Rockwell Commander

114A

PILOTS
OPERATING HANDBOOK

ISSUED 19 JANUARY 1979

MANUFACTURERS SERIAL NO. 14506

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

A.C. Jackson
DEL OP PC-203

Rockwell International

General Aviation Division
5001 North Rockwell Avenue
Bethany, Oklahoma 73008

P/N M114002-1

LIST OF EFFECTIVE PAGES

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Revision 1	2/23/79
Revision 2	4/30/79
Revision 3	10/23/81
Revision 4	6/21/83

FAA Approved: 21 June 1983

A.C. Jackson
Delegation Option PC-203

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Revision 1	2/23/79
Revision 2	4/30/79
Revision 3	10/23/81

FAA Approved: 23 October 1981

D.C. Jackson
Delegation Option PC-203

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FAA Approved: 19 January 1979

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SECTION I

GENERAL

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INTRODUCTION

This handbook must be read carefully by the owner and operator in order to become familiar with the operation of the Rockwell Commander 114A. 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 contains the information necessary for safe and efficient operation of the Rockwell Commander 114A. 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 Rockwell Commander 114A's are equipped with a variety 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 Sections I thru VIII of 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 date of that revision. Upon receipt of revised pages from Rockwell International, the revised pages must be inserted in the handbook and the obsolete 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 114A.

AIRPLANE DIMENSIONS

See Figure 1-1.

DESCRIPTIVE DATA

ENGINE

One Lycoming IO-540-T4B5D

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, three-blade McCauley propeller, Model Number B3D 34C 405/90DFA-13. Diameter: 77 inches maximum, 76 inches minimum. Pitch Range: $11.5^{o}(\pm 0.2^{o})$ (low pitch) 33.0^{o} ($\pm$ 0.5^{o}) (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)

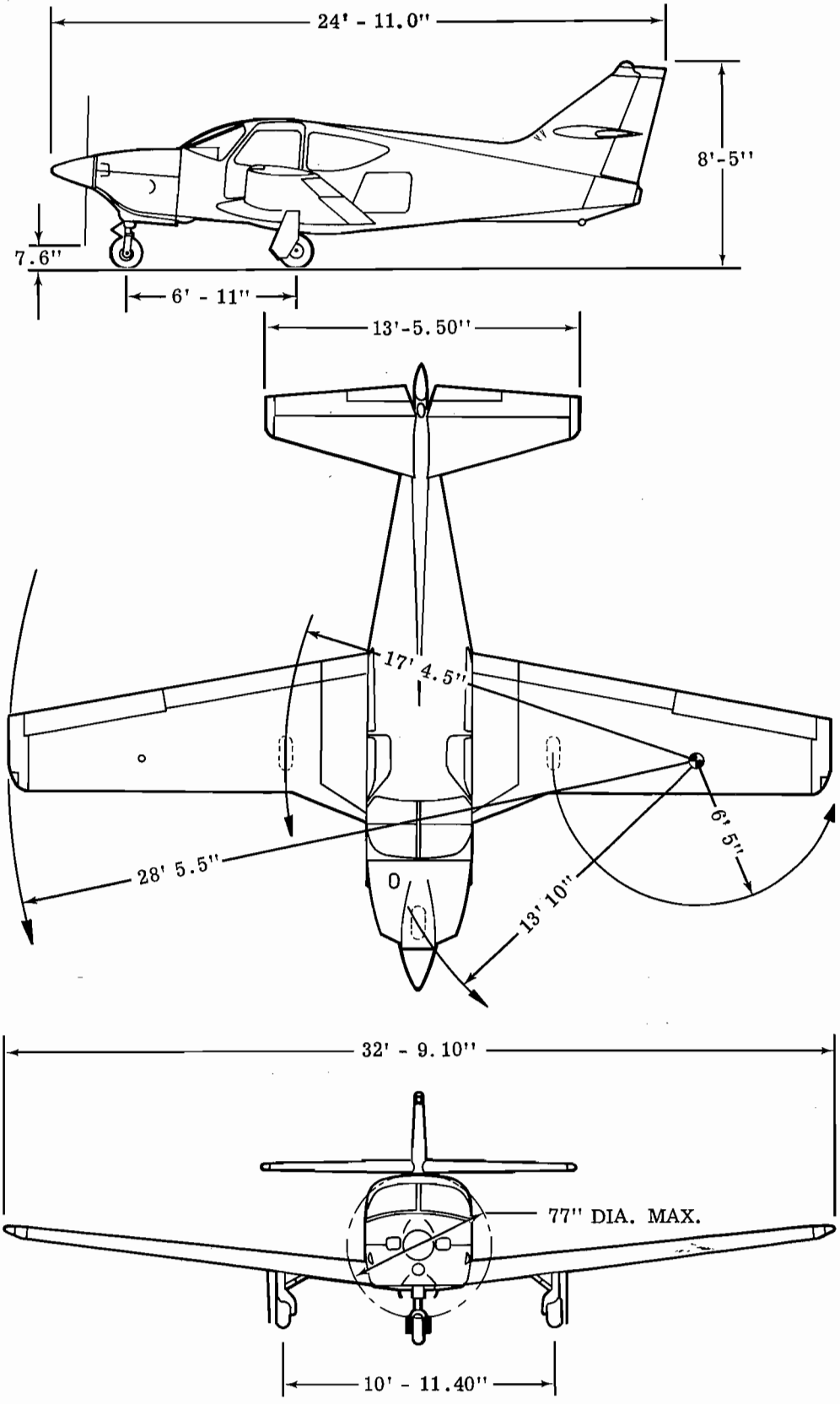

Figure 1-1. Airplane Dimensions

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

Maximum Ramp Weight	3260 lbs.
Maximum Takeoff Weight	3250 lbs.
Maximum Landing Weight	3140 lbs.
Maximum Weight in Baggage Compartment	200 lbs.
Maximum Zero Fuel Weight	2852 lbs. from 24.7 % MAC to 31.5 % MAC 2250 lbs. at 12 % MAC varying linearly to 2852 lbs. at 24.7 % MAC.

MINIMUM CERTIFICATED WEIGHTS

Minimum Weight
2095 lbs at 12.00% MAC to
2100 lbs at 14.70% MAC to
2338 lbs at 26.00% MAC to
2575 lbs at 31.50% MAC.

NOTE

Straight line variation between points.

STANDARD AIRPLANE WEIGHTS

Standard Empty Weight	2074 lbs.
Standard Useful Load	1186 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	Compartment Volume:	22 cu.ft.
	40 in. Rear	Minimum Entry Width:	21 in.
Compartment Length:	28 in.	Minimum Entry Height:	18 in.
Compartment Height:	36 in.		

SPECIFIC LOADINGS

Wing Loading: 21.4 lbs./sq.ft.

Power Loading: 12.5 lbs./hp.

SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

GENERAL AIRSPEED TERMINOLOGY AND SYMBOLS

CAS	Calibrated Airspeed means the indicated speed of an airplane, 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 airplane 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.
KTAS	True Airspeed expressed in "Knots".
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 airplane 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}	Never Exceed Speed is the speed limit that may not be exceeded at any time.
V_{NO}	Maximum Structural Cruising Speed 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 airplane 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 -1.98°C (-3.566°F) per 1000 feet 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 scheduled 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	A 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.
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.

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.

CONVERSION FACTORS

MULTIPLY	By	TO OBTAIN
centimeters	0.3937	inches
feet	0.3048	meters
inches	25.40	millimeters
meters	3.2808	feet
meters	39.37	inches
kilometers	0.6214	statute miles
kilometers	0.53996	nautical miles
statute miles	1.6094	kilometers
statute miles	0.8690	nautical miles
gallons	3.785	liters
liters	0.2642	gallons
quarts (liquid)	0.9463	liters
liters	1.057	quarts (liquid)
kilograms	2.205	pounds
pounds	0.45359	kilograms

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 # A12SO.

For limitations associated with optional systems or equipment, see Section IX (Supplements).

AIRSPEED LIMITATIONS

SPEED	KCAS	KIAS	REMARKS
Maneuvering V_A	118 (3250 lbs) 109 (2658 lbs) 95 (2023 lbs)	118 109 95	Do not make full or abrupt control movements above this speed.

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°)	150 122 112	Do not exceed this speed with a given flap setting.
Maximum Landing Gear Operating V_{LO}	130	130	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)	187 176 161 147	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)	148 139 128 117	Do not exceed this speed except in smooth air and then only with caution.
Maximum Side Window Open	130	130	Do not exceed this speed with the side window open.
*Straight Line Variation between points.			

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

AIRSPEED INDICATOR MARKINGS

MARKING	KCAS	KIAS	SIGNIFICANCE
White Arc	53-109	54-112	Full Flap Operating Range. Lower limit is maximum landing weight zero thrust stall speed in landing configuration. Upper limit is maximum speed allowable with flaps fully extended.
Green Arc	60-148	59-148	Normal Operating Range. Lower limit is maximum weight zero thrust stall speed with flaps and landing gear retracted. Upper limit is maximum structural cruising speed.
Yellow Arc	148-186	148-187	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-T4B5D

Engine Operating Limits for Takeoff and Continuous Operations:

Maximum BHP	-	260	Maximum Oil Pressure	-	100 PSI
Maximum RPM	-	2700	Minimum Fuel Injector Inlet Pressure	-	14 PSI
Maximum Cylinder Head Temp.	-	500°F	Maximum Fuel Injector Inlet Pressure	-	45 PSI
Maximum Oil Temperature	-	245°F	Maximum Fuel Nozzle Pressure	-	9.5 PSI
Minimum Oil Pressure	-	25 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)	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.
Maximum certified alternator capacity - 60 amperes.

SEATS

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

WEIGHT LIMITS

Maximum Ramp Weight	3260 lbs.
Maximum Takeoff Weight	3250 lbs.
Maximum Landing Weight	3140 lbs.
Maximum Weight in Baggage Compartment	200 lbs.

Maximum Zero Fuel Weight

3000 lbs. from 106.83 inches (24.9% MAC) to 110.50 inches (31.5% MAC)
2450 lbs. at 100.48 inches (13.3% MAC) varying linearly to
3000 lbs. at 106.83 inches (24.9% MAC)

Minimum Weight

2095 lbs. at 99.75 inches (12.0 % MAC) to
2100 lbs. at 101.24 inches (14.7 % MAC) to
2338 lbs. at 107.46 inches (26.0 % MAC) to
2575 lbs. at 110.50 inches (31.5 % MAC)

NOTE

Straight line variation between points.

Issued: 19 January 1979
Revised: 23 October 1981

CENTER OF GRAVITY LIMITS

Forward: 106.97 inches Aft of Datum (25.1 % MAC) at 3260 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 3260 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.

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.

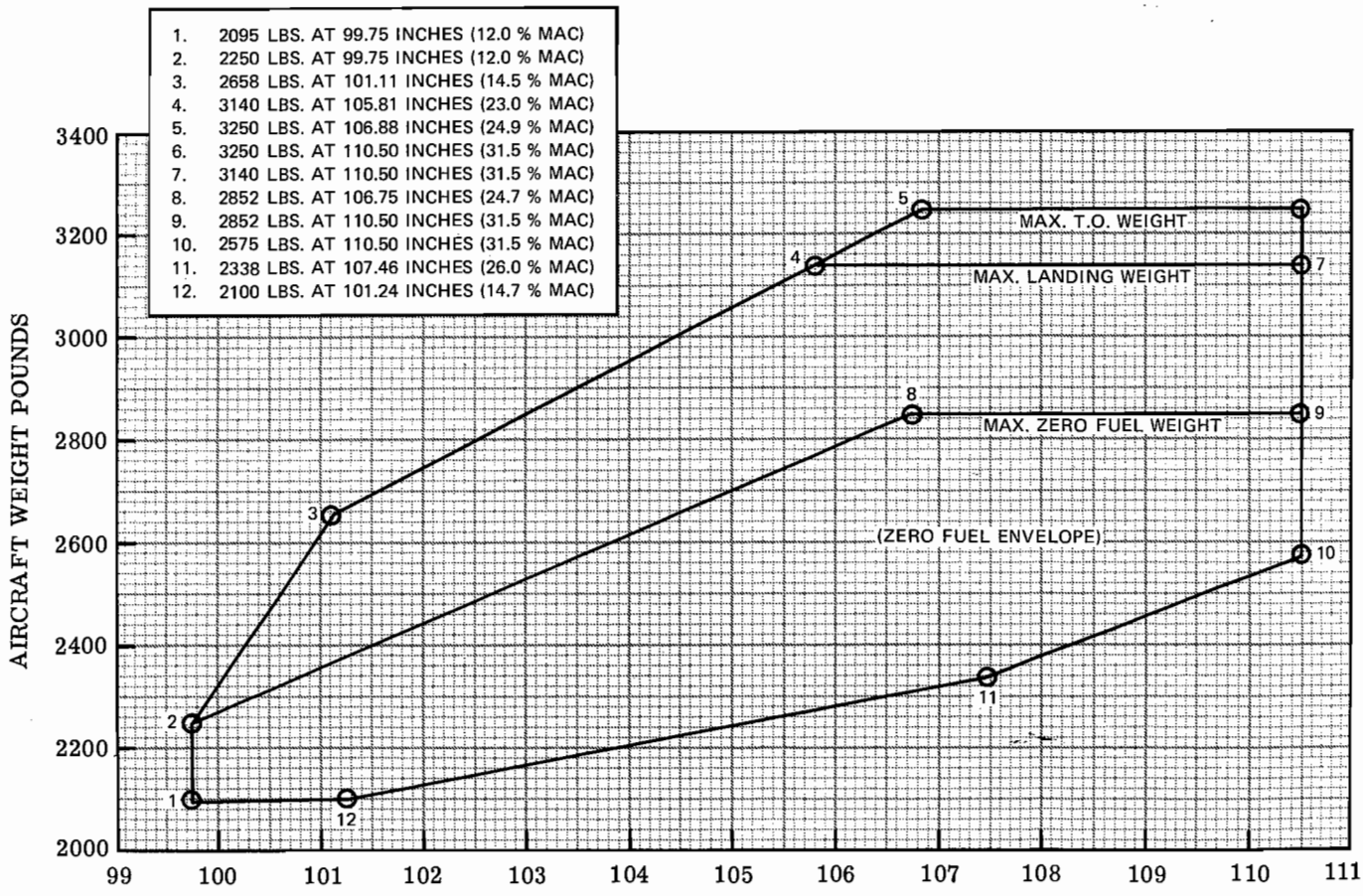

Figure 2-4. Flight Envelope

MANEUVER LIMITS

This airplane is certified in the Normal Category. The following maneuvers are either authorized or unauthorized as indicated.

AUTHORIZED MANEUVERS

Maneuver	Recommended Entry Speeds (KCAS)
Lazy Eights (Angle of Bank Not to Exceed 60°.)	118 Knots at 3250 lbs. 109 Knots at 2658 lbs. 95 Knots at 2023 lbs.
Chandelles (Angle of Bank Not to Exceed 60°.)	118 Knots at 3250 lbs. 109 Knots at 2658 lbs. 95 Knots at 2023 lbs.
Steep Turns (Angle of Bank Not to Exceed 60°.)	118 Knots at 3250 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.

LIMIT MANEUVERING LOAD FACTORS

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

TYPES OF OPERATION

This airplane 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 airplane 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 airplane. 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

MANEUVERING SPEED (3250 LBS)	118 KCAS
MAX GEAR OPERATING SPEED	130 KCAS
MAX SPEED 20° FLAP	150 KCAS
MAX SPEED 25° FLAP	120 KCAS

Near Airspeed Indicator

+ HEADREST TO BE IN PLACE DURING TAKEOFF & LANDING +

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

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

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

34 GAL. USEABLE EACH TANK

USE BOTH FOR T.O. & LANDING

Center Console at Fuel Selector

FLAPS
USE 10° TO 20° FOR TAKEOFF

Under Flap Indicator

MAXIMUM SPEED-
WINDOW
OPEN 130K

Near Vent Window

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

SECTION III

EMERGENCY PROCEDURES

TABLE OF CONTENTS

INTRODUCTION

Emergencies caused by airplane or engine malfunctions are 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 refer-

ence. 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 176 - 16,000 Ft 161 - 20,000 Ft 147 - 24,000 Ft	Gear Down, Flaps Up
Power Off Glide (Best Glide Angle)	86 - 3250 Lbs ** 76 - 2600 Lbs 66 - 2023 Lbs	Gear Up, Flaps Up Cowl Flaps Closed
Power Off Approach	73 * - 88	Gear Down, Flaps 35°
Extreme Turbulence Encounter	118 - 3250 Lbs ** 109 - 2658 Lbs 95 - 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 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.
6. Fire Extinguisher (if available) - DISCHARGE as required.

WARNING

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

ELECTRICAL FIRE ON THE GROUND

1. BAT-ALT Master Switch - OFF.
2. Mixture - IDLE CUTOFF.

3. Fuel Selector - OFF.
4. Fire Extinguisher (if available) - DISCHARGE.

WARNING

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

ENGINE FAILURE

DURING TAKEOFF ROLL

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

IN FLIGHT

1. Airspeed - 86 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 - 86 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 - 86 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 - ON.
9. Transponder - 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 - 73 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 - 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 - 73 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 - 73 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 - 73 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 - 73 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 - 73 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 - 76 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 - 86 KIAS.
2. Mixture - IDLE CUTOFF.
3. Ignition Switch - OFF.
4. Fuel Selector - OFF.
5. Flaps - UP.
6. Cowl Flaps - CLOSED.
7. Emergency Locator Transmitter - ON.
8. Transponder - 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 - 76 KIAS MINIMUM.

Touchdown and Slide

14. Elevator Control - FULL AFT.

DITCHING

NOTE

The airplane has not been flight tested in an actual ditching. The procedure recommended below is based on the best judgment of General Aviation Division, Rockwell International.

Approach

1. Airspeed - 86 KIAS.
2. Transponder - 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 - 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 - 76 KIAS MINIMUM.
13. Landing Gear - RETRACTED.
14. Propeller - HIGH RPM.

Touchdown

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

SMOKE AND FIRE

FIRE DURING TAKEOFF

1. Throttle - IDLE.
2. Brakes - APPLY.
3. Flaps - RETRACT.
4. Mixture - IDLE CUTOFF.
5. Fuel Selector - OFF.
6. Master Switch - OFF.
7. Fire Extinguisher (if available) - 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 available) - 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 available) - 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 130 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.

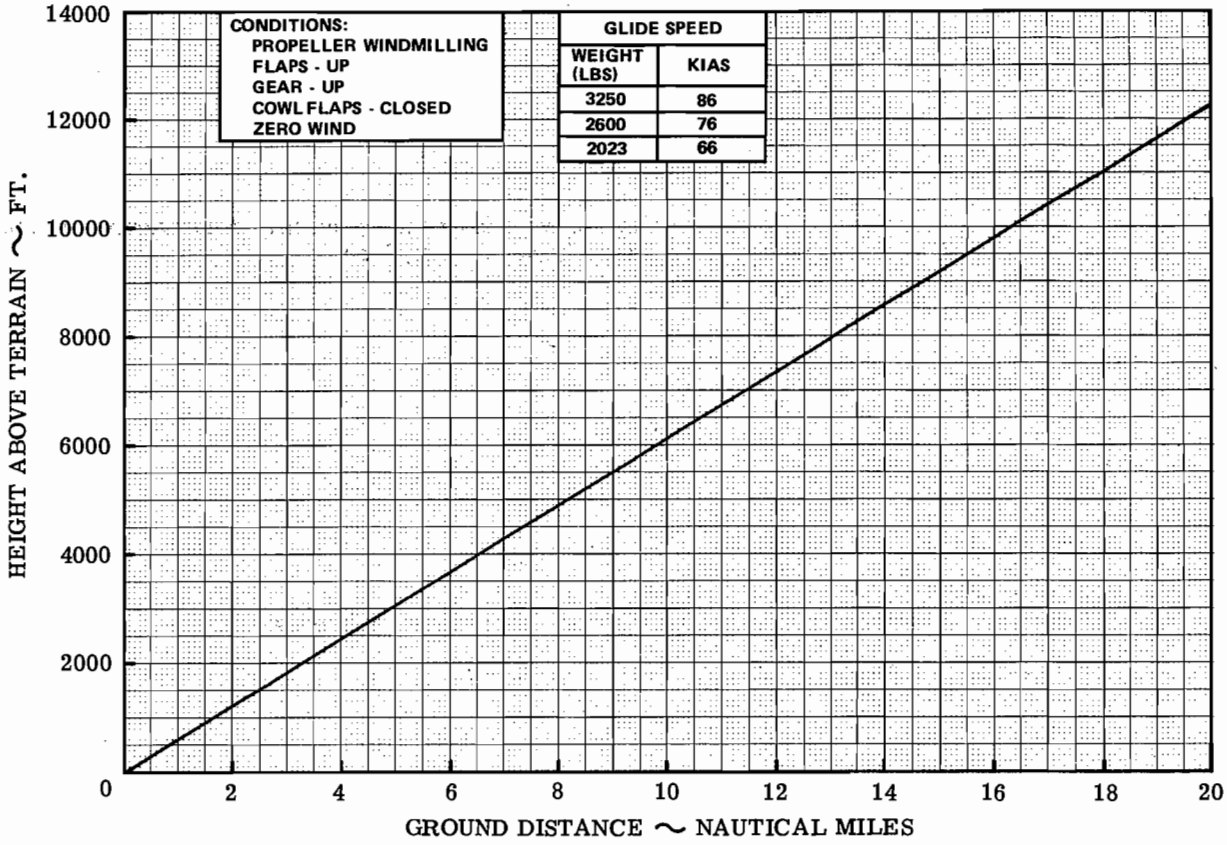

Figure 3-2. Maximum Gliding Distance

FAILURE TO EXTEND

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

If an unsafe indication persists, proceed as follows:

4. Landing Gear Switch - DOWN.
5. Throttle - MINIMIZE POWER.
6. Airspeed - 82 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.

BATTERY DISCHARGE INDICATED BY AMMETER

1. All Non-essential Electrical Equipment - OFF.
2. Voltmeter - CHECK between 12 and 14 volts.
3. Ammeter - CHECK.
   If ammeter now shows CHARGE, alternator is back on line. Turn on electrical equipment as required.
   If ammeter continues to show discharge:
4. ALT Switch - CYCLE OFF and back ON.

NOTE

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

5. Voltmeter - CHECK 12 to 14 volts.
6. Ammeter - CHECK for CHARGE indication.
   If ammeter shows CHARGE, turn on electrical equipment as required.
   If ammeter shows DISCHARGE, place alternator switch OFF, reduce electrical load to minimum for flight, and land as soon as practical.

NOTE

Excessive load on alternator, or alternator failure, will indicate ammeter on discharge side and a continuous reduction in voltage on the voltmeter.

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.

RADIO MASTER SWITCH/CIRCUIT BREAKERS TRIPPED

NOTE

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

1. Radio Master Switch - ON.

If unable to keep it in the ON position:

2. All Individual Radio Switches - OFF.
3. Radio Master Switch - ON.

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

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

NOTE

When the radio at fault is turned on, the Radio Master Switch may open again.

5. Faulty Radio Switch - OFF (leave off).
6. Repeat Steps 3. and 4. until all radios (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 and land as soon as practical.

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

Induction air system icing is possible. Should induction system 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

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

AIR PIRACY

1. Transponder - 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 checks that should be made 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 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 steadly 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. Electrical load should be 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 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/Extension 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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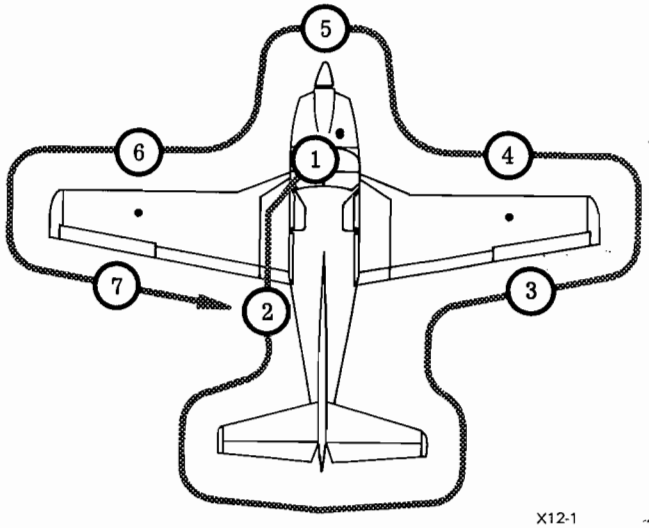


Figure 4-1. Pre-Flight Inspection Stations

NORMAL PROCEDURES CHECKLIST

PRE-FLIGHT INSPECTION

WARNING

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

(1) INTERIOR

1. Controls Lock - REMOVE.
2. Parking Brake - SET.
3. Airplane Documents - REVIEW.
4. Ignition Switch - OFF.
5. Static Source - NORMAL.
6. Landing Gear Position Switch - DOWN.
7. All Circuit Breakers - SET.
8. All Switches - OFF or NORMAL.
9. Master Switch - ON.
10. Fuel Quantity Gages - CHECK.

NOTE

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

11. Landing Gear Position Lights - CHECK/SAFE.
12. Fuel Selector - BOTH.
13. Elevator Trim Tab - NEUTRAL.
14. Oxygen (if installed) - CHECK QUANTITY and AVAILABILITY OF MASKS.

NOTE

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

(2) LEFT SIDE OF FUSELAGE AND EMPENNAGE

1. Baggage Door - CLOSED and LOCKED.
2. Side of Fuselage - INSPECT.
3. Static Port - UNOBSTRUCTED.
4. Horizontal Stabilizer and Elevator - INSPECT.
5. Elevator - CHECK for freedom of movement.
6. Elevator Trim Tab - CHECK for excessive free play, security, condition, and neutral position.
7. Rudder Gust Lock (if installed) - REMOVE.
8. Vertical Stabilizer and Rudder - INSPECT.
9. Rudder - CHECK for freedom of movement.
10. Navigation Light - CHECK.
11. Flashing Beacon - CHECK condition.

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

1. Side of Fuselage - INSPECT.
2. Static Port - UNOBSTRUCTED.
3. Wing Flap - INSPECT.
4. Aileron - CHECK for security and freedom of movement.
5. Wing Tip - INSPECT.
6. Navigation Light - CHECK.

(4) RIGHT WING LEADING EDGE

1. Wing Leading Edge - CHECK condition.
2. Fuel Vent - UNOBSTRUCTED.
3. 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.

4. Fuel Filler Cap - SECURE.
5. Wing Tie-down - REMOVE.
6. Fuel Tank Sump - DRAIN SAMPLE. Check valve closed.
7. Right Main Gear and Wheel Weel - INSPECT. Remove chock.
8. Main Gear Tire - CHECK inflation and wear.
9. Squat Switch - INSPECT.
10. Landing Gear Limit Switches (2) - CHECK condition.
11. Wheel Well Fuel Drain - DRAIN SAMPLE. Check valve closed.

(5) ENGINE SECTION

1. Fuel Gascolator - DRAIN SAMPLE. Check valve closed.
2. Engine Accessory Section - INSPECT.
3. Cowl Fasteners - SECURED.
4. Oil Cooler Inlet - UNOBSTRUCTED.
5. Lower Cowl and Cowl Flap - INSPECT and SECURE.
6. Nose Gear Assembly and Strut - CHECK condition and proper inflation.
7. Nose Gear Tire - CHECK proper inflation and wear.
8. Landing Gear Limit Switches (2) - CHECK condition.
9. Engine Inlets - UNOBSTRUCTED.
10. Propeller and Spinner - INSPECT.
11. Oil Quantity - CHECK, minimum 6 quarts.

(6) LEFT WING LEADING EDGE

1. Left Main Gear and Wheel Well - INSPECT. Remove chock.
2. Wheel Well Fuel Drain - DRAIN SAMPLE. Check valve closed.
3. Landing Gear Limit Switches (2) - CHECK condition.
4. Fuel Tank Sump - DRAIN SAMPLE. Check valve closed.
5. 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.

6. Fuel Filler Cap - SECURE.
7. Wing Leading Edge - CHECK condition.
8. 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.

9. Wing Tie-down - REMOVE.
10. 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.

11. Fuel Vent - UNOBSTRUCTED.
12. Wing Tip - INSPECT.

(7) LEFT WING TRAILING EDGE

1. Navigation Light - CHECK.
2. Aileron - CHECK security and freedom of movement.
3. 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. Circuit Breakers - CHECK and SET.
5. Radio Master Switch - OFF.

CAUTION

Failure to keep radio master switch OFF during engine start may cause damage to radio equipment.

6. All Electrical Equipment - OFF.
7. Landing Gear Position Switch - DOWN.
8. Cowl Flaps - FULL OPEN.
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 second periods 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 second periods. 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. Anti-Col Lights - ON.

CAUTION

If the engine is started with the anti-collision lights ON, it may be necessary to cycle the switch to reestablish the flashing mode.

2. Strobe Lights - OFF.
3. Radio Master Switch - ON.
4. Instruments and Radios - SET.
5. 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 - 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 - CLOSED and LATCHED.
16. Parking Brake - RELEASE.
17. Strobe Lights - ON after taking runway.

OPERATION		KIAS	CONFIGURATION
Maximum Performance Takeoffs:	Short Field	Initial Climb 72* MINIMUM	Gear DOWN, Flaps - 20°
	Soft Field	Initial Climb 72* MINIMUM	Gear DOWN, Flaps - 20°
Maximum Performance Landings:	Short Field	Approach 73* MINIMUM	Gear DOWN, Flaps - 35°
	Soft Field	Approach 73* MINIMUM	Gear DOWN, Flaps - 35°
Best Rate-of-Climb V_y		94 - S.L. ** 91 - 5000 Ft. 88 - 10,000 Ft.	Gear UP, Flaps UP
Best Angle of Climb V_x		76 - S.L. ** 78 - 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.

NORMAL TAKEOFF

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

NOTE

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

5. 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.

6. Elevator Control - SLIGHTLY AFT OF NEUTRAL.
7. Rotate - 70 KIAS.
8. Climb Speed - 73 KIAS.
9. Landing Gear - RETRACT, when safely airborne.
10. Wing Flaps - RETRACT after obstacle clearance is assured.

WARNING

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

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.
4. Aileron Control - FULL AILERON, in the direction of the crosswind. Reduce aileron deflection as speed is increased.
6. Elevator Control - SLIGHTLY FORWARD OF NEUTRAL.
7. Rotate - 76 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 - 81 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 - 69 KIAS.
9. Climb Speed - 72 KIAS
10. Landing Gear - RETRACT, when safely airborne.
11. Wing Flaps - RETRACT when obstacles are safely cleared and airspeed has increased to 81 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 - 72 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 - 72 KIAS.
8. Landing Gear - RETRACT, when safely airborne.
9. Wing Flaps - RETRACT when obstacles are safely cleared and airspeed has increased to 81 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 - 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 - 94 KIAS at SEA LEVEL and 81 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. Lean to BEST POWER above 8000 FT.
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 - 70 KIAS MINIMUM.
5. Cowl Flaps - OPEN.

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

6. Airspeed - 81 KIAS.
7. Flaps - RETRACT.

NORMAL LANDING

1. Propeller Control - FULL FORWARD.
2. Power - AS REQUIRED.
3. Flaps - 35 DEGREES.
4. Airspeed - 81 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 - 73 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 - 73 KIAS.
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 - 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, engine powers, altitudes and temperatures. Examples of the use of each graph is shown on the graph.

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 Humidity, Runway Slope or Wet Runway.

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 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	125 DEG (MAG)/14 KT
Runway Direction	170 DEG (MAG)
Airplane Ramp Weight	2860 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 10 LB. Therefore; Airplane Takeoff Weight	2850 LB

TAKEOFF

From Figure 5-8, using 14 KT wind at 45 DEG from left of runway	
Headwind Component	10 KT
From Figure 5-9	
Ground Roll Distance	930 FT
From Figure 5-10 for 20 DEG Flaps: Short Field Takeoff	
Lift-Off Speed	66 KIAS
50-FT Height Speed	69 KIAS
From Figure 5-10	
Takeoff Distance to 50 FT	1540 FT

* The airport tower, flight service stations, and National Weather Service normally give surface temperatures in DEG F.

FLIGHT PLANNING (CONTD)

CLIMB

A climb at Maximum Continuous Power is assumed; Enter Figure 5-12* 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 5-8, 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:

$$\text{Distance} = 7.0\ \text{NM} - \left[\left(5\ \frac{\text{NM}}{\text{HR}}\right) \times \left(\frac{4.3\ \text{MIN}}{60\ \text{MIN/HR}}\right)\right] = 6.6\ \text{NM (Round off to 7 NM)}$$

Weight at level off (including 10 LB start and taxi allowance) is 2841 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 2750 LB, determine the Cruise True Airspeed from Figure 5-22.

Cruise True Airspeed = 133 KTAS.

To determine Level Flight Cruise performance use the Cruise Power Setting Charts, Figures 5-15 and 5-16, 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 . . . . . 20.0 IN. HG.

The distance to Houston from level off is 351 NM less the climb distance of 7 NM or 344 NM. Enter Figure 5-8 using a wind velocity of 15 KT from 230 DEG, 70 DEG to right of true course and read:
Headwind Component . . . . . 5 KT

* Figure 5-12 is presented for 3250 LBS. Therefore, the actual time, distance, and fuel used in climb will be slightly less.

FLIGHT PLANNING (CONTD)

CRUISE (Continued)

Compute the ground speed as true airspeed minus the wind or (133 KTAS - 5 KT) = 128 KTAS. Time and fuel can be computed as:

Time = 344/128 = 2.69 HR *
Fuel = 11.2 x 2.69 = 30.1 U.S. GAL (180.6 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 5-26 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	0.4 NM	equals	13.5 NM
Fuel	0.85 U.S.Gal	minus	0.03 U.S.Gal	equals	0.82 U.S. Gal (4.9 LB)

The distance in descent with the wind is:

$$\text{Distance} = 13.5\ \text{NM} - \left[\left(5\ \frac{\text{NM}}{\text{HR}}\right) \times \left(\frac{4.8\ \text{MIN}}{60\ \text{MIN/HR}}\right)\right] = 13.1\ \text{NM}$$

The distance from Houston to begin letdown point is 13 NM.

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

Time = (344 -13)/128 = 2.586 HR = 2 HR 35 MIN
Fuel = 11.2 x 2.586 = 29.0 U.S. GAL (173.8 LB)

LANDING

The weight at touchdown is:

Weight = 2860 LB -10 LB -8.4 LB -173.8 LB -4.9 LB = 2662.9 LB.

The landing performance can be obtained from Figure 5-27. It should be noted that the data in this figure is presented for 3140 LB only.

To get the landing distance, first enter Figure 5-8 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 5-27
Final Approach Speed . . . . . 73 KIAS
Landing Ground Roll . . . . . 790 FT
and From Figure 5-28
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	--	--	--	--	0:10/0:10	60	10./10.	2860
TAKEOFF (OKC)	1540 FT	--	+10	--	0:00/0:10	0	0./10.	2850
CLIMB	7 NM	105	+ 5	100	0:04/0:14	126	8.4/18.4	2850
CRUISE	331 NM	133	+ 5	128	2:35/2:49	70	180.8/199.2	2842
DESCENT	13 NM	156	+ 5	151	0:05/2:54	59	4.9/204.1	2668
LANDING (HOU)	1322 FT	--	- 2	--	0:00/2:54	--	0./204.1	2663

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

THROTTLE CLOSED STALL SPEEDS

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

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	3250 LB
	Configuration	CRUISE (Gear: Retracted, Flaps: 0 Deg.)
	Bank Angle	0 DEG
FIND:	Stall Speed Fig. 5-1	61 KCAS

THROTTLE CLOSED STALL SPEEDS - CALIBRATED AIRSPEED, KNOTS

ANGLE OF BANK ~ DEGREES	GROSS WEIGHT 3250 LB (MOST FWD C.G.)					GROSS WEIGHT 2250 LB (MOST FWD C.G.)				
	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	61	64	61	59	56	57	57	55	53	51
15	62	65	62	60	57	58	58	56	54	52
30	66	69	66	63	60	61	62	59	57	55
45	73	76	73	70	66	68	68	66	63	61
60	87	90	86	83	79	80	81	78	75	72

Figure 5-1.

* The effects of cowl flap position on stall speeds is negligible.

AIRSPEED CALIBRATION (PRIMARY STATIC SOURCE)(TAKEOFF CONFIGURATION)

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

ASSOCIATED CONDITIONS

Power	SUFFICIENT FOR LEVEL FLIGHT (Nominal)
Configuration	TAKEOFF
Wing Flaps	10 or 20 DEG
Landing Gear	EXTENDED
Cowl Flaps	OPEN

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

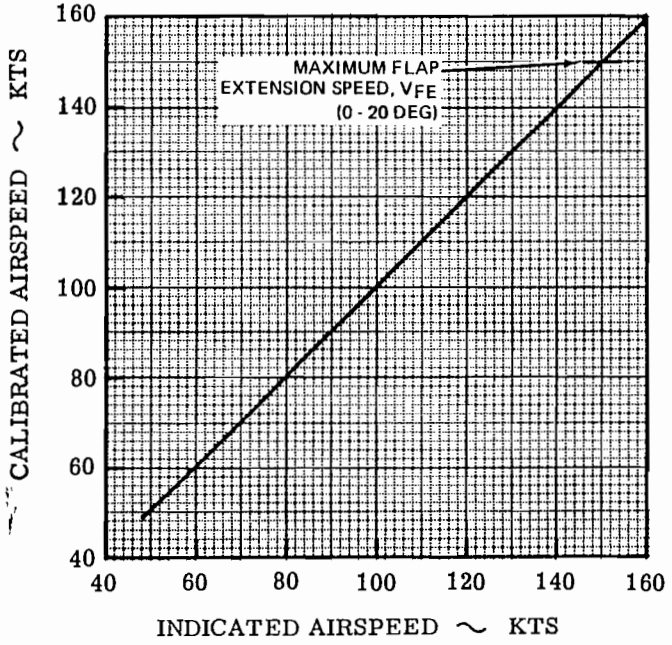
GIVEN:	Configuration		TAKEOFF (20 DEG FLAPS)
	Indicated Airspeed		92 KIAS
FIND:	Calibrated Airspeed	Fig. 5-2.	91 KCAS

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

AIRSPEED CALIBRATION (PRIMARY STATIC SOURCE)(TAKEOFF CONFIGURATION)

NOTE: INDICATED AIRSPEED ASSUMES ZERO INSTRUMENT ERROR.

TAKEOFF (10 DEG FLAPS)



TAKEOFF (20 DEG FLAPS)

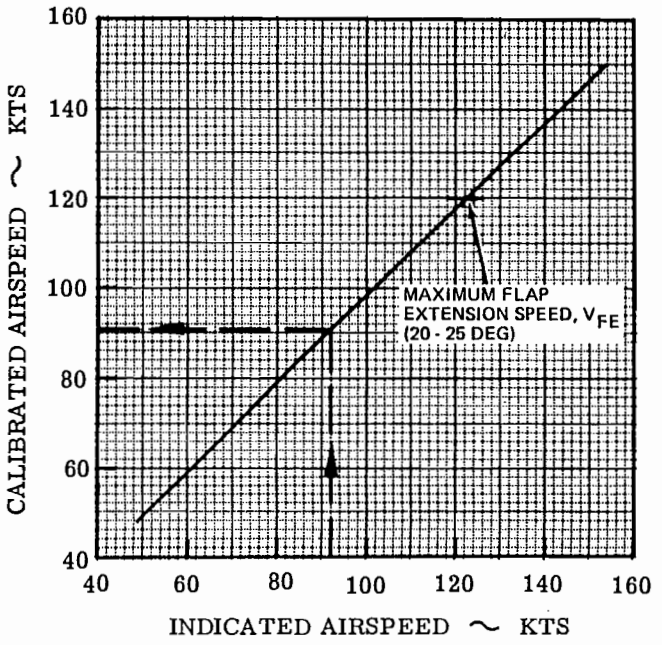


Figure 5-2.

AIRSPEED CALIBRATION (PRIMARY STATIC SOURCE)(CRUISE AND LANDING CONFIGURATION)

The variation of Calibrated Airspeed with Indicated Airspeed is shown in Figure 5-3 for 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	CRUISE	LANDING
Wing Flaps	0 DEG	35 DEG
Landing Gear	RETRACTED	EXTENDED
Cowl Flaps	CLOSED	OPEN

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

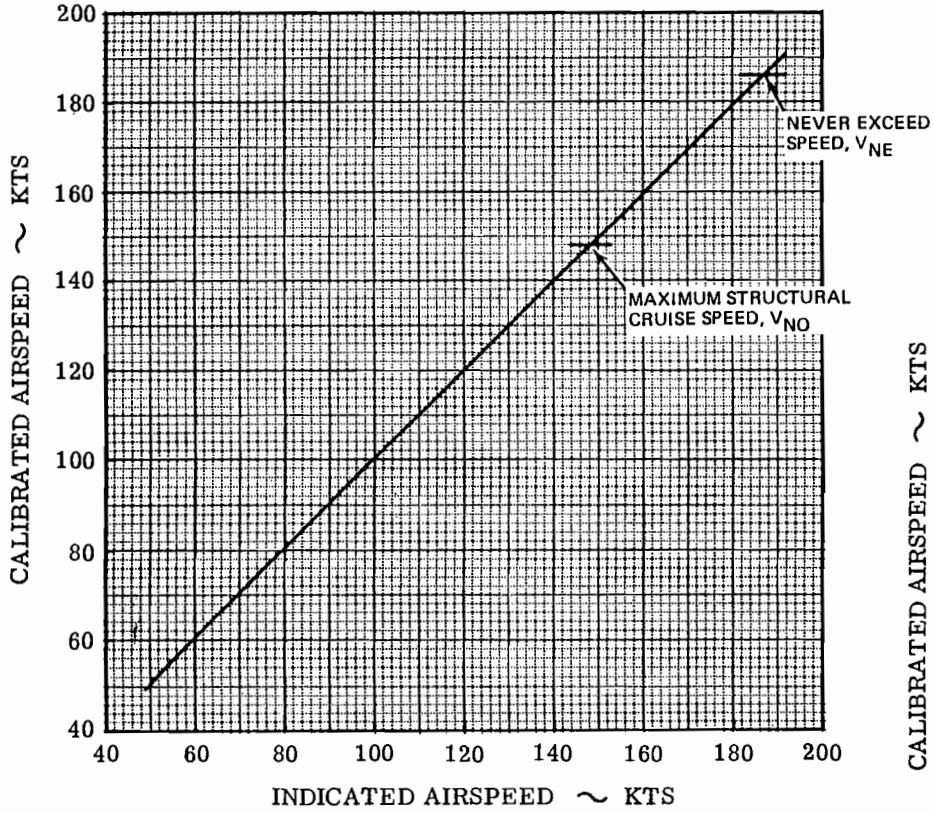
GIVEN:	Configuration		LANDING
	Indicated Airspeed		90 KIAS
FIND:	Calibrated Airspeed	Fig. 5-3.	88 KCAS

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

AIRSPEED CALIBRATION (PRIMARY STATIC SOURCE)(CRUISE AND LANDING CONFIGURATION)

NOTE: INDICATED AIRSPEED ASSUMES ZERO INSTRUMENT ERROR.

CRUISE



LANDING (35 DEG FLAPS)

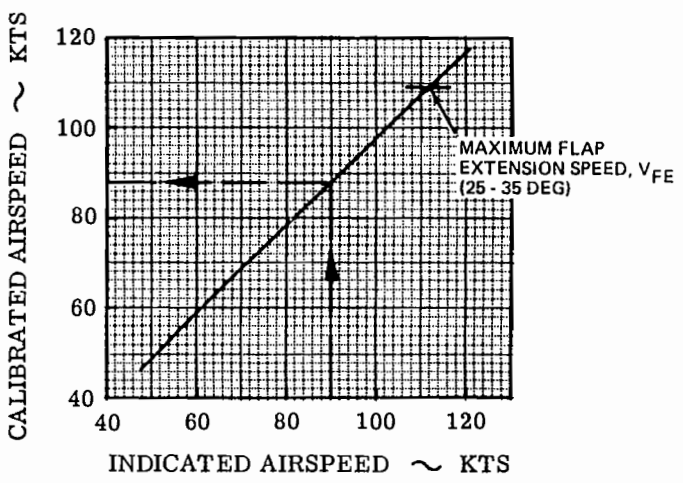


Figure 5-3.

AIRSPEED CALIBRATION (ALTERNATE STATIC SOURCE)

The variation of Calibrated Airspeed with Indicated Airspeed is shown in Figure 5-4 for 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	CRUISE	LANDING
Wing Flaps	0 DEG	35 DEG
Landing Gear	RETRACTED	EXTENDED
Cowl Flaps	CLOSED	CLOSED
Cabin Vent Control	OFF	OFF
Overhead Air Outlets	OFF	OFF
Heater	AS DESIRED	AS DESIRED
Defroster	AS DESIRED	AS DESIRED
Vent Windows	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	118 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 the pilot's side window is opened with the airplane in a landing configuration and the alternate static source is selected, the airspeed will read higher by approximately 15 knots.
3. A conveniently located card is provided in the cockpit, which tabulates the Airspeed Calibration information presented in Figure 5-4.

AIRSPEED CALIBRATION (ALTERNATE STATIC SOURCE)

NOTE: INDICATED AIRSPEED ASSUMES ZERO INSTRUMENT ERROR.

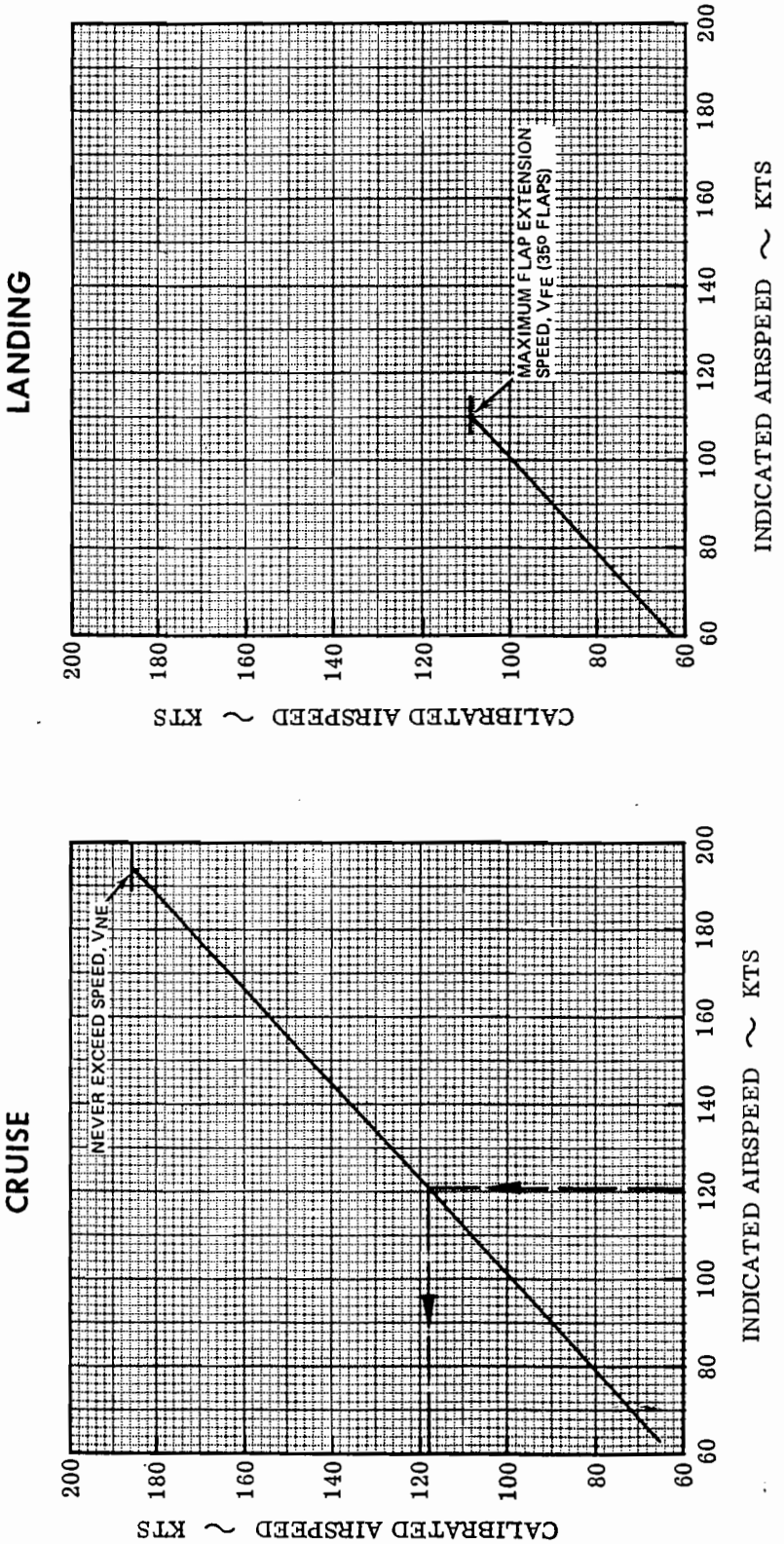


Figure 5-4.

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	LANDING
	Indicated Pressure Altitude	1200 FT
	Indicated Airspeed	73 KIAS
FIND:	Altimeter Correction Fig. 5-5	-10 FT
	Calibrated Pressure Altitude	1200 -10 = 1190 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	5 FT
	Flight Altitude	5000 +5 = 5005 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.

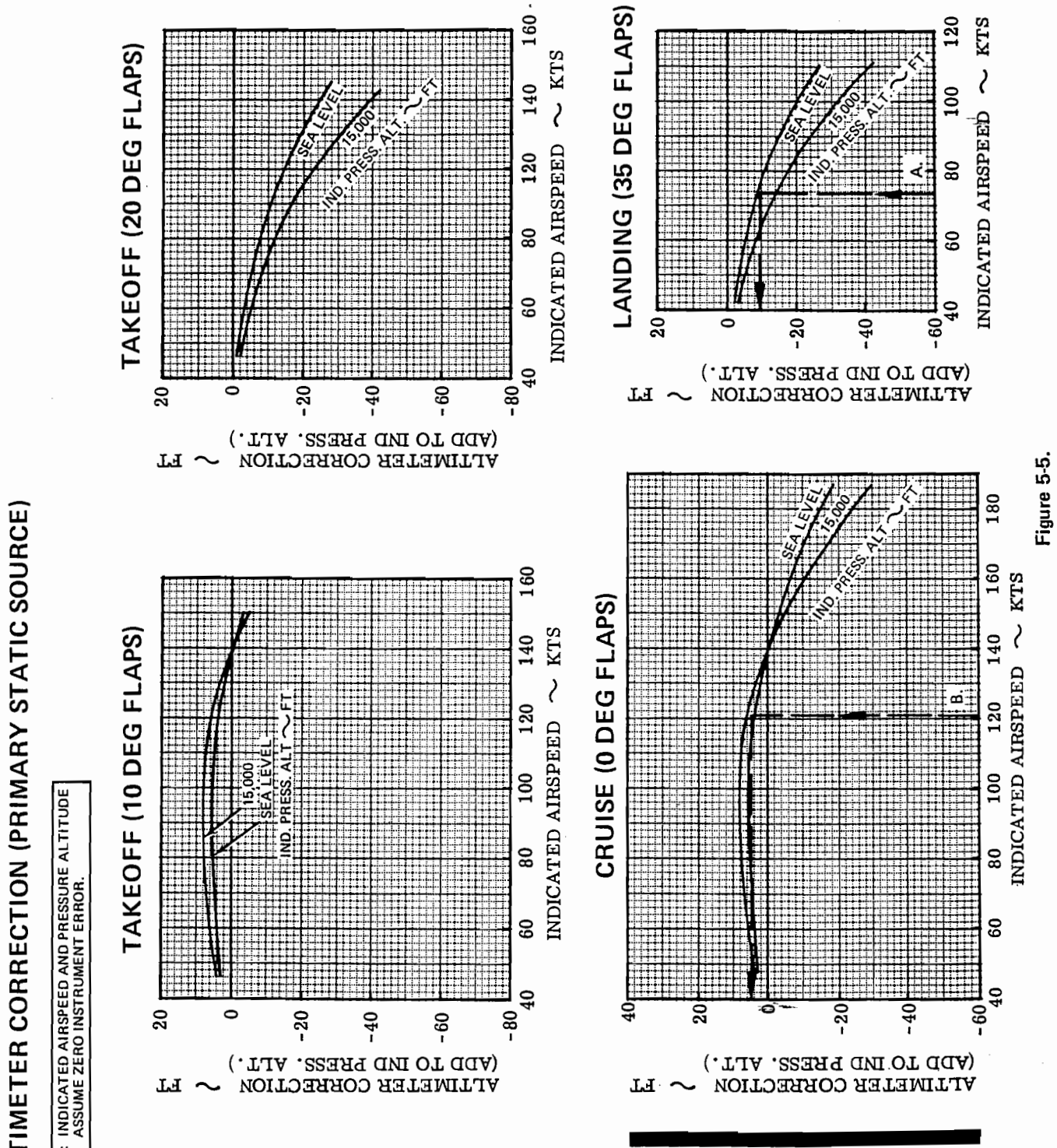

ALTIMETER CORRECTION (PRIMARY STATIC SOURCE)
NOTE: INDICATED AIRSPEED AND PRESSURE ALTITUDE ASSUME ZERO INSTRUMENT ERROR.
TAKEOFF (10 DEG FLAPS)
TAKEOFF (20 DEG FLAPS)
LANDING (35 DEG FLAPS)
CRUISE (0 DEG FLAPS)
ALTIMETER CORRECTION ~ FT
(ADD TO IND PRESS. ALT.)
INDICATED AIRSPEED ~ KTS
SEA LEVEL
15,000
IND. PRESS. ALT. ~ FT.
A.
B.

Figure 5-5.

ALTIMETER CORRECTION (ALTERNATE STATIC SOURCE)

The variation of Altimeter Correction with Indicated Airspeed and Indicated Pressure Altitude is shown in Figure 5-6 for 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	CRUISE	LANDING
Wing Flaps	0 DEG	35 DEG
Landing Gear	RETRACTED	EXTENDED
Cowl Flaps	CLOSED	CLOSED
Cabin Vent Control	OFF	OFF
Overhead Air & Outlets	OFF	OFF
Heater	AS DESIRED	AS DESIRED
Defroster	AS DESIRED	AS DESIRED
Vent Windows	CLOSED	CLOSED

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	FIND:	Altimeter Correction Fig. 5-6	-35 FT
	Indicated Pressure Altitude	7500 FT		Calibrated Pressure Altitude	7500 + (-35) = 7465 FT
	Indicated Airspeed	120 KIAS			

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	LANDING	FIND:	Altimeter Correction Fig. 5-6	-8 FT
	Indicated Pressure Altitude	5000 FT		Flight Altitude	5000 + (-8) = 4992 FT
	Indicated Airspeed	100 KIAS			

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 the pilot's side window is opened with the airplane in a landing configuration and the alternate static source is selected, the altimeter will read higher by approximately 160 Ft.
3. A conveniently located card is provided in the cockpit, which tabulates the Altimeter Correction presented in Figure 5-6.

ALTIMETER CORRECTION (ALTERNATE STATIC SOURCE)

NOTE: INDICATED AIRSPEED AND ALTITUDE ASSUMES ZERO INSTRUMENT ERROR.

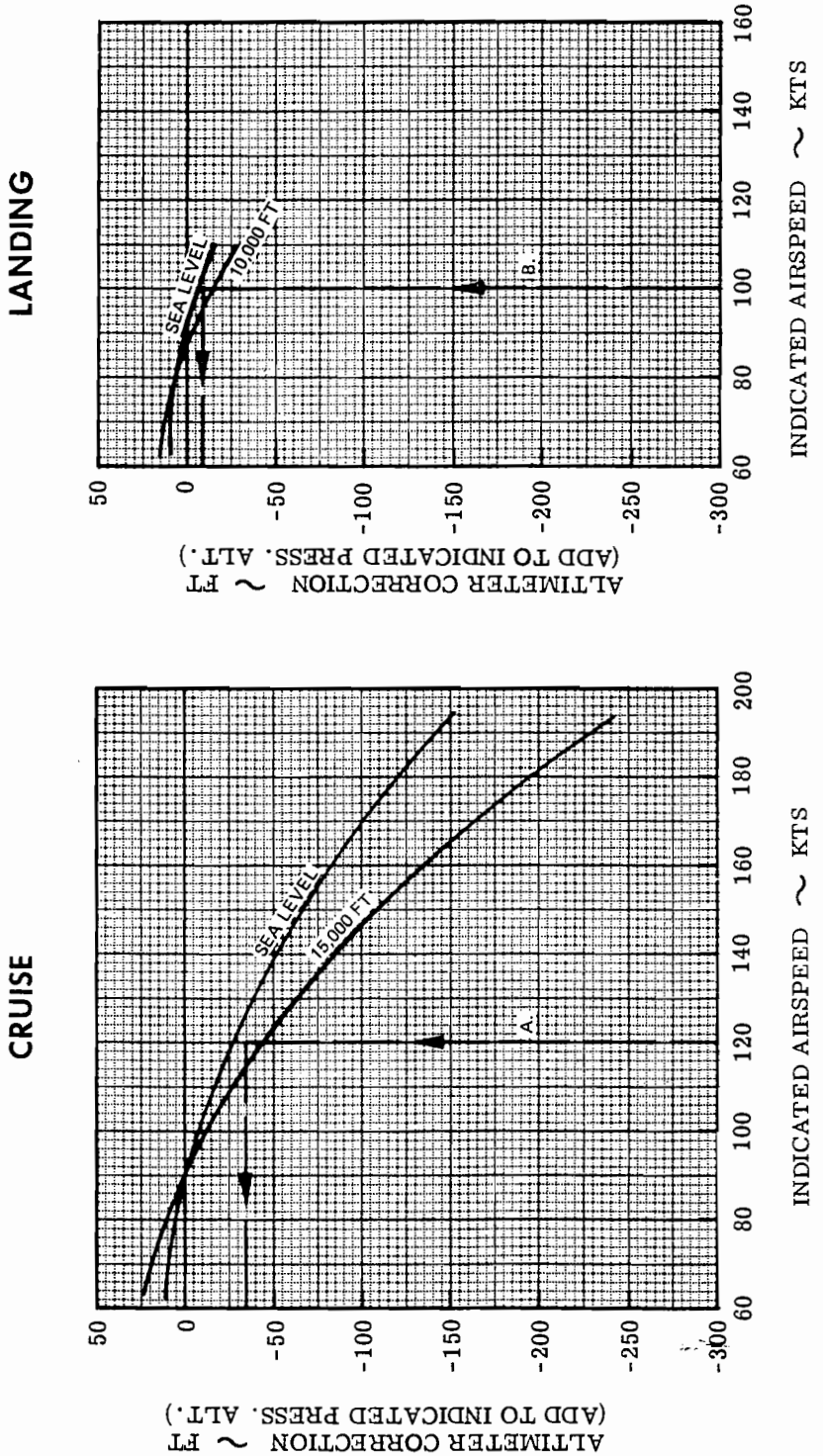


Figure 5-6.

TEMPERATURE CONVERSION

Temperature in Degrees Celsius is presented in Figure 5-7 for varying temperature in Degrees Fahrenheit.

EXAMPLE

GIVEN:	Temperature Deg C	20 DEG C
FIND:	Temperature Deg F, Fig. 5-7.	68 DEG F

TEMPERATURE CONVERSION

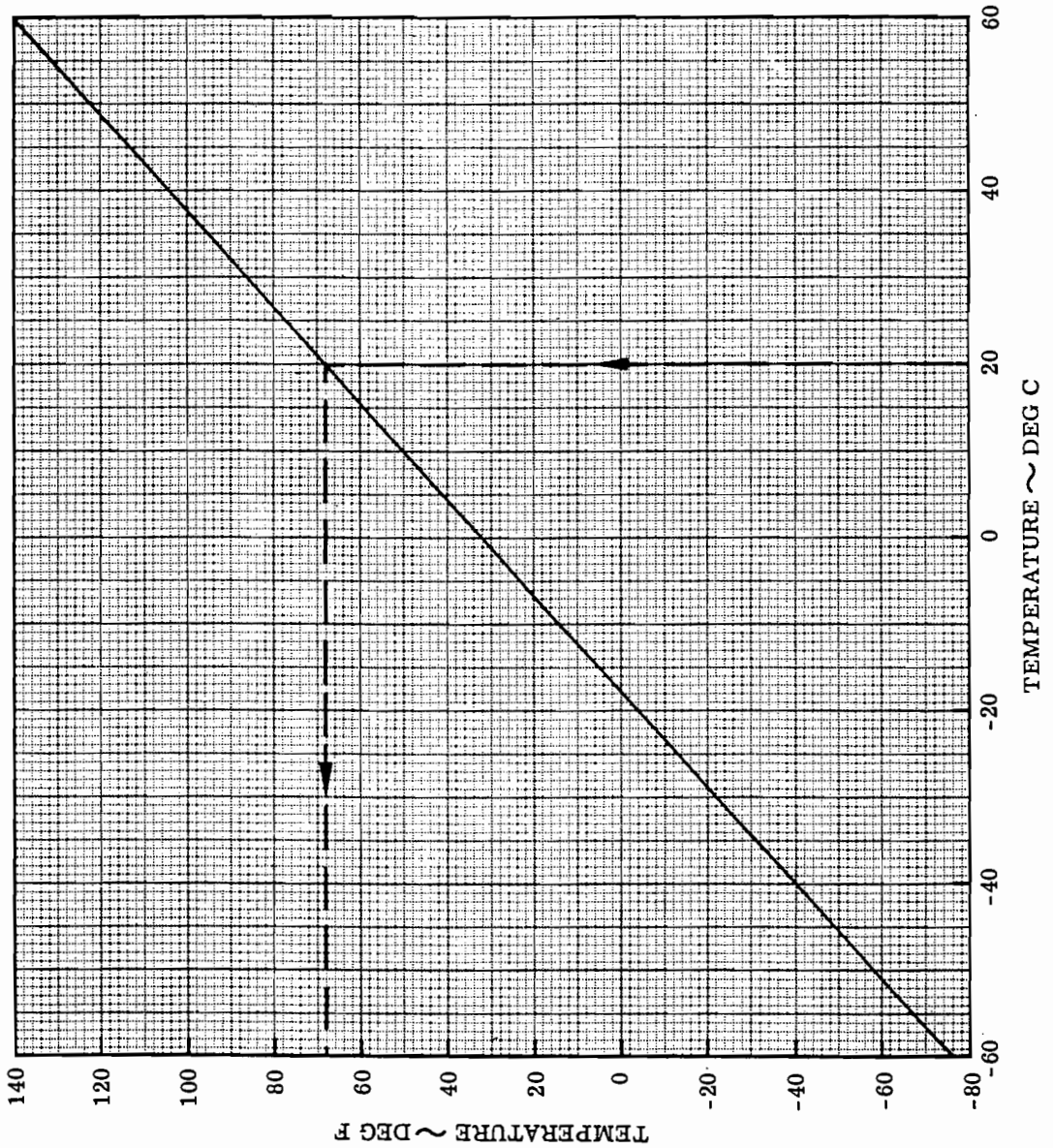


Figure 5-7.

WIND COMPONENTS

Wind Components are presented in Figure 5-8 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. 5-8.	10 KT
	Crosswind Component, Fig. 5-8.	10 KT

Issued: 23 February 1979
Revised: 30 April 1979

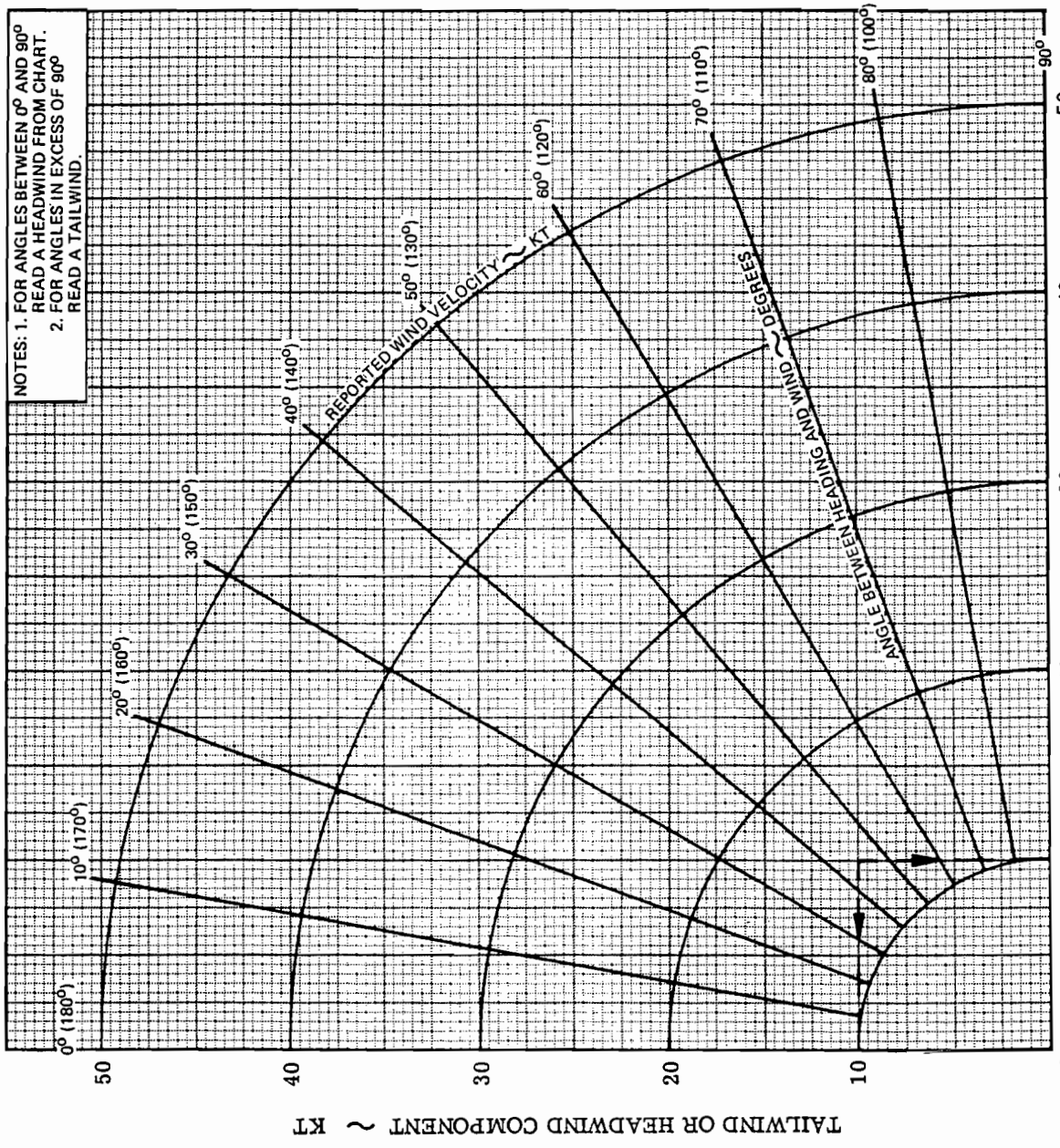


Figure 5-8.

WIND COMPONENTS

SHORT FIELD TAKEOFF GROUND ROLL DISTANCE (20 DEG FLAPS)

The Short Field Takeoff Ground Roll Distance with 20 Deg. Flaps is shown in Figure 5-9 for varying outside air temperature, pressure altitude, wind speed, and gross weight.

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 speed.

EXAMPLE

GIVEN:	Takeoff Weight	2850 LB
	Outside Air Temperature	20 DEG C
	Pressure Altitude	1100 FT
	Wind Component	10 KTS HEADWIND
FIND:	Liftoff Speed	66 KIAS
	Distance to Liftoff	930 FT
	Fig. 5-9.	

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)

CONDITIONS: DRY, LEVEL, PAVED RUNWAYS*

SCHEDULED SPEEDS	
GROSS WEIGHT LB	LIFT-OFF SPEED KIAS
3250	69
3000	67
2750	65
2500	63
2250	62

NOTES:
1. KIAS ASSUMES ZERO INSTRUMENT ERROR.
*2. FOR TAKEOFF ON DRY, GRASS SURFACES, INCREASE THE GROUND ROLL DISTANCE BY 27% AT SEA LEVEL LINEARLY INCREASING TO 65% AT 8000 FT.

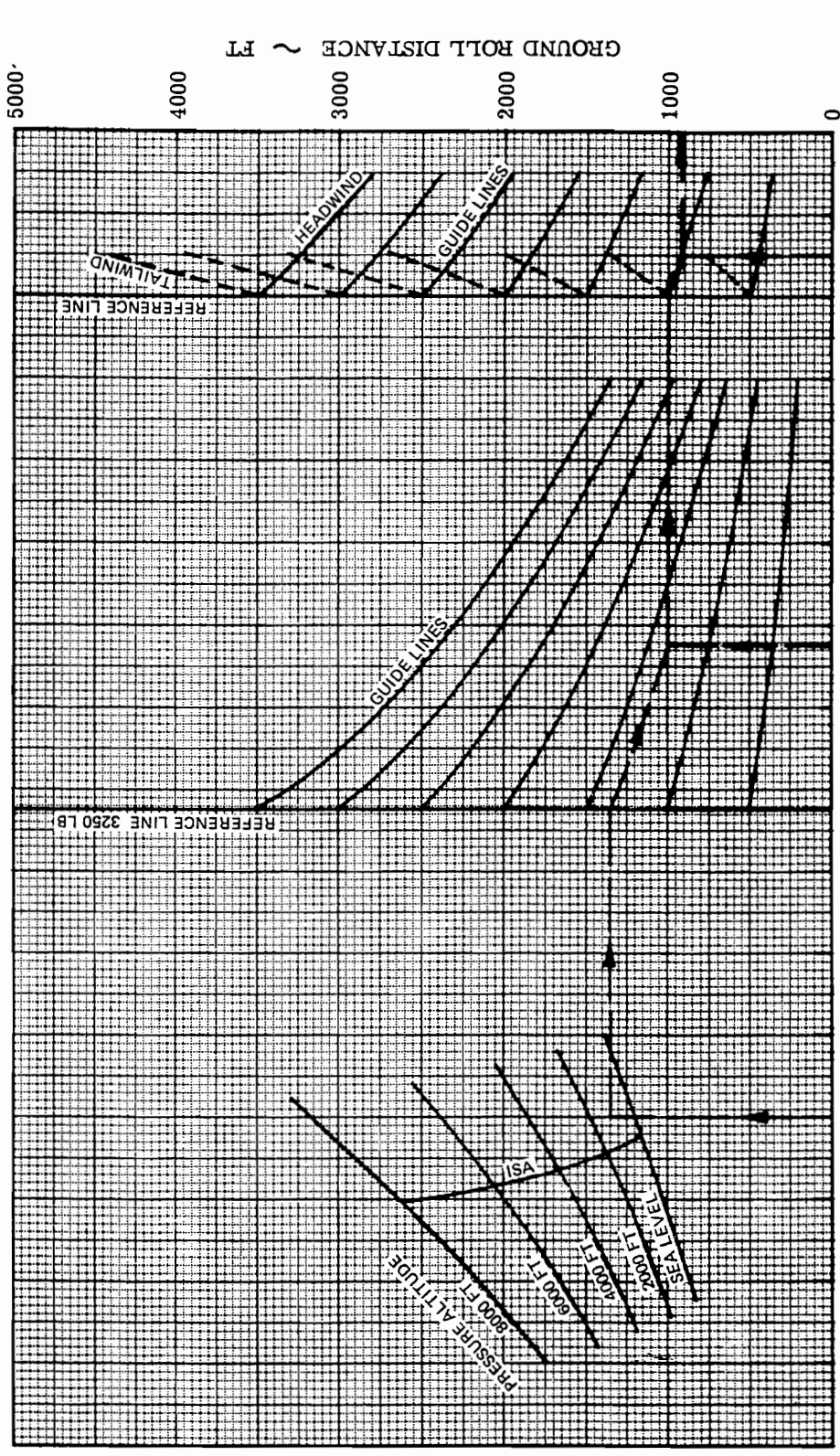


Figure 5-9.

SHORT FIELD TAKEOFF DISTANCE TO 50 FT HEIGHT (20 DEG FLAPS)

The Takeoff Distances to 50-Ft Height with 20 Degree Flaps are shown in Figure 5-10 for varying Outside Air Temperature, Pressure Altitude, Wind Speed, and Gross Weight.

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 liftoff speed and accelerate to obstacle height speed.

EXAMPLE

GIVEN:	Takeoff Weight	2850 LBS
	Outside Air Temperature	20 DEG C
	Pressure Altitude	1100 FT
	Wind Component	10 KTS (HEADWIND)
FIND:	Liftoff Speed	66 KIAS
	Obstacle Height Speed	69 KIAS
	Distance to 50 Ft. Height Fig. 5-10.	1540 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.

SHORT FIELD TAKEOFF DISTANCE TO 50 FT HEIGHT (20 DEG FLAPS)

CONDITIONS: DRY, LEVEL, PAVED RUNWAYS*

SCHEDULED SPEEDS		
GROSS WEIGHT LB	LIFT-OFF SPEED KIAS	OBSTACLE SPEED KIAS
3250	69	72
3000	67	70
2750	65	68
2500	63	66
2250	62	65

NOTES:
1. KIAS ASSUMES ZERO INSTRUMENT ERROR.
*2. FOR TAKEOFF ON DRY, GRASS RUNWAYS, INCREASE THE TAKEOFF DISTANCE BY 16%.

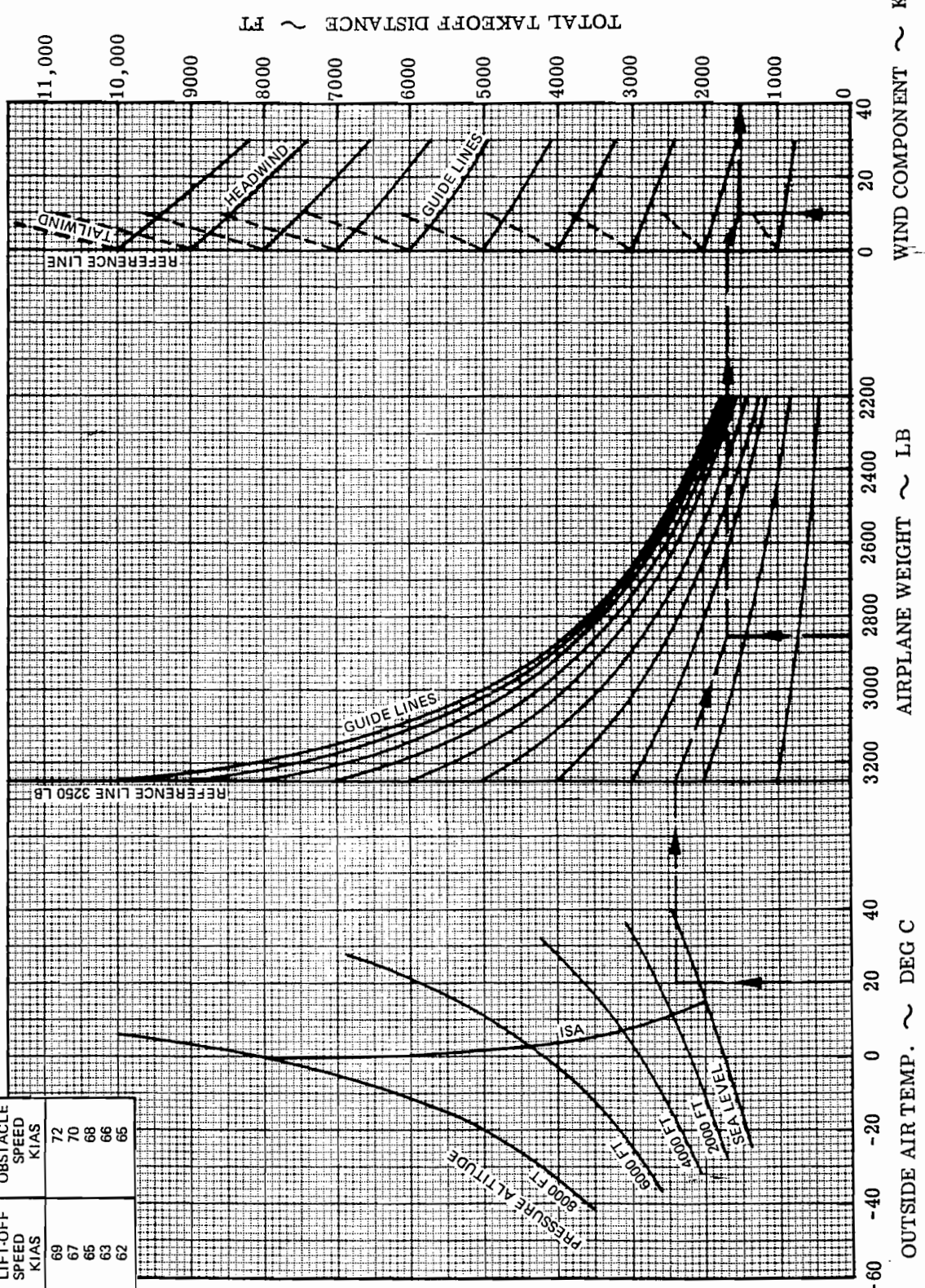


Figure 5-10.

RATE OF CLIMB, CLEAN CONFIGURATION

The Rate of Climb for the Clean Configuration is shown in Figure 5-11 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

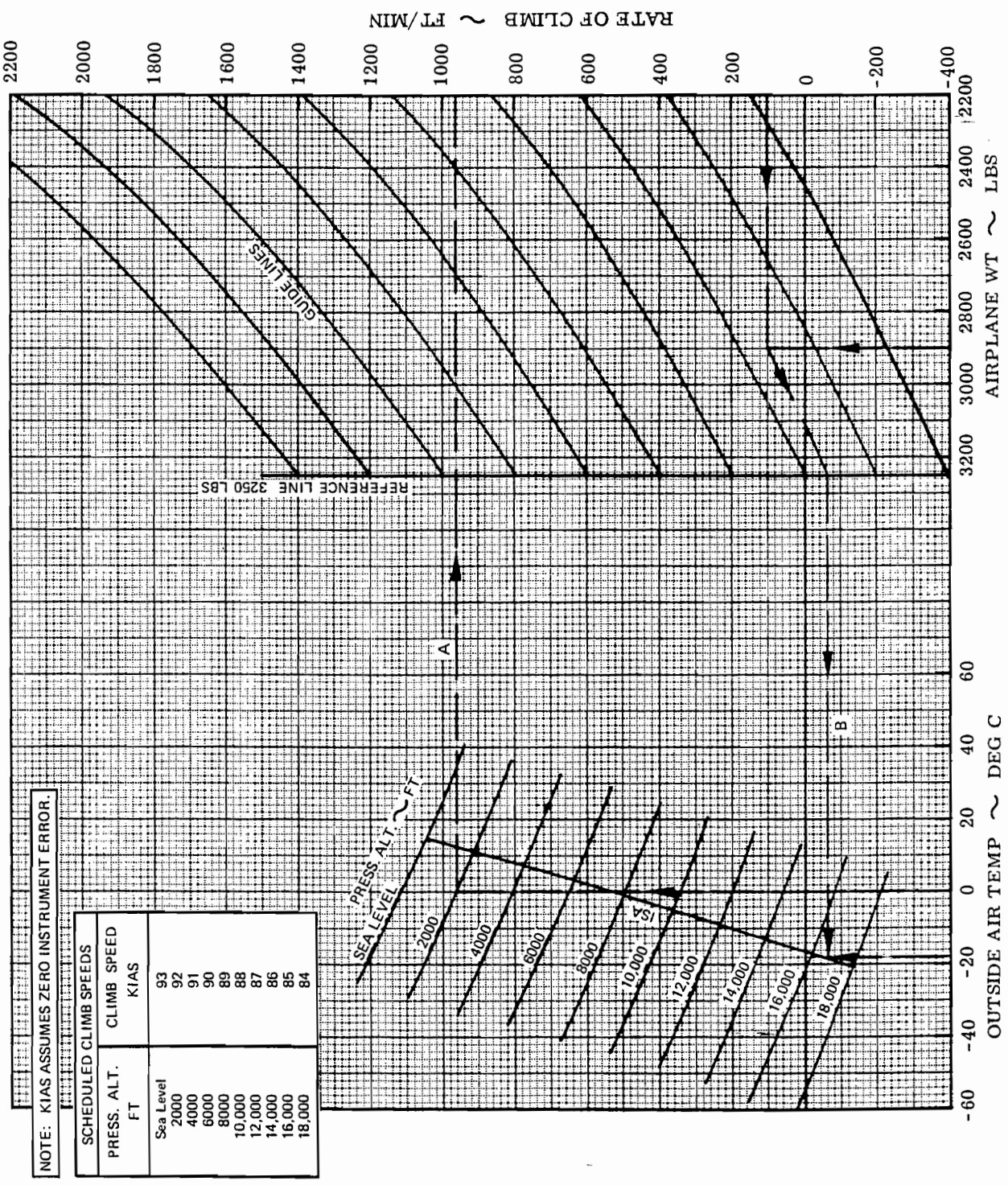
GIVEN:	Airplane Weight	3250 LB
	Outside Air Temperature	0 DEG C
	Pressure Altitude	2000 FT
FIND:	Rate of Climb, Fig. 5-11.	960 FT/MIN
	Scheduled Climb Speed, Fig. 5-11.	92 KIAS

EXAMPLE B

GIVEN:	Airplane Weight	2900 LB
	Rate of Climb	100 FT/MIN
	Outside Air Temperature	ISA (-18°C)
FIND:	Service Ceiling, Fig. 5-11	16,800 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: 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



NOTE: KIAS ASSUMES ZERO INSTRUMENT ERROR.

SCHEDULED CLIMB SPEEDS	
PRESS. ALT. FT	CLIMB SPEED KIAS
Sea Level	93
2000	92
4000	91
6000	90
8000	89
10,000	88
12,000	87
14,000	86
16,000	85
18,000	84

Figure 5-11.

TIME, DISTANCE AND FUEL REQUIRED IN CLIMB

The Time, Distance and Fuel Required in Climb for the clean configuration is shown in Figure 5-12 for varying outside air temperature and pressure altitude at 3250 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	2850 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 5-12.

	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

CONDITIONS: TAKEOFF GROSS WEIGHT 3250 LBS.

NOTE: KIAS ASSUMES ZERO INSTRUMENT ERROR.

SCHEDULED CLIMB SPEEDS	
PRESS. ALT FT	CLIMB SPEED KIAS
Sea Level	93
2000	92
4000	91
6000	90
8000	89
10,000	88
12,000	87
14,000	86
16,000	85

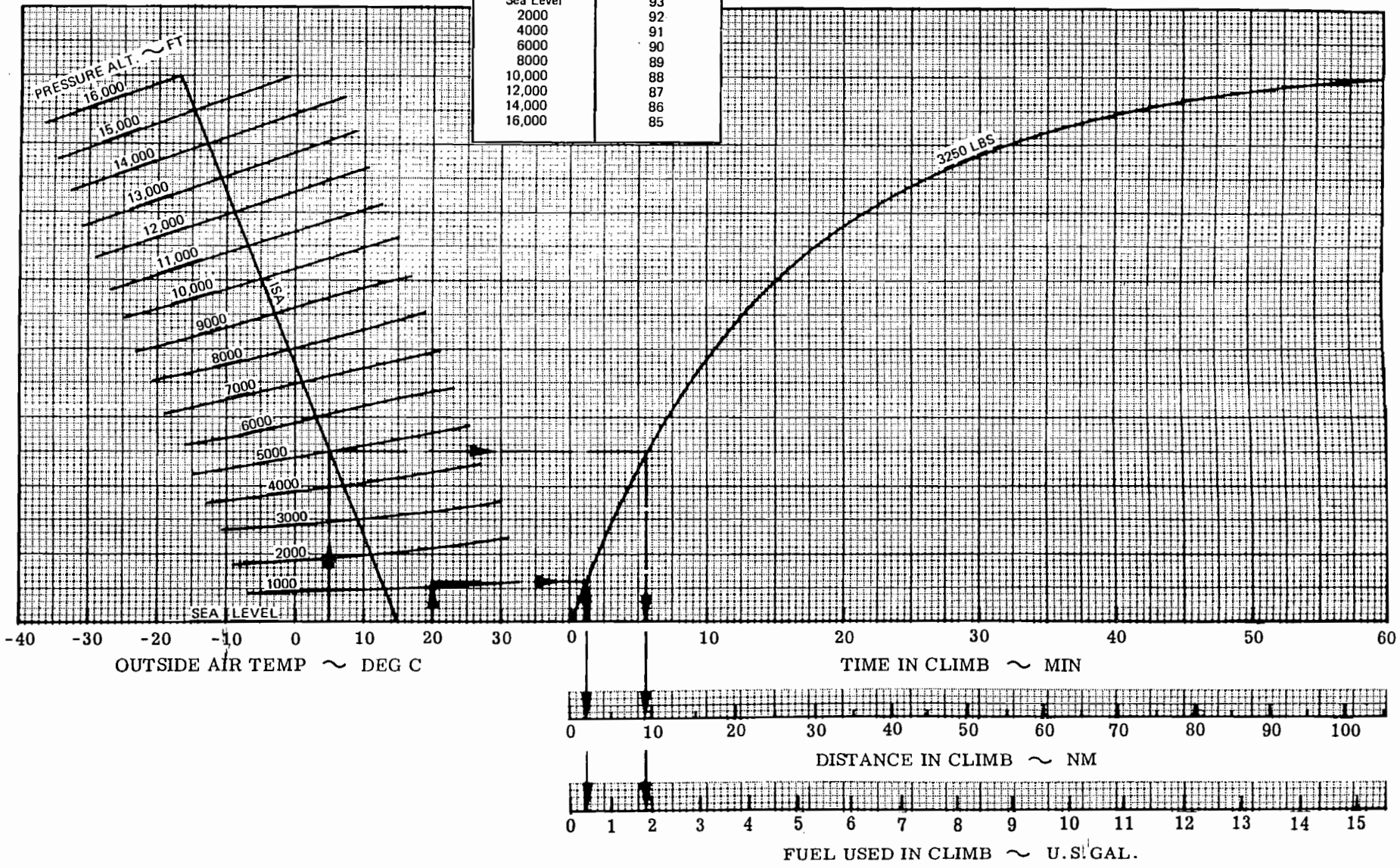


Figure 5-12.

CRUISE POWER SETTING TABLES

The following tables are based on Lycoming 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. 5-16	19.6 IN.HG.
	Fuel Flow, Fig. 5-16	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 1-7, "Power Terminology", GENERAL Section.

Figure 5-13.

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 1-7, "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 5-14.

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 1-7, "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 5-15.

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 1-7, "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 5-16.

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 1-7, "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 5-17.

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 1-7, "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 5-18.

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 1-7, "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.

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 1-7, "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.

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CRUISE TRUE AIRSPEED (AIRPLANE WEIGHT OF 3250 LBS)

The Cruise True Airspeed is presented in Figure 5-21 for varying outside air temperature, pressure altitude, and power setting at maximum gross weight of 3250 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. 5-21.	126 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 1-7.

CRUISE TRUE AIRSPEED

CONDITIONS: AIRPLANE WEIGHT 3250 LBS.

NOTE: THE TRUE AIRSPEEDS PRESENTED HERE ARE FOR A BEST ECONOMY MIXTURE. IF A BEST POWER MIXTURE IS SELECTED, THE AIRSPEED WILL INCREASE BY 1%. BEST POWER CAN BE OBTAINED BY FOLLOWING THE PROCEDURE DESCRIBED UNDER "POWER TERMINOLOGY", GENERAL SECTION, PAGE 1-7.

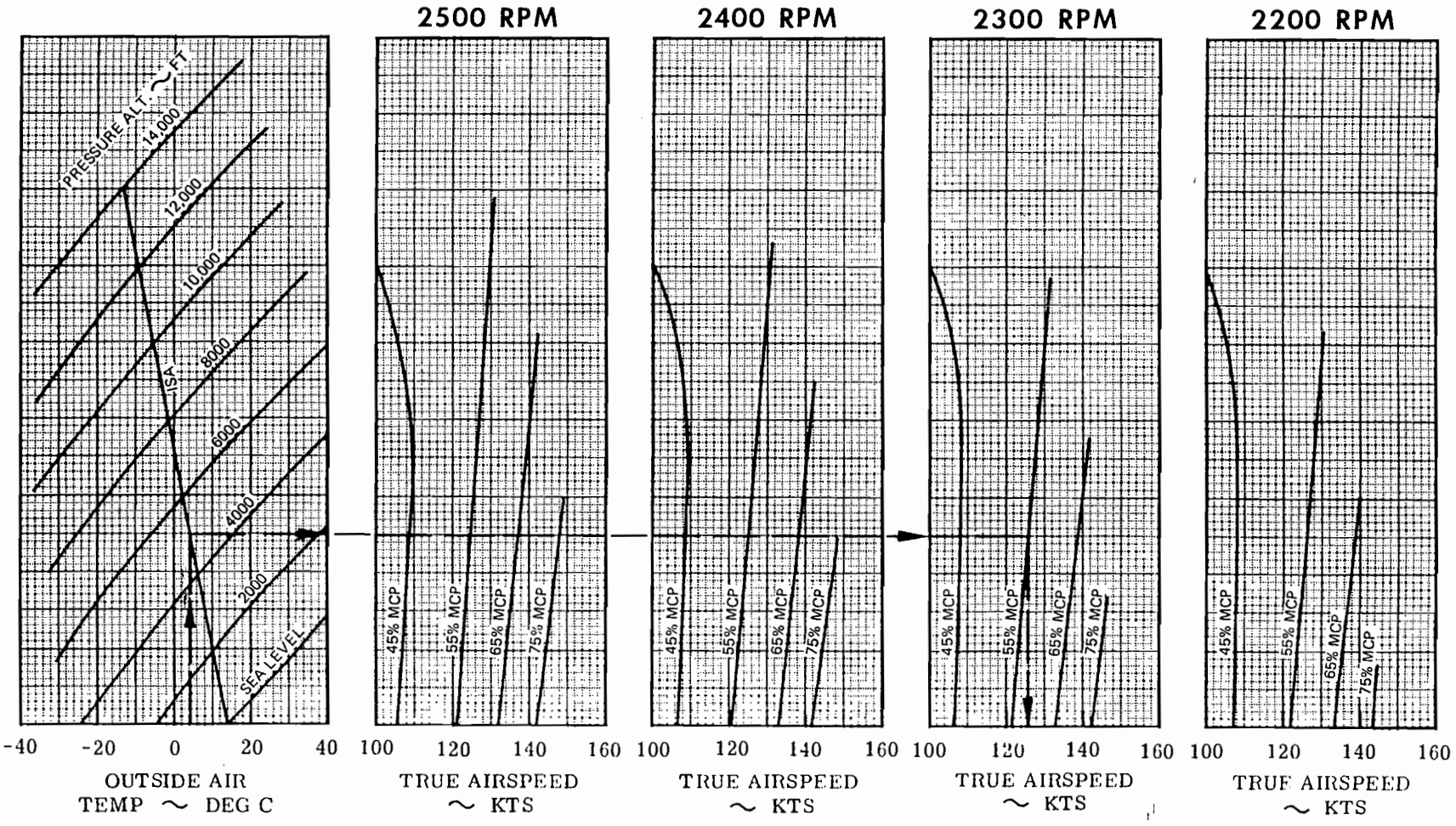


Figure 5-21.

CRUISE TRUE AIRSPEED (AIRPLANE WEIGHT OF 2750 LBS)

The Cruise True Airspeed is presented in Figure 5-22 for varying outside air temperature, pressure altitude, and power setting at maximum gross weight of 2750 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. 5-22.	133 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 1-7.

CRUISE TRUE AIRSPEED

CONDITIONS: AIRPLANE WEIGHT ~ 2750 LBS.

NOTE: THE TRUE AIRSPEEDS PRESENTED HERE ARE FOR A BEST ECONOMY MIXTURE. IF A BEST POWER MIXTURE IS SELECTED, THE AIRSPEED WILL INCREASE BY 1%. BEST POWER CAN BE OBTAINED BY FOLLOWING THE PROCEDURE DESCRIBED UNDER "POWER TERMINOLOGY", GENERAL SECTION, PAGE 1-7.

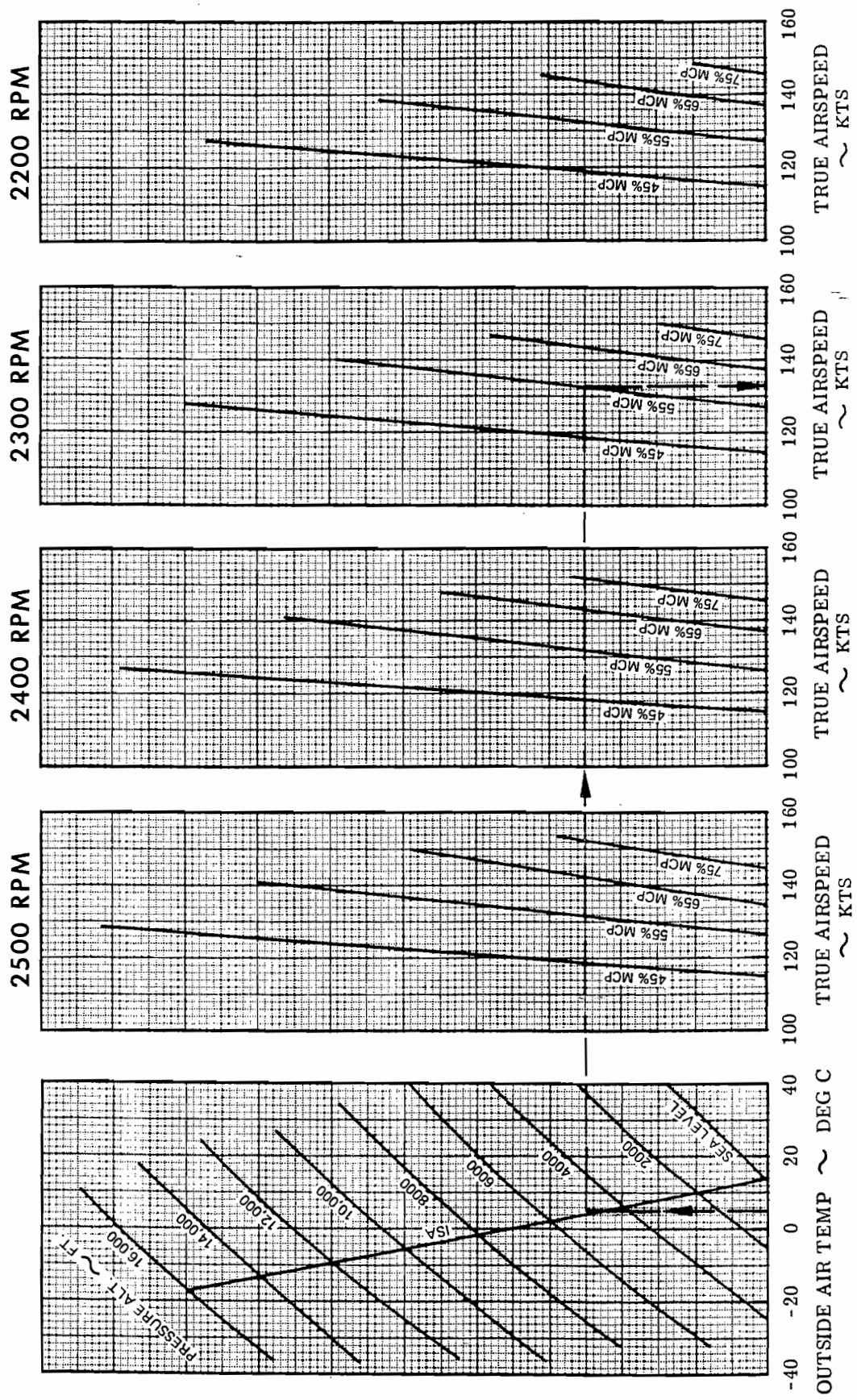


Figure 5-22.

RANGE PROFILES

The Range is presented in Figure 5-23 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 5-13 thru 5-20.

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 (1.7 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. 5-23	672 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 1-7.

RANGE PROFILES

NOTE: THE RANGE DATA IS PRESENTED FOR BEST ECONOMY MIXTURE. IF A BEST POWER MIXTURE IS SELECTED, THE RANGE WILL DECREASE BY ABOUT 15%. BEST POWER CAN BE OBTAINED BY FOLLOWING THE PROCEDURE DESCRIBED UNDER "POWER TERMINOLOGY", GENERAL SECTION, PAGE 1-7.

CONDITIONS: ISA DAY

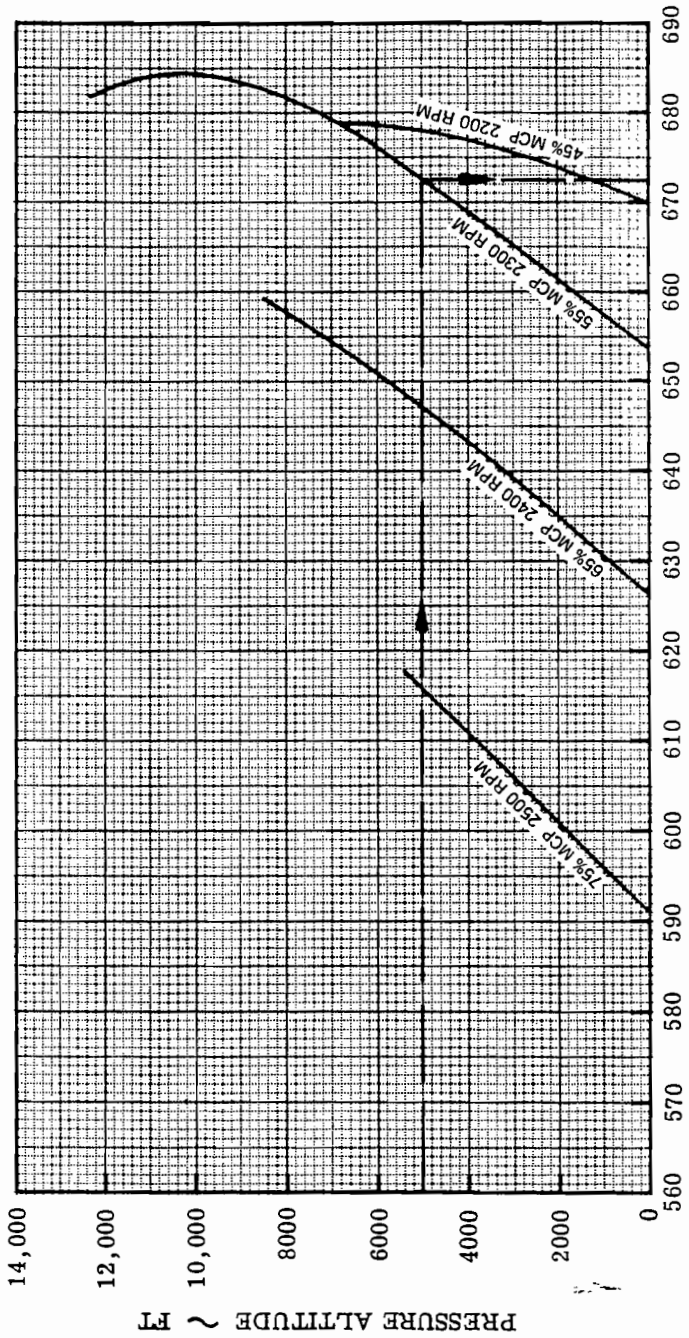


Figure 5-23.

ENDURANCE PROFILES

Figure 5-24 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 (1.7 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

GIVEN:	Pressure Altitude	5000 FT
	Power Setting	55% MCP (2300 RPM)
FIND:	Endurance, Fig. 5-24.	5.31 Hrs = 5 HR 19 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 1-7.

ENDURANCE PROFILES

CONDITIONS: ISA DAY

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 TERMINOLGY", GENERAL SECTION, PAGE 1-7.

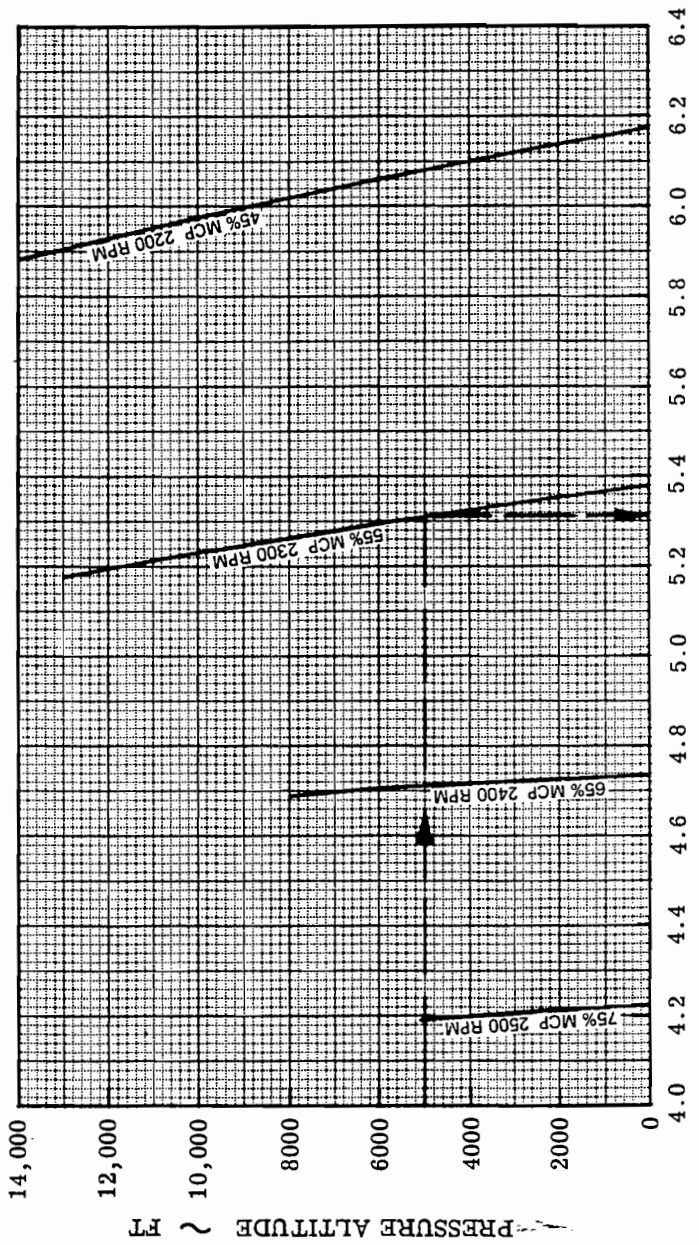


Figure 5-24.

HOLDING TIME

The Holding Time is presented in Figure 5-25 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. 5-25	44 LB

EXAMPLE B

GIVEN:	Holding Fuel	240 LB
FIND:	Holding Time, Fig. 5-25	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

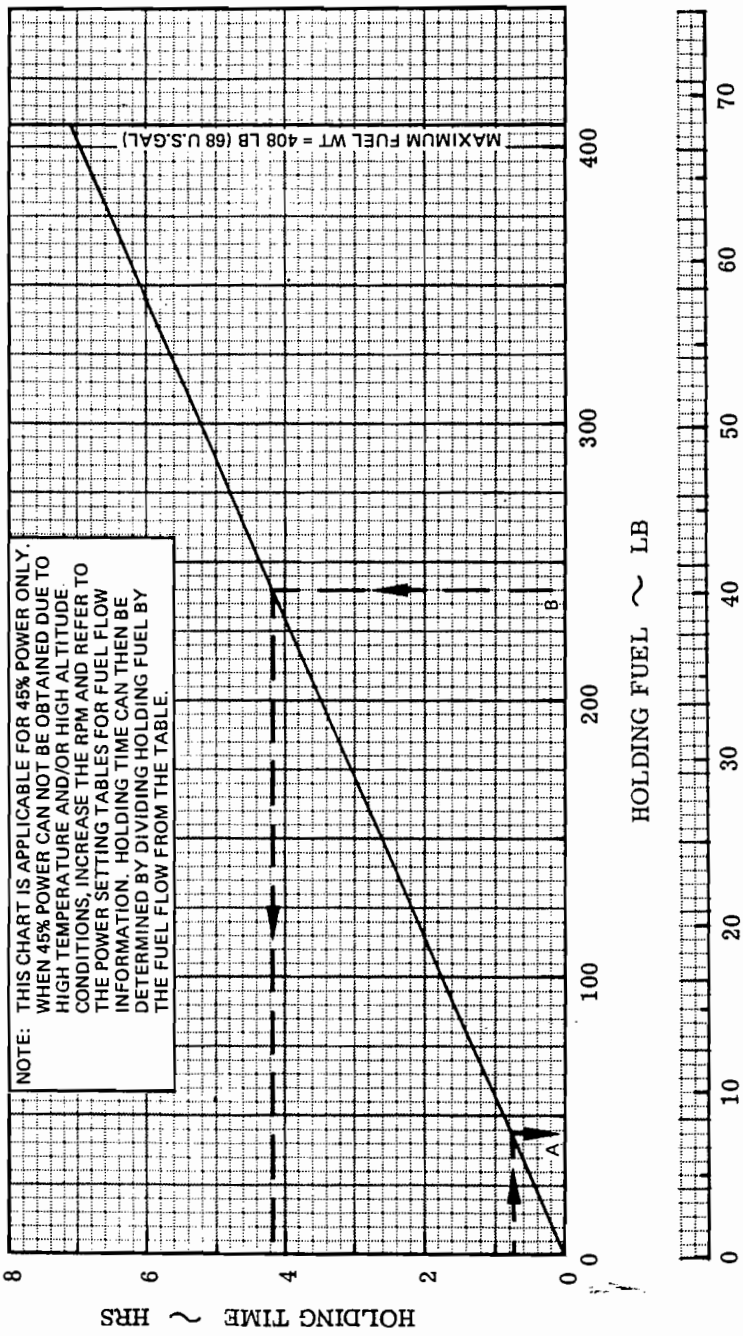


Figure 5-25.

TIME, DISTANCE AND FUEL USED IN DESCENT

The Time, Distance and Fuel used in Descent are presented in Figure 5-26 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 below 15,000 Ft. Full Throttle above 15,000 Ft. Pressure Altitude)
Wing Flaps	0 DEG
Landing Gear	RETRACTED
Cowl Flaps	CLOSED

TECHNIQUE

Follow the Scheduled Descent Speed versus Pressure Altitude as the descent progresses, and adjust throttle to maintain manifold 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 5-26.

	INITIAL ALTITUDE		FINAL ALTITUDE		NET
Time	5.0 MIN	minus	0.2 MIN	equals	4.8 MIN
Distance	13.9 NAM	minus	0.4 NAM	equals	13.5 NAM
Fuel	0.85 U.S.Gal	minus	0.03 U.S.Gal	equals	0.82 U.S. Gal (4.9 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 3250 and 2100 Lbs.

TIME, DISTANCE AND FUEL USED IN DESCENT

NOTES: 1. RATE OF DESCENT ~ 1000 FT/MIN.
2. KIAS ASSUMES ZERO INSTRUMENT ERROR.

SCHEDULED SPEEDS	
PRESS. ALT. FT.	DESCENT SPEED KIAS
Sea Level	140
2000	140
4000	140
6000	140
8000	140
10,000	140
12,000	140
14,000	138
16,000	135
18,000	131

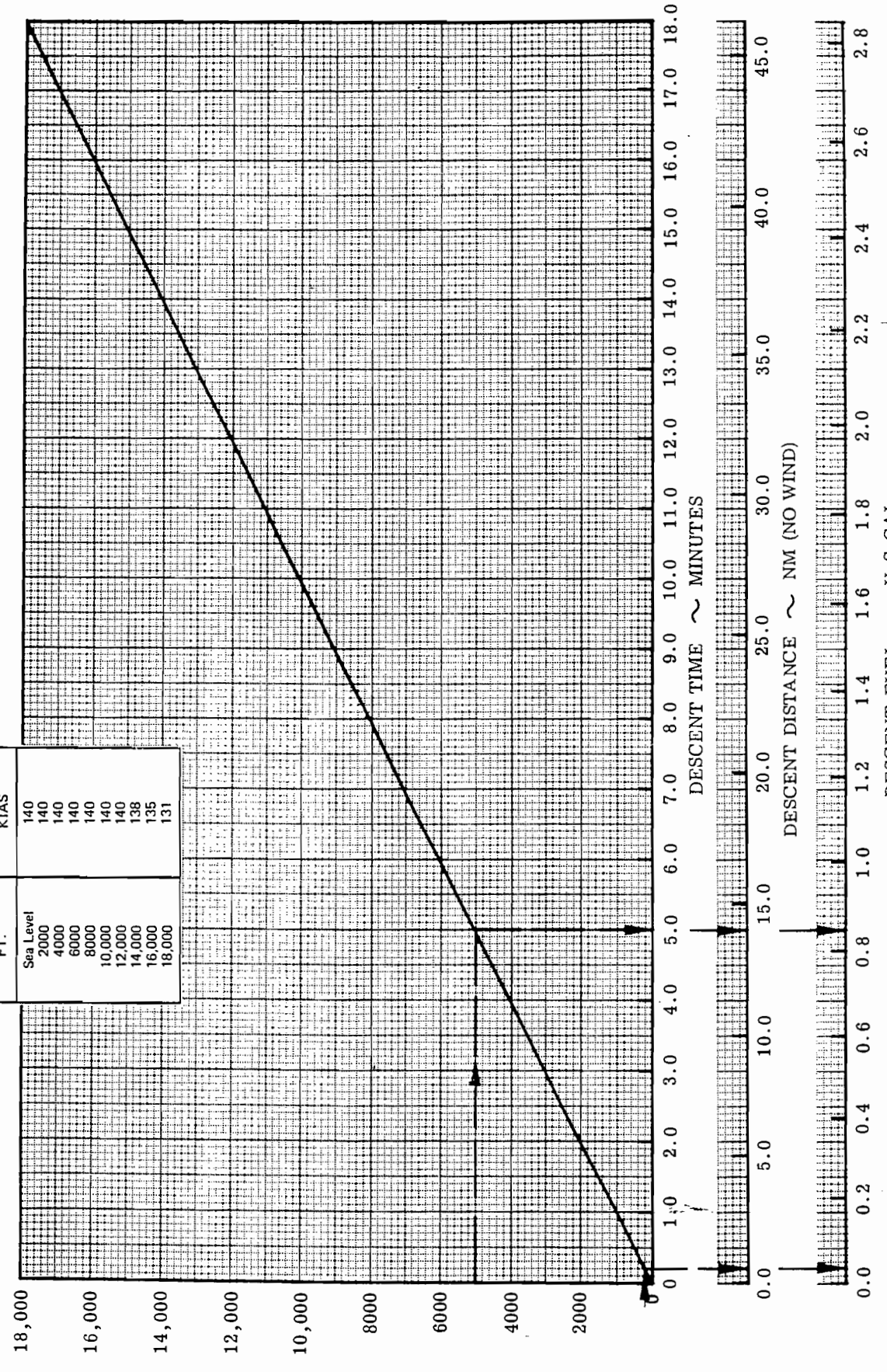


Figure 5-26.

SHORT FIELD LANDING GROUND ROLL DISTANCE

The Short Field Landing Ground Roll Distance is shown in Figure 5-27 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 73 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. 5-27.	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%.
4. Maximum landing weight is 3140 lbs.

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

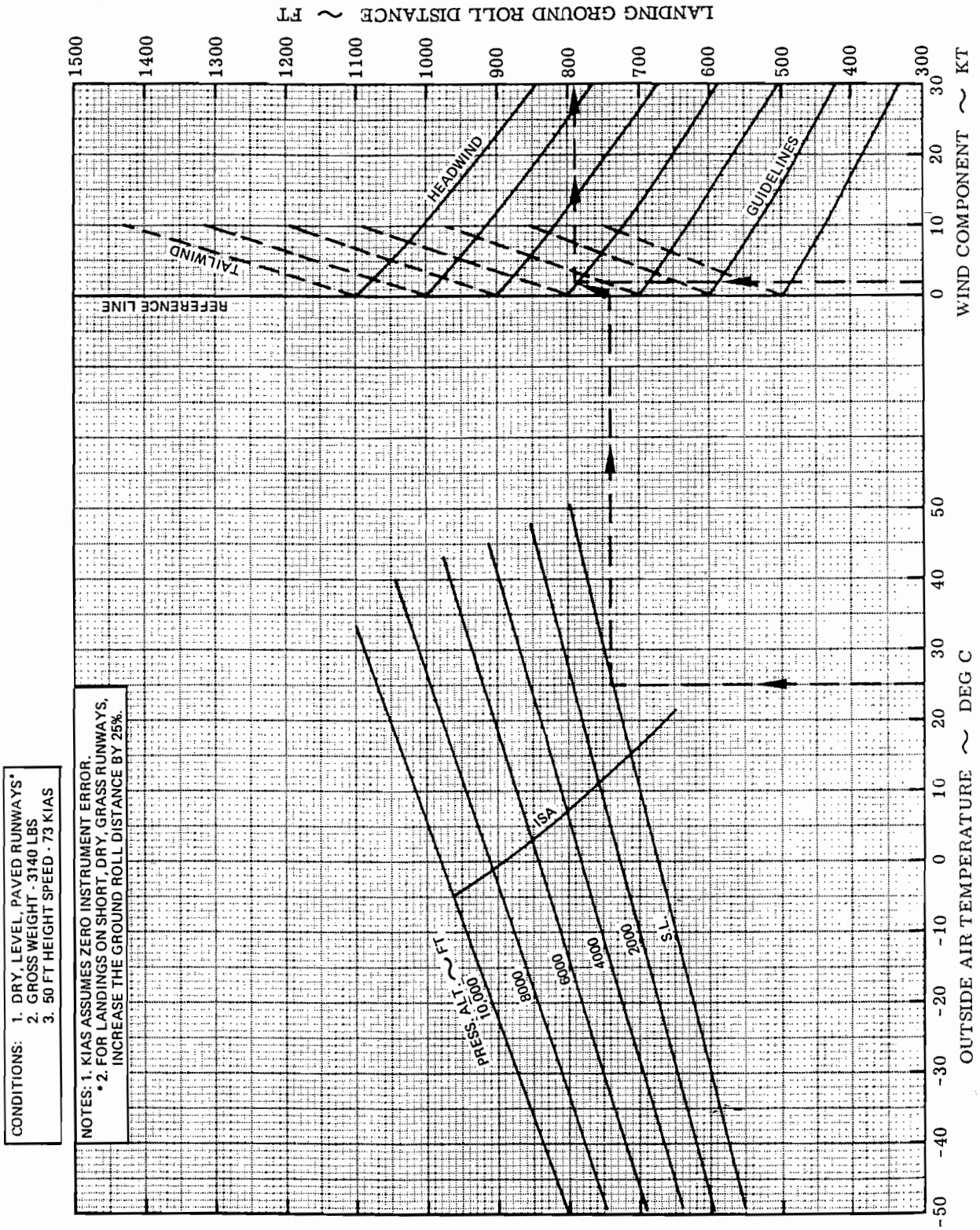


Figure 5-27.

SHORT FIELD LANDING DISTANCE FROM 50 FT HEIGHT

The Short Field Total Landing Distance from 50 Ft. height is shown in Figure 5-28 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 73 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. 5-28.	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%.
4. Maximum landing weight is 3140 lbs.

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 DISTANCE FROM 50 FT HEIGHT

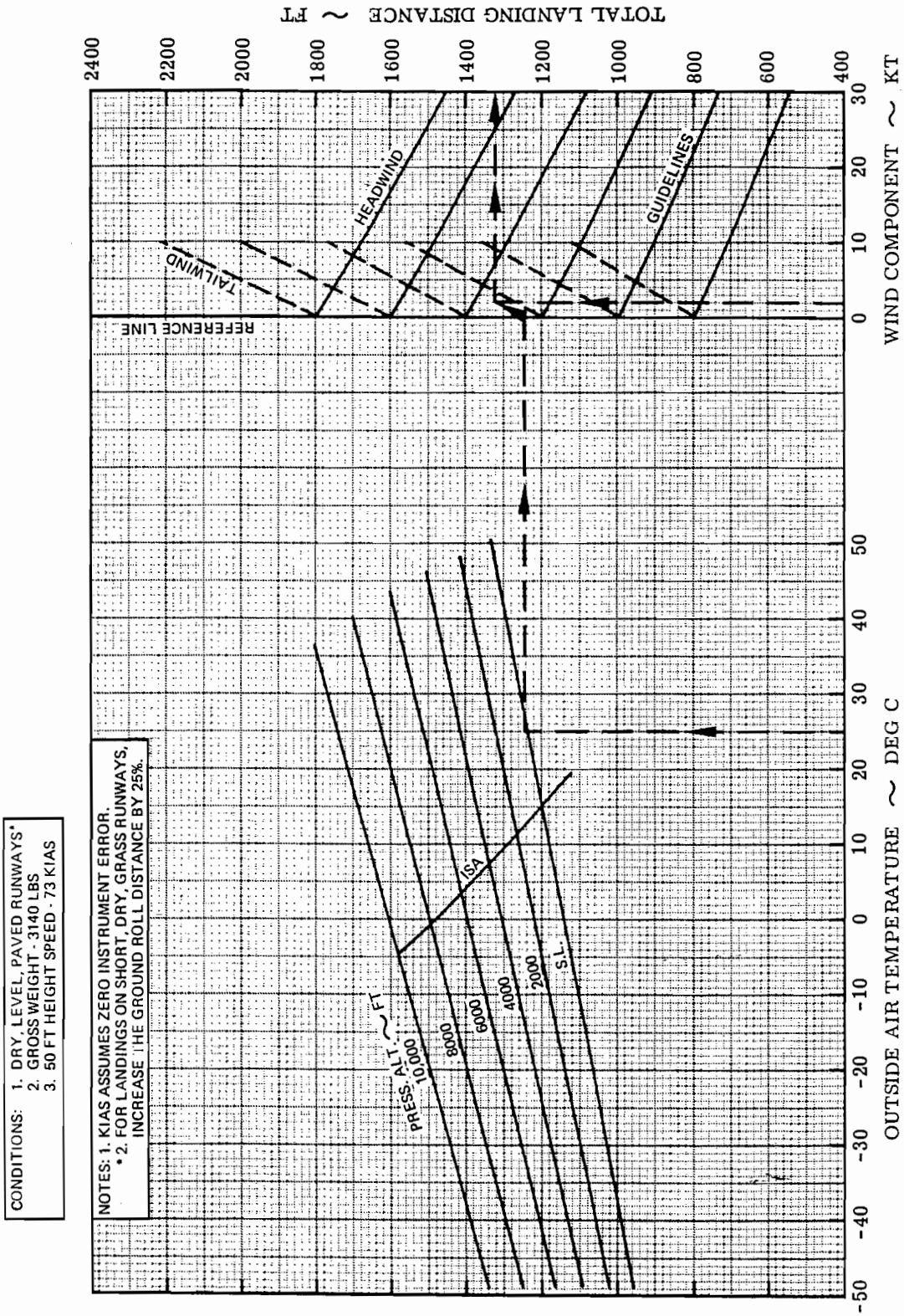


Figure 5-28.

SECTION VI

WEIGHT AND BALANCE/EQUIPMENT LIST

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 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 internal 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 been 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

Weighing should always be accomplished 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

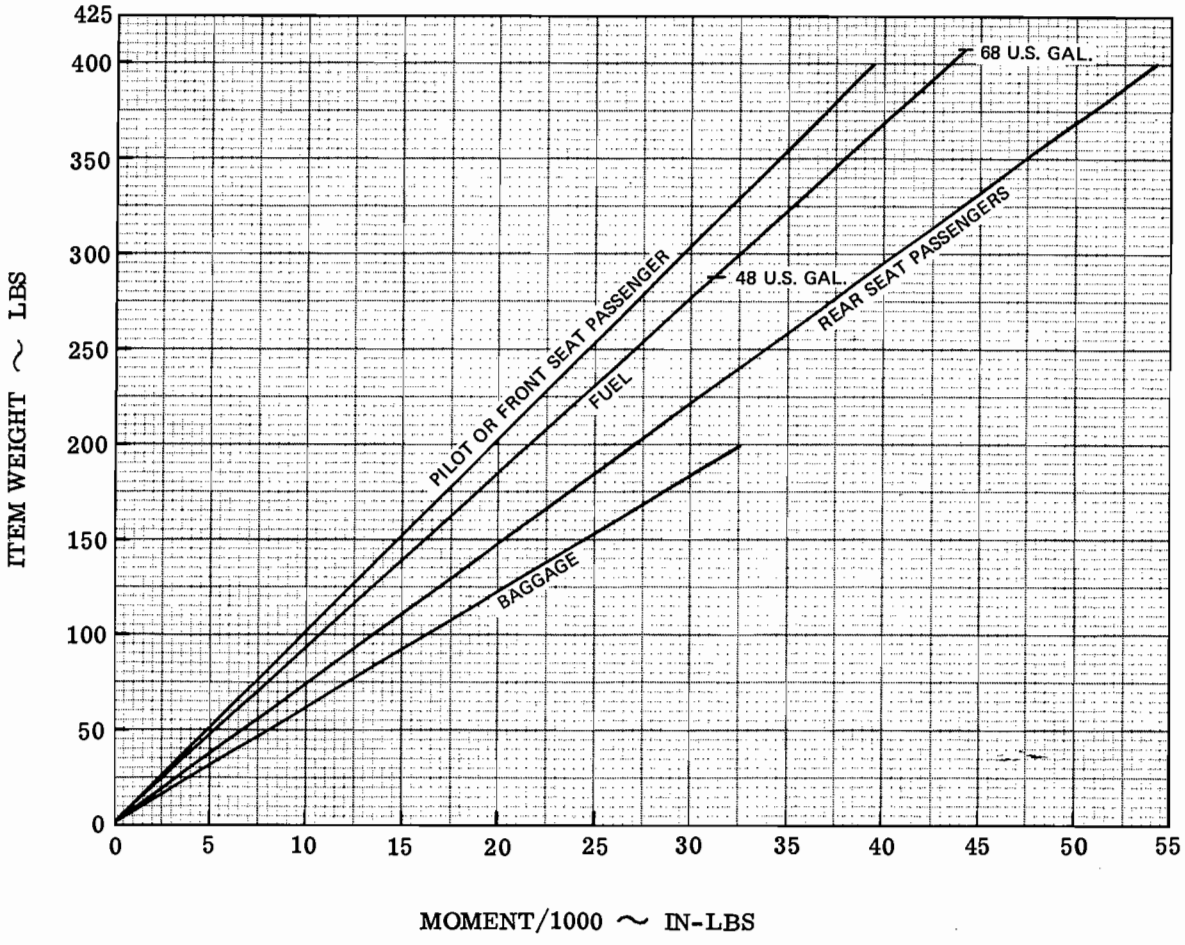


Figure 6-1. Loading Graph

CABIN STATION DIAGRAM

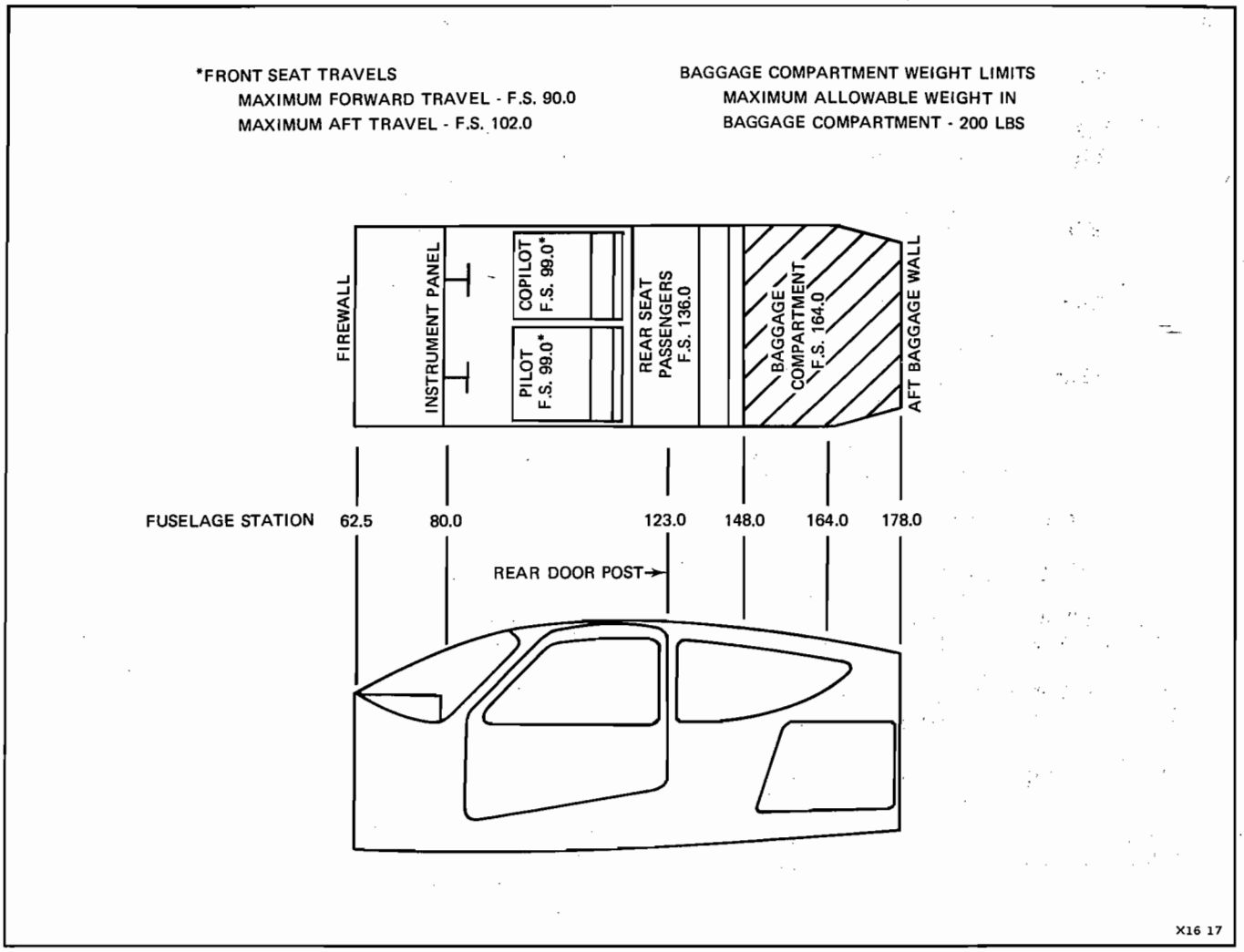


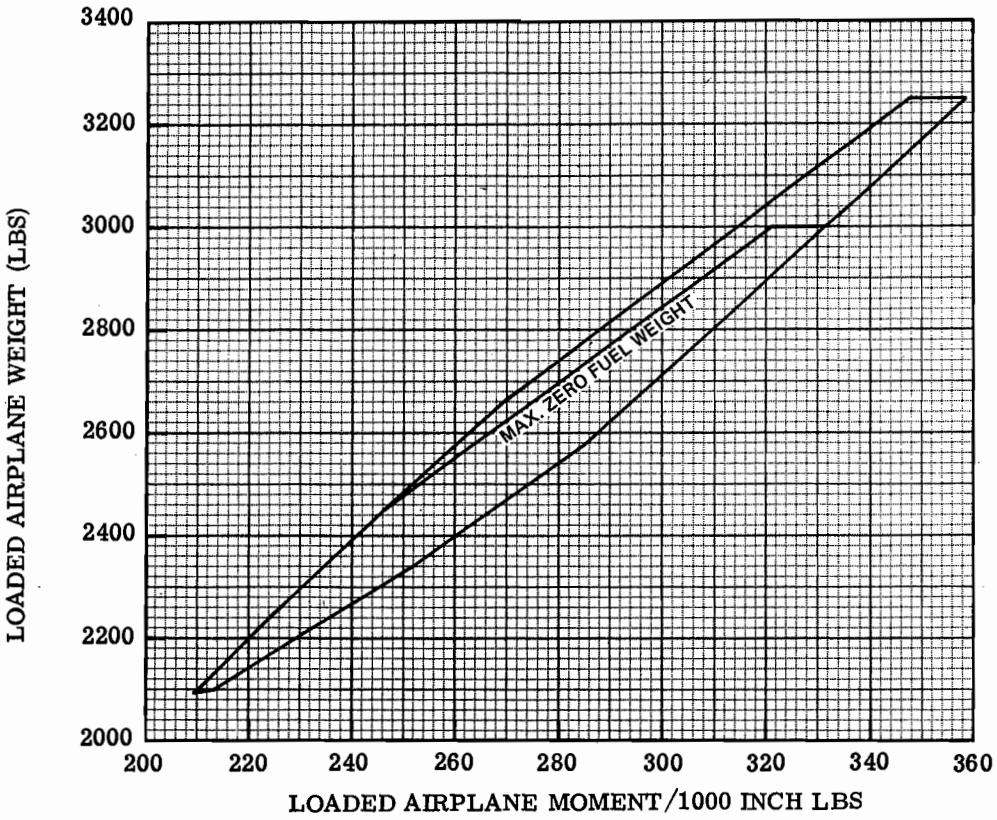
Figure 6-2. Cabin Station Diagram

AIRCRAFT OPERATIONAL LIMITATIONS - See Figure 6-3.

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

AIRPLANE OPERATIONAL LIMITATIONS

WEIGHT AND MOMENT ALLOWABLES



NOTES:
1. OPERATION OUTSIDE MINIMUM AND MAXIMUM VALUES IS PROHIBITED.
2. GEAR RETRACTION MOMENT ACCOUNTED FOR.

Figure 6-3. Airplane Operational Limitations

Issued: 19 January 1979
Revised: 23 October 1981

TEJAS AVIONICS, INC.

PREVIOUS WEIGHT/BALANCE
2-10-89

EMPTY WEIGHT 2055.39

MOMENT 209373.09

C.G. 101.87

USEFUL LOAD 1204.61

EVISED WEIGHT AND BALANCE DATA

IRCRAFT TYPE 114A

ERIAL NUMBER 14506

DATE 3-19-90

N NUMBER 5893N

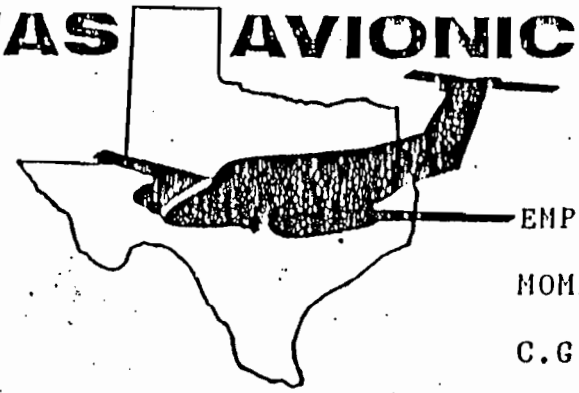
NOMENCLATURE	S/N	WEIGHT	ARM	MOMENT
Installed:				
KLN 88	1779	6.2	73.00	452.60
A 83 antenna	-	0.5	153.00	76.50

IEW EMPTY WEIGHT 2062.09 C.G. 103.77 MOMENT 213975.59

ISEFUL LOAD 1197.91 GROSS WEIGHT 3260.00

MUNICIPAL AIRPORT / 205 CORSAIR DRIVE / GEORGETOWN, TEXAS 78628 / (512) 863-9566

TEJAS AVIONICS, INC.



PREVIOUS WEIGHT/BALANCE 2-10-89

EMPTY WEIGHT 2055.39

MOMENT 209373.09

C.G. 101.87

USEFUL LOAD 1204.61

EVISED WEIGHT AND BALANCE DATA

IRCRAFT TYPE 114A

ERIAL NUMBER 14506

DATE 3-19-90

N NUMBER 5893N

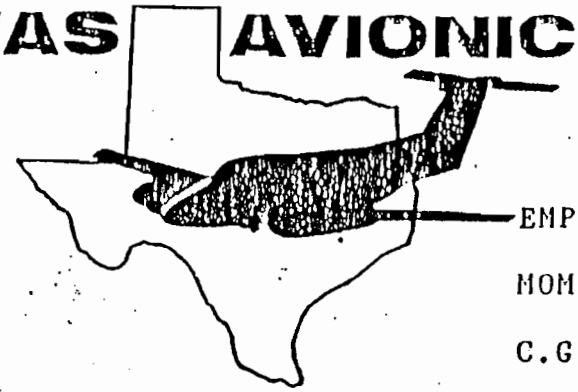
NOMENCLATURE	S/N	WEIGHT	ARM	MOMENT
Installed:				
KLN 88	1779	6.2	73.00	452.60
A 83 antenna	-	0.5	153.00	76.50

NEW EMPTY WEIGHT 2062.09 C.G. 103.77 MOMENT 213975.59

USEFUL LOAD 1197.91 GROSS WEIGHT 3260.00

MUNICIPAL AIRPORT / 205 CORSAIR DRIVE / GEORGETOWN, TEXAS 78628 / (512) 863-9566

TEJAS AVIONICS, INC.



PREVIOUS WEIGHT/BALANCE

2-10-89

EMPTY WEIGHT 2055.39

MOMENT 209373.09

C.G. 101.87

USEFUL LOAD 1204.61

EVISED WEIGHT AND BALANCE DATA

IRCRAFT TYPE 114A

DATE 3-19-90

ERIAL NUMBER 14506

N NUMBER 5893N

NOMENCLATURE	S/N	WEIGHT	ARM	MOMENT
Installed:				
KLN 88	1779	6.2	73.00	452.60
A 83 antenna	-	0.5	153.00	76.50

IEW EMPTY WEIGHT 2062.09 C.G. 103.77 MOMENT 213975.59

ISEFUL LOAD 1197.91 GROSS WEIGHT 3260.00

MUNICIPAL AIRPORT / 205 CORSAIR DRIVE / GEORGETOWN, TEXAS 78628 / (512) 863-9566

US Department of Transportation
Federal Aviation Administration

MAJOR REPAIR AND ALTERATION
(Airframe, Powerplant, Propeller, or Appliance)

Form Approved
OMB No. 2120-0020

For FAA Use Only

Office Identification

INSTRUCTIONS: Print or type all entries. See FAR 43.9, FAR 43 Appendix B, and AC 43.9-1 (or subsequent revision thereof) for instructions and disposition of this form. This report is required by law (49 U.S.C. 1421). Failure to report can result in a civil penalty not to exceed $1,000 for each such violation (Section 901 Federal Aviation Act of 1958).

1. Aircraft	Make: Rockwell International	Model: 114A
	Serial No.: 14506	Nationality and Registration Mark: N5893N
2. Owner	Name *(As shown on registration certificate)*: Targa Inc.	Address *(As shown on registration certificate)*: P.O. Box 12817 Austin TX 78711

3. For FAA Use Only

4. Unit Identification / **5. Type**

Unit	Make	Model	Serial No.	Repair	Alteration
AIRFRAME	~~~~~ *(As described in Item 1 above)* ~~~~~				X
POWERPLANT					
PROPELLER					
APPLIANCE	Type				
	Manufacturer				

6. Conformity Statement

A. Agency's Name and Address	B. Kind of Agency		C. Certificate No.
Tejas Avionics Inc. 205 Corsair Drive Georgetown TX 78628		U.S. Certificated Mechanic	
		Foreign Certificated Mechanic	
	X	Certificated Repair Station	CRS 210-65
		Manufacturer	

D. I certify that the repair and/or alteration made to the unit(s) identified in item 4 above and described on the reverse or attachments hereto have been made in accordance with the requirements of Part 43 of the U.S. Federal Aviation Regulations and that the information furnished herein is true and correct to the best of my knowledge.

Date	Signature of Authorized Individual
04-01-90	S.R.Diver

7. Approval for Return To Service

Pursuant to the authority given persons specified below, the unit identified in item 4 was inspected in the manner prescribed by the Administrator of the Federal Aviation Administration and is ☒ APPROVED ☐ REJECTED

BY							Other *(Specify)*
		FAA Flt. Standards Inspector		Manufacturer		Inspection Authorization	
		FAA Designee	X	Repair Station		Person Approved by Transport Canada Airworthiness Group	

Date of Approval or Rejection	Certificate or Designation No.	Signature of Authorized Individual
04-01-90	CRS 210-65	S.R.Diver

FAA Form 337 (12-88)

NOTICE

Weight and balance or operating limitation changes shall be entered in the appropriate aircraft record. An alteration must be compatible with all previous alterations to assure continued conformity with the applicable airworthiness requirements.

8. Description of Work Accomplished
(If more space is required, attach additional sheets. Identify with aircraft nationality and registration mark and date work completed.)

Installed KLN 88 Loran and antenna.

All component & system installation of the equipment listed was accomplished in accordance with AC 43.13-2A, chapters 1 & 2.

Electrcial load, circuit protection and wire installation were accomplished in accordance with AC 43.13-1A, chapter 11, sections 2, 3, 4, 5 & 6.

Installation of the King Loran was completed in accordance with manufacturer's instructions

Antenna was installed in accordance with manufacturer's instructions and AC 43.13-2A, chapter 3.

Aircraft equipment list & weight/balance were revised & recorded in aircraft records.

A functional test of all the equipment listed has been performed in accordance with FAR 23.1301 and checked in accordance with FAR 23.1431 for operating satisfactorily and did not adversely affect any other components in the aircraft.

Aircraft was placarded 'LORAN NOT APPROVED FOR IFR'

END

☐ Additional Sheets Are Attached

TEJAS AVIONICS, INC.

REVISED WEIGHT AND BALANCE DATA DATE 2-10-89

AIRCRAFT TYPE 114A Rockwell International N NUMBER N5893N

SERIAL NUMBER 14506

NOMENCLATURE	WEIGHT	ARM	MOMENT
Removed :			
Ind. 350 s/n7291	1.0	75.0	75.00
Installed:			
KMT112 s/n33201	.3	241.0	72.30
KG102 s/n29119	4.8	194.5	933.60
KA51B s/n11405	.2	79.5	15.90
KA57 s/n5236	.4	75.5	30.20
KI525A s/n33804	4.0	73.0	292.00
GLS350 s/n5349	2.0	193.0	386.00
CI503	.15	153.0	22.95
S.B.-114-23A	1.439	224.17	322.58

EW EMPTY WEIGHT 2055.39 C.G. 101.87 MOMENTS 209,373.09

USEFUL LOAD 1204.61 GROSS WEIGHT 3260

MUNICIPAL AIRPORT / 205 CORSAIR DRIVE / GEORGETOWN, TEXAS 78628 / (512) 863-9566

F.A.A. APPROVED REPAIR STATION 210-65

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

MAJOR REPAIR AND ALTERATION
(Airframe, Powerplant, Propeller, or Appliance)

Form Approved
Budget Bureau No. 04-R060.1

FOR FAA USE ONLY

OFFICE IDENTIFICATION

INSTRUCTIONS: Print or type all entries. See FAR 43.9, FAR 43 Appendix B, and AC 43.9-1 (or subsequent revision thereof) for instructions and disposition of this form.

1. AIRCRAFT	MAKE: Rockwell International	MODEL: 114A
	SERIAL NO.: 14506	NATIONALITY AND REGISTRATION MARK: N5893N
2. OWNER	NAME (As shown on registration certificate): Targa Inc.	ADDRESS (As shown on registration certificate): P.O. Box 12817 Austin TX 78711

3. FOR FAA USE ONLY

4. UNIT IDENTIFICATION / **5. TYPE**

UNIT	MAKE	MODEL	SERIAL NO.	5. TYPE: REPAIR	5. TYPE: ALTERATION
AIRFRAME	◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆ (As described in item 1 above) ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆				X
POWERPLANT					
PROPELLER					
APPLIANCE	TYPE				
	MANUFACTURER				

6. CONFORMITY STATEMENT

A. AGENCY'S NAME AND ADDRESS	B. KIND OF AGENCY		C. CERTIFICATE NO.
Tejas Avionics Inc. 205 Corsair Drive Georgetown TX 78628		U.S. CERTIFICATED MECHANIC	CRS 210-65
		FOREIGN CERTIFICATED MECHANIC	
	X	CERTIFICATED REPAIR STATION	
		MANUFACTURER	

D. I certify that the repair and/or alteration made to the unit(s) identified in item 4 above and described on the reverse or attachments hereto have been made in accordance with the requirements of Part 43 of the U.S. Federal Aviation Regulations and that the information furnished herein is true and correct to the best of my knowledge.

DATE	SIGNATURE OF AUTHORIZED INDIVIDUAL
2-10-89	R.F.Diver

7. APPROVAL FOR RETURN TO SERVICE

Pursuant to the authority given persons specified below, the unit identified in item 4 was inspected in the manner prescribed by the Administrator of the Federal Aviation Administration and is [X] APPROVED [ ] REJECTED

BY							OTHER (Specify)
		FAA FLT. STANDARDS INSPECTOR		MANUFACTURER		INSPECTION AUTHORIZATION	
		FAA DESIGNEE	X	REPAIR STATION		CANADIAN DEPARTMENT OF TRANSPORT INSPECTOR OF AIRCRAFT	

DATE OF APPROVAL OR REJECTION	CERTIFICATE OR DESIGNATION NO.	SIGNATURE OF AUTHORIZED INDIVIDUAL
2-10-89	CRS 210-65	R.F.Diver

NOTICE

Weight and balance or operating limitation changes shall be entered in the appropriate aircraft record. An alteration must be compatible with all previous alterations to assure continued conformity with the applicable airworthiness requirements.

8. DESCRIPTION OF WORK ACCOMPLISHED *(If more space is required, attach additional sheets. Identify with aircraft nationality and registration mark and date work completed.)*

Removed Collins IND 350.

Installed KCS55A HSI, KA57 Autopilot adapter, GLS 350 Glideslope, KA 44B, KR 87.

All component and system installation of the equipment listed were accomplished in accordance with AC 43.13-2A, chapers 1 & 2.

Electrcial load, circuit protection and wire installation were accomplished in accordance with AC 43.13-1A, chapter 11, sections 2, 3, 4, 5 & 6.

Instrument installation in accordance with AC 43.13-2A, chapter 11.

Antenna was installed in accordance with AC 43.13-2A, chapter 3.

Aircraft equipment list & weight/balance were revised & recorded in aircraft records.

A functional test of all the equiment listed has been performed in accordance with FAR 23.1301 and checked in accordance with FAR 23.1431 for operating satisfactorily, and did not adversely affect any other components in the aircraft.

END

☐ ADDITIONAL SHEETS ARE ATTACHED

☆U.S. GOVERNMENT PRINTING OFFICE: 1986-659-121/40260

Avionics specialists OF TUCSON

6724 South Plumer • Tucson, Arizona • 85706 • (602) 746-1481 • FAA# 409-54

WEIGHT AND BALANCE CALCULATION

Date 3-18-81 W.O.# 0778

A/C type ROCKWELL Model 114A ID# N 5893N S/N 14506

PREVIOUS DATA

Lic. EW 2,041.40 CG 101.52 Mom. 207245 Useful Load 1,184

ITEMS ADDED (+) / REMOVED (-)

MFG	Description	WT.	Arm	Moment
SDI	CFS1000 PANEL UNIT	1.40*	78.30	109.62
SDI	201B FUEL TRANSDUCER	.30*	59.80	17.94

DRY New EW 2043.1 New CG 101.50 New Moment 207372.56

Gross WT. 3260 Useful Load 1182.3

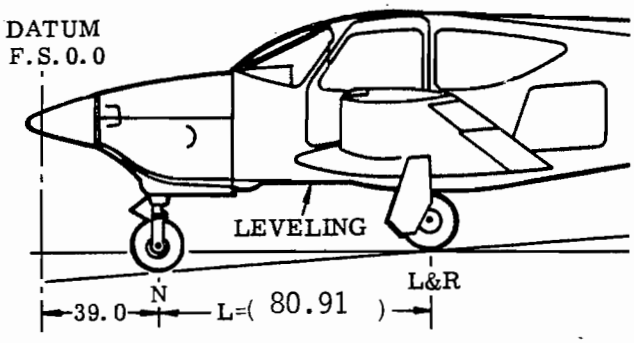
Prepared by R. Emmons

cert.# 008249185

AIRPLANE WEIGHT AND BALANCE STATEMENT

MODEL 114 A

SERIAL NUMBER 14506



AIRPLANE AS WEIGHED CONDITION
FUEL = UNUSABLE
OIL = FULL
AIRPLANE MUST BE LEVEL WHEN WEIGHED

SCALE READINGS

REACTION		WEIGHT	TARE	NET
Nose Wheel	F	482.	0	482.
L. Main Wheel		809.	-1.34	809.
R. Main Wheel		788.	-1.34	786.66
Total Weight	W	2,079.	-2.68	2,076.32

AIRPLANE AS WEIGHED C.G.

$D = 39.0 + L$

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

$C.G. = 119.91 - \frac{(482.)(80.91)}{(2,076.)} = 101.12$

AIRPLANE WEIGHT AND CENTER OF GRAVITY CALCULATIONS

ITEM	WEIGHT	ARM	MOMENT
Airplane AS WEIGHED 2 - 22 -79 PER W.R.O. P-9506, REV. 5	2,076.	101.12	209,925.
Basic Empty Weight	2,076.	101.12	209,925.
-Drainable Oil	-15.0	43.0	- 645.
-Undrainable Oil	- 4.0	48.6	- 194.
-Unusable Fuel	-12.0	112.2	-1,346.
-Hydraulic Fluid	- 3.6	137.5	- 495.
Dry Empty Weight (Equipped)	2,041.40	101.52	207,245.

USEFUL LOAD = 3260 - 2,076. = 1,184. LBS

SUPERCEDED 3-18-81
AVIONIC SPECIALISTS OF TUCSON

NOTE: It is the responsibility of the airplane owner and the pilot to ensure that the airplane is loaded properly. The basic empty weight, basic empty weight C.G. and useful load are noted on this page for this airplane as delivered from the factory. If the airplane has been altered, refer to the latest approved Repair and Alteration Form (FAA-337) and or Airframe Log Book for Revisions to this Report. W.O. # 0778

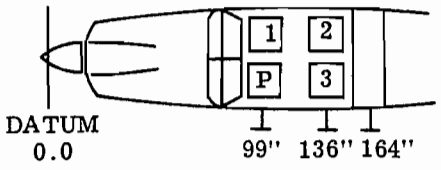
AIRPLANE WEIGHT AND BALANCE STATEMENT

MODEL 114 A

SERIAL NUMBER 14506

AIRPLANE WEIGHT AND MOMENT TABLES

LOADING CALCULATION TABLES
(TO BE USED WITH BASIC EMPTY WEIGHT)



SEATING PLAN

PASSENGER LOADING

Seat No.	Wgt.	Mom/1000
PILOT	170	17
1	170	17
2	170	23
3	170	23

BAGGAGE (D=164.0)	
WGT.	MOM/1000
20	3
40	7
60	10
80	13
100	16
120	20
140	23
160	26
180	30
200	33

USABLE FUEL (D=108.6)		
GAL.	WGT.	MOM/1000
5	30	3
10	60	7
15	90	10
20	120	13
25	150	16
30	180	20
35	210	23
40	240	26
45	270	29
48	288	31
50	300	33
55	330	36
60	360	39
65	390	42
68	408	44

LOADING SCHEDULE (EXAMPLE)

	ITEM	WGT	MOM/1000
1.	BASIC EMPTY WEIGHT	2,076.	210.
2.	PILOT	170	17
3.	PASSENGERS — 1	170	17
	PASSENGERS — 2	170	23
	PASSENGERS — 3	170	23
4.	BAGGAGE	96.	16.
5.	ZERO FUEL WT (NOT TO EXCEED 2852 LBS)	2,852.	306.
6.	FUEL	408.	44.
7.	LOADED ACFT. WGT.	3,260.	350.

Weights Engineer 2-22-79

AIRPLANE WEIGHT AND BALANCE STATEMENT

MODEL 114A

SERIAL NUMBER 14506

LIST OF REQUIRED EQUIPMENT
INCLUDED IN BASIC EMPTY WEIGHT
(In Addition to Basic Required Equipment, Type Data Sheet A12SO)

X (ITEMS INSTALLED AT TIME OF FACTORY CERTIFICATION)

X	ITEM	WT(LBS)	H-ARM
	PROPELLERS & ACCESSORIES		
(X)	1. Propeller Assembly a. Hartzell HC-C2YR-1BF/F8467-7R B3D34C405/90DFA-13	74.5	15.0
(X)	2. Governor a. Edo-Aire 34-828-014-16	2.8	24.6
(X)	3. Spinner a. Globe 46390B-9P 46390-501	5.5	12.0
	ENGINE ACCESSORIES		
(X)	101. Starter a. Prestolite MZ-4218	18.0	24.0
(X)	102. Oil Cooler a. Harrison 8534108	2.6	59.3
(X)	103. Auxiliary Elec. Fuel Pump a. Weldon A8120-C	2.6	59.8
(X)	104. Alternator, a. Prestolite ALX-8421	13.0	25.0
(X)	105. Oil Filter a. Champion CH48103/CH or 48922 Converter	1.2	55.0
(X)	b. A.C. 6439153	2.1	55.0
	LANDING GEAR & BRAKES		
(X)	201. Main Wheel a. Cleveland 40-75H (2)	12.8	122.0
(X)	202. Main Wheel Tires a. Type III, 7.00-6, 6 Ply (2)	20.00	122.0

X	ITEM	WT(LBS)	H-ARM
(X)	203. Nose Wheel a. Cleveland 40-77	2.6	39.0
(X)	204. Nose Wheel Tire a. Type III, 5.00-5, 6 Ply	5.5	39.0
(X)	205. Brake Assembly Cleveland 30-52H (2)	5.4	122.0
	ELECTRICAL EQUIPMENT		
(X)	301. Regulator a. Lamar B-00331-1	.3	74.0
(X)	302. Battery a. Rebat R35	29.6	186.0
(X)	303. Landing Light a. General Electric 4509	0.5	26.0
	304. Hydraulic Power Pack		
	a. Prestolite HYC 5001	8.5	180.0
(X)	b. 795000-1	8.5	180.0
	INTERIOR EQUIPMENT		
(X)	401. a. Flight Manual Dated 1/19/79		
	MISCELLANEOUS		
(X)	501. Heated Pitot Tube a. Rockwell 48611	.4	122.6
1	FIRE EXTINGUISHER	2.7	99.0

AIRPLANE WEIGHT AND BALANCE STATEMENT

MODEL 114 A SERIAL NUMBER 14506

OPTIONAL EQUIPMENT LIST
(INCLUDED IN BASIC EMPTY WEIGHT)
ONLY EQUIPMENT LISTED ABOVE MARKED LINE IS INCLUDED
IN BASIC EMPTY WEIGHT WHEN LEAVING FACTORY

ITEM		WT (LBS)	H-ARM	H-MOM
AVIONICS: 48784-1401				
1. Antenna Inst'l. Transponder	48777-635	.25	92.0	23.00
2. Antenna Inst'l. ADF Loop	48777-633	2.50	161.0	402.50
3. DME Inst'l. DME-451	873059-1083	5.34	198.0	1,057.32
4. Antenna Inst'l.	48777-667	.48	194.0	93.12
5. Circuit Breaker Instl.	835028-561	.87	79.0	68.73
6. Wiring Diagram - Collins Radio	835000-637	2.98	135.0	402.30
7. G.S. Receiver Inst'l. GLS-350	830737-553	1.85	195.0	360.75
8. Instrument Panel for Following:	835004			
2 - VHF-251		7.54	74.3	560.22
2 - VIR-351		6.46	74.8	483.21
1 - IND-351		1.13	78.6	88.82
1 - IND-350		1.05	78.2	82.11
1 - AMR-350		1.66	78.3	129.98
1 - TDR-950		2.03	77.1	156.51
1 - ADF-650		2.12	76.3	161.76
1 - IND-650		.84	78.6	66.02
1 - IND-450		.60	77.8	46.68

NOTE: THE ABOVE LISTING IS A MODIFICATION TO THE STANDARD AVIONICS PACKAGE.

2-22-79

COMMANDER AIRCRAFT COMPANY
7200 N.W. 63RD - HANGAR 8
BETHANY, OKLAHOMA 73008

WEIGHT AND BALANCE

DATE: 2-5-91 W.O.# M0332

AIRCRAFT: 114A SERIAL #: 14506

REG:# N5893N HOURS: 1053.24

THIS FORM SUPERSEDES WEIGHT AND BALANCE DATED: 2-10-89

ITEM	WEIGHT	ARM	MOMENT
PREVIOUS WEIGHT AND BALANCE	2062.09	103.77	213975.59
SB-114-21C PART V BOTH WINGS	5.4	123.0	664.2
NEW EMPTY WEIGHT:	2067.49		214639.79
NEW EMPTY WEIGHT C.G.:		103.81	
MAX GROSS WEIGHT:	3260		
USEFUL LOAD:	1192.51		

PREPARED BY: _____
FOR COMMANDER AIRCRAFT COMPANY REPAIR STATION#CMKR305K

CACSERVE.010

TEJAS AEROCENTER
Aircraft Weight/Balance Summary
CRS# BW2R731K

Page 1
4/27/1994

Aircraft ID: N893N
Type : 60-J14
Serial Nmbr: 14506

Total Time: 0.0
Hobbs Time: 0.0
Tach Time: 0.0

Description	Date	Weight	Arm	Moment
Previous Empty Figures	2/10/1989	2055.39	101.87	209382.57
Items Removed				
Items Installed				
KLN88 S/N1777	4/01/1990	6.20	73.00	452.60
KA83 ANT.	4/01/1990	0.50	153.00	76.50
New Empty Figures		2062.09	101.80	209911.67

Summary:
New Empty Weight: 2062.09 lbs
New CG 101.80 inches
New Useful Load : 1197.91 lbs

INSPECTOR

Installations and Removals listed above have been performed in accordance with manufactuer's specifications and is approved for return to service.

TEJAS AEROCENTER
TEJAS AVIONICS INC.
205 CORSAIR DRIVE
GEORGETOWN, TX 78628
512-863-9566

SECTION VII

AIRPLANE AND SYSTEMS DESCRIPTIONS

TABLE OF CONTENTS

GENERAL

The Model 114A is a four-place, low-wing, all-metal, retractable gear airplane powered by a six cylinder, normally aspirated Lycoming engine that is equipped with a McCauley, all metal constant-speed three-blade propeller. Access to the cabin is through two lockable cabin doors, one in each side of the airplane. The cabin interior is divided 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 airplane 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 access to the airplane from either side. The pilots area is equipped with a wide-vision windshield and large door windows. 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. 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

The airplane is 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 bayonet-type 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 the right door, may be used to lock the door 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 and rotate the black lever up.

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. The seats rise slightly when moved forward. To reposition seats, lift handle 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. The seat backs for the front seats must be in upright position during takeoff and landing.

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 inertia 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 airplane. The door is equipped with a spring-loaded latch assembly, plus a 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 portion of the cabin area. Access is through the baggage door on the left side of the airplane, or through the cabin area behind the rear passenger seats. Volume of the baggage compartment is twenty two (22) cubic feet and maximum allowable baggage weight is two hundred (200) pounds. When loading the airplane, refer to the Weight and Balance section of the Pilots Operating Handbook to assure that airplane 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, to prevent movement during airplane 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 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 structure to provide attach 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. 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 leading edge of the vertical stabilizer, provides 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 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 for the pilot's control column which locks the aileron and elevator surfaces. The control lock pin and flag assembly should be inserted through the instrument panel control column mount and the 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 the 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 three-position switch labeled WING FLAPS mounted directly to the right of the accessory electrical switches. Flap position is displayed on an electrical indicator 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. 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 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 elevator trim is required over the full flap extension range, however, minor changes in trim may be required depending on airspeed and airplane 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 a spring, 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 in either direction.

ELEVATOR CONTROL SYSTEM

The elevator is of all metal construction. It consists of two segments connected by a torque tube and is attached to the aft spar of the horizontal stabilizer. Each segment has three hinge points. 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 segment, 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 attach 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 system 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 airplane to the right, opposite rotation will yaw the airplane 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 system 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 airplane a minimum turn radius of 28' 5.5". Nose steering limit $\pm 30^{o}$.

LANDING GEAR

The airplane is equipped with a retractable hydraulically operated, tricycle landing gear that includes a steerable nose wheel and self-adjusting disc brakes on 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 is 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 airplane 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.

An emergency extension valve, located on the left side of the center console, is used for emergency extension of the gear. This valve bypasses 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 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, assists in preventing 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 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 WARNING) 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 instrument installation provides all instruments necessary for safe and efficient operation of the airplane. With the exception of the magnetic compass and outside air temperature gage, all instruments are installed in the main instrument panel and sub-panel areas, and are grouped according to function and for ease of surveillance (see Figure 7-2).

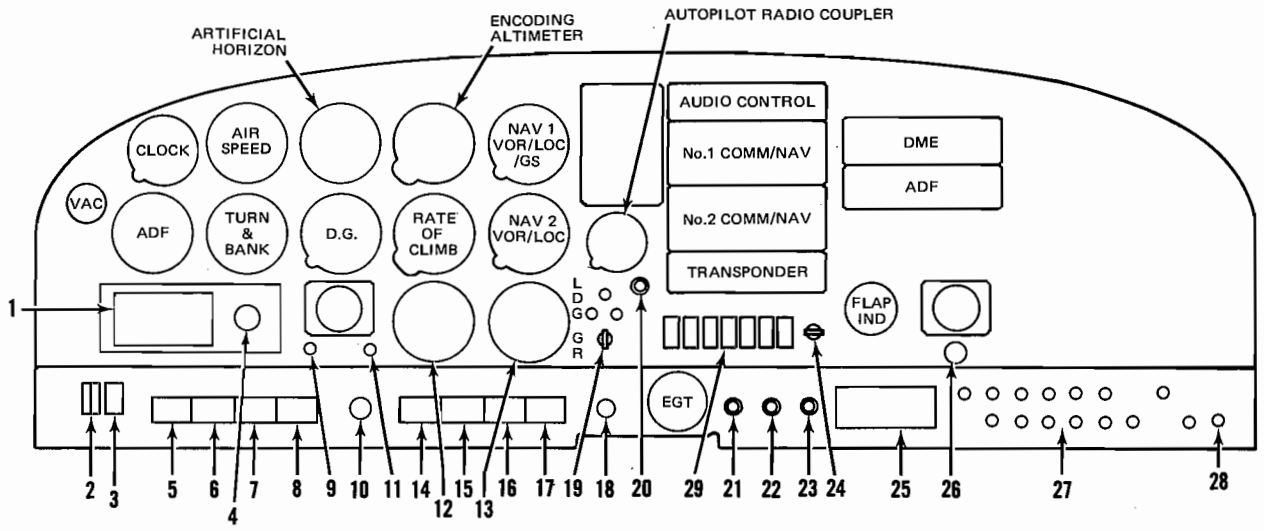
All primary flight and gyro instruments are installed in the left side of the main instrument panel. Manifold pressure and tachometer indicators are mounted in the lower center area of the main panel and the remaining engine instruments are grouped horizontally across the left instrument sub-panel. Navigation 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 include a magnetic compass, airspeed indicator, encoding altimeter, rate-of-climb (vertical speed) indicator, an electrically operated turn and bank indicator and a vacuum operated artificial horizon (attitude indicator) and directional gyro. Various combinations of communications and navigation equipment are installed to provide the airplane with a DAY/NIGHT VFR/IFR capability. See Figure 7-2. Refer to Section IX of this Handbook for information on Avionics equipment.

All electrically operated instruments receive power from the main bus and are protected by trip-free, push-to-reset circuit breakers, located on the circuit breaker panel (see Figure 7-8).

Avionics equipment receives power from the radio bus, which is connected to the main bus by the radio master switch. Individual avionics units are protected by trip-free push-to-reset circuit breakers located in the radio circuit breaker panel (see Figure 7-8). Radio master switch must be ON for avionics equipment to receive power.



1. AUTOPILOT CONTROL PANEL
2. MASTER SWITCH
3. PITCH TRIM CUTOFF SWITCH
4. FUEL PRESSURE INDICATOR
5. AMMETER
6. VOLTMETER
7. LEFT FUEL QUANTITY INDICATOR
8. RIGHT FUEL QUANTITY INDICATOR
9. DIMMER CONTROL-INSTRUMENTS
10. IGNITION SWITCH
11. DIMMER CONTROL-AVIONICS
12. MANIFOLD PRESSURE/FUEL FLOW INDICATOR
13. TACHOMETER/HOUR METER
14. CYLINDER HEAD TEMPERATURE INDICATOR
15. OIL PRESSURE INDICATOR
16. OIL TEMPERATURE INDICATOR
17. RUDDER TRIM INDICATOR
18. STATIC SOURCE SELECTOR VALVE
19. LANDING GEAR SELECTOR/GEAR POSITION INDICATORS
20. ALTERNATE INDUCTION AIR CONTROL
21. CABIN VENTILATION CONTROL
22. CABIN HEAT CONTROL
23. DEFROSTER CONTROL
24. WING FLAPS SELECTOR SWITCH
25. RADIO CIRCUIT BREAKER PANEL
26. CIGARETTE LIGHTER
27. CIRCUIT BREAKER PANEL
28. DIMMER CONTROL-CIRCUIT BREAKERS
29. CIRCUIT BREAKER SWITCHES (see Figure 7-9)

NOTE: The electrically operated instruments, ammeter (5), voltmeter (6), left fuel quantity indicator (7), right fuel quantity indicator (7), cylinder head temperature indicator (14), and oil temperature indicator (16) will indicate at zero, or at dot, upon complete loss of instrument power.

Figure 7-2. Instrument Panel

PITOT PRESSURE SYSTEM

Impact pressure (pitot pressure) is sampled by a heated 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 airplane centerline, immediately aft of the spar. From the drain, the tubing runs forward through the center console, to the instrument panel where it is connected to the airspeed indicator. Pitot heat is controlled by a trip-free circuit breaker switch, labeled PITOT HEAT, located in the lower center of the instrument panel.

STATIC PRESSURE SYSTEM

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 airplane centerline, then forward, under 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.

ALTERNATE STATIC SOURCE VALVE

A toggle-type alternate static source valve is installed in the instrument sub-panel directly below the landing gear selector handle. In the event the 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 source of static pressure. When the alternate source valve is in the ALT position, the normal static port lines are isolated and static pressure for the airspeed indicator, altimeter and vertical speed indicator is supplied from inside the cabin.

Recommend side windows be closed when operating on alternate static source. Maximum correction is required when pilot's side window is open during alternate source operation. See Airspeed and Altimeter Calibration charts (Alternate Static Source) in Section V of this Handbook when using alternate static source.

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 activate the stall warning horn at 5 to 10 knots above 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 airplane on the ground. A spring-loaded test switch, located in the left main gear wheel well, allows the stall warning system to be checked with airplane on the ground.

ENGINE

The airplane is equipped with a Lycoming IO-540-T4B5D fuel-injected, horizontally-opposed, 6 cylinder engine. The engine incorporates its own oil supply and distribution system and utilizes a separate oil cooler assembly and an air-oil separator. The engine produces 260 BHP at 2700 RPM at sea level, and is certified to operate on a minimum of 100/130 octane (green color) aviation fuel. Aviation fuel 100 LL (blue color) is an approved alternate. A Lycoming Engine Operator's Manual is supplied with each aircraft 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 7-3) and rotate fore and aft. The control levers are color and shape-coded to assist in identification. Functions of the control

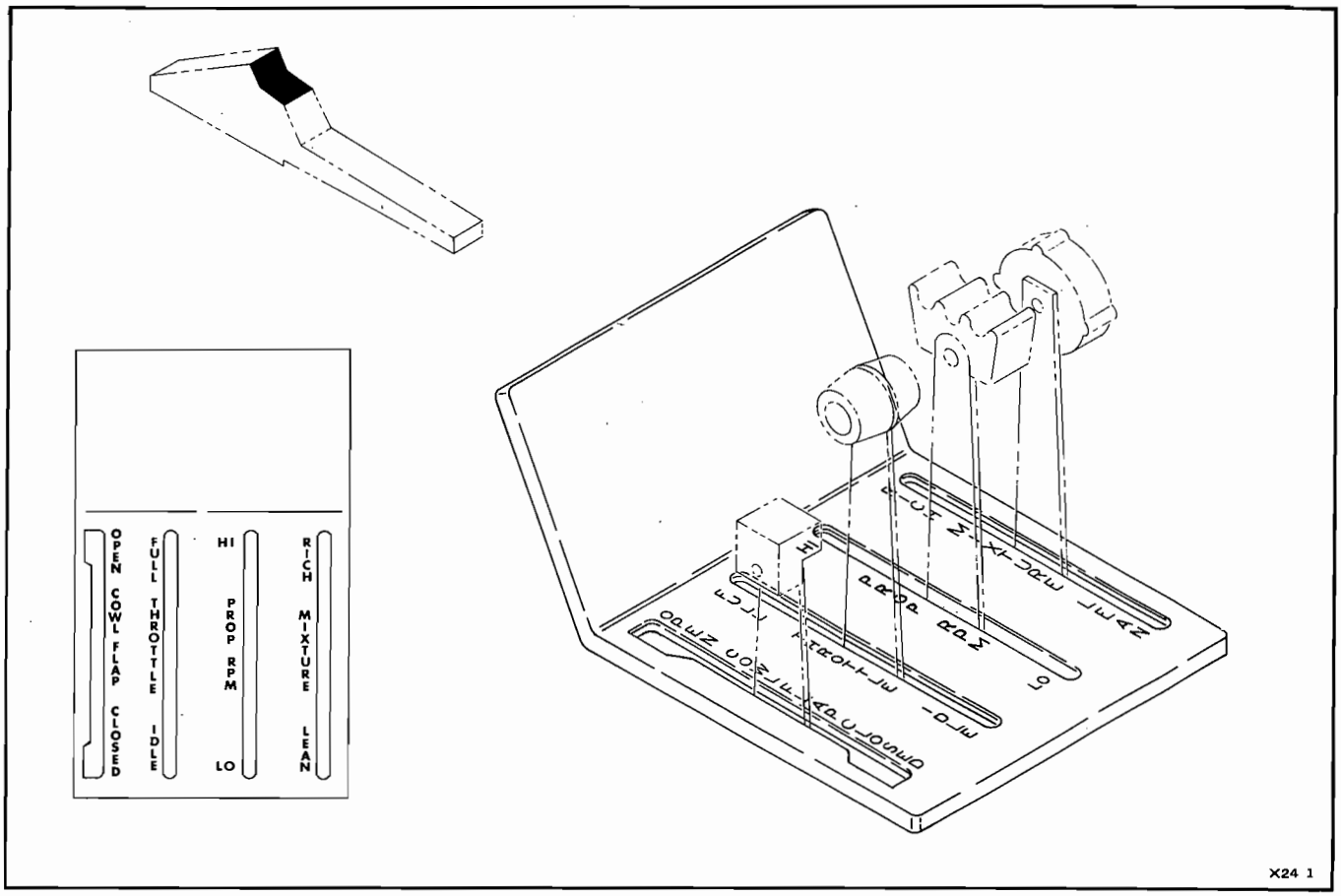


Figure 7-3. Engine Control Pedestal

levers are, proceeding from left to right: Cowl Flap (white/cube shaped), controls position of cowl flaps; Throttle (black/round), controls manifold pressure; Propeller Control (blue/crowned) regulates engine RPM; and the Mixture Control (red/hexagonal), 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.

ENGINE INSTRUMENTS - Refer to Figure 7-2

TACHOMETER

The tachometer is a mechanical indicator driven by a flexible drive shaft. The indicator displays actual engine RPM. An hour meter, located in the face of the tachometer, is mechanically driven by the tachometer and records engine operating hours. 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°F to 245°F (green arc), and temperature should not exceed 245°F (red line).

OIL PRESSURE GAGE

The Bourdon-tube type oil pressure gage is a direct-reading instrument 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 100 PSI (red line).

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 airplane 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 in selecting best power or best economy 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. Observe cylinder head temperature limits when establishing fuel-air mixtures with 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 airplane 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, perform a fifty (50) hour inspection on the engine, 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.

ON GOING

When operating the airplane, 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 airplane, 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.

An air-oil separator, mounted on the firewall, reduces loss of oil through the engine breather vent system.

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 temperature 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 (impulse coupling) magneto. This is a dual magneto system utilizing one housing. There are two ignition systems on the engine, 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) and 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 fuel injector unit for the fuel/air mixing process. Heated air, taken downstream of the engine near the left muffler and routed to the induction air manifold, provides an alternate source of intake air in the event of fuel injector impact icing, or icing of the external filter element. This heated airflow source is controlled by a round pull-to-operate control adjacent to the landing gear indicator lights.

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, and provisions for 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 engine control quadrant by a lever labeled OPEN-COWL FLAP-CLOSED. 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 front side 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 engine-driven pump is installed on the aft lower left side of the engine accessory housing. This 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 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. A vacuum gage located on the instrument panel, displays system pressure. A green arc at 4.5 to 5.2 in.Hg. indicates normal operating range. Readings above or below this range indicate a possible malfunction in the system and the vacuum gyro instruments must be considered to be unreliable.

ENGINE MOUNT

The engine mount is a welded tubular structure attached to the firewall at five (5) points. 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 114A is equipped with a McCauley, all metal B3D34C 405/90DFA-13, constant speed, three-blade propeller. Maximum diameter is 77 inches; field cutoff to 76.5 inches is allowed.

The constant speed propeller 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.

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 airplane 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 counter-clockwise. To replace the cap, depress the fastener, rotate counter-clockwise 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 tank sumps, gascolator and wheel wells (see Figure 7-4).

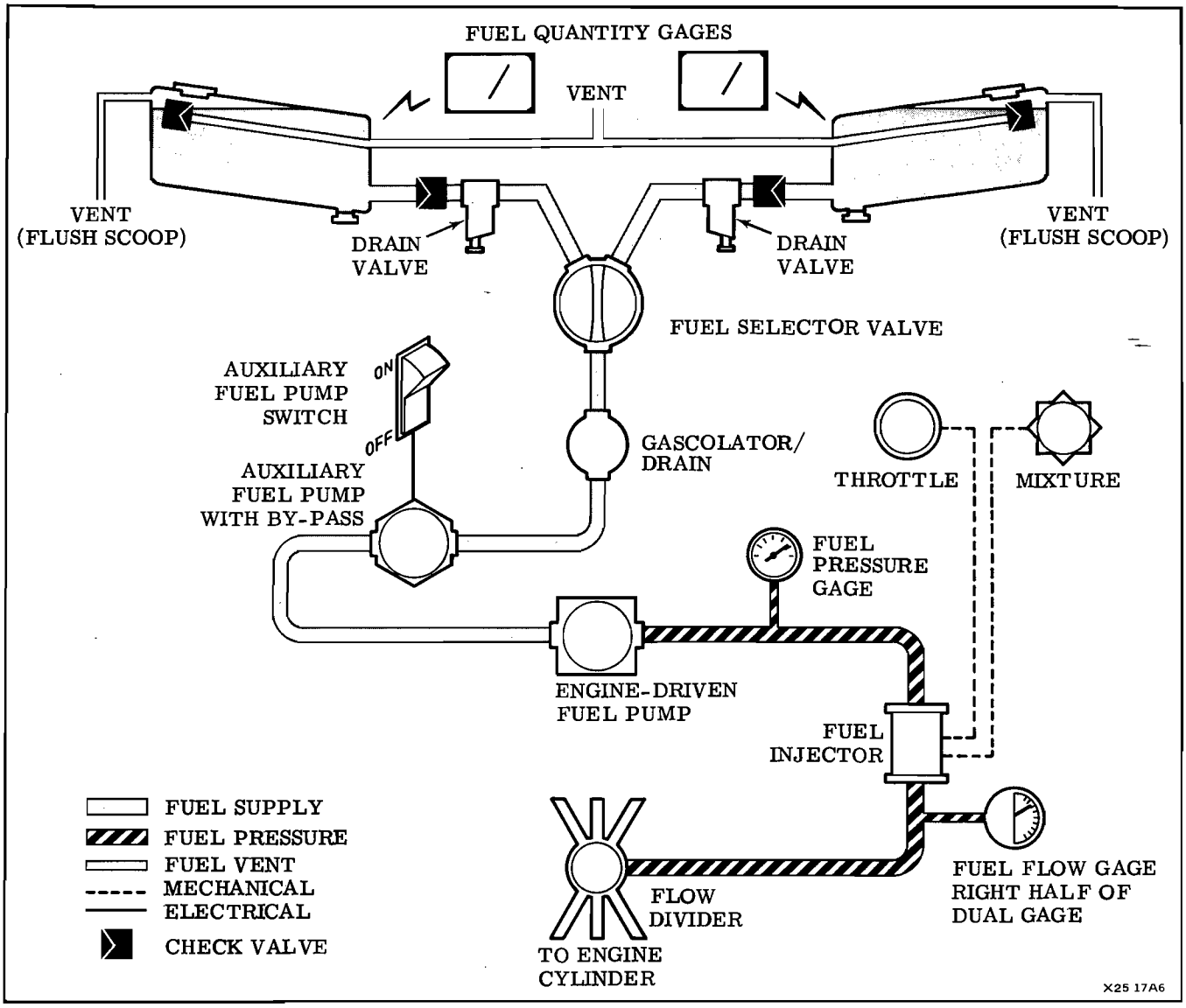


Figure 7-4. Fuel System Schematic

FUEL SELECTOR VALVE

A five-position fuel selector valve (see Figure 7-5) is installed in the forward section of the center console. The valve handle controls selection of: OFF, LEFT tank, RIGHT tank and a second OFF position. Depress red tab at rear of selector to select OFF.

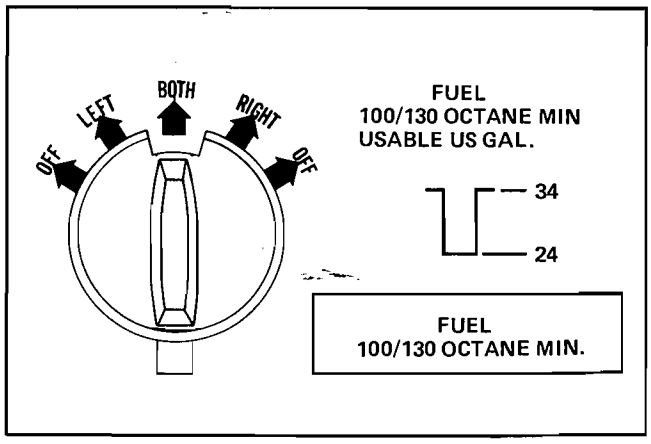


Figure 7-5. Fuel Selector Valve and Fuel Tank Placard

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. The auxiliary fuel pump is used as a boost pump 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 airplane to safely complete the planned 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 airplane 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 airplane 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 wheel well drains 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 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 equipped 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 the system does require recalibration, this should be done by a licensed A & P mechanic in accord with the current Maintenance Manual.

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. Battery switch must be ON for fuel quantity indicators to function.

HYDRAULIC SYSTEM

LANDING GEAR EXTENSION/RETRACTION SYSTEM (See Figure 7-6)

The hydraulic power supply is an integrated hydraulic pack containing a reversible, electric motor-driven hydraulic pump, a reservoir, pressure control valves, a thermal relief valve and a gear up check valve. The power pack is located in the left forward area of the fuselage tail cone and is accessible through the left aft baggage compartment panel. The sole function of the hydraulic power pack is to raise and lower the tricycle landing gear.

OPERATION: RETRACT

When the landing gear selector switch is pulled out slightly to clear the detent and placed in the UP position, hydraulic fluid, under pressure, is directed to the UP side of the landing gear actuators, causing the gear to start to retract. Fluid on the DOWN side of the actuator flows back to the reservoir. Movement of the gear from the DOWN and LOCKED position deactivates a down position switch, located on each gear drag link, causing the three gear DOWN and LOCKED lights to extinguish and illuminating the red GEAR WARNING light. As each gear is fully retracted, it activates a gear up position switch, and when all three gear up switches have activated the GEAR WARNING light extinguishes. A pressure switch, located in the UP hydraulic line, actuates when the pressure in the line reaches 1650 ($\pm$ 50) psi and shuts off the hydraulic pack motor. A gear up check

valve in the return line to the hydraulic pack closes, trapping pressure in the line, causing a hydraulic lock which holds the gear up. A loss of 250 psi of pressure in the UP line will be sensed by the pressure switch, which will allow the hydraulic pump to run and build the pressure back up to 1650 (± 50) psi.

EXTENSION:

Placing the gear selector switch in the DOWN position, directs hydraulic fluid to the down side of the actuator. Fluid in the UP line flows back to the reservoir and the gear extends. As the gear starts down, the up position switches deactivate and the GEAR WARNING light illuminates. When the gear is fully extended with the drag links over center, the down position switches activate, illuminating the three green DOWN and LOCKED lights, and the red GEAR WARNING light extinguishes. A pressure switch in the down line shuts off the hydraulic pack when pressure in the line reaches 500 (± 50) psi. A "pilot" check valve in the down line closes, trapping hydraulic pressure, locking the gear down with a hydraulic lock in the down line, plus a mechanical over center lock. If any one of the three down position switches fails to actuate when the gear is fully extended, it's corresponding green light will not illuminate, the GEAR WARNING light will remain illuminated, the down pressure switch will be bypassed electrically, and the hydraulic pump will continue to operate.

A high pressure control valve limits system pressure to 1800-2000 psi during the retraction cycle and a low pressure control valve limits system pressure to 600-700 psi during the extension cycle. A thermal relief valve limits system pressure to 2025-2425 psi when pump is not operating.

An emergency gear extension system is provided. Placing the emergency gear extension valve in the GEAR DOWN position opens the emergency dump valve and bypasses the fluid from the up side of the gear actuators back to the reservoir. This relieves the hydraulic lock which holds the gear up and allows gravity, assisted by a spring on each gear, to extend the gear. The gear cannot be retracted with the emergency dump valve open, since the pressure will continually be relieved through the valve.

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 WARNING 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 WARNING and all position lights being out.

As a reminder that the gear is retracted, the gear warning horn and red GEAR WARNING light will actuate whenever the throttle is retarded below approximately 14 inches of manifold pressure with the gear retracted, or when flaps are extended 25 degrees or more with the gear retracted (regardless of throttle position). Master switch must be on for gear warning.

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 positioned 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 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 strut extension. The squat switch deactivates the circuit to the UP side of the hydraulic pump and helps prevent accidental gear retraction when the airplane 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 or hydraulic pump failure. The valve relieves pressure which normally retains the landing gear in the up position, allowing spring assisted gravity free fall to extend the gear. To operate, pull knob out and push down. Knob must be in vertical (up) position for normal gear operation.

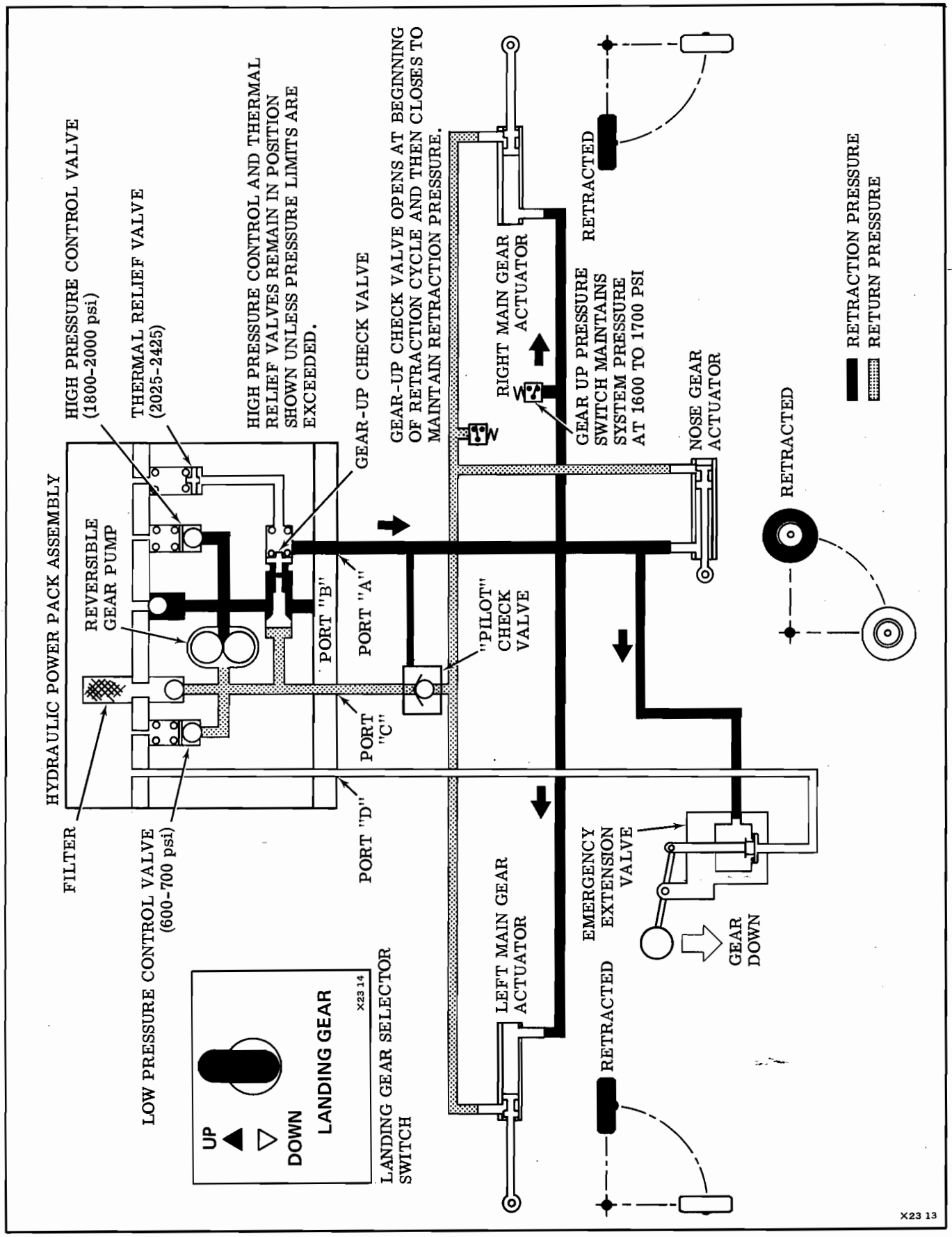


Figure 7-6. Hydraulic System Schematic - Gear Retracted (Sheet 1 of 3)

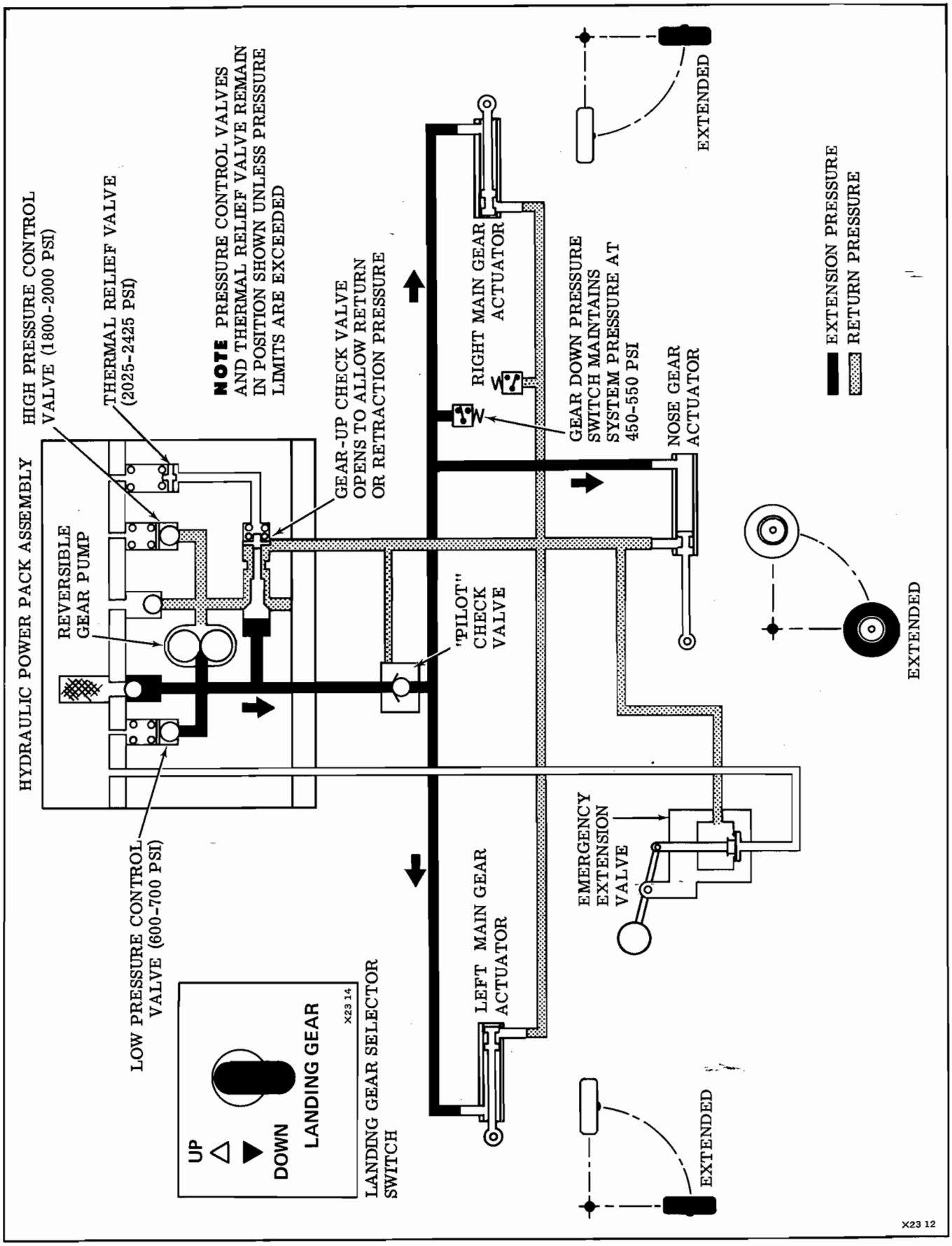


Figure 7-6. Hydraulic System Schematic - Gear Extended (Sheet 2 of 3)

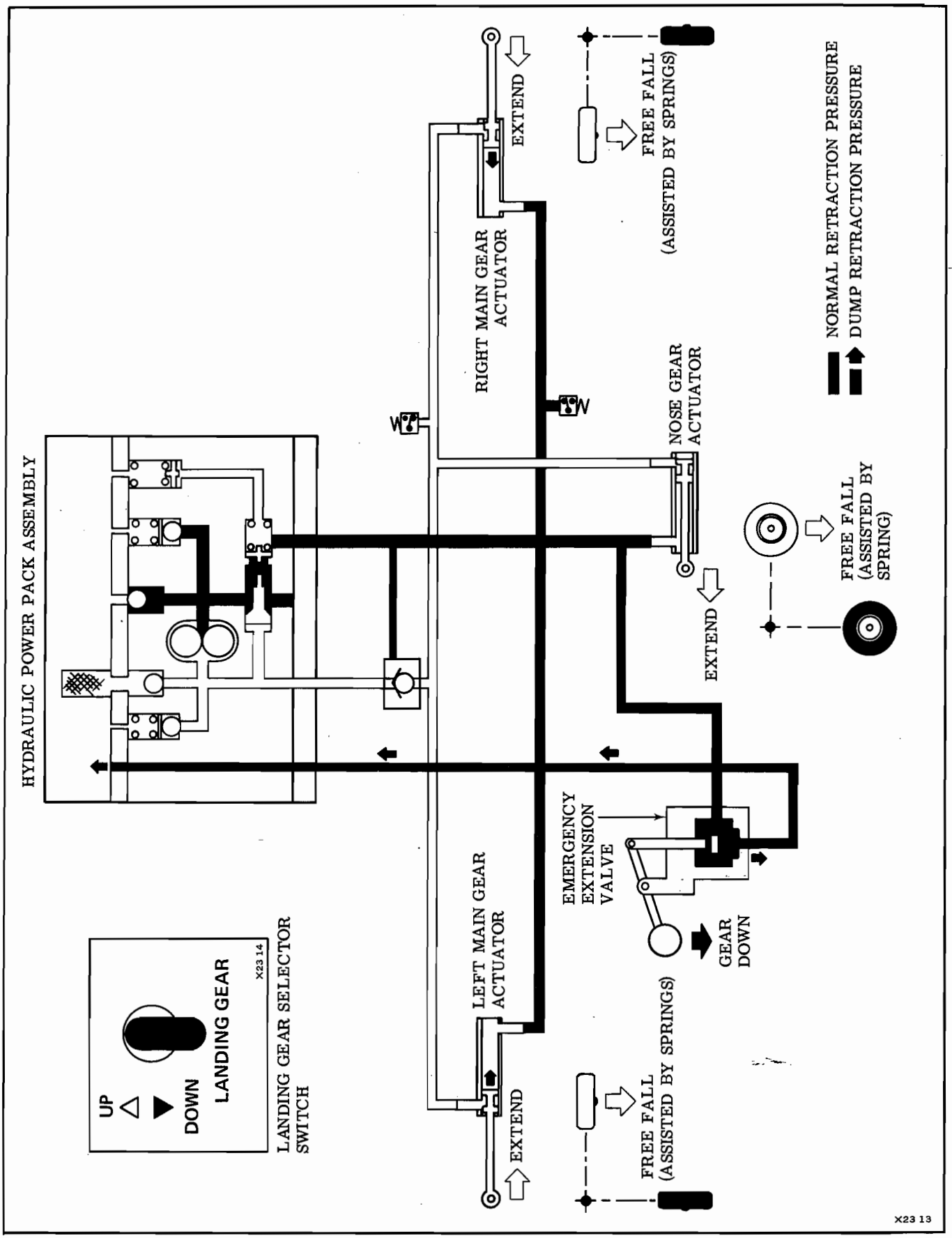


Figure 7-6. Hydraulic System Schematic - Emergency Gear Extension (Sheet 3 of 3)

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. 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, trapping hydraulic pressure to the brakes. Toe pressure may then be released. To release the parking brake, depress the tops of the rudder pedals and push control knob to the full-in position, releasing hydraulic pressure. Excessive force applied to the parking brake control knob will not increase parking brake pressure.

ELECTRICAL SYSTEM

The airplane is equipped with a 14-volt, direct current, electrical system, powered by an engine-driven alternator. A 12-volt, 35-ampere/hour, lead-acid, battery, provides power for engine start and acts as a back-up power source. The battery is located in the aft fuselage section and is accessible through the baggage compartment. Electrical power is supplied to airplane circuits through a main bus bar, a circuit breaker switch bus bar and a radio bus bar (see Figures 7-7 and 7-8). An over-voltage relay protects electrical equipment from harmful transient voltages. Alternator capacity is 60 amperes.

MASTER SWITCH

A split rocker-type master switch controls the electrical system and 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 battery power to the airplane and the right half (ALT) controls alternator output. For 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 electrical load is placed on the battery; therefore, all non-essential electrical equipment should be turned off and flight should be terminated as soon as practical when operating with ALT switch OFF. Use Emergency Gear Extension procedure when extending gear with alternator 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 until ammeter indicates on charge side.

VOLTMETER

A voltmeter, located in the lower left instrument sub-panel, allows the pilot to monitor bus voltage, and, when used in conjunction with the ammeter, provides an excellent indication of electrical system operation. When system is operating normally, voltmeter will read between 12 and 15 volts, generally at approximately 14 volts. Maximum allowable voltage is indicated by a red radial at 16.0 volts.

A low voltage reading (less than 12 volts) or a slow decrease in the voltage reading, accompanied by a very low charging reading on the ammeter, indicates the alternator is becoming overloaded. If this situation occurs, reduce the load by turning off non-essential equipment. Voltmeter reading should return to normal (approximately 14 volts) and the ammeter reading should increase. If this occurs, proceed with flight, but use caution in increasing electrical load.

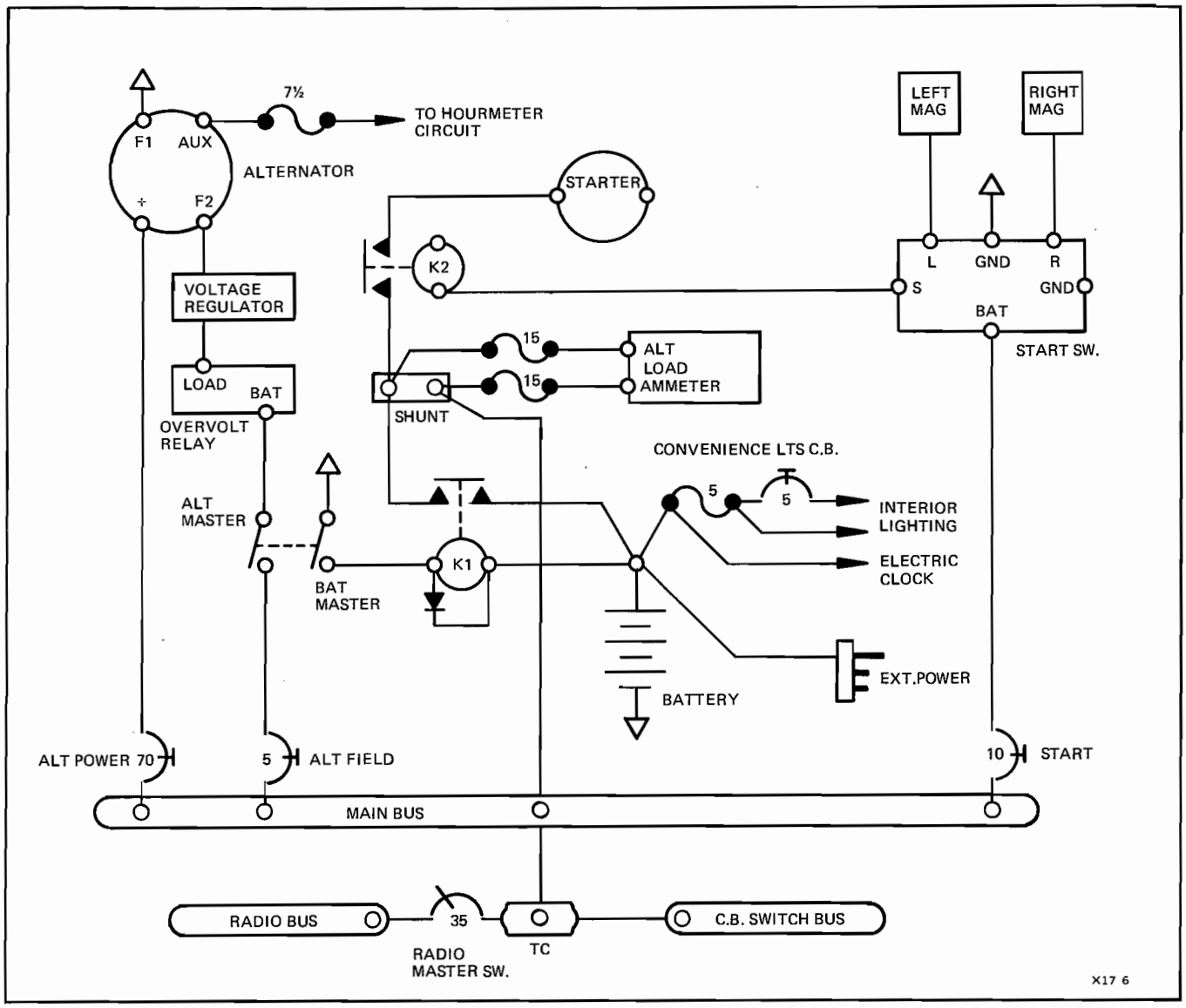


Figure 7-7. Power Distribution System

A low voltage reading (less than 12 volts) or a slowly decreasing voltmeter reading, accompanied by a discharge reading on the ammeter, indicates the alternator is not on the line and the battery is carrying the entire load. This situation will result in a complete loss of electrical power when the battery becomes discharged. To correct the condition, immediately reduce the electrical load to the minimum essential for safe operation. Place ALT half of master switch OFF and back to ON. If voltmeter reading returns to normal (approximately 14 volts) and ammeter shows a charge, alternator is on the line and operating normally. Place deactivated equipment back in operation, one unit at a time, while monitoring voltmeter and ammeter for abnormal indications, and continue normal operation.

If voltmeter reading does not return to normal and ammeter continues to show discharge, a fault exists in the alternator system. Place ALT half of master switch OFF and prepare to terminate flight as soon as practical.

It is essential to reduce the electrical load as much as possible prior to attempting to reset the alternator. If an overload caused the alternator to drop off the line initially, the alternator will not come back on the line until the overload condition is corrected.

Heavy electrical usage, such as prolonged cold weather engine starts or extended periods of ground operation, may reduce the battery charge enough for it to accept higher than normal charging rates during the initial part of the flight. This will be indicated by higher than normal ammeter readings. After a reasonable period of

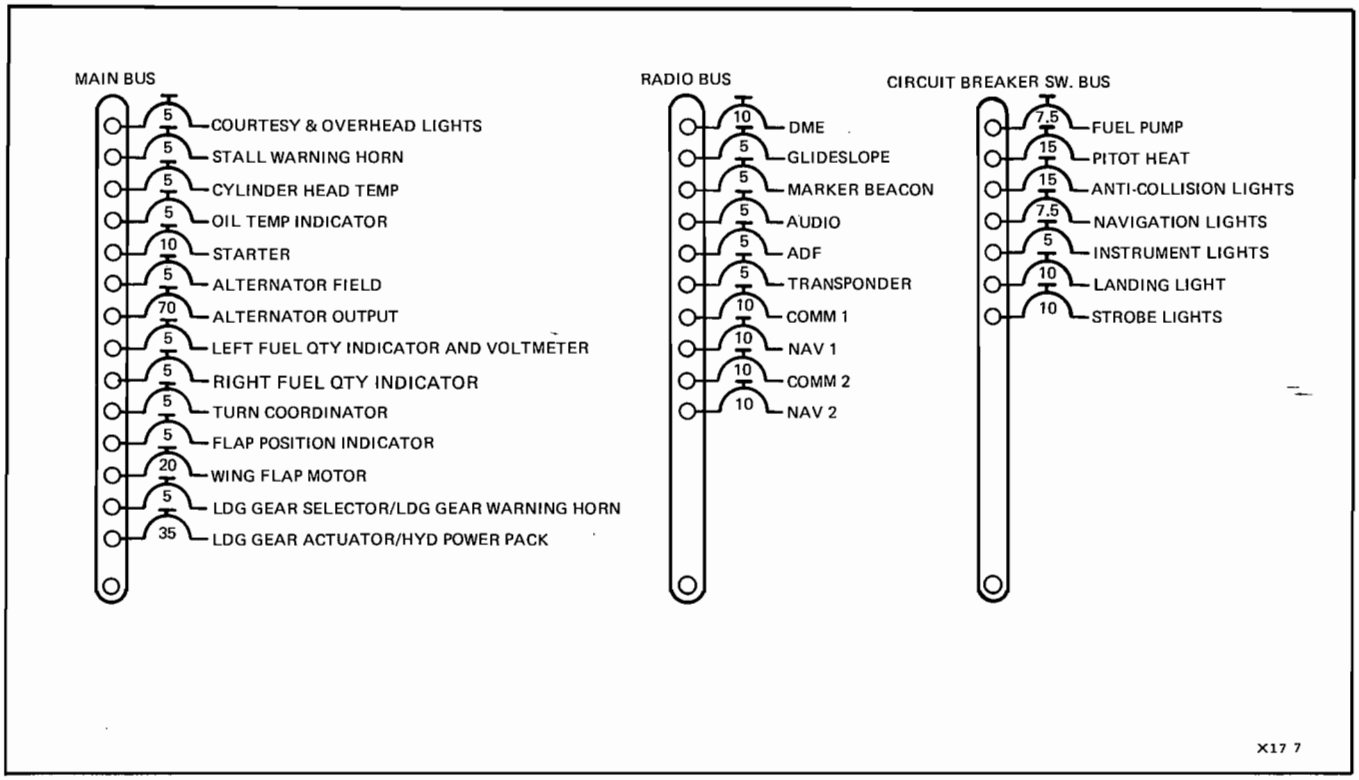


Figure 7-8. Power Distribution

time (approximately thirty minutes), ammeter readings should return to normal. If high ammeter readings continue after this time period, there is a possibility the battery may overheat and evaporate electrolyte at an excessive rate. To preclude the possibility of damaging the battery, turn ALT switch OFF, reduce electrical load to the essential minimum, and terminate flight as soon as practical.

OVERVOLT RELAY

An overvolt relay protects electrical equipment from excessive voltages. It is an electro-mechanical relay, which will open if electrical system voltage exceeds a pre-set value, and take the alternator off the line. When activated, the relay is held open electrically. The ammeter will indicate discharge if the overvolt relay opens. To reset, place ALT switch OFF and back ON.

CIRCUIT BREAKERS

Push-to-reset, push-pull, or rocker-type circuit breaker switches are used to protect electrical circuits in the airplane.

The main circuit breaker panel is located in the lower right instrument sub-panel (see Figure 7-9). All general system and avionics circuit breakers in this panel are the push-to-reset type. Exterior and instrument lighting, 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 lights, electric clock, baggage compartment light and step light circuits. Fuses are installed to protect some circuits. There are no provisions for replacing fuses in flight.

ALTERNATOR

A 14-volt, 60 amp 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.

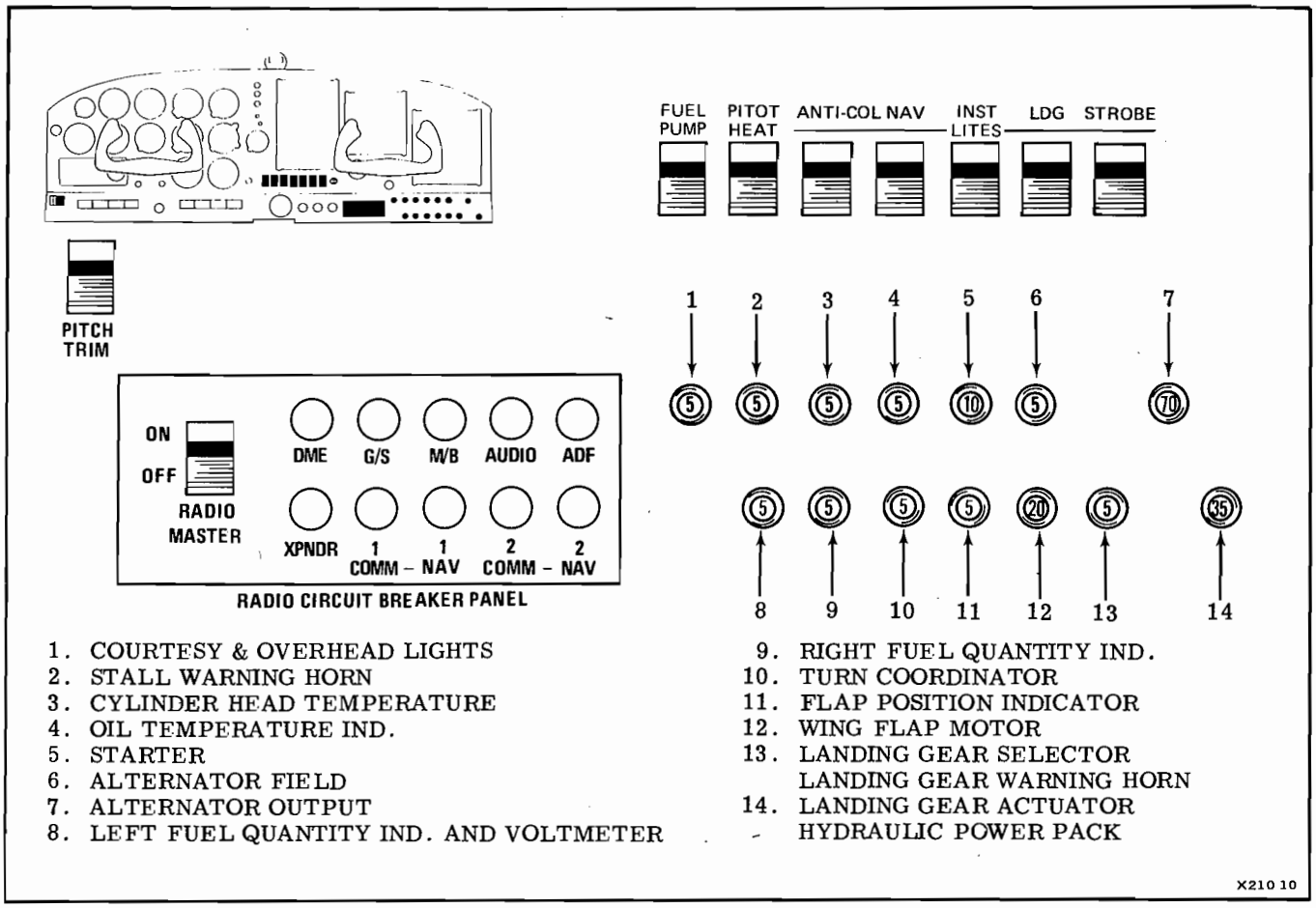


Figure 7-9. Circuit Breakers

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 airplane 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.

CAUTION

Ensure power switch on external power unit is OFF when connecting power unit to, or disconnecting power unit from, airplane. Failure to do so may cause arcing between the power unit plug and the airplane receptacle.

The position of the master switch is important in a starting operation using external power. Before connecting external power to the airplane 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 airplane 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 operation. Do not use external power cart to charge airplane battery.

LIGHTING SYSTEMS

EXTERIOR LIGHTING

Conventional navigational lights are installed on each wing tip and the aft end of the tailcone. The lights are operated by the NAV LITE rocker switch (located in 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 LDG LITE rocker switch.

A unique independent set of exterior courtesy lights is 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 receives 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 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.

Three strobe-type anti-collision lights are installed on the airplane. Strobe lights are installed on each wing tip and the tail stinger. A rocker switch, labeled STROBE, controls the strobe lights.

A flashing beacon anti-collision light is installed on the top of the vertical tail assembly. A belly-mounted flashing beacon is available as optional equipment. Flashing beacons are controlled by a rocker switch labeled ANTI-COL LITES.

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 and by individual post lights. 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.

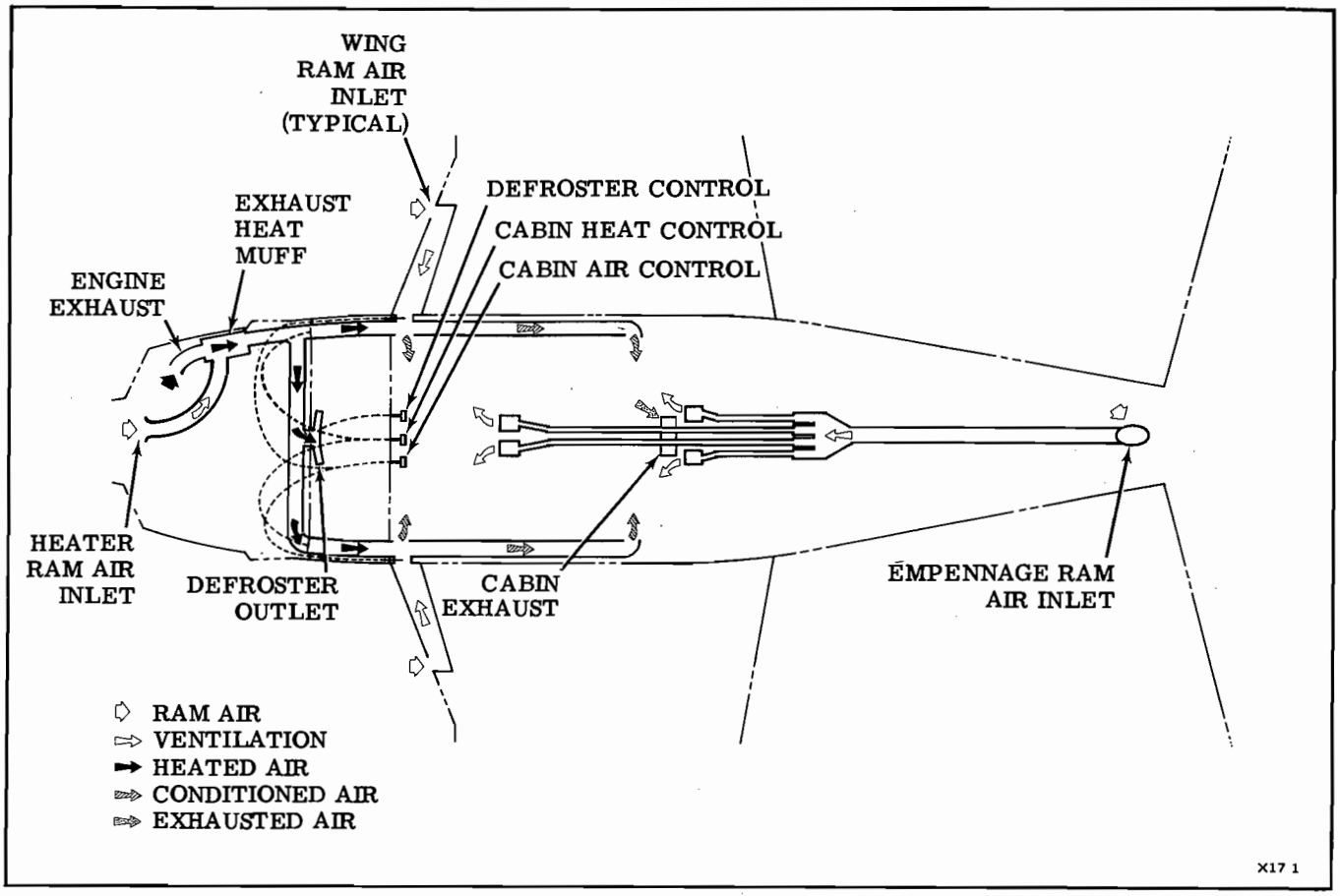


Figure 7-10 Cabin Heat and Ventilation Schematic

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 air temperature for individual requirements.

Two separate systems provide maximum air intake for cabin ventilation. 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 airplane. 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 airplane, that cannot be accomplished by a certificated pilot, be taken to an authorized Rockwell Commander Dealer or certified service station. Your authorized dealer will have available all service publications and FAA Airworthiness Directives pertaining to your airplane, as well as trained personnel, thus ensuring maximum utility and safety from your airplane.

It is the responsibility of the owner and/or operator of the airplane to ensure that the airplane is maintained by qualified mechanics and conforms to all airworthiness requirements established for this airplane.

To ensure a prompt reply, and correct information from Rockwell International, General Aviation Division, Customer Service Department, it is important to include the airplane serial number in any correspondence concerning service or maintenance on this airplane. 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.

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 airplane owner, upon receipt of his airplane, 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.

PREVENTIVE MAINTENANCE THAT MAY BE ACCOMPLISHED BY A CERTIFICATED 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 FAR, 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 airplanes 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 violated.

GROUND HANDLING

PRECAUTIONS

The following precautionary measures should be taken when handling the airplane on the ground:

1. Do not use parking brake to hold unattended airplane.
2. Do not set parking brake 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.

3. When operating the engine, remove all towing equipment and observe the following:
   a. Head airplane 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 airplane 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 airplane 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 airplane with little effort.
3. Attaching rope harness to main landing gear. This method is to be used when towing airplane forward through snow and over soft or muddy ground. Use tow bar to steer airplane.

TOWING PRECAUTIONS

1. Never push, pull, or lift airplane 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 airplane when towing, and avoid jerky motions.
4. Do not use ropes attached to main gear for towing airplane backward through mud or snow.

PARKING

Head airplane 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.

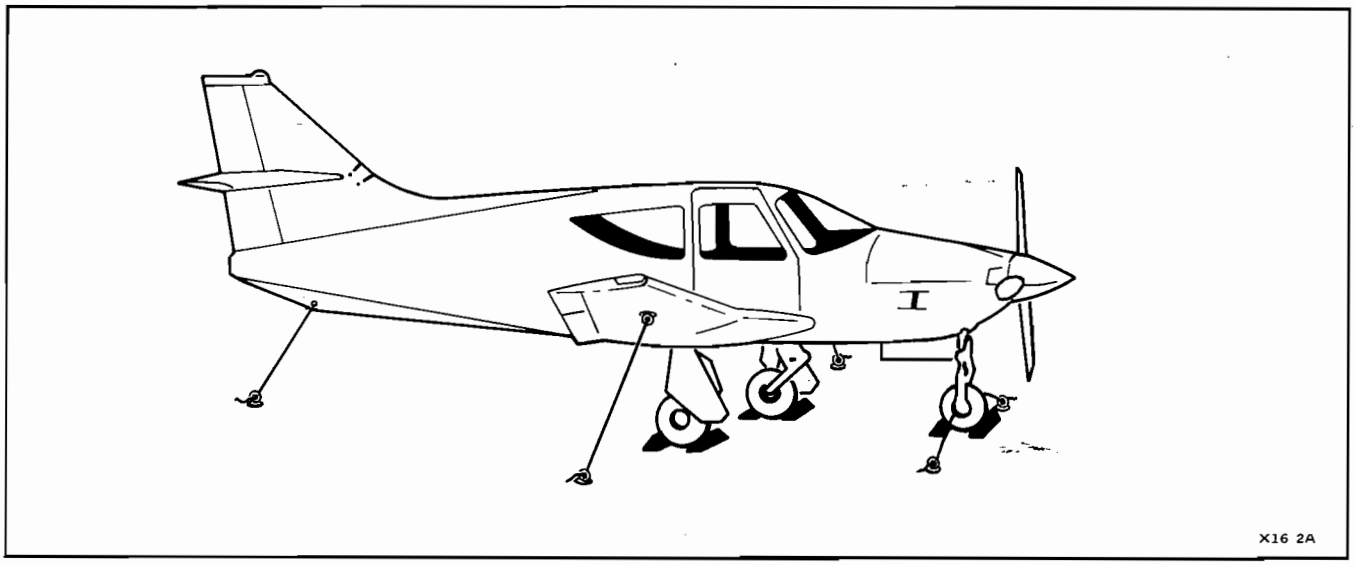


Figure 8-1. Mooring

MOORING

It is recommended that the airplane be hangared when not in use to minimize the deteriorating effect of weather and high winds. The airplane 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 airplane 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 airplane is tied down. Also, soft foam rubber intake opening plugs will prevent foreign matter from accumulating inside the engine cowling.

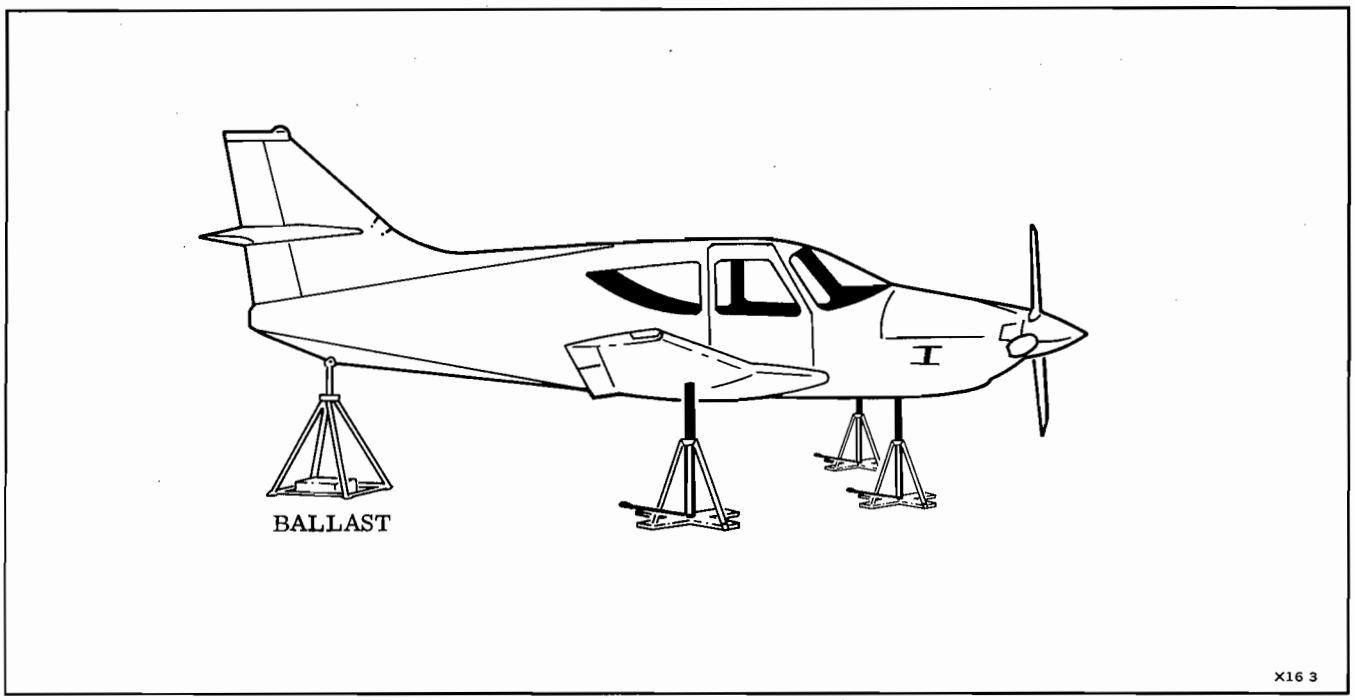


Figure 8-2. Jacking

JACKING

Airplane jacking should be accomplished in a hangar unless wind is calm. To jack the airplane 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 airplane 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 airplane 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 airplane 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 airplane is to be stored for 28 days or less. However, the following procedures should be accomplished before the airplane 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 airplane 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 airplane 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 airplane, 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 AIRPLANE TO SERVICE

If proper procedures have been observed during storage, very little preparation will be necessary to reactivate the airplane. 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 airplane 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 airplane 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 airplane with an octane rated fuel lower than 100/130 (green). Aviation fuel 100 LL (blue) is an approved alternate.

WARNING

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

Service the airplane 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 AIRPLANE 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.

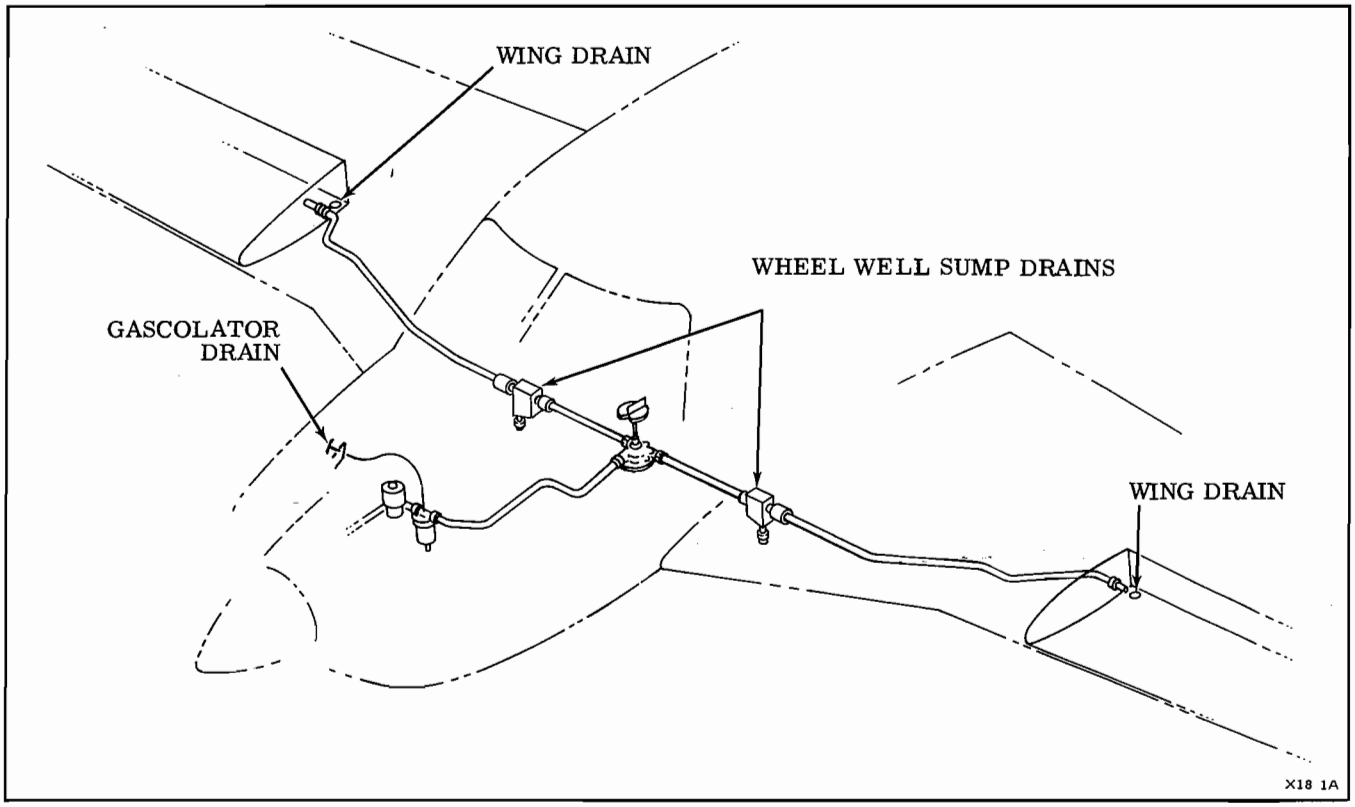


Figure 8-3. Fuel Drains

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. Drain a fuel sample from drain located in each main gear wheel well.
3. Drain fuel from gascolator by pulling tee handle fuel release.
4. 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-83282 hydraulic fluid. See Maintenance Manual if MIL-H-83282 hydraulic fluid is not available.

HYDRAULIC BRAKES

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-83282 hydraulic fluid.

If bleeding of brakes is required, refer to the Maintenance Manual.

LUBRICATION - See Figure 8-4.

AIRPLANE 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 airplane 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 airplane 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 airplane 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 airplane 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-83282 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

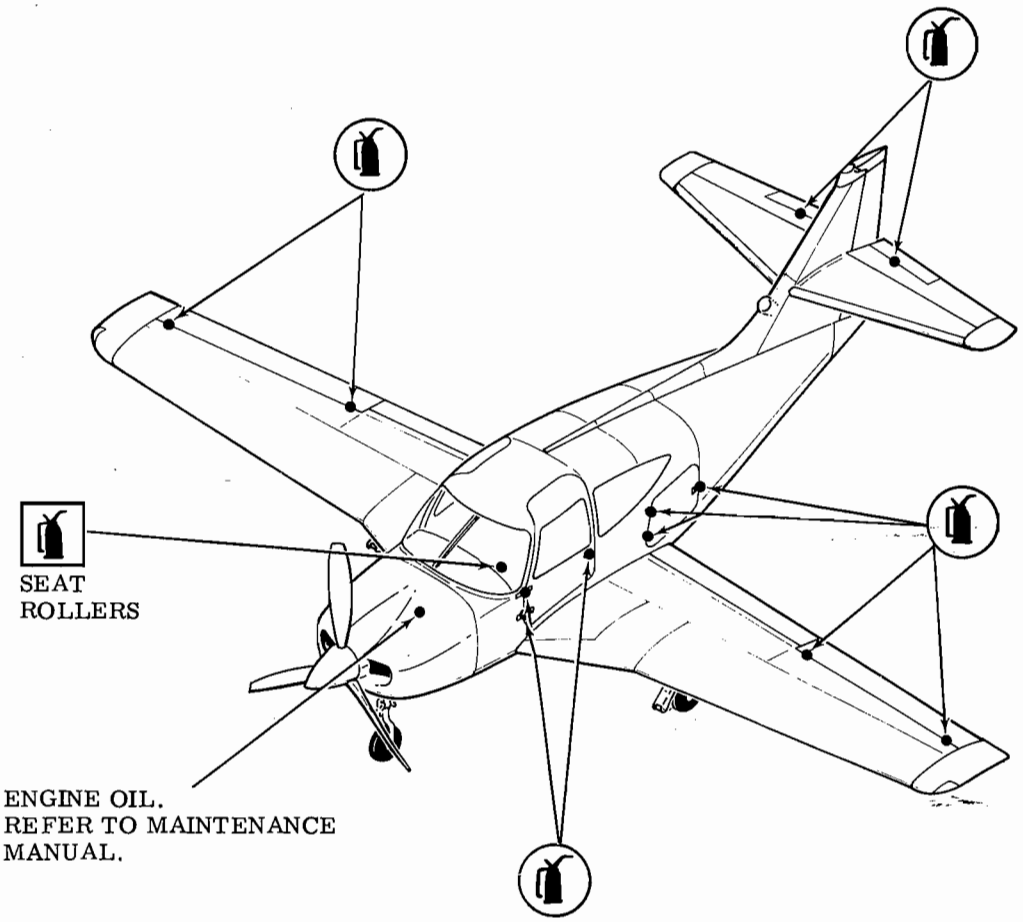


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Figure 8-4. Lubrication Chart (Sheet 1 of 2)

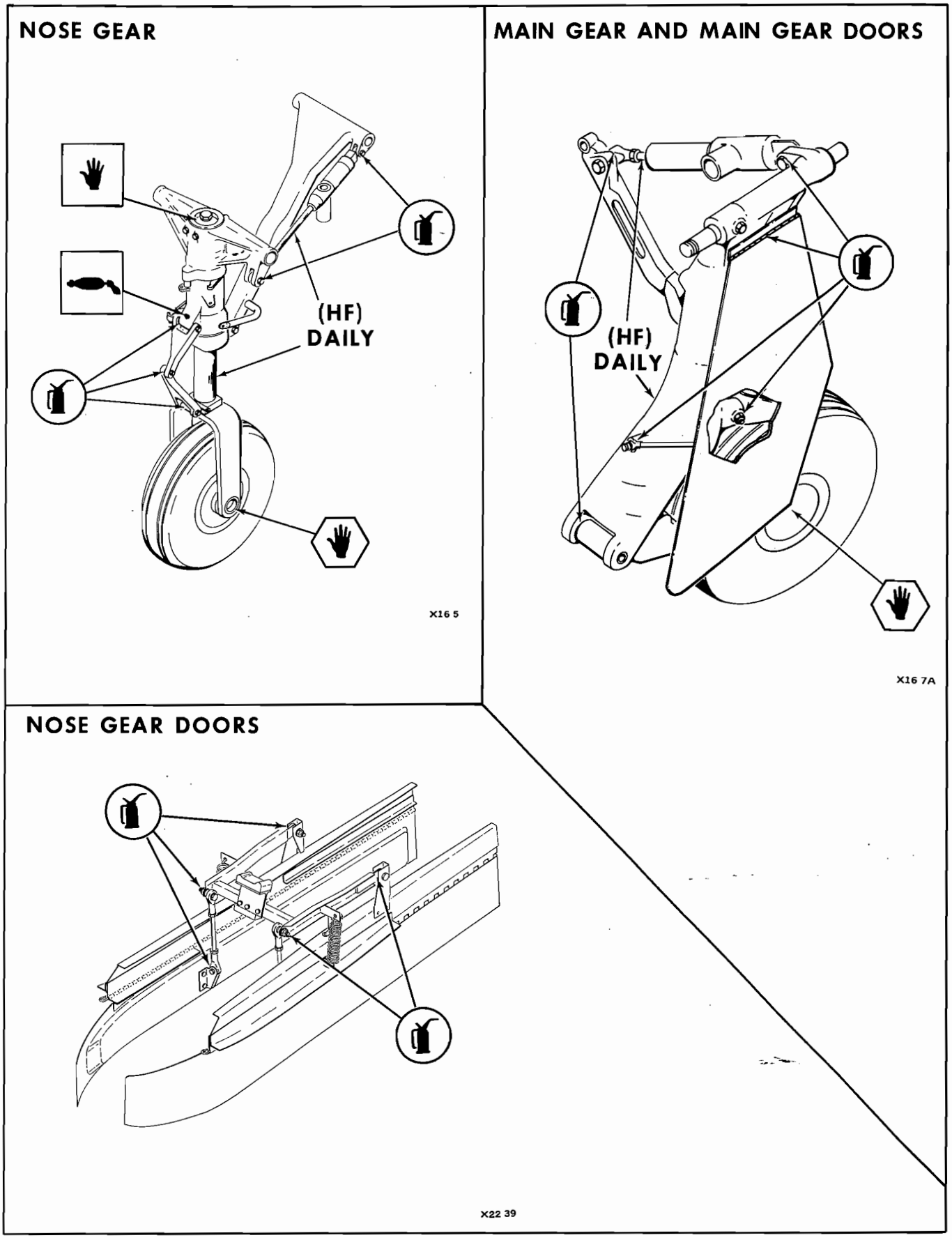


Figure 8-4. Lubrication Chart (Sheet 2 of 2)

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 or MIL-H-83282 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 airplane 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	Emergency Locator Transmitter (ELT) (SHARC 7H-2A) (Pages 1 of 2 thru 2 of 2)	O. C. Jackson DEL OP PC-203	1/19/79
2	King KMA 20 Audio Control Panel (Pages 1 of 3 thru 3 of 3)		
3	King KX 170B/KX 175B COMM/NAV (Pages 1 of 3 thru 3 of 3)		
4	King KI 204 VOR/LOC/GS Indicator (Pages 1 of 3 thru 3 of 3)		
5	King KI 203 VOR/LOC Indicator (Pages 1 of 3 thru 3 of 3)		
6	King KR 85 Automatic Direction Finder ADF (Pages 1 of 3 thru 3 of 3)		
7	King KN 65A DME (Pages 1 of 3 thru 3 of 3)		
8	King KT 76A Transponder (Pages 1 of 4 thru 4 of 4)		
9	Collins AMR 350 and AMR 350H Audio Control Systems (Pages 1 of 3 thru 3 of 3)		
10	Collins VHF-251/VHF-251E Communications Transceiver (Pages 1 of 3 thru 3 of 3)		
11	Collins VIR-351 Navigation Receiver (Pages 1 of 2 and 2 of 2)		
12	Collins IND-351 VOR/ILS Indicator (Pages 1 of 4 thru 4 of 4)		
13	Collins IND-350 VOR/LOC Indicator (Pages 1 of 3 thru 3 of 3)		
14	Collins ADF-650 Automatic Direction Finder ADF (Pages 1 of 3 thru 3 of 3)		
15	Collins DME-451 (with IND-450 Indicator) (Pages 1 of 3 thru 3 of 3)		
16	Collins TDR-950 Transponder (Pages 1 of 4 thru 4 of 4)		
18	Puritan "Altitude Traveler" Portable Oxygen System (Pages 1 of 4 thru 4 of 4)	O. C. Jackson DEL OP PC-203	1/19/79

LOG OF REVISIONS TO SUPPLEMENTS

Revision Number	Revised Supplement Number	Description of Revision	FAA Approved	Date
		EDO-AIRE MITCHELL CENTURY III AUTOPILOT MODEL AK574		
		EDO-AIRE MITCHELL COMMAND ELECTRIC TRIM SYSTEM MODEL AK582		
		SYMBOLIC DISPLAYS, INC. CFS-1000 FUEL SYSTEM STC # SA 3727 WE	V	2-1-65

SUPPLEMENT 1

EMERGENCY LOCATOR TRANSMITTER (ELT) (SHARC 7H-2A)

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 airplane 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, located on the aft avionics shelf 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 121.5 MH_Z and 243.0 MH_Z, after being subjected to a 5 "g" deceleration, 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 forced 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 $+21^O$ to $+54^OC$ ($+70$ to $+130^OF$) continuous transmission for 115 hours can be expected; a temperature of -40^OC (-40^OF) 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 2

KING KMA 20 AUDIO CONTROL SYSTEM

SECTION I

GENERAL

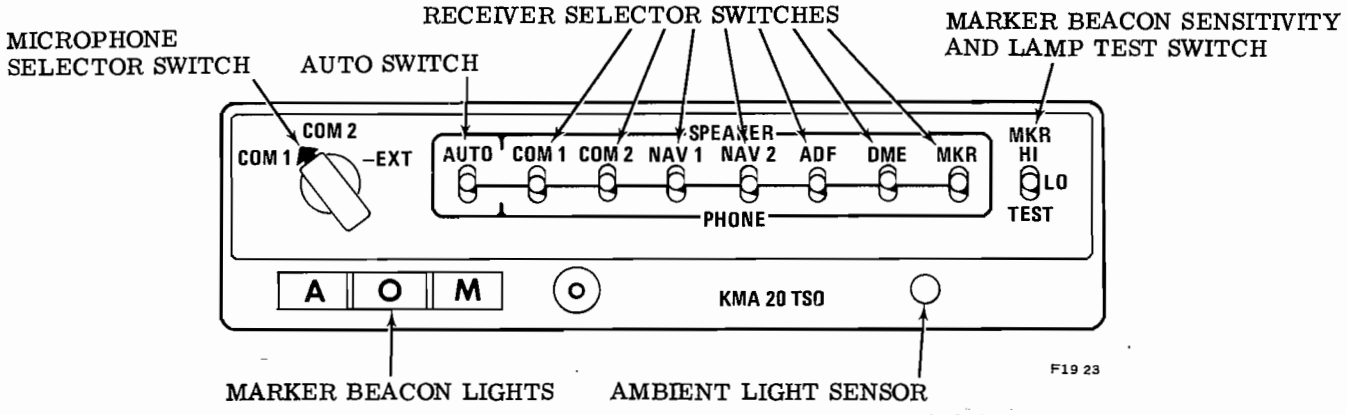
The purpose of this Pilot's Operating Handbook Supplement is to provide information necessary for the operation of the King KMA 20 Audio Control System. When an airplane is equipped with the King KMA 20 Audio Control System this supplement must be included in the Pilot's Operating Handbook.

DESCRIPTION

The King KMA 20 Audio Control System is a combination audio amplifier and switching panel. The audio amplifier raises signal strength to drive the speaker system. The switching panel provides selector switches for the speaker, headphones, microphone and transmitters. The panel also provides selector switches for audio signals from the NAV, ADF, DME and MKR beacon.

The KMA 20 contains a crystal-controlled 75 MH_Z marker beacon receiver and marker beacon lights.

CONTROL PANEL (STANDARD INSTALLATION)



Microphone Selector Switch - Connects microphone to COMM 1 or COMM 2 VHF transmitter. When microphone button is depressed output of all airplane receivers is electronically muted to prevent cockpit feedback in the transmission.

EXT position allows microphone transmission to a cabin address system or intercom system (if installed).

Receiver Selector Switches - Permits listening to seven different receivers at will by using the appropriate toggle switch. Middle switch position is OFF, upper position is SPEAKER and lower position is PHONES.

The Isolation/Speaker Amplifier automatically raises signal strength necessary to drive the speaker. During headphone reception the amplifier is bypassed and the headphones are connected to the selected receiver.

Auto Switch - Automatically matches the appropriate COMM receiver to the transmitter selected. Place both COMM receiver selector switches on OFF. Set AUTO to either SPEAKER or PHONE, as desired. COMM 1 or COMM 2 receiver will be selected by the microphone selector switch.

Marker Beacon - A complete Marker Beacon receiver is built into the KMA 20. The marker beacon receiver will be on any time power is on the airplane and circuit breakers are set.

The left, or white, lamp on the face plate, lettered A, will illuminate when the airplane passes over an airway marker or runway threshold marker. The ambient light sensor automatically regulates light intensity to ambient cockpit lighting conditions. A 3000 H_Z tone from an airway marker is also received on the marker beacon audio and can be routed to speaker or phones by the MKR toggle switch.

Outer markers are identified by flashes on the center, or blue, lamp (lettered "O"), on and off at the rate of two flashes per second. The audio signal is a series of 400 H_Z dashes, also at a rate of two per second.

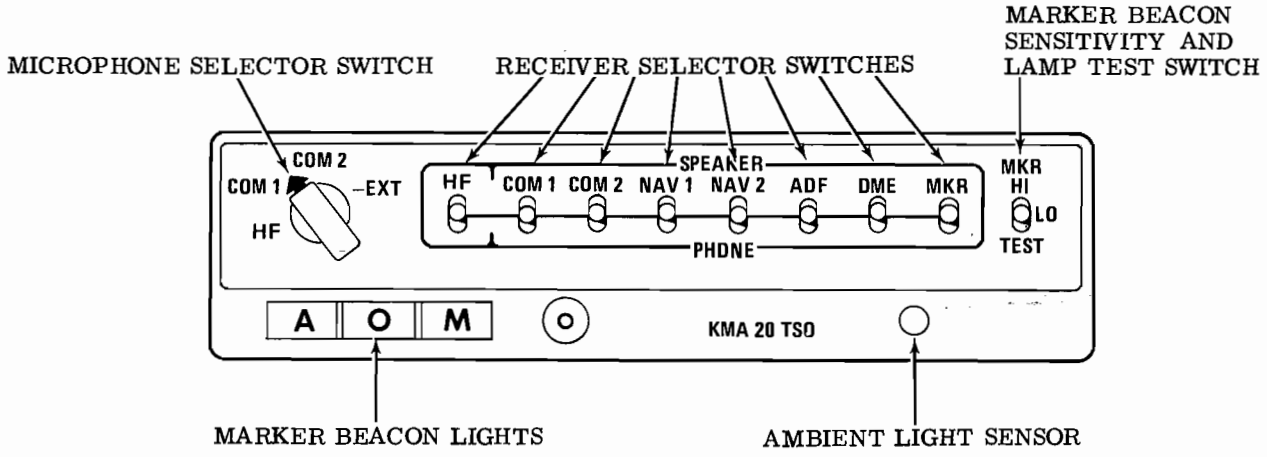
The middle marker is identified by alternating dots and dashes in a 1300 H_Z-tone and flashes from the right, or amber, lamp (lettered "M").

Marker Beacon Hi-Lo-Test Switch. The Hi-Lo-Test toggle switch is the Marker Beacon sensitivity and lamp test switch. Hi sensitivity greatly enlarges the area in which the marker signal can be received. With the sensitivity control on Hi, the aural tone will begin about one mile from the outer marker. Placing the switch in Lo reduces the area in which the signal is received and permits more precise detection of the center of the marker. Placing the switch in TEST will cause all marker beacon lamps to illuminate.

NOTE

Middle marker signals are used to activate the glideslope extension feature in some flight director systems. Placing the toggle switch in TEST position during an ILS approach may prematurely activate the glideslope extension feature.

CONTROL PANEL(INTERNATIONAL INSTALLATION)



F19 23A

The control panel for the International installation contains provisions for an HF transceiver. The AUTO position is deleted and replaced by an HF Receiver Selector Switch. When a transmitter is selected on the Microphone Selector Switch, the corresponding Receiver Selector Switch must be in SPEAKER or PHONE position, as desired, in order to receive on the same transceiver being used to transmit. Remaining operation is same as Standard installation.

SECTION II

LIMITATIONS

Not applicable.

SECTION III

EMERGENCY PROCEDURES

Not applicable.

SECTION IV

NORMAL PROCEDURES

NOTE

If the audio amplifier fails to operate, position the receiver selector switches to PHONE and use headset to hear receiver audio.

1. Comm Transceivers - ON and TUNE as desired.
2. Microphone Selector Switch - SELECT desired transmitter.
3. Auto Switch - SPEAKER or PHONE as desired.
4. Receiver Selector Switch - COMM 1 and COMM 2 - OFF.

NOTE

Microphone Selector Switch will automatically match transmitter and receiver with AUTO Switch ON.

Other receivers may be pre-tuned and audio signals selected as desired.

SECTION V

PERFORMANCE

Not applicable.

SUPPLEMENT 3

KING KX 170B/KX175B COMM/NAV

SECTION I

GENERAL

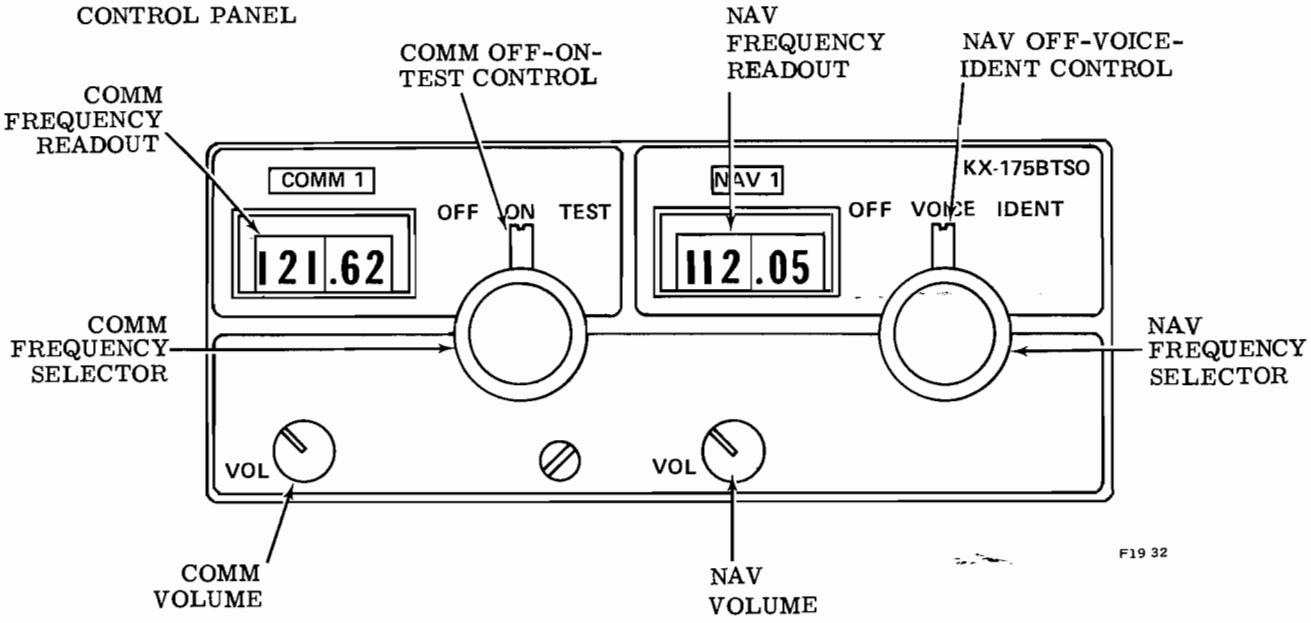
The purpose of this Supplement is to provide information necessary for the operation of the King KX 170B or KX 175B Communications Transceiver/Navigation Receiver. When an airplane is equipped with a KX 170B or KX 175B Comm/Nav, this Supplement must be included in the Pilot's Operating Handbook.

DESCRIPTION

The King KX 170B and the KX 175B COMM/NAV combine a 720 channel VHF Communications Transceiver and a 200 channel VHF NAV receiver in a single unit. The NAV receiver supplies VOR/LOC information to navigation equipment and provides automatic frequency selection for Distance Measuring Equipment (DME) and Glideslope Receivers. The equipment operations on DC power furnished by the radio bus.

All controls required to operate the KX 170B or the KX 175B are located on the front panel. Operation of the KX 170B and the KX 175B is identical. The following information is applicable to either unit.

CONTROL PANEL



In dual installations one unit will be labeled COMM 1/NAV 1 and second unit will be labeled COMM 2/NAV 2.

COMM FREQUENCY READOUT - Displays COMM frequency selected by COMM Frequency Selector.

COMM FREQUENCY SELECTOR - Two concentric knobs used to dial VHF COMM frequencies. The larger knob selects MHz and the smaller knob selects KHz. Frequency range is from 118.00 to 135.975 MHz with 25 Hz spacing. Clockwise rotation selects higher frequencies. The dial mechanism has no stops, permitting continuous rotation.

COMM OFF-ON-TEST CONTROL - The OFF-ON-TEST control is located directly above the COMM frequency selector. Power is supplied to the transceiver when this control is either in the ON or TEST position. The TEST position is used to defeat the COMM automatic squelch for both test purposes and listening to extremely weak signals.

COMM VOLUME CONTROL - The VOL control is used to adjust the transceiver audio volume. The OFF/ON switch is independent of this control, allowing the COMM volume to remain at a desired preset level.

NAV FREQUENCY READOUT - Displays NAV frequency selected by NAV frequency selector.

NAV OFF-VOICE-IDENT CONTROL - The OFF-VOICE-IDENT control supplies power to the NAV receiver when this control is either in VOICE or IDENT position. NAV operation is independent of COMM. With the switch on IDENT, the ground station voice and identification tone are coupled to the airplane speaker and/or headphone circuitry. With the switch on VOICE the identification tone is eliminated, permitting the pilot to monitor the VOR ground station for voice transmissions without receiving the VOR ident tone.

NAV FREQUENCY SELECTORS - Two concentric knobs used to dial navigation frequencies. The larger knob selects MHz frequencies and the smaller knob selects KHz frequencies. Frequency range is from 108.00 to 117.95 MHz with 50 KHz spacing. Clockwise rotation selects higher frequencies. DME, Glideslope and ILS channeling are also performed by this control.

SECTION II

LIMITATIONS

Not applicable.

SECTION III

EMERGENCY PROCEDURES

Not applicable.

SECTION IV

NORMAL PROCEDURES

Before Takeoff

1. Airplane Power - ON.
2. Radio Master Circuit Breaker Switch - ON.
3. COMM:
   a. OFF-ON-TEST Control - ON.
   b. Desired COMM Frequency - SELECT.
   c. Audio Control Panel - AS DESIRED.
   d. VOL Control - AS DESIRED.

4. NAV:
   a. OFF-VOICE-IDENT Control - IDENT.
   b. Local VOR Frequency - SELECT.
   c. NAV 1/NAV 2 Selector - AS REQUIRED.
   d. Audio Control Panel - AS DESIRED.
   e. Station Identification - VERIFY.
   f. OFF-VOICE-IDENT Control - IDENT or VOICE as desired.
   g. VOL Control - AS DESIRED.

Inflight

COMM:
1. OFF-ON-TEST Control - ON.
2. Desired COMM Frequency - SELECT.
3. Audio Control Panel - AS DESIRED.

NAV:
1. OFF-VOICE- IDENT Control - VOICE.
2. NAV 1/NAV 2 Selector Switch - AS DESIRED.
3. Audio Control Panel - AS DESIRED.
4. Desired NAV Frequency - SELECT.
5. Station Identification - VERIFY.

SECTION V

PERFORMANCE

Not applicable.

SUPPLEMENT 4

KING KI 204 VOR/LOC/GS INDICATOR

SECTION I

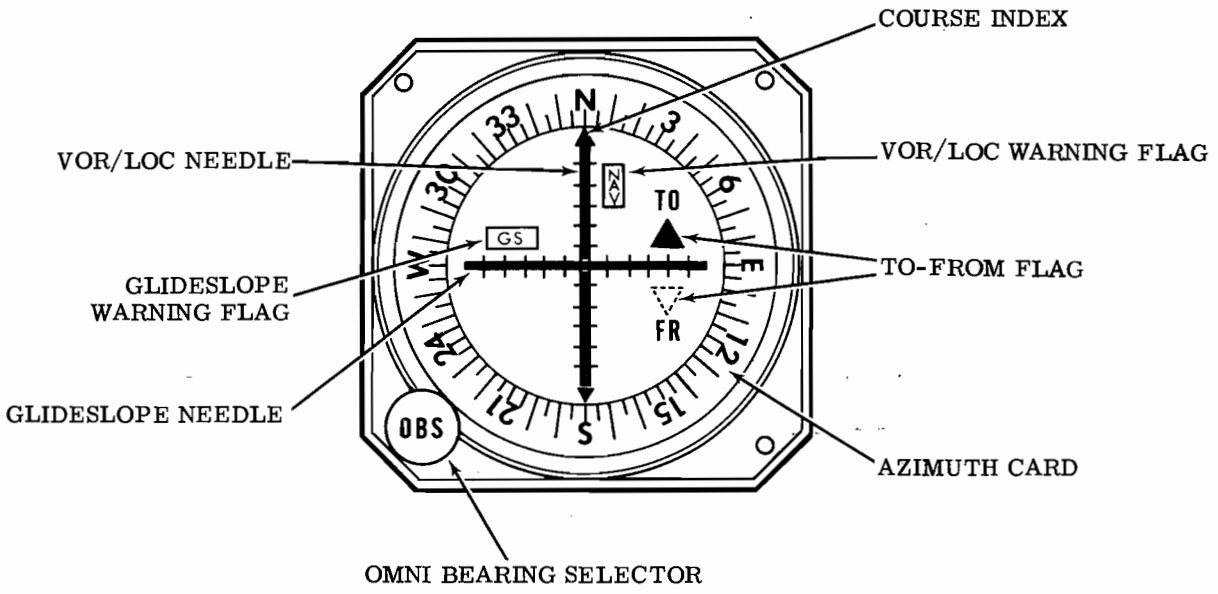
GENERAL

The purpose of this Supplement is to provide information necessary for the operation of the King KI 204 VOR/LOC/GS Indicator. When an airplane is equipped with a KI 204, this supplement must be included in the Pilot's Operating Handbook.

DESCRIPTION

The King KI 204 is a panel-mounted, dual-pointer, VOR/ILS indicator. It is used with a King KX 170B or KX 175B NAV receiver and receives its navigation data from NAV 1. The KI 204 displays left or right deviation from a selected VOR radial, TO/FROM information relative to a selected VOR station and ILS Locator and Glideslope deviation information.

INDICATOR AND CONTROLS



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OBS (OMNI BEARING SELECTOR) - Used to rotate the azimuth card to the desired bearing which is read at the Course Index.

GLIDESLOPE NEEDLE - Displays deviation from the glidepath during an ILS approach. The needle represents the glidepath center line and presents a "fly to the needle" indication when a valid glideslope signal is being received.

GLIDESLOPE WARNING FLAG - Will appear when no usable glideslope signal is being received. May be caused by incorrect frequency selection on NAV 1 receiver, glideslope transmitter failure, glideslope receiver failure or airplane out of range of glideslope transmitter.

VOR/LOC NEEDLE - Indicates the amount and direction of deviation from a selected VOR course or localizer path. The bar represents the center line of the selected VOR course or localizer path.

Each mark on the VOR/LOC deviation scale represents 2-degrees deviation when on a VOR course and approximately 0.25-degrees deviation when on a localizer course.

COURSE INDEX - A fixed reference point for selecting a course on the azimuth card. Selected course is read at the top of the course index.

VOR/LOC WARNING FLAG - Will appear when no usable VOR or LOC signal is being received by NAV 1 receiver. May be caused by incorrect frequency selection, transmitter failure, receiver failure or airplane out of range.

TO-FROM FLAG - Indicates, with reference to the selected course setting, whether the airplane is flying TO or FROM the selected VOR station. Is out of view when tuned to a Localizer frequency.

AZIMUTH CARD - A manually controlled compass card used to select VOR courses and orient localizer path. Controlled by the OBS knob.

SECTION II

LIMITATIONS

Not applicable.

SECTION III

EMERGENCY PROCEDURES

Not applicable.

SECTION IV

NORMAL PROCEDURES

VOR OPERATION

1. NAV 1 Receiver - TUNE to desired VOR frequency.
2. VOR Station Identification - VERIFY.
3. To determine the bearing to a selected VOR station, rotate OBS knob until TO/FR arrow indicates TO and VOR/LOC needle is centered. Read TO bearing at the Couse Indicator. Centering the VOR/LOC needle with a FR arrow showing, will give magnetic bearing from the station.

VOR STATION PASSAGE

The VOR/LOC needle indicates angular deviation, therefore, needle sensitivity increases as the airplane approaches the station. Recommend airplane be flown on a constant magnetic heading during station passage until the TO/FR arrow displays a positive FR indication.

LOCALIZER OPERATION

Localizer circuitry is energized when NAV 1 receiver is tuned to an ILS frequency. The VOR/LOC Warning Flag will be out of view when a usable localizer signal is being received.

The localizer course width is much narrower than the VOR course, therefore smaller course corrections are required to maintain an intercepted localizer course.

To accomplish a front course ILS approach:

1. NAV 1 Receiver - TUNE to published ILS frequency.

NOTE

Glideslope receiver is automatically channeled at same time.

2. VOR/LOC Flag - CHECK out of view.
3. Published Inbound Course - SET at the Course Index.

NOTE

Setting the inbound course has no effect on the VOR/LOC needle when receiver is tuned to an ILS frequency, however, recommend published inbound course be set on the indicator to aid in pilot orientation.

4. Localizer Course - INTERCEPT and TRACK.

NOTE

When intercepting a localizer course close to the airport, recommend that pilot begin turning the airplane when the VOR/LOC needle moves off the stop. This will reduce the possibility of course over-shoot.

When flying a front-course approach or flying outbound on the back-course, corrections are made by flying toward the VOR/LOC needle. When flying a back-course approach or flying outbound on the front-course, corrections are made by flying away from the VOR/LOC needle.

GLIDESLOPE OPERATION

The glideslope needle provides vertical deviation information during an ILS approach. When an ILS frequency is selected on the NAV 1 receiver, the associated glideslope receiver is also channeled to the correct frequency. If a reliable glideslope signal is being received, the GS flag will be out of view. The glideslope needle will deflect in the direction the pilot must fly to remain on the glidepath.

WARNING

Indications other than those received when properly positioned for a front-course ILS approach should be ignored. Spurious glideslope indications may at times appear to be valid glideslope indications. Never make an ILS approach in any manner except in accordance with an FAA-approved approach procedure. Cross-check barometric altitude throughout approaches, and never descend below published minimum altitude for the approach, regardless of any glideslope indications, until safe landing by visual reference is assured.

SECTION V

PERFORMANCE

Not applicable.

SUPPLEMENT 5

KING KI 203 VOR/LOC INDICATOR

SECTION I

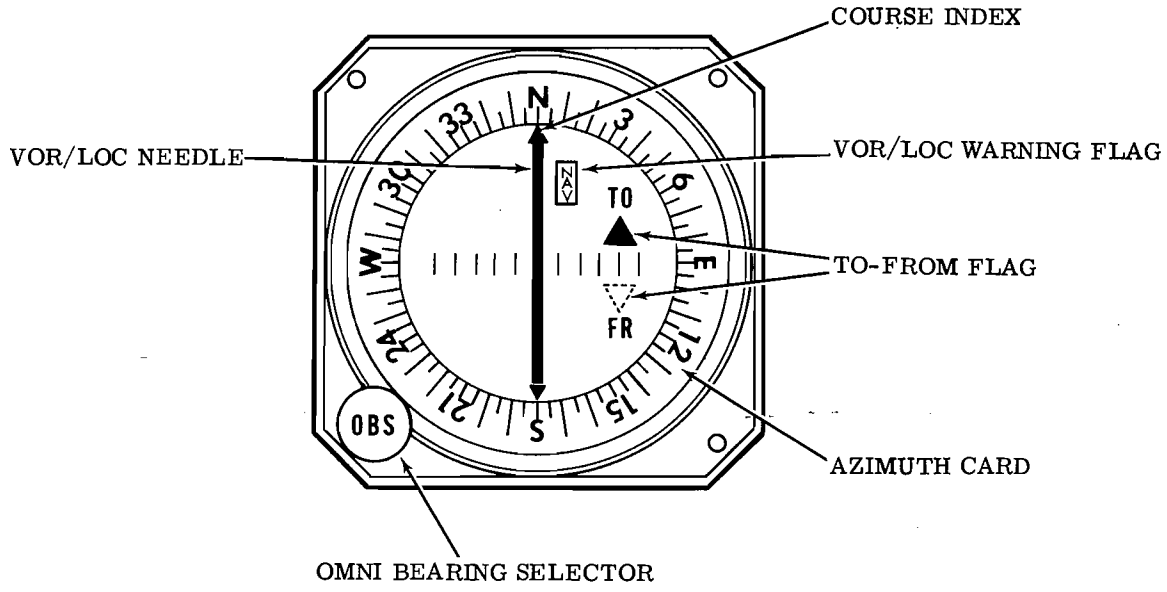
GENERAL

The purpose of this Supplement is to provide information necessary for the operation of the King KI 203 VOR/LOC indicator. When an airplane is equipped with a KI 203, this supplement must be included in the Pilot's Operating Handbook.

DESCRIPTION

The King KI 203 is a panel-mounted, VOR/LOC indicator. It is used with a King KX 170B or KX 175B NAV receiver and receives its navigation data from NAV 2. The KI 203 displays left or right deviation from a selected VOR radial, TO/FROM information relative to a selected VOR station and ILS Locator deviation deviation information. The KI 203 does not display Glideslope information.

INDICATOR AND CONTROLS



F19 21B

OBS (OMNI BEARING SELECTOR) - Used to rotate the azimuth card to the desired bearing which is read at the Course Index.

VOR/LOC NEEDLE - Indicates the amount and direction of deviation from a selected VOR course or localizer path. The bar represents the center line of the selected VOR course or localizer path.

Each mark on the VOR/LOC deviation scale represents 2-degrees deviation when on a VOR course and approximately 0.25-degrees deviation when on a localizer course.

COURSE INDEX - A fixed reference point for selecting a course on the azimuth card. Selected course is read at the top of the course index.

VOR/LOC WARNING FLAG - Will appear when no usable VOR or LOC signal is being received by NAV 2 receiver. May be caused by incorrect frequency selection, transmitter failure, receiver failure or airplane out of range.

TO-FROM FLAG - Indicates, with reference to the selected course setting, whether the airplane is flying TO or FROM the selected VOR station. Is out of view when tuned to a Localizer frequency.

AZIMUTH CARD - A manually controlled compass card used to select VOR courses and orient localizer path. Controlled by the OBS knob.

SECTION II

LIMITATIONS

Not applicable.

SECTION III

EMERGENCY PROCEDURES

Not applicable.

SECTION IV

NORMAL PROCEDURES

VOR OPERATION

1. NAV 2 Receiver - TUNE to desired VOR frequency.
2. VOR Station Identification - VERIFY.
3. To determine the bearing to a selected VOR station, rotate OBS knob until TO/FR arrow indicates TO and VOR/LOC needle is centered. Read TO bearing at the Couse Indicator. Centering the VOR/LOC needle with a FR arrow showing, will give magnetic bearing from the station.

VOR STATION PASSAGE

The VOR/LOC needle indicates angular deviation, therefore, needle sensitivity increases as the airplane approaches the station. Recommend airplane be flown on a constant magnetic heading during station passage until the TO/FR arrow displays a positive FR indication.

LOCALIZER OPERATION

Localizer circuitry is energized when NAV 2 receiver is tuned to an ILS frequency. The VOR/LOC Warning Flag will be out of view when a usable localizer signal is being received.

The localizer course width is much narrower than the VOR course, therefore smaller course corrections are required to maintain an intercepted localizer course.

To accomplish a front course ILS approach:

1. NAV 2 Receiver - TUNE to published ILS frequency.
2. VOR/LOC Flag - CHECK out of view.
3. Published Inbound Course - SET at the Course Index.

NOTE

Setting the inbound course has no effect on the VOR/LOC needle when receiver is tuned to an ILS frequency, however, recommend published inbound course be set on the indicator to aid in pilot orientation.

4. Localizer Course - INTERCEPT and TRACK.

NOTE

When intercepting a localizer course close to the airport, recommend that pilot begin turning the airplane when the VOR/LOC needle moves off the stop. This will reduce the possibility of course over-shoot.

When flying a front-course approach or flying outbound on the back-course, corrections are made by flying toward the VOR/LOC needle. When flying a back-course approach or flying outbound on the front-course, corrections are made by flying away from the VOR/LOC needle.

SECTION V

PERFORMANCE

Not applicable.

SUPPLEMENT 6

KING KR 85 AUTOMATIC DIRECTION FINDER (ADF)

SECTION I

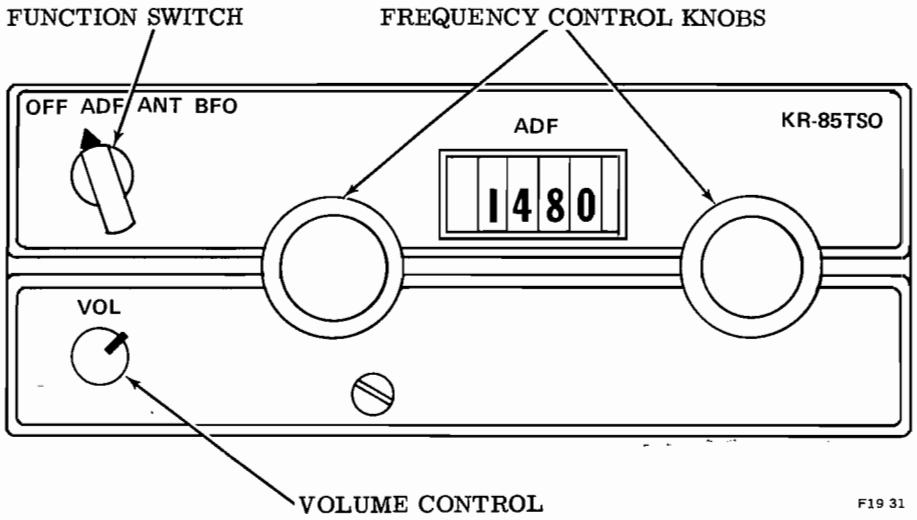
GENERAL

The purpose of this Supplement is to provide information necessary for the operation of the King KR 85 ADF. When an airplane is equipped with a King KR 85 ADF, this supplement must be included in the Pilot's Operating Handbook.

DESCRIPTION

The King KR 85 ADF provides aural reception and a visual bearing indication of the direction of the radio transmitter from which a signal is being received. The equipment can be used for plotting position, for homing and for aural reception of AM signals. A beat frequency oscillator (BFO) permits the coded identifier to be heard from stations which transmit keyed CW signals (Morse Code). The receiver has a frequency range of 200 to 1699 KHz in 1 - KHz steps and operates on airplane DC power.

CONTROLS AND INDICATORS



FUNCTION SWITCH - Controls the mode of operation

NOTE

To prevent voltage transients from causing damage to KR 85, it is recommended that function switch be in OFF position when starting airplane engine.

1. OFF - Removes all power from the ADF receiver. ADF needle is inoperative.
2. ADF - System is in automatic direction finder mode. ADF needle will point to transmitting station.
3. ANT - In this position system acts as a standard radio receiver. Will provide clearest aural reception. ADF function is inhibited and ADF needle will rotate to a 90° position relative to the lubber line.
4. BFO - Activates beat frequency oscillator tone to permit coded identifier to be heard from stations transmitting keyed CW signals (Morse Code). ADF function is inhibited and ADF needle will rotate to a 90° position relative to the lubber line.

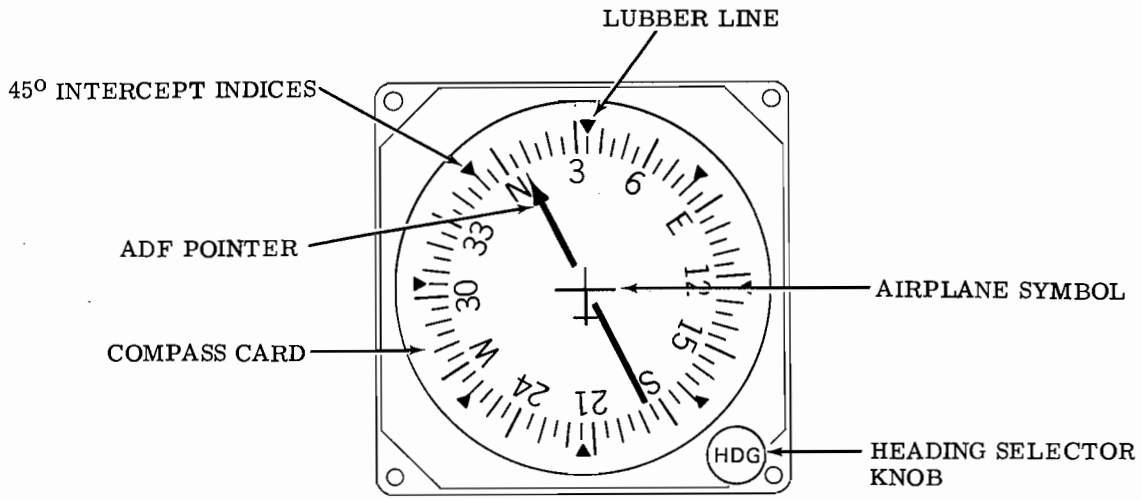
FREQUENCY CONTROL KNOBS - Used to select the desired frequency for ADF operation. The selected frequency is displayed in the window between the knobs.

1. LEFT KNOB - Acts as one knob and selects frequencies in 100 KHz intervals.
2. LARGE OUTER RIGHT KNOB - Selects frequencies in 10 KHz intervals.
3. SMALL INNER RIGHT KNOB - Selects frequencies in 1 KHz intervals.

Turn knobs clockwise to increase frequency and counter-clockwise to decrease frequency. Mechanical stops limit knob rotation in either direction.

VOLUME CONTROL - Controls volume of incoming signal. Clockwise rotation increases volume. An Automatic Gain Control circuit holds the receivers audio output relatively constant over wide variations of signal input level.

ADF INDICATOR



F19 25A

COMPASS CARD - Manually operated compass card controlled by the HDG knob.

LUBBER LINE - A fixed heading reference.

ADF POINTER - The arrow of the ADF pointer indicates the direction of the transmitter station, relative to the heading of the airplane, with receiver in ADF mode. Indicates magnetic bearing when airplane heading is set under the lubber line.

HEADING SELECTOR KNOB - Used to set airplane heading under the lubber line.

AIRPLANE SYMBOL - A fixed, symbolic representation of the airplane. Always points to the lubber line.

45° INTERCEPT INDICES - Fixed index markers used to assist in establishing intercept angles relative to selected ADF bearings.

SECTION II

LIMITATIONS

Not applicable.

SECTION III

EMERGENCY PROCEDURES

Not applicable.

SECTION IV

NORMAL PROCEDURES

1. Audio Control Panel - ADF switch to speaker or phone, as desired.
2. Function Switch - ANT.
3. Frequency Selector - SELECT desired ADF frequency.
4. Station Identification - VERIFY.
5. Function Switch - ADF.
6. Airplane Heading - SET under lubber line.

When flying towards a station, correct right if pointer moves right and correct left if pointer moves left. Station passage is identified by a 180-degree reversal of the pointer.

SECTION V

PERFORMANCE

Not applicable.

SUPPLEMENT 7

KING KN 65A DME

SECTION I

GENERAL

This Pilot's Operating Handbook Supplement provides information necessary for the operation of the King KN65A DME (Distance Measuring Equipment). When an airplane is equipped with a KN65A DME, this Supplement must be included in the Pilot's Operating Handbook.

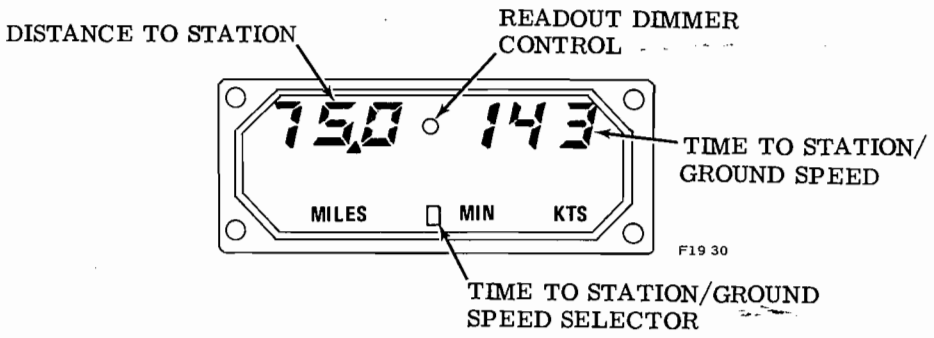
DESCRIPTION

The King KN65A DME is a distance measuring unit which also computes groundspeed and time-to-station.

The KN65A electronically converts to distance the elapsed time required for a transmitted signal to travel to and from a ground station. This distance is then indicated in nautical miles on the Range/Speed/Time-to-station indicator. This distance, commonly referred to as slant-range distance, should not be confused with actual along-the-ground distance. The difference between the ground distance and slant range is smallest at low altitude and long range. If the range to the station is three times the airplane altitude, or greater, error is negligible.

Channeling of the KN65A is accomplished with the #1 and #2 NAV receivers. The DME system uses TACAN channels that are paired with VOR frequencies. Tuning the desired VORTAC frequency on the NAV selectors automatically pairs the proper DME channel. A NAV 1/NAV 2 selector switch, located on the pilot's instrument panel, selects the NAV receiver used to channel the DME.

DME INDICATOR



Located on the pilot's instrument panel. When no DME signal is available or DME is in search mode, digital display will be blank.

DISTANCE TO STATION - Displays slant range distance to VORTAC. Distances are displayed to nearest 0.1 nm from 0.0 to 99.9 nautical miles. Above 99.9 nm distances are displayed in 1.0 nm increments. Indicator reads to 199 nm at "line-of-sight' altitude.

TIME-TO-STATION/GROUND SPEED - Displays a continuously computed ground speed or time-to-station, as desired. For accurate ground speed read-outs two conditions must be satisfied; (1) airplane must be tracking directly TO or FROM the VORTAC station and (2) the range of the airplane from the VORTAC must be 3 times the airplane altitude, or greater. With these conditions satisfied and the DME locked on the VORTAC, the DME computer determines the rate of change between the station and the airplane and then computes ground-speed from 0 to 400 knots. About 3 minutes after lock-on, displayed ground speed is within 10% of true ground speed. For other flight paths the DME ground speed will read low an amount which depends on the geometry of the flight path relative to the VORTAC station.

Once the ground speed has been accurately computed, up to 60 minutes Time-To-Station information is available by use of the TIME-TO-STATION/GROUND SPEED SELECTOR. Since the accuracy of the Time-To-Station display is determined by the distance from the VORTAC and accurate ground speed, be sure these factors have time to stabilize before relying on Time-To-Station reading.

TIME-TO-STATION/GROUND SPEED SELECTOR. A push-to-operate button type switch used to select either ground speed or time-to-station display. With ground speed displayed, depressing the button will erase ground speed display and cause time-to-station to appear. Depressing the button again will erase the time-to-station display and ground speed will reappear.

READOUT DIMMER CONTROL - An ambient light sensor which adjusts the brilliance of the digital display with respect to the amount of light in the cockpit.

SECTION II

LIMITATIONS

Not applicable

SECTION III

EMERGENCY PROCEDURES

Not applicable

SECTION IV

NORMAL PROCEDURES

Before Takeoff

NOTE

An airplane on the ground may not be able to receive a DME signal from a VORTAC due to line-of-sight limitations.

1. Airplane Power - ON.
2. Circuit Breakers - SET.
3. Radio Master Circuit Breaker Switch - ON.
4. DME Power Switch - ON.

NOTE

Recommend that power to avionics equipment be turned on only after engine start as this procedure increases the reliability of solid state circuitry. An initial warm-up period of one minute is required before the DME will lock on to a ground station.

5. NAV 1/NAV 2 Selector Switch - #1 NAV.
6. #1 NAV Receiver - ON. Tune local VORTAC station.
7. DME Indicator - CHECK distance. Ground speed and time-to-station data can not be checked on ground.

In Flight

1. DME Power Switch - ON.
2. NAV 1/NAV 2 Selector Switch - AS DESIRED.
3. Selected NAV Receiver - TUNE to desired VORTAC frequency.
4. VORTAC Station Identifier - VERIFY.
5. TIME TO STATION/GROUND SPEED Selector - AS DESIRED.

CAUTION

DME may unlock due to loss of signal with certain combinations of distance from station, altitude and airplane attitude.

SECTION V

PERFORMANCE

Not applicable.

SUPPLEMENT 8

KING KT 76A TRANSPONDER

SECTION I

GENERAL

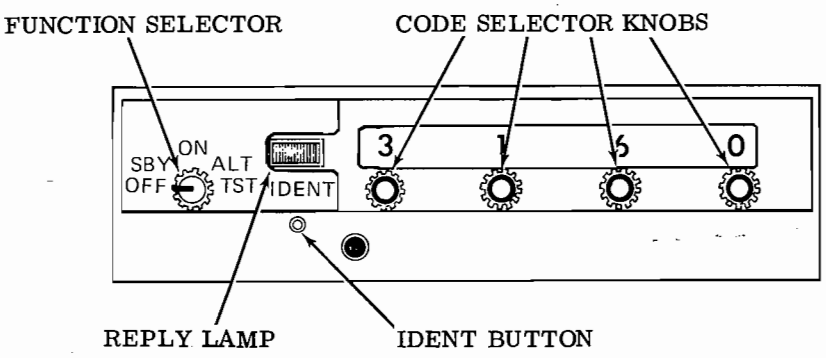
The purpose of this Supplement is to provide information necessary for the operation of the King KT 76A Transponder. When an airplane is equipped with a KT 76A Transponder this supplement must be included in the Pilot's Operating Handbook.

DESCRIPTION

The KT 76A Transponder is an integral part of the air traffic control radar beacon system. The transponder provides identification of the airplane on the ATC ground controller's plan position indicator. When the airplane is also equipped with an encoding altimeter, the transponder provides the ATC controller with the pressure altitude of the airplane.

When interrogated by valid radar pulses from the ground station, the transponder will reply automatically with a series of pulses coded to provide a discrete identification of the airplane. When the airplane is also equipped with an encoding altimeter and the KT 76A Function Selector is in ALT position, automatic altitude reporting will be included in response to Mode C (ALT) interrogations.

INDICATOR AND CONTROLS



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FUNCTION SELECTOR - Selects transponder mode of operation. There is a 45-second delay from the time primary power is applied (function selector in any position other than OFF) until transponder will operate.

OFF - All power is removed from unit.
SBY - Selection of SBY position maintains power on the transponder but responses to any interrogations are inhibited.

ON - Places the transponder in Mode A, the airplane identification mode. The transponder will not provide altitude information in this mode.

ALT - Places the transponder in Mode C. Transponder will respond with identification and pressure altitude information if airplane is equipped with an encoding altimeter.

TST - The TST position provides a means to check the operational readiness of the transponder. If the transponder is operating properly, holding the switch in the TST position will cause the REPLY lamp to illuminate.

REPLY LAMP/IDENT BUTTON

REPLY LAMP - Lamp flashes each time a response is made to a valid interrogation. The REPLY lamp will remain on for a period of time after releasing the IDENT button; this signifies transmission of the SPIP. Selection of the TST position lights the REPLY lamp if the KT 76A is operational.

IDENT BUTTON - Momentarily depressing the IDENT button adds a SPIP (Special Position Identification Pulse) to the normal reply pulses for airplane identification. The SPIP is transmitted for an interval of at least one radar sweep. Depress IDENT button only when ATC requests the airplane to "squawk IDENT".

CODE SELECTOR KNOBS - The reply code, which is displayed in the windows, is selected by rotating the code selector knobs. The 4-digit code selected will determine the configuration of the reply pulse.

SECTION II

LIMITATIONS

Not applicable.

SECTION III

EMERGENCY PROCEDURES

A. To Transmit an Emergency Signal

1. Function Switch - ON.
2. Code Selector Knobs - 7700.
3. IDENT Button - PRESS to effect immediate identification on ground controller's display.

B. To Transmit a Signal Representing Loss of All Voice Communications.

1. Function Switch - ON.
2. Code Selector Knobs - 7700 for one minute, then select 7600 for 15 minutes. Repeat this procedure for remainder of flight.
3. IDENT Button - PRESS to effect immediate identification on ground controller's display

NOTE

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

SECTION IV

NORMAL PROCEDURES

A. Before Takeoff

1. Airplane Power - ON.
2. Radio Master Circuit Breaker Switch - ON.
3. Function Switch - SBY. Allow 45-seconds for warm-up.
4. Function Switch - TST. Observe Reply lamp is illuminated as long as switch is held in TST position.
5. Function Switch - SBY.

B. After Takeoff

1. To Transmit Mode A (Airplane Position Identification).

   a. Code Select Knobs - SELECT assigned code.
   b. Function Switch - ON.

NOTE

With Function Switch ON, REPLY lamp will flash to indicate transponder is replying to interrogations.

   c. IDENT Button - PRESS momentarily when instructed by ground controller to "Squawk IDENT". REPLY lamp will glow steadily for a period of time to indicate IDENT operation.

2. To Transmit Mode C (Altitude Information)

   a. Code Selector Knobs - SELECT assigned code.
   b. Function Switch - ALT.

NOTE

When directed by ground controller to "stop altitude squawk", turn Function Switch to ON for Mode A operation.

Pressure altitude is transmitted, and conversion to indicated altitude is done in ATC computers.

3. Transponder Phraseology

Air traffic controllers will use the phraseology listed below when referring to operation in the air traffic control radar beacon system. Instructions directed to the pilot by air traffic control refer to operation on mode A and mode C only.

TERM	INTERPRETATION
IDENT	Initiate transponder special position identification pulse by depressing IDENT button.
SQUAWK (number)	Operate transponder on designated code with function selector switch in ON or ALT position.
SQUAWK ALTITUDE	Set transponder function selector switch to ALT (mode C). Applicable to airplanes with encoding altimeter only.
SQUAWK (number) & IDENT	Set transponder to specified code with function selector switch in ON or ALT position and engage IDENT button.
SQUAWK MAYDAY	Turn function selector to ON or ALT and select code 7700.
SQUAWK STANDBY	Switch transponder function selector switch to SBY.

3. Transponder Phraseology (continued)

TERM	INTERPRETATION
STOP ALTITUDE SQUAWK	Turn transponder function selector switch from ALT (mode C) to ON (mode A).
STOP SQUAWK	Turn transponder function switch to SBY.

NOTE

Under no circumstances should civil airplanes operate on code 0000. This particular code is reserved for military interceptor operations.

c. After Landing

1. Function Selector - OFF.

SECTION V

PERFORMANCE

Not applicable.

SUPPLEMENT 9

COLLINS AMR 350 AND AMR 350H AUDIO CONTROL SYSTEMS

SECTION I

GENERAL

The purpose of this Pilot's Operating Handbook Supplement is to provide information necessary for the operation of the Collins AMR 350 and AMR 350H Audio Control Systems. When an airplane is equipped with either of these systems, this Supplement must be included in the Pilot's Operating Handbook.

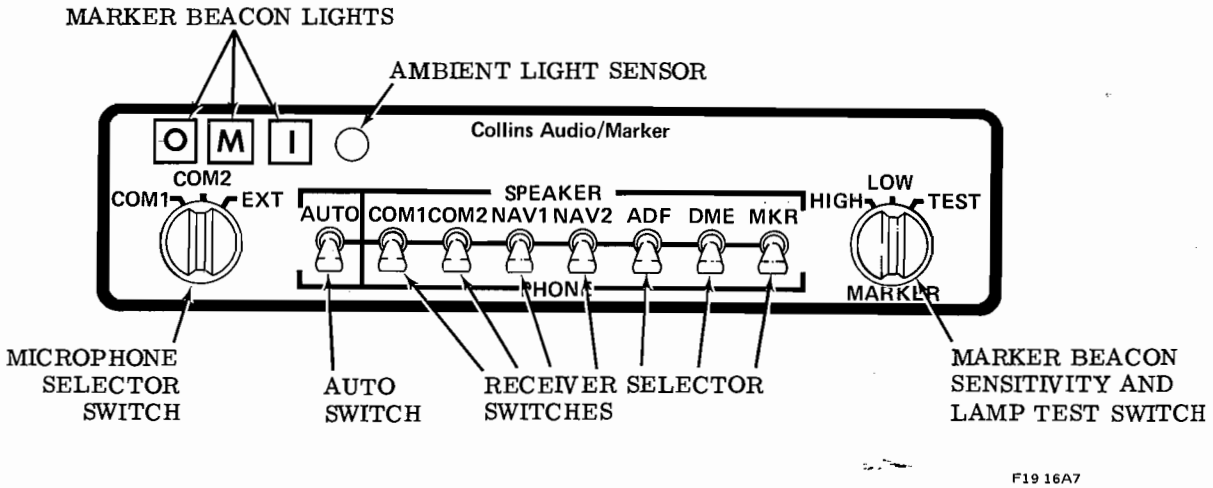
DESCRIPTION

The Collins AMR 350 and AMR 350H are combination audio amplifiers and switching panels. The audio amplifier raises signal strength to drive the speaker system. The switching panel provides selector switches for the speaker, headphones, microphone and communications transceivers. The panel also provides selector switches for monitoring audio signals from the NAV, ADF, DME and MKR beacon receivers.

Both audio control systems contain a crystal controlled 75 MH_Z Marker Beacon receiver and marker beacon lights.

CONTROL PANELS

AMR 350
The AMR 350 control panel is used when the airplane is not HF equipped.



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MICROPHONE SELECTOR SWITCH - Connects microphone to Comm 1 or Comm 2 VHF transmitter. When the microphone button is depressed output to all airplane receivers is electronically muted to prevent cockpit feedback in the transmission.

EXT position allows transmission to a cabin address sytem or a ramp hailer (if installed).

RECEIVER SELECTOR SWITCHES - Selector switches route the audio signal from the selected unit into the speaker or headphones. Center position is OFF.

An isolation amplifier automatically raises signal strength to drive the speaker when selector switch is in SPEAKER position. When selector switch is in PHONE position, the amplifier is bypassed and the headphones are connected directly to the selected receiver.

AUTO SWITCH - The AUTO switch eliminates the constant switching of the COM 1 and COM 2 selector switches when switching back and forth between VHF transmitters. The AUTO switch automatically matches the appropriate COM receiver to the transmitter selected. The audio from the receiver selected by the microphone selector switch will be routed to the speaker or headphones, depending upon the position of the AUTO switch.

MARKER BEACON - A 75 MH_Z Marker Beacon receiver is built into the AMR-350. The marker beacon receiver will be in operation any time airplane power is on and circuit breakers are set.

The left, or blue, indicator labeled O, will illuminate when the airplane passes over an outer marker. The indicator will flash on and off two times per second and a 400-Hz dashed tone is applied to the audio system.

The middle marker is identified by alternating dots and dashes on the amber lamp, labeled M, and a 1300 Hz audio signal in dots and dashes.

The white light, labeled I, will illuminate with a series of dots, and a modulated 3000 Hz aural tone is applied to the audio system, when the airplane passes over the inner marker. The white light will also illuminate, and a 3000 Hz modulated tone will be available, when airplane passes over an airways marker.

AMBIENT LIGHT SENSOR - The Ambient Light Sensor is a photocell which monitors cockpit ambient light level and automatically adjusts the marker display brightness to an optimum level.

MARKER HIGH-LOW-TEST SWITCH. The High-Low-Test Switch is the marker beacon sensitivity control and lamp test.

HIGH position enlarges the area in which the marker signal can be received, and is normally used for enroute flight. In HIGH position, the aural tone will begin about one mile from the center of the outer marker. Placing the switch in LOW reduces the area in which the signal is received and permits more precise detection of the center of the marker.

Placing the switch in TEST position will cause all three marker beacon lamps to illuminate.

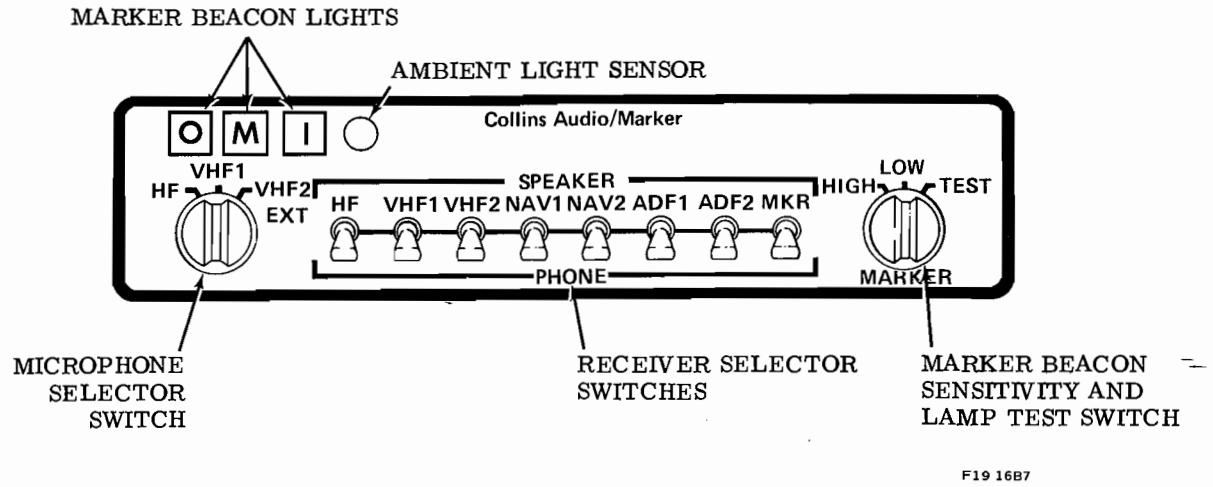
NOTE

Middle marker signals are used to activate the glideslope extension feature in some flight director systems. Placing the switch in TEST position during an ILS approach may activate the glideslope extension feature prematurely.

AMR-350H

The AMR 350H provides all marker beacon functions, isolation amplification and audio switching functions that are provided by the AMR-350; however, inputs are provided for an HF transceiver, two VHF transceivers, two navigation receivers and two automatic direction finders. The AMR-350H does not contain the AUTO function.

All selector and control functions in the AMR-350H are the same as in the AMR-350 except for AUTO function.



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SECTION II

LIMITATIONS

Not applicable.

SECTION III

EMERGENCY PROCEDURES

Not applicable.

SECTION IV

NORMAL PROCEDURES

NOTE

If the audio amplifier fails to operate, position the receiver selector switches to PHONE and use headset to hear audio signals.

1. Communications Transceivers - ON and TUNED to desired frequency.
2. Microphone Selector Switch - SELECT desired transmitter.
3. AMR-350
   a. AUTO Switch - SPEAKER or PHONE as desired.
   b. COM 1 and COM 2 Selector Switches - OFF.

NOTE

COM 1 and COM 2 Receiver Selector Switches must be OFF (center position) when AUTO function is used.

4. AMR-350H
   HF, VHF 1 or VHF 2 Receiver Selector Switch - SPEAKER or PHONE as desired.
   Receiver selected must be same as unit selected by microphone selector switch.
5. Other receivers - SPEAKER or PHONE as desired.

SECTION V

PERFORMANCE

Not applicable.

SUPPLEMENT 10

COLLINS VHF-251/VHF-251E COMMUNICATIONS TRANSCEIVER

SECTION I

GENERAL

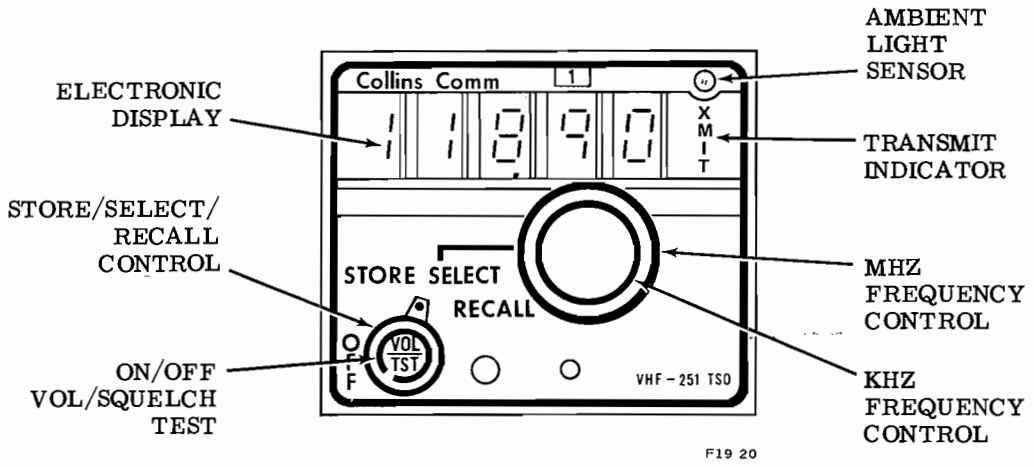
This Supplement provides information necessary for the operation of the Collins VHF-251/VHF-251E Communications Transceiver. When an airplane is equipped with a VHF-251 or VHF-251E, this supplement must be included in the Pilot's Operating Handbook.

DESCRIPTION

The Collins VHF-251 and VHF-251E Communications Transceiver are panel mounted voice transceivers which provide AM communication in the VHF range. They provide 720-channel operation from 118.000 through 135.975 MHz in 25 kHz increments. The units operate on airplane dc power.

The VHF-251E is designed for operation in Europe, however, appearance and pilot operation is identical to VHF-251.

CONTROLS AND INDICATORS



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ON/OFF/VOL/TST - This control performs these functions:

a. ON/OFF - When control is fully counterclockwise, power is OFF. Turning the control clockwise turns power to the unit ON and information will be observed on the electronic display. Continued clockwise rotation increases the audio output level.

b. VOL/TST - An automatic squelch circuit eliminates background noise during a no-signal condition. Pulling out the VOL/TST knob tests the squelch circuit by disabling the automatic squelch, allowing noise to be heard in the airplane audio system. This provides a rough check of receiver operation and a noise signal to use in making a preliminary volume control setting before an intelligible signal is heard. Knob should be pushed in for normal operation.

STORE/SELECT/RECALL CONTROL - Controls a single channel frequency memory. Two frequencies may be entered into a transceiver. To store a desired frequency:

a. Place control in SELECT.
b. Tune desired frequency.
c. Place control momentarily in STORE. This will cause the selected frequency to be stored in the memory, replacing any previously stored frequency. When released the control will automatically return to SELECT.
d. Tune second frequency.
e. Turn control to RECALL to operate on stored frequency. The unit may be switched between SELECT frequency and RECALL frequency as often as desired.

The Electronic Display will display the frequency being used for transmit and receive.

NOTE

When operating in the RECALL position, always return the STORE/SELECT/RECALL control to the SELECT position before attempting to select a new frequency. If either the kHz or MHz controls are changed when in the RECALL position, the operating frequency will continue to be controlled by memory, and therefore will not change. Upon return to the SELECT position, the frequency previously in that position will no longer be present.

NOTE

Removal of transceiver primary power will erase the frequency stored in the memory circuitry. When power is reapplied, the memory will automatically store the frequency set on the frequency selector controls.

ELECTRONIC DISPLAY - The electronic display provides a 5-digit frequency display of the transceiver frequency. The sixth digit in the frequency, which must be a 5 or a 0, is redundant information and is not displayed. The displayed frequency will always be the frequency on which the transceiver will transmit and receive.

AMBIENT LIGHT SENSOR - A photocell which monitors cockpit ambient light level and automatically adjusts the display brightness to an optimum level.

XMIT - The transmit indicator is illuminated when the microphone is keyed to talk. The intensity of the light varies with the transmitter audio to provide a modulation monitor.

FREQUENCY SELECTOR CONTROLS - The two concentric knobs are used to select communication frequencies. The smaller knob selects kHz frequencies; the larger knob selects MHz frequencies. There are no end stops; therefore frequencies may be selected by turning the knobs in either direction any number of times. Selection of frequencies is made when STORE/SELECT/RECALL control is in the SELECT position.

SECTION II

LIMITATIONS

Not applicable.

SECTION III

EMERGENCY PROCEDURES

Not applicable.

SECTION IV

NORMAL PROCEDURES

1. Airplane Power - ON.
2. Circuit Breakers - SET.
3. Radio Master Circuit Breaker Switch - ON.
4. Audio Control Panel - SET.
5. ON/OFF/VOL/TST Switch - ON.
6. STORE/SELECT/RECALL Control - SELECT.
7. Desired Comm Frequency - SELECT.
8. STORE Control - AS DESIRED.
9. RECALL Control - AS DESIRED.

SECTION V

PERFORMANCE

Not applicable.

SUPPLEMENT 11

COLLINS VIR-351 NAVIGATION RECEIVER

SECTION I

GENERAL

This Supplement provides information necessary for the operation of the Collins VIR-351 Navigation Receiver. When an airplane is equipped with a VIR-351 Navigation Receiver, this supplement must be included in the Pilots Operating Handbook.

DESCRIPTION

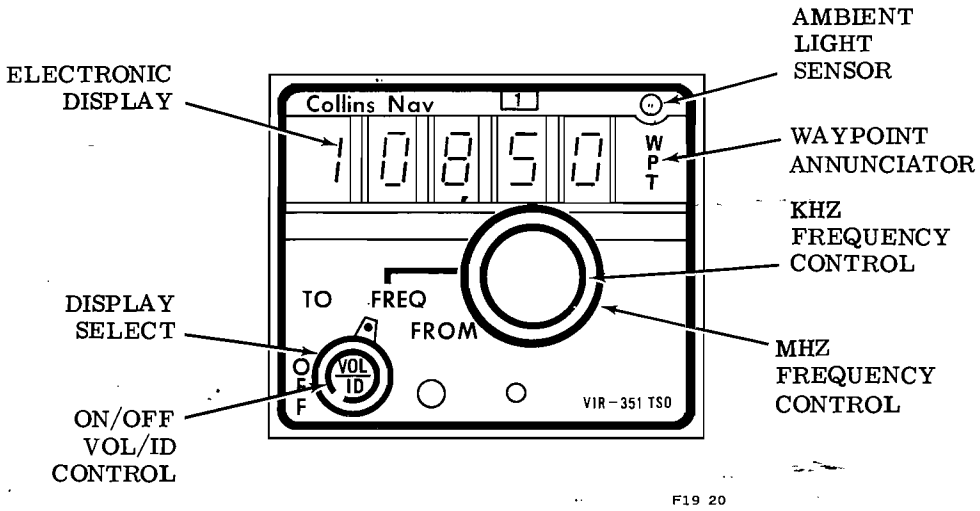
The VIR-351 Navigation Receiver is a 200-channel VHF receiver which receives omni and localizer signals from 108.00 through 117.95 MHz in 50 kHz steps. The frequency selected is digitally displayed on the front panel of the unit.

The DME receiver-transmitter and the glideslope receiver are automatically channeled along with the Navigation receiver when a VORTAC or LOCALIZER frequency is selected.

When dual VIR-351 Navigation Receivers are installed, they are labeled NAV 1 and NAV 2. NAV 1 receiver provides omni, localizer and glideslope data to the NAV 1 VOR/LOCALIZER/GLIDESLOPE indicator or the pilot's Horizontal Situation Indicator, if installed; NAV 2 provides omni and localizer data to the Nav 2 VOR/LOCALIZER indicator.

The VIR-351 operates on airplane 14 volt dc power.

CONTROLS AND INDICATORS



ON/OFF/VOL/ID CONTROL - Controls application of power to the unit, varies audio gain, selects voice only or voice and identification code together. In full counterclockwise position power is OFF. Turning control clockwise applies power to the unit and information will be observed on the display. Continued clockwise rotation increases the level of the audio and/or identification

tone output from the receiver. To select the identification position, pull the VOL/ID control out. In this position, the ground station voice and identification code are coupled to the airplane audio system. To select voice only, push the VOL/ID control in. In this position the identification code is attenuated, permitting monitoring of VOR ground-station voice transmissions without receiving the VOR identification code.

DISPLAY SELECT - The TO/FREQ/FROM control determines what information will be presented on the electronic display. In FREQ position, the frequency of the selected ground station will be displayed. The FROM position displays the VOR bearing from the station in degrees, followed by the letter F. Selection of TO position displays the bearing to the station (radial ± 180 degrees) in degrees. Approximately 1 second is required to obtain a bearing reading from the display. Three dashes will appear in the electronic display if no signal is received or a localizer frequency is selected and switch is placed in TO or FROM.

FREQUENCY SELECTOR CONTROLS - The two concentric knobs, right of center are used to select VOR or LOC frequencies. The smaller knob selects kHz frequencies in 50-kHz steps, the larger knob selects MHz frequencies in 1-MHz steps. There are no end stops, therefore frequencies may be selected by turning the knobs in either direction any number of times.

The DME receiver-transmitter (NAV 1 and NAV 2) and the glideslope receiver (NAV 1 only) are automatically channeled along with the Navigation receiver when a VORTAC or LOCALIZER frequency is selected.

AMBIENT LIGHT SENSOR - Controls brightness of electronic display by monitoring the ambient light level in the cockpit.

WPT (WAYPOINT) ANNUNCIATOR - Located on #1 NAV receiver. Illuminates when RNAV mode is in operation to alert the pilot that TO/FROM bearing displays are relative to the RNAV waypoint. Annunciator is inactive if airplane is not RNAV equipped.

SECTION II

LIMITATIONS

Not Applicable.

SECTION III

EMERGENCY PROCEDURES

Not Applicable.

SECTION IV

NORMAL PROCEDURES

1. Airplane Power - ON.
2. Circuit Breakers - SET.
3. Radio Master Circuit Breaker Switch - ON.
4. Audio Control Panel Receiver Selector Switches - NAV 1 or NAV 2 as desired.
5. ON/OFF/VOL/ID Switch - ON.
6. Display Select Control - FREQ.
7. Frequency Selector Controls - SELECT desired frequency.
8. VOL/ID Control - PULL OUT to verify identification code.
9. Display Select Control - AS DESIRED.
10. VOL/ID Control - AS DESIRED.

SECTION V

PERFORMANCE

Not Applicable.

SUPPLEMENT 12

COLLINS IND-351 VOR/ILS INDICATOR

SECTION I

GENERAL

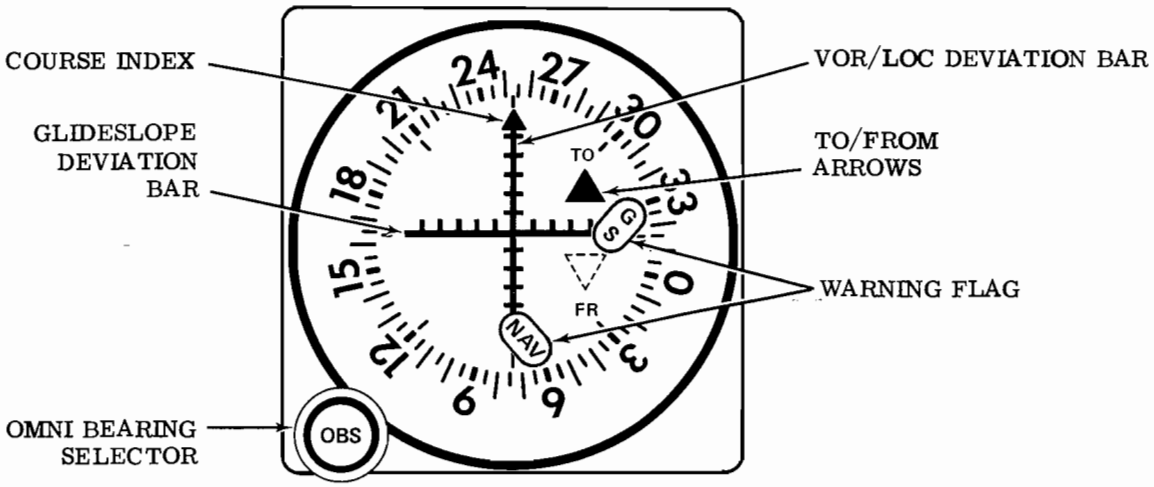
The purpose of this Supplement is to provide information necessary for the operation of the Collins IND-351 VOR/ILS Indicator. When an airplane is equipped with an IND-351, this supplement must be included in the Pilot's Operating Handbook.

DESCRIPTION

The IND-351 is a panel-mounted, dual-pointer VOR/ILS indicator. It is used with a Collins VIR-351 NAV receiver to provide a manual omnibearing selector. The IND-351 displays VOR/LOC and Glideslope deviation, TO/FROM information, a NAV warning flag and a GS (glidelope) warning flag.

The IND-351 receives required radio navigation data from the NAV 1 receiver.

INDICATOR AND CONTROLS



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OBS (OMNI BEARING SELECTOR) - Used to rotate the azimuth card to the desired bearing which is read under the course index.

GLIDESLOPE DEVIATION BAR - Displays deviation from the glidepath. The bar represents the center line of the glideslope beam. When the deviation bar is above the glideslope center line scale, the airplane is below the glideslope beam center line. If deviation bar is below the center scale, the airplane is above the glideslope beam center line.

WARNING

Indications other than those received when properly positioned for a front course ILS approach should be ignored. These spurious glideslope indications may at times appear to be valid glideslope indications. Never make an ILS approach in any manner except in accordance with an FAA-approved approach procedure. Maintain a cross-check with a barometric altitude throughout approaches, and never descend below minimum altitudes for the approach, regardless of any glideslope indications, until safe landing by visual reference is assured.

COURSE INDEX - Point of reference for selecting a course. Selected course is read under the index.

VOR/LOC DEVIATION BAR - Indicates the amount of deviation and the direction from a selected VOR course or localizer path. The bar represents the center line of the selected VOR course or localizer path. Each mark on the VOR/LOC deviation scale represents 2° deviation when on a VOR course and approximately 0.25° deviation when on a localizer course.

GS FLAG - If in view indicates an unreliable glideslope signal when navigation receiver is tuned to a localizer frequency.

TO/FR ARROW - Indicates whether the bearing of a selected VOR station is TO or FROM the airplane when flying a selected VOR course. The TO/FR arrow will not be visible when the navigation receiver is tuned to a localizer frequency.

NAV FLAG - If in view indicates unreliable information is being supplied to the VOR/LOC deviation bar.

SECTION II

LIMITATIONS

Not applicable.

SECTION III

EMERGENCY PROCEDURES

Not applicable.

SECTION IV

NORMAL PROCEDURES

VOR OPERATION

1. NAV-1 Receiver - TUNE to desired VOR frequency.
2. VOR Station Identification Code - VERIFY.
3. To determine the bearing to a selected VOR station, rotate OBS knob until TO/FR arrow indicates TO and VOR/LOC deviation bar is centered. Read TO bearing under the course index.

NOTE

Display Select Control on NAV receiver may also be used to determine bearing TO or FROM a selected VOR station.

4. To intercept and track a selected VOR radial, use OBS knob to set desired radial under the course index, and then maneuver airplane to establish correct intercept angle. VOR/LOC deviation bar will center when an on-course condition has been established.

VOR STATION PASSAGE

The VOR/LOC deviation bar indicates angular deviation, therefore, the bar sensitivity will increase as the airplane approaches the station. Recommend airplane be flown on a magnetic heading during station passage until the TO/FR arrow displays a positive FROM indication.

LOCALIZER OPERATION

Localizer operation occurs when NAV-1 receiver is tuned to a published localizer frequency. The NAV flag will be out of view when a reliable localizer signal is being received.

The localizer course width is much narrower than the VOR course, therefore smaller course corrections are required to maintain the intercepted localizer course.

To intercept a localizer for a front course approach:

1. NAV-1 Receiver - TUNE to published localizer frequency.

NOTE

Glideslope receiver is automatically channeled at same time.

2. NAV Flag - CHECK out of view.
3. Published Inbound Course - SET under the Course Index.

NOTE

Setting the localizer course has no effect on the VOR/LOC deviation bar when receiver is tuned to a localizer frequency. However, it is recommended that the published course be set on the indicator to aid in pilot orientation.

4. Localizer Course - INTERCEPT and TRACK.

NOTE

When intercepting a localizer course close to an airport, recommend that pilot begin turning the airplane when the VOR/LOC deviation bar moves off the stop. This will reduce the possibility of course over-shoot.

When flying a front-course approach, or flying outbound on the back-course, heading corrections are made by flying toward the VOR/LOC deviation bar. When flying a back-course approach, or flying outbound on the front-course, corrections are made by flying away from the VOR/LOC deviation bar.

GLIDESLOPE OPERATION

The glideslope deviation bar provides vertical deviation information during an ILS approach. When an ILS frequency is selected on the NAV-1 receiver, the associated glideslope receiver is also channeled to the correct frequency. If a reliable glideslope signal is being received, the GS flag will be biased out of view. The glideslope deviation bar will deflect in the direction the pilot must fly to remain on the glidepath.

WARNING

Indications other than those received when properly positioned for a front-course ILS approach should be ignored. These spurious glideslope indications may at times appear to be valid glideslope indications. Never make an ILS approach in any manner except in accordance with an FAA-approved approach procedure. Maintain a cross-check with barometric altitude throughout approaches, and never descend below minimum altitudes for the approach, regardless of any glideslope indications, until safe landing by visual reference is assured.

SECTION V

PERFORMANCE

Not applicable.

SUPPLEMENT 13

COLLINS IND-350 VOR/LOC INDICATOR

SECTION I

GENERAL

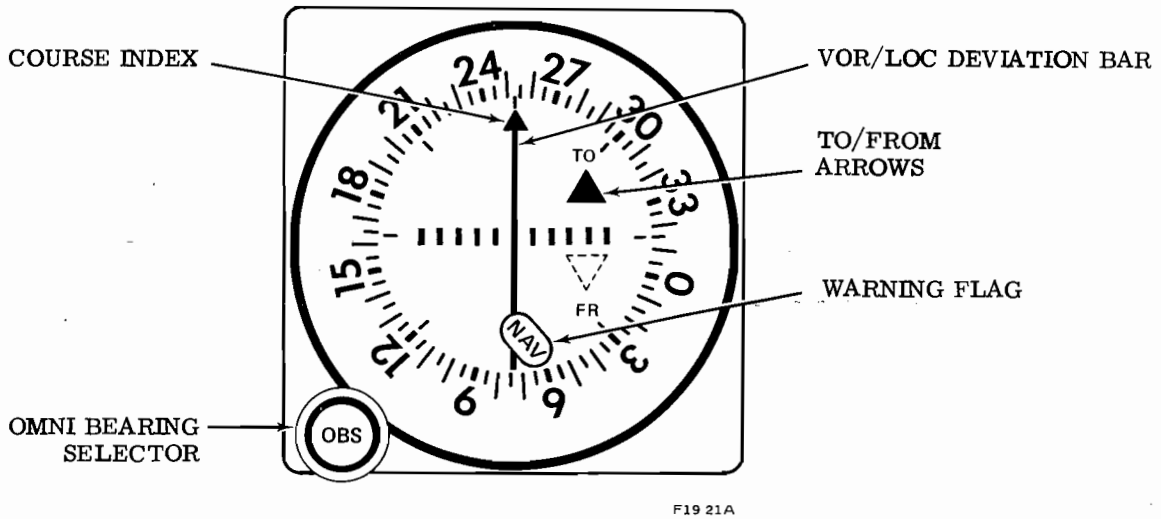
The purpose of this Supplement is to provide information necessary for the operation of the Collins IND-350 VOR/LOC Indicator. When an airplane is equipped with an IND-350, this supplement must be included in the Pilot's Operating Handbook.

DESCRIPTION

The IND-350 is a panel-mounted, single-pointer VOR/LOC indicator. It is used with a Collins VIR-351 NAV receiver to provide a manual omnibearing selector. The IND-350 displays VOR/LOC deviation, TO/FROM information and a NAV warning flag.

The IND-350 receives required radio navigation data from the NAV 2 receiver.

INDICATOR AND CONTROLS



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OBS (OMNI BEARING SELECTOR) - Used to rotate the azimuth card to the desired bearing which is read under the course index.

COURSE INDEX - Point of reference for selecting a course. Selected course is read under the index.

VOR/LOC DEVIATION BAR - Indicates the amount of deviation and the direction from a selected VOR course or localizer path. The bar represents the center line of the selected VOR course or localizer path. Each mark on the VOR/LOC deviation scale represents 2^{o} deviation when on a VOR course and approximately 0.25^{o} deviation when on a localizer course.

TO/FR ARROW - Indicates whether the bearing of a selected VOR station is TO or FROM the airplane when flying a selected VOR course. The TO/FR arrow will not be visible when the navigation receiver is tuned to a localizer frequency.

NAV FLAG - If in view indicates unreliable information is being supplied to the VOR/LOC deviation bar.

SECTION II

LIMITATIONS

Not applicable.

SECTION III

EMERGENCY PROCEDURES

Not applicable.

SECTION IV

NORMAL PROCEDURES

VOR OPERATION

1. NAV-2 Receiver - TUNE to desired VOR frequency.
2. VOR Station Identification Code - VERIFY.
3. To determine the bearing to a selected VOR station, rotate OBS knob until TO/FR arrow indicates TO and VOR/LOC deviation bar is centered. Read TO bearing under the course index.

NOTE

Display Select Control on NAV receiver may also be used to determine bearing TO or FROM a selected VOR station.

4. To intercept and track a selected VOR radial, use OBS knob to set desired radial under the course index, and then maneuver airplane to establish correct intercept angle. VOR/LOC deviation bar will center when an on-course condition has been established.

VOR STATION PASSAGE

The VOR/LOC deviation bar indicates angular deviation, therefore, the bar sensitivity will increase as the airplane approaches the station. Recommend airplane be flown on a magnetic heading during station passage until the TO/FR arrow displays a positive FROM indication.

LOCALIZER OPERATION

Localizer operation occurs when NAV receiver is tuned to a published localizer frequency. The NAV flag will be out of view when a reliable localizer signal is being received.

The localizer course width is much narrower than the VOR course, therefore smaller course corrections are required to maintain the intercepted localizer course.

To intercept a localizer for a front course approach:

1. NAV 2 Receiver - TUNE to published localizer frequency.
2. NAV Flag - CHECK out of view.
3. Published Inbound Course - SET under the Course Index.

NOTE

Setting the localizer course has no effect on the VOR/LOC deviation bar when receiver is tuned to a localizer frequency. However, it is recommended that the published course be set on the indicator to aid in pilot orientation.

4. Localizer Course - INTERCEPT and TRACK.

NOTE

When intercepting a localizer course close to an airport, recommend that pilot begin turning the airplane when the VOR/LOC deviation bar moves off the stop. This will reduce the possibility of course over-shoot.

When flying a front-course approach, or flying outbound on the back-course, heading corrections are made by flying toward the VOR/LOC deviation bar. When flying a back-course approach, or flying outbound on the front-course, corrections are made by flying away from the VOR/LOC deviation bar.

SECTION V

PERFORMANCE

Not applicable.

SUPPLEMENT 14

COLLINS ADF-650 AUTOMATIC DIRECTION FINDER (ADF)

SECTION I

GENERAL

This Supplement provides information necessary for the operation of the Collins ADF-650 ADF system. When an airplane is equipped with this system, this Supplement must be included in the Pilot's Operating Handbook.

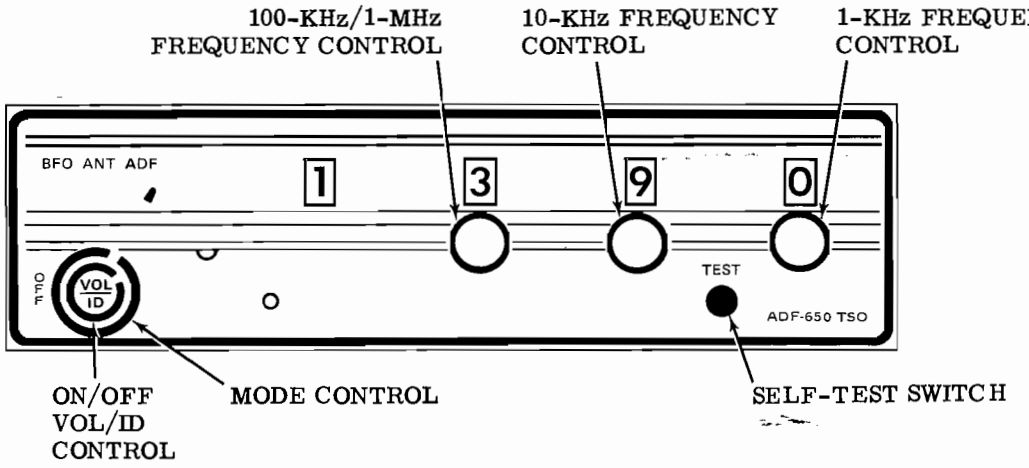
DESCRIPTION

The Collins ADF-650 is an automatic direction finder system which provides continuous, visual bearing indications of the direction from which a radio signal is being received. The system can be used for plotting position, for homing and for aural reception of AM signals. A crystal controlled, beat frequency oscillator (BFO) permits coded identifier to be heard from stations transmitting keyed CW signals (Morse Code).

The basic units of the ADF-650 are a Collins RCR-650 receiver, an IND-650 indicator and an externally mounted combined loop-sense antenna. Operating controls are mounted on the receiver front panel. The receiver has a frequency range of 200 through 1799 kHz in 1-kHz steps and operates on airplane dc power.

CONTROLS AND INDICATORS

ADF-650 RECEIVER



ON/OFF/VOL/ID CONTROL - Controls the application of power to the system, varies the audio gain and selects or removes the identification filter from the audio circuit. When control is full counterclockwise, power is OFF. Turning control clockwise applies power to the unit. Continued clockwise rotation of the control increases the level of the audio and/or identification output. Pulling the control outward causes the identification tone to become louder and improves identification verification. Pushing the control in attenuates the identification tone.

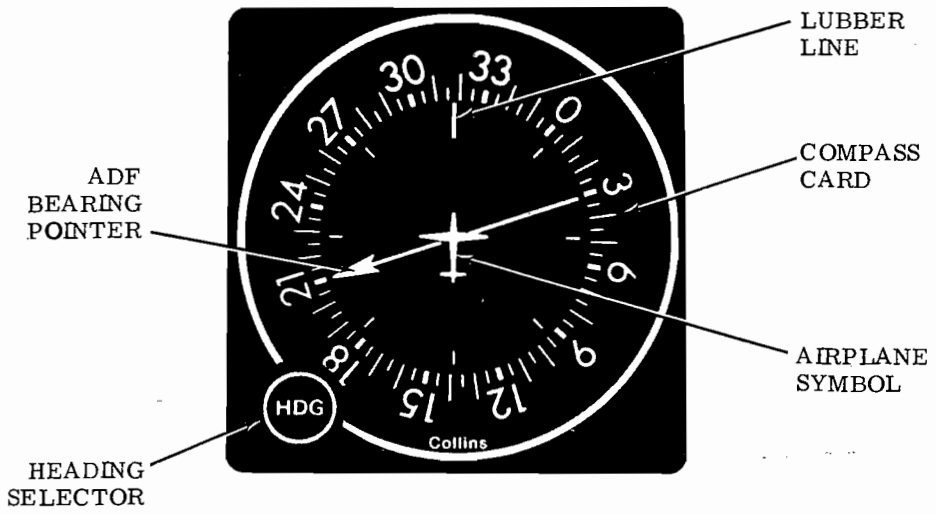
MODE CONTROL - Controls the mode of operation of the system.

1. BFO - Activates beat frequency oscillator tone to permit coded identifier to be heard from stations transmitting keyed CW signals (Morse Code). ADF needle continues to operate in BFO mode.
2. ANT - In this position system operates as a standard radio receiver. Will provide clearest reception of the identification code. ADF function is inoperative.
3. ADF - This mode is used for automatic direction finding. Drives ADF pointer.

FREQUENCY SELECTOR CONTROLS - Used to select the operating frequency of the ADF. The selected frequency is displayed in the four backlighted windows above the selector controls.

TEST BUTTON - Pressing the TEST button while in ADF or BFO mode initiates a system self-test. If the receiver, antenna and ADF indicator are operating properly, the indicator pointer will rotate 90° from its position prior to pressing the TEST button. Releasing the TEST button allows the pointer to return to its original position and normal operation is restored.

IND-650 INDICATOR



COMPASS CARD - A manually rotatable compass card used to determine the magnetic bearing to the station.

HEADING SELECTOR - Rotates compass card to allow setting airplane heading under the lubber line.

ADF BEARING POINTER - Indicates the bearing between the longitudinal centerline of the airplane and the selected station. If airplane heading is set under the lubber line, magnetic bearing to the station is read under the ADF pointer.

LUBBER LINE - Point of reference for setting airplane heading.

AIRPLANE SYMBOL - A fixed symbolic representation of the airplane. Always points to the lubber line.

SECTION II

LIMITATIONS

Not applicable.

SECTION III

EMERGENCY PROCEDURES

Not applicable.

SECTION IV

NORMAL PROCEDURES

ADF OPERATION

1. Audio Control Panel - ADF switch to speaker or phone, as desired.
2. ON/OFF/VOL/ID Control - ON.
3. Mode Control - ANT.
4. Frequency Selector - SELECT desired ADF frequency.
5. Station Identification - VERIFY.
6. Mode Control - ADF.

When flying to a station, if pointer moves right, correct to the right; If it moves left, correct to the left. Station passage is identified by a 180-degree reversal of the pointer.

SECTION V

PERFORMANCE

Not applicable.

SUPPLEMENT 15
COLLINS DME-451

(WITH IND-450 INDICATOR)

SECTION I

GENERAL

This Supplement provides information necessary for the operation of the Collins DME-451 Distance Measuring Equipment (DME) system. When an airplane is equipped with a Collins DME-451 this supplement must be included in the Pilot's Operating Handbook.

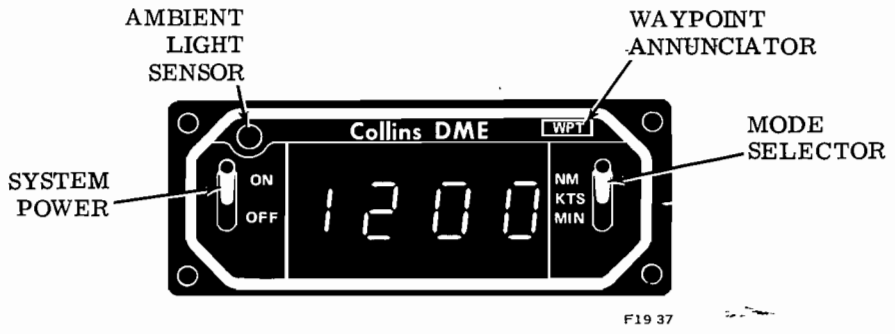
DESCRIPTION

The Collins DME-451, when used in conjunction with VORTAC stations, computes distance in nautical miles to or from a selected ground station, ground speed in knots and time-to-station.

The DME-451 translates the time required for a transmitted signal to travel from the airplane to the ground station and return into distance between the airplane and the ground station. Since the airplane is airborne, the direct distance to the station will be slant-range distance. The difference between a measured distance on the surface and DME slant-range distance is known as slant-range error and is smallest at low altitude and long range. The error will be the greatest when the airplane is directly over the ground facility, at which time the DME indicator will display altitude in nautical miles above the station. Slant-range error will be negligible.when the airplane is one mile or more from the ground station for each 1000 feet of altitude above the elevation of the station.

The DME-451 is channeled by the #1 or #2 NAV receiver. The DME system utilizes TACAN frequencies that are paired with VOR frequencies. Tuning the selected VORTAC frequency on the NAV receiver automatically selects the proper DME channel.

IND-450 INDICATOR



Dashes will be observed on the display until station lock-on occurs in NM mode or until a velocity of at least 30 knots is established with lock-on in KTS or MIN mode.

CONTROL OR INDICATOR — FUNCTION

SYSTEM POWER CONTROL - Controls application of airplane dc power to DME system.

AMBIENT LIGHT SENSOR - Automatically adjusts display intensity as a function of cockpit ambient light.

WAYPOINT ANNUNCIATOR - Illuminates to inform pilot that RNAV system is in operation. With RNAV system in operation, all displayed data is relative to the waypoint. Inactive if airplane is not equipped with R-NAV.

MODE SELECTOR

NM Position - Indicator displays slant-range distance to or from the selected station in nautical miles up to 199.9 nm.

KTS Position - Indicator displays airplane ground speed up to 399 knots.

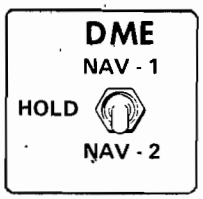
MIN Position - Indicator displays time-to-station from 0 to 120 minutes out.

NOTE

Airplane ground speed and time-to-station are meaningful only when the airplane track is directly to or from the ground station. The KTS and MIN indications require approximately 1.5 minutes after station acquisition for final accuracy.

NAVIGATION SYSTEM MODE CONTROL

Located to left of Comm/Nav control heads.



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NAV 1 position provides DME frequency control by #1 Navigation receiver; NAV 2 position provides DME frequency control by #2 Navigation receiver. The HOLD position is selected when the currently controlling NAV receiver frequency is to be changed but the pilot wishes the DME to remain operating on the current frequency after the navigation frequency has been changed.

SECTION II

LIMITATIONS

Not applicable.

SECTION III

EMERGENCY PROCEDURES

Not applicable.

SECTION IV

NORMAL PROCEDURES

Before Takeoff

NOTE

An airplane on the ground may not be able to receive a DME signal from a VORTAC due to line-of-sight limitations.

1. Airplane Power - ON.
2. Circuit Breakers - SET.
3. Radio Master Circuit Breaker Switch - ON.
4. DME System Power Switch - ON.

NOTE

Recommend that avionics equipment be turned on only after engine start. This procedure increases the reliability of solid state circuitry.

5. DME Navigation System Mode Control - NAV 1.
6. #1 NAV Receiver - ON. Tune to local VORTAC station.
7. DME Mode Selector - NM. Check distance readout. Ground speed and time-to-station can not be checked on ground.

In Flight

1. DME System Power Switch - ON.
2. DME Navigation System Mode Control - NAV 1 or NAV 2, as desired.
3. Selected NAV Receiver - TUNE to desired VORTAC frequency.

WARNING

It is important to listen to the DME audio. This is the only reliable means of identifying the DME beacon being used.

4. Audio Control Panel - SELECT DME AUDIO.
5. DME Identifier Signal - VERIFY.
6. DME Mode Selector - AS DESIRED.
7. To use Hold function proceed as follows:
   a. Select VHF Nav frequency associated with desired DME station and obtain lock-on.
   b. Set Nav System Mode Control to HOLD.
   c. Select a new frequency on the NAV receiver used to control the DME lock-on.
   d. Monitor DME audio to ensure DME is still on the previously selected frequency.

CAUTION

DME may unlock due to loss of signal with certain combinations of distance from station, altitude and airplane attitude.

SECTION V

PERFORMANCE

Not applicable.

SUPPLEMENT 16

COLLINS TDR-950 TRANSPONDER

SECTION I

GENERAL

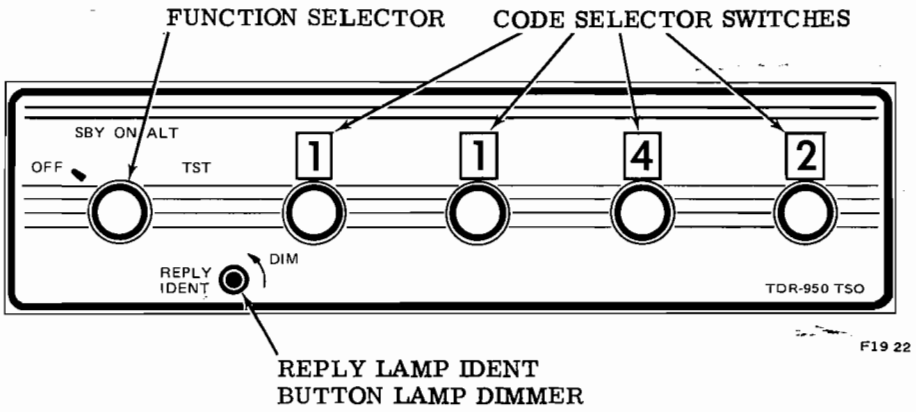
The purpose of this supplement is to provide information necessary for the operation of the Collins TDR - 950 Transponder. When an airplane is equipped with a TDR - 950, this Supplement must be included in the Pilot's Operating Handbook.

DESCRIPTION

The TDR-950 Transponder is an integral part of the air traffic control radar beacon system. The transponder provides identification of the airplane on the ATC ground controller's plan position indicator. When the airplane is also equipped with an encoding altimeter, the transponder provides the ATC controller with the pressure altitude of the airplane.

When interrogated by valid radar pulses from the ground station, the transponder will reply automatically with a series of pulses coded to provide a discrete identification of the airplane. When the airplane is also equipped with an encoding altimeter and the TDR-950 Function Selector is in ALT position, automatic altitude reporting will be included in response to Mode C (ALT) interrogations.

INDICATOR AND CONTROLS



FUNCTION SELECTOR - Selects transponder mode of operation. There is a 20-second delay from the time primary power is applied (function selector in any position other than OFF) until transponder will operate.

OFF - All power is removed from unit.
SBY - Selection of SBY position maintains power on the transponder but responses to any interrogations are inhibited.
ON - Places the transponder in Mode A, the airplane identification mode. The transponder will not provide altitude information in this mode.
ALT - Places the transponder in Mode C. Transponder will respond with identification and pressure altitude information if airplane is equipped with an encoding altimeter. If airplane is not equipped with an encoding altimeter, transponder will respond with identification code.
TST - The TST position provides a means to check the operational readiness of the transponder. If the transponder is operating properly, holding the spring-loaded switch in the TST position will cause the REPLY lamp to illuminate.

REPLY LAMP/IDENT BUTTON

REPLY LAMP - Lamp flashes each time a response is made to a valid interrogation. The REPLY lamp will remain on for approximately 20 seconds after releasing the IDENT button; this signifies transmission of the SPIP. Selection of the TST position lights the REPLY lamp if the TDR-950 is operational.
IDENT BUTTON - Momentarily depressing the IDENT button adds a SPIP (Special Position Identification Pulse) to the normal reply pulses for airplane identification. The SPIP is transmitted for approximately 20 seconds longer than the time during which the IDENT button is depressed. Depress IDENT button only when ATC requests the airplane to "squawk IDENT".
LAMP DIMMER - Rotation of the IDENT button controls the brightness of the REPLY lamp.

CODE SELECTOR SWITCHES - The reply code, which is displayed in the windows, is selected by rotating the code selector switches. The switches are rotary type, each having eight positions with no end stops. The 4-digit code selected will determine the configuration of the reply pulse.

SECTION II

LIMITATIONS

Not applicable.

SECTION III

EMERGENCY PROCEDURES

A. To Transmit an Emergency Signal

1. Function Switch - ON.
2. Code Selector Switches - 7700.
3. IDENT Button - PRESS to effect immediate identification on ground controller's display.

B. To Transmit a Signal Representing Loss of All Voice Communications.

1. Function Switch - ON.
2. Code Selector Switches - 7700 for one minute, then select 7600 for 15 minutes. Repeat this procedure for remainder of flight.
3. IDENT Button - PRESS to effect immediate identification on ground controller's display.

NOTE

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

SECTION IV

NORMAL PROCEDURES

A. Before Takeoff

1. Airplane Power - ON.
2. Circuit Breakers - SET.
3. Radio Master Circuit Breaker Switch - ON.
4. Function Switch - SBY. Allow 20-seconds for warm-up.
5. Function Switch - TST. Observe REPLY lamp is illuminated as long as switch is held in TST position.
6. Function Switch - SBY.

B. After Takeoff

1. To Transmit Mode A (Airplane Position Identification).

   a. Code Select Switches - SELECT assigned code.
   b. Function Switch - ON.
   c. Lamp Dimmer - ADJUST as desired.

NOTE

With Function Switch ON, REPLY lamp will flash to indicate transponder is replying to interrogations.

   d. IDENT Button - PRESS momentarily when instructed by ground controller to "squawk IDENT". REPLY lamp will glow steadily for 20 seconds to indicate IDENT operation.

2. To Transmit Mode C (Altitude Information)

   a. Code Selector Switches - SELECT assigned code.
   b. Function Switch - ALT.

NOTE

When directed by ground controller to "stop altitude squawk", turn Function Switch to ON for Mode A operation.

Pressure altitude is transmitted, and conversion to indicated altitude is done in ATC computers.

3. Transponder Phraseology

Air traffic controllers will use the phraseology listed below when referring to operation in the air traffic control radar beacon system. Instructions directed to the pilot by air traffic control refer to operation on mode A and mode C only.

TERM	INTERPRETATION
IDENT	Initiate transponder special position identification pulse by depressing IDENT button.
SQUAWK (number)	Operate transponder on designated code with function selector switch in ON or ALT position.
SQUAWK ALTITUDE	Set transponder function selector switch to ALT (mode C). Applicable to aircraft with encoding altimeter only
SQUAWK (number) AND IDENT	Set transponder to specified code with function selector switch in ON or ALT position and engage IDENT button.
SQUAWK MAYDAY	Turn function selector to ON or ALT and select code 7700.

3. Transponder Phraseology (continued)

TERM	INTERPRETATION
SQUAWK STANDBY	Switch transponder function selector switch to SBY.
STOP ALTITUDE SQUAWK	Turn transponder function selector switch from ALT (mode C) to ON (mode A).
STOP SQUAWK	Turn transponder function switch to SBY.

NOTE

Under no circumstances should civil airplanes operate on code 0000. This particular code is reserved for military interceptor operations.

c. After Landing.

1. Function Selector - OFF.

SECTION V

PERFORMANCE

Not applicable.

SUPPLEMENT 17

PURITAN "ALTITUDE TRAVELER" PORTABLE OXYGEN SYSTEM

SECTION I

GENERAL

The purpose of this Pilot's Operating Handbook Supplement is to provide information necessary for the operation of the Puritan "Altitude Traveler" Portable Oxygen System. When an airplane 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.

DATA ON THIS PAGE IS F.A.A. APPROVED

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 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.

EDO-AIRE MITCHELL
P. O. Box 610
Mineral Wells, Texas 76067

FAA/DAS APPROVED
PILOT'S OPERATING HANDBOOK SUPPLEMENT
FOR
EDO-AIRE MITCHELL CENTURY III AUTOPILOT
MODEL AK574
WHEN INSTALLED IN
ROCKWELL COMMANDER MODELS 114 AND 114A

Reg. No. N5893N

Ser. No. 14506

SECTION 1

GENERAL

This supplement must be used in conjunction with the applicable FAA Approved Pilot's Operating Handbook when Edo-Aire Mitchell Century III Autopilot Model AK574 is installed in accordance with STC SA3122SW-D. The information contained herein supplements the information of the basic Pilot's Operating Handbook; for limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook.

SECTION 2

LIMITATIONS

1. Maximum speed for autopilot operation is 170 KIAS. (Autopilot Vmo)
2. Reduce autopilot Vmo 4.0 KIAS per each 1000 feet P.A. above 13,000 feet P.A.
3. Autopilot operation not authorized with more than 20° (approach) flap extension.
4. Required Placard P/N 13A660-1 "Conduct trim check prior to flight - (See POH)" to be installed in clear view of pilot.
5. Autopilot OFF during take-off and landing.

SECTION 3

EMERGENCY PROCEDURES

NOTE: During examination of this supplement, the pilot is advised to locate and identify the autopilot controls and the trim master switch and circuit breakers for both systems.

AUTOPILOT

1. In the event of an autopilot malfunction, the autopilot can be:
   a. Disconnected by depressing the trim switch "AP OFF" bar.
   b. Disconnected by pushing the roll rocker switch OFF.
   c. Overpowered at either control wheel.

cause electric trim action will increase overpower force.

2. Altitude Loss During Malfunction:
   a. In climb, cruise or descending flight, an autopilot malfunction with a 3 second delay in recovery initiation could result in as much as 50° bank and 300' altitude loss. Maximum altitude loss measured at 170 KIAS in a descent.
   b. In approach configuration, an autopilot malfunction with a 1 second delay in recovery initiation could result in as much as 15° bank and 60' altitude loss. Maximum altitude loss measured in approach configuration, gear down, and operating either coupled or uncoupled.

TRIM

1. In the event of a trim malfunction:
   a. Operate the trim command switch in a direction opposite the runaway. This will open the trim circuit breaker and stop all trim action.
   b. Trim master switch - OFF. Retrim aircraft as necessary using manual trim system.
   c. Trim circuit breaker - Pull. Do not operate trim until problem is corrected.
2. If a trim runaway occurs with the autopilot operating, the above procedures will disconnect the autopilot which will immediately result in higher control wheel forces. Be prepared to manually retrim, as necessary, to eliminate undesirable forces.

COMPASS SYSTEM

1. Emergency Operation With Optional NSD 360A (HSI) Slaved and/or Non-Slaved:

   NSD 360A

   a. Appearance of HDG Flag:
      1. Check air supply gauge (vac or pressure) for adequate air supply (4 in. Hg. min.).
      2. Check compass circuit breaker.
      3. Observe display for proper operation.
   b. To disable heading card - pull circuit breaker and use magnetic compass for directional data.
      NOTE: If heading card is not operational, autopilot should not be used.
   c. With card disabled VOR/Localizer and Glide Slope displays are still functional; use card set to rotate card to aircraft heading for correct picture.
   d. Slaving Failure - (i.e. failure to self correct for gyro drift):
      1. Check gyro slaving switch is set to No. 1 position (if equipped with Slave No. 1 - No. 2 switch) or "Slaved" position when equipped with Slaved and Free Gyro Mode Switch.
      2. Check for HDG Flag.
      3. Check compass circuit breaker.
      4. Reset heading card while observing slaving meter.
         NOTE: Dead slaving meter needle or a needle displaced fully one direction indicates a slaving system failure.
      5. Select slaving amplifier No. 2, if equipped. If not equipped, proceed with No. 7 below.

6. Reset heading card while checking slaving meter. If proper slaving indication is not obtained,
7. Switch to free gyro mode and periodically set card as an unslaved gyro.

NOTE: In the localizer mode, the "TO-FROM" arrows may remain out of view, depending upon the design of the NAV converter used in the installation.

SECTION 4

NORMAL PROCEDURES

AUTOPILOT

Refer to Edo-Aire Mitchell Pilot's Operating Manual, P/N 68S25, dated 2-71 for autopilot pre-flight and normal in-flight procedures and NSD 360A Operator's Manual, P/N 68S85, dated 4-1-74, revised 5-1-76, as applicable.

TRIM SYSTEM

GENERAL

This aircraft is equipped with an electric elevator trim system that has two operating modes:

1. Manual command trim
2. Autotrim follow-up mode when the autopilot pitch section is engaged

The electric trim system is designed to withstand any type of single malfunction, either mechanical or electrical, without uncontrolled operation resulting. The pre-flight check procedure is designed to uncover hidden failures that might otherwise go undetected. Proper operation of the electric elevator trim system is predicated on conducting the following pre-flight check before each flight. If the trim system fails any portion of the procedure, pull the trim circuit breaker and leave the circuit breaker out until trim system is repaired. Substitution of any trim system component for another model is not authorized.

The command electric trim switch on the left hand portion of the pilot's control wheel has two functions:

1. When the top bar (autopilot off) is pressed, it disconnects the autopilot.
2. When the top bar is pressed AND the rocker is moved forward, nose down trim will occur - when moved aft, nose up trim will occur.

PRE-FLIGHT: COMMAND TRIM - BEFORE EACH FLIGHT

1. Check trim circuit breaker - IN.
2. Trim master switch - ON.
3. Autopilot OFF - Check normal trim operation - UP. Grasp trim control and check override capability. Check nose down operation. Recheck override.
4. Activate center bar only - push rocker fore and aft - only. Trim should not operate with either separate action.

AUTOTRIM - BEFORE EACH FLIGHT

1. Autopilot ON - (Roll and Pitch Sections) Check automatic Operation by activating autopilot pitch command disc UP then DN. Observe trim operation follows pitch command direction.

   NOTE: In autopilot mode, there will be approximately a 3 second delay between operation of pitch command and operation of trim.

2. Press center bar (AP OFF) - release - check autopilot disengagement.
3. Rotate trim control to check manual trim operation.
4. Recheck aircraft pitch trim to correct take-off position after autopilot and trim system check.

SPECIAL OPERATIONS AND INFORMATION

1. Altitude Hold Operation - For best results reduce rate of climb or descent to 500 FPM before engaging altitude hold mode. For precise altitude control in altitude hold mode below approximately 100 KIAS, extend up to 20° landing flaps.
2. Instrument Approach Operations - Initial and/or intermediate approach segments should be conducted with 20° flaps and approximately 100 KIAS. Upon intercepting the glide path or when passing the final approach fix (FAF) immediately lower landing gear and reduce the power for approximately 85 KIAS on the final approach segment. Adjust power as necessary during remainder of approach to maintain correct airspeed. For approaches without glide path coupling adjust pitch command disc in conjunction with power to maintain desired airspeed and descent rate.
3. Instrument Approach Go-Around Maneuver - At the decision height (DH) or missed approach point (MAP) perform the go-around as follows:
   a. Select pitch mode and adjust for desired attitude.

      NOTE: During glide slope coupled approach the pitch command disc can be preset to the desired attitude. At the decision height, disengage the altitude hold to initiate the go-around attitude.

   b. Add take-off power or power as desired.
   c. After positive rate of climb is established, raise landing gear and flaps.
   d. Select HDG mode at coupler for turn from the approach course and set the desired heading on the DG.

SECTION 5

PERFORMANCE

No change.

APPROVED Walter F. Davis
Walter F. Davis

EDO-AIRE MITCHELL
DAS 2 SW
DATE: 1-23-79
P/N 68S331-1

United States of America

Department of Transportation — Federal Aviation Administration

Supplemental Type Certificate

Number SA3122SW-D

This certificate, issued to Mitchell Industries, Inc., dba
EDO-AIRE MITCHELL
P. O. Box 610
Mineral Wells, Texas 76067

certifies that the change in the type design for the following product with the limitations and conditions therefor as specified hereon meets the airworthiness requirements of Part 23 *of the* Federal Aviation *Regulations.*

Original Product — Type Certificate Number: A12SO
Make: Rockwell Commander
Model: 112, 112B, 112TC, 112TCA, 114, 114A

Description of Type Design Change:
Installation of Mitchell Automatic Flight System Model AK574 consisting of a Century III Autopilot with Optional Radio Coupler and Glide Slope Coupler according to Bulletin No. 698, Revision 6, dated 1-10-79 and Master Drawing List No. 87A828, Revision F, dated 1-10-79 (14 Volt System) and/or later FAA Approved Revisions of the above data.

Limitations and Conditions: The following FAA/DAS Approved Pilot's Operating Handbook Supplements are required: P/N 68S331-1, dated 1-23-79 for Rockwell Commander Models 114 and 114A; P/N 68S379-1, dated 4-29-76, revised 12-23-76 for Rockwell Commander Model 112TC and 112TCA; P/N 68S428, dated 10-11-76 for Rockwell Commander Model 112B. FAA/DAS Approved Airplane Flight Manual Supplement, P/N 68S359, dated 3-19-76 is required for Rockwell Commander Model 112 and/or later FAA Approved Revisions of the above Supplements. Placard, P/N 13A660 is required for Rockwell Commander Model 112; Placard, P/N 13A660-1 is required for Rockwell Commander Models 112B, 112TC, 112TCA, 114 and 114A.

This certificate and the supporting data which is the basis for approval shall remain in effect until surrendered, suspended, revoked, or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.

Date of application: 3-1-76

Date of issuance: 3-19-76

Date reissued: 4-29-76; 10-11-76; 12-23-76; 1-23-79 Revision 4

Date amended:

By direction of the Administrator

(Signature)
Harold W. Holdeman
DAS Staff Coordinator, DAS 2 SW
(Title)

Any alteration of this certificate is punishable by a fine of not exceeding $1,000, or imprisonment not exceeding 3 years, or both.

This certificate may be transferred in accordance with FAR 21.47.

FAA Form 8110-2 (10-68)

EDO-AIRE MITCHELL
P. O. Box 610
Mineral Wells, Texas 76067

FAA/DAS APPROVED
PILOT'S OPERATING HANDBOOK SUPPLEMENT
FOR
EDO-AIRE MITCHELL COMMAND ELECTRIC TRIM SYSTEM
MODEL AK582
WHEN INSTALLED IN
ROCKWELL COMMANDER MODELS 114 AND 114A

Reg. No. N5893N

Ser. No. 14506

SECTION 1

GENERAL

This supplement must be used in conjunction with the applicable FAA Approved Pilot's Operating Handbook when Edo-Aire Mitchell Command Electric Trim System Model AK582 is installed in accordance with STC SA3123SW-D. The information contained herein supplements the information of the basic Pilot's Operating Handbook; for limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook.

SECTION 2

LIMITATIONS

Required Placard, P/N 13A660-1 "Conduct trim check prior to flight - See POH" to be installed in clear view of the pilot.

SECTION 3

EMERGENCY PROCEDURES

1. Overpower control wheel forces initially, and depress and hold the master interrupt switch on the control wheel. This will stop all trim action.
2. Retrim aircraft with manual trim system to alleviate control force.
3. Move the trim master switch to the OFF position.
4. Release interrupt switch while observing trim wheel to assure that the trim system is disabled.
5. Pull trim circuit breaker. Leave circuit breaker open until the trim system is corrected.

SECTION 4

NORMAL PROCEURES

1. PRE-FLIGHT INSPECTION - BEFORE EACH FLIGHT

    a. Circuit breaker - IN.
    b. Trim Master Switch - ON.

c. Depress switch center bar and rock switch fore (down) and aft (up) - check trim operates in correct direction both Up and Down.
d. Release trim switch. Depress only the center bar - Trim should not operate.
e. Rock switch fore and aft only - (Do not depress center bar) Trim should not operate.
f. Operate trim normally - grasp trim wheel and check that trim may be overpowered by hand.

If the trim system fails any portion of the above check procedures, turn the trim master switch OFF and do not operate the trim system until the system is corrected. This trim system has been designed to require two separate failures before uncontrolled operation can occur. The pre-flight inspection procedure is established to identify a system failure that might otherwise go undetected.

2. IN-FLIGHT PROCEDURES

Depress center bar and move switch rocker fore or aft to obtain electric trim nose down or up. Release switch to stop trimming.

SECTION 5

PERFORMANCE

No change.

APPROVED Walter F Davis
Walter F. Davis

EDO-AIRE MITCHELL
DAS 2 SW
DATE: 1-23-79
P/N 68S366-1

United States of America

Department of Transportation—Federal Aviation Administration

Supplemental Type Certificate

Number SA3123SW-D

This certificate, issued to Mitchell Industries, Inc. dba
EDO-AIRE MITCHELL
P. O. Box 610
Mineral Wells, Texas 76067

certifies that the change in the type design for the following product with the limitations and conditions thereof as specified hereon meets the airworthiness requirements of Part 23 *of the* Federal Aviation *Regulations.*

Original Product—Type Certificate Number: A12SO

Make: Rockwell Commander

Model: 112, 112B, 112TC, 112TCA, 114, 114A

Description of Type Design Change:

Installation of Mitchell Command Electric Trim System Model AK582 according to Bulletin No. 706, Revision 4, dated 1-10-79 and Master Drawing List No. 87A851, Revision D, dated 1-10-79 (14 Volt System) and/or later FAA Approved Revisions of the above data.

Limitations and Conditions: FAA/DAS Approved Pilot's Operating Handbook Supplements are required: P/N 68S366-1, dated 1-23-79 for Rockwell Commander Models 114 and 114A; P/N 68S380-1, dated 4-29-76, revised 12-23-76 is required for Rockwell Commander Models 112TC and 112TCA, P/N 68S431, dated 10-11-76 for Rockwell Commander Model 112B. FAA/DAS Approved Airplane Flight Manual Supplement, P/N 68S365, dated 3-19-76 is required for Rockwell Commander Model 112 and/or later FAA Approved Revisions of the above Supplements. Placard P/N 13A660 is required for Rockwell Commander Model 112; Placard P/N 13A660-1 is required for Rockwell Commander Models 112TC, 112TCA, 112B, 114 and 114A.

This certificate and the supporting data which is the basis for approval shall remain in effect until surrendered, suspended, revoked, or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.

Date of application: 3-1-76

Date of issuance: 3-19-76

Date reissued: 4-29-76; 10-11-76; 12-23-76; 1-23-79 Revision 4

Date amended:

By direction of the Administrator

(Signature)

Harold W. Holdeman
DAS Staff Coordinator, DAS 2 SW

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