SARATOGA II HP

PA-32R-301

SN 3246018 AND UP

PILOT'S OPERATING HANDBOOK

AND

FAA APPROVED AIRPLANE FLIGHT MANUAL

AIRPLANE SERIAL NO. 3246060 **AIRPLANE REGIST. NO.** N123AX

PA-32R-301
REPORT: VB-1600 FAA APPROVED BY: Peter E. Peck

PETER E. PECK
D.O.A. No. SO-1
THE NEW PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA

DATE OF APPROVAL:
NOVEMBER 30, 1995

FAA APPROVED IN NORMAL CATEGORY BASED ON CAR 3. THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY CAR 3 AND CONSTITUTES THE APPROVED AIRPLANE FLIGHT MANUAL AND MUST BE CARRIED IN THE AIRPLANE AT ALL TIMES

Piper

WARNING

EXTREME CARE MUST BE EXERCISED TO LIMIT THE USE OF THIS HANDBOOK TO APPLICABLE AIRCRAFT. THIS HANDBOOK IS VALID FOR USE WITH THE AIRPLANE IDENTIFIED ON THE FACE OF THE TITLE PAGE. SUBSEQUENT REVISIONS SUPPLIED BY PIPER MUST BE PROPERLY INSERTED.

Published by
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Issued: November 30, 1995

APPLICABILITY

Application of this handbook is limited to the specific Piper PA-32R-301 model airplane designated by serial number on the face of the title page of this handbook.

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

REVISIONS

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

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

I. Revisions

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

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

II. Identification of Revised Material

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

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.

ORIGINAL PAGES ISSUED

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

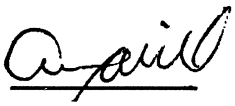
Title, ii through vii, 1-1 through 1-12, 2-1 through 2-12, 3-1 through 3-18, 4-1 through 4-28, 5-1 through 5-32, 6-1 through 6-14, 7-1 through 7-34, 8-1 through 8-18, 9-1 through 9-25, 10-1 through 10-2.

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Current Revision to the PA-32R-301, Saratoga II HP Pilot's Operating Handbook, REPORT: VB-1600 issued November 30, 1995.

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 1 (PR960717)	v 2-8 3-ii 3-17 5-9 5-17 6-9 6-13 7-i 7-7 7-20	Revised Log or Rev.'s. Revised Header & Placards. Revised TOC. Revised Heading No. Revised List of Figs. Revised Fig. 5-13. Revised Para. 6.7. Revised Fig. 6-13. Revised TOC. Revised Para. 7.9. Revised Caution.	Peter E. Peck July 17, 1996 Date
Rev. 2 (PR960830)	v 9-26 9-27 thru 9-28	Revised Log or Rev.'s. Revised Footer Typo. Added Supplement No. 5.	Peter E. Peck Aug. 30, 1996 Date
Rev. 3 (PR970918)	v 4-ii 4-9 4-10 4-27 4-28 5-16 5-29 7-7 7-26 7-27	Revised Log of Rev.'s. Revised Table of Contents. Revised Para. 4.5. Revised Para. 4.5. Added Para. 4.39. Added Para. 4.39. Revised Fig. 5-11. Revised Fig. 5-37. Revised Para. 7.9. Revised Para. 7.23. Revised Para. 7.23.	Peter E. Peck Sep. 18, 1997 Date

PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 4 (PR020415)	vi 2-3 2-4	Added Rev. 4 to L of R. Revised para. 2.7. Revised para. 2.9.	 Albert J. Mill April 15, 2002 Date

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SECTION 1

GENERAL

1.1 INTRODUCTION

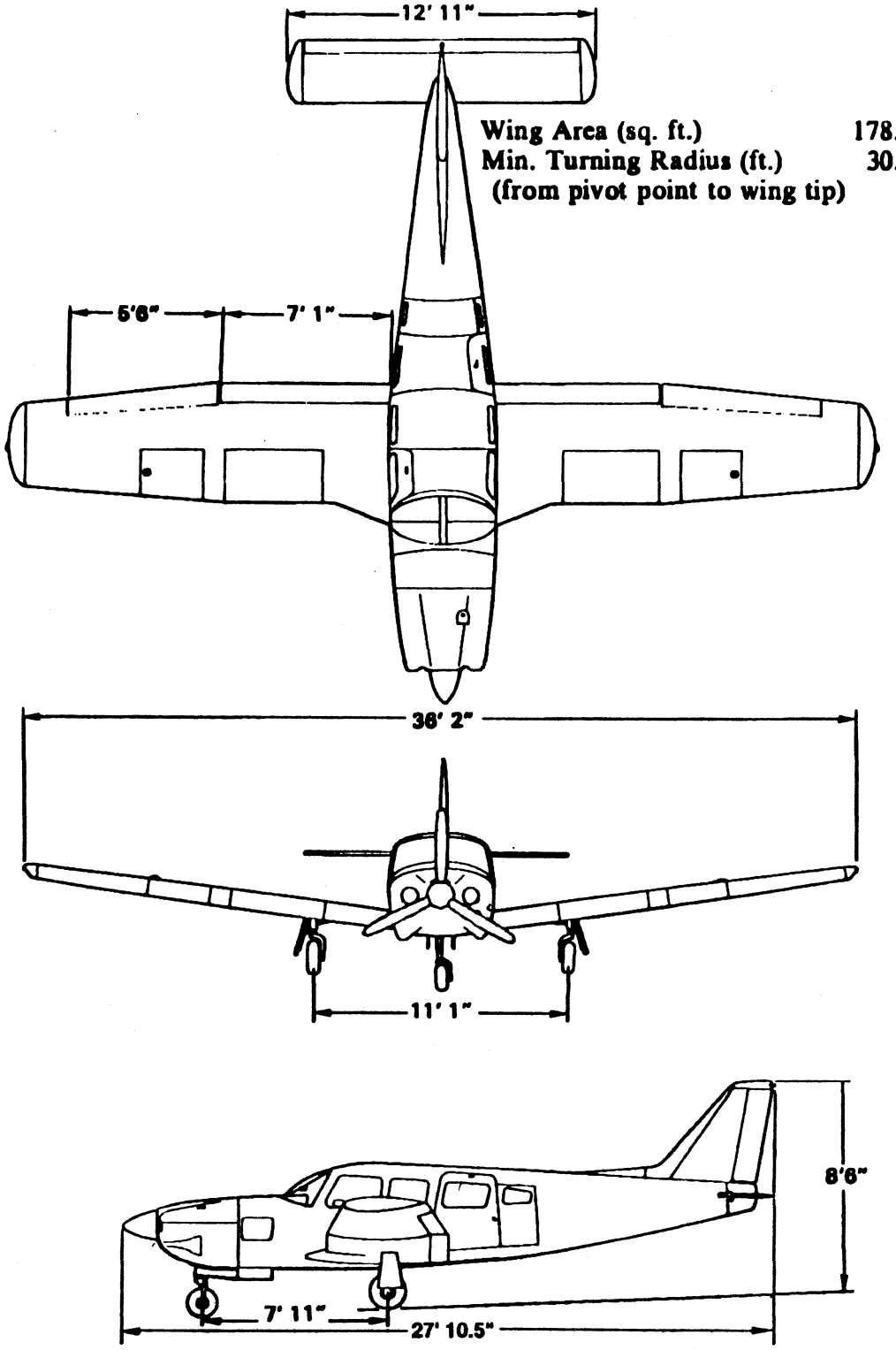
This Pilot's Operating Handbook is designed for maximum utilization as an operating guide for the pilot. It includes the material required to be furnished to the pilot by FAR/CAR. It also contains supplemental data supplied by the airplane manufacturer.

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 intentionally left blank.



THREE VIEW
Figure 1-1

1.3 ENGINE

(a) Number of Engines	1
(b) Engine Manufacturer	Lycoming
(c) Engine Model Number	IO-540-K1G5
(d) Rated Horsepower	300
(e) Rated Speed (rpm)	2700
(f) Bore (inches)	5.125
(g) Stroke (inches)	4.375
(h) Displacement (cubic inches)	541.5
(i) Compression Ratio	8.7:1
(j) Engine Type	Six Cylinder, Direct Drive, Horizontally Opposed, Air Cooled, Fuel Injected

1.5 PROPELLER

(a) Number of Propellers	1
(b) Propeller Manufacturer	Hartzell
(c) Blade Model	F7663DR
(d) Number of Blades	3
(e) Hub Model	HC-I3YR-1RF
(f) Propeller Diameter (inches)	
(1) Minimum	77
(2) Maximum	78
(g) Propeller Type	Constant Speed, Hydraulically Actuated

1.7 FUEL

AVGAS ONLY

(a) Fuel Capacity (U.S. gal.) (total)	107
(b) Usable Fuel (U.S. gal.) (total)	102
(c) Fuel Grade, Aviation	
(1) Minimum Grade	100 - Green or 100LL - Blue Aviation Grade
(2) Alternate Fuels	Refer to latest revision of Lycoming Service Instruction 1070

1.9 OIL

(a) Oil Capacity (U.S. quarts)	12
(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 80°F	60	60
(2) Above 60°F	50	40 or 50
(3) 30°F to 90°F	40	40
(4) 0° to 70°F	30	30, 40 or 20W-30
(5) 0°F to 70°F	20	20W50 or 15W-50
(6) 0°F to 90°F	20	30 or 20W-30

1.11 MAXIMUM WEIGHTS

(a) Maximum Takeoff Weight (lbs.)	3600
(b) Maximum Landing Weight (lbs.)	3600
(c) Maximum Ramp Weight (lbs.)	3615

	FORWARD	AFT
Compartments	100	100

1.13 STANDARD AIRPLANE WEIGHTS

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

1.15 BAGGAGE SPACE

	FORWARD	AFT
(a) Compartment Volume (cubic feet)	7.0	17.3
(b) Entry Width (inches)	16.0	48.0
(c) Entry Height (inches)	22.0	26.0

1.17 SPECIFIC LOADING

(a) Wing Loading (lbs. per sq. ft.)	20.2
(b) Power Loading (lbs. per hp)	12.0

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 Airpseed is the speed of an aircraft as shown on the airspeed indicator when corrected for instrument error. IAS values published in this handbook assume zero instrument error.
KIAS	Indicated Airspeed expressed in "Knots."
M	Mach number is the ratio of true airspeed to the speed of sound.
TAS	True Airspeed is the airspeed of an airplane relative to undisturbed air which is the CAS corrected for altitude, temperature and compressibility.
V_A	Maneuvering Speed is the maximum speed at which application of full available aerodynamic control will not overstress the airplane.
V_{FE}	Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a prescribed extended position.

V_{LE}	Maximum Landing Gear Extended Speed is the maximum speed at which an aircraft can be safely flown with the landing gear extended.
V_{LO}	Maximum Landing Gear Operating Speed is the maximum speed at which the landing gear can be safely extended or retracted.
V_{NE}/M_{NE}	Never Exceed Speed or Mach Number is the speed limit that may not be exceeded at any time.
V_{NO}	Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air and then only with caution.
V_S	Stalling Speed or the minimum steady flight speed at which the airplane is controllable.
V_{SO}	Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration.
V_X	Best Angle-of-Climb Speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.
V_Y	Best Rate-of-Climb Speed is the airspeed which delivers the greatest gain in altitude in the shortest possible time.

(b) Meteorological Terminology

ISA	International Standard Atmosphere in which: The air is a dry perfect gas; the temperature at sea level is 15° Celsius (59° Fahrenheit); The pressure at sea level is 29.92 inches Hg (1013.2 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 (-0.003564°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 (1013.2 millibars).
Pressure Altitude	Altitude measured from standard sea-level pressure (29.92 in Hg) by a pressure or barometric altimeter. It is the indicated pressure altitude corrected for position and instrument error. In this handbook, altimeter instrument errors are assumed to be zero.
Station Pressure	Actual atmospheric pressure at field elevation.
Wind	The wind velocities recorded as variables on the charts of this handbook are to be understood as the headwind or tailwind components of the reported winds.

(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.
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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SECTION 2

LIMITATIONS

2.1 GENERAL

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

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 (VNE) - Do not exceed this speed in any operation.	191	189
Maximum Structural Cruising Speed (VNO) - Do not exceed this speed except in smooth air and then only with caution.	160	158
Design Maneuvering Speed (VA) - Do not make full or abrupt control movements above this speed.		
At 3600 LBS. G.W.	134	132
At 2230 LBS. G.W.	105	104

CAUTION

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

SPEED	KIAS	KCAS
Maximum Flaps Extended Speed (VFE) - Do not exceed this speed with the flaps extended.	110	109
Maximum Landing Gear Extension Speed (VLO) - Do not exceed this speed when extending the landing gear.	132	130
Maximum Landing Gear Retraction Speed (VLO) - Do not exceed this speed when retracting the landing gear.	110	109
Maximum Landing Gear Extended Speed (VLE) Do not exceed this speed with the landing gear extended.	132	130

2.5 AIRSPEED INDICATOR MARKINGS

MARKING	IAS
Red Radial Line (Never Exceed)	191 KTS
Yellow Arc (Caution Range - Smooth Air Only)	160 KTS to 191 KTS
Green Arc (Normal Operating Range)	67 KTS to 160 KTS
White Arc (Flap Down)	63 KTS to 110 KTS

2.7 POWER PLANT LIMITATIONS

(a)	Number of Engines	1
(b)	Engine Manufacturer	Lycoming
(c)	Engine Model No.	IO-540-K1G5
(d)	Engine Operating Limits	
	(1) Maximum Horse Power	300
	(2) Maximum Rotation Speed (RPM)	2700
	(3) Maximum Oil Temperature (°F)	245
(e)	Oil Pressure	
	Minimum (red line)	25 PSI
	Maximum (red line)	115 PSI
(f)	Fuel Grade (minimum grade)	100 - Green or 100LL - Blue Aviation Grade
(g)	Number of Propellers	1
(h)	Propeller Manufacturer	Hartzell
(i)	Propeller Hub and Blade Model	HC-I3YR-1 RF F7663DR
(j)	Propeller Diameter (inches)	
	Minimum	77
	Maximum	78
(k)	Blade Angle Limits	
	Low Pitch Stop	12.4° ± 0.2°
	High Pitch Stop	32.0° ± 1.0°

2.9 POWER PLANT INSTRUMENT MARKINGS

(a)	Tachometer	
	Green Arc (Normal Operating Range)	600 to 2700 RPM
	Red Line (Maximum)	2700 RPM
(b)	Oil Temperature	
	Green Arc (Normal Operating Range)	100° to 245°F
	Red Line (Maximum)	245F
(c)	Oil Pressure	
	Green Arc (Normal Operating Range)	55 PSI to 95 PSI
	Yellow Arc (Caution Range) (Idle)	25 PSI to 55 PSI
	Yellow Arc (Caution Range) (Start and Warm Up)	95 PSI to 115 PSI
	Red Line (Minimum)	25 PSI
	Red Line (Maximum)	115 PSI
(d)	Cylinder Head Temperature (Not required equipment)	
	Green Arc (Normal Operationg Range)	200° to 500°F
	Red Radial Line (Maximum)	500°F
(e)	Fuel Flow/Pressure	
	Normal Operating Range	0 gal/hr. to 34.9 gal/hr.
(f)	Vacuum Pressure	
	Green arc (normal operating range)	4.8 to 5.2 in. Hg.
	Red Line (minimum)	4.8 in. Hg.
	Red Line (maximum)	5.2 in. Hg.

2.11 WEIGHT LIMITS

(a)	Maximum Takeoff Weight	3600 LBS.
(b)	Maximum Ramp Weight	3615 LBS.
(c)	Maximum Baggage (100 lbs. each compartment)	200 LBS.

NOTE

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

2.13 CENTER OF GRAVITY LIMITS

Weight Pounds	Forward Limit Inches Aft of Datum	Rearward Limit Inches Aft of Datum
3600	91.4	95.0
3200	83.5	95.0
2400 (and less)	78.0	95.0

NOTES

Straight line variation between points given.

The datum used is 78.4 inches ahead of the wing leading edge at the intersection of the untapered and inboard 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

No acrobatic maneuvers including spins approved.

2 17 FLIGHT LOAD FACTORS

(a) Positive Load Factor (Maximum)	3.8 G
(b) Negative Load Factor (Maximum)	No inverted maneuvers approved
(c) Positive Load Factor - Flaps Down (Maximum)	2.0 G
(d) Negative Load Factor - Flaps Down (Maximum)	No inverted maneuvers approved

2.19 TYPES OF OPERATIONS

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.....107 U.S. GAL.
(b) Unusable Fuel.....5 U.S. GAL.
The unusable fuel for this airplane has been determined as 2.5 gallons in each wing in critical flight attitudes (2.5 gallons is the total per side, each side having two interconnected tanks).
(c) Usable Fuel.....102 U.S. GAL.
The usable fuel in this airplane has been determined as 51 gallons in each wing (51 gallons is the total per side, each side having two interconnected tanks).

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2.25 PLACARDS

In full view of the pilot:

THIS AIRPLANE MUST BE OPERATED AS A NORMAL CATEGORY AIRPLANE IN COMPLIANCE WITH THE OPERATING LIMITATIONS STATED IN THE FORM OF PLACARDS, MARKINGS AND MANUALS. NO ACROBATIC MANEUVERS INCLUDING SPINS, APPROVED.

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

WARNING

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

On the instrument panel in full view of the pilot:

VA 134 KIAS at 3600 LBS.
(See A.F.M.)

On the instrument panel in full view of the pilot:

DEMO X-WIND 17 KTS

In full view of the pilot:

V_{LO} 132 DN, 110 UP
V_{LE} 132 MAX

Near gear selector switch:

GEAR UP	**110 KIAS MAX**
DOWN	**132 KIAS MAX**

Adjacent to upper door latch (rear door):

ENGAGE LATCH BEFORE FLIGHT

In full view of the pilot:

DO NOT EXCEED 23 INCHES OF MANIFOLD PRESSURE BELOW 2100 RPM.

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

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

On the inside of the forward baggage compartment:

MAXIMUM BAGGAGE THIS COMPARTMENT 100 LBS. SEE THE LIMITATIONS SECTION OF THE AIRPLANE FLIGHT MANUAL.

On aft baggage closeout:

MAXIMUM BAGGAGE THIS COMPARTMENT 100 LBS. NO HEAVY OBJECTS ON HAT SHELF.

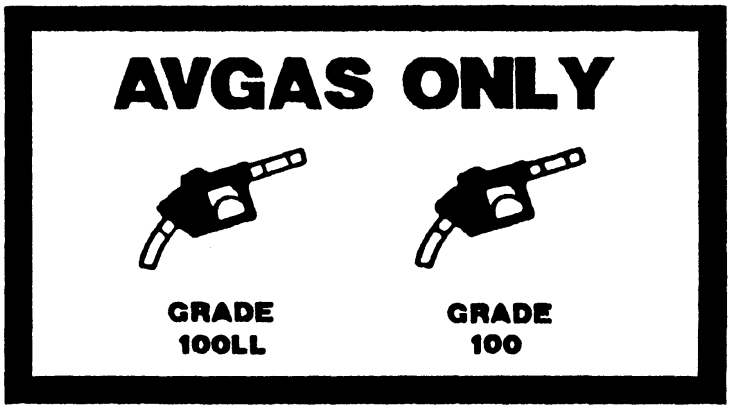
On storm window:

DO NOT OPEN ABOVE 129 KIAS.

On executive writing table:

CAUTION — THIS TABLE MUST BE STOWED DURING TAKEOFF AND LANDING.

Adjacent to fuel tank filler caps:



In full view of the pilot:

SECURE ARMRESTS FOR TAKEOFF AND LANDING

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SECTION 3

EMERGENCY PROCEDURES

3.1 GENERAL

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

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

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

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

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

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

3.3 AIRSPEEDS FOR SAFE OPERATION

Stall Speeds
3600 lbs (Gear Up, 0° Flap) ..... 67 KIAS
3600 lbs (Gear Down, 40° Flap) ..... 63 KIAS
Maneuvering Speeds
3600 lbs ..... 134 KIAS
2230 lbs ..... 105 KIAS
Never Exceed Speed ..... 191 KIAS
Power Off Glide Speed
3600 lbs (Gear Up, 0° Flap) ..... 83 KIAS

3.5 EMERGENCY PROCEDURES CHECKLIST

ENGINE FIRE DURING START

Start ..... 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, leave gear down and land straight ahead.

If area ahead is rough, or if it is necessary to clear obstructions:
Gear selector switch ..... UP

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
Alternate air ..... OPEN
If power is not regained, proceed with power off landing.

ENGINE POWER LOSS IN FLIGHT

If at low altitude:

Airspeed ..... MAINTAIN 83 KIAS Minimum
Prepare for power off landing.

ENGINE POWER LOSS IN FLIGHT (continued)

If altitude permits:

Fuel selector.....switch to tank containing fuel
Electric fuel pump.....ON
Mixture.....RICH
Alternate air.....OPEN
Engine gauges.....check for indication of cause of power loss

If no fuel flow is indicated, check tank selector position to be sure it is on a tank containing fuel.

When power is restored:
Alternate air.....CLOSED
Electric fuel pump.....OFF
Mixture.....adjust as necessary

If power is not restored prepare for power off landing.

POWER OFF LANDING

Trim for 83 KIAS
Locate suitable field.
Establish spiral pattern.
1000 ft. above field at downwind position for normal landing approach.
When field can easily be reached extend full flaps for shortest landing.

Touchdowns should normally be made at lowest possible airspeed with full flaps.

When committed to landing:
Landing gear selector.....DOWN
Flaps.....As desired
Throttle.....Close
Mixture.....idle cut-off
Magnetos.....OFF
Battery Master switch.....OFF
ALTR Switch.....OFF
Fuel selector.....OFF
Seat belt and harness.....tight

NOTE:

If battery master switch is OFF, the landing gear can not be retracted and the gear position lights and flaps will be inoperative

FIRE IN FLIGHT

Source of fire ..... check

Electrical fire (smoke in cabin):

Batt. Master switch ..... OFF
ALTR 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 and defroster ..... 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.

LOSS OF OIL PRESSURE

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

LOSS OF FUEL FLOW

Electric fuel pump ..... ON
Fuel selector ..... check on tank containing usable fuel

ENGINE DRIVEN FUEL PUMP FAILURE

Throttle ..... retard
Electric fuel pump ..... ON
Throttle ..... reset as required

CAUTION:

If normal engine operation and fuel flow is not immediately re-established, the electric fuel pump should be turned OFF. The lack of a fuel flow indication while the electric fuel pump is on could indicate a leak in the fuel system or fuel exhaustion. If fuel system leak is verified, switch fuel selector to off.

HIGH OIL TEMPERATURE

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

ELECTRICAL FAILURES

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

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

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

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

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

ELECTRICAL OVERLOAD (ALTERNATOR OVER 20 AMPS ABOVE KNOWN ELECTRICAL LOAD)

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

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

Land as soon as practical.

NOTE

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

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

Land as soon as possible. Anticipate complete electrical failure.

NOTE

If the battery is depleted, the landing gear must be lowered using the emergency extension procedure. The gear position lights will be inoperative.

PROPELLER OVERSPEED

Throttle .....retard
Oil pressure .....check
Prop control .....full DECREASE rpm, then set if any control available
Airspeed.....reduce
Throttle .....as required to remain below 2700 rpm

EMERGENCY LANDING GEAR EXTENSION

NOTE:

Refer to paragrap;h 4.39 for differences when emergency gear extension is being performed for training purposes.

Prior to emergency extension procedure:

Batt. Master switch .....check ON
ALTR switch .....check ON
Circuit breakers.....check
Day /night dimming switch (in daytime) .....day
Gear indicator bulbs.....check by depressing Annunc. test

If landing gear does not check down and locked:

Airspeed .....Reduce below 90 KIAS

Landing gear selector.....GEAR DOWN POSITION

If landing gear still does not check down and locked:

Emergency gear knob .....PULL, while fish tailing airplane (under normal conditions will take approx. 10 seconds to be down and locked)

If all electrical power has been lost, the landing gear must be extended using the above procedures. The gear position indicator lights will not illuminate.

SPIN RECOVERY

Rudder.....full opposite to direction of rotation

Control wheel.....full forward while neutralizing ailerons

Throttle.....idle
Rudder.....neutral (when rotation stops)

Control wheel .....as required to smoothly regain level flight attitude

OPEN DOOR

If the door latch is open, the door will trail slightly open and airspeeds will be reduced slightly.

To close the door in flight:
Slow airplane to 90 KIAS
Cabin vents .....close
Storm window .....open

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

3.7 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.

3.9 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 valve should be OFF and the mixture at idle cut-off if an external fire extinguishing method is to be used.

3.11 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, leave the landing gear down and land straight ahead.

If the area ahead is rough, or if it is necessary to clear obstructions, move the gear selector switch to the UP position.

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 alternate air should be OPEN.

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 Power Off Landing procedure (refer to the emergency checklist and paragraph 3.15).

3.13 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 a power off landing (refer to paragraph 3.15). An airspeed of at least 83 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 alternate air to OPEN. Check the engine gauges for an indication of the cause of the power loss. If no fuel flow is indicated, check the tank selector position to be sure it is on a tank containing fuel.

When power is restored move the alternate air to the CLOSED position, turn OFF the electric fuel pump and adjust the mixture control as necessary.

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 flow 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 checklist and paragraph 3.15).

3.15 POWER OFF LANDING

If loss of power occurs at altitude, trim the aircraft for best gliding angle (83 KIAS, Air Cond. off) 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. At best gliding angle, with no wind, with the engine windmilling and the propeller control in full DECREASE rpm, the aircraft will travel approximately 1.5 miles for each thousand feet of altitude in a no wind condition. If possible, notify the FAA or any other authority, by radio of your difficulty and intentions. If another pilot or passenger is aboard, let them 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, extend full flaps for the shortest landing. Excess altitude may be lost by widening your pattern, using flaps or slipping, or a combination of these.

Whether to attempt a landing with gear up or down depends on many factors. If the field chosen is obviously smooth and firm, and long enough to bring the plane to a stop, the gear should be down. If there are stumps or rocks or other large obstacles in the field, the gear in the down position will better protect the occupants of the aircraft. If, however, the field is suspected to be excessively soft or short, or when landing in water of any depth, a wheels-up landing will normally be safer and do less damage to the airplane.

Touchdown should normally be made at the lowest possible airspeed with flaps fully extended.

When committed to landing, verify the landing gear selector position as required by field conditions. Lower the flaps as desired, close the throttle, move the mixture to idle cut-off, and shut off the magnetos. Turn the battery master and alternator switches OFF. Move the fuel selector valve to OFF. The seat belts and shoulder harness should be tightened.

NOTE

If the battery master switch is OFF, the gear cannot be retracted. The gear position lights and flaps will be inoperative.

3.17 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 by promptly identified through instrument readings, character of 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), turn the battery master and alternator switches 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, close the throttle, and move the mixture to idle cut-off. Check that the electric fuel pump is OFF. In all cases, the heater and defroster should be OFF. If radio communication is not required select battery master and alternator switches OFF. If the terrain permits, a landing should be made immediately.

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.

3.19 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.

3.21 LOSS OF FUEL FLOW

The most probable cause of loss of fuel flow is either fuel depletion in the fuel tank selected or failure of the engine driven fuel pump. If loss of fuel flow occurs, turn ON the electric fuel pump and check that the fuel selector is on a tank containing usable fuel.

If loss of fuel pressure is due to failure of the engine driven fuel pump the electric fuel pump will supply sufficient fuel flow.

After fuel flow and power are regained, turn the electric fuel pump OFF. If fuel flow starts to drop, turn the electric fuel pump ON and land at the nearest suitable airport as soon as possible and have the cause investigated.

CAUTION

If normal engine operation and fuel flow is not immediately re-established, the electric fuel pump should be turned off. The lack of fuel flow indication could indicate a leak in the fuel system, or fuel exhaustion.

3.23 ENGINE DRIVEN FUEL PUMP FAILURE

If an engine driven fuel pump failure is indicated, retard the throttle and turn ON the electric fuel pump. The throttle should then be reset as required. A landing should be made at the nearest appropriate airport as soon as possible and the cause of the failure investigated.

CAUTION

If normal engine operation and fuel flow is not immediately re-established, the electric fuel pump should be turned off. The lack of a fuel flow indication while the electric fuel pump is on could indicate a leak in the fuel system, or fuel exhaustion. If fuel system leak is verified, switch fuel selector to off.

3.25 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.

3.26 ELECTRICAL FAILURES

Loss of alternator output is detected through zero reading on the ammeter. Before executing the following procedure, insure that the reading is zero and not merely low by actuating an electrically powered device, such as the pitot heat, recognition light, etc. 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 (30.5 volts and up) this procedure should return the ammeter to a normal reading.

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

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

If abnormally high alternator output is observed (more than 20 amps above known electrical load for the operating conditons) it may be caused by a low battery, a battery fault or other abnormal electrical load. If the cause is a low battery, the indication should begin to decrease toward normal within 5 minutes. If the overload condition persists attempt to reduce the load by turning off non-essential equipment.

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

NOTE

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

NOTE

If the battery is depleted, the landing gear must be lowered using the emergency extension procedure. The gear position lights will be inoperative.

3.29 PROPELLER OVERSPEED

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

If propeller overspeed should occur, retard the throttle and check the oil pressure. The propeller control should be moved to full DECREASE rpm and then set if any control is available. Airspeed should be reduced and throttle used to maintain below 2700 RPM.

3.31 EMERGENCY LANDING GEAR EXTENSION

Prior to proceeding with an emergency gear extension, check to insure that the battery master and alternator switches are ON and that the circuit breakers have not opened. If it is daytime, the day/night dimmer switch should be in the day position. Check the landing gear indicators for faulty bulbs by depressing the annunciator press to test..

NOTE

Refer to Par. 4.39 for differences when emergency extension procedure is performed for training purposes.

If the landing gear does not check down and locked, reduce the airspeed to below 90 KIAS. Move the landing gear selector to the DOWN position. If the landing gear still does not check down and locked, PULL the emergency extend knob while fish tailing the airplane.

Under normal conditions, the above procedure, will require approximately 10 seconds for the gear to extend and lock down.

If all electrical power has been lost, the landing gear must be extended using the above procedure. The gear position indicator lights will not illuminate.

3.33 SPIN RECOVERY

Intentional spins are prohibited in this airplane. If a spin is inadvertently entered, immediately apply full rudder opposite to the direction of rotation. Move the control wheel full forward while neutralizing the ailerons. Move the throttle to IDLE. When the rotation stops, neutralize the rudder and ease back on the control wheel as required to smoothly regain a level flight attitude.

3.35 OPEN DOOR

The cabin door is latched through a pin mechanism, so the chances of its springing open in flight is remote. However, should you forget to fully engage the door 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 the door latch is open, the door will trail slightly open, and airspeed will be reduced slightly.

To close the door in flight, slow the airplane to 90 KIAS, close the cabin vents and open the storm window. If the door latch is open, pull on the armrest while moving the latch handle to the latched position.

3.37 ENGINE ROUGHNESS

Engine roughness may be caused by dirt in the injector nozzles, induction filter icing, or ignition problems.

First adjust the mixture for maximum smoothness. The engine will run rough if the mixture is too rich or too lean.

Move the alternate air to OPEN and then turn ON the electric fuel pump.

Switch the fuel selector to another tank to see if fuel contamination is the problem.

Check the engine gauges for abnormal readings. If any gauge readings are abnormal proceed accordingly.

The magneto switch should then be moved to "L" then "R," then back to "BOTH." If operation is satisfactory on either magneto, proceed on that magneto at reduced power with full RICH mixture to a landing at the first available airport.

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

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SECTION 4

NORMAL PROCEDURES

4.1 GENERAL

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

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

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

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

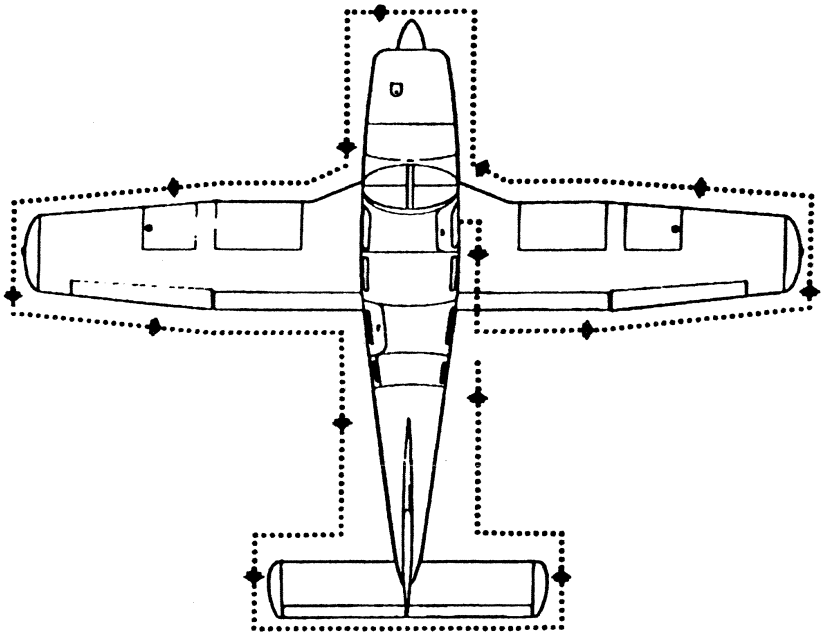
The remainder of the section is devoted to amplified normal procedures which provide detailed information and explanations of the procedures and how to perform them. This portion of the section is not intended for use as an in-flight reference due to the lengthy explanation. The short form checklist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

4.3 AIRSPEEDS FOR SAFE OPERATIONS

The following airspeeds are those which are significant to the 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
gear down, flaps up ..... 85 KIAS
gear up, flaps up ..... 93 KIAS
(b)Turbulent Air Operating Speed (See Subsection 2.3) ..... 134 KIAS
(c)Maximum Flap Speed ..... 111 KIAS
(d)Landing Final Approach Speed (Full Flaps) ..... 80 KIAS
(e)Maximum Demonstrated Crosswind Velocity ..... 17 KTS



WALK-AROUND
Figure 4-1

4.5 NORMAL PROCEDURES CHECKLIST

PREFLIGHT CHECK

COCKPIT

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

Fuel strainer.....drain & check for water & sediment
Control wheel.....release restraints
Gear Handle.....down
Parking brake.....set
Avionics.....OFF
All switches.....OFF
Mixture.....idle cut-off
Magneto switches.....OFF
Battery master switch.....ON
Fuel gauges.....check quantity
Annunciator panel.....check
Flaps.....extend
Battery master switch.....OFF
Primary flight controls.....proper operation
Trim.....neutral
Pitot and static systems.....drain
Windows.....check clean
Required papers and POH.....check on board
Tow bar and baggage.....stow properly - secure
Baggage door-Rear.....close and secure

RIGHT WING

Surface condition.....clear of ice, frost, snow
Flap and hinges.....check
Aileron and hinges.....check
Static wicks.....check - secure
Wing tip and lights.....check
Fuel tank.....check supply visually - secure cap
Fuel quantity gauge.....check
Fuel tank vent.....clear

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

Fuel tank sumps.....drain and check for water, sediment and proper fuel
Tie down and chock.....remove
Main gear strut.....proper inflation (4.5 ± .5 in.)
Tire.....check
Brake block and disc.....check
Fresh air inlet.....clear

NOSE SECTION

Baggage door.....close and secure
General condition.....check
Baggage door.....close and secure
Cowling.....secure
Windshield.....clean
Propeller and spinner.....check
Air inlets.....clear
Engine baffle seals.....check
Chock.....remove
Nose gear strut.....proper inflation (3.25 ± .25 in.)
Nose Gear Doors.....check
Nose wheel tire.....check
Landing Light.....secure
Oil.....check quantity
Dipstick.....properly seated
Oil filler cap.....secure

LEFT WING

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

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

Fuel tank sump.....drain and check for water, sediment and proper fuel
Tie down and chock.....remove
Main gear strut .....proper inflation (4.5 ± .5 in.)
Tire .....check
Brake block and disc .....check
Fuel tank vent.....clear
Fuel quantity gauge .....check
Fuel tank .....check supply visually - secure cap
Stall warning vanes .....check
Pitot head.....remove cover - holes clear
Wing tip and lights .....check
Aileron and hinges.....check
Flap and hinges.....check
Static wicks .....check secure

FUSELAGE

Antennas.....check
Static Vents.....clear
Empennage.....clear of ice, frost, snow
Stabilator and trim tab .....check
Tie down .....remove

MISCELLANEOUS

Battery master switch.....ON
Flaps .....retract
Interior lighting.....ON and check
Pitot heat switch.....ON

CAUTION: Care should be taken when an operational check of the heated pitot head is being performed. The unit becomes very hot. Ground operation should be limited to three minutes to avoid damaging the heater elements.

Exterior lighting switches .....ON and check
Pitot .....check - warm
Stall warning horn.....check
All lighting switches .....OFF
Pitot heat switch.....OFF
Battery master switch .....OFF
Passengers .....board
Doors.....Closed and secure
Seats .....Adjusted & Locked
Seat belts and harness .....fasten/adjust
check inertia reel

NOTE: With the shoulder harness fastened and adjusted, a pull test of it's locking restraint feature should be performed.

ENGINE START - GENERAL

CAUTION: Do not attempt flight if there is no indication of alternator output.

CAUTION: If a positive oil pressure is not indicated within 30 seconds following an engine start, stop the engine and determine the trouble. In cold weather it will take a few seconds longer to get a positive oil pressure indication.

NOTE: Starter manufacturers recommend that starter cranking periods be limited to 30 seconds with a two minute rest period between cranking periods. Longer cranking periods will shorten the life of the starter.

BEFORE STARTING ENGINE

Brakes .....set
Circuit breakers.....check in
Alternate air .....OFF
Propeller .....full INCREASE rpm
Avionics .....OFF
Fuel selector.....desired tank

NORMAL START - COLD ENGINE

Throttle.....1/2 in. open
Battery master switch .....ON
Alternator switch .....ON
Magneto switches .....ON
Electric fuel pump .....ON
Mixture .....prime - then idle cut-off
Propeller.....clear
Starter.....engage
Mixture.....full RICH
Throttle .....adjust
Oil pressure .....check

NORMAL START - HOT ENGINE

Throttle ..... 1/2 in. open
Battery master switch ..... ON
Alternator switch ..... ON
Magneto switches ..... ON
Electric fuel pump ..... ON
Mixture ..... idle cut-off
Propeller ..... clear
Starter ..... engage
Mixture ..... advance
Throttle ..... adjust
Oil pressure ..... check

ENGINE START WHEN FLOODED

Throttle ..... open full
Battery master switch ..... ON
Alternator switch ..... ON
Magneto switches ..... ON
Electric fuel pump ..... OFF
Mixture ..... idle cut-off
Propeller ..... clear
Starter ..... engage
Mixture ..... advance
Throttle ..... retard
Oil Pressure ..... check

STARTING WITH EXTERNAL POWER SOURCE

CAUTION: It is possible to use the ship's battery in parallel by turning only the battery master switch ON. This will give longer cranking capabilities, but will not increase the amperage. Care should be exercised because if the ship's battery has been depleted , the external power supply can be be reduced to the level of the ship's battery. This can be tested by turning only the battery master switch momentarily while the starter is engaged. If cranking speed increases, the ship's battery is at a higher level than the external power supply.

NOTE: For all normal operations using the PEP jumper cables, the battery master and alternator switches should be OFF.

Battery master switch ..... OFF
Alternator switch ..... OFF
Magneto switches ..... ON

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
Battery master switch .....ON - check ammeter
Alternator switch .....ON - check ammeter
Oil pressure .....check

WARM-UP

Throttle .....1000 to 1200 RPM

TAXIING

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

GROUND CHECK

Parking brake .....set
Propeller .....full INCREASE
Throttle .....2000 RPM
Magnetos .....max. drop 175 RPM
- max. diff. 50 RPM
Vacuum .....4.8 to 5.2 in. Hg.
Oil temperature .....check
Oil pressure .....check
Air conditioner .....check
Ammeter .....check
Annunciator panel .....press-to-test
Propeller .....exercise - then
full INCREASE

CAUTION: Alternate air is unfiltered, use of alternate air during ground or flight operations when dust or other contaminant's are present may result in damage from particle ingestion.

Alternate air .....check
Electric fuel pump .....OFF
Fuel flow .....check
Throttle .....retard

BEFORE TAKEOFF

Battery master switch ..... Verify ON
Alternator switch ..... Verify ON
Magneto switches ..... Verify ON
Flight instruments ..... check
Fuel selector ..... proper tank
Electric fuel pump ..... ON
Engine gauges ..... check
Alternate air ..... CLOSED
Seats ..... Adjusted & Locked
Seat backs ..... erect
Belts/harness ..... fastened/check
Empty seats ..... seat belts, securely fastened
Mixture ..... set
Propeller ..... set
Flaps ..... set
Trim ..... set
Controls ..... free
Doors ..... latched
Air conditioner ..... OFF

TAKEOFF

NORMAL TECHNIQUE

Flaps ..... retracted
Trim ..... set
Accelerate to 84 to 88 KIAS, depending on aircraft weight.
Control wheel ..... back pressure to smoothly rotate to climb attitude
Landing gear (when straight ahead landing on runway not possible) ..... up

SHORT FIELD, OBSTACLE CLEARANCE

Flaps ..... 25°
Trim ..... slightly aft of neutral
Throttle ..... full power prior to brake release
Accelerate to 69 to 72 KIAS depending on aircraft weight.
Control wheel ..... back pressure to rotate to climb attitude

After breaking ground, accelerate to 74 to 77 KIAS depending on aircraft weight.

Landing gear .....up
Accelerate to climb speed
Flaps .....retract slowly

CLIMB

Best rate (3600 lb) (gear down)
(flaps up).....85 KIAS
Best rate (3600 lb) (gear up)
(flaps up).....93 KIAS
En route.....105 KIAS
Electric fuel pump .....OFF at desired altitude

CRUISE

Power .....set per power table
Mixture .....adjust

APPROACH AND LANDING

Fuel selector.....proper tank
Seats .....Adjusted & Locked
Seat backs.....erect
Belts/harness .....fasten/adjust
Electric fuel pump .....ON
Mixture .....set
Propeller .....full increase
Gear .....down - 132 KIAS max.
Flaps.....set - 110 knots max.
Air conditioner.....OFF

NORMAL TECHNIQUE

Flaps .....as required
Trim.....95 KIAS
Throttle .....as required

SHORT FIELD TECHNIQUE

Flaps .....40°
Trim.....80 KIAS
Throttle .....as required

GO-AROUND

Propeller.....full INCREASE
Throttle.....full FORWARD
Control wheel.....back pressure to rotate to climb attitude
Airspeed.....83 KIAS
Gear.....UP
Flaps .....retract slowly
Trim .....as required

STOPPING ENGINE

CAUTION:

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

Flaps.....retract
Electric fuel pump.....OFF
Air conditioner.....OFF
Avionics .....OFF
Electrical switches .....OFF
Propeller.....full INCREASE
Throttle.....closed
Mixture .....idle cut-off
Magneto Switches.....OFF
Alternator switch .....OFF
Battery master switch .....OFF

MOORING

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

4.7 PREFLIGHT CHECK

Prior to entering the cockpit place a container under the fuel strainer valve located under the fuselage. 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.

COCKPIT

CAUTION

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

Upon entering the cockpit, drain the fuel strainer by pressing down on the lever located on the right-hand side of the cabin, below the forward edge of center seat. The fuel selector should be positioned in the following sequence while draining the strainer: "OFF," "LEFT" and "RIGHT." This is done to insure that the fuel in the lines between each tank outlet and the fuel strainer is drained, as well as the fuel in the fuel strainer. When the fuel tanks are full, it will take approximately six seconds to drain all the fuel in one of the lines from a tank to the fuel strainer. If the fuel tanks are less than full, it will take a few seconds longer. After draining the fuel strainer, check for leakage and for water and sediment at the drain under the aircraft with the fuel selector on a tank position.

Release the seat belts securing the control wheel and check that the gear selector is in the down position. Set the parking brake by first depressing and holding the toe brake pedals and then pull the parking brake lever while depressing the knob attached to the top of he handle. Insure that all electrical switches are OFF. Turn OFF all avionics equipment (to save power and prevent wear on the units). The mixture should be in idle cut-off and the magneto switches in the OFF position. . Turn ON the battery master switch, check the fuel quantity gauges for adequate supply, check that the annunciator panel illuminates and check the flaps for proper operation. Turn OFF the battery master switch. Check the primary flight controls for proper operation and set the trim to neutral. Open the pitot and static drains to remove any moisture that has accumulated in the lines. Check the windows for cleanliness and that the required papers are on board. Properly stow and secure the tow bar and baggage. Close and secure the rear baggage door.

RIGHT WING

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

Open the fuel cap and visually check the fuel supply. Check the fuel indicator gauge. Each inboard tank is furnished with an external fuel quantity indicator to assist the pilot in determining fuel quantities of less than 35 gallons. The quantity should match the indication that was on the fuel quantity gauge. Replace cap securely. The fuel tank vent should be clear of obstructions.

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

CAUTION

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

Remove the tie down and chock.

Next, complete a check of the landing gear. Check the gear strut for proper inflation; there should be 4.5 ± .5 inches of strut exposure under a normal static load. Check the tire for cuts, wear, and proper inflation. Make a visual check of the brake block and disc.

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

NOSE SECTION

Check the general condition of the nose section. Verify that the nose baggage door is closed, secure, and locked. Look for oil or fluid leakage and that the cowling is secure. Check the windshield and clean if necessary. The propeller and spinner should be checked for detrimental nicks, cracks, or other defects. The air inlets should be clear of obstructions. Check the condition of the engine baffel seals. Check the general condition of the nose wheel door and for excessive play.

Remove the chock and check the nose gear strut for proper inflation; there should be 3.25 ± .5 inches of strut exposure under a normal static load. Check the tire for cuts, wear, and proper inflation. The landing light should be checked for cleanliness and security. Check the oil level; make sure that the dipstick has been properly seated and that the oil filler cap has been properly secured.

LEFT WING

The wing surface should be clear of ice, frost, snow, or other extraneous substances. Check that the fresh air inlet is clear of foreign matter and remove the tie downs and chocks. Check the main gear struts for proper inflation: there should be 4.5 ± .5 inches of strut exposure under a normal static load. Check the tire and the brake block and disc. Remove the chock.

Open the fuel cap and visually check the fuel supply. The quantity should match the indication that was on the fuel quantity gauge. Replace cap securely. (See RIGHT WING for further fuel system description.) The fuel tank vent should be clear of obstructions. Place a container under the quick drain. Drain enough fuel to verify the proper fuel and to insure that all water and sediment has been removed.

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

FUSELAGE

Check the condition of any antennas located on the fuselage. Check that the static vent holes are free of obstructions. All surfaces of the empennage should be examined for damage and operational interference. Fairings and access covers should be attached properly. Check the baggage to be sure it is stowed properly. Check that the lights on the tail are clean and intact. The elevator and rudder should be operational and free from interference of any type. Check the condition of the tabs and insure that all hinges and push rods are sound and operational. If the tail has been tied down, remove the tie down rope.

MISCELLANEOUS

Turn the battery master switch "ON" and begin checking the interior lights by turning "ON" the necessary switches. After the interior lights are checked, turn "ON" the pitot heat switch and the exterior light switches. Next, perform a walk-around check on the exterior lights and examine and dispose of the contents in the container placed under the fuel strainer drain.

With 0° flaps check the stall warning horn by moving the inboard lift detector slightly up. Reset the flaps to 25° or 40° and check the outboard lift detector. Check the heated pitot head for proper heating. Turn all electrical switches and battery master switch OFF.

CAUTION:

Care should be taken when an operational check of the heated pitot head is being performed. The unit becomes very hot. Ground operation should be limited to three minutes maximum to avoid damaging the heating elements.

When all passengers are on board, the pilot should check the cabin doors for proper closing and latching procedures. The rear door should be closed, and the overhead latch button turned to the ``LOCK" position. The front door should be gently pulled shut while the door handle is firmly latched. Seat belts on empty seats should be snugly fastened. All passengers should fasten their seat belts and shoulder harnesses and check that the seats are adjusted and locked in position.

NOTE:

With the shoulder harness fastened and adjusted, a pull test of it's locking restraint feature should be performed.

ENGINE START - GENERAL

CAUTION:

Do not attempt flight if there is no indication of alternator output.

CAUTION:

If a positive oil pressure is not indicated within 30 seconds following an engine start, stop the engine and determine the trouble. In cold weather it will take a few seconds longer to get a positive oil pressure indication.

4.9 BEFORE STARTING ENGINE

Before starting the engine, the brakes should be set and the propeller lever moved to the full INCREASE rpm position. The fuel selector should then be moved to the desired tank. Check to make sure all the circuit breakers are in and the radios are OFF.

4.11 STARTING ENGINE

(a) NORMAL START: Cold Engine

Open the throttle lever approximately 1/2 inch. Turn ON the battery master, alternator, and magneto switches. Turn on the electric fuel pump. Move the mixture control to full RICH for approximately 4 seconds. The engine is now primed.

Move the mixture control to idle cut-off, verify that the propeller area is clear, and engage the starter. When the engine fires, release the starter switch, advance the mixture control to full RICH and move the throttle to the desired setting. Check for proper oil pressure indication.

If the engine does not fire within five to ten seconds, disengage the starter and reprime.

(b) NORMAL START: Hot Engine

Open the throttle approximately 1/2 inch. Turn ON the battery master, alternator, and magneto switches. Turn on the electric fuel pump. Leave the mixture control in idle cut-off. Verify that the propeller area is clear, and engage the starter. When the engine fires, release the starter switch, advance the mixture and move the throttle to the desired setting. Check for proper oil pressure indication.

(c) Starting Engine When Flooded

The throttle lever should be full OPEN. Turn ON the battery master, alternator, and magneto switches. Turn OFF the electric fuel pump. Move the mixture control to idle cut-off, verify that the propeller area is clear, and engage the starter. When the engine fires, release the starter switch, advance the mixture and retard the throttle. Check for proper oil pressure indication.

(d) Starting Engine With External Power Sources

CAUTION

It is possible to use the ship's battery in parallel by turning the battery master switch ON. This will give longer cranking capabilities, but will not increase the amperage. 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.

NOTE

For all normal operations using the PEP jumper cables, the master switch should be OFF.

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.

Verify the battery master and alternator switches are OFF, magneto switches are ON, and all external equipment is OFF. Connect the RED lead of the PEP kit jumper cable to the POSITIVE (+) terminal of an external 24-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. Turn the magneto swithces ON and proceed with the normal starting technique. Batery master and alternator switches will be OFF.

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.

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.

4.13 WARM-UP

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

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

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

4.15 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 chocks have been removed and that propeller back blast and taxi areas are clear. Release the parking brake.

Power should be applied slowly to start the taxi roll. Taxi a few feet forward and apply the brakes to determine their effectiveness. Taxi with the propeller set in low pitch, high RPM setting. While taxiing, make slight turns to ascertain the effectiveness of the steering.

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

Avoid holes and ruts when taxiing over uneven ground.

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

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4.17 GROUND CHECK

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

Check the vacuum gauge; the indicator should read 4.8 inches Hg. to 5.2 inches Hg. at 2000 RPM. Check oil temperature and oil pressure. The temperature may be low for some time if the engine is being run for the first time of the day.

Check the air conditioner and the ammeter for proper operation. The ammeter can be checked by temporary activation of the pitot heat or landing light and observing an increase on the ammeter. .Check the annunciator panel lights with the press-to-test button.

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

CAUTION:

Alternate air is unfiltered. Use of alternate air during ground or flight operations when dust or other contaminant's are present may result in damage from particle ingestion.

The electric fuel pump should be turned OFF briefly 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 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.

4.19 BEFORE TAKEOFF

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

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

Ensure that the battery master, altenator, and magneto switches are ON. 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 alternate air should be in the CLOSED position. All seat backs should be erect, adjusted and locked in position.. All seat belts and shoulder harness must be fastened

NOTE

With the shoulder harness fastened and adjusted, a pull test of its locking restraint feature should be performed.

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

Exercise and set the flaps and trim tab. Insure proper flight control movement and response. All doors should be properly secured and latched and the parking brake released. On air conditioned models, the air conditioner must be OFF to insure normal takeoff performance.

4.21 TAKEOFF

NORMAL TECHNIQUE (SEE CHART, SECTION 5)

When the available runway length is well in excess of that required and obstacle clearance is no factor, the normal takeoff technique may be used. The flaps should be set in the retracted position and the pitch trim set slightly aft of neutral. Align the airplane with the runway, apply full power, and accelerate to 84 to 88 KIAS depending on weight. Apply back pressure to the control wheel to lift off, then control pitch attitude as required to attain the desired climb speed. Retract the landing gear when a straight-ahead landing on the runway is no longer possible.

SHORT FIELD TECHNIQUE (SEE CHART, SECTION 5)

For departure from short runways with adjacent obstructions, a short field takeoff technique with flaps set to 25° should be used in accordance with the short field takeoff ground roll -flaps 25° and short field performance - flaps 25° charts. Maximum power is established before brake release and the airplane is accelerated to 69 to 72 KIAS depending on aircraft weight for liftoff. After liftoff, control the airplane attitude to accelerate to 74 to 77 KIAS depending on aircraft weight, passing through the 50 foot obstacle height. Once clear of the obstacle retract the landing gear and accelerate to 93 KIAS while retracting the flaps.

4.23 CLIMB

The best rate of climb at gross weight and maximum continuous power will be obtained at 93 KIAS. The recommended procedure for climb is to use maximum continuous power with the mixture full rich. For climbing en route, a speed of 105 KIAS is recommended. This will produce better forward speed and increased visibility over the nose during the climb.

Upon reaching a safe altitude, the electric fuel pump may be turned off.

4.25 CRUISING

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

When leveling off at cruise altitude, the pilot may reduce to a cruise power setting in accordance with the *power setting table in section 5 of this manual. When selecting cruising RPM below 2300, limiting manifold pressure for continuous operation, as specified by the appropriate ``Avco-Lycoming Operator's Manual", should be observed.

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

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

*To obtain the performance presented in the Performance Section of this handbook, all conditions listed on the performance charts must be met.

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. The fuel flow meter will give a close approximation of the fuel being consumed. The low side of the power setting, as shown on the fuel flow meter, indicates best economy for that percent of power while the high side indicates best power.

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

Following level-off for cruise, the airplane should be trimmed.

The pilot should monitor weather conditions while flying and should be alert to conditions which might lead to icing. If induction system icing is expected, place the alternate air control in the ON position.

During preflight, keep account of time and fuel used in connection with power settings to determine how the fuel flow and fuel quantity gauge systems are operating. If the fuel flow indication is considerably higher than the fuel actually being consumed, a fuel nozzle may be clogged and require cleaning.

There are no mechanical uplocks in the landing gear system. In the event of a hydraulic system malfunction, the landing gear will free-fall to the gear down position. The true airspeed with gear down is approximately 75% of the gear retracted airspeed for any given power setting. Allowances for the reduction in airspeed and range should be made when planning extended flight between remote airfields or flight over water.

In order to keep the airplane in best lateral trim during cruise flight, the fuel should be used alternately from each tank at one hour intervals.

Always remember that the electric fuel pump should be turned ON before switching tanks, and should be left on for a short period thereafter. To preclude making a hasty selection, and to provide continuity of flow, the selector should be changed to another tank before fuel is exhausted from the tank in use. The electric fuel pump should be normally OFF so that any malfunction of the engine driven fuel pump is immediately apparent. If signs of fuel starvation should occur at any time during flight, fuel exhaustion should be suspected, at which time the fuel selector should be immediately

positioned to the fullest tank and the electric fuel pump switched to the ON position.

4.27 APPROACH AND LANDING

Accomplish the Landing Checklist early in the landing approach.

NOTE

With the shoulder harness fastened and adjusted, a pull test of its locking restraint feature should be performed. Check that all seats are adjusted and locked in position.

Depending on field length and other factors the following procedures are appropriate:

NORMAL TECHNIQUE (No Performance Chart Furnished)

When available runway length is in excess of required runway length, a normal approach and landing technique may be utilized. The aircraft should be flown down the final approach course at 95 KIAS with power required to maintain the desired approach angle. The amount of flap used during approach and landing and the speed of the aircraft at contact with the runway should be varied according to the conditions of wind and aircraft loading. It is generally good practice to contact the ground at the minimum possible safe speed consistent with existing conditions. As landing distances with this technique will vary, performance charts are not furnished.

SHORT FIELD LANDING APPROACH POWER OFF (See Chart, Section 5)

When available runway length is minimal or obstacle clearance to landing is of major concern, this approach/landing technique may be employed. The aircraft should be flown on the final approach at 80 KIAS with full flaps, gear down and idle power. The glide path should be stabilized as early as possible. Reduce the speed slightly during landing flareout and contact the ground close to stall speed. After ground contact, retract the flaps and apply full aft travel on the control wheel and maximum braking consistent with existing conditions.

4.29 GO-AROUND

To initiate a go-around from a landing approach, the prop control should be set to full INCREASE and the throttle should be advanced to full throttle while the pitch attitude is increased to obtain the balked landing climb speed of 83 KIAS. Retract the landing gear and slowly retract the flaps when a positive climb is established. Allow the airplane to accelerate to the best rate of climb speed (93 KIAS). Reset the longitudinal trim as required.

4.31 STOPPING ENGINE

Prior to shutdown, all radio and electrical equipment should be turned OFF.

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

NOTE

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

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

4.33 MOORING

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

The gross weight stalling speed with power off and full flaps is 63 KIAS. With the flaps up this speed is increased 4 KTS. Loss of altitude during stalls can be as great as 400 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, setting the flaps to 25° or 40° and raising the outboard lift detector to determine if the horn is actuated. The flaps should then be reset to 0° and the inboard lift detector raised to determine if the horn is actuated.

4.37 TURBULENT AIR OPERATION

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

4.39 LANDING GEAR

The pilot should become familiar with the function and significance of the landing gear position indicators and warning lights.

The red gear warning light on the instrument panel and the horn operate simultaneously in flight when the throttle is reduced to where the manifold pressure is approximately 14 inches of mercury or below, and the gear selector switch is not in the DOWN position.

The red gear warning light in the annunciator cluster and the horn will operate simultaneously on the ground when the master switch is ON and the gear selector switch is in the UP position.

4.39 LANDING GEAR (CONT'D)

The three green lights on the instrument panel operate individually as each associated gear is locked in the extended position.

When the Emergency Landing Gear Extension Procedure (Par. 3.29) is performed for training purposes, the following changes must be made to the procedure in order to prevent the hydraulic pump from activating during the procedure. Pull the LANDING GEAR PUMP circuit breaker prior to executing the emergency extension procedure. The circuit breaker must be reset after completion of the procedure to allow normal gear system operation.

4.41 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).

4.43 NOISE LEVEL

The corrected noise level of this aircraft is 81.7 dB(a).

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

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

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SECTION 5

PERFORMANCE

5.1 GENERAL

All of the required (FAA regulations) and complementary performance information applicable to the Saratoga II HP is provided in this section.

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

5.3 INTRODUCTION - PERFORMANCE AND FLIGHT PLANNING

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

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

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

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

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

WARNING

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

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5.5 FLIGHT PLANNING EXAMPLE

(a)Aircraft Loading

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

The basic empty weight for the airplane as licensed at the factory has been entered in Figure 6-5. If any alterations to the airplane have been made affecting 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 and C.G. location of the airplane.

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

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

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

(1)Basic Empty Weight	2100 lbs.
(1)Occupants (6 x 170 lbs.)	1020 lbs.
(3)Baggage and Cargo	60 lbs.
(4)Fuel (6 lb/gal. x 50)	300 lbs.
(5)Takeoff Weight	3480 lbs.
(6)Landing Weight	
(a)(5) minus (g)(1),	
(3480 lbs. minus 180 lbs.)	3300 lbs.

The takeoff weight is below the maximum of 3600 lbs. and the weight and balance calculations have determined the C.G. position within the approved limits.

(b) Takeoff and Landing

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

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

Apply the departure airport conditions and takeoff weight to the appropriate Takeoff Performance and Takeoff Ground Roll graph (Figures 5-7, 5-9, 5-11, and 5-13) to determine the length of runway necessary for the takeoff and/or the barrier distance.

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

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

	Departure Airport	Destination Airport
(1)Pressure Altitude	1200 ft.	400 ft.
(2)Temperature	16°C	24°C
(3)Wind Component	10 KTS Headwind	5 KTS Headwind
(4)Runway Length Available	3000 ft.	4600 ft.
(5)Runway Required	2638 ft.*	1460 ft.**
(6)Take off fuel	2 gal.	

*reference Figure 5-7
**reference Figure 5-37

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 the flight plan example is to determine the necessary climb segment components.

The desired cruise pressure altitude and corresponding cruise outside air temperature values are the first variables to be considered in determining the climb components from the Fuel, Distance, and Time to Climb graph (Figure 5-21). After the fuel, distance and time for the cruise pressure altitude and outside air temperature values have been established, apply the existing conditions at the departure field to graph (Figure 5-21). 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 the flight planning example.

(1) Cruise Pressure Altitude	6000 ft.
(2) Cruise OAT	6° C
(3) Time to Climb (7 min. minus 1 min.)	6 min.*
(4) Distance to Climb (11.3 nautical miles minus 1 nautical miles)	10.3 nautical miles*
(5) Fuel to Climb (3.3 gal minus 1 gal.)	2.3 gal.*

*reference Figure 5-21

(d) Descent

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

Utilizing the cruise pressure altitude and OAT, determine the basic fuel, distance and time for descent (Figure 5-33). These figures must be adjusted for the field pressure altitude and temperature at the destination airport. To find the necessary adjustment values, use the existing pressure altitude and temperature conditions at the destination airport as variables to find the fuel, distance and time values from the graph (Figure 5-33). Now, subtract the values obtained from the field conditions from the values obtained from the cruise conditions to find the true fuel, distance and time values needed for the flight plan.

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

(1) Time to Descend (12 min. minus 1 min.)	11 min*
(2) Distance to Descend (28 nautical miles minus 2 nautical miles)	26 nautical miles*
(3) Fuel to Descend (3 gal. minus 0.5 gal.)	2.5 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 and the Power Setting Table (Figure 5-23) 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 Speed Cruise Power graph (Figure 5-27).

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

*reference Figure 5-33

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 consumption by the cruise time.

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

(1)	Total Distance	253 nautical miles
(2)	Cruise Distance (c)(1) minus (c)(4) minus (d)(2), (253 nautical miles minus 10.3 nautical miles minus 26 nautical miles)	217 nautical miles
(3)	Cruise Power	Economy
(4)	Cruise Speed	154 KTAS
(5)	Cruise Fuel Consumption	16.5 GPH
(6)	Cruise Time (e)(2) divided by (e)(4), (217 nautical miles divided by 154 KTS)	1.41 hr. (1 hr. 24 min.)
(7)	Cruise Fuel (e)(5) multiplied by (e)(6), (16.5 GPH multiplied by 1.41 hrs.)	23.2 gal.

(f) Total Flight Time

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

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

(1)	Total Flight Time (c)(3) plus (d)(1) plus (e)(6), (.10 hrs. plus .18 hrs. plus 1.41 hrs.)	1.69 hr.
	(6 min. plus 11 min. plus 1 hr. 24 min.)	1 hr. 41 min.

*reference Figure 5-27

(g) Total Fuel Required

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

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

(1) Total Fuel Required

(b)(5) plus (c)(5) plus (d)(3) plus (e)(7),	
(2.0 gal. plus 2.3 gal. plus 2.5 gal. plus 23.2 gal.)	30.0
(30.0 gal. multiplied by 6 lb/gal.)	180.0 lbs.

5.7 PERFORMANCE GRAPHS

LIST OF FIGURES

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5-2	ISA Conversion	5-12
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5-5	Stall Speed Versus Angle of Bank	5-13
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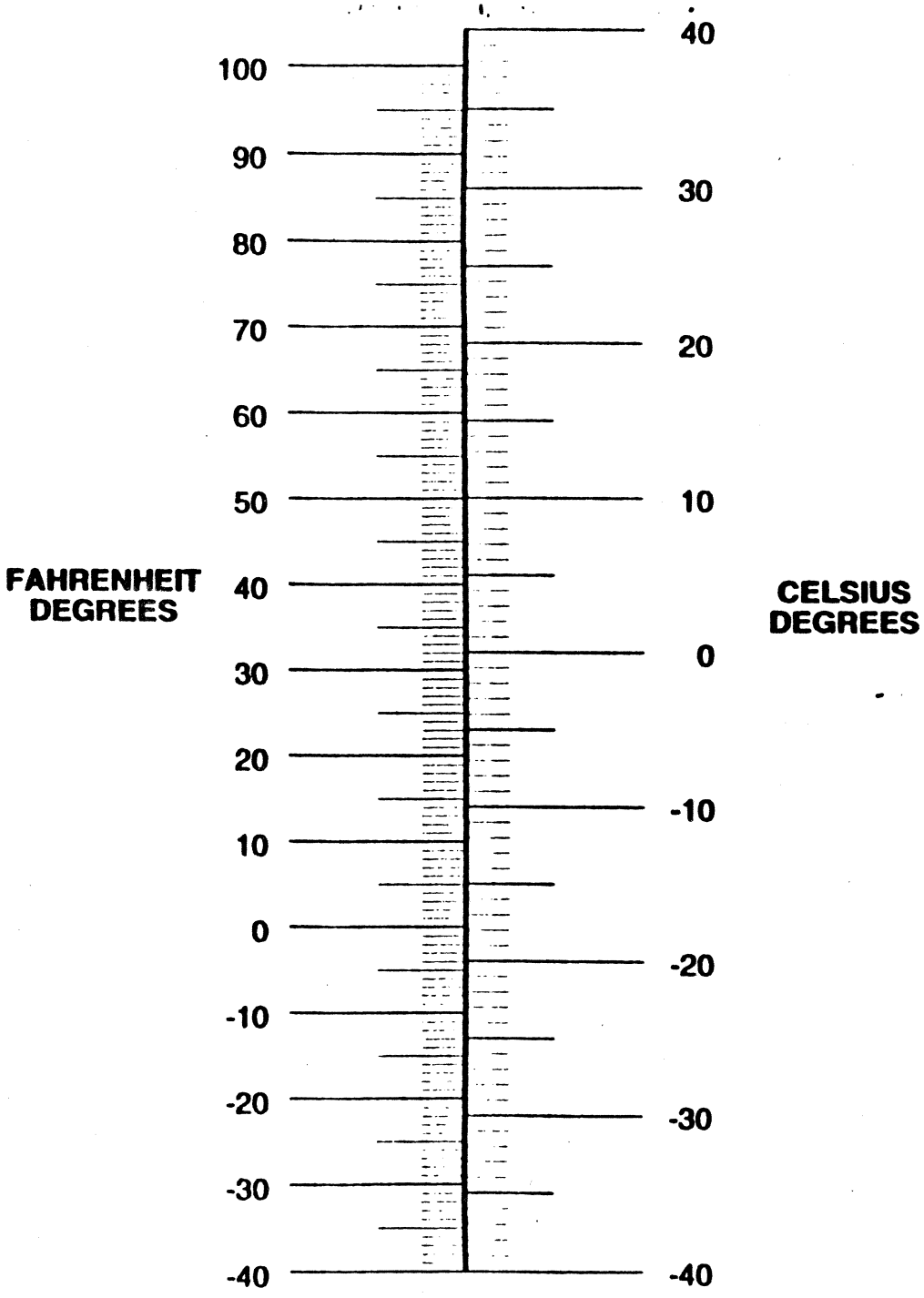
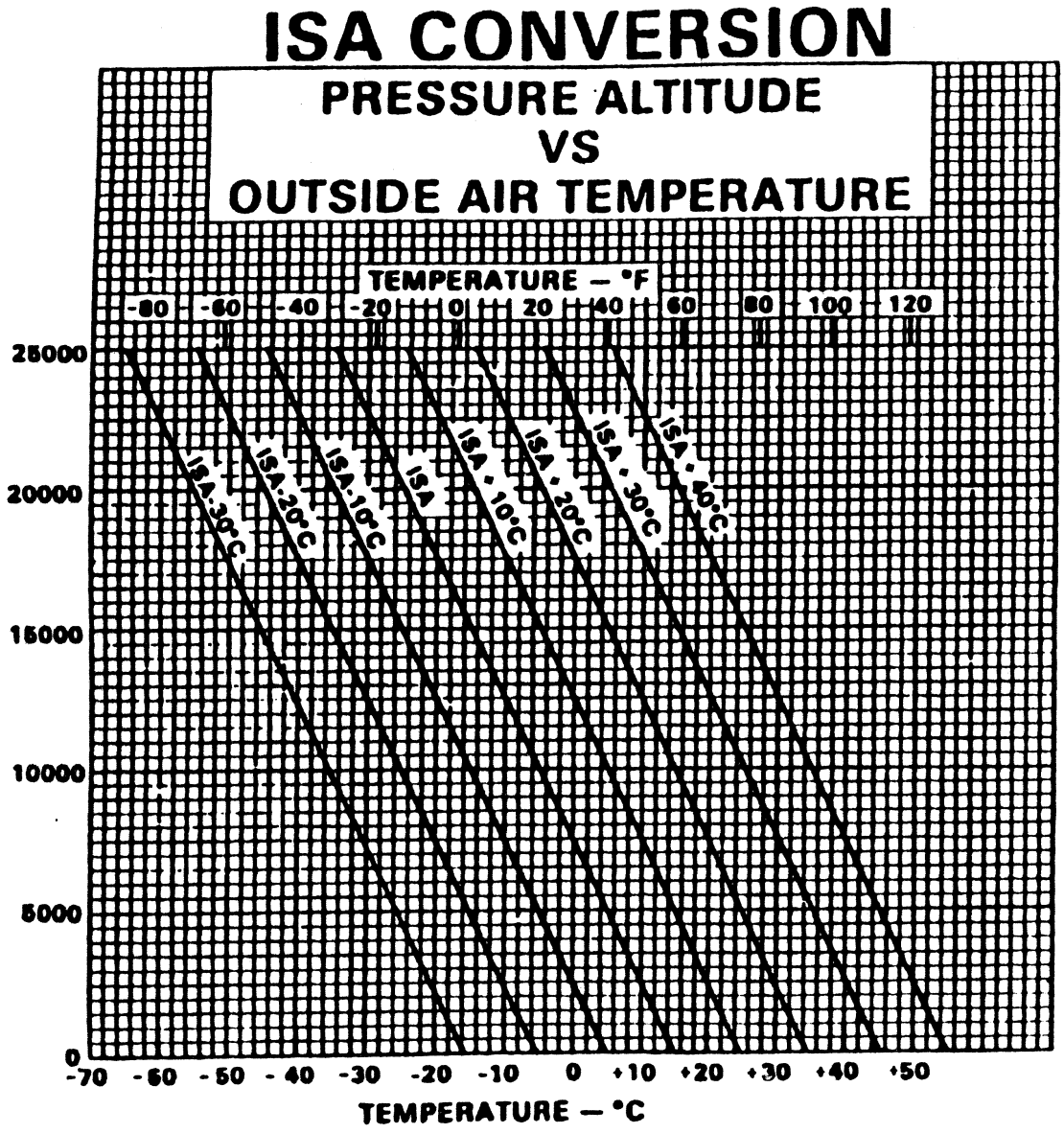
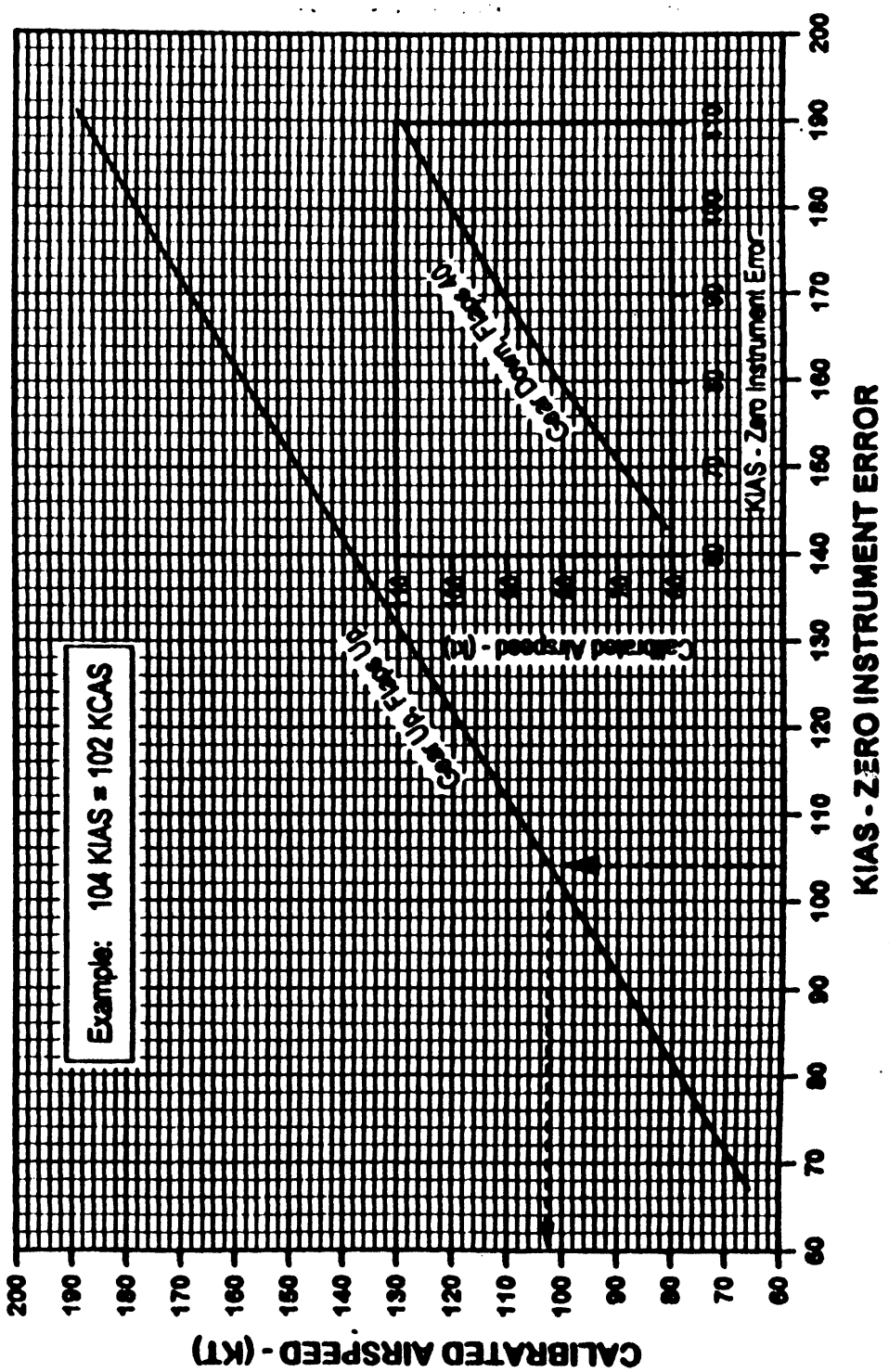


TEMPERATURE CONVERSION
Figure 5-1



PRESSURE ALTITUDE
VS
OUTSIDE AIR TEMPRATURE
Figure 5-2



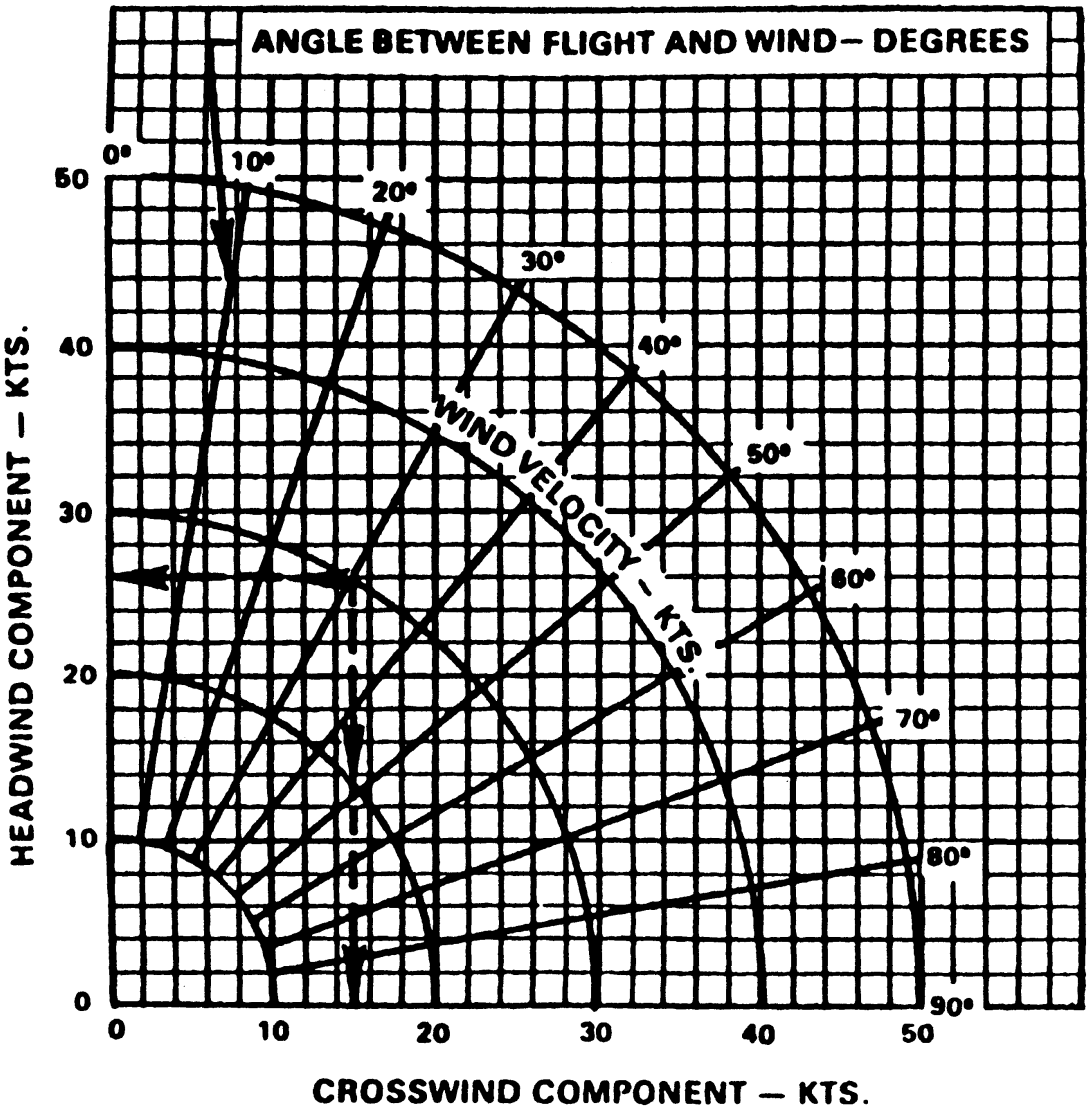
AIRSPEED SYSTEM CALIBRATION
ALL FLAP DEFLECTIONS
Figure 5-3

WIND COMPONENTS

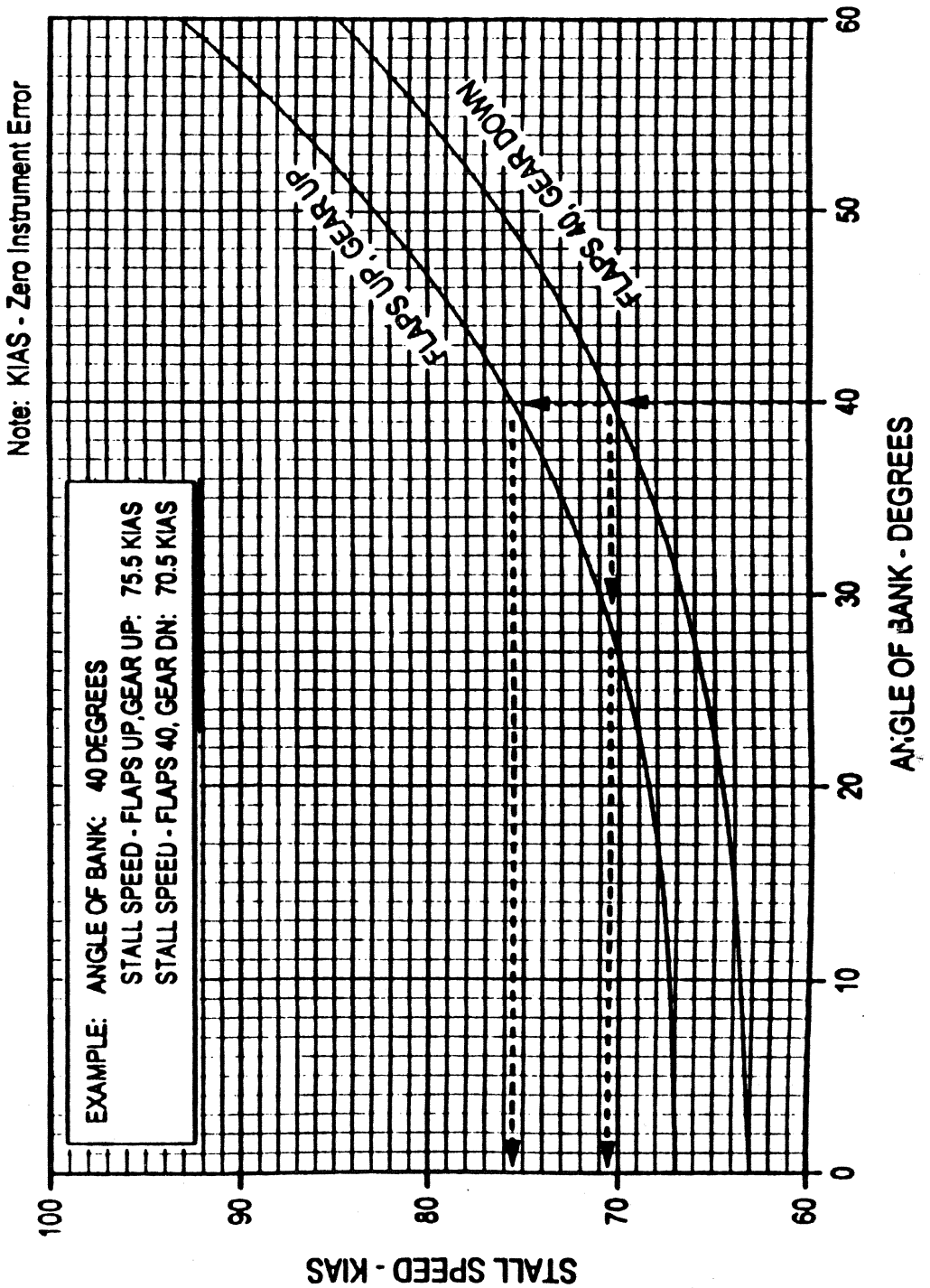
NOTE: Maximum demonstrated crosswind velocity is 17 knots. (not a limitation)

EXAMPLE:

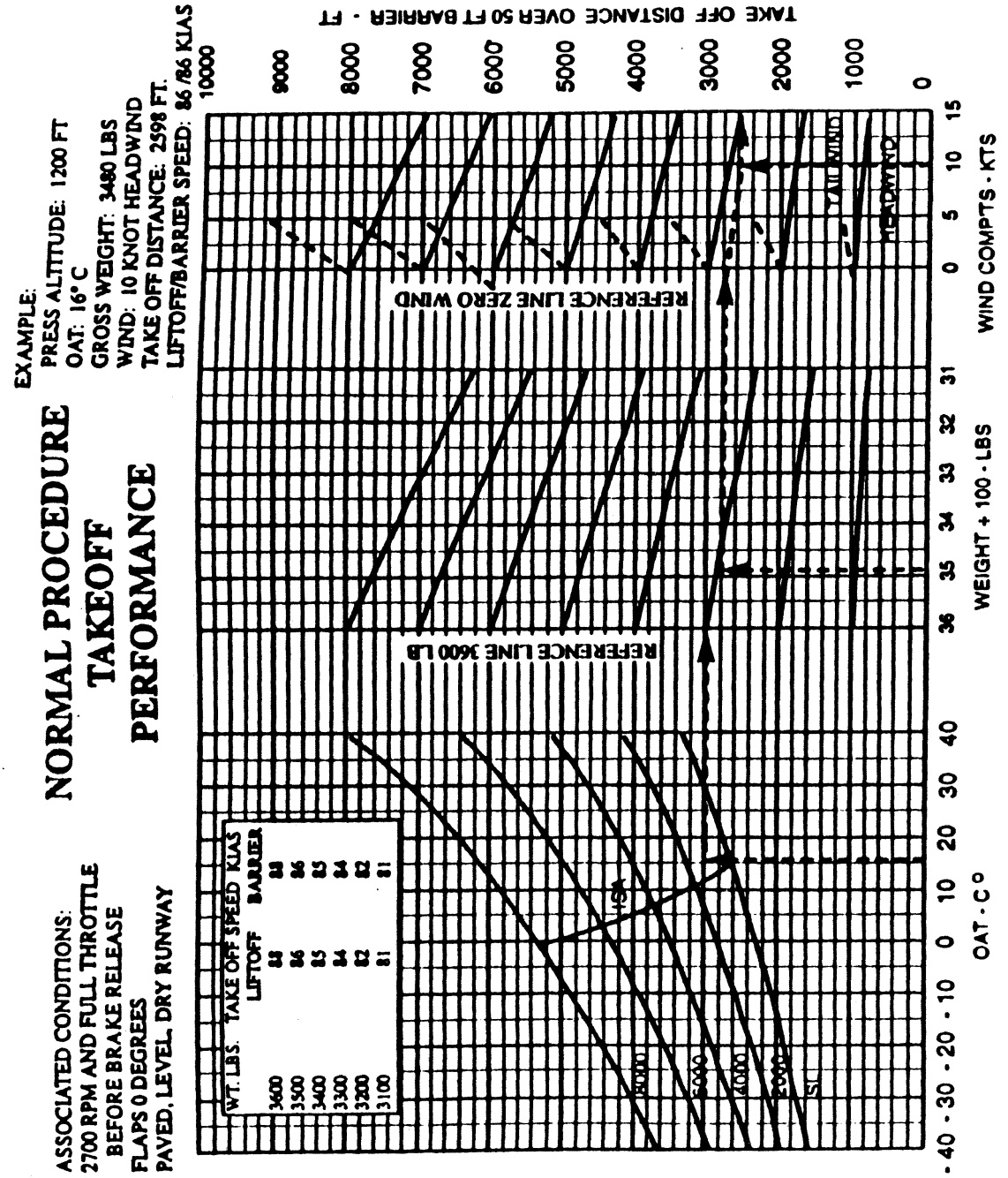
Wind velocity: 30 knots
Angle between flight path and wind: 30°
Headwind component: 26 knots
Crosswind component: 15 knots



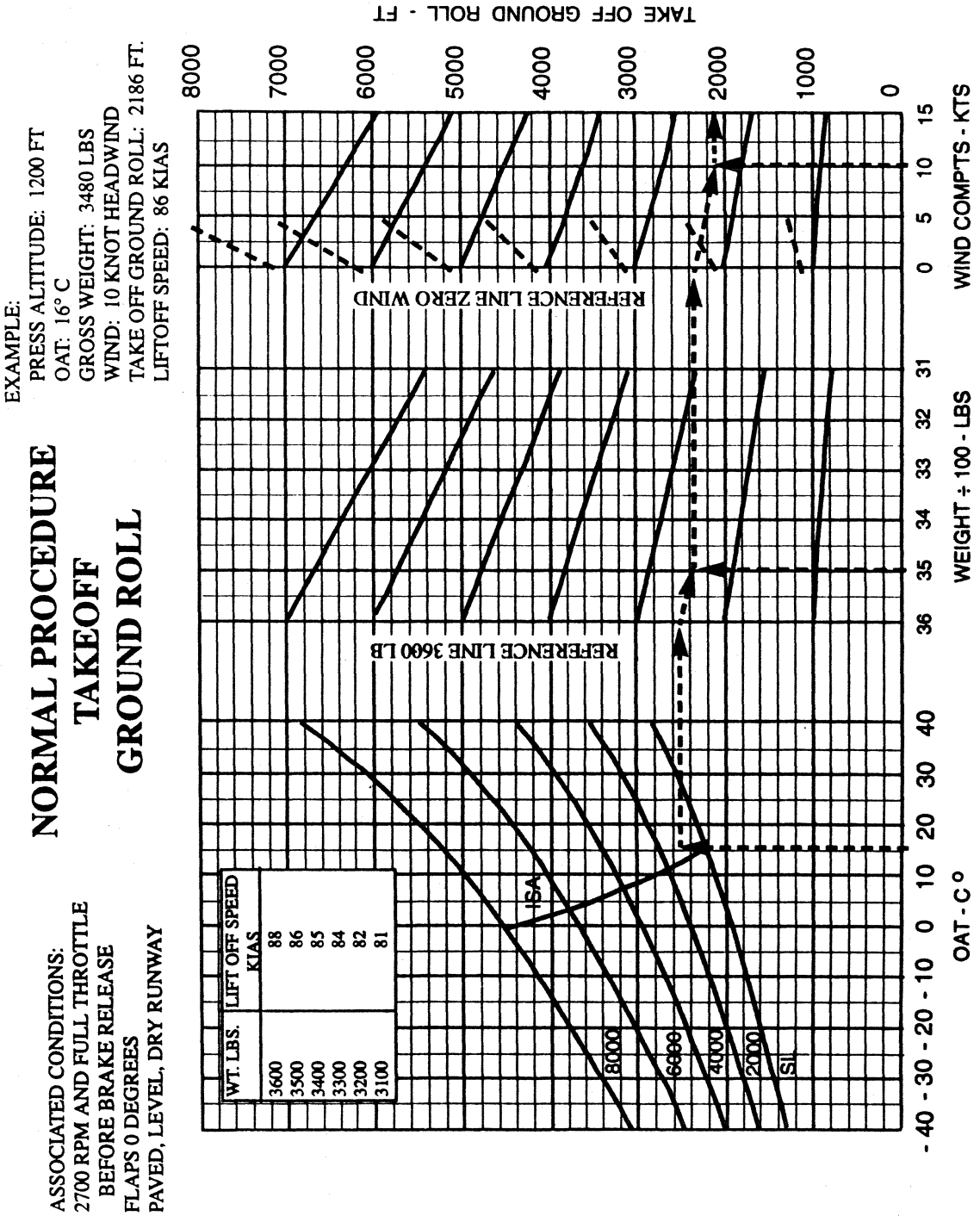
WIND COMPONENTS
Figure 5-6



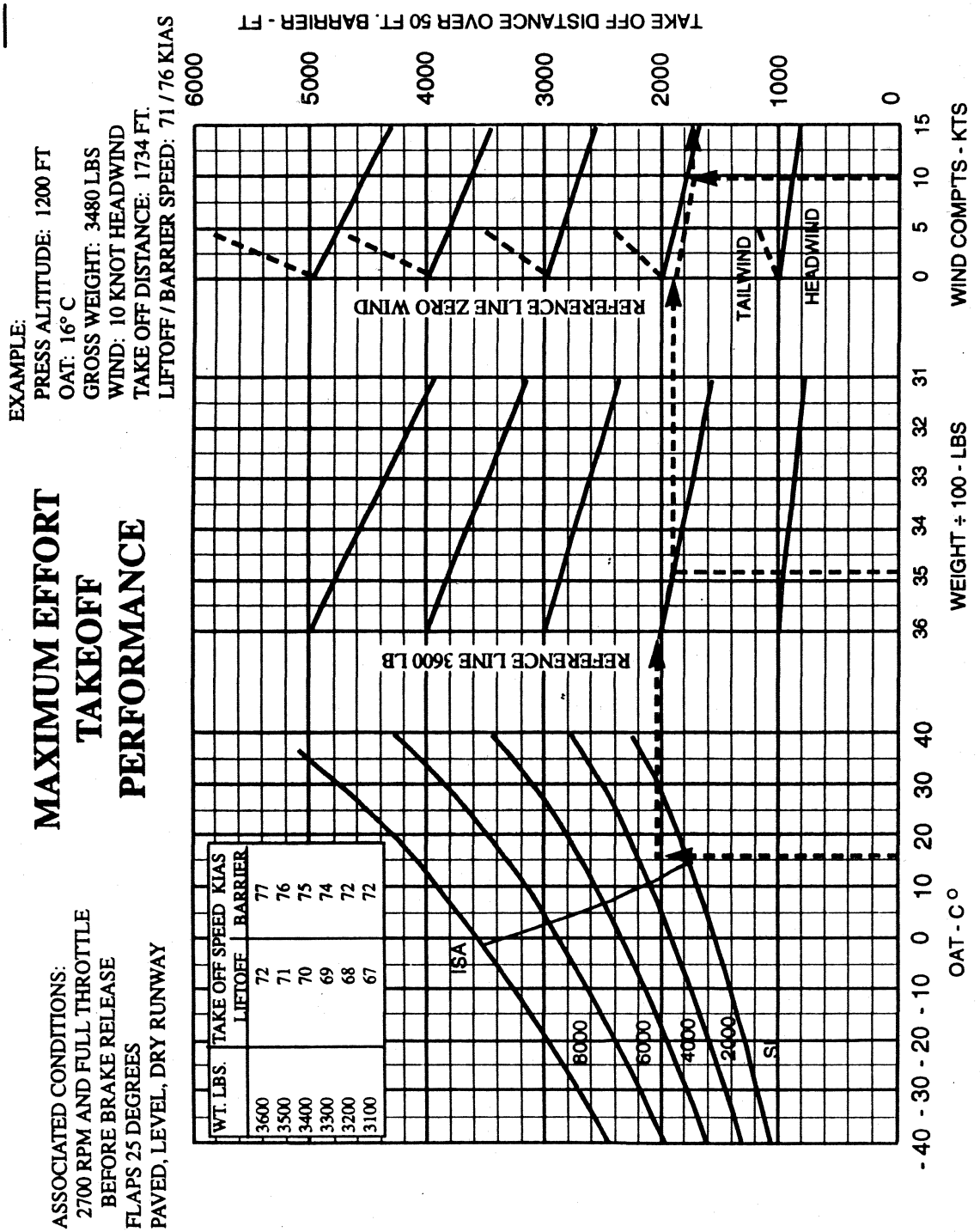
STALL SPEED VERSUS ANGLE OF BANK
GROSS WEIGHT 3600 LBS
Figure 5-5



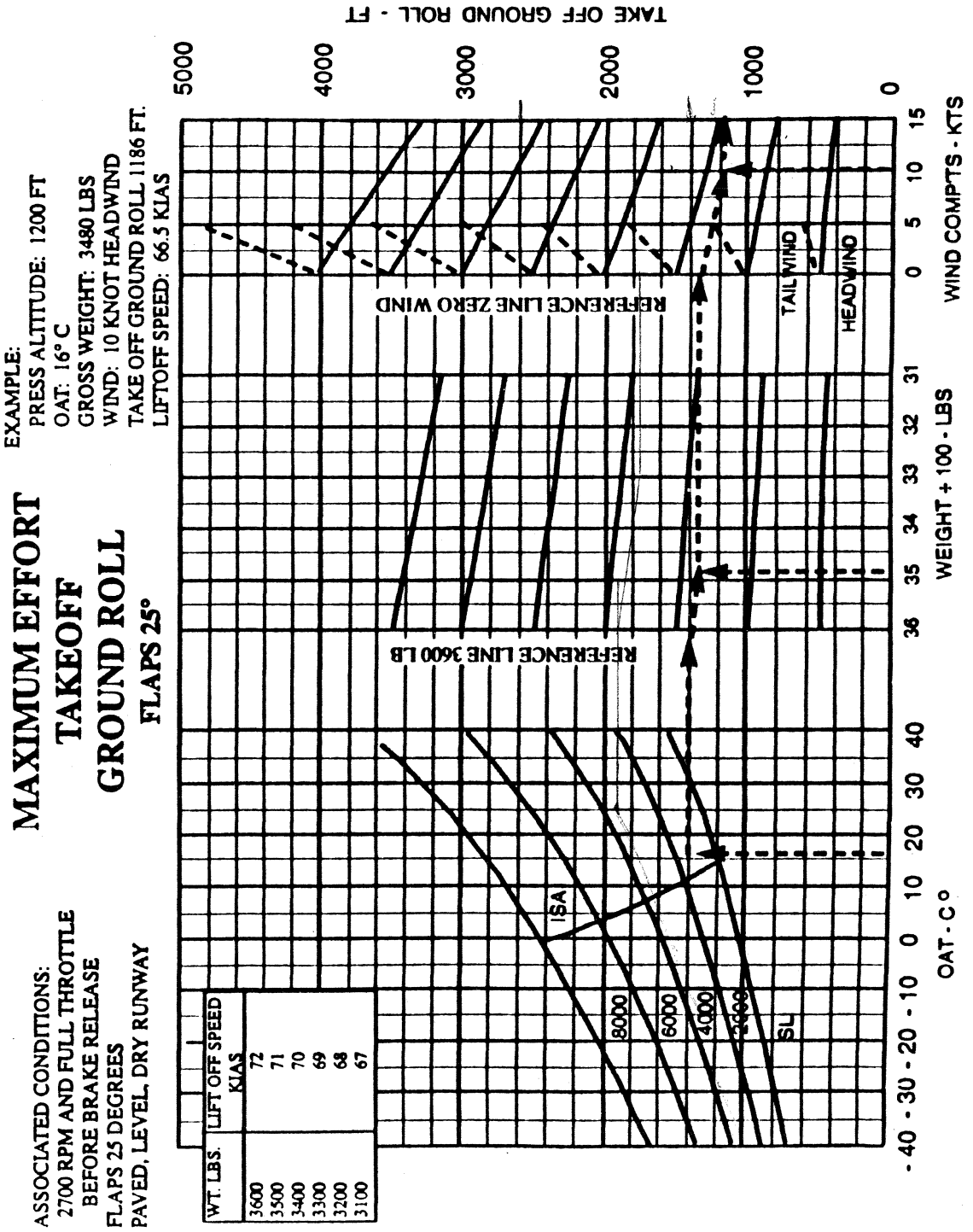
NORMAL PROCEDURE TAKEOFF PERFORMANCE
OVER 50 FEET
Figure 5-7



NORMAL PROCEDURE TAKEOFF GROUND ROLL
Figure 5-9



MAXIMUM EFFORT TAKEOFF PERFORMANCE - FLAPS 25°
Figure 5-11



MAXIMUM EFFORT TAKEOFF GROUND ROLL - FLAPS 25°
Figure 5-13

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MAXIMUM RATE OF CLIMB, GEAR UP

ASSOCIATED CONDITIONS		EXAMPLE	
POWER	2700 RPM FULL THROTTLE	PRESSURE ALTITUDE OAT	2500 FT 10 ° C
MIXTURE	FULL RICH	RATE OF CLIMB	957 FPM
LANDING GEAR	UP		
FLAPS	UP		
AIRSPEED	93 KIAS		

PRESSURE ALTITUDE FT.	OAT			
	-20 ° C	0 ° C	20 ° C	40 ° C
SL	1582	1305	1057	806
1000	1467	1204	968	734
2000	1368	1111	892	662
3000	1256	1019	805	579
4000	1159	934	725	509
5000	1062	843	645	434
6000	967	754	568	366
7000	866	665	490	299
8000	773	585	420	233
9000	681	505	345	169
10000	588	425	270	99
11000	505	347	198	37
12000	423	277	138	- 19
13000	334	194	67	- 80
14000	247	119	- 4	- 135
15000	174	51	- 54	- 196
16000	96	- 9	- 117	- 250

MAXIMUM RATE OF CLIMB (3600 LBS GROSS WEIGHT)
Figure 5-19

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FUEL, TIME AND DISTANCE TO CLIMB

ASSOCIATED CONDITIONS		EXAMPLE	
POWER	2700 RPM	AIRPORT	
	FULL THROTTLE	PRESSURE ALTITUDE	1800 FT
MIXTURE	FULL RICH	OAT	ISA + 5 °C
		RATE OF CLIMB	957 FPM
LANDING		CRUISE	
GEAR	UP	ALTITUDE	8500 FT
FLAPS	UP	OAT	ISA - 6 °C
AIRSPEED	93 KIAS	TIME TO CLIMB (10-2)	8 MIN.
		FUEL TO CLIMB (5-1)	4 GAL.
		DISTANCE TO CLIMB (17-3)	14 N.M.

NOTES: 1. DISTANCES SHOWN ARE BASED ON ZERO WIND.
2 ADD 2 GALLONS OF FUEL FOR ENGINE START, TAXI, AND TAKEOFF.

PRESSURE ALTITUDE FT.	OAT								
	ISA - 10 °C			ISA			ISA + 10 °C		
	FROM SEA LEVEL								
	TIME MIN	FUEL GAL	DIST NM	TIME MIN	FUEL GAL	DIST NM	TIME MIN	FUEL GAL	DIST NM
SL	0	0	0	0	0	0	0	0	0
1000	1	1	1	1	1	1	1	1	2
2000	2	1	3	2	1	3	2	1	3
3000	3	2	4	3	2	5	3	2	5
4000	4	2	6	4	2	6	5	2	7
5000	5	3	7	5	3	8	6	3	10
6000	6	3	9	7	3	11	7	4	12
7000	7	4	11	8	4	13	9	4	15
8000	8	4	14	10	5	16	11	5	18
9000	10	5	16	11	5	19	13	6	22
10000	12	6	19	13	6	22	15	7	26
11000	14	6	22	15	7	26	18	8	31
12000	16	7	26	18	8	31	21	9	37
13000	18	8	31	21	9	37	25	10	44
14000	21	9	37	25	10	44	30	12	53
15000	25	10	44	30	12	53	37	14	67

FUEL, TIME AND DISTANCE TO CLIMB
3600 LBS TAKEOFF WEIGHT
Figure 5-21

POWER SETTING TABLE

SARATOGA II HP

Press. Alt. Feet	Std. Alt. Temp. °C	LONG RANGE RPM 2100	2200	2300	2400	ECONOMY RPM 2100	2200	2300	2400	NORMAL RPM 2200	2300	2400	2500	HIGH SPEED 2700
		MANIFOLD PRESSURE - INCHES MERCURY												
SL	15	23.2	22.7	22.2	21.7	25.6	25.0	24.4	23.8	28.0	27.2	26.5	25.9	27.0
1000	13	22.9	22.3	21.9	21.4	25.2	24.6	24.0	23.5	27.6	26.9	26.2	25.6	26.8
2000	11	22.5	22.0	21.5	21.1	24.9	24.3	23.7	23.2	27.3	26.6	25.9	25.3	26.5
3000	9	22.2	21.7	21.2	20.8	24.6	23.9	23.4	22.9	26.8	26.2	25.6	24.9	26.2
4000	7	21.9	21.4	20.9	20.5	24.3	23.7	23.1	22.6	—	25.8	25.3	24.7	25.8
5000	5	21.6	21.1	20.6	20.2	24.0	23.4	22.8	22.3	—	—	25.0	24.4	
6000	3	21.3	20.8	20.3	19.9	23.7	23.1	22.5	22.0	—	—	—	24.1	
7000	1	21.0	20.5	20.0	19.6	23.3	22.8	22.3	21.7	—	—	—	—	
8000	-1	20.7	20.2	19.8	19.3	—	22.4	22.0	21.4					
9000	-3	20.5	20.0	19.5	19.1	—	—	—	21.2					
10,000	-5	20.2	19.7	19.2	18.8	—	—	—	—					
11,000	-7	19.9	19.4	19.0	18.5									
12,000	-9	—	19.0	18.7	18.3									
13,000	-11	—	—	—	18.0									
14,000	-13	—	—	—	—									

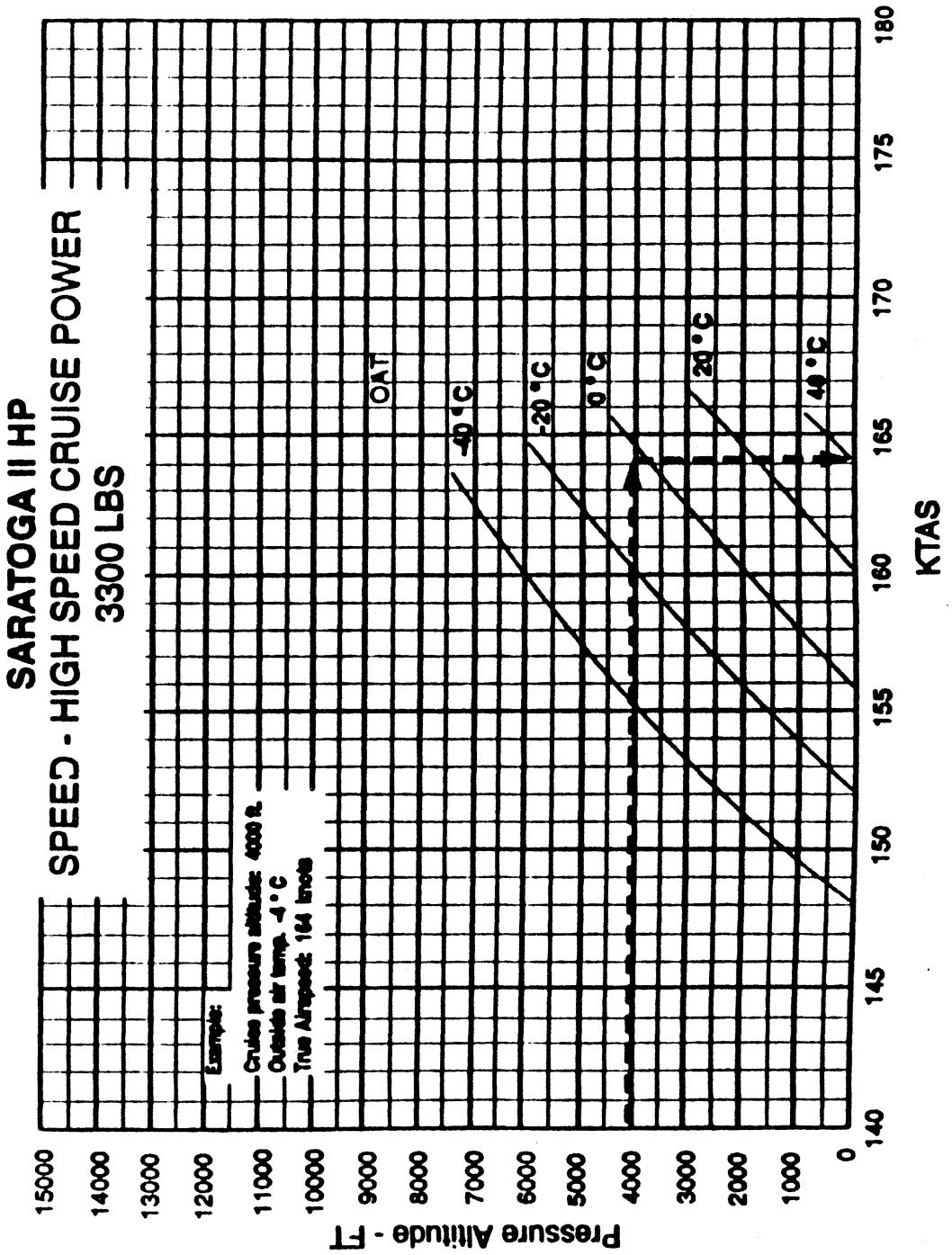
APPROX. FUEL FLOW / MIXTURE

Long range	14.5 GPH / 50° Rich of Peak EGT
Economy	16.5 GPH / 50° Rich of Peak EGT
Normal	18.5 GPH / 50° Rich of Peak EGT
High Speed	29.0 GPH / Full Rich

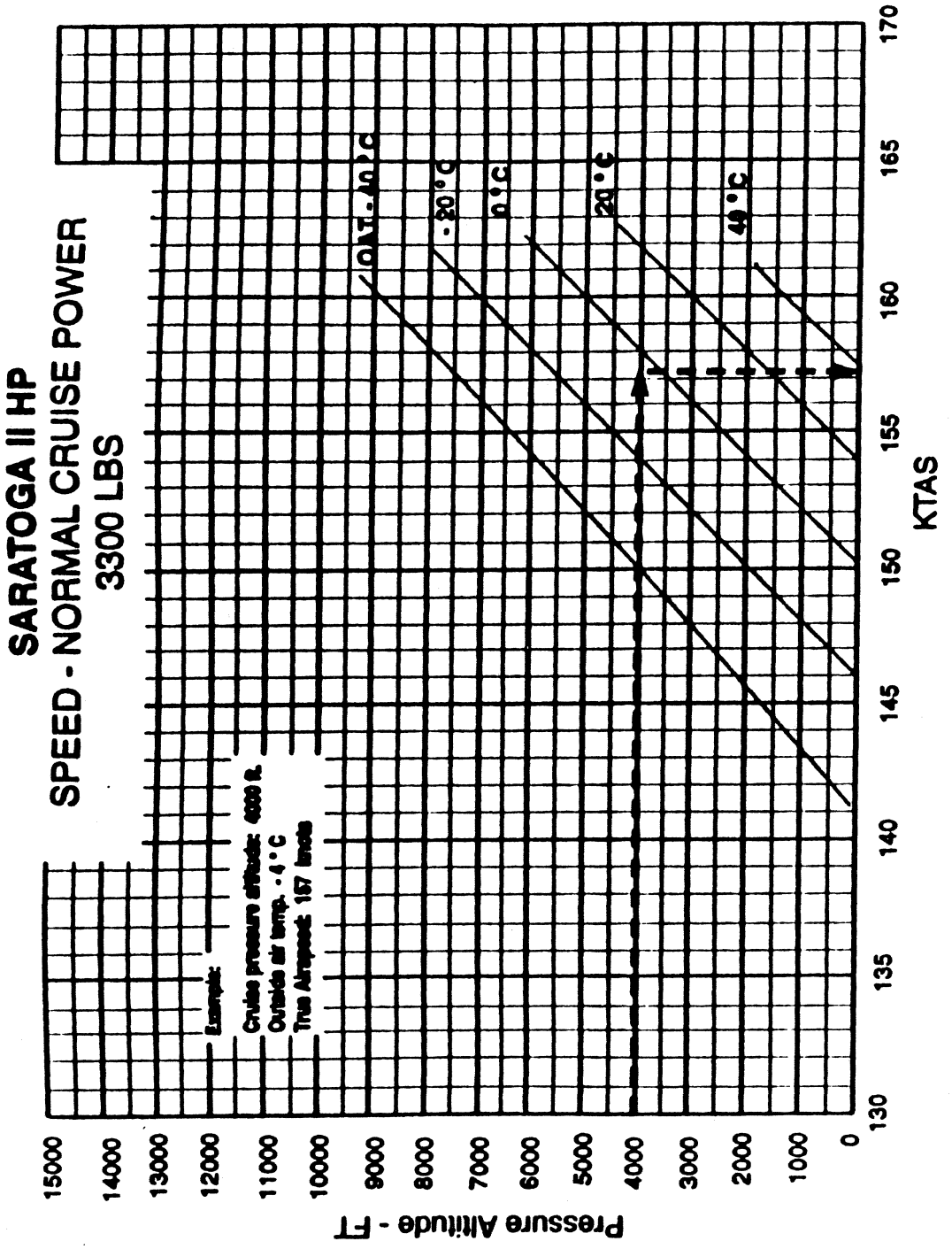
To maintain constant power, correct manifold pressure approximately 0.5 in Hg for each 10°C variation in induction air temperature from standard altitude temperature. Add manifold pressure for air temperature above standard; subtract for temperature below standard.

NOTE: Full throttle manifold pressure values may not be obtainable when atmospheric conditions are non-standard.

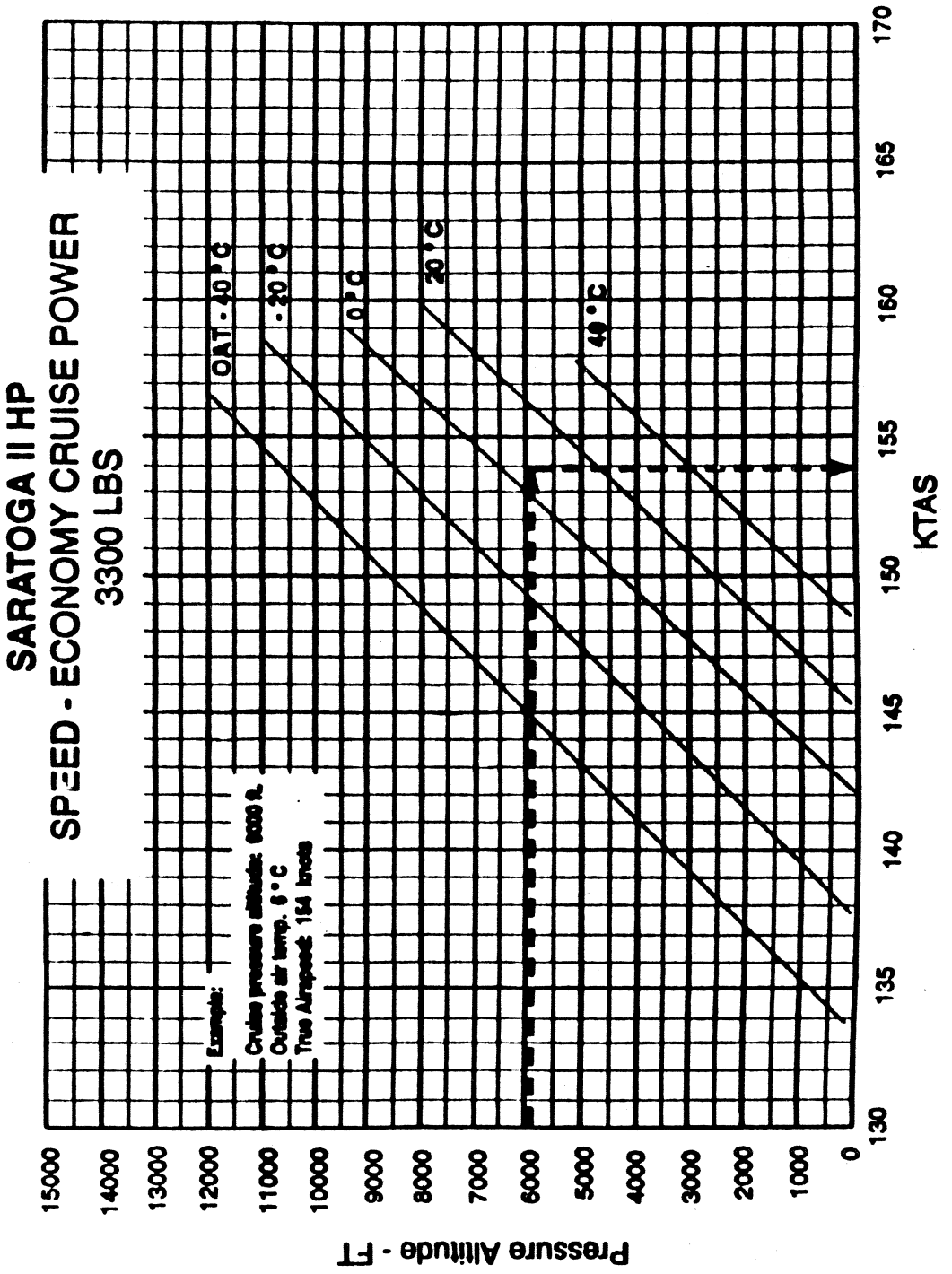
POWER SETTING TABLE
Figure 5-23



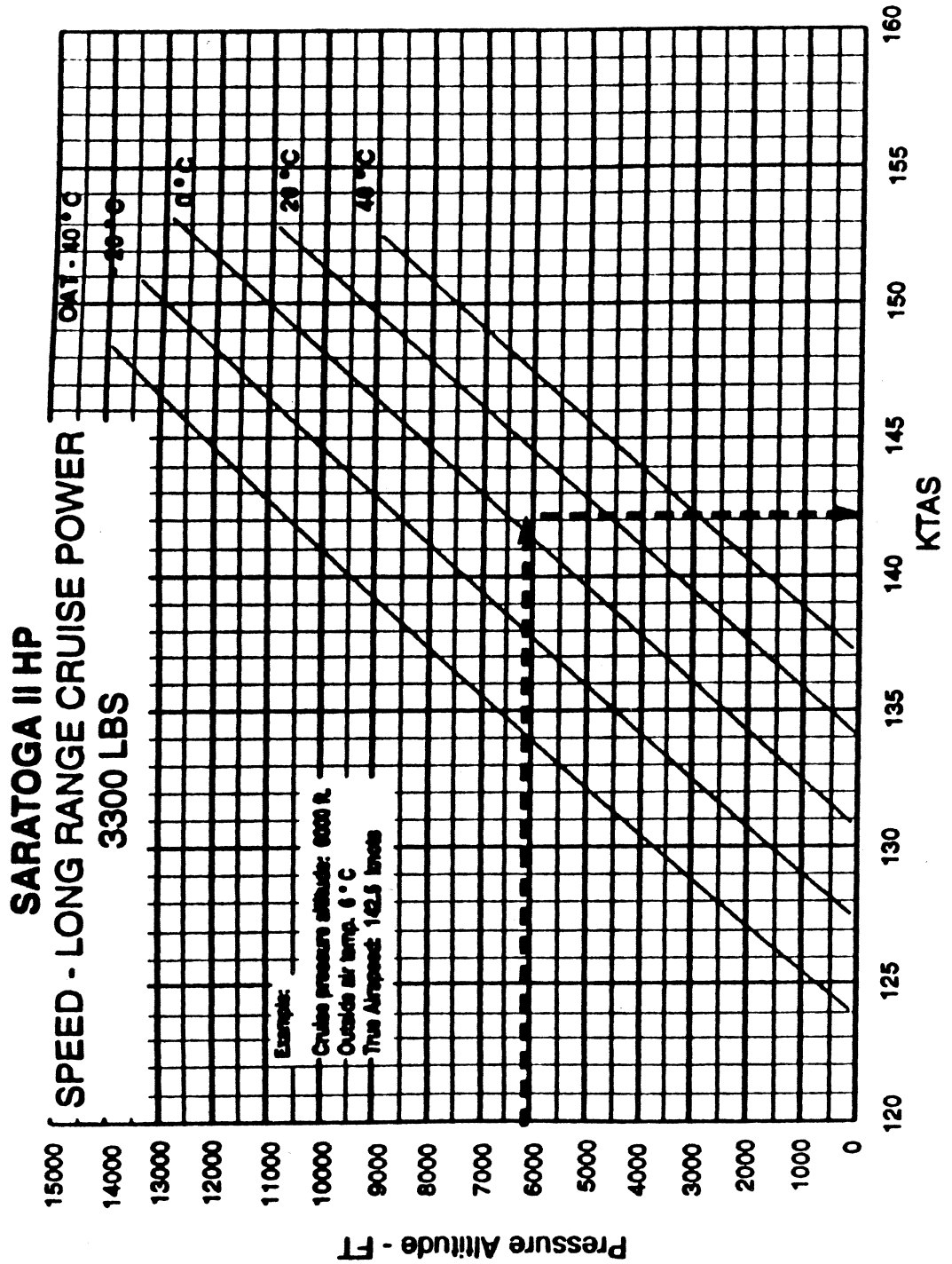
SPEED - HIGH SPEED CRUISE
Figure 5-25



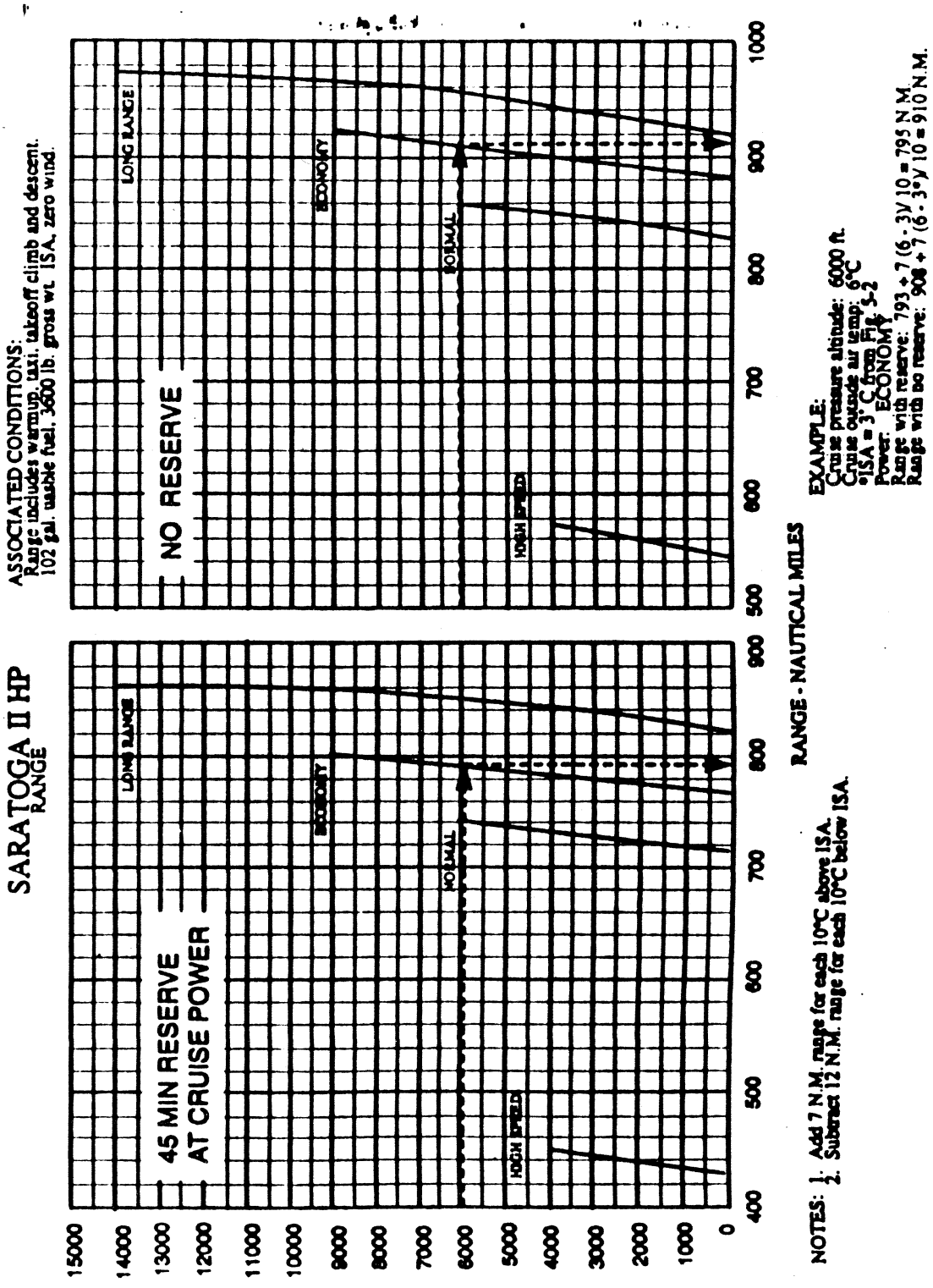
SPEED - NORMAL CRUISE POWER
Figure 5-27



SPEED - ECONOMY CRUISE POWER
Figure 5-27a

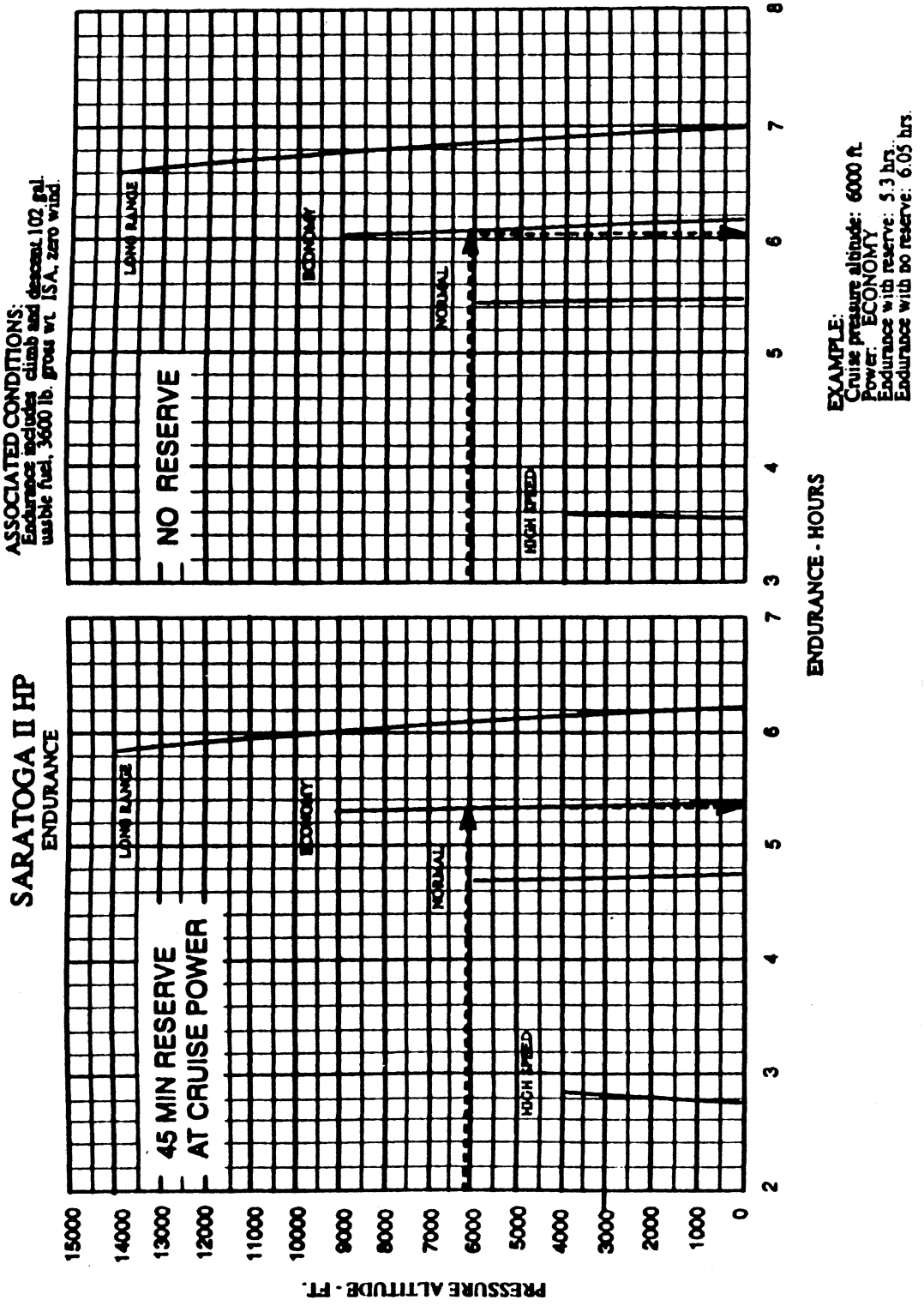


SPEED - LONG RANGE CRUISE POWER
Figure 5-27b



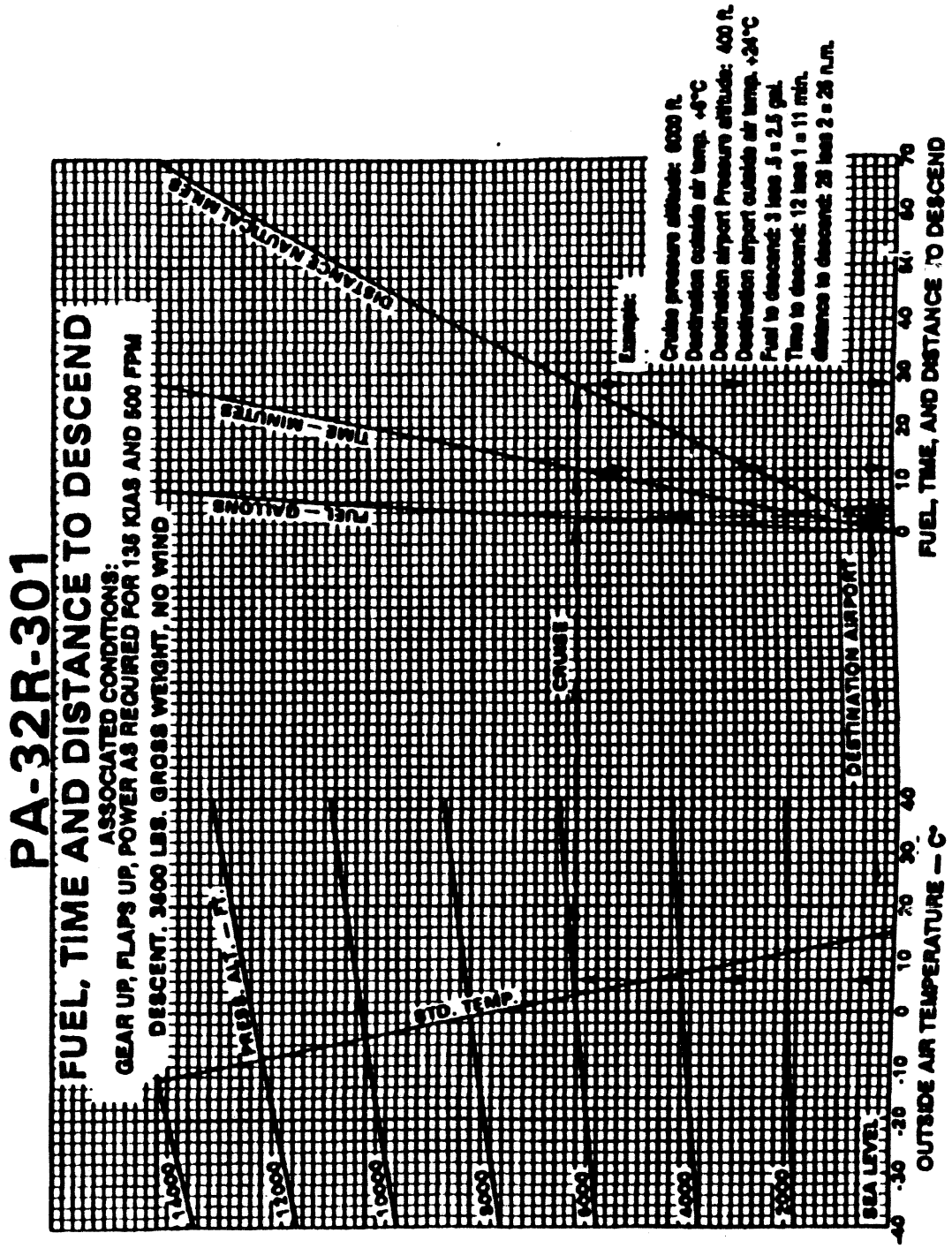
RANGE - CRUISE POWER

Figure 5-29

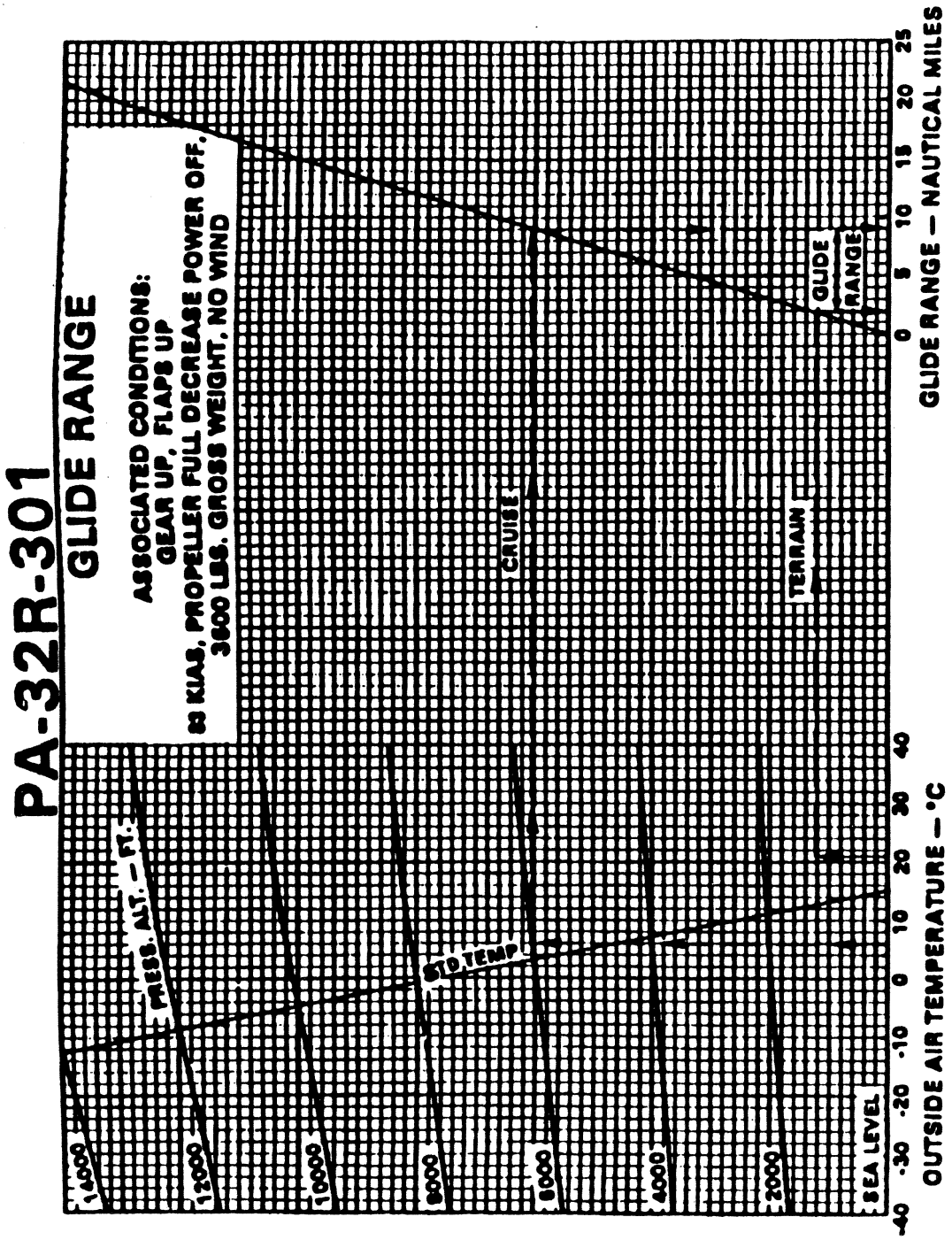


ENDURANCE

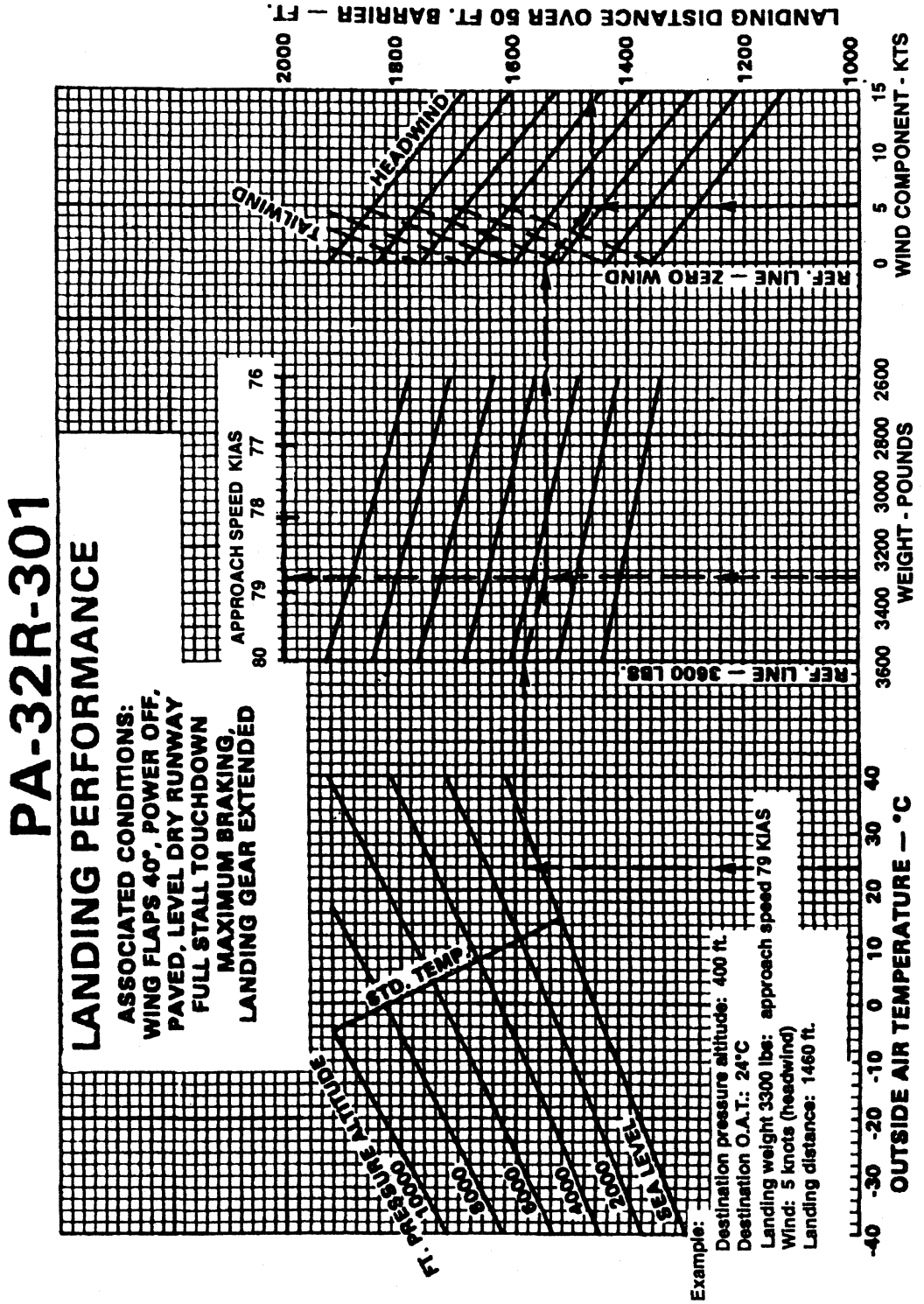
Figure 5-31



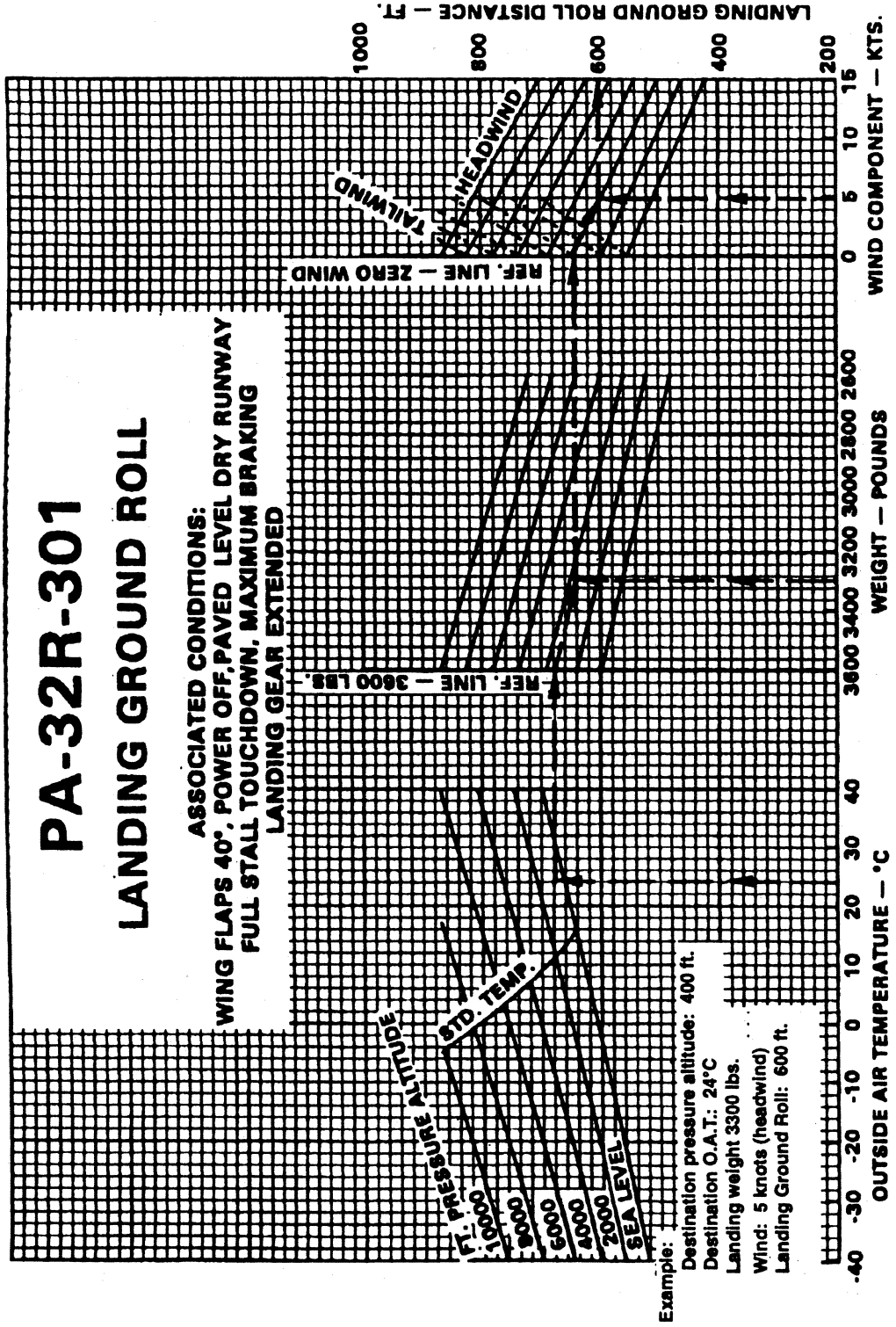
FUEL, TIME, AND DISTANCE TO DESCEND
Figure 5-33



GLIDE RANGE
Figure 5-35



LANDING PERFORMANCE
Figure 5-37



LANDING GROUND ROLL
Figure 5-38

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TABLE OF CONTENTS

SECTION 6

WEIGHT AND BALANCE

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6.3	Airplane Weighing Procedure	6-2
6.5	Weight and Balance Data and Record	6-5
6.7	General Loading Recommendations	6-9
6.9	Weight and Balance Determination for Flight	6-10

**Equipment List .....ENCLOSED WITH THIS HANDBOOK.

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SECTION 6

WEIGHT AND BALANCE

6.1 GENERAL

In order to achieve the performance and flying characteristics which are designed into the airplane, it must be flown with the weight and center of gravity (C.G.) position within the approved operating range (envelope). Although the airplane offers 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. Before the airplane is licensed, it is weighed, and a basic empty weight and C.G. location is computed (basic empty weight consists of the standard empty weight of the airplane plus the optional equipment). Using the basic empty weight and C.G. location, the pilot can determine the weight and C.G. position for the loaded airplane by computing the total weight and moment and then determining whether they are within the approved envelope.

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

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

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

6.3 AIRPLANE WEIGHING PROCEDURE

At the time of licensing, Piper 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, and foreign items such as rags and tools, from the airplane before weighing.

(3) Defuel airplane. Then open all fuel drains until all remaining fuel is drained. Operate engine on each tank until all undrainable fuel is used and engine stops. Then add the unusable fuel (5 gallons total, 2.5 gallons each wing).

CAUTION

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

(4) Fill with oil to full capacity.

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

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

(b) Leveling

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

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

(c) Weighing - Airplane Basic Empty Weight

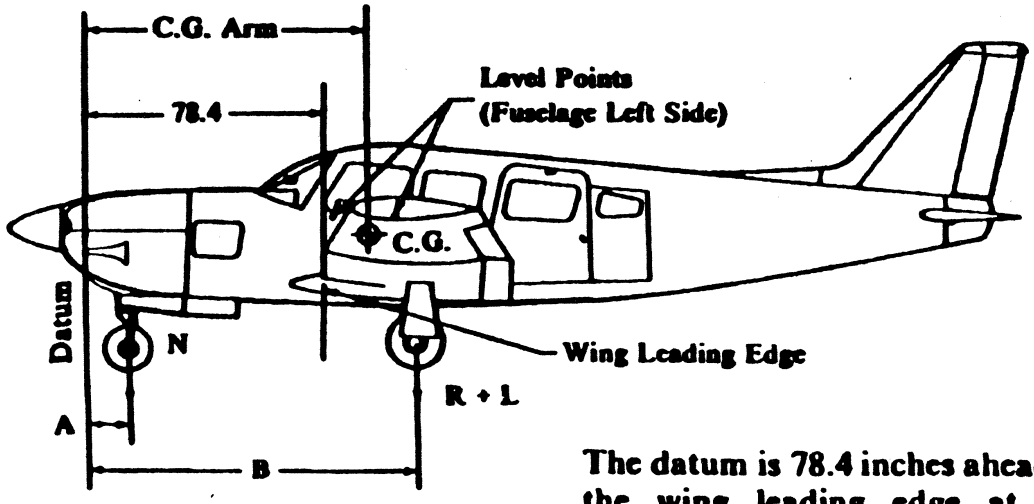
(1) With the airplane level and brakes released, record the weight shown on each scale. Deduct the tare, if any, from each reading.

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

WEIGHING FORM
Figure 6-1

(d) Basic Empty Weight Center of Gravity

(1) The following geometry applies to the PA-32R-301 airplane when it is level. Refer to Leveling paragraph 6.3 (b).



A = 14.2

B = 109.7

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

LEVELING DIAGRAM
Figure 6-3

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

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

Where: $T = N + R + L$

6.5 WEIGHT AND BALANCE DATA AND RECORD

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

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

MODEL PA-32R-301 SARATOGA II HP

Airplane Serial Number 3246060

Registration Number N123AX

Date 12/19/96

AIRPLANE BASIC EMPTY WEIGHT

Item		Weight (Lbs)	x C.G. Arm (Inches Aft of Datum)	= Moment (In-Lbs)
Standard Empty Weight*	Actual	2391.8	83.4	199430
	~~Computed~~			
Optional Equipment		12.6	88.5	1116
Basic Empty Weight		2404.4	83.4	200546

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

AIRPLANE USEFUL LOAD - NORMAL CATEGORY OPERATION

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

(3615 lbs) - (2404.4 lbs) = 1210.6 lbs.

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

WEIGHT AND BALANCE DATA FORM
Figure 6-5

PA-32R-301 | Serial Number 3246060 | Registration Number N1234X | Page Number

DATE	Item No.	Description of Article or Modification	Added (+) / Removed (-)	Weight Change			Running Basic Empty Weight	
				Wt. (lb)	Arm (in)	Moment /100	Wt. (lb)	Moment /100
12/19/96		As licensed					2404.4	200546

WEIGHT AND BALANCE RECORD
Figure 6-7

PA-32R-301	Serial Number	Registration Number	Page Number

DATE	Item No.	Description of Article or Modification	Added (+) Removed (-)	Weight Change			Running Basic Empty Weight	
				Wt. (lb)	Arm (in)	Moment /100	Wt. (lb)	Moment /100
		As licensed						

WEIGHT AND BALANCE RECORD (cont)

6.7 GENERAL LOADING RECOMMENDATIONS

The following general loading recommendation is intended only as a guide. The charts, graphs and instructions should be checked to assure that the airplane is within the allowable weight vs. center of gravity envelope.

(a) Pilot Only
Load rear baggage compartment to capacity first. Without aft baggage, fuel load may be limited by fwd. envelope for some combinations of optional equipment.

(b) 2 Occupants - Pilot and Passenger in Front
Load rear baggage compartment first. Without aft baggage, fuel load may be limited by fwd. envelope for some combinations of optional equipment.

(c) 3 Occupants - 2 in front, 1 in middle
Load rear baggage compartment to capacity first. Baggage in nose may be limited by fwd. envelope. Without aft baggage, fuel may be limited by fwd. envelope for some combinations of optional equipment.

(d) 4 Occupants - 2 in front, 2 in middle
Load rear baggage compartment to capacity first. Baggage in nose may be limited by fwd. envelope. Without aft baggage, fuel may be limited by fwd. envelope for some combinations of optional equipment.

(e) 5 Occupants - 2 in front, 2 in middle, 1 in rear
Investigation is required to determine optimum loading for baggage.

(f) 6 Occupants - 2 in front, 2 in middle, 2 in rear
With six occupants fuel and/or baggage may be limited by envelope. Load fwd. baggage compartment to capacity first.

For all airplane configurations, it is the responsibility of the pilot in command to make sure that the airplane always remains within the allowable weight vs. center of gravity while in flight.

6.9 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	2272	83.4	189485
Pilot and Front Passenger	340.0	85.5	29070
Passengers (Center Seats) (Aft Facing)		119.1	
Passengers (Rear Seats)	340.0	157.6	53584
Fuel (102 Gallon Maximum)	500	94.0	47000
Baggage (Forward) (100 Lb. Limit)	100	42.0	4200
Baggage (Aft) (100 Lb. Limit)	63	178.7	11258
Ramp Weight (3615 Lbs. Max.)	3615	92.6	334597
Fuel Allowance for Engine Start, Taxi & Runup	-15.0	94.0	-1410
Take-off Weight (3600 Lbs. Max.)	3600	92.6	333187

The center of gravity (C.G.) for the take-off weight of this sample loading problem is at 92.6 inches aft of the datum line. Locate this point (92.6) 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.

Take-off Weight	3600	92.6	333187
Minus Estimated Fuel Burn-off (climb & cruise) @ 6.0 Lbs/Gal.	-360	94.0	-33840
Landing Weight	3240	92.4	299347

Locate the center of gravity of the landing weight on the C.G. range and weight graph. Since this point falls within the weight - C.G. envelope, the loading may be assumed acceptable for landing.

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

SAMPLE LOADING PROBLEM
(NORMAL CATEGORY)
Figure 6-9

	Weight (Lbs)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Basic Empty Weight			
Pilot and Front Passenger		85.5	
Passengers (Center Seats) (Aft Facing)		119.1	
Passengers (Rear Seats)		157.6	
Fuel (102 Gallon Maximum)		94.0	
Baggage (Forward) (100 Lb. Limit)		42.0	
Baggage (Aft) (100 Lb. Limit)		178.7	
Ramp Weight (3615 Lbs. Max.)			
Fuel Allowance for Engine Start, Taxi & Runup	-15.0	94.0	-1410
Take-off Weight (3600 Lbs. Max.)			

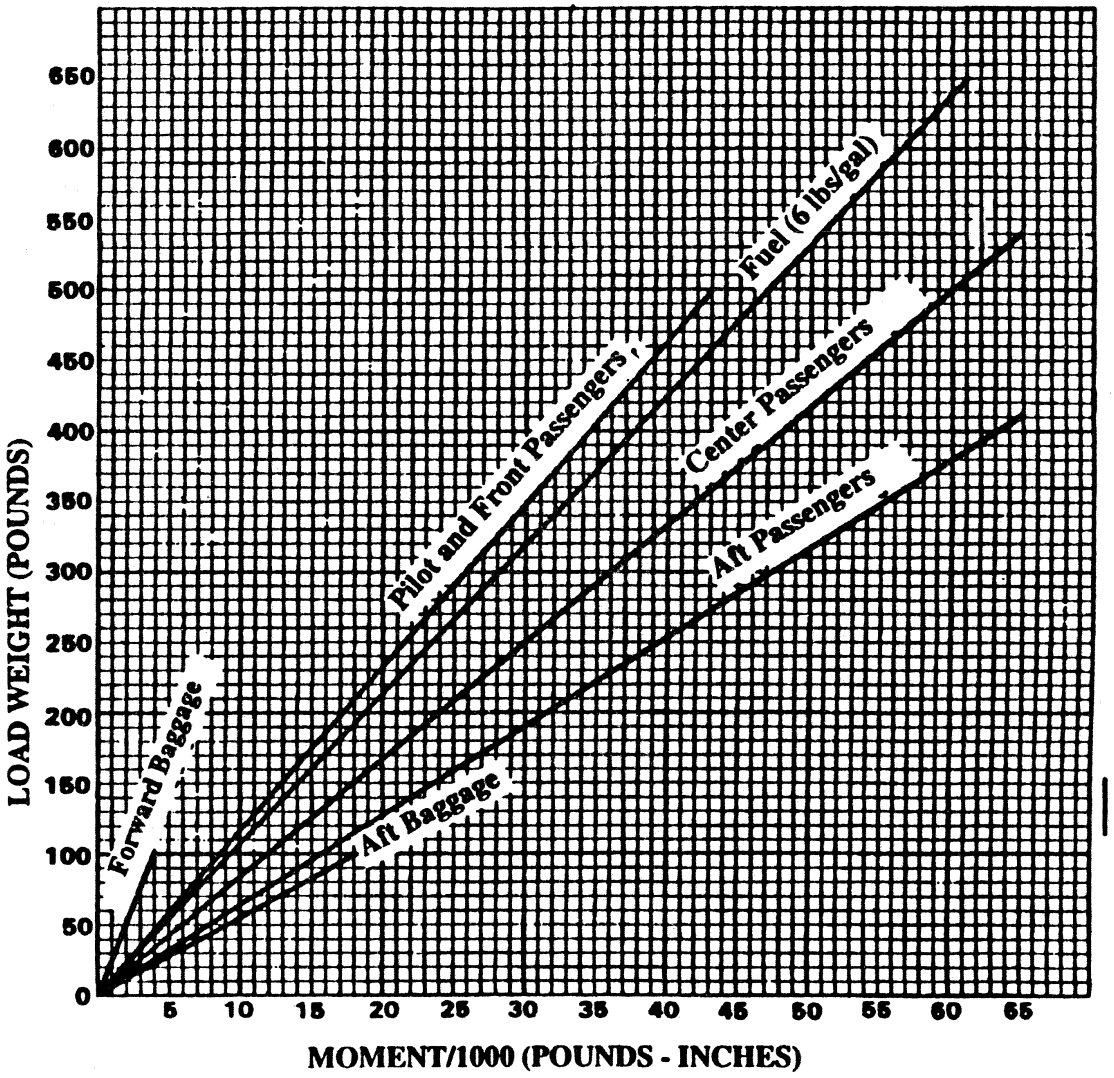
The center of gravity (C.G.) for the take-off weight of this loading problem is at inches aft of the datum line. Locate this point on the C.G. range and weight graph. Since this point falls within the weight - C.G. envelope, this loading meets the weight and balance requirements.

Take-off Weight			
Minus Estimated Fuel Burn-off (climb & cruise) @ 6.0 Lbs/Gal.		94.0	
Landing Weight			

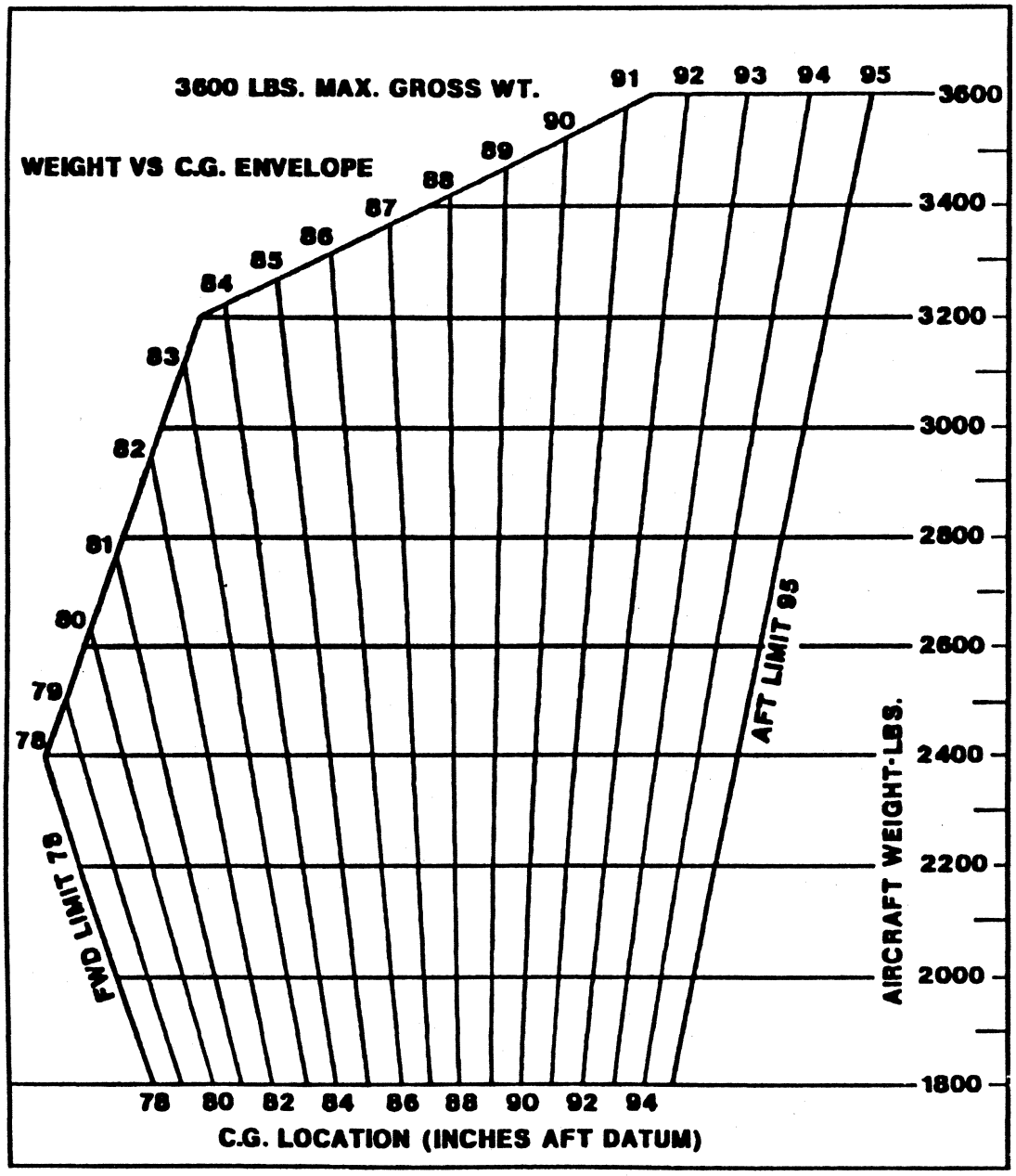
Locate the center of gravity of the landing weight on the C.G. range and weight graph. Since this point falls within the weight - C.G. envelope, the loading may be assumed acceptable for landing.

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

WEIGHT AND BALANCE LOADING FORM
(NORMAL CATEGORY)
Figure 6-11



LOADING GRAPH
Figure 6-13



C.G. RANGE AND WEIGHT
Figure 6-15

Anglo American Airmotive

Incorporating A & G Aviation Ltd

WEIGHT & CENTRE OF GRAVITY SCHEDULE

A/C Type	**Piper PA32R-301**	Report Ref:	**AAA/WB/015**
A/C Reg:	N123AX	Max. Auth Wt:	**3600 lbs**
Con No:	**3246060**	C of G limits or Flt Manual Ref:	**VB 1600**

PART "A" BASIC WEIGHT

The basic weight of the aircraft as calculated from weighing report No: **See P.O.H.** on date: **19.12.96** is **2404.4** lbs.
The Centre of Gravity of the aircraft in the same condition at this weight and with the landing gear extended is **83.4** inches Aft/~~Fwd~~ of the datum.
The total moment about the datum in this condition in lb-ins/100 is: **200546**

This datum is the one which the limits in the Certificate of Airworthiness/Flight Manuals relate and is defined as: **92.6 inches aft of the datum line.**

All lever arms are distances in inches Aft/~~Fwd~~ of the datum.

The basic weight includes the weight of the total quantity of unusable fuel and usable oil and weight of the following which comprise of the list of **BASIC EQUIPMENT.** (Please refer to the American Flight Manual Equipment List - 6 seats installed).

BASIC EQUIPMENT

Refer to Pilots Operating Manual VB 1600

NOTE:-

Additional equipment is as per the Pilots Operating Manual equipment list.

PART "B" VARIABLE LOAD

The weight and lever arms of the variable load are shown below. The variable load depends upon the equipment carried for the particular role

ITEM	Weight lb.	Lever Arm inches.	Moment lbin/100
..... Crew member @ 165 lb per person **		**85.5**	
Row 1 Passenger Seat ( )		**85.5**	
Row 2 Passenger Seats ( )		**119.1**	
Row 3 Passenger Seats ( )		**157.6**	
Navigation Bag ( )		**178.7**	

** The actual weight and moment of the pilot may be used provided that the total weight and moment of variable load is adjusted accordingly.

PART "C" - LOADING INFORMATION (Disposable Load)

The total moment change when the landing gear is retracted in lbs ins/100 is:

ITEM	Weight lb.	Lever Arm inches.	Moment lbin/100
Fuel in tanks - MAIN * 48 gallons maximum		**94.0**	
Engine Oil *	Included in	basic weight	
Baggage (Fwd) 100 lbs maximum		**42.0**	
Baggage (Aft) 100 lbs maximum		**178.7**	
Passengers in - Row 1 seat		**85.5**	
Passengers in - Row 2 seats		**119.1**	
Passengers in - Row 3 seats		**157.6**	

* Fuel density 7.2 lb/gal and Oil density 9.1 lb/gals.

NOTE: The total loaded weight of the aircraft is the sum of the operating weight of the disposable load.

This schedule was prepared on **30 January 1997** and supersedes all previous issues.

Signed:  ... Chief Engineer for Anglo American Airmotive Ltd

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SECTION 7

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

7.1 THE AIRPLANE

The Saratoga II HP is a single engine, low wing, retractable landing gear airplane. It is all metal, seats up to six occupants, and has two separate one hundred pound capacity baggage compartments.

7.3 AIRFRAME

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

The fuselage is a semi-monocoque structure. There is a front door on the right side and a rear door on the left. A cargo door is installed aft of the rear passenger door. When both rear doors are open, large pieces of cargo can be loaded through the extra-wide opening. A door on the right side of the nose section gives access to the nose baggage compartment.

The wing is of a semi-tapered design and employs a laminar flow NACA 652-415 airfoil section. The main spar is located at approximately 40% of the chord aft of the leading edge. The wings are attached to the fuselage by the insertion of the butt ends of the spar into a spar box carry-through, which is an integral part of the fuselage structure. The bolting of the spar ends into the spar box carry-through structure, which is located under the center seats, provides in effect a continuous main spar. The wings are also attached fore and aft of the main spar by an auxiliary front spar and a rear spar. The rear spar, in addition to taking torque and drag loads, provides a mount for flaps and ailerons. Each wing contains two interconnected fuel tanks. Both tanks on one side are filled through a single filler neck located in the outboard tank.

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

7.5 ENGINE AND PROPELLER

The Lycoming engine is rated at 300 horsepower at 2700 rpm. This engine has a compression ratio of 8.7 to 1 and requires 100 minimum grade fuel. The engine is equipped with a geared starter, a 90 ampere alternator, dual magnetos, vacuum pump drive, a diaphragm-type fuel pump, and fuel injection.

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

The cowling is designed to cool the engine in all normal flight conditions, including protracted climb, without the use of cowl flaps or cooling flanges.

An induction scoop is located on the left side of the lower cowl. An intake air box is attached to the inside of the cowl adjacent to the air filter box.

The intake air box incorporates a manually operated two-way valve designed to allow induction air either to pass through the filter or to bypass the filter and supply heated air directly to the engine. Alternate air selection insures induction air flow should the filter become blocked. Since the air is heated, the alternate air system offers protection against induction system blockage caused by snow or freezing rain, or by the freezing of moisture accumulated in the induction air filter. Alternate air is unfiltered; therefore, it should not be used during ground operation when dust or other contaminants might enter the system. The primary (through the filter) induction source should always be used for takeoffs.

The fuel injection system consists of a servo regulator which meters fuel flow in proportion to airflow to the engine, giving the proper fuel-air mixture at all engine speeds, and a fuel flow divider which receives the metered fuel and accurately divides the fuel flow among the individual cylinder fuel nozzles.

A combination fuel flow indicator and manifold pressure gauge is installed in the left side of the instrument panel. The fuel flow indicator is connected to the fuel flow divider and monitors fuel pressure. The instrument converts fuel pressure to an indication of fuel flow in gallons per hour and percentage of cruise power.

The constant speed propeller is controlled by a governor mounted at the left forward side of the crankcase. Control from the engine control quadrant is provided by a push-pull control.

7.7 ENGINE CONTROLS

Engine controls consist of a throttle control, a propeller control and a mixture control lever. These controls are located on the control quadrant on the lower center of the instrument panel (Figure 7-1) where they are accessible to both the pilot and the copilot. The controls utilize teflon-lined control cables to reduce friction and binding.

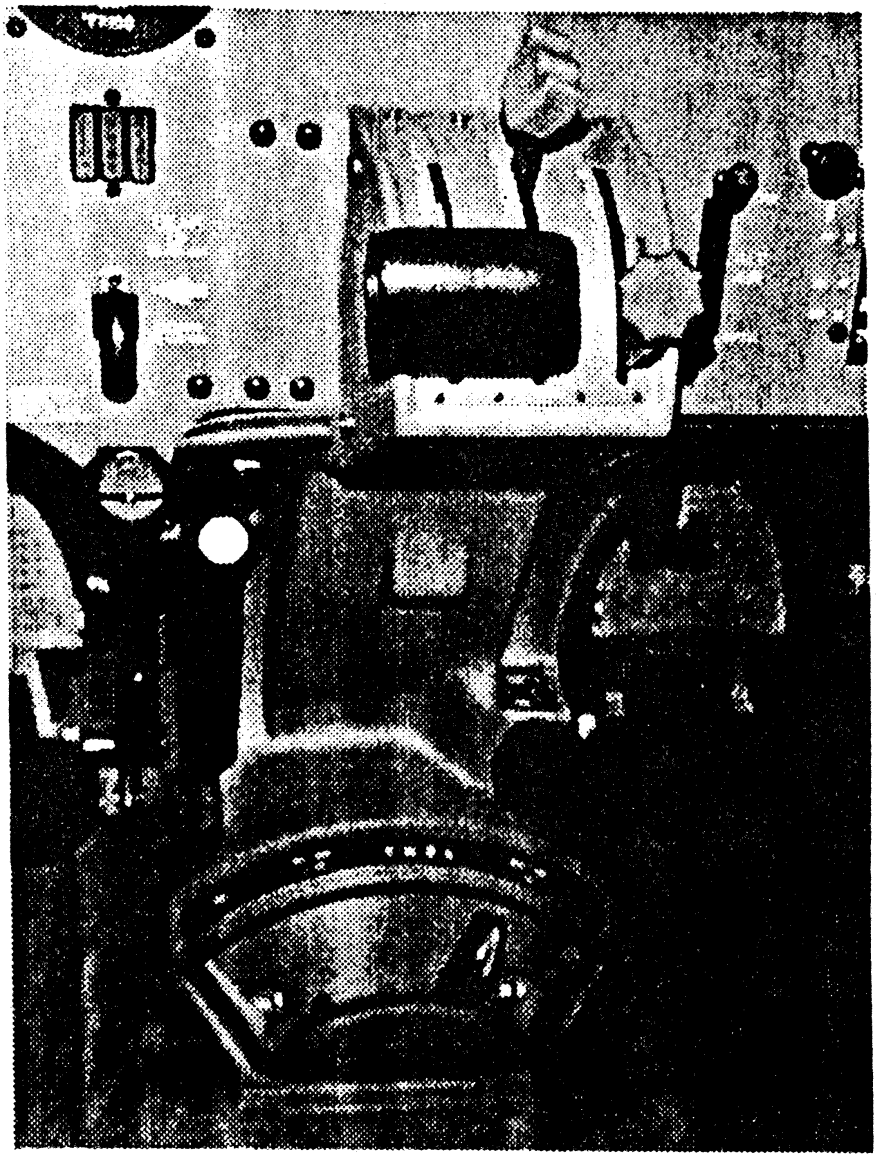
The throttle lever is used to adjust the manifold pressure. It incorporates a gear up warning horn switch which is activated during the last portion of travel of the throttle lever to the low power position. If the landing gear is not locked down, the horn will sound until the gear is down and locked or until the power setting is increased. This is a feature to prevent an inadvertent gear up landing.

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

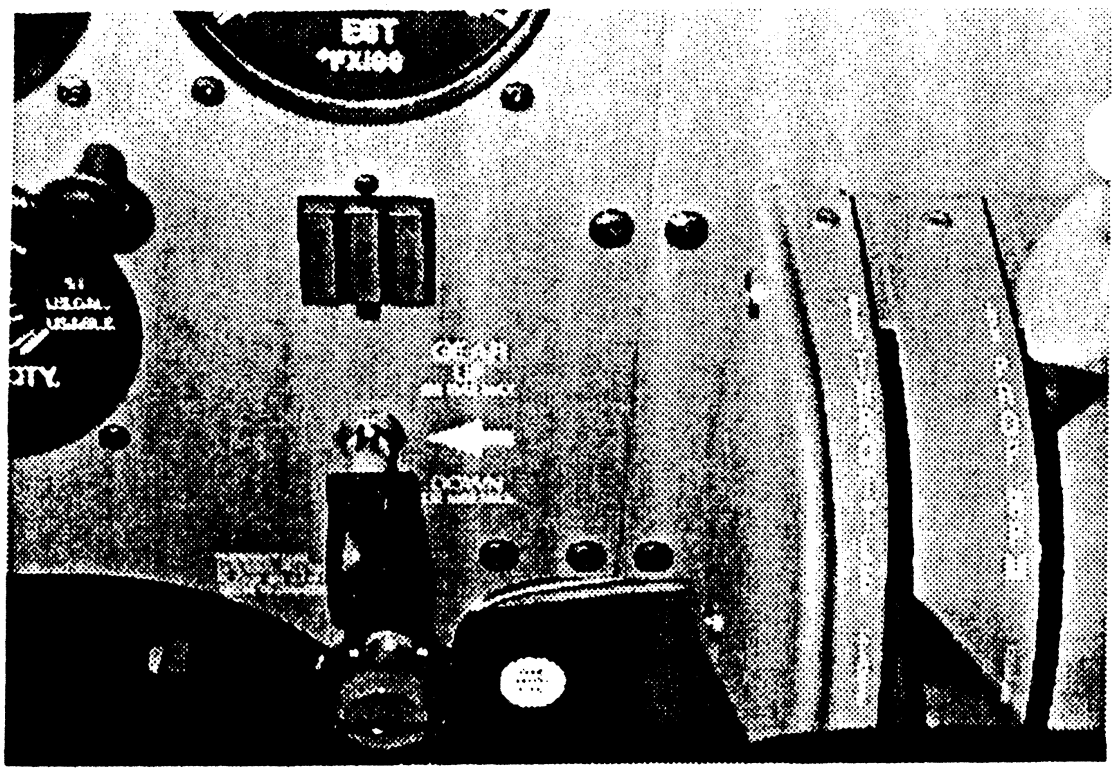
The mixture control lever is used to adjust the air to fuel ratio. The engine is shut down by the placing of the mixture control lever in the full lean position. In addition, the mixture control has a lock to prevent activation o the mixture control instead of the pitch control. For information on the leaning procedure, see the Avco-Lycoming Operator's Manual and the leaning procedure in Section 4 of this handbook.

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

The alternate air control is located to the right of the control quadrant. When the alternate air lever is in the up, or closed, position the engine is operating on filtered air; when the lever is in the down, or open, position the engine is operating on unfiltered, heated air. The control is operated by pressing the knob to the left to clear the retaining gate and then moved in the desired direction (refer to Figure 7-1).



CONTROL QUADRANT AND CONSOLE
Figure 7-1



LANDING GEAR SELECTOR
Figure 7-3

7.9 LANDING GEAR

The airplane is equipped with a retractable tricycle landing gear, which is hydraulically actuated by an electrically powered reversible pump. The pump is controlled by a selector switch on the instrument panel to the left of the control quadrant (Figure 7-3). The landing gear is retracted or extended in about seven seconds.

EMERGENCY GEAR extension system allows the landing gear to free fall, with spring assist on the nose gear, into the extended position where the mechanical locks engage. If a gear system malfunction has been indicated and the EMERGENCY Gear extension system used, it is recommended that the EMERGENCY GEAR extension control be left in the pulled position until the aircraft is safely on jacks. See the Service Manual for proper landing gear system check-out procedures. If the aircraft is being used for training purposes or a pilot check-out flight the EMERGENCY GEAR extension control and HYD PUMP circuit breaker must be reset in order f hydraulic pressure to be generated in the UP side of the system and the g retracted.

Gear down and locked positions are indicated by three green lights located above the selector, and a red " GEAR WARN" light located in the annunciator cluster. An all lights out condition indicates the gear is up. The landing gear should not be retracted above a speed of 110 KIAS and should not be extended above a speed of 132 KIAS.

NOTE:

Day/night dimmer switch must be in the DAY position to obtain full intensity of the gear position indicator lights during daytime flying. When aircraft is operated at night, the switch should be in the NIGHT position to dim the gear lights.

A micro-switch in the throttle quadrant activates a warning horn and red "GEAR WARN" light under the following conditions:

(1) Gear up and power reduced below approximately 14 inches of manifold pressure.

(2) Gear selector switch UP while on the ground and throttle in retarded position.

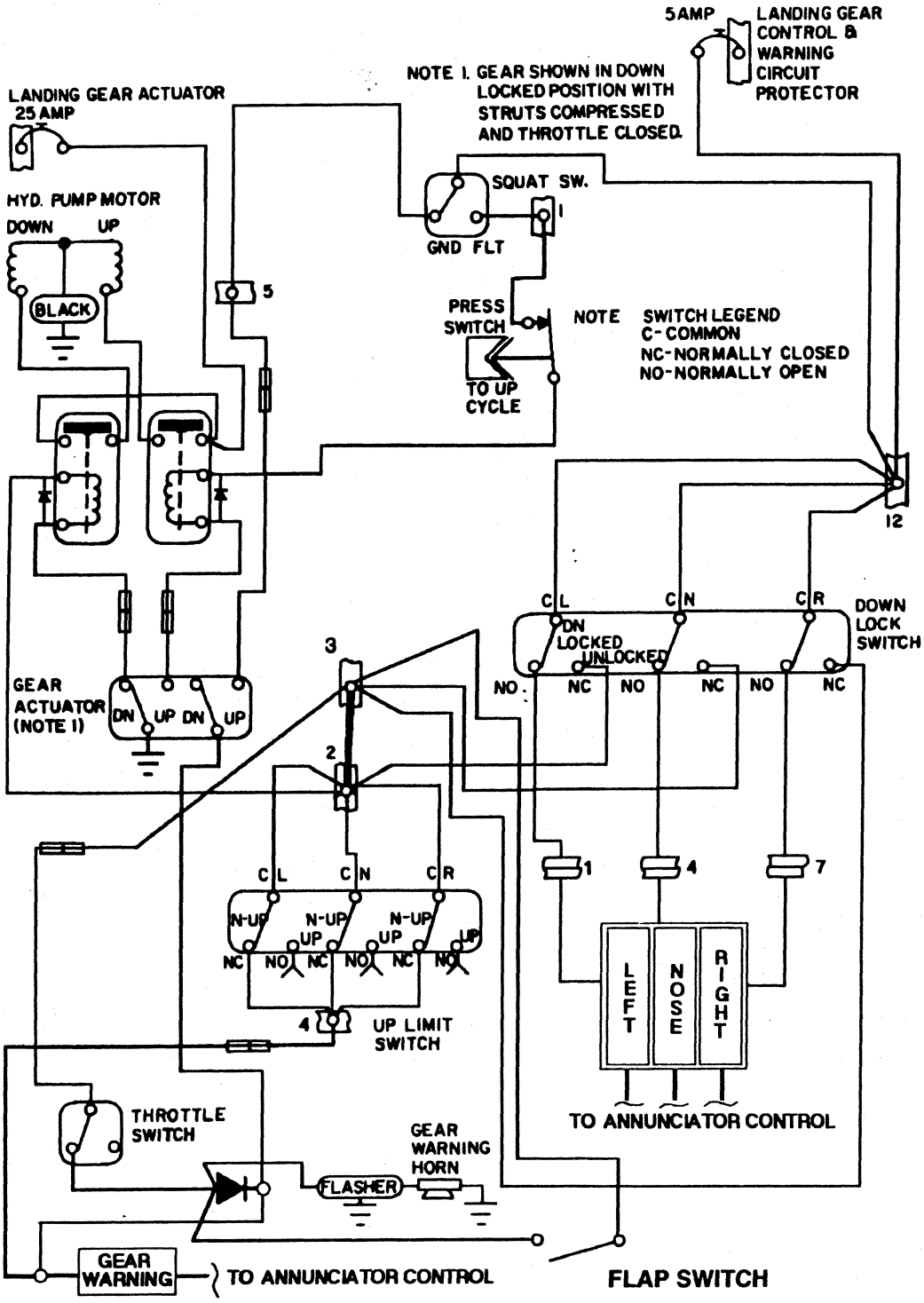
(3) Whenever the flaps are extended beyond the approach position (10°)and the landing gear is not down and locked.

The gear warning horn emits a 90 cycle per minute beeping sound in contrast to the stall warning horn which emits a continuous sound.

The nose gear is steerable through a 22.5 degree arc each side of center through the use of the rudder pedals. As the nose wheel retracts, the steering linkage disengages to reduce rudder pedal loads in flight. The nose wheel is equipped with a hydraulic shimmy dampener to reduce nose wheel shimmy.

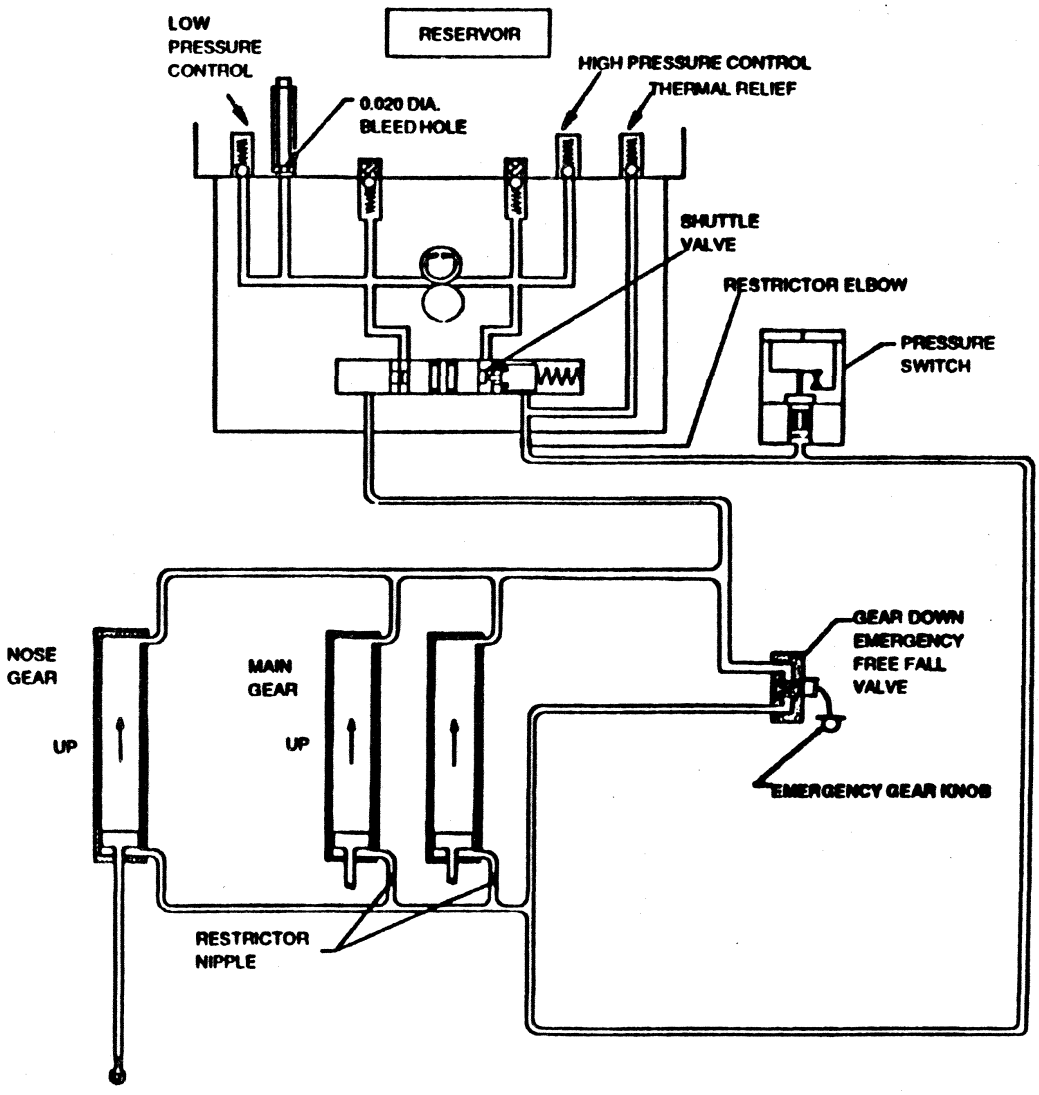
The oleo struts are of the air-oil type, with normal extension being 3.25 ± .25 inches for the nose gear and 4.5 ± .5 inches for the main gear under normal static load (empty weight of airplane plus full fuel and oil).

The standard brake system includes toe brakes on the left and right set of rudder pedals and a hand brake located below and near the center of the instrument panel. The toe brakes and the hand brake have individual brake cylinders, but all cylinders use a common reservoir. The parking brake is incorporated in the lever brake and is operated by first depressing and holding the toe brake pedals and then pulling back on the lever and depressing the knob attached to the top of the handle. To release the parking brake, first depress and hold the toe brake pedals and then pull back on the brake lever; then allow the handle to swing forward.



LANDING GEAR ELECTRICAL SCHEMATIC

Figure 7-5



LANDING GEAR HYDRAULIC SYSTEM SCHEMATIC
Aircraft equipped with Oildyne pump and cable emergency gear release
Figure 7-7

7.11 FLIGHT CONTROLS

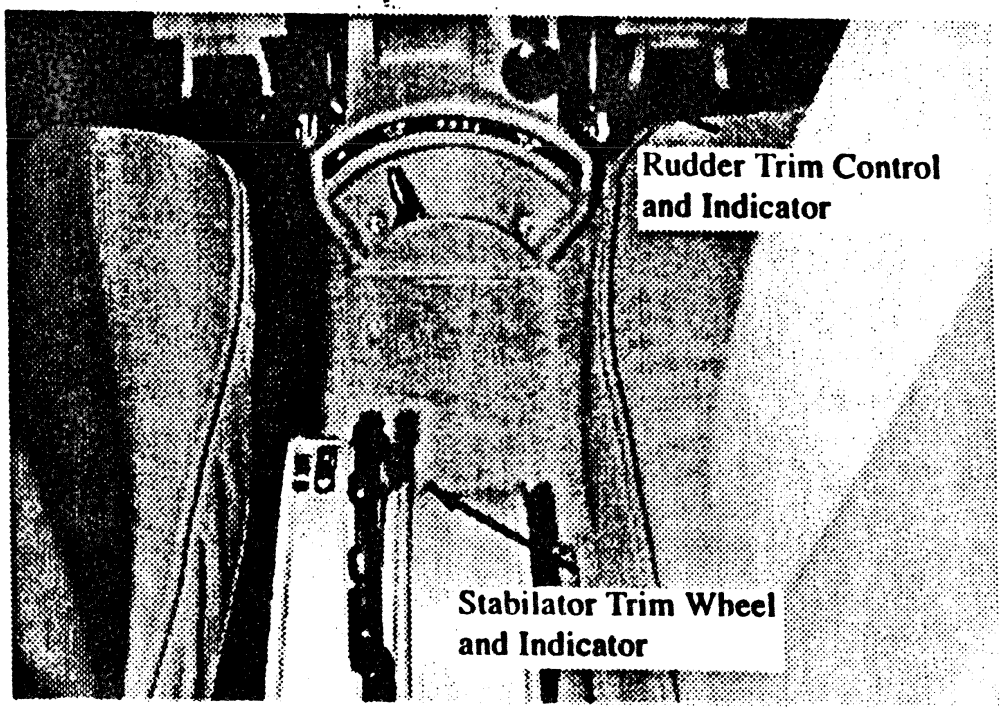
Dual flight controls are provided as standard equipment. A cable system provides actuation of the control surfaces when the flight controls are moved in their respective directions.

The horizontal surface (stabilator) features a trim tab/servo mounted on the trailing edge. This tab serves the dual function of providing trim control and pitch control forces. The trim function is controlled by a trim control wheel located on the control console between the two front seats (Figure 7-9). Rotating the wheel forward gives nose down trim and rotation aft 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. Turning the trim control clockwise gives nose right trim and counterclockwise rotation gives nose left trim.

The wing flaps are electrically controlled (fig. 7-10) by a selector lever mounted on the instrument panel to the right of the control pedestal. A flap annunciator light is provided as part of the annunciator panel located in the upper center section of the instrument panel. Selection of a new flap position will activate the flap motor and the light. When the flaps reach the desired position, the flap motor is automatically switched off and the indicator light goes out.

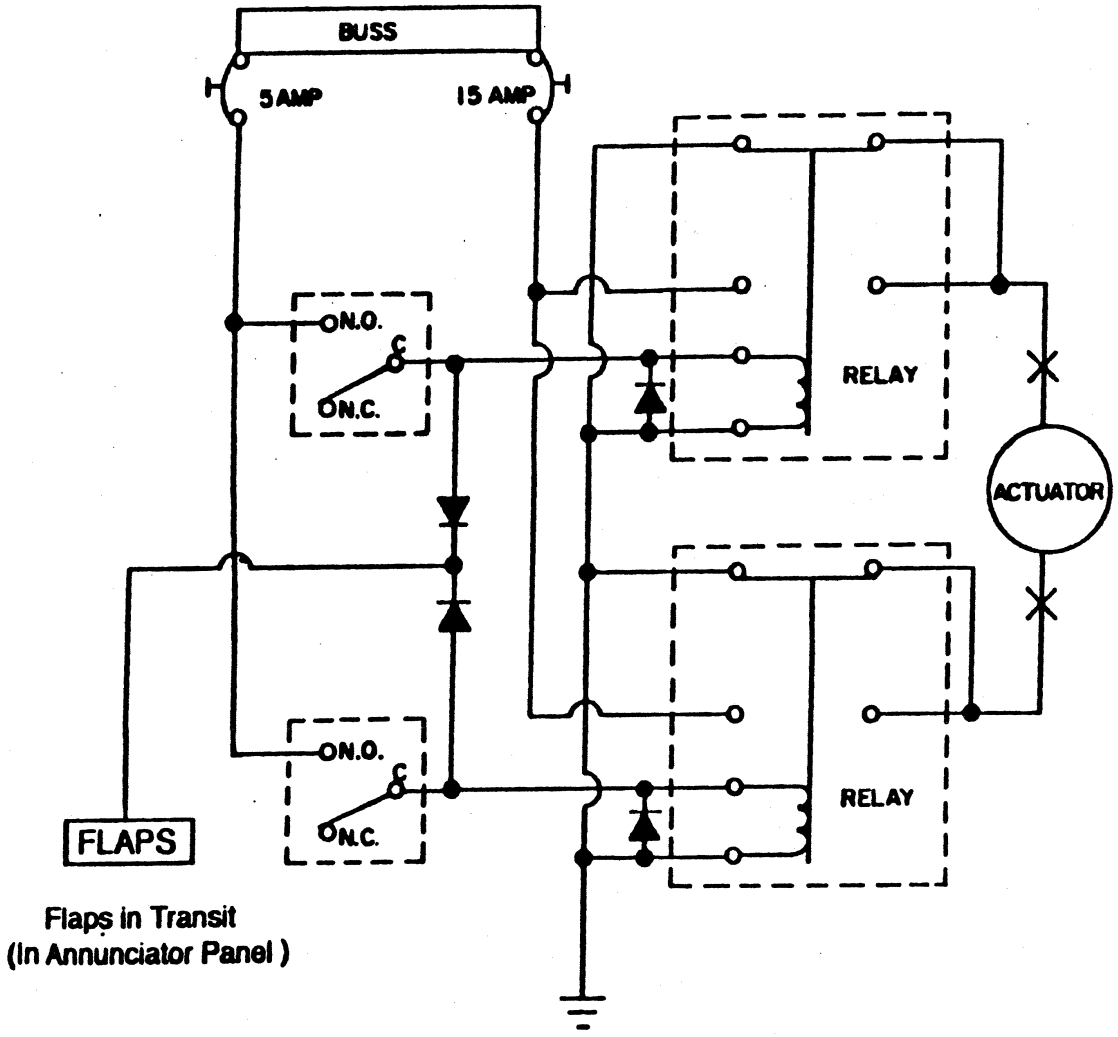
In the event of a flap drive malfunction; move the flap lever until the light goes out. The position of the flap lever relative to the instrument panel markings indicates the approximate flap position.



FLIGHT CONTROL CONSOLE
Figure 7-9

There are four stops for the flap control lever, full up (0° flap), 1st notch (10° flap), 2nd notch (25° flap) and full down (40° flap).
When extending or retracting flaps, there is a pitch change in the aircraft. This pitch change can be corrected either by stabilator trim or increased control wheel force. When the flaps are in the retracted position the right flap is provided with a over-center lock mechanism which acts as a step.

NOTE
The right flap will support a load only in the fully retracted (up) position. When loading and unloading passengers make sure the flaps are in the retracted (up) position.



ELECTRIC FLAP SCHEMATIC
Figure 7-10

7.13 FUEL SYSTEM

The standard fuel capacity of the Saratoga II HP is 107 gallons, of which 102 gallons are usable. The inboard tank is attached to the wing structure ith screws and nut plates and can be removed for service or inspection. The utboard tank consists of a bladder fuel cell that is interconnected with the inboard tank. A flush fuel cap is located in the outboard tank only.

When using less than the standard 107 gallon capacity of the tanks, fuel should be distributed equally between each side.

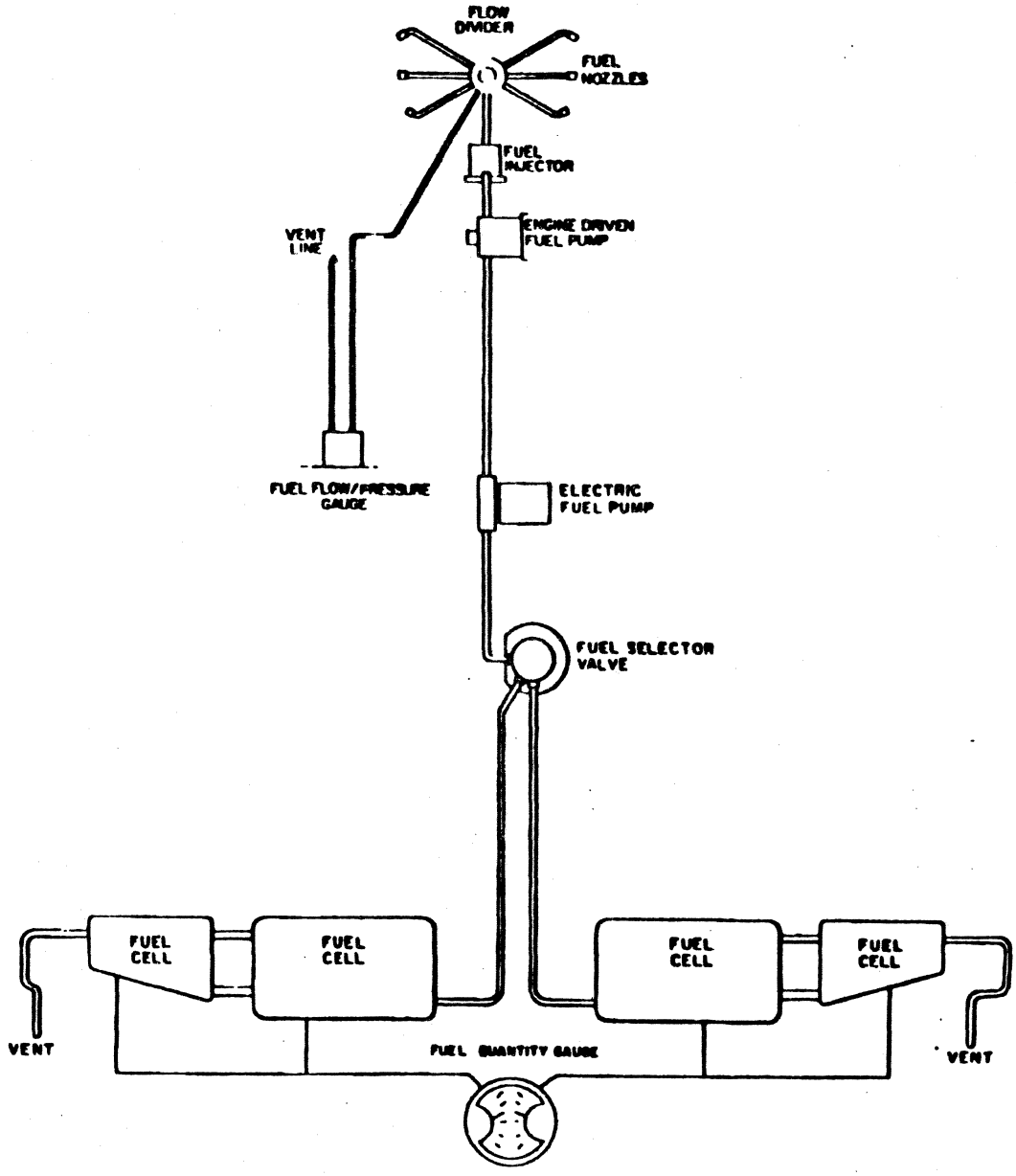
The fuel selector control is located below the center of the instrument panel on the sloping face of the control tunnel (refer to Figure 7-1). It has three positions, one position corresponding to each wing tank plus an OFF position.

To avoid the accumulation of water and sediment, the fuel tank sumps and strainer should be drained daily prior to first flight and after refueling. Each inboard tank is equipped with an individual quick drain located at the lower inboard rear corner of the tank. The fuel strainer and a system quick drain valve are located in the fuselage at the lowest point of the fuel system. It is important that the fuel system be drained in the following manner:

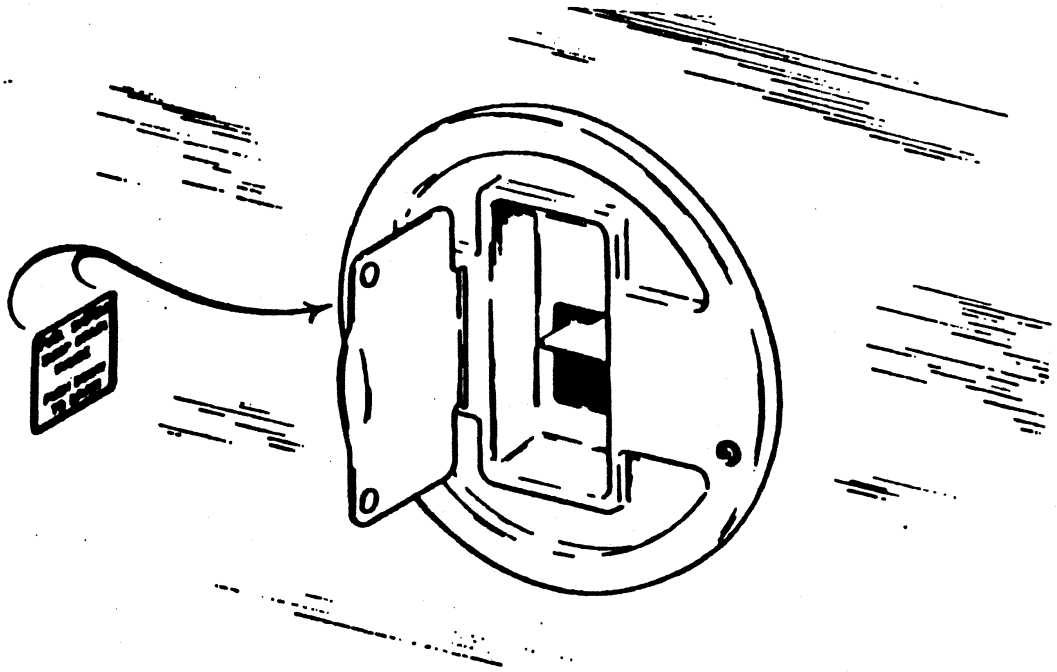
1. Drain each tank sump through its individual quick drain located at the lower inboard rear corner of the tank, making sure that enough fuel has flowed to ensure the removal of all water and sediment.
2. Place a container beneath the fuel strainer sump drain outlet located under the fuselage.
3. Drain the fuel strainer sump by pressing down on the lever located on the right side of the cabin on the forward edge of the wing spar housing (Figure 7-13). Move the selector through the following sequence: OFF position, left, right, while draining the strainer sump. Make sure that enough fuel has flowed to drain the fuel line between each tank outlet and the fuel strainer, as well as the strainer itself. With full fuel tanks, it will take approximately 6 seconds to drain all of the fuel from the line from either tank to the fuel strainer. When the tanks are less than full, it will take a few seconds longer.
4. Examine the contents of the container placed under the fuel sump drain outlet. When the fuel flow is free of water and sediment, close the drain and dispose of the contents of the bottle.

CAUTION

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



FUEL SYSTEM SCHEMATIC
Figure 7-11



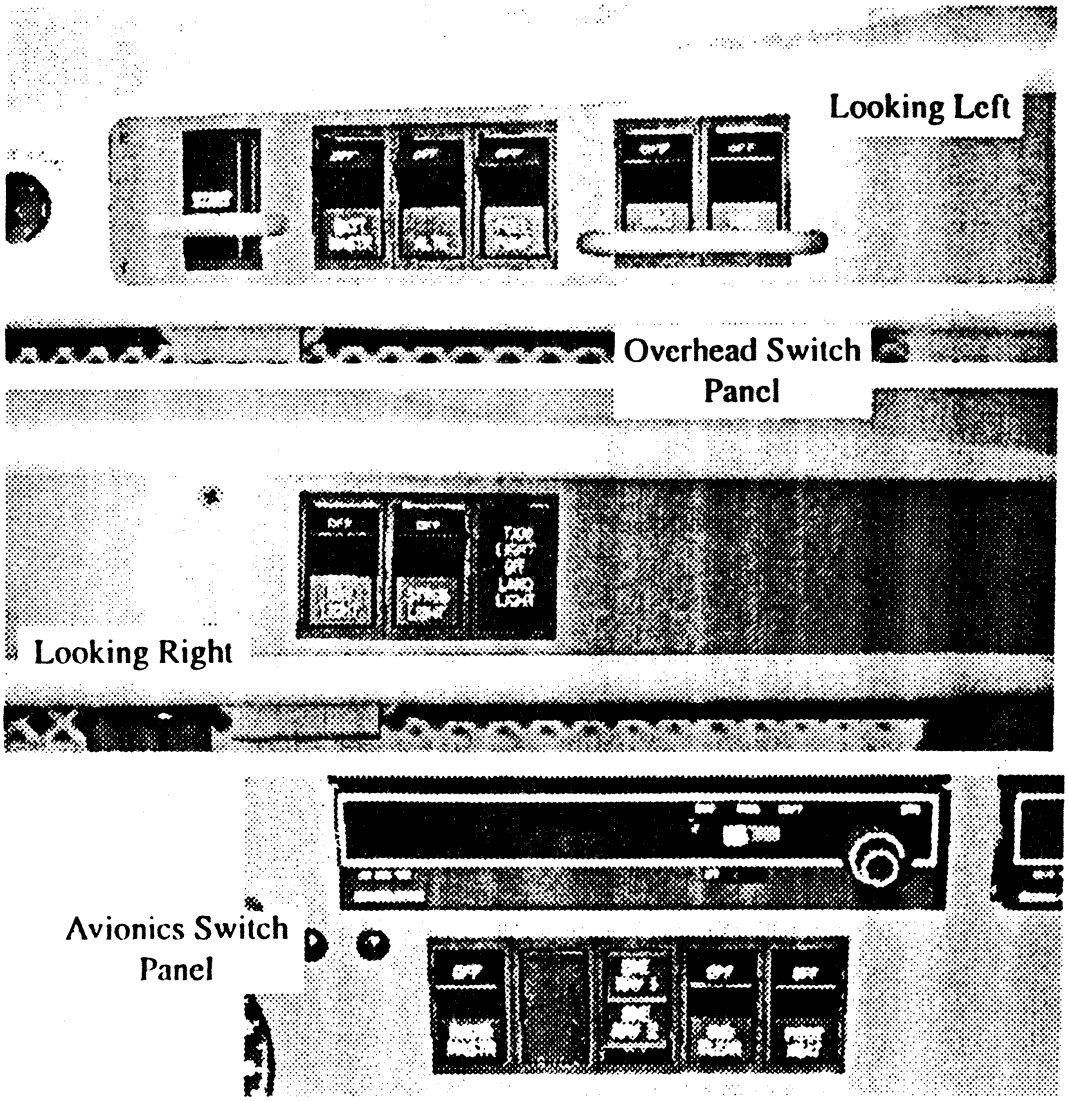
FUEL DRAIN LEVER
Figure 7-13

After using the underseat quick drain, check from the outside to make sure that it has closed completely and is not leaking.

A dual fuel quantity gauge is located in the lower center of the instrument panel next to the gear selector.

A fuel quantity indicator to measure the fuel not visible through the filler neck in each wing is installed in the inboard fuel tank. This gauge indicates usable fuel quantities from 5 gallons to 35 gallons in the ground attitude. The sole purpose of this gauge is to assist the pilot in determining fuel quantities of less than 35 gallons during the preflight inspection.

An electric fuel pump is provided for use in case of failure of the engine driven pump. The electric pump operates from a single switch and independent circuit protector. It should be ON for all takeoffs and landings.



SWITCH PANELS
Figure 7-15

7.15 ELECTRICAL SYSTEM

The 28-volt electrical system includes a 24-volt battery for starting and to back up alternator output. Electrical power is supplied by a 90 ampere alternator. The battery, a master switch relay, a voltage regulator and an overvoltage relay are located beneath the floor of the forward baggage compartment. Access to these electrical components is gained by removing the compartment floor and access panel located on the left side of the forward fuselage.

All powerplant and exterior light switches are grouped in an overhead switch panel with all avionics switches grouped in a switch panel located just above the throttle quadrant. (figure 7-15). The circuit breaker panel is located on the lower right side of the instrument panel (figure 7-19). Each breaker is clearly marked to show which circuit it protects. Also, circuit provisions are made to handle the addition of communications and navigational equipment.

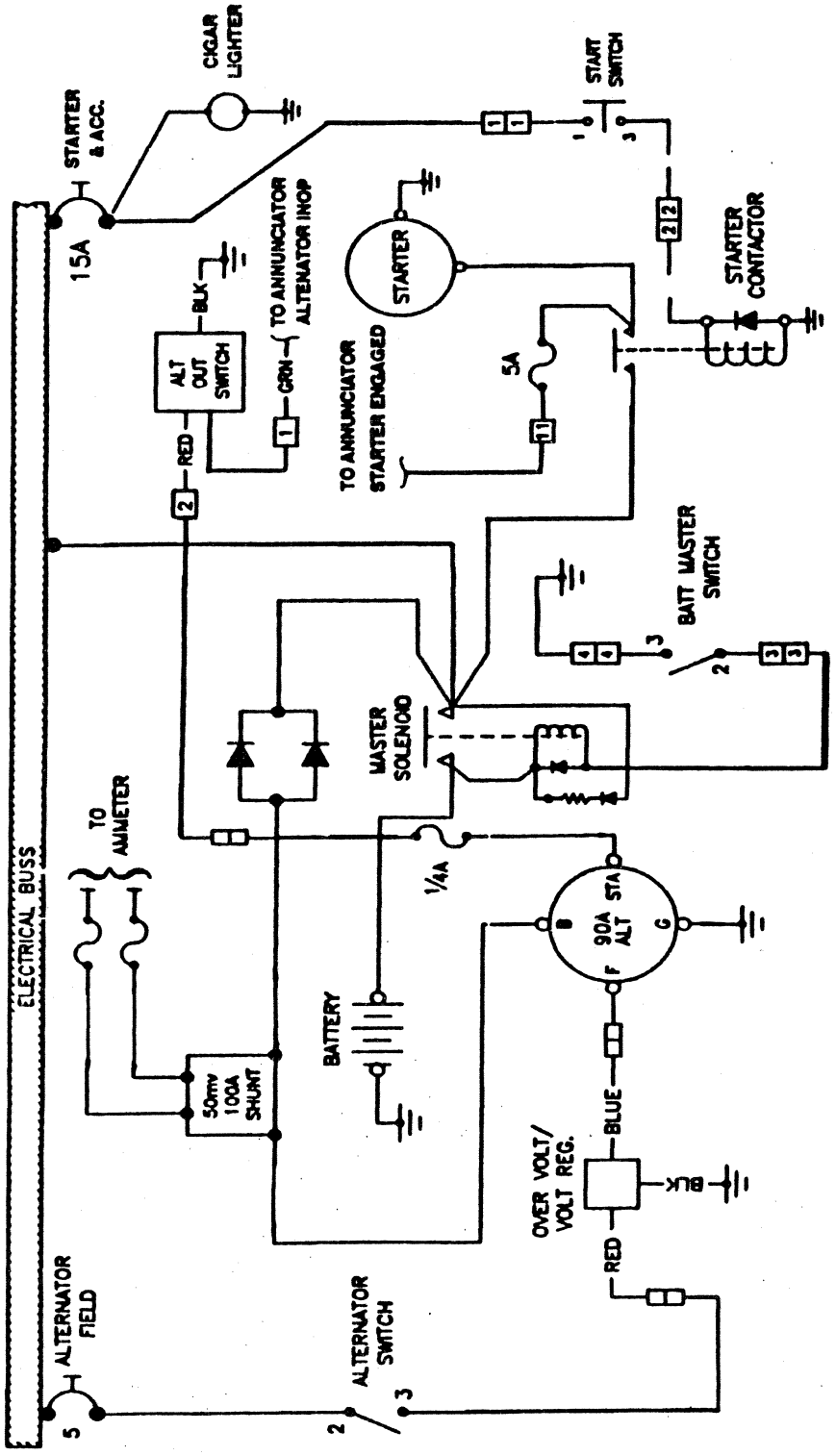
Standard electrical accessories include the starter, the electric fuel pump, the stall warning horn, the ammeter, and the annunciator panel.The annunciator panel includes, alternator inop, oil pressure, gear warn, flaps, starter engaged, low bus voltage, pitot heat off/inop, and vacuum inop indicator lights and provisions for optional baggage door ajar, air conditioner door open. The annunciator panel lights are provided only as a warning to the pilot that a system may not be operating properly, and that the applicable system gauge should be checked and monitored to determine when or if any corrective action is required.

Optional electrical accessories include the navigation lights, anti-collision strobe lights, instrument panel lighting and cabin courtesy lights. The cabin courtesy light installation consists of two light/switch panels, one mounted above each cabin entrance. Make sure the lights are off when leaving the aircraft. Leaving the lights on for an extended period of time could cause depletion of the battery.

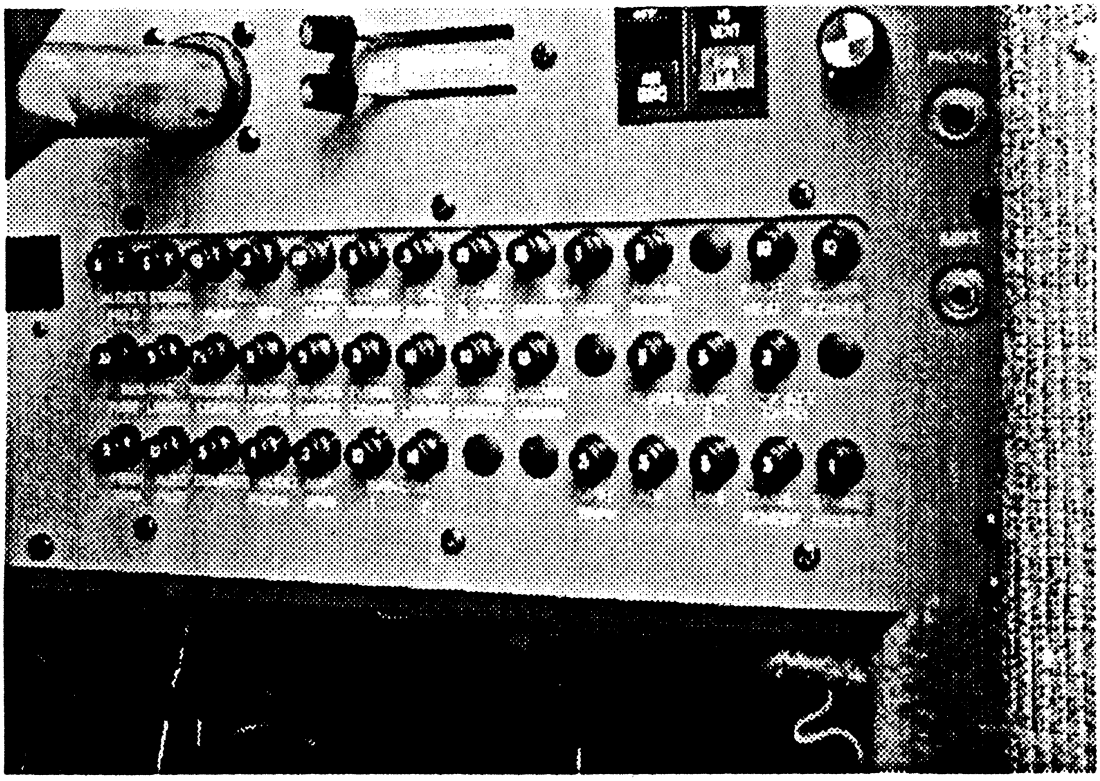
Two lights, mounted in the overhead panel, provide instrument and cockpit lighting for night flying. The lights are controlled by rheostat switches located adjacent to them. A map light window in each lens is actuated by an adjacent switch. A wing tip recognition/landing light system consists of 2 lights (one in each wing tip) and is operated by a rocker type switch mounted in the overhead switch panel.

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

The ammeter in the alternator system displays in amperes the load placed on the alternator. It does not indicate battery discharge. With all electrical equipment off (except the master switch) the ammeter will be indicating the amount of charging current demanded by the battery. As each item of electrical equipment is turned on, the current will increase to a total appearing on the ammeter. This total includes the battery. The average continuous load for night flight, with radios on, is about 35 amperes. This 35 ampere value, plus approximately 2 amperes for a fully charged battery, will appear continuously under these flight conditions.



ALTERNATOR AND STARTER SCHEMATIC
Figure 7-17



CIRCUIT BREAKER PANEL
Figure 7-19

For Abnormal and/or Emergency procedures, see Section 3.

WARNING

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

CAUTION

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

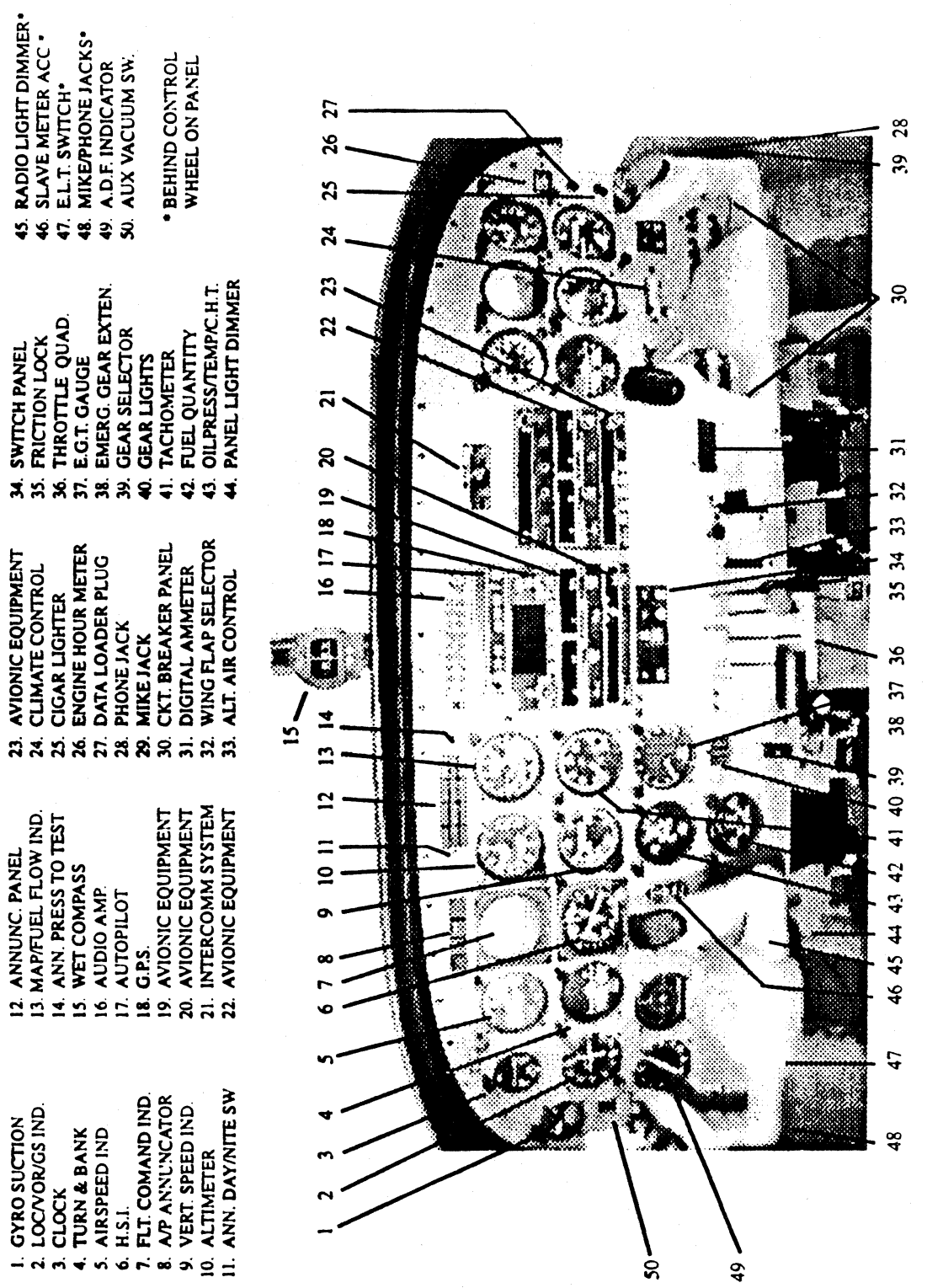
7.17 VACUUM SYSTEM

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 which eliminates the need for an air/oil separator and its plumbing. A shear drive protects the engine from damage. If the drive shears the gyros will become inoperative.

The vacuum gauge, mounted on the left instrument panel, (refer to Figure 7-21) provides valuable information to the pilot about the operation of the vacuum system. A decrease in pressure in a system that has remained constant over an extended period, may indicate a dirty filter, dirty screens, possibly a sticking vacuum regulator or leak in system (a vacuum inop 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 4.8 to 5.2 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.



TYPICAL INSTRUMENT PANEL
Figure 7-21

7.19 INSTRUMENT PANEL

The instrument panel is designed to accommodate the customary advanced flight instruments and the normally required power plant instruments. The artificial horizon and directional gyro are vacuum operated and are located in the center of the left-hand instrument panel. The vacuum gauge is located on the upper left hand instrument panel. The turn indicator, on the left side, is electrically operated.

The radios are located in the center section of the panel, and the circuit breakers are in the lower right corner of the panel. An optional radio MASTER switch is located on the lower center instrument panel in the switch cluster. It controls the power to all radios through the aircraft MASTER switch. The radio power switch has an OFF, and ON position.

A ground clearance energy saver system is available to provide direct power to Comm 1 without turning on the master switch. An internally lit pushbutton switch, located on the instrument panel, provides annunciation for engagement of the system. When the button is engaged direct aircraft battery power is applied to Comm 1, audio amplifier (speaker) and radio accessories. The switch must be turned OFF or depletion of the battery could result.

7.21 PITOT-STATIC SYSTEM

Pitot pressure for the airspeed indicator is sensed by a heated pitot head installed on the bottom of the left wing and is carried through lines within the wing and fuselage to the gauge on the instrument panel (refer to Figure 7-23). Static pressure for the altimeter, vertical speed and airspeed indicators is sensed by two static source pads, one on each side of the rear fuselage forward of the elevator. The dual pickups balance out differences in static pressure caused by slight side slips or skids.

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

If one or more of the pitot static instruments malfunction, the system should be checked for dirt, leaks or moisture. The static lines may be drained by a valve located on the side panels next to the pilot's seat. The pitot system drains through the pitot mast.

The holes in the sensors for pitot and static pressure must be fully open and free from blockage. Blocked sensor holes will give erratic or zero readings on the instruments.

NOTE

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

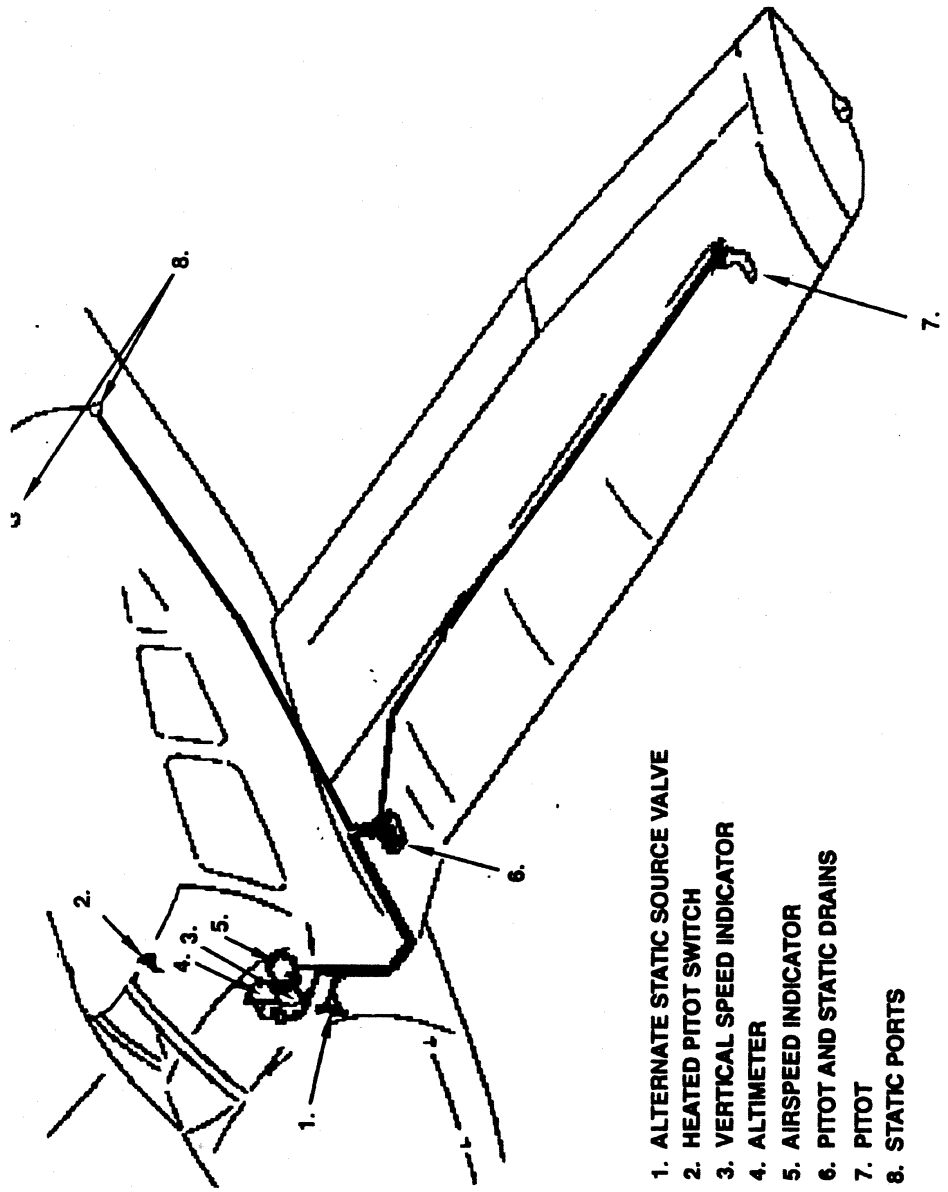
A heated pitot head, which alleviates problems with icing and heavy rain is installed as standard equipment. The switch for pitot heat is located in the overhead switch panel. The pitot heat system has a separate circuit breaker located in the circuit breaker panel and labeled PITOT/STALL, WARN HEAT. Static source pads have been demonstrated to be non-icing: however, in the event icing does occur, selecting the alternate static source will alleviate the problem.

7.23 CABIN FEATURES

For ease of entry and exit and for pilot and passenger comfort, the front seats are adjustable fore and aft. All seats recline and have armrests and are available with optional headrests. The front seats can be equipped with optional vertical adjustment. The center and rear seats may be removed for additional cargo space.

NOTE

To remove the center seats, retainers securing the back legs of the seats must be unlocked. This is accomplished by depressing the plunger behind each rear leg. Any time the seats are installed in the airplane, the retainers should be in the locked position. To remove the rear seats, depress the plunger behind each front leg and slide seat to rear.



PITOT-STATIC SYSTEM
Figure 7-23

Shoulder harnesses with inertia reels are standard equipment for all seats.

The inertia reel should be checked by tugging sharply on the strap. The reel will lock in place under this test and prevent the strap from extending. Under normal movement, the strap will extend and retract as required.

For each front seat passenger, a single strap adjustable shoulder harness is installed. The shoulder strap is routed over the shoulder adjacent to the windows and attached to the lap belt in the general area of the person's inboard hip. Adjust this fixed strap so that all controls are accessible while maintaining adequate restraint for the occupant.

Shoulder harnesses should be routinely worn during takeoff, landing and whenever an inflight emergency occurs.

An optional refreshment console is located between the center seats. It is removed in an identical manner to the center seats.

A cabin work table, serving the two seats on the right side of the passenger cabin is available as optional equipment. The table must be stowed during takeoff and landing. If the table is to be used, it should be set up after a level cruise is established.

To set up the cabin work table, simply pull up, then out. To stow the cabin work table, lift up and slide it back in to the side panel.

7.25 BAGGAGE AREA

The airplane has two separate baggage areas, each with a 100 pound capacity. A 7 cubic foot forward luggage compartment, located just aft of the fire wall, is accessible through a 16 x 22 inch door on the right side of the fuselage. A 17.3 cubic foot aft compartment is located behind the fifth and sixth seats and is accessible through the cargo door on the aft side of the fuselage and during flight from inside the cabin.

An automatic forward baggage compartment light feature is available which utilizes a magnetic reed switch and a magnet for activation. The switch and magnet are mounted just above the hinge line of the forward baggage door.

Opening the baggage door fully, activates the switch which turns on the baggage compartment light. The baggage compartment light is independent of the aircraft master switch; therefore, the light will illuminate regardless of the position of the master switch. The baggage door should not be left open for extended time periods, as battery depletion could result.

An optional forward baggage door ajar annunciation system is available which senses baggage door latch pin position. Failing to latch the forward baggage door will illuminate an amber light located on the pilot's annunciator panel. The annunciation, when illuminated, is "BAGG DOOR AJAR" advising the pilot of this condition.

NOTE

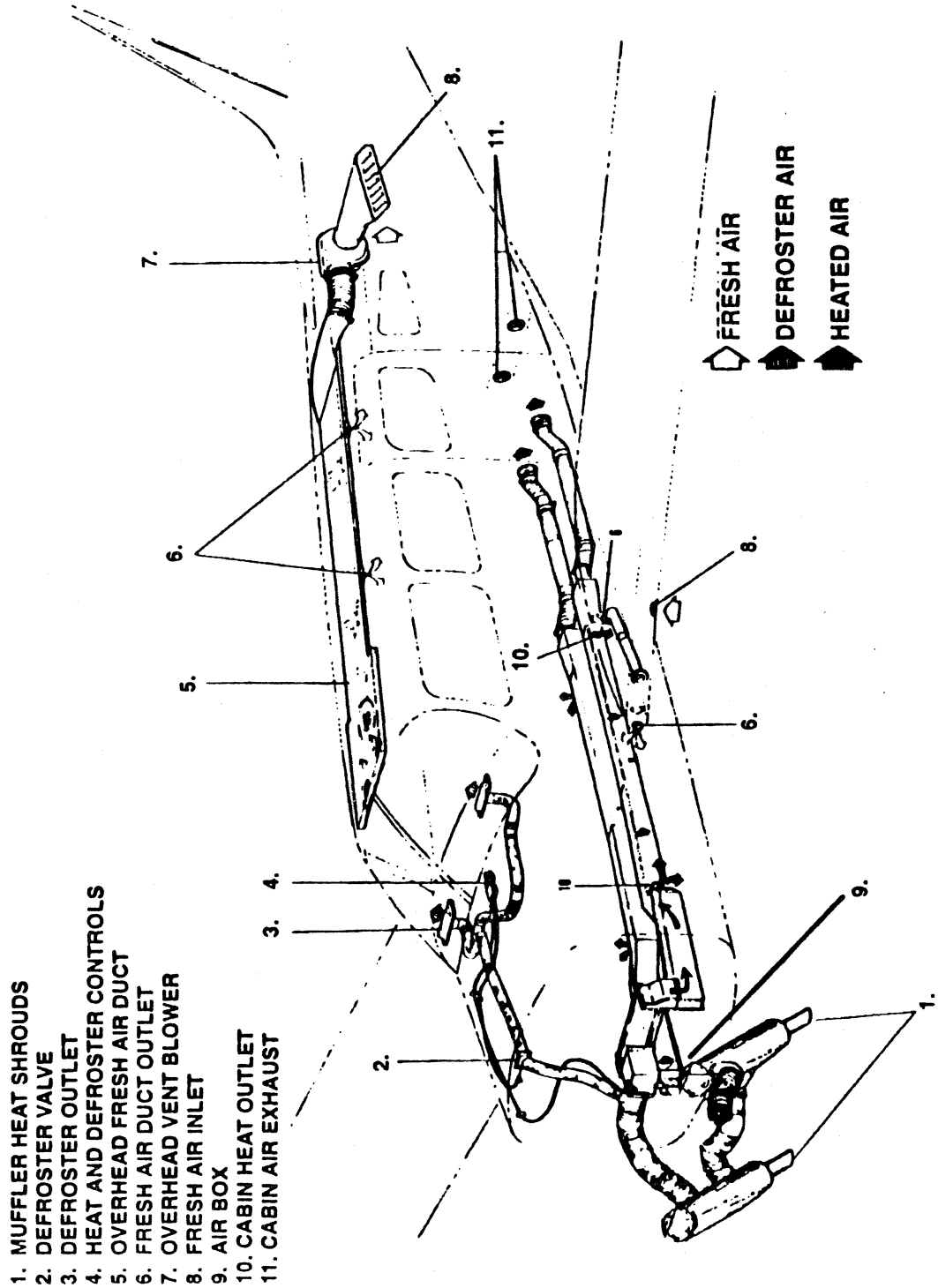
It is the pilot's responsibility to be sure when the baggage is loaded that the airplane's C.G. falls within the allowable C.G. range. (Refer to Weight and Balance Section.)

7.27 HEATING AND VENTILATING SYSTEM

Fresh air is ducted from a vent in the forward left lower cowling to the left heater muff by a flexible hose. It is then routed to the right heater muff by flexible hose Hot air from the right heater muff is routed through a flexible hose on the right side of the engine compartment, to the valve box mounted on the fire wall just above the tunnel cut out. It is then ducted down each side of the tunnel below the baggage floor to the cabin ducting and outlets (Figure 7-25).

CAUTION

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



HEATING AND VENTILATING SYSTEM
Figure 7-25

Defrost heat is bled off from the main flow at the heater muff and routed through flexible hose to a shut-off valve located to the right of center at the top of the fire wall. From this point, it is ducted to the defroster outlets.

Fresh air inlets are located in the leading edge of each wing and in the left side of the tail cone. Two adjustable outlets are located on each side of the cabin, one forward and one aft of the front seat near the floor. There are also adjustable outlets above each seat. In airplanes without air conditioning, an optional blower may be added to the overhead vent system to aid in the circulation of cabin air.

7.29 STALL WARNING

An approaching stall is indicated by a stall warning horn which is activated between five and ten knots above stall speed. Mild to moderate airframe buffeting may also precede the stall. Stall speeds are shown on graphs in the Performance Section. The stall warning horn emits a continuous sound. The landing gear warning horn is different in that it emits a 90 cycle per minute beeping sound. The stall warning horn is activated by lift detectors installed on the leading edge of the left wing. During preflight, the stall warning system should be checked by turning the master switch ON, lifting the detectors and checking to determine if the horn is actuated.

7.31 FINISH

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

An optional polyurethane enamel finish is available.

7.33 AIR CONDITIONING*

The air conditioning system is a recirculating air system. The major components include an evaporator, a condenser, a compressor, a blower, switches and temperature control.

The evaporator is located behind the rear baggage compartment. This cools the air used for the air conditioning system.

*Optional equipment

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

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

Air from the baggage area is drawn through the evaporator by the blower and distributed through an overhead duct to individual outlets located adjacent to each occupant.

The switches and temperature control are located on the lower right side of the instrument panel in the climate control center panel. The temperature control regulates the temperature of the cabin. Turning the control clockwise increases cooling; counterclockwise decreases cooling.

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

NOTE

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

The fan switch allows operation of the fan with the air conditioner turned OFF to aid in cabin air circulation. "LOW" or "HIGH" can be selected to direct a flow of air through the air conditioner outlets in the overhead duct. These outlets can be adjusted or turned off individually.

The condenser door light is located in the annunciator cluster at the top center of the instrument panel in front of the pilot. The door light illuminates when the door is open and is off when the door is closed.

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

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

7.35 PIPER EXTERNAL POWER*

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

7.37 EMERGENCY LOCATOR TRANSMITTER*

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

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

NOTE

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

*Optional equipment

ARTEX 110-4 ELT OPERATION

On the ELT unit itself is a two position switch placarded ON and OFF. The OFF 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.

A pilots remote switch, placarded ON and ARM is located on the pilot's lower left instrument panel to allow the transmitter to be armed or turned on from inside the cabin. The switch is normally in ARM position. Moving the switch to ON will activate the transmitter. A warning light located above the remote switch will alert you when ever the ELT is activated.

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

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

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

NOTE:

Three sweeps of the emergency tone and an illuminated warning light indicates a normally functioning unit. The warning light must illuminate during the first 3 second test period. If it does not illuminate, a problem is indicated such as a "G" switch failure.

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

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SECTION 8

AIRPLANE HANDLING, SERVICING, AND MAINTENANCE

8.1 GENERAL

This section provides guidelines relating to the handling, servicing, and maintenance of the Saratoga II HP. For complete maintenance instructions, refer to the latest revision of the appropriate Maintenance Manual.

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

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

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

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

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

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

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

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

8.3 AIRPLANE INSPECTION PERIODS

Piper has developed inspection items and required inspection intervals for the PA-32R (see the latest revision of the PA-32R Maintenance and Inspection Manuals). The PA-32R Inspection Manual contains appropriate forms, and all inspection procedures should be complied with by a properly trained, knowledgeable, and qualified mechanic at a Piper Authorized Service Center or a reputable repair shop. Piper cannot accept responsibility for the continued airworthiness of any aircraft not maintained to these standards, and/or not brought into compliance with applicable Service Bulletins issued by Piper, instructions issued by the engine, propeller, or accessory manufacturers, or Airworthiness Directives issued by the FAA.

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

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

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

8.5 PREVENTIVE MAINTENANCE

The holder of a pilot certificate issued under Federal Aviation Regulations (FAR) Part 61 may perform certain preventive maintenance as defined in the FARs. This maintenance may be performed only on an aircraft which the pilot owns and operates, and which is not used in air carrier or air taxi/commercial operations service.

All other aircraft maintenance must be accomplished by a person or facility appropriately certificated by the Federal Aviation Administration (FAA) to perform that work.

Anytime maintenance is accomplished, an entry must be made in the appropriate aircraft maintenance records. The entry shall include:

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

8.7 AIRPLANE ALTERATIONS

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

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

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

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

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

8.9 GROUND HANDLING

(a) Towing

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

CAUTION

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

CAUTION

Do not tow the airplane when the controls are secured.

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

(b) Taxiing

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

(1) Taxi a few feet forward and apply the brakes to determine their effectiveness.
(2) Taxi with the propeller set in low pitch, high RPM setting.
(3) While taxiing, make slight turns to ascertain the effectiveness of the steering.

(4) Observe wing clearance when taxiing near buildings or other stationary objects. If possible, station an observer outside the airplane.
(5) When taxiing over uneven ground, avoid holes and ruts.
(6) Do not operate the engine at high RPM when running up or taxiing over ground containing loose stones, gravel, or any loose material that 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) To set the parking brake, first depress and hold the toe brakes and then pull back on the brake lever and depressing the knob on the handle. To release the parking brake, first depress the brake pedals and then 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 ring at approximately 45 degree angles to the ground, When using rope of non-synthetic material, leave sufficient slack to avoid damage to the airplane should the ropes contract.

CAUTION

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

NOTE

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

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

8.11 ENGINE AIR FILTER

(a) Removing Engine Air Filter

(1) Remove the upper cowling.
(2) Remove the screws securing the filter box to the lower cowl. Remove the filter.

(b) Cleaning Engine Air Filter

The injector air filter must be cleaned at least once every 50 hours, and more often, even daily, when operating in dusty conditions. Extra filters are inexpensive, and a spare should be kept on hand for use as a rapid replacement.

To clean the filter:
(1) Tap the filter gently to remove dirt particles, being careful not to damage the filter. DO NOT wash the filter in any liquid. DO NOT attempt to blow out dirt with compressed air.

(2) If the filter is excessively dirty or shows any damage, replace it immediately.
(3) Wipe the filter housing with a clean cloth soaked in unleaded gasoline. When the housing is clean and dry, install the filter.

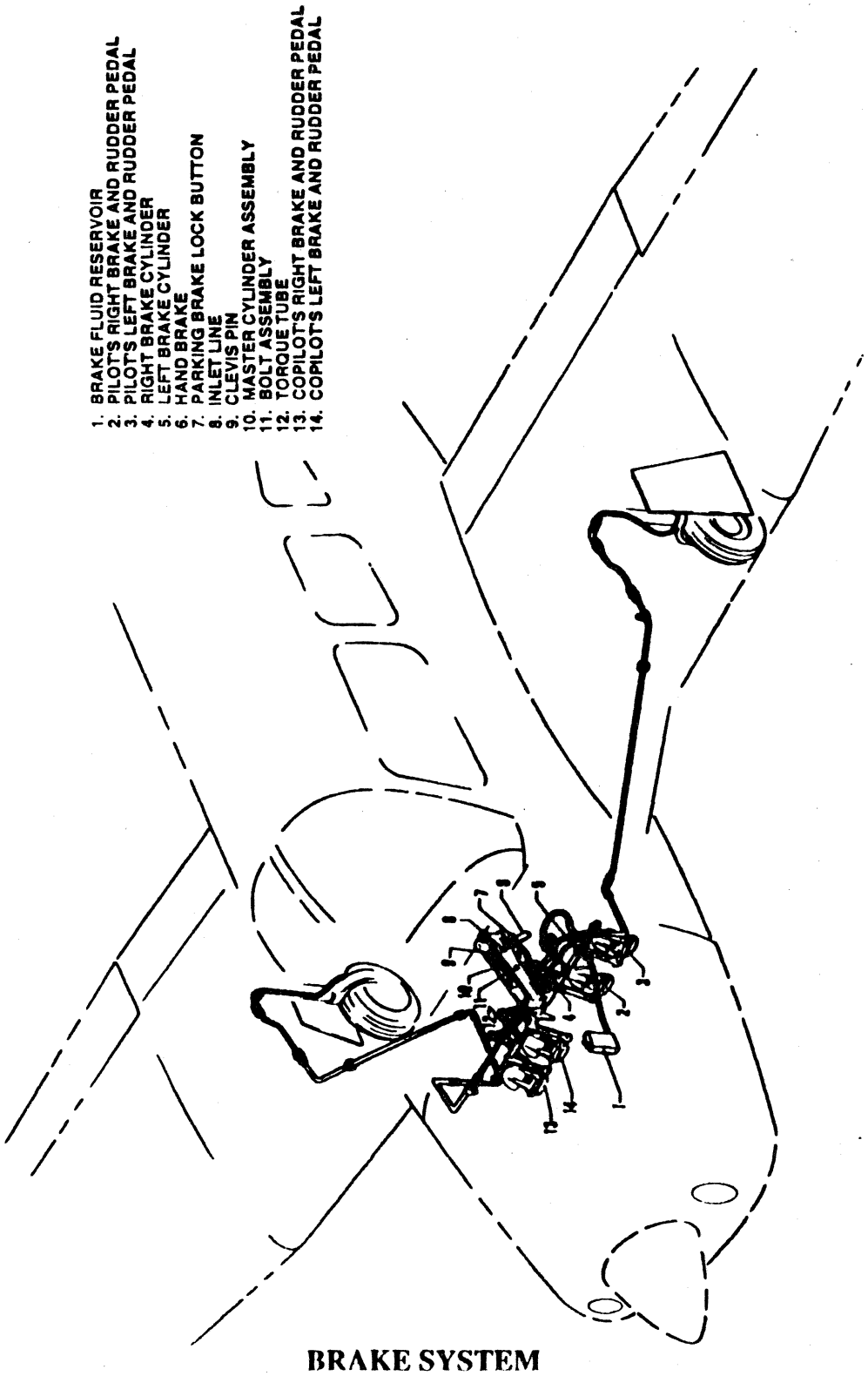
(c) Installation of Engine Air Filter

After cleaning or 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 100 hour inspection and replenished when necessary. The brake reservoir is located on the left side of the fire wall in the engine compartment. If the entire system must be refilled, fill with fluid under pressure from the brake end of the system. This will eliminate air from the system.

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



BRAKE SYSTEM
Figure 8-1

8.15 LANDING GEAR SERVICE

The main landing gear uses Cleveland Aircraft Products 6.00 x 6 wheels with 6.00 x 6, eight-ply rating tires and tubes. The nose wheel uses a Cleveland Aircraft Products 5.00 x 5 wheel with a 5.00 x 5 six-ply rating, type III tire and tube. (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 should be serviced according to the instructions on the units. The main oleos should be extended under normal static load until 4.5 ± .5 inches of oleo piston tube is exposed, and the nose gear should show 3.25 ± .25 inches. To add air to the oleo struts, attach a strut pump to the valve assembly near the top of the oleo strut housing and pump the oleo to the desired position. To add oil, jack the aircraft, release the air pressure in the strut, remove the valve core and add oil through this opening with the strut extended. After the strut is full, compress it slowly and fully to allow excess air and oil to escape. With the strut still compressed reinsert the valve core and pump up the strut as above.

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 rudder pedals or 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 22.5° +/- 2° in either direction and is limited by stops at the rudder pedals.

8.17 PROPELLER SERVICE

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

8.19 OIL REQUIREMENTS

The oil capacity of the Lycoming IO-540 series engine is 12 quarts, and the minimum safe quantity is 2-3/4 quarts. It is recommended that engine oil be drained and renewed every 50 hours, or sooner under unfavorable conditions. Full flow cartridge type oil filters should be replaced each 50 hours of operation. The interval between oil and oil filter change is not to exceed four (4) months. Lycoming Service Bulletin No. 446 should also be complied with each 50 hours. The following grades are required for temperatures:

Average Ambient Temperature All Temperatures	MIL-L-6082B SAE Grade --	MIL-L-22851 Ashless Dispersant SAE Grades 15W-50 or 20W-50
Above 80°F	60	60
Above 60°F	50	40 or 50
30°F to 90°F	40	40
0°F to 70°F	30	30, 40 or 20W-40
0°F to 90°F	20W50	20W50 or 15W50
Below 10°F	20	30 or 20W-30

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

NOTE

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

8.21 FUEL SYSTEM

(a) Servicing Fuel System

At every 50 hour inspection, the fuel screens in the strainer and in the injector must be cleaned. The screen in the injector is located in the housing where the fuel line connects to the injector. The fuel strainer is located under the floor panel and is accessible for cleaning through an access plate on the underside of the fuselage. After cleaning, a small amount of grease applied to the gasket will facilitate reassembly.

(b) Fuel Requirements (AVGAS ONLY)

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

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

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

FUEL GRADE COMPARISON CHART

Previous Commercial Fuel Grades (ASTM-D910)			Current Commercial Fuel Grades (ASTM-D910-75)			Current Military Fuel Grades (MIL-G-5572F)		
Grade	Color	Max. TEL ml/U.S. gal	Grade	Color	Max. TEL ml/U.S. gal	Grade	Color	Max. TEL ml/U.S. gal
80/87	red	0.5	80	red	0.5	80/87	red	0.5
91/98	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 overseas 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.

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

CAUTIONS

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

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

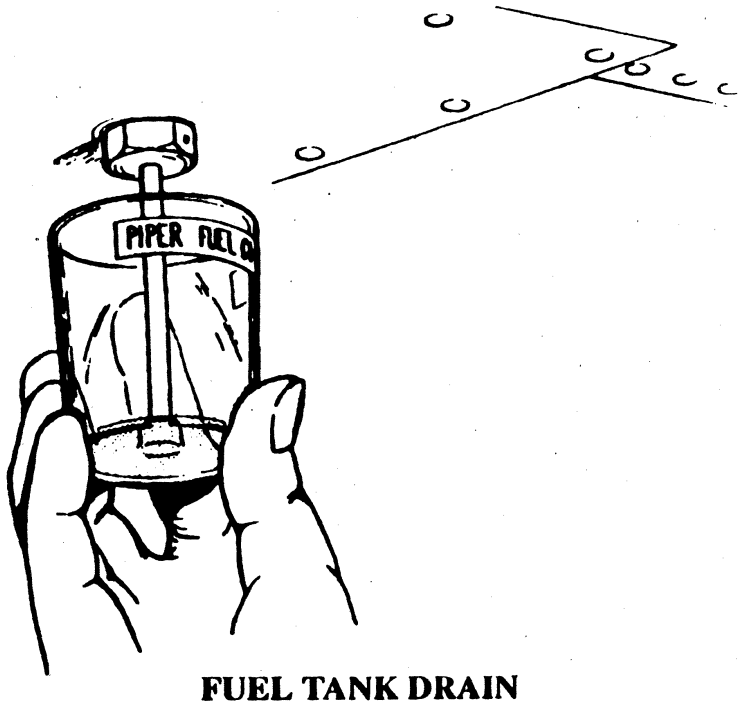
Fuel additive can not be used as a substitute for preflight draining of the fuel system drains.

(c) Filling Fuel Tanks

Observe all safety precautions required when handling gasoline. Fill the fuel tanks through the filler located on the forward slope of the wing. Each wing holds a maximum of 53.5 U.S. gallons. When using less than the standard 107 gallon capacity, fuel should be distributed equally between each side.

(d) Draining Fuel Strainer, Sumps and Lines

The fuel tank sumps and strainer should be drained before the first flight of the day and after refueling to avoid the accumulation of water and sediment. Each inboard fuel tank has an individual quick drain at the lower inboard corner. A fuel strainer with a fuel system quick drain is located at the lowest point in the system. Each tank sump should be drained through its individual quick drain until sufficient fuel has flowed to ensure the removal of any contaminants. The fuel strainer sump quick drain, operated by a lever inside the cabin on the right forward edge of the wing spar housing should be opened while the fuel selector valve is moved through the two tank positions. Enough fuel should flow at each position to allow the fuel lines and the strainer to ensure removal of contaminants. A quick drain fuel sampler is provided for the checking of the fuel clarity. (See Description-Airplane and Systems Section for more detailed instructions.)



FUEL TANK DRAIN
Figure 8-3

CAUTION

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

After using the fuel system quick drain, check from outside the airplane to be sure that it has closed completely and is not leaking.

(e) Draining Fuel System

The bulk of the fuel may be drained by opening the individual drain on each tank. The remaining fuel may be drained through the fuel strainer.

CAUTION

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

8.23 TIRE INFLATION

For maximum service from the tires, keep them inflated to the proper essures - 35 psi for the nose gear and 38 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 24-volt battery is through an access panel in the left side of the fuselage and by removing the floor of the forward baggage compartment. The battery box has a plastic tube which is normally closed off with a cap and which should be opened occasionally to drain off any accumulation of liquid. The battery should be checked for proper fluid level. DO NOT fill the battery above the baffle plates. DO NOT fill the battery with acid - use water only. A hydrometer check will determine the percent of charge in the battery.

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

8.27 CLEANING

(a) Cleaning Engine Compartment

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

(1) Place a large pan under the engine to catch waste.

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

CAUTION

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

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

CAUTION

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

(4) Remove the protective tape from the magnetos.

(5) Lubricate the controls, bearing surfaces, etc., in accordance with the Lubrication Chart in the applicable Service Manual.

(b) Cleaning Landing Gear

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

(1) Place a pan under the gear to catch waste.
(2) Spray or brush the gear area with solvent or a mixture of solvent and degreaser, as desired. Where heavy grease and dirt deposits have collected, it may be necessary to brush areas that were sprayed, in order to clean them.
(3) Allow the solvent to remain on the gear from five to ten minutes. Then rinse the gear with additional solvent and allow to dry.
(4) Remove the cover from the wheel and remove the catch pan.
(5) Lubricate the gear in accordance with the Lubrication Chart.

CAUTION

Do not brush the micro switches.

(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 tetrachloride, thinner, acetone, or window cleaning sprays.

(4) After cleaning plastic surfaces, apply a thin coat of hard polishing wax. Rub lightly with a soft cloth. Do not use a circular motion.
(5) A severe scratch or mar in plastic can be removed by rubbing out the scratch with jeweler's rouge. Smooth both sides and apply wax.

(e) Cleaning Headliner, Side Panels and Seats

(1) Clean headliner, side panels, and seats with a stiff bristle brush, and vacuum where necessary.
(2) Soiled upholstery, except leather, may be cleaned with a good upholstery cleaner suitable for the material. Avoid soaking or harsh rubbing.

CAUTION

Solvent cleaners require adequate ventilation.

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

(f) Cleaning Carpets

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

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SECTION 9
SUPPLEMENTS

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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PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT 1 FOR AIR CONDITIONING INSTALLATION

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when optional air conditioning is installed. This supplement supplies information necessary for the operation of the airplane when the optional air conditioning system is installed. The information contained herein supplements or supersedes the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED _____

PETER E. PECK
D.O.A. NO. SO-1
THE NEW PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA

DATE OF APPROVAL NOVEMBER 30, 1995

SECTION 1 - GENERAL

This supplement supplies information necessary for the efficient operation of the airplane when the optional air conditioning system 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 air conditioning system is installed.

SECTION 2 - LIMITATIONS

(a) To insure maximum climb performance the air conditioner must be turned OFF manually prior to takeoff to disengage the compressor and retract the condenser door. Also the air conditioner must be turned OFF manually before the landing approach in preparation for a possible go-around.

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

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

In the annunciator cluster (condenser door light):

AIR COND DOOR

SECTION 3 - EMERGENCY PROCEDURES

No changes to the basic Emergency Procedures provided by Section 3 of this Pilot's Operating Handbook are necessary for this supplement.

SECTION 4 - NORMAL PROCEDURES

Prior to takeoff, the air conditioner should be checked for proper operation as follows:

(a) Check aircraft master switch ON.

(b) Turn the air conditioner control switch to ON and the fan switch to one of the operating positions - the "AIR COND DOOR" warning light will turn on, thereby indicating proper air conditioner condenser door actuation.

(c) Turn the air conditioner control switch to OFF - the "AIR COND DOOR" warning light will go out, thereby indicating the air conditioner condenser door is in the up position.

(d) If the "AIR COND DOOR" light does not respond as specified above, an air conditioner system or indicator bulb malfunction is indicated and further investigation should be conducted prior to flight.

The above operational check may be performed during flight if an in flight failure is suspected.

The condenser door light is located in the annunciator cluster in front of the pilot. The door light illuminates when the door is open and is off when the door is closed.

SECTION 5 - PERFORMANCE

Operation of the air conditioner will cause slight decreases in cruise speed and range. Power from the engine is required to run the compressor, and the condenser door, when extended, causes a slight increase in drag. When the air conditioner is turned off there is normally no measurable difference in climb, cruise or range performance of the airplane.

NOTE

To insure maximum climb performance the air conditioner must be turned off manually before takeoff to disengage the compressor and retract the condenser door. Also the air conditioner must be turned off manually before the landing approach in preparation for a possible go-around.

Although the cruise speed and range are only slightly affected by the air conditioner operation, these changes should be considered in preflight planning. To be conservative, the following figures assume that the compressor is operating continuously while the airplane is airborne. This will be the case only in extremely hot weather.

(a) The decrease in true airspeed is approximately 6 KTS at all power settings.
(b) The decrease in range may be as much as 55 nautical miles for the 102 gallon capacity.

The climb performance is not compromised measurably with the air conditioner operating since the compressor is declutched and the condenser door is retracted, both automatically, when full throttle position is selected. When full throttle position is not used or in the event of a malfunction which would cause the compressor to operate and the condenser door to be extended, a decrease in rate of climb of as much as 100 fpm can be expected. Should a malfunction occur which prevents condenser door retraction when the compressor is turned off, a decrease in rate of climb of as much as 50 fpm can be expected.

PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT 2 FOR AUXILIARY VACUUM SYSTEM

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Piper Auxiliary Vacuum System is installed in accordance with Piper Drawing No. 87778-3. The information contained herein supplements or supersedes the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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PETER E. PECK
D.O.A. NO. SO-1
THE NEW PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA

DATE OF APPROVAL NOVEMBER 30, 1995

SECTION 1 - GENERAL

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

SECTION 2 - LIMITATIONS

(a) The auxiliary vacuum system is limited to standby function only, do not take off with the engine driven dry air pump inoperative.

(b) Discontinue flight in Instrument Meteorological Conditions (IMC) if vacuum pressure falls below 4.8 In. Hg.

(c) The auxiliary pump/motor assembly and elapsed time indicator must be removed from service after 500 hours accumulated operating time or 10 years whichever occurs first.

SECTION 3 - EMERGENCY PROCEDURES

(a) VAC OFF or Vacuum Inop. Warning - Auxiliary Vacuum Switch AUX ON.

(b) Verify vacuum system suction 4.8 to 5.2 In. Hg.

CAUTION

Compass error may exceed 10° when auxiliary vacuum system is in operation.

(c) Monitor electrical load - verify alternator capacity is not being exceeded as indicated by the ammeter. If required turn off non-essential electrical equipment.

(d) Land at the earliest opportunity to have primary system repaired.

SECTION 4 - NORMAL PROCEDURES

(a) Preflight Check.

(1) Turn on battery switch and verify VAC OFF light illuminated.

NOTE

Due to the electrical power requirement of the auxiliary vacuum pump it is suggested that the engine be operating while making the following checks.

(2) Turn on auxiliary vacuum pump and verify AUX ON light is illuminated and electrical load (approximately 15 amps) on ammeter.

(3) Turn off auxiliary vacuum pump and verify AUX ON light extinguished

(b) Inflight Check.

(1) Turn off non-essential electrical equipment.

(2) Turn on auxiliary vacuum pump and verify AUX ON light illuminated and electrical load (approximately 15 amps) on ammeter.

(3) Turn off auxiliary vacuum pump and verify AUX ON light extinguished and return to normal flight.

NOTE

For maximum service life, avoid continuous non-emergency operation of the auxiliary vacuum pump.

SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT & BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in Section 6 of the Basic Pilot's Operating Handbook.

SECTION 7 - DESCRIPTION AND OPERATION

The auxiliary dry air pump system provides an independent back-up source of pneumatic power to operate the gyro flight instruments in the event the engine driven air pump fails.

The control switch (labeled AUX VAC) for the auxiliary pump system is located on the left side of the instrument panel below the vacuum suction gage. The control switch operating modes are "push-for-on" and "push-for-off".

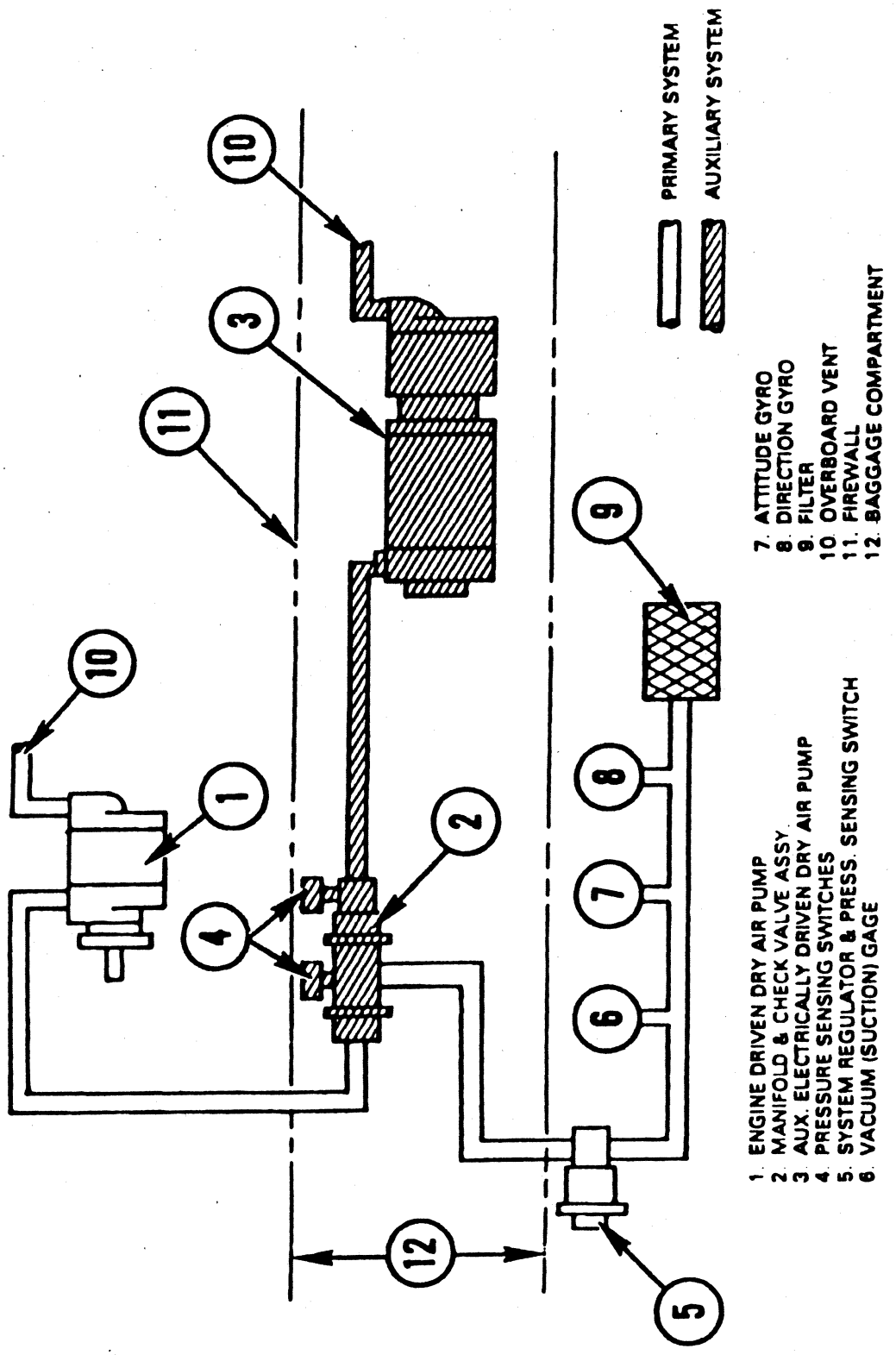
The switch button incorporates two annunciator light sections labeled VAC OFF and AUX ON. The VAC OFF section is controlled by a vacuum switch in the primary pneumatic system and illuminates an amber light when the engine driven pump is inoperative or when the system vacuum falls below the switch activation level. The AUX ON section is controlled by a vacuum switch in the auxiliary pneumatic system and illuminates a blue light when the auxiliary pump is operating and creating a vacuum in the system. When the auxiliary pump is activated at high altitude, or if the system has developed air leaks, the AUX ON light may fail to illuminate. This indicates that the system vacuum is still below theAUX ON switch activation level even though the auxiliary pump is operating and can be verified by observing the vacuum system indicator.

The annunciator lights do not incorporate a press-to-test feature. If the lights do not illuminate as expected, check for burned out lamps, replace with MS 25237-330 bulbs and retest the system.

System electrical protection is provided by a 20 amp circuit breaker in the pump motor circuit and a 5 amp in line fuse in the annunciator light circuit. The breaker is mounted on the circuit breaker panel.

SECTION 7 - DESCRIPTION AND OPERATION (CONT)

The auxiliary pump is in the forward baggage compartment under the right side floor board. The auxiliary system connects to the primary system at a manifold downstream of the vacuum regulator. Isolation of the primary and auxiliary systems from each other is accomplished by check valves on each side of the manifold. The primary system vacuum switch is located in the center of the manifold and senses vacuum supplied to the gyros. The auxiliary system vacuum switch is located on the manifold between the check valve and the auxiliary pump and senses vacuum generated by the auxiliary pump. In order to assure high reliability of the auxiliary air pump system as a back-up power supply for gyro instruments, the pump/motor assembly must be removed and replaced after a time in service as specified in the limitations Section 2 of this handbook. An elapsed time indicator is incorporated into the auxiliary pump electrical system to show accumulated hours of operation.


PRIMARY SYSTEM
AUXILIARY SYSTEM
1. ENGINE DRIVEN DRY AIR PUMP
2. MANIFOLD & CHECK VALVE ASSY.
3. AUX. ELECTRICALLY DRIVEN DRY AIR PUMP
4. PRESSURE SENSING SWITCHES
5. SYSTEM REGULATOR & PRESS. SENSING SWITCH
6. VACUUM (SUCTION) GAGE
7. ATTITUDE GYRO
8. DIRECTION GYRO
9. FILTER
10. OVERBOARD VENT
11. FIREWALL
12. BAGGAGE COMPARTMENT

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 3
FOR
BENDIX/KING KLN 90B GPS
NAVIGATION SYSTEM WITH
KAP/KFC 150 AUTOPILOT SYSTEM

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the optional Bendix/King KLN 90B GPS Navigation System is installed per Equipment List. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED _____

PETER E. PECK
D.O.A. NO. SO.-1
THE NEW PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA

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SECTION 1 - GENERAL

The KLN 90B GPS panel mounted unit contains the GPS sensor, the navigation computer, a CRT display, and all controls required to operate the unit. It also houses the data base cartridge which plugs directly into the back of the unit.

The data base cartridge is an electronic memory containing information on airports, navaids, intersections, SID's, STAR's, instrument approaches, special use airspace, and other items of value to the pilot.

Every 28 days, Bendix/King receives new data base information from Jeppesen Sanderson for the North American data base region. This information is processed and downloaded onto the data base cartridges. Bendix/King makes these data base cartridge updates available to KLN 90B GPS users.

Provided the KLN 90B GPS navigation system is receiving adequate usable signals, it has been demonstrated capable of and has been shown to meet the accuracy specifications of:

VFR/IFR en route oceanic and remote, en route domestic, terminal, and instrument approach (GPS, Loran-C, VOR, VOR-DME, TACAN, NDB, NDB-DME, RNAV) operation within the U.S. National Airspace System, North Atlantic Minimum Navigation Performance Specifications (MNPS) Airspace and latitudes bounded by 74° North and 60° South using the WGS-84 (or NAD 83) coordinate reference datum in accordance with the criteria of AC 20-138, AC 91-49, and AC 120-33. Navigation data is based upon use of only the global positioning system (GPS) operated by the United States.

NOTE:

Aircraft using GPS for oceanic IFR operations may use the KLN 90B to replace one of the other approved means of long-range navigation. A single KLN 90B GPS installation may also be used on short oceanic routes which require only one means of long range navigation.

NOTE:

FAA approval of the KLN 90B does not necessarily constitute approval for use in foreign airspace.

SECTION 2 - LIMITATIONS

A. The KLN 90B GPS Pilot's Guide, P/N 006-08773-0000, dated December, 1994 (or later applicable revision) must be immediately available to the flight crew whenever navigation is predicated on the use of the system. The Operational Revision Status (ORS) of the Pilot's Guide must match the ORS level annunciated on the Self Test page.

B. IFR Navigation is restricted as follows:

1. The system must utilize ORS level 20 or later FAA approved revision.
2. The data on the self test page must be verified prior to use. Verify valid altitude data is available to the KLN 90B prior to flight.
3. IFR en route and terminal navigation is prohibited unless the pilot verifies the currency of the data base or verifies each selected waypoint for accuracy by reference to current approved data.
4. Instrument approaches must be accomplished in accordance with approved instrument approach procedures that are retrieved from the KLN 90B data base. The KLN 90B data base must incorporate the current update cycle.

   (a) The KLN 90B Memory Jogger, P/N 006-08785-0000, dated 12/94
   (or later applicable revision) must be immediately available to the flight crew during instrument approach operations.

   (b) Instrument approaches must be conducted in the approach mode and RAIM must be available at the Final Approach Fix.

   (c) APR ACTV mode must be annunciated at the Final Approach Fix.

   (d) Accomplishment of ILS, LOC, LOC-BC, LDA, SDF, and MLS approaches are not authorized.

   (e) When an alternate airport is required by the applicable operating rules, it must be served by an approach based on other than GPS or Loran-C navigation.

   (f) The KLN 90B can only be used for approach guidance if the reference coordinate datum system for the instrument approach is WGS-84 or NAD-83. (All approaches in the KLN 90B data base use the WGS-84 or the NAD-83 geodetic datums.)

5. The aircraft must have other approved navigation equipment appropriate to the route of flight installed and operational.

SECTION 3 - EMERGENCY PROCEDURES

ABNORMAL PROCEDURES

A. If the KLN 90B GPS information is not available or invalid, utilize remaining operational navigation equipment as required.

B. If a "RAIM NOT AVAILABLE" message is displayed while conducting an instrument approach, terminate the approach. Execute a missed approach if required.

C. If a "RAIM NOT AVAILABLE" message is displayed in the en route or terminal phase of flight, continue to navigate using the KLN 90B or revert to an alternate means of navigation appropriate to the route and phase of flight. When continuing to use GPS navigation, position must be verified every 15 minutes using another IFR approved navigation system.

D. Refer to the KLN 90B Pilot's Guide, Appendices B and C, for appropriate pilot actions to be accomplished in response to annunciated messages.

SECTION 4 - NORMAL PROCEDURES

WARNING:

Familiarity with the en route operation of the KLN 90B does not constitute proficiency in approach operations. Do not attempt approach operations in IMC prior to attaining proficiency in the use of the KLN 90B.

A. OPERATION

Normal operating procedures are outlined in the KLN 90B GPS Pilot's Guide, P/N 006-08773-0000, dated December, 1994, (or later applicable revision). A KLN 90B Memory Jogger, P/N 006-08785-0000 dated 12/94 (or later applicable revision) containing an approach sequence, operating tips and approach related messages is intended for cockpit use by the KLN 90B familiar pilot when conducting instrument approaches.

B. SYSTEM ANNUNCIATORS/SWITCHES/CONTROLS

1. HSI NAV presentation (NAV/GPS) switch annunciator - May be used to select data for presentation on the pilot's HSI; either NAV data from the number one navigation receiver or GPS data from the KLN 90B GPS. Presentation on the HSI is also required for autopilot coupling. NAV is green. GPS is blue.

2. Message (MSG) annunciator -Will flash to alert the pilot of a situation that requires attention. Press the MSG button on the KLN 90B GPS to view the message. (Appendix B of the KLN 90B Pilot's Guide contains a list of all of the message page messages and their meanings). MSG is amber.

SECTION 4 - NORMAL PROCEDURES (CONT'D)

3. Waypoint (WPT) annunciator - Prior to reaching a waypoint in the active flight plan, the KLN 90B GPS will provide navigation along a curved path segment to ensure a smooth transition between two adjacent legs in the flight plan. This feature is called turn anticipation. Approximately 20 seconds prior to the beginning of turn anticipation the WPT annunciator will flash, going solid upon initialization of the turn, and extinguishing upon turn completion. WPT is amber.

WARNING:

Turn anticipation is automatically disabled for FAF waypoints and those used exclusively in SID/STARS where overflight is required. For waypoints shared between SID/STARS and published en route segments (requiring overflight in the SID/STARS), proper selection on the presented waypoint page is necessary to provide adequate route protection on the SID/STARS.

4. GPS omni bearing or leg (GPS CRS OBS/LEG) course switch/ annunciator - Used to select the basic modes of KLN 90B operation, either a) single waypoint with omni - bearing course (OBS) selection through that waypoint (like a VOR) or b) automatic leg sequencing (LEG) between waypoints. GPS CRS is white. OBS may either be white or amber. LEG is green.

NOTE:

Either LEG or OBS will illuminate during system self test depending upon switch position.

5. HSI course control ① knob - Provides analog course input to the KLN 90B in OBS when the NAV/GPS switch/annunciator is in GPS. When the NAV/GPS switch annunciation is in NAV, GPS course selection in OBS mode is digital through the use of the controls and display at the KLN 90B. The HSI course control knob must also be set to provide proper course datum to the autopilot if coupled to the KLN 90B in LEG or OBS.

SECTION 4 - NORMAL PROCEDURES (CONT'D)

NOTE

Manual HSI course centering in OBS using the control knob can be difficult, especially at long distances. Centering the dbar can best be accomplished by pressing [-D-] and then manually setting the HSI pointer to the course value prescribed in the KLN 90B displayed message.

6. GPS approach (GPS APR ARM/ACTV) switch/annunciator - Used to a) manually select or deselect approach ARM (or deselect approach ACTV) and b) annunciate the stage of approach operation either armed (ARM) or activated (ACTV). Sequential button pushes if in ACTV would first result in approach ARM and then approach arm canceled. Subsequent button pushes will cycle between the armed state (if an approach is in the flight plan) and approach arm canceled. Approach ACTV cannot be selected manually. GPS APR and ARM are white. ACTV is green.
7. RMI NAV presentation switch - May be used to select data for presentation on the RMI; either NAV 2 data from the number two navigation receiver, or GPS data from the KLN 90B GPS.

C. PILOT'S DISPLAY

Left/right steering information is presented on the pilot's HSI as a function of the NAV/GPS switch position.

D. AUTOPILOT COUPLED OPERATION

The KLN 90B may be coupled to the autopilot by first selecting GPS on the NAV/GPS switch. Manual selection of the desired track on the pilot's HSI course pointer is required to provide course datum to the autopilot. (Frequent manual course pointer changes may be necessary, such as in the case of flying a DME arc.) The autopilot approach mode (APR) should be used when conducting a coupled GPS approach.

NOTE

Select HDG mode for DME arc intercepts. NAV or APR coupled DME arc intercepts can result in excessive overshoots (aggravated by high ground speeds and/or intercepts from inside the arc).

SECTION 4 - NORMAL PROCEDURES (CONT'D)

E. APPROACH MODE SEQUENCING AND RAIM PREDICTION

NOTE

The special use airspace alert will automatically be disabled prior to flying an instrument approach to reduce the potential for message congestion.

1. Prior to arrival, select a STAR if appropriate from the APT 7 page. Select an approach and an initial approach fix (IAF) from the APT 8 page.

NOTES

- Using the right hand outer knob, select the ACT (Active Flight Plan Waypoints) pages. Pull the right hand inner knob out and scroll to the destination airport, then push the inner knob in and select the ACT 7 or ACT 8 page.

- To delete or replace a SID, STAR or approach, select FPL 0 page. Place the cursor over the name of the procedure, press ENT to change it, or CLR then ENT to delete it.

2. En route, check for RAIM availability at the destination airport ETA on the STA 5 page.

NOTE

RAIM must be available at the FAF in order to fly an Instrument approach. Be prepared to terminate the approach upon loss of RAIM.

3. At 30 nm from the FAF:

   a. Verify automatic annunciation of APR ARM.
   b. Note automatic dbar scaling change from ± 5.0nm to ± 1.0 nm over the next 30 seconds.
   c. Update the KLN 90B altimeter baro setting as required.
   d. Internally the KLN 90B will transition from en route to terminal integrity monitoring.

SECTION 4 - NORMAL PROCEDURES (CONT'D)

4. Select Super NAV 5 page to fly the approach procedure.
   a. If receiving radar vectors, or need to fly a procedure turn or holding pattern, fly in OBS until inbound to the FAF.

      NOTE:
      OBS navigation is TO-FROM (like a VOR) without waypoint sequencing.

   b. NoPT routes including DME arc's are flown in LEG. LEG is mandatory from the FAF to the MAP.

      NOTE:
      Select HDG mode for DME arc intercepts. NAV or APR coupled DME arc intercepts can result in excessive overshoots (aggravated by high ground speeds and/or intercepts from inside the arc).

      WARNING:
      Flying final outbound from an off airport vortac on an overlay approach; beware of the DME distance increasing on final approach, and the GPS distance-to-waypoint decreasing, and not matching the numbers on the approach plate!

5. At or before 2 nm from the FAF inbound:
   a. Select the FAF as the active waypoint, if not accomplished already.
   b. Select LEG operation.
6. Approaching the FAF inbound (within 2 nm.):
   a. Verify APR ACTV.
   b. Note automatic dbar scaling change from ± 1.0 nm to ± 0.3 nm over the 2 nm inbound to the FAF.
   c. Internally the KLN 90B will transition from terminal to approach integrity monitoring.
7. Crossing the FAF and APR ACTV is not annunciated:
   a. Do not descend.
   b. Execute missed approach.

SECTION 4 - NORMAL PROCEDURES (CONT'D)

8. Missed Approach:
   a. Climb
   b. Navigate to the MAP (in APR ARM if APR ACTV is not available).

NOTE:
There is no automatic LEG sequencing at the MAP.

c. After climbing in accordance with the published missed approach procedure, press [—D►], verify or change the desired holding fix and press ENT.

GENERAL NOTES

- The data base must be up to date for instrument approach operation.
- Only one approach can be in the flight plan at a time.
- If the destination airport is the active waypoint at the time of the instrument approach selection, the active waypoint will shift automatically to the chosen IAF.
- Checking RAIM prediction for your approach while en route using the STA 5 page is recommended. A self check occurs automatically within 2nm of the FAF. APR ACTV is inhibited without RAIM.
- Data cannot be altered, added to or deleted from the approach procedures contained in the data base. (DME arc intercepts may be relocated along the arc through the SUPER NAV 5 or the FPL 0 pages).
- Some approach waypoints do not appear on the approach plates (including in some instances the FAF)!

SECTION 4 - NORMAL PROCEDURES (CONT'D)

- Waypoint suffixes in the flight plan:

  i - IAF
  f - FAF
  m - MAP
  h - missed approach holding fix.

- The DME arc IAF (arc intercept waypoint) will be a) on your present position radial off the arc VOR when you load the IAF into the flight plan, or b) the beginning of the arc if currently on a radial beyond the arc limit. To adjust the arc intercept to be compatible with a current radar vector, bring up the arc IAF waypoint in the SUPER NAV 5 page scanning field or under the cursor on the FPL 0 page, press CLR, then ENT. Fly the arc in LEG. adjust the HSI or CDI course pointer with reference to the desired track value on the SUPER NAV5 page (it will flash to remind you). Left/right dbar information is relative to the arc. Displayed distance is not along the arc but direct to the active waypoint. If desired, select NAV 2 page for digital DME arc distance to and radial from the reference VOR. (The ARC radial is also displayed on the SUPERNAV5 page.)

- The DME arc IAF identifier may be unfamiliar. Example: D098G where 098 stands for the 098° radial off the referenced VOR, and G is the seventh letter in the alphabet indicating a 7 DME arc.

SECTION 4 - NORMAL PROCEDURES (CONT'D

- APR ARM to APR ACTV is automatic provided:
  a. You are in APR ARM (normally automatic).
  b. You are in LEG mode!
  c. The FAF is the active ; waypoint
  d. Within 2 n.m. of the FAF.
  e. Outside of the FAF.
  f. Inbound to the FAF.
  g. RAIM is available.

- Direct-To operation between the FAF and MAP cancels APR ACTV. Fly the missed approach in APR ARM.

- Flagged navigation inside the FAF may usually be restored (not guaranteed) by pressing the GPS APR button changing from ACTV to ARM. Fly the missed approach.

- The instrument approach using the KLN 90B may be essentially automatic starting 30 nm out (with a manual baro setting update) or it may require judicious selection of the OBS and LEG modes.

- APR ARM may be canceled at any time by pressing the GPS APR button. (A subsequent press will reselect it.)

SECTION 5 - PERFORMANCE

No Change.

SECTION 6 - WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in Section 6 of the Basic Pilot's Operating Handbook.s

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PILOT'S OPERATING HANDBOOK

SUPPLEMENT NO. 4
FOR
KING 150 SERIES FLIGHT CONTROL SYSTEM

This supplement has been DELETED as the FAA Approved Operational Supplement to the Bendix/King 150 Series Flight Control System as installed per STC SA1572CE-D. An approved operational supplement is provided by Bendix/King and will be revised as required by Bendix/King. It is permitted to include the Bendix/King supplement in this location of the Pilots Operating Handbook unless otherwise stated by Bendix/King.

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SECTION 7
SYSTEM DESCRIPTION AND OPERATION

2. CONTROL WHEEL STEERING (CWS) BUTTON - When depressed, allows pilot to manually control the aircraft (disengages the pitch and roll servos) without cancellation of any of the selected modes. Will engage the Flight Director mode if not previously engaged. Automatically synchronizes the Flight Director/Autopilot to the pitch attitude present when the CWS switch is released, or to the present pressure altitude when operating in the ALT hold mode. Will cancel GS couple. The aircraft must pass through the glideslope again to allow GS recouple. When the KAP 100 is installed, only the above comments related to the roll axis are applicable.

3. AUTOPILOT CONTROL WHEEL SWITCH ASSEMBLY - Switch assembly mounted on the pilot's control wheel associated with the autopilot and manual electric trim systems.

4. MANUAL ELECTRIC TRIM CONTROL SWITCHES - A split switch unit in which the left half provides power to engage the trim servo clutch and the right half to control the direction of motion of the trim servo motor. Both halves of the split trim switch must be actuated in order for the manual trim to operate in the desired direction. When the autopilot is engaged, operation of the manual electric trim will automatically disconnect the autopilot.

King Radio Corporation
Olathe, Kansas 66062
A wholly-owned subsidary of
AlliedSignal Inc.

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

FOR

PIPER MODEL PA-32R-301
(S/N 3213042 AND UP)

SARATOGA II HP

WITH

BENDIX/KING 100/150 SERIES FLIGHT CONTROL SYSTEM

Reg. No. N123AX

Ser. No. 3246060

The information contained in this manual is FAA Approved material, along with the FAA Approved Airplane Flight Manual, placards and instrument markings, and is applicable to the operation of the airplane when modified by the installation of the Bendix/King 100/150 Series Automatic Flight Control System as per STC SA1572CE-D.

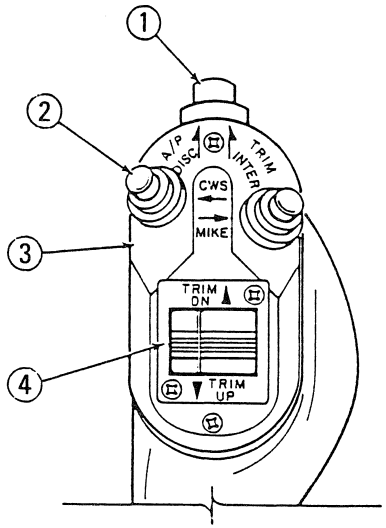
FAA APPROVED: Chris Durkin

CHRIS DURKIN
DAS Coordinator
King Radio Corporation
DAS4CE

DATE: 6-4-93

SECTION 7 - SYSTEM DESCRIPTION AND OPERATION

Refer to the Pilot's Guide for the Bendix/King KFC 150/KAP 150 and KAP 100 Flight Control Systems P/N 006-08377-0001.



AUTOPILOT CONTROL WHEEL SWITCH CAP

1. AUTOPILOT DISCONNECT/TRIM INTERRUPT (A/P DISC/TRIM INTER) Switch - When depressed will disengage the autopilot and cancel all operating Flight Director modes (if equipped with a Flight Director). When depressed and held will interrupt all electric trim power (stop trim motion), disengage the autopilot and cancel all operating Flight Director modes.

SECTION 4
NORMAL PROCEDURES

********** WARNING **********
WHEN OPERATING AT OR NEAR THE BEST RATE OF CLIMB AIRSPEED AND USING VERTICAL SPEED HOLD, IT IS EASY TO DECELERATE TO AN AIRSPEED ON THE BACK SIDE OF THE POWER CURVE (A DECREASE IN AIRSPEED RESULTS IN A REDUCED RATE OF CLIMB). CONTINUED OPERATION ON THE BACK SIDE OF THE POWER CURVE IN VERTICAL SPEED HOLD MODE WILL RESULT IN A STALL.

WHEN OPERATING AT OR NEAR THE MAXIMUM AUTOPILOT SPEED, IT WILL BE NECESSARY TO REDUCE POWER IN ORDER TO MAINTAIN THE DESIRED RATE OF DESCENT AND NOT EXCEED THE MAXIMUM AUTOPILOT SPEED.
****

3. ALTITUDE PRESELECT

   a. **ALTITUDE SELECT** knob - **PUSH** small knob to the "IN" position.

********** WARNING **********
VERIFY UNIT IS DISPLAYING ALTITUDE SELECT WINDOW PRIOR TO INITIATING ANY CHANGE IN THE SELECTED ALTITUDE VALUE.
****

   b. **ALTITUDE SELECT** knob - **ROTATE** until the desired altitude is displayed.

   c. ALTITUDE SELECT MODE **(ARM)** button - **PUSH** to arm the Altitude Select Mode.

   d. Airplane - **ESTABLISH THE AIRCRAFT ATTITUDE** necessary to intercept the selected altitude.

SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT AND BALANCE

No change from basic Airplane Flight Manual.

PIPER MODEL PA-32R-301

FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

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C. FLIGHT DIRECTOR OPERATION (KFC 150 Systems Only)

The flight director modes of operation are the same as those used for autopilot operations except the autopilot is not engaged and the pilot must maneuver the aircraft to satisfy the flight director commands.

D. KAS 297B VERTICAL SPEED AND ALTITUDE SELECTOR OPERATION (IF INSTALLED)

1. Vertical Speed Select

a. **VERTICAL SPEED SELECT** knob - **PULL** small knob to the **"OUT"** position.

********** **WARNING** **********
VERIFY UNIT IS DISPLAYING VERTICAL SPEED SELECT WINDOW PRIOR TO INITIATING ANY CHANGE IN THE SELECTED VERTICAL SPEED VALUE.
****

b. **VERTICAL SPEED SELECT** knob - **ROTATE** until desired vertical speed is displayed.

c. VERTICAL SPEED MODE **(ENG)** button - **PUSH** to engage the Vertical Speed Hold mode.

2. Changing Vertical Speed

a. Using CWS

1) **CWS** Button - **PRESS** and **HOLD.**

2) Airplane - Establish desired vertical speed.

3) **CWS** Button - **RELEASE.**

b. Using Vertical Trim Control

1) **VERTICAL TRIM CONTROL** - **PRESS** either up or down to increase or decrease the vertical speed. Displayed vertical speed changes 100 fpm for every second the control is held down.

SECTION 4
NORMAL PROCEDURES

9. Glideslope Coupling (Not applicable for KAP 100).

NOTE

GLIDESLOPE COUPLING IS INHIBITED WHEN OPERATING IN **NAV** OR **APR BC** MODES. GLIDESLOPE COUPLING OCCURS AUTOMATICALLY IN THE **APR** MODE.

a. **APR** Mode - **ENGAGED.**

b. At glideslope centering - **NOTE GS** annunciator **ON.**

NOTE

AUTOPILOT CAN CAPTURE GLIDESLOPE FROM ABOVE OR BELOW THE BEAM WHILE OPERATING IN EITHER PITCH ATTITUDE HOLD OR ALT HOLD MODES.

10. Missed Approach

a. **A/P DISC/TRIM INTER** Switch - **PRESS** to disengage AP.

b. **MISSED APPROACH - EXECUTE.**

c. **CWS** Button - **PRESS** (KFC 150 only) as desired to activate FD mode during go-around maneuver.

d. **AP ENG** Button - **PRESS** (If AP operation is desired). Note AP annunciator **ON.**

NOTE

THE KAP 100 ONLY PROVIDES ROLL CONTROL. THE PILOT MUST MANUALLY FLY THE PITCH AXIS.

NOTE

IF IT IS DESIRED TO TRACK THE ILS COURSE OUTBOUND AS PART OF THE MISSED APPROACH PROCEDURE, USE THE NAV MODE TO PREVENT INADVERTANT GS COUPLING.

11. Before Landing

a. **A/P DISC/TRIM INTER** Switch - **PRESS** to disengage AP.

SECTION 1 - GENERAL

This manual is provided to acquaint the pilot with the limitations as well as normal and emergency operating procedures of the King 100/150 Series Automatic Flight Control Systems. The limitations presented are pertinent to the operation of the 100/150 System as installed in the Piper Model PA-32R-301 airplane; the Flight Control System must be operated within the limitations herein specified.

The 100 Series AFCS is certified in this airplane with roll axis control only.

The 150 Series AFCS is certified in this airplane with 2 axis autopilot control, pitch and roll.

The KAS 297B vertical speed and altitude selector, when added to a KFC 150 or a KAP 150 Flight Control System provides the pilot with the following features: ability to select vertical speed hold: ability to select, arm and, upon approaching the selected altitude, automatically transfer into Altitude Hold; altitude alerting as specified by F.A.R. 91.51.

The 100 Series AFCS has an optional manual electric pitch trim system.

The 150 Series AFCS has an electric pitch trim system which provides autotrim during autopilot operation and manual electric trim for the pilot. The trim system is designed to withstand any single inflight malfunction. Trim faults are visually and aurally annunciated.

A lockout device prevents autopilot engagement until the system has been successfully preflight tested.

The following conditions will cause the Autopilot to automatically disengage:

A. Power failure.

B. Internal Flight Control System failure.

C. With the KCS 55A Compass System, a loss of compass valid (displaying HDG flag) disengages the Autopilot when a mode using heading information is engaged. With the HDG flag present, the autopilot may be re-engaged in the basic wings level mode along with any vertical mode.

D. Roll rates in excess of 14° per second will cause the autopilot to disengage except when the CWS switch is held depressed.

SECTION 1
GENERAL

E. Pitch rates in excess of 8° per second will cause the autopilot to disengage except when the CWS switch is held depressed.

The airplane BATTERY MASTR function is unchanged and can be used in an emergency to shut off electrical power to all flight control systems while the problem is isolated. The alternator must also be shut off.

The RADIO MASTR switch supplies power to the avionics bus bar of the radio circuit breakers and the autopilot circuit breaker.

The following circuit breakers are used to protect the following elements of the King 150 Series Autopilot:

LABEL	FUNCTION
AUTO PILOT	Supplies power to the KC 192, the KC 191, or the KC 190 Computer, the autopilot pitch and roll servos, and the Trim Circuit Breaker. It also applies power to the Optional KAS 297B Altitude/Vertical Speed Selector, when installed.
PITCH TRIM	Supplies power to the Autotrim and Manual Electric Pitch Trim Systems.
COMPASS	Supplies power to the optional KCS 55A Compass System.
ENCODING ALT	Supplies power to the Bendix/King KEA 130A Altimeter, when installed.

SECTION 4
NORMAL PROCEDURES

a) If the Course Deviation Bar is greater than 2 to 3 dots: the aircraft will continue in **HDG** mode (or wings level if **HDG** not selected) with **BC** annunciated steady and **APR** annunciator flashing; when the computed capture point is reached the **HDG** will disengage, and the **BC** and **APR** annunciators will illuminate steady and the selected course will be automatically captured and tracked.

b) If the D-Bar is less than 2 to 3 dots: the **HDG** mode will disengage upon selecting **BC** mode; the **APR** **BC** annunciators will illuminate and the capture/track sequence will automatically begin.

b. When equipped with DG.

1) **OBS** knob - **SELECT** the ILS front course inbound heading.

2) **BC** Mode Selector Button - **PRESS.**

3) Heading Selector Knob - **ROTATE** Bug to the **ILS** front course inbound heading.

NOTE

WHEN BC IS SELECTED, THE LATERAL OPERATING MODE WILL CHANGE FROM HDG (IF SELECTED) TO WINGS LEVEL FOR 5 SECONDS. A 45° INTERCEPT ANGLE WILL THEN BE ESTABLISHED BASED ON THE POSITION OF THE BUG.

a) If the D-Bar is greater than 2 to 3 dots: the autopilot will annunciate **HDG** (unless **HDG** not selected) and **BC** modes with **APR** flashing; when the computed capture point is reached the **HDG** annunciator will go out, the **BC** and **APR** annunciators will illuminate steady and the selected course will be automatically captured and tracked.

b) If the D-Bar is less than 2 to 3 dots: the **HDG** mode will disengage upon selecting **BC** mode; the **BC** and **APR** annunciators will illuminate and the capture/track sequence will automatically begin.

SECTION 4
NORMAL PROCEDURES

NOTE

WHEN APR IS SELECTED THE LATERAL OPERATING MODE WILL CHANGE FROM HDG (IF SELECTED) TO WINGS LEVEL FOR 5 SECONDS. A 45° INTERCEPT ANGLE WILL THEN BE AUTOMATICALLY ESTABLISHED BASED ON THE POSITION OF THE BUG.

a) If the D-Bar is greater than 2 to 3 dots: the autopilot will annunciate HDG mode (unless HDG not selected) and APR flashing; when the computed capture point is reached the HDG annunciator will go out, the APR annunciator will illuminate steady and the selected course will be automatically captured and tracked.

b) If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting APR mode; the APR annunciator will illuminate steady and the capture/track sequence will automatically begin.

8. BC Approach Coupling

a. When equipped with HSI.

1) Course Bearing Pointer - **SET** to the ILS front course inbound heading.

NOTE

WHEN EQUIPPED WITH NAV 1/NAV 2 SWITCHING AND NAV 2 IS SELECTED, SET OBS TO THE ILS FRONT COURSE INBOUND HEADING.

2) **HEADING** Selector Knob - **SET BUG** to provide desired intercept angle.

3) **BC** Mode Selector Button - **PRESS**.

SECTION 2 - LIMITATIONS

A. During autopilot operation, a pilot with seat belt fastened must be seated at the left pilot position.

B. The autopilot must be OFF during takeoff and landing.

C. Do not overide the autopilot to change pitch or roll attitude.

D. The system is approved for Category I operation only (Approach mode selected).

E. Autopilot maximum airspeed limitation: 175 KIAS.

F. Autopilot flap limitation: Maximum flap extension 25°.

G. Maximum fuel imbalance with the autopilot engaged: 12 Gallons.

H. Continued autopilot or manual electric trim system use is prohibited following abnormal or malfunctioning operation, and prior to corrective maintenance.

I. The entire preflight test procedure outlined under Section 4, paragraph A of this supplement, including steps 1 through 10, must be successfully completed prior to each flight. Use of the autopilot or manual electric trim system is prohibited prior to completion of these tests.

J. The PITCH TRIM circuit breaker must be pulled following any inflight illumination of the red TRIM warning light, but only after first completing the Emergency Procedures Section 3 paragraph A. The manual electric trim and autopilot autotrim systems will be disabled with the PITCH TRIM circuit breaker pulled.

K. Altitude Select captures below 800 feet AGL are prohibited (when the optional KAS 297B Altitude/Vertical Speed selector is installed).

L. The autopilot must be disengaged below 200 feet AGL during approach operations and below 800 feet AGL for all other phases of flight.

M. The KFC 150/KAP 150 and KAP 100 Flight Control Systems Pilot's Guide, P/N 006-08377-0001 dated July 1990 or later revisions must be immediately available to the pilot whenever the autopilot or manual electric trim are in use.

SECTION 3 - EMERGENCY PROCEDURES

The five step procedure listed under paragraph A should be among the basic airplane emergency procedures that are committed to memory. It is important that the pilot be proficient in accomplishing all five steps without reference to this manual.

A. In case of Autopilot, Autopilot Trim, or Manual Electric Trim malfunction, (accomplish Items 1 and 2 simultaneously):

1. Airplane Control Wheel - **GRASP FIRMLY** and regain aircraft control.
2. **A/P DISC/TRIM INTER** Switch - **PRESS** and **HOLD** throughout recovery.
3. Aircraft - **RETRIM** manually as needed.
4. **PITCH TRIM** Circuit Breaker - **PULL.**
5. **AUTO PILOT** Circuit Breaker - **PULL.**

NOTE

THE **RADIO MASTR** SWITCH MAY BE USED AS AN ALTERNATE MEANS OF REMOVING ALL POWER FROM THE AUTOPILOT AND ELECTRIC TRIM SYSTEMS. IF NECESSARY PERFORM STEPS 1 THROUGH 3 ABOVE, THEN TURN THE **RADIO MASTR** SWITCH **OFF** BEFORE LOCATING AND PULLING THE **AUTO PILOT** AND **PITCH TRIM** CIRCUIT BREAKERS. TURN THE **RADIO MASTR** SWITCH **ON** AS SOON AS POSSIBLE TO RESTORE POWER TO ALL OTHER AVIONICS EQUIPMENT. PRIMARY ATTITUDE, AIRSPEED, SLAVED COMPASS, AND ALTITUDE INSTRUMENTS WILL REMAIN OPERATIONAL AT ALL TIMES.

********** **WARNING** **********
DO NOT ATTEMPT TO RE-ENGAGE THE AUTOPILOT FOLLOWING AN AUTOPILOT, AUTOTRIM, OR MANUAL ELECTRIC TRIM MALFUNCTION.
****

Maximum Altitude losses due to autopilot malfunction:

Configuration	Alt Loss
Cruise Climb, Descent	300′
Maneuvering	75′
APPR	60′

7. Approach (**APR**) Coupling

a. When equipped with HSI.

1) Course Bearing Pointer - **SET** to desired course.

NOTE

WHEN EQUIPPED WITH NAV1/NAV 2 SWITCHING AND NAV 2 IS SELECTED, SET OBS TO THE DESIRED COURSE.

2) Heading Selector Knob - **SET BUG** to provide desired intercept angle.

3) **APR** Mode Selector Button - **PRESS.**

a) If the Course Deviation Bar is greater than 2 to 3 dots: the aircraft will continue in **HDG** mode (or wings level if **HDG** not selected) with the **APR** annunciator flashing; when the computed capture point is reached the **HDG** will disengage, the **APR** annunciator will illuminate steady and the selected course will be automatically captured and tracked.

b) If the D-Bar is less than 2 to 3 dots: the **HDG** mode will disengage upon selecting **APR** mode; the **APR** annunciator will illuminate steady and the capture/track sequence will automatically begin.

b. When equipped with DG.

1) **OBS** knob - **SELECT** desired approach course.

2) **APR** Mode Selector Button - **PRESS.**

3) **HEADING** Selector Knob - Rotate Bug to agree with **OBS** course.

a) If the Course Deviation Bar is greater than 2 to 3 dots: the aircraft will continue in HDG mode (or wings level if **HDG** not selected) with the **NAV** annunciator flashing; when the computed capture point is reached the **HDG** will disengage, the **NAV** annunciator will illuminate steady and the selected course will be automatically captured and tracked.

b) If the D-Bar is less than 2 to 3 dots: the **HDG** mode will disengage upon selecting **NAV** mode; the **NAV** annunciator will illuminate and the capture/ track sequence will automatically begin.

b. When equipped with DG.

1) **OBS** knob - **SELECT** desired course.

2) **NAV** Mode Selector Button - **PRESS.**

3) **HEADING** Selector Knob - **ROTATE BUG** to agree with **OBS** course.

NOTE

WHEN NAV IS SELECTED, THE LATERAL OPERATING MODE WILL CHANGE FROM HDG (IF SELECTED) TO WINGS LEVEL FOR 5 SECONDS. A 45° INTERCEPT ANGLE WILL THEN BE AUTOMATICALLY ESTABLISHED BASED ON THE POSITION OF THE BUG.

a) If the D-Bar is greater than 2 to 3 dots: the autopilot will annunciate HDG mode (unless HDG not selected) and NAV flashing; when the computed capture point is reached the HDG annunciator will go out, the NAV annunciator will illuminate steady and the selected course will be automatically captured and tracked.

b) If the D-Bar is less than 2 to 3 dots: the HDG mode will disengage upon selecting NAV mode; the NAV annunciator will illuminate steady and the capture/track sequence will automatically begin.

B. Amplified Emergency Procedures

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 for an emergency situation.

1. An autopilot or autopilot trim malfunction occurs when there is an uncommanded deviation in the airplane flight path or when there is abnormal control wheel or trim wheel motion. In some cases, and especially for autopilot trim, there may be little to no airplane motion, yet the red **TRIM** annunciator may illuminate and an alert tone may sound. The KAP 100 and KAP/KFC 150 autopilots incorporate monitors that detect abnormal airplane motion, therefore, if the airplane for any reason is moved rapidly in pitch or roll the autopilot may be disconnected automatically.

The main concern in reacting to an autopilot or autopilot trim malfunction, or to an automatic disconnect of the autopilot, is in maintaining control of the airplane. Immediately grasp the control wheel and press and hold down the A/P DISC/TRIM INTER switch throughout the recovery. Manipulate the controls as required to safely maintain operation of the airplane within all of its operating limitations. Elevator trim should be used manually as needed to relieve control forces. Once the airplane has been stabilized the A/P DISC/TRIM INTER switch may be released.

With the autopilot mode OFF the servo motors are no longer connected to the airplane's flight controls; autopilot trim will also be isolated from the electric trim system. Finally, the AUTO PILOT and PITCH TRIM circuit breakers must be pulled to completely disable these systems.

********** **WARNING** **********
DO NOT ATTEMPT TO RE-ENGAGE THE AUTOPILOT FOLLOWING AN AUTOPILOT/AUTOTRIM MALFUNCTION UNTIL CORRECTIVE SERVICE ACTION HAS BEEN PERFORMED ON THE SYSTEM.
****

SECTION 3
EMERGENCY PROCEDURES

2. A manual electric trim malfunction may be recognized by the illumination of a red **TRIM** fail annunciator accompanied by an alert tone, or by unusual trim wheel motions with the autopilot mode OFF without pilot actuation of the manual electric trim switch. As with an autopilot malfunction, the first concern following a manual electric trim malfunction is regaining control of the airplane. Grasp the control wheel firmly and press and hold down the A/P DISC/TRIM INTER switch. For the Piper Model PA-32R-301 airplane, locate and pull the PITCH TRIM and AUTO PILOT circuit breakers (located on the left extreme of the right hand circuit breaker subpanel). The RADIO MASTR switch may be used as required to remove all power from the Autopilot and Electric Trim systems while the circuit breakers are located and pulled. Return the RADIO MASTR switch to the ON position as soon as possible. With the RADIO MASTR switch off, all flight instruments will remain operational; however, communications, navigation, and identification equipment will be inoperable.

********** **WARNING** **********
DO NOT ATTEMPT TO RE-ENGAGE THE AUTOPILOT OR TO USE THE MANUAL ELECTRIC TRIM SYSTEM FOLLOWING A MANUAL ELECTRIC TRIM MALFUNCTION UNTIL CORRECTIVE SERVICE ACTION HAS BEEN PERFORMED ON THE SYSTEM.
****

3. Note that the emergency procedure for any malfunction is essentially the same: immediately grasp the control wheel and regain airplane control while pressing and holding the A/P DISC/TRIM INTER switch down, and manually retrim the airplane as needed. After these steps have been accomplished secure the autopilot or electric trim system using the proper switches and circuit breakers. As with any other airplane emergency procedure, it is important that the 5 steps of the Autopilot/Electric Trim Emergency Procedures located on Page 4 of this supplement are committed to memory.

4. It is important that all portions of the autopilot and electric trim system are preflight tested prior to each flight in accordance with the procedures published herein in order to assure their integrity and continued safe operation during flight.

SECTION 4
NORMAL PROCEDURES

1) **CWS** Button - **PRESS** and **MANEUVER** aircraft to the desired heading.

2) **CWS** Button - **RELEASE.** The autopilot will maintain aircraft in wings level attitude.

NOTE

AIRCRAFT HEADING MAY CHANGE IN THE WINGS LEVEL MODE DUE TO AN AIRCRAFT OUT OF TRIM CONDITION.

b. Heading Hold

1) **HEADING** Selector Knob - **SET BUG** to desired heading.

2) **HDG** Mode Selector Button - **PRESS.** Note **HDG** mode annunciator **ON.** Autopilot will automatically turn the aircraft to the selected heading.

c. Command Turns (Heading Hold mode ON)

1) **HEADING** Selector Knob - **MOVE BUG** to the desired heading. Autopilot will automatically turn the aircraft to the new selected heading.

6. NAV Coupling

a. When equipped with HSI.

1) Course Bearing Pointer - **SET** to desired course.

NOTE

WHEN EQUIPPED WITH NAV 1/NAV 2 SWITCHING AND NAV 2 IS SELECTED, SET OBS TO THE DESIRED COURSE.

2) **HEADING** Selector Knob - **SET BUG** to provide desired intercept angle.

3) **NAV** Mode Selector Button - **PRESS.**

SECTION 4
NORMAL PROCEDURES

c. Using Vertical Speed Select (if installed).

Refer to paragraphs E.1 and E.2 on Page 19 for Climb or Descent using the Optional Vertical Speed Selector.

4. Altitude Hold (Not applicable for KAP 100).

a. **ALT** Mode Selector Button - **PRESS.** Note **ALT** mode annunciator **ON.** Autopilot will maintain the selected pressure altitude.

NOTE

IN ACCORDANCE WITH FAA RECOMMENDATION (AC00-24B), USE OF BASIC "PITCH ATTITUDE HOLD" MODE IS RECOMMENDED DURING OPERATION IN SEVERE TURBULENCE.

b. Change selected altitudes

1) Using CWS (recommended for altitude changes greater than 100 ft.)

a) **CWS** Button - **PRESS** and fly aircraft to desired pressure altitude.

b) **CWS** Button - **RELEASE** when desired pressure altitude is reached. The autopilot will maintain the desired pressure altitude.

2) Using Vertical Trim (Recommended for altitude changes less than 100 ft.)

a) **VERTICAL TRIM** Control - **PRESS** either up or down. Vertical Trim will seek an altitude rate of change of about 500 fpm.

b) **VERTICAL TRIM** Control - **RELEASE** when desired pressure altitude is reached. The autopilot will maintain the desired pressure altitude.

5. Heading Changes

a. Manual Heading Changes

BENDIX/KING 100/150 AFCS SUPPLEMENT

SECTION 4 - NORMAL PROCEDURES

A. Preflight (Perform prior to each flight)

1. **GYROS** - Allow 3-4 minutes for gyros to come up to speed.

2. **RADIO MASTR - ON.**

3. **PREFLIGHT TEST BUTTON - PRESS** momentarily (Wait 5 seconds after power on) and **NOTE:**

a. All annunciator lights on (**TRIM** annunciator flashing). All legends and digits are displayed on the KAS 297B Altitude/Vertical Speed Selector (if installed).

b. After approximately 5 seconds, all annunciator lights off except AP which will flash approximately 12 times and then remain off.

c. Note the aural alert tone sounds along with the flashing AP light.

********** **WARNING** **********
IF TRIM WARNING LIGHT STAYS ON THEN THE AUTOTRIM DID NOT PASS PREFLIGHT TEST. MANUAL ELECTRIC TRIM CAN NOT BE USED. WHEN THE KAP/KFC 150 SYSTEM IS INSTALLED THE AUTOPILOT CIRCUIT BREAKER MUST BE PULLED AND THE AUTOPILOT SYSTEM IS NOT OPERATIONAL OR USABLE. WHEN THE KAP 100 SYSTEM WITH THE OPTIONAL MANUAL ELECTRIC TRIM SYSTEM IS INSTALLED, THE PITCH TRIM CIRCUIT BREAKER MUST BE PULLED. THE AUTOPILOT IS STILL OPERATIONAL.
****

4. **MANUAL ELECTRIC TRIM - TEST** as follows:

a. Actuate left side of split switch unit to the fore and aft positions. The trim wheel should not move on its own. Rotate the trim wheel manually against the engaged clutch to check the pilot's overpower capability.

b. Actuate right side of split switch unit to the fore and aft positions. Trim wheel should not move on its own and normal trim wheel force is required to move it manually.

c. Press the **A/P DISC/TRIM INTER** switch down and hold. Manual Electric Trim should not operate either nose up or nose down.

5. **FLIGHT DIRECTOR** (KFC 150 ONLY) - **ENGAGE** by pressing **FD** or **CWS** button.

6. **AUTOPILOT - ENGAGE** by pressing **AP ENG** button.

7. **CONTROL WHEEL** (KAP 150 AND KFC 150 ONLY) - **HOLD** to keep from moving. Use the vertical trim switch on the Mode Controller to command a pitch **UP**. Observe that the autotrim runs in the nose up direction after approximately four seconds. Depress and hold control wheel steering switch **(CWS)** and verify that autotrim stops; then release vertical trim and **CWS** switches. Use the vertical trim switch on the Mode Controller to command a pitch **DN**. Observe that the autotrim runs in the nose down direction after approximately four seconds. Release Mode Controller vertical trim switch and control wheel.

8. **FLIGHT CONTROLS - MOVE** fore, aft, left and right to verify that the autopilot can be overpowered.

9. **AP/DISC/TRIM INTER** Switch - **PRESS**. Verify that the autopilot disconnects and all flight director modes are canceled (KFC 150 ONLY).

10. **TRIM - SET** to take off position manually.

B. AUTOPILOT OPERATION

********** **WARNING** **********
THE PILOT IN COMMAND MUST CONTINUOUSLY MONITOR THE AUTOPILOT WHEN IT IS ENGAGED, AND BE PREPARED TO DISCONNECT THE AUTOPILOT AND TAKE IMMEDIATE CORRECTIVE ACTION - INCLUDING MANUAL CONTROL OF THE AIRPLANE AND/OR PERFORMANCE OF EMERGENCY PROCEDURES - IF AUTOPILOT OPERATION IS NOT AS EXPECTED OR IF AIRPLANE CONTROL IS NOT MAINTAINED.

DURING ALL AUTOPILOT COUPLED OPERATIONS THE PILOT IN COMMAND MUST USE PROPER AUTOPILOT COMMANDS AND USE THE APPROPRIATE COMBINATION OF ENGINE POWER AND WING FLAPS TO ENSURE THAT THE AIRPLANE DOES NOT STALL, EXCEED 175 KIAS, OR EXCEED OTHER BASIC AIRPLANE OPERATING LIMITATIONS.
****

1. Before takeoff

   A/P DISC/TRIM INTER Switch - **PRESS**.

2. Autopilot Engagement

   a. **FD** Mode Selector Button (KFC 150 ONLY) - **PRESS**.

   b. Verify or set Elevator to place the airplane in a trimmed condition prior to Autopilot engagement.

      AP ENG Button - **PRESS**. Note **AP** annunciator **ON**. If no other modes are selected the autopilot will operate in wings level and pitch attitude hold. (KAP 100 DOES NOT HAVE A PITCH MODE).

********** **WARNING** **********
DO NOT HELP THE AUTOPILOT OR HAND-FLY THE AIRPLANE WITH THE AUTOPILOT ENGAGED AS THE AUTOPILOT WILL RUN THE PITCH TRIM TO OPPOSE YOUR CONTROL WHEEL MOVEMENT. A MISTRIM OF THE AIRPLANE, WITH ACCOMPANYING LARGE ELEVATOR CONTROL FORCES, MAY RESULT IF THE PILOT MANIPULATES THE CONTROL WHEEL MANUALLY WHILE THE AUTOPILOT IS ENGAGED. NOT APPLICABLE TO THE KAP 100.
****

3. Climb or Descent (Not applicable for KAP 100 - system may be used for roll control during climb or descent but only roll control is provided. The pilot must manually control the pitch axis.)

   a. Using CWS

      1) **CWS** Button - **PRESS** and **MOVE** aircraft nose to the desired attitude.

      2) **CWS** Button - **RELEASE**. Autopilot will maintain aircraft pitch attitude up to the pitch limits of +15° or -10°.

   b. Using Vertical Trim

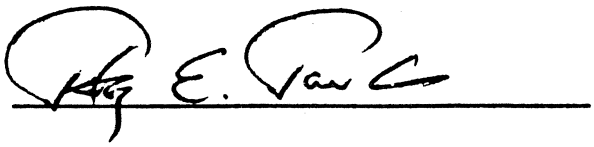
      1) **VERTICAL TRIM** Control - **PRESS** either up or down to modify aircraft attitude at a rate of .7 deg/sec up to the pitch limits of +15° or -10°.

      2) **VERTICAL TRIM** Control - **RELEASE** when desired aircraft attitude is reached. The autopilot will maintain the desired pitch attitude.

PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 5 FOR KING KHF-950 HF TRANCEIVER

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the optional King KHF-950 HF Tranceiver is installed. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures, and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED 

PETER E. PECK
D.O.A. NO. SO-1
THE NEW PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA

DATE OF APPROVAL AUGUST 30, 1996

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional King KHF-950 HF Transceiver is installed in accordance with FAA approved Piper data.

SECTION 2 - LIMITATIONS

(a) No baggage aft compartment.

(b) Placards

Located on aft baggage closeout:
No baggage allowed this compartment.

SECTION 3 - EMERGENCY PROCEDURES

No change.

SECTION 4 - NORMAL PROCEDURES

Normal operating procedures are outlined in the King KHF-950 Pilot's Operating Handbook, P/N 006-8343-0001, latest revision.

SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in the Equipment List attached to the Pilot's Operating Handbook.

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SECTION 10

OPERATING TIPS

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SECTION 10

OPERATING TIPS

10.1 GENERAL

This section provides operating tips of particular value in the operationof the Saratoga II HP.

10.3 OPERATING 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) Use the best speed for takeoff as found in chapter 5 of this manual. Keep in mind that 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 108 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) Anti-collision lights should not be operating when flying through cloud, fog or haze, since reflected light can produce spacial disorientation. Strobe lights should not be used in close proximity to the ground such as during taxiing, takeoff or landing.

(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) 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.

EQUIPMENT LIST

The following is a list of standard and optional equipment for the PA-32R-301 Saratoga II HP. Optional equipment items marked with an X are installed on the airplane. All items are as described below at the time of licensing by the manufacturer. The New Piper Aircraft, Inc. will not revise this equipment list after the aircraft is licensed. It is the owner's responsibility to retain and amend this equipment list to reflect changes in equipment installed in this airplane.

Unless otherwise indicated, the installation certification basis for the equipment included in this list is the aircraft's approved type design.

THE NEW PIPER AIRCRAFT, INC. PA-32R-301, SARATOGA II HP

SERIAL NO. 3246060 **REGISTRATION NO.** N1234X **DATE** 12/19/96

Item No.	Item	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb.-In.)
	(a) Propeller and Propeller Accessories			
1.	Propeller, Hartzell HC-I3YR-1RF/F7663DR, Cert. Basis - TC P33EA	74.5	-14.1	-1050.5
3.	Spinner, Hartzell, C-3575-1(P)	4.2	-15.2	-63.8
5.	Propeller Governor, (Hartzell V-5-4), Cert. Basis - TC P33EA	3.6	-3.1	-11.2
	(b) Engine and Engine Accessories, Fuel and Oil Systems			
9.	Engine, Lycoming Model IO-540-K1G5, Cert. Basis - TC 1E4	467.0	11.25	5253.8
11.	Engine Driven Fuel Pump, Lycoming P/N 75247, Cert. Basis - TC 1E4 (Included in dry engine weight)	1.7	27.6	46.9
13.	Electric Fuel Pump, Airborne P/N 1B5-6	3.0	112.6	337.8
15.	Fuel Valve, Piper Dwg. 69735-5 (Cameron or Airborne P/N 1-H65-5)	2.4	110.8	265.9
17.	Oil Coolers (2), (Harrison P/N 8543897) or (Niagara P/N N.D.M. 20014A)	4.2	22.5	94.5
19.	Air Filter, Fram P/N CA-161PL (PMA 638873)	1.0	16.0	16.0
21.	Starter, Lycoming P/N 76211 (Prestolite P/N MZ 4218) Cert. Basis - TC 1E4 (Included in dry Engine Weight)	18.0	0.7	12.6
23.	Oil Filter, Lycoming P/N 63459, Cert. Basis - TC 1E4 (Included in dry engine weight)	1.6	43.5	69.6
25.	Alternator, Piper Dwg. 87415-6 (Electro Systems Inc., ES4011-1 (28v DC)	15.9	-2.5	-39.8

Item No.	Item	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb.-In.)
	(c) Landing Gear and Brakes			
33.	Main Wheel Assemblies Heavy Duty Group (a) Cleveland Aircraft Products Wheel Assy. 40-120C (2) PS50035- 14 Brake Assy. 30-83 (2) PS50121-5, Cert. Basis - TSO C62 6.00 x 6 Type III 8 Ply Rating Tire (2) PS50119-13, Cert. Basis - TSO C62d, and Tube, PS50119-101.	44.8	109.7	4914.6
35.	Nose Wheel Assembly (a) Cleveland Aircraft Products Wheel Assy. No. 40-77B PS50035-24, Cert. Basis - TSO C26a	3.0	14.3	42.9
	(b) 5.00 - 5 Type III 6 Ply Rating Tire PS50119-10, Cert. Basis - TSO C62d, and Tube, PS50119-100.	6.8	14.3	97.2
37.	Handbrake Master Cylinder, Cleveland Aircraft Products No. 10-22	0.6	60.9	36.5
39.	Toe Brake Cylinders a. Cleveland Aircraft Products No. 10-27	0.7	55.1	38.6
	b. Gar-Kenyon Instruments 17000	0.4	55.1	22.0
41.	Landing Gear Hydraulic Pump (Oildyne 636294), Piper Dwg. 38998-5	9.0	46.6	419.4
43.	Main Gear Hydraulic Cylinders (2), (Syncro Devices SFA 232-3)	2.2	108.0	237.6
45.	Nose Gear Hydraulic Cylinder (Gar Kenyon 94951), Piper Dwg. 35797-2	2.0	41.8	83.6
	(d) Electrical Equipment			
47.	Battery Master Relay, Cutler Hammer P/N 6041H202A	0.8	47.0	37.6
49.	Voltage Regulator, Piper Dwg. 68804-5	0.4	19.4	7.8
51.	Battery, Gill G-243, Piper Dwg. 85504-2	28	36.7	1027.6
53.	Starter Relay - Piper Dwg. 26898-3	0.8	32.4	25.9
55.	Stall Warning Lift Detectors, Safe Flight 148-7, Piper Dwg. 85455-2	0.4	85.9	34.4
57.	Stall Warning Horn (Safe Flight P/N 35214) Piper Dwg. 85455-2	0.2	62.8	12.6
59.	Radio Master Switch Relay, 6041H299, Piper Dwg. 39870-10	0.5	62.6	31.3
61.	Instrument Panel Lights Instl., Piper Dwg.85455-2	0.3	67.8	20.3
63.	Cockpit Flood Light (2), Whelen A300-W-28, Piper Dwg. 95229-5	0.2	99.0	19.8
65.	Reading Lights (4), Piper Dwg. 85311-4	0.6	133.0	79.8
67.	Courtesy Lights Instl., Piper Dwg. 87348-5	0.4	125.2	50.1

Item No.	Item	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb.-In.)
	(d) Electrical Equipment (cont)			
69.	Forward Baggage Light, Piper Dwg. 87348-5	0.2	43.5	8.7
71.	Nose Taxi Light, Piper Dwg. 85347-3 (G.E. Model 4594)	0.8	24.9	19.9
73.	Navigation Lights (Wings) (2) Red/White and Green/White With White Strobe, Whelen, Piper Dwg. 85505-2 Left, Whelen Part No. 90071-00, Right, Whelen Part No. 90071-01	6.6	106.6	703.6
75.	Wing Tip Landing Lights (2), G.E. Model 4594	1.6	94.1	150.6
77.	Heated Pitot Head, Piper Dwg. 46609-0 (AN Headed)	0.9	115.1	103.6
79.	Auxiliary Power Receptacle, Piper Dwg. 85504-2	2.6	43.4	112.8
81.	Lighter, Casco P/N 208083-28 Volt, Piper Dwg. 38453-18	0.2	67.9	13.6
	(e) Instruments			
83.	Altimeter, Piper PS50008-10-2 (United Instruments U15934-PD-I) Cert. Basis - TSO C10b	0.9	65.9	59.3
85.	True speed, Airspeed Indicator, Piper PS50049-65T (United Instruments 8125-B.765), Cert. Basis - TSO C2b	0.6	66.8	40.1
89.	Manifold & Fuel Flow Indicator, Piper PS50031-16 (United Instruments 6331-H.95), Cert. Basis - TSO C45 & C47	1.2	66.2	79.4
91.	Compass, Piper Dwg. 67462-9 (Airpath P/N C-2200-L4-1B), Cert. Basis TSO C7c	0.9	64.9	58.4
93.	Tachometer, PS50048-15-1	0.7	66.2	46.3
95.	Oil press./Cyl temp./Oil temp./PS50160-5 Rochester Gauges Inc., 6246-00674	1.0	67.1	67.1
97.	Fuel Quantity Indicator PS50161-7, Rochester Gauges Inc., 6246-00694	0.5	67.1	33.6
99.	Altitude Reporter, (Narco AR-850), Piper Dwg. 69875-7, Cert. Basis - TSO C88	0.7	56.2	39.3
101.	Rate of Climb, Piper Dwg. 99010-5 (United Instruments P/N UI-7000), Cert. Basis - TSO C8b	0.7	65.9	46.1
103.	Alternate Static Source Installation, Piper Dwg. 85462-2	0.4	66.0	26.4
105.	Turn Coordinator, Piper PS50030-3-5 (Electric Gyro Corp.1394T100-7Z) Cert. Basis - TSO C8b	1.1	65.9	72.5

Item No.	Item	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb.-In.)
	(e) Instruments (cont)			
107.	Ammeter, Non-Linear Systems PM-349 (548-885)	0.2	66.0	13.2
109.	Engine Hour Meter, P/N 550-580	0.3	67.3	20.2
111.	Clock, DVR-300i-XT - Piper Dwg. 87347-5	0.9	67.4	60.7
113.	Outside Air Temperature Gauge (Rockwell Gauge 1592-70062), Piper Dwg. 87702-5	0.3	77.6	23.3
115.	Gyro Suction Gauge, (Airborne P/N 1G10-1) Piper Dwg. 99480-3	0.5	67.2	33.6
117.	Vacuum Regulator, Airborne P/N 2H3-19	0.6	53.2	31.9
119.	Vacuum Filter, Airborne P/N 1J7-1 (Piper Dwg. 66673-0)	0.3	53.5	16.1
121.	Auxiliary Vacuum System, (Piper Dwg. 87778-4)	11.0	44.0	484.0
123.	Vacuum Pump (Airborne P/N 211CC), Piper Dwg. 79399-0	2.1	27.4	57.5
125.	Exhaust Gas Temperature Gauge, (PS50159-4-1)	0.6	69.4	41.6
	(f) Cabin Interior			
129.	Pilot Adjustable Seat (leather) with headrest, armrest and lumbar support - Piper Dwg. 89026-12	29.1	91.2	2653.9
131.	CoPilot Adjustable Seat (leather) with headrest, armrest and lumbar support - Piper Dwg. 89026-13	29.7	91.2	2708.6
133.	Center Club Seat (leather) - (right) with headrest, Piper Dwg. 89036-2	21.7	112.8	2447.8
135.	Center Club Seat (leather) - (left) with headrest, Piper Dwg. 89036-2	21.7	112.8	2447.8
137.	Aft Seat (leather) - (left) with headrest, Piper Dwg. 89046-2	18.2	163.4	2973.9
139.	Aft Seat (leather) - (right) with headrest and center armrest, Piper Dwg. 89046-2	20.8	162.2	3373.8
141.	Front Seat Belts (2), Piper PS50039-4-46 and -4-52, Cert. Basis - TSO C22f	1.8	91.2	164.2
143.	Center Seat Belts (2) aft facing, Piper PS50039-4-50 and -4-52, Cert. Basis - TSO C22f	1.7	113.2	192.4
145.	Aft Seat Belts (2), Piper PS50039-4-46 and 4-52, Cert. Basis - TSO C22f	1.8	163.4	294.1
147.	Shoulder Harness - Inertia Front (2), Piper PS50039-4-39	1.5	120.1	180.1
149.	Shoulder Harness - Center (aft) (2), Piper PS50039-4-45	0.9	108.9	98.0

Item No.	Item	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb.-In.)
	(f) Cabin Interior (cont)			
151.	Shoulder Harness - Inertia (Rear) (2), Piper PS50039-4-41	1.4	181.5	254.1
153.	Refreshment Console with dividers, 79750-0	7.4	118.5	876.9
155.	Executive Writing Table, Piper Dwg. 85366-2	2.9	142.1	412.1
157.	Window Shades Installation, Piper Dwg. 85293-2	7.8	143.6	1120.1
159.	Assist Straps, Piper Dwg. 79455-0	0.3	120.0	36.0
161.	Baggage Straps, Piper Dwg. 66804-0	1.3	177.0	230.1
	(g) Autopilot			
165.	Bendix/King KFC-150 Autopilot with KCS 55A Compass System, Piper Dwg. 39880-28, Cert. Basis - STC SA1575CE-D	30.2	159.1	4804.8
	(h) Standard Avionics Equipment			
167.	Bendix/King KX 165-25 VHF Comm/Nav with Glide Slope Receiver (#1) Cert. Basis - TSO C37b, C38b, C40a, C36a	4.4	63.0	277.2
169.	Bendix/King KX 165-25 VHF Comm/Nav with Glide Slope Receiver (#2) Cert. Basis - TSO C37b, C38b, C40a, C36a	4.4	63.0	277.2
171.	Bendix/King KI-206 - Nav Indicator Cert. Basis - TSO C34c, C36c, C40a	1.2	66.0	79.2
173.	Bendix/King KN-62A DME, Cert. Basis - TSO C66g	3.3	63.3	208.9
175.	Bendix/King KLN 90B GPS/RNAV Navigation System Instl., Cert. Basis - TSO C129	6.0	63.1	378.6
177.	PS Engineering PMA6000M-S Audio Control Panel	.8	64.8	51.8
179.	Bendix/King KR-87 ADF Receiver			
	a. Receiver/ Cert. Basis - TSO C47c	2.9	64.0	185.6
	b. KA 44b Antenna			
	(1) Single (weight includes cable)	3.8	179.1	680.6
181.	Bendix/King KI-227-01 Slaved Indicator	0.7	66.7	46.7
189.	Bendix/King KT 71 Transponder (weight includes antenna and cable) Cert. Basis - TSO 74c	3.8	62.6	237.9

Item No.	Item	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb.-In.)
	(h) Standard Avionics Equipment (cont)			
191.	Antenna and Cable			
	a. Nav Receiving AV-12PPR	0.4	209.4	83.8
	b. #1 VHF Comm PS50040-18	0.8	146.3	117.0
	c. #2 VHF Comm PS50040-18	0.8	181.1	144.9
	d. Antenna Coupler - Dual G/S Comant CI-1125	0.3	58.8	17.6
	e. Bendix/King KA-60 Transponder Antenna (P/N 071-1174-00), Piper Dwg. 37864	0.2	60.2	12.0
193.	Bendix/King GPS-KA-91 Antenna, Piper Dwg. 39737-5	0.6	96.1	57.7
195.	Marker Beacon Antenna, Comant CI 102, Piper Dwg. 39737-6 (weight includes antenna coax wire to Marker Beacon Receiver)	1.2	199.0	238.8
197.	Emergency Locator Transmitter			
	a. Artex Model ELT-4 and mounting tray	XXX	XXX	XXX
	b. Antenna and Coax	0.2	255.4	51.1
	Cert. Basis - TSO-C91a			
199.	Pilot's Headset, - Telex Comm P/N 61650-03	0.5	85.5	42.8
200.	Intercom System Headsets			
	a. PS Engineering Headsets (2) - center	.2.4	113.2	271.7
	b. PS Engineering Headsets (2) - aft	2.4	163.4	392.2
201.	Pilot's Microphone - Telex Acoustics P/N 62800-04 (Model 100T/NH) Single	0.3	70.8	21.2
203.	Cabin Speaker, Piper Dwg. 85430-2 (2)	1.4	97.5	136.5
205.	Radio Shelf, Piper Dwg. 67367-0	2.3	201.8	464.1
207.	Avionics Cooling Fan (Bendix/King KA-33, 14v), Piper Dwg. 85317-2	0.9	52.4	47.2
211.	Dual Mike and Phone jacks	0.5	66.8	33.4
213.	Static Wicks (4) - Wing	0.1	139.9	14.0
	Static Wicks (3) - Empennage	0.1	303.7	30.4
	Piper Dwg. 78947-12			
215.	Ground Clearance Installation, Piper Dwg. 87458-4	0.3	63.0	18.9

Item No.	Item	Mark if installed	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lb.-In.)
	(i) Miscellaneous				
217.	Locking Fuel Caps, Piper Dwg. 39824-2 (2)		0.9	94.1	84.7
219.	Fire extinguisher installation - 100801-3 a. Saber Halon 1211-1301 fire extinguisher model 600 and instl. hardware.		2.5	103.6	259.0
221.	Tow Bar, Piper Dwg. 69975-2		2.3	193.9	446.0
	END OF STANDARD EQUIPMENT				
	(j) Electrical (Optional Equipment)				
229.	Tail Light Assembly - Piper Dwg. 63886-4	X	0.4	308.0	123.2
	(k) Instruments (Optional Equipment)				
	Copilot's Advanced Instrumentation				
231.	True Speed Indicator, Piper PS50049-65T United Instruments 8125-B.765, Cert. Basis - TSO C2b	X	0.7	66.8	46.8
233.	Attitude Gyro, RCA26BK-6, Cert. Basis - TSO C4c	X	2.2	64.4	141.7
235.	Altimeter, Piper PS50008-10-2D - United UI5934PD-3A134, Cert. Basis - TSO C10b	X	0.9	65.9	59.3
237.	Turn and Bank Coordinator, Piper PS50030-3-5, Cert. Basis - TSO C3b	X	1.2	64.7	77.6
239.	Directional Gyro, Piper PS50126-5, Cert. Basis - TSO C5c	X	2.4	64.7	155.3
241.	Vertical Speed, Piper Dwg. 99010-5, Cert. Basis - TSO C8b	X	0.7	65.9	46.1
	(l) Avionics (Optional Equipment)				
243.	Strike Finder System				
	a. Strike finder Display / Processor	X	1.2	64.5	77.4
	b. Strike finder Antenna	X	0.6	232.0	139.2
	c. Strike finder Harness	X	2.3	108.3	249.1
	(m) Miscellaneous (Optional Equipment)				
245.	Air Conditioning Installation Piper Dwg. 88506-2		70.4	98.5	6934.4
	END FACTORY INSTALLED OPTIONS				
	TOTAL OPTIONAL EQUIPMENT		12.6	88.5	1115.7

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

NO FACTORY INSTALLED EQUIPMENT LISTED THIS PAGE