DAKOTA INFORMATION MANUAL

Dakota

PA-28-236

HANDBOOK PART NO. 761 689

APPLICABILITY

Application of this handbook is limited to the specific Piper PA-28-236 model airplane designated by serial number and registration number on the face of the title page of this handbook.

This handbook cannot be used for operational purposes unless kept in a current status.

REVISIONS

The information compiled in the Pilot's Operating Handbook with the exception of the equipment list, will be kept current by revisions distributed to the airplane owners. The equipment list was current at the time the airplane was licensed by the manufacturer and thereafter must be maintained by the owner.

Revision material will consist of information necessary to update the text of the present handbook and/or to add information to cover added airplane equipment.

I. Revisions

Revisions will be distributed whenever necessary as complete page replacements or additions and shall be inserted into the handbook in accordance with the instructions given below:

1. Revision pages will replace only pages with the same page number.
2. Insert all additional pages in proper numerical order within each section.
3. Page numbers followed by a small letter shall be inserted in direct sequence with the same common numbered page.

II. Identification of Revised Material

Revised text and illustrations shall be indicated by a black vertical line along the outside margin of the page, opposite revised, added or deleted material. A line along the outside margin of the page opposite the page number will indicate that an entire page was added.

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GENERAL

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GENERAL

1.1 INTRODUCTION

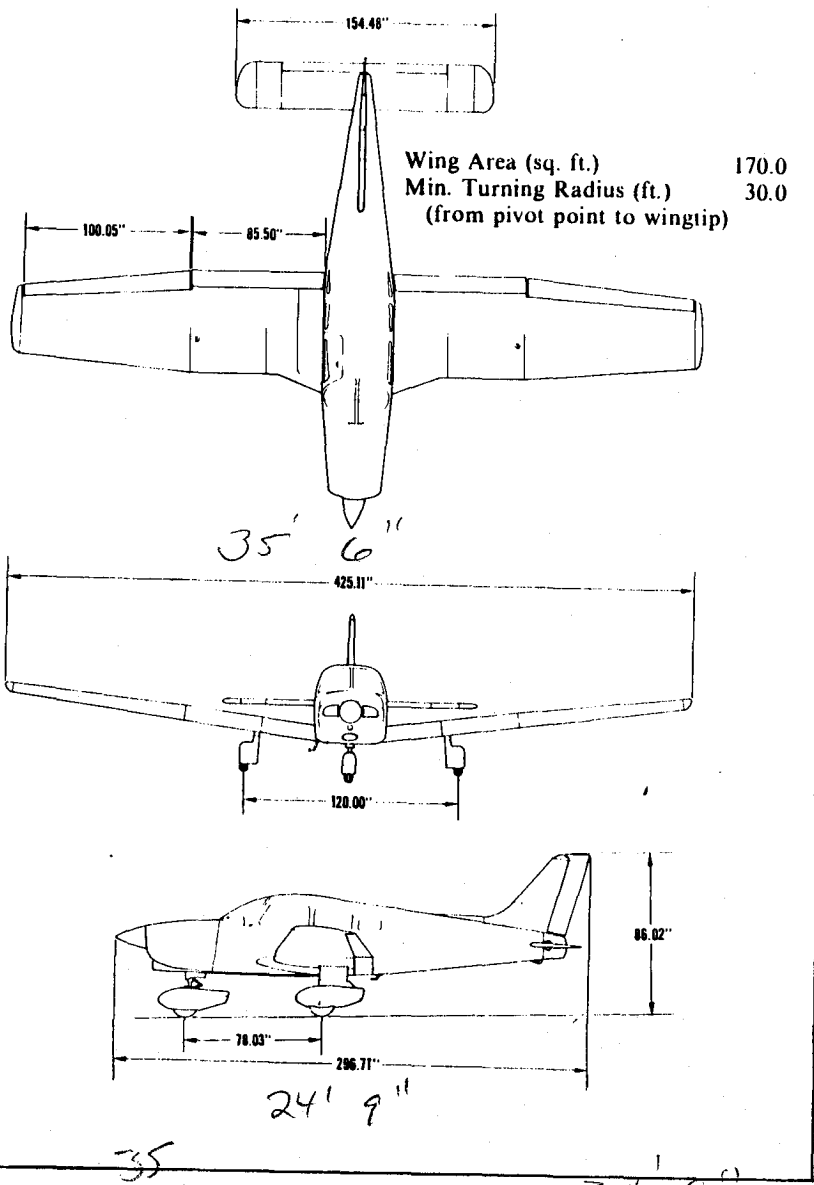
This Pilot's Operating Handbook is designed for maximum utilization as an operating guide for the pilot. It includes the material required to be furnished to the pilot by CAR 3. It also contains supplemental data supplied by the airplane manufacturer.

This handbook is not designed as a substitute for adequate and competent flight instruction, knowledge of current airworthiness directives, applicable federal air regulations or advisory circulars. It is not intended to be a guide for basic flight instruction or a training manual and should not be used for operational purposes unless kept in a current status.

Assurance that the airplane is in an airworthy condition is the responsibility of the owner. The pilot in command is responsible for determining that the airplane is safe for flight. The pilot is also responsible for remaining within the operating limitations as outlined by instrument markings, placards, and this handbook.

Although the arrangement of this handbook is intended to increase its in-flight capabilities, it should not be used solely as an occasional operating reference. The pilot should study the entire handbook to become familiar with the limitations, performance, procedures and operational handling characteristics of the airplane before flight.

The handbook has been divided into numbered (arabic) sections, each provided with a "finger-tip" tab divider for quick reference. The limitations and emergency procedures have been placed ahead of the normal procedures, performance and other sections to provide easier access to information that may be required in flight. The "Emergency Procedures" Section has been furnished with a red tab divider to present an instant reference to the section. Provisions for expansion of the handbook have been made by the deliberate omission of certain paragraph numbers, figure numbers, item numbers and pages noted as being intentionally left blank.



THREE VIEW
Figure 1-1

1.3 ENGINE

(a) Number of Engines	1
(b) Engine Manufacturer	Lycoming
(c) Engine Model Number	O-540-J3A5D
(d) Rated Horsepower	235
(e) Rated Speed (rpm)	2400
(f) Bore (in.)	5.125
(g) Stroke (in.)	4.375
(h) Displacement (cu. in.)	541.5
(i) Compression Ratio	8.5:1
(j) Engine Type	Six Cylinder, Direct Drive, Horizontally Opposed, Air Cooled

1.5 PROPELLER

(a) Number of Propellers	1
(b) Propeller Manufacturer	Hartzell
(c) Blade Model	F8468A-4R
(d) Number of Blades	2
(e) Hub Model	HC-F2YR-1( )F
(f) Propeller Diameter (in.)	
(1) Maximum	80
(2) Minimum	78
(g) Propeller Type	Constant Speed, Hydraulically Actuated

1.7 FUEL

AVGAS ONLY

(a) Fuel Capacity (U.S. gal.) (total)	77
(b) Usable Fuel (U.S. gal.) (total)	72
(c) Fuel	
(1) Minimum Grade	100 Green or 100LL Blue Aviation Grade
(2) Alternate Fuel	Refer to latest issue of Lycoming Instruction No. 1070.

1.9 OIL

(a) Oil Capacity (U.S. qts.)	12
(b) Oil Specification	Refer to latest issue of Lycoming Service Instruction 1014.
(c) Oil Viscosity	Refer to Section 8 - paragraph 8.19.

1.11 MAXIMUM WEIGHTS

(a) Maximum Ramp Weight (lbs.)	3011
(b) Maximum Takeoff Weight (lbs.)	3000
(c) Maximum Landing Weight (lbs.)	3000
(d) Maximum Weights in Baggage Compartment (lbs.)	200

1.13 STANDARD AIRPLANE WEIGHTS

Refer to Figure 6-5 for the Standard Empty Weight and the Useful Load.

1.15 BAGGAGE SPACE

(a) Compartment Volume (cu. ft.)	24
(b) Entry Width (in.)	22
(c) Entry Height (in.)	20

1.17 SPECIFIC LOADINGS

(a) Wing Loading (lbs. per sq. ft.)	17.6
(b) Power Loading (lbs. per hp)	12.8

1.19 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

The following definitions are of symbols, abbreviations and terminology used throughout the handbook and those which may be of added operational significance to the pilot.

(a) 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 standard atmosphere at sea level.
KCAS	Calibrated Airspeed expressed in "Knots."
GS	Ground Speed is the speed of an airplane 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."
M	Mach Number is the ratio of true airspeed to the speed of sound.
TAS	True Airspeed is the airspeed of an airplane relative to undisturbed air which is the CAS corrected for altitude, temperature and compressibility.
V_A	Maneuvering Speed is the maximum speed at which application of full 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_{NE}/M_{NE}	Never Exceed Speed or Mach Number is the speed limit that may not be exceeded at any time.
V_{NO}	Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air and then only with caution.
V_S	Stalling Speed or the minimum steady flight speed at which the airplane is controllable.
V_{SO}	Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration.
V_X	Best Angle-of-Climb Speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.
V_Y	Best Rate-of-Climb Speed is the airspeed which delivers the greatest gain in altitude in the shortest possible time.

(b) Meteorological Terminology

ISA	International Standard Atmosphere in which: The air is a dry perfect gas; The temperature at sea level is 15° Celsius (59° Fahrenheit); The pressure at sea level is 29.92 inches Hg (1013 mb); The temperature gradient from sea level to the altitude at which the temperature is -56.5°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, adjusted 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 of mercury (1013 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.

(c) Power Terminology

Takeoff Power	Maximum power permissible for takeoff.
Maximum Continuous Power	Maximum power permissible continuously during flight.
Maximum Climb Power	Maximum power permissible during climb.
Maximum Cruise Power	Maximum power permissible during cruise.

(d) Engine Instruments

EGT Gauge	Exhaust Gas Temperature Gauge

(e) Airplane Performance and Flight Planning Terminology

Climb Gradient	The demonstrated ratio of the change in height during a portion of a climb, to the horizontal distance traversed in the same time interval.
Demonstrated Crosswind Velocity (DEMO. X-WIND)	The demonstrated crosswind velocity is the velocity of the crosswind component for which adequate control of the airplane during takeoff and landing was actually demonstrated during certification tests.
Accelerate-Stop Distance	The distance required to accelerate an airplane to a specified speed and, assuming failure of an engine at the instant that speed is attained, to bring the airplane to a stop.
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.

(f) Weight and Balance Terminology

Reference Datum	An imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Station	A location along the airplane fuselage usually given in terms of distance in inches 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. (Moment divided by a constant is used to simplify balance calculations by reducing the number of digits.)

Center of Gravity (C.G.)	The point at 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.
Usable Fuel	Fuel available for flight planning.
Unusable Fuel	Fuel remaining after a runout test has been completed in accordance with governmental regulations.
Standard Empty Weight	Weight of a standard airplane including unusable fuel, full operating fluids and full oil.
Basic Empty Weight	Standard empty weight plus optional equipment.
Payload	Weight of occupants, cargo and baggage.
Useful Load	Difference between takeoff weight, or ramp weight if applicable, and basic empty weight.
Maximum Ramp Weight	Maximum weight approved for ground maneuver. (It includes weight of start, taxi and run up fuel.)
Maximum Takeoff Weight	Maximum weight approved for the start of the takeoff run.

Maximum Landing Weight	Maximum weight approved for the landing touchdown.
Maximum Zero Fuel Weight	Maximum weight exclusive of usable fuel.

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LIMITATIONS

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LIMITATIONS

2.1 GENERAL

This section provides the FAA Approved operating limitations, instrument markings, color coding and basic placards necessary for operation of the airplane and its systems.

This airplane must be operated as a normal category airplane in compliance with the operating limitations stated in the form of placards and markings and those given in this section and handbook.

Limitations associated with those optional systems and equipment which require handbook supplements can be found in Section 9 (Supplements).

2.3 AIRSPEED LIMITATIONS

SPEED	KIAS	KCAS
Design Maneuvering Speed (V_A) - Do not make full or abrupt control movements above this speed.		
3000 lbs.	124	122
1761 lbs.	96	94

CAUTION

Maneuvering speed decreases at lighter weight as the effects of aerodynamic forces become more pronounced. Linear interpolation may be used for intermediate gross weights. Maneuvering speed should not be exceeded while operating in rough air.

SPEED	KIAS	KCAS
Never Exceed Speed (V_{NE}) - Do not exceed this speed in any operation.	173	171
Maximum Structural Cruising Speed (V_{NO}) - Do not exceed this speed except in smooth air and then only with caution.	137	135
Maximum Flaps Extended Speed (V_{FE}) - Do not exceed this speed with the flaps extended.	102	100

2.5 AIRSPEED INDICATOR MARKINGS

MARKING	IAS
Red Radial Line (Never Exceed)	173 KTS
Yellow Arc (Caution Range - Smooth Air Only)	137 KTS to 173 KTS
Green Arc (Normal Operating Range)	65 KTS to 137 KTS
White Arc (Flap Down)	56 KTS to 102 KTS

2.7 POWER PLANT LIMITATIONS

(a) Number of Engines	1
(b) Engine Manufacturer	Lycoming
(c) Engine Model No.	O-540-J3A5D
(d) Engine Operating Limits	
(1) Maximum Horsepower	235
(2) Maximum Rotation Speed (RPM)	2400
(3) Maximum Oil Temperature	245°F
(e) Oil Pressure	
Minimum (red line)	25 PSI
Maximum (red line)	100 PSI

(f) Fuel Pressure	
Minimum (red line)	0.5 PSI
Maximum (red line)	8 PSI
(g) Fuel (AVGAS ONLY) (minimum grade)	100 or 100LL Aviation Grade
(h) Number of Propellers	1
(i) Propeller Manufacturer	Hartzell
(j) Propeller Hub and Blade Model	HC-F2YR-1 ( )F/ F8468A-4R
(k) Propeller Diameter	
Maximum	80 IN.
Minimum	78 IN.
(l) Blade Angle Limits (at 30 inch station)	
Low Pitch Stop	16.25° ± 0.25°
High Pitch Stop	32° ± 2.0°

2.9 POWER PLANT INSTRUMENT MARKINGS

(a) Tachometer	
Green Arc (Normal Operating Range)	500 to 2400 RPM
Red Line (Maximum Continuous Power)	2400 RPM
(b) Oil Temperature	
Green Arc (Normal Operating Range)	75° to 245°F
Red Line (Maximum)	245°F
(c) Oil Pressure	
Green Arc (Normal Operating Range)	60 PSI to 90 PSI
Yellow Arc (Caution Range) (Idle)	25 PSI to 60 PSI
Yellow Arc (Ground Warm-Up)	90 PSI to 100 PSI
Red Line (Minimum)	25 PSI
Red Line (Maximum)	100 PSI
(d) Fuel Pressure	
Green Arc (Normal Operating Range)	0.5 PSI to 8 PSI
Red Line (Minimum)	0.5 PSI
Red Line (Maximum)	8 PSI

2.11 WEIGHT LIMITS

(a) Maximum Ramp Weight	3011 lbs.
(b) Maximum Weight	3000 lbs.
(c) Maximum Baggage	200 lbs.

2.13 CENTER OF GRAVITY LIMITS

Weight Pounds	Forward Limit Inches Aft of Datum	Rearward Limit Inches Aft of Datum
3000	88.5	92.0
2500	82.5	92.0
1900	79.8	92.0

NOTES

Straight line variation between points given.

The datum used is 78.4 inches ahead of the wing leading edge.

It is the responsibility of the airplane owner and the pilot to insure that the airplane is properly loaded. See Section 6 (Weight and Balance) for proper loading instructions.

2.15 MANEUVER LIMITS

No acrobatic maneuvers including spins approved.

2.17 FLIGHT MANEUVERING LOAD FACTORS

(a) Positive Load Factor (Maximum)	3.8 G
(b) Negative Load Factor (Maximum)	No inverted maneuvers approved.

2.19 TYPES OF OPERATION

The airplane is approved for the following operations when equipped in accordance with FAR 91 or FAR 135.

(a) Day V.F.R.
(b) Night V.F.R.
(c) Day I.F.R.
(d) Night I.F.R.
(e) Non Icing

2.21 FUEL LIMITATIONS

(a) Total Capacity	77 U.S. GAL.
(b) Unusable Fuel The unusable fuel for this airplane has been determined as 2.5 gallons in each wing in critical flight attitudes.	5 U.S. GAL.
(c) Usable Fuel The usable fuel in this airplane has been determined as 36 gallons in each wing.	72 U.S. GAL.
(d) Fuel remaining when a quantity indicator reads zero cannot be used safely in flight.	

2.23 NOISE LEVEL

The noise level of this aircraft is 72.9 d B(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.

The above statement notwithstanding, the noise level stated above has been verified by and approved by the Federal Aviation Administration in noise level test flights conducted in accordance with FAR 36, Noise Standards - Aircraft Type and Airworthiness Certification. This aircraft model is in compliance with all FAR 36 noise standards applicable to this type.

2.25 PLACARDS

In full view of the pilot:

THIS AIRPLANE MUST BE OPERATED AS A NORMAL CATEGORY AIRPLANE IN COMPLIANCE WITH THE OPERATING LIMITATIONS STATED IN THE FORM OF PLACARDS, MARKINGS AND MANUALS.

THIS AIRCRAFT APPROVED FOR NIGHT I.F.R. NON-ICING FLIGHT WHEN EQUIPPED IN ACCORDANCE WITH FAR 91 OR FAR 135.

In full view of the pilot:

TAKEOFF CHECK LIST

Fuel on Proper Tank	Propeller Set
Electric Fuel Pump - On	Fasten Belts/Harness
Engine Gages Checked	Flaps Set
Carburetor Heat Off	Trim Tab Set
Seat Backs Erect	Controls Free
Primer Locked	Door Latched
Mixture Set	Air Conditioner Off

LANDING CHECK LIST

Seat Backs Erect	Mixture Rich
Fasten Belts/Harness	Propeller Set
Fuel on Proper Tank	Flaps Set - (White Arc)
Electric Fuel Pump On	Air Conditioner Off

The "Air Conditioner Off" item in the above Takeoff and Landing Check List is mandatory for air conditioned aircraft only.

On the aft baggage compartment:

MAXIMUM BAGGAGE 200 LBS. NO HEAVY OBJECTS ON HAT SHELF

In full view of the pilot, near the airspeed indicator:

MANEUVERING SPEED 124 KIAS
AT 3000 LBS (SEE A.F.M.)
OR
V_A = 124 KIAS AT 3,000# (SEE P.O.H.)

In full view of the pilot:

FUEL REMAINING WHEN THE QUANTITY INDICATORS READ ZERO CANNOT BE USED SAFELY IN FLIGHT

Adjacent to upper door latch:

ENGAGE LATCH BEFORE FLIGHT

On the instrument panel in full view of the pilot:

DEMONSTRATED CROSSWIND COMPONENT 17 KTS
OR
DEMO. X-WIND 17 KTS

In full view of the pilot:

NO ACROBATIC MANEUVERS,
INCLUDING SPINS, APPROVED

WARNING

TURN OFF STROBE LIGHTS WHEN IN CLOSE PROXIMITY TO GROUND OR DURING FLIGHT THROUGH CLOUD, FOG OR HAZE.

On the instrument panel in full view of the pilot when the AutoFlite is installed:

OPERATION

TURN AUTOFLITE ON. ADJUST TRIM KNOB FOR MINIMUM HEADING CHANGE: FOR HEADING CHANGE, PRESS DISENGAGE SWITCH ON CONTROL WHEEL, CHANGE HEADING, RELEASE SWITCH. ROTATE TURN KNOB FOR TURN COMMANDS. PUSH TURN KNOB IN TO ENGAGE TRACKER. PUSH TRIM KNOB IN FOR HI SENSITIVITY. LIMITATIONS AUTOFLITE OFF FOR TAKEOFF AND LANDING.

In full view of the pilot, in the area of the air conditioner controls when the air conditioner is installed:

WARNING - AIR CONDITIONER MUST BE OFF TO INSURE NORMAL TAKEOFF CLIMB PERFORMANCE.

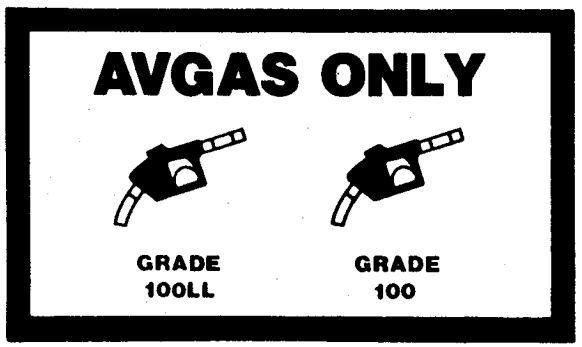
Adjacent to fuel filler cap:

FUEL - 100 OR 100LL AVIATION GRADE

OR

FUEL - 100/130 AVIATION GRADE - MIN. USABLE CAPACITY 36 GAL. USABLE CAPACITY TO BOTTOM OF FILLER NECK INDICATOR 25 GAL.

Adjacent to fuel filler cap (serial numbers 28-8311009 and up):



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SECTION 3

EMERGENCY PROCEDURES

3.1 GENERAL

The recommended procedures for coping with various types of emergencies and critical situations are provided by this section. All of required (FAA regulations) emergency procedures and those necessary for operation of the airplane as determined by the operating and design features of the airplane are presented.

Emergency procedures associated with those optional systems and equipment which require handbook supplements are provided by Section 9 (Supplements).

The first portion of this section consists of an abbreviated emergency check list which supplies an action sequence for critical situations with little emphasis on the operation of systems.

The remainder of the section is devoted to amplified emergency procedures containing additional information to provide the pilot with a more complete understanding of the procedures.

These procedures are suggested as a course of action for coping with the particular condition described, but are not a substitute for sound judgment and common sense. Pilots should familiarize themselves with the procedures given in this section and be prepared to take appropriate action should an emergency arise.

Most basic emergency procedures, such as power off landings, are a normal part of pilot training. Although these emergencies are discussed here, this information is not intended to replace such training, but only to provide a source of reference and review, and to provide information on procedures which are not the same for all aircraft. It is suggested that the pilot review standard emergency procedures periodically to remain proficient in them.

3.3 EMERGENCY PROCEDURES CHECK LIST

SPEEDS

Stall speeds
3000 lbs. (0° flap) ..... 65 KIAS
3000 lbs. (full flap) ..... 56 KIAS
Maneuvering speeds
3000 lbs. ..... 124 KIAS
1761 lbs. ..... 96 KIAS
Never exceed speed ..... 173 KIAS
Power off glide speed
3000 lbs. (0° flap) ..... 85 KIAS

ENGINE INOPERATIVE PROCEDURES

ENGINE POWER LOSS DURING TAKEOFF (NOT AIRBORNE)

Sufficient runway remaining:
Throttle ..... close immediately
Brakes ..... apply as required
Stop straight ahead.

Insufficient runway remaining:
Throttle ..... close immediately
Brakes ..... apply as required
Mixture ..... IDLE CUT-OFF
Fuel selector ..... OFF
Master switch ..... OFF
Magnetos ..... OFF
Maintain directional control and maneuver to avoid obstacles.

ENGINE POWER LOSS DURING TAKEOFF (IF AIRBORNE)

Sufficient runway remaining:
Airspeed ..... maintain above stall
Directional control ..... maintain
Land straight ahead.

Insufficient runway remaining:
Airspeed ..... maintain above stall
Throttle ..... close
Mixture ..... IDLE CUT-OFF
Fuel selector ..... OFF
Master switch ..... OFF
Magnetos ..... OFF
Flaps ..... as situation requires
Directional control ..... maintain - make only shallow turns to avoid obstacles.

If sufficient altitude has been gained to attempt a restart:
Airspeed ..... maintain safe airspeed
Fuel selector ..... switch to other tank containing fuel
Electric fuel pump ..... ON
Mixture ..... RICH
Carburetor heat ..... ON
If power is not regained proceed with power off landing.

ENGINE POWER LOSS IN FLIGHT

Fuel selector ..... switch to other tank containing fuel
Electric fuel pump ..... ON
Mixture ..... RICH
Carburetor heat ..... ON
Engine gauges ..... check for indication of cause of power loss
Primer ..... locked
If no fuel pressure is indicated, check that fuel selector is on a tank containing fuel.

If power has not been restored:
Ignition switch ..... L then R, then back to BOTH
Throttle and mixture ..... try different settings

When power is restored:
Carburetor heat ..... OFF
Electric fuel pump ..... OFF

If power cannot be restored:
Trim for best glide angle (85 KIAS) and prepare for power off landing.

POWER OFF LANDING

Trim for best glide angle (85 KIAS).
Locate most suitable landing area.
Establish spiral pattern.
1000 feet above field at downwind position for normal landing approach.
When field can be easily reached, slow to 72 KIAS for shortest landing with a full stall touchdown.
Touchdowns should normally be made at lowest possible airspeed with full flaps.

When committed to landing:
Ignition ..... OFF
Master switch ..... OFF
Fuel selector ..... OFF
Mixture ..... IDLE CUT-OFF
Seat belts and harness ..... tight

FIRE

ENGINE FIRE DURING START

Starter ..... crank engine
Mixture ..... IDLE CUT-OFF
Throttle ..... open
Electric fuel pump ..... OFF
Fuel selector ..... OFF
Abandon airplane if fire continues.

FIRE IN FLIGHT

Source of fire ..... check

Engine fire:
Fuel selector ..... OFF
Throttle ..... closed
Mixture ..... IDLE CUT-OFF
Electric fuel pump ..... OFF
Cabin heat ..... OFF
Defroster ..... OFF
Prepare for power off landing.

Electrical fire (smoke in cabin):
Master switch ..... OFF
Cabin heat ..... OFF
Defroster ..... OFF
Vents ..... open to clear cabin
Land as soon as practicable.

LOSS OF OIL PRESSURE

Land as soon as possible and investigate cause.
Prepare for power off landing.

LOSS OF FUEL PRESSURE

Electric fuel pump ..... ON
Fuel selector ..... check on full tank

HIGH OIL TEMPERATURE

Land at nearest airport and investigate the problem.
Prepare for power off landing.

ELECTRICAL FAILURES

ALT annunciator light illuminated
Ammeter ..... check to verify inop. alt.

If ammeter shows zero
ALT switch ..... OFF

Reduce electrical loads to minimum
ALT circuit breaker ..... check and reset as required
ALT switch ..... ON

If power not restored
ALT switch ..... OFF

If alternator output cannot be restored, reduce electrical loads and land as soon as practical. The battery is the only remaining source of electrical power.

ELECTRICAL OVERLOAD (alternator over 20 amps above known electrical load)

FOR AIRPLANES WITH INTERLOCKED BAT AND ALT SWITCH OPERATION

Electrical load ..... reduce

If alternator loads are not reduced
ALT switch ..... OFF

Land as soon as practical. Battery is the only remaining source of power. Anticipate complete electrical failure.

FOR AIRPLANES WITH SEPARATE BAT AND ALT SWITCH OPERATION

ALT switch ..... ON
BAT switch ..... OFF

If alternator loads are reduced
Electrical load ..... reduce to minimum

Land as soon as practical.

NOTE

Due to increased system voltage and radio frequency noise, operation with ALT switch ON and BAT switch OFF should be made only when required by an electrical system failure.

If alternator loads are not reduced
ALT switch ..... OFF
BAT switch ..... as required

Land as soon as possible. Anticipate complete electrical failure.

SPIN RECOVERY

Rudder ..... full opposite to direction of rotation
Control wheel ..... full forward while neutralizing ailerons
Throttle ..... close
Rudder ..... neutral (when rotation stops)
Control wheel ..... as required to smoothly regain level flight attitude

OPEN DOOR

If both upper and side latches are open, the door will trail slightly open and airspeeds will be reduced slightly.

To close the door in flight:
Slow airplane to 83 KIAS.
Cabin vents ..... close
Storm window ..... open

If upper latch is open ..... latch
If side latch is open ..... pull on arm rest while moving latch handle to latched position.

If both latches are open ..... latch side latch then top latch

CARBURETOR ICING

Carburetor Heat ..... ON
Mixture ..... adjust for max. smoothness

ENGINE ROUGHNESS

Carburetor heat ..... ON

If roughness continues after one min:
Carburetor heat ..... OFF
Mixture ..... adjust for max. smoothness
Electric fuel pump ..... ON
Fuel selector ..... switch tanks
Engine gauges ..... check
Magneto switch ..... L then R, then Both

If operation is satisfactory on either one, continue on that magneto at reduced power and full "RICH" mixture to first airport.

Prepare for power off landing.

PROPELLER OVERSPEED

Throttle ..... retard
Oil pressure ..... check
Prop control ..... full DECREASE rpm, then set if any control available
Airspeed ..... reduce
Throttle ..... as required to remain below 2400 rpm

3.5 AMPLIFIED EMERGENCY PROCEDURES (GENERAL)

The following paragraphs are presented to supply additional information for the purpose of providing the pilot with a more complete understanding of the recommended course of action and probable cause of an emergency situation.

3.7 ENGINE INOPERATIVE PROCEDURES

ENGINE POWER LOSS DURING TAKEOFF (NOT AIRBORNE)

If engine failure occurs before the airplane has lifted off, and if there is sufficient runway left for a safe stop, simply maintain directional control, close the throttle, and brake to a stop.

If there is not sufficient runway remaining for a safe stop, close the throttle, apply maximum braking, pull the mixture control to IDLE CUT-OFF, and turn OFF the fuel selector, the master switch and the magnetos. Maintain directional control, slow the airplane as much as possible, and maneuver to avoid obstacles.

ENGINE POWER LOSS DURING TAKEOFF (IF AIRBORNE)

If engine failure occurs after the airplane has lifted off, and if sufficient landing area remains for a touchdown and stop, lower the nose and maintain airspeed to avoid a stall. Maintain directional control and land and stop straight ahead.

If liftoff has occurred and there is not sufficient landing area remaining for a safe landing and stop, maintain a safe airspeed to avoid a stall. Close the throttle, pull the mixture control to IDLE CUT-OFF, and turn OFF the fuel selector, the master switch, and the magnetos. Use of flaps depends upon the circumstances; however, normally full flaps allow the slowest and softest touchdown.

At low altitudes with a failed engine, turns should not be attempted, except for slight and gentle deviations to avoid obstacles. A controlled crash landing straight ahead is preferable to risking a stall which could result in an uncontrolled roll and crash out of a turn.

If sufficient altitude has been gained to permit a restart attempt, maintain a safe airspeed and switch the fuel selector to another tank containing fuel. Check the electric fuel pump to ensure that it is ON. Check that the mixture control is set RICH and that carburetor heat is ON. If engine failure was caused by fuel exhaustion, power will not be regained after switching tanks until the empty fuel lines are filled. This may require up to ten seconds.

If the propeller has stopped turning, it will be necessary to engage the starter to execute a restart. If power is not regained, proceed with a Power Off Landing.

ENGINE POWER LOSS IN FLIGHT

A complete loss of power is usually caused by a fuel flow interruption, in which case power will be restored shortly after fuel flow is restored. If power loss occurs at a low altitude, the first step should be to prepare for an emergency Power Off Landing. Maintain an airspeed of at least 85 KIAS.

If altitude permits, attempt a restart. Switch the fuel selector to another tank containing fuel. Turn ON the electric fuel pump, set the mixture RICH, and turn ON carburetor heat.

Check the engine gauges for an indication of the cause of the power loss. Be sure that the primer is locked if one is installed. If no fuel pressure is indicated, check the fuel selector to be sure that it is on a tank containing fuel. If fuel exhaustion is the problem, it may take up to ten seconds after switching tanks for empty fuel lines to fill and for power to be restored. If there is water contamination of the fuel, fuel pressure indications will be normal. Water in the fuel could take some time to be passed through, and allowing the propeller to windmill may restore power. If the propeller has stopped turning, engage the starter.

When power is restored and the engine is operating smoothly, turn OFF the carburetor heat and the electric fuel pump.

If the preceding steps do not restore power, prepare for an emergency Power Off Landing. If time permits, try turning the ignition switch to L, then to R, then back to BOTH. Try moving the throttle and mixture controls to various settings. This may restore power if the problem is too rich or too lean a mixture or if there is a partial fuel system restriction.

If power is not regained, proceed with preparations for a Power Off Landing.

POWER OFF LANDING

If loss of power occurs at altitude, trim the airplane for best gliding angle (85 KIAS), and look for a suitable landing area. If the procedures for restoring power are not effective, and if time permits, check charts for airports in the immediate vicinity; it may be possible to reach one if the airplane's altitude is sufficient. If possible, notify the FAA by radio of the situation and intended course of action. If another pilot or a passenger is aboard, that person may assist.

After locating the most suitable landing area, establish a spiral pattern around the field. Try to be at 1000 feet above the field at the downwind position to make a normal landing approach. When assured of reaching the field, slow to 72 KIAS for the shortest landing. Excess altitude may be lost by widening the pattern, extending flaps, slipping, or a combination of these methods.

Once committed to a landing, shut OFF the ignition, the master switch, and the fuel selector. Pull the mixture to IDLE CUT-OFF. Tighten seat belts and shoulder harness.

Flaps may be used as deemed necessary. Normally a full stall touchdown should be made at the lowest possible airspeed with flaps fully extended.

3.9 FIRE

ENGINE FIRE DURING START

Engine fires during start are usually the result of overpriming. The first step in extinguishing the fire is to cut off the source of fuel and to keep the engine turning to use up excess fuel.

Continue cranking the engine with the starter, while pulling the mixture control to IDLE CUT-OFF and advancing the throttle fully open. Turn OFF the electric fuel pump and the fuel selector. Radio for assistance if possible.

If the engine has started, it should be left running. If the engine is not running, continue cranking with the starter. This is an attempt to draw the fire back into the engine.

If the fire continues, leave the fuel selector OFF and the mixture at IDLE CUT-OFF, and abandon the airplane, applying the best external extinguishing means available.

If the fire is on the ground near the airplane, it may be possible to taxi to safety.

FIRE IN FLIGHT

The presence of fire is indicated by smoke, smell, or heat. It is essential that the source of the fire be promptly identified through instrument readings, character of the smoke or other indications, since the action to be taken differs in each case.

If an engine fire is indicated, immediately turn the fuel selector OFF and close the throttle. Pull the mixture control to IDLE CUT-OFF. Be sure that the electric fuel pump is OFF. Turn OFF the cabin heat and defroster. If radio transmission is not required, turn OFF the master switch. Proceed with a Power Off Landing.

NOTE

The possibility of an engine fire in flight is extremely remote. The procedure given is general and pilot judgment should be the determining factor for action in such an emergency.

If smoke or fumes in the cabin indicate an electrical fire, turn OFF the master switch. Turn OFF the cabin heat and defroster, and open the vents to clear smoke and fumes from the cabin. Land as soon as practicable.

NOTES

When the master switch is turned off, the stall warning system will not function.

During night flight a flashlight should be in hand before turning off the master switch.

3.11 LOSS OF OIL PRESSURE

Loss of oil pressure may be either partial or complete. A partial loss of oil pressure usually indicates a malfunction in the oil pressure regulating system, and a landing should be made as soon as possible to allow investigation of the cause and to prevent engine damage.

A complete loss of oil pressure indication may signify oil exhaustion or may be the result of a faulty gauge. In either case, proceed toward the nearest airport, and be prepared for a forced landing. If the problem is not a pressure gauge malfunction, the engine may stop suddenly. Maintain altitude until such time as a power off landing can be accomplished. Do not change power settings unnecessarily, as this may hasten complete power loss.

Depending on the circumstances, it may be advisable to make an off airport landing while power is still available, particularly if other indications of actual oil pressure loss, such as sudden increases in temperatures, or oil smoke, are apparent, and an airport is not close.

If engine stoppage occurs, proceed with Power Off Landing.

3.13 LOSS OF FUEL PRESSURE

If loss of fuel pressure occurs, turn ON the electric fuel pump and check that the fuel selector is on a tank containing fuel.

If the problem is not an empty tank, land as soon as practical and have the engine-driven fuel pump and fuel system checked.

3.15 HIGH OIL TEMPERATURE

An abnormally high oil temperature indication may be caused by a low oil level, an obstruction in the oil cooling installation, damaged or improper baffle seals, a defective gauge, or other causes. Land as soon as possible at an appropriate airport and have the cause investigated.

A steady, rapid rise in oil temperature is a sign of trouble. Land at the nearest airport and let a mechanic investigate the problem. Watch the oil pressure gauge for an accompanying loss of pressure.

3.17 ELECTRICAL FAILURES

Loss of alternator output is detected through zero reading on the ammeter. Before executing the following procedure, insure that the reading is zero and not merely low by actuating an electrically powered device, such as the landing light. If no increase in the ammeter reading is noted, alternator failure can be assumed.

The electrical load should be reduced as much as possible. Check the alternator circuit breakers for a popped circuit.

The next step is to attempt to reset the overvoltage relay. This is accomplished by moving the ALT switch to OFF for one second and then to ON. If the trouble was caused by a momentary overvoltage condition (16.5 volts and up) this procedure should return the ammeter to a normal reading.

If the ammeter continues to indicate "0" output, or if the alternator will not remain reset, turn off the ALT switch, maintain minimum electrical load and land as soon as practical. All electrical load is being supplied by the battery.

3.18 ELECTRICAL OVERLOAD (Alternator over 20 amps above known electrical load)

If abnormally high alternator output is observed (more than 20 amps above known electrical load for the operating conditions) it may be caused by a low battery, a battery fault or other abnormal electrical load. If the cause is a low battery, the indication should begin to decrease toward normal within 5 minutes. If the overload condition persists attempt to reduce the load by turning off nonessential equipment. For airplanes with interlocked BAT and ALT switch operation, when the electrical load cannot be reduced turn the ALT switch OFF and land as soon as practical. The battery is the only remaining source of electrical power. Also anticipate complete electrical failure.

For airplanes with separate BAT and ALT switch operations, turn the BAT switch OFF and the ammeter should decrease. Turn the BAT switch ON and continue to monitor the ammeter. If the alternator output does not decrease within 5 minutes, turn the BAT switch OFF and land as soon as practical. All electrical loads are being supplied by the alternator.

—NOTE—

Due to higher voltage and radio frequency noise, operation with the ALT switch ON and the BAT switch OFF should be made only when required by an electrical failure.

3.19 SPIN RECOVERY

Intentional spins are prohibited in this airplane. Should a spin be entered inadvertently, the following procedure should be initiated:

(a) Apply and maintain full rudder opposite the direction of rotation.
(b) As the rudder hits the stop, push the control wheel fully forward and neutralize ailerons. As the stall is broken, relax forward pressure as necessary to prevent an excessive nose down attitude.
(c) Close the throttle.
(d) As rotation stops, neutralize the rudder and ease back on the control wheel to recover smoothly from the dive.

3.21 OPEN DOOR

The cabin doors on the Dakota are double latched; so the chances of one springing open in flight at both the top and side are remote. However, if improperly latched, a door may spring partially open. This will usually happen at takeoff or soon afterward. A partially open door will not affect normal flight characteristics, and a normal landing can be made with the door open.

If both upper and side latches are open, the door will trail slightly open, and airspeed will be reduced slightly.

To close the door in flight, slow the airplane to 83 KIAS, close the cabin vents and open the storm window. If the top latch is open, latch it. If the side latch is open, pull on the arm rest while moving the latch handle to the latched position. If both latches are open, close the side latch then the top latch.

3.22 CARBURETOR ICING

Under certain moist atmospheric conditions at temperatures of -5°C to +20°C, it is possible for ice to form in the induction system, even in summer weather. This is due to the high air velocity through the carburetor venturi and the absorption of heat from this air by vaporization of the fuel.

To avoid this, carburetor preheat is provided to replace the heat lost by vaporization. Carburetor heat should be full on when carburetor ice is encountered. Adjust mixture for maximum smoothness.

3.23 ENGINE ROUGHNESS

Engine roughness is usually due to carburetor icing which is indicated by a drop in manifold pressure, and may be accompanied by a slight loss of airspeed or altitude. If too much ice is allowed to accumulate, restoration of full power may not be possible; therefore, prompt action is required.

Turn carburetor heat ON (See Note). Manifold pressure will decrease slightly and roughness will increase. Wait for a decrease in engine roughness or an increase in manifold pressure, indicating ice removal. If no change in approximately one minute, return the carburetor heat to OFF.

If the engine is still rough, adjust the mixture for maximum smoothness. The engine will run rough if too rich or too lean. The electric fuel pump should be switched to ON and the fuel selector switched to the other tank to see if fuel contamination is the problem. Check the engine gauges for abnormal readings. If any gauge readings are abnormal, proceed accordingly. Move the magneto switch to L then R, then back to BOTH. If operation is satisfactory on either magneto, proceed on that magneto at reduced power, with mixture full RICH, to a landing at the first available airport.

If roughness persists, prepare for a precautionary landing at pilot's discretion.

NOTE

Partial carburetor heat may be worse than no heat at all, since it may melt part of the ice, which will refreeze in the intake system. When using carburetor heat, therefore, always use full heat, and when ice is removed return the control to the full cold position.

3.25 PROPELLER OVERSPEED

Propeller overspeed is caused by a malfunction in the propeller governor or low oil pressure which allows the propeller blades to rotate to full low pitch.

If propeller overspeed should occur, retard the throttle and check the oil pressure. The propeller control should be moved to full "DECREASE rpm" and then set if any control is available. Airspeed should be reduced and throttle used to maintain 2400 RPM.

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SECTION 4

NORMAL PROCEDURES

4.1 GENERAL

This section describes the recommended procedures for the conduct of normal operations. All of the required (FAA regulations) procedures and those necessary for operation of the airplane as determined by the operating and design features of the airplane are presented.

Normal procedures associated with those optional systems and equipment which require handbook supplements are provided by Section 9 (Supplements).

These procedures are provided to present a source of reference and review and to supply information on procedures which are not the same for all aircraft. Pilots should familiarize themselves with the procedures given in this section in order to become proficient in the normal operations of the airplane.

The first portion of this section consists of a short form check list which supplies an action sequence for normal operations with little emphasis on the operation of the systems.

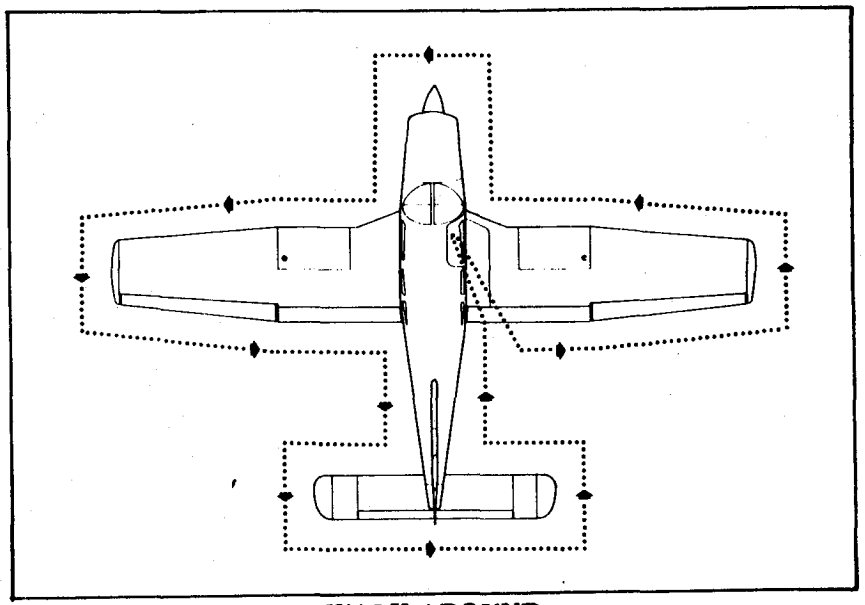
The remainder of the section is devoted to amplified normal procedures which provide detailed information and explanations of the procedures and how to perform them. This portion of the section is not intended for use as an in-flight reference due to the lengthy explanations. The short form check list should be used for this purpose.

4.3 AIRSPEEDS FOR SAFE OPERATIONS

The following airspeeds are those which are significant to the safe operation of the airplane. These figures are for standard airplanes flown at gross weight under standard conditions at sea level.

Performance for a specific airplane may vary from published figures depending upon the equipment installed, the condition of the engine, airplane and equipment, atmospheric conditions and piloting technique.

(a) Best Rate of Climb Speed	85 KIAS
(b) Best Angle of Climb Speed	73 KIAS
(c) Turbulent Air Operating Speed (See Subsection 2.3)	124 KIAS
(d) Maximum Flap Speed	102 KIAS
(e) Landing Final Approach Speed (Flaps 40°)	72 KIAS
(f) Maximum Demonstrated Crosswind Velocity	17 KTS



WALK-AROUND
Figure 4-1

4.5 NORMAL PROCEDURES CHECK LIST

PREFLIGHT CHECK

COCKPIT

Control wheel	release restraints
Parking brake	set
All switches	OFF
All avionics	OFF
Mixture	idle cut-off
Master switch	ON
Fuel gauges	check quantity
Annunciator panel	check
Master switch	OFF
Primary flight controls	proper operation
Flaps	proper operation
Trim	neutral
Pitot and static systems	drain
Windows	check clean

Required papers ..... check on board
Tow bar and baggage ..... stow properly - secure
Baggage door ..... close and secure

RIGHT WING

Surface condition ..... clear of ice, frost, snow
Flap and hinges ..... check
Aileron and hinges ..... check
Wing tip and lights ..... check
Fuel tank ..... check supply visually - secure cap
Fuel tank vent ..... clear
Fuel tank sump ..... drain and check for water, sediment and proper fuel
Tie down and chock ..... remove
Main gear strut ..... proper inflation (4.5 in.)
Tire ..... check
Brake block and disc ..... check
Fresh air inlet ..... clear

NOSE SECTION

General condition ..... check
Cowling ..... secure
Windshield ..... clean
Propeller and spinner ..... check
Air inlets ..... clear
Alternator belt ..... check tension
Chock ..... remove
Nose gear strut ..... proper inflation (3.25 in.)
Nose wheel tire ..... check
Oil ..... check quantity
Dipstick ..... properly seated
Fuel strainer ..... drain

LEFT WING

Surface condition ..... clear of ice, frost, snow
Fresh air inlet ..... clear

Chock ..... remove
Main gear strut ..... proper inflation (4.5 in.)
Tire ..... check
Brake block and disc ..... check
Fuel tank ..... check supply visually - secure cap
Fuel tank vent ..... clear
Fuel tank sump ..... drain and check for water, sediment and proper fuel
Tie down ..... remove
Pitot head ..... remove cover - holes clear
Wing tip and lights ..... check
Aileron and hinges ..... check
Flap and hinges, ... check

FUSELAGE

Antennas ..... check
Left static pad ..... clear
Empennage ..... clear of ice, frost, snow
Fresh air inlet ..... clear
Stabilator and trim tab ..... check
Tie down ..... remove
Right static pad ..... clear
Master switch ..... ON
Cockpit lighting ..... check
Nav and strobe lights ..... check
Stall warning ..... check
Pitot heat ..... check
All switches ..... OFF
Passengers ..... board
Cabin door ..... close and secure
Seat belts and harness ..... fasten/adjust - check inertia reel

BEFORE STARTING ENGINE

Parking brake ..... set
Propeller ..... full INCREASE rpm
Fuel selector ..... desired tank
Carburetor heat ..... OFF
Radios ..... OFF

STARTING ENGINE WHEN COLD

Master switch ..... ON
Electric fuel pump ..... ON
Mixture ..... full RICH
Throttle ..... 1/4 open
Starter ..... engage
Throttle ..... adjust
Oil pressure ..... check
If engine does not start, add 1 to 3 strokes of priming pump and repeat above. After engine starts, lock primer.

STARTING ENGINE WHEN HOT

Throttle ..... 1/2" open
Master switch ..... ON
Electric fuel pump ..... ON
Mixture ..... full RICH
Starter ..... engage
Throttle ..... adjust
Oil pressure ..... check

STARTING ENGINE WHEN FLOODED

Throttle ..... open full
Master switch ..... ON
Electric fuel pump ..... OFF
Mixture ..... idle cut-off
Starter ..... engage
Mixture ..... advance
Throttle ..... retard
Oil pressure ..... check

STARTING WITH EXTERNAL POWER SOURCE

Master switch ..... OFF
All electrical equipment ..... OFF
Terminals ..... connect
External power plug ..... insert in fuselage

Proceed with normal start
Throttle ..... lowest possible RPM
External power plug ..... disconnect from fuselage
Master switch ..... ON - check ammeter
Oil pressure ..... check

WARM-UP

Throttle ..... 1000 to 1200 RPM

TAXIING

Chocks ..... removed
Taxi area ..... clear
Parking brake ..... release
Throttle ..... apply slowly
Prop ..... high RPM
Brakes ..... check
Steering ..... check

GROUND CHECK

Parking brake ..... set
Propeller ..... full INCREASE
Throttle ..... 2000 RPM
Magnetos ..... max. drop 175 RPM - max. diff. 50 RPM
Vacuum ..... 5.0" Hg. + .1
Oil temp ..... check
Oil pressure ..... check
Annunciator panel ..... press-to-test
Air conditioner ..... check
Carburetor heat ..... check
Propeller ..... exercise - then full INCREASE
Electric fuel pump ..... OFF
Fuel pressure ..... check
Throttle ..... retard

BEFORE TAKEOFF

Master switch ..... ON
Flight instruments ..... check
Fuel selector ..... proper tank
Electric fuel pump ..... ON
Engine gauges ..... check
Carburetor heat ..... OFF
Seat backs ..... erect
Primer ..... locked
Mixture ..... set
Prop ..... set
Belts/harness ..... fastened/adjusted
Empty seats ..... seat belts snugly fastened
Flaps ..... set
Trim tabs ..... set
Controls ..... free
Doors ..... latched
Air conditioner ..... OFF
Parking brake ..... release

TAKEOFF

NORMAL

Flaps ..... set
Tab ..... set
Accelerate to 60 to 65 KIAS.
Control wheel ..... back pressure to rotate to climb attitude

SHORT FIELD, OBSTACLE CLEARANCE

Flaps ..... 25° (second notch)
Accelerate to 50 to 60 KIAS depending on aircraft weight.
Control wheel ..... back pressure to rotate to climb attitude
After breaking ground, accelerate to 73 KIAS and climb past obstacle.
Accelerate to best rate of climb speed - 85 KIAS and slowly retract the flaps.

SHORT FIELD, NO OBSTACLE

Flaps ..... 25° (second notch)
Accelerate to 50 to 60 KIAS depending upon aircraft weight.
Control wheel ..... back pressure to rotate to climb attitude

Accelerate to best rate of climb speed - 85 KIAS and slowly retract the flaps while climbing out.

SOFT FIELD, OBSTACLE CLEARANCE

Flaps ..... 25° (second notch)
Accelerate; pull nose wheel off as soon as possible.
Control wheel ..... lift off at lowest possible airspeed
Just above the ground, accelerate to best angle of climb speed - 73 KIAS and climb past obstacle.
Continue climb while accelerating to best rate of climb speed - 85 KIAS.
Flaps ..... retract slowly

SOFT FIELD, NO OBSTACLE

Flaps ..... 25° (second notch)
Accelerate; pull nose wheel off as soon as possible.
Control wheel ..... lift off at lowest possible airspeed
Just above the ground, accelerate to best rate of climb speed - 85 KIAS and climb out.
Flaps ..... retract slowly

CLIMB

Best rate (3000 lb) (flaps up) ..... 85 KIAS
Best angle (3000 lb) (flaps up) ..... 73 KIAS
En route ..... 100 KIAS
Electric fuel pump ..... OFF at desired altitude

CRUISING

Reference performance charts, Avco-Lycoming Operator's Manual and power setting table.
Normal max power 75%
Power ..... set per power table
Mixture ..... adjust

DESCENT

NORMAL

Throttle ..... as required for 1000 FPM descent
Propeller ..... 2400 RPM
Airspeed ..... 137 KIAS
Mixture ..... rich
Carburetor heat ..... on if required

POWER OFF

Carburetor heat ..... on if required
Throttle ..... closed
Airspeed ..... as required
Mixture ..... as required
Power ..... verify with throttle every 30 seconds

APPROACH AND LANDING

Fuel selector ..... proper tank
Seat backs ..... erect
Belts/harness ..... fasten/adjust
Electric fuel pump ..... ON
Air conditioner ..... OFF
Mixture ..... set
Propeller ..... set
Flaps ..... down - 102 KIAS max.
Trim to 72 KIAS.

STOPPING ENGINE

Flaps ..... retract
Electric fuel pump ..... OFF
Air conditioner ..... OFF
Radios ..... OFF
Propeller ..... full INCREASE
Throttle ..... full aft
Mixture ..... idle cut-off
Magnetos ..... OFF
Master switch ..... OFF

PARKING

Parking brake ..... set
Control wheel ..... secured with belts
Flaps ..... full up
Wheel chocks ..... in place
Tie downs ..... secure

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4.7 AMPLIFIED NORMAL PROCEDURES (GENERAL)

The following paragraphs are provided to supply detailed information and explanations of the normal procedures necessary for operation of the airplane.

4.9 PREFLIGHT CHECK

The airplane should be given a thorough preflight and walk-around check. The preflight should include a check of the airplane's operational status, computation of weight and C.G. limits, takeoff and landing distances, and in-flight performance. A weather briefing should be obtained for the intended flight path, and any other factors relating to a safe flight should be checked before takeoff.

CAUTION

The flap position should be noted before boarding the airplane. The flaps must be placed in the UP position before they will lock and support weight on the step.

COCKPIT

Upon entering the cockpit, release the seat belts securing the control wheel and set the parking brake. Turn off all avionics equipment. Insure that all electrical switches and the magneto switch are OFF and the mixture is in idle cut-off. Turn ON the master switch, check the fuel quantity gauges for adequate supply and check that the annunciator panel illuminates. Turn OFF the master switch. Check the primary flight controls and flaps for proper operation and set the trim to neutral. Open the pitot and static drains to remove any moisture that has accumulated in the lines. Check the windows for cleanliness and that the required papers are on board. Properly stow and secure the tow bar and baggage. Close and secure the baggage door.

RIGHT WING

Begin the walk-around at the trailing edge of the right wing by checking that the wing surface and control surfaces are clear of ice, frost, snow or other extraneous substances. Check the flap, aileron and hinges for damage and operational interference. Static wicks should be firmly attached and in good condition. Check the wing tip and lights for damage.

Open the fuel cap and visually check the fuel color and the quantity should match the indication that was on the fuel quantity gauge, replace cap securely. The fuel tank vent should be clear of obstructions.

Drain the fuel tank through the quick drain located at the lower inboard rear corner of the tank, making sure that enough fuel has been drained to insure that all water and sediment is removed. The fuel system should be drained daily prior to the first flight and after each refueling.

CAUTION

When draining any amount of fuel, care should be taken to insure that no fire hazard exists before starting engine.

Remove the tie down and chock.

Next, a complete check of the landing gear. Check the gear strut for proper inflation, there should be 4.5 inches of strut exposure under a normal static load. Check the tire for cuts, wear, and proper inflation. Make a visual check of the brake block and disc.

Check that the fresh air inlet is clear of foreign matter.

NOSE SECTION

Check the general condition of the nose section, look for oil or fluid leakage and that the cowling is secure. Check the windshield and clean if necessary. The propeller and spinner should be checked for detrimental nicks, cracks, or other defects. The air inlets should be clear of obstructions and check the alternator belt for proper tension. The landing light should be clean and intact.

Remove the chock and check the nose gear strut for proper inflation, there should be 3.25 inches of strut exposure under a normal static load. Check the tire for cuts, wear, and proper inflation. Check the oil level, make sure that the dipstick has been properly seated.

Open the fuel strainer located on the left side of the firewall long enough to remove any accumulation of water and sediment.

LEFT WING

The wing surface should be clear of ice, frost, snow, or other extraneous substances. Check that the fresh air inlet is clear of foreign matter and remove the chock. Check the main gear strut for proper inflation, there should be 4.5 inches of strut exposure under a normal static load. Check the tire and the brake block and disc.

Open the fuel cap and visually check the fuel color and the quantity should match the indication that was on the fuel quantity gauge, replace cap securely. The fuel tank vent should be clear of obstructions. Drain enough fuel to insure that all water and sediment has been removed.

Remove tie down and remove the cover from the pitot head on the underside of the wing. Make sure the holes are open and clear of obstructions. Check the wing tip and lights for damage. Check the aileron, flap, and hinges for damage and operational interference and that the static wicks are firmly attached and in good condition.

FUSELAGE

Check the condition and security on the antennas and that the holes in the left static pad are clean and unobstructed. The empennage should be clear of ice, frost, snow, or other extraneous substances and the fresh air inlet at the top of the fin should be clear of foreign matter. Check the stabilator and trim tab for damage and operational interference, the trim tab should move in the same direction as stabilator. Remove the tie down. Check that the holes in the right static pad are clean and unobstructed.

Upon returning to the cockpit, an operational check of the interior lights, exterior lights, stall warning system, and pitot heat should now be made. Turn the master switch and the appropriate switches ON. Check the panel lighting and the overhead flood light. Visually confirm that exterior lights are operational. Lift the stall detector on the leading edge of the left wing and determine that the warning horn is activated. With the pitot heat switch ON the pitot head will be hot to the touch. After these checks are complete the master switch and all electrical switches should be turned OFF.

Board the passengers and close and secure the cabin door. Fasten the seat belts and shoulder harness and check the function of the inertia reel by pulling sharply on the strap. Fasten seat belts on empty seats.

— NOTE —

If the fixed shoulder harness (non-inertia reel type) is installed, it must be connected to the seat belt and adjusted to allow proper accessibility to all controls, including fuel selector, flaps, trim, etc., while maintaining adequate restraint for the occupant.

If the inertia reel type shoulder harness is installed, a pull test of its locking restraint feature should be performed.

4.11 BEFORE STARTING ENGINE

Before starting the engine the parking brake should be set and the propeller lever moved to the full INCREASE rpm position. The fuel selector should then be moved to the desired tank. Be sure carburetor heat is OFF. Check all radios to be sure they are OFF.

4.13 STARTING ENGINE

(a) Starting Engine When Cold

Turn ON the master switch and the electric fuel pump. Move the mixture control to the full RICH position. Open the throttle approximately 1/4 of its travel.

Engage the starter by rotating the magneto switch clockwise. When the engine starts, release the starter and adjust the throttle to the desired setting.

If the engine does not start within 5 to 10 seconds, disengage the starter and prime with 1 to 3 strokes of the priming pump. Repeat the starting procedure without pumping the throttle.

(b) Starting Engine When Hot

Open the throttle approximately 1/2 inch. Turn ON the master switch and the electric fuel pump. Move the mixture control lever to full RICH and engage the starter by rotating the magneto switch clockwise. When the engine fires, release the magneto switch and move the throttle to the desired setting.

(c) Starting Engine When Flooded

The throttle lever should be full OPEN. Turn ON the master switch and turn OFF the electric fuel pump. Move the mixture control lever to idle cut-off and engage the starter by rotating the magneto switch clockwise. When the engine fires, release the magneto switch, advance the mixture and retard the throttle.

(d) Starting Engine With External Power Source

An optional feature called the Piper External Power (PEP) allows the operator to use an external battery to crank the engine without having to gain access to the airplane's battery.

Turn the master switch OFF and turn all electrical equipment OFF. Connect the RED lead of the PEP kit jumper cable to the POSITIVE (+) terminal of an external 12-volt battery and the BLACK lead to the NEGATIVE (-) terminal. Insert the plug of the jumper cable into the socket located on the fuselage. Note that when the plug is inserted, the electrical system is ON. Proceed with the normal starting technique.

After the engine has started, reduce power to the lowest possible RPM, to reduce sparking, and disconnect the jumper cable from the aircraft. Turn the master switch ON and check the alternator ammeter for an indication of output. DO NOT ATTEMPT FLIGHT IF THERE IS NO INDICATION OF ALTERNATOR OUTPUT.

NOTE

For all normal operations using the PEP jumper cables, the master switch should be OFF, but it is possible to use the ship's battery in parallel by turning the master switch ON. This will give longer cranking capabilities, but will not increase the amperage.

CAUTION

Care should be exercised because if the ship's battery has been depleted, the external power supply can be reduced to the level of the ship's battery. This can be tested by turning the master switch ON momentarily while the starter is engaged. If cranking speed increases, the ship's battery is at a higher level than the external power supply.

When the engine is firing evenly, advance the throttle to 800 RPM. If oil pressure is not indicated within thirty seconds, stop the engine and determine the trouble. In cold weather it will take a few seconds longer to get an oil pressure indication. If the engine has failed to start, refer to the Lycoming Operating Handbook, Engine Troubles and Their Remedies.

Starter manufacturers recommended that cranking periods be limited to thirty seconds with a two minute rest between cranking periods. Longer cranking periods will shorten the life of the starter.

4.15 WARM-UP

Warm-up the engine at 1000 to 1200 RPM. Avoid prolonged idling at low RPM, as this practice may result in fouled spark plugs.

Takeoff may be made as soon as the ground check is completed and the engine is warm.

Do not operate the engine at high RPM when running up or taxiing over ground containing loose stones, gravel or any loose material that may cause damage to the propeller blades.

4.17 TAXIING

Before attempting to taxi the airplane, ground personnel should be instructed and approved by a qualified person authorized by the owner. Ascertain that the propeller back blast and taxi areas are clear. Release the parking brake.

Power should be applied slowly to start the taxi roll. Taxi a few feet forward and apply the brakes to determine their effectiveness. Taxi with the

propeller set in low pitch, high RPM setting. While taxiing, make slight turns to ascertain the effectiveness of the steering.

Observe wing clearances when taxiing near buildings or other stationary objects. If possible, station an observer outside the airplane.

Avoid holes and ruts when taxiing over uneven ground.

Do not operate the engine at high RPM when running up or taxiing over ground containing loose stones, gravel or any loose material that may cause damage to the propeller blades.

4.19 GROUND CHECK

Set the parking brake. The magnetos should be checked at 2000 RPM with the propeller set at high RPM. Drop off on either magneto should not exceed 175 RPM and the difference between the magnetos should not exceed 50 RPM. Operation on one magneto should not exceed 10 seconds.

Check the vacuum gauge; the indicator should read 5.0" + .1" Hg at 2000 RPM. Check both oil temperature and oil pressure. The temperature may be low for some time if the engine is being run for the first time of the day.

Check the annunciator panel lights with the press-to-test button. Also check the air conditioner.

Carburetor heat should be checked prior to takeoff to be sure that the control is operating properly and to clear any ice that might have formed during taxiing. When the carburetor heat is ON the air to the engine is unfiltered; therefore, avoid prolonged ground operation with the carburetor heat ON.

The propeller control should be moved through its complete range to check for proper operation, and then placed in full INCREASE rpm for takeoff. To obtain maximum rpm, push the pedestal mounted control fully forward on the instrument panel. Do not allow a drop of more than 500 RPM during this check. In cold weather the propeller control should be cycled from high to low RPM at least three times before takeoff to make sure that warm engine oil has circulated.

The electric fuel pump should be turned OFF after starting or during warm-up to make sure that the engine driven pump is operating. Prior to takeoff the electric pump should be turned ON again to prevent loss of power during takeoff should the engine driven pump fail. Check the fuel pressure and retard the throttle.

4.21 BEFORE TAKEOFF

All aspects of each particular takeoff should be considered prior to executing the takeoff procedure.

After all aspects of the takeoff are considered, a pretakeoff check procedure must be performed.

The master switch should be ON and all of the flight instruments set and checked as required. Check the fuel selector to make sure it is on the proper tank (fullest). Turn ON the electric fuel pump and check the engine gauges. The carburetor heat should be in the OFF position. Check to ensure that the primer is locked.

All seat backs should be erect.

The mixture and propeller control levers should be set and the seat belts and shoulder harness fastened. Fasten the seat belts snugly around the empty seats.

NOTE

If the fixed shoulder harness (non-inertia reel type) is installed, it must be connected to the seat belt and adjusted to allow proper accessibility to all controls, including fuel selector, flaps, trim, etc., while maintaining adequate restraint for the occupant.

If the inertia reel type shoulder harness is installed, a pull test of its locking restraint feature should be performed.

Exercise and set the flaps and trim tabs. Insure proper flight control movement and response.

All doors should be properly secured and latched and the parking brake released.

On air conditioned models, the air conditioner must be OFF to insure normal takeoff performance.

4.23 TAKEOFF

The normal takeoff technique is conventional. The tab should be set slightly aft of neutral, with the exact setting determined by the loading of the airplane. Allow the airplane to accelerate to 50 to 65 KIAS depending on the weight of the aircraft and ease back on the control wheel to rotate to climb attitude.

Takeoffs are normally made with flaps up. However, for short field takeoffs, and for takeoffs under difficult conditions, such as in deep grass or on a soft surface, distance can be reduced appreciably by lowering flaps to 25° (second notch).

SHORT FIELD, OBSTACLE CLEARANCE

Lower flaps to 25° (second notch), accelerate aircraft to 50 to 60 KIAS and ease back on the wheel to rotate. After breaking ground, accelerate to best angle of climb speed, 73 KIAS, and climb past obstacle. Continue climb and accelerate to best rate of climb speed, 85 KIAS, and slowly retract the flaps.

SHORT FIELD, NO OBSTACLE

Lower flaps to 25° (second notch), accelerate aircraft to 50 to 60 KIAS and ease back on the wheel to rotate. After breaking ground, accelerate to best rate of climb speed, 85 KIAS, and slowly retract the flaps while climbing out.

SOFT FIELD, OBSTACLE CLEARANCE

Lower flaps to 25° (second notch), accelerate aircraft, pull nose gear off as soon as possible and lift off at lowest possible airspeed. Accelerate just above the ground the best angle of climb speed, 73 KIAS, to climb past obstacle clearance height. Continue climb while accelerating to best rate of climb speed, 85 KIAS, and slowly retract the flaps.

SOFT FIELD, NO OBSTACLE

Lower flaps to 25° (second notch), accelerate aircraft, pull nose gear off as soon as possible and lift off at lowest possible airspeed. Accelerate just above the ground to best rate of climb speed, 85 KIAS, and climb out while slowly retracting the flaps.

4.25 CLIMB

The best rate of climb at gross weight will be obtained at 85 KIAS. The best angle of climb may be obtained at 73 KIAS. At lighter than gross weight these speeds are reduced somewhat*. For climbing en route, a speed of 100 KIAS is recommended. This will produce better forward speed and increased visibility over the nose during the climb.

When reaching the desired altitude, the electric fuel pump may be turned off.

4.27 CRUISING

The cruising speed is determined by many factors, including power setting, altitude, temperature, loading and equipment installed in the airplane.

The normal maximum cruising power is 75% of the rated horsepower of the engine. When selecting cruising RPM below 2300, limiting manifold pressure for continuous operation, as specified by the appropriate "Avco-Lycoming Operator's Manual," should be observed.

To obtain the desired power, set the manifold pressure and RPM according to the power setting table in this manual.

*To obtain the performance presented in the Performance Section of this handbook, full power (full throttle and 2400 RPM) must be used. Above 8000 feet I.S.A., reduce airspeed one knot per 1000 feet altitude and lean mixture to 125°F rich of peak EGT.

Use of the mixture control in cruising flight reduces fuel consumption significantly, especially at higher altitudes. The mixture should be leaned during cruising operation above 5000 ft. altitude and at pilot's discretion at lower altitudes when 75% power or less is being used. If any doubt exists as to the amount of power being used, the mixture should be in the full RICH position for all operations under 5000 feet.

To lean the mixture, disengage the lock and pull the mixture control until the engine becomes rough, indicating that the lean mixture limit has been reached in the leaner cylinders. Then enrich the mixture by pushing the control towards the instrument panel until engine operation becomes smooth.

If the airplane is equipped with the optional exhaust gas temperature (EGT) gauge, a more accurate means of leaning is available to the pilot. For this procedure, refer to the "Avco-Lycoming Operator's Manual."

The continuous use of carburetor heat during cruising flight decreases engine efficiency. Unless icing conditions in the carburetor are severe, do not cruise with the heat on. Apply full carburetor heat slowly and only for a few seconds at intervals determined by icing severity. Use of partial carburetor heat is not recommended.

In order to keep the airplane in best lateral trim during cruise flight, the fuel should be used alternately from each main tank. It is recommended that one main tank be used for one hour after takeoff, the other main tank used until nearly exhausted, then return to the first main tank.

Always remember that the electric fuel pump should be turned ON before switching tanks, and should be left on for a short period thereafter. To preclude making a hasty selection, and to provide continuity of flow, the selector should be changed to another tank before fuel is exhausted from the tank in use. The electric fuel pump should be normally OFF so that any malfunction of the engine driven fuel pump is immediately apparent. If signs of fuel starvation should occur at any time during flight, fuel exhaustion should be suspected, at which time the fuel selector should be immediately positioned to a full tank and the electric fuel pump switched to the ON position. Fuel tank selection at low altitude is not recommended, since little recovery time is available in the event of an error in tank selection. When switching tanks, make sure that the selector drops into a detent and is lined up with the desired tank.

4.28 DESCENT

NORMAL

To achieve the performance on Figure 5-31 the power on descent must be used. The throttle should be set for 1000 FPM descent, propeller 2400 RPM, mixture full rich and maintain an airspeed of 137 KIAS. In case carburetor ice is encountered apply full carburetor heat.

POWER OFF

If a prolonged power off descent is to be made, apply full carburetor heat prior to power reduction if icing conditions are suspected. Throttle should be retarded and mixture control leaned as required. Power response should be verified approximately every 30 seconds by partially opening and then closing the throttle (clearing the engine). When leveling off enrichen mixture, set power as required and select carburetor heat off unless carburetor icing conditions are suspected.

4.29 APPROACH AND LANDING

Check to insure the fuel selector is on the proper (fullest) tank and that the seat backs are erect. The seat belts and shoulder harness should be fastened and the inertia reel checked.

NOTE

If the fixed shoulder harness (non-inertia reel type) is installed, it must be connected to the seat belt and adjusted to allow proper accessibility to all controls, including fuel selector, flaps, trim, etc., while maintaining adequate restraint for the occupant.

If the inertia reel type shoulder harness is installed, a pull test of its locking restraint feature should be performed.

Turn ON the electric fuel pump, and turn OFF the air conditioner. The mixture should be set in the full RICH position and the propeller at full INCREASE rpm to facilitate ample power for an emergency go-around. Carburetor heat should not be applied unless there is an indication of carburetor icing, since the use of carburetor heat causes a reduction in power which may be critical in case of a go-around. Full throttle operation with carburetor heat ON can cause detonation.

The airplane should be trimmed to a final approach speed of 72 KIAS with flaps extended. The flaps can be lowered at speeds up to 102 KIAS, if desired.

The amount of flap used during landings and the speed of the aircraft at contact with the runway should be varied according to the landing surface and conditions of wind and airplane loading. It is generally good practice to contact the ground at the minimum possible safe speed consistent with existing conditions.

Normally, the best technique for short and slow landings is to use full flap and enough power to maintain the desired airspeed and approach flight path. Mixture should be full RICH, fuel on the fullest tank, carburetor heat OFF, and electric fuel pump ON. Reduce the speed during the flareout and contact the ground close to the stalling speed (50 to 65 KIAS). After ground contact hold the nose wheel off as long as possible. As the airplane slows down, gently lower the nose and apply the brakes. Braking is most effective when flaps are raised and back pressure is applied to the control wheel, putting most of the aircraft weight on the main wheels. In high wind conditions, particularly in strong crosswinds, it may be desirable to approach the ground at higher then normal speeds with partial or no flaps.

4.31 STOPPING ENGINE

At the pilot's discretion, the flaps should be raised and the electric fuel pump turned OFF.

NOTE

The flaps must be placed in the UP position for the flap step to support weight. Passengers should be cautioned accordingly.

The air conditioner and radios should be turned OFF, the propeller set in the full INCREASE position, and the engine stopped by disengaging the mixture control lock and pulling the mixture control back to idle cut-off. The throttle should be left full aft to avoid engine vibration while stopping. Then the magneto and master switches must be turned OFF.

4.33 PARKING

If necessary, the airplane should be moved on the ground with the aid of the nose wheel tow bar provided with each airplane and secured behind the rear seats. The parking brake should be set. The aileron and stabilator controls should be secured by looping the safety belt through the control wheel and pulling it snug. The flaps are locked when in the UP position and should be left retracted.

Wheel chocks should be in place and tie downs secured to the rings provided under each wing and tail skid. The rudder is held in position by its connections to the nose wheel steering and normally does not have to be secured.

4.35 STALLS

The stall characteristics are conventional. An approaching stall is indicated by a stall warning horn which is activated between five and ten knots above stall speed. Mild airframe buffeting and gentle pitching may also precede the stall.

The gross weight stalling speed with power off and full flaps is 56 KIAS. With the flaps up this speed is 65 KIAS. Loss of altitude during stalls can be as great as 350 feet, depending on configuration and power.

NOTE

The stall warning system is inoperative with the master switch OFF.

During preflight, the stall warning system should be checked by turning the master switch ON, lifting the detector and checking to determine if the horn is actuated. The master switch should be returned to the OFF position after the check is complete.

4.37 TURBULENT AIR OPERATION

In keeping with good operating practice used in all aircraft, it is recommended that when turbulent air is encountered or expected, the airspeed be reduced to maneuvering speed to reduce the structural loads caused by gusts and to allow for inadvertent speed build-ups which may occur as a result of the turbulence or of distractions caused by the conditions.

4.39 WEIGHT AND BALANCE

It is the responsibility of the owner and pilot to determine that the airplane remains within the allowable weight vs. center of gravity envelope while in flight.

For weight and balance data, refer to Section 6 (Weight and Balance).

TABLE OF CONTENTS

SECTION 5

PERFORMANCE

SECTION 5

PERFORMANCE

5.1 GENERAL

All of the required (FAA regulations) and complementary performance information applicable to this aircraft is provided by this section.

Performance information associated with those optional systems and equipment which require handbook supplements is provided by Section 9 (Supplements).

5.3 INTRODUCTION - PERFORMANCE AND FLIGHT PLANNING

The performance information presented in this section is based on measured Flight Test Data corrected to I.C.A.O. standard day conditions and analytically expanded for the various parameters of weight, altitude, temperature, etc.

The performance charts are unfactored and do not make any allowance for varying degrees of pilot proficiency or mechanical deterioration of the aircraft. This performance, however, can be duplicated by following the stated procedures in a properly maintained airplane.

Effects of conditions not considered on the charts must be evaluated by the pilot, such as the effect of soft or grass runway surface on takeoff and landing performance, or the effect of winds aloft on cruise and range performance. Endurance can be grossly affected by improper leaning procedures, and inflight fuel flow quantity checks are recommended.

REMEMBER! To get chart performance, follow the chart procedures.

The information provided by paragraph 5.5 (Flight Planning Example) outlines a detailed flight plan using the performance charts in this section. Each chart includes its own example to show how it is used.

WARNING

Performance information derived by extrapolation beyond the limits shown on the charts should not be used for flight planning purposes.

5.5 FLIGHT PLANNING EXAMPLE

(a) Aircraft Loading

The first step in planning the flight is to calculate the airplane weight and center of gravity by utilizing the information provided by Section 6 (Weight and Balance) of this handbook.

The basic empty weight for the airplane as licensed at the factory has been entered in Figure 6-5. If any alterations to the airplane have been made effecting weight and balance, reference to the aircraft logbook and Weight and Balance Record (Figure 6-7) should be made to determine the current basic empty weight of the airplane.

Make use of the Weight and Balance Loading Form (Figure 6-11) and the C.G. Range and Weight graph (Figure 6-15) to determine the total weight of the airplane and the center of gravity position.

After proper utilization of the information provided, the following weights have been determined for consideration in the flight planning example.

The landing weight cannot be determined until the weight of the fuel to be used has been established [refer to item (g)(1)].

(1) Basic Empty Weight	1734 lbs.
(2) Occupants (4 x 170 lbs.)	680 lbs.
(3) Baggage and Cargo	20 lbs.
(4) Fuel (6 lb./gal. x 72)	432 lbs.
(5) Takeoff Weight	2866 lbs.
(6) Landing Weight (a)(5) minus (g)(1), (2866 lbs. minus 337 lbs.)	2529 lbs.

The takeoff weight is below the maximum of 3000 lbs. and the weight and balance calculations have determined the C.G. position within the approved limits.

(b) Takeoff and Landing

After determining the aircraft loading, all aspects of takeoff and landing must be considered.

All of the existing conditions at the departure and destination airport must be acquired, evaluated and maintained throughout the flight.

Apply the departure airport conditions and takeoff weight to the appropriate Takeoff Performance graph (Figure 5-5, 5-7, 5-9, or 5-11) to determine the length of runway necessary for the takeoff and/or the barrier distance.

The landing distance calculations are performed in the same manner using the existing conditions at the destination airport and, when established, the landing weight.

The conditions and calculations for the example flight are listed below. The takeoff and landing distances required for the example flight have fallen well below the available runway lengths.

	Departure Airport	Destination Airport
(1) Pressure Altitude	2000 ft.	1800 ft.
(2) Temperature	27°C	31°C
(3) Wind Component (Headwind)	15 KTS	15 KTS
(4) Runway Length Available	7000 ft.	4500 ft.
(5) Runway Required	1460 ft.*	1380 ft. **

NOTE

The remainder of the performance charts used in this flight plan example assume a no wind condition. The effect of winds aloft must be considered by the pilot when computing climb, cruise and descent performance.

*reference Figure 5-7
**reference Figure 5-35

(c) Climb

The next step in the flight plan example is to determine the necessary climb segment components.

The desired cruise pressure altitude and corresponding cruise outside air temperature values are the first variables to be considered in determining the climb components from the Fuel, Time and Distance to Climb graph (Figure 5-15). After the fuel, time and distance for the cruise pressure altitude and outside air temperature values have been established, apply the existing conditions at the departure field to the graph (Figure 5-15). Now, subtract the values obtained from the graph for the field of departure conditions from those for the cruise pressure altitude.

The remaining values are the true fuel, time and distance components for the climb segment of the flight plan corrected for field pressure altitude and temperature.

The following values were determined from the above instructions in the flight planning example.

(1) Cruise Pressure Altitude	8000 ft.
(2) Cruise OAT	12°C
(3) Time to Climb (10.5 min. minus 2 min.)	8.5 min.*
(4) Distance to Climb (16 naut. miles minus 3 naut. miles)	13 naut. miles*
(5) Fuel to Climb (3.5 gal. minus 1 gal.)	2.5 gal.*

(d) Descent

The descent data will be determined prior to the cruise data to provide the descent distance for establishing the total cruise distance.

Utilizing the cruise pressure altitude and OAT, determine the basic fuel, time and distance for descent (Figure 5-31). These figures must be adjusted for the field pressure altitude and temperature at the destination airport. To find the necessary adjustment values, use the existing pressure altitude and temperature conditions at the destination airport as variables to find the fuel, time and distance

*reference Figure 5-15

values from the graph (Figure 5-31). Now, subtract the values obtained from the field conditions from the values obtained from the cruise conditions to find the true fuel, time and distance values needed for the flight plan.

The values obtained by proper utilization of the graphs for the descent segment of the example are shown below.

(1) Time to Descend
(8 min. minus 2 min.) — 6 min.*

(2) Distance to Descend
(20 naut. miles minus 4.5 naut. miles) — 15.5 naut. miles*

(3) Fuel to Descend
(2 gal. minus .5 gal.) — 1.5 gal.*

(e) Cruise

Using the total distance to be traveled during the flight, subtract the previously calculated distance to climb and distance to descend to establish the total cruise distance. Refer to the appropriate Avco Lycoming Operator's Manual when selecting the cruise power setting. The established pressure altitude and temperature values and the selected cruise power should now be utilized to determine the true airspeed from the appropriate Speed Power graph (Figure 5-19 or 5-21).

Calculate the cruise fuel flow for the cruise power setting from the information provided by the Avco Lycoming Operator's Manual.

The cruise time is found by dividing the cruise distance by the cruise speed and the cruise fuel is found by multiplying the cruise fuel flow by the cruise time.

The cruise calculations established for the cruise segment of the flight planning example are as follows:

(1) Total Distance — 620 naut. miles

(2) Cruise Distance
(e)(1) minus (c)(4) minus (d)(2),
(620 naut. miles minus 13 naut. miles minus 15.5 naut. miles) — 592 naut. miles

*reference Figure 5-31

(3) Cruise Power (Mixture leaned to 50° F rich of peak EGT) — 65% rated power

(4) Cruise Speed — 134 KTS TAS*

(5) Cruise Fuel Consumption — 11.8 GPH*

(6) Cruise Time
(e)(2) divided by (e)(4), (592 naut. miles divided by 134 KTS) — 4.4 hrs.

(7) Cruise Fuel
(e)(5) multiplied by (e)(6), (11.8 GPH multiplied by 4.5 hrs.) — 52.1 gal.

(f) Total Flight Time

The total flight time is determined by adding the time to climb, the time to descend and the cruise time. Remember! the time values taken from the climb and descent graphs are in minutes and must be converted to hours before adding them to the cruise time.

The following flight time is required for the flight planning example.

(1) Total Flight Time
(c)(3) plus (d)(1) plus (e)(6),
(.14 hrs. plus .1 hrs. plus 4.4 hrs.) — 4.64 hrs.

(g) Total Fuel Required

Determine the total fuel required by adding the fuel to climb, the fuel to descend and the cruise fuel. When the total fuel (in gallons) is determined, multiply this value by 6 lb./gal. to determine the total fuel weight used for the flight.

The total fuel calculations for the example flight plan are shown below.

(1) Total Fuel Required
(c)(5) plus (d)(3) plus (e)(7),
(2.5 gal. plus 1.5 gal. plus 52.1 gal.) — 56.1 gal.
(56.1 gal. multiplied by 6 lb./gal.) — 337 lbs.

*reference Figure 5-21

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5.7 PERFORMANCE GRAPHS

LIST OF FIGURES

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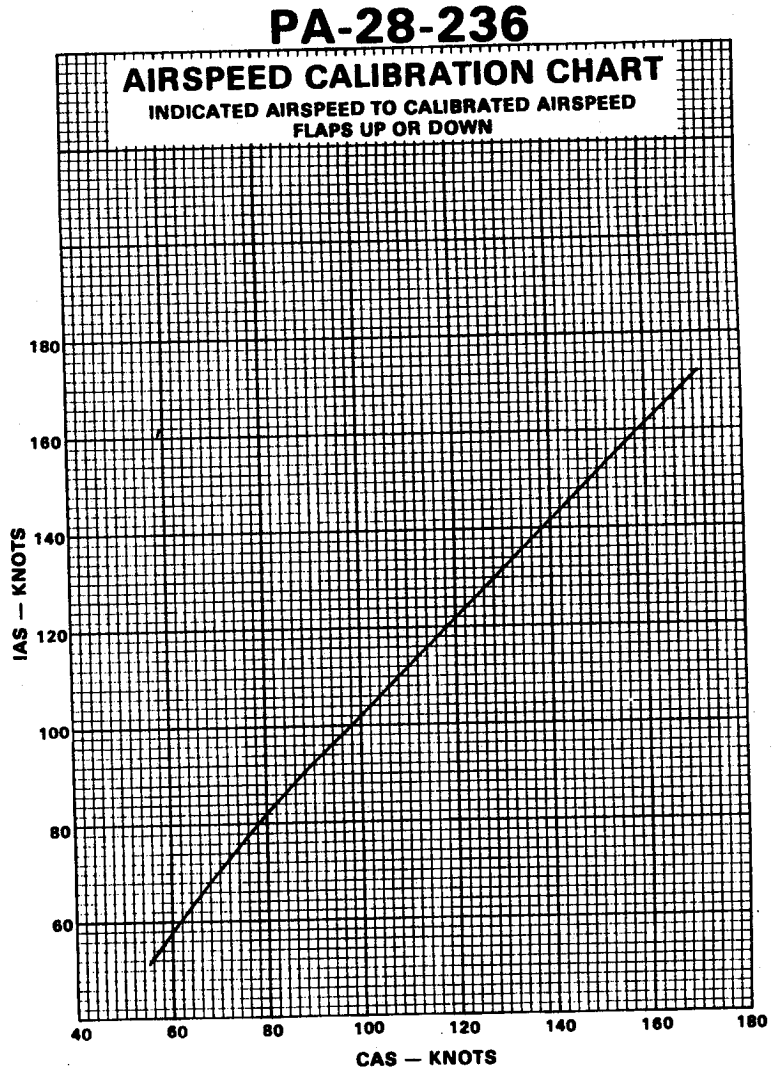
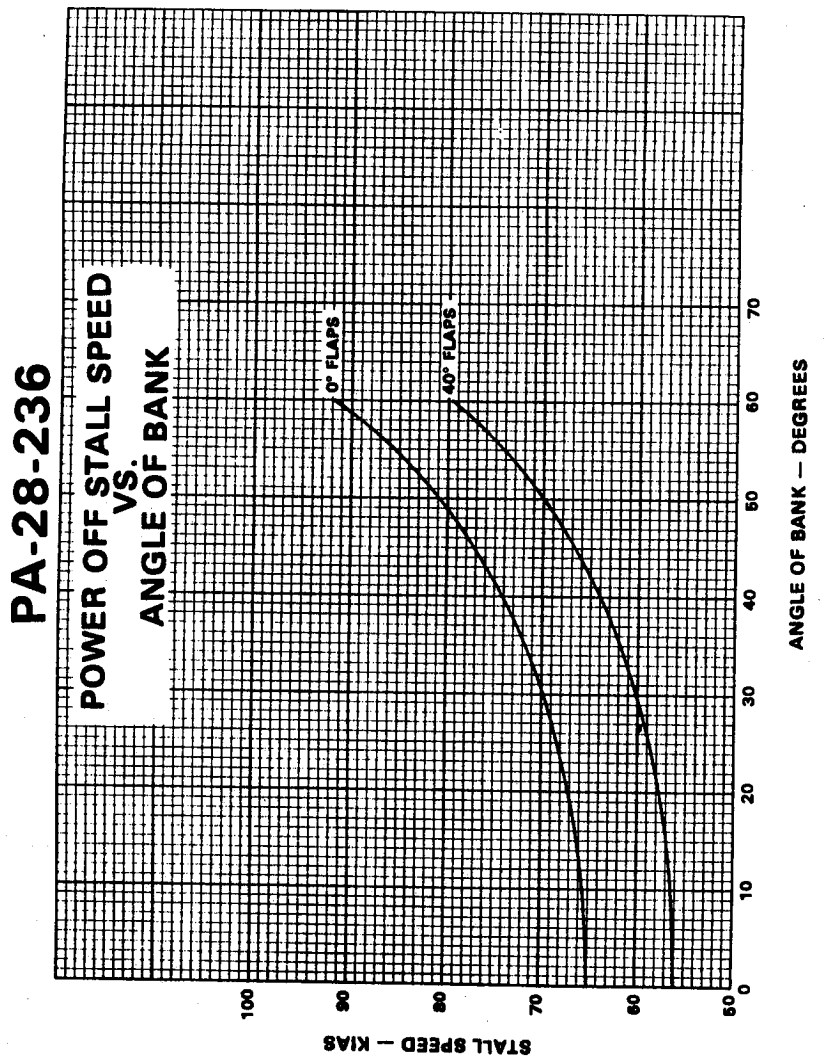
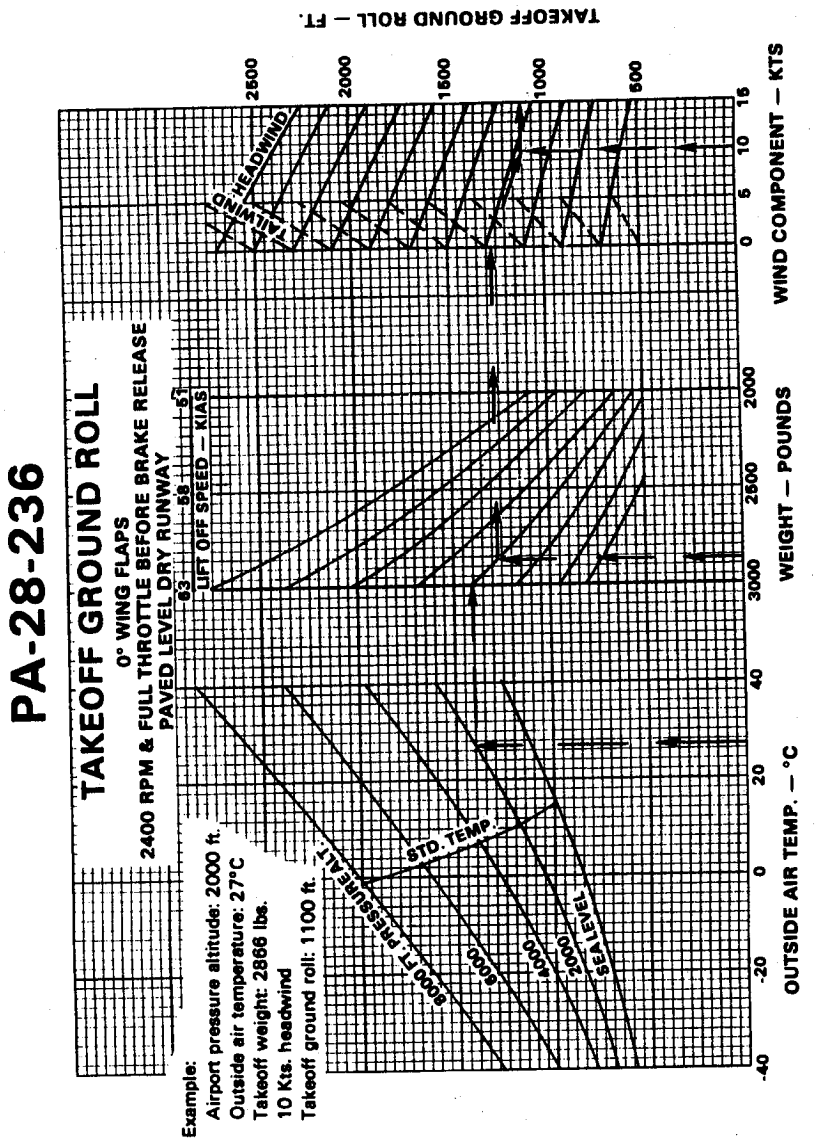


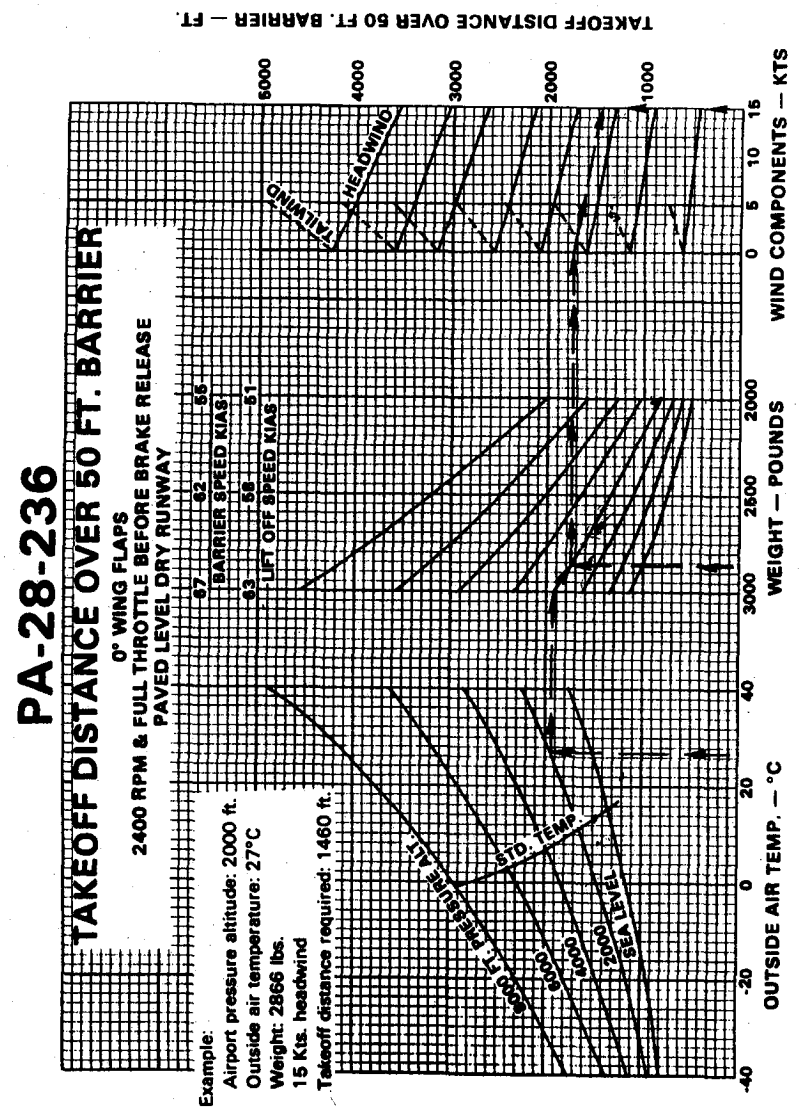
AIRSPEED CALIBRATION
Figure 5-1



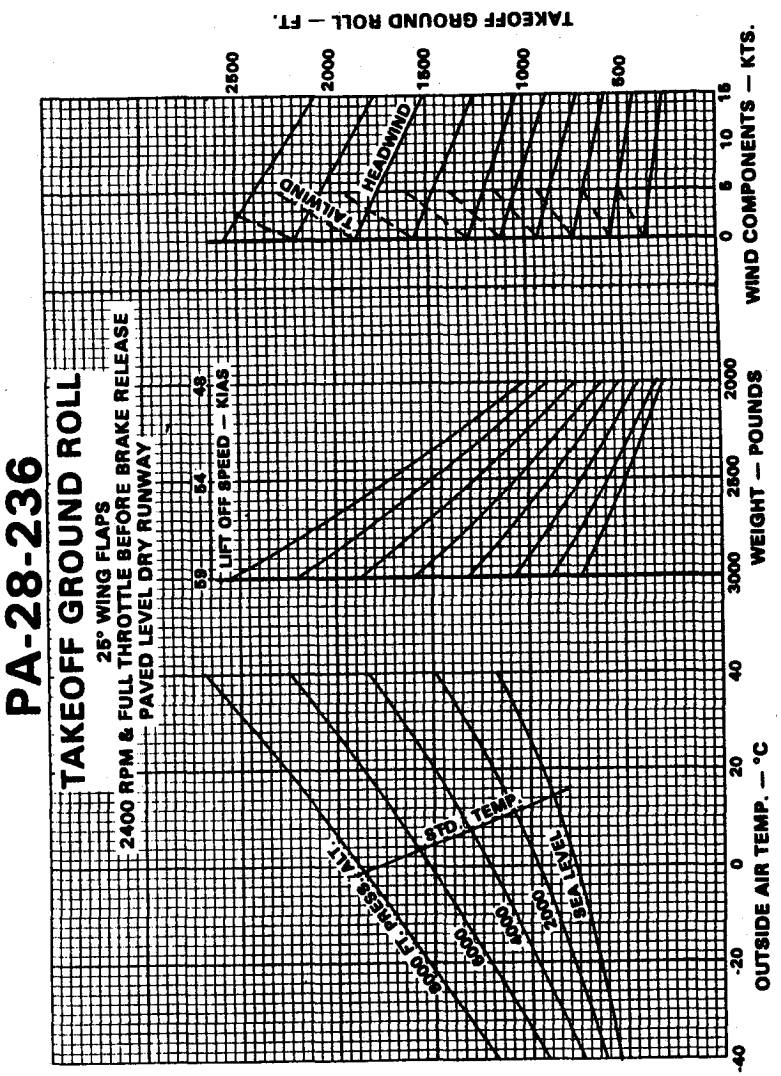
STALL SPEED VS. ANGLE OF BANK
Figure 5-3



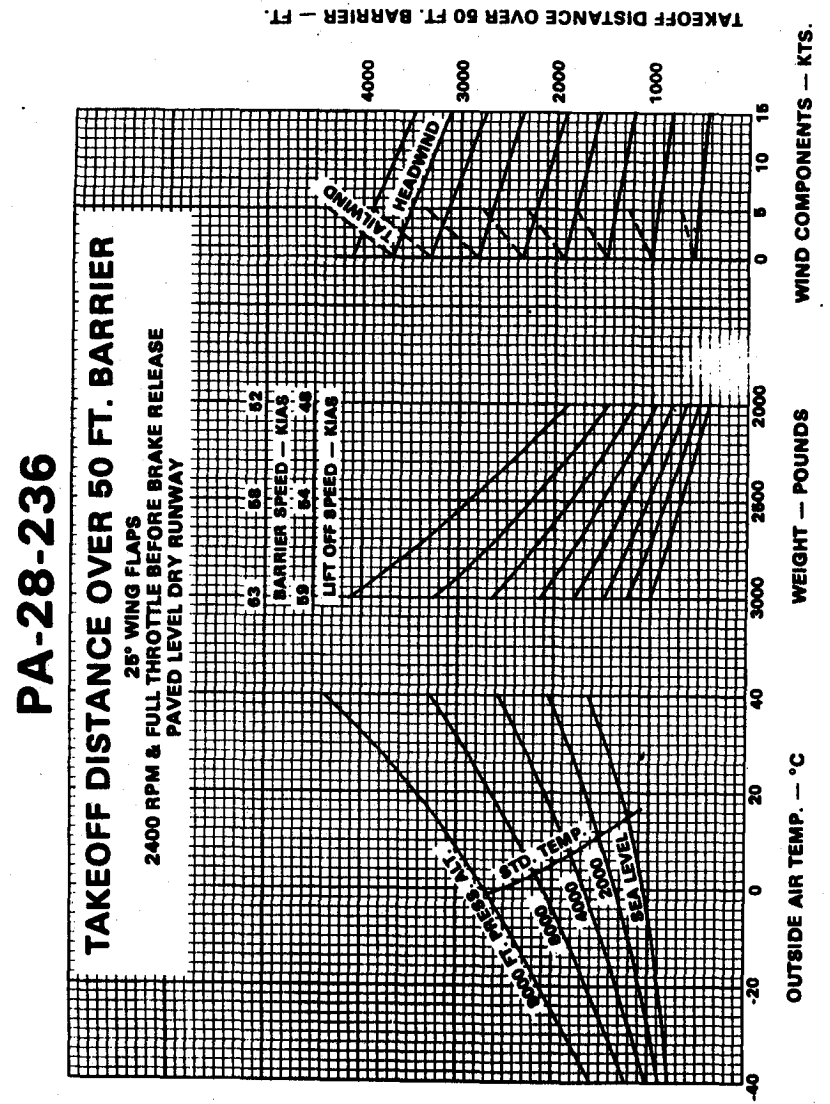
TAKEOFF GROUND ROLL (0° FLAPS)
Figure 5-5



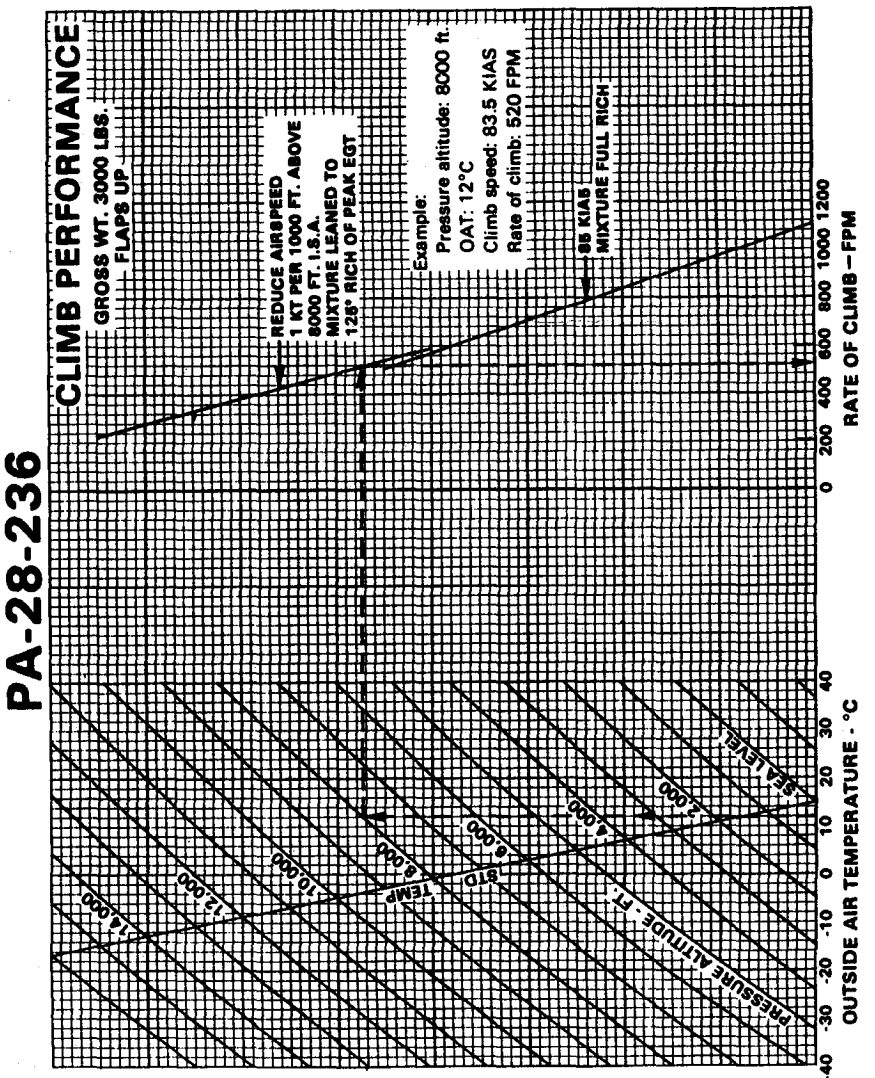
TAKEOFF DISTANCE OVER 50 FT. BARRIER (0° FLAPS)
Figure 5-7



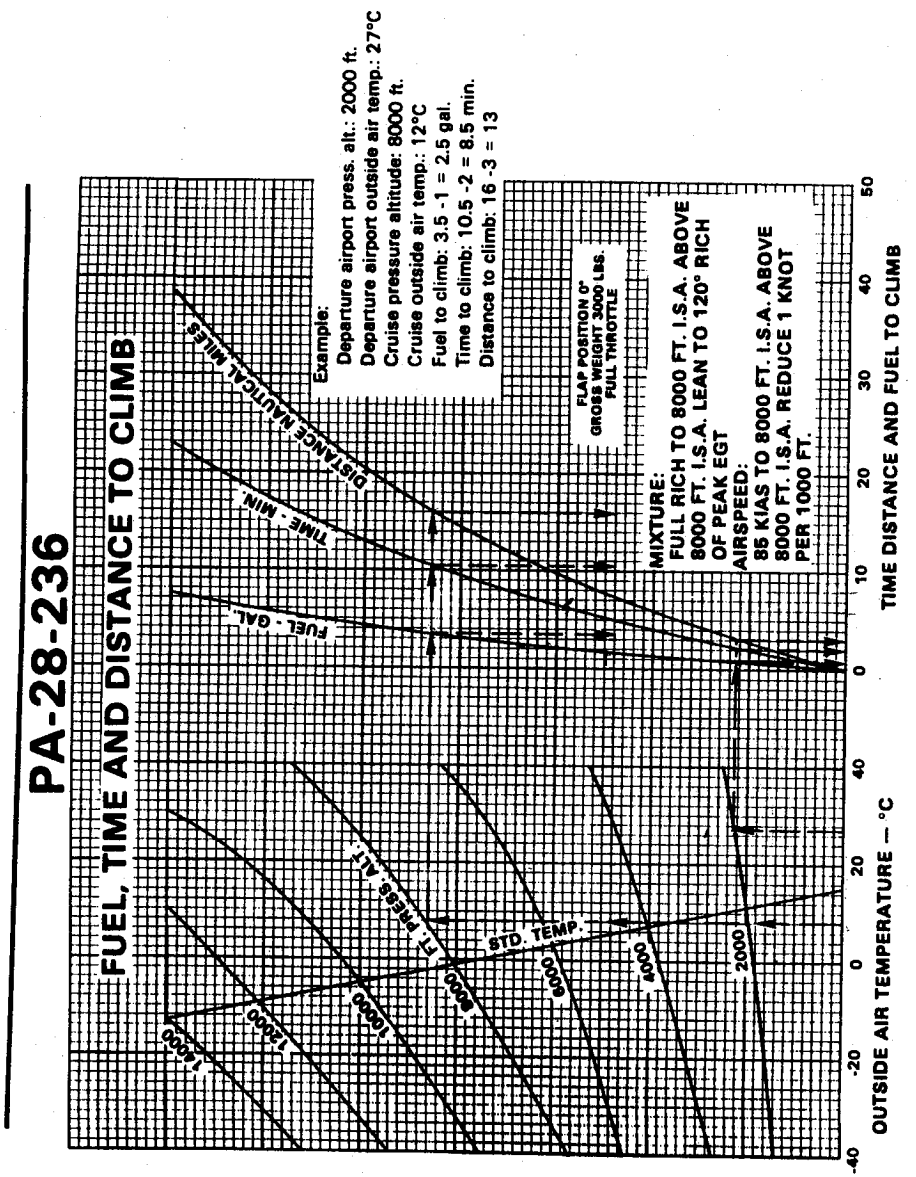
TAKEOFF GROUND ROLL (25° FLAPS)
Figure 5-9



TAKEOFF DISTANCE OVER 50 FT. BARRIER (25° FLAPS)
Figure 5-11



CLIMB PERFORMANCE
Figure 5-13



FUEL, TIME AND DISTANCE TO CLIMB
Figure 5-15

POWER SETTING TABLE — AVCO LYCOMING O-540-J3A5D, 235 HP @ 2400 RPM

Press. Alt. Feet	Std. Alt. Temp. °C	129 HP - 55% Rated RPM & MAN. PRESS. 2100	2200	2300	2400	153 HP - 65% Rated RPM & MAN. PRESS. 2100	2200	2300	2400	175 HP - 75% Rated RPM & MAN. PRESS. 2200	2300	2400	200 HP - 85% Rated RPM & MAN. PRESS. 2200	2300	2400
SL	15	20.8	20.0	19.4	18.7	23.2	22.4	21.7	21.0	24.6	23.9	23.1	27.2	26.4	25.5
1000	13	20.5	19.8	19.2	18.5	22.9	22.2	21.5	20.8	24.3	23.6	22.9	26.9	26.1	25.3
2000	11	20.3	19.5	19.0	18.3	22.7	21.9	21.2	20.6	24.1	23.4	22.6	F.T.	25.8	25.0
3000	9	20.0	19.3	18.8	18.1	22.4	21.7	21.0	20.4	23.8	23.1	22.4	—	F.T.	24.7
4000	7	19.8	19.1	18.5	17.9	22.1	21.4	20.8	20.2	23.5	22.8	22.1	—	—	F.T.
5000	5	19.5	18.9	18.3	17.7	21.9	21.2	20.5	20.0	23.2	22.6	21.9			
6000	3	19.3	18.6	18.1	17.5	21.6	21.0	20.3	19.7	F.T.	22.3	21.7			
7000	1	19.1	18.4	17.9	17.3	21.3	20.7	20.1	19.5	—	F.T.	21.5			
8000	-1	18.8	18.2	17.7	17.2	21.1	20.5	19.9	19.3	—	—	F.T.			
9000	-3	18.6	18.0	17.5	17.0	F.T.	20.2	19.7	19.1						
10,000	-5	18.3	17.7	17.2	16.8	—	F.T.	19.4	18.9						
11,000	-7	18.1	17.5	17.0	16.6	—	—	F.T.	F.T.						
12,000	-9	17.8	17.3	16.8	16.4										
13,000	-11	F.T.	17.0	16.6	16.2										
14,000	-13	—	F.T.	16.4	16.0										
15,000	-15	—	—	F.T.	15.8										
16,000	-17	—	—	—	F.T.										

NOTE: To maintain constant power, add approximately 1% for each 6°C above standard, subtract approximately 1% for each 6°C below standard.

POWER SETTING TABLE
Figure 5-17

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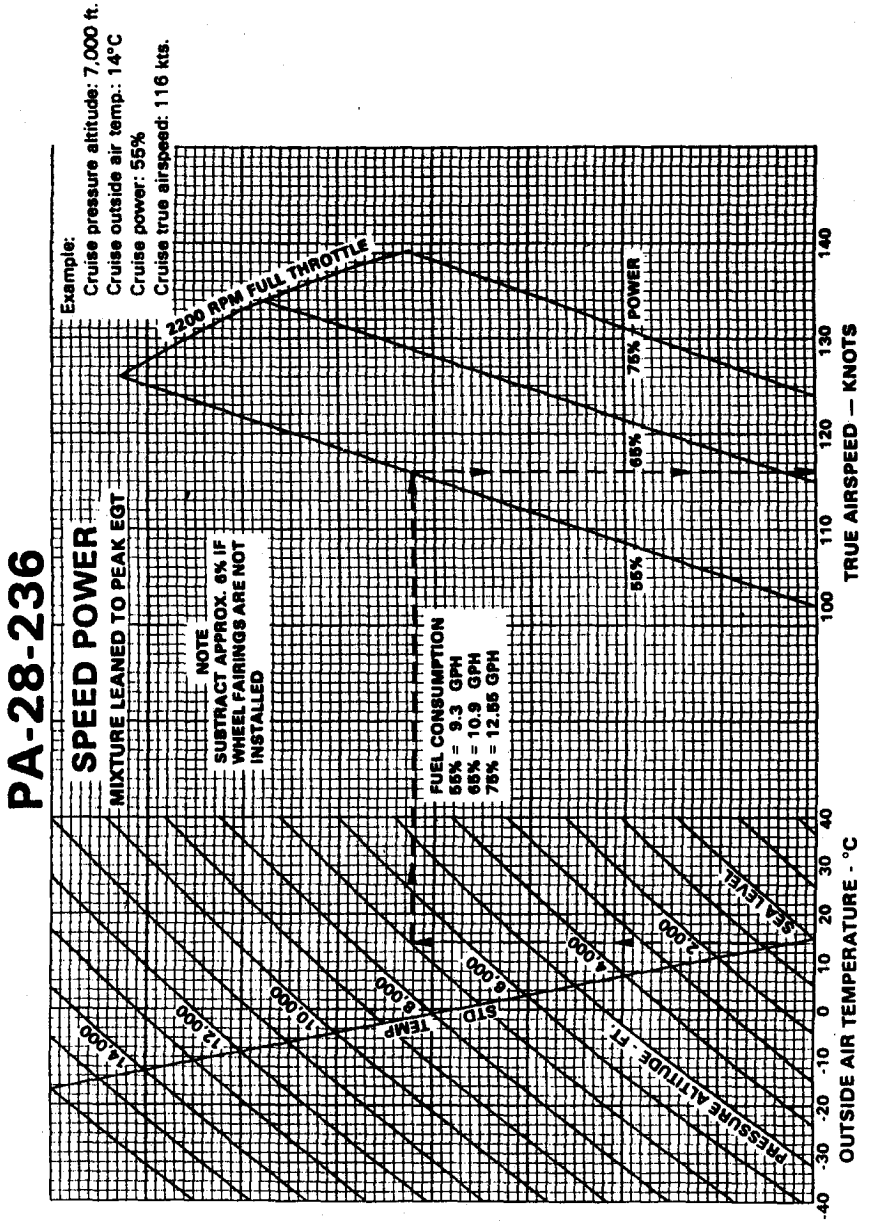
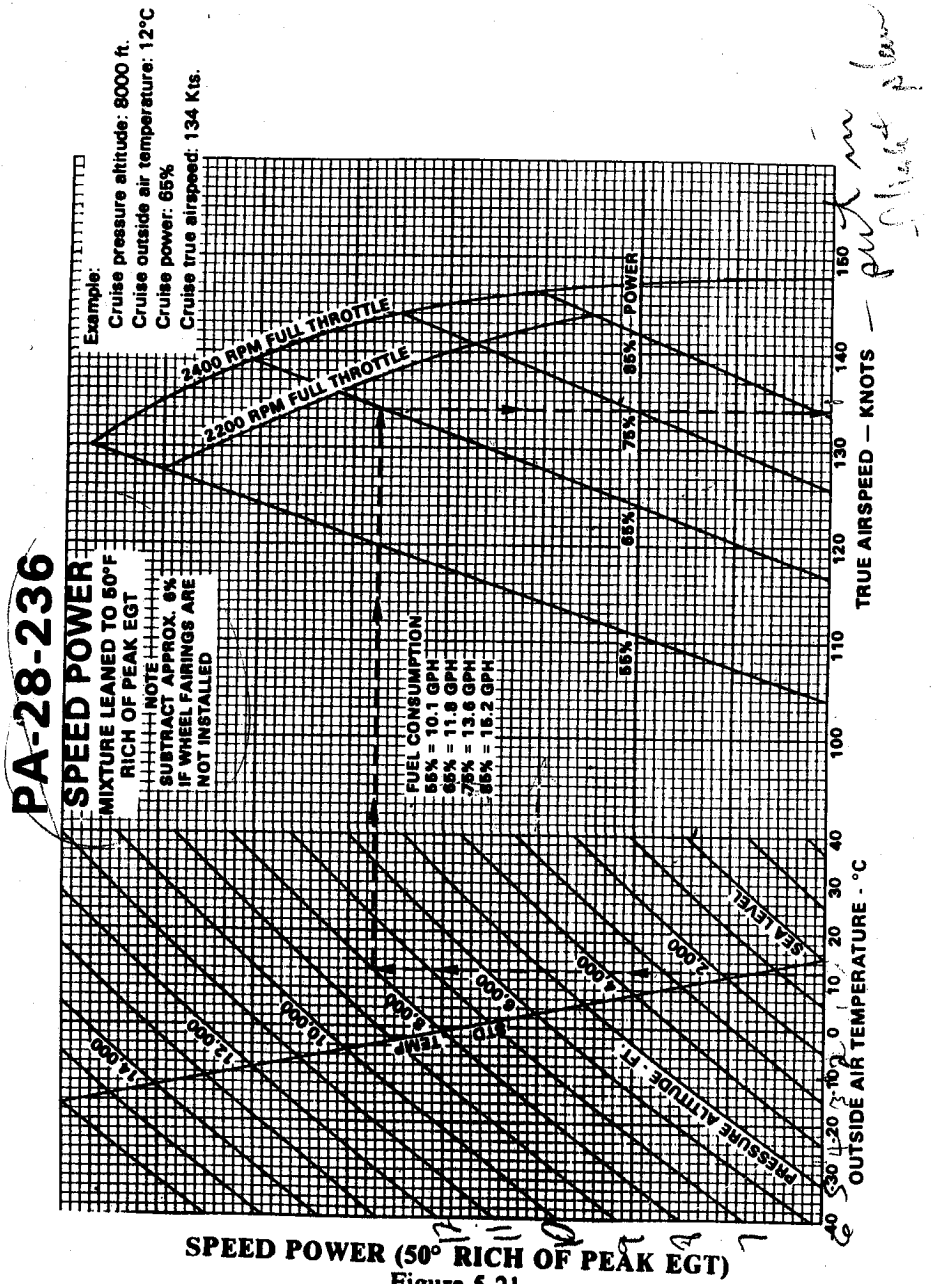
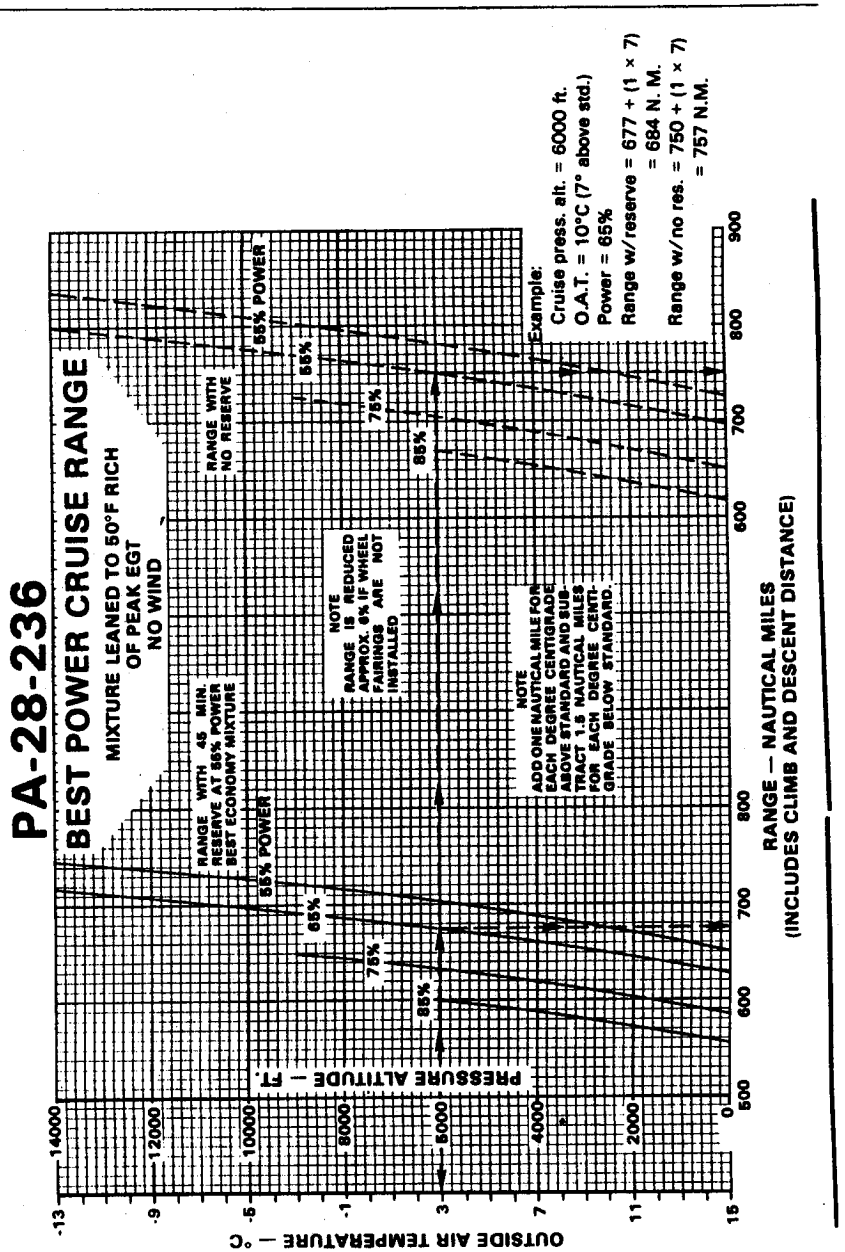


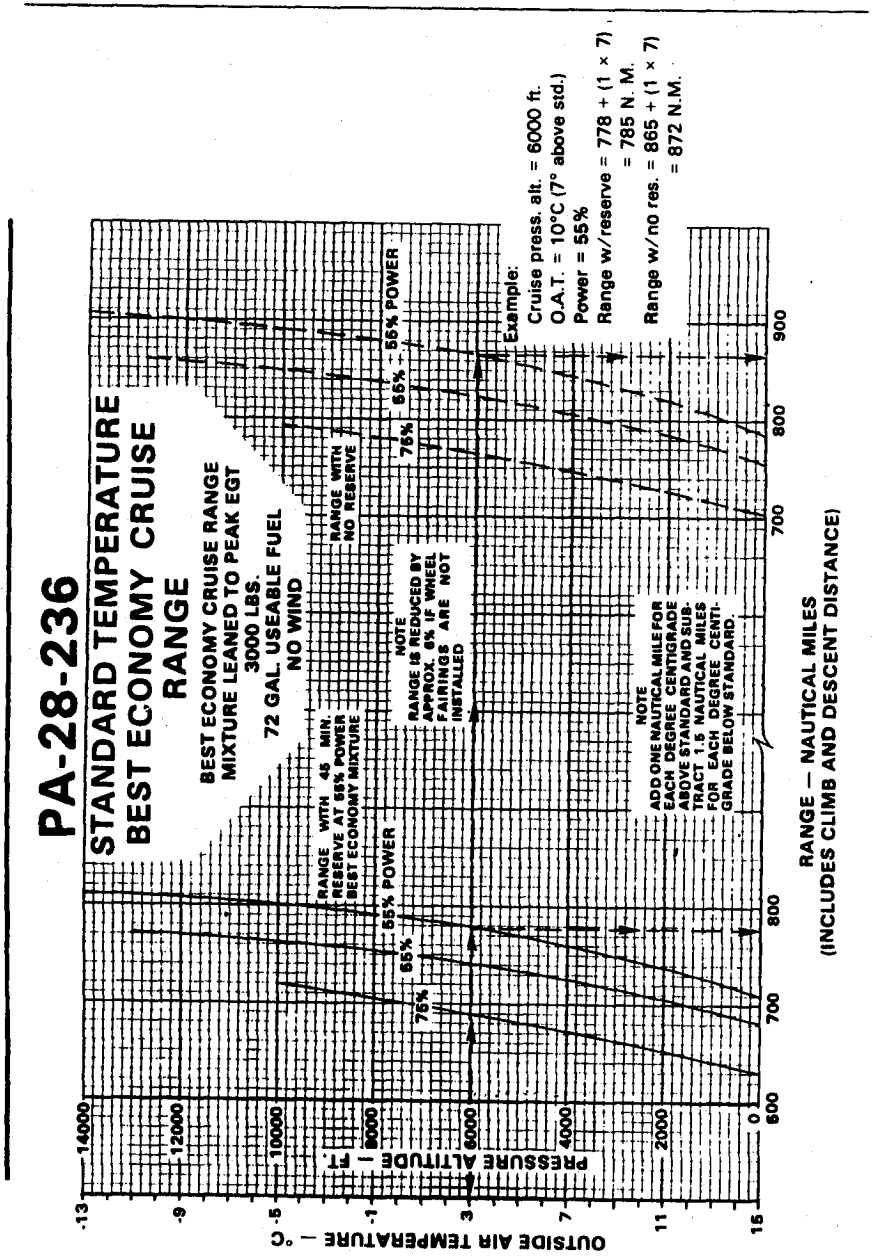
SPEED POWER (PEAK EGT)
Figure 5-19



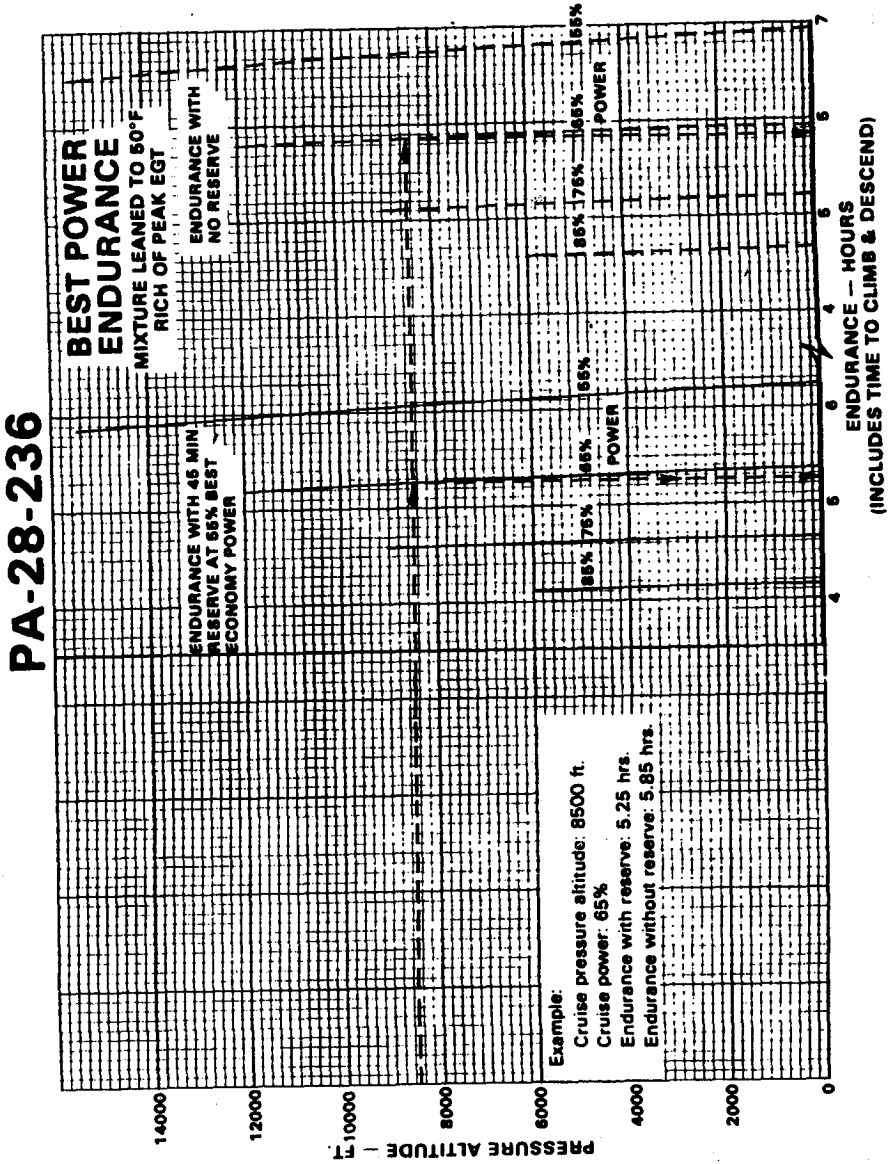
SPEED POWER (50° RICH OF PEAK EGT)
Figure 5-21



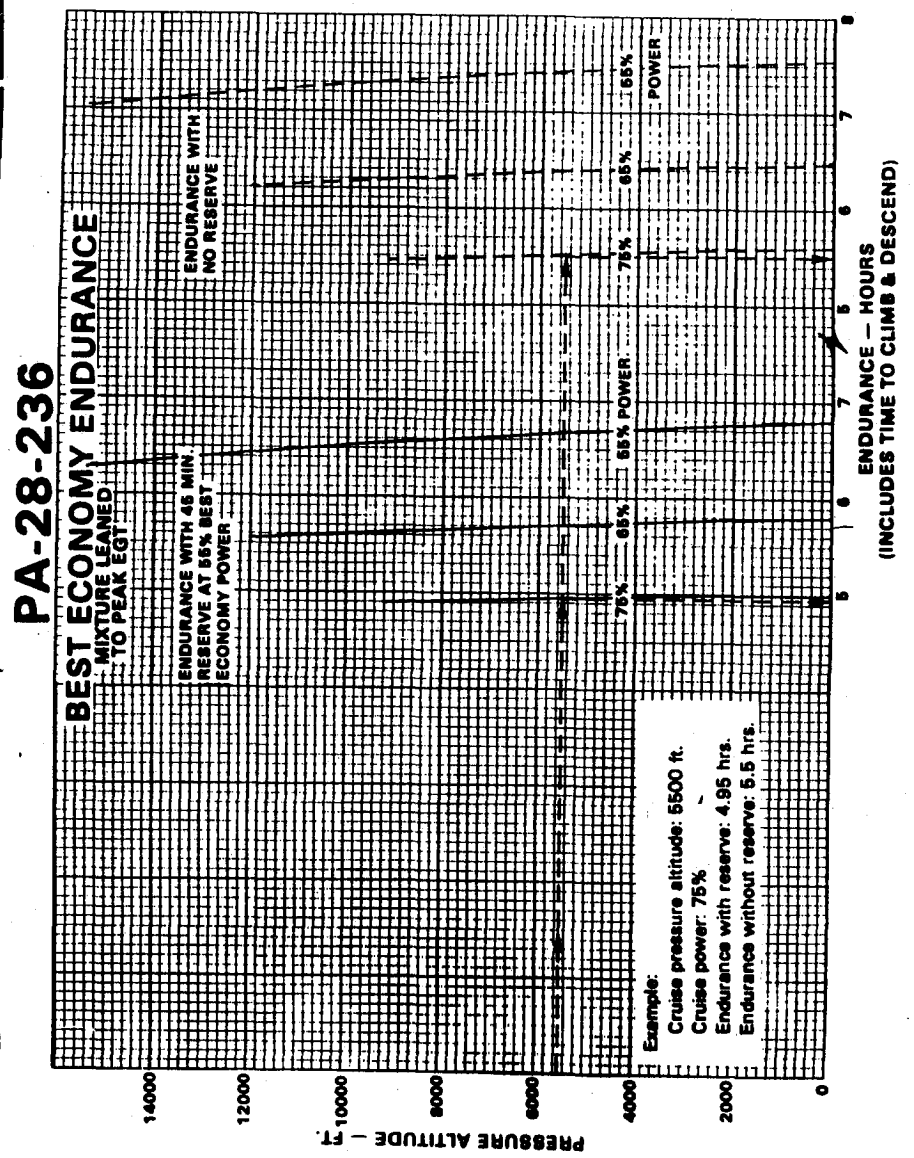
BEST POWER CRUISE RANGE
Figure 5-23



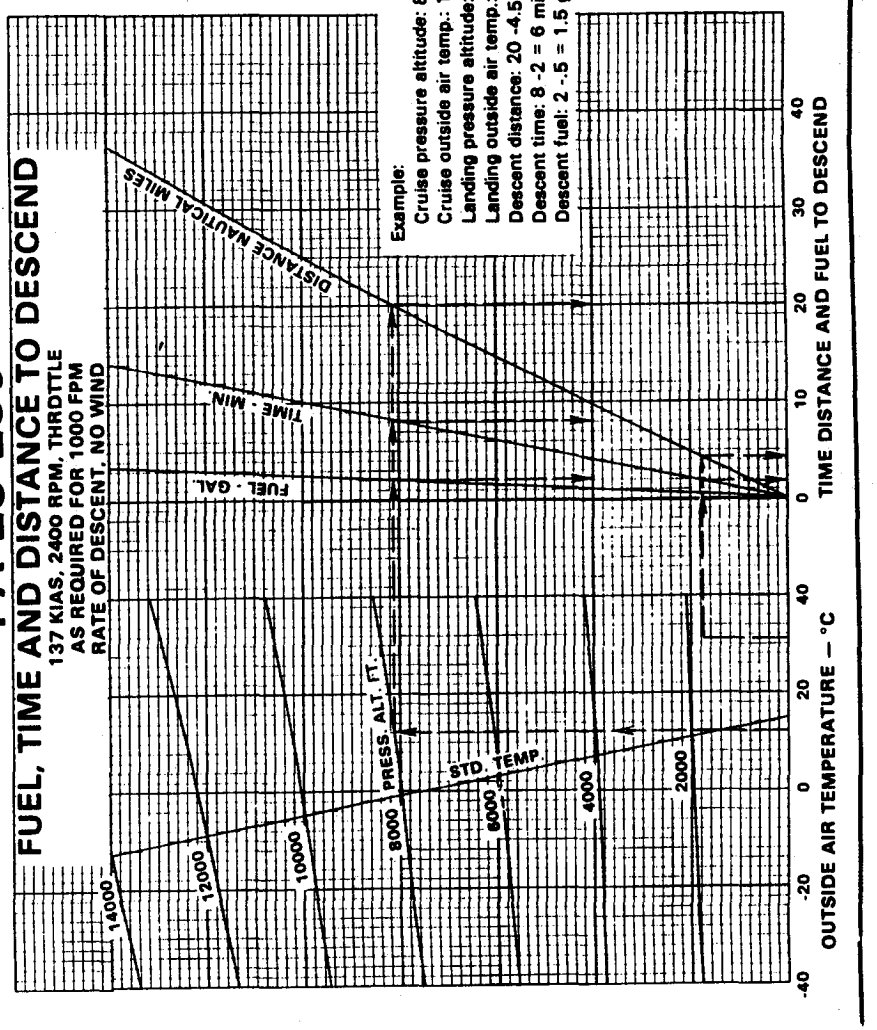
BEST ECONOMY CRUISE RANGE
Figure 5-25



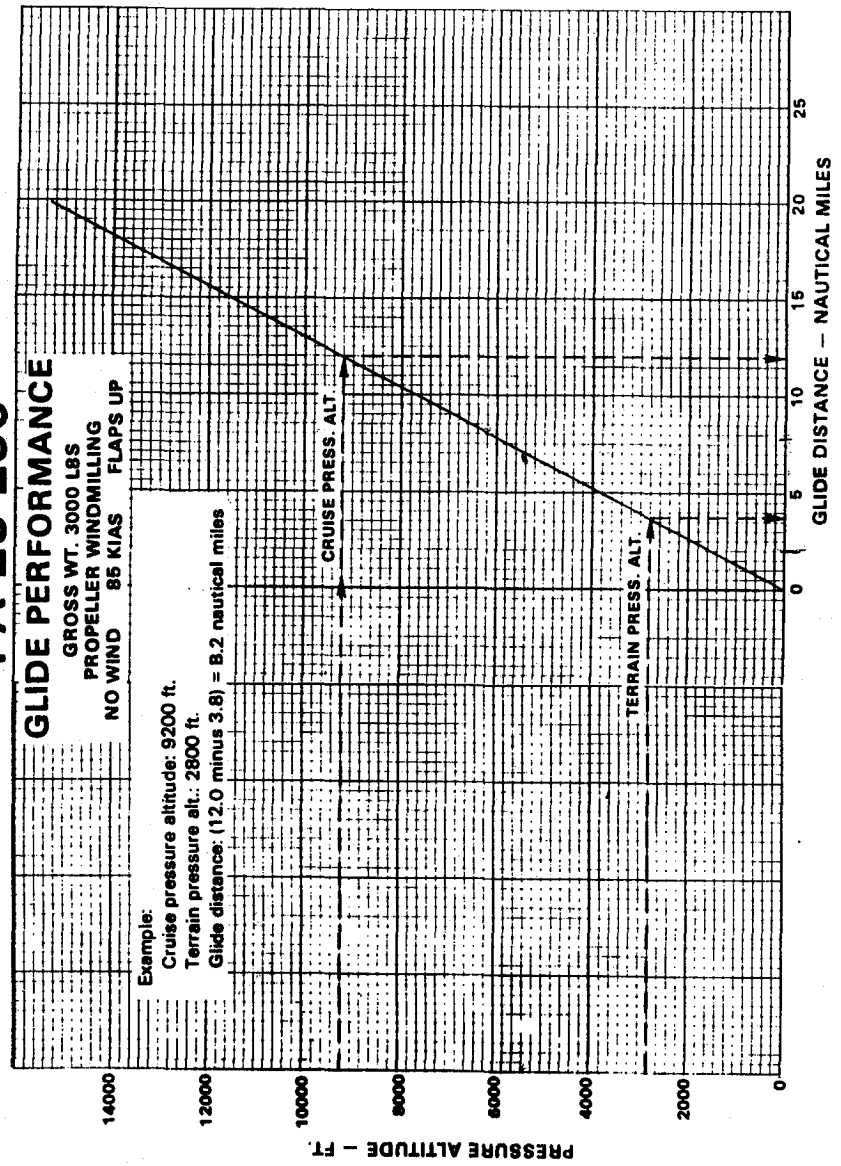
BEST POWER CRUISE ENDURANCE
Figure 5-27



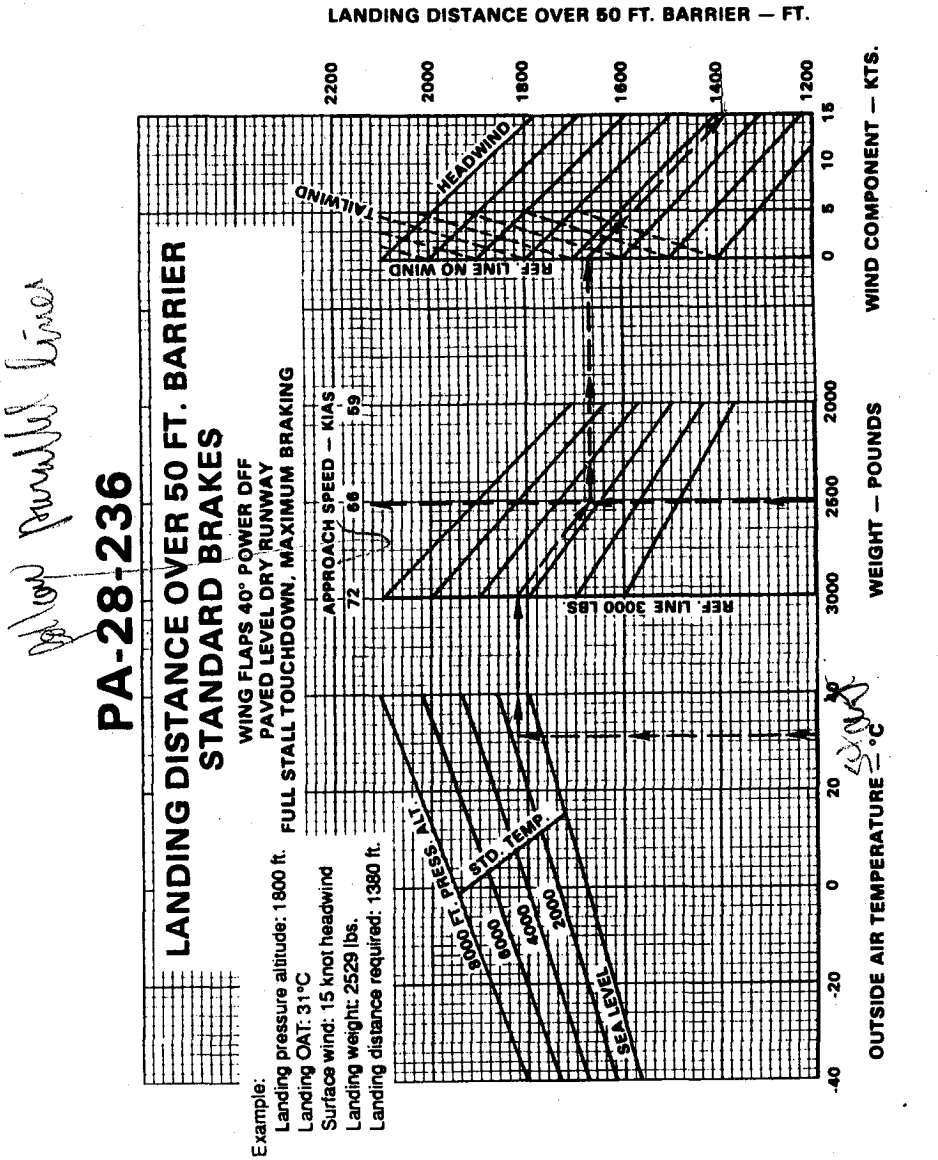
BEST ECONOMY CRUISE ENDURANCE
Figure 5-29



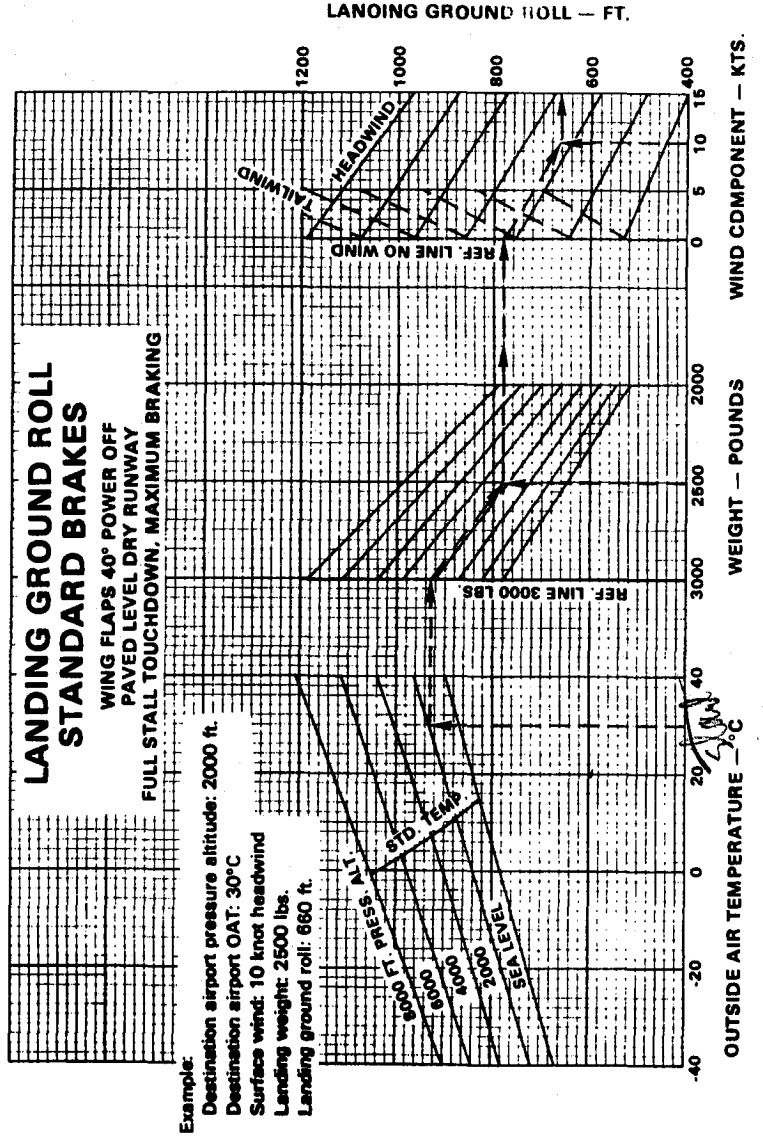
FUEL, TIME AND DISTANCE TO DESCEND
Figure 5-31



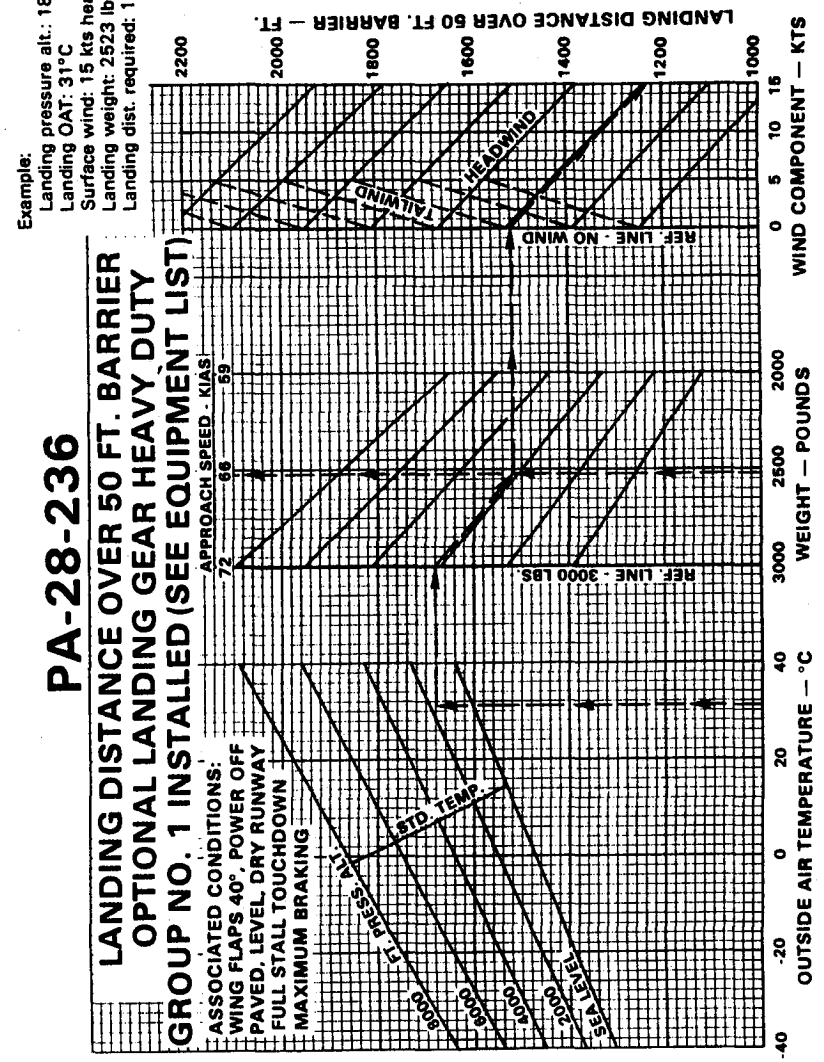
GLIDE PERFORMANCE
Figure 5-33



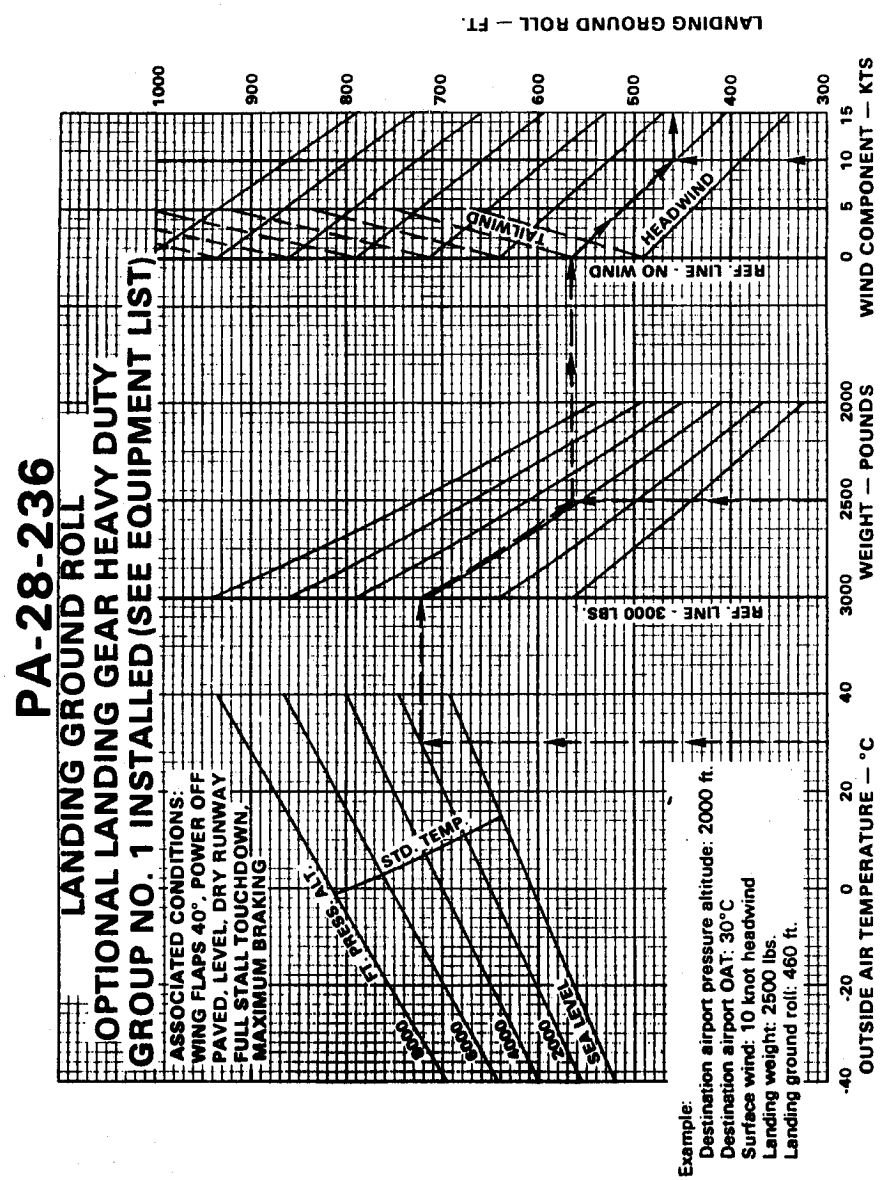
LANDING DISTANCE OVER 50 FT. BARRIER
STANDARD BRAKES
Figure 5-35



LANDING GROUND ROLL - STANDARD BRAKES
Figure 5-37



LANDING DISTANCE OVER 50 FT. BARRIER
HEAVY DUTY BRAKES
Figure 5-39



LANDING GROUND ROLL - HEAVY DUTY BRAKES
Figure 5-41

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SECTION 6

WEIGHT AND BALANCE

SECTION 6

WEIGHT AND BALANCE

6.1 GENERAL

In order to achieve the performance and flying characteristics which are designed into the airplane, it must be flown with the weight and center of gravity (C.G.) position within the approved operating range (envelope). Although the airplane offers a flexibility of loading, it cannot be flown with the maximum number of adult passengers, full fuel tanks and maximum baggage. With the flexibility comes responsibility. The pilot must insure that the airplane is loaded within the loading envelope before he makes a takeoff.

Misloading carries consequences for any aircraft. An overloaded airplane will not take off, climb or cruise as well as a properly loaded one. The heavier the airplane is loaded, the less climb performance it will have.

Center of gravity is a determining factor in flight charateristics. If the C.G. is too far forward in any airplane, it may be difficult to rotate for takeoff or landing. If the C.G. is too far aft, the airplane may rotate prematurely on takeoff or tend to pitch up during climb. Longitudinal stability will be reduced. This can lead to inadvertent stalls and even spins; and spin recovery becomes more difficult as the center of gravity moves aft of the approved limit.

A properly loaded airplane, however, will perform as intended. This airplane is designed to provide performance within the flight envelope. Before the airplane is licensed, it is weighed, and a basic empty weight and C.G. location is computed (basic empty weight consists of the standard empty weight of the airplane plus the optional equipment). Using the basic empty weight and C.G. location, the pilot can determine the weight and C.G. position for the loaded airplane by computing the total weight and moment and then determining whether they are within the approved envelope.

The basic empty weight and C.G. location are recorded in the Weight and Balance Data Form (Figure 6-5) and the Weight and Balance Record (Figure 6-7). The current values should always be used. Whenever new equipment is added or any modification work is done, the mechanic responsible for the work is required to compute a new basic empty weight and C.G. position and to write these in the Aircraft Log Book and the Weight and Balance Record. The owner should make sure that it is done.

A weight and balance calculation is necessary in determining how much fuel or baggage can be boarded so as to keep within allowable limits. Check calculations prior to adding fuel to insure against overloading.

The following pages are forms used in weighing an airplane in production and in computing basic empty weight, C.G. position, and useful load. Note that the useful load includes usable fuel, baggage, cargo and passengers. Following this is the method for computing takeoff weight and C.G.

6.3 AIRPLANE WEIGHING PROCEDURE

At the time of licensing, Piper Aircraft Corporation provides each airplane with the basic empty weight and center of gravity location. This data is supplied by Figure 6-5.

The removal or addition of equipment or airplane modifications can affect the basic empty weight and center of gravity. The following is a weighing procedure to determine this basic empty weight and center of gravity location:

(a) Preparation

(1) Be certain that all items checked in the airplane equipment list are installed in the proper location in the airplane.

(2) Remove excessive dirt, grease, moisture, foreign items such as rags and tools from the airplane before weighing.

(3) Defuel airplane. Then open all fuel drains until all remaining fuel is drained. Operate engine on each tank until all undrainable fuel is used and engine stops. Then add the unusable fuel (5.0 gallons total, 2.5 gallons each wing).

CAUTION

Whenever the fuel system is completely drained and fuel is replenished it will be necessary to run the engine for a minimum of 3 minutes at 1000 RPM on each tank to insure no air exists in the fuel supply lines.

(4) Fill with oil to full capacity.

(5) Place pilot and copilot seats in fourth (4th) notch, aft of forward position. Put flaps in the fully retracted position and all control surfaces in the neutral position. Tow bar should be in the proper location and all entrance and baggage doors closed.

(6) 'Weigh the airplane inside a closed building to prevent errors in scale readings due to wind.

(b) Leveling

(1) With airplane on scales, block main gear oleo pistons in the fully extended position.

(2) Level airplane (refer to Figure 6-3) deflating nose wheel tire, to center bubble on level.

(c) Weighing - Airplane Basic Empty Weight

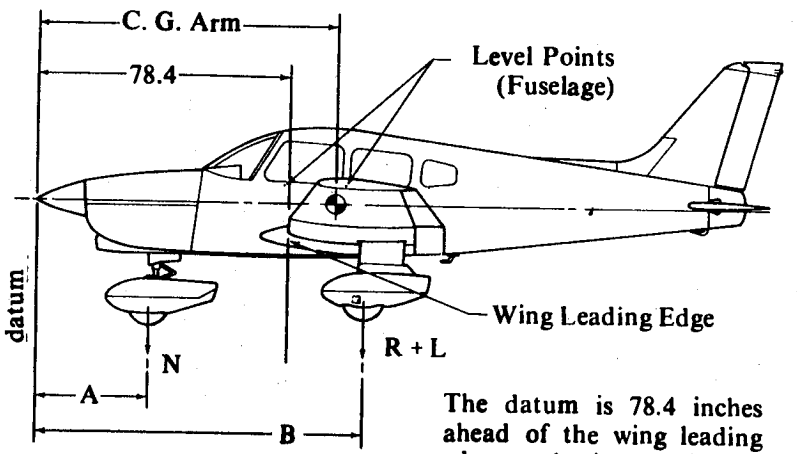
(1) With the airplane level and brakes released, record the weight shown on each scale. Deduct the tare, if any, from each reading.

Scale Position and Symbol	Scale Reading	Tare	Net Weight
Nose Wheel (N)			
Right Main Wheel (R)			
Left Main Wheel (L)			
Basic Empty Weight, as Weighed (T)			

WEIGHING FORM
Figure 6-1

(d) Basic Empty Weight Center of Gravity

(1) The following geometry applies to the PA-28-236 airplane when it is level. Refer to Leveling paragraph 6.3 (b).



A = 32.4
B = 109.7

The datum is 78.4 inches ahead of the wing leading edge at the intersection of the straight and tapered section.

LEVELING DIAGRAM
Figure 6-3

(2) The basic empty weight center of gravity (as weighed including optional equipment, full oil and unusable fuel) can be determined by the following formula:

$$\text{C.G. Arm} = \frac{N\,(A) + (R + L)\,(B)}{T} \quad \text{inches}$$

Where: $T = N + R + L$

6.5 WEIGHT AND BALANCE DATA AND RECORD

The Basic Empty Weight, Center of Gravity Location and Useful Load listed in Figure 6-5 are for the airplane as licensed at the factory. These figures apply only to the specific airplane serial number and registration number shown.

The basic empty weight of the airplane as licensed at the factory has been entered in the Weight and Balance Record (Figure 6-7). This form is provided to present the current status of the airplane basic empty weight and a complete history of previous modifications. Any change to the permanently installed equipment or modification which affects weight or moment must be entered in the Weight and Balance Record.

MODEL PA-28-236, DAKOTA

Airplane Serial Number _____

Registration Number _____

Date _____

AIRPLANE BASIC EMPTY WEIGHT

Item	Weight (Lbs)	× C.G. Arm Inches Aft of Datum)	= Moment (In-Lbs)
Standard Empty Weight* Actual / Computed			
Optional Equipment			
Basic Empty Weight			

*The standard empty weight includes full oil capacity and 5.0 gallons of unusable fuel.

AIRPLANE USEFUL LOAD - NORMAL CATEGORY OPERATION

(Ramp Weight) - (Basic Empty Weight) = Useful Load

Normal Category: (3011 lbs.) - (lbs.) = lbs.

THIS BASIC EMPTY WEIGHT, C.G. AND USEFUL LOAD ARE FOR THE AIRPLANE AS LICENSED AT THE FACTORY. REFER TO APPROPRIATE AIRCRAFT RECORD WHEN ALTERATIONS HAVE BEEN MADE.

WEIGHT AND BALANCE DATA FORM
Figure 6-5

PA-28-236	Serial Number	Registration Number						Page Number		
Date	Item No.	Description of Article or Modification	Added (+) / Removed (-)	Weight Change				Running Basic Empty Weigh:		
				Wt. (Lb.)	Arm (In.)	Moment 100		Wt. (Lb.)	Moment 100	
		As licensed								

WEIGHT AND BALANCE RECORD
Figure 6-7

PA-28-236	Serial Number	Registration Number	Page Number

Date	Item No.	Description of Article or Modification	Added (+) / Removed (-)	Weight Change: Wt. (Lb.)	Weight Change: Arm (In.)	Weight Change: Moment 100	Running Basic Empty Weight: Wt. (Lb.)	Running Basic Empty Weight: Moment 100

WEIGHT AND BALANCE RECORD (cont)
Figure 6-7 (cont)

6.7 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT

(a) Add the weight of all items to be loaded to the basic empty weight.
(b) Use the Loading Graph (Figure 6-13) to determine the moment of all items to be carried in the airplane.
(c) Add the moment of all items to be loaded to the basic empty weight moment.
(d) Divide the total moment by the total weight to determine the C.G. location.
(e) By using the figures of item (a) and item (d) (above), locate a point on the C.G. range and weight graph (Figure 6-15). If the point falls within the C.G. envelope, the loading meets the weight and balance requirements.

	Weight (Lbs)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Basic Empty Weight	1780	83.7	148986
Pilot and Front Passenger	340	80.5	27370
Passengers (Rear Seats)	340	118.1	40154
Fuel (72 Gallons Maximum)	432	95.0	41040
Baggage (200 Lbs. Maximum)	119	142.8	16993
Ramp Weight (3011 Lbs. Maximum)	3011	91.2	274543
Fuel allowance for engine start, taxi and run-up	-11	95.0	-1045
Takeoff Weight (3000 Lbs. Maximum)	3000	91.2	273498

The center of gravity (C.G.) of this sample loading problem is at 91.2 inches aft of the datum line. Locate this point (91.2) on the C.G. range and weight graph. Since this point falls within the weight - C.G. envelope, this loading meets the weight and balance requirements.

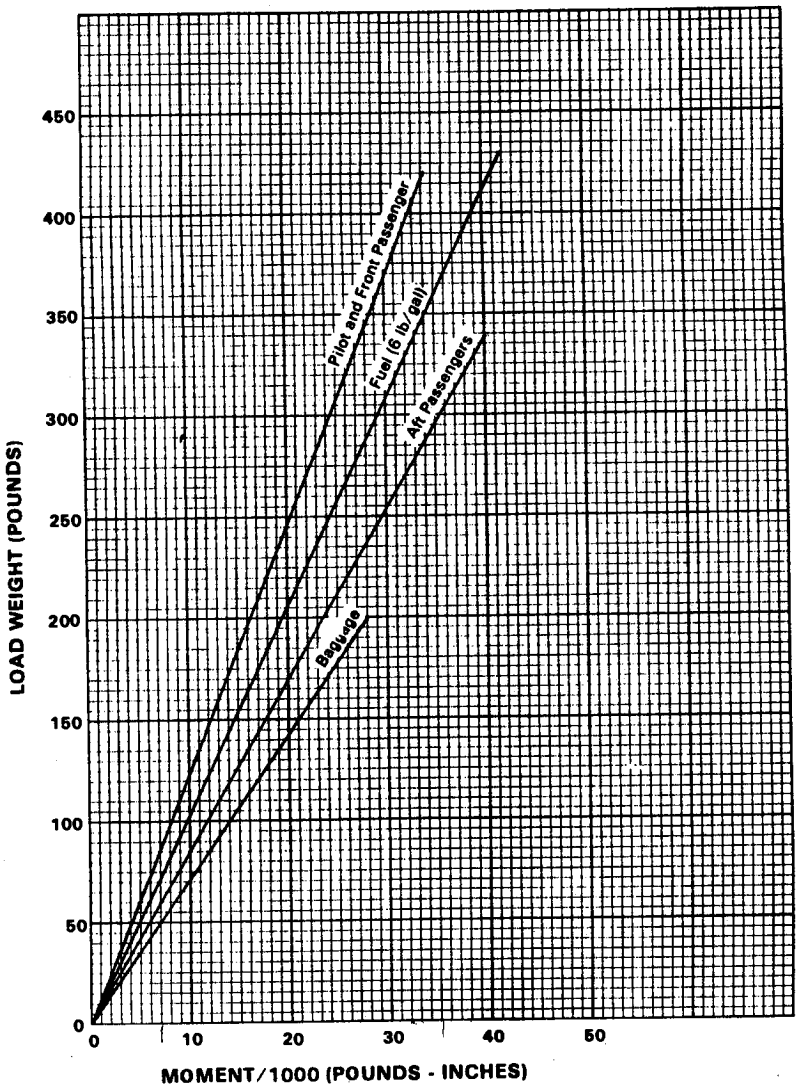
IT IS THE RESPONSIBILITY OF THE PILOT AND AIRCRAFT OWNER TO INSURE THAT THE AIRPLANE IS LOADED PROPERLY.

SAMPLE LOADING PROBLEM (NORMAL CATEGORY)
Figure 6-9

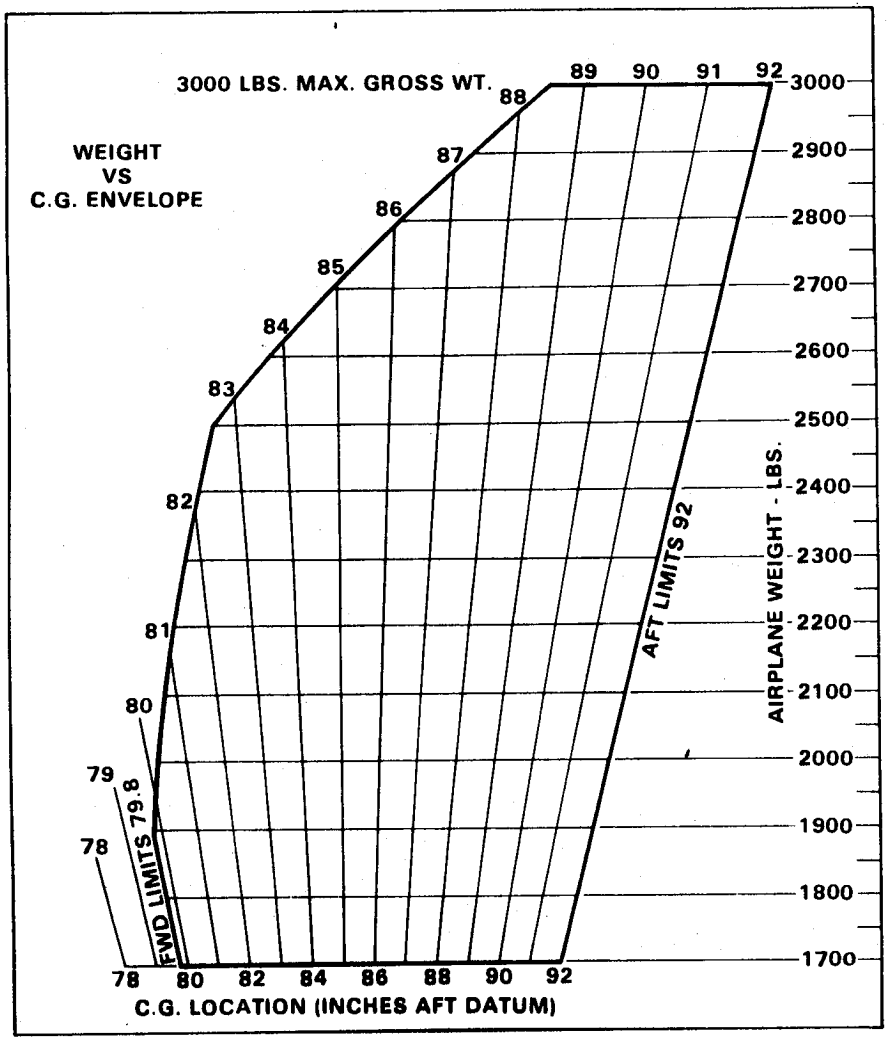
	Weight (Lbs)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Basic Empty Weight	1826.1		1513.1
Pilot and Front Passenger	425	80.5	34,2
Passenger (Rear Seats)	160	118.1	19
Fuel (72 Gallons Maximum)	432	95.0	41
Baggage (200 Lbs. Maximum)	125	142.8	17.9
Ramp Weight (3011 Lbs. Maximum)	2958	89,3	264.1
Fuel allowance for engine start, taxi and run-up	-11	95.0	-1045
Takeoff Weight (3000 Lbs. Maximum)			

Totals must be within approved weight and C.G. limits. It is the responsibility of the airplane owner and the pilot to insure that the airplane is loaded properly. The Basic Empty Weight C.G. is noted on the Weight and Balance Data Form (Figure 6-5). If the airplane has been altered, refer to the Weight and Balance Record for this information.

WEIGHT AND BALANCE LOADING FORM
Figure 6-11



LOADING GRAPH
Figure 6-13



C. G. RANGE AND WEIGHT
Figure 6-15

6.9 INSTRUCTIONS FOR USING THE WEIGHT AND BALANCE PLOTTER

This plotter is provided to enable the pilot quickly and conveniently to:

(a) Determine the total weight and C.G. position.

(b) Decide how to change his load if his first loading is not within the allowable envelope.

Heat can warp or ruin the plotter if it is left in the sunlight. Replacement plotters may be purchased from Piper dealers and distributors.

The "Basic Empty Weight and Center of Gravity" location is taken from the Weight and Balance Form (Figure 6-5), the Weight and Balance Record (Figure 6-7) or the latest FAA major repair or alteration form.

The plotter enables the user to add weights and corresponding moments graphically. The effect of adding or disposing of useful load can easily be seen. The plotter does not cover the situation where cargo is loaded in locations other than on the seats or in the baggage compartments.

Brief instructions are given on the plotter itself. To use it, first plot a point on the grid to locate the basic weight and C.G. location. This can be put on more or less permanently because it will not change until the airplane is modified. Next, position the zero weight end of any one of the loading slots over this point. Using a pencil, draw a line along the slot to the weight which will be carried in that location. Then position the zero weight end of the next slot over the end of this line and draw another line representing the weight which will be located in this second position. When all the loads have been drawn in this manner, the final end of the segmented line locates the total load and the C.G. position of the airplane for takeoff. If this point is not within the allowable envelope it will be necessary to remove fuel, baggage, or passengers and/or to rearrange baggage and passengers to get the final point to fall within the envelope.

Fuel burn-off does not significantly affect the center of gravity.

SAMPLE PROBLEM

A sample problem will demonstrate the use of the weight and balance plotter.

Assume a basic weight and C.G. location of 1800 pounds at 81.00 inches respectively. We wish to carry a pilot and 3 passengers. Two men weighing 180 and 200 pounds will occupy the front seats, and two children weighing 80 and 100 pounds will ride in the rear. Two suitcases weighing 25 pounds and 20 pounds respectively, will be carried in the rear compartment. We wish to carry 60 gallons of fuel. Will we be within the safe envelope?

(a) Place a dot on the plotter grid at 1800 pounds and 81.00 inches to represent the basic airplane. (See illustration.)

(b) Slide the slotted plastic into position so that the dot is under the slot for the forward seats, at zero weight.

(c) Draw a line up the slot to the 380 pounds position (180 + 200) and put a dot.

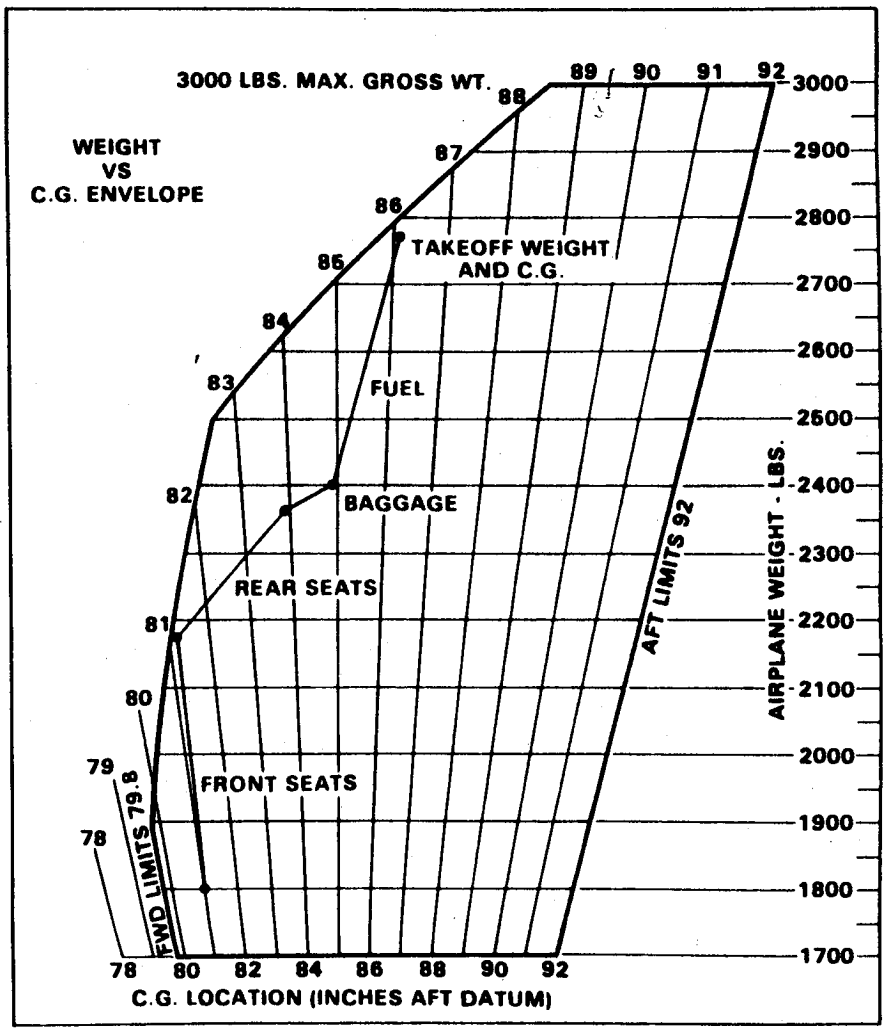
(d) Continue moving the plastic and plotting points to account for weight in the rear seats (80 + 100), baggage compartment (45), and fuel tanks (360).

(e) As can be seen from the illustration, the final dot shows the total weight to be 2765 pounds with the C.G. at 86.18. This is well within the envelope.

(f) There will be room for some more fuel.

As fuel is burned off, the weight and C.G. will follow down the fuel line and stay within the envelope for landing.

SAMPLE PROBLEM



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SECTION 7

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

SECTION 7

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

7.1 THE AIRPLANE

The PA-28-236 Dakota is a single-engine, low-wing monoplane of all metal construction. It has seating for up to four occupants and has a two hundred pound luggage compartment.

7.3 AIRFRAME

With the exception of the steel engine mount, the landing gear, miscellaneous steel parts, the cowling, and the lightweight plastic extremities (tips of wings, tail fin, rudder and stabilator), the basic airframe is of aluminum alloy. Aerobatics are prohibited in this airplane since the structure is not designed for aerobatic loads.

The fuselage is a semi-monocoque structure with a passenger door on the forward right hand side and a cargo door on the aft right hand side.

The wing is of a semitapered design and employs a laminar flow NACA 65_2-415 airfoil section. The main spar is located at approximately 40% of the chord aft of the leading edge. The wings are attached to the fuselage by the insertion of the butt ends of the spar into a spar box carry-through, which is an integral part of the fuselage structure. The bolting of the spar ends into the spar box carry-through structure, which is located under the aft seats, provides in effect a continuous main spar. The wings are also attached fore and aft of the main spar by an auxiliary front spar and a rear spar. The rear spar, in addition to taking torque and drag loads, provides a mount for flaps and ailerons. The four-position wing flaps are mechanically controlled by a handle located between the front seats. When fully retracted, the right flap locks into place to provide a step for cabin entry. Each wing contains one fuel tank.

A vertical stabilizer, an all-movable horizontal stabilator, and a rudder make up the empennage. The stabilator incorporates an anti-servo tab which improves longitudinal stability and provides longitudinal trim. This tab moves in the same direction as the stabilator, but with increased travel.

7.5 ENGINE AND PROPELLER

The Lycoming O-540-J3A5D engine is rated at 235 horsepower at 2400 rpm. The engine is equipped with a geared starter, a 60 ampere alternator, dual magnetos, shielded ignition system, vacuum pump drive, a diaphragm-type fuel pump and a float carburetor.

The exhaust system consists of individual exhaust pipes routed in pairs to three heavy gauge stainless steel mufflers. Exhaust gases are directed overboard at the underside of the engine cowling. The mufflers are surrounded by a shroud which provides heat for the cabin and for windshield defrosting.

The propeller is a Hartzell HC-F2YR-1( )F/F8468A-4R constant speed propeller. The Hartzell propeller is 80 inches in diameter, and is controlled by a Hartzell F-4-21 governor mounted on a pad on the forward end of the crankcase. This governor supplies oil to the propeller through the engine shaft. The governor is controlled by a cable from the cockpit.

The two-piece cowling cools the engine in normal flight conditions, including protracted climb, without the use of cowl flaps or cooling flanges.

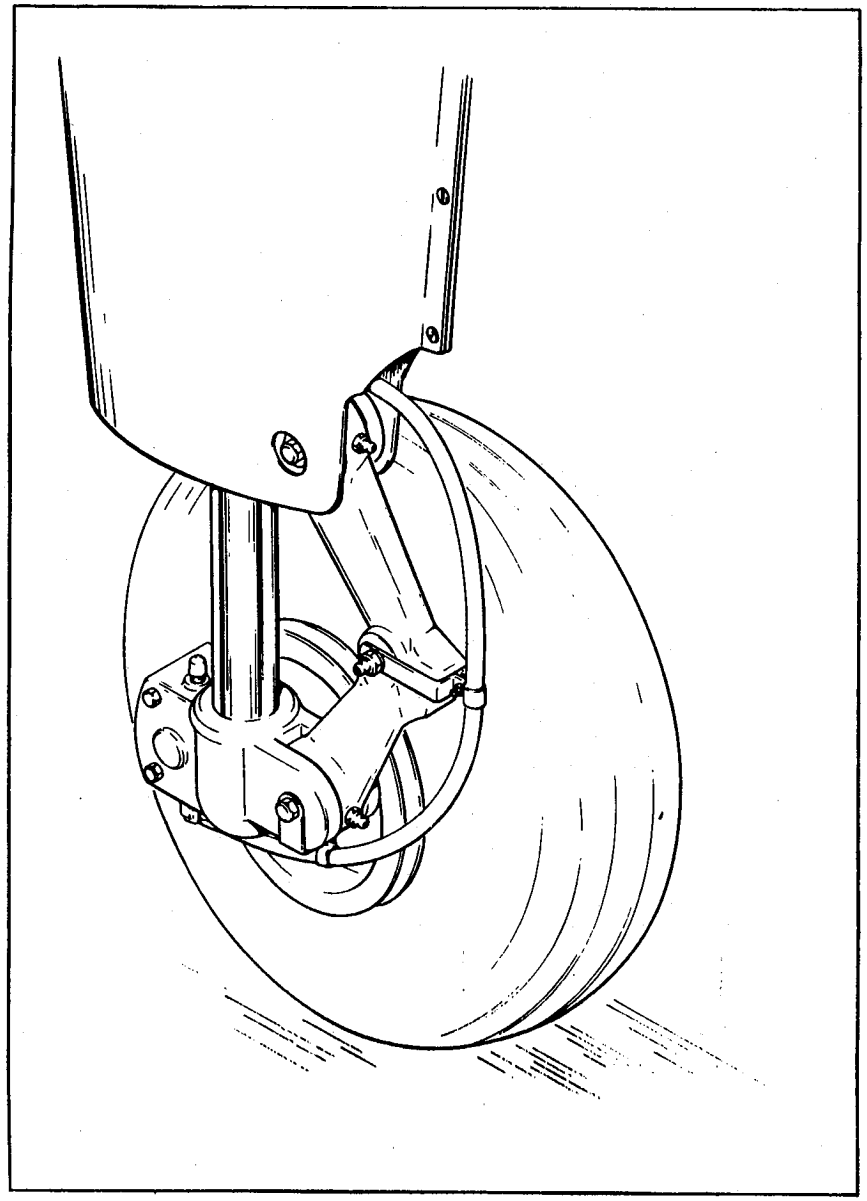
The throttle quadrant, located in the lower center instrument panel, contains the throttle, the mixture control, and the propeller governor control. A friction lock on the right side of the quadrant prevents creeping of the controls. In addition, the mixture control has a lock to prevent activation of the mixture control instead of the pitch control. To the right of the quadrant is the carburetor heat control. Maximum carburetor heat is provided with the control in the ON position. Air passes through a dry-type filter when the carburetor heat is in the OFF position.

A fuel pressure gauge is installed on the engine gauge cluster and a manifold pressure gauge is installed in the left side of the instrument panel.

7.7 INDUCTION SYSTEM

An induction scoop is located at the lower front of the cowling. This scoop is removable for access to the air filter which is attached to the air filter housing immediately behind the scoop. This air filter housing is ducted to the carburetor air box. The air box is mounted onto the bottom of the carburetor and either ram air from the front scoop and through the filter or unfilter heated air from a shroud mounted on the muffler may be manually selected through a two way valve.

Carburetor heat selection insures induction air flow should the filter become blocked. Since the air is heated, the carburetor heat system offers protection against induction system blockage caused by snow or freezing rain or by the freezing of moisture accumulated in the carburetor air intake throat. Carburetor heat air is unfiltered; therefore, it should not be used during ground operation when dust or other contaminants might enter the system. Filtered air should always be used for takeoff.



MAIN WHEEL ASSEMBLY
Figure 7-1

7.9 LANDING GEAR

The landing gears have 6.00 x 6 wheels. The main wheels (Figure 7-1) are equipped with hydraulically operated disc brakes. The nose wheel carries a four ply rating tube type tire and the main gear carry six ply rating tube type tires.

A spring device is incorporated in the rudder pedal torque tube assembly to provide rudder trim. A bungee in the nose gear steering mechanism reduces steering effort and dampens bumps and shocks during taxiing. By use of the rudder pedals and brakes, the nose gear is steerable through a 30-degree arc each side of center. Later aircraft have the bungee removed from the nose gear steering mechanism and are steerable through a 20-degree arc each side of center. A shimmy dampener is also included in the nose gear.

The struts are of the air-oil type, with a normal extension of 3.25 inches for the nose gear and 4.5 inches for the main gear under normal static load (empty weight of airplane plus full fuel and oil).

The brakes are actuated by a hand lever and master cylinder, which is located below and near the center of the instrument panel or by toe brakes mounted on each rudder pedal. The toe brakes and the hand lever each have their own brake cylinders, but they share a common reservoir. The parking brake is incorporated in the lever brake and is operated by pulling back on the lever and depressing the knob attached to the top of the handle. To release the parking brake, pull back on the brake lever to disengage the catch mechanism; then allow the handle to swing forward.

7.11 ENGINE CONTROLS

Engine controls consist of a throttle control, a propeller control and a mixture control lever. These controls are located on the control quadrant on the lower center of the instrument panel (Figure 7-3) where they are accessible to both the pilot and the copilot. The controls utilize teflon-lined control cables to reduce friction and binding.

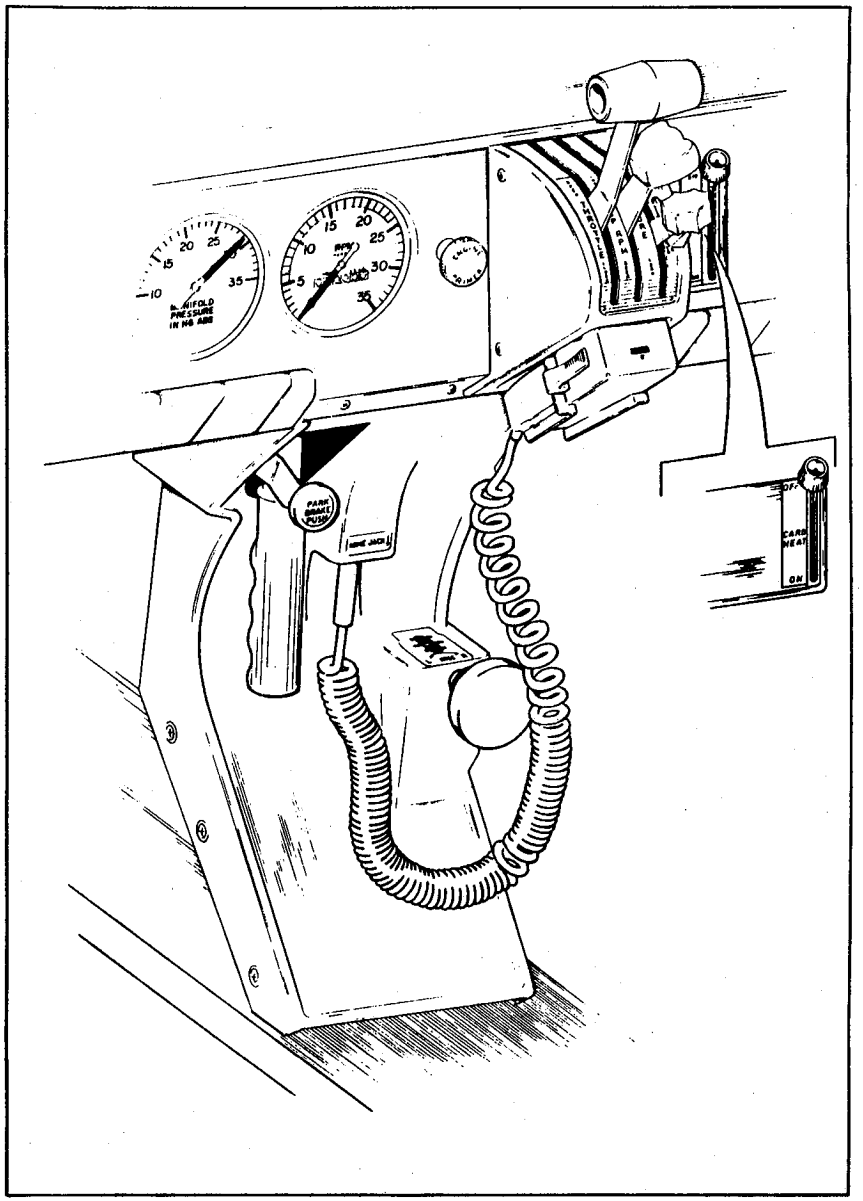
The throttle lever is used to adjust the manifold pressure. The propeller control lever is used to adjust the propeller speed from high RPM to low RPM.

The mixture control lever is used to adjust the air to fuel ratio. The engine is shut down by the placing of the mixture control lever in the full lean position. The mixture control has a lock to prevent activation of the mixture control instead of the pitch control. For information on the leaning procedure, see the Avco-Lycoming Operator's Manual.

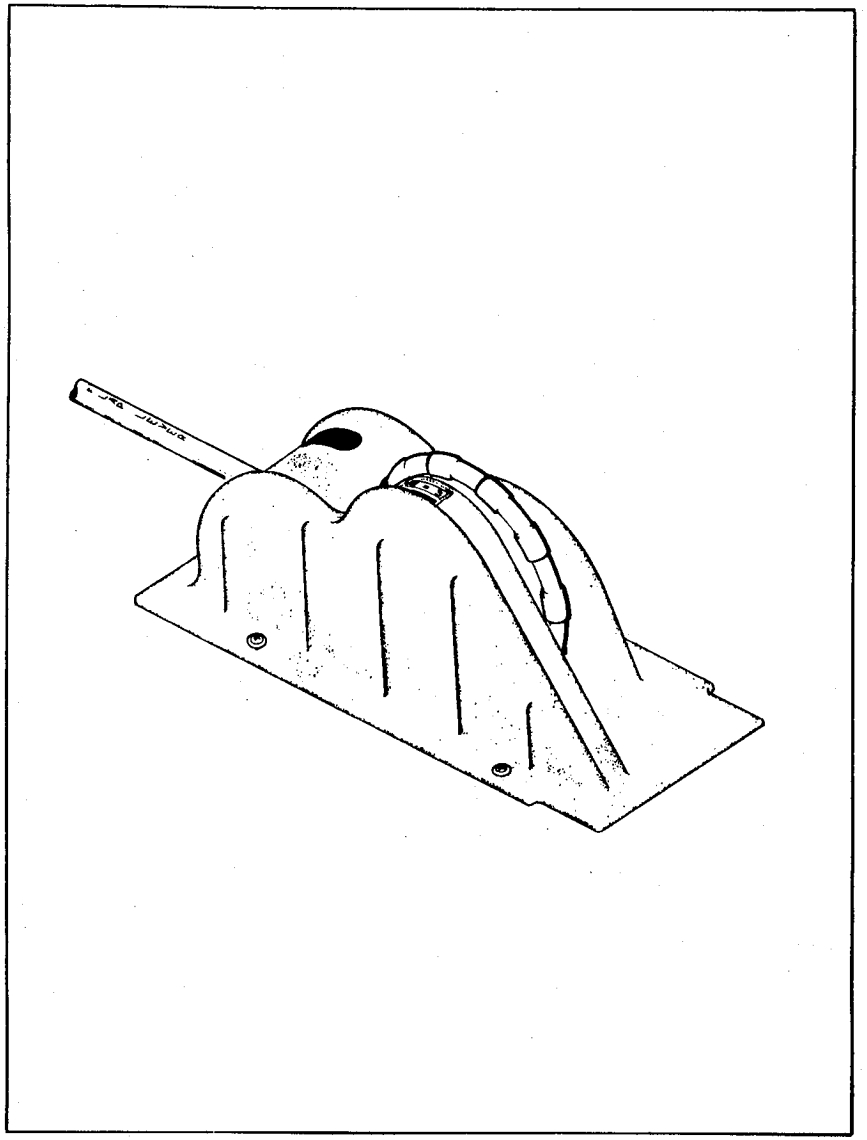
The friction adjustment lever on the right side of the control quadrant may be adjusted to increase or decrease the friction holding the throttle, propeller, and mixture controls or to lock the controls in a selected position.

The carburetor heat control is located to the right of the control quadrant. When the carburetor heat lever is in the OFF position the engine is operating on filtered air; when the lever is in the ON position the engine is operating on unfiltered, heated air. Prolonged ground operation with the carburetor heat control in the ON position should be avoided.

prop RPM = or greater than manifold pressure
increase - speed - prop 1st, power 2nd
slow - power 1st, then



CONTROL QUADRANT AND CONSOLE
Figure 7-3



FLIGHT CONTROL CONSOLE
Figure 7-5

7.13 FLIGHT CONTROLS

Dual controls are provided as standard equipment, with a cable system used between the controls and the surfaces. The horizontal tail is of the all-movable slab type, with an anti-servo tab which also acts as a longitudinal trim tab, actuated by a control mounted on the control tunnel between the two front seats (Figure 7-5).

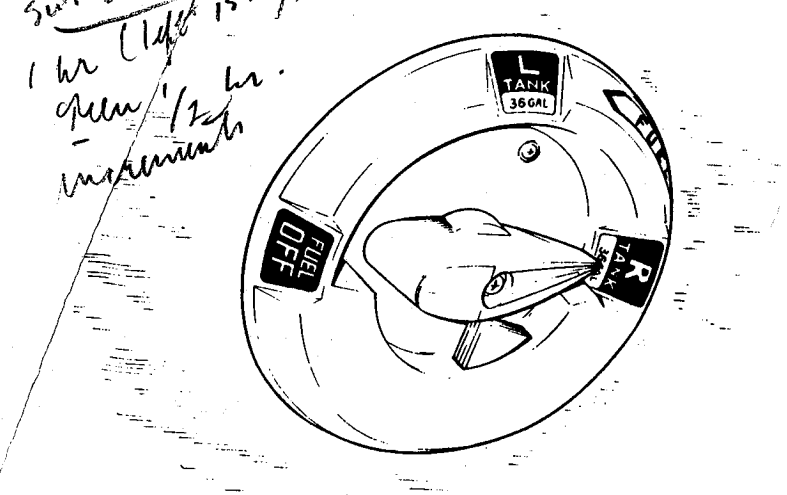
The flaps are manually operated and spring-loaded to return to the up position. A past-center lock incorporated in the actuating linkage holds the flap when it is in the up position so that it may be used as a step on the right side. The flap will not support a step load except when in the full up position, so it must be completely retracted when used as a step. The flaps have three extended positions, 10, 25 and 40 degrees.

7.15 FUEL SYSTEM

The fuel system incorporates two fuel tanks, one in each wing. Each has a capacity of 38.5 U.S. gallons, giving a total of 77 gallons, of which 72 gallons is usable. Each tank is equipped with a filler neck indicator tab to aid in determining fuel remaining when the tanks are not full. Usable capacity to bottom of the indicator tab is 25 gallons. The tanks are attached to the leading edges of the wings and are an integral part of the wing structure. The fuel tanks are vented individually through vent tubes which protrude below the bottom of the wings at the rear outboard corner of each tank. The vents should be checked periodically for obstructions which might block the free passage of air.

Normally, fuel is supplied to the engine through an engine-driven fuel pump. An auxiliary electric fuel pump serves as a back-up feature. The electric fuel pump is controlled by a rocker switch on the switch panel above the throttle quadrant. The electric fuel pump should be ON when switching fuel tanks and during takeoffs and landings (Figure 7-9).

The fuel tank selector (Figure 7-7), which allows the pilot to select the tank supplying fuel to the engine, is located on the left sidewall of the cockpit, below the instrument panel. It has three positions: OFF, LEFT TANK and RIGHT TANK. The arrow on the handle of the selector points to the tank which is supplying fuel to the engine. The valve also incorporates a safety latch which prevents inadvertently selecting the OFF position.



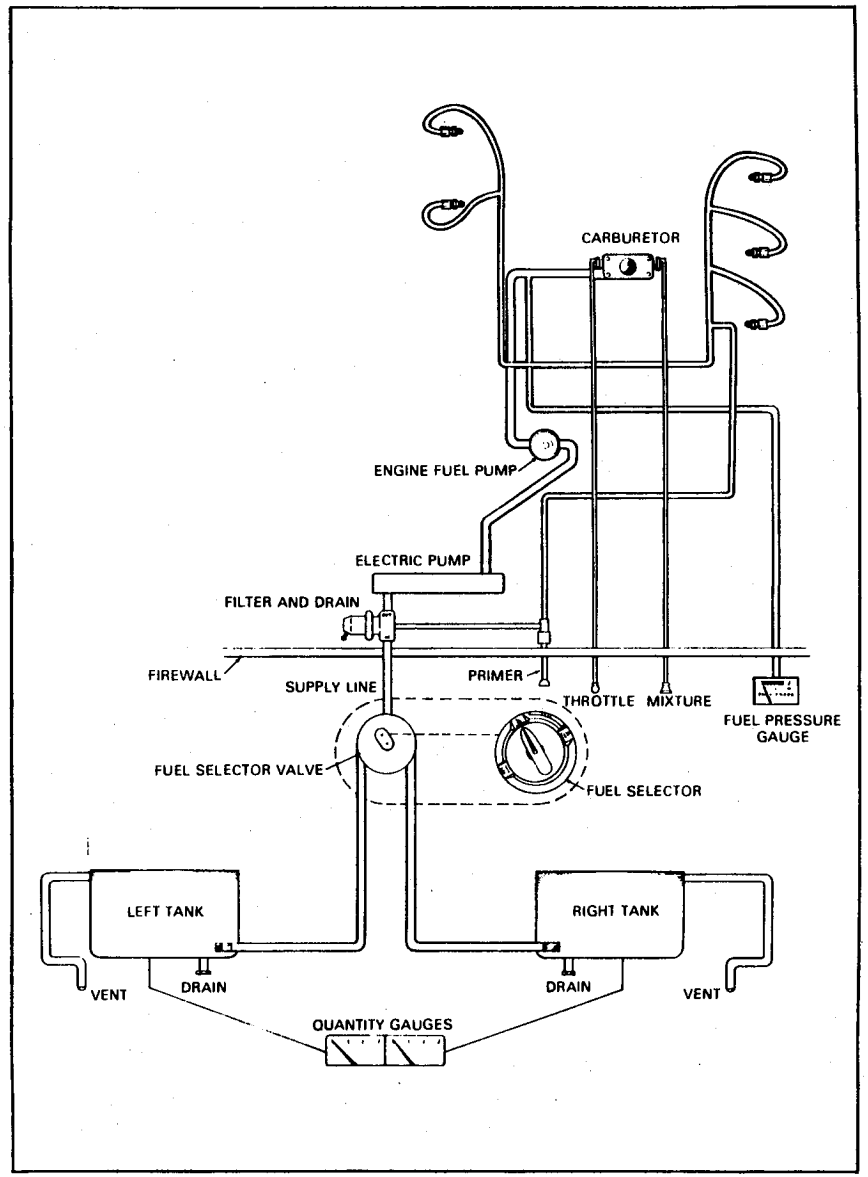
FUEL SELECTOR
Figure 7-7

Fuel quantity and pressure are indicated on gauges on the instrument panel. There is a separate fuel quantity gauge for each tank.

Each fuel tank has an individual quick drain located at the bottom inboard rear corner (see Figure 8-3). These drains are opened by insertion of the probe in the fuel sampler container into the drain. The fuel strainer incorporates a drain which protrudes from the cowling at the lower left front corner of the firewall. All three drains should be drained before flights and the drained fuel checked for contaminants.

CAUTION

When draining fuel, care should be exercised to insure that no fire hazard exists before start-ing the engine.



FUEL SYSTEM SCHEMATIC
Figure 7-9

7.17 ELECTRICAL SYSTEM

The electrical system includes a 14-volt, 60 amp alternator, a voltage regulator, an overvoltage relay, and a master switch relay (Figure 7-11). The 12-volt battery is mounted in a thermoplastic box immediately aft of the baggage compartment. The regulator and overvoltage relay are located on the forward left side of the fuselage behind the instrument panel.

Electrical switches are located on the right center instrument panel (Figure 7-15), and the circuit breakers are located on the lower right instrument panel (Figure 7-13). A rheostat switch on the left side of the switch panel controls the navigational lights and the radio lights. The similar switch on the right side controls and dims the panel lights.

Standard electrical accessories include starter, electric fuel pump, stall warning indicator, ammeter and annunciator panel.

The annunciator panel includes alternator and low oil pressure indicator lights. When the optional gyro system is installed, the annunciator panel also includes a low vacuum indicator light. The annunciator panel lights are provided only as a warning to the pilot that a system may not be operating properly, and that the applicable system gauge should be checked and monitored to determine when or if any necessary action is required.

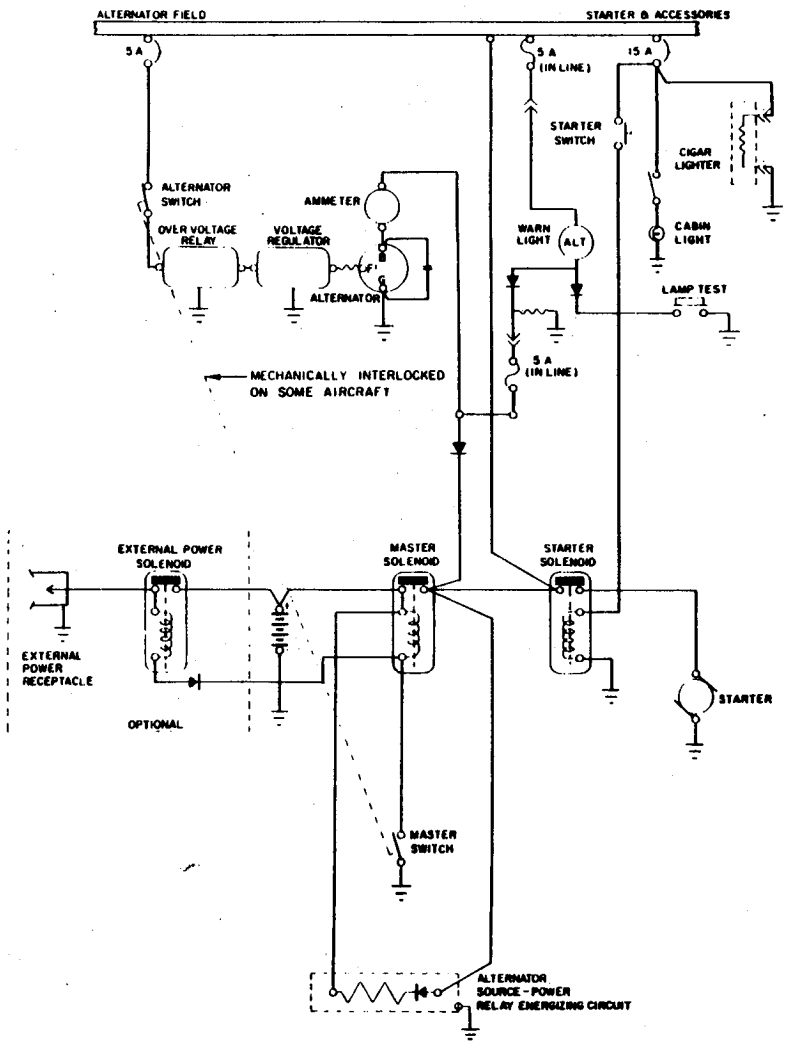
Optional electrical accessories includes navigation, ground recognition, anti-collision, landing, instrument and cabin dome lighting.

An optional light, mounted in the overhead panel, provides instrument and cockpit lighting for night flying. The light is controlled by a rheostat switch located adjacent to the light. A map light window in the lens is actuated by an adjacent switch.

An optional wing tip/recognition light system consists of 2 lights (one in each wing tip) and is operated by a split landing light/recognition light rocker type switch mounted on the switch panel.

WARNING

Anti-collision lights should not be operating when flying through cloud, fog or haze, since the reflected light can produce spatial disorientation. Strobe lights should not be used in close proximity to the ground such as during taxiing, takeoff or landing.



ALTERNATOR AND STARTER SCHEMATIC
Figure 7-11

NOTE

On airplanes with interlocked BAT and ALT switches, the ALT switch is mechanically interlocked with the BAT switch. When ALT switch is turned ON, the BAT switch will also be turned ON. On airplanes with separate BAT and ALT switch operation, the switches may be positioned independently as desired.

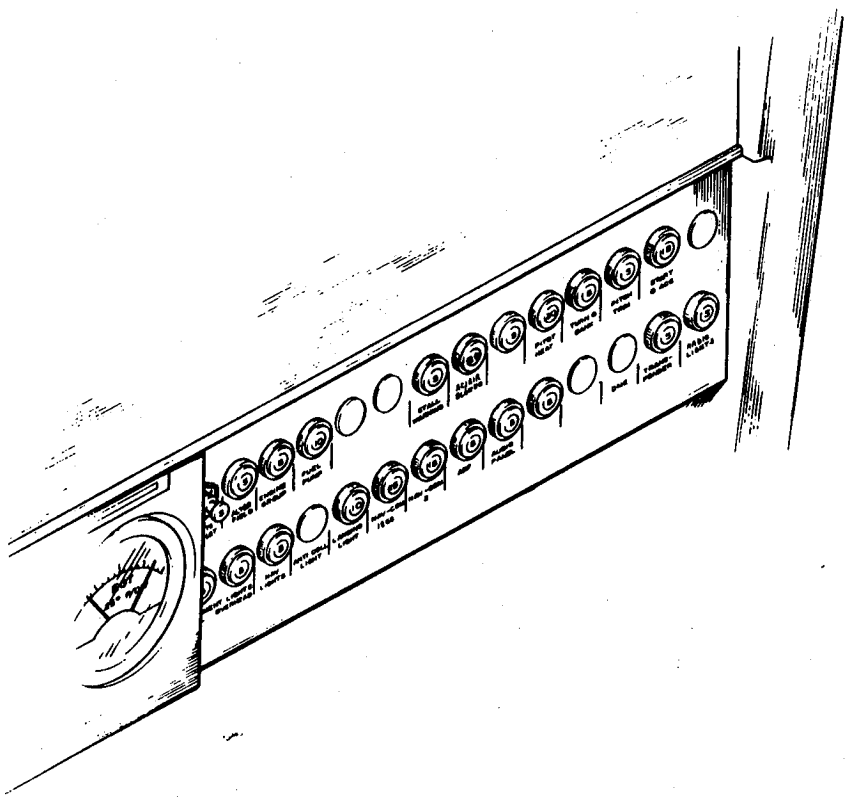
Circuit provisions are made to handle the addition of communications and navigational equipment.

Unlike previous generator systems, the ammeter does not indicate battery discharge; rather it displays in amperes the load placed on the alternator. With all electrical equipment off (except the master switch), the ammeter will be indicating the amount of charging current demanded by the battery. As each item of electrical equipment is turned on, the current will increase to a total appearing on the ammeter. This total includes the battery. The maximum continuous load for night flight, with radios on, is about 30 amperes. This 30 ampere value, plus approximately two amperes for a fully charged battery, will appear continuously under these flight conditions. The amount of current shown on the ammeter will tell immediately whether the alternator system is operating normally, as the amount of current shown should equal the total amount of amperes being drawn by the equipment which is operating.

If no output is indicated on the ammeter, during flight, reduce the electrical load by turning off all unnecessary electrical equipment. Check the 5 ampere field breaker, reset if open. If the breaker is not open, turn off the "ALT" switch for one second to reset the overvoltage relay. If ammeter continues to indicate no output, maintain minimum electrical load and terminate flight as soon as practical.

CAUTION

Do not use cigar lighter receptacles as power sources for any devices other than the cigar lighters supplied with the airplane. Any other device plugged into these receptacles may be damaged.



CIRCUIT BREAKER PANEL
Figure 7-13

7.19 VACUUM SYSTEM*

The vacuum system operates the air driven gyro instruments. This system consists of an engine-driven vacuum pump, a vacuum regulator, a filter, a vacuum gauge, the necessary plumbing, and, when installed, the directional and attitude gyro instruments.

The vacuum pump is a dry type pump. A shear drive protects the engine from damage. If the drive shears, the gyros will become inoperative.

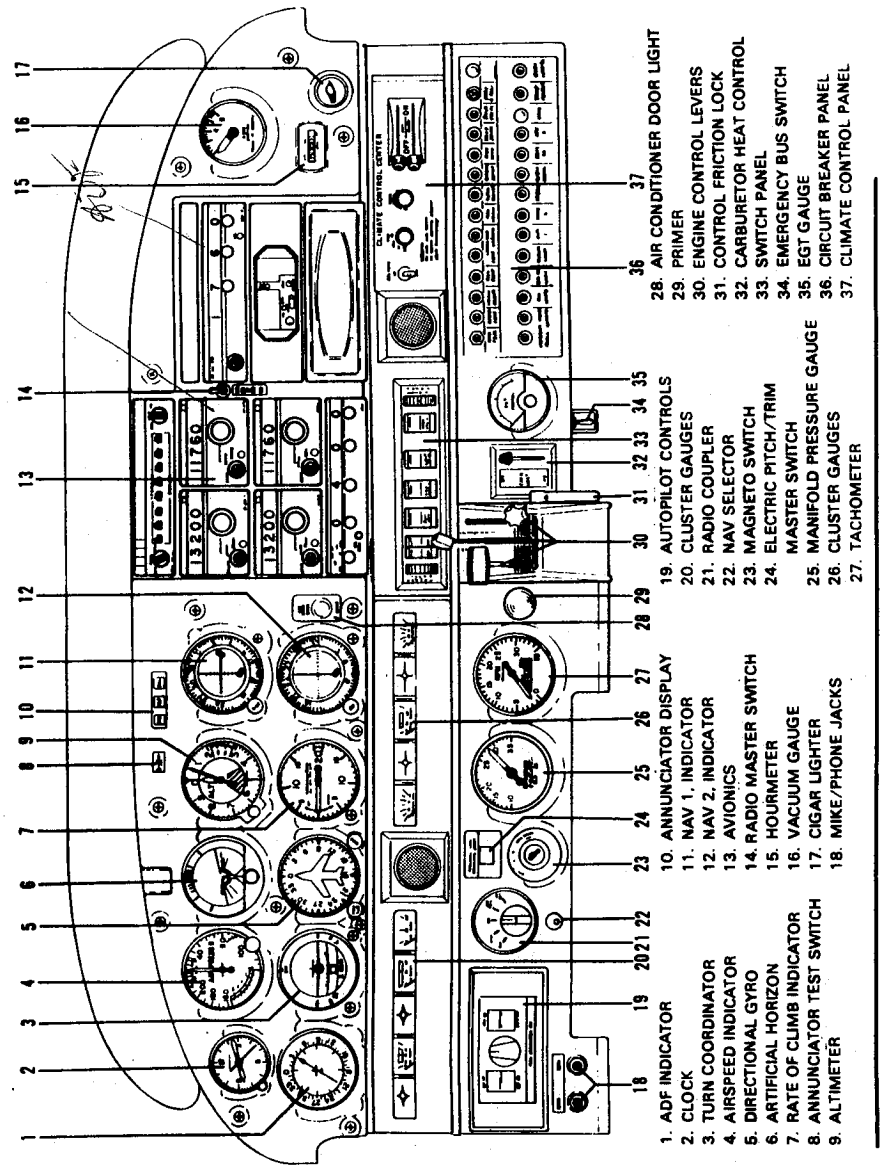
The vacuum gauge, mounted on the right instrument panel to the right of the radios, provides valuable information to the pilot about the operation of the vacuum system. A decrease in pressure in a system that has remained constant over an extended period may indicate a dirty filter, dirty screens, possibly a sticking vacuum regulator or leak in system (a low vacuum indicator light is provided in the annunciator panel). Zero pressure would indicate a sheared pump drive, defective pump, possibly a defective gauge or collapsed line. In the event of any gauge variation from the norm, the pilot should have a mechanic check the system to prevent possible damage to the system components or eventual failure of the system.

A vacuum regulator is provided in the system to protect the gyros. The valve is set so the normal vacuum reads 5.0 ± .1 inches of mercury, a setting which provides sufficient vacuum to operate all the gyros at their rated RPM. Higher settings will damage the gyros, and with a low setting the gyros will be unreliable. The regulator is located behind the instrument panel.

7.21 INSTRUMENT PANEL

The instrument panel accommodates the customary advanced flight instruments and the normally required power plant instruments (Figure 7-15). The artificial horizon and directional gyro are vacuum operated through use of a vacuum pump installed on the engine, while the turn and bank instrument is electrically operated. A vacuum gauge is mounted on the far right side of the instrument panel. The radios and circuit breakers are on the right-hand instrument panel, and extra circuits are provided for the addition of optional radio equipment. An optional radio master switch is located near the top of the instrument panel between the radio stacks. It controls the power to all radios through the aircraft master switch. An emergency bus

*Optional equipment



INSTRUMENT PANEL
Figure 7-15

switch is also provided to give auxiliary power to the avionics bus in the event of a radio master switch circuit failure. The emergency bus switch is located behind the lower right shin guard left of the circuit breaker panel. An annunciator panel is mounted in the upper instrument panel to warn the pilot of a possible malfunction in the alternator, oil pressure or vacuum systems.

7.23 PITOT-STATIC SYSTEM

The system (Figure 7-17) supplies both pitot and static pressure for the airspeed indicator and static pressure for the altimeter and vertical speed indicator (when installed).

Pitot pressure is picked up by the pitot head on the underside of the left wing. An optional heated pitot head, which alleviates problems with icing or heavy rain, is available. The switch for pitot heat is located on the switch panel.

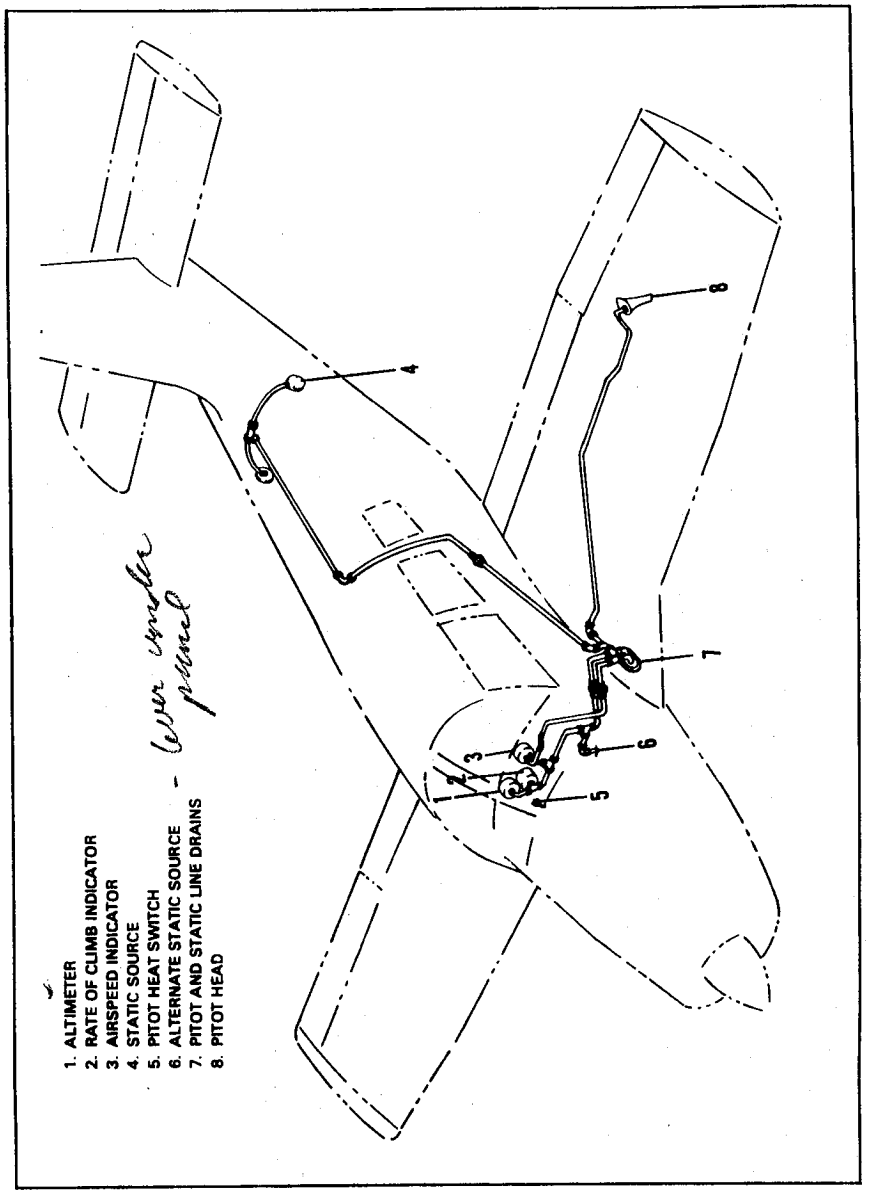
Static pressure is sensed by static pads on each side of the aft fuselage. Push-button type pitot and static drains are located on the lower left sidewall of the cockpit.

An alternate static source control valve is located below the left side of the instrument panel. When the valve is set in the alternate position, the altimeter, vertical speed indicator and airspeed indicator will be using cabin air for static pressure. The storm window and cabin vents must be closed and the cabin heater and defroster must be on during alternate static source operation. The altimeter error is less than 50 feet unless otherwise placarded.

To prevent bugs and water entering the pitot pressure hole when the airplane is parked, a cover should be placed over the pitot head. A partially or completely blocked pitot head will give erratic or zero readings on the instruments.

NOTE

During preflight, check to make sure the pitot cover is removed.



PITOT-STATIC SYSTEM
Figure 7-17

7.25 HEATING AND VENTILATING SYSTEM

The heating system is designed to supply warm air to the cabin during winter and cool weather flights. The system includes a heat shroud, heat ducts, defroster outlets, heat and defroster controls.

CAUTION

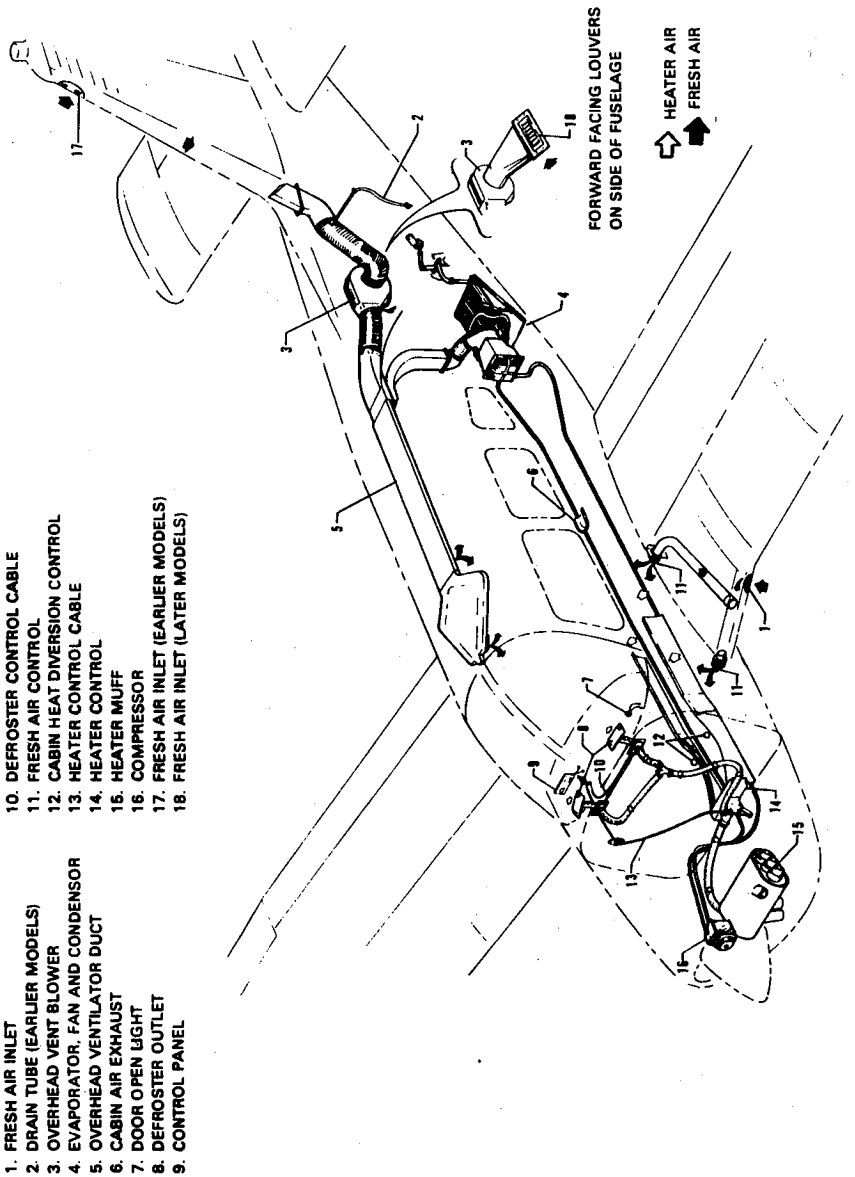
When cabin heat is operated, heat duct surface becomes hot. This could result in burns if arms or legs are placed too close to heat duct outlets or surface.

Fresh air is ducted from the left engine baffle to the heater muff which is attached to the muffler. The heated air is then ducted to the valve box mounted on the firewall. When the valve is open, heated air enters the heat ducts located along each side of the center console. Outlets in the heat ducts are located at each seat location. Airflow to the rear seats can be regulated by controls in the heat ducts located between the front seats. The temperature of the cabin is regulated by the heater control located on the right side of the instrument panel.

Defrosting is accomplished by heat outlets located on the right and left side of the cowl cover. Heated air is ducted directly from the heater valve box to the defroster shut-off valves at the firewall and then to the defroster outlets. The airflow is regulated by a defroster control located below the heat control.

To aid air distribution, the cabin air is exhausted overboard by an outlet located on the bottom of the fuselage. Cabin exhaust outlets are located below and outboard of the rear seats.

An optional overhead ventilating system with outlets over each seat is also available. An additional option to aid in fresh air circulation on models without air conditioning is a cabin air blower to force air through the overhead vent system. This blower is operated by a fan switch with three positions - "OFF," "LOW," and "HIGH." The switch is located on the right side of the instrument panel with the heater and defroster controls.



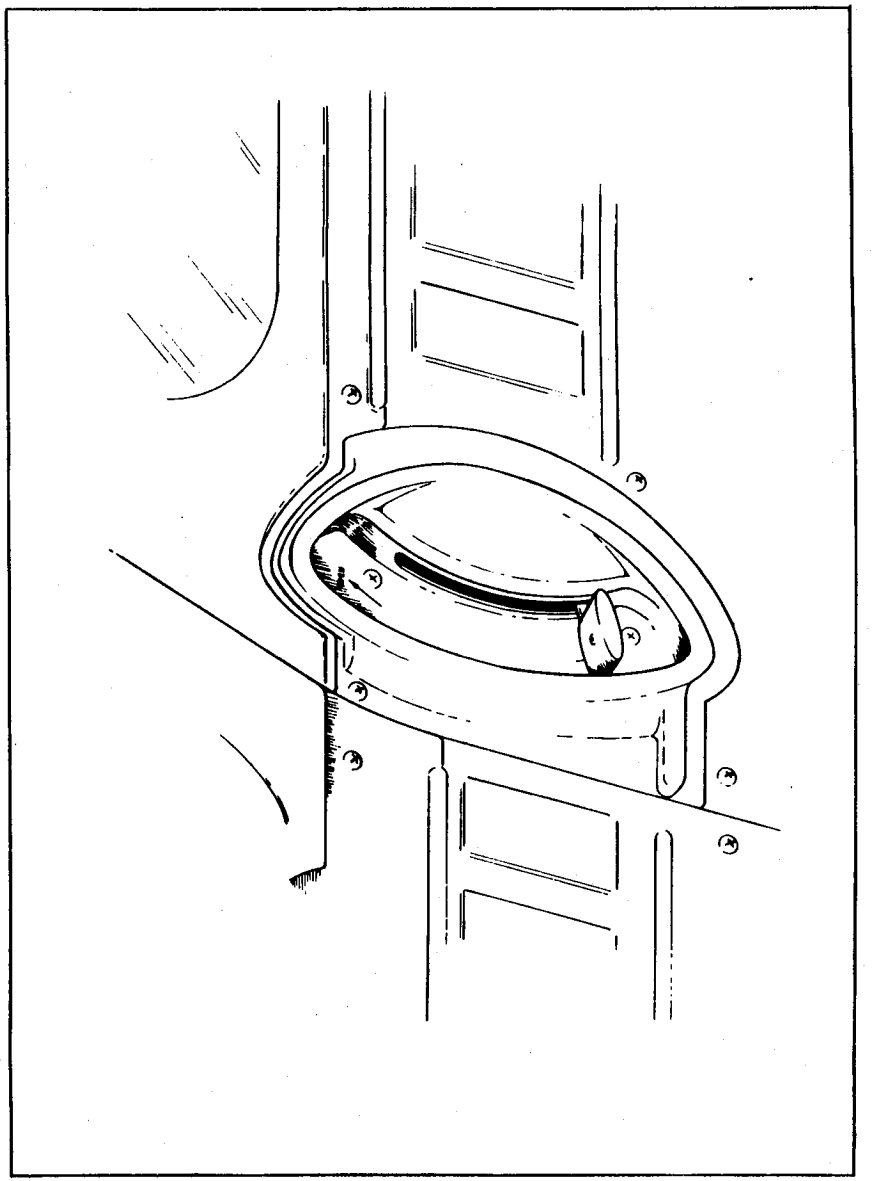
HEATING AND VENTILATING SYSTEM
Figure 7-19

7.27 CABIN FEATURES

All seat backs have three positions: normal, intermediate and recline. The adjustment lever is located at the base of the seat back on the outboard side of the seat. The front seats adjust fore and aft for ease of entry and occupant comfort. An armrest is located on the side panels adjacent to the front seat. The rear seats are removable to provide room for bulky items. Rear seat installations incorporate leg retainers with latching mechanisms which must be released before the rear seats can be removed. Releasing the retainers is accomplished by depressing the plunger behind each rear leg. Optional headrests are available.

Shoulder harnesses with inertia reels are provided for each front seat occupant. On aircraft serial numbers 28-7911001 through 28-8411031, shoulder harnesses with inertia reels were provided as optional equipment for the occupants of the rear seats. On aircraft serial numbers 28-8511001 and up, shoulder harnesses with inertia reels are provided as standard equipment for the occupants of the rear seats. A check of the inertia reel mechanism can be made by pulling sharply on the strap and checking that the reel will lock in place under sudden stress. This locking feature prevents the strap from extending and holds the occupant in place. Under normal movement, the strap will extend and retract as required. On earlier aircraft provided with a single strap adjustable shoulder harness located above the side window for each front seat, the shoulder strap is routed over the shoulder adjacent to the window and attached to the lap belt in the general area of the occupant's hip. Adjust this fixed strap so that all controls are accessible while maintaining adequate restraint for the occupant. Shoulder harnesses should be routinely worn during takeoff, landing, and whenever an inflight emergency situation occurs.

Additional features include pilot storm window, two sun visors, ash-trays for each occupant, map pockets located on the side panels below the instrument panel, miscellaneous pockets on the rear of the front seat backs, armrests for the front occupants, cabin or baggage door locks and ignition lock.



CABIN DOOR LATCH
Figure 7-21

7.29 BAGGAGE AREA

A 24 cubic foot baggage area, located behind the rear seats, is accessible either from the cabin or through an outside baggage door on the right side of the aircraft. Maximum capacity is 200 pounds. Tie-down straps are provided and should be used at all times.

NOTE

It is the pilot's responsibility to be sure when the baggage is loaded that the aircraft C.G. falls within the allowable C.G. Range. (See Weight and Balance Section.)

7.31 STALL WARNING

An approaching stall is indicated by a stall warning indicator which is activated between five and ten knots above stall speed. Mild airframe buffeting and gentle pitching may also precede the stall. Stall speeds are shown on graphs in the Performance Section. The stall warning indicator is a continuous sounding horn located behind the instrument panel. The stall warning indicator is activated by a lift detector installed on the leading edge of the left wing. During preflight, the stall warning system should be checked by turning the master switch ON, lifting the detector and checking to determine if the indicator is actuated.

7.33 FINISH

All exterior surfaces are primed with etching primer and finished with acrylic lacquer. An optional polyurethane enamel finish is available.

7.35 PIPER EXTERNAL POWER*

An optional starting installation known as Piper External Power (PEP) is accessible through a receptacle located on the right side of the fuselage aft of the wing. An external battery can be connected to the socket, thus allowing the operator to crank the engine without having to gain access to the airplane's battery.

7.37 EMERGENCY LOCATOR TRANSMITTER*

The Emergency Locator Transmitter (ELT) when installed, is located in the aft portion of the fuselage just below the stabilator leading edge and is accessible through a plate on the right side of the fuselage. This plate is attached with slotted-head nylon screws for ease of removal; these screws may be readily removed with a variety of common items such as a dime, a key, a knife blade, etc. If there are no tools available in an emergency the screw heads may be broken off by any means. The ELT is an emergency locator transmitter which meets the requirements of FAR 91.52.

A battery replacement date is marked on the transmitter. To comply with FAA regulations, the battery must be replaced on or before this date. The battery must also be replaced if the transmitter has been used in an emergency situation or if the accumulated test time exceeds one hour, or if the unit has been inadvertently activated for an undetermined time period.

NOTE

If for any reason a test transmission is necessary, the test transmission should be conducted only in the first five minutes of any hour and limited to three audio sweeps. If tests must be made at any other time, the tests should be coordinated with the nearest FAA tower or flight service station.

NARCO ELT 10 OPERATION

On the ELT unit itself is a three position switch placarded "ON," "OFF" and "ARM." The ARM position sets the ELT so that it will transmit after impact and will continue to transmit until its battery is drained. The ARM position is selected when the ELT is installed in the airplane and it should remain in that position.

*Optional equipment

To use the ELT as a portable unit in an emergency, remove the cover and unlatch the unit from its mounting base. The antenna cable is disconnected by a left quarter-turn of the knurled nut and a pull. A sharp tug on the two small wires will break them loose. Deploy the self-contained antenna by pulling the plastic tab marked "PULL FULLY TO EXTEND ANTENNA." Move the switch to ON to activate the transmitter.

In the event the transmitter is activated by an impact, it can only be turned off by moving the switch on the ELT unit to OFF. Normal operation can then be restored by pressing the small clear plastic reset button located on the top of the front face of the ELT and then moving the switch to ARM.

A pilot's remote switch located on the left side panel is provided to allow the transmitter to be turned on from inside the cabin. The pilot's remote switch is placarded "ON" and "ARMED." The switch is normally in the ARMED position. Moving the switch to ON will activate the transmitter. Moving the switch back to the ARMED position will turn off the transmitter only if the impact switch has not been activated.

The ELT should be checked to make certain the unit has not been activated during the ground check. Check by selecting 121.50 MHz on an operating receiver. If there is an oscillating chirping sound, the ELT may have been activated and should be turned off immediately. This requires removal of the access cover and moving the switch to OFF, then press the reset button and return the switch to ARM. Recheck with the receiver to ascertain the transmitter is silent.

CCC CIR 11-2 OPERATION

On the unit itself is a three position selector switch placarded "OFF," "ARM" and "ON." The ARM position is provided to set the unit to the automatic position so that it will transmit only after impact and will continue to transmit until the battery is drained to depletion or until the switch is manually moved to the OFF position. The ARM position is selected when the transmitter is installed at the factory and the switch should remain in that position whenever the unit is installed in the airplane. The ON position is provided so the unit can be used as a portable transmitter or in the event the automatic feature was not triggered by impact or to periodically test the function of the transmitter.

Select the OFF position when changing the battery, when rearming the unit if it has been activated for any reason, or to discontinue transmission.

NOTE

If the switch has been placed in the ON position for any reason, the OFF position has to be selected before selecting ARM. If ARM is selected directly from the ON position, the unit will continue to transmit in the ARM position.

A pilot's remote switch, located on the left side panel, is provided to allow the transmitter to be controlled from inside the cabin. The pilot's remote switch is placarded "ON", "AUTO/ARM" and "OFF/RESET". The switch is normally in the AUTO/ARM position. To turn the transmitter off, move the switch momentarily to the OFF/RESET position. The aircraft master switch must be ON to turn the transmitter OFF. To actuate the transmitter for tests or other reasons, move the switch upward to the ON position and leave it in that position as long as transmission is desired.

The unit is equipped with a portable antenna to allow the locator to be removed from the aircraft in case of an emergency and used as a portable signal transmitter.

The locator should be checked during the ground check to make certain the unit has not been accidently activated. Check by tuning a radio receiver to 121.50 MHz. If there is an oscillating sound, the locator may have been activated and should be turned off immediately. Reset to the ARM position and check again to ensure against outside interference.

NARCO ELT 910 OPERATION

On the ELT unit itself is a three position switch placarded ON, OFF and ARM. The ARM position sets the ELT so that it will transmit after impact and will continue to transmit until its battery is drained. The ARM position is selected when the ELT is installed in the airplane and it should remain in that position.

A pilot's remote switch, placarded ON and ARM, is located on the left side panel to allow the transmitter to be armed or turned on from inside the cabin. The switch is normally in the ARM position. Moving the switch to ON will activate the transmitter. A warning light, located above the remote switch, will blink continuously whenever the ELT is activated.

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NOTE

The warning light will not blink if the ELT is activated by an incident that also results in severance of the airplane's power supply lines.

Should the ELT be activated inadvertently it can be reset by either positioning the remote switch to the ON position for two seconds, and then relocating it to the ARM position, or by setting the switch on the ELT to OFF and then back to ARM.

In the event the transmitter is activated by an impact, it can be turned off by moving the ELT switch OFF. Normal operation can then be restored by resetting the switch to ARM. It may also be turned off and reset by positioning the remote switch to the ON position for two seconds, and then to the ARM position.

The transmitter can be activated manually at any time by placing either the remote switch or the ELT switch to the ON position.

The ELT should be checked during postflight to make certain the unit has not been activated. Check by selecting 121.50 MHz on an operating receiver. If a downward sweeping audio tone is heard the ELT may have been activated. Set the remote switch to ON. If there is no change in the volume of the signal, your airplane's ELT is probably transmitting. Setting the remote switch back to ARM will automatically reset the ELT and should stop the signal being received on 121.50 MHz.

7.39 AIR CONDITIONING*

The air conditioning system is a recirculating air system. The major items include: evaporator, condenser, compressor, blower, switches and temperature controls.

The evaporator is located behind the left rear side of the baggage compartment. This cools the air that is used for air conditioning.

The condenser is mounted on a retractable scoop located on the bottom of the fuselage and to the rear of the baggage compartment area. The scoop extends when the air conditioner is on and retracts to a flush position when the system is off.

The compressor is mounted on the forward right underside of the engine. It has an electric clutch which automatically engages or disengages the compressor to the belt drive system of the compressor.

An electrical blower is mounted on the aft side of the rear cabin panel. Air from the baggage area is drawn through the evaporator by the blower and distributed through an overhead duct to individual outlets located adjacent to each occupant.

The switches and temperature control are located on the lower right side of the instrument panel in the climate control center panel. The temperature control regulates the desired temperature of the cabin. Turn the control clockwise for increased cooling, counterclockwise for decreased cooling.

Located inboard of the temperature control is the fan speed switch and the air conditioning ON-OFF switch. The fan can be operated independently of the air conditioning. However, it must be on for air conditioner operation. Turning either switch off will disengage the compressor clutch and retract the condenser door. Cooling air should be felt within one minute after the air conditioner is turned on.

NOTE

If the system is not operating in 5 minutes, turn the system OFF until the fault is corrected.

*Optional equipment

The FAN switch allows operation of the fan with the air conditioner turned OFF to aid cabin air circulation if desired. A "LOW," "MED" or "HIGH" flow of air can be selected to the air conditioner outlets located in the overhead duct. The outlets can be adjusted or turned off by each occupant to regulate individual cooling effect.

The "DOOR OPEN" indicator light is located to the left of the radio stack in front of the pilot. The light illuminates whenever the condenser door is open and remains on until the door is closed.

A circuit breaker located on the circuit breaker panel protects the air conditioning electrical system.

Whenever the throttle is in the full throttle position, it actuates a micro switch which disengages the compressor and retracts the scoop. This is done to obtain maximum power and maximum rate of climb. The fan continues to operate and the air will remain cool for approximately one minute. When the throttle is retarded approximately 1/4 inch, the clutch will engage and the scoop will extend, again supplying cool, dry air.

7.41 CARBURETOR ICE DETECTION SYSTEM

A carburetor ice detection system is available as optional equipment. The system consists of a control box mounted on the instrument panel, a probe sensor mounted in the carburetor and a red warning light to indicate the presence of ice in the carburetor.

If ice is present apply full carburetor heat. Refer to 3.22, Carburetor Icing, in the emergency procedures.

To adjust the system for critical ice detection first turn on the airplane's master switch and then turn on the ice detection unit. Turn the sensitivity knob fully counter clockwise causing the carb ice light to come on. Now rotate the sensitivity knob back (clockwise) until the ice light just goes out. This establishes the critical setting.

WARNING

This instrument is approved as optional equipment only and flight operations should not be predicated on its use.

TABLE OF CONTENTS

SECTION 8

AIRPLANE HANDLING, SERVICING AND MAINTENANCE

SECTION 8

AIRPLANE HANDLING, SERVICING, AND MAINTENANCE

8.1 GENERAL

This section provides general guidelines relating to the handling, servicing, and maintenance of the Dakota. For complete maintenance instructions, refer to the PA-28-236 Maintenance Manual.

Every owner should stay in close contact with an authorized Piper Service Center or Piper's Customer Service Department to obtain the latest information pertaining to their airplane, and to avail themselves of Piper Aircraft's support systems.

Piper Aircraft Corporation takes a continuing interest in having owners get the most efficient use from their airplane and keeping it in the best mechanical condition. Consequently, Piper Aircraft, from time to time, issues service releases incluidng Service Bulletins, Service Letters, Service Spares Letters, and others relating to the airplane.

Piper Service Bulletins are of special importance and Piper considers compliance mandatory. These are sent directly to the latest FAA-registered owners in the United States (U.S.) and Piper Service Centers worldwide. Depending on the nature of the release, material and labor allowances may apply. This information is provided to all authorized Piper Service Centers.

Service Letters deal with product improvements and servicing techniques pertaining to the airplane. They are sent to Piper Service Centers and, if necessary, to the latest FAA-registered owners in the U.S. Owners should give careful attention to Service Letter information.

Service Spares Letters offer improved parts, kits and optional equipment which were not available originally, and which may be of interest to the owner.

Piper Aircraft Corporation offers a subscription service for Service Bulletins, Service Letters, and Service Spares Letters. This service is available to interested persons, such as owners, pilots, and mechanics at a nominal fee, and may be obtained through an authorized Piper Service Center or Piper's Customer Services Department.

Maintenance manuals, parts catalogs, and revisions to both are available from Piper Service Centers or Piper's Customer Services Department.

Any correspondence regarding the airplane should include the airplane model and serial number to ensure proper response.

8.3 AIRPLANE INSPECTION PERIODS

Piper Aircraft Corporation has developed inspection items and required inspection intervals (i.e.: 50, 100, 500, and 1000 hours) for the PA-28-236 Dakota. Appropriate forms are contained in the PA-28-236 Maintenance Manual, and should be complied with by a properly trained, knowledgeable, and qualified mechanic at an authorized Piper Service Center or a reputable repair shop. Piper Aircraft Corporation cannot accept responsibility for the continued airworthiness of any aircraft not maintained to these standards, and/or not brought into compliance with applicable Service Bulletins issued by Piper Aircarft Corporation, instructions issued by the engine, propeller, or accessory manufacturers, or Airworthiness Directives issued by the FAA.

A programmed inspection, approved by the Federal Aviation Administration (FAA), is also available to the owner. This involves routine and detailed inspections to allow maximum utilization of the airplane. Maintenance inspection costs are reduced, and the maximum standard of continued airworthiness is maintained. Complete details are available from Piper Aircraft Corporation.

In addition, but in conjunction with the above, the FAA requires periodic inspections on all aircraft to keep the Airworthiness Certificate in effect. The owner is responsible for assuring compliance with these inspection requirements and for maintaining proper documentation in logbooks and/or maintenance records.

A spectographic analysis of the engine oil is available from several sources. This inspection, if performed properly, provides a good check of the internal condition of the engine. To be accurate, induction air filters must be cleaned or changed regularly, and oil samples must be taken and sent in at regular intervals.

8.5 PREVENTIVE MAINTENANCE

The holder of a Pilot Certificate issued under FAR Part 61 may perform certain preventive maintenance described in FAR Part 43. This maintenance may be performed only on an aircraft which the pilot owns or operates and which is not used to carry persons or property for hire, except as provided in applicable FAR's. Although such maintenance is allowed by law, each individual should make a self-analysis as to whether he has the ability to perform the work.

All other maintenance required on the airplane should be accomplished by appropriately licensed personnel.

If maintenance is accomplished, an entry must be made in the appropriate logbook. The entry should contain:

(a) The date the work was accomplished.
(b) Description of the work.
(c) Number of hours on the aircraft.
(d) The certificate number of pilot performing the work.
(e) Signature of the individual doing the work.

8.7 AIRPLANE ALTERATIONS

If the owner desires to have his aircraft modified, he must obtain FAA approval for the alteration. Major alterations accomplished in accordance with Advisory Circular 43.13-2, when performed by an A & P mechanic, may be approved by the local FAA office. Major alterations to the basic airframe or systems not covered by AC 43.13-2 require a Supplemental Type Certificate.

The owner or pilot is required to ascertain that the following Aircraft Papers are in order and in the aircraft.

(a) To be displayed in the aircraft at all times:
- (1) Aircraft Airworthiness Certificate Form FAA-8100-2.
- (2) Aircraft Registration Certificate Form FAA-8050-3.
- (3) Aircraft Radio Station License if transmitters are installed.

(b) To be carried in the aircraft at all times:
- (1) Pilot's Operating Handbook.
- (2) Weight and Balance data plus a copy of the latest Repair and Alteration Form FAA-337, if applicable.
- (3) Aircraft equipment list.

Although the aircraft and engine logbooks are not required to be in the aircraft, they should be made available upon request. Logbooks should be complete and up to date. Good records will reduce maintenance cost by giving the mechanic information about what has or has not been accomplished.

8.9 GROUND HANDLING

(a) Towing

The airplane may be moved on the ground by the use of the nose wheel steering bar that is stowed in the rear baggage compartment or by power equipment that will not damage or excessively strain the nose gear steering assembly. Towing lugs are incorporated as part of the nose gear fork.

CAUTION

When towing with power equipment, do not turn the nose gear beyond its steering radius in either direction, as this will result in damage to the nose gear and steering mechanism.

CAUTION

Do not tow the airplane when the controls are secured.

In the event towing lines are necessary, ropes should be attached to both main gear struts as high up on the tubes as possible. Lines should be long enough to clear the nose and/or tail by not less than fifteen feet, and a qualified person should ride in the pilot's seat to maintain control by use of the brakes.

(b) Taxiing

Before attempting to taxi the airplane, ground personnel should be instructed and approved by a qualified person authorized by the owner. Engine starting and shut-down procedures as well as taxi techniques should be covered. When it is ascertained that the propeller back blast and taxi areas are clear, power should be applied to start the taxi roll, and the following checks should be performed:

(1) Taxi a few feet forward and apply the brakes to determine their effectiveness.
(2) Taxi with the propeller set in low pitch, high RPM setting.
(3) While taxiing, make slight turns to ascertain the effeetiveness of the steering.
(4) Observe wing elearance when taxiing near buildings or other stationary objects. If possible, station an observer outside the airplane.
(5) When taxiing over uneven ground, avoid holes and ruts.
(6) Do not operate the engine at high RPM when running up or taxiing over ground containing loose stones, gravel, or any loose material that might cause damage to the propeller blades.

(c) Parking

When parking the airplane, be sure that it is suffieiently protected from adverse weather conditions and that it presents no danger to other aircraft. When parking the airplane for any length of time or overnight, it is suggested that it be moored securely.

(1) To park the airplane, head it into the wind if possible.

(2) Set the parking brake by pulling back on the brake lever and depressing the knob on the handle. To release the parking brake, pull back on the handle until the catch disengages; then allow the handle to swing forward.

CAUTION

Care should be taken when setting brakes that are overheated or during cold weather when accumulated moisture may freeze a brake.

(3) Aileron and stabilator controls should be secured with the front seat belt and chocks used to properly block the wheels.

(d) Mooring

The airplane should be moored for immovability, security and protection. The following procedures should be used for the proper mooring of the airplane:

(1) Head the airplane into the wind if possible.
(2) Retract the flaps.
(3) Immobilize the ailerons and stabilator by looping the seat belt through the control wheel and pulling it snug.
(4) Block the wheels.
(5) Secure tie-down ropes to the wing tie-down rings and to the tail skid at approximately 45 degree angles to the ground. When using rope of non-synthetic material, leave sufficient slack to avoid damage to the airplane should the ropes contract.

CAUTION

Use bowline knots, square knots or locked slip knots. Do not use plain slip knots.

NOTE

Additional preparations for high winds include using tie-down ropes from the landing gear forks and securing the rudder.

(6) Install a pitot head cover if available. Be sure to remove the pitot head cover before flight.
(7) Cabin and baggage doors should be locked when the airplane is unattended.

8.11 ENGINE AIR FILTER

(a) Removing Engine Air Filter

(1) Remove the front cowl scoop.
(2) Unfasten the quarter-turn fasteners securing the filter.

(b) Cleaning Engine Air Filter

The induction air filter should be checked during each preflight inspection and cleaned or replaced if found to be dirty. Replace the filter after one year, after ten cleanings or 500 flight hours, whichever comes first.

To clean the filter:
(1) Blow compressed air through the filter in the opposite direction of normal airflow to remove light dust contaminants. Air pressure is to be less than 100 psi and keep the nozzle at least one inch from the filter to prevent damage.
(2) If the filter is excessively dirty, flush filter with running water (less than 40 psi) and soak it in a solution of Donaldson D-1400 compound and water. Do not use solvents or gasoline. Rinse until clear water comes through the filter.
(3) Dry the filter thoroughly before inspection. Mechanical dryers may be used provided the heated air is circulated and maintained below 180° F. Do not use a light bulb.
(4) Inspect filter medium for holes or tears and insure the frame provides a good air seal. Replace filter if defects are found.

(c) Installation of Engine Air Filter

After cleaning or replacing the filter, install the filter in the reverse order of removal.

8.13 BRAKE SERVICE

The brake system is filled with MIL-H-5606 (petroleum base) hydraulic brake fluid. The fluid level should be checked periodically or at every 50 hour inspection and replenished when necessary. The brake reservoir is located on the left side of the fire wall in the engine compartment. If the entire system must be refilled, fill with fluid under pressure from the brake end of the system. This will eliminate air from the system.

No adjustment of the brake clearances is necessary. If after extended service brake blocks become excessively worn, they should be replaced with new segments.

8.15 LANDING GEAR SERVICE

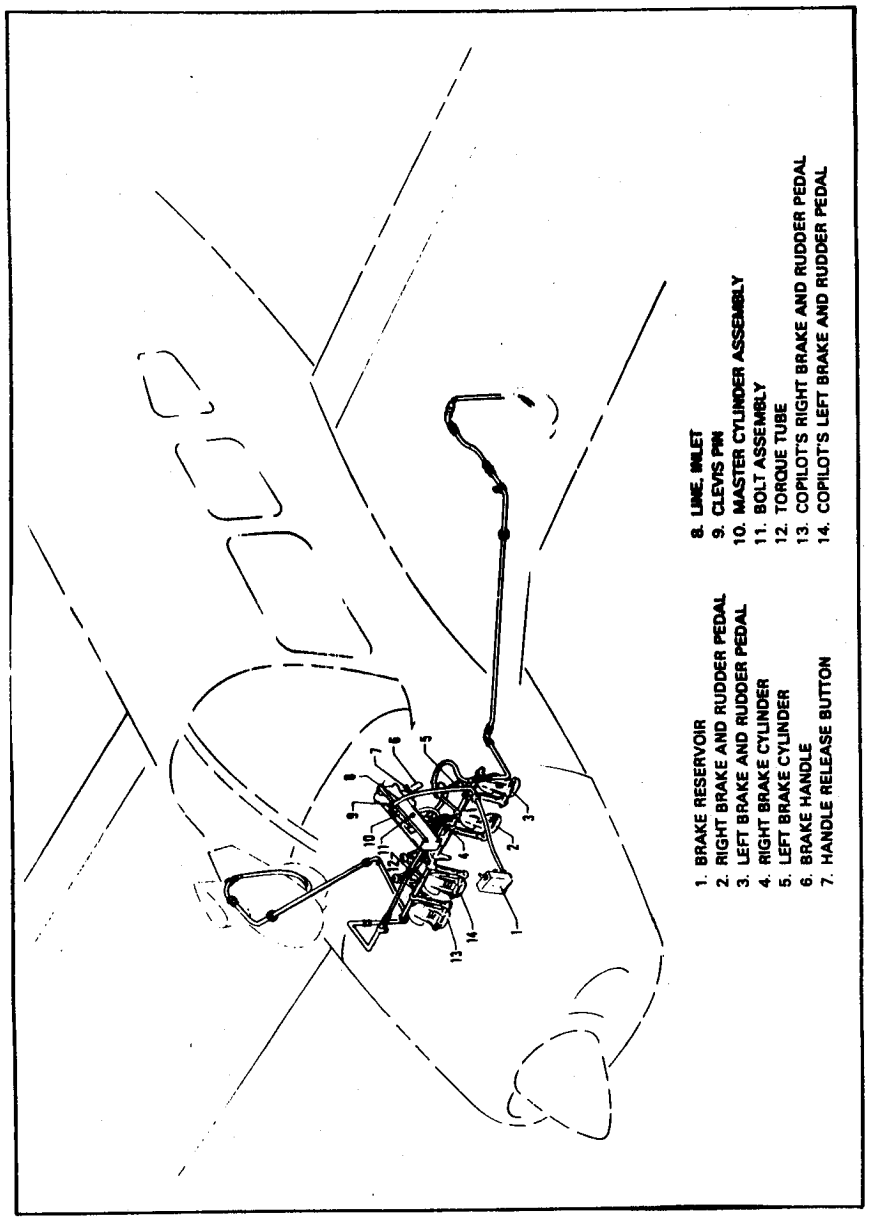
The landing gears use 6.00 x 6 wheels. All three tires are 6.00 x 6 tube type. The main gear tires are 6 ply rating and the nose gear tire is 4 ply rating. (See Section 8.23.)

Main wheels are removed by taking off the hub cap, axle nut, and the two bolts holding the brake segment in place, after which the wheel slips easily from the axle.

The nose wheel is removed by taking off the axle nut and washer from one side, sliding out the axle rod and plugs, lightly tapping out the axle tube, and then removing the wheel and spacer tubes from between the fork. Wheels are replaced by reversing the procedure.

Tires are removed from the wheels by deflating the tire, removing the through bolts, and separating the wheel halves.

Landing gear oleo struts should be checked for proper strut exposure and visible leaks. The required extensions for the struts under normal static load (empty weight of airplane plus full fuel and oil) are 3.25 inches for the nose gear and 4.5 inches for the main gear. If the strut exposure is below that required, it should be determined whether air or oil is needed by first raising the airplane on jacks. Depress the valve core to allow air to escape from the strut housing chamber. Remove the filler plug and slowly raise the strut to full compression. If the fluid is then visible up to the bottom of the filler plug hole, only proper inflation with air is required.



BRAKE SYSTEM
Figure 8-1

If fluid is below the bottom of the filler plug hole, oil should be added. Replace the plug with the valve core removed. Then attach a clear plastic hose to the valve stem of the filler plug and submerge the free end in a container of hydraulic fluid (MIL-H-5606). Fully compress and extend the strut several times, thus drawing fluid into the strut chamber and expelling air. To allow fluid to enter the bottom chamber of the main gear strut housing, it is necessary to disconnect the torque link assembly and allow the strut to extend a full 10 inches. (The nose gear torque links need not be disconnected.) DO NOT allow the strut to extend beyond 12 inches. When air bubbles cease to flow through the hose, fully compress the strut, remove the filler plug, and again check the fluid level. When the fluid level is correct, disconnect the hose, reinstall the valve core, the filler plug, and the main gear torque links.

With the fluid in the strut housing at the proper level, attach a strut pump to the air valve. With the airplane on the ground under normal static load, inflate the oleo strut to the proper strut exposure.

In jacking the airplane for landing gear or other service, two hydraulic jacks and a tail stand should be used. At least 425 pounds of ballast should be placed on the base of the tail stand before jacking up the airplane. The hydraulic jacks are placed under the jack points on the underside of the wings, and the airplane is jacked up until the tail stand can be attached to the tail skid. After attaching the tail stand and adding ballast, the jacking can be continued until the airplane is at the desired height.

8.17 PROPELLER SERVICE

The spinner and backing plate should be cleaned and inspected for cracks frequently. Before each flight the propeller should be inspected for nicks, scratches, and corrosion. If found, they should be repaired as soon as possible by a rated mechanic, since a nick or scratch causes an area of increased stress which can lead to serious cracks or the loss of a propeller tip. The back face of the blades should be painted when necessary with flat black paint to retard glare. To prevent corrosion, the surface should be cleaned and waxed periodically.

8.19 OIL REQUIREMENTS

The oil capacity of the Lycoming O-540 series engine is 12 quarts, and the minimum safe quantity is 2-3/4 quarts. It is recommended that engine oil be drained and replenished every 50 hours. The oil filter element should be changed every 50 hours of operation. The interval between oil and oil filter changes should not exceed a total of four (4) months. Under unfavorable dusty conditions, the oil and oil filter should be changed more frequently.

The following seasonal aviation oil grades and seasonal ambient temperature ranges are recommended:

Average Ambient Temperature All Temperatures	MIL-L-6082B SAE Grade --	MIL-L-22851 Ashless Dispersant SAE Grades 15W-50 or 20W-50
Above 80°F	60	60
Above 60°F	50	40 or 50
30°F to 90°F	40	40
0°F to 70°F	30	30, 40 or 20W-40
Below 10°F	20	30 or 20W-30

When operating temperatures overlap indicated ranges, use the lighter grade oil.

NOTE

Refer to the latest issue of Textron Lycoming Service Instruction 1014 (Lubricating Oil Recommendations) for further information.

8.21 FUEL SYSTEM

(a) Servicing Fuel System

At every 50 hour inspection, the fuel screens in the strainer and in the carburetor must be cleaned. The screen in the carburetor is located in the housing where the fuel line connects to the carburetor. The fuel strainer is located on the lower left side of the firewall and is accessible for cleaning with the lower cowl removed. After cleaning, a small amount of grease applied to the gasket will facilitate reassembly.

(b) Fuel Requirements (AVGAS ONLY)

The minimum aviation grade fuel is 100. Since the use of lower grades can cause serious engine damage in a short period of time, the engine warranty is invalidated by the use of lower octanes.

Whenever 100 or 100LL grade fuel is not available, commercial grade 100/130 should be used. (See Fuel Grade Comparison Chart.) Refer to the latest issue of Lycoming Service Instruction No. 1070 for additional information.

A summary of the current grades as well as the previous fuel designations is shown in the following chart:

FUEL GRADE COMPARISON CHART

Previous Commercial Fuel Grades (ASTM-D910)			Current Commercial Fuel Grades (ASTM-D910-75)			Current Military Fuel Grades (MIL-G-5572F)		
Grade	Color	Max. TEL ml/U.S. gal	Grade	Color	Max. TEL ml/U.S. gal	Grade	Color	Max. TEL ml/U.S. gal
80/87	red	0.5	80	red	0.5	80/87	red	0.5
91/96	blue	2.0	*100LL	blue	2.0	100/130	blue	2.0
100/130	green	3.0	100	green	**3.0	none	none	none
115/145	purple	4.6	none	none	none	115/145	purple	4.6

* - Grade 100LL fuel in some overseas countries is colored green and designated as "100L".
** - Commercial fuel grade 100 and grade 100/130 having TEL content of up to 4 ml/U.S. gallons are approved for use in all engines certificated for use with grade 100/130 fuel.

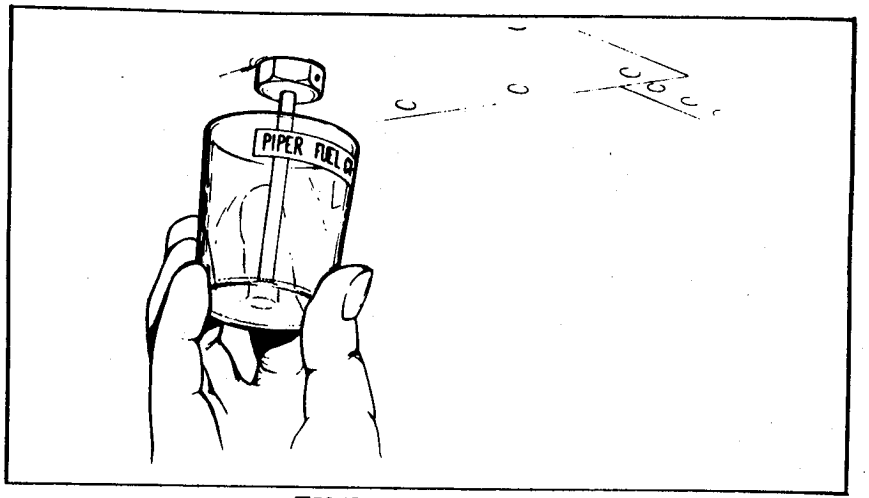
The operation of the aircraft is approved with an anti-icing additive in the fuel. When an anti-icing additive is used, it must meet the specification MIL-I-27686, must be uniformly blended with the fuel while refueling, must not exceed .15% by volume of the refueled quantity, and to ensure its effectiveness should be blended at not less than .10% by volume. One and one half liquid ozs. per ten gallons of fuel would fall within this range. A blender supplied by the additive manufacturer should be used. Except for the information contained in this section, the manufacturer's mixing or blending instructions should be carefully followed.

CAUTIONS

Assure that the additive is directed into the flowing fuel stream. The additive flow should start after and stop before the fuel flow. Do not permit the concentrated additive to come in contact with the aircraft painted surfaces or the interior surfaces of the fuel tanks.

Some fuels have anti-icing additives pre-blended in the fuel at the refinery, so no further blending should be performed.

Fuel additive cannot be used as a substitute for preflight draining of the fuel system drains.



FUEL TANK DRAIN
Figure 8-3

(c) Filling Fuel Tanks

Observe all safety precautions required when handling gasoline. Fill the fuel tanks through the filler located on the forward slope of the wing. Each wing holds a maximum of 38.5 U.S. gallons. When using less than the standard 77 gallon capacity, fuel should be distributed equally between each side. There is approximately 25 gallons in the fuel tank when the fuel level is even with the bottom of the filler neck indicator.

(d) Draining Fuel Valves and Lines

The fuel strainer, located on the lower left side of the firewall, is provided with a quick drain which should be drained before the first flight of the day or after refueling, to check for fuel contamination. If contamination is found, fuel should be drained until the contamination stops. If contamination persists after draining fuel for a minute, contact a mechanic to check the fuel system.

Each fuel tank is provided with a fuel quick drain to check for contamination. Each tank should be checked for contamination in accordance with the above procedure.

(e) Draining Fuel System

The bulk of the fuel may be drained from the fuel cells by the use of a siphon hose placed in the cell or tank through the filler neck. The remainder of the fuel may be drained by opening all the drain valves.

— CAUTION —

When draining fuel, be sure that no fire hazard exists before starting the engine.

After using the fuel system drains, check to be sure that they are closed completely and are not leaking.

8.23 TIRE INFLATION

For maximum service from the tires, keep them inflated to the proper pressures — 29 psi for the nose gear and 35-40 psi for the main gear. All wheels and tires are balanced before original installation, and the relationship of tire, tube, and wheel should be maintained upon reinstallation. Unbalanced wheels can cause extreme vibration in the landing gear; therefore, in the installation of new components, it may be necessary to rebalance the wheels with the tires mounted. When checking tire pressure, examine the tires for wear, cuts, bruises, and slippage.

8.25 BATTERY SERVICE

Access to the 12-volt battery is through the right rear baggage compartment. The battery box has a plastic tube which is normally closed off with a cap and which should be opened occasionally to drain off any accumulation of liquid. The battery should be checked for proper fluid level. DO NOT fill the battery above the baffle plates. DO NOT fill the battery with acid - use water only. A hydrometer check will determine the percent of charge in the battery.

If the battery is not up to charge, recharge starting at a 4 amp rate and finishing with a 2 amp rate. Quick charges are not recommended.

8.27 CLEANING

(a) Cleaning Engine Compartment

Before cleaning the engine compartment, place a strip of tape on the magneto vents to prevent any solvent from entering these units.

(1) Place a large pan under the engine to catch waste.
(2) With the engine cowling removed, spray or brush the engine with solvent or a mixture of solvent and degreaser. In order to remove especially heavy dirt and grease deposits, it may be necessary to brush areas that were sprayed.

CAUTION

Do not spray solvent into the alternator, vacuum pump, starter, or air intakes.

(3) Allow the solvent to remain on the engine from five to ten minutes. Then rinse the engine clean with additional solvent and allow it to dry.

CAUTION

Do not operate the engine until excess solvent has evaporated or otherwise been removed.

(4) Remove the protective tape from the magnetos.
(5) Lubricate the controls, bearing surfaces, etc., in accordance with the Lubrication Chart in the PA-28 Service Manual.

(b) Cleaning Landing Gear

Before cleaning the landing gear, place a plastic cover or similar material over the wheel and brake assembly.

(1) Place a pan under the gear to catch waste.
(2) Spray or brush the gear area with solvent or a mixture of solvent and degreaser, as desired. Where heavy grease and dirt deposits have collected, it may be necessary to brush areas that were sprayed, in order to clean them.

(3) Allow the solvent to remain on the gear from five to ten minutes. Then rinse the gear with additional solvent and allow to dry.
(4) Remove the cover from the wheel and remove the catch pan.
(5) Lubricate the gear in accordance with the Lubrication Chart in the PA-28 Service Manual.

(c) Cleaning Exterior Surfaces

The airplane should be washed with a mild soap and water. Harsh abrasives or alkaline soaps or detergents could make scratches on painted or plastic surfaces or could cause corrosion of metal. Cover areas where cleaning solution could cause damage. To wash the airplane, use the following procedure:

(1) Flush away loose dirt with water.
(2) Apply cleaning solution with a soft cloth, a sponge or a soft bristle brush.
(3) To remove exhaust stains, allow the solution to remain on the surface longer.
(4) To remove stubborn oil and grease, use a cloth dampened with naptha.
(5) Rinse all surfaces thoroughly.
(6) Any good automotive wax may be used to preserve painted surfaces. Soft cleaning cloths or a chamois should be used to prevent scratches when cleaning or polishing. A heavier coating of wax on the leading surfaces will reduce the abrasion problems in these areas.

(d) Cleaning Windshield and Windows

(1) Remove dirt, mud and other loose particles from exterior surfaces with clean water.
(2) Wash with mild soap and warm water or with aircraft plastic cleaner. Use a soft cloth or sponge in a straight back and forth motion. Do not rub harshly.

(3) Remove oil and grease with a cloth moistened with kerosene.

CAUTION

Do not use gasoline, alcohol, benzene, carbon tetrachloride, thinner, acetone, or window cleaning sprays.

(4) After cleaning plastic surfaces, apply a thin coat of hard polishing wax. Rub lightly with a soft cloth. Do not use a circular motion.

(5) A severe scratch or mar in plastic can be removed by rubbing out the scratch with jeweler's rouge. Smooth both sides and apply wax.

(e) Cleaning Headliner, Side Panels and Seats

(1) Clean headliner, side panels, and seats with a stiff bristle brush, and vacuum where necessary.

(2) Soiled upholstery, except leather, may be cleaned with a good upholstery cleaner suitable for the material. Carefully follow the manufacturer's instructions. Avoid soaking or harsh rubbing.

CAUTION

Solvent cleaners require adequate ventilation.

(3) Leather should be cleaned with saddle soap or a mild hand soap and water.

(f) Cleaning Carpets

To clean carpets, first remove loose dirt with a whisk broom or vacuum. For soiled spots and stubborn stains use a noninflammable dry cleaning fluid. Floor carpets may be cleaned like any household carpet.

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SECTION 9

SUPPLEMENTS