or maintain the selected course.

COURSE SELECT KNOB - Used to rotate the Selected Course Pointer to the desired course on the Compass Card.

VOR/LOC DEVIATION BAR - Forms the center section of the Selected Course Pointer and represents a selected VOR radial or Localizer Course. When the airplane is located precisely on the selected VOR radial or Localizer Course, the Bar will be positioned under the Reference Airplane and over the center dot in the Deviation Scale. When airplane is off course, or approaching a new course, the bar will move to one side or the other to indicate the location of the selected course. Since the entire VOR or LOC display rotates with the Compass Card, the angular relationship between the Deviation Bar and the Reference airplane provides a pictorial display of airplane position with respect to the selected course.

VOR/LOC DEVIATION SCALE - When receiver is tuned to a VOR frequency, each white dot represents 5-degrees deviation right or left of selected course. When tuned to a Localizer, the deviation is approximately 1.25-degrees per dot. In RNAV ENROUTE mode, scale is 2.5 nm per dot and in RNAV APPR mode is 0.625 nm per dot.

TO-FROM INDICATOR - Indicates, with reference to the selected course, whether airplane is flying TO or FROM the VOR station. It is out of view when the receiver is tuned to a Localizer frequency.

NAV FLAG - Red flag indicates inadequate VOR or LOC signal, loss of VOR or LOC signal, or loss of power to meter circuits. With the NAV FLAG in view, VOR or LOC information is unusable, however, heading information is valid and glideslope information is valid if glideslope mask is out of view.

GLIDESLOPE DEVIATION INDICATOR - Triangular yellow pointer on left side of display. During an ILS approach, the pointer represents the center line of the glideslope, while the center dot on the deviation scale represents the airplane. This provides a visual indication of the position of the airplane relative to the glideslope.

GLIDESLOPE DEVIATION SCALE - White dots which, in conjunction with the Glideslope Deviation Indicator, indicates either "too high", "too low", or "on glideslope" during an ILS approach. Each dot, above and below the center dot, represents approximately 0.4-degree vertical deviation from the glideslope center line.

GLIDESLOPE MASK - Covers the Glideslope Deviation Indicator to indicate no usable glideslope signal is being received. Navigation and heading information is valid if their flags are out of view.

RNAV - The legend "RNAV" will appear in the lower right corner of the instrument face when the HSI is part of an Area Navigation system and the RNAV mode is engaged.

SLAVING METER - A slaving meter is located in the upper right corner of the instrument face. The meter needle will oscillate slowly when the slaved directional gyro is properly aligned to the flux compass. If directional gyro is not properly aligned with the flux compass, the slaving meter will display a constant deflection in the direction of the error.

D/G FREE/SLAVE SWITCH - A two position toggle switch labeled DG, FREE, SLAVE, located in the upper center of the instrument panel, controls the slaving system.

With the switch in SLAVE position, the compass card will automatically rotate at the rate of 15-degrees per second until the card is aligned with the directional gyro. The gyro will slave to the correct magnetic heading, as determined by the remote compass system, at the rate of 2-degrees per minute.

NOTE

Due to the slow slaving rate of the directional gyro, it may be necessary to use the Compass Card Set Knob to manually set the magnetic heading under the lubber line, using the standby compass for reference.

With the switch in FREE position, the directional gyro is unslaved and does not receive heading information from the slave compass system. Heading must be adjusted manually, at periodic intervals, to correct for gyro drift. Use the standby compass for reference.

SECTION II

LIMITATIONS

Placards

SET COMPASS CARD BEFORE TAKEOFF

Adjacent to HSI

DO NOT PULL NAV IDENT AFTER GLIDESLOPE CAPTURE

Below Glideslope Capture Light

SECTION III

EMERGENCY PROCEDURES

If slaving system malfunctions place D/G switch in FREE position. Manually align compass card with standby magnetic compass, at periodic intervals, to correct for gyro drift.

SECTION IV

NORMAL PROCEDURES

Before Taxi

1. Radio Master Switch - ON.
2. NAV 1 Circuit Breaker - CHECK IN.
3. D/G Switch - SLAVE.
4. Heading Flag - CHECK.

NOTE

Heading flag may take as long as 60 seconds to retract.

5. Compass Card - MANUALLY ALIGN with standby magnetic compass.
6. Slave Meter - CHECK.

NOTE

Gyro requires approximately five minutes to attain full speed.

7. NAV 124 Receiver - TUNE to local omni or test signal.
8. NAV Flag - RETRACTED when valid radio navigation signal is received.
9. Course Pointer - ROTATE until Course Deviation Bar centers, course pointer is pointing to omni station and TO indicator appears.
10. Course Pointer - ROTATE 30-degrees clockwise; Course Deviation Bar should move left. Rotate Course Pointer 30-degrees counterclockwise; Course Deviation Bar should center. Rotate Course Pointer 30-degrees counterclockwise; Course Deviation Bar should move right. Rotate Course Pointer 30-degrees clockwise. Course Deviation Bar should center.
11. Course Pointer - ROTATE 180-degrees. Course Deviation Bar should center and FROM indicator should appear.
12. Course Pointer - SET as desired.

Before Takeoff

1. Directional Gyro - CHECK operation by observing the gyro during turns while taxiing.
2. Heading - CHECK against known heading.

NOTE

Perform VOR checks as required by FAR 91.33.

In-Flight Operation

NOTE

The following descriptions assume the airplane is maneuvered automatically by a Mitchell Century III Autopilot. If the autopilot is not engaged, the airplane must be maneuvered manually, but the HSI-100S equipment management and displays remain the same.

Heading

1. Autopilot - ENGAGED.
2. Heading Bug - SET to desired heading.
3. Guidance Mode Selector - HDG.
4. Autopilot HDG Mode Switch - ON. Autopilot will turn airplane in shortest direction to intercept and track selected heading. Turns up to 180-degrees may be programmed.

VOR Navigation

To Intercept

1. Autopilot - ENGAGED.
2. Autopilot HDG Mode Switch - ON.
3. NAV 124 Receiver - TUNE to selected OMNI frequency.
4. Selected Course Pointer - SET to desired OMNI course (radial).
5. Guidance Mode Selector - OMNI. If airplane is 10-degrees, or more, off selected radial, a 45-degree interception angle will be established. Inside the 10-degree area, the system will automatically direct a tangential intercept, without overshoot, and arrive on the radial with crosswind correction established.

NOTE

Limit initial intercept angle to 90-degrees, or less.

NOTE

If less than 45-degrees from selected radial, airplane will intercept before station. If more than 45-degrees, interception will occur after station passage.

Station Passage:

With Guidance Mode Selector in OMNI, as the airplane nears the station (approximately 1 mile) the zone of confusion will cause the Course Deviation Bar to swing from side to side, resulting in an "S" turn. To ensure smooth station passage, set Heading Bug under the lubber line. When close to station, place Guidance Mode Selector in HDG. Observe TO-FROM indicator and when it displays a constant FROM indication, station passage has occurred. Place Mode Selector back to OMNI and autopilot will track outbound on selected course.

To Select New Course:

To select a new outbound course at station passage -

1. With Mode Selector in HDG mode, rotate Selected Course Pointer to new course.
2. Rotate Heading Bug to new course. Airplane will turn to new heading.
3. Place Guidance Mode Selector in OMNI. Autopilot will capture and track new course.

VOR Approach

1. Track inbound to station.
2. At station passage, select outbound course.
3. After airplane is established on outbound radial, set Heading Bug to outbound procedure turn heading.
4. Guidance Mode Selector - HDG.
5. After one minute, rotate Heading Bug to inbound procedure turn heading, in direction of turn.
6. Set Course Pointer to inbound course and when 90-degrees to inbound course set Mode Selector to OMNI.
7. Place Heading Bug under lubber line when airplane is established on inbound course and use HDG mode for station passage.

ILS Approach - Front Course

To Intercept Localizer:

1. NAV 124 Receiver - TUNE to localizer frequency.
2. Course Pointer - SET to published inbound course.
3. Heading Bug - SET to desired intercept heading (90-degree, or less, intercept angle).
4. Mode Selector - HDG.
5. Use Altitude Hold or Pitch mode for altitude control.

If Procedure Turn will be accomplished:

6. Mode Selector - LOC REV when Course Deviation Bar indicates airplane is approaching localizer course.
7. After intercept, and at appropriate time, descend to published approach altitude and place autopilot in Altitude Hold mode.
8. Heading Bug - SET to outbound procedure turn heading.
9. Mode Selector Switch - HDG.
10. After one minute, rotate Heading Bug, in direction of turn, to inbound procedure turn heading.
11. Mode Selector - LOC NORM when between 90 and 45-degrees to inbound heading.

NOTE

For optimum results switch to LOC NORM at 45-degrees.

If front course is to be intercepted with turn directly to inbound course:

12. Mode Selector - LOC NORM when Course Deviation Bar indicates airplane is approaching localizer course.
13. Airplane will intercept inbound localizer course. Autopilot should be on Altitude Hold and Glideslope deviation indicator should be up. If these conditions are met for 20 seconds or more, automatic glideslope coupler will be armed.
14. Heading Bug - SET to published GO AROUND heading.
15. Upon interception of glide path (when deviation indicator moves down to center) the glideslope coupler will automatically engage, the Glideslope Coupled indicator light will illuminate and the airplane will assume a pre-set nose down attitude for descent.

NOTE

Monitor deviation indicators for actual airplane position relative to the localizer and glidepath.

WARNING

If the VOLUME-IDENT knob on the NAV 124 receiver is held in the IDENT position with an ILS frequency selected, the Glideslope Deviation Indicator will move to a full scale "Fly Up" indication, regardless of the airplane position relative to the glideslope. If an autopilot coupled ILS approach is being accomplished, and, if the glideslope has been captured, the autopilot will cause the airplane to fly up in an attempt to satisfy the false climb indication.

16. Upon completion of approach, or when VFR, disconnect autopilot and adjust the airplane for landing.

For Approach Control Vectors to ILS Front Course approach:

1. Use Altitude Hold or Pitch Control for altitude control.
2. Use HDG mode and Heading Bug to comply with vector instructions.
3. NAV 124 Receiver - TUNE to published localizer frequency.
4. Course Pointer - SET to published inbound localizer course.
5. Guidance Mode Selector - LOC NORM when on inbound course or when instructed to intercept localizer and deviation bar is moving towards center.
6. Autopilot - Altitude Hold for at least 20 seconds prior to glideslope intercept.
7. Heading Bug - SET to published GO AROUND heading.
8. ILS Approach - ACCOMPLISH.

ILS Approach - Back Course:

ILS Back Course Approach procedures are same as ILS Front Course Approach except:

1. Use LOC REV mode.
2. Course Pointer must be set on published Front Course inbound heading during approach.
3. Altitude Hold must be disengaged prior to initiating descent.
4. Glideslope Coupler is inoperative with Mode Selector in REV LOC mode.
5. Set Heading Bug under lubber line and use HDG mode when approximately 1/2 mile from runway to prevent "S" turn when passing over ILS transmitter.

SECTION V

PERFORMANCE

There is no change in airplane performance when this equipment is installed.

SUPPLEMENT 8

NARCO ADF 141

SECTION I

GENERAL

The purpose of this Supplement is to provide information necessary for the operation of the NARCO ADF 141. When an airplane is equipped with an ADF 141, this Supplement must be included in the Pilot's Operating Handbook.

DESCRIPTION

The NARCO ADF 141 is an airborne Automatic Direction Finder (ADF) system. The system is made up of a Receiver, an ADF 101 Indicator and a non-rotating Loop Antenna.

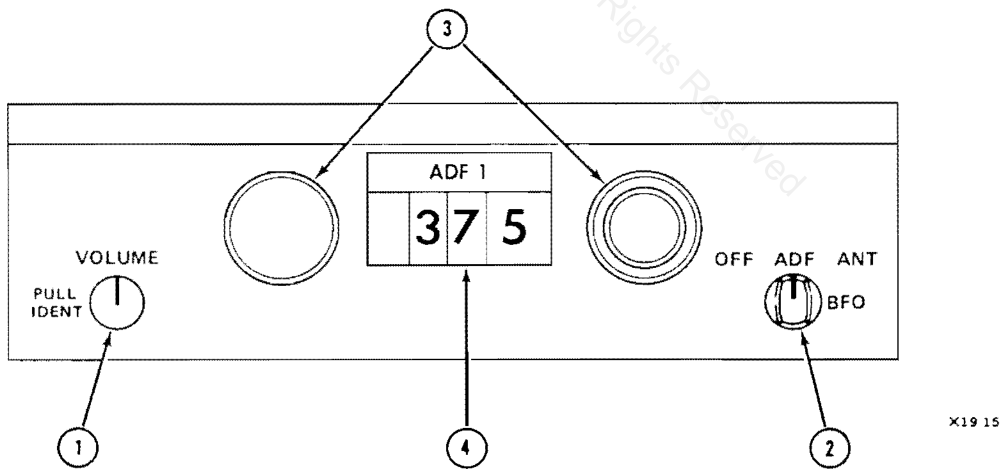
CONTROLS

ADF 141 RECEIVER

The ADF 141 Receiver is a digitally tuned, full band (200 to 1799 kHz) ADF Receiver. The receiver operates on airplane DC power.

Station frequency selection is by means of knobs located on either side of the frequency read-out window.

The Receiver has Automatic Gain Control (AGC) circuitry that holds the audio output level constant over a wide range of RF signal level.



(1) VOLUME CONTROL/PULL IDENT - This knob is used to set the volume of the audio signal. Clockwise rotation increases the volume. Pulling the knob boosts the IDENT audio above the background noise for easier station identification. Depressing the knob provides the clearest voice information. Pulling or depressing the knob does not affect the ADF function.

(2) FUNCTION SWITCH - This switch controls the power to the ADF system and allows selection of modes.

OFF - Cuts off all power to the system.

ADF - This mode is used for automatic direction finding.

ANT - ANT, or antenna mode, provides optimum intelligibility of the received identification signal. In this mode the loop signal is off, rendering the direction finding capability inoperative and the indicator needle rests at 135° ($\pm 10^{\circ}$).

BFO - The BFO mode turns on a beat frequency oscillator to generate a tone in the presence of a carrier. The BFO mode is needed to identify keyed carrier stations. The needle rests at 135° ($\pm 10^{\circ}$) in BFO mode.

On modulated CW stations tone will be continuous between IDENTS and two tones will be present during IDENT. On "CW only" stations tone will be present between IDENTS and IDENTS will be clear.

(3) FREQUENCY SELECTION KNOBS (200-1799 kHz)

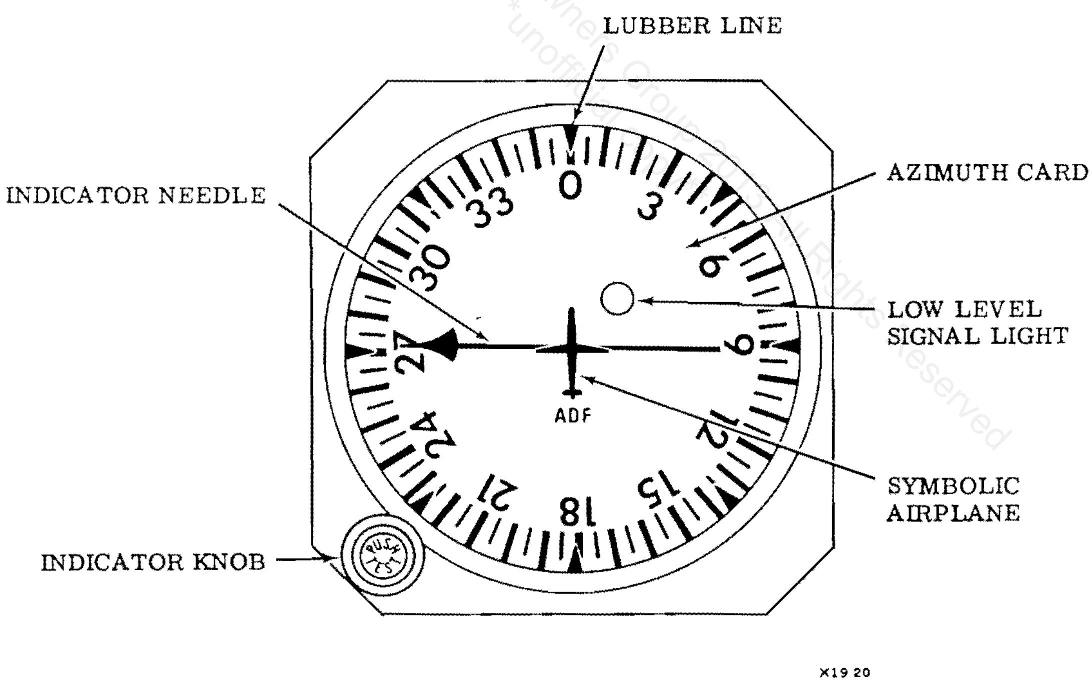
Left knob controls Hundreds digit(s) from 2 to 17 with stops at each end. The right small knob controls the Ten digit from 0 to 9 and has no stops. The right large knob controls the Units digit from 0 to 9 and has no stops.

All knobs increase numeral readout when turned clockwise and may be rotated in either direction.

(4) FREQUENCY READOUT - Displays selected frequency.

ADF 101 INDICATOR

The ADF 101 Indicator is a manually controlled indicator which displays the relative bearing to the station when the ADF 141 Receiver is tuned to a transmitting station.



CONTROL OR INDICATOR	FUNCTION
LUBBER LINE -	A fixed marker that indicates airplane heading on azimuth card.
AZIMUTH CARD -	Manually rotatable compass card, controlled by the indicator knob. Displays magnetic bearing to the station when airplane heading is manually placed under the lubber line.

CONTROL OR INDICATOR (CONTD)	FUNCTION
LOW LEVEL SIGNAL LIGHT -	A Light Emitting Diode (LED) which glows red when the signal strength being received is marginal or unusable. When the light is on, verify system is operating properly by depressing the Indicator Knob. A proper reaction is seeing the indicator needle rotate 90° CCW. When knob is released needle should return to its original position. If system is operating properly, it is a good verification that signal strength is marginal but usable. If system does not test properly it usually indicates insufficient signal strength.
SYMBOLIC AIRPLANE -	A fixed representation of the airplane. Always points to lubber line.
INDICATOR KNOB -	Controls the azimuth card and accomplishes system test. Rotating the knob sets the azimuth card to the desired heading. Depressing the Indicator Knob tests the complete Receiver and Indicator for normal operation and indicates that a reliable signal is being received. During the test function the loop is electrically rotated 90°.
INDICATOR NEEDLE -	The Indicator Needle points to the station when a usable signal is being received and Receiver is in ADF mode. With Receiver in ANT or BFO mode, the needle will point to 135° (± 10°). Needle will indicate the magnetic bearing to the station when the airplane heading is set on the azimuth card under the lubber line. If airplane heading is not set under the lubber line the needle will indicate the relative bearing from the airplane to the station.

SECTION II

LIMITATIONS

There are no changes to the airplane operating limitations when this equipment is installed.

SECTION III

EMERGENCY PROCEDURES

There are no changes to the emergency procedures when this equipment is installed.

SECTION IV

NORMAL PROCEDURES

Before Taxi

1. Radio Master Switch - ON.
2. ADF Circuit Breaker - CHECK IN.
3. ADF Receiver Function Switch - ADF.
4. Audio Control Panel - ADF.
5. ADF Receiver - TUNE to local transmitter in 200 to 1799 kHz range whose geographical position is known.
6. Indicator Needle - CHECK. Needle should point to station.
7. Indicator Knob - DEPRESS. Needle should rotate 90° CCW and return to original position when released.

In Flight

1. ADF Receiver - TUNE to desired frequency.
2. Audio Control Panel - ADF.
3. Function Switch - ADF.
4. Airplane Heading - SET under indicator lubber line to read magnetic bearing.
5. Low Level Signal Light - MONITOR.

SECTION V

PERFORMANCE

There is no change to airplane performance with this equipment installed.

SUPPLEMENT 9

NARCO AT 150 TRANSPONDER

SECTION I

GENERAL

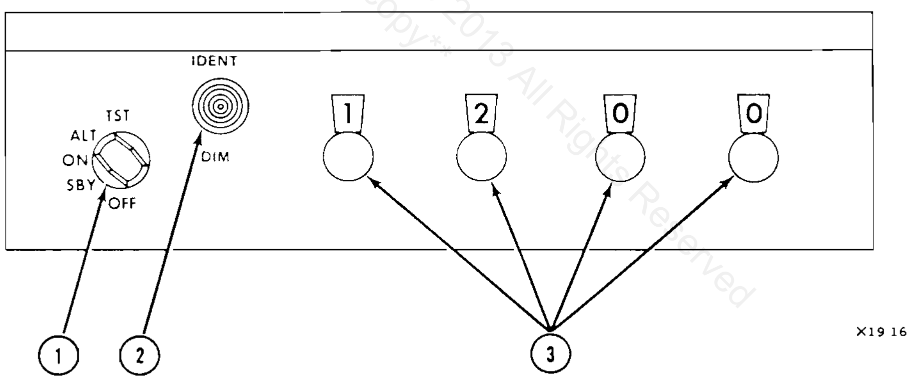
The purpose of this Supplement is to provide information necessary for the operation of the NARCO AT 150 Transponder. When an airplane is equipped with an AT 150 Transponder, this Supplement must be included in the Pilot's Operating Handbook.

DESCRIPTION

The NARCO AT 150 consists of a Receiver tuned to the frequency of a ground interrogation station (1030 MHz), logic circuitry to check the validity of the received interrogation and encode a reply containing pertinent identification information, and a transmitter which sends the coded reply to the ground station. The transponder operates on airplane DC power.

When an optional encoding altimeter is installed in the airplane, coded standard pressure altitude (29.92 In.Hg.) information will be transmitted to the ground station.

CONTROLS



(1) FUNCTION SELECTOR SWITCH - A five position rotary switch. The five positions are:

OFF - Turns off all power to the transponder.

SBY - Turns transponder power supply on and applies power to the transmitter filament. When in SBY, the transponder will not reply to any interrogation.

SBY is used at the request of the air traffic controller to selectively clear his scope of traffic. The SBY mode not only prevents the transponder from replying to interrogations, but also permits the transponder to activate the ON and ALT modes instantly.

ON - Places the transponder in Mode A, the airplane identification mode. In addition to the airplane's identification code, the transponder will also reply to altitude interrogations (Mode C) with discrete signals that do not contain altitude information.

ALT - The ALT position causes the transponder to respond to ATC (Air Traffic Control) altitude interrogations and airplane identification interrogations with standard pressure altitude (29.92 In.Hg), provided airplane is equipped with an encoding altimeter.

The ALT position may be used in airplanes that are not equipped with an encoding altimeter, however, the only response will be discrete signals that do not contain altitude information.

TST - The TST position injects a test signal into the transponder. This test signal tests all transponder circuitry involved in a Mode A reply and causes the IDENT/DIM button to come on at full brilliance. This full brilliance indicates that transponder has the capability of receiving and responding to interrogations. The TST function may be activated at any time, as it does not interfere with normal operation.

The TST position is spring-loaded and must be held in position during the test process. Upon release, it will automatically return to the ALT position.

(2) IDENT/DIM BUTTON - When the airplane comes within range of a ground station, the IDENT/DIM button will blink ON and OFF. Momentarily depressing the IDENT/DIM button will activate the SPIP (Special Position Identification Pulse) signal for approximately 20 seconds. This signal will "paint" an instantly identifiable image on the controller"s scope. This signal must be used only upon request of a "Squawk IDENT" from the controller. Use at any other time could interfere with another airplane sending a SPIP. During "IDENT" periods, the IDENT/DIM button will glow continuously. Rotating the IDENT/DIM button will control the intensity at which the button glows.

(3) CODE SELECTOR - The Code Selector consists of four, eight-position switches that provide 4096 active identification codes. The identification code to be used is directed by the traffic controller.

SECTION II

LIMITATIONS

Federal Regulations prohibit civil airplanes from transmitting on Code 0000. This code is reserved for military operations.

SECTION III

EMERGENCY PROCEDURES

1. Two-way radio communications failure.
   TRANSPONDER-SQUAWK 7700 for one minute then 7600 for next 15 minutes. Repeat procedure every 15 minutes.

2. Hijacking.
   TRANSPONDER-SQUAWK 7500.

3. All other emergencies (MAYDAY).
   TRANSPONDER-SQUAWK 7700.

SECTION IV

NORMAL PROCEDURES

Before Taxi

1. Radio Master Switch - ON.
2. Transponder Circuit Breaker - CHECK IN.
3. Function Selector Switch - SBY.
4. Code Selector Switches - SET as required.
5. Function Selector Switch - TST. Observe IDENT/DIM button for maximum brilliance. Return switch to SBY.

Before Takeoff

1. Code Selector - AS REQUIRED.
2. Function Selector Switch - AS REQUIRED.

After Landing

Place Function Selector Switch to SBY or OFF.

SECTION V

PERFORMANCE

There are no changes in the airplane performance when this equipment is installed.

SUPPLEMENT 10

NARCO DME 195

SECTION I

GENERAL

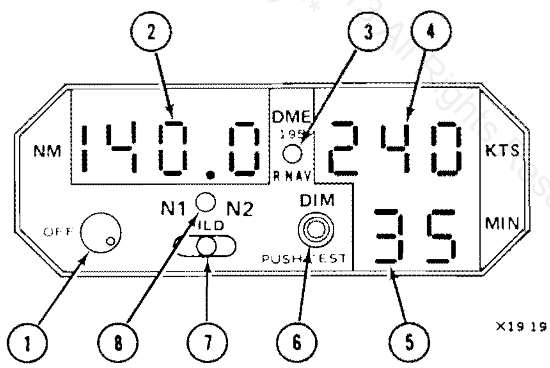
The purpose of this Supplement is to provide the information necessary for the operation of the NARCO DME 195. When an airplane is equipped with a DME 195, this Supplement must be included in the Pilot's Operating Handbook.

DESCRIPTION

The NARCO DME 195 is the airborne "interrogator" portion of a navigation system which displays continuous, accurate, direct-line distance information from a fixed ground station to the airplane in flight.

Except for selection of the operating channel, which is accomplished by the VHF navigation receiver frequency selector, the DME is capable of independent operation. The equipment consists of a panel-mounted control unit which contains all of the operating controls and displays, a remotely mounted receiver-transmitter and an antenna. The receiver-transmitter transmits interrogating pulse pairs on 200 channels between 1041 MHz and 1150 MHz; it receives associated ground-to-air replies between 978 MHz and 1213 MHz. The control unit digitally displays distances up to 200 NM, ground speed up to 400 knots and time-to-station up to 89 minutes.

DME INDICATOR AND CONTROLS



1 OFF/ON, IDENT Volume Control - This knob turns the unit ON or OFF. Rotating knob fully counter-clockwise turns unit OFF. Knob also adjusts identification volume. Clockwise rotation increases volume.

2 DISTANCE DISPLAY - Displays slant range distance from ground station to airplane from 0 to 199.9 NM. Displays horizontal bars when DME is not locked on a station.

3 RNAV INDICATOR LIGHT - This lamp is lit whenever the DME is used in conjunction with the NARCO R-NAV system and is displaying RNAV distance (distance to waypoint). When this lamp is lighted, only distance to waypoint is displayed, and only the RNAV receiver will channel the DME, regardless of position of Nav Receiver Selector Switch.

4 VELOCITY DISPLAY - Displays velocity from 10 to 400 knots. Velocity is accurate only when airplane is flying directly to or from the DME station. Display is extinguished when DME is not locked on or Distance Display is reading RNAV distance to waypoint.

5 TIME DISPLAY - Displays time TO or FROM a station from 0 to 89 minutes. Display is accurate only when airplane is flying directly TO or FROM the DME station. Display is extinguished when the DME is not locked on, when it is displaying the RNAV distance or when the computed time is in excess of 89 minutes.

6 DIM/PUSH-TO-TEST SWITCH - This knob controls the brightness of all digits and advisory lamps, as well as N1/N2 lamps.

Depressing the switch conducts a test of all digits in the indicator. With DME ON and switch depressed, distance display should read 188.8, velocity display should read 888 and time display should read 88.

7 NAV RECEIVER SELECTOR SWITCH - A 3-position toggle switch which selects NAV receiver to be used to channel the DME. A light illuminates N1 or N2 for night operation.

The HLD (hold) position will hold the channel last tuned by either NAV 1 or NAV 2. Place the selector switch to the desired NAV position and then into HLD. The unit will continue to display the DME information from the last channel tuned just prior to selecting the HLD position, but the NAV receiver may be tuned to another frequency, such as an ILS. When in HLD the yellow annunciator light is illuminated as an advisory.

NOTE

If DME is switched OFF when Nav Selector is in HLD, the channel will be indeterminate when DME is turned on. Select N1 or N2 as desired to set channel.

8 HOLD ANNUNCIATOR - Illuminates as an advisory when DME is in HLD.

SECTION II

LIMITATIONS

There are no changes to the airplane operating limitations when this equipment is installed.

SECTION III

EMERGENCY PROCEDURES

There are no changes to the emergency procedures when this equipment is installed.

SECTION IV

NORMAL PROCEDURES

Before Taxi

1. Radio Master Switch - ON.
2. DME Circuit Breaker - CHECK IN.
3. OFF/ON Switch - ON.
4. Dim/Push-to-Test Switch - PUSH. Observe:
   a. NM Display - 188.8.
   b. KTS Display - 888.
   c. MIN Display - 88.

In Flight

1. OFF/ON Switch - ON.
2. N1/N2 Switch - SET to NAV receiver to be used.

NOTE

Always verify station identification before relying on signal.

4. DME Display - MONITOR as required.

CAUTION

DME may unlock due to loss of signal with certain combinations of distance from station, altitude and airplane attitude.

SECTION V

PERFORMANCE

There are no changes to the airplane performance when this equipment is installed.

ENCLOSED VERTICAL STABILIZER BEACON

This supplement must be attached to the FAA approved Commander 114 Pilot's Operating Handbook and Airplane Flight Manual when an enclosed vertical stabilizer beacon has been installed.

The information contained herein supplements or supersedes the information of the basic Pilot's Operating Handbook and Airplane Flight Manual only in those areas listed. For Limitations, Procedures and Performance data not contained in this supplement, consult the basic Pilot's Operating Handbook and Airplane Flight Manual.

SECTION 1, GENERAL

The purpose of this Pilot's Operating Handbook Supplement is to provide additional information appropriate to the Model 114 when the vertical stabilizer mounted beacon is enclosed by a clear faring.

NOTE
The three position strobe lights, originally an optional installation, must be installed if the enclosed vertical stabilizer beacon is to be installed.

SECTION 2, LIMITATIONS

KINDS OF OPERATION LIMITS

INSTRUMENT, SYSTEM, OR EQUIPMENT	KINDS OF OPERATION		
	DAY	NIGHT	IFR
* Light(s), anti-collision; (Three Position Strobes)	- -	X	- -
* Light; Beacon	- -	- -	- -

* NOTE: The beacon strobe is a supplemental light only and does not meet the field of coverage requirements of an anti-collision light alone. Only the three position anti-collision strobes are qualified as anti-collision lights under Part 91 Night Operations.

PLACARDS

The following information must be displayed in the form of a placard:

Below the beacon switch:

**SEE POH FOR INFORMATION
ON BCN USAGE**

P/N POHSUP-114-11

The Stobe Light switch must be re-placarded:

ANTI COLL (S/N 14000 thru 14149) **ANTI COL** (S/N 14150 thru 14500)

The Anti-Collision Light Switch must be re-placarded:

BCN

SECTION 3, EMERGENCY PROCEDURES

No change from basic Pilot's Operating Handbook.

SECTION 4, NORMAL PROCEDURES

No change from basic Pilot's Operating Handbook.

SECTION 5, PERFORMANCE

No change in airplane performance except for a small increase in speed due to reduction of drag.

SECTION 6, WEIGHT & BALANCE/EQUIPMENT LIST

No change from basic Pilot's Operating Handbook.

Approved:

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