Pilot's Operating Handbook

Rockwell Commander

112TCA

TRAINING PURPOSES ONLY

FAA APPROVED IN NORMAL CATEGORY BASED ON FAR 23. THIS DOCUMENT MUST BE CARRIED IN THE AIRPLANE AT ALL TIMES.

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REGISTRATION NO. _____

FAA APPROVED Larry L. McHughes
DEL OP PC - 203

Rockwell International

General Aviation Division
5001 North Rockwell Avenue
Bethany, Oklahoma 73008

WELCOME ABOARD

Rockwell International welcomes you to a world of new comfort and fun in personal flying in the Commander 112TCA.

Built in the tradition of the P-51 Mustang, the Sabre and Super Sabre fighters, the Sabre business jets and the famed Commander business twins, the Commander 112TCA offers comfort and conveniences not available in any four-place retractable in general aviation.

The Rockwell Commander 112TCA has the largest roomiest cabin of any four-place retractable.

Two doors. Magnificient visibility. Integrated restraint systems built into the seats . . . not the cabin structure. The trailing-beam suspension landing gear truly makes landings easy.

This manual is prepared by Rockwell International, General Aviation Division for use by personnel interested in owning and/or operating a Model 112TCA. Data included is current through 7-20-77.

THIS DOCUMENT IS NOT FAA APPROVED, and must not be utilized in place of the FAA Approved Flight Manual which is carried aboard each Model 112TCA aircraft.

This document will not be kept current by the manufacturer but be reissued from time to time as required.

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Approved: 17 June 1977

Larry L. McHughes

Delegation Option PC-203

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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 112TCA. This handbook includes the material required to be furnished to the pilot by FAR Part 23 and constitutes the Approved Airplane Flight Manual. It also contains additional data supplied by the airframe manufacturer. The FAA Approved data is identified by the notation "Data on this page is F.A.A. Approved" at the bottom of each page, as applicable.

CONTENTS OF HANDBOOK

The Pilot's Operating Handbook is designed to contain information necessary for safe and efficient operation of the Rockwell Commander 112TCA. The handbook is divided into ten 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
Section X	Safety Tips

NOTE

Since a large number of Rockwell Commander 112TCA's are equipped with different varieties of optional equipment, the illustrations shown in this handbook will not be typical of every airplane.

REVISING THE HANDBOOK

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

NOTE

It is the responsibility of the pilot to assure this handbook is current when using it to operate the Rockwell Commander 112TCA.

AIRPLANE DIMENSIONS

See Figure 1-1.

DESCRIPTIVE DATA

ENGINE

One Lycoming TO-360-C1A6D

Engine Type: Reciprocating, turbo-charged, carbureted, direct-drive, air-cooled, horizontally-opposed, four-cylinder, 360 cubic inch displacement.

Maximum Horsepower Rating: 210 BHP at 2575 RPM and 42 inches manifold pressure.

PROPELLER

One constant speed, hydraulically actuated, two-bladed Hartzell propeller, Model Number HC-E2YR-1BF/F8467-7R. Diameter: 76.5-77 inches. Pitch Change: 15° (low pitch) to 30° (high pitch) at Propeller Station 30.0

FUEL

Minimum Approved Fuel Grade (Color): 100 Octane Low Lead Aviation Fuel (Light Blue).
100/130 Aviation Grade Gasoline (Green).
Total Fuel Capacity: 50 U.S. Gallons (Standard), 70 U.S. Gallons (Optional).
Usable Fuel Capacity: 48 U.S. Gallons (Standard), 68 U.S. Gallons (Optional).

OIL

TYPES (Specifications) ASHLESS DISPERSANT (MIL-L-22851)

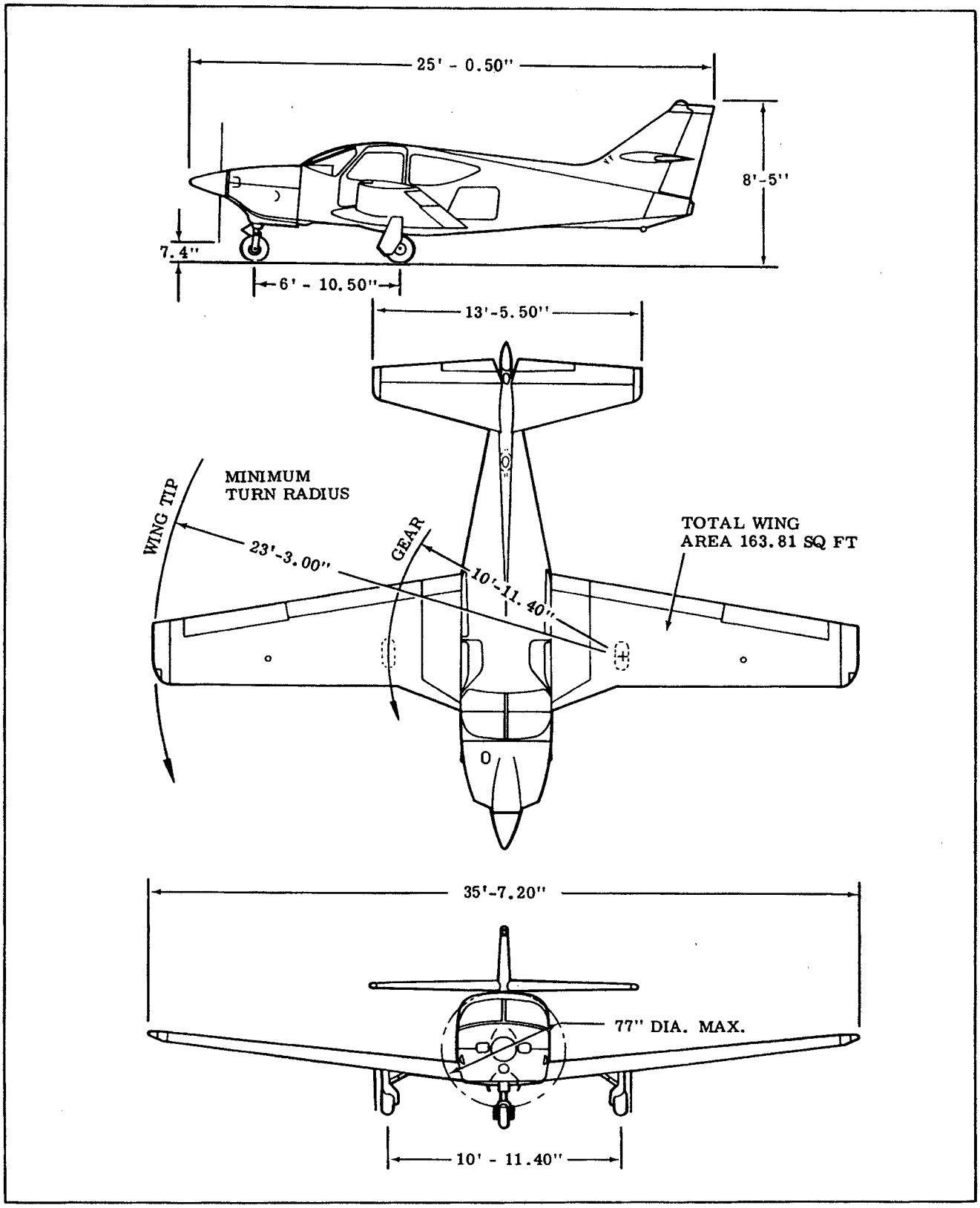

Figure 1-1. Airplane Dimensions

Grades and Recommended Operating Temperatures:	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's maintenance manual.

Total Oil Capacity: 8 Quarts
Minimum Safe Oil Quantity: 2 Quarts
Normal Oil Quantity Operating Range: 6 to 8 Quarts

HYDRAULIC SYSTEMS

Gear Operating MIL-H-5606
Brake System MIL-H-5606

MAXIMUM CERTIFICATED WEIGHTS

NOTE

Utility Category applicable to Serial Numbers 13150 thru 13175 with Custom Kit No. CK-112-6 installed, and Serial Numbers 13176 and Subs.

Maximum Takeoff Weight:
- Normal Category 2950 lbs.
- Utility Category 2800 lbs.

Maximum Landing Weight: 2950 lbs.
Maximum Weight in Baggage Compartment: 200 lbs.

Maximum Zero Fuel Weight:
- Normal Category: 2720 lbs from 26.76% MAC to 31.77% MAC; 2200 lbs at 18.07% MAC varying linearly to 2331 lbs at 18.70% MAC varying linearly to 2720 lbs at 26.76% MAC
- Utility Category: 2500 lbs from 22.20% MAC to 28.09% MAC; 2200 lbs at 18.07% MAC varying linearly to 2331 lbs at 18.70% MAC varying linearly to 2500 lbs at 22.20% MAC.

MINIMUM CERTIFICATED WEIGHTS

Minimum Weight - Normal Category
2005 lbs at 18.07% MAC to
1998 lbs at 20.44% MAC to
2035 lbs at 26.42% MAC to
2096 lbs at 28.09% MAC to
2229 lbs at 31.77% MAC.

Minimum Weight - Utility Category
2005 lbs at 18.07% MAC to
1998 lbs at 20.44% MAC to
2035 lbs at 26.42% MAC to
2096 lbs at 28.09% MAC.

NOTE

Straight line variation between points.

STANDARD AIRPLANE WEIGHTS

Standard Empty Weight: 1861 lbs.
Maximum Useful Load: 1089 lbs.

CABIN AND ENTRY DIMENSIONS

Maximum Cabin Width:	44 in. Front	Minimum Entry Width:	18 in.
	40 in. Rear	Minimum Entry Height:	34 in.
Maximum Cabin Length:	75 in.	Minimum Door Sill Height:	11 in.
Maximum Compartment Height:	49 in.		

BAGGAGE SPACE AND ENTRY DIMENSIONS

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

SPECIFIC LOADINGS

Wing Loading:	18.0 lbs/sq.ft.	Power Loading:	14.0 lbs/hp.

SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

GENERAL AIRSPEED TERMINOLOGY AND SYMBOLS

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

KCAS — Calibrated Airspeed expressed in "Knots".

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

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

KIAS — Indicated Airspeed expressed in "Knots".

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

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

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

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

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

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

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

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

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

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

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

METEOROLOGICAL TERMINOLOGY

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

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

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

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

Station Pressure — Actual atmospheric pressure at field elevation.

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

POWER TERMINOLOGY

MCP — Maximum Continuous Power (MCP) is the maximum power rating not limited by time. MCP is obtainable on this airplane by setting the engine speed to 2575 RPM, establishing full rich mixture and observing the following manifold pressure schedule:
42 IN.Hg. to 8000 feet
40 IN.Hg. to 16,000 feet
38 IN.Hg. to 20,000 feet

Leaning — Manually adjusting fuel flow to achieve a desired fuel/air ratio in the carburetor.

Manifold Pressure — Manifold pressure is the pressure of the fuel/air mixture entering the cylinder for combustion. Manifold pressure is measured in terms of inches of mercury (IN.Hg.).

RPM — The speed at which the engine and propeller are operating.

Bootstrapping — This is a term describing variations of manifold pressure due to changes in airspeed, mass flow through the turbocharger, or other variables.

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 at the inlet to the turbocharger. Since 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 of the fuel/air mixture at the intake port of number four cylinder.
Fuel Pressure Gage	An instrument that indicates fuel pressure at the carburetor fuel inlet.
Carburetor Air Temp. Gage	An instrument that indicates the temperature of the air entering the carburetor.
Propeller Governor	An engine component located on the engine which maintains a selected propeller RPM, and is set by the propeller control.

AIRPLANE PERFORMANCE AND FLIGHT PLANNING TERMINOLOGY

Climb Gradient	The ratio of the height gained during some period of a climb. to the horizontal distance traversed in the same time interval.
Demonstrated Crosswind Velocity	The demonstrated crosswind velocity (20 kts) is the velocity of the crosswind component for which adequate control of the airplane during takeoff and landing was actually demonstrated during certification tests. The value shown is limiting.
MEA	Minimum enroute IFR altitude.
Route Segment	A part of a route. Each end of that part is identified by: (1) a geographical location; or (2) a point at which a definite radio fix can be established.

WEIGHT AND BALANCE

Reference Datum	An imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Fuselage Station	A location along the airplane fuselage given in terms of distance from the reference datum.
Arm	The horizontal distance from the reference datum to the center of gravity (C.G.) of an item.
Moment	The product of the weight of an item multiplied by its arm. (For convenience, moment is sometimes quoted in 1000's of In-Lbs to reduce the number of digits.)
Tare	The weight of chocks, blocks, stands, etc., that were on the scales when the aircraft 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 aircraft.
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 (48 U.S. Gallons, Standard) (68 U.S. Gallons, Optional).
Unusable Fuel	Fuel remaining after a runout test has been completed in accordance with governmental regulations.
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).
Payload	Weight of occupants, cargo and baggage.
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.
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.

DEFINITIONS

WARNING	—	Operating procedures, techniques, etc., which could result in personal injury or loss of life if not carefully followed.
CAUTION	—	Operating procedures, techniques, etc., which could result in damage to equipment if not carefully followed.
NOTE	—	An operating procedure, technique, etc., which is considered essential to emphasize.

SECTION II

LIMITATIONS

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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 No. A12S0.

AIRSPEED LIMITATIONS

NOTE

Utility Category applicable to Serial Numbers 13150 thru 13175 with Custom Kit No. CK-112-6 installed, and Serial Numbers 13176 and Subs.

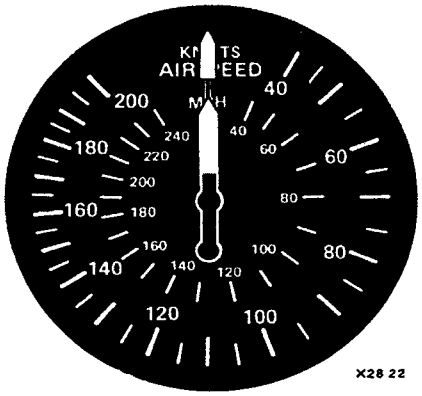
SPEED	KCAS	KIAS	REMARKS
	Normal Category		
Maneuvering* V_A	111 (2950 lbs) 91 (1998 lbs)	111 91	Do not make full or abrupt control movements above this speed.
	Utility Category		
	117 (2800 lbs) 99 (1998 lbs)	117 99	
Maximum Flap Extended V_{FE}	150 (0-20°) 120 (20-25°) 109 (25-35°)	151 121 111	Do not exceed this speed with a given flap setting.

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

SPEED	KCAS	KIAS	REMARKS
Maximum Landing Gear Operating V_{LO}	130	130	Do not extend or retract landing gear above this speed.
Maximum Landing Gear Extended V_{LE}	180	181	Do not exceed this speed with landing gear extended. Do not exceed V_{NE}.
Never Exceed V_{NE}	180	181	Do not exceed this speed in any operation.
Maximum Structural Cruising V_{NO}	143	143	Do not exceed this speed except in smooth air and then only with caution.
Maximum Side Window Open	130	131	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	52-109	52-111	Full Flap Operating Range. Lower limit is maximum weight stalling speed in landing configuration. Upper limit is maximum speed allowable with flaps fully extended.
Green Arc	57-143	59-143	Normal Operating Range. Lower limit is maximum weight stalling speed with flaps and landing gear retracted. Upper limit is maximum structural cruising speed.
Yellow Arc	143-180	143-181	Operations must be conducted with caution.
Red Line	180	181	Maximum Speed for ALL operations.
NOTE: Airspeed indicator markings are based on Calibrated Airspeeds.			

Figure 2-2. Airspeed Indicator Markings

POWER PLANT LIMITATIONS

PROPELLER

Hartzell HC-E2YR-1BF/F8467-7R

1. Continuous operation between 2250 and 2450 RPM with manifold pressure below 20 IN-HG is prohibited.
2. Continuous operation below 2350 RPM at manifold pressure above 34 IN-HG is prohibited.

ENGINE

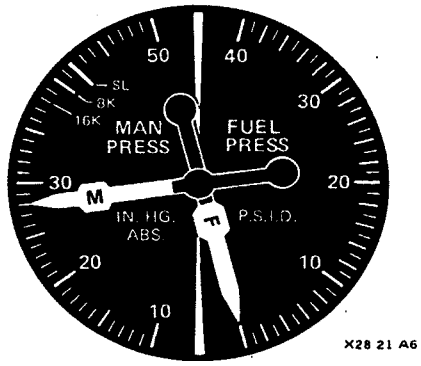
Lycoming TO-360-C1A6D

Engine Operating Limits for Takeoff and Continuous Operations:

Maximum BHP	-	210
Maximum RPM	-	2575
Maximum Manifold Pressure	-	42 IN-HG - S.L. to 8000 FT.
	-	40 IN-HG - 8001 FT. to 16,000 FT.
	-	38 IN-HG - 16,001 FT to 20,000 FT.
Maximum Cylinder Head Temp.	-	475°F
Maximum Oil Temperature	-	245°F
Minimum Oil Pressure (Idle)	-	25 PSI
Minimum Cruise Oil Pressure	-	55 PSI
Maximum Oil Pressure	-	100 PSI

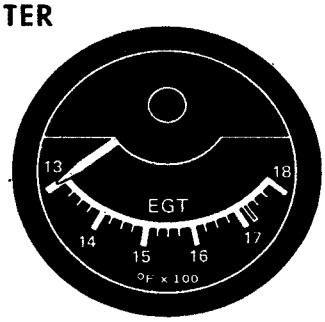
POWERPLANT INSTRUMENT MARKINGS

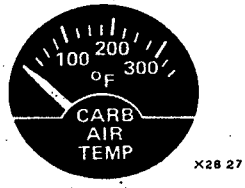
ENGINE TACHOMETER



MANIFOLD PRESSURE/FUEL PRESSURE

EXHAUST GAS TEMPERATURE



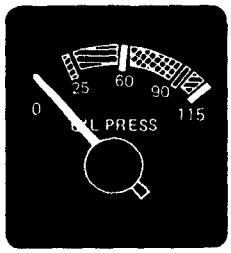


CARBURETOR TEMPERATURE

INSTRUMENTS	Red Line Minimum Limit	Yellow Arc Caution Range	Green Arc Normal Operating	Red Line Maximum Limit
TACHOMETER (RPM)	—	—	2200-2575	2575
MANIFOLD PRESSURE (IN-HG)	—	—	20-42	42
FUEL PRESSURE (PSI)	15	—	15-30	30
EGT (°F)	—	—	—	1725
CARB. AIR TEMP. (°F)	—	0-100	100-325	325

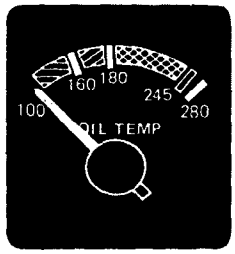
Figure 2-3. Power Plant Instrument Markings (Sheet 1 of 2)

CYLINDER HEAD TEMPERATURE



X28 24

OIL PRESSURE



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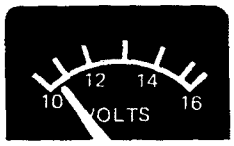
OIL TEMPERATURE



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VOLTMETER

INSTRUMENTS	Red Line Minimum Limit	Yellow Arc Caution Range	Green Arc Normal Operating	Yellow Arc Caution Range	Red Line Maximum Limit
CYLINDER HEAD TEMPERATURE (°F)	—	—	200-475	—	475
OIL PRESSURE (PSI)	25	25-55	55-90	90-115	115
OIL TEMPERATURE (°F)	—	100-160	160-245	—	245
VOLTMETER (VOLTS)	—	—	—	—	16.0

Figure 2-3. Power Plant Instrument Markings (Sheet 2 of 2)

SEATS

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

No passengers allowed in rear seat during Utility Category operations.

WEIGHT LIMITS

NOTE

Utility Category applicable to Serial Numbers 13150 thru 13175 with Custom Kit No. CK-112-6 installed and Serial Numbers 13176 and Subs.

Maximum Takeoff Weight:	
Normal Category	2950 lbs.
Utility Category	2800 lbs
Maximum Landing Weight:	2950 lbs.
Maximum Weight in Baggage Compartment:	200 lbs.

Maximum Zero Fuel Weight:	
Normal Category	2720 lbs from 26.76% MAC to 31.77% MAC 2200 lbs at 18.07% MAC varying linearly to 2331 lbs at 18.70% MAC varying linearly to 2720 lbs at 26.76% MAC.
Utility Category	2500 lbs from 22.20% MAC to 28.09% MAC 2200 lbs at 18.07% MAC varying linearly to 2331 lbs at 18.70% MAC varying linearly to 2500 lbs at 22.20% MAC.

Minimum Weight:

Normal Category
2005 lbs at 18.07% MAC to
1998 lbs at 20.44% MAC to
2035 lbs at 26.42% MAC to
2096 lbs at 28.09% MAC to
2229 lbs at 31.77% MAC

Utility Category
2005 lbs at 18.07% MAC to
1998 lbs at 20.44% MAC to
2035 lbs at 26.42% MAC to
2096 lbs at 28.09% MAC.

NOTE

Straight line variation between points.

CENTER OF GRAVITY LIMITS

NORMAL CATEGORY

Forward: 106.15 Inches Aft of Datum (26.68% MAC) at 2950 lbs.
102.20 Inches Aft of Datum (20.07% MAC) at 2608 lbs.
101.00 Inches Aft of Datum (18.07% MAC) at 2200 lbs.
101.00 Inches Aft of Datum (18.07% MAC) at 2005 lbs.

Aft: 109.20 Inches Aft of Datum (31.77% MAC) at 2950 lbs.
109.20 Inches Aft of Datum (31.77% MAC) at 2229 lbs.

Maximum Zero Fuel Weight:

106.20 Inches (26.76% MAC) to 109.20 Inches (31.77% MAC) at 2720 lbs.
101.00 Inches (18.07% MAC) at 2200 lbs. to 101.38 Inches (18.70% MAC) at 2331 lbs. to 106.20 Inches (26.76% MAC) at 2720 lbs.

UTILITY CATEGORY

Forward: 104.44 Inches Aft of Datum (23.82% MAC) at 2800 lbs.
102.20 Inches Aft of Datum (20.07% MAC) at 2608 lbs.
101.00 Inches Aft of Datum (18.07% MAC) at 2200 lbs.
101.00 Inches Aft of Datum (18.07% MAC) at 2005 lbs.

Aft: 107.00 Inches Aft of Datum (28.09% MAC) at 2800 lbs.
107.00 Inches Aft of Datum (28.09% MAC) at 2096 lbs.

Maximum Zero Fuel Weight:

103.48 Inches (22.20% MAC) to 107.00 Inches (28.09% MAC) at 2500 lbs.
101.00 Inches (18.07% MAC) at 2200 lbs. to 101.38 Inches (18.70% MAC) at 2331 lbs. to 103.48 Inches (22.20% MAC) at 2500 lbs.

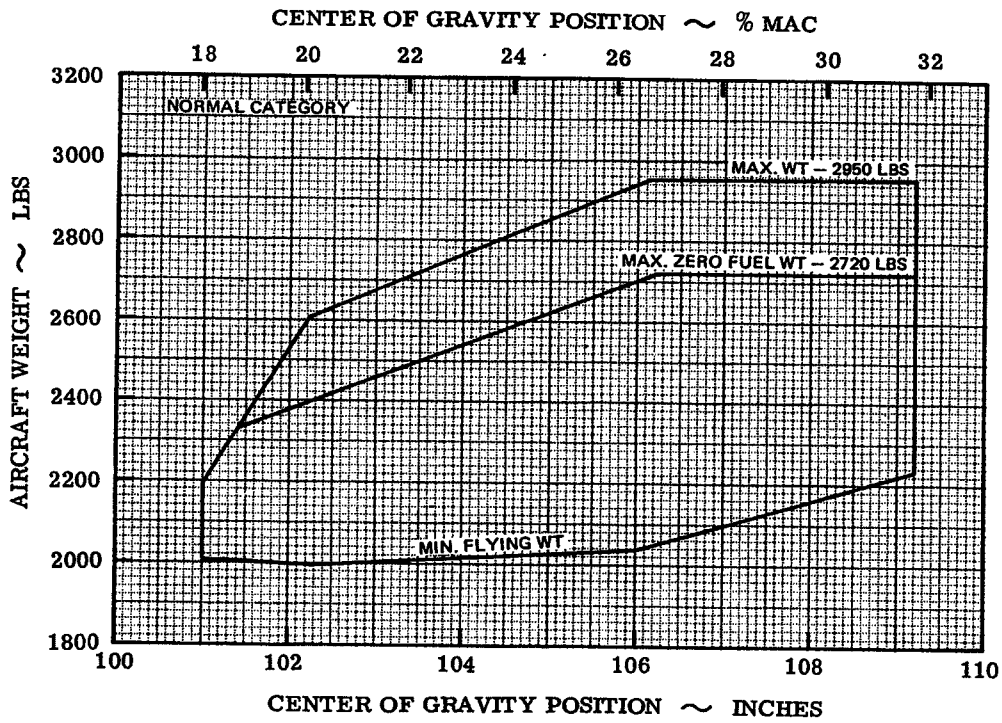
NOTE

Straight line variation between points.

Datum Location:	Fuselage Station 0.0 Inches.
Mean Aerodynamic Chord:	59.84 Inches.
L.E. of Mean Aerodynamic Chord:	Fuselage Station 90.188 Inches.

FATIGUE LIFE

If airplane is operated under both Normal and Utility Categories, the lower published fatigue life will apply. (Ref. FAA Type Certificate Data Sheet No. A12S0)



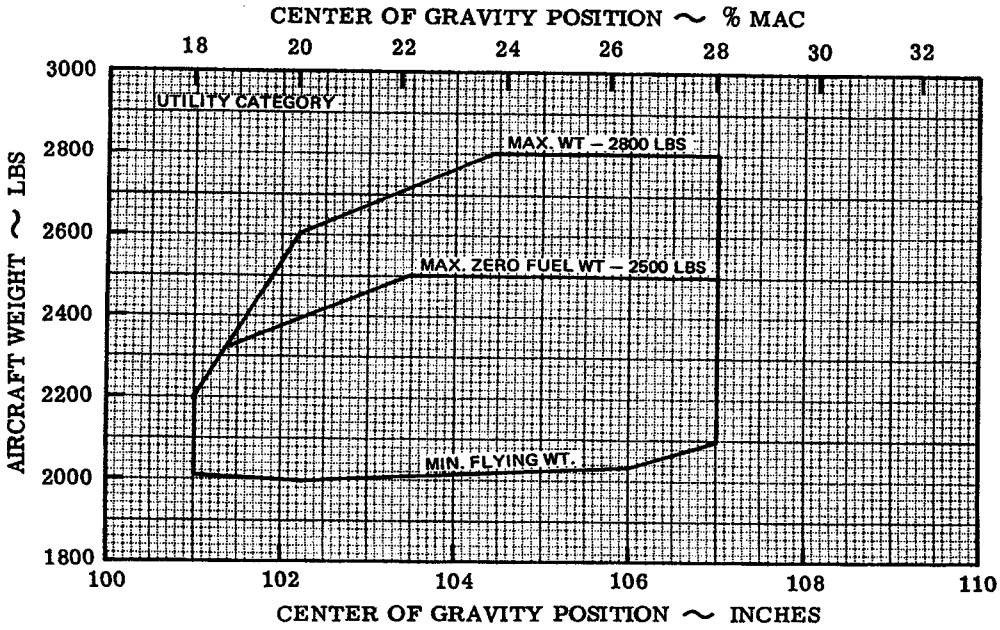


Figure 2-4. Flight Envelope

MANEUVER LIMITS

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

NORMAL CATEGORY

AUTHORIZED MANEUVERS

Maneuver	Recommended Entry Speeds (KCAS)
Lazy Eights (Angle of Bank Not to Exceed 60°.)	111 Knots at 2950 lbs. 91 Knots at 1998 lbs.
Chandelles (Angle of Bank Not to Exceed 60°.)	111 Knots at 2950 lbs. 91 Knots at 1998 lbs.
Steep Turns (Angle of Bank Not to Exceed 60°.)	111 Knots at 2950 lbs. 91 Knots at 1998 lbs.
Stalls (Except Whip Stalls)	Slow Entry Rate Only

NOTE

Maximum altitude loss during a wings level stall recovery is 500 feet.

Any other maneuver incidental to normal flying.

Unauthorized Maneuvers

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

Intentional spins are prohibited.

Inverted maneuvers are prohibited.

UTILITY CATEGORY

AUTHORIZED MANEUVERS

Maneuver	Recommended Entry Speeds (KCAS)
Lazy Eights (Angle of Bank in Excess of 60°.)	117 Knots at 2800 lbs. 99 Knots at 1998 lbs.
Chandelles (Angle of Bank in Excess of 60°.)	117 Knots at 2800 lbs. 99 Knots at 1998 lbs.
Steep Turns (Angle of Bank in Excess of 60°.)	117 Knots at 2800 lbs. 99 Knots at 1998 lbs.

In addition, all maneuvers approved for Normal Category Operation.

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 and inverted maneuvers are prohibited.

FLIGHT LOAD FACTOR LIMITS

NORMAL CATEGORY

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

UTILITY CATEGORY

Limit Load Factors:

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

MAXIMUM AUTHORIZED ALTITUDE

Maximum authorized altitude is 20,000 Ft.

TYPES OF OPERATION

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

Operations up to and including 20,000 feet is approved in accordance with FAR 91 when equipped with oxygen.

Flight into known icing conditions is prohibited.

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

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

INSTRUMENT, SYSTEM OR EQUIPMENT	KINDS OF OPERATION			
	DAY VFR	NIGHT VFR	DAY IFR	NIGHT IFR
Airspeed Indicator	Reqd	Reqd	Reqd	Reqd
Altimeter	Reqd	Reqd	Sensitive Altimeter	Sensitive Altimeter
Altimeter - Sensitive	Not Reqd	Not Reqd	Reqd	Reqd
Altimeter - Encoding	Reqd above 12,500 MSL Reqd in all TCA's	Reqd above 12,500 MSL Reqd in all TCA's	Reqd above 12,500 MSL Reqd in all TCA's	Reqd above 12,500 MSL Reqd in all TCA's
Magnetic Direction Indicator	Reqd	Reqd	Reqd	Reqd
Fuel Quantity Indicators	Reqd	Reqd	Reqd	Reqd
Oil Pressure Indicator	Reqd	Reqd	Reqd	Reqd
Oil Temperature Indicator	Reqd	Reqd	Reqd	Reqd
Tachometer	Reqd	Reqd	Reqd	Reqd
Cylinder Head Temperature Indicator	Reqd	Reqd	Reqd	Reqd
Manifold Pressure Indicator	Reqd	Reqd	Reqd	Reqd
Carb Air Temp Ind.	Reqd	Reqd	Reqd	Reqd
EGT Indicator	Reqd	Reqd	Reqd	Reqd
Master Switch	Reqd	Reqd	Reqd	Reqd

INSTRUMENT, SYSTEM OR EQUIPMENT	KINDS OF OPERATION			
	DAY VFR	NIGHT VFR	DAY IFR	NIGHT IFR
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	Reqd	Reqd	Reqd	Reqd
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	Not 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 - 50 U.S. Gallons (Standard), 70 U.S. Gallons (Optional)

Unusable - 2 U.S. Gallons

Usable - 48 U.S. Gallons (Standard), 68 U.S. Gallons (Optional)

EXHAUST GAS TEMPERATURE LIMITATIONS

Leaning at power settings in excess of 75% MCP is prohibited.

Continuous mixtures leaner than Best Power are prohibited between 66% and 75% MCP.

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

Maximum allowable EGT is 1725°F.

Carburetor Air Temperature Limitations

Operation at temperatures above 325°F is prohibited.
Operation at temperatures below 100°F in visible moisture may require use of alternate air.

PLACARDS - See Figure 2-5.

MAX. BAGGAGE COMPARTMENT
CAPACITY 200 LBS

Baggage Door Upper Left Corner

MAXIMUM SPEED-
WINDOW
OPEN 130K

Near Vent Window

MANEUVERING SPEED (2950 LBS) ..... 111 KCAS
MAX GEAR OPERATING SPEED ..... 130 KCAS
MAX SPEED 20° FLAP ..... 150 KCAS
MAX SPEED 25° FLAP ..... 120 KCAS

Near Airspeed Indicator

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

Center Console at Fuel Selector (Standard)

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

Center Console at Fuel Selector (Optional)

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.

MAX AUTHORIZED ALTITUDE 20,000 FT.

REFER TO PILOTS OPERATING HANDBOOK FOR OXYGEN REQUIREMENTS.

Windshield Center Frame
NORMAL CATEGORY

OPERATING LIMITATIONS

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

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

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

MAX AUTHORIZED ALTITUDE 20,000 FT

REFER TO PILOTS OPERATING HANDBOOK FOR OXYGEN REQUIREMENTS

Windshield Center Frame
UTILITY CATEGORY

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

ALTERNATE STATIC SOURCE CORRECTION CARD MODELS 112TC & 112TCA

- HEATER & DEFROSTER FULL ON OR VENTS FULL OPEN
- PILOT & OPT. RIGHT SIDE WINDOW MUST BE CLOSED
- GEAR DOWN
- COWL FLAPS OPEN OR CLOSED
- WING FLAPS 35°

AIRSPEED		ALTITUDE CORRECTION IN FT.		
KIAS	KCAS	IPA:SL	IPA:10K	IPA:20K
65	68	15	20	28
70	72	13	17	24
80	81	6	8	11
90	89	-4	-6	-8
100	98	-18	-24	-34
112	109	-35	-53	-73

49307-201

ALTERNATE STATIC SOURCE CORRECTION CARD MODELS 112TC & 112TCA

ALTERNATE STATIC SOURCE CORRECTION CARD MODELS 112TC & 112TCA

- HEATER & DEFROSTER FULL ON OR VENTS FULL OPEN
- PILOT & OPT. RIGHT SIDE WINDOW MUST BE CLOSED
- GEAR UP
- COWL FLAPS OPEN OR CLOSED
- FLAPS FULL UP

AIRSPEED		ALTITUDE CORRECTION IN FT.		
KIAS	KCAS	IPA: SL	IPA: 10K	IPA: 20K
65	66	5	7	10
70	70	2	3	4
80	79	-4	-6	-8
90	89	-11	-15	-21
100	98	-18	-25	-34
110	107	-27	-37	-51
120	117	-36	-49	-68
130	126	-48	-65	-90
140	135	-60	-81	-113
148	143	-71	-94	-130

ALTERNATE STATIC SOURCE CORRECTION CARD MODELS 112TC & 112TCA

In Pocket on Pilot's Map Case

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

SCHEDULE MP ABOVE 8 K FT

Above Altimeter

MIN 20 IN. MP
2250 TO 2450 RPM
MAX 34 IN. MP
BELOW 2350 RPM

Between Manifold Pressure/ Fuel Pressure Gage and Tachometer

HEADREST TO BE IN PLACE DURING TAKEOFF & LANDING

On Top of Pilot and Front Passenger Seat Back Beneath Headrest

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

SECTION III

EMERGENCY PROCEDURES

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INTRODUCTION

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

The following information is presented to enable the pilot to form, in advance, a definite plan of action for coping with the most probable emergency situations which could occur in the operation of the airplane. Where practicable, the emergencies requiring immediate corrective action are shown in checklist form for easy 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 *	111	Gear Down, Flaps Down
Power Off Glide (Best Glide Angle)	76 - 2950 Lbs ** 70 - 2500 Lbs 66 - 2200 Lbs	Gear Up, Flaps Up Cowl Flaps Closed
Power Off Approach	*72 - 88	Gear Down, Flaps 35°
Extreme Turbulence Encounter	111 - 2950 Lbs ** 91 - 1998 Lbs	Gear Up, Flaps Up
* Smooth Air Only ** Straight Line Variation between points		

Figure 3-1. Airspeeds for Safe Operations

EMERGENCY PROCEDURES CHECKLIST

ENGINE FAILURE

DURING TAKEOFF ROLL

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

IN FLIGHT

1. Airspeed - 75 KIAS.
2. Auxiliary Fuel Pump - ON.
3. Alternate Induction Air - HOT.
4. Mixture - FULL RICH (then lean for smooth engine operation).
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).

CAUTION

Monitor manifold pressure carefully when engine restarts.
Use throttle to maintain desired manifold pressure.

AIRSTART

1. Airspeed - 84 KIAS, minimum for windmilling propeller.

NOTE

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

2. Fuel Selector - FULLEST TANK.
3. Mixture - RICH.
4. Throttle - OPEN APPROXIMATELY 1/4.
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.

HIGH ALTITUDE RESTART

1. Airspeed - 84 KIAS, minimum for windmilling propeller.
2. Fuel Selector - FULLEST TANK.
3. Mixture - LEAN.
4. Throttle - OPEN APPROXIMATELY 1/2 TO 3/4.
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.

UNINTENTIONAL OVERBOOST

1. Retard throttle to 42 IN-HG or below.

NOTE

Refer to Lycoming Operator's Manual for procedures in event of overboost.

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 - 75 KIAS.
2. Mixture - IDLE CUTOFF.
3. Ignition Switch - OFF.
4. Fuel Selector - OFF.
5. Flaps - UP.
6. Landing Gear - RETRACTED.
7. Cowl Flaps - CLOSED.
8. Emergency Locator Transmitter (if installed) - ON.
9. Transponder (if installed) - CODE 7700.
10. Seats, Seat Belts and Shoulder Straps - SECURE.
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 - 72 KIAS MINIMUM.

PRECAUTIONARY OFF-AIRPORT LANDING WITH POWER

Approach

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

On Final Approach

9. Flaps - 35 DEGREES.
10. Airspeed - 72 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 - 72 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 - 72 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 - 72 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 - 72 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 - 75 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 - 75 KIAS.
2. Mixture - IDLE CUTOFF.
3. Ignition Switch - OFF.
4. Fuel Selector - OFF.
5. Flaps - UP.
6. Cowl Flaps - CLOSED.
7. Emergency Locator Transmitter (if installed) - ON.
8. Transponder (if installed) - CODE 7700.
9. Ground Controller Briefing - ACCOMPLISH, if circumstances permit.
10. Seats, Seat Belts and Shoulder Straps - SECURE (front seats in upright position).
11. Loose Objects - SECURE.

On Final Approach

12. Flaps - 20 DEGREES.
13. Airspeed - 75 KIAS MINIMUM.

Touchdown and Slide

14. Elevator Control - FULL AFT.

DITCHING

Approach

1. Airspeed - 75 KIAS.
2. Transponder (if installed) - CODE 7700.
3. MAYDAY Transmission - TRANSMIT information which may expedite search and rescue AS REQUIRED.

NOTE

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

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

On Final Approach

NOTE

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

11. Flaps - 20 DEGREES.
12. Airspeed - 75 KIAS MINIMUM.
13. Landing Gear - RETRACTED.
14. Propeller - HIGH RPM.

Touchdown

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

SMOKE AND FIRE

ELECTRICAL FIRE ON THE GROUND

1. Master Switch - OFF.
2. All Electrical Switches - OFF.
3. Mixture - IDLE CUTOFF.
4. Fuel Selector - OFF.
5. Fire Extinguisher (if installed) - DISCHARGE.

WARNING

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

ENGINE FIRE ON THE GROUND

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

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

WARNING

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

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

FIRE DURING TAKEOFF

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

ELECTRICAL FIRE IN FLIGHT

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

If smoke and fire persists, proceed as follows:

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

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

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

ENGINE FIRE IN FLIGHT

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

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

CABIN FIRE

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

If smoke and fire persist, proceed as follows:

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

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

7. Cabin Heat and Defrost Controls - AS DESIRED.
8. Air Vents - AS DESIRED.
9. Storm Window - OPEN (to clear cabin of smoke).

EMERGENCY DESCENT

1. Landing Gear - SELECT DOWN below 130 KIAS.
2. Flaps - DOWN 35° below 110 KIAS
3. Throttle - IDLE.
4. Propeller Control - HIGH RPM.
5. Bank - APPROXIMATELY 45 DEGREES, if practical.
6. Airspeed - 110 KIAS.

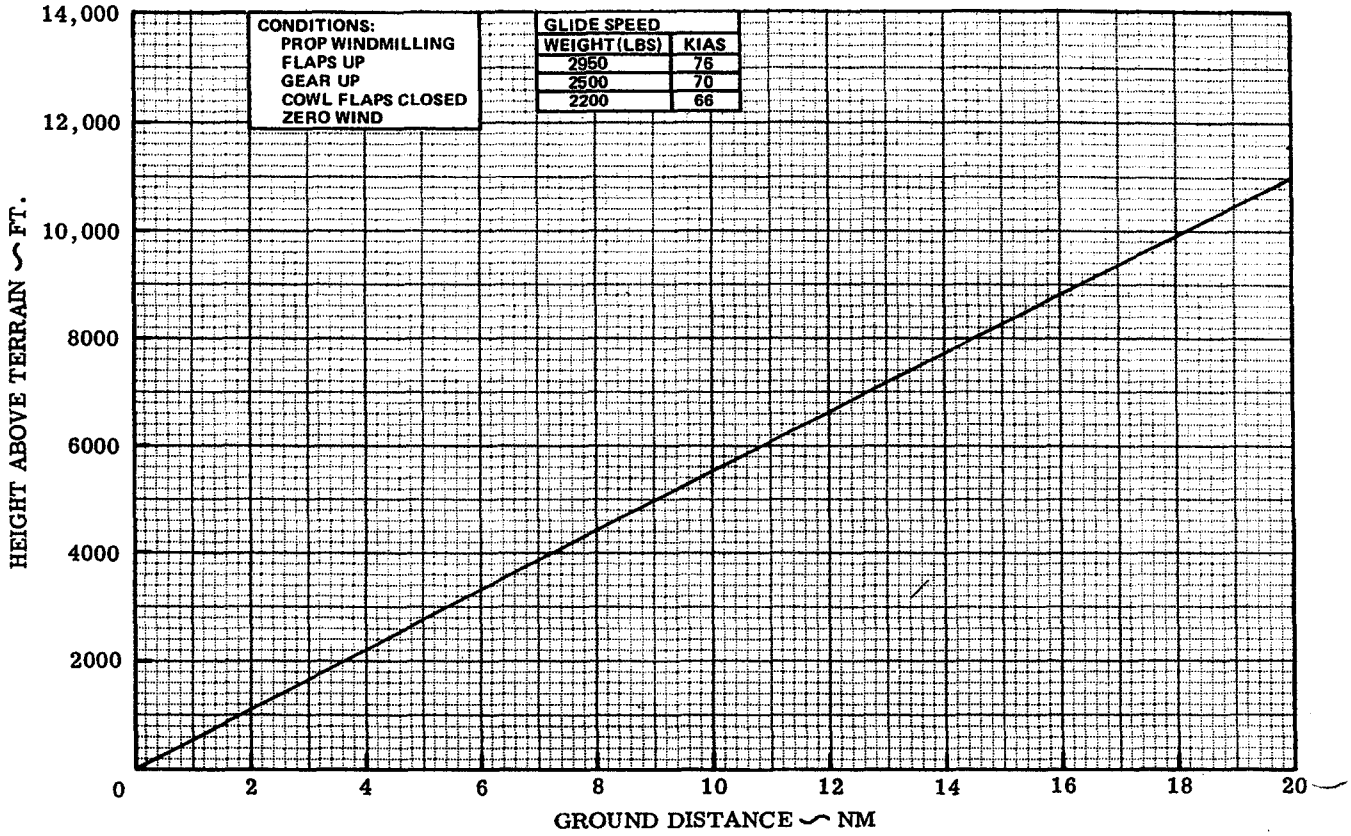

Figure 3-2. Maximum Gliding Distance

MAXIMUM GLIDING DISTANCE - Refer to Figure 3-2.

LANDING GEAR SYSTEM EMERGENCIES

FAILURE TO RETRACT

1. Circuit Breaker - CHECK.
2. Landing Gear Switch - CYCLE.

If unsafe indication persists, proceed as follows:

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

FAILURE TO EXTEND

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

If an unsafe indication persists, proceed as follows:

4. Landing Gear Switch - DOWN.
5. Throttle - MINIMIZE POWER.
6. Airspeed - 78 KIAS MAXIMUM.
7. Rudder Trim - NEUTRAL.
8. Emergency Extension Valve Knob - PULL OUT and DOWN.

NOTE

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

9. Gear Down Position Lights - VERIFY GEAR DOWN.

ELECTRICAL SYSTEM EMERGENCIES

EXCESSIVE BATTERY CHARGING INDICATED ON AMMETER

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

ALTERNATOR FAILURE

1. Alternator Switch - CYCLE.

NOTE

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

2. Circuit Breakers - CHECK.

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

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

CIRCUIT BREAKER TRIPPING

1. Affected Circuit Breaker - RESET.

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

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

AVIONICS MASTER SWITCH/CIRCUIT BREAKER TRIPPING

NOTE

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

1. Reset Avionics Master Switch - ON.

If unable to keep it in the ON position:

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

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

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

NOTE

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

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

NOTE

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

POWER PLANT EMERGENCIES

LOSS OF OIL PRESSURE INDICATION

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

CAUTION

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

LOW OIL PRESSURE (BELOW 55 PSI)

1. Reduce RPM to 2500 or below.
2. Do not exceed 143 KCAS.
3. Monitor oil pressure.

CAUTION

If oil pressure continues to decline proceed to nearest airport and land.

EXCESSIVE OIL PRESSURE

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

CAUTION

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

EXCESSIVE OIL/CYLINDER HEAD TEMPERATURE

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

CAUTION

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

ROUGH RUNNING ENGINE OR LOSS OF POWER

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

NOTE

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

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

PROPELLER OVERSPEED

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

CAUTION

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

MISCELLANEOUS EMERGENCIES

INADVERTENT ICING ENCOUNTER

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

WARNING

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

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

NOTE

A climb is usually preferred, if practical.

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

NOTE

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

CAUTION

When operating with alternate air selected, monitor carburetor air temperature gage to assure that excessive temperatures do not occur.

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

EXTREME TURBULENCE ENCOUNTER

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

NOTE

Avoid large excursions in pitch attitude.

OBSTRUCTED STATIC SOURCE

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

NOTE

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

OBSTRUCTED PITOT

1. Pitot Heat - ON.

NOTE

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

CABIN DOOR OPENING IN FLIGHT

NOTE

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

1. Airspeed - 78 KIAS.
2. Storm Window - OPEN.
3. Affected Door - OPEN approximately 4-inches and THEN SLAM SHUT.
4. Main Door Latch - CHECK for free play (no more than 1/8 to 1/4-inch).
5. Upper Door Latch - SECURE.

AIR PIRACY

1. Transponder (if installed) - CODE 7500 or any CODE 7500 to 7577.
2. Ground Controller Briefing - PERFORM as circumstances permit.

NOTE

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

INADVERTENT SPINS

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

NOTE

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

As rotation stops,

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

Recover smoothly from the resulting dive.

AMPLIFIED EMERGENCY PROCEDURES

LANDING GEAR MALFUNCTIONS

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

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

Extension Malfunction: If a positive "gear down and locked" indication cannot be obtained with normal extension procedures, operate press-to-test feature of indicator lights, and if still no indication, recycle the landing gear. If a recycling attempt does not provide positive indication (gear down lights on, absence of the gear warning lights and warning bell 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, and electrical load reduced to an essential minimum if an immediate landing is impractical.

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

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

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

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

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

SECTION IV

NORMAL PROCEDURES

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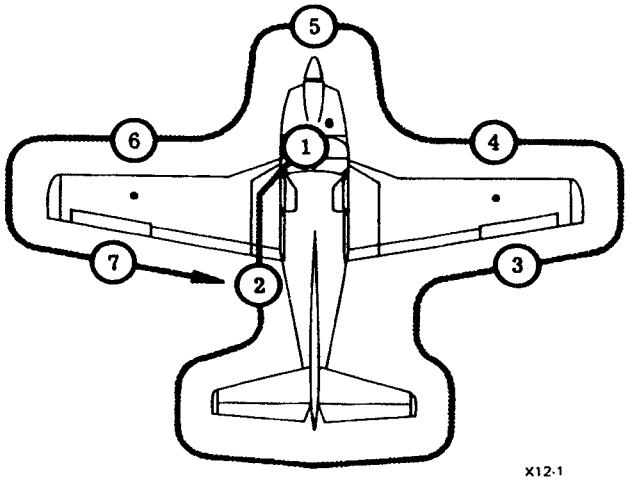

Figure 4-1. Pre-Flight Inspection Stations

NORMAL PROCEDURES CHECKLIST

PRE-FLIGHT INSPECTION

WARNING

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

(1) INTERIOR

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

NOTE

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

10. Fuel Quantity Gages - CHECK.

NOTE

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

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

(2) LEFT SIDE OF FUSELAGE AND EMPENNAGE

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

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

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

(4) RIGHT WING LEADING EDGE

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

NOTE

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

32. Fuel Filler Cap - SECURE.
33. Wing Tie-down - REMOVE.
34. Right Main Gear and Wheel Well - INSPECT.
35. Main Gear Tire - CHECK inflation and wear.
36. Squat Switch - INSPECT.
37. Landing Gear Limit Switches (2) - CHECK condition.
38. Fuel Tank Sump - DRAIN SAMPLE. Check valve closed.
39. Wheel Well Fuel Drain - DRAIN SAMPLE. Check valve closed.

(5) ENGINE SECTION

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

(6) LEFT WING LEADING EDGE

51. Left Main Gear and Wheel Well - INSPECT.
52. Landing Gear Limit Switches (2) - CHECK condition.
53. Wheel Well Fuel Drain - DRAIN SAMPLE. Check valve closed.
54. Fuel Tank Sump - DRAIN SAMPLE. Check valve closed.
55. Fuel Quantity - CHECK.

NOTE

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

56. Fuel Filler Cap - SECURE.
57. Wing Leading Edge - CHECK condition.
58. 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.

59. Wing Tie-down - REMOVE.
60. 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.

61. Fuel Vent - UNOBSTRUCTED.
62. Wing Tip - INSPECT.

(7) LEFT WING TRAILING EDGE

63. Navigation Light - CHECK.
64. Aileron - CHECK security and freedom of movement.
65. Wing Flap - INSPECT.

BEFORE STARTING ENGINE

1. Exterior Inspection - COMPLETE.
2. Seats, Seat Belts and Shoulder Straps - ADJUST and SECURE (front seats in upright position for takeoff).
3. Fuel Selector Valve - BOTH.
4. Avionics Master Switch - OFF.
5. All Electrical Equipment - OFF.
6. Circuit Breakers - CHECK.
7. Clock - OPERATING and SET.
8. Cowl Flaps - FULL OPEN.
9. Landing Gear Position Switch - DOWN.
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 - FULL RICH.
2. Propeller Control - HIGH RPM.
3. Throttle - CLOSED.
4. Alternate Induction Air Control - COLD.
5. Master Switch - ON.

NOTE

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

6. Fuel Pump Switch - ON (check fuel pressure) then OFF.

NOTE

In extremely cold weather prime engine with momentary use of primer button on control quadrant.

7. Propeller Area - CLEAR.
8. Ignition Switch - START then to BOTH when engine starts.

NOTE

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

9. Throttle - 800 to 1000 RPM.
10. Oil Pressure - CHECK for indication within 30 seconds.

NOTE

High oil pressure (in yellow arc) may exist until oil temperature increases to normal operating range.

11. Alternator - ON.

NOTE

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

12. Ammeter - CHECK for charging indication.

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. Fuel Pump Switch - ON (check fuel pressure) then OFF.
7. Propeller Area - CLEAR.
8. Ignition Switch - START then to BOTH.

NOTE

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

As engine fires:

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

NOTE

High oil pressure (in yellow arc) may exist until oil temperature increases to normal operating range.

13. Alternator - ON and CHARGING.

NOTE

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

14. Ammeter - CHECK for charging indication.

BEFORE TAXIING

1. Flashing Beacon - ON.

CAUTION

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

2. Instruments and Radios - SET.
3. Parking Brake - RELEASE.

TAXIING

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

NOTE

Rapid throttle movement during taxi operations may cause engine surging. Use slow, smooth throttle motion to obtain desired taxi speed.

BEFORE TAKEOFF

1. Parking Brake - SET.
2. Controls - CHECK for freedom of movement and proper direction.
3. Rudder Trim - NEUTRAL.
4. Elevator Trim Tab - TAKEOFF RANGE.
5. Throttle - 2200 RPM.
6. 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. Maximum power checks on the ground are not recommended unless the pilot has good reason to suspect that the engine is not operating properly. If a maximum power runup is necessary, monitor oil temperature and cylinder head temperature to assure that their limits are not exceeded; do not exceed 42 In.Hg. at any time.

7. Propeller Control - CYCLE and RETURN TO HIGH RPM.
8. Alternate Induction Air Control - FULL HOT and RETURN TO FULL COLD. Set friction lock.

NOTE

At 2200 RPM a 50 to 100 RPM drop should be observed.

9. Voltmeter - CHECK, should be below red line.
10. Gyro Suction Gage (if installed) - 4.5 to 5.2 IN.HG.
11. Throttle - CHECK for proper IDLE RPM, should be 600 to 700 RPM.
12. Instruments and Radios - CHECK and SET.
13. Fuel Selector Valve - BOTH.
14. Cabin Doors - LATCHED and LOCKED.

OPERATION		KIAS	CONFIGURATION
Maximum Performance Takeoffs:	Short Field	Initial Climb 66 * MINIMUM	Gear DOWN, Flaps - 20°
	Soft Field	Initial Climb 66 * MINIMUM	Gear DOWN, Flaps - 20°
Maximum Performance Landings:	Short Field	Approach 72 * MINIMUM	Gear DOWN, Flaps - 35°
	Soft Field	Approach 72 * MINIMUM	Gear DOWN, Flaps - 35°
Best Angle of Climb V_x		72 **	Gear UP, Flaps UP Cowl Flaps Open
Normal Climb Speed ***		100***	Gear UP, Flaps UP Cowl Flaps Open

* SMOOTH AIR ONLY, INCREASE AS REQUIRED FOR TURBULENCE.
** MONITOR ENGINE TEMPERATURE WHEN IN PROLONGED CLIMB AT V_x.
*** ESTABLISH NORMAL CLIMB AFTER TAKEOFF TO ASSURE ADEQUATE ENGINE COOLING WHEN CLIMBING AT MAXIMUM CONTINUOUS POWER.

Figure 4-2. Airspeeds For Normal Operations

NOTE

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

15. Parking Brake - RELEASE.

TAKEOFFS

NOTE

Proper 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. Prior to brake release the throttle should be advanced to obtain 40 to 42 In.Hg., pausing briefly at approximately 30 In.Hg. to allow the turbocharger speed to stabilize. It may be necessary to retard the throttle slightly during the takeoff roll to prevent bootstrapping in excess of 42 In.Hg.

NOTE

Oil pressure may indicate high (in yellow range) during takeoff if oil temperature is below green arc. Oil pressure should return to normal (green) range as oil temperature increases to normal (green) range.

CAUTION

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

WARNING

Do not use full throttle for takeoff. Use only enough throttle to obtain rated manifold pressure. Refer to Lycoming Engine Operator's Manual if rated manifold pressure is exceeded.

NORMAL TAKEOFF

1. Fuel Pump Switch - ON.
2. Wing Flaps - RETRACTED.
3. Power - 2575 RPM and 40 In.Hg.

NOTE

For maximum performance takeoff, set manifold pressure to 42 In.Hg. and monitor during takeoff roll.

4. Elevator Control - SLIGHTLY AFT OF NEUTRAL.
5. Rotate - 70 KIAS.
6. Initial Climb Speed - 76 KIAS.
7. Landing Gear - RETRACT, when safely airborne.
8. Normal Climb - 100 KIAS, transition as soon as practical.

WARNING

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

CROSSWIND TAKEOFF

NOTE

Maximum demonstrated crosswind is 20 knots.

1. Fuel Pump Switch - ON.
2. Wing Flaps - RETRACTED.
3. Power - 2575 RPM and 40 In.Hg.

NOTE

For maximum performance takeoff, set manifold pressure to 42 In.Hg. and monitor during takeoff roll.

4. Aileron Control - FULL AILERON, in the direction of the crosswind. Reduce aileron deflection as speed is increased.
5. Elevator Control - SLIGHTLY FORWARD OF NEUTRAL.
6. 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.

7. Climb Speed 86 KIAS.
8. Landing Gear - RETRACT, when safely airborne.
9. Normal Climb - 100 KIAS, transition as soon as practical.

SHORT FIELD TAKEOFF

1. Fuel Pump Switch - ON.
2. Wing Flaps - 20 DEGREES.
3. Brakes - HOLD.
4. Power - 2575 RPM and 40 In.Hg.

NOTE

For maximum performance takeoff, set manifold pressure to 42 In.Hg. and monitor during takeoff roll.

5. Brakes - RELEASE.
6. Elevator Control - SLIGHTLY AFT OF NEUTRAL.
7. Rotate - 61 KIAS.
8. Climb Speed - 66 KIAS.
9. Landing Gear - RETRACT, when safely airborne.
10. Wing Flaps - RETRACT when obstacles are safely cleared and airspeed has increased to 86 KIAS.
11. Normal Climb - 100 KIAS, transition as soon as practical.

SOFT FIELD TAKEOFF - NO OBSTACLES

1. Fuel Pump Switch - ON.
2. Wing Flaps - 20 DEGREES.
3. Power - 2575 RPM and 40 In.Hg.

NOTE

For maximum performance takeoff, set manifold pressure to 42 In.Hg. and monitor during takeoff roll.

4. 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.

5. Takeoff Roll/Liftoff - NOSE HIGH.

NOTE

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

6. Climb - 66 KIAS.
7. Landing Gear - RETRACT, when safely airborne.
8. Wing Flaps - RETRACT after increasing airspeed to 86 KIAS.
9. Normal Climb - 100 KIAS, transition as soon as practical.

SOFT FIELD TAKEOFF - OBSTACLES AHEAD

1. Fuel Pump Switch - ON.
2. Wing Flaps - 20 DEGREES.
3. Power - 2575 RPM and 40 IN.Hg.

NOTE

For maximum performance takeoff set manifold pressure to 42 In.Hg. and monitor during takeoff roll.

4. 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.

5. Takeoff Roll/Liftoff - NOSE HIGH.

NOTE

Nose wheel should be just clear of the runway.

6. Climb - 66 KIAS.
7. Landing Gear - RETRACT, when safely airborne.
8. Wing Flaps - RETRACT when obstacles are safely cleared and airspeed has increased to 86 KIAS.
9. Normal Climb - 100 KIAS, transition as soon as practical.

NORMAL CLIMB

1. Airspeed - 100 KIAS.
2. Manifold Pressure - 36 In.Hg.
3. Engine Speed - 2575 RPM.
4. Mixture - FULL RICH.
5. Cowl Flaps - AS REQUIRED.
6. Fuel Pump Switch - ON.

MAXIMUM PERFORMANCE CLIMB

1. Airspeed - 100 KIAS
2. Manifold Pressure - 42 In. Hg. SL to 8000 Ft., 40 In. Hg. 8001 to 16,000 Ft., 38 In. Hg. above 16,000 Ft.
3. Engine Speed - 2575 RPM.
4. Mixture - FULL RICH.
5. Cowl Flaps - OPEN.
6. Fuel Pump Switch - ON.

CRUISE

1. Cowl Flaps - AS REQUIRED.
2. Manifold Pressure - 20 to 36 In.Hg.
3. Engine Speed - 2200 to 2575 RPM.
4. Power - 75% MCP OR LESS.
5. Fuel Pump Switch - OFF.
6. Mixture - BEST POWER or BEST ECONOMY. Leaning for smooth operation is acceptable.

NOTE

Leaning should always be accomplished using the Exhaust Gas Temperature (EGT) indicating system. 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 slightly if engine roughness occurs at peak EGT. If enrichment is required for smooth engine operation, refer to Section V for changes to fuel flow and range performance. Enrichen mixture prior to increasing engine power.

CAUTION

Leaning at power settings in excess of 75% MCP is prohibited. Continuous mixtures leaner than best power are prohibited between 66% and 75% MCP. Operation on the lean side of peak EGT is prohibited except to momentarily establish peak EGT. Maximum allowable EGT is 1725°F. Refer to AVCO Lycoming Service Instruction No. 1094 for further information on leaning procedures.

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

DESCENT

1. Mixture - FULL RICH.

NOTE

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

2. Throttle - AS REQUIRED. Maintain 20 In.Hg. or higher except when rapid descent is 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.

CAUTION

Closing throttle at high altitude with mixture full rich will result in rough engine operation due to excessive fuel flow. Adjust mixture for smooth engine operation if descent is made with less than 20 In.Hg. manifold pressure.

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 20 knots.

BALKED LANDING

1. Mixture - FULL RICH.
2. Power - 42 In.Hg. and 2575 RPM.
3. Landing Gear - RETRACT.
4. Flaps - 20 DEGREES.
5. Airspeed - 70 KIAS MINIMUM.
6. Cowl Flaps - OPEN.

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

7. Airspeed - 86 KIAS.
8. Flaps - RETRACT.

CAUTION

Monitor manifold pressure during balked landing climb to assure that 42 In.Hg. is not exceeded.

NORMAL LANDING

1. Propeller Control - FULL FORWARD.
2. Power - AS REQUIRED.
3. Flaps - 35 DEGREES.
4. Airspeed - 82 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 - 72 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 - 18 to 20 In.Hg.
4. Airspeed - 82 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.

SHUTDOWN

1. Parking Brake - SET.
2. Radio Master Switch - OFF.
3. Electrical Equipment - OFF.

NOTE

Throttle 800 to 1000 RPM for short period of time to allow turbocharger temperature to stabilize prior to shutdown.

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 112TCA per Federal Aviation Regulation Procedures is 74.8 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 112TCA noise level is well below established 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

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INTRODUCTION

The graphs and tables in this section present performance information for flight planning at various weights, powers, altitudes and temperatures. Examples of the use of each graph is shown on the 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 the following: Humidity, Runway Slopes or Wet Runways.

FLIGHT PLANNING

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

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

FLIGHT PLANNING EXAMPLE

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

Runway Data at (OKC)	
Outside Air Temperature	20°C (68°F) *
Available Runway Length	9500 FT
Field Pressure Altitude	1100 FT
Reported Wind	120 DEG (MAG)/14 KT
Runway Direction	170 DEG (MAG)
Airplane Ramp Weight	2950 LB
Cruise Data	
Outside Air Temperature	-15°C
Cruise Pressure Altitude to (HOU)	15,000 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 6 lb. Therefore; Airplane Takeoff Weight	2944 LB

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

FLIGHT PLANNING (CONTD)

TAKEOFF

Takeoff performance can be obtained for flap deflections of 0 and 20 DEG.

From Figure 5-9 for 0 DEG Flaps: NORMAL TAKEOFF	
Lift-off Speed	66 KIAS
50-Ft Height Speed	69 KIAS
From Figure 5-7 using 15 KT wind at 50 DEG from left of runway	
Headwind Component	10 KT
From Figure 5-8	
Ground Roll Distance	1200 FT
From Figure 5-9	
Takeoff Distance to 50 FT	2070 FT

CLIMB

A climb/cruise power setting (36 In.Hg./2575 RPM) is assumed. Enter Figure 5-14 at 1100 FT field pressure altitude and 20 DEG C and determine Time, Distance and Fuel; then using the cruise altitude of 15,000 FT and -15 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	31 MIN	minus	2.0 MIN	equals	29.0 MIN
Zero Wind Distance	59 NM	minus	4.5 NM	equals	54.5 NM
Fuel	9.5 U.S.Gal	minus	0.8 U.S.Gal	equals	8.7 U.S.Gal (52.2 LB)

From Figure 5-7, 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:

$$\text{Distance} = 54.5\ \text{NM} - \left[\left(5\ \frac{\text{NM}}{\text{HR}}\right) \times \left(\frac{29\ \text{MIN}}{60\ \text{MIN/HR}}\right)\right] = 52\ \text{NM}$$

Weight at level off (including 6 LB start and taxi allowance) is 2892 LB.

FLIGHT PLANNING (CONTD)

CRUISE

Select the cruise type desired: 65 percent of MCP at 2400 RPM. At a pressure altitude of 15,000 FT and an OAT of -15°C, determine the Cruise True Airspeed from Figure 5-20 or the appropriate Cruise Power Setting Charts, Figure No.s 5-16 through 5-19.

Cruise True Airspeed = 147 KTAS *

To determine the Cruise Power Setting use the Cruise Power Setting Chart, Figure 5-17, a portion of which is reproduced below.

	ISA -20°C			ISA			ISA +20°C		
PRESS.ALT	OAT	MAP	TAS	OAT	MAP	TAS	OAT	MAP	TAS
FT	°C	IN Hg	KTS	°C	IN Hg	KTS	°C	IN Hg	KTS
12,000	-29	28.9	141	-9	30.2	144	11	31.3	146
14,000	-33	28.9	143	-13	30.2	146	7	31.4	148
16,000	-37	28.9	145	-17	30.3	148	3	31.6	149
18,000	-41	28.9	147	-21	30.4	149	-1	31.8	151

From the table interpolate for 15,000 FT and -15 DEG C to find:

True Airspeed . . . . . 147 KTS *
Manifold Pressure . . . . . 30.3 IN Hg.

The distance to Houston from level off is 351 NM less the climb distance of 52 NM or 299 NM. Enter Figure 5-7 using a wind velocity of 15 KT from 230 DEG, 70 DEG to right of true course and read:

Headwind Component . . . . . 5 KT

Compute ground speed as true airspeed minus headwind or (147 KTAS - 5 KT) = 142 KTAS. Time and fuel can be computed as:

Time = 299 MI/142 KTS = 2.1 HR **

Fuel = 10.0 GPH x 2.1 HR = 21.0 U.S.GAL (126 LB) **

(NOTE: Fuel flow can be determined from the Cruise Power Setting Chart)

* Figures 5-17 and 5-20 are presented for 2950 pounds. Therefore the actual cruise speed will be slightly higher. This will result in a small increase in range.

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

FLIGHT PLANNING (CONTD)

DESCENT

To compute the descent performance, enter Figure 5-24 and read:

	Cruise Altitude To Sea Level		Field Pressure Altitude To Sea Level		Cruise Altitude To Field Pressure Altitude
Time	15 MIN	minus	0.2 MIN	equals	14.8 MIN
Zero Wind Distance	39.3 NM	minus	0.5 NM	equals	38.8 NM
Fuel	2.1 U.S.Gal	minus	0.02 U.S.Gal	equals	2.08 U.S.Gal (12.5 LB)

The distance in descent with the wind is:

$$\text{Distance} = 58.8\ \text{NM} - \left[\left(5\ \frac{\text{NM}}{\text{HR}}\right) \times \left(\frac{14.8\ \text{MIN}}{60\ \text{MIN/HR}}\right)\right] = 37.6\ \text{NM}$$

The distance from Houston to begin letdown point is 37.6 NM.

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

Time = (299 MI - 37.6 MI) / 142 KTS = 1.8 HR; 1 Hr 48 MIN

Fuel = 10.0 GPH x 1.8 HR = 18 U.S.GAL (108 LB)

LANDING

The weight at touchdown is:

Weight = 2950 LB - 6 LB - 52.2 LB - 108 LB - 12.5 LB = 2771 LB

The landing performance can be obtained from Figure 5-26. It should be noted that the data in this figure is presented for 2950 LB only, therefore the data will be conservative for 2777 LB.

To get the landing distance, first enter Figure 5-7 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 5-25
- Final Approach Speed . . . . . 72 KIAS
- Landing Ground Roll . . . . . 870 FT

and From Figure 5-26
- Landing Distance from 50 FT . . . . . 1400 FT

FLIGHT PLANNING (CONTD)

SAMPLE FLIGHT LOG

LEG	DISTANCE	TRUE AIRSPEED	WIND COMP*	GROUND SPEED	TIME LEG/TOTAL	AVERAGE FUEL FLOW	FUEL LEG/TOTAL	WEIGHT
	SEE BELOW	KTAS	KT	KT	HR:MIN	LB/HR	LB	LB
RAMP	--	--	--	--	-	--	--	2950
TAKEOFF (OKC)	2070 FT	--	+10	--	0:10/0:10	36	6.0/6/0	2944
CLIMB	52 NM	114 (AVG)	+5	109 (AVG)	0:29/0:39	108.0	52.2/58.2	2892
CRUISE	261 NM	147	+5	142	1:50/2:29	60	108/166.2	2784
DESCENT	37.6 NM	159 (AVG)	+5	155 (AVG)	0:15/2:44	50	12.5/178.2	2771
LANDING (HOU)	1400 FT	--	-2	--	- / -	-	0/178.2	2771

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

THROTTLE CLOSED STALL SPEEDS

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

ASSOCIATED CONDITIONS

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

EXAMPLE

GIVEN:	Gross Weight	2950 LBS
	Configuration	TAKEOFF (GEAR EXTENDED, FLAPS 20°)
	Bank Angle	30 DEG
FIND:	Stall Speed Fig. 5-1	60 KCAS

CALIBRATED AIRSPEED-KNOTS								
	GROSS WEIGHT 2950 LBS				GROSS WEIGHT 2400 LBS			
ANGLE OF BANK DEGREES	GEAR RET FLAPS 0°	GEAR EXT FLAPS 0°	GEAR EXT FLAPS 20°	GEAR EXT FLAPS 35°	GEAR RET FLAPS 0°	GEAR EXT FLAPS 0°	GEAR EXT FLAPS 20°	GEAR EXT FLAPS 35°
0	58	59	56	54	52	53	51	48
15	59	60	57	55	53	54	51	49
30	62	63	60	58	56	57	54	52
45	69	70	67	64	62	63	60	57
60	82	83	79	76	74	75	71	68

Figure 5-1.

AIRSPEEED CALIBRATION (PRIMARY STATIC SOURCE)

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

ASSOCIATED CONDITIONS

Power	SUFFICIENT FOR LEVEL FLIGHT (Nominal)		
Configuration	TAKEOFF AND CRUISE	TAKEOFF	LANDING
Wing Flaps	0 DEG	20 DEG	35 DEG
Landing Gear	EXTENDED OR RETRACTED	EXTENDED	EXTENDED
Cowl Flaps	OPEN OR CLOSED	OPEN	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	80 KIAS	
FIND:	Calibrated Airspeed	Fig. 5-2	78 KCAS

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

AIRSPEED CALIBRATION (ALTERNATE STATIC SOURCE)

The variation of Calibrated Airspeed with Indicated Airspeed is shown in Figure 5-3 for Takeoff, Cruise and Landing configurations. It applies only when the Alternate Static Pressure Source has been selected.

ASSOCIATED CONDITIONS

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

EXAMPLE

GIVEN:	Configuration		TAKEOFF & CRUISE
	Indicated Airspeed		100 KIAS
FIND:	Calibrated Airspeed	Fig. 5-3	98 KCAS

NOTES:
1. If the particular Airspeed Indicator Instrument mechanical errors are known, apply these to the Indicated Airspeed before entering the chart.
2. A conveniently located card is provided in the cockpit, which tabulates the Airspeed Calibration information presented in Figure 5-3.

PRIMARY AIRSPEED SYSTEM CALIBRATION

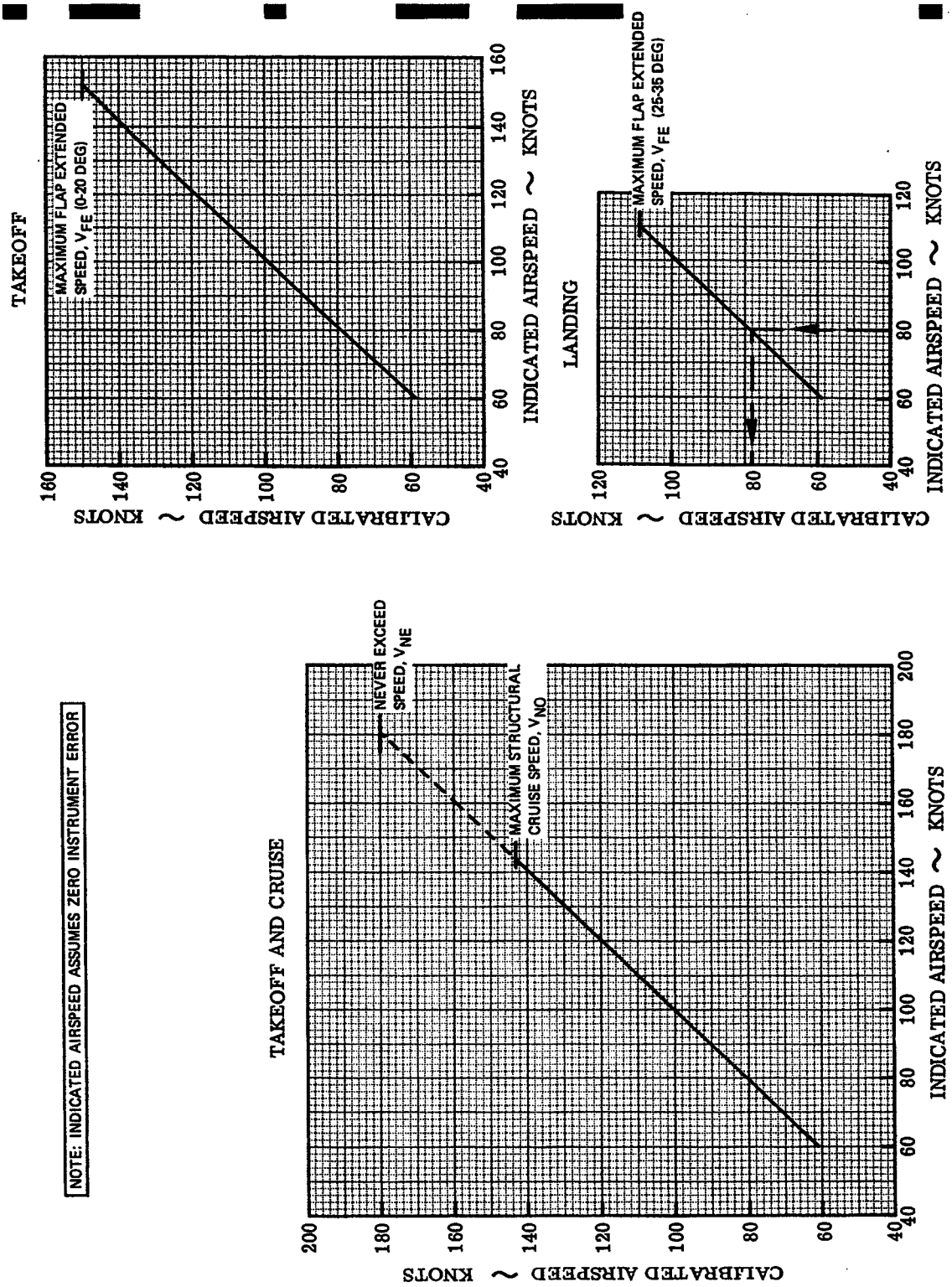


Figure 5-2.

ALTERNATE AIRSPEED SYSTEM CALIBRATION

NOTE: INDICATED AIRSPEED ASSUMES ZERO INSTRUMENT ERROR

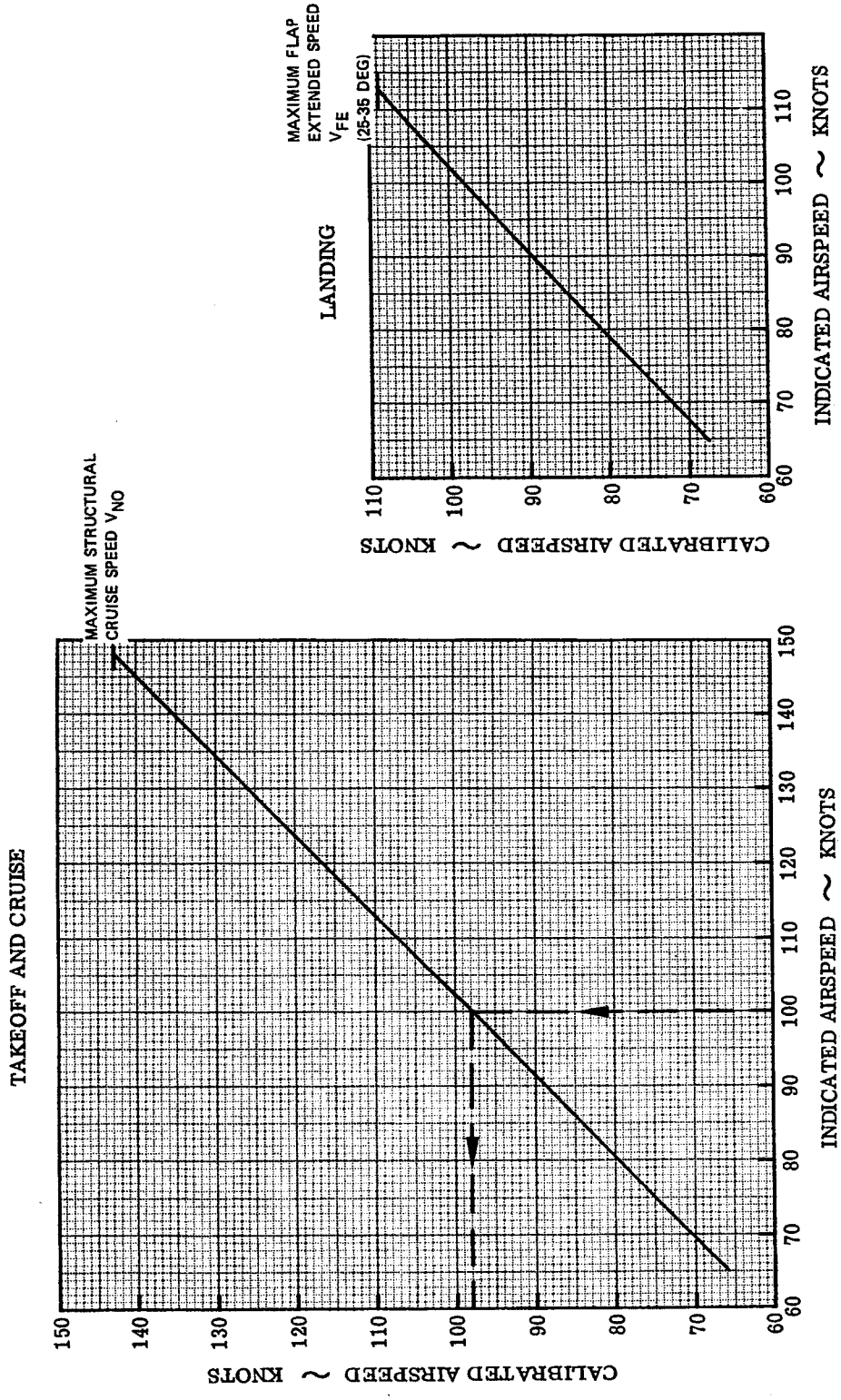


Figure 5-3.

ALTIMETER CORRECTION (PRIMARY STATIC SOURCE)

The variation of Altimeter Correction with Indicated Airspeed and Indicated Pressure Altitude is shown in Figure 5-4 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	TAKEOFF	LANDING
Wing Flaps	0 DEG	20 DEG	35 DEG
Landing Gear	EXTENDED or RETRACTED	EXTENDED	EXTENDED
Cowl Flaps	OPEN or CLOSED	OPEN	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	1100 FT
	Indicated Airspeed	90 KIAS
FIND:	Altimeter Correction, Fig. 5-4	-12 FT
	Calibrated Pressure Altitude	1100 -12 = 1088 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.

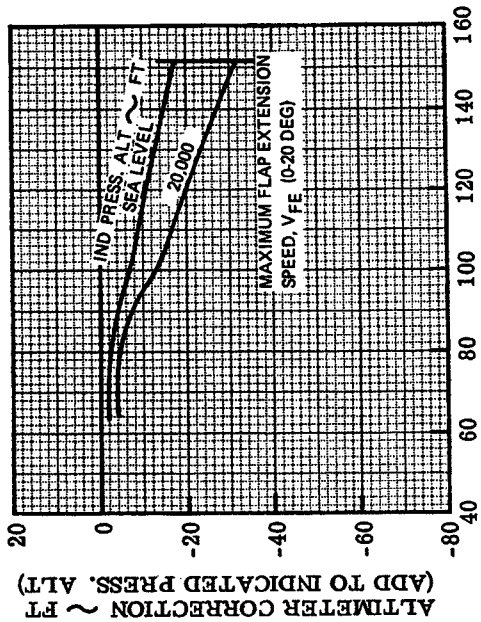
EXAMPLE B

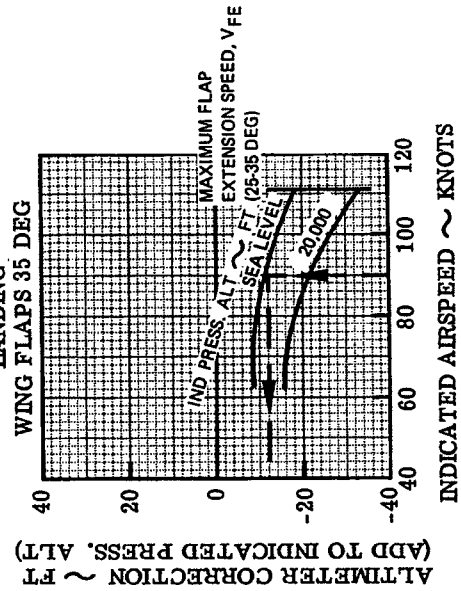
GIVEN:	Configuration	TAKEOFF/CRUISE
	Indicated Pressure Altitude	5000 FT
	Indicated Airspeed	128 KIAS
FIND:	Altimeter Correction, Fig.5-4	-5 FT
	Flight Altitude	5000 -5 = 4995 FT

NOTE: 1. If the particular airspeed indicator and altimeter instrument mechanical errors are known, apply them to the indicated airspeed and indicated altitudes before entering the chart.

PRIMARY SYSTEM ALTIMETER CORRECTION

NOTE: INDICATED AIRSPEED AND INDICATED PRESSURE ALTITUDE ASSUME ZERO INSTRUMENT ERROR





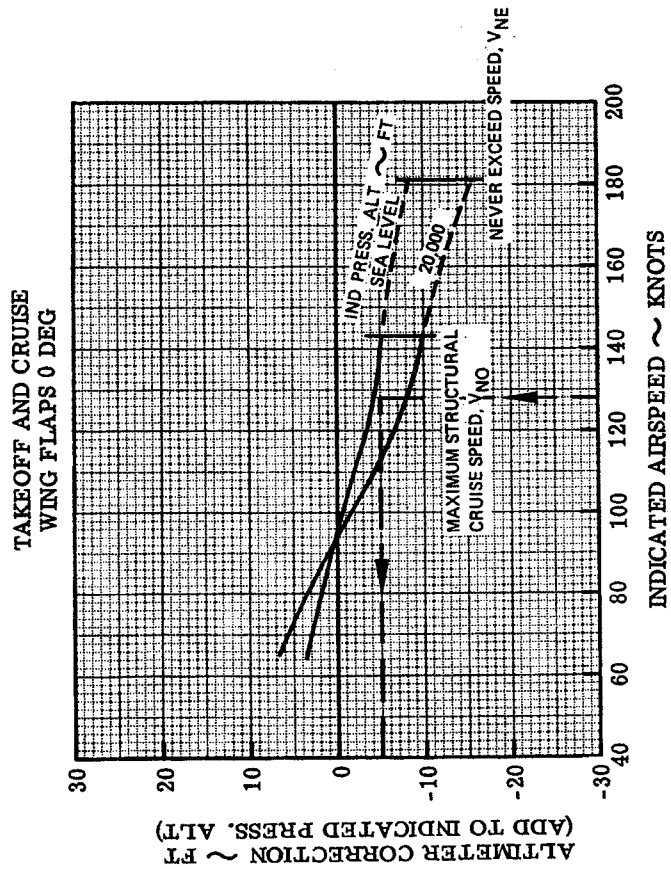


Figure 5-4.

ALTIMETER CORRECTION (ALTERNATE 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 alternate static pressure source has been selected.

ASSOCIATED CONDITIONS

Power	SUFFICIENT FOR LEVEL FLIGHT (Nominal)	
Configuration	TAKEOFF & CRUISE	LANDING
Wing Flaps	0 DEG	35 DEG
Landing Gear	EXTENDED or RETRACTED	EXTENDED
Cowl Flaps	OPEN or CLOSED	CLOSED
Cabin Vent Controls	ON	ON
Overhead Air Outlets	OFF	OFF
Heater	OFF	OFF
Defroster	OFF	OFF
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 IN Hg. 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	1100 FT
	Indicated Airspeed	90 KIAS
FIND:	Altimeter Correction, Fig. 5-5	-5 FT
	Calibrated Pressure Altitude	1100 -5 = 1095 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	TAKEOFF & CRUISE
	Indicated Pressure Altitude	5000 FT
	Indicated Airspeed	130 KIAS
FIND:	Altimeter Correction, Fig. 5-5	-55 FT
	Flight Altitude	5000 -55 = 4945 FT

NOTES: 1. If the particular airspeed indicator and altimeter instrument mechanical errors are known, apply them to the indicated airspeed and indicated altitudes before entering the chart.

2. A conveniently located plasticized card is provided in the cockpit, which tabulates the altimeter correction presented in Figure 5-5.

ALTERNATE SYSTEM ALTIMETER CORRECTION

NOTE: INDICATED AIRSPEED AND INDICATED PRESSURE ALTITUDE ASSUME ZERO INSTRUMENT ERROR

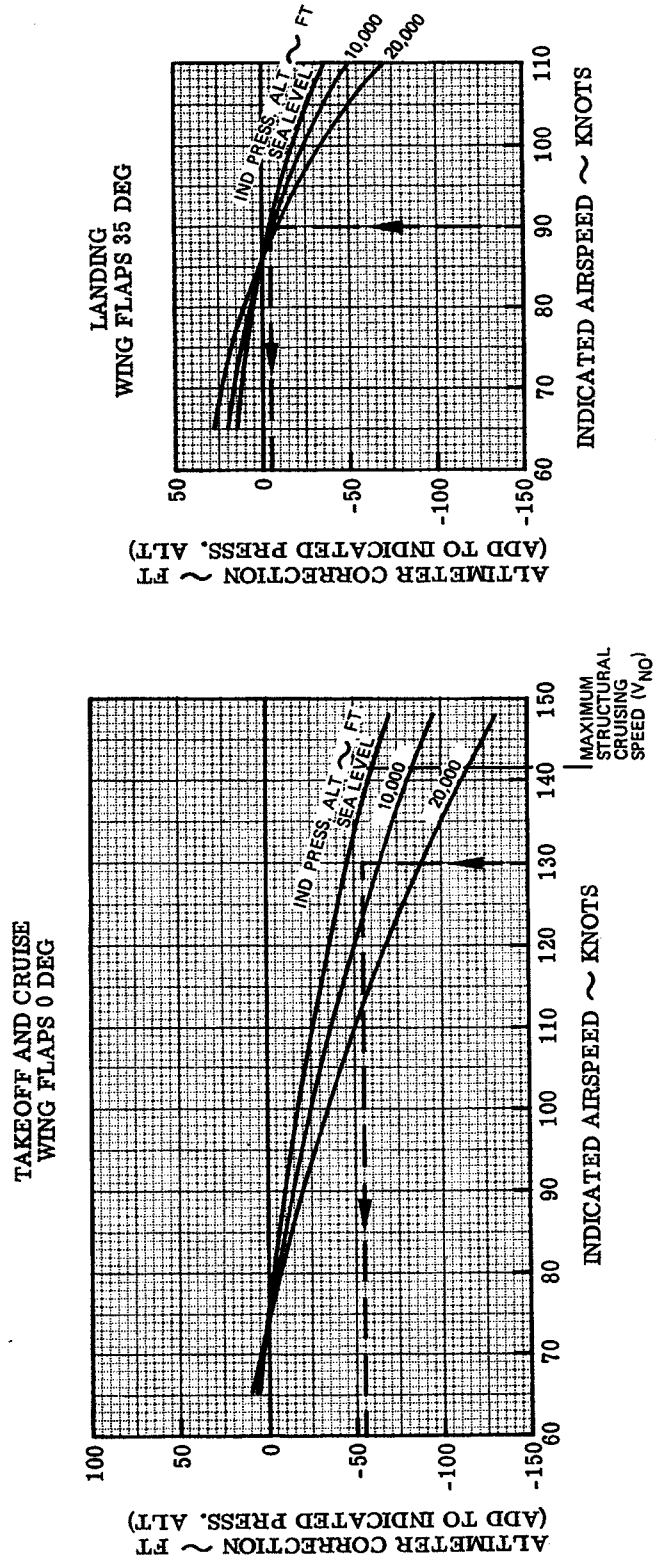


Figure 5-5.

TEMPERATURE CONVERSION

Temperature in Degrees Celsius is presented in Figure 5-6 for varying temperature in Degrees Fahrenheit

EXAMPLE

GIVEN:	Temperature Deg C	20 DEG C
FIND:	Temperature Deg F Fig. 5-6	68 DEG F

TEMPERATURE CONVERSION

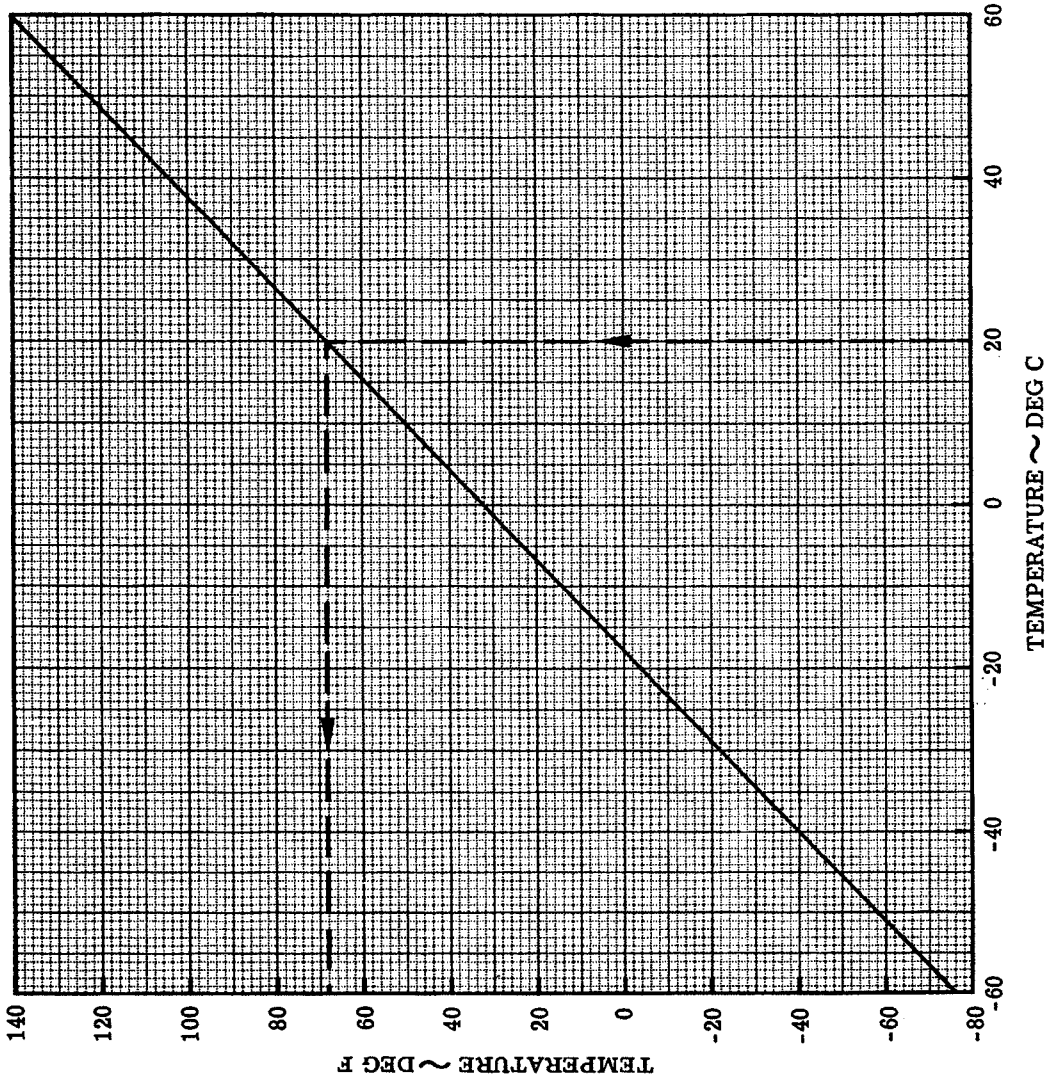


Figure 5-6.

WIND COMPONENTS

Wind Components are presented in Figure 5-7 for various wind speeds and angles relative to the airplane heading.

EXAMPLE

GIVEN:	Reported Wind Speed	14 KT
	Relative Angle	45 DEG
FIND:	Headwind Component Fig. 5-7	10 KT
	Crosswind Component Fig. 5-7	10 KT

WIND COMPONENTS

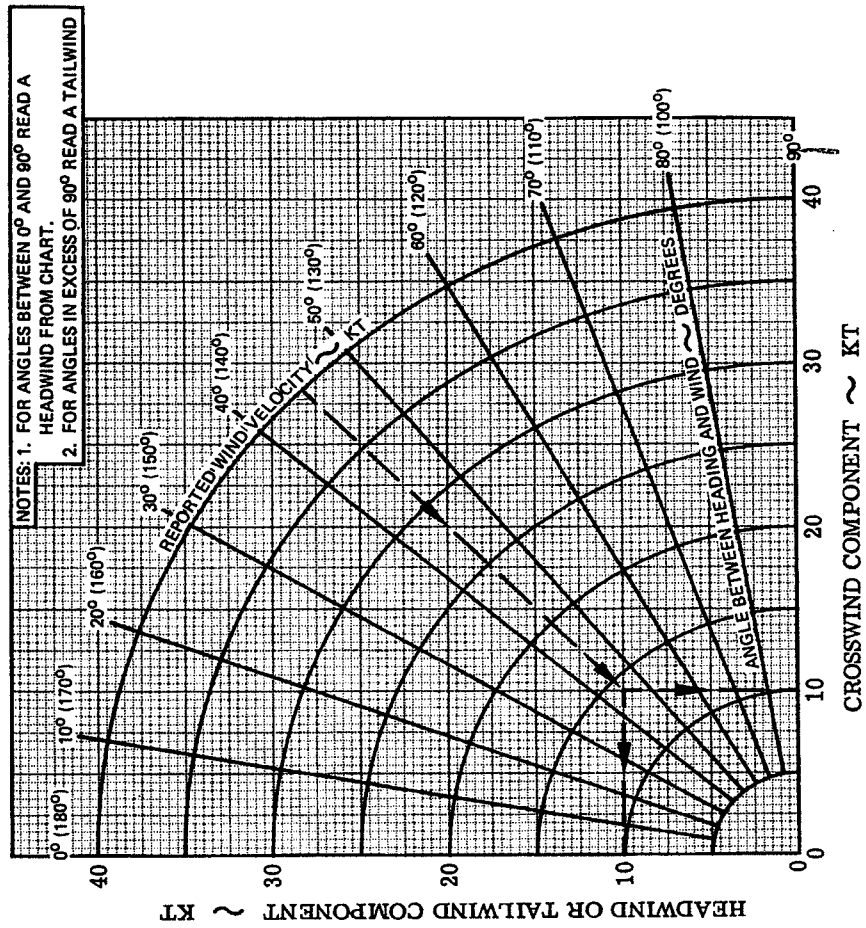


Figure 5-7.

TAKEOFF GROUND ROLL DISTANCE, NORMAL (WING FLAPS 0 DEG)

Figure 5-8 presents the Takeoff Ground Roll Distance from brake release to liftoff. Distances are shown for varying outside air temperatures, pressure altitudes, and wind speeds at a gross weight of 2950 lbs.

ASSOCIATED CONDITIONS

Power	2575 RPM, FULL RICH MIXTURE, 40 IN HG. OR AS LIMITED BY FIGURE 5-15.
Wing Flaps	0 DEG
Landing Gear	EXTENDED
Cowl Flaps	OPEN
Runway Conditions	PAVED, DRY, LEVEL

TECHNIQUE

Obtain the scheduled power, 40 In.Hg. and 2575 RPM, prior to brake release. Release the brakes and accelerate to the liftoff speed of 66 KIAS.

EXAMPLE

GIVEN:	Gross Weight	2950 LB
	Outside Air Temperature	20 DEG C
	Pressure Altitude	1100 FT
	Wind Component	10 KT HEADWIND
FIND:	Distance to Liftoff, Fig. 5-8	1200 FT

NOTES:
1. IAS assumes zero instrument error.
2. For short dry grass runways, increase ground roll distance by 25% at Sea Level linearly increasing to 37% increase at 10,000 Ft.

TAKEOFF GROUND ROLL DISTANCE, NORMAL
(0 DEG FLAPS)

DRY, LEVEL, PAVED RUNWAYS
TAKEOFF GROSS WEIGHT = 2950 LB

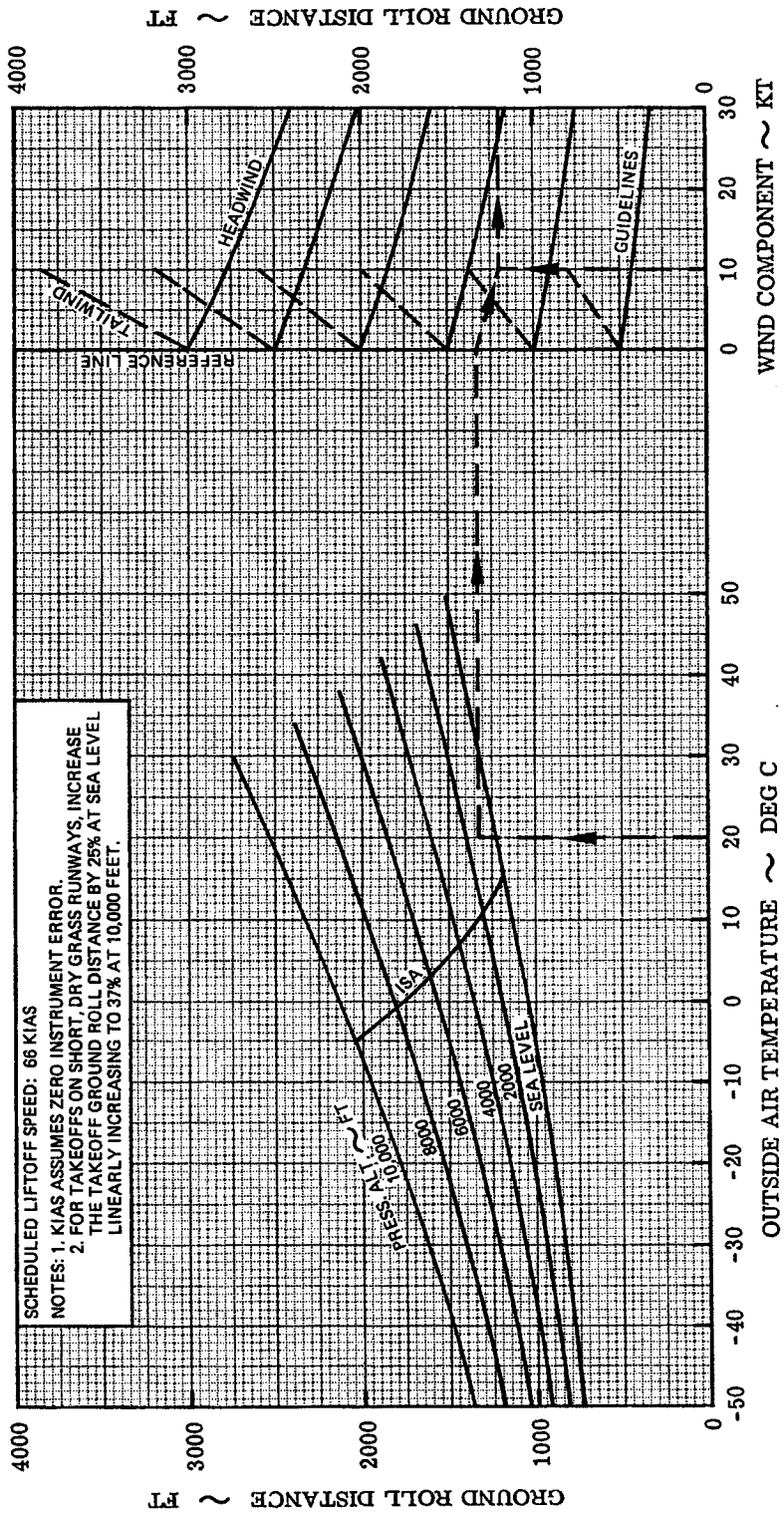


Figure 5-8.

TOTAL TAKEOFF DISTANCE, NORMAL (WING FLAPS 0 DEG)

Figure 5-9 presents the Total Takeoff Distance from brake release to 50-Ft obstacle height. Distances are shown for varying outside air temperatures, pressure altitudes, and wind speeds at a gross weight of 2950 lbs.

ASSOCIATED CONDITIONS

Power	2575 RPM, FULL RICH MIXTURE, 40 IN HG. OR AS LIMITED BY FIGURE 5-15.
Wing Flaps	0 DEG
Landing Gear	EXTENDED
Cowl Flaps	OPEN
Runway Conditions	PAVED, DRY, LEVEL

TECHNIQUE

Obtain the scheduled power, 40 In.Hg., and 2575 RPM, prior to brake release. Release the brakes and accelerate to liftoff speed of 66 KIAS. Accelerate to 69 KIAS while climbing to the 50-Ft. height.

EXAMPLE

GIVEN:	Gross Weight	2950 LB
	Outside Air Temperature	10 DEG C
	Pressure Altitude	1000 FT
	Wind Component	10 KT HEADWIND
FIND:	Distance to 50-Ft Height Fig. 5-9	2070 FT

NOTES:
1. IAS assumes zero instrument error.
2. For short dry grass runways, increase total takeoff distance by 15% at sea level linearly increasing to 20% at 10,000 Ft.

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TOTAL TAKEOFF DISTANCE, NORMAL
(0 DEG FLAPS)

DRY, LEVEL, PAVED RUNWAYS
TAKEOFF GROSS WEIGHT = 2950 LB

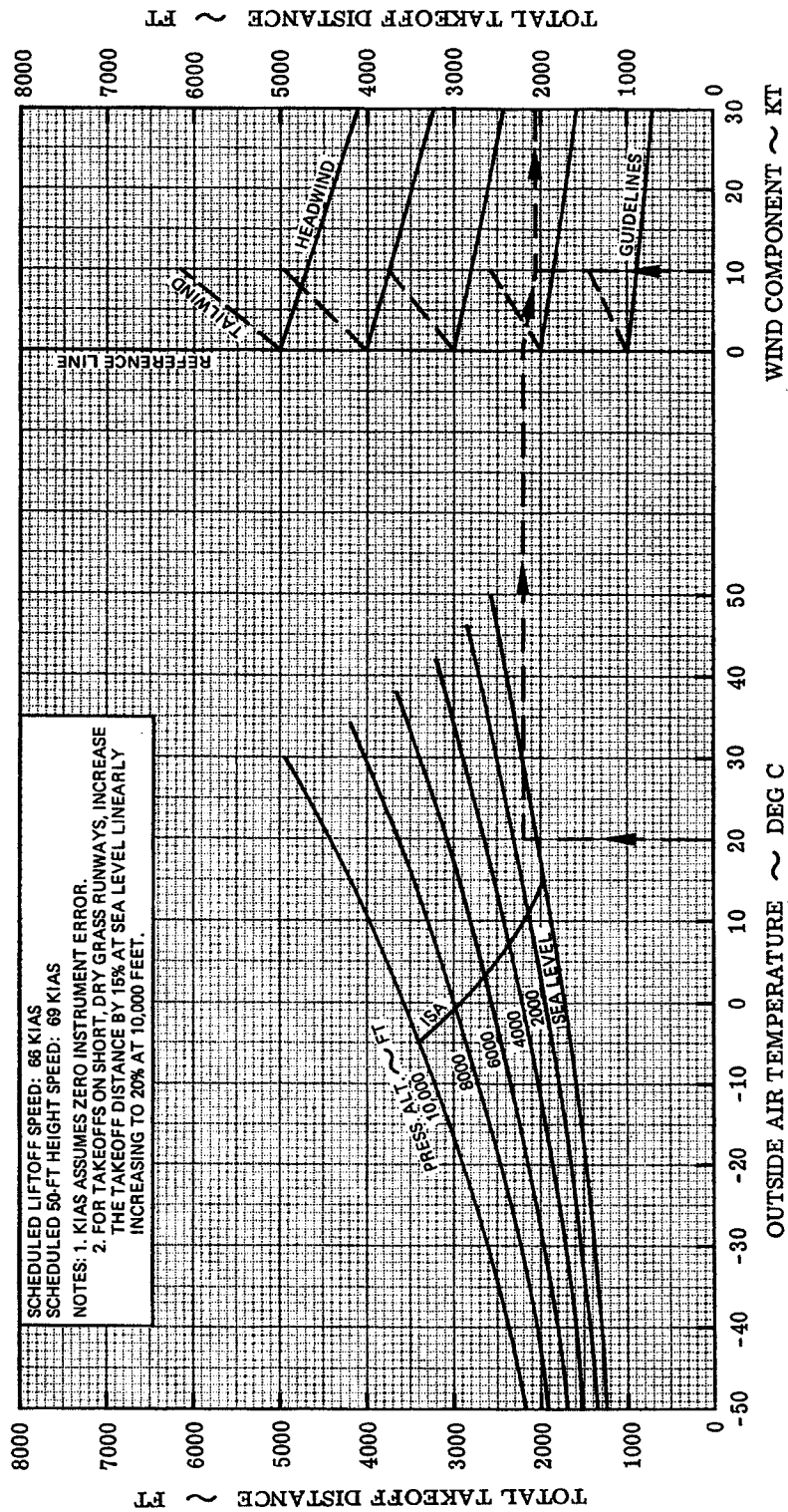

Figure 5-9.

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

Figure 5-10 presents the Takeoff Ground Roll Distance from brake release to liftoff. Distances are shown for varying outside air temperatures, pressure altitudes, and wind speeds at a gross weight of 2950 lbs.

ASSOCIATED CONDITIONS

Power	MAXIMUM CONTINUOUS POWER, SEE FIGURE 5-15.
Wing Flaps	20 DEG
Landing Gear	EXTENDED
Cowl Flaps	OPEN
Runway Conditions	PAVED, DRY, LEVEL

TECHNIQUE

Obtain Maximum Continuous Power, see Figure 5-15, prior to brake release. Release the brakes and accelerate to the liftoff speed of 63 KIAS.

EXAMPLE

GIVEN:	Gross Weight	2950 LB
	Outside Air Temperature	20 DEG C
	Pressure Altitude	1100 FT
	Wind Component	10 KT HEADWIND
FIND:	Distance to Liftoff Speed, Fig. 5-10	1100 FT

NOTES: 1. IAS assumes zero instrument error.
2. For short dry grass runways, increase ground roll distance by 25% at Sea Level linearly increasing to 40% increase at 10,000 Ft.

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

DRY, LEVEL, PAVED RUNWAYS
TAKEOFF GROSS WEIGHT = 2950 LB

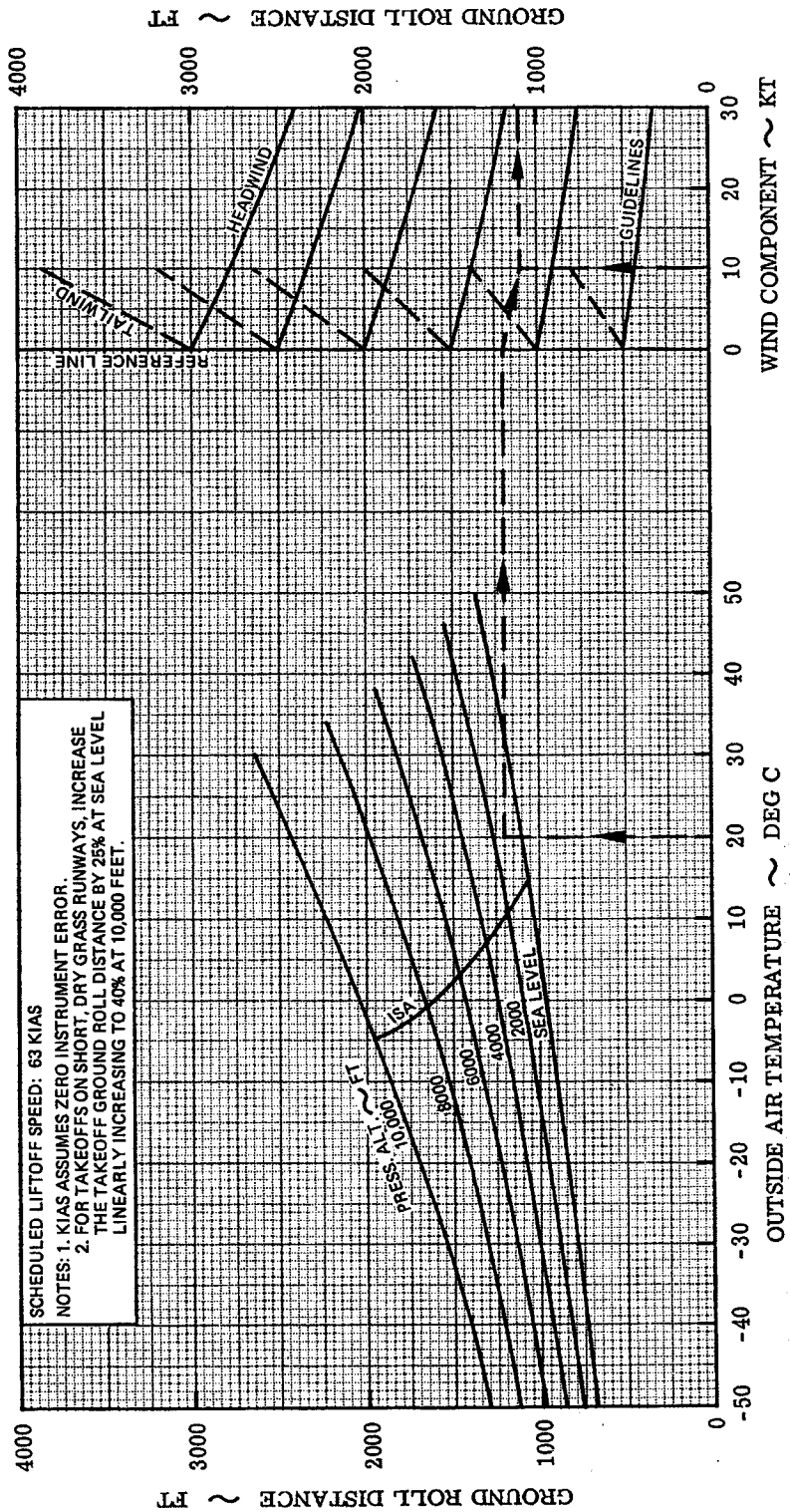

Figure 5-10.

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

Figure 5-11 presents the Takeoff Distance to Liftoff and the 50-Ft obstacle height. Distances are shown for varying outside air temperatures, pressure altitudes, and wind speeds at a gross weight of 2950 lbs.

ASSOCIATED CONDITIONS

Power	MAXIMUM CONTINUOUS POWER, SEE FIGURE 5-15.
Wing Flaps	20 DEG
Landing Gear	EXTENDED
Cowl Flaps	OPEN
Runway Conditions	PAVED, DRY, LEVEL

TECHNIQUE

Obtain takeoff power prior to brake release. Release the brakes and accelerate to the liftoff speed (63 KIAS). Monitor manifold pressure during the ground roll. Liftoff and accelerate to 66 KIAS while climbing to the 50-Ft height.

EXAMPLE

GIVEN:	Gross Weight	2950 LB
	Outside Air Temperature	20 DEG C
	Pressure Altitude	1000 FT
	Wind Component	10 KT HEADWIND
FIND:	Distance to 50-Ft Height Fig. 5-11	1790 FT

NOTES: 1. IAS assumes zero instrument error.
2. For takeoffs on short, dry grass runways, increase the takeoff distance by 15% at Sea Level linearly increasing to 23% at 10,000 Ft.

TOTAL TAKEOFF DISTANCE, SHORT FIELD
(20 DEG FLAPS)

DRY, LEVEL, PAVED RUNWAYS
TAKEOFF GROSS WEIGHT = 2950 LB

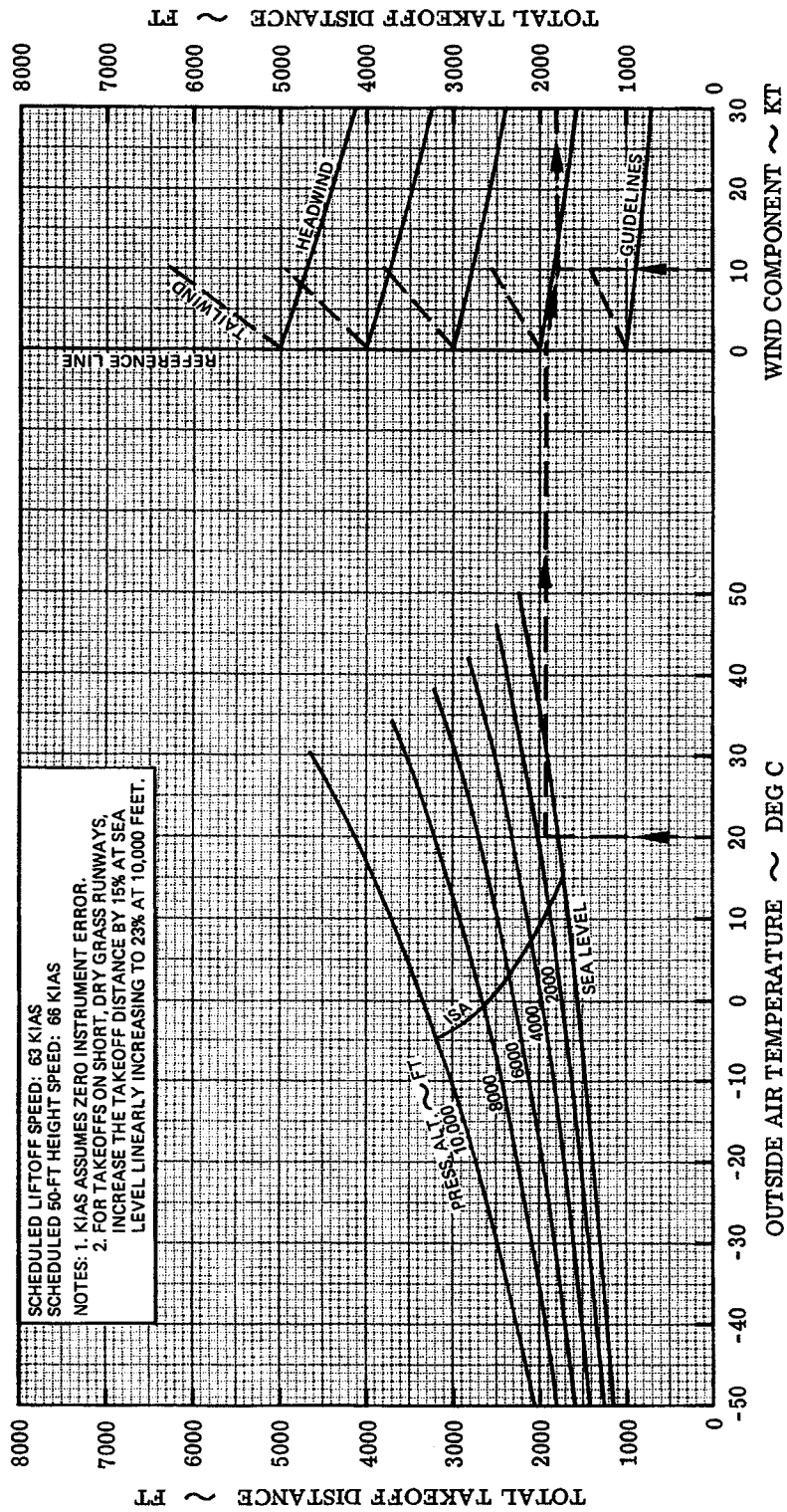

Figure 5-11.

RATE OF CLIMB, CLEAN CONFIGURATION - NORMAL CLIMB SPEED

The Rate of Climb for the Clean Configuration is shown in Figure 5-12 for varying outside air temperature, pressure altitude, and airplane weight. The climb performance presented on the following page is based on the normal climb speed of 100 KIAS.

ASSOCIATED CONDITIONS

Power	MAXIMUM CONTINUOUS, SEE FIGURE 5-15
Mixture	FULL RICH
Wing Flaps	0 DEG
Landing Gear	RETRACTED
Cowl Flaps	FULL OPEN

TECHNIQUE

Establish the airplane in a steady climb at 100 KIAS and obtain maximum continuous power.

EXAMPLE

GIVEN:	Gross Weight	2600 LB
	Outside Air Temperature	15 DEG C
	Pressure Altitude	4000 FT
FIND:	Rate of Climb, Fig. 5-12	965 FT/MIN

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

RATE OF CLIMB, CLEAN CONFIGURATION - NORMAL CLIMB SPEED

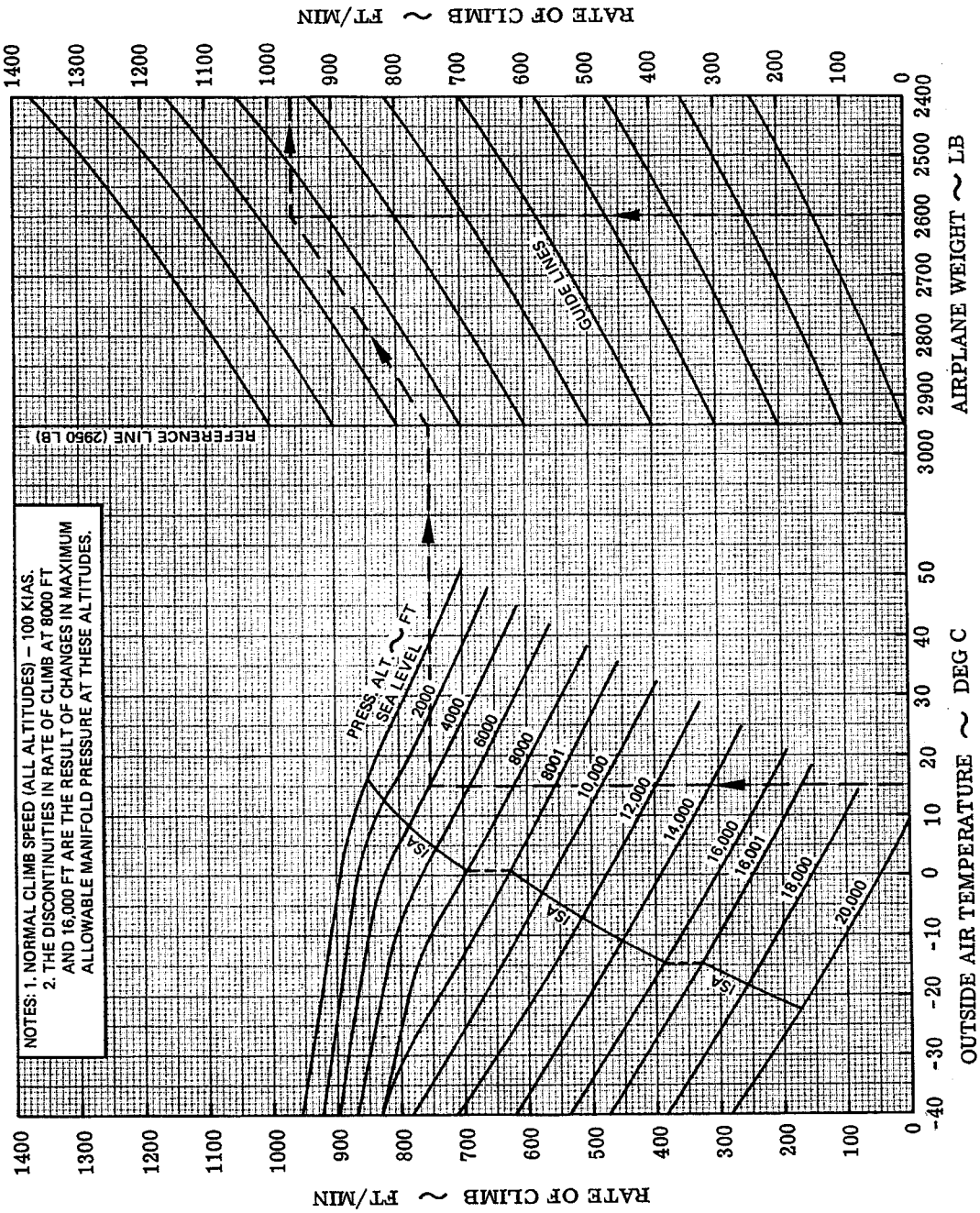

Figure 5-12.

RATE OF CLIMB, CLEAN CONFIGURATION - BEST RATE OF CLIMB SPEED

The Rate of Climb for the Clean Configuration is shown in Figure 5-13 for varying outside air temperature, pressure altitude, and airplane weight. The climb performance presented on the following page is based on the best rate of climb speed, 86 KIAS.

ASSOCIATED CONDITIONS

Power	MAXIMUM CONTINUOUS, SEE FIGURE 5-15.
Mixture	FULL RICH
Wing Flaps	0 DEG
Landing Gear	RETRACTED
Cowl Flaps	FULL OPEN

TECHNIQUE

Establish the airplane in a steady climb at 86 KIAS and obtain maximum continuous power.

EXAMPLE

GIVEN:	Gross Weight	2600 LB
	Outside Air Temperature	15 DEG C
	Pressure Altitude	4000 FT
FIND:	Rate of Climb, Fig. 5-13	1065 FT/MIN

NOTES:
1. IAS assumes zero instrument error.
2. The rate of climb is a true tapeline rate obtained in smooth air and allowance must be made for actual conditions which may differ.
3. At speeds below 100 KIAS, carefully monitor engine temperatures. Should any of the temperatures approach its limit, increase the airspeed.

RATE OF CLIMB, CLEAN CONFIGURATION - BEST RATE OF CLIMB SPEED

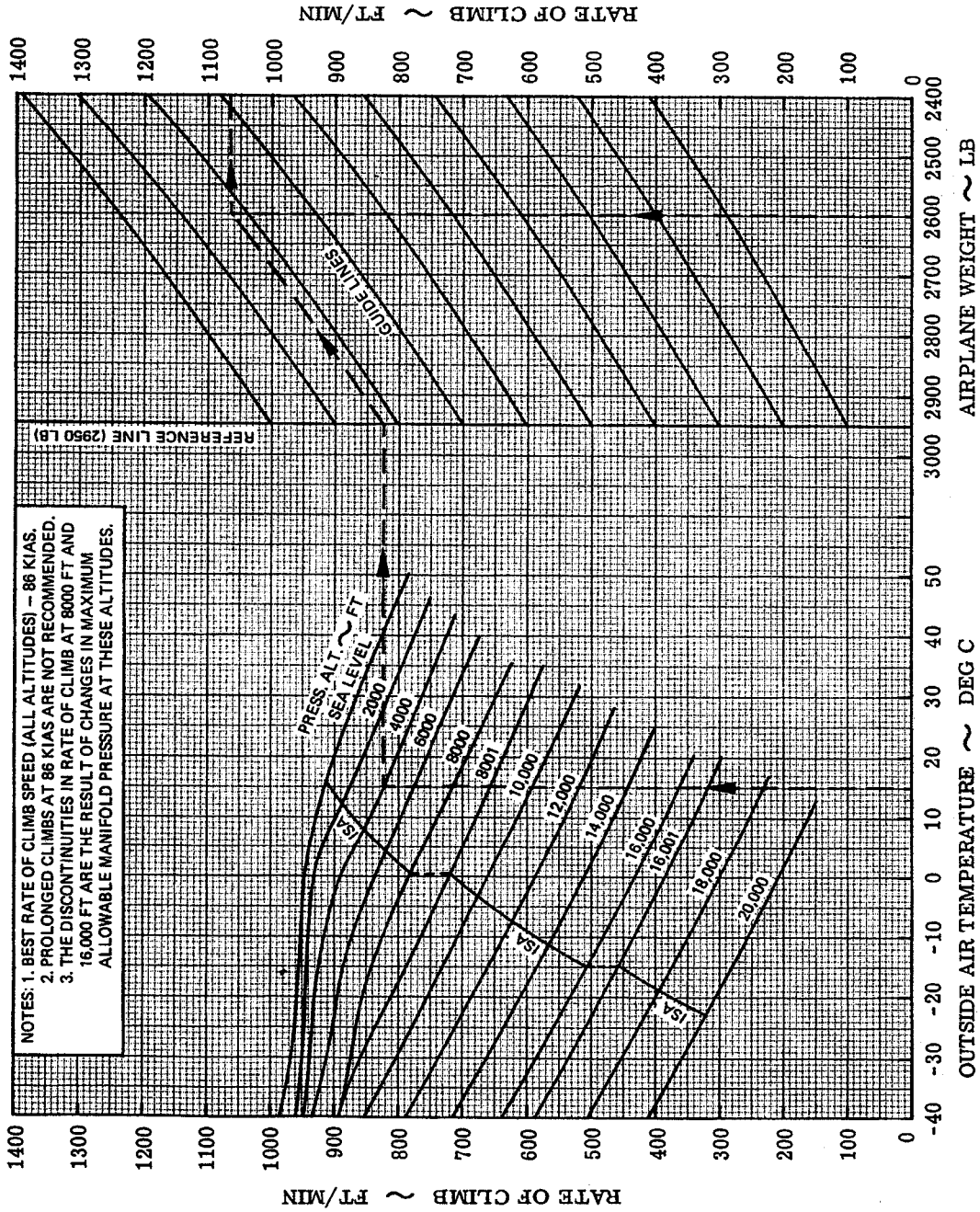

Figure 5-13.

TIME, DISTANCE AND FUEL REQUIRED IN CLIMB

The Time, Distance and Fuel Required in Climb for the clean configuration are shown in Figure 5-14 for varying outside air temperature and pressure altitude at 2950 Lb. gross weight.

ASSOCIATED CONDITIONS

Power	2575 RPM, 36 IN.HG.
Mixture	FULL RICH
Wing Flaps	0 DEG
Landing Gear	RETRACTED
Cowl Flaps	FULL OPEN

TECHNIQUE

Establish the airplane in a steady 100 KIAS climb at the scheduled power.

EXAMPLE

GIVEN:	Gross Weight	2950 LB
	Outside Air Temperature	20 DEG C at Takeoff Altitude
		-15 DEG C at Final Altitude
	Takeoff Altitude	1100 FT
	Final Altitude	15,000 FT

FIND: The total time, distance and fuel to climb from 1100 Ft to 15,000 Ft from Figure 5-14

	FINAL ALTITUDE		INITIAL ALTITUDE		NET
Time	31 MIN	minus	2.0 MIN	equals	29.0 MIN
Distance	59 NM	minus	4.5 NM	equals	54.5 NM
Fuel	9.5 U.S.GAL	minus	0.8 U.S.GAL	equals	8.7 U.S.GAL (52.2 LB)

NOTE: IAS assumes zero instrument error.

TIME, DISTANCE AND FUEL REQUIRED IN CLIMB
GROSS WEIGHT = 2950 LB

CLIMB SPEED: 100 KIAS POWER: 2575 RPM, 36 IN. HG.
MIXTURE FULL RICH

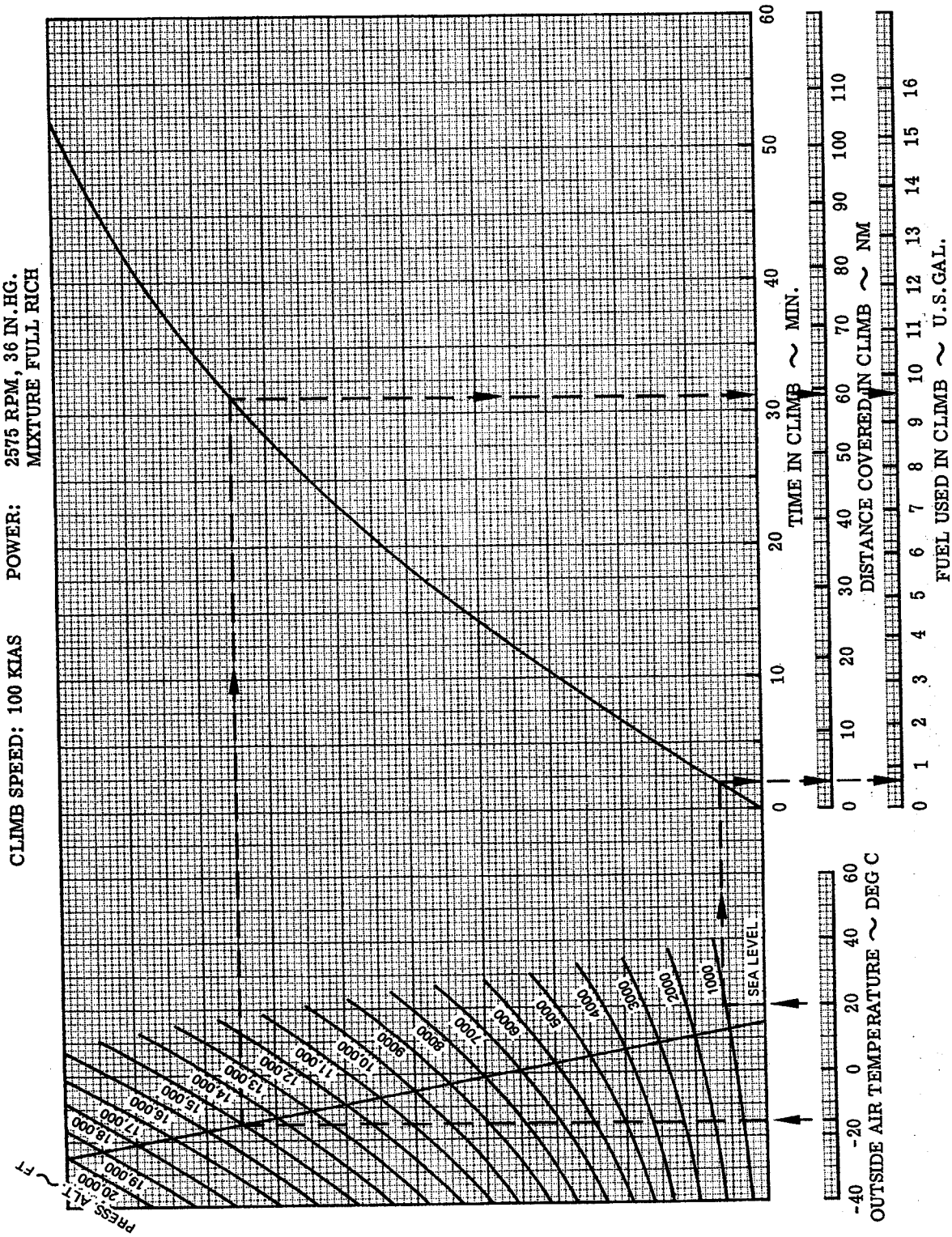

Figure 5-14.

MAXIMUM CONTINUOUS POWER SETTING CHART

Figure 5-15 presents manifold pressures for varying pressure altitudes and temperatures at 2575 RPM. Adherence to this manifold pressure schedule will insure that the installed horsepower will not exceed 210 HP.

The manifold pressure schedule given in Figure 5-15 was used to calculate the airplanes performance at maximum continuous power.

TECHNIQUE

To obtain maximum continuous power, establish 2575 RPM, a full rich mixture and charted manifold pressure appropriate to the outside air temperature at the desired altitude.

EXAMPLE A

GIVEN:	Altitude	2000 FT
	Outside Air Temperature	-10 DEG C
FIND:	Manifold Pressure	40.8 IN.Hg.

EXAMPLE B

GIVEN:	Altitude	12,000 FT
	Outside Temperature	-20 DEG C
FIND:	Manifold Pressure	40.0 IN.Hg.

NOTES: 1. Leaning is not authorized at maximum continuous power.
2. Normal interpolation techniques can be used to determine manifold pressure for non-tabulated values of OAT and altitude.

MAXIMUM CONTINUOUS POWER SETTING CHART
MAXIMUM CONTINUOUS POWER
2575 RPM - 21.9 GPH (S.L.)
21.5 GPH (8000 FT)
19.7 GPH (16000 FT)
17.7 GPH (20000 FT)
FULL RICH MIXTURE

ALTITUDE	MANIFOLD PRESSURE ~ IN.HG.								
FEET	-40°C	-30°C	-20°C	-10°C	0°C	10°C	20°C	30°C	40°C
S.L.	38.1	38.8	39.6	40.4	41.2				
2000	38.2	39.0	39.9	40.8	41.6				
4000	38.5	39.4	40.3	41.2			42.0		
6000	38.9	39.8	40.8	41.7					
8000	39.4	40.5	41.5						
8001									
10,000									
12,000				40.0					
14,000									
16,000									
16,001									
18,000				38.0					
20,000									

Figure 5-15.

CRUISE POWER SETTING CHARTS

The following tables are based on the Lycoming TO-360-C1A6D engine chart.

TECHNIQUE

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

EXAMPLE

GIVEN:	Percent Power	65% MCP
	Engine RPM	2400
	Pressure Altitude	10,000 FT
	Outside Air Temperature	-5 DEG C (ISA)
	Mixture	BEST ECONOMY
FIND:	Manifold Pressure	30.2 IN Hg.
	True Airspeed	142 KTS

NOTES: 1. Mixture settings for power settings of 65% MCP and below are presented for Best Economy. If a Best Power mixture is selected, fuel flow would increase by 25%. Mixtures leaner than Best Power at power settings between 66 and 75% MCP are not authorized. A full rich mixture is required for all power settings in excess of 75% MCP. Refer to Sections II and IV for leaning limitations and procedures, respectively.

2. Normal interpolation techniques can be used to determine manifold pressures for non-tabulated values of OAT and pressure altitude.

CRUISE POWER SETTING CHART

75% MAXIMUM CONTINUOUS POWER
2400 RPM - 13.2 GPH
BEST POWER MIXTURE

	ISA -20°C			ISA			ISA +20°C		
PRESS ALT	OAT	MAP	TAS	OAT	MAP	TAS	OAT	MAP	TAS
FT	°C	IN.HG.	KTS	°C	IN.HG.	KTS	°C	IN.HG.	KTS
S.L.	-5	32.8	136	15	34.0	140	35	35.2	142
2000	-9	32.6	139	11	33.9	142	31	35.1	144
4000	-13	32.4	141	7	33.7	144	27	35.0	147
6000	-17	32.3	144	3	33.6	147	23	35.0	149
8000	-21	32.2	146	-1	33.6	149	19	34.9	151
10000	-25	32.1	148	-5	33.6	151	15	35.1	154
12000	-29	32.2	151	-9	33.8	153	11	35.4	156
14000	-33	32.3	153	-13	34.1	156	7	35.6	158
16000	-37	32.5	155	-17	34.3	158	3	35.9	160
18000	-41	32.8	157	-21	34.6	160	-	-	-
20000	-45	33.1	160	-25	35.1	163	-	-	-

Figure 5-16.

CRUISE POWER SETTING CHART

65% MAXIMUM CONTINUOUS POWER
2400 RPM - 10.0 GPH
BEST ECONOMY MIXTURE

	ISA -20°C			ISA			ISA +20°C		
PRESS ALT	OAT	MAP	TAS	OAT	MAP	TAS	OAT	MAP	TAS
FT	°C	IN.HG.	KTS	°C	IN.HG.	KTS	°C	IN.HG.	KTS
S.L.	-5	29.7	129	15	30.8	132	35	31.8	134
2000	-9	29.5	131	11	30.6	134	31	31.6	136
4000	-13	29.3	134	7	30.4	136	27	31.5	138
6000	-17	29.1	136	3	30.3	138	23	31.4	140
8000	-21	29.0	138	-1	30.2	140	19	31.3	142
10000	-25	28.9	140	-5	30.2	142	15	31.3	144
12000	-29	28.9	141	-9	30.2	144	11	31.3	146
14000	-33	28.9	143	-13	30.2	146	7	31.4	148
16000	-37	28.9	145	-17	30.3	148	3	31.6	149
18000	-41	28.9	147	-21	30.4	149	-1	31.8	151
20000	-45	29.0	149	-25	30.5	151	-5	32.0	154

Figure 5-17.

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CRUISE POWER SETTING CHART

55% MAXIMUM CONTINUOUS POWER
2400 RPM - 8.5 GPH
BEST ECONOMY MIXTURE

	ISA -20°C			ISA			ISA +20°C		
PRESS ALT	OAT	MAP	TAS	OAT	MAP	TAS	OAT	MAP	TAS
FT	°C	IN.HG.	KTS	°C	IN.HG.	KTS	°C	IN.HG.	KTS
S.L.	-5	26.0	118	15	26.9	121	35	27.7	124
2000	-9	25.8	120	11	26.6	124	31	27.5	126
4000	-13	25.5	123	7	26.4	125	27	27.3	128
6000	-17	25.2	125	3	26.1	127	23	27.1	129
8000	-21	25.0	127	-1	26.0	129	19	26.9	131
10000	-25	24.8	129	-5	25.8	131	15	26.8	132
12000	-29	24.6	130	-9	25.7	132	11	26.7	134
14000	-33	24.5	132	-13	25.6	134	7	26.7	135
16000	-37	24.4	133	-17	25.5	135	3	26.6	136
18000	-41	24.3	135	-21	25.5	136	-1	26.6	136
20000	-45	24.1	136	-25	25.4	137	-5	26.6	137

Figure 5-18.

CRUISE POWER SETTING CHART

45% MAXIMUM CONTINUOUS POWER
2200 RPM - 7.0 GPH
BEST ECONOMY MIXTURE

	ISA -20°C			ISA			ISA +20°C		
PRESS ALT	OAT	MAP	TAS	OAT	MAP	TAS	OAT	MAP	TAS
FT	°C	IN.HG	KTS	°C	IN.HG.	KTS	°C	IN.HG.	KTS
S.L.	-5	24.4	107	15	25.2	109	35	25.9	110
2000	-9	23.9	108	11	24.7	110	31	25.5	112
4000	-13	23.4	110	7	24.2	111	27	25.0	112
6000	-17	23.0	111	3	23.9	112	23	24.7	113
8000	-21	22.6	112	-1	23.6	113	19	24.5	113
10000	-25	22.2	113	-5	23.2	113	15	24.1	114
12000	-29	22.0	113	-9	23.0	114	11	23.9	113
14000	-33	21.8	114	-13	22.8	113	7	23.7	112
16000	-37	21.7	114	-17	22.7	112	3	23.6	109
18000	-41	21.5	113	-21	22.5	109	-1	23.5	105
20000	-45	21.2	110	-25	22.2	105	-5	23.3	100

Figure 5-19.

Issued: 6 December 1976
Revised: 17 June 1977

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CRUISE TRUE AIRSPEED

The Cruise True Airspeeds are presented in Figure 5-20 for varying outside air temperatures, pressure altitudes, and percent powers at the maximum gross weight of 2950 lbs.

ASSOCIATED CONDITIONS

Power	AS REQUIRED
Mixture	BEST POWER at 75% MCP
	BEST ECONOMY at 65% MCP and below
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	0 DEG C
	Pressure Altitude	12,000 FT
	Power Setting	55% (2400 RPM)
FIND:	True Airspeed, Fig.5-20	133 KNOTS

NOTE: See Section IV, Normal Procedures, for appropriate leaning procedure.

CRUISE TRUE AIRSPEEDS

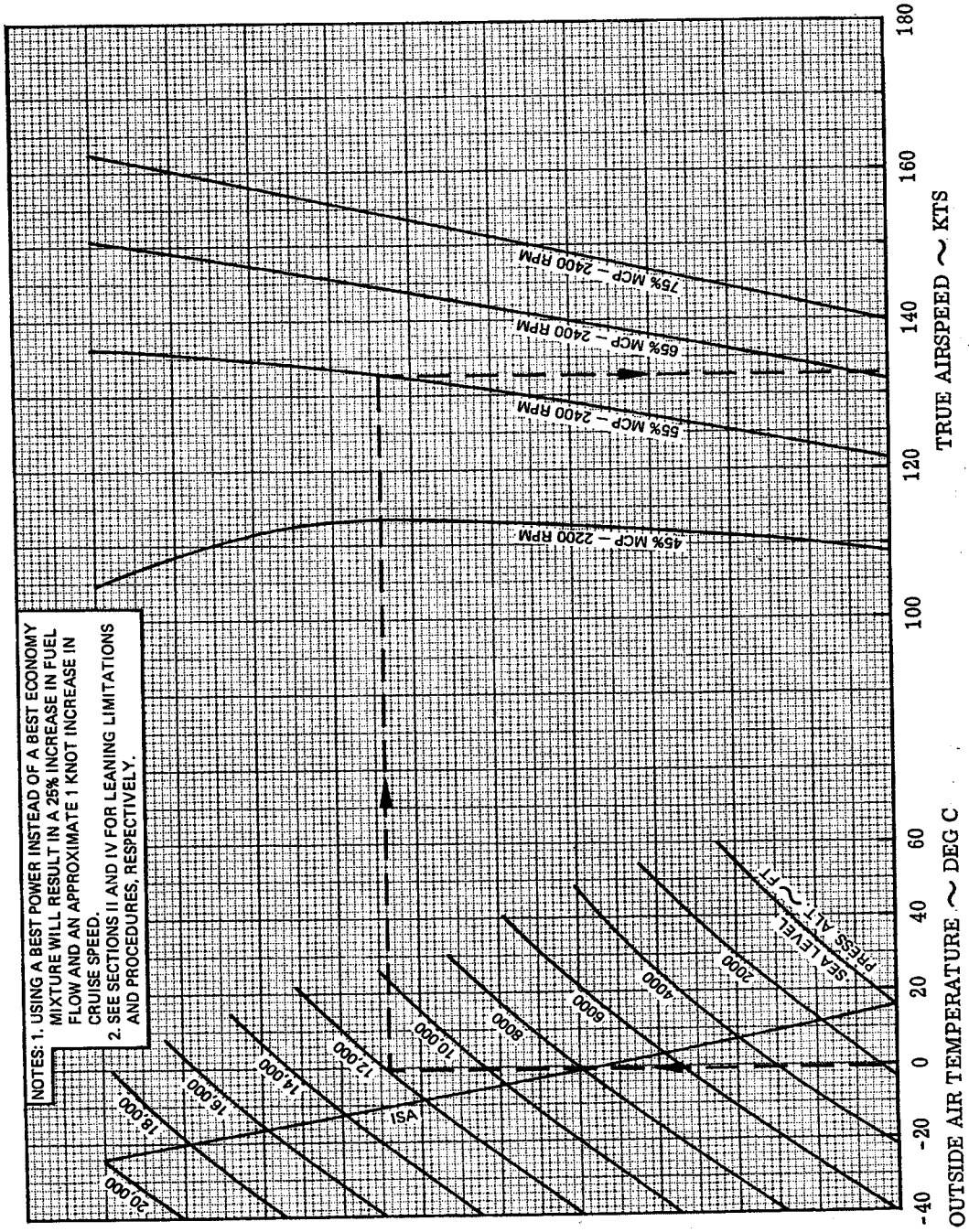

Figure 5-20.

RANGE PROFILE

The Range for standard and optional fuel is presented in Figure 5-21 for standard day conditions with varying pressure altitudes and power settings. Cruise true airspeeds are average cruise speeds. Tables of cruise power settings are given in Figures 5-16 through 5-19.

ASSOCIATED CONDITIONS

Power	AS DESIRED
Mixture	BEST POWER (75% MCP)
	BEST ECONOMY (BELOW 75% MCP)
Wing Flaps	0 DEG
Landing Gear	RETRACTED
Cowl Flaps	CLOSED
Wind	0 KTS

Fuel Allowances

1. Start, run-up, and taxi (1 U.S. Gal).
2. Climb to cruise altitude at 2575 RPM, 36 IN.Hg. and 100 KIAS.
3. Cruise at the specified mixture.
4. 45 minute reserve at 45% MCP (5 U.S.Gal).

TECHNIQUE

See individual climb and cruise charts for discussion of techniques.

EXAMPLE

GIVEN:	Outside Air Temperature	ISA
	Pressure Altitude	12,000 FT
	Power Setting	55% MCP (2400 RPM, Best Economy)
	Usable Fuel Capacity	68 U.S.GAL. (408 LB at 6.0 LB/U.S.GAL)
FIND:	Range, Fig. 5-21	900 NM

NOTE: Range at Best Power may be reduced by as much as 20% from range at Best Economy. The actual reduction in range will depend on the cruise time, altitude and percent power.

RANGE PROFILES
INTERNATIONAL STANDARD ATMOSPHERE
NO WIND

NOTE: RANGE AT BEST POWER MAY BE REDUCED BY AS MUCH AS 20% FROM RANGE AT BEST ECONOMY. THE ACTUAL REDUCTION IN RANGE WILL DEPEND ON THE CRUISE TIME, ALTITUDE AND PERCENT POWER.

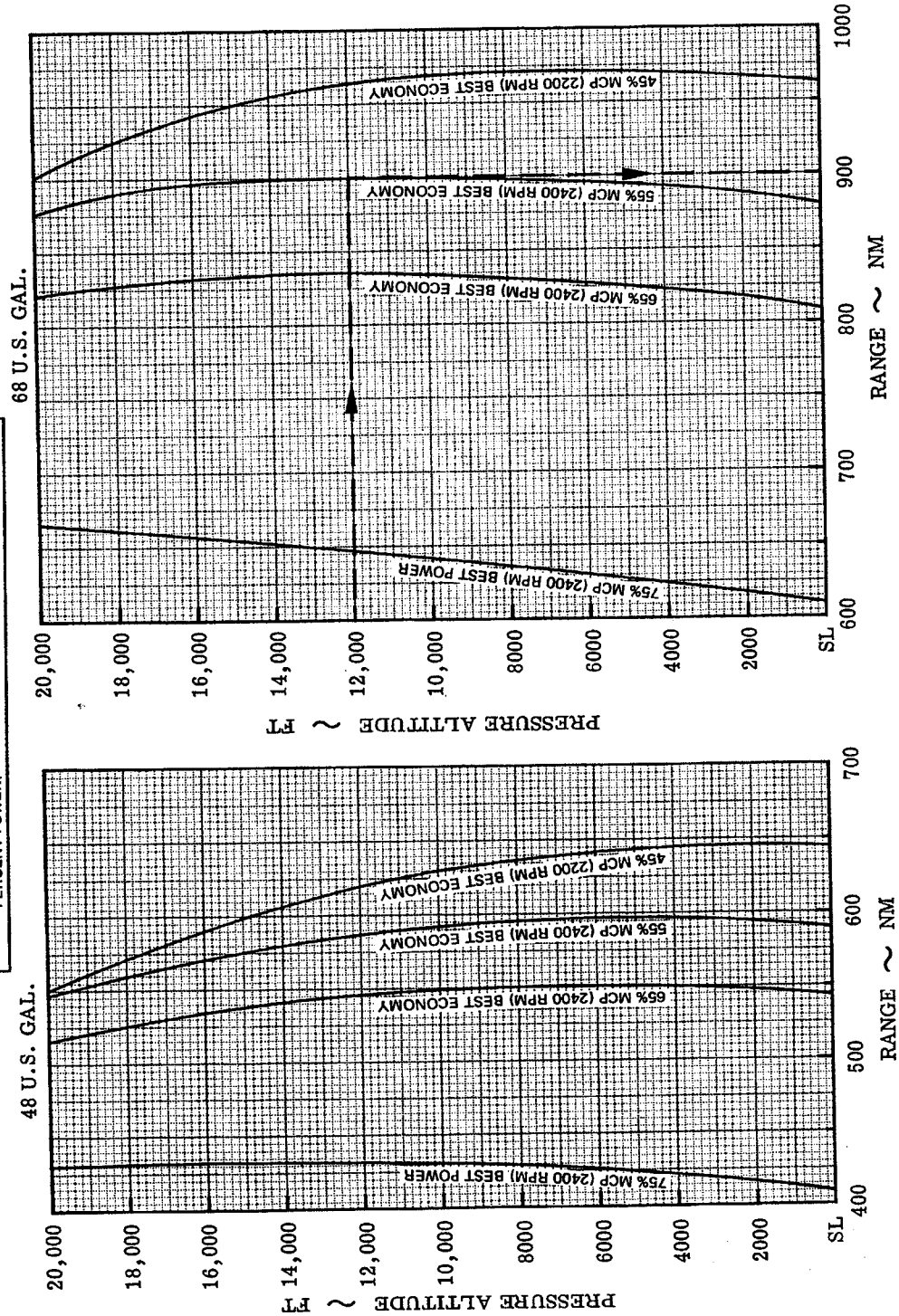

Figure 5-21.

ENDURANCE PROFILES

Figure 5-22 presents the maximum endurance for standard day conditions with varying pressure altitude and percent power.

ASSOCIATED CONDITIONS

Power	AS DESIRED
Mixture	BEST POWER (75% MCP)
	BEST ECONOMY (BELOW 75% MCP)
Wing Flaps	0 DEG
Landing Gear	RETRACTED
Cowl Flaps	CLOSED

Fuel Allowances

1. Start, warm up and taxi out (1 U.S.Gal).
2. Climb from S.L. to cruise altitude at 2575 RPM, 36 IN.Hg. and 100 KIAS.
3. Cruise at constant power and constant altitude.
4. 45 minute reserve at 45% MCP.
5. Descend from cruise altitude to sea level at 1000 ft/min (2200 RPM, 22 IN.Hg.).

TECHNIQUE

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

EXAMPLE

GIVEN:	Pressure Altitude	12,000 FT
	Cruise Power Setting	55% MCP (Best Economy)
	Fuel Loading	68 U.S. GAL. (Optional Fuel)
FIND:	Maximum Endurance Fig. 5-22	7.0 HRS

NOTE: See Section IV, Normal Procedures, for appropriate leaning procedures.

ENDURANCE PROFILES
INTERNATIONAL STANDARD ATMOSPHERE

NOTE: ENDURANCE AT BEST POWER MAY BE REDUCED BY AS MUCH AS 20% FROM ENDURANCE AT BEST ECONOMY. THE ACTUAL REDUCTION IN ENDURANCE WILL DEPEND ON THE CRUISE TIME, ALTITUDE AND POWER.

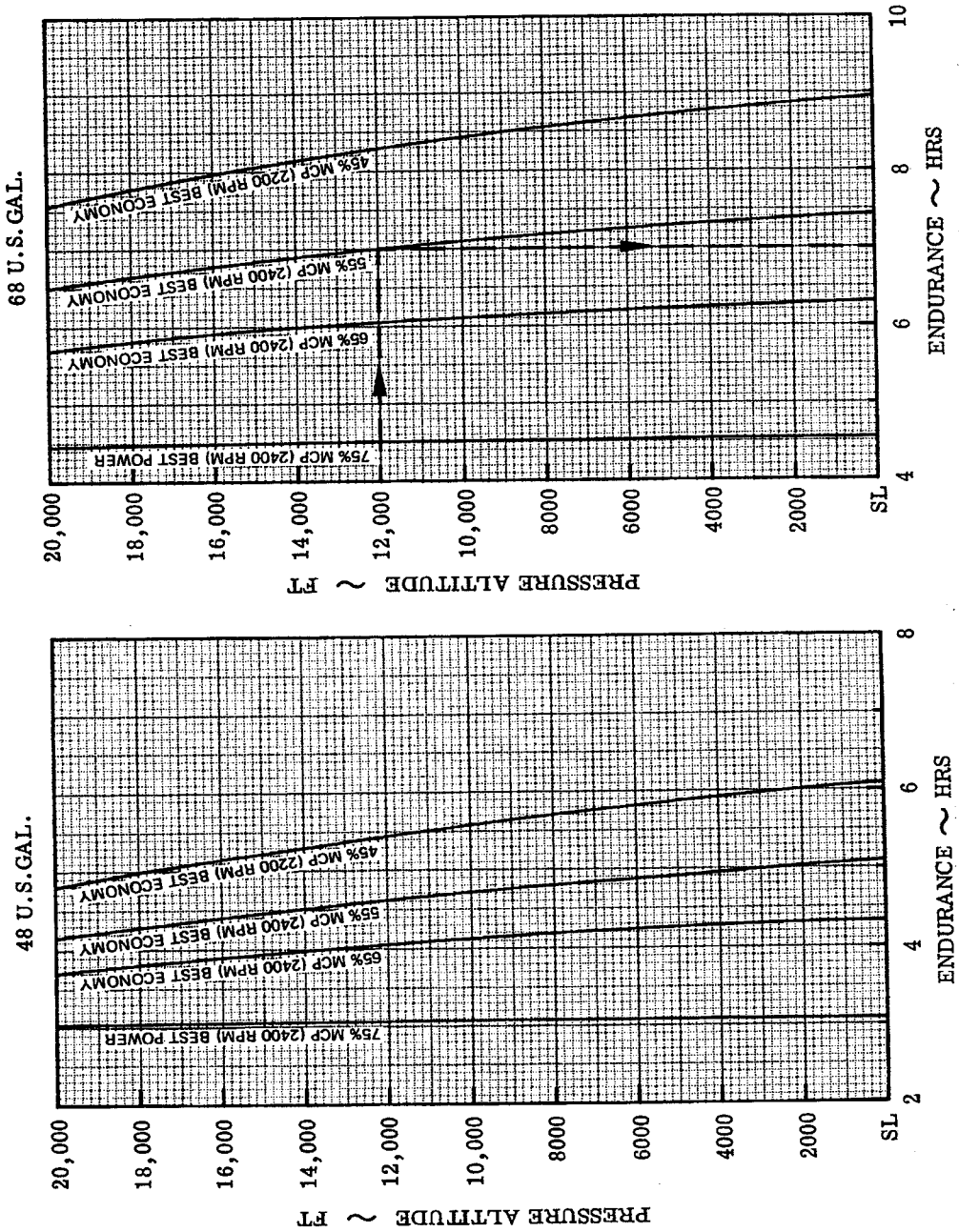

Figure 5-22.

HOLDING TIME

The Holding Time is presented in Figure 5-23 for varying amounts of Holding Fuel.

ASSOCIATED CONDITIONS

Power	45% MCP
Mixture	BEST ECONOMY
Wing Flaps	0 DEG
Landing Gear	RETRACTED
Cowl Flaps	CLOSED

TECHNIQUE

Obtain 45 percent power.

EXAMPLE

GIVEN:	Holding Fuel		48 U.S. GAL.
FIND:	Holding Time	Fig. 5-23	6.9 HRS

NOTES:
1. Holding time calculations do not include any allowance for reserves.
2. See cruise power setting charts for manifold pressure schedule.
3. See Section IV, Normal Procedures, for appropriate leaning procedure.

HOLDING TIME AT 45% MCP

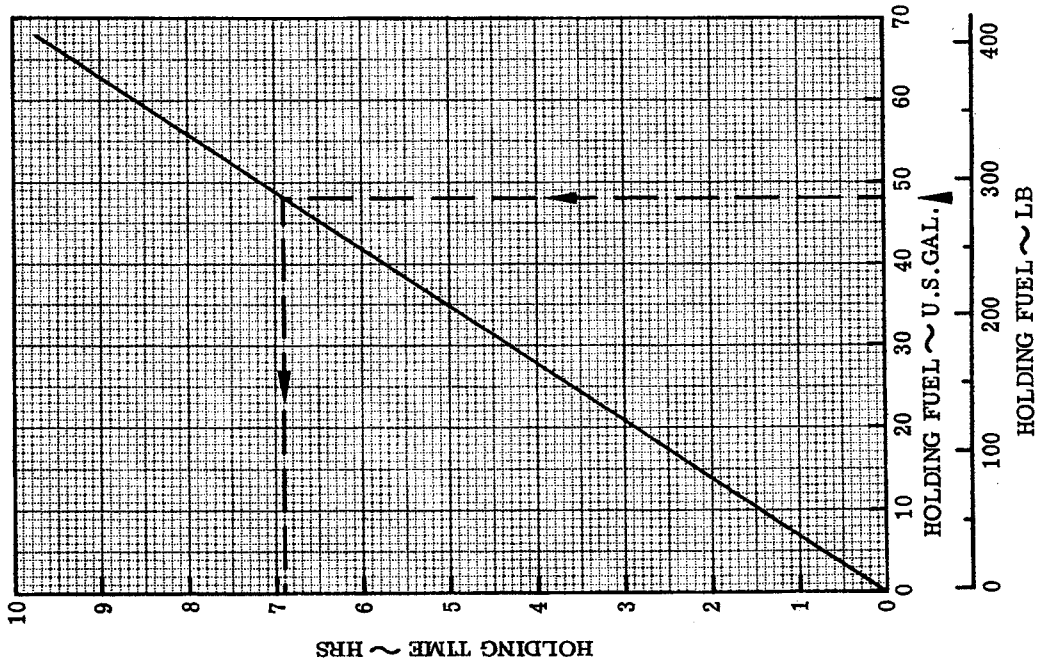

Figure 5-23.

TIME, DISTANCE, AND FUEL USED IN DESCENT

The Time, Distance and Fuel used in Descent are presented in Figure 5-24 for varying Pressure Altitude at 1000 Ft/Min rate of descent. A table of Scheduled Descent Speed versus Pressure Altitude is presented in upper portion of chart.

ASSOCIATED CONDITIONS

Power	2200 RPM, MANIFOLD PRESSURE 22 IN.HG.
Wing Flaps	0 DEG
Landing Gear	RETRACTED

TECHNIQUE

Maintain a 1000 FT/MIN rate of descent at the scheduled RPM and manifold pressure.

EXAMPLE

GIVEN: Initial Pressure Altitude 15,000 FT
Final Pressure Altitude 200 FT

FIND: The total time, distance and fuel to descent from initial to final altitude from Figure 5-24.

	INITIAL ALTITUDE TO S.L.		FINAL ALTITUDE TO S.L.		NET
Time	15.0 MIN	minus	0.2 MIN	equals	14.8 MIN
Distance	39.3 NM	minus	0.5 NM	equals	38.8 NM
Fuel	2.1 U.S.GAL	minus	0.02 U.S.GAL	equals	2.08 U.S.GAL (12.5 LB)

NOTES:
1. Descent data is presented for zero wind conditions only.
2. The chart applies for all outside air temperatures and airplane weights.
3. Recommended descent procedure from high altitude: Begin descent with mixture in cruise setting. Enrichen slightly each 1000 feet to assure full rich mixture prior to landing.

TIME, DISTANCE, FUEL USED IN DESCENT

RATE OF DESCENT = 1000 FT/MIN
2200 RPM, 22 IN.HG.

DESCENT SPEEDS	
PRESSURE ALTITUDE FT	KIAS
Sea Level	144
2000	144
4000	143
6000	142
8000	142
10,000	141
12,000	139
14,000	138
16,000	136
18,000	135
20,000	134

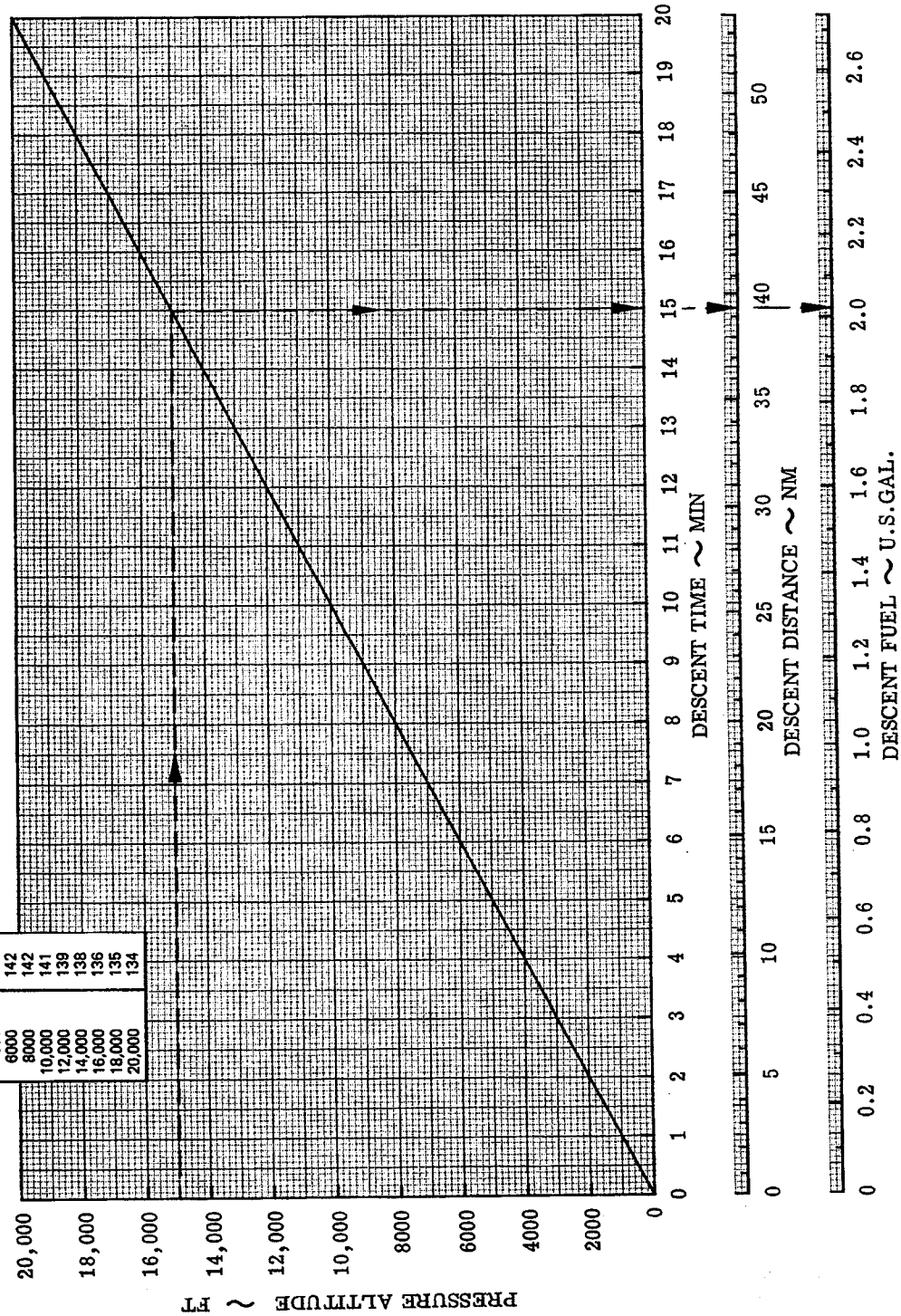

Figure 5-24.

LANDING GROUND ROLL DISTANCE, SHORT FIELD

The Short Field Landing Ground Roll Distance is shown in Figure 5-25 for varying conditions of outside air temperature, pressure altitude and wind speeds at a gross weight of 2950 Lbs.

ASSOCIATED CONDITIONS

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

TECHNIQUE

Make the final approach with the landing gear extended and the wing flaps at 35 degrees arriving at the 50-Ft height at 72 KIAS. Touchdown on the main wheels first, lower the nose wheel and apply maximum braking.

EXAMPLE

GIVEN:	Gross Weight	2950 LB
	Outside Air Temperature	25 DEG C
	Pressure Altitude	200 FT
	Wind Component (Tailwind)	2 KT
FIND:	Ground Distance, Fig. 5-25	870 FT

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

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

LANDING GROUND ROLL DISTANCE, SHORT FIELD

DRY, LEVEL, PAVED RUNWAYS
GROSS WEIGHT = 2950 LB
50 FT HEIGHT SPEED = 72 KIAS

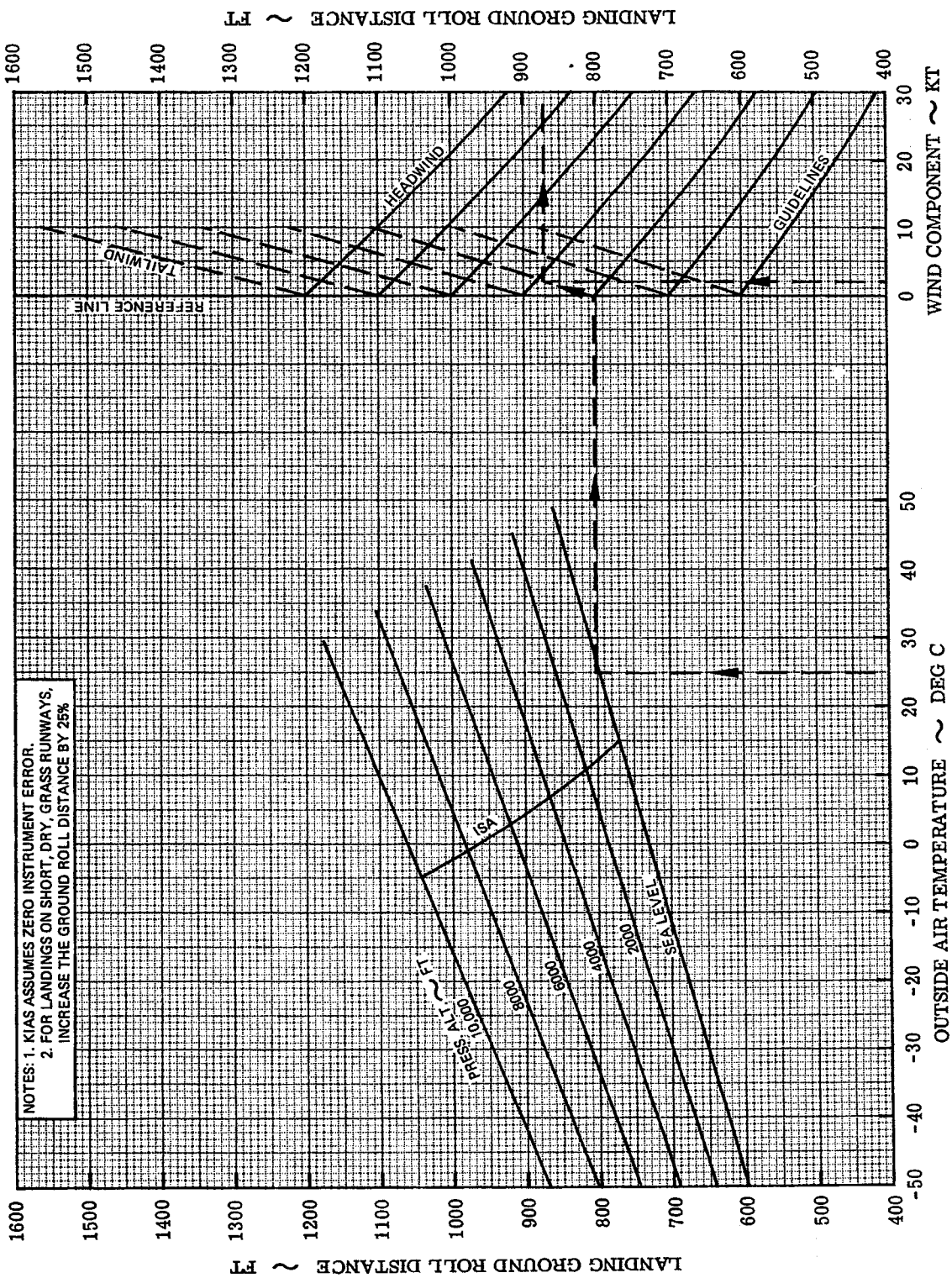

Figure 5-25.

TOTAL LANDING DISTANCE, SHORT FIELD

The Short Field Total Landing Distance from 50 Ft height is shown in Figure 5-26 for varying conditions of outside air temperatures, pressure altitudes, and wind speeds at a gross weight of 2950 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 72 KIAS. Touchdown on the main wheels first, lower the nose wheel and apply maximum braking.

EXAMPLE

GIVEN:	Gross Weight	2950 LB
	Outside Air Temperature	25 DEG C
	Pressure Altitude	200 FT
	Wind Component (Tailwind)	2 KT
FIND:	Total Landing Distance, Fig. 5-26	1400 FT

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

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

TOTAL LANDING DISTANCE, SHORT FIELD

DRY, LEVEL, PAVED RUNWAYS
GROSS WEIGHT = 2950 LB
50 FT HEIGHT SPEED = 72 KIAS

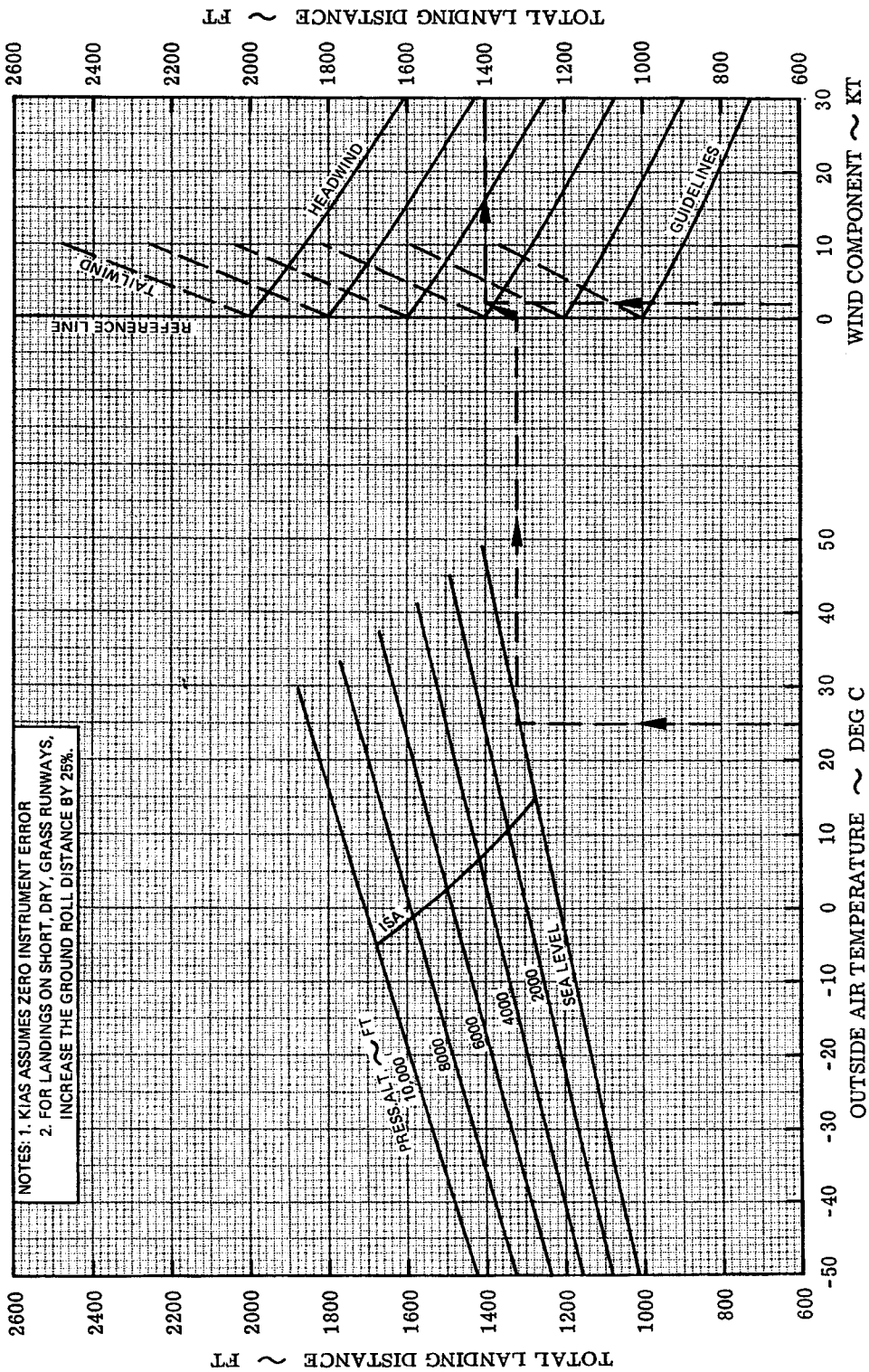

Figure 5-26.

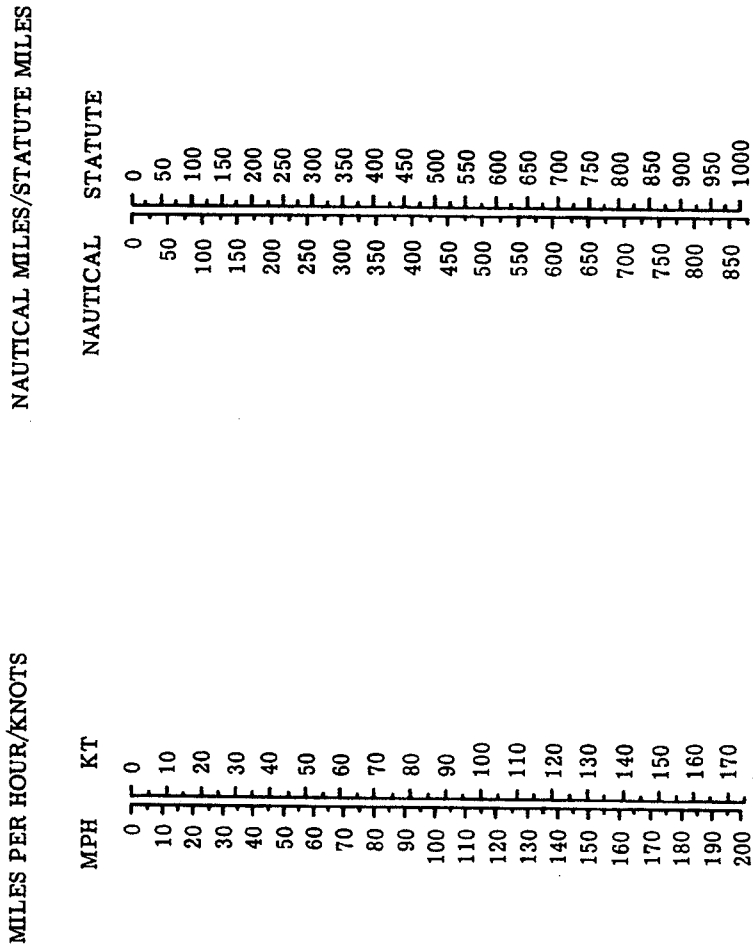
MILES PER HOUR/KNOTS
MPH KT
0 0
10 10
20 20
30 30
40 40
50 50
60 60
70 70
80 80
90 90
100 100
110 110
120 120
130 130
140 140
150 150
160 160
170 170
180
190
200
NAUTICAL MILES/STATUTE MILES
NAUTICAL STATUTE
0 0
50 50
100 100
150 150
200 200
250 250
300 300
350 350
400 400
450 450
500 500
550 550
600 600
650 650
700 700
750 750
800 800
850 850
900
950
1000

Figure 5-27.

SECTION VI

WEIGHT AND BALANCE/EQUIPMENT LIST

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INTRODUCTION

This section provides procedures for establishing the airplane's basic empty weight and moment. 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 Weight and Balance Record form is included for easily keeping track of changes to the airplane which affect weight and balance (such as installation or removal of optional equipment).

AIRPLANE WEIGHING PROCEDURES

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

Configuration

The airplane must be weighed in the following configuration:

1. Oil
   Oil sump should be full. Total engine oil is 19 pounds at an ARM of 46.15 inches. A small portion of this oil is undrainable (4 pounds at an ARM of 48.6 inches).

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

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

4. Wing Flaps
The wing flaps should be retracted.

5. Doors
All doors closed.

6. Parking Brake
The parking brake should be released.

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

8. Pilot and Front Passenger Seat Position
Seats should be located per Weight and Balance Statement (Form No. AC 1753) with the seat backs in a vertical position (see Figure 6-2).

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

Fuel Draining

Drain fuel system in accordance with the Airplane Maintenance Manual.

After the airplane fuel tanks have drained, one (1) gallon 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 hign 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 centerline on the lower fuselage between stations 62.50 and 97.60 in a fore and aft position. Inflating or deflating the nose tire or strut raises or lowers the nose of the airplane as required until the bubble of the spirit level is centered.

Scale Capacity

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

The scales should be properly calibrated and certified.

Scale Location

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

Measuring

Stretch a line between the centers of the main gear (from centerline of left axle to centerline of right axle). Measure directly fore and aft along the airplane centerline to each side of the nose gear centerline and average the measurements. This is the distance "L" used in the Airplane Weight and Balance Statement (Form No. AC 1753).

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 1753).

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 1753).

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 1753) 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 1753). For the Weight and Balance calculations, the flight envelope in this section is defined in terms of weight and moment/1000.

Procedure

1. 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 1753).

2. 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. 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. 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. Add the columns of Rows 1-4 of the Airplane Weight and Balance Statement. This subtotal becomes the zero fuel weight. Refer to the flight envelope (Figure 6-3) to determine that this weight limitation has 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. 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 gross weight will dictate the amount of fuel that can be carried.

7. 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

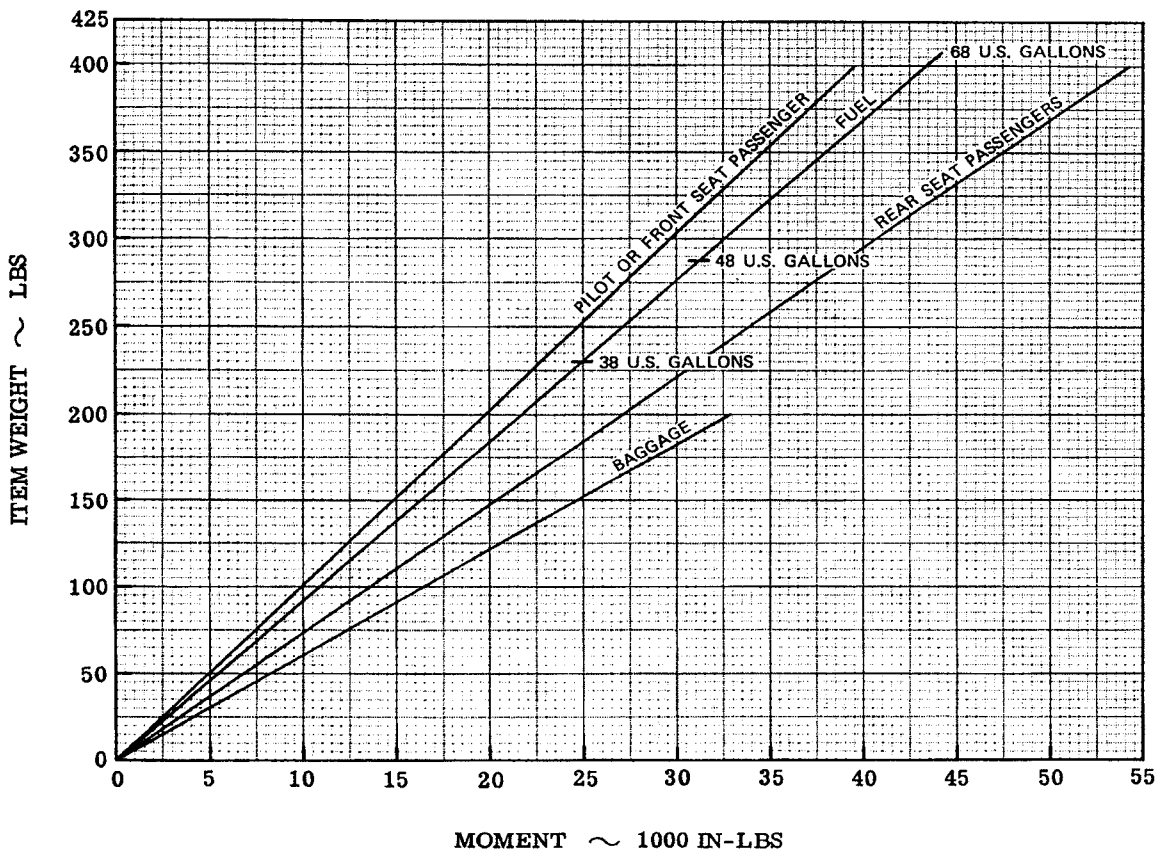

Figure 6-1. Loading Graph

CABIN STATION DIAGRAM

*FRONT SEAT TRAVELS
MAXIMUM FORWARD TRAVEL - F.S. 90.0
MAXIMUM AFT TRAVEL - F.S. 102.0

BAGGAGE COMPARTMENT WEIGHT LIMITS
MAXIMUM ALLOWABLE WEIGHT IN
BAGGAGE COMPARTMENT - 200 LBS

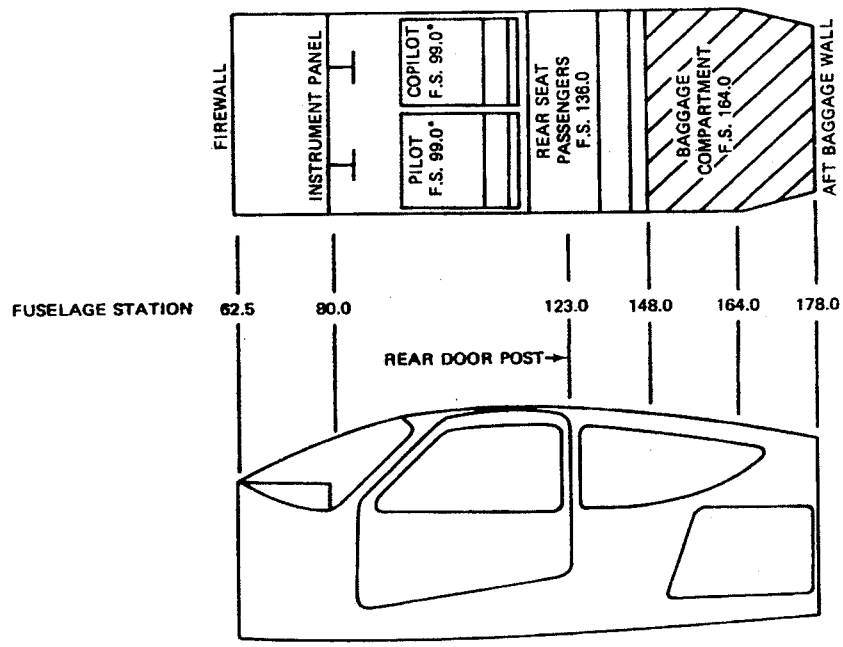

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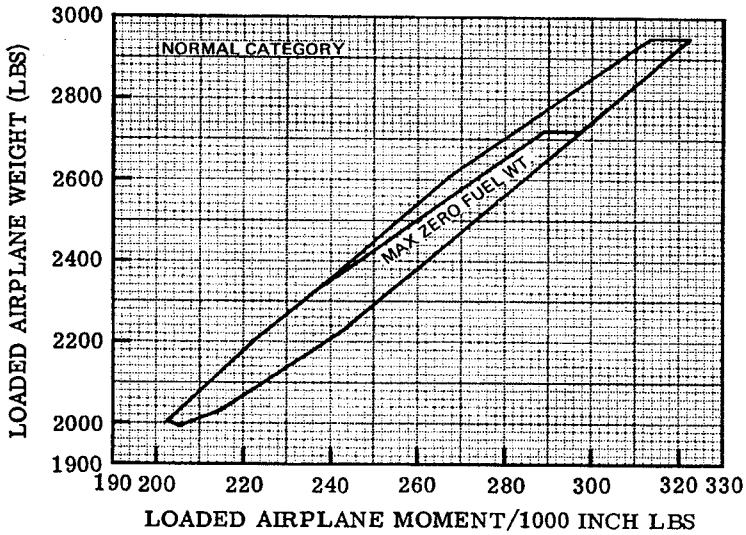
Figure 6-2. Cabin Station Diagram

AIRCRAFT OPERATIONAL LIMITATIONS - See Figure 6-3.

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

AIRCRAFT OPERATIONAL LIMITATIONS

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



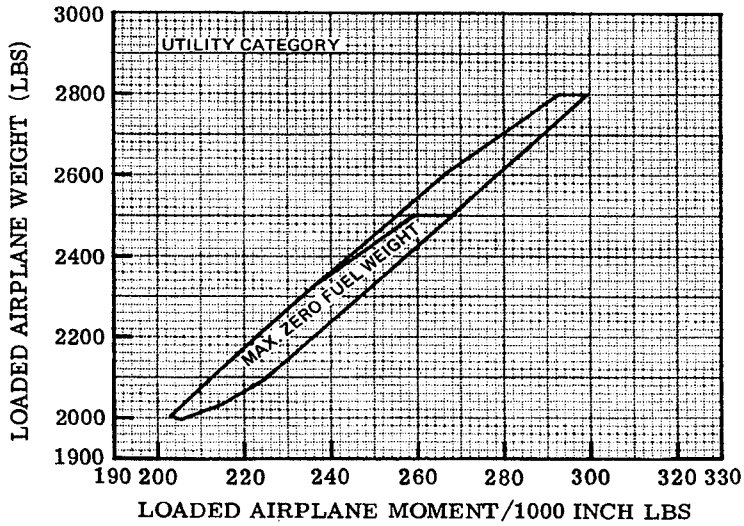


Figure 6-3. Aircraft Operational Limitations

SECTION VII

AIRPLANE AND SYSTEMS DESCRIPTIONS

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GENERAL

The Model 112TCA is a four-place, low-wing, all metal, retractable gear aircraft, powered by a four-cylinder, turbo-charged Lycoming engine equipped with a Hartzell, all metal, constant-speed, two-bladed propeller. Access to the cabin interior is through two lockable cabin doors, one in each side of the aircraft. The cabin interior is sectioned into four seating areas by a center console which houses engine and propeller controls, elevator trim control wheel, engine primer switch and passenger convenience items.

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

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

AIRFRAME

FUSELAGE

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

CABIN DOORS

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

CLOSING DOOR IN FLIGHT

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

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

NOTE

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

6. Secure upper door latch.

SEATS

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

SEAT BELTS AND SHOULDER HARNESSES

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

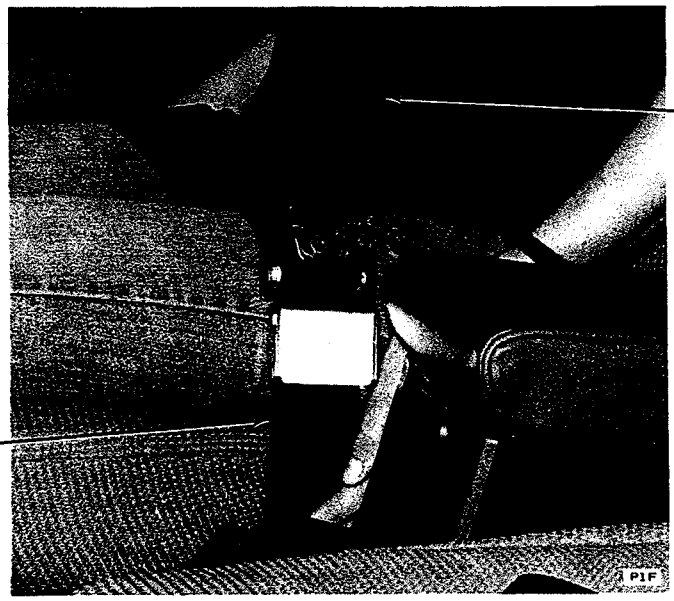


Figure 7-1. Shoulder Harness Secured

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

To secure the shoulder harness, fasten the seat belt first(Refer to Figure 7-1). Extend the harness strap over the outboard 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, unlatch the seat belt and allow the reel to retain the harness and seat belt portion against the seat back.

BAGGAGE DOOR

The baggage door is of all-metal construction, and is located aft of the wing on the left side of the aircraft. The door is equipped with a spring-loaded latch assembly and a keyed rotary-type lock. The key may be removed in either the locked or unlocked position.

NOTE

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

BAGGAGE COMPARTMENT

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

WARNING

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

Do not carry hazardous material.

WING

Each wing is of all-metal stressed-skin construction incorporating spars, formed ribs and an integral fuel tank contained in a three-rib section, forward of the main spar. The main spar of each wing is joined together at the center of the fuselage with spar cap splices. The wing is installed in the lower center fuselage section. It is secured to the fuselage load-bearing frames and fittings by bolts and nuts at stations 85.00, 123.00 and forward of station 148.00. Access plates located at various points on the lower skin of the wing provide access for inspection and repair of the fuel system and the flight control cabling. Landing gear fitting/retraction mechanisms are installed in the basic wing structures to provide attachment points for the main landing gear. An opening in the inboard leading edge of each wing serves as a ram air intake for the lower cabin ventilation system. An electrically operated wing flap is installed between the fuselage and aileron on each wing. The flaps are attached to the aft wing spar by hinge assemblies. Extension and retraction of the wing flaps is controlled by an electrically operated jackscrew and torque tube arrangement. Metal ailerons, extending outboard from the flaps to wing station 190.70, are attached to the aft wing spar by hinge assemblies.

EMPENNAGE

The empennage consists of the vertical stabilizer, horizontal stabilizer, rudder and elevator. 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 thermoplastic fin cap contains provisions for mounting the VHF navigation antenna and the flashing beacon. A ram air intake, recessed into the center of the vertical stabilizer, provides ambient air for in-flight cabin ventilation. The horizontal stabilizer is attached to the lower vertical stabilizer stub assembly. The horizontal and vertical stabilizers both utilize stressed and beaded skin construction to provide maximum strength with minimum structural components. The horizontal tail is of single unit construction with a fixed forward surface and a hinged elevator control surface. The elevator provides mounting attachment for a thermoplastic tip-fairing at each outboard end for streamlined appearance.

FLIGHT CONTROLS

CONTROL LOCK

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

FLAP CONTROL SYSTEM

Wing flap position is controlled by a switch labeled WING FLAPS mounted directly to the right of the accessory electrical switches. Flap position is electrically indicated by a gage mounted above and to the right of the flap switch. Power from the electric motor is transmitted to the flaps through a jackscrew connected to a torque tube, and from the torque tube to the flaps with push-pull rods. Use of a single jackscrew and torque tube prevents asymmetric flap operation. To extend the wing flaps, the wing flap switch must be depressed and held DOWN. The degree of extension is determined by pilot reference to the flap position indicator. After the desired flap extension is obtained, releasing the switch allows it to return to the center OFF position. When flap retraction is necessary, place the switch in the UP position. The switch will remain in the UP position without manual assistance due to an over-center design within the switch. With the flaps extended in flight, placing the flap switch UP will retract the flaps in approximately 6 seconds. Gradual flap retraction can be accomplished by intermittent operation of the flap switch to UP. Normal full flap extension in flight will require approximately 9 seconds. After the flaps reach maximum extension or retraction, limit switches will automatically shut off the flap motor; however, when the flaps reach the fully retracted position, the wing flap switch should be manually returned to the center-off position. An additional limit switch is installed on the flap motor drive to activate the gear warning system when flaps are extended 25 degrees or more with the landing gear retracted. No appreciable change in trim is required over the full flap extension range, however, minor changes in trim may be required depending on airspeed and aircraft loading. Normally, there will be a slight nose down trim change.

AILERON CONTROL SYSTEM

The aileron control wheels are mechanically interconnected through a series of control chains, sprockets and cables. Control cables extend aft from the control column passing under the floor structure and through idler pulleys to a bracket assembly. The cables are then routed through the bracket assembly and out through the wing to the aileron bellcranks. Adjustable push-pull rods connect the aileron bellcranks to the ailerons. An aileron balance assembly is mounted on the outboard end of each aileron. The aileron and rudder control systems are interconnected by the use of a spring assembly to provide improved lateral stability, particularly during low speed, high power operations. The springs apply a coordinated aileron force when rudder forces are applied.

AILERON TRIM TAB

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

ELEVATOR CONTROL SYSTEM

Each elevator is of all-metal construction, and is hinged at three places and attached to the aft spar of the horizontal stabilizer. The elevators are operated by the fore and aft movement of the control column. Elevator arms, attached to the control column in the console tunnel, are connected to control cables which are routed through a series of pulleys to the elevator bellcrank. The bellcrank is connected to the elevator horn with a push-pull rod. When the control wheel is moved forward or aft, the cables move in opposite directions, turning the bellcrank, which in turn pushes or pulls the control rod, causing the elevators to move up or down. Two turnbuckles, installed in the elevator control system between fuselage stations 205.00 and 230.50, permit control cable tension adjustment.

ELEVATOR TRIM SYSTEM

Controllable trim tabs, located on the inboard trailing edge of each elevator, are operated by an elevator trim tab control wheel installed in the center console. A portion of the trim tab control wheel extends through the center console, and when rotated, actuates the trim tab through a mechanical linkage consisting of cables, chains, jackscrew assembly and push rods that 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 takeoff range, neutral, nose up or nose down positions. Rotating the wheel forward, toward the nose down indicator will provide nose-down trim, rotation in the opposite direction produces nose-up trim.

RUDDER CONTROL SYSTEM

Dual rudder-brake control pedals enable the pilot or copilot to control the rudder, brakes, and nose wheel steering. The rudder control system consists of mechanical linkage and cables connecting the rudder pedals to the rudder. The rudder pedals are connected to rudder bars, which in turn are connected to the rudder bellcrank with push-pull rods. Cables are attached to the bellcrank and are routed aft through a series of pulleys to the rudder horn. When force is applied to one rudder pedal, the cables move in opposite directions, turning the rudder horn and rudder. The pedals are connected to the nose wheel steering with cables and bungee assemblies which act as return springs for the rudder pedals. The rudder controls 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 the knob clockwise will yaw the aircraft to the right, opposite rotation will yaw the aircraft to the left. An indicator is incorporated in the right side of the lower instrument cluster to indicate rudder trim position. Rudder trim is set at 3 degree right rudder with indicator at zero position.

GROUND STEERING

The nose wheel steering system is tied in with the rudder control 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 aircraft a minimum turn radius of 23' 3". Minimum turn radius is achieved by locking one brake and rotating aircraft about the locked wheel. Use maximum turn radius when conditions permit to avoid excessive tire wear and undesirable side loads on the locked wheel.

LANDING GEAR

The aircraft is equipped with a hydraulically operated tricycle landing gear that includes a steerable nose wheel and self-adjusting disc brakes for the main landing gear wheels. Landing shocks are absorbed in the nose gear by a conventional oleo strut assembly and by an oleo strut connecting rod arrangement connected to the trailing arm of the main landing gear. Nose wheel steering is controlled by a cable-pulley system attached to the nose gear and to the rudder/brake pedal and actuated by depressing the rudder/brake pedals from either pilot's position. The single-disc, dual piston hydraulic brakes are operated by individual master brake cylinders attached to the rudder/brake pedals. The brakes are actuated by applying toe pressure to the top of the rudder/

brake pedals. The aircraft is also equipped with a parking brake system which operates from the master brake cylinders and is actuated by a parking brake control knob. A shimmy dampener is attached to the fixed and movable portions of the nose gear strut to provide a dampening action on the gear. The emergency extension valve, located on the left side of center console, is used for emergency extension of the gear. This valve 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 the wheel wells in the lower side of the wing. The nose landing gear retracts aft and upward into the wheel well. Mechanically operated doors, connected to the landing gear by link assemblies, open and close during the extension and retraction cycle. When the nose gear is retracted the doors completely enclose the wheel well. When the main gear is retracted all of the gear, except the wheel, is enclosed by a large door hinged on the wing and actuated by a strut attached to the gear and a smaller door fixed to the gear. 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 gears are retained in the uplock position by a hydraulic pressure lock. A loss of 250 psi hydraulic pressure will energize the hydraulic power pack and buildup pressure to the pressure switch setting. When the landing gear selector switch is placed in the DOWN position, the hydraulic pressure lock is released and hydraulic fluid is directed to the down side of the landing gear actuator cylinders extending the gear until the pressure switch is actuated. When the pressure switch is actuated, the hydraulic power pack pump is shutoff and all three gear are held in the downlock position by overcenter braces assisted by trapped hydraulic pressure. A ground contact switch, on the right main gear, will prevent landing gear retraction while on the ground caused by an unintentional positioning of the landing gear selector switch to the UP position. Landing gear position indicators and a warning bell system are provided to alert the pilot when the landing gear is in the up, or down and locked position. Position indicators, both red and green, are installed in front of the pilot. The green lights are installed in the instrument panel and the red light is installed on the glareshield. The gear down position is indicated by three green lights above the gear selector switch. The unsafe red (GEAR WARN) light, on the glareshield, indicates the gear is intransit or not fully down and locked. There is no electrical indication of gear being fully retracted other than all indicator lights being extinguished. When the landing gear extends to the full down position, three landing gear down switches are actuated causing the green lights to illuminate, indicating the gear is down and locked.

INSTRUMENTS

The standard equipment instrument installation provides all instruments necessary for day and night VFR operation. With the exception of the magnetic compass and the optional outside air temperature gage, all instruments are installed in the main instrument panel and sub-panel areas (see Figure 7-2).

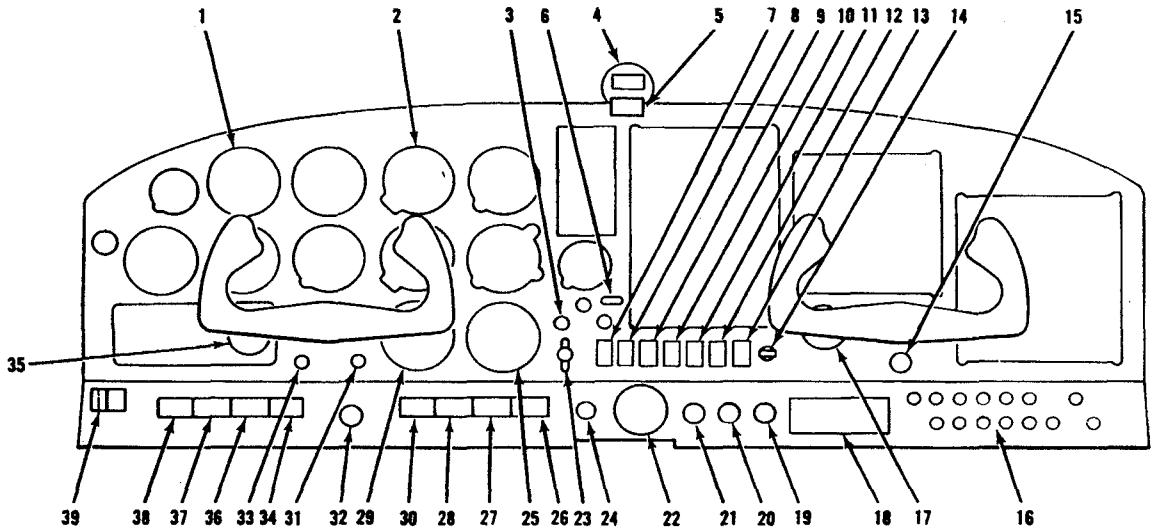
All primary flight and gyro instruments are installed in the left side of the main instrument panel. Manifold pressure, carburetor air temperature and tachometer gages are mounted in the lower area of the main panel and the remaining engine instruments are grouped horizontally across the left instrument sub-panel. Optional navigation and communications equipment is located in the center and right side of the main instrument panel. The lower right instrument sub-panel contains electrical system circuit breakers and heating-ventilation control knobs.

FLIGHT INSTRUMENTS

Standard flight instruments consist of the magnetic compass, airspeed indicator and altimeter. An optional vacuum-driven attitude and directional gyro, electrically-driven turn coordinator, and a vertical speed indicator are available. Refer to Figure 7-3. A pitot-static system provides pitot (impact) and static (atmospheric) air pressure to the airspeed indicator, and static air pressure to the altimeter and vertical speed indicator.

The optional gyros are driven by ambient air drawn into the instrument case to replace the air evacuated by the vacuum pump. The inlet air for the gyro instruments is filtered through the instrument vacuum air filter.

The optional turn coordinator is an electrically operated instrument. It is powered by the aircraft electrical system and operates only when the master switch is on.



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

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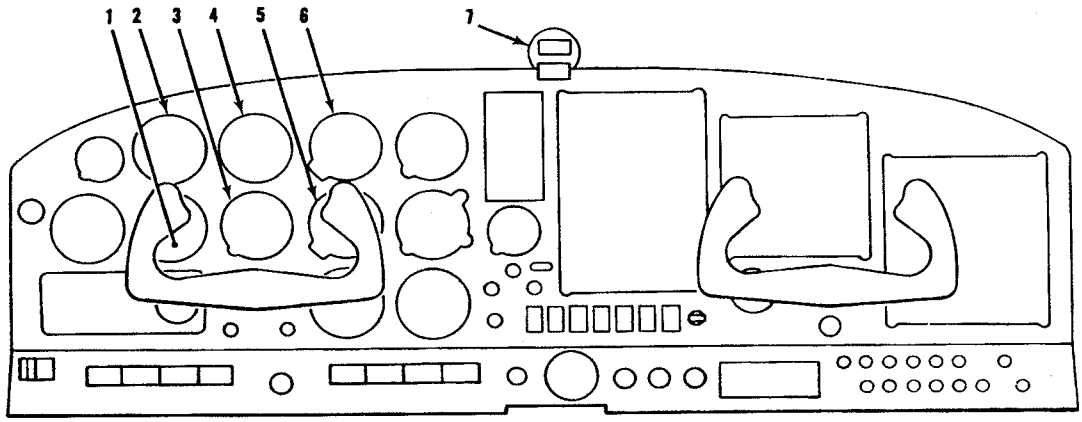
Figure 7-2. Instrument Panel



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

X210 10

Figure 7-3. Flight Instruments

The magnetic compass is liquid-filled, with expansion provisions to compensate for temperature changes. It is equipped with compensating magnets adjustable from the front of the case. Access to the compass light and the compensating magnets is provided by pivoted covers. No maintenance is required on the compass except periodic checks on a compass rose with possible adjustment of the compensating magnets.

PITOT PRESSURE SYSTEM

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

STATIC PRESSURE SYSTEM

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

ALTERNATE STATIC SOURCE VALVE

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

NOTE

Consult Section II of this Handbook for airspeed and altimeter alternate static source corrections.

STALL WARNING SYSTEM

NOTE

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

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

ENGINE

The aircraft is equipped with a Lycoming TO-360-C1A6D, horizontally-opposed, air-cooled, turbo-charged, four cylinder engine. The fuel-air mixture is supplied to the cylinders by a carburetor located downstream of the turbocharger. This engine utilizes a wet sump oil system and a separate oil cooler assembly. The engine is certified to operate on a minimum of 100/130 octane (green color) and low lead 100 octane (light blue) aviation fuel, and is rated to produce 210 BHP at 2575 RPM and 42 In. Hg. manifold pressure at sea level. A Lycoming Engine Operator's Manual is supplied with each aircraft and should be consulted for complete engine specifications.

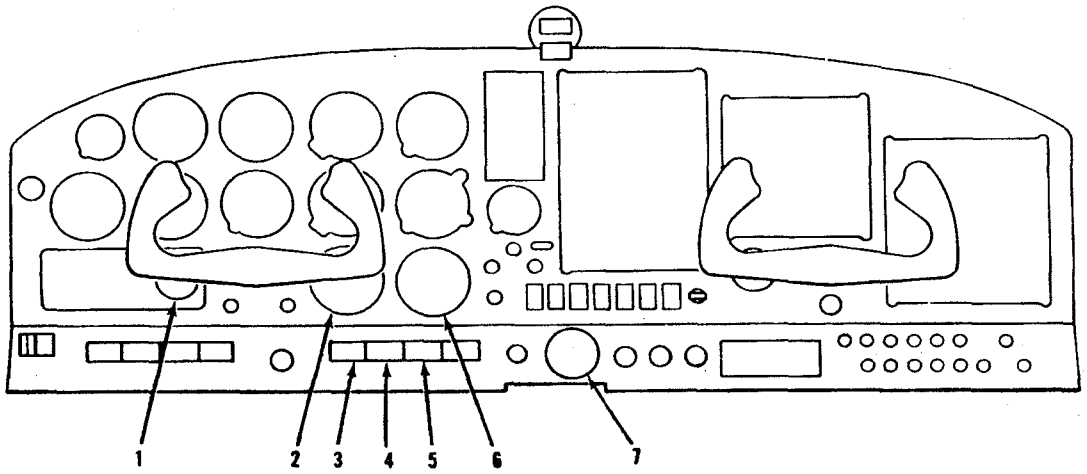
ENGINE CONTROLS

The power plant controls are located on the forward end of the center console and rotate in fore and aft movements. The control levers are color and shape-coded to assist in identification. Functions of the control levers are, proceeding from left to right: Alternate Induction Air (black/half-round shaped), controls heating of intake air to the turbocharger; Throttle (black/round), controls manifold pressure; Propeller Control (blue/crowned), selects engine RPM; and the Mixture Control (red/hexagonal), which manually controls the fuel/air ratio. Friction control knobs are mounted on the left and right side of the control quadrant to permit locking the control levers at a desired setting. For further Power Plant information refer to the Maintenance Manual.

ENGINE INSTRUMENTS - Refer to Figure 7-4.

RECORDING TACHOMETER

The tachometer is a mechanical indicator driven at one half crankshaft speed by a flexible drive shaft. The indicator reads true engine RPM on the outer dial. The center window indicates engine operating time in hours and tenths of hours. The instrument mechanically translates engine RPM into time increments and maintains a running total of operating time up to a maximum of 9999.99 hours.



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

X210 10

Figure 7-4. Engine Instruments

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.

OIL PRESSURE GAGE

The Bourdon-tube type oil pressure gage is a direct-reading gage, operated by a pressure pickup line connected to the engine main oil gallery. 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 55 PSI (yellow arc), and normal operating range is from 55 PSI to 90 PSI (green arc). Oil pressure should not exceed 115 PSI (red line).

MANIFOLD PRESSURE/FUEL PRESSURE GAGE

The manifold pressure/fuel pressure gage is a dual indicating, direct reading instrument. The left half of the indicator indicates pressure of the fuel/air mixture at the intake port of number four cylinder in inches of mercury. The right half indicates fuel pressure at the carburetor fuel inlet in pounds per square inch.

CYLINDER HEAD TEMPERATURE

The cylinder head temperature indications are provided by an electrical resistance type temperature probe installed in the number four cylinder and receives power from the aircraft electrical system. During normal operations temperatures should remain between 200°F and 475°F (green arc) and temperatures should never be allowed to exceed 475°F (red line).

EXHAUST GAS TEMPERATURE (EGT) GAGE

An EGT gage is installed in the instrument sub-panel, directly above the engine control levers. The gage is used to aid the pilot in establishing the fuel/air mixture 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 bypass to the turbocharger wastegate. For best power mixture, lean to peak EGT, then enrichen 100°F. For best economy mixture, lean to and operate at peak EGT. Do not exceed 1725°F EGT at any time.

NOTE

Fuel flow rates at Best Power are 20% higher than at Best Economy.

CARBURETOR AIR TEMPERATURE INDICATOR

A carburetor air temperature indicator, installed in the left side of the instrument panel, is connected to a sensitive resistance bulb. This resistance bulb is installed in the duct between the turbo-charger and the carburetor. As the temperature of the incoming air in the duct varies, the resistance in the bulb varies and the resulting variations in current are expressed by the indicator in terms of temperature change. A red radial line at 325°F indicates the maximum permissible operating temperature. A green arc from 100°F to 325°F indicates normal operating range. A yellow arc from 0°F to 100°F indicates a precautionary range of possible carburetor icing in certain environmental conditions.

PROPER OPERATION AND CARE OF ENGINE

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

In addition to proper operation, pre-flight and periodic inspections should be performed, and any indications of leaks or malfunctions should be corrected before they can develop into major problems. Careful attention should be given when checking oil and fuel systems, and any problems should be corrected before next flight. When servicing aircraft, the proper fuels and lubricating oils should always be used. Use only Aviation Grade Fuel with a minimum octane rating of 100/130 (green color) or low lead 100/130 (light blue). 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-22851)
Below 10°F	30
0°F to 70°F	40 or 30
30°F to 90°F	40
Above 60°F	40 or 50

ENGINE LUBRICATION

The oil supply and distribution system is integral with the basic engine except for an independent oil cooler assembly mounted on the left forward side of the engine firewall. A thermostatically operated oil cooler bypass valve causes oil to bypass the cooler in the event of congealed oil or an obstruction in the cooler. This bypass valve also routes oil directly to the main pressure gallery until a predetermined oil temperature is reached and then the oil is routed through the cooler.

The oil pump draws oil through the oil sump pick-up screen, and directs it to the oil filter. Cooled oil is then routed to the oil gallery.

ENGINE OIL SCREENS

An oil suction screen is located on the right side of the oil sump and an oil filter is located in the accessory housing on the right side of the engine. Use of this screen and filter provides dual protection for positive screening of damaging foreign material from the oil.

IGNITION SYSTEM

The engine is equipped with a Bendix Type D4LN-2021 (impulse coupling) magneto. This is a dual magneto system utilizing one housing. There are two complete independent ignition systems on the engine. 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) and three (3), and the top plugs in cylinders two (2) and four (4). The right magneto fires the top plugs in cylinders one (1) and three (3), and the bottom plugs in cylinders two (2) and four (4).

INDUCTION AIR SYSTEM

The external scoop on the right side of the cowling serves as the ram air source for the induction air system. Intake air is directed through an oil-impregnated filter element, induction air box, and flexible ducts for delivery to the turbo-charger. The air is compressed and delivered to the carburetor for the fuel/air mixing process. A second (heated) air source utilizes engine cooling air drawn from the interior of the lower engine cowl. This provides an alternate source of intake air in the event of carburetor icing, or icing of the external filter element. This heated airflow source is controlled by the induction air control lever on the engine control pedestal.

EXHAUST SYSTEM

The engine is equipped with one (1) exhaust stack. Stainless steel exhaust pipes are flange-mounted to each cylinder exhaust port and extend across and aft to where they attach to the turbine section of the turbo-charger. A single stack extends through the lower cowl to direct exhaust gases overboard. A heat shroud is fitted around the exhaust stack assembly to provide a source of heated air for the cabin heat and defroster system.

CARBURETOR

The engine is equipped with a Marvel Schebler Type HA-6 side draft, single barrel, float type carburetor equipped with a manual mixture control and idle cut-off. The idle speed adjustment is a conventional spring-loaded needle valve. The carburetor is located between the turbocharger compressor outlet and the fuel air intake manifold.

TURBO-CHARGER

A complete turbo-charger system, installed on the aft end of the engine consists of a turbine and compressor assembly and an overboost pressure relief valve. The turbo-charger is utilized to increase the power output and efficiency of the engine by supplying compressed air to the engine intake system. The power to drive the turbo-charger is extracted from energy in the exhaust gas. A manually controlled (interconnected with throttle) exhaust wastegate valve assembly determines the amount of boost supplied to the engine.

ENGINE COWLING

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

BAFFLES INSTALLATION

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

STARTER

A Bendix-type starter is installed on the lower left side of the front of the engine. The starter drive pinion engages the engine flywheel ring gear to provide direct cranking of the engine. The starter relay, installed on the battery box in the tailcone, is energized by a key-operated, spring-loaded ignition-starter switch. When starting the engine, avoid energizing the starter for more than 30 seconds, and allow at least five (5) minutes between cranking periods to permit the starter to cool.

ACCESSORIES

FUEL PUMP

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

VACUUM PUMP

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

ENGINE MOUNT

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

PROPELLER

The Model 112TCA is equipped with a Hartzell, all metal HC-E2YR-1BF/F8467-7R, constant speed, two-blade propeller. Maximum diameter is 77 inches.

The constant speed propeller used on this aircraft is a single-acting type in which oil pressure from the engine, boosted and regulated by a governor, is used to increase blade pitch. The natural centrifugal twisting moment of the rotating blades and the force of a spring are used to decrease blade pitch.

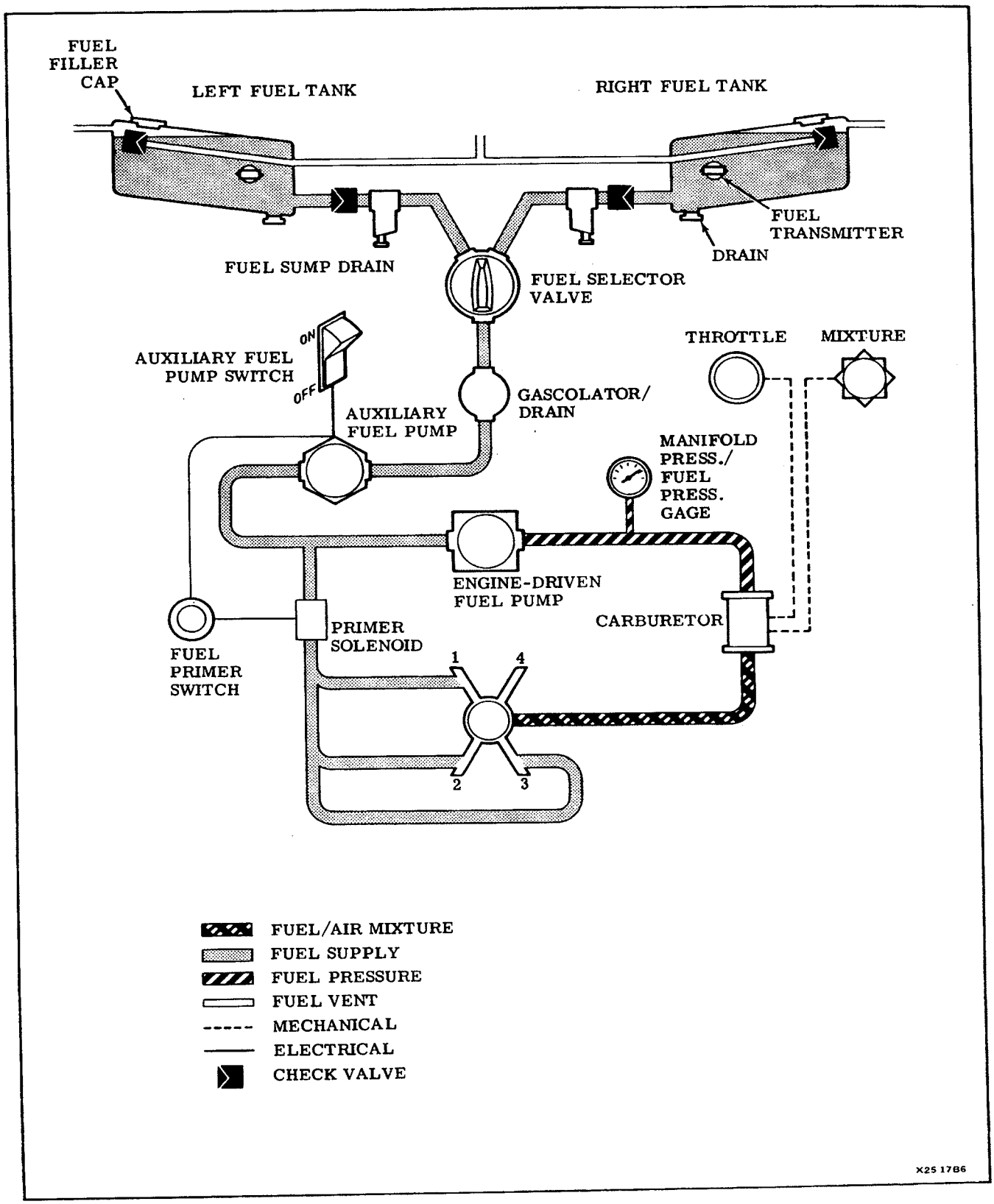


Figure 7-5. Fuel System Schematic

PROPELLER GOVERNOR

The propeller governor is a single-acting, centrifugal type, which boosts oil pressure from the engine and directs it to the propeller where the oil is used to increase blade pitch. The 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 air in the dome.

FUEL SYSTEM

Aviation fuel (100/130 minimum octane, green color or low lead 100 octane, blue color) is supplied to the engine by two (2) integral fuel tanks, one in the forward center section of each wing. Normal fuel tank capacity is 25 U.S. gallons for each wing tank, 24 gallons of which are considered usable (see Figure 7-5). Optional fuel filler inlets are available that will increase total fuel capacity to 35 U.S. gallons in each tank, 34 gallons of which are considered usable. A reduced fuel load indicator is located in the filler neck of the optional installation. This indicator is used to indicate a usable fuel capacity of 24 U.S. gallons with aircraft in normal flight attitude. From the wing tanks, fuel flow is directed through a selector valve, gascolator, electric fuel pump (with by-pass) to an engine-driven fuel pump for delivery to the engine.

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, depress the fastener in the center of the cap and rotate one-quarter turn. To replace the cap depress the fastener, rotate counterclockwise one-quarter turn (until the unit clicks) then rotate clockwise one-quarter turn.

FUEL FILTERS AND DRAIN VALVES

Fuel filters are located in the outlet line of each wing fuel tank, in the firewall mounted gascolator, and in the carburetor inlet fitting. Prior to the first flight of the day, the wing tank sumps, gascolator, and wheel well sumps should be drained to check for the presence of water or sediment in the fuel system. If water is found in the gascolator, there is a possibility that the wing tank sumps or the wheel well sumps may contain water. Therefore, the wing tank sumps and wheel well sumps should be redrained as necessary. For fuel system servicing information, refer to Servicing.

FUEL SELECTOR VALVE

A five-position fuel selector valve (see Figure 7-6) is installed in the aft section of the center console. The valve handle controls selection of: OFF, LEFT tank, BOTH tanks, RIGHT tank and a second OFF position.

AUXILIARY FUEL PUMP

The electric auxiliary fuel pump is located on the forward side of the firewall, and is controlled by a two-position rocker switch labeled FUEL PUMP in the row of accessory electrical switches. The auxiliary fuel pump is used as a primer during engine start; to supply fuel pressure to the engine in the event of engine-driven fuel pump failure; and to suppress fuel vapor at altitudes above 10,000 feet. For further Fuel System information refer to the Maintenance Manual.

ENGINE PRIMER SYSTEM

The engine primer system consists of an electrically operated solenoid valve and tubes connecting the auxiliary fuel pump directly to number 1, 2 and 3 cylinders. Fuel pressure from the auxiliary fuel pump is utilized to introduce fuel directly into the cylinders. The solenoid valve is located adjacent to the auxiliary fuel pump on the left forward side of the engine firewall, and is controlled by a push button switch labeled PUSH TO PRIME which is located on the center console adjacent to the engine controls. Depressing the primer switch opens the solenoid valve and energizes the auxiliary fuel pump.

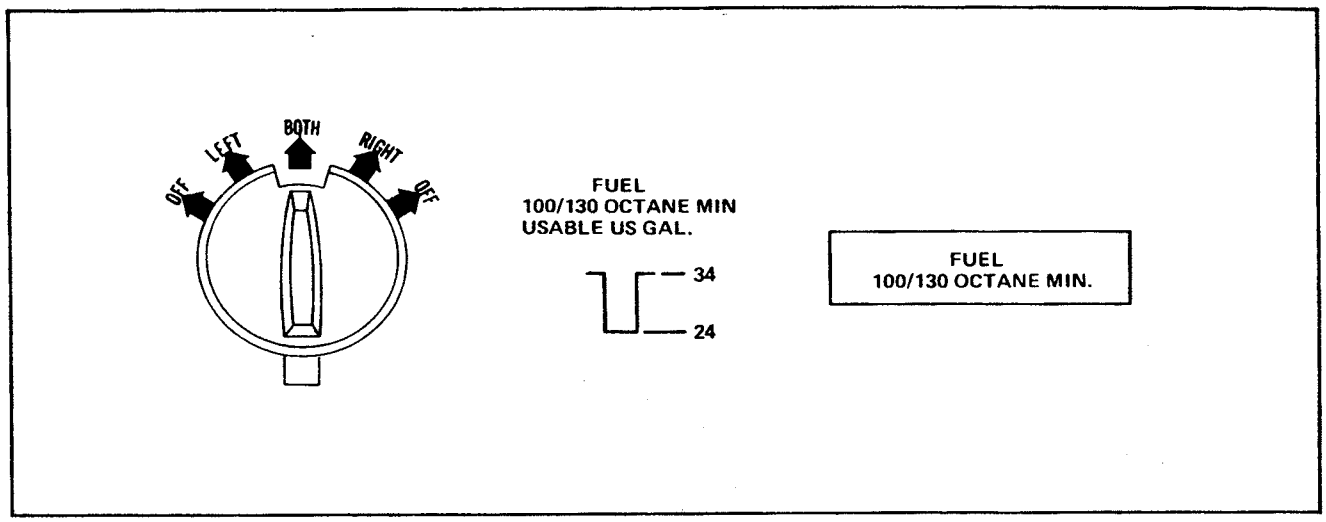


Figure 7-6. Fuel Selector Valve and Fuel Tank Placard

FUEL MANAGEMENT

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

FUEL CONTAMINATION

To avoid fuel contamination, always service the aircraft from fuel facilities that utilize proper filter systems to remove impurities and water accumulations from the bulk fuel. If filtering facilities are not available, filter the fuel through a quality grade chamois. Fuel tanks should be serviced after the last flight of each day to reduce condensation and allow any entrapped water accumulations to settle to the fuel system drains prior to the next flight. Prior to the first flight of the day, the wing tank sumps, gascolator, and wheel well sumps 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 flush vent scoops located on the lower outboard wing surfaces and a vent port located under the center fuselage. These vents must be free of obstructions and should be checked prior to the first flight of the day. Should a vent become obstructed it could result in fuel starvation of the engine, and possible engine stoppage.

FUEL QUANTITY INDICATORS

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

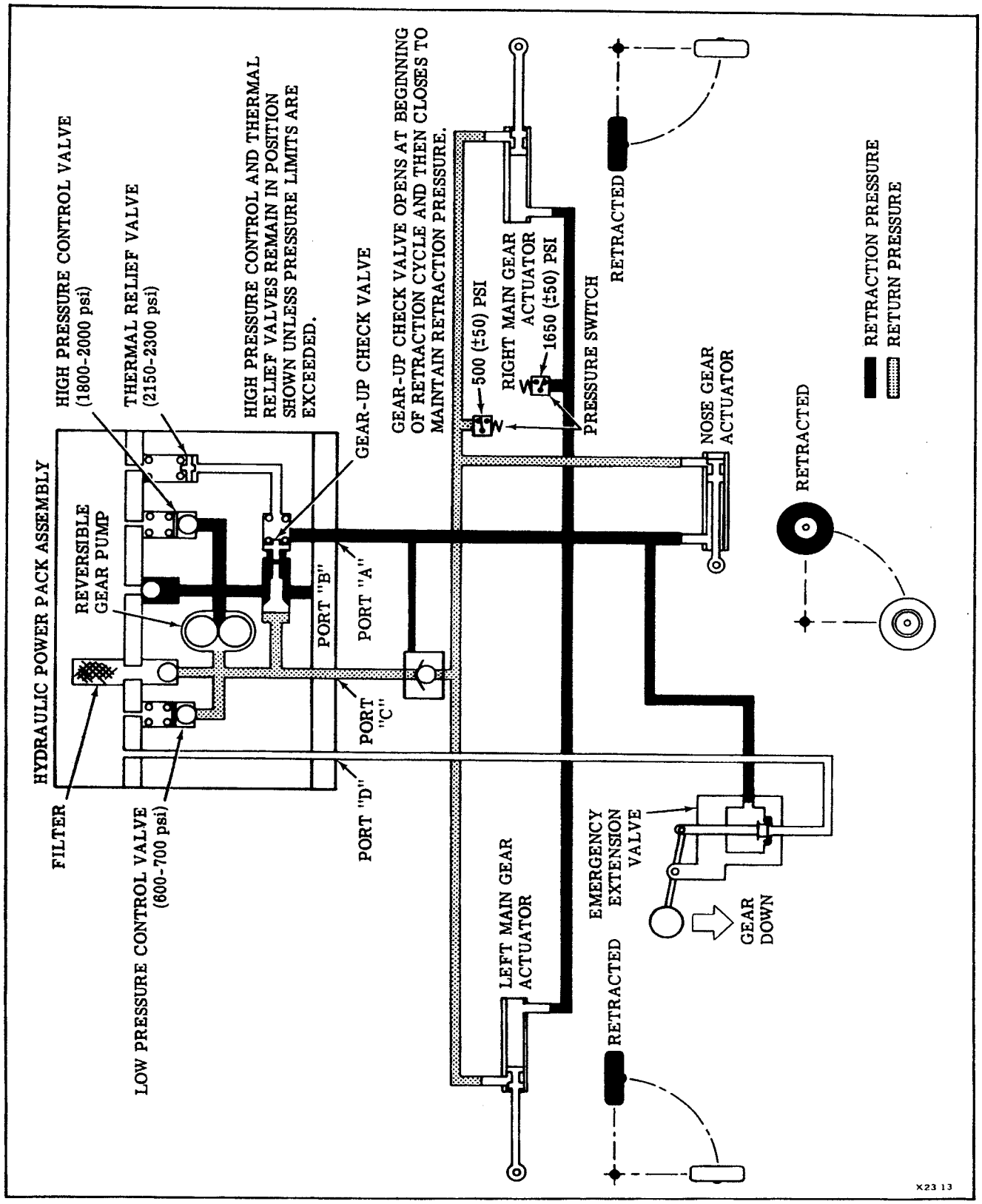


Figure 7-7. Hydraulic System Schematic (Gear Retracted)

WARNING

Fuel gages do not indicate fuel levels above 27 gallons. During preflight, visually check fuel levels in each tank to get an accurate assessment of actual fuel load.

HYDRAULIC SYSTEM

LANDING GEAR EXTENSION/RETRACTION SYSTEM

Refer to Figure 7-7. The hydraulic power supply is an integrated pack containing a reversible electric motor-driven hydraulic pump, reservoir, pressure control valves, thermal relief valve and a gear up check valve. The power pack is located in the left forward area of the fuselage tailcone. A landing gear selector switch, mounted on the instrument panel, controls the direction of fluid flow from the pump to permit gear retraction or extension. A hydraulic manifold serves as the mounting base for attaching the power pack to the airframe. When the landing gear selector switch is placed in the UP position, pressurized hydraulic fluid is directed through the manifold to the actuators. Fluid on the opposite side of the cylinder piston flows back through the manifold into the power pack. When all three gears are retracted, the pump is shutoff and the gears are held up by a hydraulic lock. The hydraulic pressure switch controls the pump by removing power to the pump when the pressure reaches 1650 (± 50) psi. A loss of hydraulic pressure is sensed by the pressure switch and turns on the power pack to build up additional pressure. When the landing gear selector switch is placed in the DOWN position, pressurized hydraulic fluid is directed through the hydraulic manifold to the down side of the actuator cylinders. When the gear are all down and locked (drag brace over center) the power pack is turned off by a gear down pressure switch set at 500 (± 50) psi. Hydraulic pressure is maintained in the gear down system by a check valve. The emergency dump valve bypasses fluid from the up side of the hydraulic actuators (which form the hydraulic uplock) directly to the reservoir; the gears then drop by gravity, assisted by down springs. With the emergency dump valve in the down position, the gear will not retract because the pressure is being relieved through the dump valve back to the reservoir and not to the hydraulic cylinders.

POSITION INDICATOR LIGHTS AND GEAR WARNING LIGHT

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

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

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

LANDING GEAR SELECTOR SWITCH

The wheel-shaped landing gear selector switch 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 to UP. After the gear handle is placed in the desired position, hydraulic pressure is directed within the gear system to retract or extend the gear to the position selected. Gear DOWN is indicated by illumination of the three (green) gear-down indicator lights, and absence of the gear warning bell and GEAR WARN light. Gear UP is indicated by the GEAR WARN light being out. If a position indicator light fails to illuminate, check bulb condition by pressing to test. A burned out bulb may be replaced in flight with the bulb from the magnetic compass.

GEAR DOWN GROUND CONTACT (SQUAT) SWITCH

The gear down ground contact (squat) switch is located on the right main landing gear trunnion. This switch is adjusted so that the switch is actuated within the last quarter of an inch of gear extension. The function of the gear down contact (squat) switch is to prevent inadvertent retraction of the landing gear when aircraft is on the ground.

EMERGENCY GEAR EXTENSION SYSTEM

An emergency gear extension system is provided for use in the event of a total hydraulic or electrical system failure. A red emergency gear extension knob, located in the forward left side of the center console, actuates an emergency extension valve. The valve relieves the hydraulic pressure in the landing gear up line, allowing gravity, assisted by a spring, to extend the gear.

BRAKE SYSTEM

HYDRAULIC BRAKE SYSTEM

The two main wheels are equipped with self-adjusting, single-disc, dual piston hydraulic brakes which are actuated by individual master cylinders attached to the pilot and copilot rudder pedals. A brake fluid reservoir, located in the engine compartment, supplies system fluid to both pilot and copilot master cylinders. The brakes are actuated by applying pressure to the tops of the rudder pedals.

PARKING BRAKE SYSTEM

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

ELECTRICAL SYSTEM

Electrical power is supplied by a 12-volt, direct-current system powered by an engine-driven alternator. The 12-volt battery is located in the aft tailcone structure and is accessible through the baggage compartment. Electrical power is supplied to all accessory circuits through a bus bar. Wiring and circuit breaker provisions are provided to accommodate optional communications and navigational equipment. Alternator capacity is limited to 60 amperes.

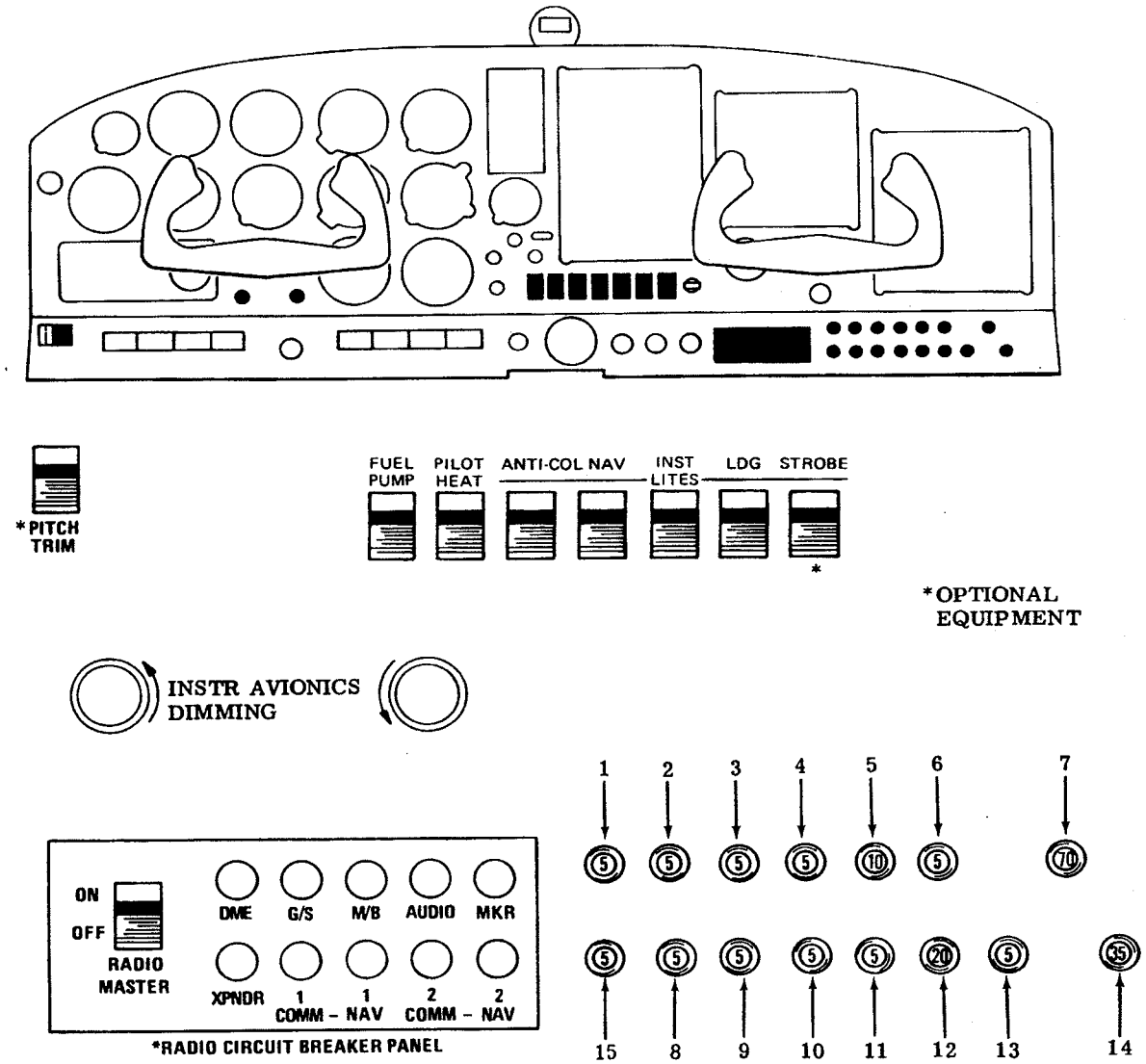
MASTER SWITCH

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

With the ALT side turned OFF, the entire electrical load is placed on the battery; therefore, all non-essential electrical equipment should be turned off.

AMMETER

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



1. COURTESY & OVERHEAD LIGHTS
2. STALL WARNING HORN
3. CYLINDER HEAD TEMPERATURE
4. OIL TEMPERATURE IND.
5. STARTER
6. ALTERNATOR FIELD
7. ALTERNATOR OUTPUT
8. LEFT FUEL QUANTITY IND. VOLTMETER
9. RIGHT FUEL QUANTITY IND.
10. TURN COORDINATOR
11. FLAP POSITION INDICATOR
12. WING FLAP MOTOR
13. LANDING GEAR SELECTOR LANDING GEAR WARNING HORN
14. LANDING GEAR ACTUATOR HYDRAULIC POWER PACK
15. CARBURETOR AIR TEMPERATURE GAGE

Figure 7-8. Circuit Breaker and Switches

VOLTMETER

A voltmeter, located in the lower left instrument sub-panel, allows the pilot to monitor bus bar voltage. See Section III for details concerning over-charging or insufficient voltage problems. Maximum allowable voltage is indicated by a red radial at 16.0 volts.

CIRCUIT BREAKERS

Push-to-reset, push-pull, or rocker switch circuit breakers are used to protect all electrical circuits in the aircraft.

The main circuit breaker panel is contained within the lower right instrument sub-panel (see Figure 7-8). All general system and avionics circuit breakers contained in this panel are the push-to-reset type. All accessory lighting equipment, pitot heat and the auxiliary fuel pump circuits are protected by circuit breakers built directly into the back of the individual rocker switch. Ammeters, cigarette lighter and primer circuits are protected by fuses. A convenience circuit breaker is installed near the battery for overhead reading light, electric clock, baggage compartment light, and step lights circuits. See Airplane Maintenance Manual for details on circuits and their protection.

ALTERNATOR

A 14-volt, aircraft type alternator is installed on the forward lower right side of the engine. A ram air blast tube extending from the slip ring cover of the alternator to the forward engine baffle supplies cooling air to the alternator. A belt from the alternator pulley, to a pulley which is integral with the aft propeller flange, drives the alternator at 3.25 times the speed of the engine.

EXTERNAL POWER

A dc power receptacle, located aft of the battery on the left side of the fuselage, provides a means for connecting external power to the aircraft electrical system. To conserve battery life, external power should always be used for starting a cold soaked engine when ambient temperature is below 40°F or when performing maintenance requiring electrical power. Voltage setting on external power supply should not exceed 14.0 volts.

Before connecting external power to the aircraft the BATT half of the split master switch should be turned OFF, and the ALT portion of the master switch left OFF. Turn the battery switch ON to apply external power to aircraft electrical system. After the engine has started, disconnect the external power. The ALT half of the master switch should then be turned ON to allow normal electrical system charging. It is not recommended to use external power cart to charge aircraft battery. See Airplane Maintenance Manual.

LIGHTING SYSTEMS

EXTERIOR LIGHTING

The navigational lights installed on the wing tips and aft end of the tailcone are operated by the NAV LITE switch located in the accessory electrical system of the lower instrument panel. A landing light is mounted in the lower center area of the nose cowl for night operations and is controlled by the LAND LITE switch.

A unique independent set of exterior courtesy lights are provided. One light is mounted on each lower side of the aft fuselage to illuminate the baggage area and wing steps. This light system is "independent" in the sense that it can receive its power directly from the battery (without the master switch being on), and operates through a time-delay circuit to automatically turn the lights off after night boarding and deplaning operations. The left forward cabin reading light also operates off this time delay circuit. The lights are activated by a switch button on the left entrance step attach plate. Depressing the switch within the step plate activates the lights to provide approximately three minutes of illumination before the lights go off automatically. Lights can be reset if additional time is needed.

A standard anti-collision light is installed on the vertical tail. An optional anti-collision light is provided in lower fuselage. Optional strobe lights will be wing-tip mounted, and installed on the tail stinger. The strobe light installation provides superior identification lighting, as compared with conventional flashing beacon lights.

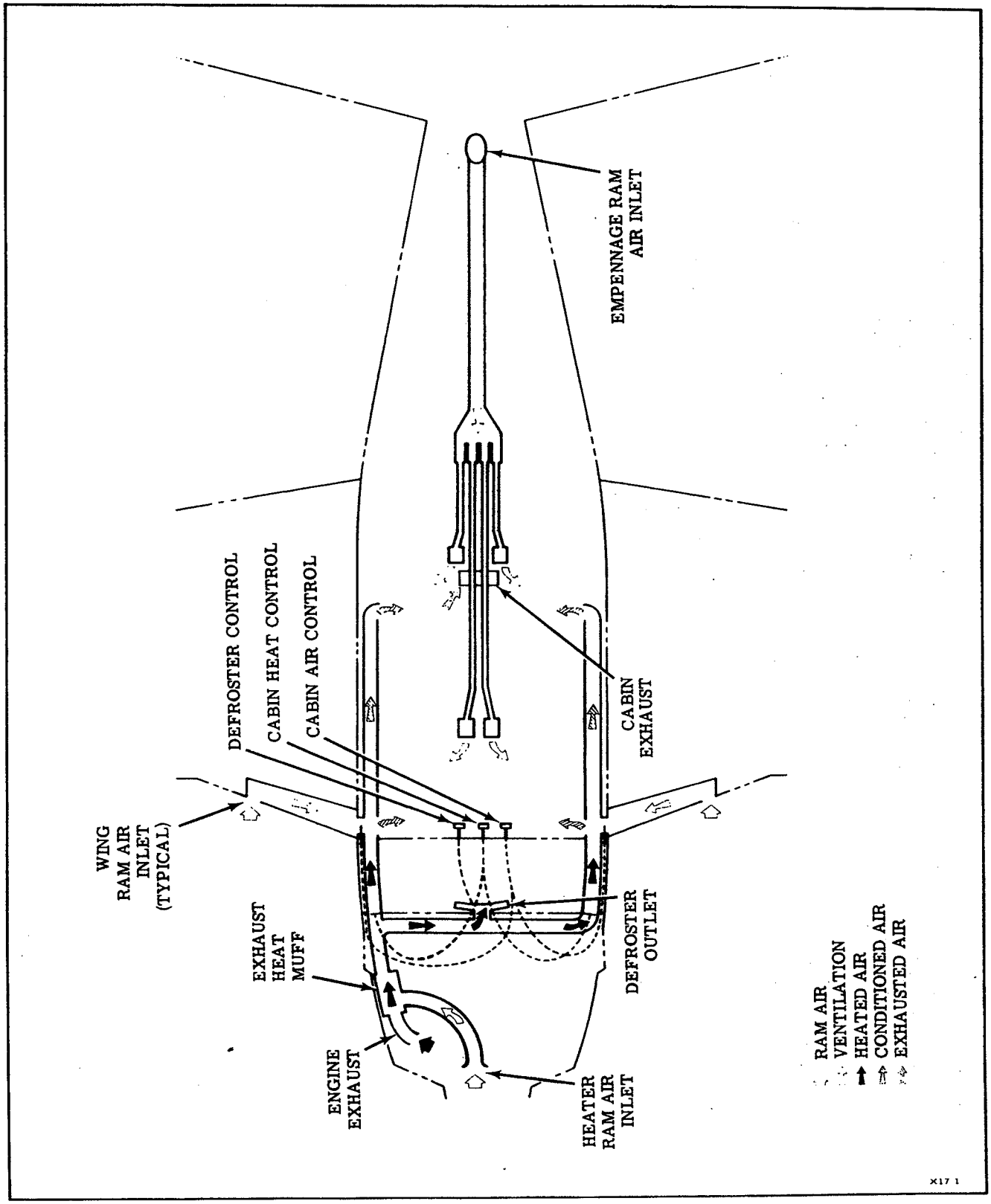


Figure 7-9. Cabin Heat and Ventilation Schematic

NOTE

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

INTERIOR LIGHTING

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

The individual reading lights are controlled by a rocker type on/off switch. Lamp bulb removal is accomplished by inserting a pencil in the lamp unit and pressing the pencil eraser on the 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. Whenever the baggage door is opened, the baggage compartment courtesy light illuminates and remains illuminated until the baggage door is closed. Lamp bulb replacement access in this unit is gained by carefully prying off the translucent lens cover.

A map light is installed on the bottom edge of the pilot's control wheel to provide convenient chart illumination during night operation. The light is turned on and off by a slide-type switch on the under side of the control wheel. Move left for off and right for on.

Instrument panel illumination is provided by blue-white flood light units installed on the under side of the glareshield. The magnetic compass and radio installations contain integral lighting. Instrument panel lighting intensity is controlled by a rheostat control knob labeled INSTR: radio and engine instrument light intensity is controlled by a second rheostat knob labeled AVIONICS. Rotating either rheostat control clockwise will increase light intensity. Both rheostat controls are located on the instrument panel directly below the pilot's control column. In addition to flood lights, some instruments are integrally lighted or lighted by post lights.

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, located within the nose cowl landing light housing, an exhaust shroud to heat the incoming air, and three (3) air box assemblies to direct heated air to two (2) windshield defroster outlets or four cabin floor side outlets for interior heating.

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

Two separate systems provide maximum air intake for cabin ventilation. The four individually adjustable outlets in the overhead console utilize an intake in the vertical fin leading edge. The second system utilizes one intake in the inboard leading edge of each wing to supply four adjustable outlets at cabin floor level. Ventilation airflow is controlled by a knob labeled VENT, located adjacent to the CABIN HEAT and DEFROSTER controls. Pulling knob to full extension provides maximum ventilation airflow.

SECTION VIII

HANDLING, SERVICING AND MAINTENANCE

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INTRODUCTION

Some general procedures covering ground handling, servicing, and lubrication should be included in the pilots general knowledge of his aircraft. Those procedures most likely to be encountered or accomplished by a pilot are included in this section. Adherence to the procedures outlined in this section can save many hours of maintenance and down time.

It is recommended that service or maintenance required on the aircraft, that cannot be accomplished by a certificated pilot, be taken to an authorized Rockwell Commander Aircraft Dealer or certified service station. Your authorized dealer will have available all service publications and FAA Airworthiness Directives pertaining to your aircraft, as well as trained personnel, thus ensuring maximum utility and safety from your aircraft.

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

To ensure a prompt reply, and correct information from Rockwell International, General Aviation Division, Customer Service Department, it is important to include the aircraft serial number in any correspondence concerning service or maintenance on this aircraft. The serial number appears on the General Aviation Manufacturers Association Plate attached to the left side of the ventral fin adjacent to the tailcone tie-down ring.

PUBLICATIONS

The General Aviation Division of Rockwell International delivers with each aircraft a Maintenance Manual and an FAA Approved Pilot's Operating Handbook. All revisions to the initially furnished Pilot's Operating Handbook and Maintenance Manual will be provided to the aircraft owner. The aircraft owner will also receive, on a continuing basis, Service Releases (which include Service Bulletins, Service Letters, Service Information and Custom Kit Sales Sheets). An Illustrated Parts Catalog may be purchased from Rockwell International, General Aviation Division, and once purchased, subsequent revisions will be furnished.

NOTE

It is the responsibility of the aircraft owner, upon receipt of his aircraft, to notify the General Aviation Division Publications Department, in writing, his complete mailing address and any subsequent changes thereto.

Change of address cards are provided in all copies of technical manuals, and a "Publication Change Request" form is also provided in all copies of technical manuals for the purpose of recommending 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 CERTIFIED PILOT

Those items of maintenance which may be performed by a certificated pilot are listed in Part 43 of Federal Aviation Regulations. Before attempting to perform any maintenance refer to Part 43. All other maintenance must be performed by properly licensed personnel.

NOTE

All maintenance must be accomplished in accord with current Maintenance Manual.

ALTERATIONS OR REPAIRS TO AIRCRAFT

All alterations or repairs to aircraft must be accomplished by licensed personnel. The FAA should be contacted prior to any unapproved alterations on the airplane to ensure the airworthiness of the airplane is not inadvertently violated.

GROUND HANDLING

PRECAUTIONS

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

1. Do not use parking brake to hold unattended aircraft.
2. Do not set parking brake 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 aircraft into the wind and chock wheels.
   b. Remove all control locks.
   c. All personnel, work stands, and equipment shall be clear of danger areas.
   d. Set Parking Brake.
   e. Position nose wheel straight ahead and hold rudder pedals in neutral position when operating engine at high power.
   f. Perform engine ground runup in clear area to prevent foreign object damage to engine and propeller.

TOWING

Movement of the aircraft on the ground may be accomplished by the following methods:

1. Pulling and guiding with nose gear tow bar. The nose wheel may be turned a maximum of 30 degrees to the left or right of center. Nose wheel tow limits must be strictly observed to prevent nose gear damage.
2. Rotating aircraft overcenter on main landing gear to clear nose gear of ground and towing backwards. The main wheels are near the center of balance, and two men can lower the tail and move the aircraft with little effort.
3. Attaching rope harness to main landing gear. This method is to be used when towing aircraft forward through snow and over soft or muddy ground. Use tow bar to steer aircraft.

TOWING PRECAUTIONS

1. Never push, pull, or lift aircraft by use of control surfaces.
2. Never use nose gear strut body or tail cone tie-down ring as an attach point for towing.
3. Never place undue strain on aircraft when towing, and avoid jerky motions.
4. Do not use ropes attached to main gear for towing aircraft backward through mud or snow.

PARKING

Head aircraft into wind and set parking brake. Do not set parking brake if brakes are overheated or if brakes are wet and ambient air is 32°F (0°C) or less as there is a possibility of moisture accumulation freezing brake assembly. Close cowl flaps, install internal control lock, place chocks under wheels, and release parking brake.

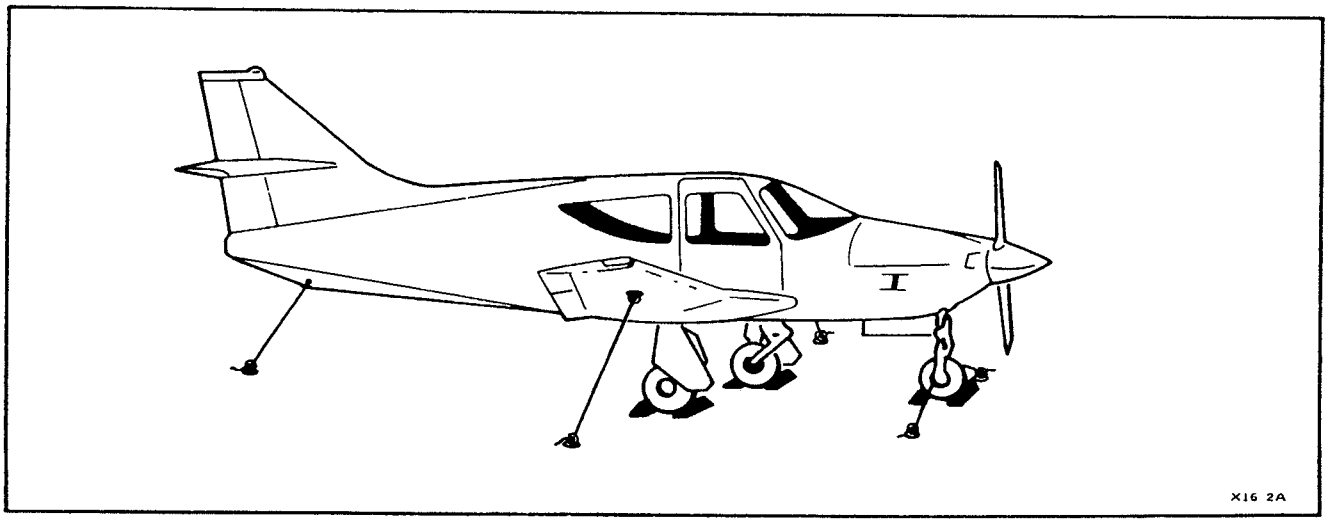

Figure 8-1. Mooring

MOORING

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

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

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

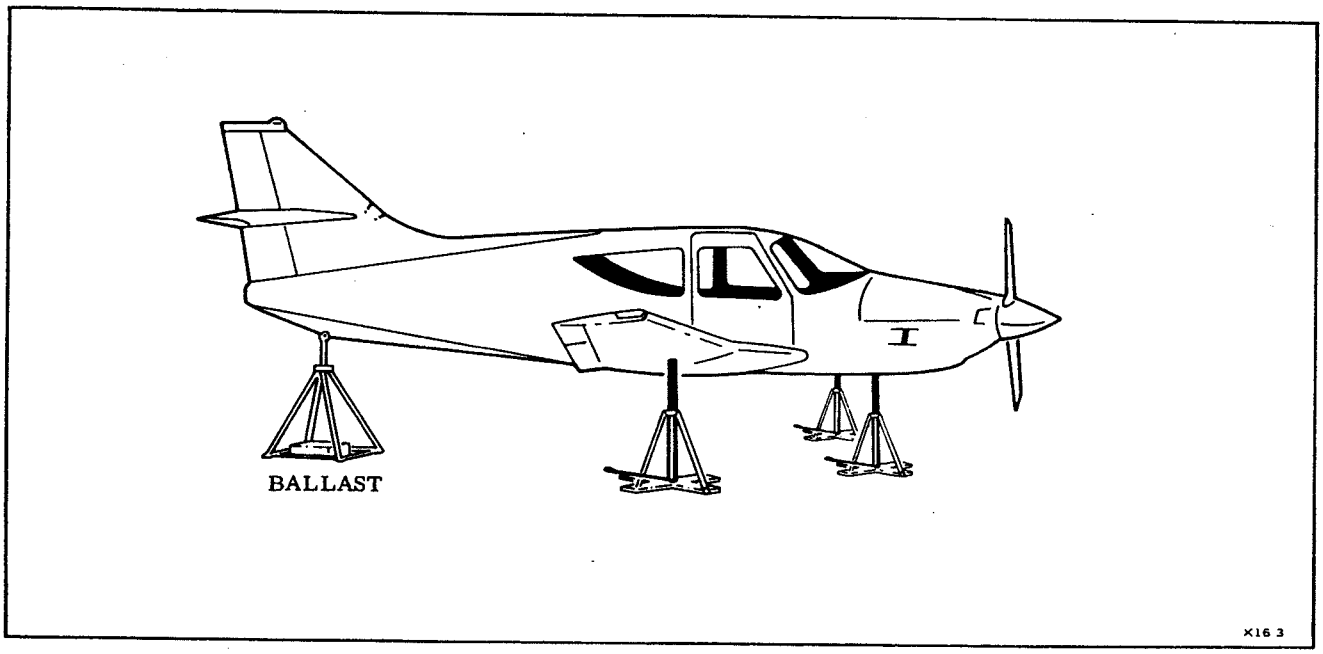

Figure 8-2. Jacking

JACKING

Aircraft jacking should be accomplished in a hangar unless wind is calm. To jack the aircraft for landing gear maintenance, etc., refer to Figure 8-2 and proceed as follows:

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

CAUTION

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

The nose gear may be raised without the use of jacks, by lowering aft fuselage and securing with weighted tail stand.

PROLONGED OUT OF SERVICE CARE

STORAGE

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

SHORT TERM (less than 28 days)

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

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

LONG TERM (more than 28 days)

When the aircraft is to be stored for periods greater than 28 days, the general steps under the period of 28 days or less, plus cleaning and polishing of the aircraft, should be followed to prepare the airframe for storage. In addition the engine must be prepared and stored in accordance with INSTALLATION AND STORAGE details contained in the Lycoming Operator's Manual. Pull convenience circuit breaker, located near battery, and reset (push) it when aircraft becomes operational.

RETURNING AIRCRAFT TO SERVICE

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

SERVICING

BATTERY

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

Check the battery electrolyte level frequently, especially during hot weather. If visual check shows low cell level, add distilled water to bring the cell(s) up to proper level. Periodic hydrometer check for proper specific gravity of electrolyte is recommended. Battery charging and specific gravity requirements are defined in the Maintenance Manual.

TIRES

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

	TIRE PRESSURE	STRUT PRESSURE
Nose Gear (5.00 x 5, 6 Ply)	50 PSI	120 PSI
Main Gear (7.00 x 6, 6 Ply)	38 PSI	405 PSI

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

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

SHOCK STRUT SERVICING

Maintain nose strut air pressure at 120 PSI and main strut pressures at 405 PSI. Check the landing gear daily for general cleanliness, security of mounting, and hydraulic leaks. Keep machined surfaces of strut piston wiped free of excessive hydraulic fluid.

ENGINE OIL SYSTEM

The oil level should be checked prior to each flight. Maintain a minimum of 6 quarts and fill to 8 quarts for extended duration flight. The oil may be changed every 100 hours of operation, provided that the filter element is changed every 50 hours. Oil that becomes dirty and contains sludge deposits should be changed regardless of time since last oil change. When preflight check indicates low oil level, service with aviation grade engine oil as follows:

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

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

After the first 25 hours of operation, drain engine oil, clean suction and oil pressure screens and replace the filter element.

FUEL SYSTEM

The fuel tank filler caps are located on the upper outboard surface of each wing tank and contain anti-siphoning flapper valves. Do not service the aircraft with an octane rated fuel lower than 100/130 (green) or 100/130 low lead (light blue).

WARNING

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

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

TO REFUEL AIRCRAFT PROCEED AS FOLLOWS:

1. Verify battery switch OFF.
2. Verify fuel selector is in OFF position.
3. Remove filler cap and service with 100/130 (green) or 100 low lead (light blue) 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.

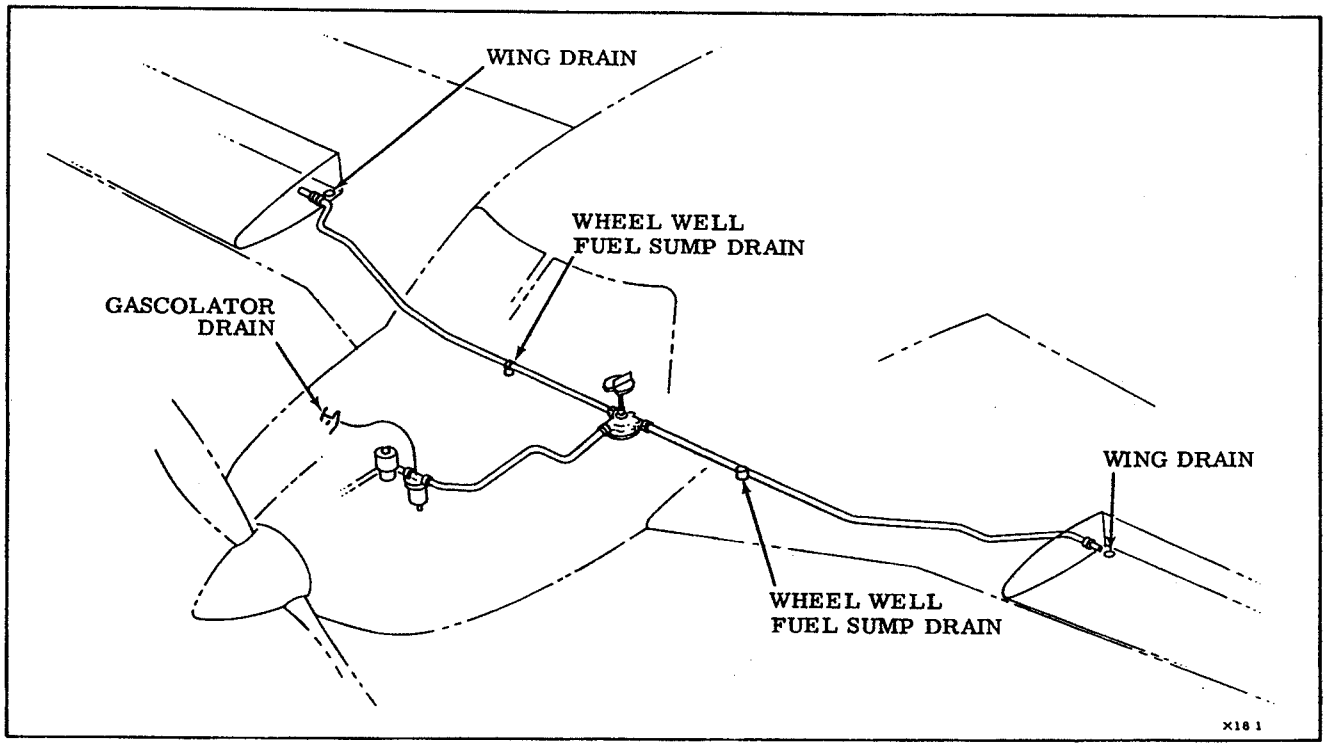

Figure 8-3. Fuel Drains

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 in the inboard underside area of each tank, using the drain cup provided.
2. Drain a fuel sample from the wing wheel well fuel sumps, using the drain cup provided.
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-5606 hydraulic fluid.

HYDRAULIC BRAKES

The hydraulic brake system utilizes two fluid reservoirs incorporated on the pilot's rudder pedal cylinders. Each reservoir contains a plastic filler plug for inspection and servicing the system with MIL-H-5606 hydraulic fluid. Before removing a filler plug, wipe the top of the master cylinders to prevent dirt from entering the brake reservoir. Reservoir level should be maintained to the bottom of the filler plug opening. The co-pilot's brakes are hydraulically interconnected to the pilot's master cylinders. If bleeding of brakes is required, refer to the Maintenance Manual.

LUBRICATION - See Figure 8-4.

AIRCRAFT FINISH CARE

Exterior Cleaning - Climate and operating conditions will determine the extent and frequency of cleaning required. Frequent washing when operating near salt water areas will help to minimize corrosion. Prior to cleaning the exterior of the aircraft cover the wheels, making certain the brake discs are covered. Securely install plugs or mask off all openings. Be particularly careful to mask off both static air sources before washing or waxing. Do not apply wax or polish to the exterior surface of the aircraft for a period of 90 days after delivery, as waxes and polishes seal the paint from the air and prevent curing. If it is necessary to clean the painted surfaces before the expiration of the 90-day curing period, use cold or luke warm water and a mild soap. Never use hot water or detergents. Any rubbing of the painted surface should be gentle and held to a minimum to avoid damaging the paint film. Use a mild commercial soap to wash the aircraft and rinse with clean water. Loose dirt should be flushed away with clean water before soap is applied. Harsh or abrasive soaps or detergents may cause corrosion or scratches and should never be used. Soft cleaning clothes or a chamois should be used to prevent scratches when cleaning and polishing. The exterior surfaces may be waxed with a quality grade automotive paste wax after allowing adequate curing time.

The windshield and cabin side windows are made from plastic; therefore, care must be exercised when servicing the aircraft to prevent scratching or otherwise damaging the window surfaces. The windshield and cabin windows may be cleaned by carefully washing with a mild commercial soap and clean water.

CAUTION

Do not use gasoline, alcohol, benzene, acetone, methyl-ethyl-ketone, carbon tetrachloride, deicer fluids or glass cleaning compounds on plastic surfaces as they will soften the plastic and cause crazing.

APPLICATION SYMBOL	SPECIFICATIONS AND TYPE OF LUBRICATION
HAND PACK	MIL-G-81322 AIRCRAFT GREASE MIL-G-23827 AIRCRAFT GREASE (Top of nose gear trunnion only)
(HF) CLOTH WIPE	MIL-H-5606 HYDRAULIC FLUID
OIL CAN	MIL-L-7870 LOW TEMPERATURE GENERAL PURPOSE LUBRICATING OIL.
	MIL-G-81322 AIRCRAFT GREASE
	50 HRS. / 100 HRS. / AS REQD

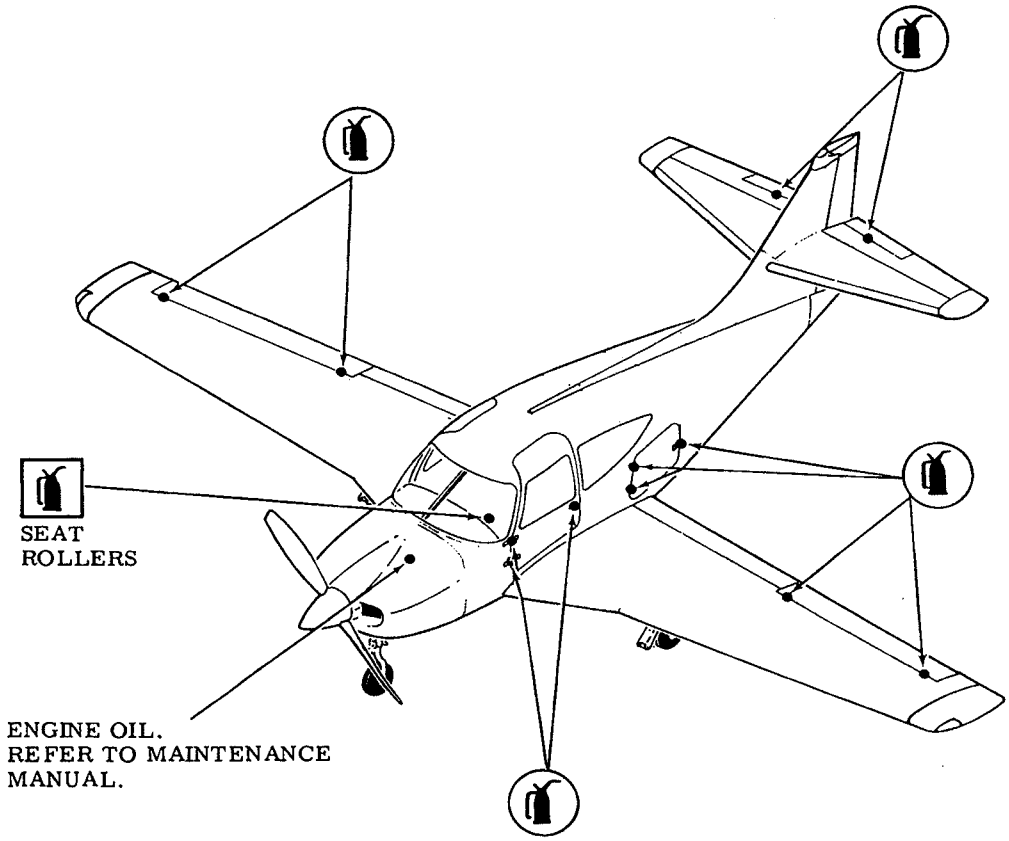

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Figure 8-4. Lubrication Chart (Sheet 1 of 2)

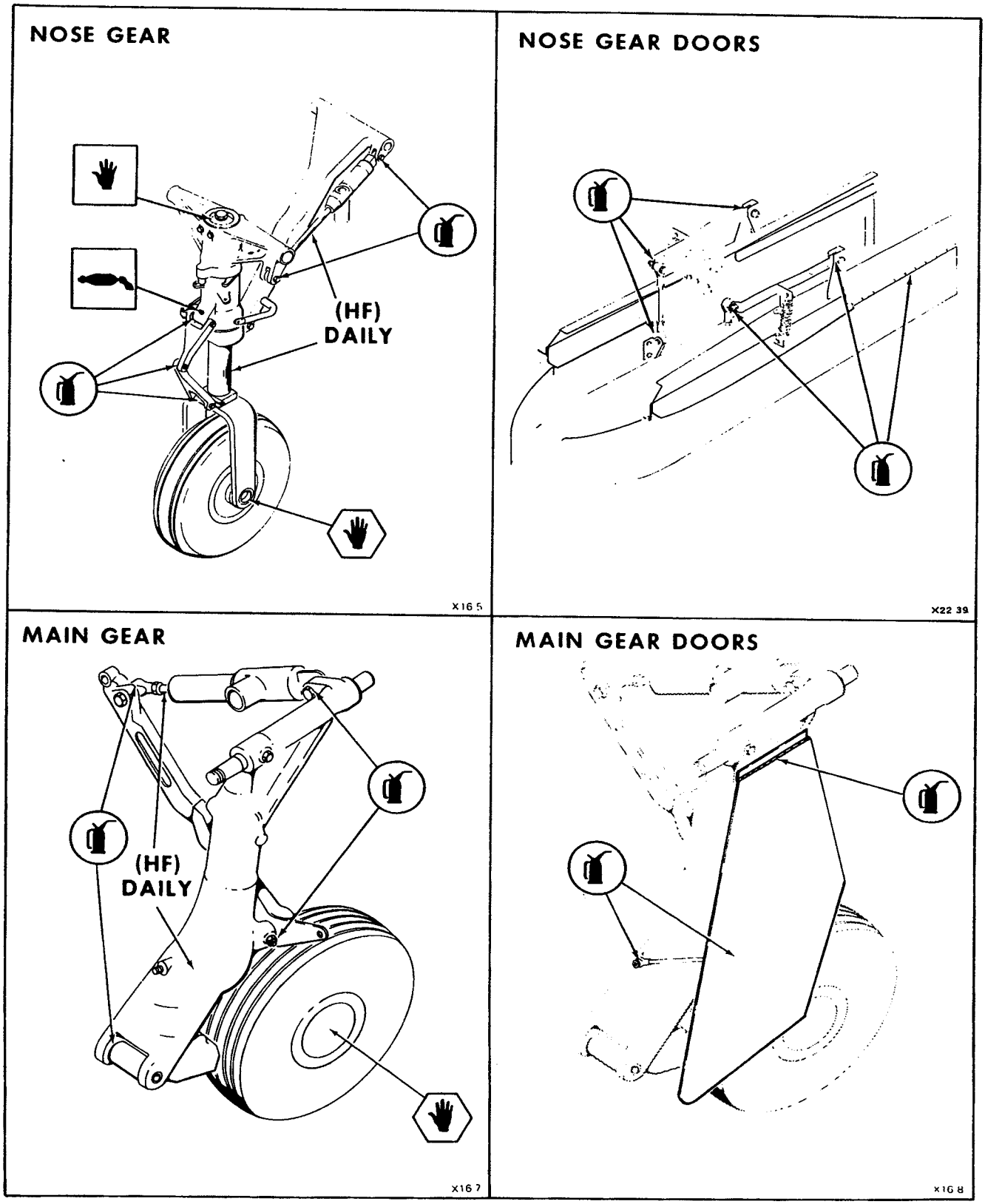

Figure 8-4. Lubrication Chart (Heet 2 of 2)

Avoid rubbing the plastic surface with a dry cloth since this can cause scratches and build up an electric static charge that will attract dust particles. If scratches are visible after removing dirt accumulations, finish the plastic with a quality grade of commercial wax. Apply wax in a thin even coat and carefully buff out with a soft cloth. Do not buff or polish in one area for more than a brief period of time; heat generated by rubbing the surface may soften the plastic and produce visual distortion.

ENGINE CLEANING

Engine and cowling may be cleaned with any standard engine solvent approved for this purpose. Prior to cleaning engine, cover all openings to prevent solvent from entering engine. Spray or brush solvent over engine and wipe dry. Blow excess cleaning solution from engine with compressed air.

CAUTION

Do not allow commercial cleaning solvents to enter magnetos, starter, alternator or any primary component housing. Protect engine components by wrapping in suitable plastic or otherwise covering areas to prevent solvent contact.

LANDING GEAR AND WHEEL WELLS

Clean landing gear and wheel wells with a compound containing an emulsifying agent to remove oil, grease, and surface dirt. The emulsion is removed by rinsing with water or spraying with a petroleum solvent. Cover the wheel and brake during landing gear and wheel well cleaning. If a water rinse is used in cold weather, blow all water from wheel well with an air hose, to prevent freezing. Emulsion type cleaners usually contain solvents which are injurious to rubber if allowed to remain in contact for any length of time; therefore, rinse affected area immediately with water. After cleaning landing gear, wipe exposed strut piston with a clean cloth moistened with MIL-H-5606 hydraulic fluid. To clean tires, rinse with water and scrub with a brush. Tire surface may be brightened after washing by rubbing with glycerene or applying a brush coat of commercial tire paint.

NOTE

Assure that ground contact (squat) switch and all landing gear limit switches are dry prior to flight.

PROPELLER

Check propeller blades and hub periodically for oxidation, corrosion, cracks and nicks. Brush oxidized or corroded area with a phosphating agent to remove superficial corrosion, then remove etched and pitted area by buffing smooth with an aluminum polish. Small nicks, particularly near the prop tips and on the leading edges, should be dressed out as soon as practical since these nicks can produce stress concentration.

NOTE

Any repairs of metal propellers involves evaluating the damage and determining whether the repair will be a major or minor one. Federal Aviation Regulations, Part 43 (FAR 43) defines major and minor repairs and alterations and who may accomplish them. Federal Aviation Regulations and the Hartzell manufacturer's instructions must be observed.

Never use an alkaline cleaner on the propeller blade surfaces. Remove dirt with a petroleum base solvent. After cleaning, wiping propeller blades and hubs occasionally with an oily cloth to clean off stains, will assure long trouble-free operation. When cleaning propeller, take the following precautions:

a. Check that ignition switch is OFF.
b. Make sure engine has cooled completely.
c. When moving propeller, do not stand in line of blades.
d. Avoid using excessive amounts of liquid cleaner as it may splatter or run down blade and enter propeller hub or engine.
e. After cleaning, check area around propeller hub to be sure all cleaning solution is removed.

INTERIOR CLEANING

Seats, rugs, upholstery panels, and instrument panels should be vacuumed frequently to remove surface dust. Spots and stains should be removed with products specifically manufactured for this purpose. Clean the aircraft interior with commercial cleaning compounds designated for plastic, vinyls and rug materials. Such products can be purchased locally. Do not use water to clean fabric surfaces, since it will spot upholstery and remove the flame-resistant chemical impregnated in the cloth. Before applying any cleaner, carefully read the directions and test the cleaner on an obscure piece of material to check its compatibility and cleaning reaction.

SECTION IX

SUPPLEMENTS

LOG OF SUPPLEMENTS

Supplement No.	Title	FAA Approved	Date
1	Puritan "Altitude Traveler" Portable Oxygen System (Pages 1 of 4 thru 4 of 4)	Larry L. McHughes DEL OP PC-203	12/6/76
2	Emergency Locator Transmitter (ELT) (SHARC 7H-2A and SHARC 7K) (Pages 1 of 2 and 2 of 2)	Larry L. McHughes DEL OP PC-203	12/6/76
3	Winterization Kit (Pages 1 of 2 thru 2 of 2)	Larry L. McHughes DEL OP PC-203	6/17/77

LOG OF REVISIONS TO SUPPLEMENTS

Revision Number	Revised Supplement Number	Description of Revision	FAA Approved	Date

SUPPLEMENT 1

PURITAN "ALTITUDE TRAVELER" PORTABLE OXYGEN SYSTEM

SECTION I

GENERAL

The purpose of this Pilot's Operating Handbook Supplement is to provide additional information appropriate to the operation of the Puritan "Altitude Traveler" Portable Oxygen System. When an aircraft is equipped with the Puritan Portable Oxygen System, this Supplement must be included in the Pilot's Operating Handbook.

DESCRIPTION

The Puritan "Altitude Traveler" Portable Oxygen System consists of 1800 PSI oxygen cylinder, a manual regulator, four oxygen outlets, four oxygen masks and hoses and a protective carrying case. The manual regulator provides a means of varying the oxygen flow rate, thus giving the system a wide selection of operating altitudes. The system meets the flow rate requirements set forth in FAR 23.1443 and is authorized for use at altitudes up to 30,000 feet. The oxygen system is installed in the center of the rear seat and is easily removable for servicing.

To operate the system, the manual regulator should be adjusted to the altitude range bracketing the intended operating altitude. Plug in the number of oxygen masks desired, verify that there is flow to each mask by noting that the oxygen flow indicators, located in each delivery hose, have changed from Red to Green, place the mask over the nose and mouth, adjust the retaining strap and breath normally. Never plug in more masks than are necessary as this will result in a needless use of oxygen. Any time a flight altitude change is made, a readjustment of the manual regulator may be necessary to assure that its altitude range brackets the newly selected flight altitude. If this is not accomplished, inadequate flow rates would result if the flight altitude selected is higher than the altitude range selected on the manual regulator, while excessive and wasteful flow rates would result if the flight altitude selected is lower than the altitude range selected on the manual controller. An emergency position is available on the manual regulator. When this position is selected, an oxygen flow rate of 6 liters per minute at Sea Level is established.

Oxygen duration is a function of the manual regulator setting and the number of occupants utilizing the system. The following table depicts that relationship.

Altitude Setting on Regulator	NUMBER OF MASKS IN USE			
	1	2	3	4
8 - 12	6:10	2:50	1:56	1:30
12 - 16	4:56	2:28	1:35	1:08
16 - 20	3:53	1:50	1:16	0:54
20 - 25	3:06	1:30	0:58	0:42
25 - 30	2:30	1:12	0:48	0:36

OXYGEN DURATION - HOURS:MINUTES

NOTE: The above chart is based on 1800 PSI, starting at noted altitude.

The oxygen duration chart only shows average durations and assumes that the oxygen bottle has been filled to maximum capacity prior to use. As these durations are approximate, it is advisable to periodically check the oxygen level to preclude the possibility of unexpectedly exhausting the oxygen supply. It is also advisable to periodically check the oxygen flow indicators to each mask to assure that each occupant utilizing the system is receiving oxygen. Should the oxygen supply become exhausted or should the flow to any mask cease (and flow cannot be restored), a descent should be made immediately to an altitude that would not require the use of supplemental oxygen.

Oxygen capacity is a direct function of oxygen bottle pressure. 1800 psi at 70°F represents a fully charged bottle, while 75% capacity represents 1350 psi, 50% capacity represents 900 psi and 25% capacity represents 450 psi. These pressure values vary slightly with temperature but have no significant effect on oxygen duration. For more detailed information concerning this temperature/pressure relationship and for servicing instructions refer to the "Altitude Traveler" Owner's Instruction Manual provided with each unit.

Oxygen Cylinder

Rating - 1800 PSI, steel cylinder with DOT3AA - 1800 Rating

Capacity - 22 Cubic Ft. (625 Liters) when charged to 1800 PSI at 70°F.

Oxygen

Type - Aviators Breathing Oxygen per MIL-O-27210, Type I or equivalent.

Weight

Approximate total weight of cylinder and masks - 17.5 Lbs.

SECTION II

LIMITATIONS

There are no changes to the operating limitations when this equipment is installed.

SECTION III

EMERGENCY PROCEDURES

Oxygen Flow Interruption

1. Oxygen Regulator - EMERGENCY .

If oxygen flow is re-established:

2. Oxygen Regulator - RESET TO DESIRED ALTITUDE RANGE.

If oxygen flow is not restored:

3. Descent - DESCEND TO AN ALTITUDE THAT DOES NOT REQUIRE THE USE OF SUPPLEMENTAL OXYGEN.

WARNING

The Effective Performance Time (Time of Useful Consciousness) above 15,000 Ft. varies greatly as a function of health and physical condition. An insufficient supply of oxygen can severely limit a pilot's ability to effectively fly his aircraft.

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.

SUPPLEMENT 2

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

SECTION I

GENERAL

The purpose of this Pilot's Operating Handbook Supplement is to provide additional information appropriate to the operation of the SHARC-7 Emergency Locator Transmitter (ELT). When an aircraft is equipped with a SHARC-7 Emergency Locator Transmitter, this Supplement must be included in the Pilot's Operating Handbook.

DESCRIPTION

The ELT is a self-contained battery powered transmitter. It is colored bright orange and located on the left side of the tail cone behind the aft baggage wall or on the aft mounted avionics shelf (if installed) and is accessible thru the removable panel just inside the baggage door. A placard located on the removable panel shows battery replacement date.

Its purpose is to automatically transmit a sweeping audio signal on the international distress frequencies of 121.5 MH_z with the SHARC 7K, or 121.5 MH_z and 243.0 MH_z with the SHARC 7H-2A, after being subjected to a 5 "g" deceleration for a short period of time, along the airplane line of flight. The transmitter may be controlled from the cockpit by actuation of the switch on the upper right instrument panel. With the control switch in the ARM position, the ELT is armed for transmitting when the "g" switch in the transmitter is activated. With the control switch in the ON position, signals are manually transmitted regardless of the "g" switch position.

General aviation and commercial aircraft, the FAA, and CAP monitor 121.5 MH_z. The military monitor 243.0 MH_z.

Following a crash landing, the ELT will provide line-of-sight transmission up to 100 miles at 10,000 feet.

The duration of ELT transmissions is affected by ambient temperature. At temperature of +21° to +54°C (+70 to +130°F) continuous transmission for 115 hours can be expected; a temperature of -40°C (-40°F) will shorten the duration to 70 hours.

SECTION II

LIMITATIONS

There are no changes to the operating limitations when this equipment is installed.

SECTION III

EMERGENCY PROCEDURES

Forced Landing Procedures

ELT procedures prior to a forced landing are included in Section III of the Pilots Operating Handbook for the specific emergency involved.

Immediately after a forced landing where emergency assistance is required, the ELT should be utilized as follows:

1. ENSURE ELT ACTIVATION: Turn ELT control switch, located on the upper right instrument panel, to the ON position. Turn a radio transceiver ON and select 121 MH_z. If the ELT can be heard transmitting, it 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 3

WINTERIZATION KIT

SECTION I

GENERAL

The purpose of this Pilot's Operating Handbook Supplement is to provide additional information regarding aircraft operation when the winterization kit is installed. When an aircraft is equipped with a winterization kit, this supplement must be included in the Pilot's Operating Handbook.

DESCRIPTION

Due to the direct relationship between Outside Air Temperature (OAT) and engine operating temperatures, it is not uncommon during cold weather operations for engine temperatures to fall below their normal operating ranges, especially at low altitudes and low power settings. In order to increase engine operating temperatures, a winterization kit has been developed. The winterization kit consists of blocking plates, which are inserted over a portion of each cowl flap exit area. The plates reduce the engine cooling exit area and, in doing so, decrease the flow of air that is normally processed through the engine for cooling purposes. This reduction in cooling air flow, in turn, has the effect of increasing engine operating temperatures.

The winterization kit is approved only to a "standard" (ISA) day. This is the equivalent of 59°F at sea level, 41°F at 5000 FT, 23°F at 10,000 FT, 6°F at 15,000 FT and -12°F at 20,000 FT. (For intermediate altitudes assume a 3.6°F/1000 FT lapse rate or use normal interpolation techniques.) If prolonged operations are anticipated above these temperatures, the winterization kit must be removed. The winterization kit is approved for all operations conducted at or below the above stated temperatures at their respective altitudes.

SECTION II

LIMITATIONS

1. There are no changes to the powerplant temperature limitations with the winterization kit installed.

2. Outside Air Temperature Limitation:
Winterization kit must be removed when the OAT exceeds standard (ISA) day.

NOTE

The winterization kit is approved for operations at or below a standard (ISA) day. This is the equivalent of 59°F at sea level, 41°F at 5000 FT, 23°F at 10,000 FT, 6°F at 15,000 FT and -12°F at 20,000 FT. (For intermediate altitudes assume a 3.6°F/1000 FT lapse rate or use normal interpolation techniques.) If prolonged operation is anticipated above any of these temperatures, the winterization kit must be removed.

3. Placard : AIRPLANE EQUIPPED WITH WINTERIZATION KIT. REMOVE KIT FOR OAT ABOVE ISA DAY.

SECTION III

EMERGENCY PROCEDURES

There are no changes to the Emergency Procedures Section when this equipment is installed.

SECTION IV

PREFLIGHT INSPECTION

1. Winterization Kit - Condition and Security.

Before Starting Engine

1. Cowl Flaps - CLOSED.

NOTE

Engine warm-up can be expedited if cowl flaps remain closed during taxi and run-up.

Before Takeoff

1. Cowl Flaps - FULL OPEN.

Normal Climb

1. Cowl Flaps - AS REQUIRED.

NOTE

Cylinder head and oil temperatures should be closely monitored during the climb. Cowl flaps should be used as required to maintain the temperatures within their respective limits.

Cruise

1. Cowl Flaps - CLOSED.
2. Mixture - BEST POWER AT 75% MCP.
   BEST ECONOMY AT 65% MCP AND BELOW.

NOTE

Refer to Sections II and IV for leaning limitations and procedures, respectively.

SECTION V

PERFORMANCE

There are no changes to the Performance Section when this equipment is installed.

SECTION X

SAFETY TIPS

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GENERAL

This section provides safety tips of particular value in the operation of the Model 112TCA.

ENGINE OPERATION

Abrupt throttle movement should be avoided since the throttle is linked directly to the turbocharger wastegate. During ground operation engine surging may result from rapid movement of the throttle, because of the added load on the engine from the turbocharger and the non-windmilling propeller. Taxi operations should be conducted using slow, smooth motion of the throttle to obtainthe desired taxi speed.

THROTTLE SETTING

Takeoff power should be obtained by smooth throttle movement, pausing momentarily at approximately 30 In.Hg manifold pressure to allow the turbocharger speed to increase, then increasing throttle smoothly to 40-42 In.Hg as desired. For normal takeoffs when runway length is not a factor, using 40 In.Hg will prevent unintentional overboosts. For maximum performance takeoffs, set 42 In.Hg prior to brake release and monitor manifold pressure during the takeoff; a slight reduction in throttle may be required to compensate for slightly increased manifold pressure as the airspeed increases. It is recommended that this technique be reviewed periodically in order to maintain proficiency.

ENGINE COOLING

Climb speed of 100 Kts. has been established to provide adequate engine cooling on a hot day with cowl flaps open. In cold weather it may be desirable to climb at a lower speed or close the cowl flaps in order to increase engine temperatures. In extremely cold weather engine temperatures during cruise may be low; cruising at a higher altitude and/or higher power setting will result in increased engine temperatures. Engine temperatures during prolonged descent may be very cool; idle power descents should be avoided when possible, and power used as necessary to maintain engine temperature.

MIXTURE LEANING

Full rich mixture is recommended for all operations except cruise. It is important to remember that leaning must be accomplished by reference to the Exhaust Gas Temperature gage, which measures EGT at the inlet to the turbocharger, therefore having an inherent lag not seen in ordinary EGT installations. As a result of this lag, it is necessary to make small mixture adjustments and allow enough time for the EGT to stabilize before making the next mixture adjustment. Another factor in the leaning process is a slight increase in manifold pressure as Best Power mixture is reached and a slight decrease in manifold pressure as peak EGT is approached. This is caused by changes in the mass flow through the turbocharger resulting from varying fuel/air mixture. It is normal to make a small manifold pressure adjustment with the throttle during the leaning procedure.

CARBURETOR AIR TEMPERATURE

When operating in extreme cold weather at low altitude it may be necessary to open the alternate air selector slightly to maintain carburetor air temperature above 100 degrees. This will eliminate the possibility of carburetor icing if there is moisture in the air.

ICING CONDITION

When flying IFR at high altitude, it is important to remember that icing conditions may be encountered at any time. Treat every cloud as a potential icing cloud and plan necessary diversions accordingly. Pitot heat and windshield defrost should be used as necessary.