CHEROKEE WARRIOR INFORMATION MANUAL

Cherokee Warrior

PA-28-151

HANDBOOK PART NO. 761 623

Published by
PUBLICATIONS DEPARTMENT
Piper Aircraft Corporation
Issued: June 17, 1976

APPLICABILITY

Application of this handbook is limited to the specific Piper PA-28-151 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 will be kept current by revisions distributed to the airplane owners.

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.

Black lines will indicate only current revisions with changes and additions to or deletions of existing text and illustrations. Changes in capitalization, spelling, punctuation or the physical location of material on a page will not be identified by symbols.

ORIGINAL PAGES ISSUED

The original pages issued for this handbook prior to revision are given below:

Title, ii through v, 1-1 through 1-14, 2-1 through 2-8, 3-1 through 3-12, 4-1 through 4-16, 5-1 through 5-24, 6-1 through 6-56, 7-1 through 7-24, 8-1 through 8-16, 9-1 through 9-10, 10-1 through 10-2.

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Current Revisions to the PA-28-151 Cherokee Warrior Pilot's Operating Handbook, REPORT: VB-780 issued June 17, 1976.

Revision Number and Code	Revised Pages	Description of Revision	FAA Approval Signature and Date
Rev. 1 - 761 623 (PR760803)	6-43	Revised items 183, 185 and 187.	Ward Evans Ward Evans August 3, 1976
Rev. 2 - 761 623 (PR770118)	3-4	Revised Open Door procedure.	
	3-11	Revised para. 3.27 info.	
	4-5	Revised Takeoff procedure.	
	4-7	Added Caution to para. 4.9; relocated material to page 4-8.	
	4-8	Added relocated material from page 4-7.	
	4-14	Added Note to para. 4.31.	
	5-11	Removed "GEAR DOWN" from Fig. 5-1.	
	6-4	Added A & B values to Fig. 6-3.	
	6-5	Revised weight and balance formula.	
	6-35	Revised item 79 Arm and Moment.	Ward Evans
	7-13	Revised wording in text.	
	10-1	Revised 10.3 (c); relocated material to page 10-2.	Ward Evans Jan. 18, 1977
	10-2	Added relocated material from page 10-1.	
Rev. 3 - 761 623 (PR770223)	1-6	Corrected to "Meteorological."	
	3-11	Revised NOTE.	
	4-4	Revised Starting Engine When Hot procedure.	Ward Evans
	4-9	Revised 4.13 (b).	
	6-4	Revised Leveling Diagram illustration.	Ward Evans Feb. 23, 1977
	7-24	Added ELT test info.	
Rev. 4 - 761 623 (PR770406)	4-4	Revised Starting With External Power Source procedure.	
	4-9	Revised 4.13 (d); added NOTE; relocated material to page 4-10.	Ward Evans
	4-10	Added CAUTION; added material relocated from page 4-9.	Ward Evans April 6, 1977

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GENERAL

SECTION 1

GENERAL

1.1 INTRODUCTION

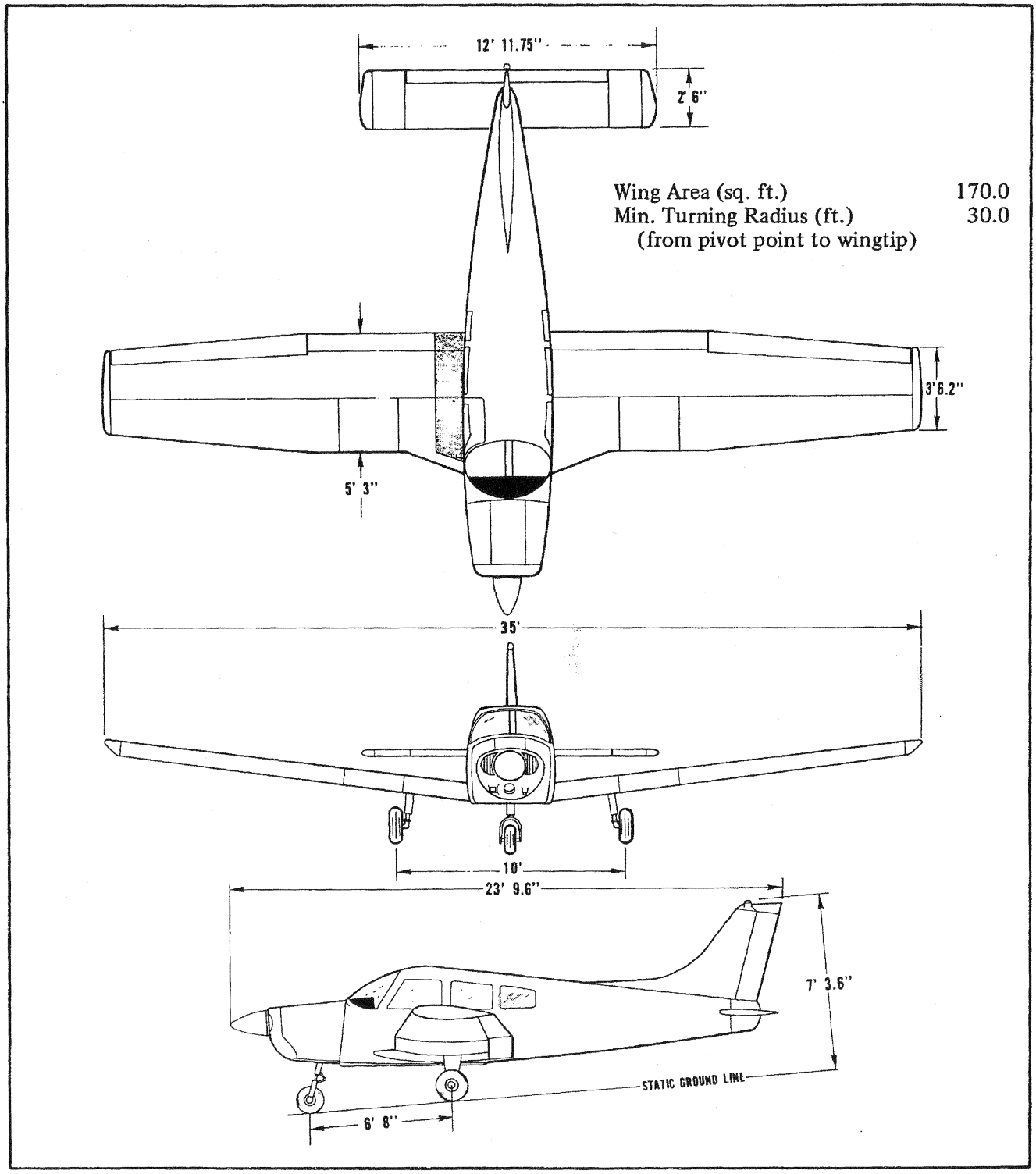
This Pilot's Operating Handbook is designed for maximum utilization as an operating guide for the pilot. It includes the material required to be furnished to the pilot by C.A.R. 3 and FAR Part 21, Subpart J. It also contains supplemental data supplied by the airplane manufacturer.

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 familiarize himself 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 left blank intentionally.



THREE VIEW

Figure 1-1

1.3 ENGINES

(a)	Number of Engines	1
(b)	Engine Manufacturer	Lycoming
(c)	Engine Model Number	O-320-E3D
(d)	Rated Horsepower	150
(e)	Rated Speed (rpm)	2700
(f)	Bore (inches)	5.125
(g)	Stroke (inches)	3.875
(h)	Displacement (cubic inches)	319.8
(i)	Compression Ratio	7:1
(j)	Engine Type	Four Cylinder, Direct Drive, Horizontally Opposed, Air Cooled

1.5 PROPELLERS

(a)	Number of Propellers		1
(b)	Propeller Manufacturer	McCauley	Sensenich
(c)	Model	1C160/EGM7653	74DM6-0-58
(d)	Number of Blades	2	2
(e)	Propeller Diameter (inches)		
	(1) Maximum	76	74
	(2) Minimum	74.5	72
(f)	Propeller Type	Fixed Pitch	Fixed Pitch

1.7 FUEL

(a)	Fuel Capacity (U.S. gal) (total)	50
(b)	Usable Fuel (U.S. gal) (total)	48
(c)	Fuel Grade, Aviation	
	(1) Minimum Octane	80/87 Red
	(2) Specified Octane	80/87 Red
	(3) Alternate Fuel	Refer to Fuel Requirements, Section 8 - Handling, Servicing and Maintenance - paragraph 8.21, item (b).

1.9 OIL

(a)	Oil Capacity (U.S. quarts)		8
(b)	Oil Specification		Refer to latest issue of Lycoming Service Instruction 1014.
(c)	Oil Viscosity per Average Ambient Temp. for Starting	SINGLE	MULTI
	(1) Above 60°F	S.A.E. 50	S.A.E. 40 or 50
	(2) 30°F to 90°F	S.A.E. 40	S.A.E. 40
	(3) 0°F to 70°F	S.A.E. 30	S.A.E. 40 or 20W-30
	(4) Below 10°F	S.A.E. 20	S.A.E. 20W-30

1.11 MAXIMUM WEIGHTS

	NORMAL	UTILITY
(a) Maximum Takeoff Weight (lbs)	2325	1950
(b) Maximum Landing Weight (lbs)	2325	1950
(c) Maximum Weights in Baggage Compartment	200	0

1.13 STANDARD AIRPLANE WEIGHTS

(a) Standard Empty Weight (lbs): Weight of a standard airplane including unusable fuel, full operating fluids and full oil.	1336
(b) Maximum Useful Load (lbs)*: The difference between the Maximum Takeoff Weight and the Standard Empty Weight.	989

1.15 BAGGAGE SPACE

(a) Compartment Volume (cubic feet)	24
(b) Entry Width (inches)	22
(c) Entry Height (inches)	20

1.17 SPECIFIC LOADINGS

(a) Wing Loading (lbs per sq ft)	13.7
(b) Power Loading (lbs per hp)	15.5

*This value is for a standard airplane without optional equipment. Refer to Figure 6-5 for the useful load value to be used for C.G. calculations for the airplane specified.

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 compressability.
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° Celcius (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	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.
MEA	Minimum en route IFR altitude.
Route Segment	A part of a route. Each end of that part is identified by: (1) a geographical location; or (2) a point at which a definite radio fix can be established.

(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 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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1.21 CONVERSION FACTORS

MULTIPLY	BY	TO OBTAIN
atmospheres	76.00	cm Hg at 0°C
	29.92	in. Hg at 0°C
	14.696	lb/sq in.
	21,116	lb/sq ft
	1.033	kg/sq cm
centimeters	0.3937	in.
	3.281×10^{-2}	ft
cm Hg	1.934×10^{-1}	lb/sq in.
	27.85	lb/sq ft
	135.95	kg/sq m
cm/second	3.281×10^{-2}	ft/sec
	2.237×10^{-2}	mph
cu centimeters	10^{-3}	liters
	6.102×10^{-2}	cu in.
	2.642×10^{-4}	U.S. gal
cu ft	2.832×10^{4}	cu cm
	1,728	cu in.
	3.704×10^{-2}	cu yards
	7.481	U.S. gal
	28.32	liters
cu ft/min	4.719×10^{-1}	liters/sec
	2.832×10^{-2}	cu m/min
cu in.	16.39	cu cm
	1.639×10^{-2}	liters
	4.329×10^{-3}	U.S. gal
	1.732×10^{-2}	quarts
cu meters	61,023	cu in.
	1.308	cu yards
	35.31	cu ft
	264.2	U.S. gal
cu yards	27.0	cu ft
	7.646×10^{-1}	cu meters
	2.022×10^{2}	U.S. gal
deg (arc)	1.745×10^{-2}	radians

MULTIPLY	BY	TO OBTAIN
feet	3.048×10^{-1}	meters
	3.333×10^{-1}	yards
	1.894×10^{-4}	miles
	1.646×10^{-4}	nautical miles
ft/min	1.136×10^{-2}	mph
	1.829×10^{-2}	km/hr
	5.080×10^{-1}	cm/sec
ft/sec	.6818	mph
	1.097	km/hr
	30.48	cm/sec
	.5925	knots
ft/lb	1.383×10^{-1}	m-kg
ft-lb/min	3.030×10^{-5}	hp
ft-lb/sec	1.818×10^{-3}	hp
fluid oz	8	dram
	29.6	cu cm
gal, Imperial	277.4	cu in.
	1.201	U.S. gal
	4.546	liters
gal, U.S. dry	268.8	cu in.
	1.556×10^{-1}	cu ft
	1.164	U.S. gal liquid
	4.405	liters
gal, U.S. liquid	231.0	cu in.
	1.337×10^{-1}	cu ft
	3.785	liters
	8.327×10^{-1}	Imperial gal
	1.280×10^{2}	fluid oz
grams/cm	0.1	kg/m
	6.721×10^{-2}	lb/ft
	5.601×10^{-3}	lb/in.
grams/cu cm	1,000	kg/cu m
	62.43	lb/cu ft

MULTIPLY	BY	TO OBTAIN
horsepower	33,000	ft-lb/min
	550	ft-lb/sec
	76.04	m-kg/sec
	1.014	metric hp
horsepower, metric	75.0	m-kg/sec
	9.863×10^{-1}	hp
inches	2.540	cm
	83.33×10^{-3}	ft
in. Hg at 0°C	3.342×10^{-2}	atmospheres
	4.912×10^{-1}	lb/sq in.
	70.73	lb/sq ft
	3.453×10^{2}	kg/sq m
kilograms	2.205	lb
	35.27	oz
	10^{3}	grams
kg-calories	3087	ft-lb
	4.269×10^{2}	m-kg
kg/cu m	62.43×10^{-3}	lb/cu ft
	10^{-3}	grams/cu m
kg/sq cm	14.22	lb/cu ft
	2.048×10^{3}	lb/sq ft
	28.96	in. Hg at 0°C
kilometers	3.281×10^{3}	ft
	6.214×10^{-1}	miles
	5.400×10^{-1}	nautical miles
	10^{5}	centimeters
km/hr	9.113×10^{-1}	ft/sec
	5.396×10^{-1}	knots
	6.214×10^{-1}	mph
	2.778×10^{-1}	m/sec
knots	1.0	nautical mph
	1.688	ft/sec
	1.151	mph
	1.853	km/hr
	5.148×10^{-1}	m/sec

MULTIPLY	BY	TO OBTAIN
liters	10^{3}	cu cm
	61.03	cu in.
	3.532×10^{-2}	cu ft
	2.642×10^{-1}	U.S. gal
	2.200×10^{-1}	Imperial gal
	1.057	quarts
meters	39.37	in.
	3.281	ft
	1.094	yards
	6.214×10^{-4}	miles
meter-kilogram	7.233	ft-lb
meter/sec	3.281	ft/sec
	2.237	miles/hr
	3.600	km/hr
microns	3.937×10^{-5}	in.
miles	5280	ft
	1.609	km
	8.690×10^{-1}	nautical miles
mph	1.467	ft/sec
	4.470×10^{-1}	m/sec
	1.609	km/hr
	8.690×10^{-1}	knots
miles/hr sq	2.151	ft/sec sq
milibars	2.953×10^{-2}	in. Hg at 0°C
nautical miles	6076.1	ft
	1.151	miles
	1852	m
ounces, fluid	29.57	cu cm
	1.805	cu in.
lb/cu ft	16.02	kg/cu m
lb/cu in.	1728	lb/cu ft
	27.68	grams/cu cm

MULTIPLY	BY	TO OBTAIN
lb/sq in.	2.036	in. Hg at 0°C
	6.805×10^{-2}	atmospheres
	7.031×10^{2}	kg/sq m
radians	57.30	deg (arc)
radians/sec	57.30	deg/sec
	15.92×10^{-2}	rev/sec
	9.549	rev/min
revolutions	6.283	radians
rev/min	1.047×10^{-1}	radians/sec
rod	16.5	ft
	5.5	yd
slug	32.174	lb
sq cm	1.550×10^{-1}	sq in.
	1.076×10^{-3}	sq ft
sq ft	929.0	sq cm
	144.0	sq in.
	1.111×10^{-1}	sq yards
	2.296×10^{-5}	acres
sq in.	6.452	sq cm
sq kilometers	3.861×10^{-1}	sq miles
sq meters	10.76	sq ft
	1.196	sq yards
sq miles	2.590	sq km
	640	acres
sq rods	30.25	sq yd
sq yards	8.361×10^{-1}	sq m
	9	sq ft
yards	9.144×10^{-1}	meters
	3.0	ft
	36.0	in.

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SECTION 2

LIMITATIONS

SECTION 2

LIMITATIONS

2.1 GENERAL

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

This airplane must be operated as a normal or utility 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
Never Exceed Speed (V_{NE}) - Do not exceed this speed in any operation.	160	153
Maximum Structural Cruising Speed (V_{NO}) - Do not exceed this speed except in smooth air and then only with caution.	126	122
Design Maneuvering Speed (V_A) - Do not make full or abrupt control movements above this speed.		
At 2325 LBS. G.W.	111	108
At 1531 LBS. G.W.	88	89

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. Manuevering speed should not be exceeded while operating in rough air.

Maximum Flaps Extended Speed (V_{FE}) - Do not exceed this speed with the flaps extended.	103	100

2.5 AIRSPEED INDICATOR MARKINGS

MARKING	IAS
Red Radial Line (Never Exceed)	160 KTS
Yellow Arc (Caution Range - Smooth Air Only)	126 KTS to 160 KTS
Green Arc (Normal Operating Range)	50 KTS to 126 KTS
White Arc (Flap Down)	44 KTS to 103 KTS

2.7 POWER PLANT LIMITATIONS

(a)	Number of Engines			1
(b)	Engine Manufacturer			Lycoming
(c)	Engine Model No.			O-320-E3D
(d)	Engine Operating Limits			
	(1) Maximum Horsepower			150
	(2) Maximum Rotation Speed (RPM)			2700
	(3) Maximum Oil Temperature			245°F
(e)	Oil Pressure			
	Minimum (red line)			25 PSI
	Maximum (red line)			90 PSI
(f)	Fuel Pressure			
	Minimum (red line)			.5 PSI
	Maximum (red line)			8 PSI
(g)	Fuel Grade (minimum octane)			80/87 Red
(h)	Number of Propellers			1
(i)	Propeller Manufacturer		McCauley	Sensenich
(j)	Propeller Model		1C160/EGM7653	74DM6-0-58
(k)	Propeller Diameter			
	Minimum		74.5 IN.	72 IN.
	Maximum		76 IN.	74 IN.
(l)	Propeller Tolerance (static RPM at maximum permissible throttle setting)	Not above	2400 RPM	2375 RPM
		Not below	2300 RPM	2275 RPM

No additional tolerance permitted.

2.9 POWER PLANT INSTRUMENT MARKINGS

(a)	Tachometer	
	Green Arc (Normal Operating Range)	500 to 2700 RPM
	Red Line (Maximum Continuous Power)	2700 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
	Red Line (Minimum)	25 PSI
	Red Line (Maximum)	90 PSI
(d)	Fuel Pressure	
	Green Arc (Normal Operating Range)	.5 PSI to 8 PSI
	Red Line (Minimum)	.5 PSI
	Red Line (Maximum)	8 PSI

2.11 WEIGHT LIMITS

		NORMAL	UTILITY
(a)	Maximum Weight	2325 LBS	1950 LBS
(b)	Maximum Baggage	200 LBS	0 LBS

NOTE

Refer to Section 5 (Performance) for maximum weight as limited by performance.

2.13 CENTER OF GRAVITY LIMITS

(a) Normal Category

Weight Pounds	Forward Limit Inches Aft of Datum	Rearward Limit Inches Aft of Datum
2325	87.0	93.0
1950 (and less)	83.0	93.0

(b) Utility Category

Weight Pounds	Forward Limit Inches Aft of Datum	Rearward Limit Inches Aft of Datum
1950 (and less)	83.0	86.5

NOTES

Straight line variation between points given.

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

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

(a) Normal Category - All acrobatic maneuvers including spins prohibited.
(b) Utility Category - Approved maneuvers for bank angles exceeding 60°:

	Entry Speed
Steep Turns	111 KIAS
Lazy Eights	111 KIAS
Chandelles	111 KIAS

2.17 FLIGHT LOAD FACTORS

	NORMAL	UTILITY
(a) Positive Load Factor (Maximum)	3.8 G	4.4 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	50 U.S. GAL
(b) Unusable Fuel The unusable fuel for this airplane has been determined as 1.0 gallon in each wing in critical flight attitudes.	2 U.S. GAL
(c) Usable Fuel The usable fuel in this airplane has been determined as 24.0 gallons in each wing.	48 U.S. GAL

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2.23 PLACARDS

In full view of the pilot:

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

ALL MARKINGS AND PLACARDS ON THIS AIRPLANE APPLY TO ITS OPERATION AS A UTILITY CATEGORY AIRPLANE. FOR NORMAL AND UTILITY CATEGORY OPERATION, REFER TO THE PILOT'S OPERATING HANDBOOK.

NO ACROBATIC MANEUVERS ARE APPROVED FOR NORMAL CATEGORY OPERATIONS. SPINS ARE PROHIBITED FOR BOTH NORMAL AND UTILITY CATEGORY."

In full view of the pilot, the following takeoff and landing check lists will be installed:

TAKEOFF CHECK LIST

Fuel on proper tank	Mixture set	Fasten belts/harness
Electric fuel pump on	Seat backs erect	Trim tab - set
Engine gauges checked		Controls - free
Flaps - set		Door - latched
Carb heat off		

LANDING CHECK LIST

Fuel on proper tank		Flaps - set (103 KIAS max.)
Mixture rich	Seat backs erect	Fasten belts/harness
Electric fuel pump on		

Adjacent to upper door latch:

"ENGAGE LATCH BEFORE FLIGHT."

On inside of the baggage compartment door:

"BAGGAGE MAXIMUM 200 LBS"
"UTILITY CATEGORY OPERATION - NO BAGGAGE OR AFT PASSENGERS ALLOWED. NORMAL CATEGORY OPERATION - SEE PILOT'S OPERATING HANDBOOK WEIGHT AND BALANCE SECTION FOR BAGGAGE AND AFT PASSENGER LIMITATIONS."

In full view of the pilot:

"MANEUVERING SPEED 111 KIAS AT 2325 LBS. (SEE P.O.H.)"

"UTILITY CATEGORY OPERATION - NO AFT PASSENGERS ALLOWED."

"DEMONSTRATED CROSS WIND COMPONENT - 17 KTS."

On the instrument panel in full view of the pilot when the oil cooler winterization kit is installed:

"OIL COOLER WINTERIZATION PLATE TO BE REMOVED WHEN AMBIENT TEMPERATURE EXCEEDS 50°F."

In full view of the pilot:

"UTILITY CATEGORY OPERATION ONLY."

(1) NO AFT PASSENGERS ALLOWED.
(2) ACROBATIC MANEUVERS ARE LIMITED TO THE FOLLOWING:

	ENTRY SPEED
SPINS PROHIBITED	
STEEP TURNS	111 KIAS
LAZY EIGHTS	111 KIAS
CHANDELLES	111 KIAS

On the instrument panel in full view of the pilot:

"WARNING – TURN OFF STROBE LIGHTS WHEN TAXIING IN VICINITY OF OTHER AIRCRAFT, OR DURING FLIGHT THROUGH CLOUD, FOG OR HAZE."

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SECTION 3

EMERGENCY PROCEDURES

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 the safe 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 the best course of action for coping with the particular condition described, but are not a substitute for sound judgment and common sense. Since emergencies rarely happen in modern aircraft, their occurrrence is usually unexpected and the best corrective action may not always be obvious. 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.

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3.3 EMERGENCY PROCEDURES CHECK LIST

ENGINE FIRE DURING START

Starter . . . . . crank engine
Mixture . . . . . idle cut-off
Throttle . . . . . open
Electric fuel pump . . . . . OFF
Fuel selector . . . . . OFF
Abandon if fire continues

ENGINE POWER LOSS DURING TAKEOFF

If sufficient runway remains for a normal landing, land straight ahead.

If insufficient runway remains:
Maintain safe airspeed
Make only shallow turn to avoid obstructions
Flaps as situation requires

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

ENGINE POWER LOSS IN FLIGHT

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

When power is restored:
Carburetor heat . . . . . OFF
Electric fuel pump . . . . . OFF
If power is not restored prepare for power off landing.
Trim for 73 KIAS

POWER OFF LANDING

Locate suitable field.
Establish spiral pattern.
1000 ft. above field at downwind position for normal landing approach.
When field can easily be reached slow to 63 KIAS for shortest landing.

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 belt and harness . . . . . tight

FIRE IN FLIGHT

Source of fire . . . . . check

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

Engine fire:
Fuel selector . . . . . OFF
Throttle . . . . . CLOSED
Mixture . . . . . idle cut-off
Electric fuel pump . . . . . check OFF
Heater . . . . . OFF
Defroster . . . . . OFF
Proceed with POWER OFF LANDING procedure.

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.

ALTERNATOR FAILURE

Verify failure
Reduce electrical load as much as possible.
Alternator circuit breakers . . . . . check
Alt switch . . . . . OFF (for 1 second), then on

If no output:
Alt switch . . . . . .OFF

Reduce electrical load and land as soon as practical.

SPIN RECOVERY

Throttle . . . . . idle
Ailerons . . . . . neutral
Rudder . . . . . full opposite to direction of rotation
Control wheel . . . . . .full forward
Rudder . . . . . neutral (when rotation stops)
Control wheel . . . . . .as required to smoothly regain level flight altitude

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 89 KIAS
Cabin vents . . . . . .close
Storm window . . . . . .open

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

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

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.

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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 FIRE DURING START

Engine fires during start are usually the result of overpriming. The first attempt to extinguish the fire is to try to start the engine and draw the excess fuel back into the induction system.

If a fire is present before the engine has started, move the mixture control to idle cut-off, open the throttle and crank the engine. This is an attempt to draw the fire back into the engine.

If the engine has started, continue operating to try to pull the fire into the engine.

In either case (above), if fire continues more than a few seconds, the fire should be extinguished by the best available external means.

The fuel selector valves should be "OFF" and the mixture at idle cut-off if an external fire extinguishing method is to be used.

3.9 ENGINE POWER LOSS DURING TAKEOFF

The proper action to be taken if loss of power occurs during takeoff will depend on the circumstances of the particular situation.

If sufficient runway remains to complete a normal landing, land straight ahead.

If insufficient runway remains, maintain a safe airspeed and make only a shallow turn if necessary to avoid obstructions. Use of flaps depends on the circumstances. Normally, flaps should be fully extended for touchdown.

If sufficient altitude has been gained to attempt a restart, maintain a safe airspeed and switch the fuel selector to another tank containing fuel. Check the electric fuel pump to insure that it is "ON" and that the mixture is "RICH." The carburetor heat should be "ON."

If engine failure was caused by fuel exhaustion, power will not be regained after switching fuel tanks until the empty fuel lines are filled. This may require up to ten seconds.

If power is not regained, proceed with the Power Off Landing procedure (refer to the emergency check list and paragraph 3.13).

3.11 ENGINE POWER LOSS IN FLIGHT

Complete engine power loss is usually caused by fuel flow interruption and power will be restored shortly after fuel flow is restored. If power loss occurs at a low altitude, the first step is to prepare for an emergency landing (refer to paragraph 3.13). An airspeed of at least 73 KIAS should be maintained.

If altitude permits, switch the fuel selector to another tank containing fuel and turn the electric fuel pump "ON." Move the mixture control to "RICH" and the carburetor heat to "ON." Check the engine gauges for an indication of the cause of the power loss. Check to insure the primer is locked. If no fuel pressure is indicated, check the tank selector position to be sure it is on a tank containing fuel.

When power is restored move the carburetor heat to the "OFF" position and turn "OFF" the electric fuel pump.

If the preceding steps do not restore power, prepare for an emergency landing.

If time permits, turn the ignition switch to "L" then to "R" then back to "BOTH." Move the throttle and mixture control levers to different 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. Try other fuel tanks. Water in the fuel could take some time to be used up, and allowing the engine to windmill may restore power. If power loss is due to water, fuel pressure indications will be normal.

If engine failure was caused by fuel exhaustion power will not be restored after switching fuel tanks until the empty fuel lines are filled. This may require up to ten seconds.

If power is not regained, proceed with the Power Off Landing procedure (refer to the emergency check list and paragraph 3.13).

3.13 POWER OFF LANDING

If loss of power occurs at altitude, trim the aircraft for best gliding angle (73 KIAS) and look for a suitable field. If measures taken to restore power are not effective, and if time permits, check your charts for airports in the immediate vicinity; it may be possible to land at one if you have sufficient altitude. If possible, notify the FAA by radio of your difficulty and intentions. If another pilot or passenger is aboard, let him help.

When you have located a suitable field, establish a spiral pattern around this field. Try to be at 1000 feet above the field at the downwind position, to make a normal landing approach. When the field can easily be reached, slow to 63 KIAS for the shortest landing. Excess altitude may be lost by widening your pattern, using flaps or slipping, or a combination of these.

Touchdown should normally be made at the lowest possible airspeed.

When committed to a landing shut "OFF" the master and ignition switches. Flaps may be used as desired. Turn the fuel selector valve to "OFF" and move the mixture to idle cut-off. The seat belts and shoulder harness should be tightened. Touchdown should be normally made at the lowest possible airspeed.

3.15 FIRE IN FLIGHT

The presence of fire is noted through smoke, smell and heat in the cabin. 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 somewhat in each case.

Check for the source of the fire first.

If an electrical fire is indicated (smoke in the cabin), the master switch should be turned "OFF." The cabin vents should be opened and the cabin heat turned "OFF." A landing should be made as soon as possible.

If an engine fire is present, switch the fuel selector to "OFF" and close the throttle. The mixture should be at idle cut-off. Turn the electric fuel pump "OFF." In all cases, the heater and defroster should be "OFF." If radio communication is not required, select master switch "OFF." Proceed with power off landing procedure.

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.

3.17 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 investigate the cause and 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 dead stick landing can be accomplished. Don't 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.

3.19 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 full tank.

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

3.21 HIGH OIL TEMPERATURE

An abnormally high oil temperature indication may be caused by a low oil level, an obstruction in the oil cooler, damaged or improper baffle seals, a defective gauge, or other causes. Land as soon as practical 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.

3.23 ALTERNATOR FAILURE

Loss of alternator output is detected through zero reading on the ammeter and illumination of the ALT light in the annunciator panel. 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 "O" 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.

3.25 SPIN RECOVERY

Intentional spins are prohibited in this airplane. If a spin is inadvertently entered, immediately move the throttle to idle and the ailerons to neutral.

Full rudder should then be applied opposite to the direction of rotation followed by control wheel full forward. When the rotation stops, neutralize the rudder and ease back on the control wheel as required to smoothly regain a level flight attitude.

3.27 OPEN DOOR

The cabin door on the Cherokee is double latched, so the chances of its springing open in flight at both the top and side are remote. However, should you forget the upper latch, or not fully engage the side latch, the 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 89 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 armrest while moving the latch handle to the latched position. If both latches are open, close the side latch then the top latch.

3.29 ENGINE ROUGHNESS

Engine roughness is usually due to carburetor icing which is indicated by a drop in RPM, 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). RPM will decrease slightly and roughness will increase. Wait for a decrease in engine roughness or an increase in RPM, 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 to "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.

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SECTION 4

NORMAL PROCEDURES

SECTION 4

NORMAL PROCEDURES

4.1 GENERAL

This section clearly describes the recommended procedures for the conduct of normal operations for the Cherokee Warrior. All of the required (FAA regulations) procedures and those necessary for the safe 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 lengthly 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	75 KIAS
(b)	Best Angle of Climb Speed	63 KIAS
(c)	Turbulent Air Operating Speed (See Subsection 2.3)	111 KIAS
(d)	Maximum Flap Speed	103 KIAS
(e)	Landing Final Approach Speed (Flaps 40°)	63 KIAS
(f)	Maximum Demonstrated Crosswind Velocity	17 KTS

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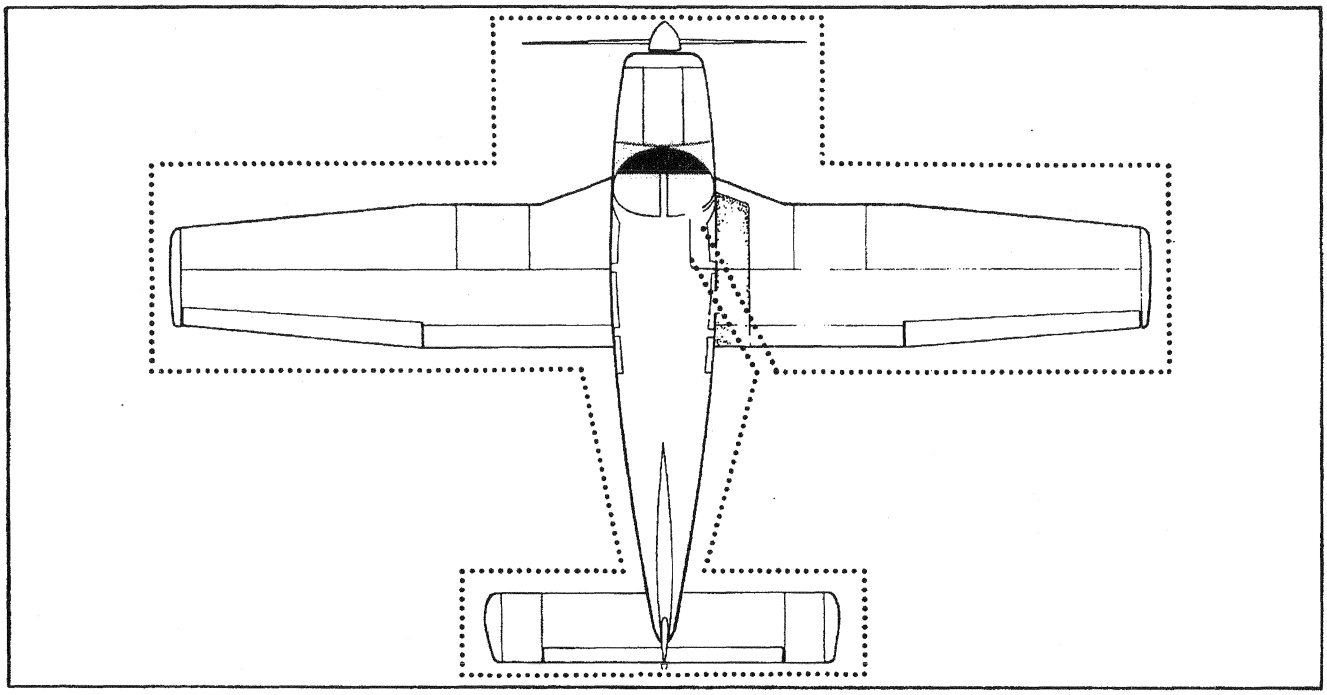

WALK-AROUND

Figure 4-1

4.5 NORMAL PROCEDURES CHECK LIST

PREFLIGHT CHECK

Control wheel . . . . . .release belts
Master switch . . . . . .ON
Fuel quantity gauges . . . . . check
Master switch . . . . . .OFF
Ignition . . . . . .OFF
Exterior . . . . . check for damage
Control surfaces . . . . . check for interference - free of ice, snow, frost
Hinges . . . . . .check for interference
Wings . . . . . free of ice, snow, frost
Stall warning . . . . . check
Navagation lights . . . . . check
Fuel tanks . . . . . check supply visually - secure caps
Fuel tank sumps . . . . . .drain
Fuel vents . . . . . .open
Main gear struts . . . . . .proper inflation (4.50 in.)
Tires . . . . . check
Brake blocks . . . . . check
Pitot head . . . . . remove cover - holes clear
Windshield . . . . . .clean
Propeller and spinner . . . . . check
Fuel and oil . . . . . check for leaks
Oil . . . . . check level
Dipstick . . . . . .properly seated
Cowling . . . . . secure
Inspection covers . . . . . secure
Nose wheel tire . . . . . check
Nose gear strut . . . . . .proper inflation (3.25 in.)
Air inlets . . . . . clear
Alternator belt . . . . . .check tension
Tow bar and control locks . . . . . stow
Baggage . . . . . stowed properly - secure
Baggage door . . . . . close and secure
Fuel strainer . . . . . .drain
Primary flight controls . . . . . .proper operation
Cabin door . . . . . close and secure
Required papers . . . . . on board
Seat belts and harness . . . . . fastened - check inertia reel

BEFORE STARTING ENGINE

Brakes . . . . . set
Carburetor heat . . . . . full OFF
Fuel selector . . . . . desired tank

STARTING ENGINE WHEN COLD

Throttle . . . . . 1/4" open
Master switch . . . . . .ON
Electric fuel pump . . . . . .ON
Mixture . . . . . full RICH
Starter . . . . . .engage
Throttle . . . . . adjust
Oil pressure . . . . . check

If engine does not start within 10 sec. prime and repeat starting procedure.

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 . . . . . 800 to 1200 RPM

TAXIING

Chocks . . . . . .removed
Taxi area . . . . . .clear
Throttle . . . . . apply slowly
Brakes . . . . . check
Steering . . . . . check

GROUND CHECK

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
Carburetor heat . . . . . check
Engine is warm for takeoff when throttle can be opened without engine faltering.
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
Mixture . . . . . .set
Belts/harness . . . . . .fastened
Empty seats . . . . . seat belts snugly fastened
Flaps . . . . . .set
Trim tab . . . . . .set
Controls . . . . . free
Doors . . . . . latched

TAKEOFF

NORMAL

Flaps . . . . . .set
Tab . . . . . .set
Accelerate to 45 to 55 KIAS
Control wheel . . . . . back pressure to rotate to climb attitude

SHORT FIELD, OBSTACLE CLEARANCE

Flaps . . . . . 25° (second notch)
Accelerate to 52 KIAS
Control wheel . . . . . back pressure to rotate to climb attitude
Maintain 52 KIAS until obstacle clearance
Accelerate to 75 KIAS after obstacle is cleared
Flaps . . . . . .retract slowly

SHORT FIELD, NO OBSTACLE

Flaps . . . . . .UP
Accelerate to 50 KIAS
Control wheel . . . . . back pressure to rotate to climb attitude
After breaking ground accelerate to best rate of climb speed 75 KIAS

SOFT FIELD, OBSTACLE CLEARANCE

Flaps . . . . . 25° (second notch)
Accelerate and lift off nose gear as soon as possible.
Lift off at lowest possible airspeed
Accelerate just above ground to 52 KIAS to climb past obstacle height.
Continue climbing while accelerating to best rate of climb speed, 75 KIAS
Flaps . . . . . .slowly retract

SOFT FIELD, NO OBSTACLE

Flaps . . . . . 25° (second notch)
Accelerate and lift off nose gear as soon as possible.
Lift off at lowest possible airspeed
Accelerate just above ground to best rate of climb speed, 75 KIAS
Flaps . . . . . .slowly retract

CLIMB

Best rate (flaps up) . . . . . 75 KIAS
Best angle (flaps up) . . . . . 63 KIAS
En route* . . . . . 87 KIAS
Electric fuel pump . . . . . OFF at desired altitude

CRUISING

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

APPROACH AND LANDING

Fuel selector . . . . . .proper tank
Seat backs . . . . . .erect
Belts/harness . . . . . fasten
Electric fuel pump . . . . . .ON
Mixture . . . . . .set
Flaps . . . . . set - 103 KIAS max
Trim to 70 KIAS
Final approach speed (flaps 40°) . . . . . 63 KIAS

STOPPING ENGINE

Flaps . . . . . .retract
Electric fuel pump . . . . . .OFF
Radios . . . . . .OFF
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

4.7 AMPLIFIED NORMAL PROCEDURES (GENERAL)

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

Upon entering the cockpit, release the seat belts securing the control wheel. Turn "ON" the master switch and check the fuel quantity gauges for sufficient fuel. After the fuel quantity check is made turn the master switch "OFF" and check that the ignition switch is "OFF."

To begin the exterior walk-around, check for external damage and operational interference of the control surfaces or hinges. Insure that the wings and control surfaces are free of snow, ice, frost or any other foreign materials.

An operational check of the stall warning system and navigation lights should now be made. Turn the master switch "ON." Lift the detector while checking to determine if the horn is actuated and check that the navigation lights are illuminated. The master switch should be returned to the "OFF" position after the checks are complete.

A visual check of the fuel tank quantity should be performed. Remove the filler cap from each tank and visually check the supply and color. Be sure to secure the caps properly after the check is complete.

The fuel system sumps and strainer should be drained daily prior to the first flight and after refueling to avoid the accumulation of contaminants such as water or sediment. Each fuel tank is equipped with an individual quick drain located at the lower inboard rear corner of the tank. The fuel strainer is equipped with a quick drain located on the front lower corner of the firewall. Each of the fuel tank sumps should be drained first. Then the fuel strainer should be drained twice, once with the fuel selector valve on each tank. Each time fuel is drained, sufficient fuel should be allowed to flow to ensure removal of contaminants. This fuel should be collected in a suitable container, examined for contaminants, and then discarded.

CAUTION

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

Each quick drain should be checked after closing it to make sure it has closed completely and is not leaking.

Check all of the fuel tank vents to make sure they are open.

Next, complete a check of the landing gear. Check the main gear shock struts for proper inflation. There should be 4.50 inches of strut exposure under a normal static load. The nose gear should be checked for 3.25 inches of strut exposure. Check all tires for cuts and wear and insure proper inflation. Make a visual check of the brake blocks for wear or damage.

Remove the cover from the pitot head on the underside of the left wing. Check the pitot head to make sure the holes are open and clear of obstructions.

Don't forget to clean and check the windshield.

The propeller and spinner should be checked for defects or nicks.

Lift the cowling and check for any obvious fuel or oil leaks. Check the oil level. Make sure that the dipstick has properly seated after checking. Secure the cowling and check the inspection covers.

Check the air inlets for foreign matter and the alternator belt for proper tension.

Stow the tow bar and check the baggage for proper storage and security. The baggage compartment doors should be closed and secure.

Upon entering the aircraft, ascertain that all primary flight controls operate properly. Close and secure the cabin door and check that all the required papers are in order and in the airplane.

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.

4.11 BEFORE STARTING ENGINE

Before starting the engine the brakes should be set "ON" and the carburetor heat lever moved to the full OFF position. The fuel selector should then be moved to the desired tank.

4.13 STARTING ENGINE

(a) Starting Engine When Cold

Open the throttle lever approximately 1/4 inch. Turn "ON" the master switch and the electric fuel pump.

Move the mixture control to full "RICH" and engage the starter by rotating the magneto switch clockwise and pressing in. When the engine fires, release the magneto switch, and move the throttle to the desired setting.

If the engine does not fire within five to ten seconds, disengage the starter, prime the engine and repeat the starting procedure.

(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 and pressing in. 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 and pressing in. 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 recommend 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 800 to 1200 RPM for not more than two minutes in warm weather and four minutes in cold. 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, provided that the throttle may be opened fully without backfiring or skipping, and without a reduction in engine oil pressure.

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.

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

The magnetos should be checked at 2000 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 the annunciator panel lights with the press-to-test button.

Carburetor heat should also be checked prior to takeoff to be sure the control is operating properly and to clear any ice which may have formed during taxiing. Avoid prolonged ground operation with carburetor heat "ON" as the air is unfiltered.

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 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. The engine is warm enough for takeoff when the throttle can be opened without the engine faltering.

4.21 BEFORE TAKEOFF

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

Turn "ON" the master switch and check and set all of the flight instruments 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.

All seat backs should be erect and the seat belts and shoulder harness fastened. Fasten the seat belts snugly around the empty seats.

The mixture should be set.

NOTE

The mixture should be set FULL RICH except a minimum amount of leaning is permitted for smooth engine operation when taking off at high elevation.

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

All doors should be properly secured and latched.

4.23 TAKEOFF

The normal takeoff technique is conventional for the Cherokee Warrior. 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 45 to 55 KIAS depending on the weight of the aircraft and ease back on the control wheel to rotate to climb attitude. Premature raising of the nose or raising it to an excessive angle will result in a delayed takeoff. After takeoff, let the airplane accelerate to the desired climb speed by lowering the nose slightly.

Takeoffs are normally made with flaps up; however, for short field takeoffs and for takeoffs under difficult conditions such as deep grass or a soft surface, total distances can be reduced appreciably by lowering the flaps to 25° and rotating at lower airspeed.

A short field takeoff with an obstacle clearance is accomplished by first lowering the flaps to 25°. Apply full power before brake release and accelerate to 52 KIAS and rotate. Maintain 52 KIAS until obstacle clearance is attained. After the obstacle has been cleared, accelerate to 75 KIAS and then slowly retract the flaps.

A short field takeoff with no obstacle is accomplished with no flaps and applying full power before brake release, lift off at 50 KIAS and accelerate to best rate of climb speed, 75 KIAS.

Takeoff from a soft field with an obstacle clearance requies the use of 25° flaps. Accelerate the airplane and lift the nose gear off as soon as possbile and lift off at the lowest possible airspeed. Accelerate just above the ground to 52 KIAS to climb past obstacle clearance height. Continue climbing while accelerating to the best rate of climb speed, 75 KIAS and slowly retract the flaps.

For a soft field takeoff without an obstacle to clear, extend the flaps 25°, accelerate the airplane and lift the nose gear off as soon as possible. Lift off at the lowest possible airspeed. Accelerate just above the ground to the best rate of climb speed, 75 KIAS and retract the flaps while climbing out.

4.25 CLIMB

The best rate of climb at gross weight will be obtained at 75 KIAS. The best angle of climb may be obtained at 63 KIAS. At lighter than gross weight these speeds are reduced somewhat. For climbing en route, a speed of 87 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 of the Cherokee Warrior 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. Airspeeds which may be obtained at various altitudes and power settings can be determined from the performance graphs provided by Section 5.

Use of the mixture control in cruising flight reduces fuel consumption significantly, especially at higher altitudes, and reduces lead deposits when the alternate fuels are used. During letdown and low power flight operations, it may be necessary to lean because of excessively rich mixture. The mixture should be leaned during cruising operation above 5000 feet altitude and 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. Always enrich the mixture before increasing power settings.

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. When leaning, carefully observe the temperature instruments.

Always remember that the electric fuel pump should be turned "ON" before switching tanks, and should be left on for a short period thereafter. In order to keep the airplane in best lateral trim during cruising flight, the fuel should be used alternately from each tank. It is recommended that one tank be used for one hour after takeoff, then the other tank be used for two hours; then return to the first tank, which will have approximately one and one half hours of fuel remaining if the tanks were full at takeoff. The second tank will contain approximately one half hour of fuel. Do not run tanks completely dry in flight. 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 the other tank and the electric fuel pump switched to the "ON" position.

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.

Turn "ON" the electric fuel pump. The mixture should be set in the full "RICH" position.

The airplane should be trimmed to an initial approach speed of about 70 KIAS with a final approach speed of 63 KIAS with flaps extended. The approach speed can be reduced approximately 3 KTS for each additional notch of flaps. The flaps can be lowered at speeds up to 103 KIAS, if desired.

The mixture control should be kept in full "RICH" position to insure maximum acceleration if it should be necessary to open the throttle again. 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 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, and electric fuel pump "ON." Reduce the speed during the flareout and contact the ground close to the stalling speed. 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 than 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 radios should be turned "OFF," 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."

NOTE

When alternate fuels are used, the engine should be run up to 1200 RPM for one minute prior to shutdown to clean out any unburned fuel.

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 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.

Tie downs can be secured to rings provided under each wing and to the 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 of the Cherokee Warrior are conventional. An approaching stall is indicated by a stall warning horn which is activated between five and ten KTS above stall speed. Mild airframe buffeting and gentle pitching may also precede the stall.

The gross weight stalling speed of the Cherokee Warrior with power off and full flaps is 44 KIAS. With the flaps up this speed is increased. Loss of altitude during stalls varies from 100 to 275 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. (See Subsection 2.3)

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 the Cherokee Warrior 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 TO 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 and 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.

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5.5 FLIGHT PLANNING EXAMPLE

(a) Aircraft Loading

The first step in planning our 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 delivered from 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 we have found the following weights for consideration in our 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	1391 lbs.
(2)	Occupants (4 x 170 lbs.)	680 lbs.
(3)	Baggage and Cargo	50 lbs.
(4)	Fuel (6 lb/gal x 30)	180 lbs.
(5)	Takeoff Weight	2316 lbs.
(6)	Landing Weight (a)(5) minus (g)(1), (2316 lbs. minus 145.2 lbs.)	2170.8 lbs.

Our takeoff weight is below the maximum of 2325 lbs. and our weight and balance calculations have determined our C.G. position within the approved limits.

(b) Takeoff and Landing

Now that we have determined our aircraft loading, we must consider all aspects of our takeoff and landing.

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 or 5-7) 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 our example flight are listed below. The takeoff and landing distances required for our example flight have fallen well below the available runway lengths.

		Departure Airport	Destination Airport
(1)	Pressure Altitude	1500 ft.	2500 ft.
(2)	Temperature	80°F	75°F
(3)	Wind Component	15 KTS	0 KTS
(4)	Runway Length Available	4800 ft.	7600 ft.
(5)	Runway Required	1200 ft.*	660**

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.

(c) Climb

The next step in our flight plan 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 Time, Distance, and Fuel to Climb graph (Figure 5-13). After the time, distance and fuel for the cruise pressure altitude and outside air temperature values have been established, apply the existing conditions at the departure field to graph (Figure 5-13). 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, distance and time 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 our flight planning example.

(1)	Cruise Pressure Altitude	5000 ft.
(2)	Cruise OAT	60°F
(3)	Time to Climb (12.5 min. minus 5.5 min.)	7 min.***
(4)	Distance to Climb (16.5 miles minus 7.5 miles)	9 miles***
(5)	Fuel to Climb (2.5 gal. minus 1.5 gal.)	1 gal.***

*reference Figure 5-5
**reference Figure 5-27
***reference Figure 5-13

(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 we determine the basic time, distance and fuel for descent (Figure 5-23). 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 time, distance and fuel values from the graph (Figure 5-23). Now, subtract the values obtained from the field conditions from the values obtained from the cruise conditions to find the true time, distance and fuel values needed for the flight plan.

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

(1)	Time to Descend (7.5 min. minus 5.5 min.)	2.0 min.*
(2)	Distance to Descend (17.0 miles minus 12.0 miles)	5 miles*
(3)	Fuel to Descend (1.5 gal. minus 1 gal.)	.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 Cruise Performance graph (Figure 5-15 or 5-17).

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 our flight planning example are as follows:

(1)	Total Distance	300 miles
(2)	Cruise Distance (e)(1) minus (c)(4) minus (d)(2), (300 miles minus 9 miles minus 5 miles)	286 miles
(3)	Cruise Power, Best Economy Mixture	75% rated power (2645 RPM)
(4)	Cruise Speed	107 KTS TAS**
(5)	Cruise Fuel	8.4 GPH
(6)	Cruise Time (e)(2) divided by (e)(4), (286 miles divided by 107 KTS)	2.7 hrs.
(7)	Cruise Fuel (e)(5) multiplied by (e)(6), (8.4 GPH multiplied by 2.67 hrs.)	22.7 gal.

*reference Figure 5-23
**reference Figure 5-17

(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 our flight planning example.

(1) Total Flight Time
(c)(3) plus (d)(1) plus (e)(6), (.12 hrs. plus .033 hrs. plus 2.7 hrs.) 2.85 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 our example flight plan are shown below.

(1) Total Fuel Required
(c)(5) plus (d)(3) plus (e)(7), (1 gal. plus .5 gal. plus 22.7 gal.) 24.2 gal.
(24.2 gal. multiplied by 6 lb/gal.) 145.2 lbs.

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5.7 PERFORMANCE GRAPHS

LIST OF FIGURES

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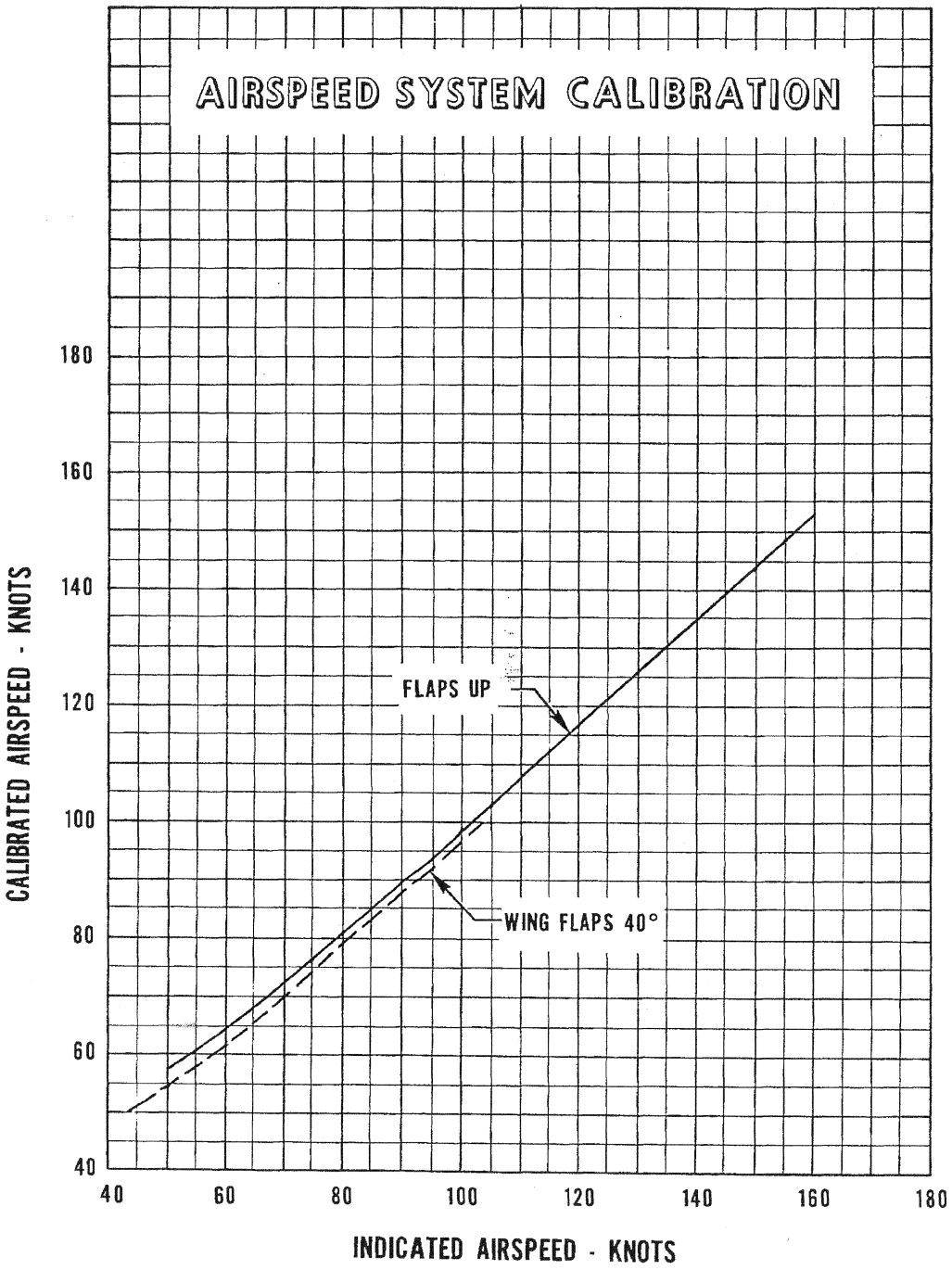
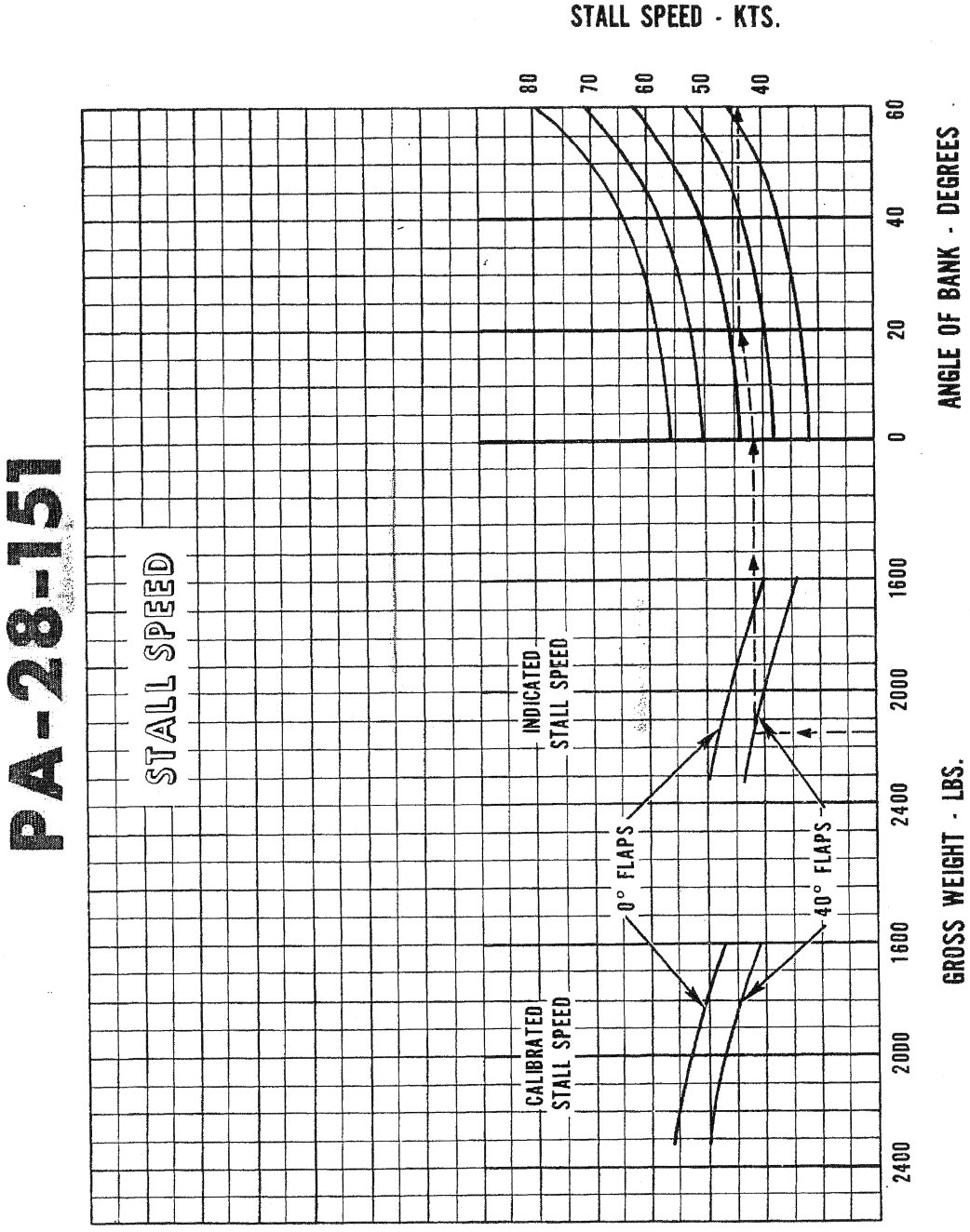


AIRSPEED SYSTEM CALIBRATION

Figure 5-1



Example:
Gross weight: 2170 lbs.
Angle of bank: 20°
Flap position: 40°
Stall speed, indicated: 44 knots

STALL SPEED

Figure 5-3

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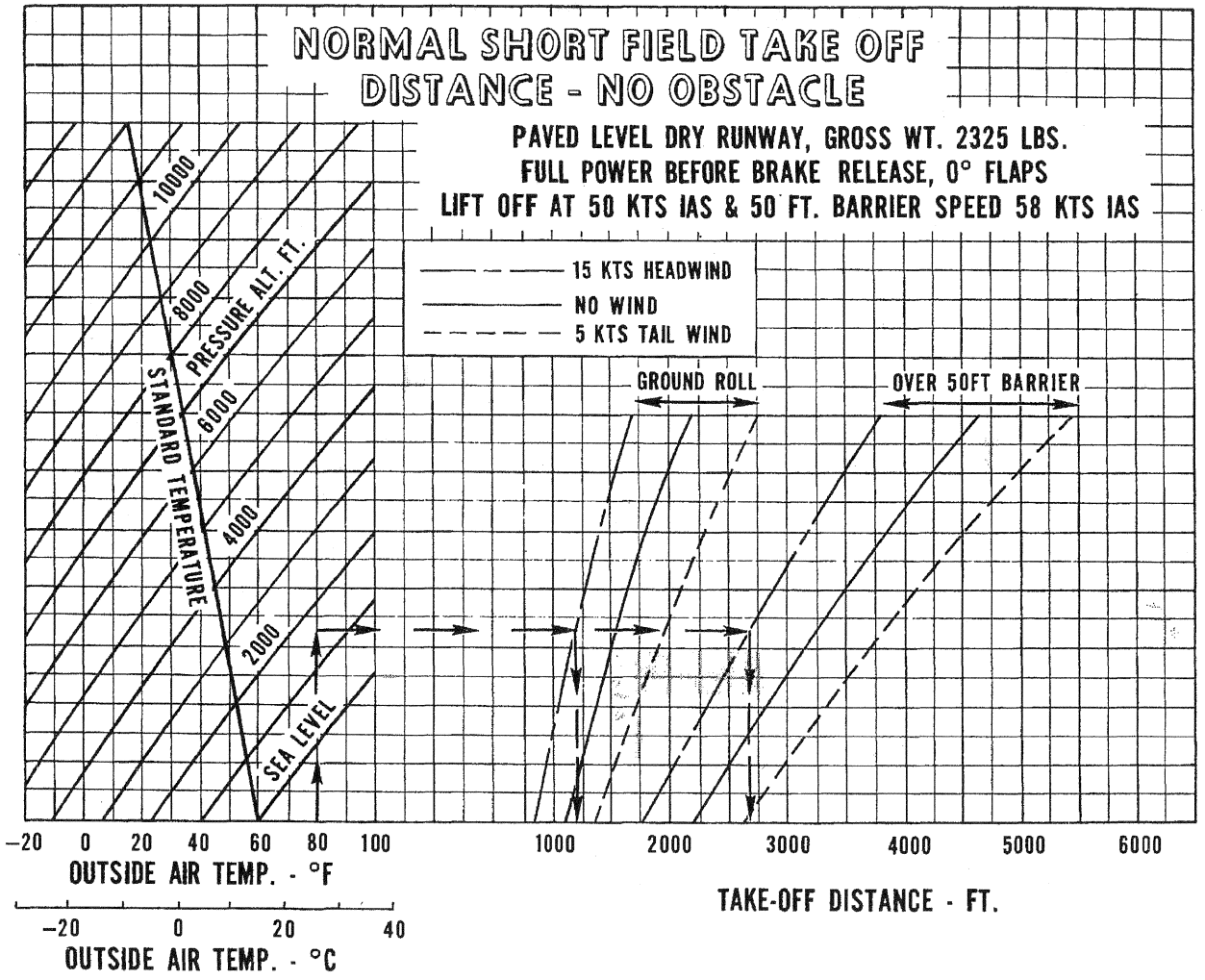
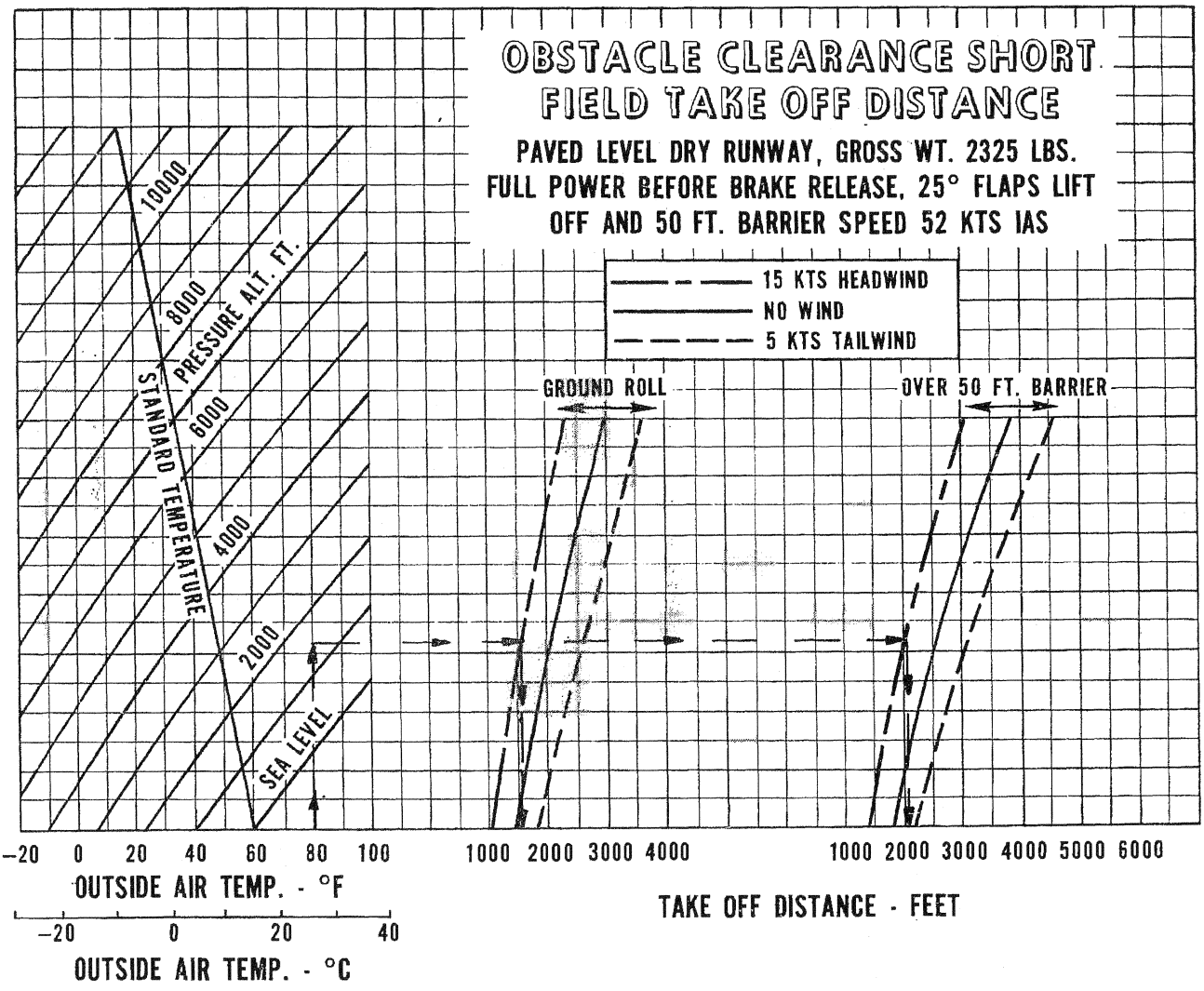


Example:
Departure airport pressure altitude: 1500 ft.
Departure airport temperature: 80°F
Wind: 15 KTS headwind
Ground roll: 1200 ft.
Distance over 50 ft. barrier: 2650 ft.

NORMAL SHORT FIELD TAKEOFF DISTANCE - NO OBSTACLE

Figure 5-5

PA-28-151

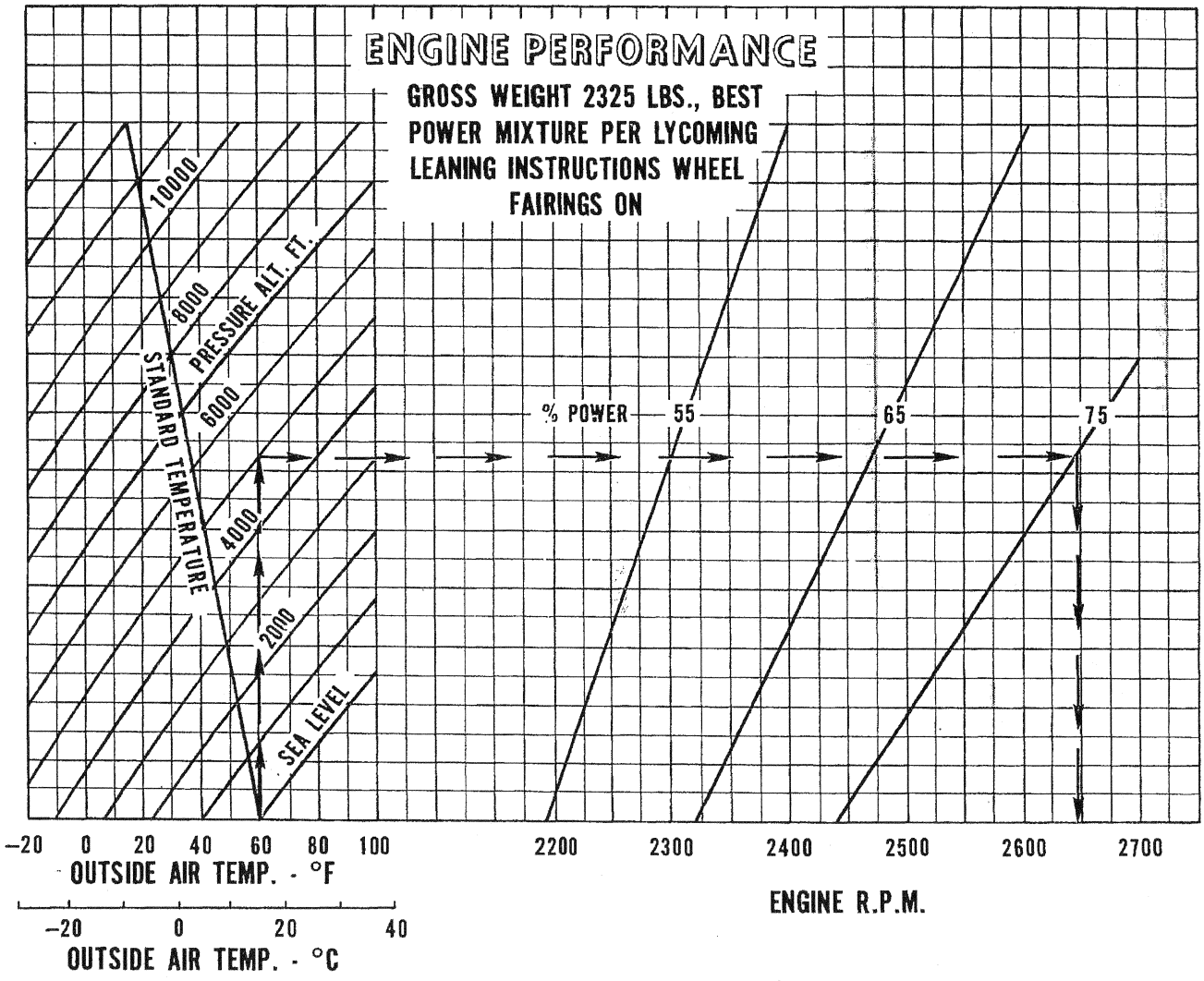


Example:
Departure airport pressure altitude: 1500 ft.
Departure airport temperature: 80°F
Wind: 15 KTS headwind
Ground roll: 1600 ft.
Distance over 50 ft. barrier: 2100 ft.

OBSTACLE CLEARANCE SHORT FIELD TAKEOFF DISTANCE

Figure 5-7

PA-28-151

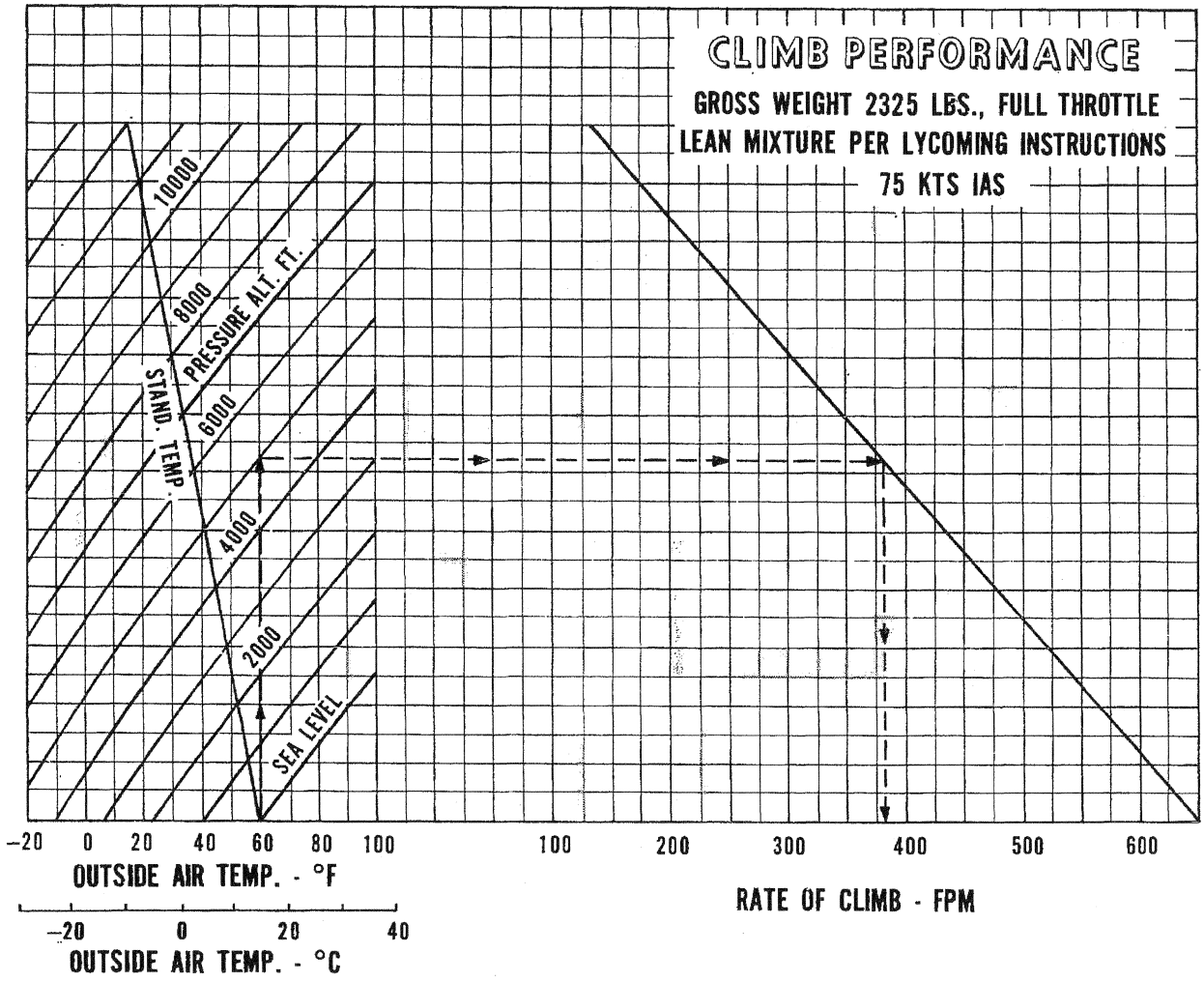


Example:
Cruise pressure altitude: 5000 ft.
Cruise OAT: 60°F
Cruise power: 75%
Engine RPM: 2645

ENGINE PERFORMANCE

Figure 5-9

PA-28-151

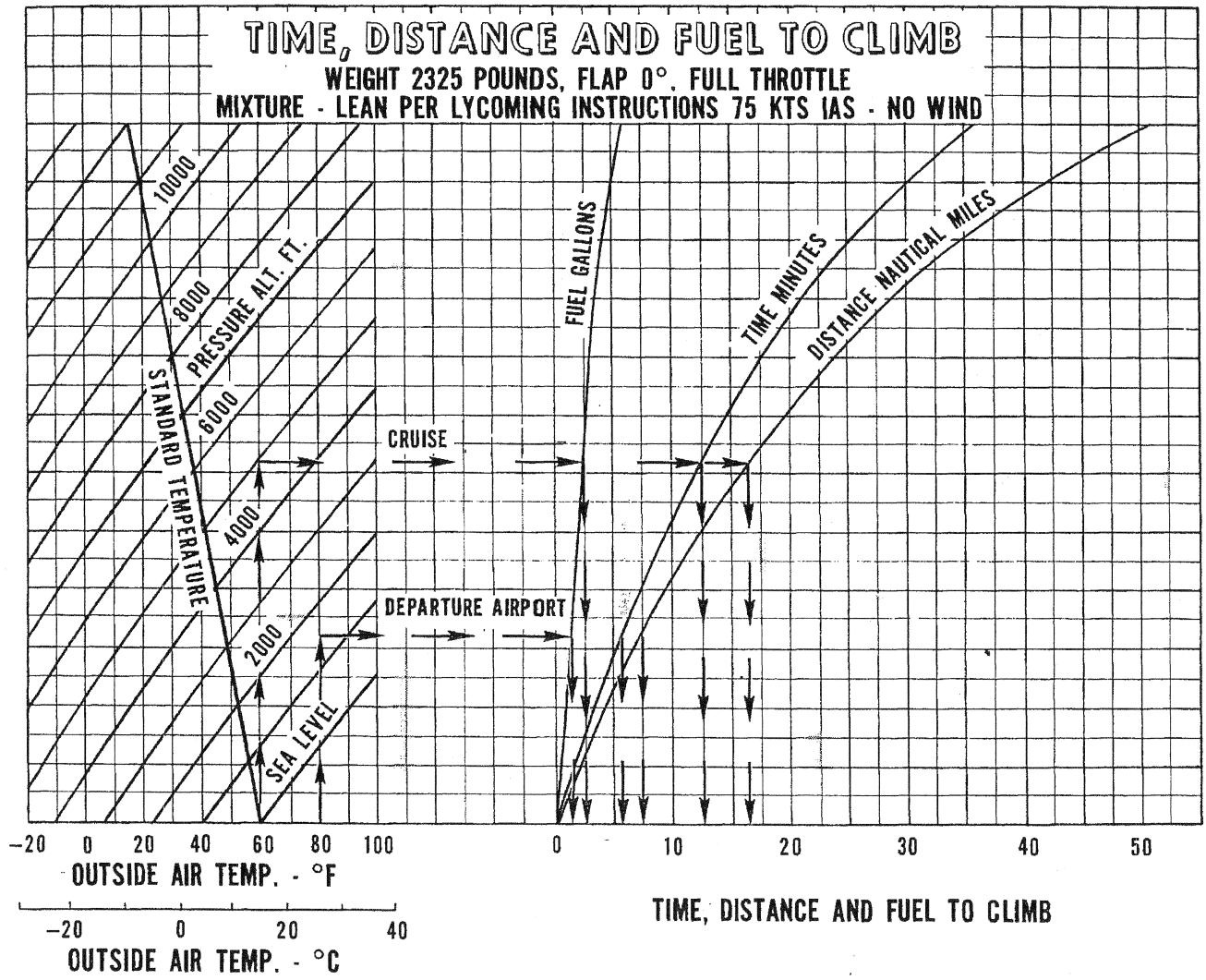


Example:
Climb pressure altitude: 5000 ft.
Climb OAT: 60°F
Rate of climb: 380 ft./min.

CLIMB PERFORMANCE

Figure 5-11

PA-28-151



Example:

Departure airport pressure altitude: 1500 ft.
Departure airport temperature: 80°F
Cruise pressure altitude: 5000 ft.
Cruise OAT: 60°F
Time to climb (12.5 min. minus 5.5 min.): 7 min.
Distance to climb (16.5 miles minus 7.5 miles): 9 nautical miles
Fuel to climb (2.5 gal. minus 1.5 gal.): 1 gal.

TIME, DISTANCE AND FUEL TO CLIMB

Figure 5-13

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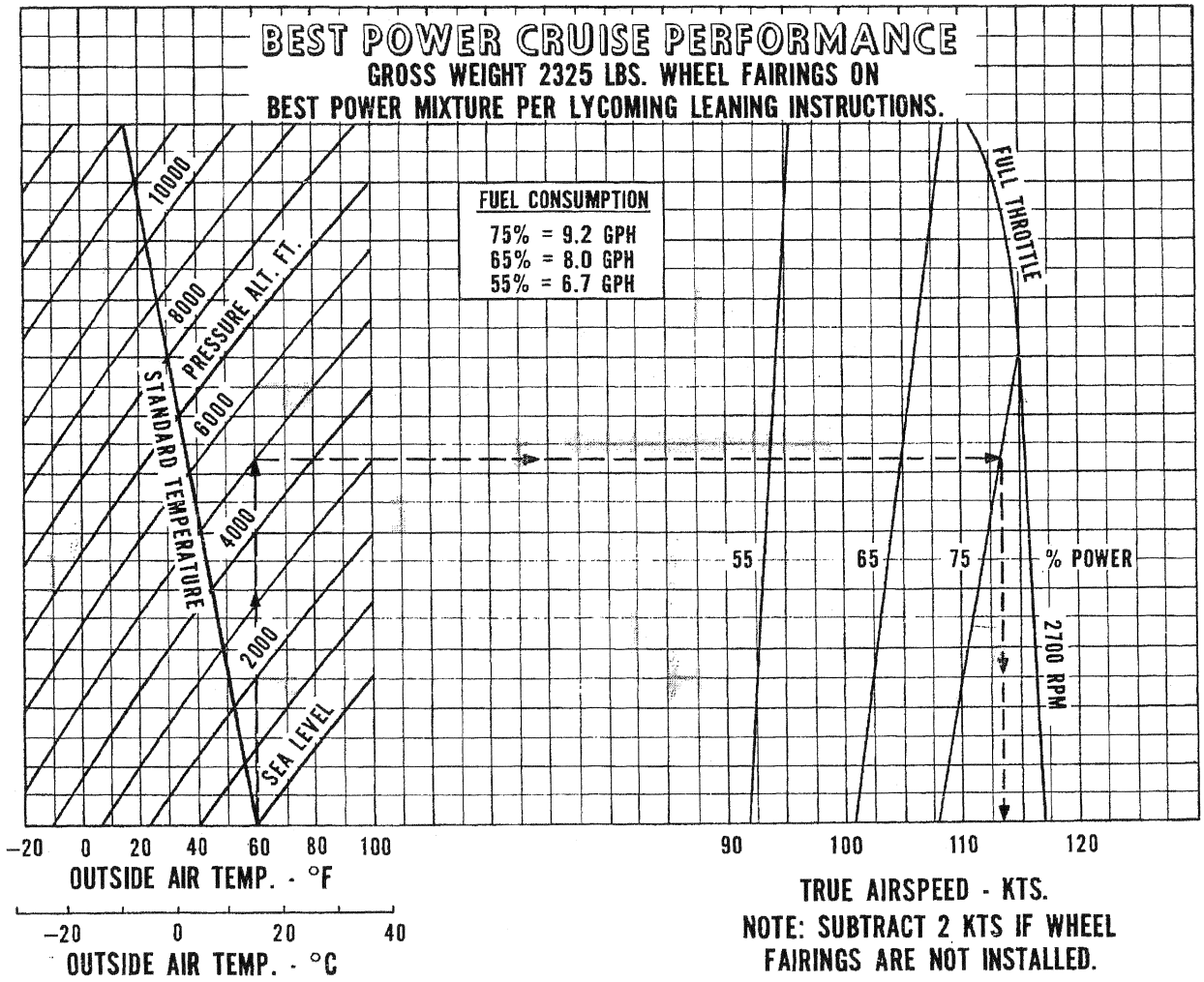
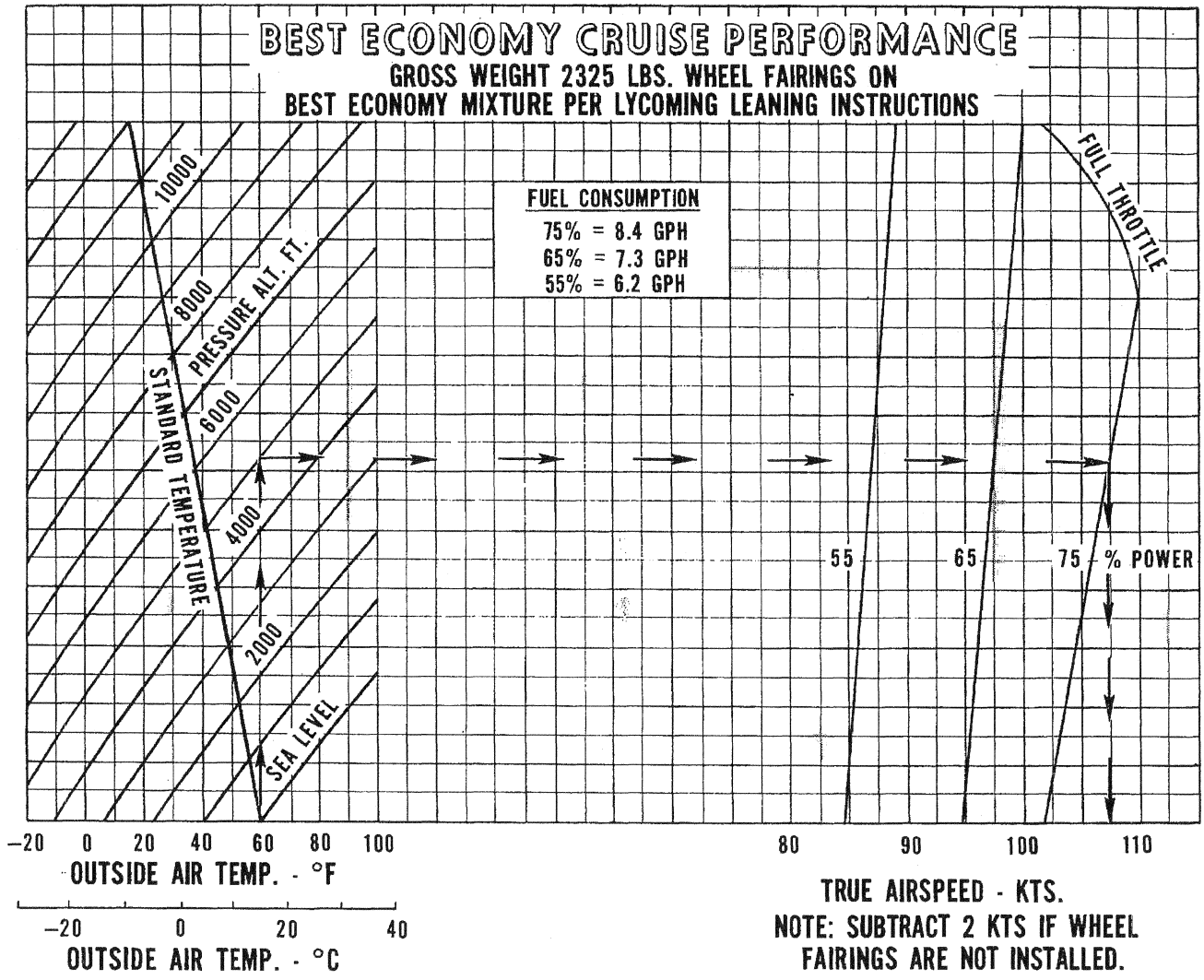


Example:
Cruise pressure altitude: 5000 ft.
Cruise OAT: 60°F
Cruise power: 75%, Best Power Mixture
Cruise speed: 113 KTS TAS

BEST POWER CRUISE PERFORMANCE

Figure 5-15

PA-28-151

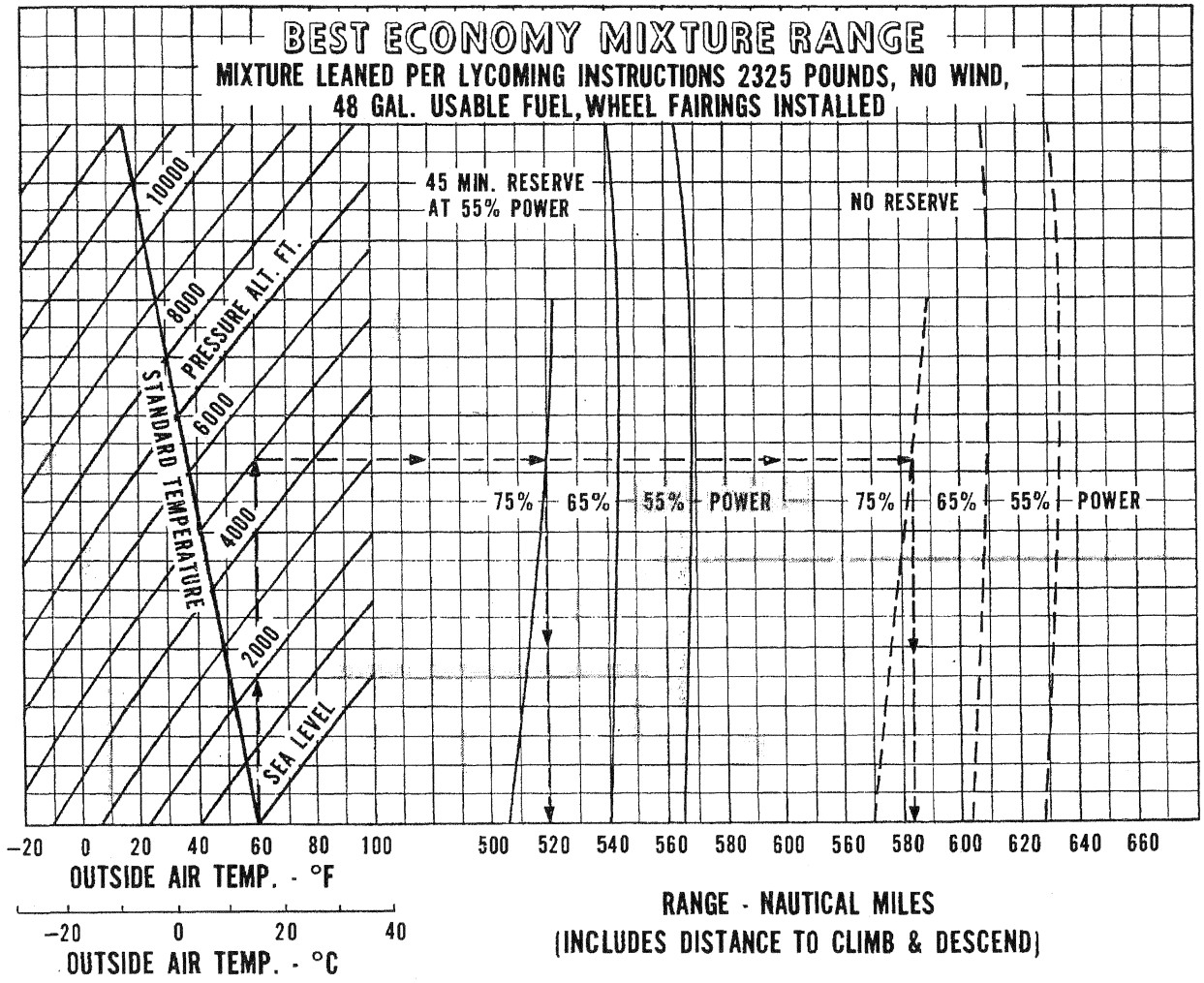


Example:
Cruise pressure altitude: 5000 ft.
Cruise OAT: 60°F
Cruise power: 75%, Best Economy Mixture
Cruise speed: 107 KTS TAS

BEST ECONOMY CRUISE PERFORMANCE

Figure 5-17

PA-28-151

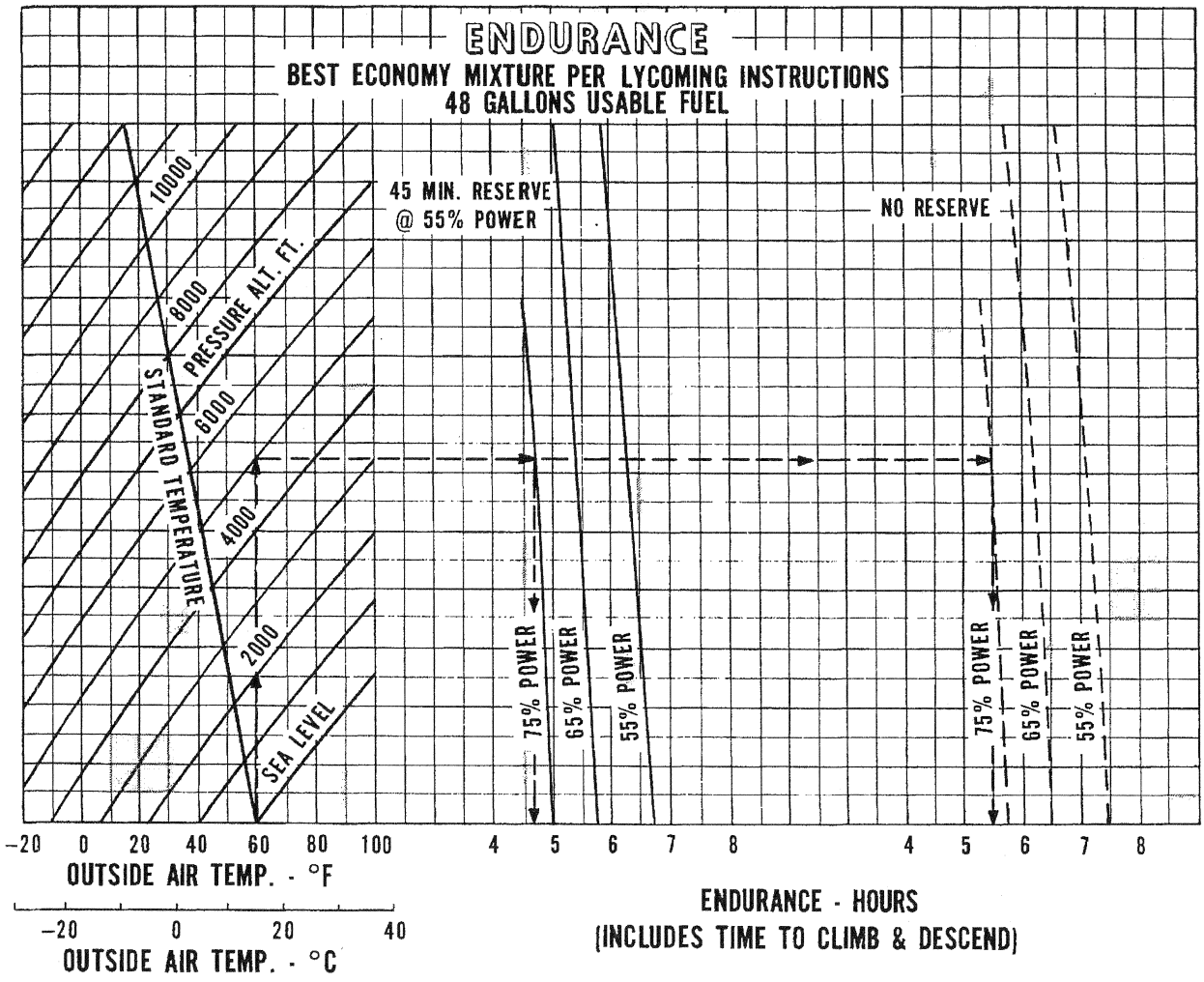


Example:
Cruise pressure altitude: 5000 ft.
Cruise OAT: 60°F
Cruise power: 75%, Best Economy Mixture
Range with 45 min. reserve at 55% power: 520 nautical miles
Range with no reserve: 583 nautical miles

BEST ECONOMY MIXTURE RANGE

Figure 5-19

PA-28-151

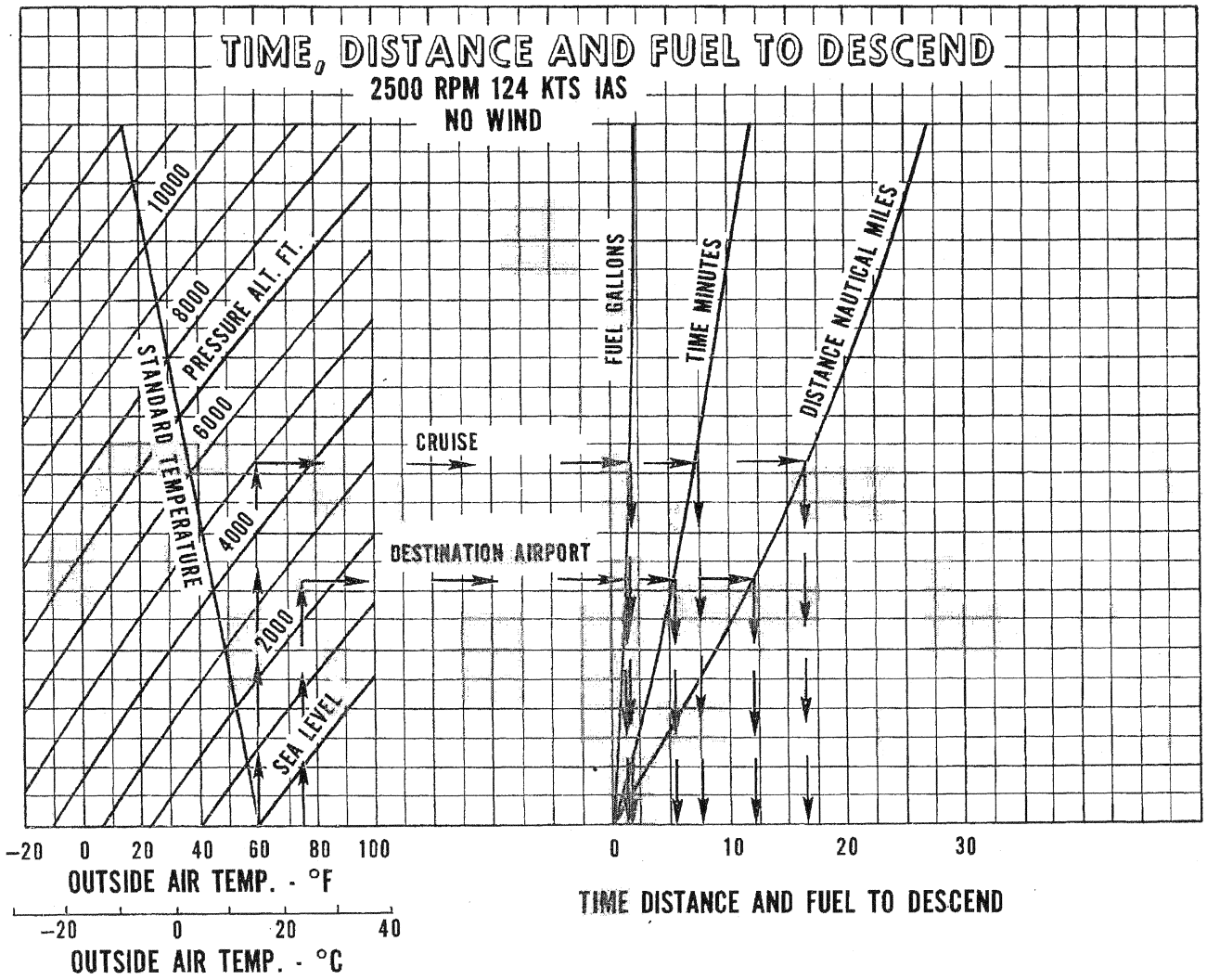


Example:
Cruise pressure altitude: 5000 ft.
Cruise OAT: 60°F
Cruise power: 75%, Best Economy Mixture
Endurance with 45 min. reserve at 55% power: 4.7 hrs.
Endurance with no reserve: 5.5 hrs.

ENDURANCE

Figure 5-21

PA-28-151



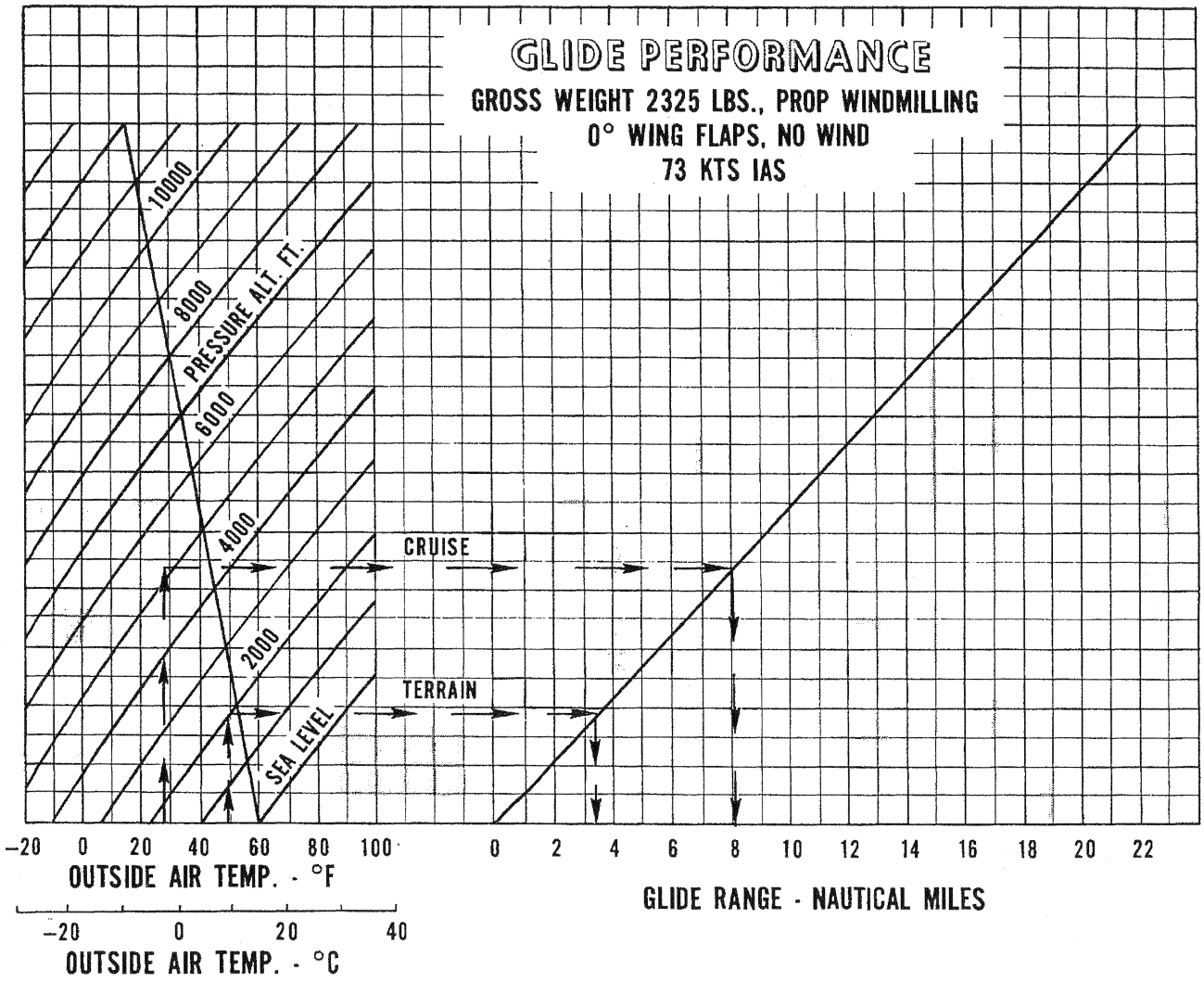
Example:

Destination airport pressure altitude: 2500 ft.
Destination airport temperature: 75°F
Cruise pressure altitude: 5000 ft.
Cruise OAT: 60°F
Time to descend (7.5 min. minus 5.5 min.): 2 min.
Distance to descend (17 miles minus 12 miles): 5 nautical miles
Fuel to descend (1.5 gal. minus 1 gal.): .5 gal.

TIME, DISTANCE AND FUEL TO DESCEND

Figure 5-23

PA-28-151

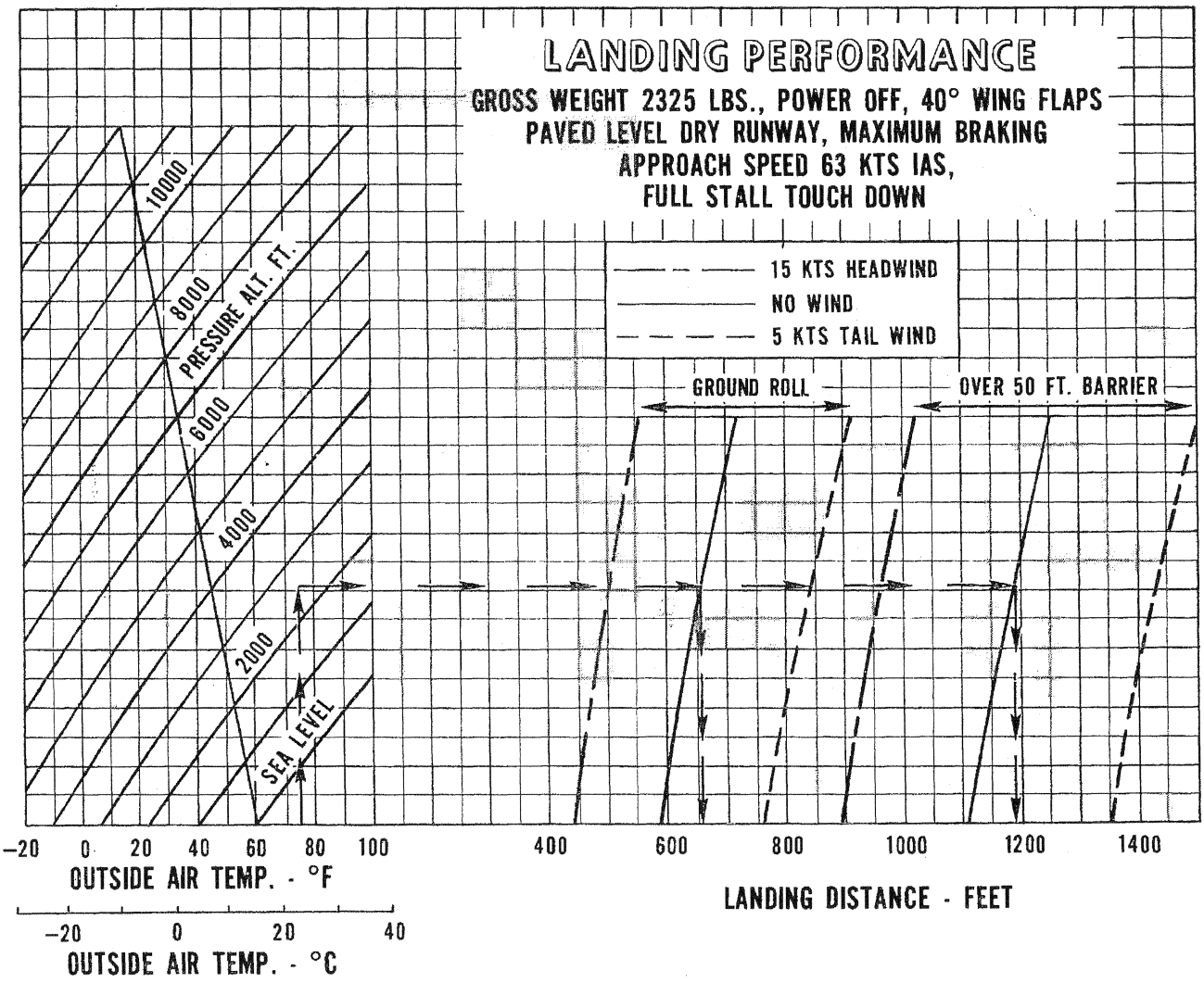


Example:
Cruise pressure altitude: 5000 ft.
Cruise OAT: 28° F
Terrain pressure altitude: 2000 ft.
Temperature at terrain: 50°F
Glide distance (8 miles minus 3.5 miles): 4.5 nautical miles

GLIDE PERFORMANCE

Figure 5-25

PA-28-151



Example:

Destination airport pressure altitude: 2500 ft.
Destination airport temperature: 75°F
Destination airport wind: 0 KTS
Ground roll: 660 ft.
Distance over 50 ft. barrier: 1190 ft.

LANDING PERFORMANCE

Figure 5-27

TABLE OF CONTENTS

SECTION 6

WEIGHT AND BALANCE

SECTION 6

WEIGHT AND BALANCE

6.1 GENERAL

In order to achieve the performance, safety and good 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 tremendous 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 ensure 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 characteristics. 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 excellent performance and safety within the flight envelope. Before the airplane is delivered, 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 easily 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 Aircraft Log Book, or 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 can be helpful 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.

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6.3 AIRPLANE WEIGHING PROCEDURE

At the time of delivery, 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 (2.0 gallons total, 1.0 gallons each wing).

(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.

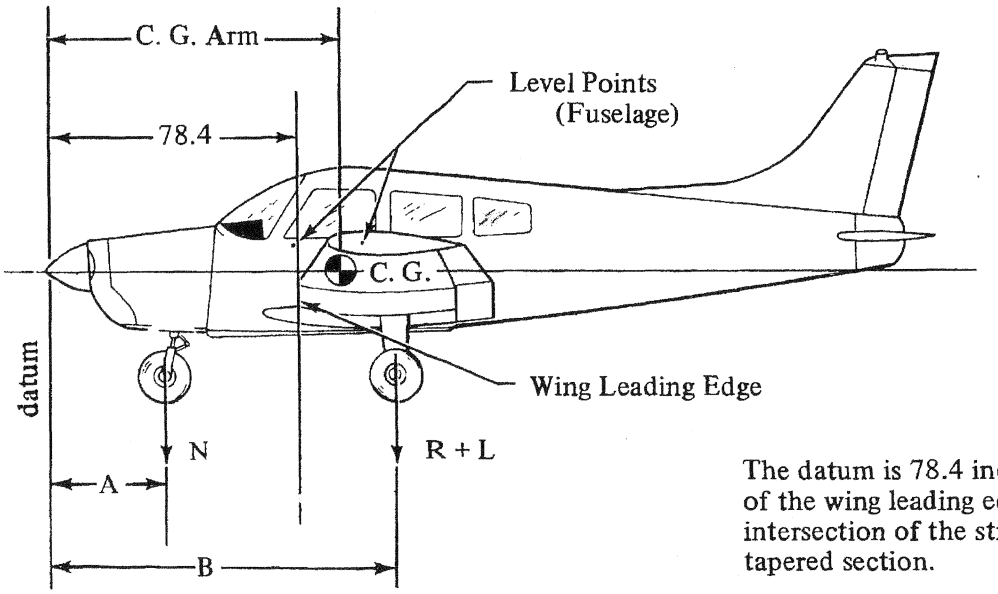
Scale Position and Symbol	Scale Reading	Tare	Net Weight
Nose Wheel (N)			
Right Main Wheel (R)			
Left Main Wheel (L)			
Basic Empty Weight, as Weighed (T)	–	–	

WEIGHING FORM

Figure 6-1

(d) Basic Empty Weight Center of Gravity

(1) The following geometry applies to the PA-28-151 airplane when it is level. Refer to Leveling paragraph 6.3 (b).



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

A = 30.9

B = 109.7

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 delivered from the factory. These figures apply only to the specific airplane serial number and registration number shown.

The basic empty weight of the airplane as delivered from 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-28-151 CHEROKEE WARRIOR

Airplane Serial Number _____

Registration Number _____

Date _____

AIRPLANE BASIC EMPTY WEIGHT

Item		Weight (Lbs)	x	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 2.0 gallons of unusable fuel.

AIRPLANE USEFUL LOAD - NORMAL CATEGORY OPERATION

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

Normal Category: (2325 lbs) - (lbs) = lbs.

Utility Category: (1950 lbs) - (lbs) = lbs.

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

WEIGHT AND BALANCE DATA FORM

Figure 6-5

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PA-28-151	Serial Number	Registration Number	Page Number

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

PA-28-151			Serial Number	Registration Number						Page Number	
Date	Item No.		Description of Article or Modification	Weight Change						Running Basic Empty Weight	
				Added (+)			Removed (-)				
	In	Out		Wt. (Lb.)	Arm (In.)	Moment /100	Wt. (Lb.)	Arm (In.)	Moment /100	Wt. (Lb.)	Moment /100
			As Delivered								

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			
Pilot and Front Passenger	340.0	80.5	27370
Passengers (Rear Seats)*	340.0	118.1	40154
Fuel (48 Gallon Maximum)		95.0	
Baggage*		142.8	
Total Loaded Airplane			

The center of gravity (C.G.) of this sample loading problem is at inches aft of the datum line. Locate this point ( ) 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.

*Utility Category Operation - No baggage or aft passengers allowed.

SAMPLE LOADING PROBLEM (NORMAL CATEGORY)

Figure 6-9

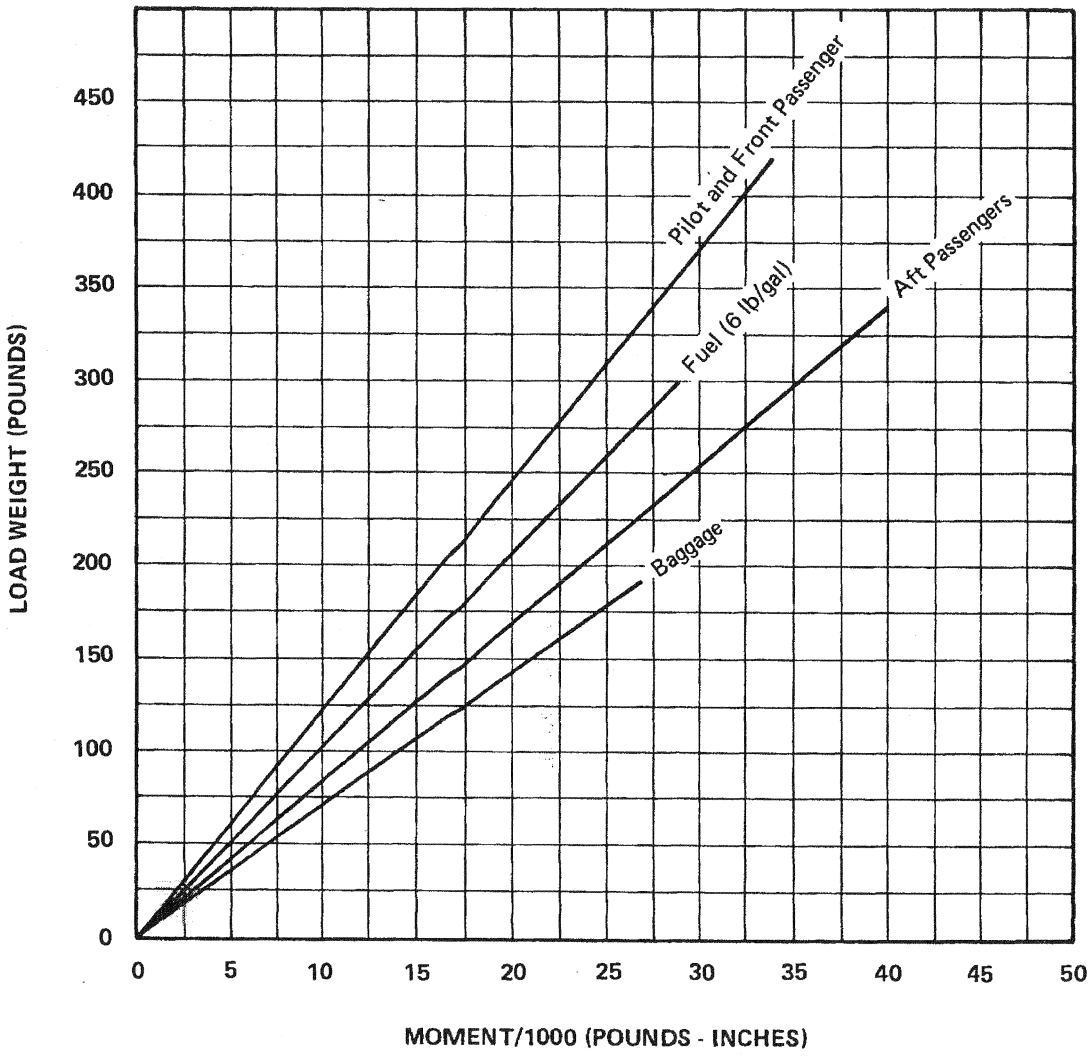
	Weight (Lbs)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Basic Empty Weight			
Pilot and Front Passenger		80.5	
Passenger (Rear Seats)*		118.1	
Fuel (48 Gallon Maximum)		95.0	
Baggage*		142.8	
Total Loaded Airplane			

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.

*Utility Category Operation - No baggage or aft passengers allowed.

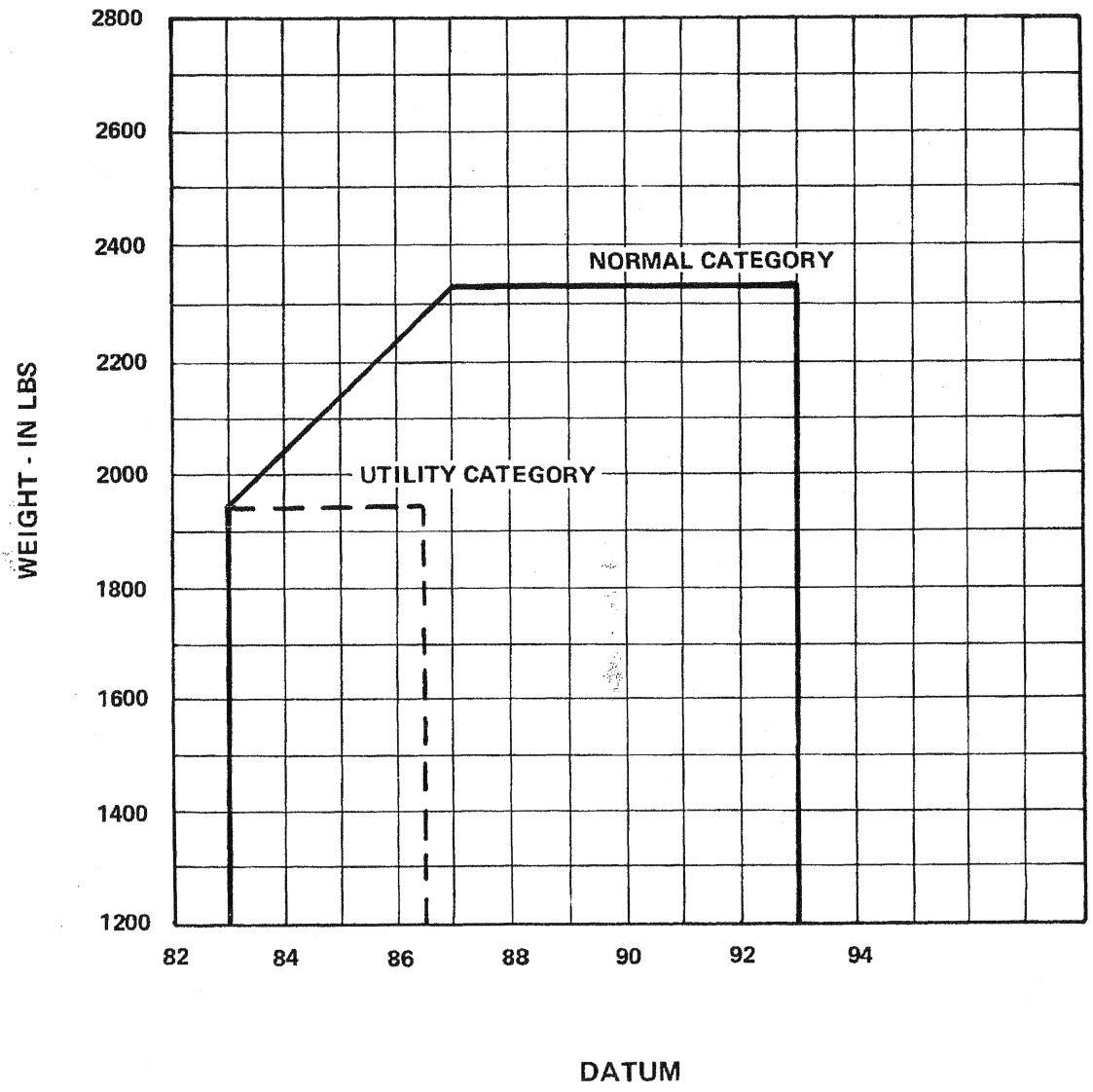
WEIGHT AND BALANCE LOADING FORM

Figure 6-11



LOADING GRAPH

Figure 6-13



C. G. RANGE AND WEIGHT

Figure 6-15

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6.9 EQUIPMENT LIST

The following is a list of equipment which may be installed in the PA-28-151. It consists of those items used for defining the configuration of an airplane when the basic empty weight is established at the time of delivery. Only those standard items which are alternate standard items and those required to be listed by the certificating authority (FAA) are presented. Items marked with an "X" are those items which were installed on the airplane described below as delivered by the manufacturer.

PIPER AIRCRAFT CORPORATION PA-28-151 CHEROKEE WARRIOR

SERIAL NO. _____ REGISTRATION NO. _____ DATE: _____

(a) Propeller and Propeller Accessories

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
1	Propeller, Sensenich 74DM6-0-58 Cert. Basis - TC P886	_____	31.6	3.8	120
3	Propeller, McCauley 1C160EGM7653 Cert. Basis - TC P910	_____	30.6	3.8	116

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(b) Engine and Engine Accessories

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
5	Lycoming Model O-320-E3D Cert. Basis - TC 274				
7	Alternator 60 Amp Prestolite No. ALY6408 Cert. Basis - TC 2A13	_____	10.5	14.0	147
9	Alternator 60 Amp Chrysler 3656623 Cert. Basis - TC 2A13	_____	12.4	14.0	174

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(c) Landing Gear and Brakes

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
13	Two Main Wheel Assemblies a. Cleveland Aircraft Products Wheel Assy. No. 40-86 Brake Assy. No. 30-55 Cert. Basis - TSO C26a b. 6.00-6 Type III 4 Ply Rating Tires with Regular Tubes Cert. Basis - TSO C62				
15	Nose Wheel Assembly a. Cleveland Aircraft Products Wheel Assy. No. 40-77A Cert. Basis - TSO C26a b. 5.00-5 Type III 4 Ply Rating Tire with Regular Tube Cert. Basis - TSO C62				

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(d) Electrical Equipment

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)

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(e) Instruments

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
21	Altimeter, Piper PS50008-2 or -3 Cert. Basis - TSO C10b				
23	Airspeed Indicator Piper PS50049-29S Cert. Basis - TSO C2b				
25	Compass Piper Dwg. 67462 Cert. Basis - TSO C7c				

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(f) Miscellaneous

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
33	Front Seat Belts (2) Piper PS50039-4-2A Cert. Basis - TSO C22f				
35	Aft Seat Belts (2) Piper PS50039-4-3 Cert. Basis - TSO C22f				

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(g) Engine and Engine Accessories
(Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
45	Primer System Piper Dwg. 35327-0 Cert. Basis - TC 2A13	_____	1.2	50.0	60
47	Starter - Lycoming 76211 Prestolite MZ4206 Cert. Basis - TC 274	_____	*1.0	14.5	15

*Weight and moment difference between standard and optional equipment.

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(h) Propeller and Propeller Accessories (Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)

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(i) Landing Gear and Brakes
(Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
63	Nose Wheel Fairing Piper Dwg. 35513 Cert. Basis - TC 2A13	_____	3.8	29.8	113
65	Main Wheel Fairings Piper Dwg. 65237 Cert. Basis - TC 2A13	_____	7.6	113.6	863

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(j) Electrical Equipment
(Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
79	Instrument Panel Lights Cert. Basis - TC 2A13	_____	0.3	62.8	19
81	Instrument Light (2), Grimes 15-0083-7 Cert. Basis - TC 2A13	_____	0.1	99.0	10
83	Cabin Light Cert. Basis - TC 2A13	_____	0.3	99.0	30
85	Landing Light, G.E. Model 4509 Cert. Basis - TC 2A13	_____	0.5	13.1	7
87	Navigation Lights (2) Grimes Model A1285 (Red and Green) Cert. Basis - TC 2A13	_____	0.4	106.6	43
89	Navigation Light (Rear) (1) Grimes Model A2064 (White) Cert. Basis - TC 2A13	_____	0.2	281.0	56
91	Rotating Beacon Cert. Basis - TC 2A13	_____	1.5	263.4	395
93	Anti-Collision Lights (Fin only) Piper Dwg. 99033-7 Cert. Basis - TC 2A13	_____	3.1	210.3	652
95	Anti-Collision Lights (Fin and Wing Tips) Piper Dwg. 99033-10 Cert. Basis - TC 2A13	_____	6.1	172.8	1054
97	Heated Pitot Head, Piper Dwg. 35493-2 Cert. Basis - TC 2A13	_____	0.4	100.0	40

(j) Electrical Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
99	Piper Pitch Trim Piper Dwg. 67496-3 Cert. Basis - TC 2A13	_____	4.3	155.3	668
101	Battery 12V 35 A.H. Rebat R35 (Wt. 27.2 lbs.) Cert. Basis - TC 2A13	_____	*5.3	114.9	609
103	Auxiliary Power Receptacle, Piper Dwg. 35289 Cert. Basis - TC 2A13	_____	2.7	178.5	482
105	External Power Cable, Piper Dwg. 62355-11 Cert. Basis - TC 2A13	_____	4.6	142.8	657
107	Lighter, *200462, 12 Volt Universal Cert. Basis - TC 2A13	_____	.2	62.9	13

*Weight and moment difference between standard and optional equipment.

(k) Instruments
(Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
113	Vacuum System Installation Cert. Basis - TC 2A13	_____	4.5	39.1	176
115	Attitude Gyro, Piper Dwg. 99002-2, -3, -4 or -5 Cert. Basis - TSO C4c	_____	2.2	59.4	131
117	Directional Gyro, Piper Dwg. 99003-2, -3, -4 or -5 Cert. Basis - TSO C5c	_____	2.6	59.7	155
119	Tru-Speed Indicator, Piper PS50049-29T Cert. Basis - TSO C2b	_____	(same as standard equipment)		
121	Encoding Altimeter, Piper PS50008-6 or -7 Cert. Basis - TSO C10b, C88	_____	* .9	60.3	54
123	Vertical Speed Piper Dwg. 99010-2, -4 or -5 Cert. Basis - TSO C8b	_____	1.0	60.9	61
125	Alternate Static Source Cert. Basis - TC 2A13	_____	.4	61.0	24
127	Turn and Slip Indicator, Piper PS50030-2 or -3 Cert. Basis - TSO C3b	_____	2.6	59.7	155

*Weight and moment difference between standard and optional equipment.

(k) Instruments
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
129	Engine Hour Meter Piper Dwg. 69889-0 Cert. Basis - TC 2A13	_____	0.3	61.2	18
131	Clock Cert. Basis - TC 2A13	_____	.4	62.4	25
133	Air Temperature Gauge, Piper Dwg. 99479-0 or -2 Cert. Basis - TC 2A13	_____	.2	72.6	15

(l) Autopilots
(Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
147	AutoFlite II Cert. Basis - STC SA3066SW-D	_____	5.6	91.8	514
149	AutoControl IIIB	_____	9.6	77.6	745
	a. Omni Coupler 1C-388 Cert. Basis - STC SA 3065SW-D	_____	1.0	59.3	59

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(m) Radio Equipment
(Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
161	Collins VHF-251 Comm Transceiver				
	a. Single	_____	3.4	56.9	193
	b. Dual	_____	6.8	56.9	387
	Cert. Basis - TSO C37b, C38b				
163	Collins VIR-351 Nav Receiver				
	a. Single	_____	2.7	57.4	155
	b. Dual	_____	5.4	57.4	310
	Cert. Basis - TSO C40a, C36c				
165	Collins IND-350 VOR/LOC Indicator				
	a. Single	_____	1.0	60.2	60
	b. Dual	_____	2.0	60.2	120
	Cert. Basis - TSO C40a, C36c				
167	Collins IND-351 VOR/LOC/ GS Indicator				
	Cert. Basis - TSO C40a, C36c	_____	1.3	60.2	78
169	Collins GLS-350 Glide Slope Receiver				
	Cert. Basis - TSO C34c	_____	2.0	183.4	367
171	Collins RCR-650 ADF Receiver and Antenna and IND-650 Indicator				
	Cert. Basis - TSO C41c	_____	6.6	104.8	692

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
173	Collins AMR-350 Audio/Marker Panel Cert. Basis - TSO C35d, C50b	_____	*3.3	110.0	363
175	Collins TDR-950 Transponder Cert. Basis - TSO C74c	_____	**2.8	62.9	176

*Weight includes antenna and cable.
**Weight includes antenna.

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
177	King KX 170 ( ) VHF Comm/Nav				
	a. Transceiver, Single	_____	7.5	56.6	425
	b. Transceiver, Dual	_____	15.0	56.6	849
	Cert. Basis - TC 2A13				
179	King KX 175 ( ) VHF				
	a. Transceiver,	_____	9.4	56.6	532
	b. King KN 73 Glide Slope Receiver,	_____	3.2	184.3	590
	c. King KN 77 VOR/LOC Converter,	_____	3.6	183.6	661
	d. King KNI 520 VOR/ILS Indicator	_____	1.7	60.5	103
	Cert. Basis - TSO C3bc, C37b, C38b, C40a				
181	King KX 175 ( ) VHF				
	a. Transceiver (2nd),	_____	8.6	56.6	487
	b. King KN 77 VOR/LOC Converter,	_____	4.2	183.6	771
	c. King KNI 520 VOR/ILS Indicator	_____	1.7	60.5	103
	Cert. Basis - TSO C36c, C37b, C38b, C40a				
183	King KI 201 ( ) VOR/ LOC Ind.				
	a. Single	_____	2.5	59.6	149
	b. Dual	_____	5.0	59.9	300
	Cert. Basis - TC 2A13				
185	King KI 213 VOR/LOC/GS Indicator				
	Cert. Basis - TC 2A13	_____	2.5	60.4	151
187	King KI 214 ( ) VOR/ LOC/GS Ind.				
	Cert. Basis - TC 2A13	_____	3.3	59.9	198

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
189	King KN 74 R-Nav Cert. Basis - TC 2A13	_____	4.7	56.6	266
191	King KN 61 DME Cert. Basis - TC 2A13	_____	12.5	179.0	2237
193	King KN 65A DME Cert. Basis - TSO C66a	_____	13.0	174.9	2274
195	King KR 85 Digital ADF	_____	8.6	85.2	733
	a. Audio Amplifier	_____	0.8	51.0	41
	Cert. Basis - TSO C41b				
197	King KR 86 ADF				
	a. First	_____	6.7	91.6	614
	b. Second	_____	9.7	107.0	1038
	c. Audio Amplifier	_____	0.8	51.0	41
	Cert. Basis - TC 2A13				
199	King KMA 20 ( ) Audio Panel Cert. Basis - TSO C35c, C50b	_____	*3.7	70.8	262
201	King KT 76/78 Transponder Cert. Basis - TSO C74b	_____	*3.1	58.1	180

*Weight includes antenna and cable.

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
203	Narco Comm 10A VHF Transceiver Cert. Basis - TC 2A13	_____	3.9	57.4	224
205	Narco Comm 11A VHF Transceiver				
	a. Single	_____	3.6	57.4	207
	b. Dual	_____	7.1	57.4	408
	Cert. Basis - TC 2A13				
207	Narco Comm 11B VHF Transceiver				
	a. Single	_____	3.9	57.4	224
	b. Dual	_____	7.8	57.4	448
	Cert. Basis - TC 2A13				
209	Narco Comm 111 VHF Transceiver				
	a. Single	_____	3.0	57.4	172
	b. Dual	_____	6.0	57.4	344
	Cert. Basis - TSO C37b, C38b				
211	Narco Comm IIIB VHF Transceiver				
	a. Single	_____	3.9	57.4	224
	b. Dual	_____	7.8	57.4	448
	Cert. Basis - TSO C37b, C38b				
213	Narco Nav 10 VHF Receiver Cert. Basis - TC 2A13	_____	1.9	58.6	111
215	Narco Nav 11 VHF Receiver				
	a. Single	_____	2.8	58.6	164
	b. Dual	_____	5.6	58.6	328
	Cert. Basis - TC 2A13				

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
217	Narco Nav 12 VHF Receiver Cert. Basis - TC 2A13	_____	3.4	58.6	199
219	Narco Nav 14 VHF Receiver Cert. Basis - TC 2A13	_____	2.5	57.4	144
221	Narco Nav 111 Cert. Basis - TSO C36c, C40a, C66a	_____	2.5	58.6	147
223	Narco Nav 112 Receiver Cert. Basis - TSO C36c, C40a, C66c, C34c	_____	3.3	58.6	193
225	Narco Nav 114 VHF Receiver Cert. Basis - TSO C38b, C40a, C36c, C34c, C66a	_____	2.5	57.4	144
227	Narco UGR-2A Glide Slope Cert. Basis - TSO C34b	_____	4.2	154.0	647
229	Narco UGR-3 Glide Slope Cert. Basis - TC 2A13	_____	4.2	154.0	647
231	Narco MBT-12-R, Marker Beacon Cert. Basis - TC 2A13	_____	3.1	69.1	214
233	Narco CP-125 Audio Selector Panel Cert. Basis - TC 2A13	_____	2.2	60.2	132

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
235	Narco DME-190 Cert. Basis - TC 2A13	_____	5.9	61.0	360
237	Narco DME 195 Receiver and Indicator Cert. Basis - TSO C66a	_____	*13.2	**154.5	2039
239	Narco ADF-140 a. Single b. Dual Cert. Basis - TSO C41c	_____ _____	6.0 17.9	91.2 107.6	547 1926
241	Narco AT50A Transponder Cert. Basis - TSO C74b a. Narco AR-500 Altitude Encoder Cert. Basis - TSO C88	_____ _____	*3.0 1.0	57.3 51.5	172 52

*Weight includes antenna and cable.
**This arm and moment is applicable only when installed with Collins avionics.

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(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
243	Antenna and Cable				
	a. Nav Receiving	_____	1.6	171.3	274
	b. *1 VHF Comm	_____	0.7	125.7	88
	c. *2 VHF Comm	_____	0.8	147.5	118
	d. Glide Slope	_____	0.9	120.0	108
	e. Single ADF Sense	_____	0.4	150.0	60
	Cert. Basis - TC 2A13				
245	Anti Static Antenna and Cable				
	a. *1 VHF Comm	_____	1.4	144.3	202
	b. *2 VHF Comm	_____	1.5	170.7	256
	c. Single ADF Sense	_____	0.5	147.5	74
	Cert. Basis - TC 2A13				
247	Emergency Locator Transmitter	_____	1.7	236.2	402
	a. Antenna and Coax	_____	0.2	224.4	45
	b. Shelf and Access Hole	_____	0.3	235.4	71
	Cert. Basis - TC 2A13				
249	Microphone				
	a. Piper Dwg. 68856-10	_____	0.3	69.9	21
	b. Piper Dwg. 68856-11	_____	0.6	69.9	42
	c. Piper Dwg. 68856-12	_____	0.3	69.9	21
	Cert. Basis - TC 2A13				
251	Cabin Speaker				
	Cert. Basis - TC 2A13	_____	0.8	99.0	79
253	Headset, Piper Dwg. 68856-10				
	Cert. Basis - TC 2A13	_____	0.5	60.0	30

*Weight and moment difference between standard and optional equipment.

(m) Radio Equipment
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)

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(n) Miscellaneous
(Optional Equipment)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
263	Zinc Chromate Finish Cert. Basis - TC 2A13	_____	5.0	158.0	790
265	Stainless Steel Control Cables Cert. Basis - TC 2A13	_____	–	–	–
267	Overhead Vent System Piper Dwg. 76304-9 Cert. Basis - TC 2A13	_____	6.4	159.6	1022
269	Overhead Vent System with Ground Ventilating Blower Piper Dwg. 76304-10 Cert. Basis - TC 2A13	_____	14.0	170.7	2390
271	Rear Seat Vents Cert. Basis - TC 2A13	_____	2.5	98.0	245
273	Assist Step, Piper Dwg. 65384 Cert. Basis - TC 2A13	_____	1.8	156.0	281
275	Super Cabin Sound Proofing, Piper Dwg. 79030-2 Cert. Basis - TC 2A13	_____	18.1	86.8	1571
277	Adjustable Front Seat (Left), Piper Dwg. 79591-0 Cert. Basis - TC 2A13	_____	*6.6	80.3	530
279	Adjustable Front Seat (Right), Piper Dwg. 79591-1 Cert. Basis - TC 2A13	_____	*6.6	79.6	525

*Weight and moment difference between standard and optional equipment.

(n) Miscellaneous
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)
281	Headrests (2) Front, Piper Dwg. 79337-18 Cert. Basis - TC 2A13	_____	2.2	94.5	208
283	Inertia Safety Belts (Rear) (2) 0.8 lbs. each, Piper PS50039-4-14 Cert. Basis - TC 2A13	_____	1.6	140.3	224
285	Sun Visors Piper Dwg. 66991-0 Cert. Basis - TC 2A13	_____	1.5	85.0	128
287	Assist Strap, Piper Dwg. 79455 Cert. Basis - TC 2A13	_____	0.2	109.5	22
289	Delux Carpeting Cert. Basis - TC 2A13	_____	*2.6	97.8	254
291	Fire Extinguisher, Piper Dwg. 76167-2 Cert. Basis - TC 2A13	_____	4.6	71.0	327
293	Tow Bar Piper Dwg. 99458 Cert. Basis - TC 2A13	_____	1.3	140.0	182

*Weight and moment difference between standard and optional equipment.

(n) Miscellaneous
(Optional Equipment) (cont)

Item No.	Item	Mark if Instl.	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb-In.)

TOTAL OPTIONAL EQUIPMENT _____ _____ _____

EXTERIOR FINISH

Base Color _____ Registration No. Color _____

Trim Color _____ Type Finish _____

Accent Color _____

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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 Cherokee Warrior is a single-engine, fixed gear monoplane of all metal construction with low semi-tapered wings. It has four place seating and a two hundred pound baggage capacity.

7.3 AIRFRAME

The primary structure, with the exception of the steel tube engine mount, steel landing gear struts and isolated areas, is of aluminum alloy construction. Fiberglass and thermoplastic are used extensively in the extremities - the wing tips, the engine cowling, etc. - and in nonstructural components throughout the airplane.

The fuselage is a conventional semi-monocoque structure. On the right side of the airplane is a cabin door for entrance and exit and a baggage door to provide loading into the 24 cubic foot compartment.

The wing is a conventional semi-tapered design incorporating a laminar flow, NACA 65_2415, airfoil section. The cantilever wings are attached to each side of the fuselage by insertion of the butt ends of the main spars into a spar box carry-through which is an integral part of the fuselage structure. The spar box carry-through structure, located under the rear seat, provides in effect a continuous main spar with splices at each side of the fuselage. There are also fore and aft attachments at the rear and at an auxiliary front spar.

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7.5 ENGINE AND PROPELLER

The PA-28-151 is powered by a Lycoming O-320-E3D four cylinder, direct drive, horizontally opposed engine rated at 150 HP at 2700 RPM. It is equipped with a starter, a 60 amp 14 volt alternator, a shielded ignition, dual magnetos, vacuum pump drive, a fuel pump, and a wetted polyurethane foam induction air filter.

The engine compartment is accessible for inspection through top-hinged side panels on either side of the engine cowlings. The engine cowlings are cantilever structures attached at the fire wall. The engine mounts are constructed of steel tubing, and dynafocal mounts are provided to reduce vibration.

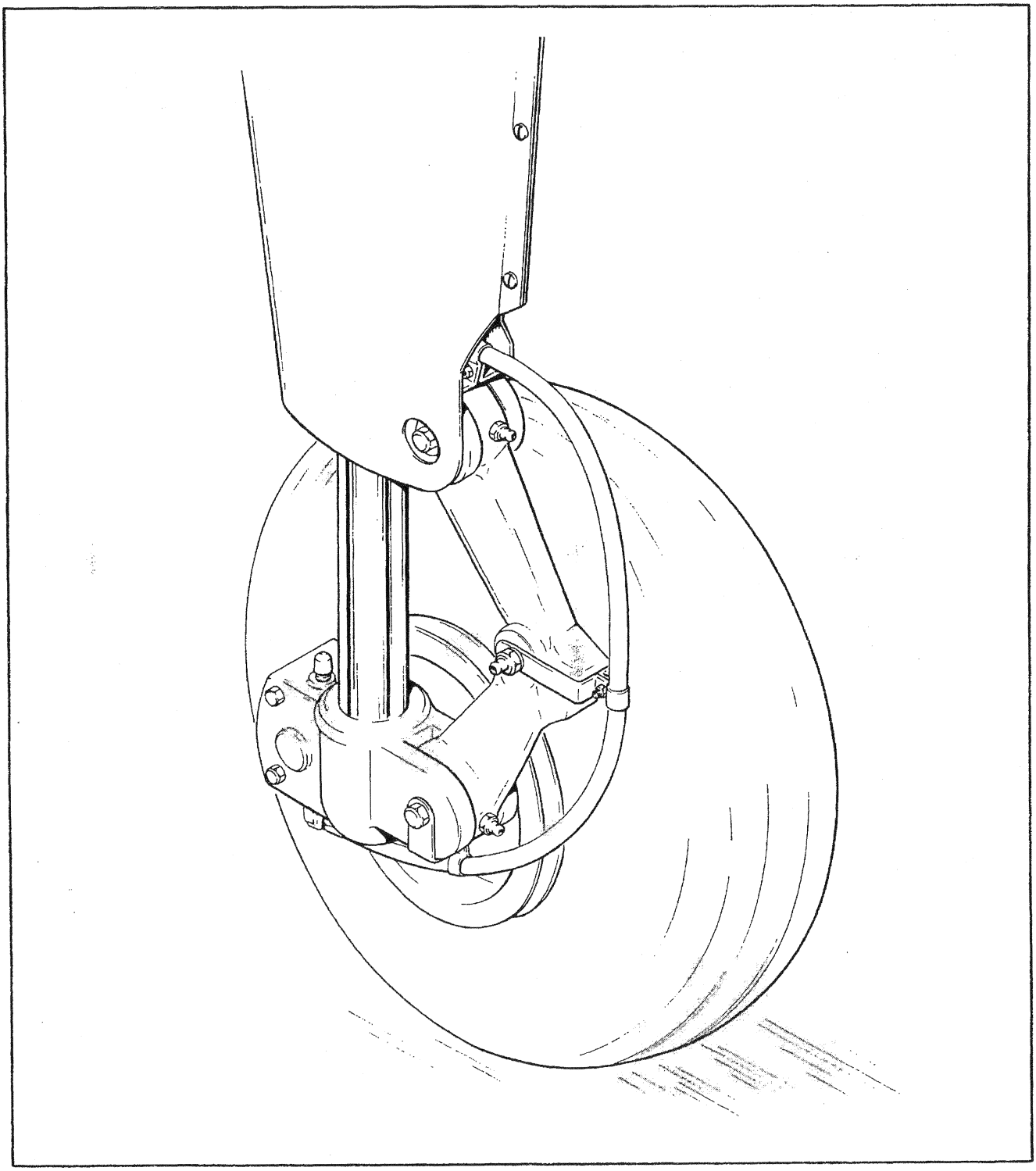
The exhaust system is constructed of stainless steel and incorporates a single muffler with heater shrouds to supply heated air for the cabin, the defroster system and the carburetor deicing system.

An oil cooler is located on the left rear of the engine mounted to the engine baffling. Engine cooling air, which is picked up in the nose section of the engine cowling and carried through the baffling, is utilized on the left side for the oil cooler. A winterization plate is provided to restrict air during winter operation (refer to paragraph 8.29).

Engine air enters on either side of the propeller through openings in a nose cowling and is carried through the engine baffling around the engine and oil cooler. Air for the muffler shroud is also picked up from the nose cowling and carried through a duct to the shroud. Carburetor induction air enters a chin scoop on the lower right cowling and is passed through a wetted polyurethane filter to the carburetor air box. Heated air enters the carburetor air box through a hose connected to the heater shroud.

A McCauley 1C160/EGM7653 or a Sensenich 74DM6-0-58 fixed pitch propeller is installed as standard equipment. The McCauley propeller has a diameter of 76 inches with a pitch of 53 inches and the Sensenich has a 74 inch diameter with a 58 inch pitch. The pitch of both propellers is determined at 75% of the diameter. Both propeller units are of an aluminum alloy construction.

The pilot should read and follow the procedures recommended in the Lycoming Operator's Manual for this engine in order to obtain maximum engine efficiency and time between engine overhauls.



MAIN WHEEL ASSEMBLY

Figure 7-1

7.7 LANDING GEAR

The fixed gear PA-28-151 is equipped with a Cleveland 5.00 x 5 wheel on the nose gear and a Cleveland 6.00 x 6 wheel on each main gear (Figure 7-1). Cleveland single disc hydraulic brake assemblies are provided on the main gear. The nose gear has a 5.00 x 5 four ply tire, while the main wheel assemblies have 6.00 x 6 four ply tires. At gross weight, the main gear tires require a pressure of 24 psi, and the nose gear tire requires a pressure of 30 psi.

The nose gear is steerable through a 30 degree arc each side of center by the use of the rudder pedals and toe brakes. A spring device is incorporated for rudder centering and to provide rudder trim. A bungee assembly on the nose gear steering mechanism reduces ground steering effort and dampens shocks and bumps during taxiing. The steering mechanism also incorporates a shimmy dampener.

The three struts are of the air-oil type with the normal static load extension being 3.25 inches for the nose gear and 4.50 inches for the main gear.

The brakes are actuated by toe brake pedals which are attached to the rudder pedals or by a hand lever and master cylinder located below and behind the center of the instrument sub panel. Hydraulic cylinders are located above each pedal and adjacent to the hand brake lever. The brake fluid reservoir is installed on the top left front face of the fire wall. The parking brake is incorporated in the master cylinder and is actuated by pulling back on the brake lever and depressing the knob attached to the left side of the handle. To release the parking brake, pull back on the brake lever to disengage the catch mechanism and allow the handle to swing forward (refer to Figure 7-5).

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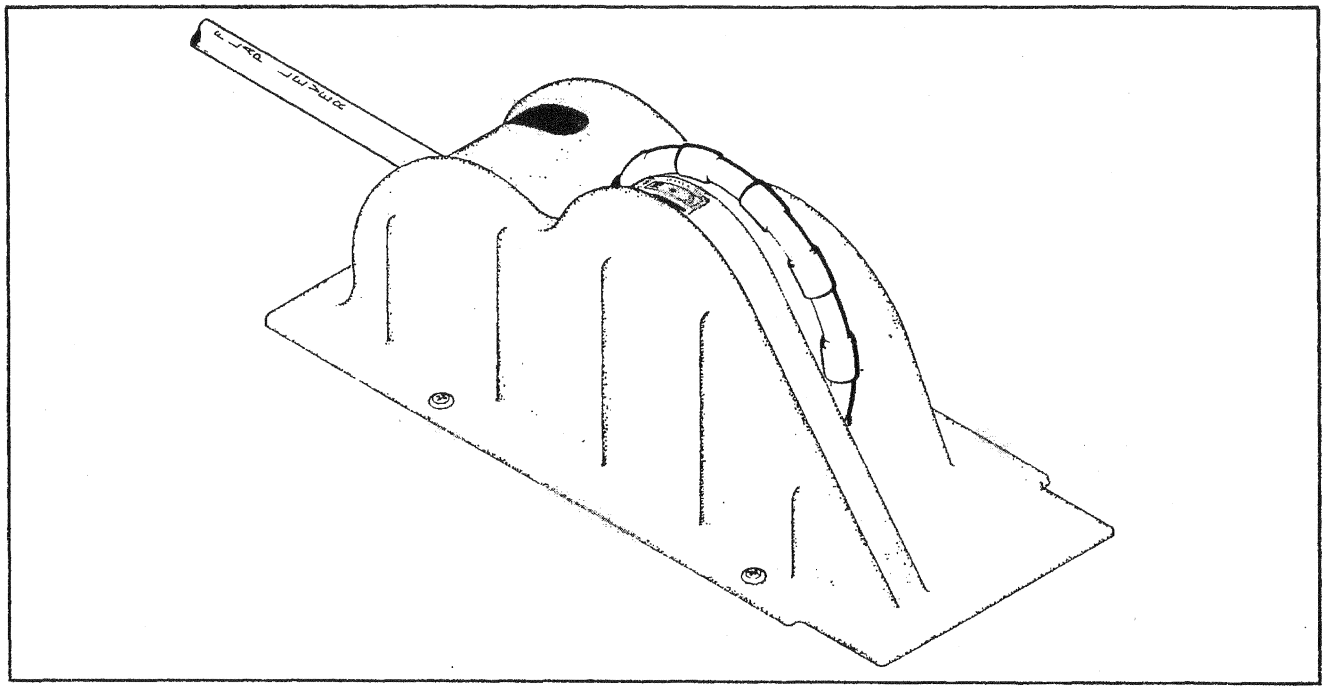


FLIGHT CONTROL CONSOLE

Figure 7-3

7.9 FLIGHT CONTROLS

Dual flight controls are provided on the Warrior as standard equipment. The flight controls actuate the control surfaces through a cable system.

The horizontal surface (stabilator) is of the flying tail design with a trim tab mounted on the trailing edge. This tab serves the dual function of providing trim control and pitch control forces. The trim tab is actuated by a trim control wheel located on the control console between the front seats (Figure 7-3). Forward rotation of the wheel gives nose down trim and aft rotation gives nose up trim.

The rudder is conventional in design and incorporates a rudder trim. The trim mechanism is a spring loaded recentering device. The trim control is located on the right side of the pedestal below the throttle quadrant (refer to Figure 7-5). Turning the trim control clockwise gives nose right trim and counterclockwise rotation gives nose left trim.

Manually controlled flaps are provided on the PA-28-151. The flaps are balanced and spring loaded to return to the retracted (up) position. A control handle, which is located between the two front seats on the control console (Figure 7-3), extends the flaps by the use of a control cable. To extend the flaps, the handle is pulled up to the desired flap setting of 10, 25 or 40 degrees. To retract, depress the button on the end of the handle and lower the control. When extending or retracting flaps, there is a pitch change in the airplane. This pitch change can be corrected either by stabilator trim or increased control wheel force. When the flaps are in the retracted (up) position the right flap, provided with an over-center lock mechanism, acts as a step.

NOTE

The right flap will support a load only in the fully retracted (up) position. When the flap is to be used as a step, make sure the flaps are in the retracted (up) position.

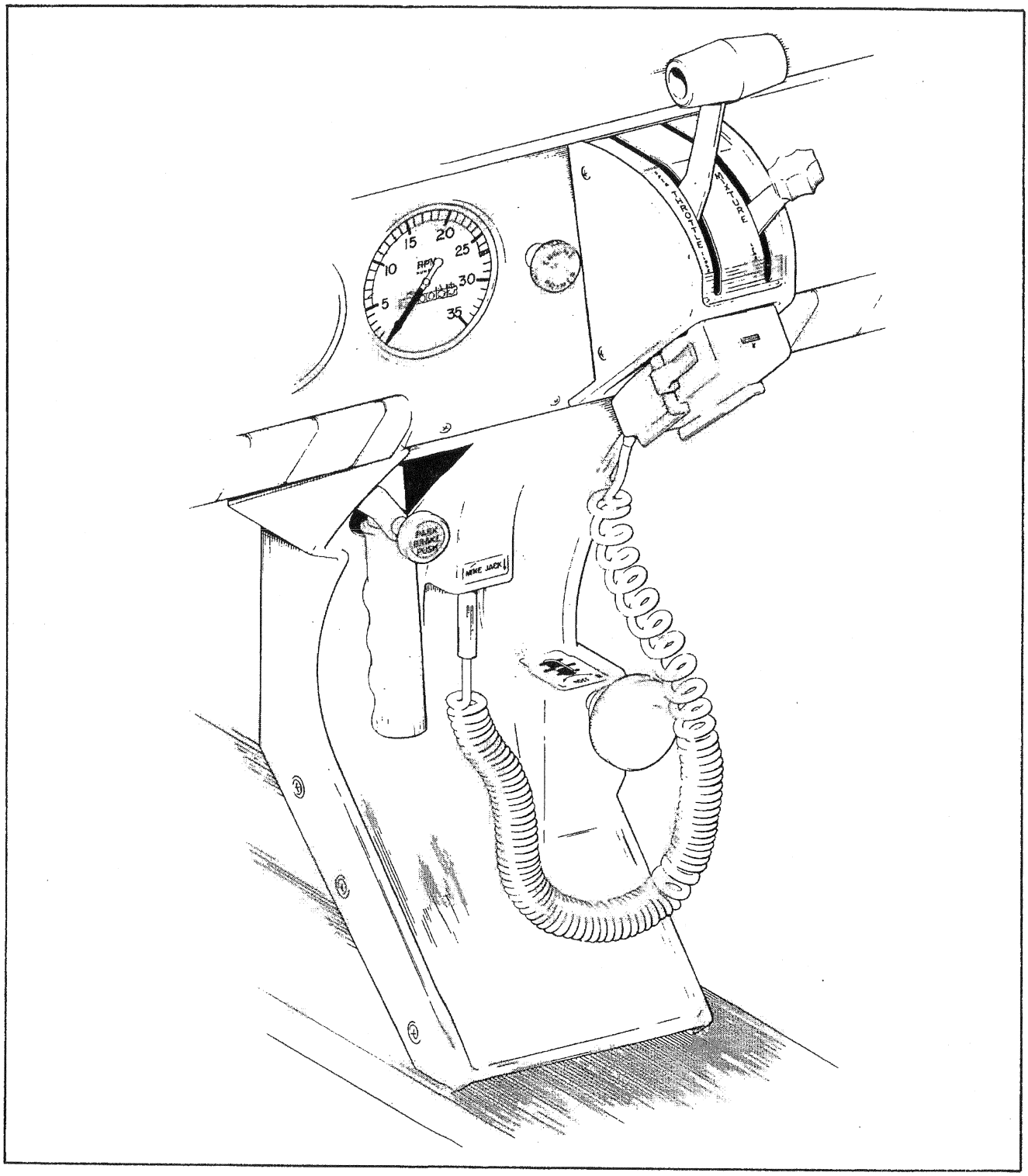
7.11 ENGINE CONTROLS

Engine controls consist of a throttle control and a mixture control lever. These controls are located on the control quadrant on the lower center of the instrument panel (Figure 7-5) 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 engine 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 lever in the full lean position. In addition, the mixture control has a lock to prevent inadvertent activation of the mixture control. For information on the leaning procedure, see the Avco-Lycoming Operator's Manual.

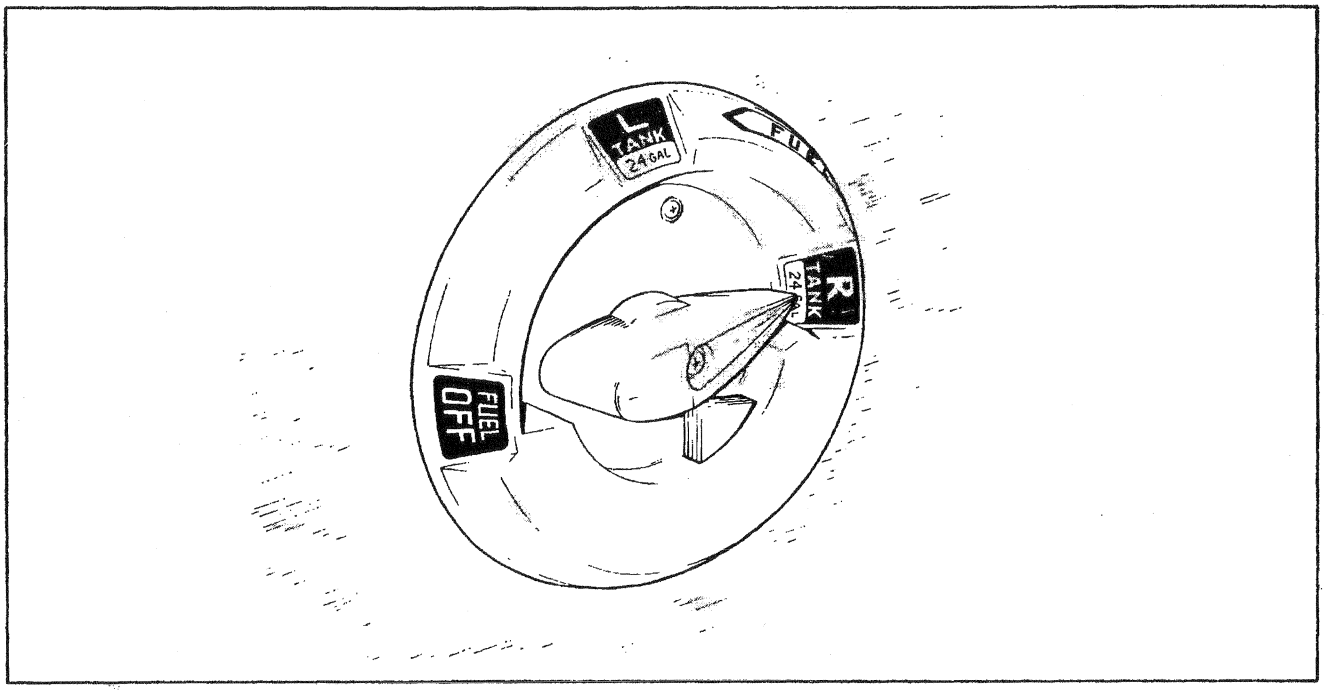
The friction adjustment lever on the right side of the control quadrant may be adjusted to increase or decrease the friction holding the throttle and mixture controls or to lock the controls in a selected position.

The carburetor heat control lever is located to the right of the control quadrant on the instrument panel. The control is placarded with two positions: "ON" (down), "OFF" (up).



CONTROL QUADRANT AND CONSOLE

Figure 7-5



FUEL SELECTOR

Figure 7-7

7.13 FUEL SYSTEM

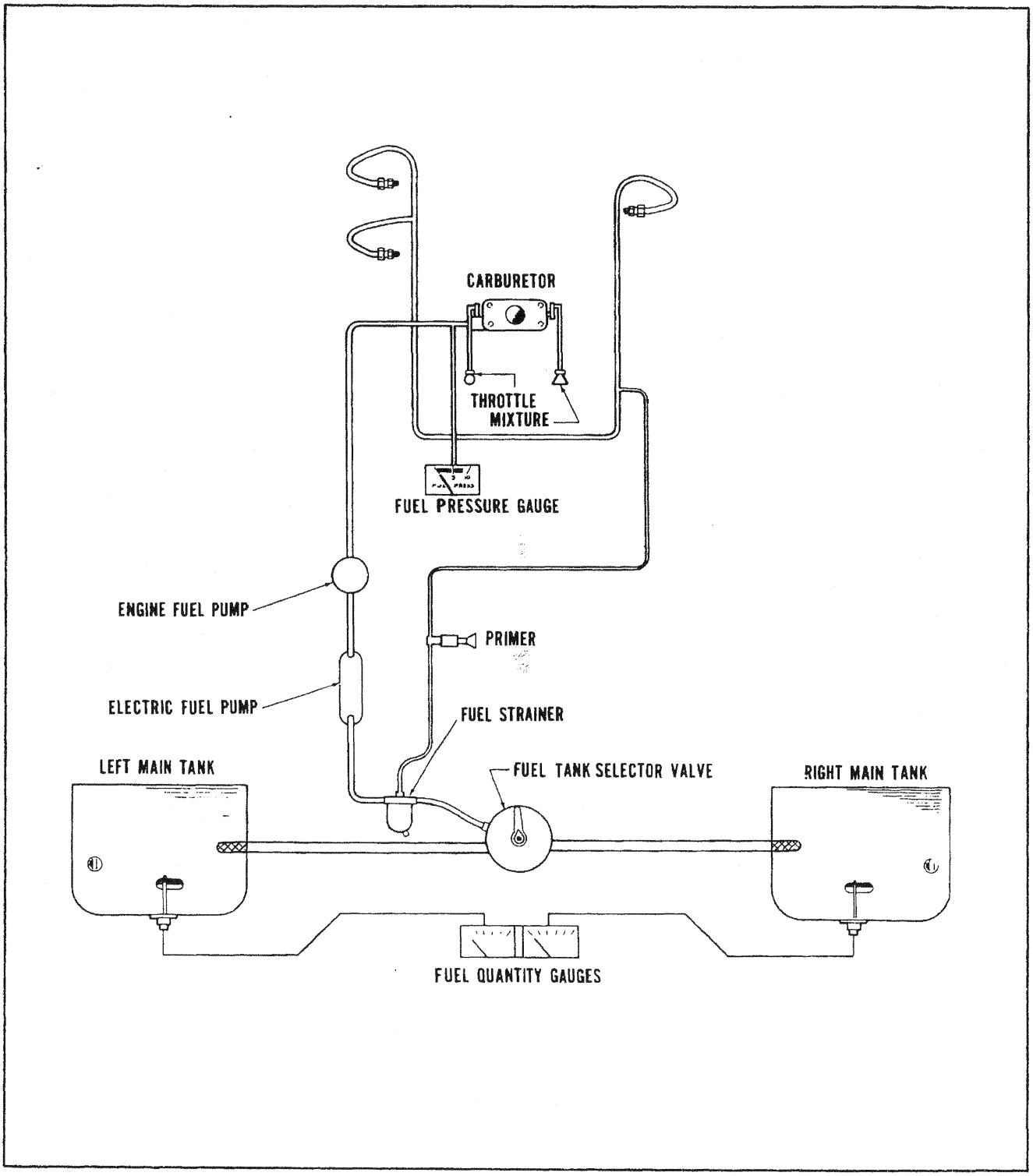
Fuel is stored in two twenty-five gallon (24 gallons usable) fuel tanks, giving the airplane a total capacity of fifty U.S. gallons (48 gallons usable). The tanks are secured to the leading edge of each wing with screws and nut plates. This allows removal for service or inspection.

The fuel tank selector control (Figure 7-7) is located on the left side panel forward of the pilot's seat. The button on the selector cover must be depressed and held while the handle is moved to the OFF position. The button releases automatically when the handle is moved back to the ON position.

An auxiliary electric fuel pump is provided in case of the failure of the engine driven pump. The electric pump should be ON for all takeoffs and landings and when switching tanks. The fuel pump switch is located in the switch panel above the throttle quadrant.

The fuel drains should be opened daily prior to first flight to check for water or sediment. Each tank has an individual drain at the bottom, inboard rear corner.

A fuel strainer, located on the lower left front of the fire wall, has a drain which is accessible from outside the nose section. The strainer should also be drained before the first flight of the day. Refer to paragraph 8.21 for the complete fuel draining procedure.



FUEL SYSTEM SCHEMATIC

Figure 7-9

Fuel quantity and fuel pressure gauges are mounted in a gauge cluster located on the left side of the instrument panel to the right of the control wheel (refer to Figure 7-15).

An optional engine priming system is available to faciliate starting. The primer pump is located to the immediate left of the throttle quadrant (refer to Figure 7-5).

7.15 ELECTRICAL SYSTEM

The electrical system includes a 14 volt 60 ampere alternator, voltage regulator, overvoltage relay, battery contactor and a standard 12 volt 25 ampere hour or an optional 12 volt 35 ampere hour battery (Figure 7-11). The battery is mounted in a thermoplastic box located immediately aft of the main spar on the right side of the fuselage below the rear passenger seat. The voltage 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, and the circuit breakers are located on the lower right instrument panel. A rheostat switch on the left side of the switch panel controls the optional navigation lights and the radio lights. A similar switch on the right side of the switch panel controls and dims the optional panel lights. The master switch, anti-collision light, landing light and fuel pump are also located on the switch panel and are controlled by rocker type switches. Each circuit breaker on the panel is of the push to reset type and is clearly marked as to its function and amperage. Circuit provisions have been included to handle the addition of communication and navigational equipment (refer to Figure 7-13).

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

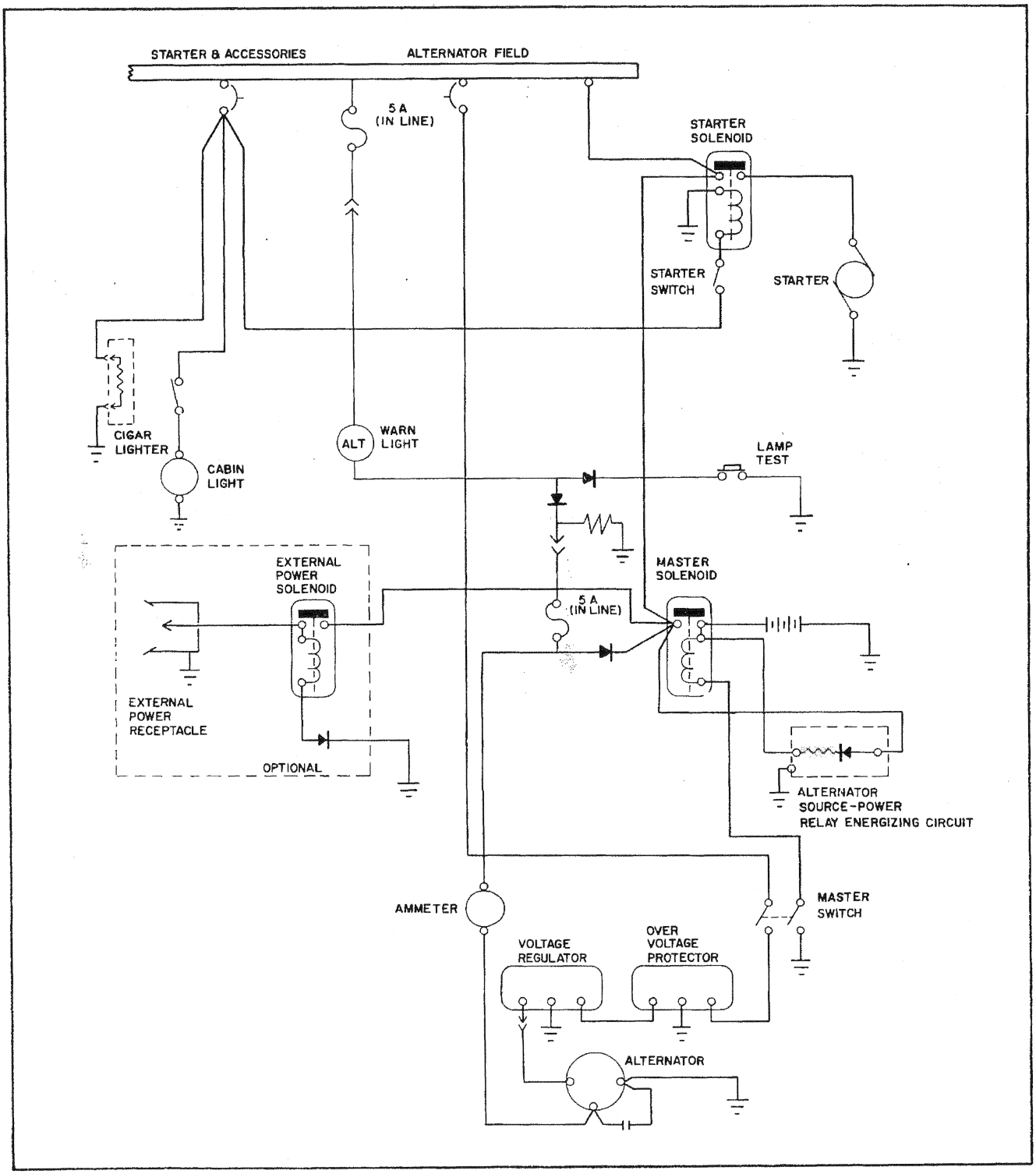
The annunciator panel includes alternator and low oil pressure indicator lights. When the optional gyro system is installed, the annunciator panel also includes a low vacuum indicator light. The annunciator panel lights are provided only as a warning to the pilot that a system may not be operating properly,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

The system also provides for such optional electrical accessories as additional lights and gauges, a heated pitot head, and communication and navigational equipment.

The master switch is a split rocker switch. One side of the switch is the battery side ("BAT") and the other is the alternator side ("ALT"). Henceforth, the words "master switch" used in this manual will mean both "BAT" and "ALT" switches and they are to be depressed simultaneously to OFF or ON as directed.

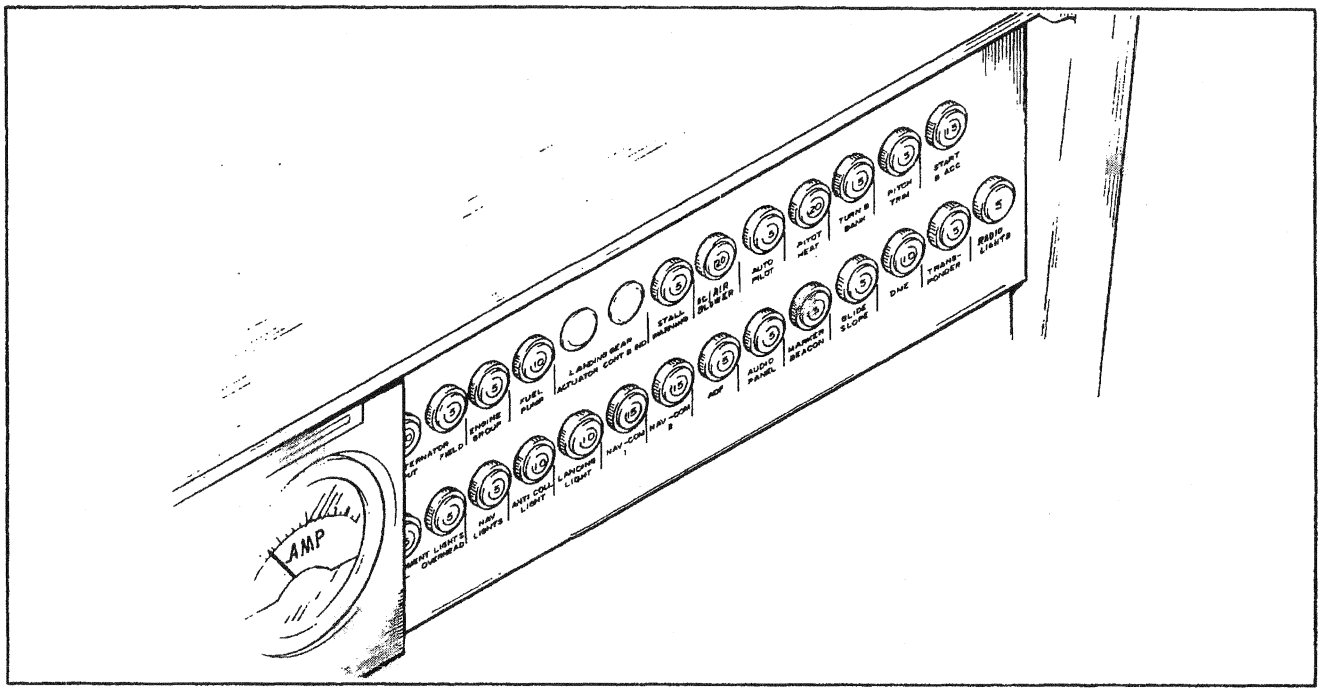
Unlike previous generator systems, the ammeter as installed does not show battery discharge: rather, it indicates the electrical load on the alternator in amperes. With all the electrical equipment off and the master switch on, the ammeter will indicate the charging rate of the battery. As each electrical unit is switched on, the ammeter will indicate the total ampere draw of all the units including the battery. For example, the maximum continuous load for night flight with radios on is about 30 amperes. This 30 ampere value plus approximately 2 amperes for a fully charged battery will appear continuously under these flight conditions. The amount of current shown on the ammeter will tell immediately if the alternator system is operating normally, as the amount of current shown should equal the total amperage drawn by the electrical equipment which is operating.

The overvoltage relay protects the electronics equipment from a momentary overvoltage condition (approximately 16.5 volts and up), or a catastrophic regulator failure. If no output is indicated on the ammeter during flight, reduce the electrical load by turning off all unnecessary electrical equipment. Check both the 5 ampere field breaker and the 60 ampere output breaker and reset if open. If neither circuit breaker is open, turn the "ALT" switch off for 1 second to reset the overvoltage relay. If the ammeter continues to indicate no output, maintain minimum electrical load and terminate the flight as soon as practical.



ALTERNATOR AND STARTER SCHEMATIC

Figure 7-11



CIRCUIT BREAKER PANEL

Figure 7-13

7.17 VACUUM SYSTEM*

The vacuum system is designed to operate the air driven gyro instruments. This includes the directional and attitude gyros when installed. The system consists of an engine driven vacuum pump, a vacuum regulator, a filter and the necessary plumbing.

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

A vacuum gauge, mounted on the far right instrument panel provides a pilot check for the system during operation. A decrease in pressure in a system that remained constant over an extended period may indicate a dirty filter, dirty screens, possibly a sticky vacuum regulator or leak in the 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. Vacuum pressure, even though set correctly, can read lower at very high altitude (above 12,000 ft), and at low engine RPM (usually on approach or during training maneuvers. This is normal and should not be considered a malfunction.

*Optional equipment

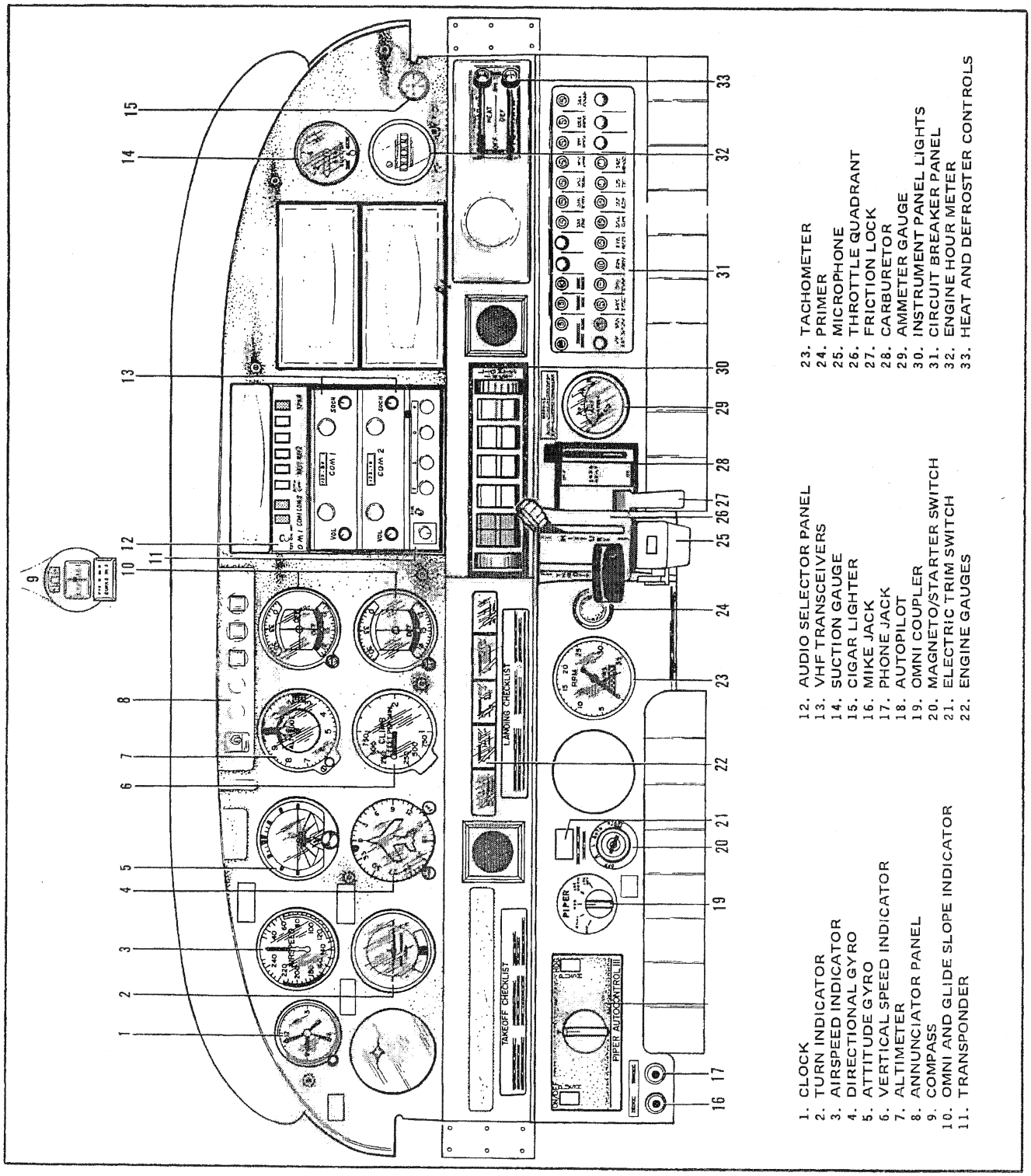
7.19 INSTRUMENT PANEL

The instrument panel (Figure 7-15) is designed to accommodate instruments and avionics equipment for VFR and IFR flights.

The radios and the circuit breakers are located on the upper and lower right panel respectively, and have circuits provided for the addition of optional radio equipment. An engine cluster is located to the right of the pilot control wheel and includes a fuel pressure gauge, a right and left main fuel quantity gauge, an oil temperature gauge and an oil pressure gauge.

Standard instruments on the Warrior panel include a compass, an airspeed indicator, a tachometer, an altimeter, an ammeter, an engine cluster, and an annunciator panel. The compass is mounted on the windshield bow in clear view of the pilot. The 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.

Instrument options available for the panel includes a suction gauge, vertical speed indicator, attitude gyro, directional gyro, clock, tru-speed indicator and a turn and slip indicator or turn coordinator. The attitude gyro and directional gyro are vacuum operated through the use of a vacuum pump installed on the engine, while the turn and slip indicator is electrically operated. The vacuum suction gauge is on the far right of the instrument panel.



INSTRUMENT PANEL

Figure 7-15

7.21 PITOT-STATIC SYSTEM

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

Pitot and static pressure are picked up by a pitot head installed on the bottom of the left wing and carried through pitot and static lines within the wing and fuselage to the gauges on the instrument panel.

A static valve, which is mounted to the knee guard below the instrument panel on the left side, provides an alternate static source for the system when opened.

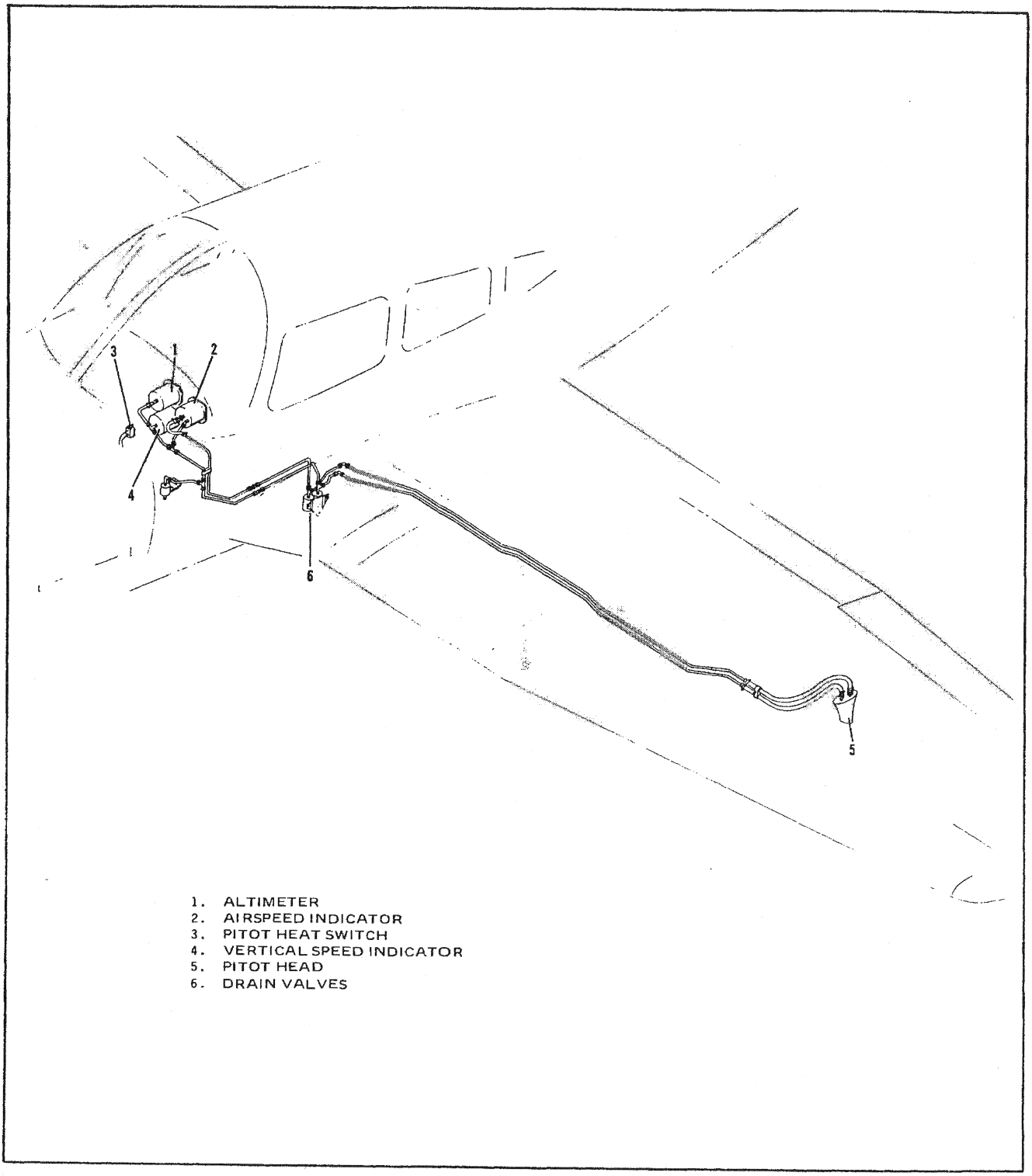
Both the pitot and static lines can be drained through separate drain valves located on the left lower side of the fuselage interior.

A heated pitot head, which alleviates problems with icing and heavy rain, is available as optional equipment. The switch for the heated pitot head is located on the electrical switch panel to the left of the right control wheel.

To prevent bugs and water from entering the pitot and static pressure holes, 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.

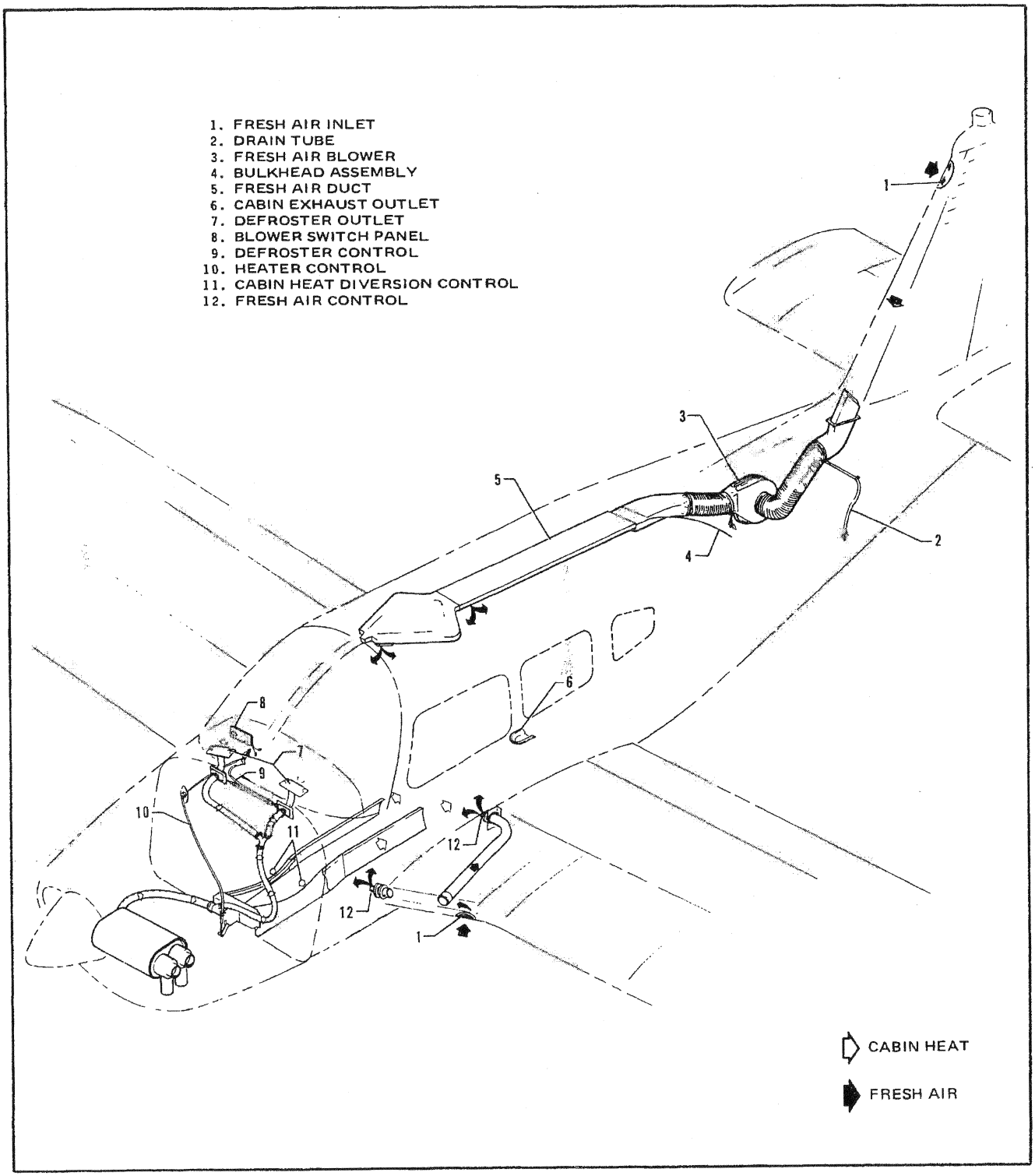
NOTE

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



PITOT-STATIC SYSTEM

Figure 7-17



HEATING AND VENTILATING SYSTEM

Figure 7-19

7.23 HEATING AND VENTILATING SYSTEM

Heat for the cabin interior and the defroster system is provided by a shroud attached to the muffler (Figure 7-19). The amount of heat can be regulated with the controls located on the far right side of the instrument panel.

The airflow between front and rear seats can be regulated by the heat diversion controls located on either side of the console atop the heat ducts.

Fresh air inlets are located in the leading edges of the wings near the fuselage. At each front seat location there is an adjustable fresh air outlet on the side of the cabin near the floor. Rear seat vents are optional. Cabin air is exhausted through an outlet located below the rear seat.

An optional overhead ventilating system with outlets over each seat is also available. An additional option to aid in fresh air circulation is a cabin air blower to force air through the overhead vent system. This blower is operated by a fan switch with four positions - "OFF," "LOW," "MED," and "HIGH." The switch is located on the right side of the instrument panel with the heater and defroster controls.

7.25 CABIN FEATURES

For ease of entry and exit and for pilot-passenger comfort, the front seats are adjustable fore and aft. The right front seat tilts forward to allow easy entry to the rear seats. The cabin interior includes a pilot storm window, ash trays and armrests on each front seat, two map pockets and pockets on the backs of the front seats.

The front seats can be equipped with optional headrests and optional vertical adjustment.

Seat belts are standard equipment for both front and rear seats. The shoulder straps controlled by inertia reels are standard equipment on the front seats and are offered as an option for the rear seats. The shoulder strap is routed over the shoulder adjacent to the window and attached to the seat belt in the general area of the occupants' inboard hip.

A check of the inertia reel mechanism is made by pulling sharply on the strap. The reel should lock in place under this test and prevent the strap from extending. For normal body movements, the strap will extend or retract as required.

7.27 BAGGAGE AREA

A 24 cubic foot baggage area, located behind the rear seat, is accessible from the cabin or loaded through a large 20 x 22 inch outside baggage door on the right side of the fuselage. Maximum capacity is 200 pounds. Tie-down straps are available and they 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.)

7.29 STALL WARNING

An approaching stall is indicated by an audible alarm located behind the instrument panel. The indicator activates at between five and ten knots above stall speed.

7.31 FINISH

All exterior surfaces are primed with etching primer and finished with acrylic lacquer. To keep the finish attractive, economy size spray cans of touch-up paint are available from Piper Dealers.

7.33 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 baggage door. 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. Instructions on a placard located on the cover of the receptacle should be followed before using the external power. For instructions on the use of the PEP see; STARTING WITH EXTERNAL POWER SOURCE in Section 4 - Normal Operating Procedures.

7.35 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 three 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. It is automatically activated by a longitudinal force of 5 g's and transmits a distress signal on both 121.5 MHz and 243.0 MHz for a period of from 48 hours in low temperature areas up to 100 hours in high temperature areas. The unit operates on a self-contained battery.

The battery has a useful life of 10 years. However, to comply with FAA regulations it must be replaced after 5 years of shelf life or service life. The battery should also be replaced if the transmitter has been used in an emergency situation of if accumulated test time exceeds one hour. The replacement date is marked on the transmitter label.

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.

*Optional equipment

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 left 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 airplane 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 accidentally activated. Check by tuning a radio receiver to 121.5 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 insure against outside interference.

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.

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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 Warrior.

Every owner should stay in close contact with his Piper dealer or distributor and Authorized Piper Service Center to obtain the latest information pertaining to his aircraft and to avail himself of the Piper Aircraft Service Back-up.

Piper Aircraft Corporation takes a continuing interest in having the owner get the most efficient use from his aircraft and keeping it in the best mechanical condition. Consequently, Piper Aircraft from time to time issues Service Bulletins, Service Letters and Service Spares Letters relating to the aircraft.

Service Bulletins are of special importance and should be complied with promptly. These are sent to the latest registered owners, distributors and dealers. Depending on the nature of the bulletin, material and labor allowances may apply, and will be addressed in the body of the Bulletin.

Service Letters deal with product improvements and service hints pertaining to the aircraft. They are sent to dealers, distributors and occasionally (at the factory's discretion) to latest registered owners, so they can properly service the aircraft and keep it up to date with the latest changes. Owners should give careful attention to the 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.

If an owner is not having his aircraft serviced by an Authorized Piper Service Center, he should periodically check with a Piper dealer or distributor to find out the latest information to keep his aircraft up to date.

Piper Aircraft Corporation has a Subscription Service for the Service Bulletins, Service Letters and Service Spares Letters. This service is offered to interested persons such as owners, pilots and mechanics at a nominal fee, and may be obtained through Piper dealers and distributors.

A service manual, parts catalog, and revisions to both, are available from your Piper dealer or distributor. Any correspondence regarding the airplane should include the airplane model and serial number to insure proper response.

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8.3 AIRPLANE INSPECTION PERIODS

The Federal Aviation Administration (FAA) occasionally publishes Airworthiness Directives (ADs) that apply to specific groups of aircraft. They are mandatory changes and are to be complied with within a time limit set by the FAA. When an AD is issued, it is sent to the latest registered owner of the affected aircraft and also to subscribers of the service. The owner should periodically check with his Piper dealer or A & P mechanic to see whether he has the latest issued AD against his aircraft.

Piper Aircraft Corporation provides for the initial and first 50-hour inspection, at no charge to the owner. The Owner Service Agreement which the owner receives upon delivery of the aircraft should be kept in the aircraft at all times. This identifies him to authorized Piper dealers and entitles the owner to receive service in accordance with the regular service agreement terms. This agreement also entitles the transient owner full warranty by any Piper dealer in the world.

One hundred hour inspections are required by law if the aircraft is used commercially. Otherwise this inspection is left to the discretion of the owner. This inspection is a complete check of the aircraft and its systems, and should be accomplished by a Piper Authorized Service Center or by a qualified aircraft and power plant mechanic who owns or works for a reputable repair shop. The inspection is listed, in detail, in the inspection report of the appropriate Service Manual.

An annual inspection is required once a year to keep the Airworthiness Certificate in effect. It is the same as a 100-hour inspection except that it must be signed by an Inspection Authorized (IA) mechanic or a General Aviation District Office (GADO) representative. This inspection is required whether the aircraft is operated commercially or for pleasure.

A Progressive Maintenance program is approved by the FAA and is available to the owner. It involves routine and detailed inspections at 50-hour intervals. The purpose of the program is to allow maximum utilization of the aircraft, to reduce maintenance inspection cost and to maintain a maximum standard of continuous airworthiness. Complete details are available from Piper dealers.

A spectographic analysis of the oil is available from several sources. This system, if used intelligently, provides a good check of the internal condition of the engine. For this system to be accurate, oil samples must be sent in at regular intervals, and induction air filters must be cleaned or changed regularly.

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 in air carrier service. The following is a list of the maintenance which the pilot may perform:

(a) Repair or change tires and tubes.
(b) Service landing gear wheel bearings, such as cleaning, greasing or replacing.
(c) Service landing gear shock struts by adding air, oil or both.
(d) Replace defective safety wire and cotter keys.
(e) Lubrication not requiring disassembly other than removal of non-structural items such as cover plates, cowling or fairings.
(f) Replenish hydraulic fluid in the hydraulic reservoirs.
(g) Refinish the exterior or interior of the aircraft (excluding balanced control surfaces) when removal or disassembly of any primary structure or operating system is not required.
(h) Replace side windows and safety belts.
(i) Replace seats or seat parts with replacement parts approved for the aircraft.
(j) Replace bulbs, reflectors and lenses of position and landing lights.
(k) Replace cowling not requiring removal of the propeller.
(l) Replace, clean or set spark plug clearance.
(m) Replace any hose connection, except hydraulic connections, with replacement hoses.
(n) Replace prefabricated fuel lines.
(o) Replace the battery and check fluid level and specific gravity.

Although the above work is allowed by law, each individual should make a self analysis as to whether he has the ability to perform the work.

If the above work 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 below the forward ledge of the 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) While taxiing, make slight turns to ascertain the effectiveness of the steering.
(3) Observe wing clearance when taxiing near buildings or other stationary objects. If possible, station an observer outside the airplane.
(4) When taxiing over uneven ground, avoid holes and ruts.
(5) 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.

(c) Parking

When parking the airplane, be sure that it is sufficiently 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

The wet-type polyurethane foam air filter must be inspected at least once every fifty hours. Under extremely adverse operating conditions, it may be necessary to inspect the filter more frequently. The filter is disposable and inexpensive and a spare should be kept on hand for a rapid replacement.

(a) Removal Of Engine Air Filter

The filter is located in the lower right front of the engine compartment and may be removed by the following procedure:

(1) Open the right side of the engine cowling.
(2) Loosen each of the four quarter-turn fasteners securing the air filter cover.
(3) Separate the cover and remove the filter.
(4) Inspect the filter. If it is excessively dirty or shows any damage, replace it immediately.

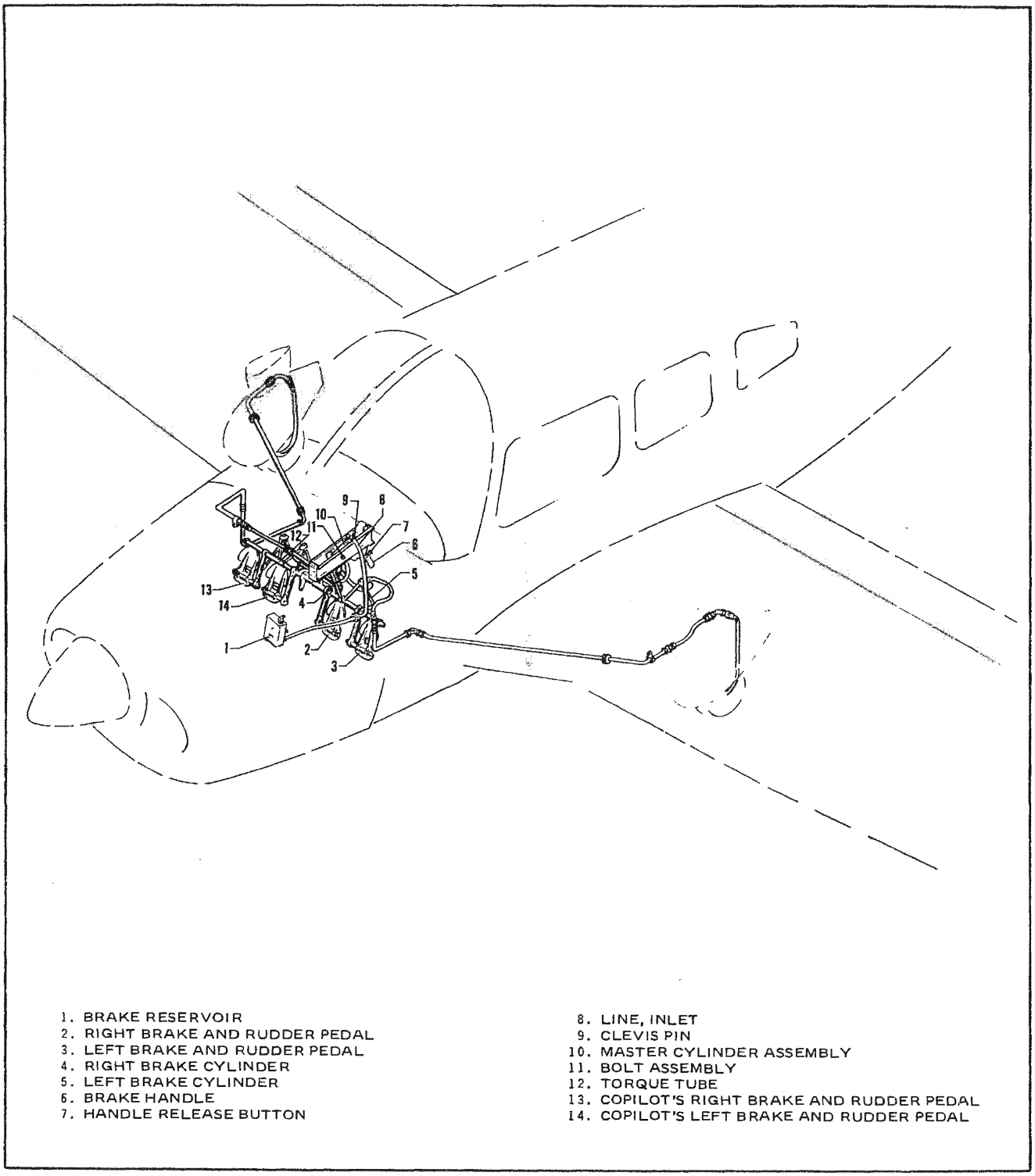
(b) Installation Of Engine Air Filter

When 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 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.



BRAKE SYSTEM

Figure 8-1

8.15 LANDING GEAR SERVICE

The main landing gears use Cleveland Aircraft Products 6.00 x 6 wheels and the nose gear carries a Cleveland 5.00 x 5 wheel. All three tires are four-ply rating, type III tires with tubes. (Refer to paragraph 8.23.)

Wheels are removed by taking off the hub cap, cotter pin, axle nut, and the two bolts holding the brake segment in place. Mark tire and wheel for reinstallation; then dismount by deflating the tire, removing the three through-bolts from the wheel and separating the wheel halves.

Landing gear oleos on the Cherokee Warrior should be serviced according to the instructions on the units. The main oleos should be extended under normal static load until 4.50 ± .25 inches of oleo piston tube is exposed, and the nose gear should show 3.25 ± .25 inches. Should the strut exposure be below that required, it should be determined whether air or oil is required 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 strut has sufficient fluid, it will be visible up to the bottom of the filler plug hole and will then require only proper inflation.

Should fluid be below the bottom of the filler plug hole, oil should be added. Replace the plug with valve core removed; attach a clear plastic hose to the valve stem of the filler plug and submerge the other end in a container of hydraulic fluid. Fully compress and extend the strut several times, thus drawing fluid from the container and expelling air from the strut chamber. To allow fluid to enter the bottom chamber of the main gear strut housing, the torque link assembly must be disconnected to let the strut be extended a minimum of 10 inches (the nose gear torque links need not be disconnected). Do not allow the strut to extend more than 12 inches. When air bubbles cease to flow through the hose, compress the strut fully and again check fluid level. Reinstall the valve core and filler plug, and the main gear torque links, if disconnected.

With fluid in the strut housing at the correct level, attach a strut pump to the air valve and with the airplane on the ground, inflate the oleo strut to the correct height.

In jacking the aircraft for landing gear or other service, two hydraulic jacks and a tail stand should be used. At least 250 pounds of ballast should be placed on the base of the tail stand before the airplane is jacked up. The hydraulic jacks should be placed under the jack points on the bottom of the wing and the airplane jacked up until the tail skid is at the right height to attach the tail stand. After the tail stand is attached and the ballast added, jacking may be continued until the airplane is at the height desired.

The steering arms from the rudder pedals to the nose wheel are adjusted at the nose wheel by turning the threaded rod end bearings in or out. Adjustment is normally accomplished at the forward end of the rods and should be done in such a way that the nose wheel is in line with the fore and aft axis of the plane when the rudder pedals and rudder are centered. Alignment of the nose wheel can be checked by pushing the airplane back and forth with the rudder centered to determine that the plane follows a perfectly straight line. The turning arc of the nose wheel is 30.0° ± 2° in either direction and is limited by stops on the bottom of the forging.

The rudder pedal arm stops should be carefully adjusted so that the pedal arms contact the stops just after the rudder hits its stops. This guarantees that the rudder will be allowed to move through its full travel.

8.17 PROPELLER SERVICE

The spinner and backing plate should be frequently cleaned and inspected for cracks. 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-320 series engine is 8 quarts, and the minimum safe quantity is 2 quarts. It is recommended that the oil be changed every 50 hours and sooner under unfavorable operating conditions. Intervals between oil changes can be increased as much as 100% on engines equipped with full flow (cartridge type) oil filters, provided the element is replaced each 50 hours of operation and the specified octane fuel is used. Should fuel other than the specified octane rating for the power plant be used, refer to the latest issue of Lycoming Service Letter No. L185 and Lycoming Service Instruction No. 1014 for additional information and recommended service procedures. The following grades are recommended for the specified temperatures:

Average Ambient Air Temperature For Starting	Single Viscosity Grade	Multi-Viscosity Grades
Above 60° F	SAE 50	SAE 40 or SAE 50
30° to 90° F	SAE 40	SAE 40
0° to 70° F	SAE 30	SAE 40 or 20W-30
Below 10° F	SAE 20	SAE 20W-30

8.21 FUEL SYSTEM

(a) Servicing Fuel System

At every 50 hour inspection, the fuel screens in the strainer, in the electric fuel pumps, and at the carburetor inlet must be cleaned.

(b) Fuel Requirements

The minimum aviation grade fuel for the PA-28-151 is 80/87. 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 80/87 is not available, the lowest lead 100 grade should be used. (See Fuel Grade Comparison Chart, Page 8-12.) Refer to the latest issue of Lycoming Service Instruction No. 1070 for additional information.

The continuous use, more than 25% of the operating time, of the higher leaded fuels can result in increased engine deposits, both in the combustion chamber and in the engine oil. It may require increased spark plug maintenance and more frequent oil changes. The frequency of spark plug maintenance and oil drain periods will be governed by the amount of lead per gallon and the type of operation. Operation at full rich mixture requires more frequent maintenance periods; therefore it is important to use proper approved mixture leaning procedures.

Reference the latest issue of Avco Lycoming Service Letter No. L185 attached to the Engine Operators Manual for care, operation and maintenance of the airplane when using the higher leaded fuel.

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-5572E) Amendment No. 3		
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
91/98	blue	2.0	*100LL	blue	2.0	none	none	none
100/130	green	3.0	100	green	**3.0	100/130	green	**3.0
115/145	purple	4.6	none	none	none	115/145	purple	4.6

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

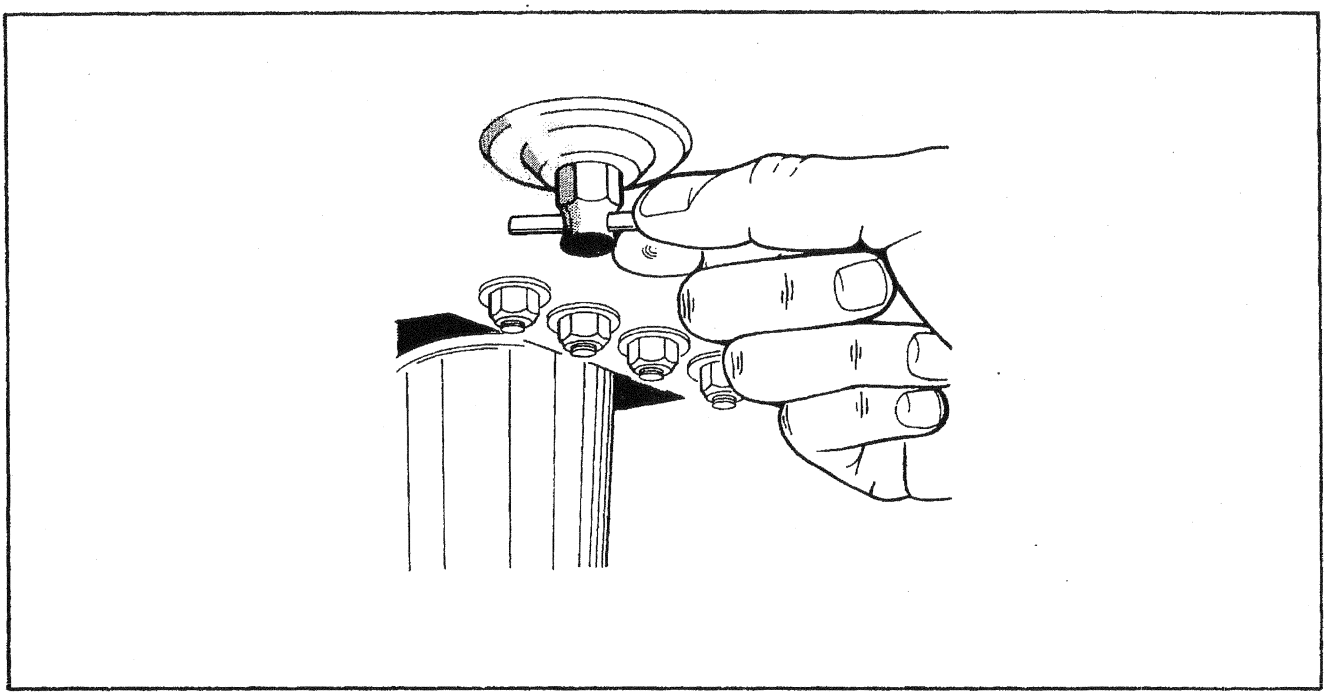
(d) Draining Fuel Strainer, Sumps and Lines

The fuel system sumps and strainer should be drained daily prior to the first flight and after refueling to avoid the accumulation of contaminants such as water or sediment. Each fuel tank is equipped with an individual quick drain located at the lower inboard rear corner of the tank. The fuel strainer is equipped with a quick drain located on the front lower corner of the firewall. Each of the fuel tank sumps should be drained first. Then the fuel strainer should be drained twice, once with the fuel selector valve on each tank. Each time fuel is drained, sufficient fuel should be allowed to flow to ensure removal of contaminants. This fuel should be collected in a suitable container, examined for contaminants, and then discarded.

CAUTION

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

Each quick drain should be checked after closing it to make sure it has closed completely and is not leaking.



FUEL DRAIN

Figure 8-3

(e) Draining Fuel System

The bulk of the fuel may be drained from the system by opening the valve at the inboard end of each fuel tank. Push up on the arms of the drain valve and turn counterclockwise to hold the drain open. The remaining fuel in the system may be drained through the filter bowl. Any individual tank may be drained by closing the selector valve and then draining the desired tank.

8.23 TIRE INFLATION

For maximum service from the tires, keep them inflated to the proper pressures - 30 psi for the nose gear and 24 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 obtained by raising the rear seat and removing the cover of the battery box. The plastic battery box has a drain 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 only water. 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.

(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.

(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 naphtha.
(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 tetrachoride, 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 removed and cleaned like any household carpet.

8.29 WINTERIZATION

For winter operation a winterization plate is installed on the inlet opening of the oil cooler. This plate should be installed whenever the ambient temperature reaches 50°F or less. The plate should be removed and stored in the cockpit when the ambient temperature exceeds 50°F.

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SUPPLEMENTS

9.1 GENERAL

This section provides information in the form of Supplements which are necessary for efficient operation of the airplane when equipped with one or more of the various optional systems and equipment not provided with the standard airplane.

All of the Supplements provided by this section are "FAA Approved" and consecutively numbered as a permanent part of this Handbook. The information contained in each Supplement applies only when the related equipment is installed in the airplane.

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SUPPLEMENT 1

AUTOFLITE II AUTOPILOT INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional AutoFlite II Autopilot is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional AutoFlite II Autopilot is installed.

SECTION 2 - LIMITATIONS

(a) Autopilot use prohibited above 155 KIAS.
(b) Autopilot "OFF" during takeoff and landing.

SECTION 3 - EMERGENCY PROCEDURES

(a) In case of malfunction PRESS disconnect switch on pilot's control wheel.
(b) Rocker switch on instrument panel "OFF."
(c) Unit may be overpowered manually at either control wheel.
(d) In climb, cruise or descent configuration a malfunction with a 3 second delay in recovery initiation may result in 60° bank and 320' altitude loss. Maximum altitude loss measured at 155 KIAS in a descent.
(e) In approach configuration a malfunction with a 1 second delay in recovery initiation results in 15° bank and 20' altitude loss.

SECTION 4 - NORMAL PROCEDURES

(a) Engagement
    (1) Rocker Switch on instrument panel - ON.
    (2) Disconnect Switch on left hand side of pilot's control wheel - RELEASED.

(b) Disengagement
    (1) Depress Disconnect Switch on pilot's control wheel (or)
    (2) Rocker Switch on instrument panel - OFF.

(c) Heading Changes
    (1) Depress Disconnect Switch, make Heading Change, release Disconnect Switch.
    (2) Move Trim Knob on instrument for Drift Correction from a constant heading.
    (3) Move Turn Command Knob on instrument for right or left banked turns.

(d) OMNI Tracker
    (1) Center Turn Command Knob and push IN to engage Tracker.
    (2) Trim Knob - push IN for high sensitivity.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 2

AUTOCONTROL IIIB AUTOPILOT INSTALLATION

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Piper AutoControl IIIB Autopilot is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional Piper AutoControl IIIB Autopilot is installed.

SECTION 2 - LIMITATIONS

(a) Autopilot use prohibited above 126 KIAS.
(b) Autopilot "OFF" during takeoff and landing.

SECTION 3 - EMERGENCY OPERATION

(a) In an emergency the AutoControl IIIB can be disconnected by:
    (1) Pushing the A/P ON-OFF Switch "OFF."
    (2) Pulling the Autopilot Circuit Breaker.
(b) The autopilot can be overpowered at either control wheel.
(c) An autopilot runaway, with a 3 second delay in the initiation of recovery while operating in a climb, cruise or descending flight, could result in a 60° bank and 100' altitude loss.
(d) An autopilot runaway, with a 1 second delay in the initiation of recovery, during an approach operation, coupled or uncoupled, could result in a 10° bank and 10' altitude loss.

SECTION 4 - NORMAL PROCEDURES

PREFLIGHT

(a) AUTOPILOT
    (1) Place Radio Coupler in "HDG" Mode and place the A/P "ON-OFF" switch to the "ON" position to engage roll section. Rotate roll command knob left and right and observe that control wheel describes a corresponding left and right turn, then center knob.
    (2) Set correct compass heading on D.G. and turn HDG bug to aircraft heading. Engage "HDG" mode switch and rotate HDG bug right and left. Aircraft control wheel should turn same direction as bug. While D.G. bug is set for a left turn, grasp control wheel and override the servo to the right. Repeat in opposite direction for right turn.

(3) Tune and identify VOR or VOT station. Position Radio Coupler to OMNI Mode. Engage Autopilot ROLL and HDG switches. Set HDG bug to aircraft heading and rotate O.B.S. to cause OMNI indicator needle to swing left and right slowly. Observe that control wheel rotates in direction of needle movement.
(4) Disengage A/P "ON-OFF" switch. Reset Radio Coupler control to HDG.

IN-FLIGHT

(a) Trim airplane (ball centered).

(b) Check air pressure vacuum to ascertain that the directional gyro and attitude gyro are receiving sufficient air.

(c) Roll Section.
(1) To engage, center ROLL knob, push A/P "ON-OFF" switch to "ON" position. To turn, rotate console ROLL knob in desired direction. (Maximum angle of bank should not exceed 30°.)
(2) For heading mode, set directional gyro with magnetic compass. Push directional gyro HDG knob in, rotate bug to aircraft heading. Push console heading (HDG) switch to "ON" position. To select a new aircraft heading, push D.G. heading knob "IN" and rotate, in desired direction of turn, to the desired heading.

NOTE

In HDG mode the maximum bank angles are limited to approximately 20° and single command, heading changes should be limited to 150° (HDG bug not more than 150° from actual aircraft heading).

(d) VOR
To Intercept:
(1) Using OMNI Bearing Selector, dial desired course inbound or outbound.
(2) Set identical heading on Course Selector D.G.
(3) After aircraft has stabilized, position coupler mode selector knob to OMNI mode. As aircraft nears selected radial, interception and crosswind correction will be automatically accomplished without further switching.

NOTE

If aircraft position is less than 45° from selected radial, aircraft will intercept before station. If position is more than 45°, interception will occur after station passage. As the aircraft nears the OMNI station, (1/2 nautical mile) the zone of confusion will direct an "S" turn in alternate directions as the OMNI indicator needle swings. This alternate banking limited to the standard D.G. bank angle, is an indication of station passage.

To Select New Course:

(1) To select a new course or radial, rotate the HDG bug to the desired HDG (match course).

(2) Rotate OBS to the new course. Aircraft will automatically turn to the intercept heading for the new course.

To Change Stations:

(1) If same course is desired, merely tune receiver to new station frequency.

(2) If different course is desired, position coupler mode selector to HDG mode. Dial course selector D.G. to new course. Dial OBS to new course and position coupler mode selector to OMNI mode.

(e) VOR Approach

Track inbound to station as described in VOR navigation section. After station passage:

(1) Dial outbound course on Course Selector D.G., then dial same course on OBS.

(2) After established on outbound radial, position coupler mode selector to HDG mode and select outbound procedure turn heading. After 40 seconds to 1 minute select a turn in the desired direction with the Course Selector D.G. to the inbound procedure turn heading.

(3) Set OBS to inbound course.

(4) When aircraft heading is 45° to the inbound course, dial Course Selector D.G. to inbound course and position coupler mode selector to OMNI mode.

NOTE

For precise tracking over OMNI station, without "S" turn, position coupler mode selector to HDG mode just prior to station passage. If holding pattern is desired, position coupler mode selector to HDG mode at station passage inbound and select outbound heading in direction of turn. After elapsed time, dial inbound course on Course Selector D.G. When aircraft heading is 45° to radial, position coupler mode selector to OMNI mode.

(f) LOC Approach Only

(1) To intercept dial ILS outbound course on Course Selector D.G. When stabilized, position coupler mode selector to LOC REV mode.

(2) After interception and when beyond outer marker, position coupler mode selector to HDG mode and dial outbound procedure turn heading. After one minute, dial inbound procedure turn heading in direction of turn.

(3) When aircraft heading is 45° to ILS inbound course dial inbound course on Course Selector D.G. and position coupler mode selector to LOC NORM mode.

(4) At the missed approach point (M.A.P.), or when missed approach is elected, position coupler mode selector to HDG mode and execute missed approach procedure.

(g) LOC Approach - Back Course (Reverse)

(1) To intercept dial ILS Back Course outbound heading on Course Selector D.G. When stabilized, position coupler mode selector to LOC NORM mode.

(2) After interception and when beyond fix, position coupler mode selector to HDG and dial outbound procedure turn heading. After one minute, dial inbound procedure turn heading in direction of turn.

(3) When heading 45° to inbound course, dial inbound course on Course Selector D.G. and position coupler mode selector to LOC REV mode.

(4) Approximately 1/2 nautical mile from runway, position coupler mode selector to HDG mode to prevent "S" turn over ILS station near runway threshold.

(5) Missed approach - same as Front Course. (See (f) (4).

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

SUPPLEMENT 3

PIPER ELECTRIC PITCH TRIM

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Piper Electric Pitch Trim is installed. The information contained within this supplement is to be used in conjunction with the complete handbook.

This supplement has been "FAA Approved" as a permanent part of this handbook and must remain in this handbook at all times when the optional Piper Electric Pitch Trim is installed.

SECTION 2 - LIMITATIONS

No changes of the basic limitations provided by Section 2 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 3 - EMERGENCY PROCEDURES

(a) In case of malfunction, disconnect electric pitch trim by pushing pitch trim switch on instrument panel to OFF position.
(b) In an emergency, electric pitch trim may be overpowered using manual pitch trim.
(c) In cruise configuration, malfunction results in 10° pitch change and 200 ft altitude variation.
(d) In approach configuration, a malfunction can result in a 5° pitch change and 50 ft altitude loss.

SECTION 4 - NORMAL PROCEDURES

The electric trim system may be turned ON or OFF by a switch located above the ignition switch. The pitch trim may be changed when the electric trim system is turned on either by moving the manual pitch trim control wheel or by operating the trim control switch on the pilot's control yoke.

SECTION 5 - PERFORMANCE

No changes to the basic performance provided by Section 5 of this Pilot's Operating Handbook are necessary for this supplement.

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SAFETY TIPS

SECTION 10

SAFETY TIPS

10.1 GENERAL

This section provides safety tips of particular value in the operation of the Cherokee Warrior.

10.3 SAFETY TIPS

(a) Learn to trim for takeoff so that only a very light back pressure on the control wheel is required to lift the airplane off the ground.

(b) The best speed for takeoff is about 55 KIAS under normal conditions. Trying to pull the airplane off the ground at too low an airspeed decreases the controllability of the airplane in the event of engine failure.

(c) Flaps may be lowered at airspeeds up to 103 KIAS. To reduce flap operating loads, it is desirable to have the airplane at a slower speed before extending the flaps. The flap step will not support weight if the flaps are in any extended position. The flaps must be placed in the "UP" position before they will lock and support weight on the step.

(d) Before attempting to reset any circuit breaker, allow a two to five minute cooling off period.

(e) Before starting the engine, check that all radio switches, light switches and the pitot heat switch are in the off position so as not to create an overloaded condition when the starter is engaged.

(f) Strobe lights should not be operating when flying through overcast and clouds, since reflected light can produce spacial disorientation. Do not operate strobe lights when taxiing in the vicinity of other aircraft.

(g) The rudder pedals are suspended from a torque tube which extends across the fuselage. The pilot should become familiar with the proper positioning of his feet on the rudder pedals so as to avoid interference with the torque tube when moving the rudder pedals or operating the toe brakes.

(h) In an effort to avoid accidents, pilots should obtain and study the safety related information made available in FAA publications such as regulations, advisory circulars, Aviation News, AIM and safety aids.

(i) The shape of the wing fuel tanks is such that in certain maneuvers the fuel may move away from the tank outlet. If the outlet is uncovered, the fuel flow will be interrupted and a temporary loss of power may result. Pilots can prevent inadvertent uncovering of the outlet by avoiding maneuvers which could result in uncovering the outlet.

Extreme running turning takeoffs should be avoided as fuel flow interruption may occur.

Prolonged slips or skids which result in excess of 2000 ft. of altitude loss, or other radical or extreme maneuvers which could cause uncovering of the fuel outlet must be avoided as fuel flow interruption may occur when tank being used is not full.