SARATOGA II HP
PA-32R-301

SN 3246088 AND UP

PILOT'S OPERATING HANDBOOK

AND

FAA APPROVED AIRPLANE FLIGHT MANUAL

AIRPLANE SERIAL NO. 3246223

AIRPLANE REGIST. NO. N3101Q

PA-32R-301
REPORT: VB-1669 FAA APPROVED BY:

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

DATE OF APPROVAL:
JUNE 30, 1997

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
PUBLICATIONS DEPARTMENT
Issued: June 30, 1997

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.

WARNING

INSPECTION, MAINTENANCE AND PARTS REQUIREMENTS FOR ALL NON-PIPER APPROVED STC INSTALLATIONS ARE NOT INCLUDED IN THIS HANDBOOK. WHEN A NON-PIPER APPROVED STC INSTALLATION IS INCORPORATED ON THE AIRPLANE, THOSE PORTIONS OF THE AIRPLANE AFFECTED BY THE INSTALLATION MUST BE INSPECTED IN ACCORDANCE WITH THE INSPECTION PROGRAM PUBLISHED BY THE OWNER OF THE STC. SINCE NON-PIPER APPROVED STC INSTALLATIONS MAY CHANGE SYSTEMS INTERFACE, OPERATING CHARACTERISTICS AND COMPONENT LOADS OR STRESSES ON ADJACENT STRUCTURES, PIPER PROVIDED INSPECTION CRITERIA MAY NOT BE VALID FOR AIRPLANES WITH NON-PIPER APPROVED STC INSTALLATIONS.

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 air-plane 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 7-46, 8-1 through 8-18, 9-1 through 9-38, 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-1669 issued June 30, 1997.

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 1			
(PR980810)	v	Added Rev. 1 to L of R page.	
	2-4	Revised Para. 2.9.	
	4-ii	Revised T of C.	
	4-8	Revised Para. 4.5.	
	4-21	Revised Para. 4.17.	
	4-27	Added Para. 4.39.	Peter E. Peck
	4-28	Added Para. 4.39.	
	7-35	Revised Para. 7.17.	Aug. 10, 1998
	9-8	Revised Section 3.	Date
Rev. 2	v	Added Rev. 2 to L of R page.	
(PR981218)	9-i	Revised T of C.	Peter E. Peck
	9-39	Added page.	
	9-40	Added page.	Dec. 18, 1998
			Date
Rev. 3	v	Added Rev. 3 to L of R page.	
(PR990212)	7-i	Revised T of C.	
	7-7	Revised Para. 7.8.	
	7-9	Revised Fig. 1.	
	7-10	Revised Para. 7.8 and Fig. 2 & 3.	
	7-11	Revised Fig. 4.	
	7-12	Revised Fig. 5 & 6.	
	7-13	Revised Fig. 7 & 8.	
	7-14	Revised Fig. 9 & 10.	
	7-15	Added info. to Para. 7.8.	
	7-16	Added info. to Para. 7.8.	
	7-17	Revised Para. 7.8 and Fig. 13 & 14.	Peter E. Peck
	7-18	Revised Para. 7.8 and Fig. 15.	Feb. 12, 1999
	7-19	Revised Para. 7.8.	Date

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Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 4 (PR991122)	vi 9-i 9-41 thru 9-48	Added Rev. 4 to L of R page. Revised T of C. Added pages and Supplement 8.	Christina L. Marsh Christina L. Marsh Nov. 22, 1999 Date
Rev. 5 (PR000612)	vi 2-9 3-5 3-6 3-15 4-4 4-5 4-14 4-15 5-9 5-14 7-36 8-10 9-i 9-47 9-49 thru 9-56 9-57 thru 9-64 9-65 thru 9-70 9-71 thru 9-74	Added Rev. 5 to L of R page. Revised Para. 2.25. Revised Para. 3.5. Revised Para. 3.5. Revised Para. 3.27. Revised Para. 4.5. Revised Para. 4.5. Revised Para. 4.7. Revised Para. 4.7. Revised List of Figures. Revised Figure 5-7 title. Revised Figure 7-21. Revised Para. 8.15. Revised T of C. Revised Section 4. Added Supplement 9. Added Supplement 10. Added Supplement 11. Added Supplement 12.	Christina L. Marsh Christina L. Marsh June 12, 2000 Date

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Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 6 (PR010109)	vi-a	Added page and Rev. 6 to L of R.	
	vi-b	Added page.	
	3-7	Revised para. 3.5.	
	3-16	Revised para. 3.31.	
	9-i	Revised T of C.	
	9-75 thru 9-84	Added pages and Supplement 13.	
	9-85 thru 9-86	Added pages and Supplement 14.	
	9-87 thru 9-92	Added pages and Supplement 15.	
	9-93 thru 9-98	Added pages and Supplement 16.	
	9-99 thru 9-102	Added pages and Supplement 17.	Christina L. Marsh Christina L. Marsh Jan. 9, 2001 Date
Rev. 7 (PR010705)	vi-a	Added Rev. 7 to L of R.	Peter E. Peck Peter E. Peck July 5, 2001 Date
	2-3	Revised Para. 2.7.	
	2-4	Revised Para. 2.9.	
	2-11	Revised Para. 2.25.	
Rev. 8 (PR020311)	vi-a	Added Rev. 8 to L of R.	A J Mill Albert J. Mill March 11, 2002 Date
	2-9	Revised para. 2.25.	
	4-2	Revised para. 4.3.	

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Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 9 (PR031015)	iii	Added Warning.	
	iv	Moved info. from page iii.	
	vi-b	Added Rev. 9 to L of R.	
	5-29	Revised Figure 5-37.	
	8-1	Moved info. to page 8-1b and revised para. 8.1.	
	8-1a	Added page and revised para. 8.1.	
	8-1b	Added page and moved info. from pages 8-1 and 8-2.	
	8-2	Moved info. to page 8-1b and revised para. 8.3.	Albert J. Mill
	9-72	Revised Section 1.	Oct. 15, 2003 Date
Rev. 10 (PR031210)	vi-b	Added Rev. 10 to L of R.	
	9-i	Revised T of C.	
	9-56	Revised Section 4.	
	9-63	Revised Section 4.	
	9-72	Moved info. to page 9-73 and revised Section 1.	
	9-73	Moved info. from page 9-72.	
	9-103 thru 9-106	Added pages and Supplement 18.	Albert J. Mill Dec. 10, 2003 Date
Rev. 11 (PR040305)	vi-b	Added Rev. 11 to L of R.	
	9-i	Revised T of C.	
	9-107 thru 9-124	Added pages and Supplement 19.	Albert J. Mill
	9-125 thru 9-128	Added pages and Supplement 20.	March 5, 2004 Date

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Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 12 (PR040419)	vi-c	Added page and Rev. 12 to L of R.	
	vi-d	Added page.	
	8-11	Revised para. 8.19.	Albert J. Mill
	9-108	Revised Section 1.	April 19, 2004 Date
Rev. 13 (PR040812)	vi-c	Added Rev. 13 to L of R.	
	4-4	Revised para. 4.5.	
	4-5	Revised para. 4.5.	
	4-14	Revised para. 4.7.	
	4-15	Revised para. 4.7.	
	7-32	Revised para. 7.15.	
	9-108	Revised Section 1.	Linda J. Dicken August 12, 2004
Rev. 14 (PR050523)	vi-c	Added Rev. 14 to L of R.	
	9-i	Revised T of C.	
	9-107 thru 9-134	Revised Supplement 19.	
	9-135 thru 9-138	Revised page numbers.	Linda J. Dicken May 23, 2005
Rev. 15 (PR050607)	vi-c	Added Rev. 15 to L of R.	
	9-i	Revised T of C.	
	9-139 thru 9-166	Added pages and Supplement 21.	Linda J. Dicken June 7, 2005

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Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 16 (PR050711)	vi-d 7-41 9-ii 9-167 thru 9-176	Added Rev. 16 to L of R. Revised para. 7.23. Revised T of C. Added pages and Supplement 22.	Linda J. Dicken July 11, 2005
Rev. 17 (PR050829)	vi-d 9-110 9-111	Added Rev. 17 to L of R. Moved info. from page 9-111. Revised Section 2.	Linda J. Dicken August 29, 2005
Rev. 18 (PR051017)	vi-d 9-ii 9-119 9-177 thru 9-210	Added Rev. 18 to L of R. Revised T of C. Revised Section 3. Added pages and Supplement 23.	Linda J. Dicken October 17, 2005
Rev. 19 (PR051121)	vi-d 9-112 9-115	Added Rev. 19 to L of R. Revised Section 3. Revised Section 3.	Linda J. Dicken Nov. 21, 2005
Rev. 20 (PR051212)	vi-d 9-i 9-107 thru 9-134 9-181 thru 9-183	Added Rev. 20 to L of R. Revised T of C. Revised Supplement 19. Revised Section 2.	Linda J. Dicken Dec. 12, 2005

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Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 21 (PR060116)	vi-e	Added page and Rev. 21 to L of R.	
	vi-f	Added page.	
	9-139	Revised Supplement title.	
	9-140	Revised Section 1.	
	9-146	Revised Section 3.	
	9-147	Revised Section 3.	
	9-148	Revised Section 5.	
	9-149	Revised Table 1.	
	9-150	Revised Section 7.	
	9-152	Revised Section 7.	
	9-153	Revised Section 7.	
	9-154	Revised Figure 7-5.	Linda J. Dicken
	9-160	Revised Section 8.	Jan. 16, 2006

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GENERAL

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SECTION 1

GENERAL

1.1 INTRODUCTION

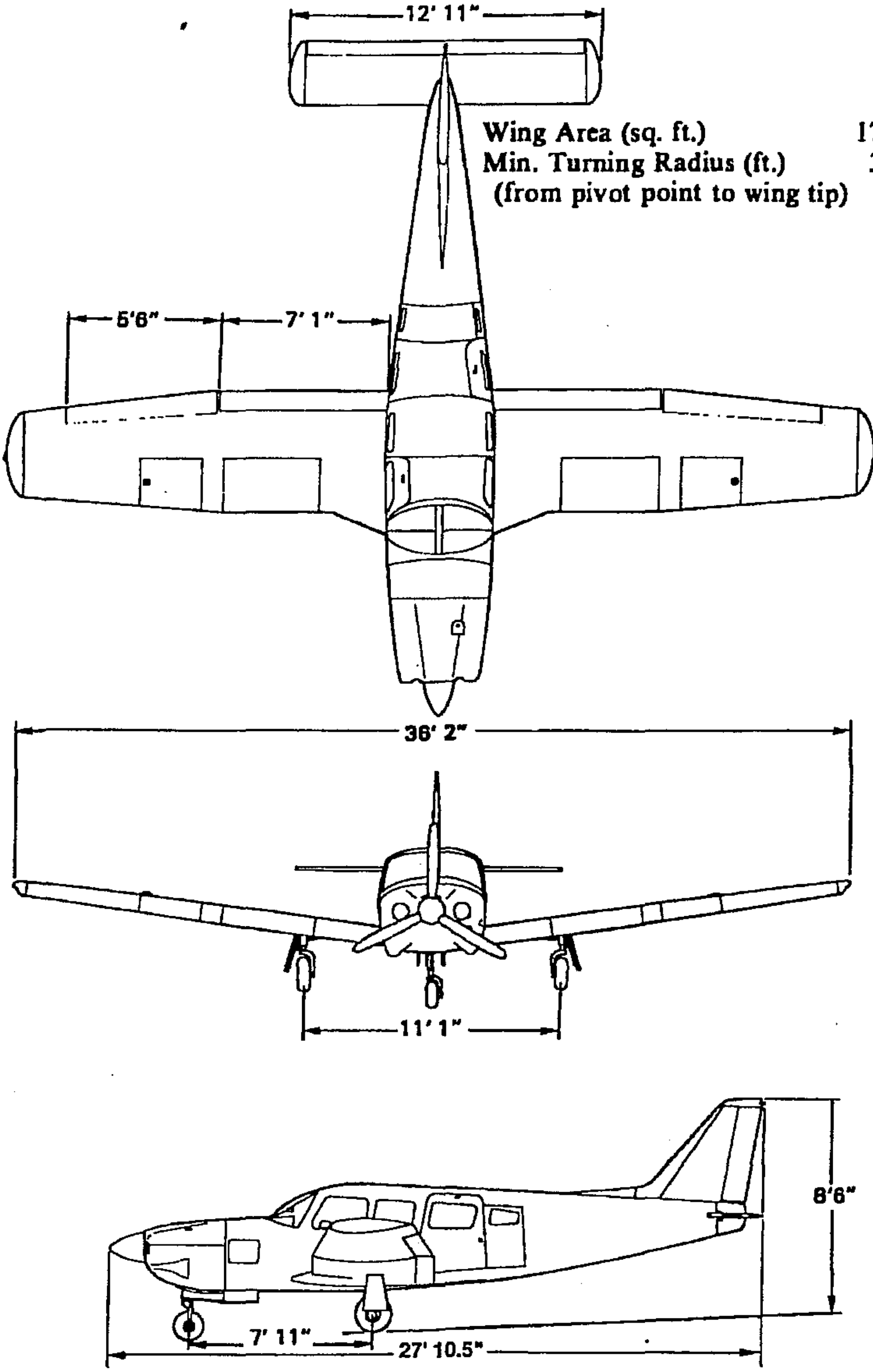
This Pilot's Operating Handbook is designed for maximum utilization as an operating guide for the pilot. It includes the material required to be furnished to the pilot by FAR/CAR. It also contains supplemental data supplied by the airplane manufacturer.

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

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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.
-or-	
Green arc (normal operating range)	4.5 to 5.2 in. Hg.
Red Line (minimum)	4.5 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.

In full view of the pilot:

WARNING

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

In full view of the pilot and passengers:

NO SMOKING

Adjacent to front door latch:

CAUTION

DO NOT ATTEMPT TO CLOSE DOOR WITH HANDLE IN LATCHED POSITION.

On the instrument panel in full view of the pilot:

V_A 134 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.

If required, on the aft close out panel:

REAR PASSENGER/BAGGAGE AREAS
MAXIMUM ALLOWABLE WEIGHT
MAXIMUM ALLOWABLE COMBINED WEIGHT IN AFT SEATS IS

POUNDS

LOAD IN ACCORDANCE
WITH WEIGHT BALANCE DATA

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.

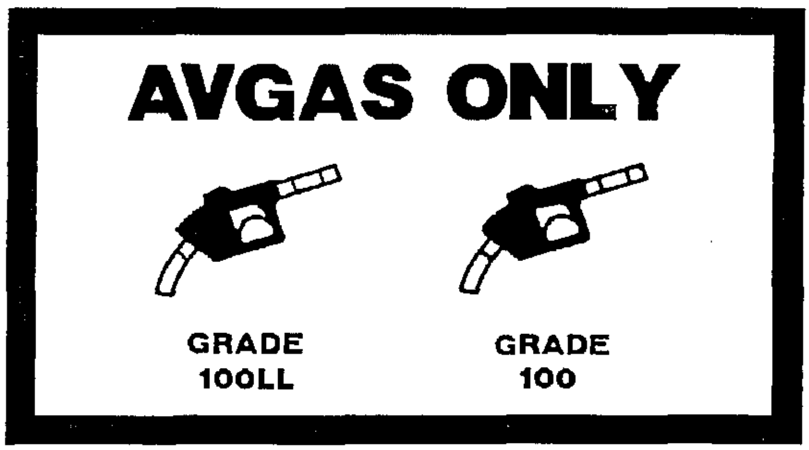
On storm window:

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:

ARMRESTS ARE TO BE IN THE STOWED POSITION FOR TAKEOFF AND LANDING

On right hand side of of console top:

MONITOR, ALL LOOSE ITEMS, AND CONSOLE TOP ARE TO BE IN THE STOWED POSITION FOR TAKEOFF AND LANDING

MAXIMUM, WEIGHT ALLOWABLE ON THE CONSOLE TOP IN THE EXTENDED POSITION IS 10 LBS

SECTION 3

EMERG. PROCEDURES

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SECTION 3

EMERGENCY PROCEDURES

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SECTION 3 (cont)

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

Alternator Inop annunciator light illuminated
Alternator ammeter .... Verify approximately Zero output
Battery ammeter .... Verify battery supplying aircraft power (neg. reading)
If indications verify loss of alternator output
ALT switch .... OFF

Reduce electrical loads to minimum

ALT circuit breaker .... check and reset as required
ALT switch .... ON

If alternator output 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. The Low Bus Voltage annunciator light will illuminate as battery power is depleted.

Note:

If the battery is depleted, the landing gear must be lowered using the Emergency Extension Procedure. The gear position lights and flaps will be inoperative.

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

If electrical overload condition is present and abnormally high battery charge load persists (longer than 5 minutes):
ALT switch .... ON
BAT switch .... OFF

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 electrical overload condition is present and battery charge load is normal:
ALT switch .... OFF
Electrical load .... reduce to minimum
BAT switch .... as required

Land as soon as possible. Anticipate complete electrical failure. The Low Bus Voltage annunciator light will illuminate if prolonged battery power usage is required.

NOTE

> If the battery is depleted, the landing gear must be lowered using the emergency extension procedure. The gear position lights and flaps 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:
Landing Gear Pump Circuit Breaker ....PULL
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, secure (OFF) one magneto at a time, then back to ON. 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 Alternator Inop annunciator illumination, zero alternator ammeter indication and negative battery ammeter indications (battery is supplying aircraft power). If these indications are present, the battery is the only source of aircraft power and electrical loads should be reduced to a minimum.

First, check the alternator circuit breaker for a popped circuit (breaker out).

Next reset the alternator 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 alternator and battery ammeters continue to indicate alternator failure, 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. The Low Bus Voltage annunciator will illuminate as battery power is depleted.

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 conditions) it may be caused by a low battery, a battery fault or other abnormal electrical load. If the cause is a low battery, the battery charge indication should begin to decrease toward normal within 5 minutes. If the high battery charge load persists, turn the battery master switch OFF and land as soon as practical. All electrical loads are being supplied by the alternator.

If the electrical overload condition is present and the battery charge load is normal, turn the alternator OFF and reduce the electrical loads to a minimum. Battery power should be used only as required and the flight should be terminated as soon as possible. If battery power is required for flight, the Low Bus Voltage annunciator light will illuminate as battery power is depleted. Complete electrical failure is possible if prolonged battery power usage is required.

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 and flaps 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 landing gear pump circuit breaker and 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.

Secure (OFF) one magneto at a time, then back to ON. 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

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NORMAL PROCEDURES

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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.

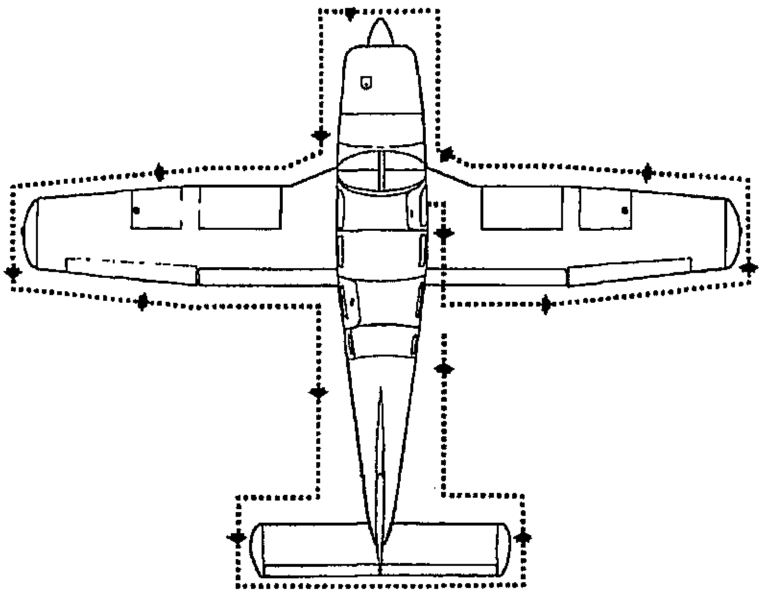
The remainder of the section is devoted to amplified normal procedures which provide detailed information and explanations of the procedures and how to perform them. This portion of the section is not intended for use as an in-flight reference due to the lengthy explanation. The short form checklist 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 ....110 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

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

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 nav/strobe lights....check
Landing light....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 (4.00 ± .25 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 (s/n 3246001 thru 3246224 only)....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 (4.00 ± .25 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
Landing light....................check
Wing tip and nav/strobe 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
Pitot heat Off/Inop annunciator....................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 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
Pitot heat Off/Inop annunciator....ON
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 on 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 external power, the battery master and alternator switches should be OFF.

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

All electrical equipment .... OFF
External power plug .... insert in fuselage
Proceed with normal start
Throttle .... lowest possible RPM
External power plug .... disconnect from fuselage
Battery master switch .... ON
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 .... Check - within normal operating range
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

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.

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
Flaps....................retract slowly
Gear....................UP
Trim....................as required

AFTER LANDING

Clear of Runway

Flaps....................retract
Air conditioner....................as desired
Electric Fuel Pump....................OFF
Strobe Lights....................OFF
Landing and Taxi Lights....................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 forward side of the spar box, right-hand side of the cabin. 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 nav/strobe lights for damage. Verify condition of landing light/lens.

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 $4.00 \pm .25$ 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 baffle 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 ± .25 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 (s/n 3246001 thru 3246224 only). 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 4.00 ± .25 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. Verify the condition of the landing light/lens. Check the wing tip and nav/strobe 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, electric fuel pump, and magneto switches. 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 external power, the master switch should be OFF.

Verify the battery master and alternator switches are OFF, magneto switches are ON, and all electrical equipment is OFF. Insert the plug of the 24 volt power source cable into the socket located on the lower aft portion of the right hand side of the fuselage. Note that when the plug is inserted, the electrical system is ON. Turn the magneto switches ON and proceed with the normal starting technique. Battery master and alternator switches will be OFF.

After the engine has started, reduce power to the lowest possible RPM, (to reduce sparking on disconnect), and disconnect the jumper cable from the aircraft. Turn the master and alternator switches 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 within the normal operating range 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 reaches peak EGT. Then enrich the mixture by pushing the control towards the instrument panel until engine EGT reaches peak EGT +50° F. The fuel flow meter will give a close approximation of the fuel being consumed. Additiional information concerning engine leaning procedures can be found in 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.

4.30 AFTER LANDING

When clear of the runway, retract the flaps. Turn the air conditioner on if desired. Turn off the electric fuel pump and strobe lights. Use the landing and taxi lights 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 (continued)

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. 3.31) 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.

SECTION 5
PERFORMANCE

TABLE OF CONTENTS

SECTION 5

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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.

5.4 DEMONSTRATED OPERATING TEMPERATURE

Satisfactory engine cooling has been demonstrated for this model aircraft to an Outside Air Temperature (OAT) of ISA +22°C for a standard day. This is not to be considered as an operating limitation. Reference should be made to Section 2 for engine operating limitations.

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 (e)(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)(6) 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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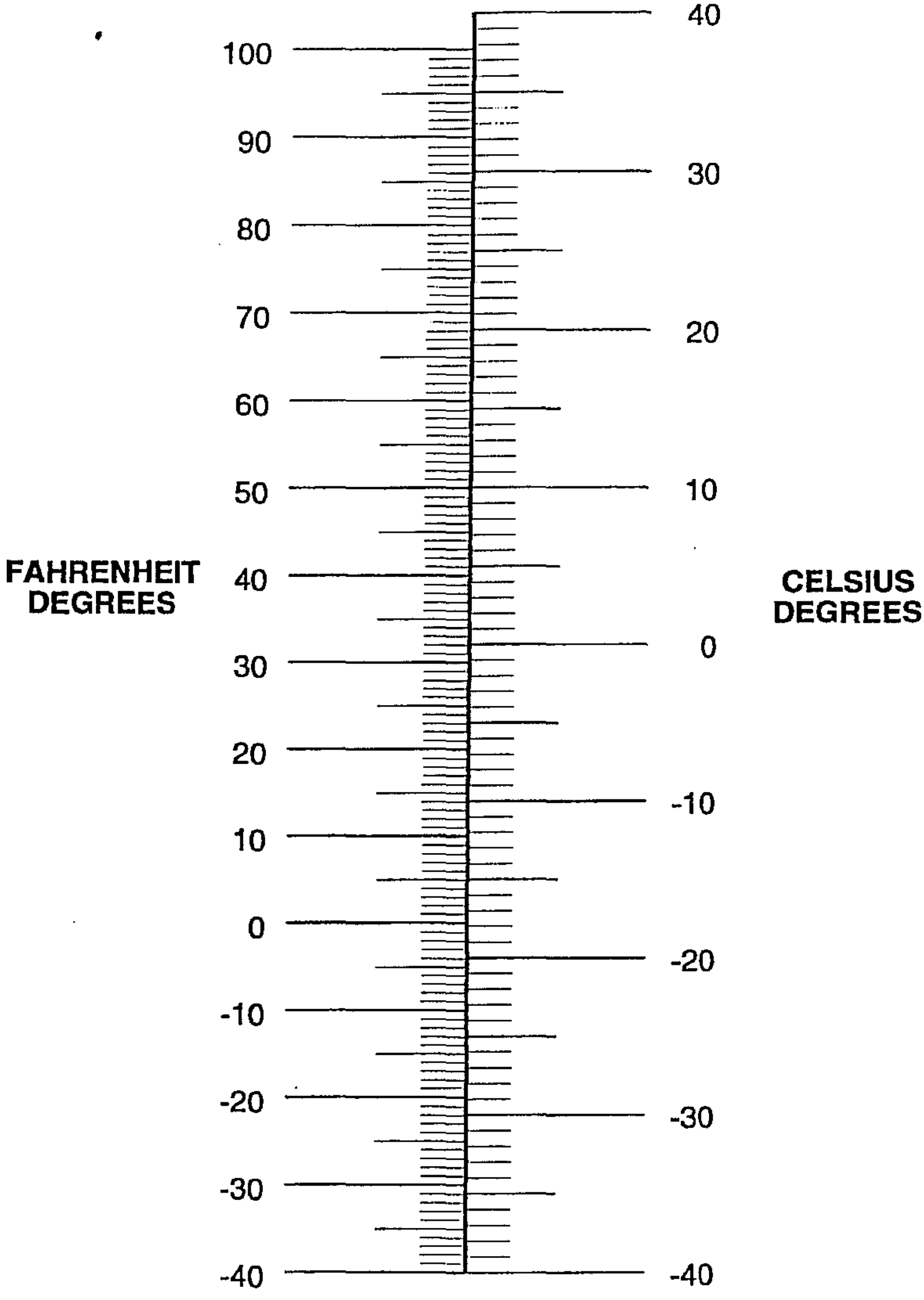
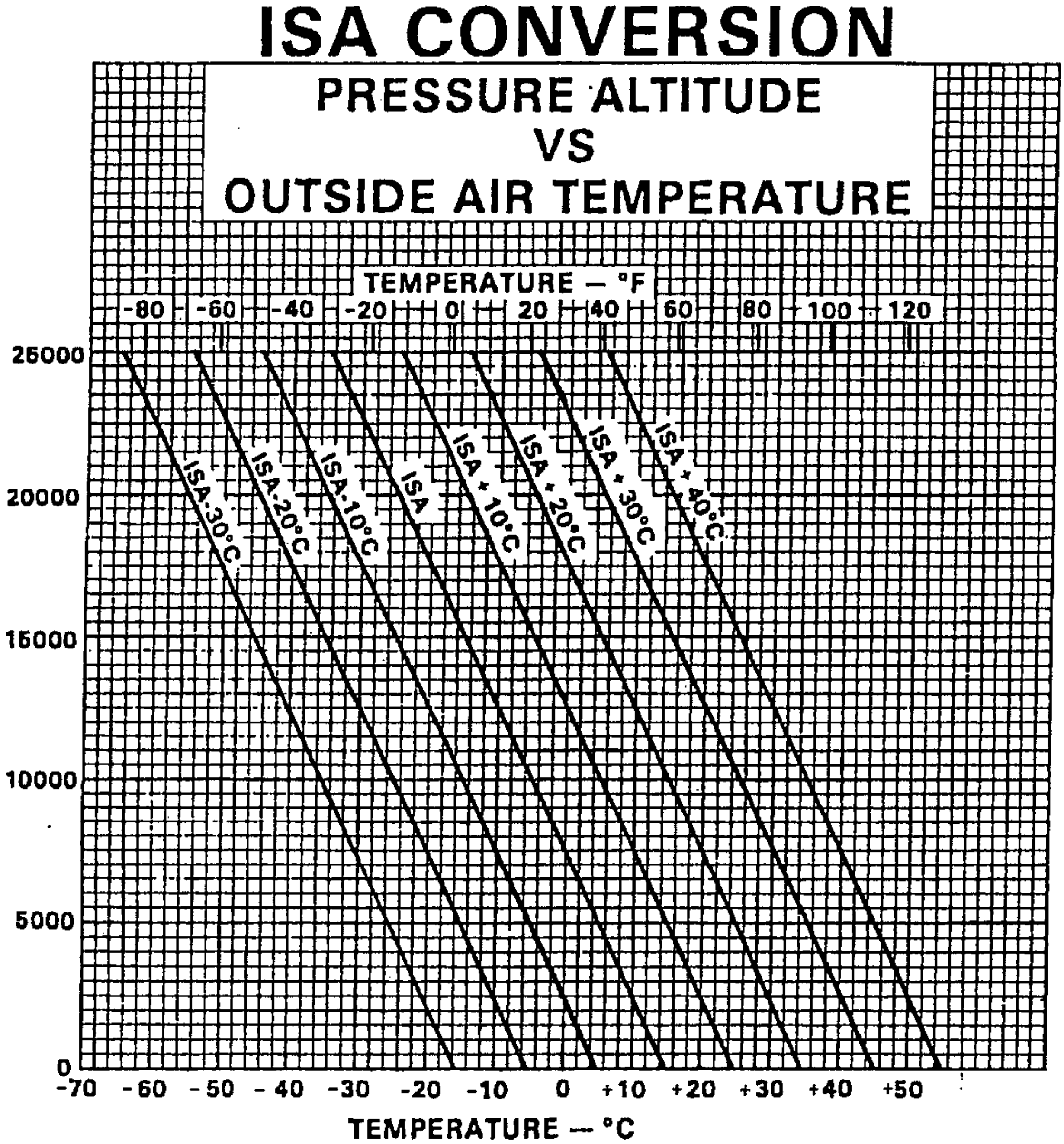
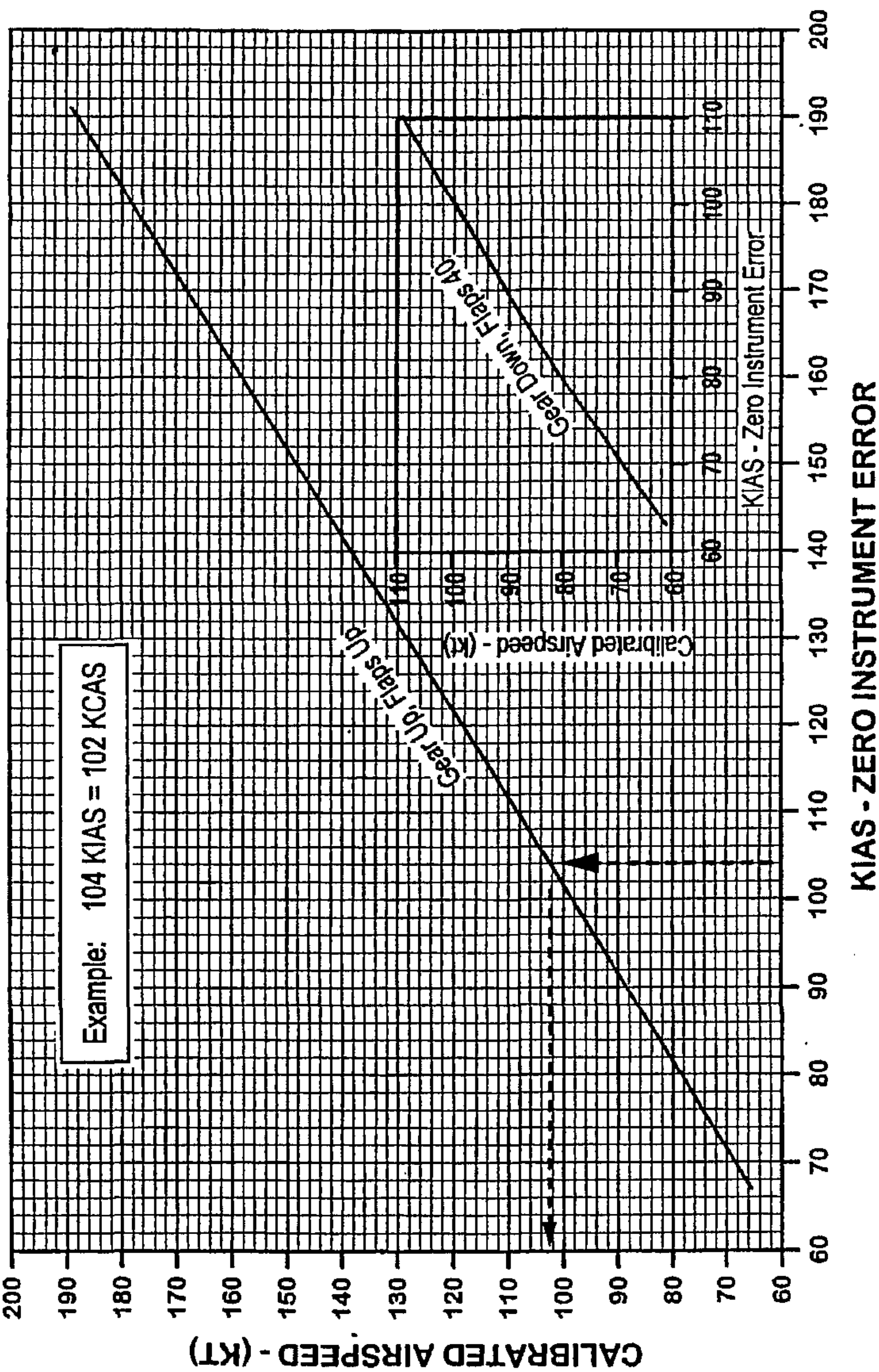


TEMPERATURE CONVERSION
Figure 5-1



PRESSURE ALTITUDE
VS
OUTSIDE AIR TEMPRATURE
Figure 5-2



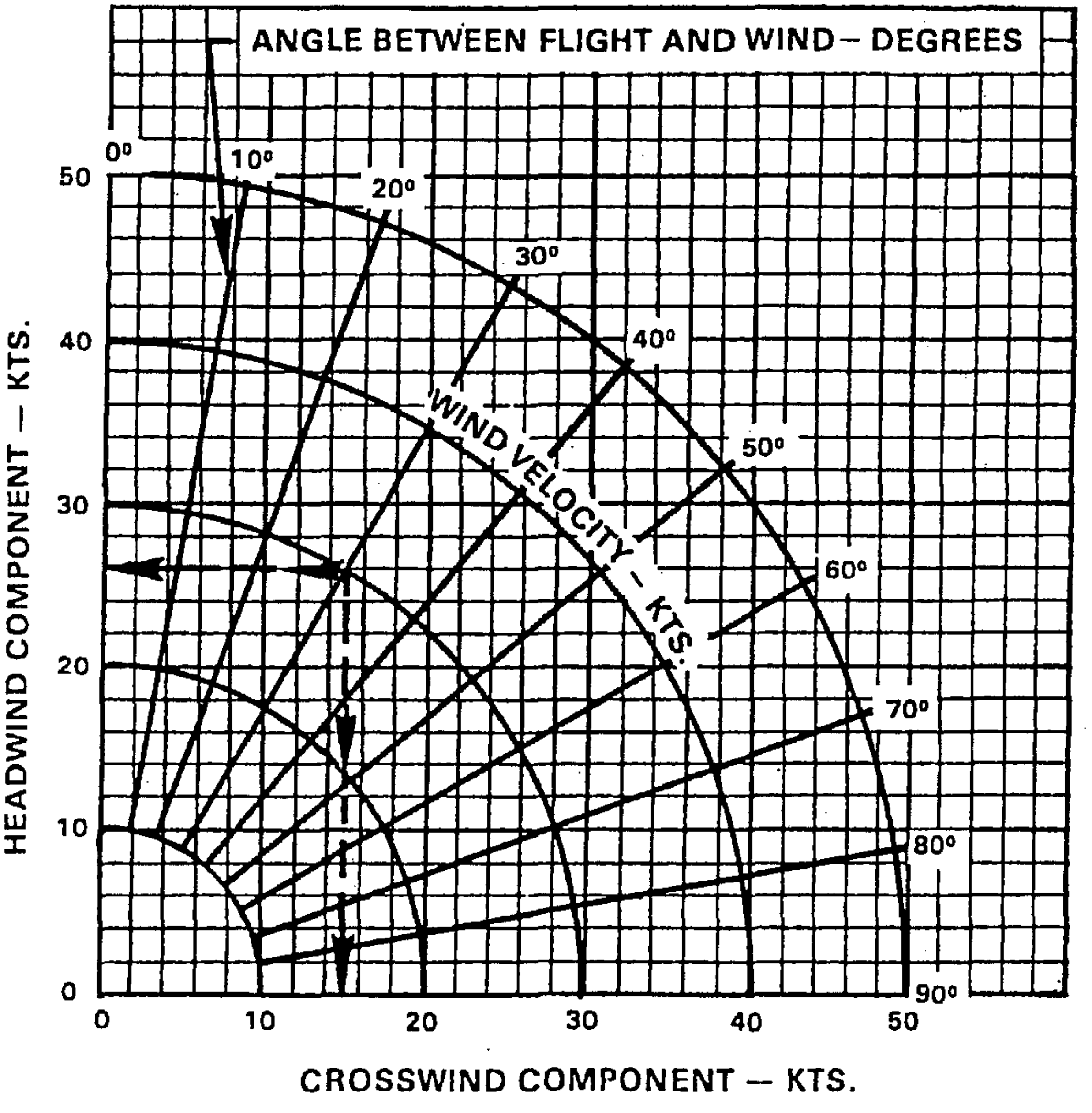
AIRSPEED SYSTEM CALIBRATION
ALL FLAP DEFLECTIONS
Figure 5-3

WIND COMPONENTS

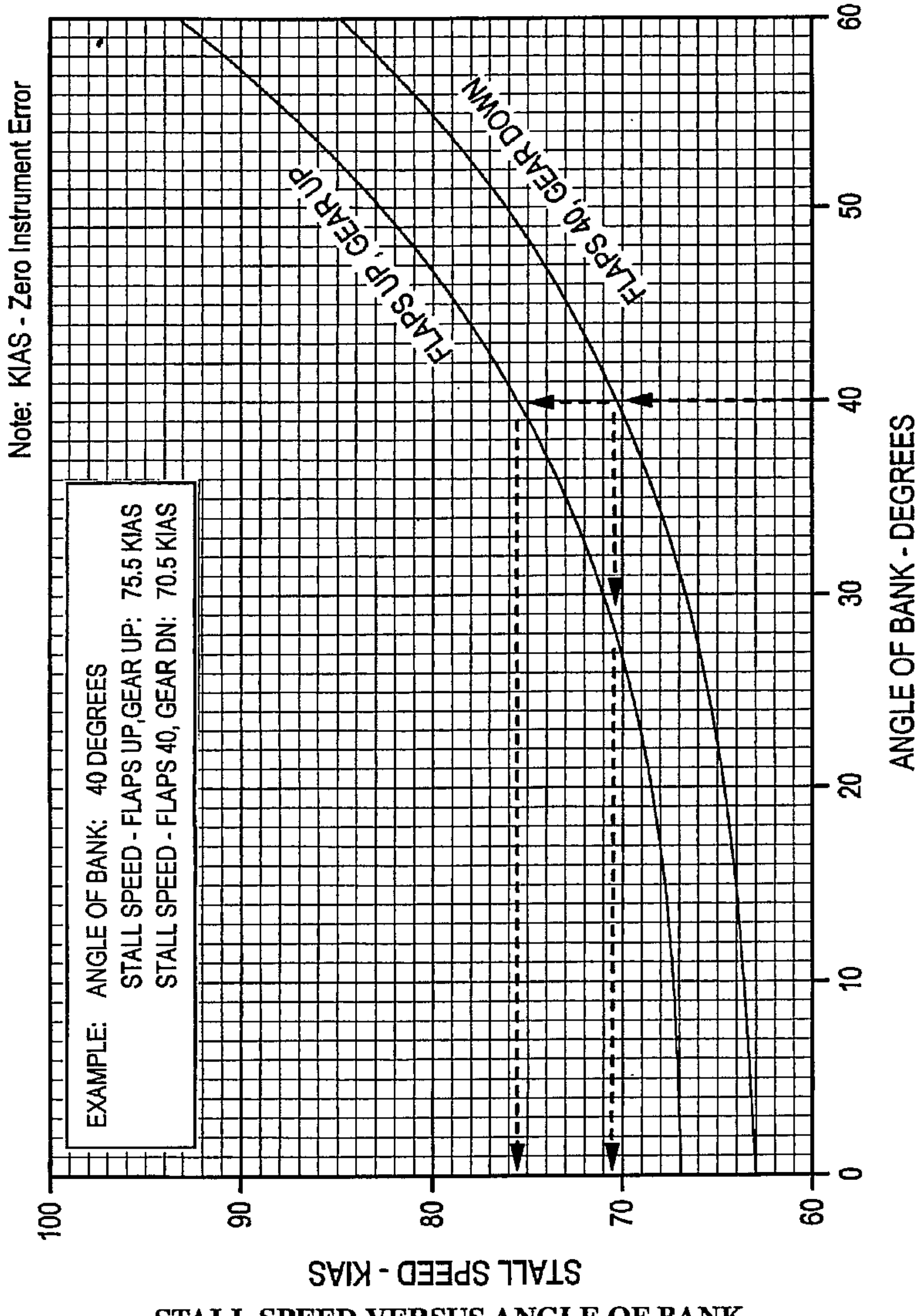
NOTE: Maximum demonstrated crosswind velocity is 17 knots. (Not a limitation)

EXAMPLE:

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



WIND COMPONENTS
Figure 5-5

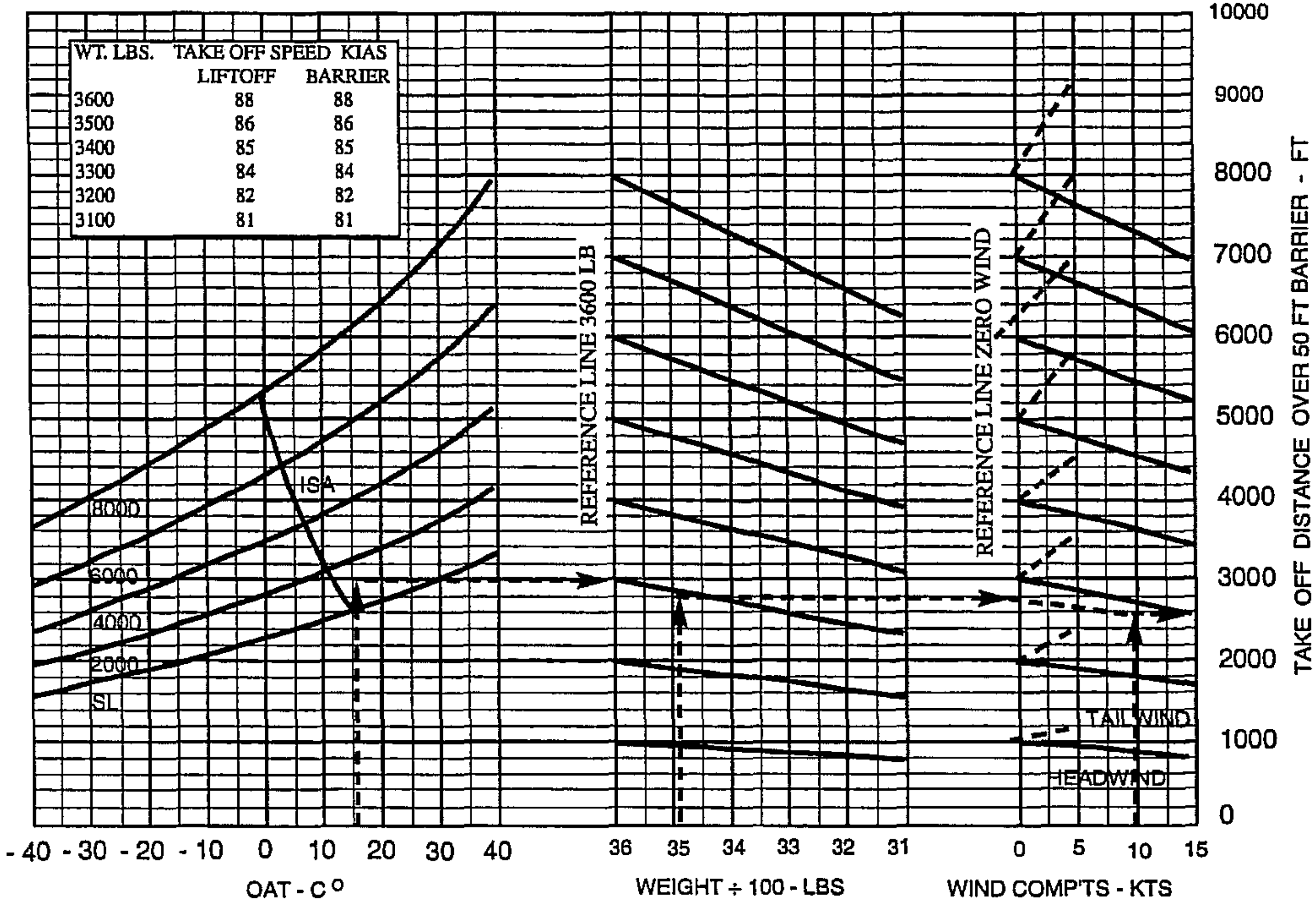


STALL SPEED VERSUS ANGLE OF BANK
GROSS WEIGHT 3600 LBS
Figure 5-6

ASSOCIATED CONDITIONS:
2700 RPM AND FULL THROTTLE
BEFORE BRAKE RELEASE
FLAPS 0 DEGREES
PAVED, LEVEL, DRY RUNWAY

NORMAL PROCEDURE TAKEOFF PERFORMANCE

EXAMPLE:
PRESS ALTITUDE: 1200 FT
OAT: 16° C
GROSS WEIGHT: 3480 LBS
WIND: 10 KNOT HEADWIND
TAKE OFF DISTANCE: 2598 FT.
LIFTOFF/BARRIER SPEED: 86 /86 KIAS



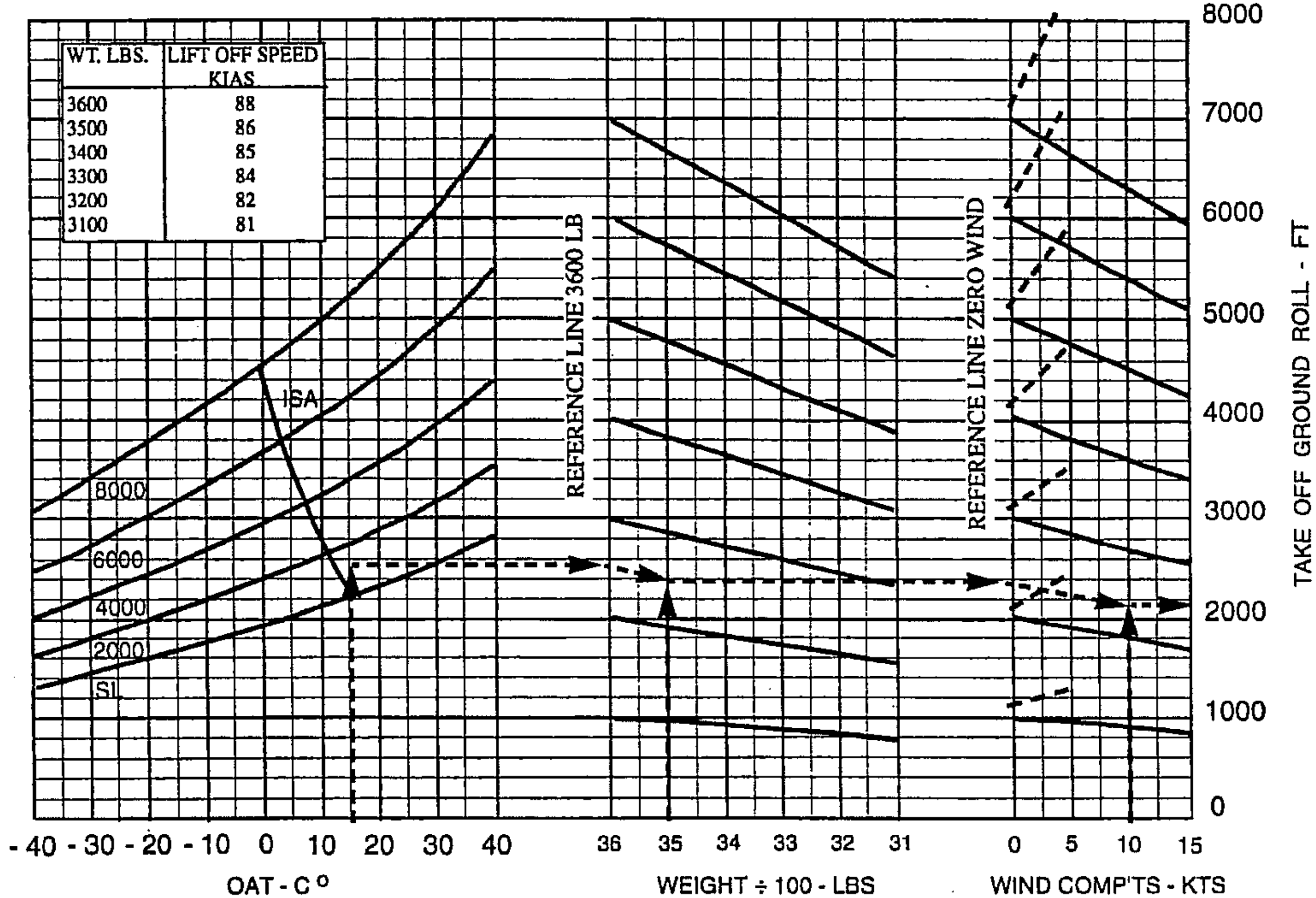
WT. LBS.	TAKE OFF SPEED KIAS LIFTOFF	BARRIER
3600	88	88
3500	86	86
3400	85	85
3300	84	84
3200	82	82
3100	81	81

NORMAL PROCEDURE TAKEOFF PERFORMANCE
FLAPS 0°
Figure 5-7

ASSOCIATED CONDITIONS:
2700 RPM AND FULL THROTTLE
BEFORE BRAKE RELEASE
FLAPS 0 DEGREES
PAVED, LEVEL, DRY RUNWAY

NORMAL PROCEDURE TAKEOFF GROUND ROLL

EXAMPLE:
PRESS ALTITUDE: 1200 FT
OAT: 16° C
GROSS WEIGHT: 3480 LBS
WIND: 10 KNOT HEADWIND
TAKE OFF GROUND ROLL: 2186 FT.
LIFTOFF SPEED: 86 KIAS



WT. LBS.	LIFT OFF SPEED KIAS
3600	88
3500	86
3400	85
3300	84
3200	82
3100	81

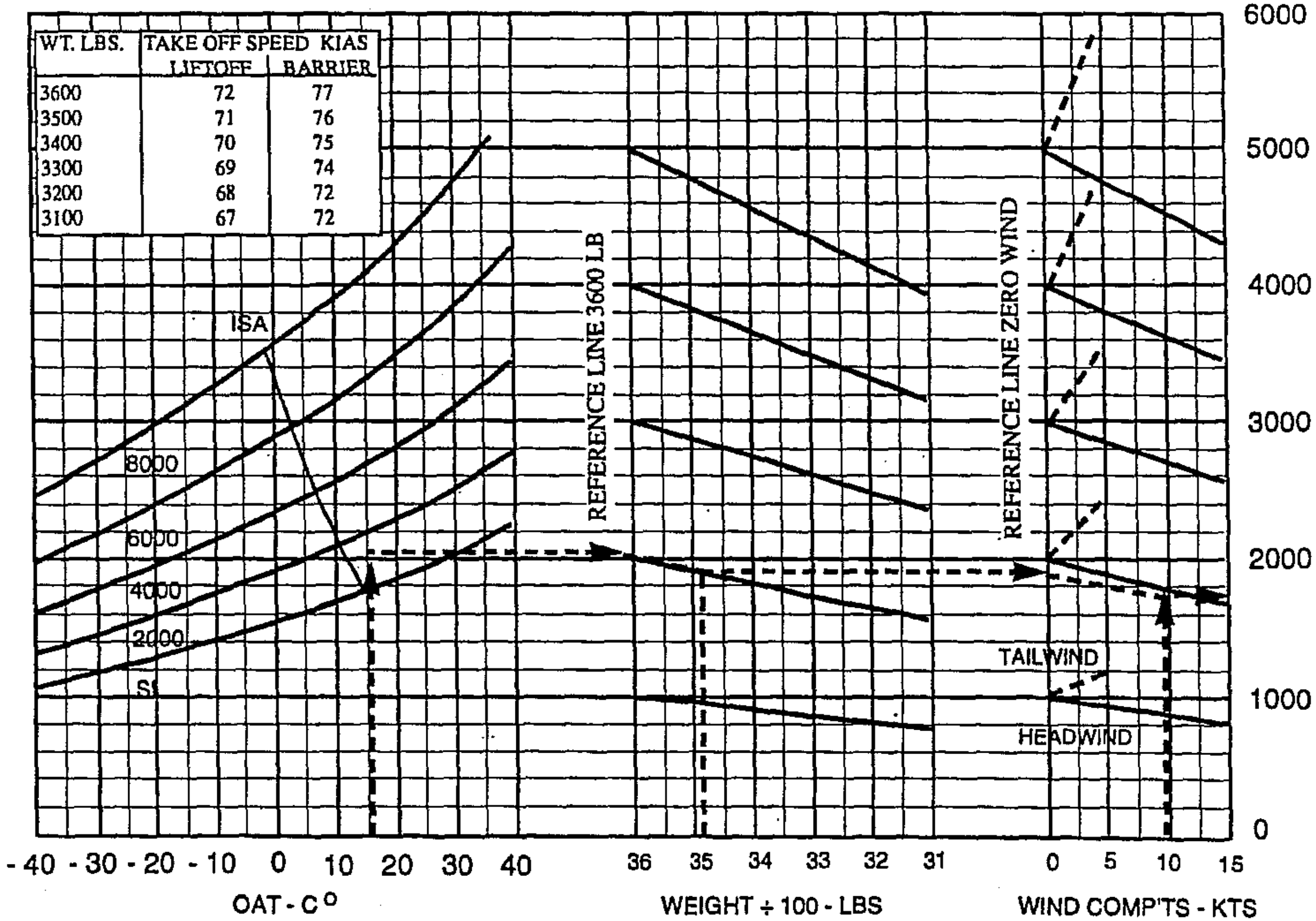
NORMAL PROCEDURE TAKEOFF GROUND ROLL
Figure 5-9

MAXIMUM EFFORT TAKEOFF PERFORMANCE

ASSOCIATED CONDITIONS:
2700 RPM AND FULL THROTTLE BEFORE BRAKE RELEASE
FLAPS 25 DEGREES
PAVED, LEVEL, DRY RUNWAY

EXAMPLE:
PRESS ALTITUDE: 1200 FT
OAT: 16° C
GROSS WEIGHT: 3480 LBS
WIND: 10 KNOT HEADWIND
TAKE OFF DISTANCE: 1734 FT.
LIFTOFF / BARRIER SPEED: 71 / 76 KIAS

WT. LBS.	TAKE OFF SPEED KIAS LIFTOFF	BARRIER
3600	72	77
3500	71	76
3400	70	75
3300	69	74
3200	68	72
3100	67	72



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

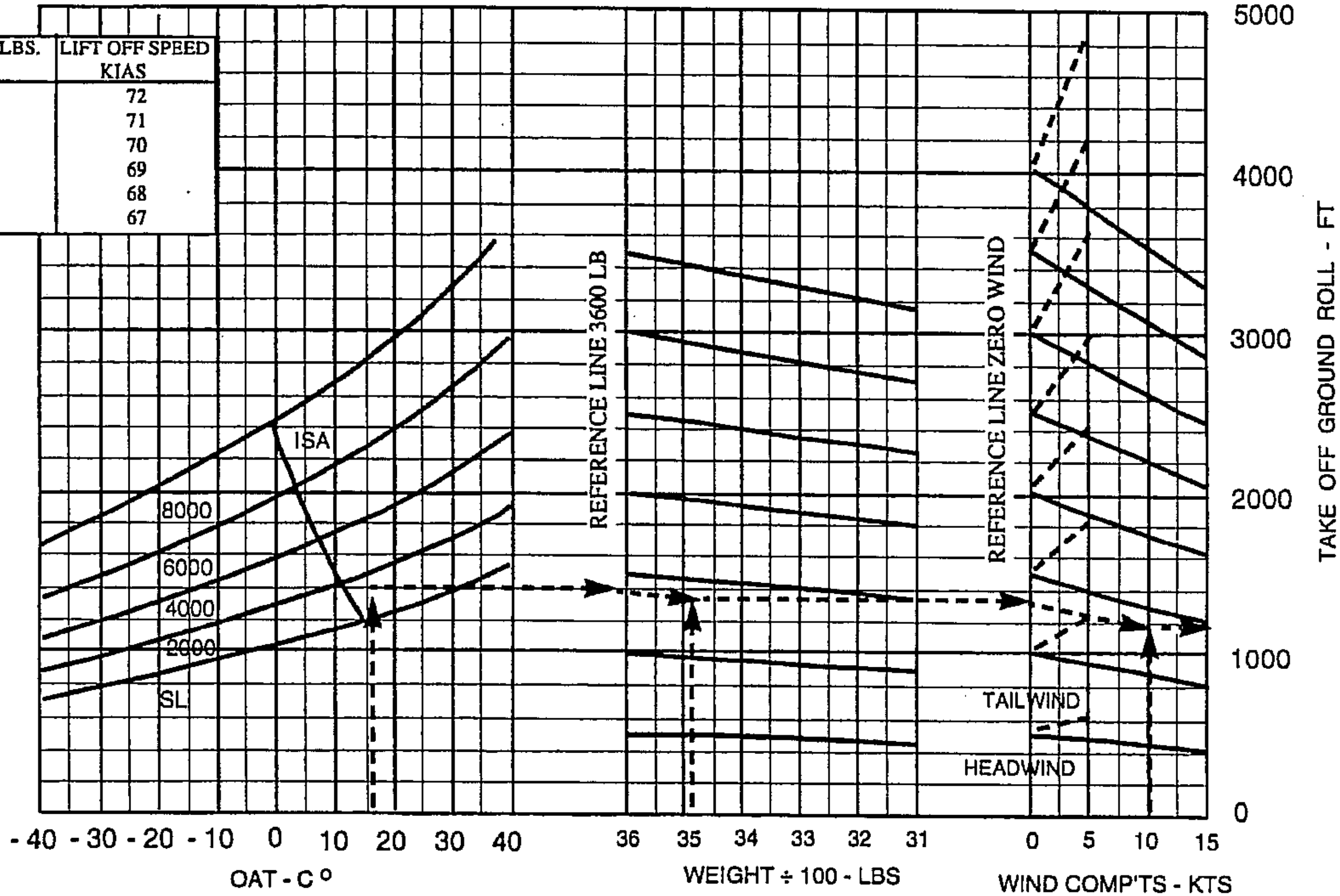
MAXIMUM EFFORT TAKEOFF GROUND ROLL

FLAPS 25°

ASSOCIATED CONDITIONS:
2700 RPM AND FULL THROTTLE BEFORE BRAKE RELEASE
FLAPS 25 DEGREES
PAVED, LEVEL, DRY RUNWAY

EXAMPLE:
PRESS ALTITUDE: 1200 FT
OAT: 16° C
GROSS WEIGHT: 3480 LBS
WIND: 10 KNOT HEADWIND
TAKE OFF GROUND ROLL 1186 FT.
LIFTOFF SPEED: 66.5 KIAS

WT. LBS.	LIFT OFF SPEED KIAS
3600	72
3500	71
3400	70
3300	69
3200	68
3100	67



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	2500 FT
		OAT	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 FULL THROTTLE	AIRPORT PRESSURE ALTITUDE	 1800 FT
MIXTURE	FULL RICH	OAT RATE OF CLIMB	ISA + 5 ° C 957 FPM
LANDING GEAR	UP	CRUISE ALTITUDE	 8500 FT
FLAPS	UP	OAT	ISA - 6 ° C
AIRSPEED	93 KIAS	TIME TO CLIMB (10-2) FUEL TO CLIMB (5-1) DISTANCE TO CLIMB (17-3)	8 MIN. 4 GAL. 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	—	—	—	—									

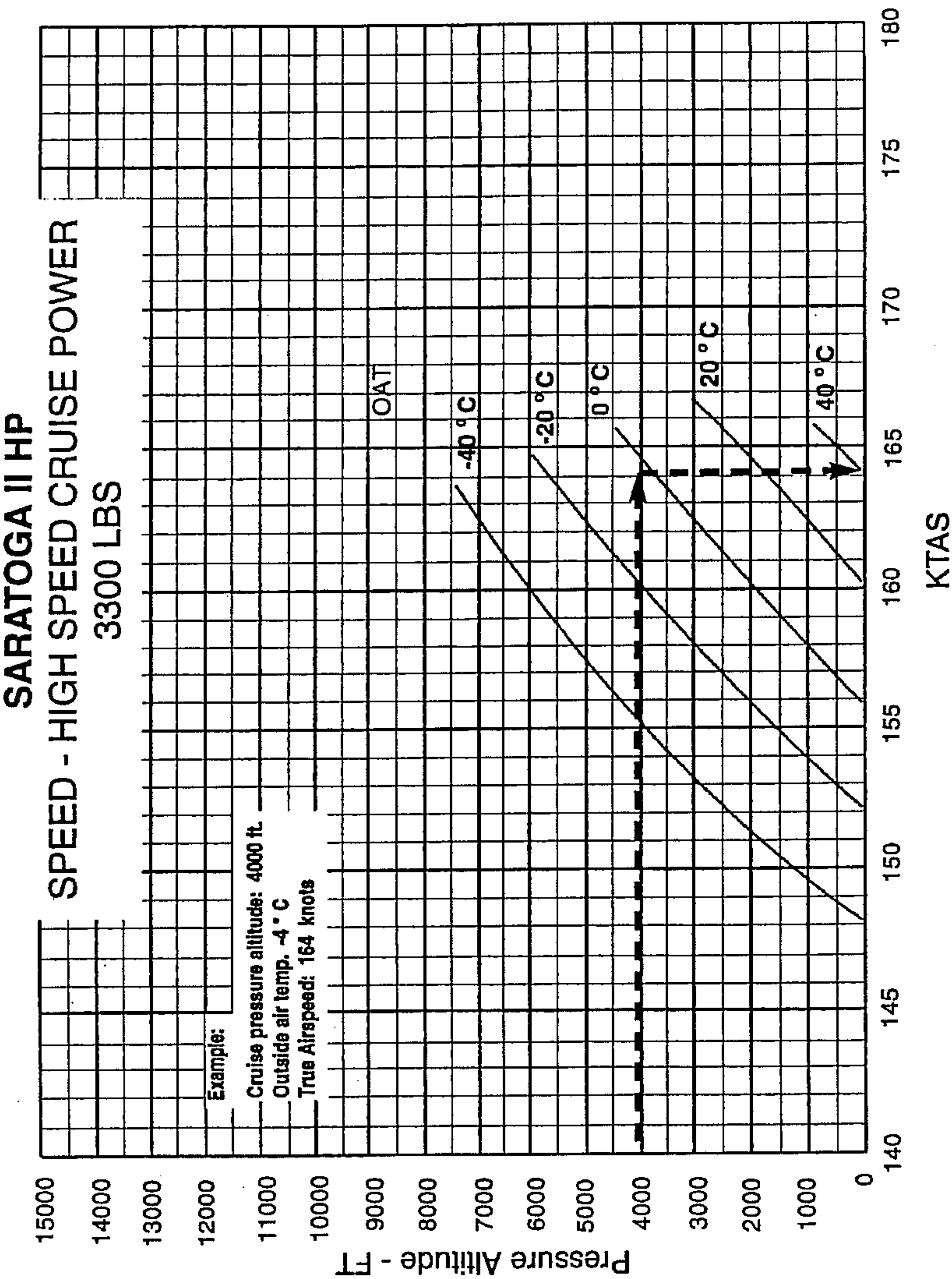
APPROX. FUEL FLOW / MIXTURE

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.

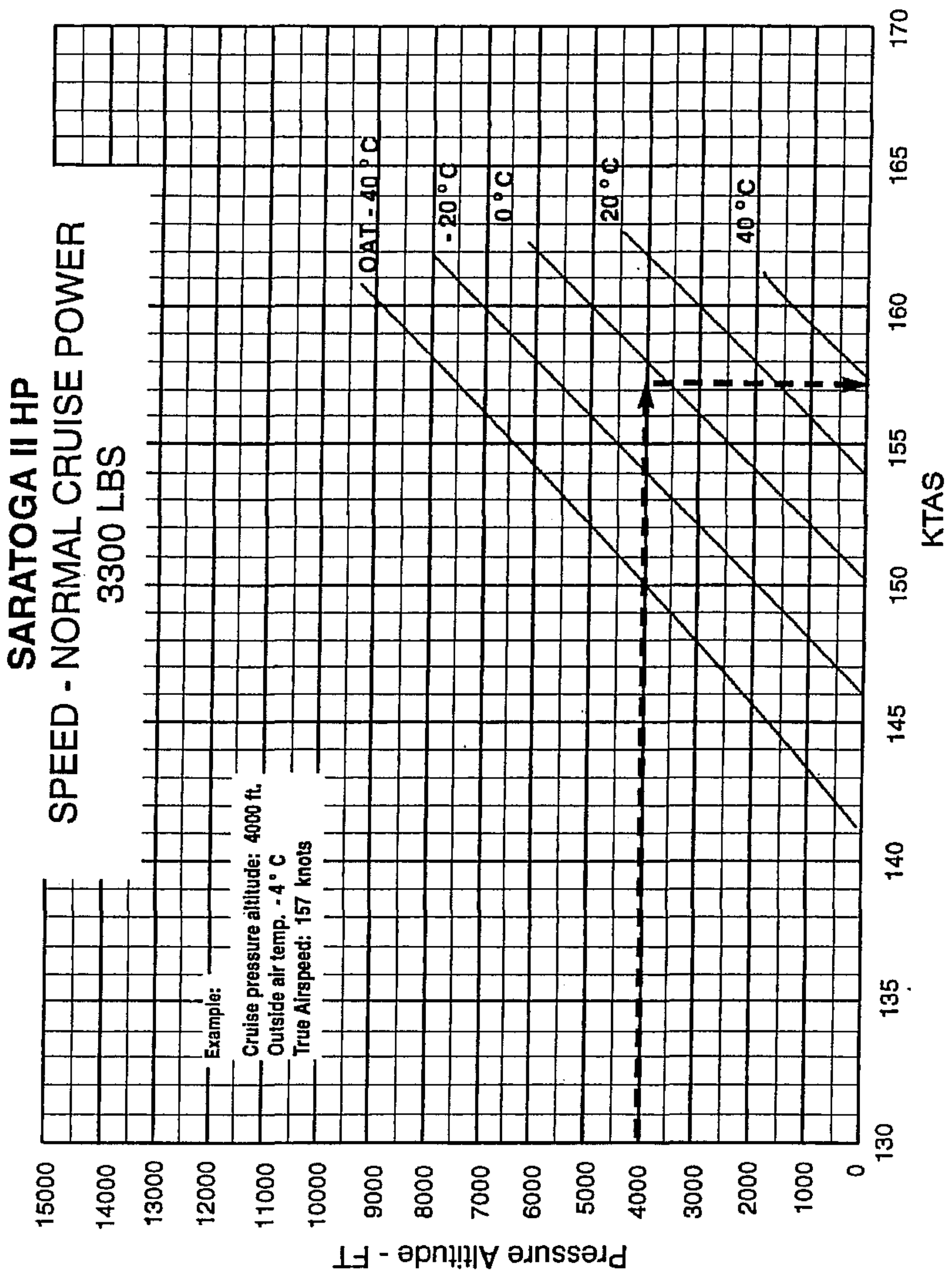
NOTE: Full throttle manifold pressure values may not be obtainable when atmospheric conditions are non-standard.

POWER SETTING TABLE
Figure 5-23

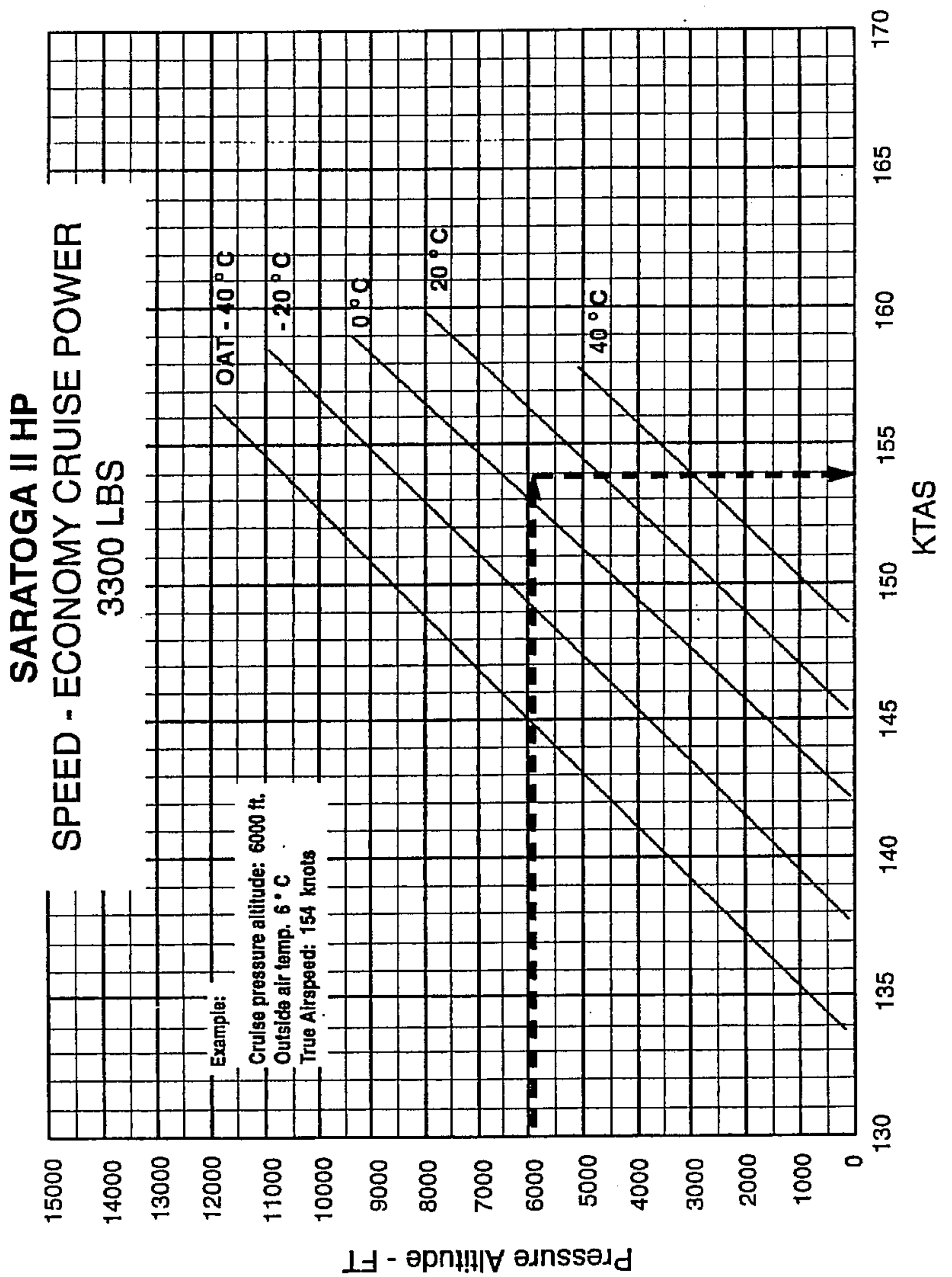


SPEED - HIGH SPEED CRUISE

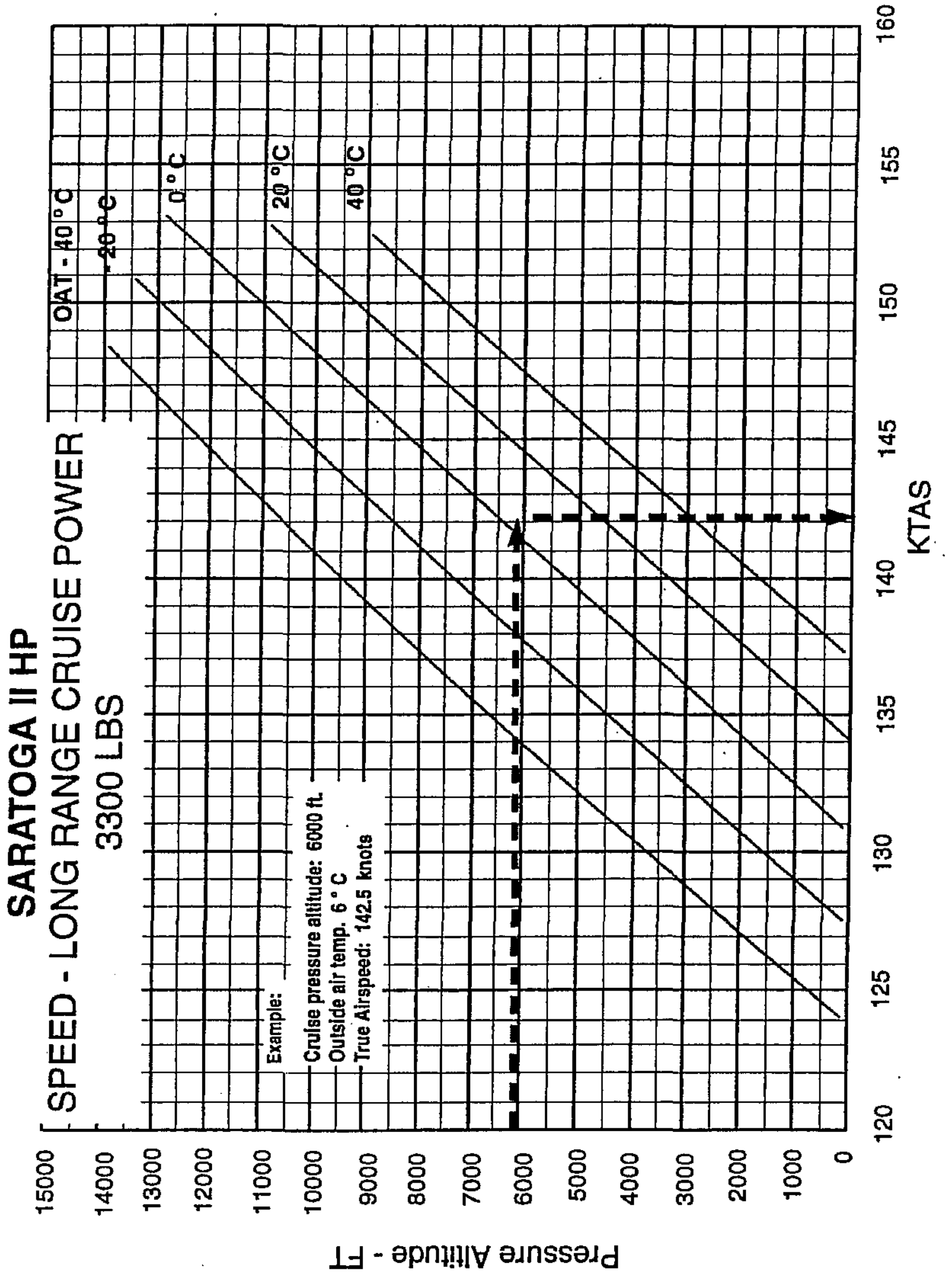
Figure 5-25



SPEED - NORMAL CRUISE POWER
Figure 5-27



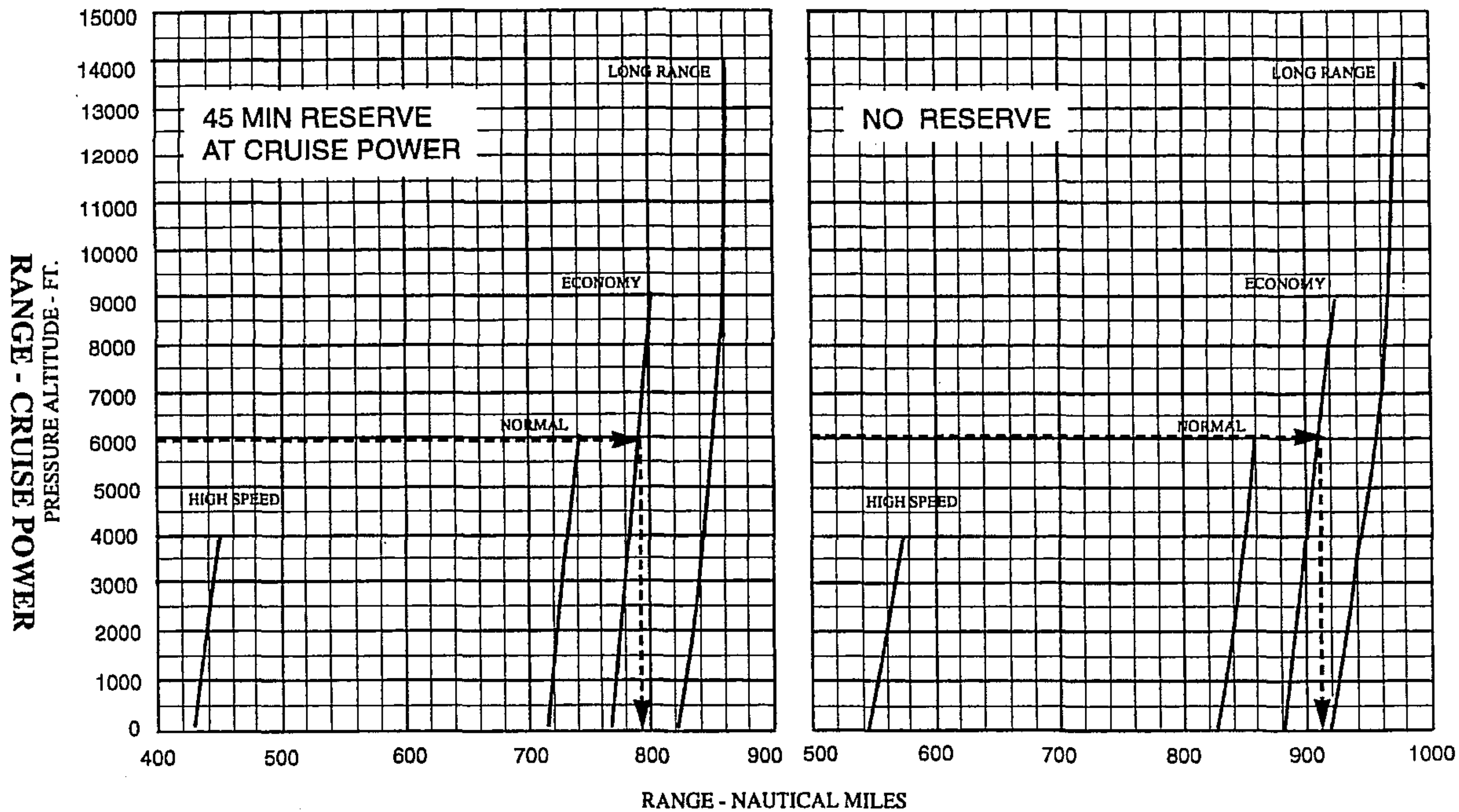
SPEED - ECONOMY CRUISE POWER
Figure 5-27a



SPEED - LONG RANGE CRUISE POWER
Figure 5-27b

SARATOGA II HP
RANGE

ASSOCIATED CONDITIONS:
Range includes warmup, taxi, takeoff climb and descent.
102 gal. uasble fuel, 3600 lb. gross wt. ISA, zero wind.



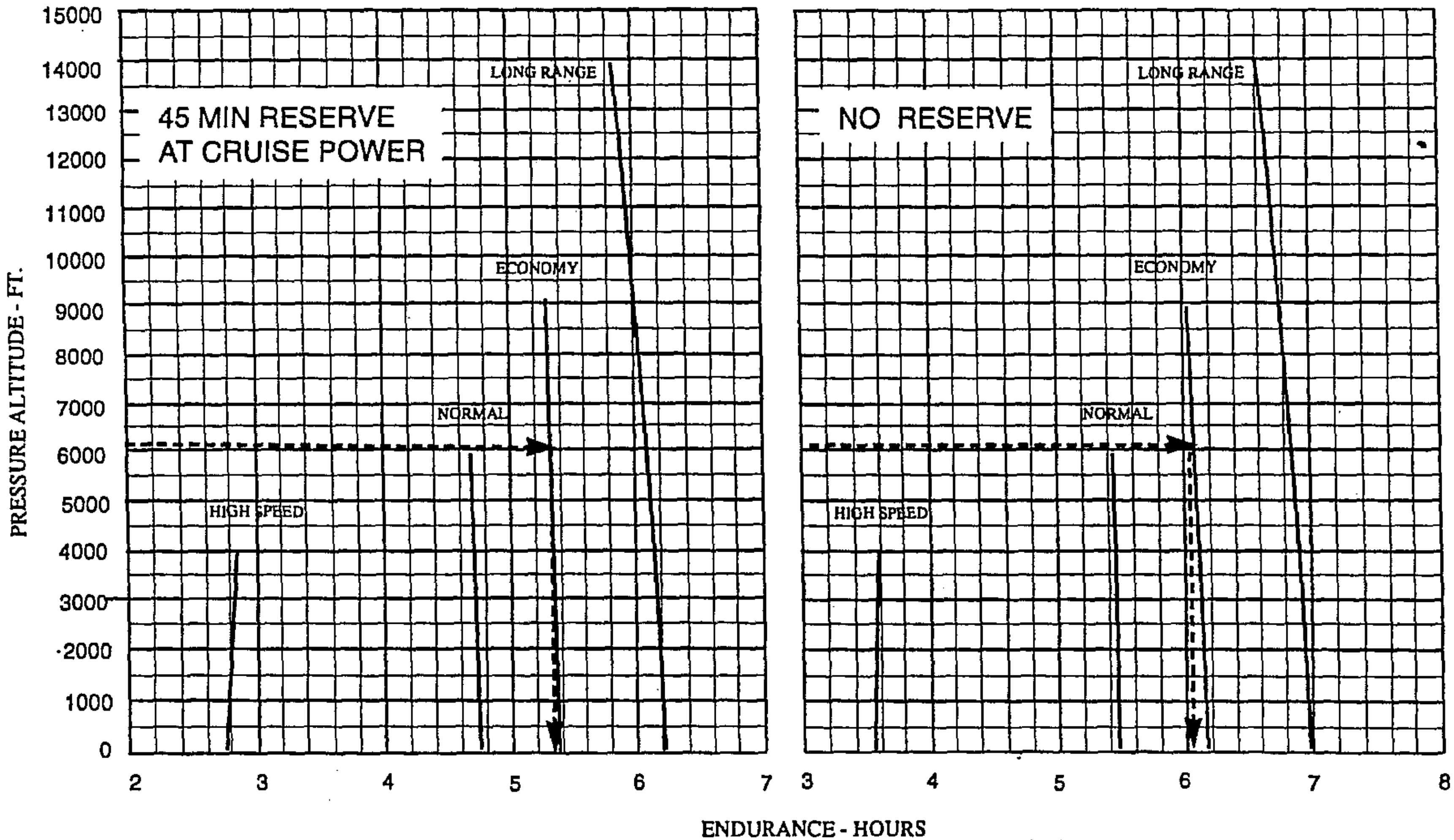
NOTES: 1. Add 7 N.M. range for each 10°C above ISA.
2. Subtract 12 N.M. range for each 10°C below ISA.

EXAMPLE:
Cruise pressure altitude: 6000 ft.
Cruise outside air temp: 6°C
*ISA = 3° C from Fig. 5-2
Power: ECONOMY
Range with reserve: 793 + 7 (6 - 3)/ 10 = 795 N.M.
Range with no reserve: 908 + 7 (6 - 3*)/ 10 = 910 N.M.

RANGE - CRUISE POWER
Figure 5-29

SARATOGA II HP
ENDURANCE

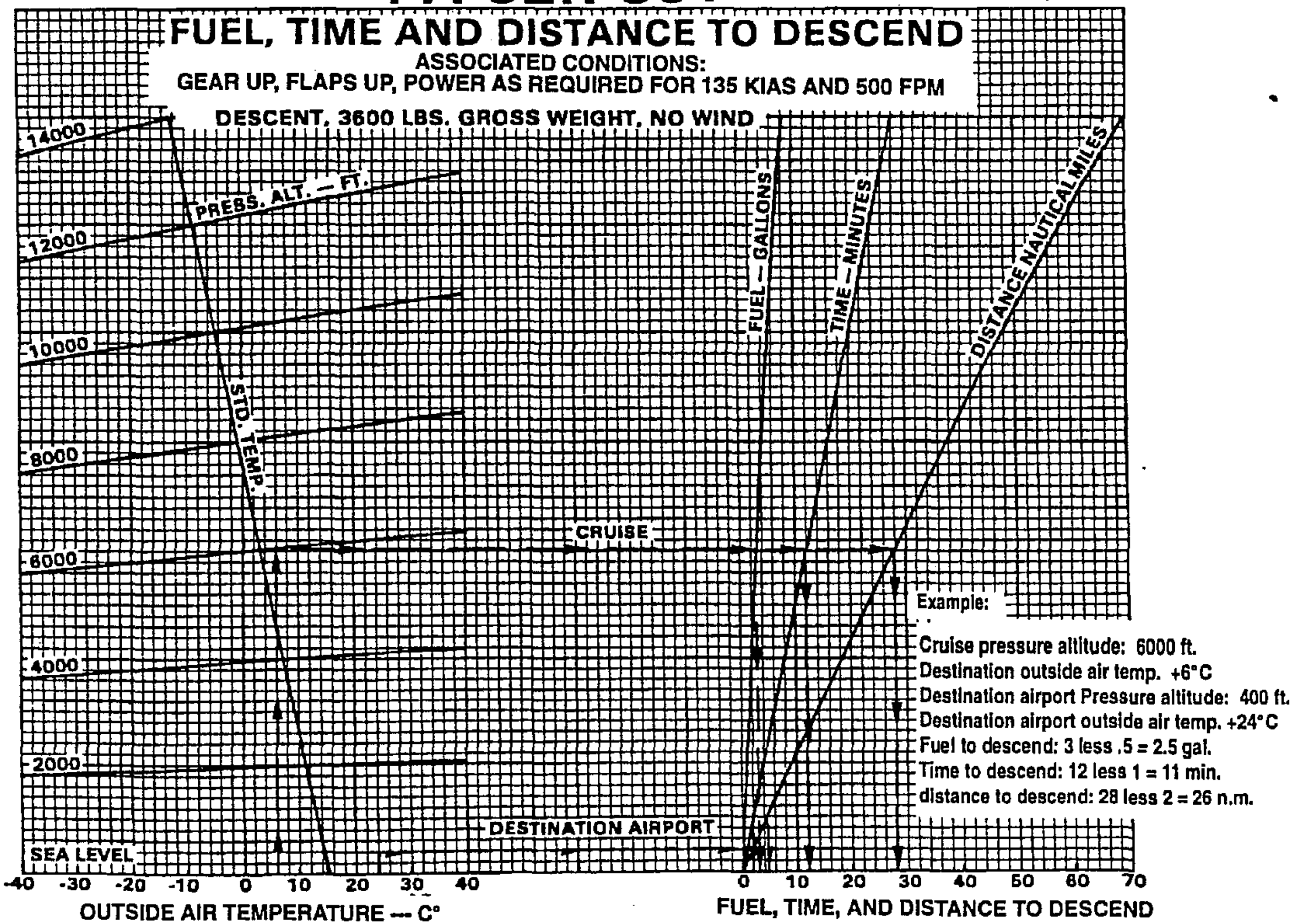
ASSOCIATED CONDITIONS:
Endurance includes climb and descent.102 gal. uasble fuel, 3600 lb. gross wt. ISA, zero wind.



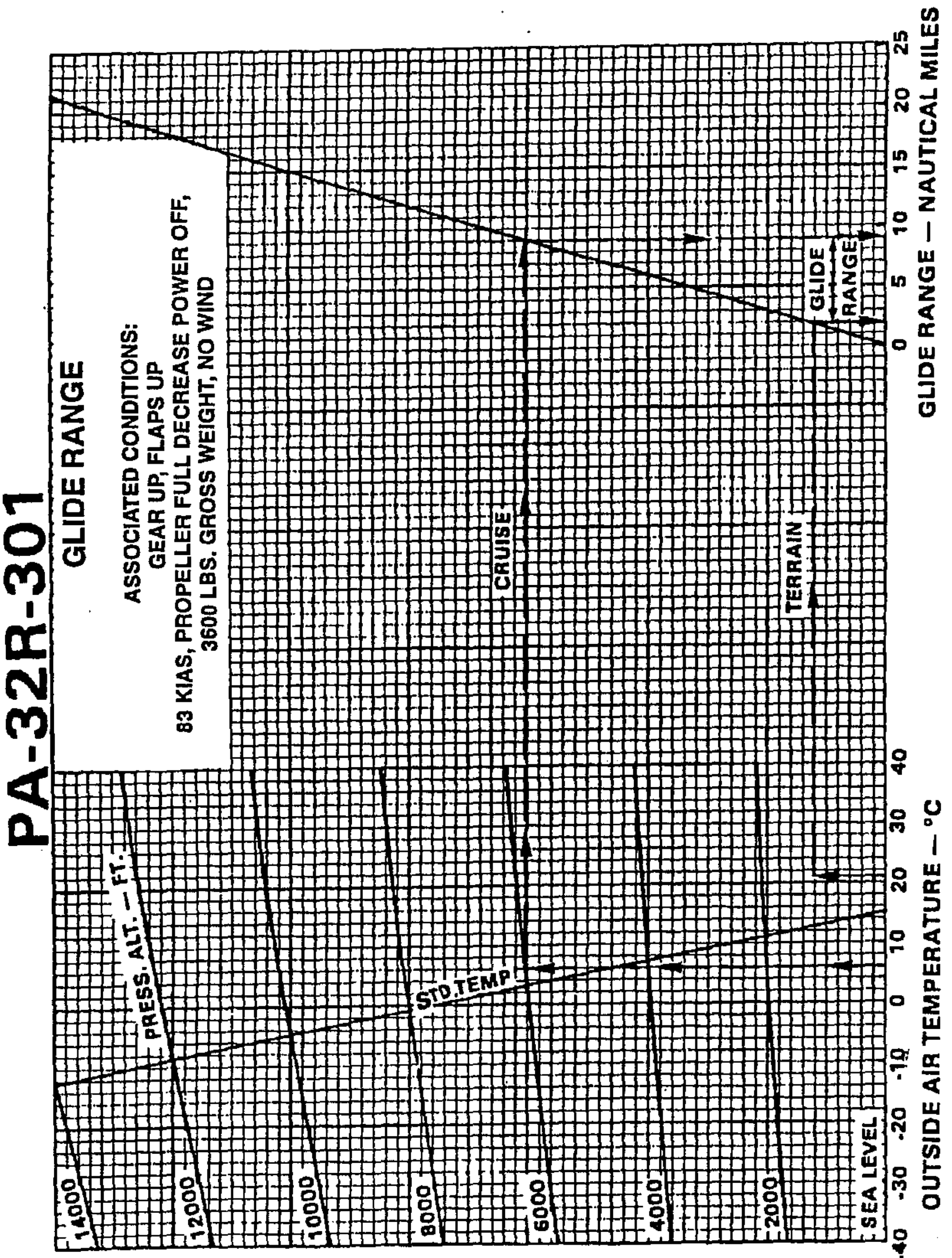
EXAMPLE:
Cruise pressure altitude: 6000 ft.
Power: ECONOMY
Endurance with reserve: 5.3 hrs..
Endurance with no reserve: 6.05 hrs.

ENDURANCE
Figure 5-31

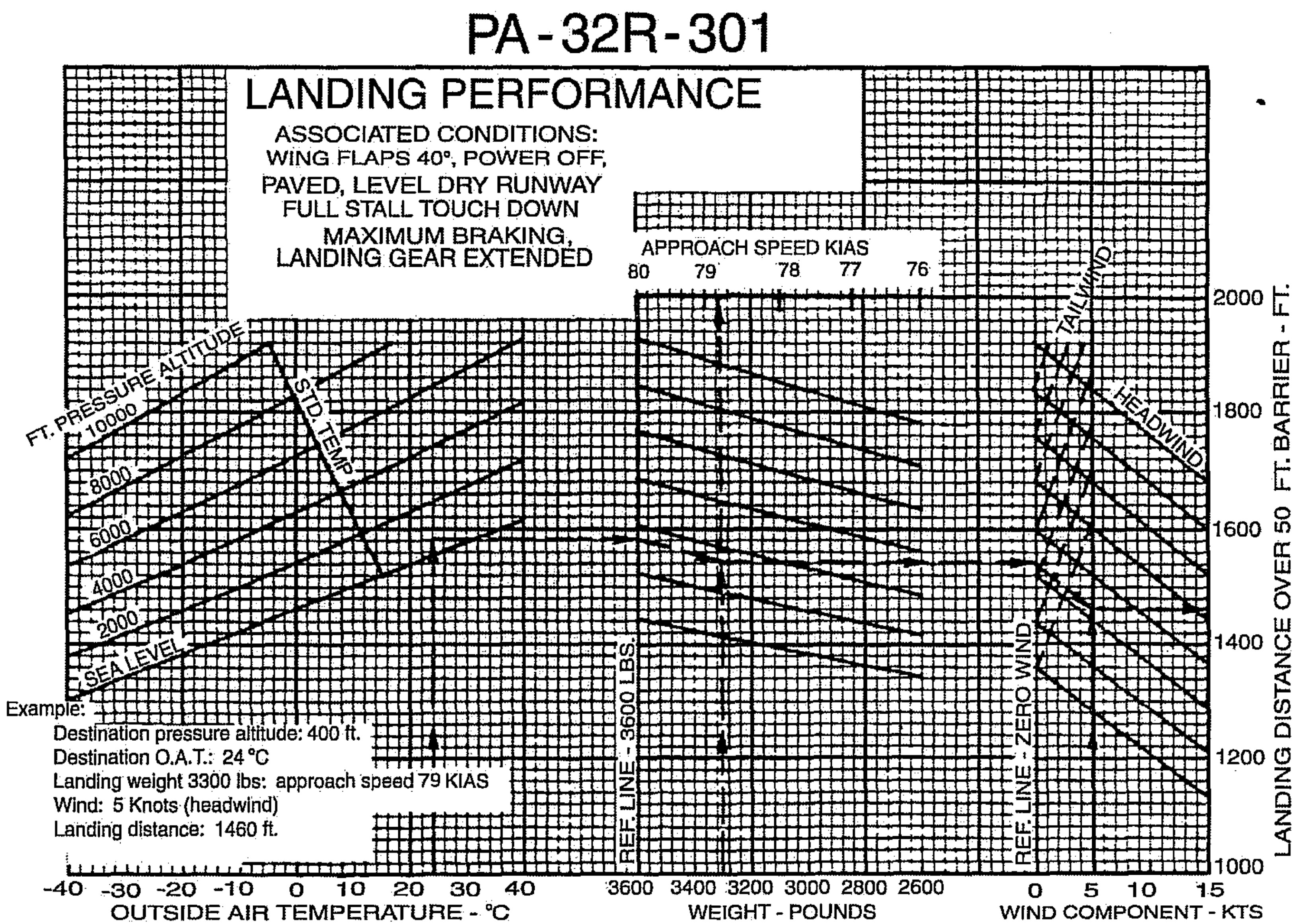
PA-32R-301



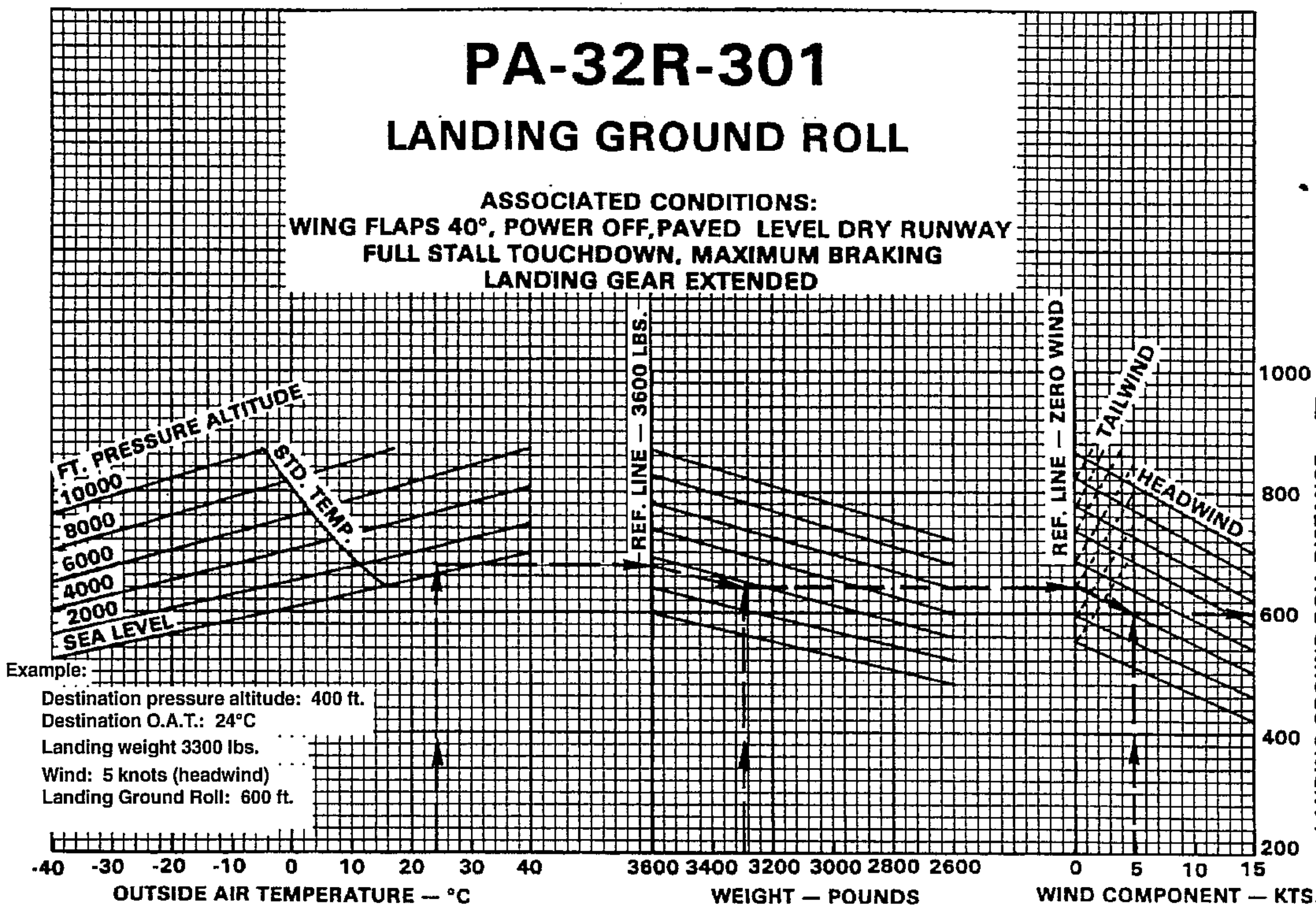
FUEL, TIME, AND DISTANCE TO DESCEND
Figure 5-33



GLIDE RANGE
Figure 5-35



LANDING PERFORMANCE
Figure 5-37



LANDING GROUND ROLL
Figure 5-38

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SECTION 6
WEIGHT & BALANCE

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WEIGHT AND BALANCE

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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

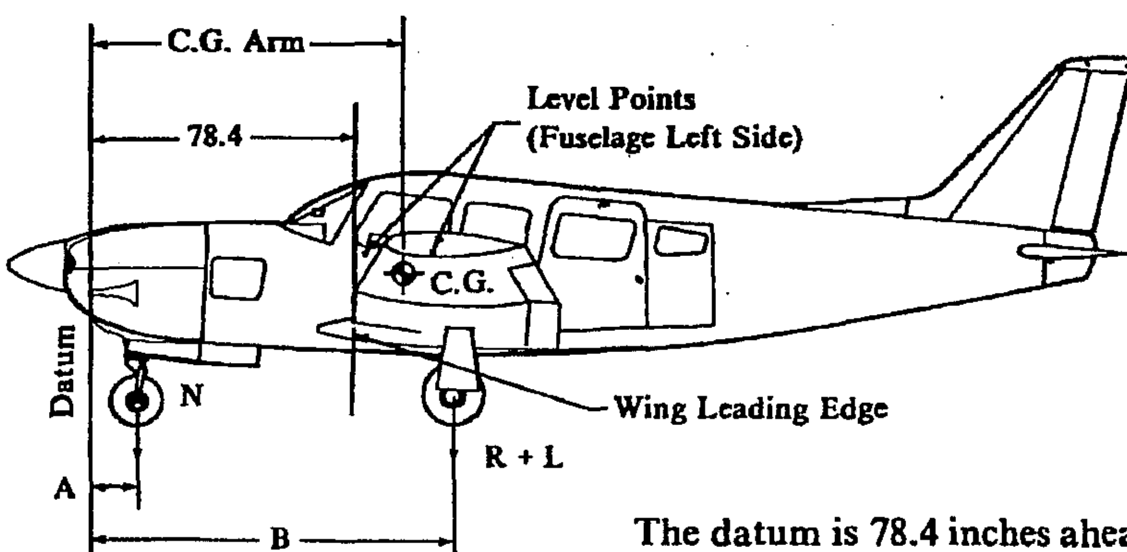
(1) With the airplane level and brakes released, record the weight shown on each scale. Deduct the tare, if any, from each reading.

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).



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

A = 14.2

B = 109.7

LEVELING DIAGRAM
Figure 6-3

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

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

$$\text{Where:} \quad T = N + R + L$$

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	**3246223**
Registration Number	**N3101Q**
Date	**07/08/04**

AIRPLANE BASIC EMPTY WEIGHT

Item		Weight (Lbs)	x	C.G Arm (Inches Aft of Datum)	=	Moment (In-Lbs)
Standard Empty Weight*	Actual	**2412.4**		**86.2662**		**208108.6**
	~~Computed~~					
Optional Equipment		**0.0**		**0.0**		**0.0**
Basic Empty Weight		**2412.4**		**86.2662**		**208108.6**

*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) - (**2412.4** lbs) = **1202.6** 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 3246223		Registration Number N3101Q			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
07/08/04		As licensed					**2412.4**	

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

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 forward. 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, 1 in middle, 1 in rear
Load rear baggage compartment 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, 1 in middle, 2 in rear
With five occupants, the aft passengers weight, fuel and baggage may be limited by envelope. Note placard if installed. Investigation is required to determine optimum loading for baggage.

OPTIONAL SIX SEAT CONFIGURATION

(d) 4 Occupants - 2 in front, 2 in middle
Load rear baggage compartment to capacity first. Baggage in nose may be limited by forward 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.

6.7 GENERAL LOADING RECOMMENDATIONS (CONT'D)

OPTIONAL SIX SEAT CONFIGURATION (Cont'd)

(e) 5 Occupants - 1 in front, 2 in middle, 2 in rear
Load forward baggage compartment to capacity first. Aft baggage and/or fuel load may be limited by aft envelope.

(f) 6 Occupants - 2 in front, 2 in middle, 2 in rear
With six occupants, the aft passengers weight, fuel and baggage may be limited by envelope. Investigation is required to determine optimum location for baggage. Note placard if installed.

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)		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)		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.)			

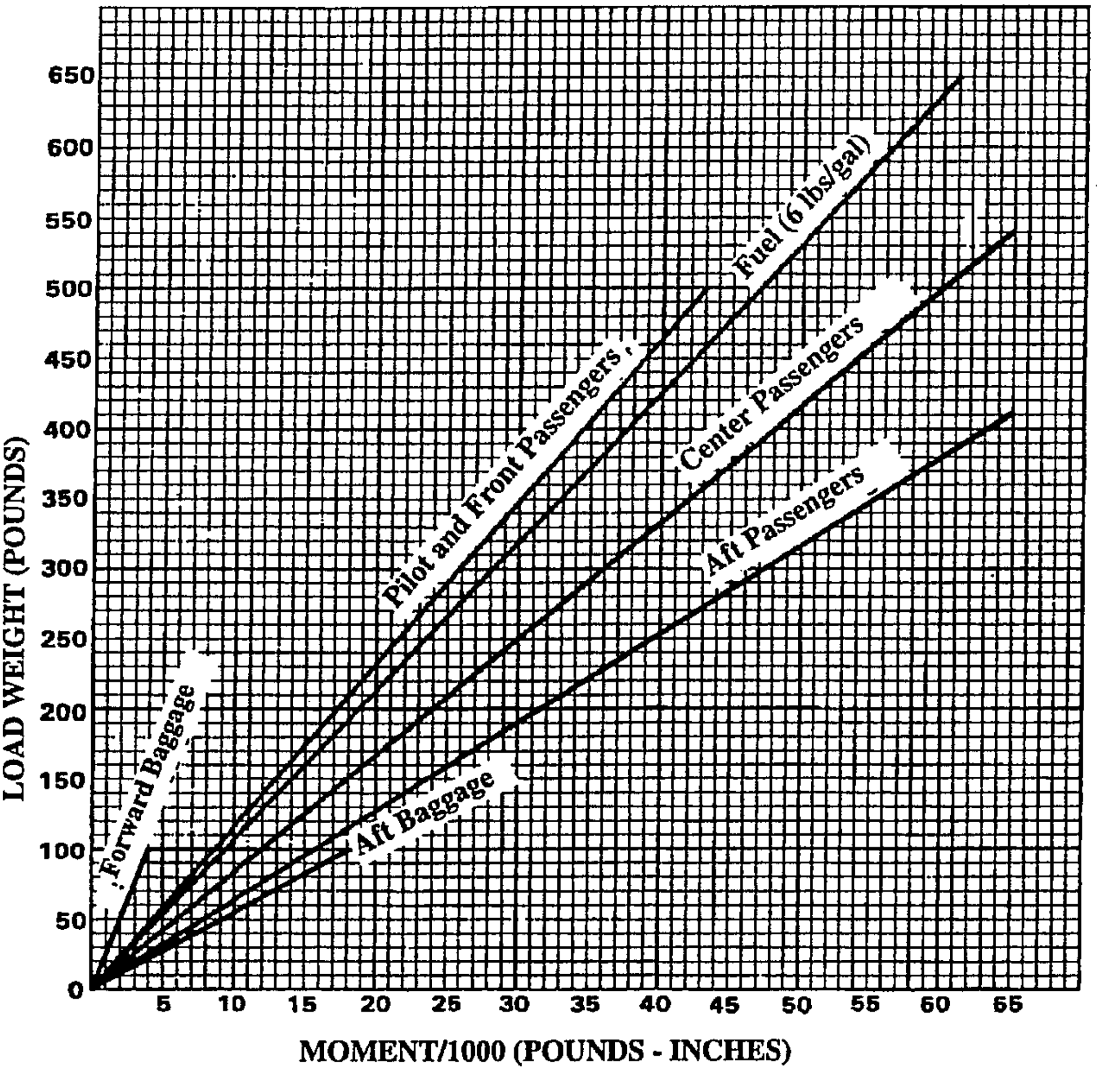
The center of gravity (C.G.) for the take-off weight of this loading problem is at inches aft of the datum line. Locate this point on the C.G. range and weight graph. Since this point falls within the weight - C.G. envelope, this loading meets the weight and balance requirements.

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

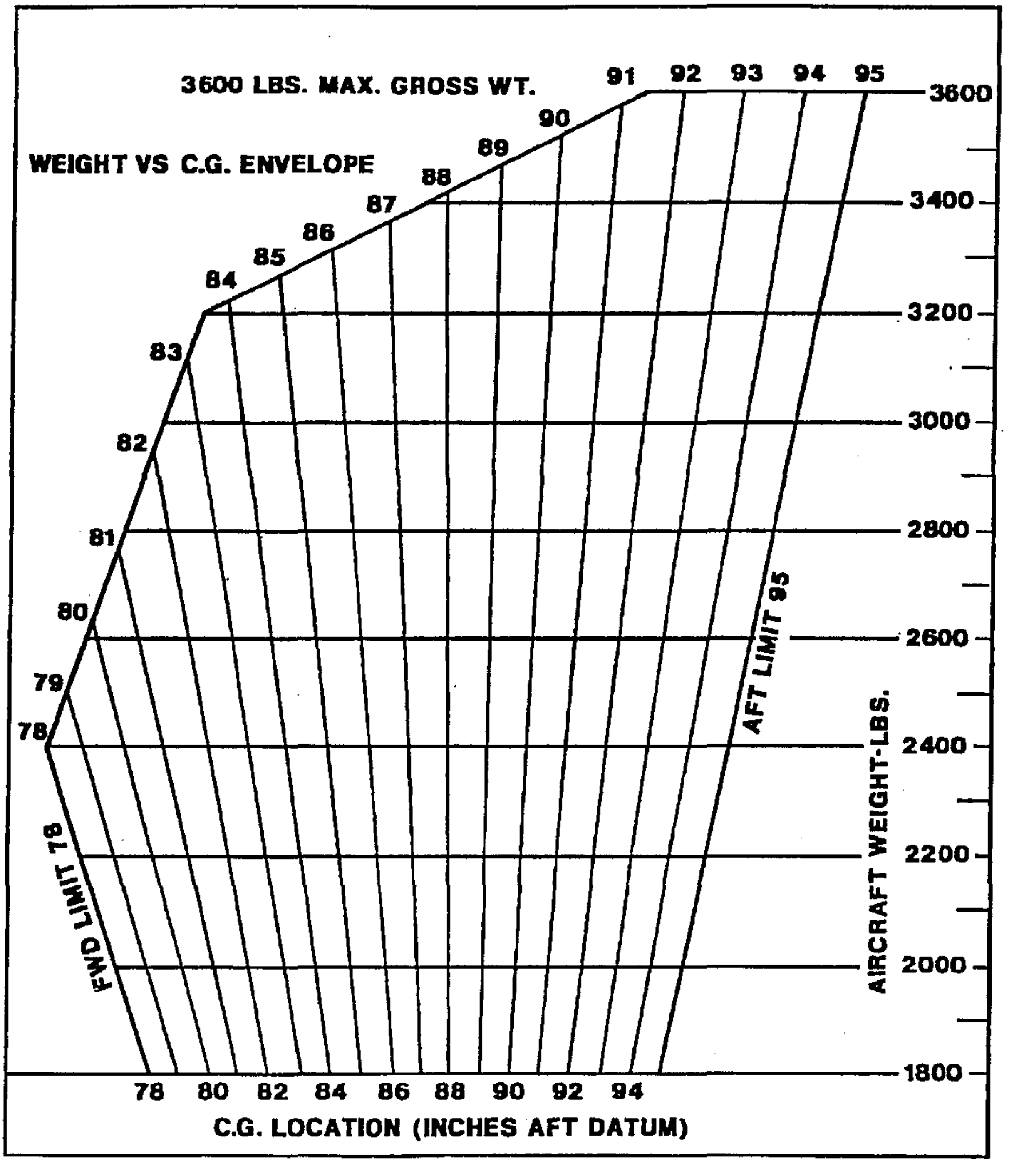
Locate the center of gravity of the landing weight on the C.G. range and weight graph. Since this point falls within the weight - C.G. envelope, the loading may be assumed acceptable for landing.

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

SECTION 7
DESC. & OPERATIONS

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SECTION 7

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

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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 65_2-415 airfoil section. The main spar is located at approximately 40% of the chord aft of the leading edge. The wings are attached to the fuselage by the insertion of the butt ends of the spar into a spar box carry-through, which is an integral part of the fuselage structure. The bolting of the spar ends into the spar box carry-through structure, which is located under the 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.

Fuel flow is determined via a fuel flow sensor and Horizon instrument microprocessors. Fuel flow information in gals/hour is then presented as an analog display on a Horizon dual indicator (EGT/Fuel Flow) and digitally displayed on the Horizon DDMP (Digital Display Monitoring Panel). Fuel totalizer/fuel used information is also derived from the fuel flow sensor and Horizon microprocessors and presented in digital format on the Horizon DDMP.

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.

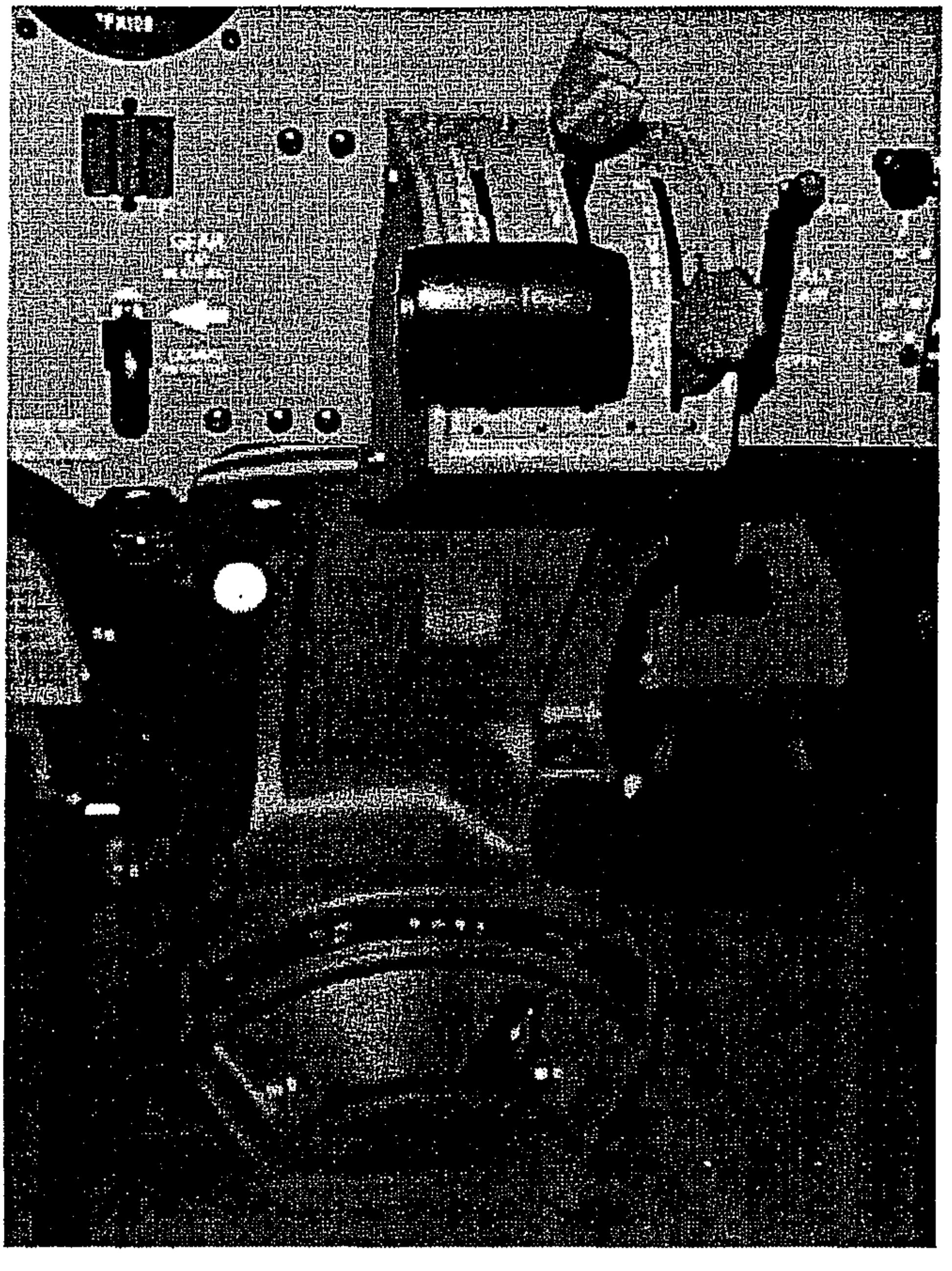
The throttle lever is used to adjust the manifold pressure. It incorporates a gear up warning horn switch which is activated during the last portion of travel of the throttle lever to the low power position. If the landing gear is not locked down, the horn will sound until the gear is down and locked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

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7.8 HORIZON ENGINE INSTRUMENT/ENGINE MONITORING SYSTEM

The Horizon Engine Instrument/Engine Monitoring System is a microprocessor based instrument with analog and digital format displays of engine related instruments. The Engine Instrument/Engine Monitoring System can be divided into two parts: 1) the Digital Display Monitoring Panel (DDMP) and 2) the single/dual analog instrument displays (see Figure 1).

The DDMP is a microprocessor which monitors/records engine parameter exceedences and provides the interface between a GPS receiver and engine parameter sensors for digital display of the analog instruments, engine % power, electrical system status, outside/cabin air temperature, and fuel management. The DDMP displays its information on 6 eight character displays which are controlled via an Up/Dwn button, a Select button, and a rotary mode selection knob.

NOTE

When both analog and digital presentations exist for an aircraft instrument, analog formats are the primary source of information and digital displays are considered as advisory only.

The rotary mode selection knob allows the user to cycle through the 6 top level operations:

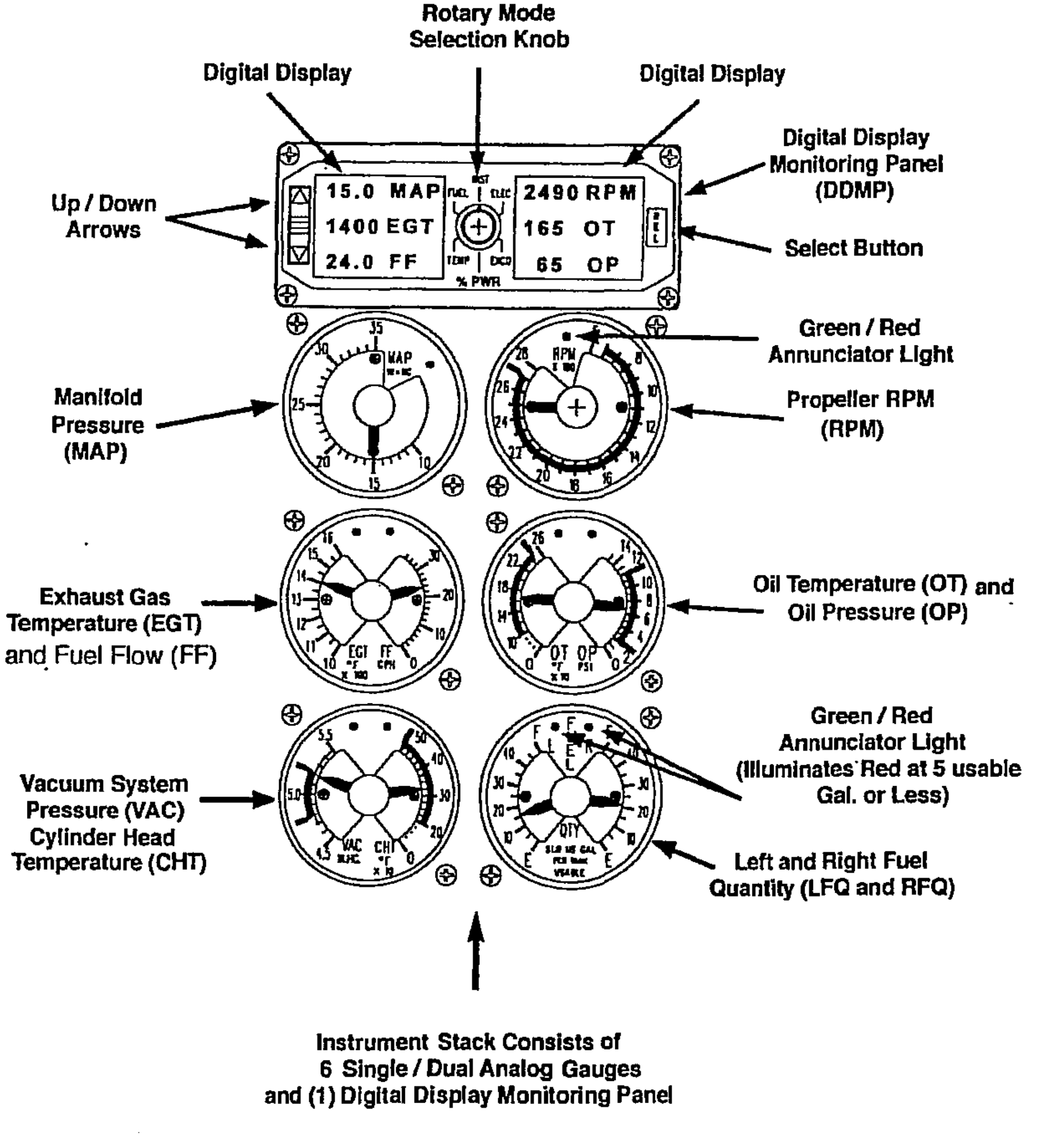
1. FUEL - Fuel management
2. INST - Engine instrument display
3. ELEC - Electrical parameter display
4. EXCD - Exceedence record display
5. % PWR - Engine percent power display/determination
6. TEMP - Temperature display

7.8 HORIZON ENGINE INSTRUMENT/ENGINE MONITORING SYSTEM (CONT'D)

Below the DDMP are two vertical stacks of analog instruments which display (going top to bottom/left to right), manifold pressure (MAP), Propeller RPM (RPM), exhaust gas temperature (EGT), fuel flow (FF), oil temperature (OT), oil pressure (OP), vacuum system pressure (VAC), cylinder head temperature (CHT), and left/right fuel quantity (QTY). Each analog indicator displays its respective engine parameter and provides data for the DDMP. Analog instruments consist of a 2 inch nonreflective glass face/dial, controllable backlighting, and an annunciator light capable of showing steady green or steady/flashing red. A steady green annunciator indicates that analog parameter is being displayed digitally in the DDMP. A steady red annunciator is illuminated when an engine parameter limit has been exceeded. Any exceedence condition will override the current DDMP display and show the parameter in exceedence, the exceedence value, illuminate a red annunciator light, (see Figure 2) and activate an audible tone. The exceedence audible tone and DDMP exceedence display will continue until the select switch is depressed. The red annunciator light will remain illuminated until the parameter is no longer in exceedence. If multiple exceedences occur, the operator must acknowledge each exceedence individually to mute the audible alarm. A steady red annunciator light in the fuel quantity gauge indicates 5 gallons or less of usable fuel remaining. Brightness of the analog instrument backlighting and DDMP display can be adjusted using the cockpit panel lighting control. Analog instrument annunciator light intensity is controlled using the panel annunciator Day/Night dimmer switch.

The Engine Instrument/Engine Monitoring System performs the following self-test sequence during initial power up to verify proper system operation:

1. DDMP displays aircraft model and Horizon Revision number.
2. Current Date/Time will be displayed.
3. Illumination of Red annunciator lights.
4. Analog indicator pointers will go to full scale.
5. Red annunciator lights will extinguish.
6. Illumination of Green annunciator lights.
7. Audible horn will sound for approximately 1 second.
8. Analog indicator pointers will return to rest position.
9. Green annunciator lights will extinguish.
10. Illumination of all 8 characters in each DDMP display window.
11. Internal system checks.



HORIZON ENGINE INSTRUMENT/ENGINE MONITORING SYSTEM
Fig. 1

7.8 HORIZON ENGINE INSTRUMENT/ENGINE MONITORING SYSTEM (CONT'D)

During normal operations, all indicators and their associated sensors will have continuous system health monitoring. In the event an indicator or sensor error is detected during the self-test sequence or during normal operations, an audible horn will sound for 3 seconds, a DDMP instrument fail message will be shown (see Fig. 3), and a flashing red annunciator light will illuminate indicating the following:

1. 2 flashes/second - instrument failure.
2. 4 flashes/second - sensor failure.

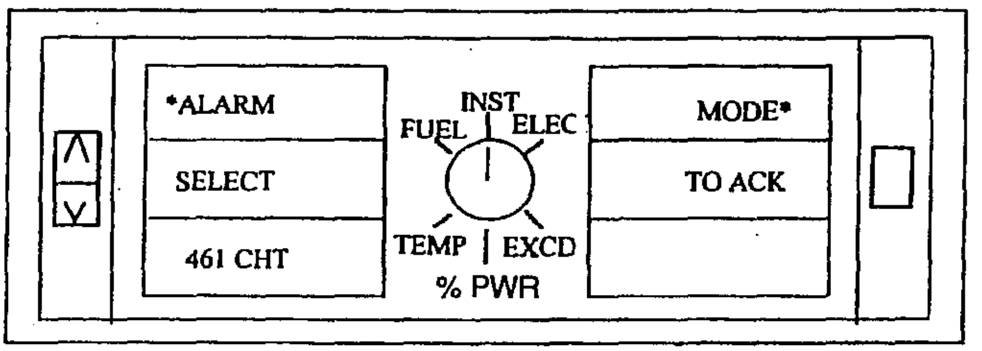


Figure 2

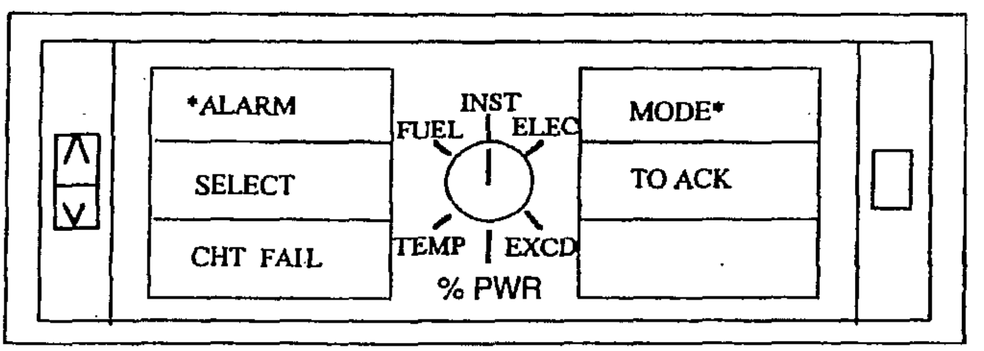


Figure 3

TOP LEVEL OPERATIONS:

FUEL MANAGEMENT (FUEL)

The fuel management mode provides fuel management functions based on inputs from pilot fuel loading entries, fuel flow sensors, and the Global Positioning System (GPS). This information is intended to assist the pilot in fuel management but should be considered as advisory only. No allowances for deviations (weather, ATC delays, etc..) or fuel reserves are factored into fuel management calculations, therefore the pilot is the final authority for all fuel management decisions.

All fuel management functions are based on total usable fuel available, therefore it is very important to visually verify and input accurate fuel loadings.

NOTE:
Usable fuel load entries are the combined total of all fuel tanks and not a per tank value.

Once an accurate fuel loading has been determined, fuel loading entry into the DDMP is initiated by placing the rotary selection knob on FUEL. Press the Select button until the Fuel Loading window is displayed (See Figure 4). The 3 options of 1) full fuel loading, 2) partial fuel loading, or 3) cancel to terminate the fuel loading procedure can be chosen.

To enter a fuel load, use the Up/Down arrows to position the cursor next to "FULL" or "PARTIAL" and press Select. "FULL" defaults to 102 gallons (maximum usable fuel) and allows the pilot to decrease the fuel loading to lower fuel loading values if desired. "PARTIAL" defaults to 0 gallons and allows the pilot to increase the fuel loading value to any value up to maximum usable fuel (102 gallons). Pressing Select again will bring up the fuel loading confirmation window. Choose yes or no using the Up/Down arrows then press Select to enter. If the fuel loading window has been selected in error, the CANCEL option can be chosen using the Up/Down arrows then the Select button to terminate the fuel loading sequence.

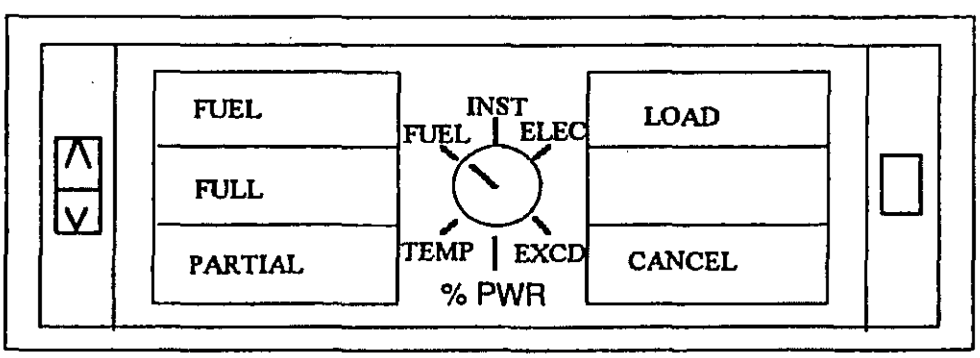


Figure 4

Once an accurate loading of usable fuel is entered in the DDMP, two additional fuel management displays (Figures 5 and 6) can be presented by pressing the Select button. More depressions of the Select button will simply cycle through the fuel load entree and two fuel management displays.

7.8 HORIZON ENGINE INSTRUMENT/ENGINE MONITORING SYSTEM (CONT'D)

FUEL MANAGEMENT DISPLAY #1

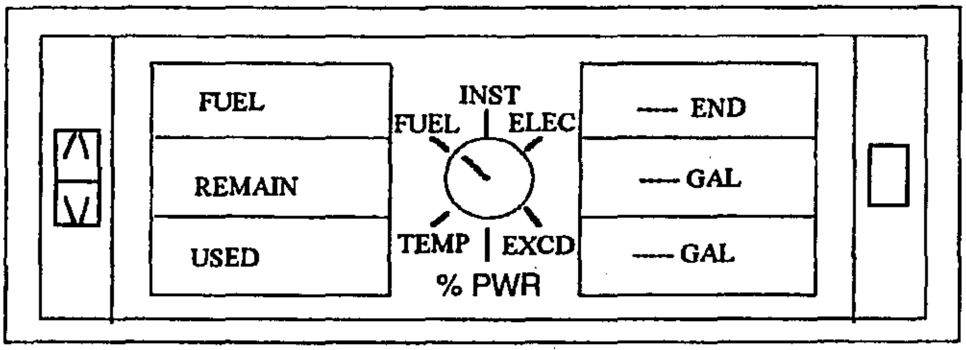


Figure 5

END - Endurance/flight time remaining. This calculation is based on current fuel flow rate and usable fuel remaining.
REMAIN - Fuel remaining in tank. This calculation is based on last usable fuel load entree and fuel used.
USED - Fuel used. This calculation is based on fuel used since last usable fuel load entree.

FUEL MANAGEMENT DISPLAY #2

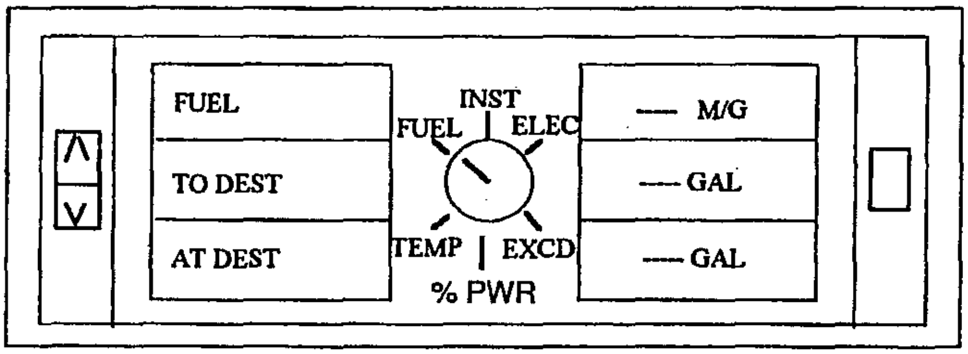


Figure 6

M/G - Nautical miles/gallon of fuel. This calculation is based on current fuel flow rate and GPS ground speed.
To DEST - fuel required to destination (current GPS waypoint). This calculation is based on current fuel flow rate, GPS distance to waypoint, and GPS ground speed.
At DEST - fuel remaining at destination (current GPS waypoint). This calculation is based on current usable fuel remaining, fuel flow rate, GPS distance to waypoint, and GPS ground speed.

ENGINE INSTRUMENT DISPLAY (INST)

The INST mode of operation enables the user to digitally display any of the engine related analog instruments in the 6 DDMP windows (See figure 7). The INST mode is selected by placing the rotary selection knob on INST. The Select button is then used to choose the parameter display location in one of the 6 DDMP windows. Once the DDMP display window is determined, the Up/Down button can be used to sequence through the appropriate analog instruments and choose the display parameter. This process would be repeated until all 6 DDMP windows are configured. The default DDMP instrument configuration after each Horizon system power up is MAP, RPM, EGT, Oil Temp., Fuel Flow, and Oil Pressure.

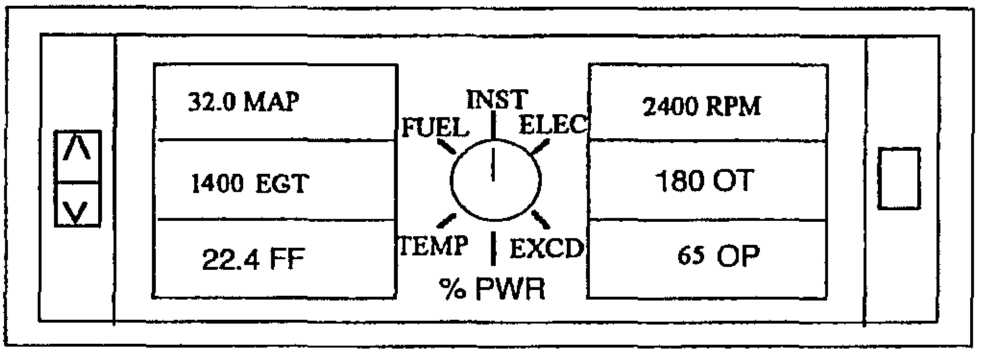


Figure 7

ELECTRICAL DISPLAY (ELEC)

The electrical mode displays electrical system information on alternator amperage output, main bus voltage, and battery charge/discharge rate (see Figure 8).

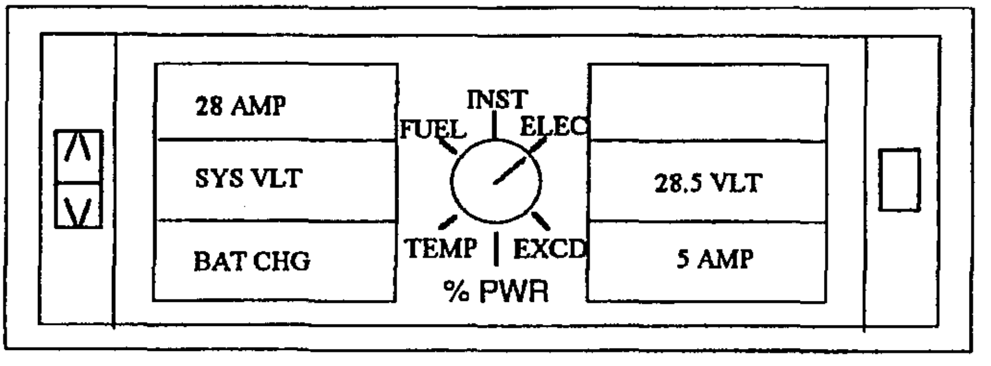


Figure 8

7.8 HORIZON ENGINE INSTRUMENT/ENGINE MONITORING SYSTEM (CONT'D)

EXCEEDENCE DISPLAY (EXCD)

The EXCD mode of operation enables the user to display any parameter limitation exceedence that has occurred during ground/flight operations. Parameter name, duration of exceedence (hrs:min:sec), exceedence peak value, exceedence sequence number, time of day, and date are recorded during each occurrence in chronological order for over 200 exceedence records. Any exceedences beyond the DDMP memory limit will start to overwrite old exceedence records. Display of exceedences is accomplished by placing the rotary knob on EXCD. The DDMP will display the most resent exceedence in the format shown in figure 9. Additional exceedence records can be viewed in chronological order using the up/down arrows. Exceedence records can be cleared from the DDMP display by pressing Select which brings up the menu in Figure 10. Using the Up/Down arrows you can move to the "Clear All" window and then press select which clears all exceedences from the DDMP display. Choosing Cancel will revert back to the exceedence display format in Figure 9.

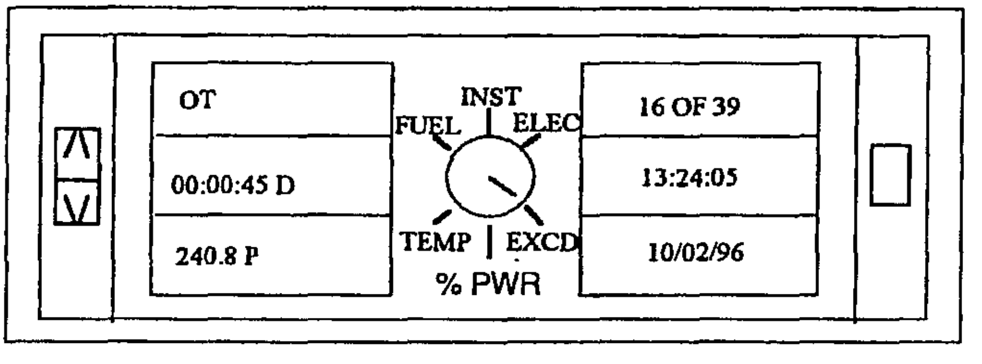


Figure 9

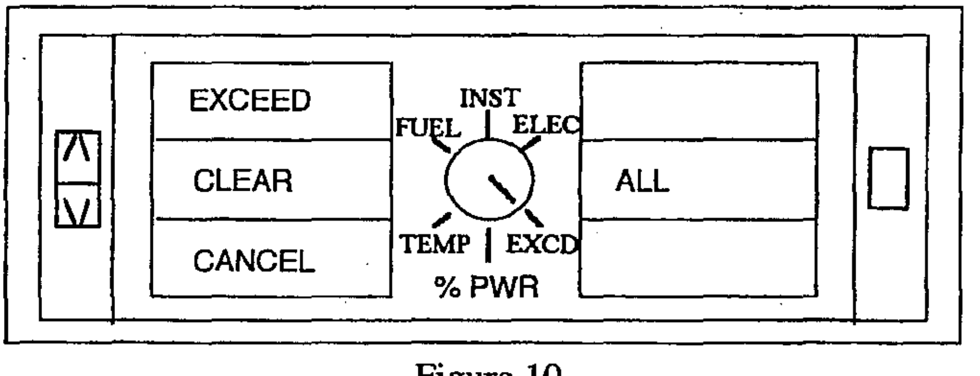


Figure 10

The föllowing abbreviations are used in the exceedence mode:

1.	LO VLT	Low System Voltage
2.	HI VLT	High System Voltage
3.	MAP	High Manifold Pressure
4.	RPM	High RPM
5.	CHT	High Cylinder Head Temperature
6.	OT	High Oil Temperature
7.	LOP	Low Oil Pressure
8.	HOP	High Oil Pressure
9.	LO VAC	Low Vacuum
10.	HI VAC	High Vacuum
11.	LFQ	Low Left Fuel Quantity
12.	RFQ	Low Right Fuel Quantity

PERCENT POWER DISPLAY (%PWR)

The percent power mode initially displays current cruise power output in 5% increments, manifold pressure, engine RPM, fuel flow, and EGT (see Figure 11). Any engine powers outside of the cruise range (50% to 75%) will produce - - - -'s in the DDMP % power window.

NOTE:

The Pilots Operating Handbook (Report: VB 1669) shall be the final authority if any inconsistency exists between DDMP % Power Display information and the Pilot's Operating Handbook performance charts.

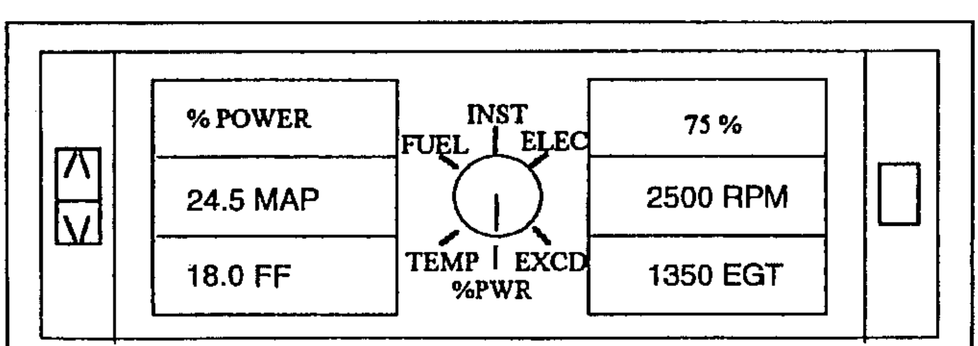


Figure 11

7.8 HORIZON ENGINE INSTRUMENT/ENGINE MONITORING SYSTEM (CONT'D)

A desired percent power setting can be obtained by pressing the select button to bring up the display shown in Figure 12. Desired percent power can be incrementally changed using the Up/Down arrows from 50% to 75% power in 5% increments. As %PWR is changed, RPM will be displayed along with approximate values of MAP and fuel flow using best power (50° F rich of peak EGT) leaning procedures. If a different engine RPM is desired, the Select button is pressed to navigate to the RPM window and the Up/Down arrows used to vary the RPM in 100 RPM increments. This variation in RPM changes expected values of MAP and fuel flow accordingly. Once the desired %PWR and RPM combination are chosen, subsequent pressing of the Select button will choose the Return window and then cycle back to the original percent power display (Figure 11).

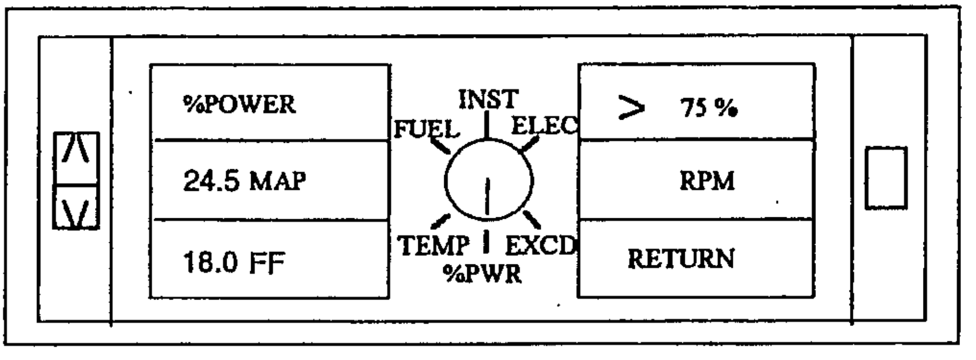


Figure 12

7.8 HORIZON ENGINE INSTRUMENT/ENGINE MONITORING SYSTEM (CONT'D)

TEMPERATURE DISPLAY (TEMP)

The temperature mode displays outside air temperature and cabin air temperature in both degrees F and degrees C. The Select button will cycle the temperature display between degrees F and degrees C. (See Figure 13).

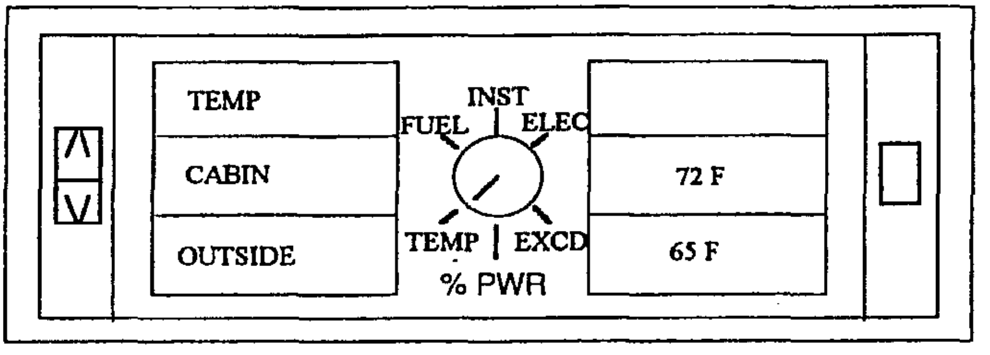


Figure 13

DDMP MAINTENANCE MODE

The maintenance mode provides maintenance operations, System Self Test, and time of day/date adjustment functions to the operator. This mode is entered by depressing the Up/Down arrow and the Select keys while in the ELEC Mode in the following sequence:

1. Up arrow
2. Down arrow
3. Up arrow - twice
4. Select Key

The DDMP will then display the format seen in Figure 14.

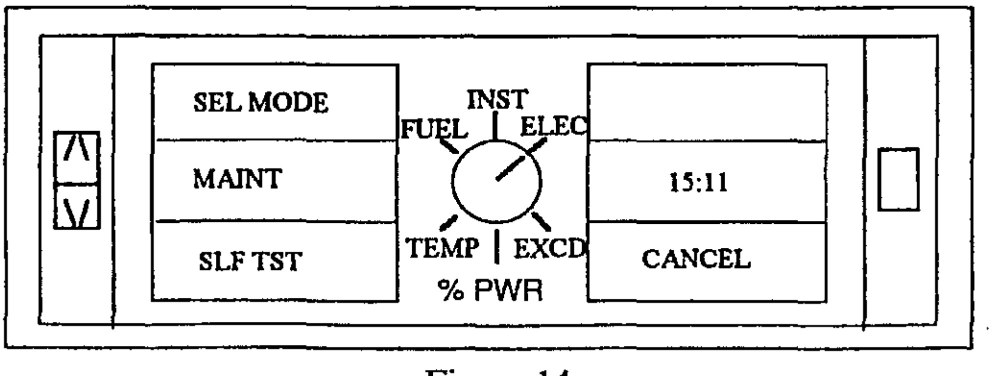


Figure 14

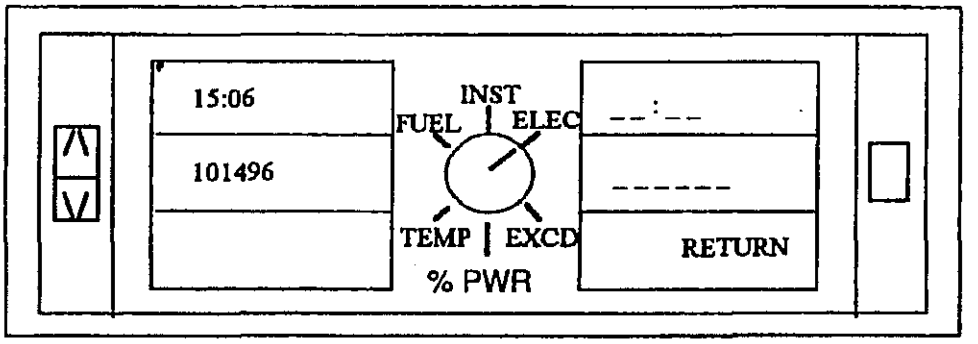


Figure 15

The MAINT menu provides access to factory calibrations of instruments and should not be entered/tampered with by unauthorized personnel. Access to this menu is limited to personnel with knowledge of the 4 character access code.

The SLF TST menu allows the operator to activate the system self test sequence that occurs during initial power up.

The Date and time menus allow initial input of date and time into system memory (see Figure 15). Maneuver to the desired window (time or date) using Up/Down buttons and press Select to open the menu. Press Select again to activate the left most pair of digits and increment the numbers to the desired setting using the Up/Down arrows. This procedure of pressing Select to activate the adjacent digit pairs and incrementing using Up/Down arrows is repeated until the new date or time is entered. Date and time will be retained in memory indefinitely until further adjustment is necessary. Termination of the date/time menu is initiated by choosing Return using the Up/Dwn arrows and then the Select button.

The Cancel menu returns the DDMP back to the ELEC display.

AUXILIARY COMMUNICATIONS

DDMP information can be accessed/stored on a personal computer via a RS-232 connection (located under pilot's side instrument panel) and standard terminal emulation software. DDMP data can be accessed using the terminal emulation software instructions and the following required settings:

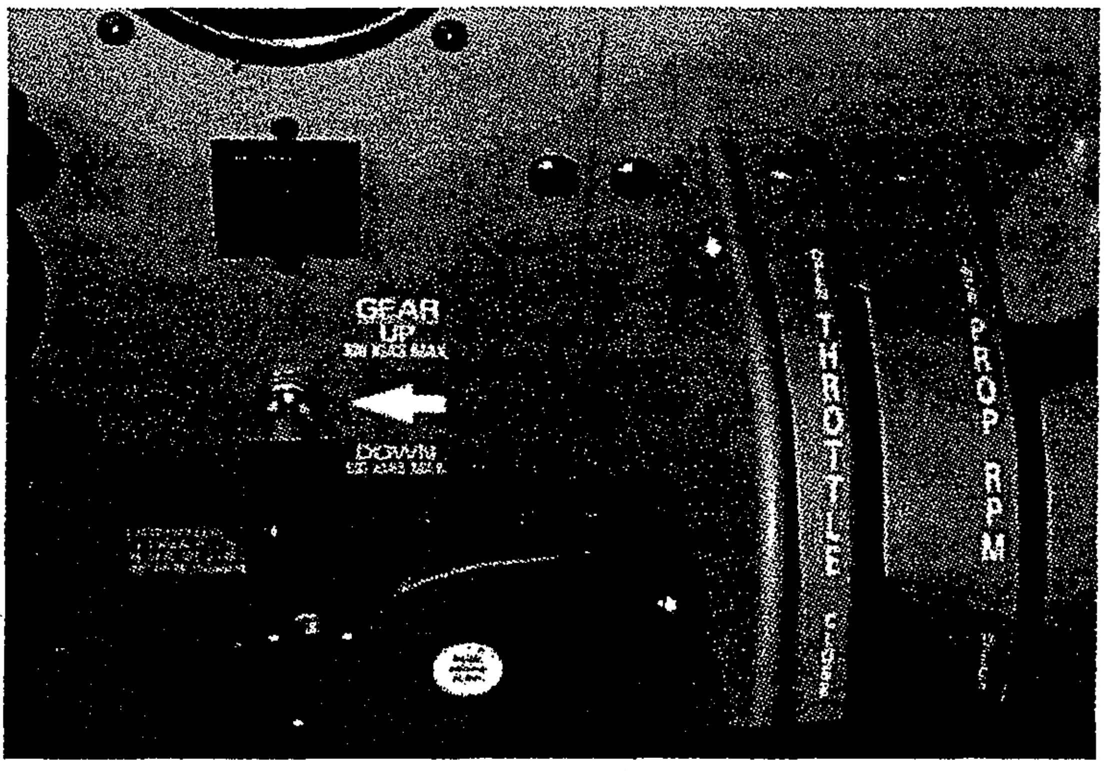
Baud Rate:	9600
Parity:	None
Data Bits	8
Stop Bits:	1

7.8 HORIZON ENGINE INSTRUMENT/ENGINE MONITORING SYSTEM (CONT'D)

Once a DDMP data connection has been made, the operator should select the "Data Dump" option. The DDMP will then send current instrument data to the connected device enabling a permanent record of the flight to be stored to disk. Data is sent approximately every 5 seconds in a comma delimited ASCII format for each of the following parameters:

Parameter	Units
Propeller RPM	RPM
Manifold Pressure	In Hg
Exhaust Gas Temperature	°F
Cylinder Head Temperature	°F
Fuel Flow	Gal/Hr
Oil Temperature	°F
Oil Pressure	PSI
Left Fuel Quantity	Gal
Right Fuel Quantity	Gal
Vacuum Pressure	In Hg
Cabin Air Temperature	°F
Outside Air Temperature	°F
Pressure Altitude	Ft
Alternator Current	Amps
Battery Charge Current	Amps
System Voltage	Volts

Additional auxiliary communication options may be found in the Horizon Instrument Maintenance Manual.



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 for hydraulic pressure to be generated in the UP side of the system and the gear 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.

Two micro-switches in the throttle quadrant activate 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.

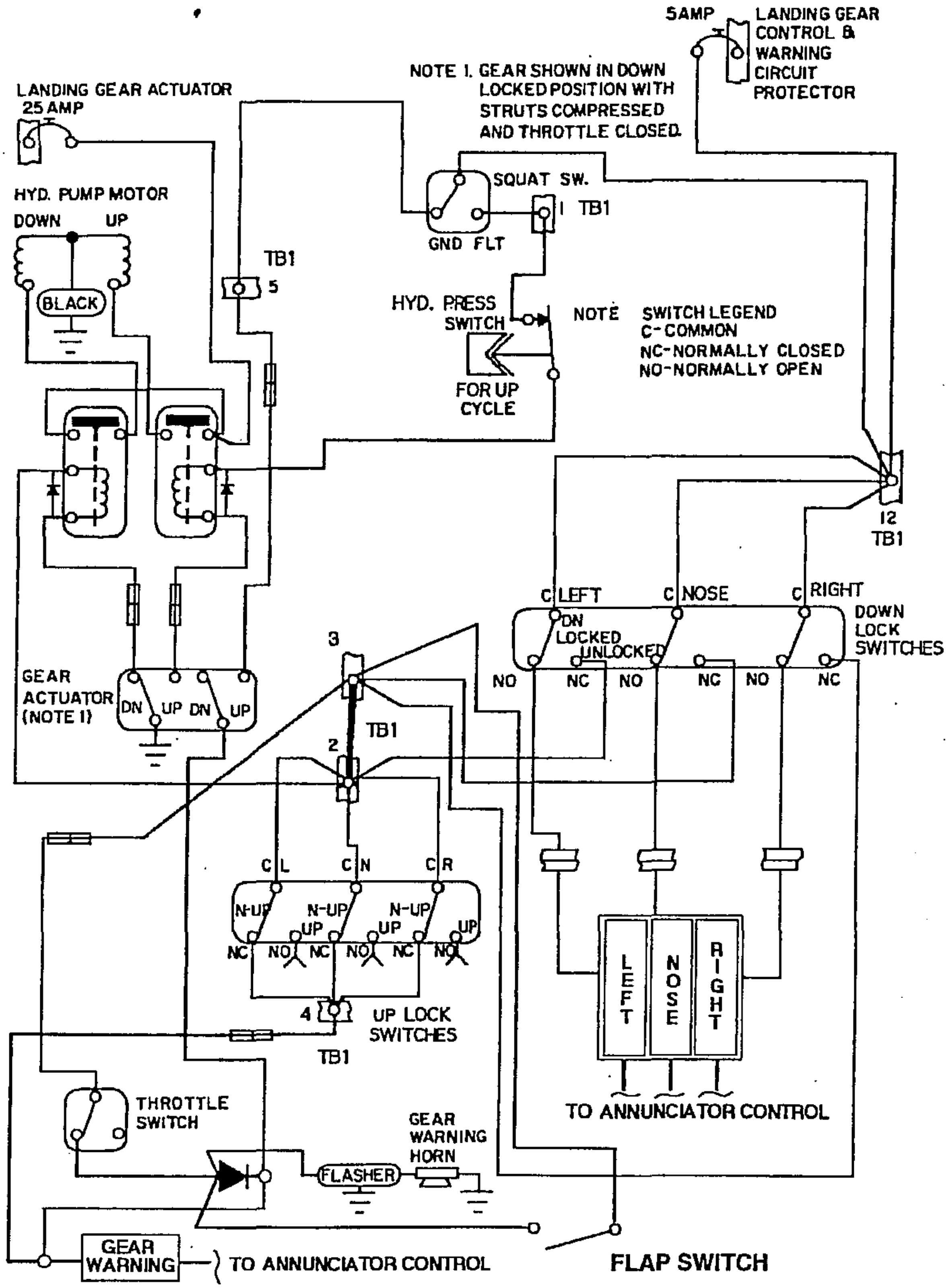
(3) Whenever the flaps are extended beyond the approach position (10°)and the landing gear is not down and locked.

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.

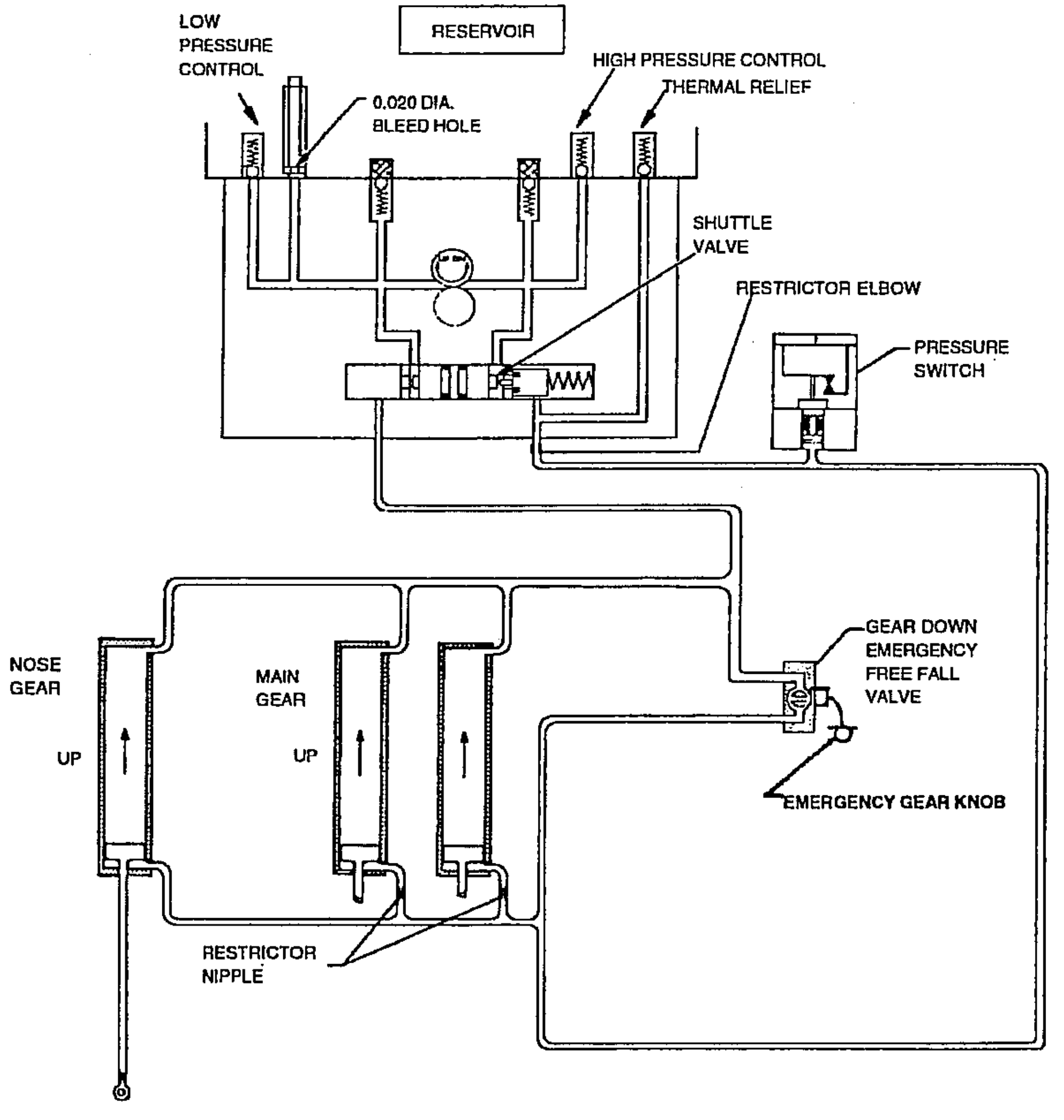
The oleo struts are of the air-oil type, with normal extension being 3.25 ± .25 inches for the nose gear and 4.5 ± .5 inches for the main gear under normal static load (empty weight of airplane plus full fuel and oil).

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

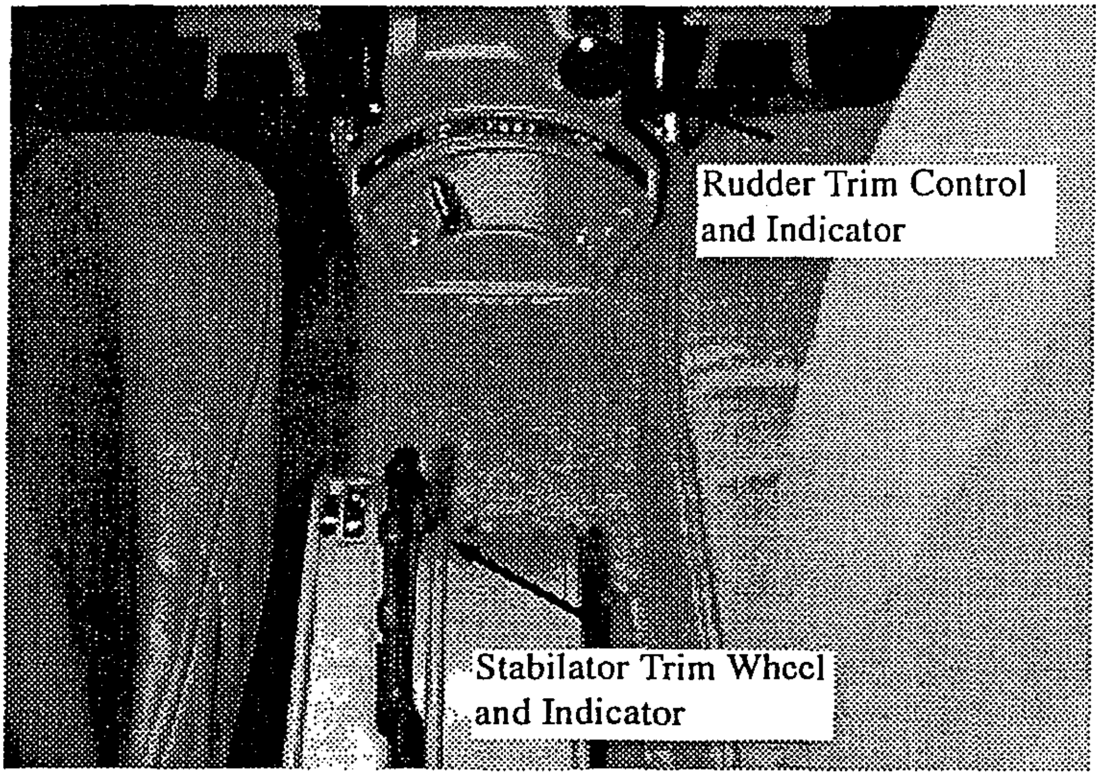
Dual flight controls are provided as standard equipment. A cable system provides actuation of the control surfaces when the flight controls are moved in their respective directions.

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.

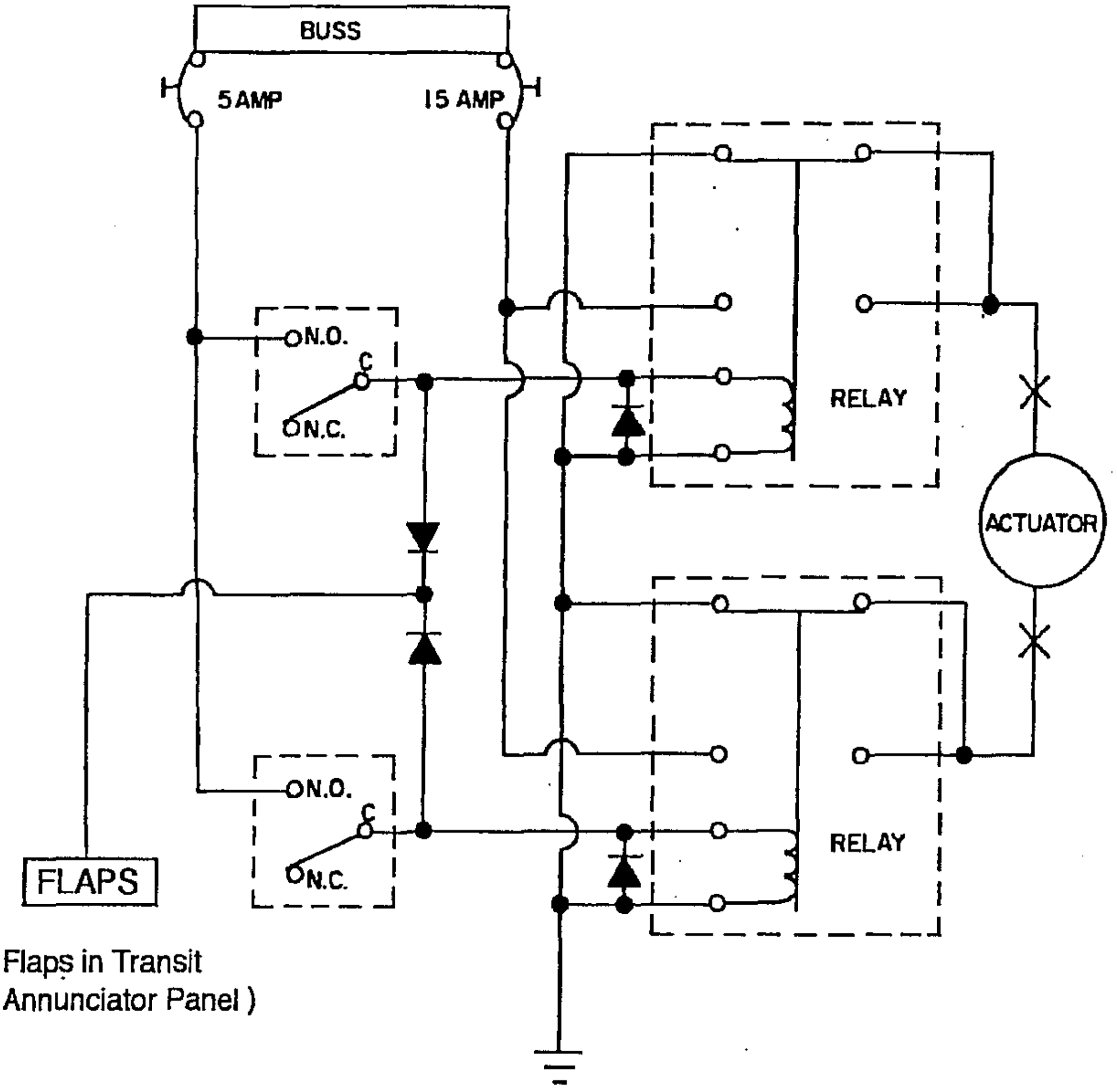


FLIGHT CONTROL CONSOLE
Figure 7-9

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 with screws and nut plates and can be removed for service or inspection. The outboard 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.

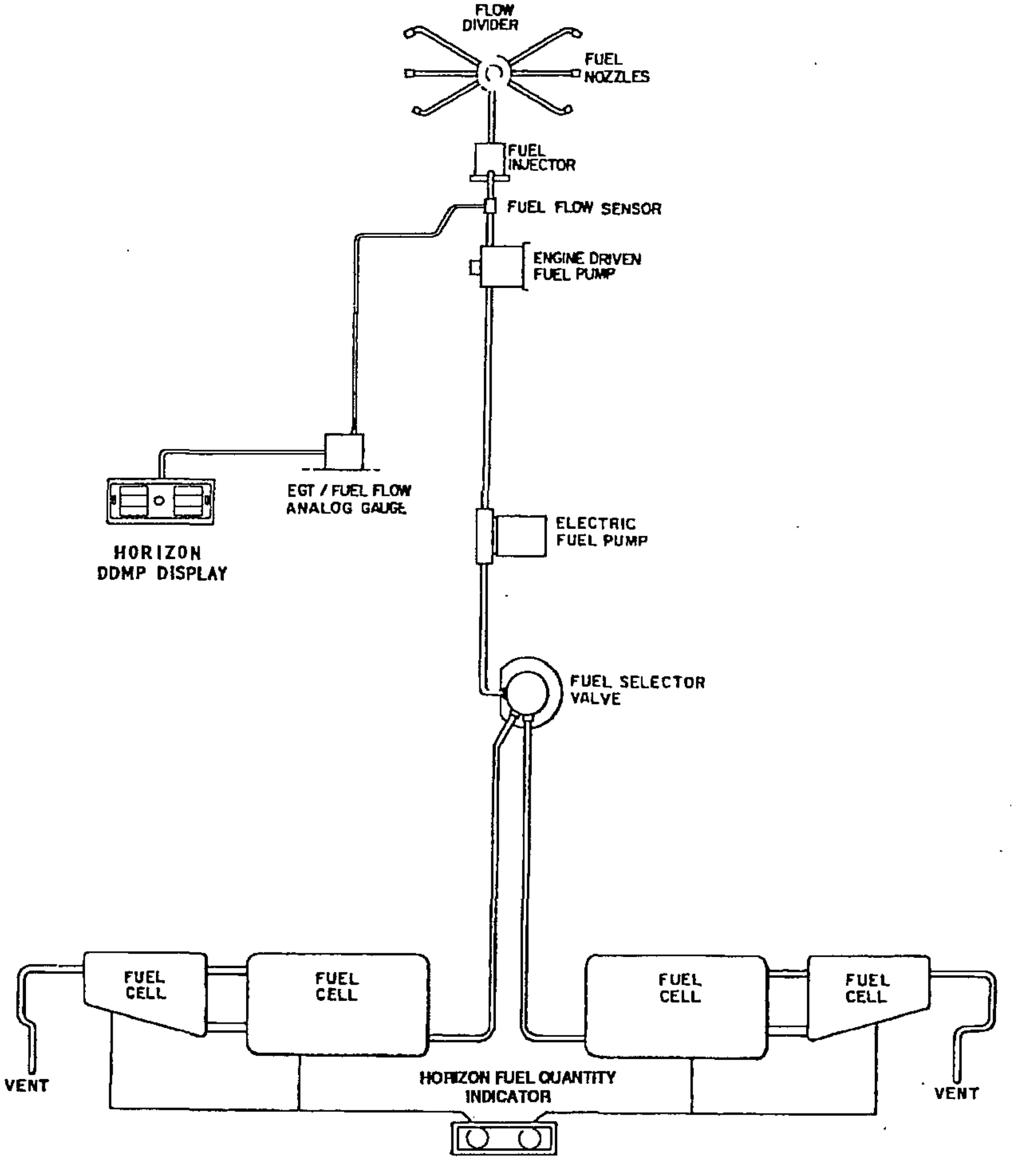
The fuel selector control is located below the center of the instrument panel on the sloping face of the control tunnel (refer to Figure 7-1). It has three positions, one position corresponding to each wing tank plus an OFF position.

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:

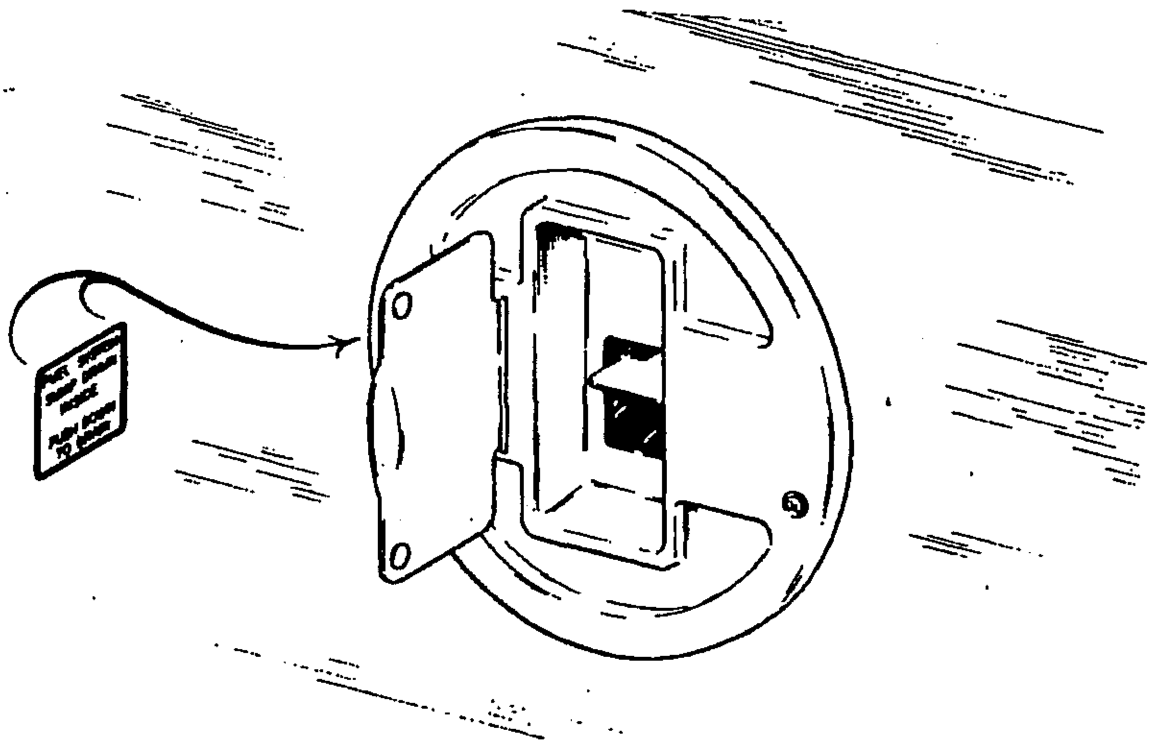
1. Drain each tank sump through its individual quick drain located at the lower inboard rear corner of the tank, making sure that enough fuel has flowed to ensure the removal of all water and sediment.
2. Place a container beneath the fuel strainer sump drain outlet located under the fuselage.
3. Drain 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



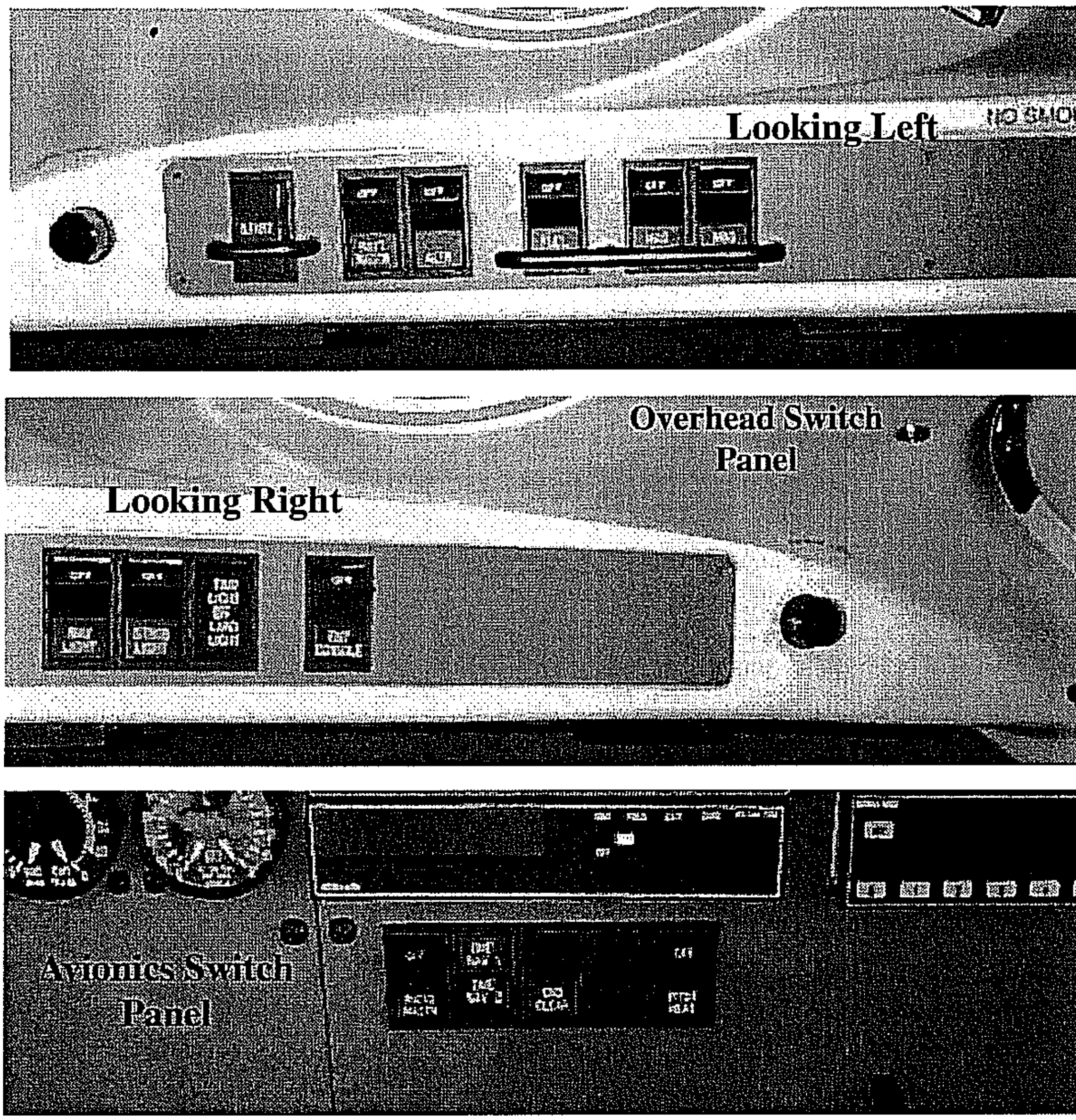
FUEL DRAIN LEVER
Figure 7-13

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

A dual analog fuel quantity gauge is located in the lower right portion of the Horizon instrument installation.

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, and an external power relay are located on the right hand side of the aft fuselage. Access to these electrical components is gained by removing the aft baggage access panel.

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.

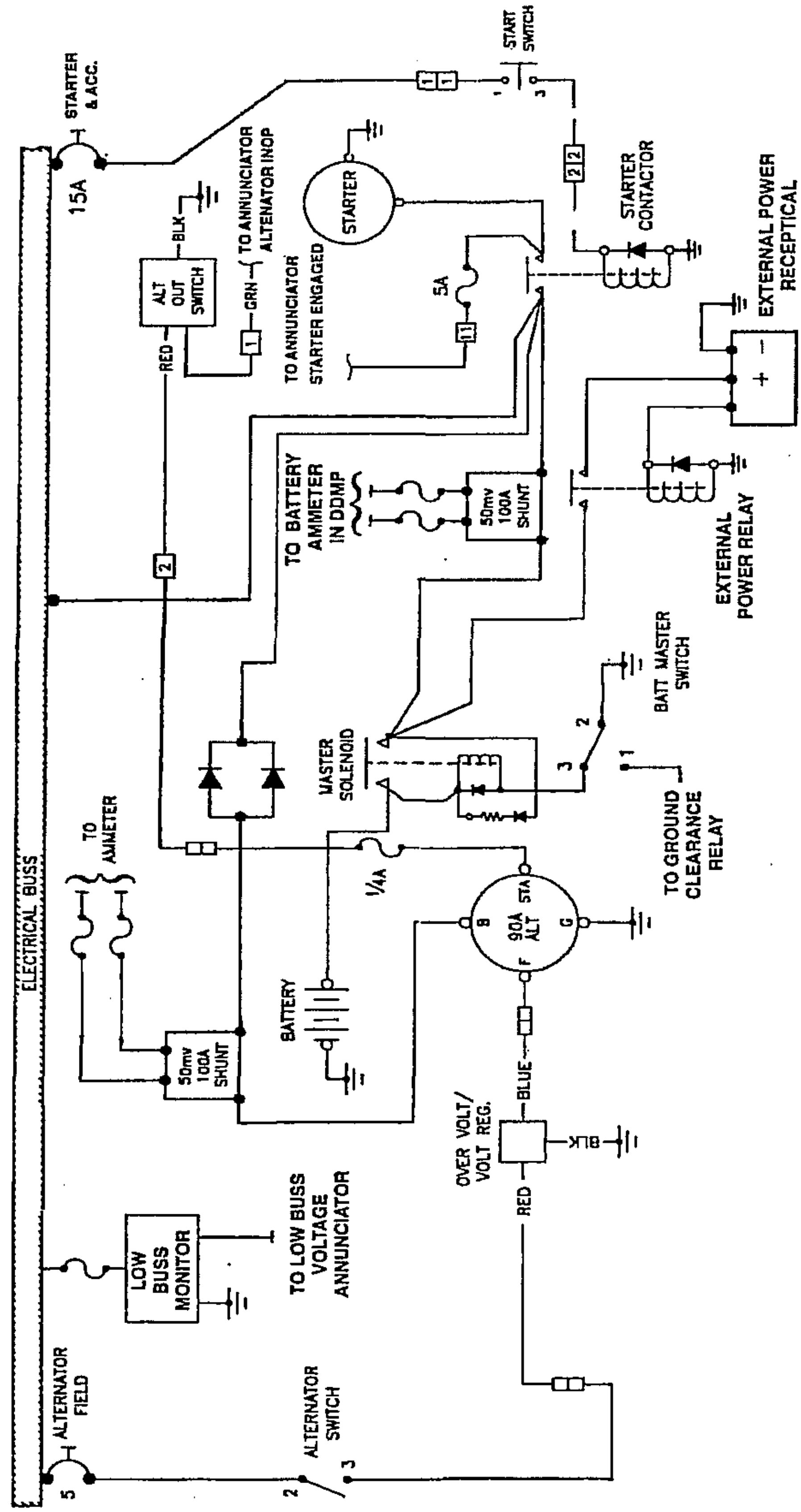
Standard electrical accessories include the starter, the electric fuel pump, the stall warning horn, and the annunciator panel. The annunciator panel includes, alternator inop, oil pressure, gear warn, flaps, starter engaged, low bus voltage, pitot heat off/inop, vacuum inop, and baggage door ajar indicator lights and provisions for optional, 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.

Electrical accessories include the navigation lights, anti-collision strobe lights, instrument panel lighting and cabin courtesy lights. The cabin courtesy light installation consists of a light and switch above the forward cabin entrance and a light above the rear entrance door with the switch in the side panel adjacent to the rear door. 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.

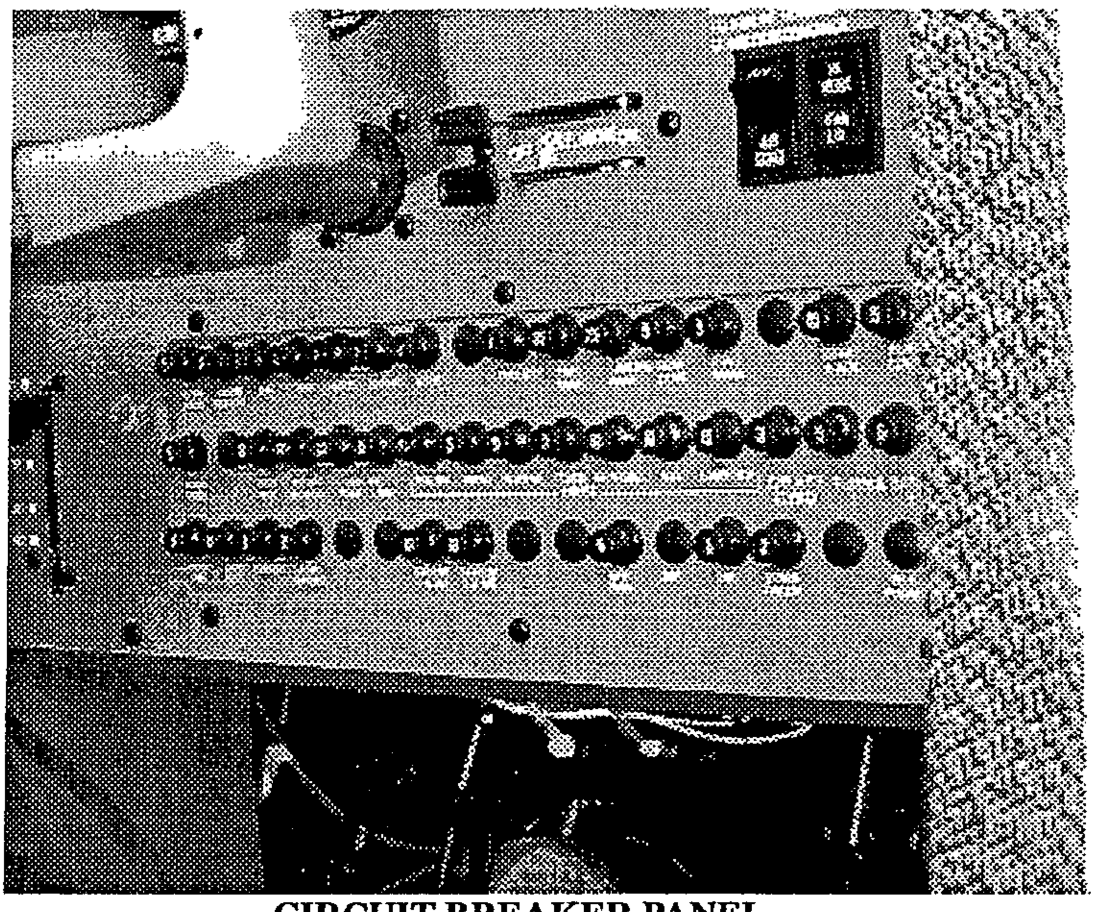
Two lights, mounted in the overhead panel, provide instrument and cockpit lighting for night flying. The lights are controlled by rheostats adjacent to the overhead switch panel. A map light window in each lens is actuated by an adjacent switch. A wing recognition/landing light system, consisting of 2 lights (one in each wing), is operated by a rocker type switch mounted in the overhead switch panel. A single light is mounted on the nose gear which operates when switch is in landing or taxi position (s/n 3246001 thru 3246224 only).

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

The alternator ammeter in the DDMP displays in amperes the load placed on the alternator. The Batt ammeter displays in amperes the amount of charge or discharge of the battery.



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.

7.17 VACUUM SYSTEM

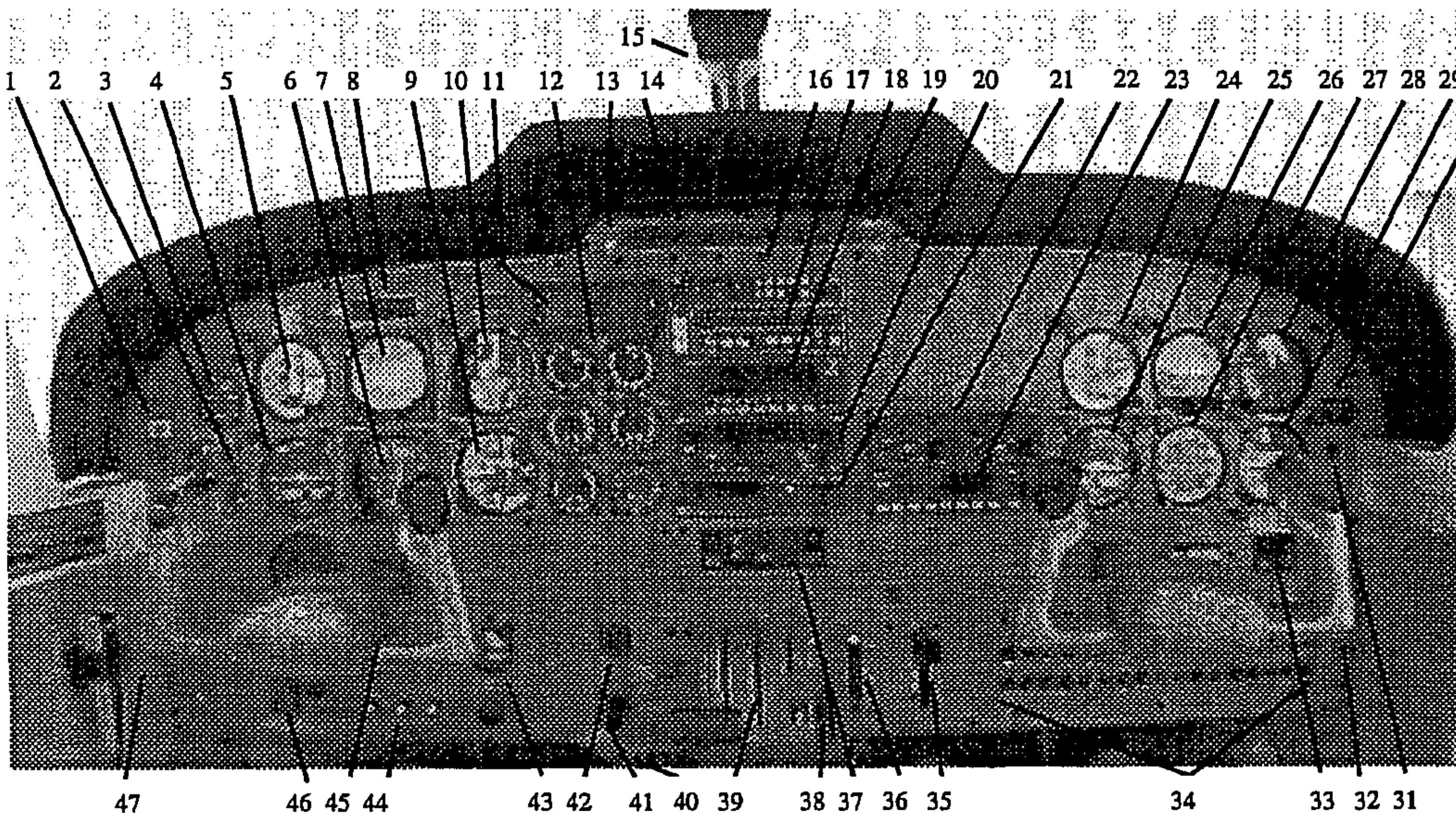
The vacuum system is designed to operate the air driven gyro instruments. This includes the directional and attitude gyros when installed. The system consists of an engine driven vacuum pump, vacuum regulator, vacuum inop annunciator light/relay, filter and the necessary plumbing.

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 is a dual instrument (cylinder head temperature/vacuum pressure), located in the left lower portion of the Horizon instrument installation, (refer to Figure 7-21) which 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 the system. Vacuum pressure which falls below approximately 4.0 in. hg. will illuminate the vacuum inop annunciator light indicating unreliable vacuum driven gyro readings. 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 within the normal operating range, 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.

1. AUX VACUUM SW.
2. LOC/VOR/GS IND.
3. CLOCK
4. TURN & BANK
5. AIRSPEED IND.
6. H.S.I.
7. FLT. COMMAND IND.
8. A/P ANNUNCIATOR
9. VERT. SPEED IND.
10. ALTIMETER
11. DDMP
12. ENGINE INSTRUMENTS TOP TO BOTTOM, LEFT TO RIGHT:
    MAP; PROP RPM;
    TIT/FUEL FLOW;
    OIL TEMP/OIL PRESS
    VACUUM/CHT;
    L & R FUEL QUANTITY
13. ANN. DAY/NITE SW
14. ANNUNC. PANEL
15. WET COMPASS
16. AUDIO AMP.
17. AUTOPILOT
18. G.P.S.
19. ANN. PRESS TO TEST
20. AVIONIC EQUIPMENT
21. AVIONIC EQUIPMENT
22. INTERCOMM SYSTEM
23. AVIONIC EQUIPMENT COPILOT INST (OPT)
24. AIRSPEED
25. TURN & BANK
26. ATITUDE GYRO
27. DIRECTIONAL GYRO
28. ALTIMETER
29. VERT. SPEED IND.
30. ENGINE HOUR METER
31. DATA LOADER PLUG
32. MIKE & PHONE JACK
33. CLIMATE CONTROL
34. CKT. BREAKER PANEL
35. WING FLAP SELECTOR
36. ALT. AIR CONTROL
37. SWITCH PANEL
38. FRICTION LOCK
39. THROTTLE QUAD.
40. EMERG. GEAR EXTEN.
41. GEAR SELECTOR
42. GEAR LIGHTS
43. OXY GAGE & CONTROL
44. DIMMING CONTROLS
45. SLAVE METER ACC.
46. E.L.T. SWITCH
47. MIKE/PHONE JACKS



TYPICAL INSTRUMENT PANEL
Figure 7-21

7.19 INSTRUMENT PANEL

The instrument panel contains customary advanced flight instruments in the standard "T" configuration. The pilot artificial horizon/copilot directional gyro (optional) are vacuum operated and the pilot HSI, turn and bank, and copilot artificial horizon are electrically driven. This configuration of electric and vacuum driven instruments provides system redundancy in the event of an electrical or vacuum system failure. A copilot flight instrument panel can be installed as an option. Power plant information is displayed in analog and digital format via the Horizon instrument installation (see Section 7.8) located to the right of the pilot's flight instruments.

The radios are located in the center section of the instrument panel and are powered through the radio master and aircraft battery master switches. A ground clearance energy saver system is available to provide direct power to Comm 1 without turning on the master switch. When the spring loaded switch is engaged direct aircraft battery power is applied to Comm 1, audio amplifier (speaker) and radio accessories. The ground clearance system must be turned OFF or depletion of the battery could result. (To turn ground clearance system off, turn battery master on then back off)

Switch locations are divided between an overhead switch panel and the standard aircraft panel. The engine start, aircraft battery master, alternator, electric fuel pump, engine magnetos, external aircraft lighting, and entertainment console switches are located on the overhead switch panel. The balance of the switches are located below the radio stack (radio master, DME-NAV1/NAV2, ground clearance, and pitot/stall warning heat) and above the circuit breaker panel (air conditioner,-optional, and fan Hi/Lo.)

Circuit breakers providing electrical circuit/component protection are located in the lower right portion of the instrument panel.

An annunciator panel is located in the top center portion of the instrument panel to warn the pilot of possible system malfunctions

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.

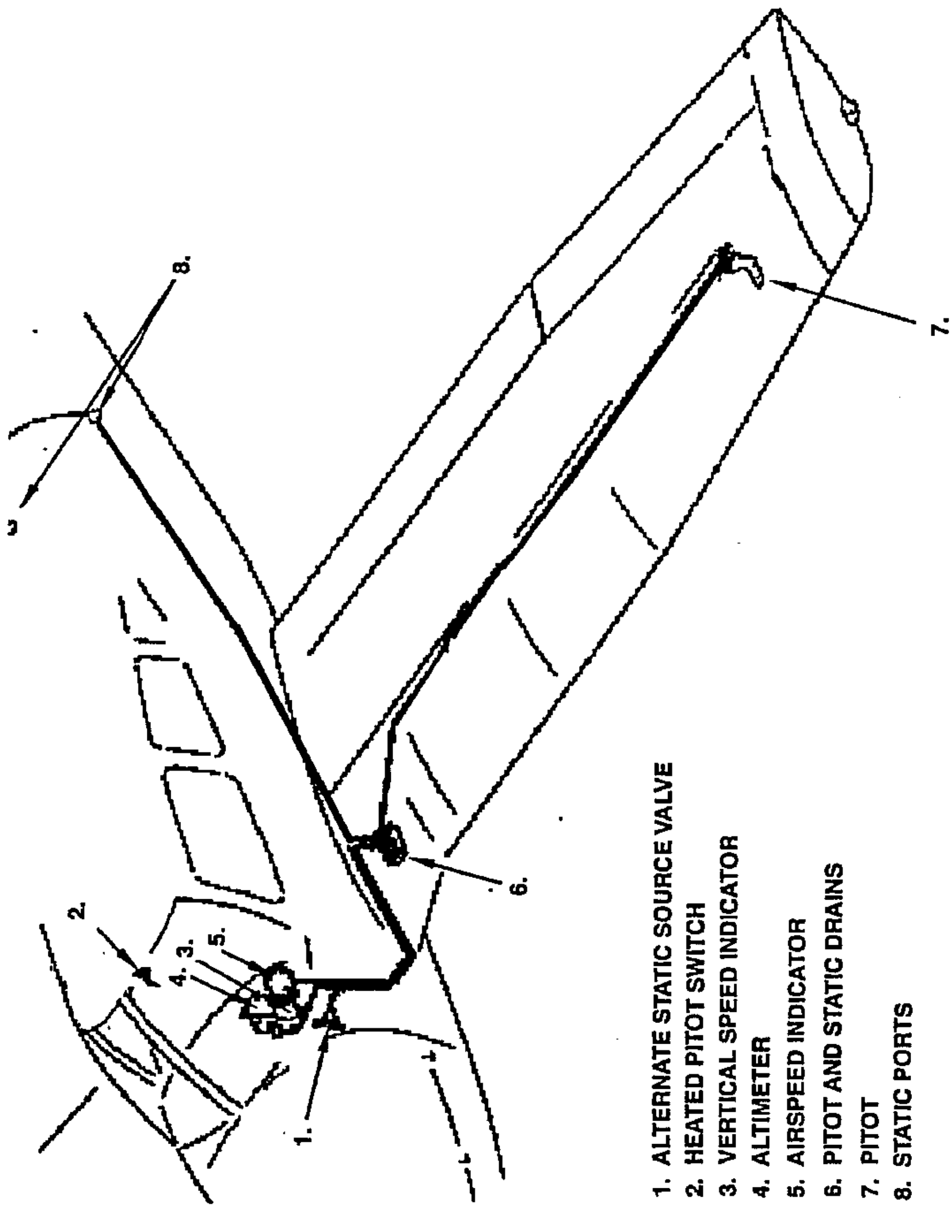
A heated pitot head, which alleviates problems with icing and heavy rain is installed as standard equipment. The switch for pitot heat is located in the switch panel located just above the throttle quadrant. The pitot heat system has a separate circuit breaker located in the circuit breaker panel and 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 extract the left center seat, (right center seat is optional) remove the front leg bolts (2)and slide seat to rear. To remove the rear seats, depress the plunger behind each front leg and slide seat to rear. Any time the seats are installed in the airplane, the retainers should be in the locked position.



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 entertainment/executive console is installed aft of the co-pilot's seat providing POH storage, beverage cooler, cup holders, and pull-out table top. Provisions for flight phone, multi media entertainment system, and lap top computer workstation are available as options. An entertainment console master switch providing power to the console electrical components is located in the cockpit overhead switch panel. Removal of the entertainment/executive console is identical to the left center seat procedure with disconnecting of the electrical harnesses required if any entertainment, computer, or phone options are installed.

All drawers and table top must be closed and secured during takeoff and landing.

To stow the cabin work table, remove the table by lifting the free end of the table upward to disengage the bottom lobes of the table supports. Lift until the top support lobes disengage at approximately 30° of tilt and remove the table. Position the table in the stowage area and, with the table work surface facing forward, place the slots in the table support into the receptacle clips mounted on the hat shelf. Make sure the white tie-down strap is not behind the table. With the table fully placed in the clips, bring the white tie-down strap across the face of the table and lock over the stud located on the bottom of the close-out bulkhead.

A portable fire extinguisher is located on the back of the right side, aft facing passenger seat, or on the forward side of the entertainment console, if installed.

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

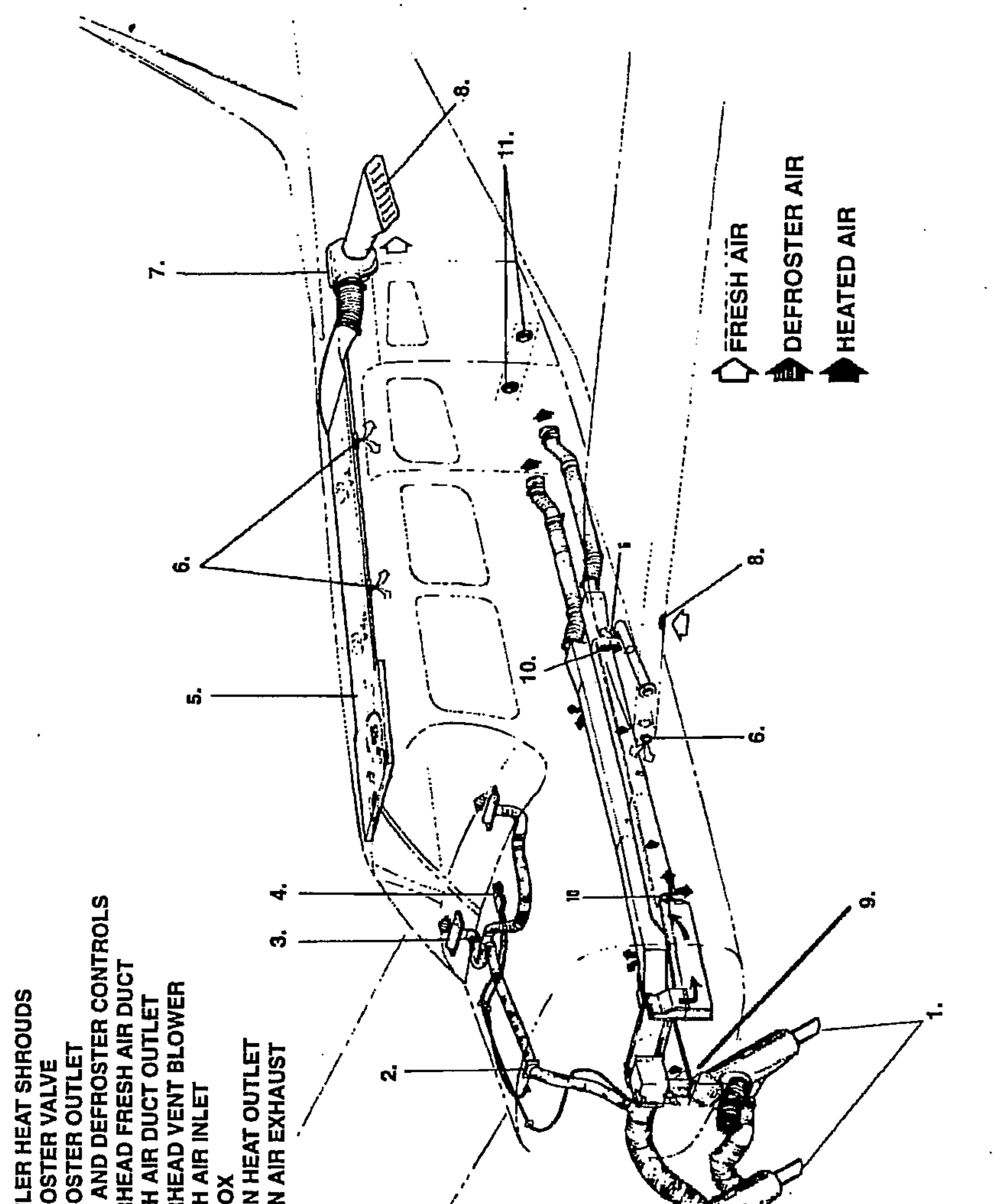
It is the pilot's responsibility to be sure when the baggage is loaded that the airplane's C.G. falls within the allowable C.G. range. (Refer to Weight and Balance Section.)

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 left 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 panel and 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 EXTERNAL POWER

An external receptacle located on the aft lower portion of the right hand side of the fuselage is provided as a source of external power. A 24 VDC external power source can be connected to the receptacle, 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

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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.

WARNING

Inspection, maintenance and parts requirements for all non-PIPER approved STC installations are not included in this handbook. When a non-PIPER approved STC installation is incorporated on the airplane, those portions of the airplane affected by the installation must be inspected in accordance with the inspection program published by the owner of the STC. Since non-PIPER approved STC installations may change systems interface, operating characteristics and component loads or stresses on adjacent structures, PIPER provided inspection criteria may not be valid for airplanes with non-PIPER approved STC installations.

WARNING

Modifications must be approved in writing by PIPER prior to installation. Any and all other installations, whatsoever, of any kind will void this warranty in it's entirety.

8.1 GENERAL (CONTINUED)

WARNING

Use only genuine PIPER parts or PIPER approved parts obtained from PIPER approved sources, in connection with the maintenance and repair of PIPER airplanes.

Genuine PIPER parts are produced and inspected under rigorous procedures to insure airworthiness and suitability for use in PIPER airplane applications. Parts purchased from sources other than PIPER, even though identical in appearance, may not have had the required tests and inspections performed, may be different in fabrication techniques and materials, and may be dangerous when installed in an airplane.

Additionally, reworked or salvaged parts or those parts obtained from non-PIPER approved sources, may have service histories which are unknown or cannot be authenticated, may have been subjected to unacceptable stresses or temperatures or may have other hidden damage not discernible through routine visual or nondestructive testing. This may render the part, component or structural assembly, even though originally manufactured by PIPER, unsuitable and unsafe for airplane use.

PIPER expressly disclaims any responsibility for malfunctions, failures, damage or injury caused by use of non-PIPER approved parts.

8.1 GENERAL (CONTINUED)

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

WARNING

All inspection intervals, replacement time limits, overhaul time limits, the method of inspection, life limits, cycle limits, etc., recommended by PIPER are solely based on the use of new, remanufactured or overhauled PIPER approved parts. If parts are designed, manufactured, remanufactured, overhauled and/or approved by entities other than PIPER, then the data in PIPER'S maintenance/service manuals and parts catalogs are no longer applicable and the purchaser is warned not to rely on such data for non-PIPER parts. All inspection intervals, replacement time limits, overhaul time limits, the method of inspection, life limits, cycle limits, etc., for such non-PIPER parts must be obtained from the manufacturer and/or seller of such non-PIPER parts.

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.

(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.

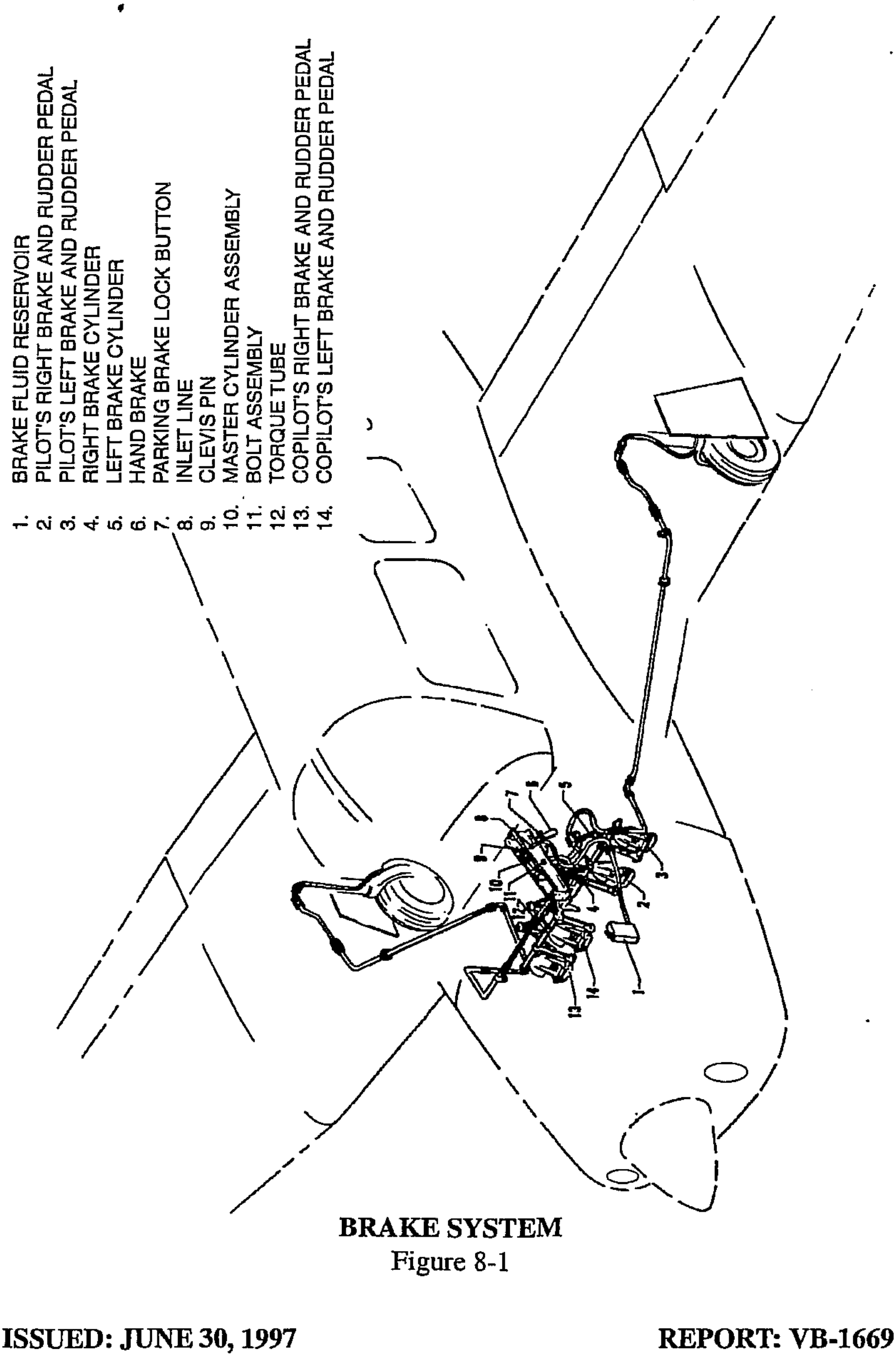
(c) Installation of Engine Air Filter

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 4.00 ± .25 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 6 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 anti-icing additive is used it must meet the specification MIL-I-27686, must be uniformly blended with the fuel while refueling, must not exceed .15% by volume of the refueled quantity, and to ensure its effectiveness should be blended at not less than .10% by volume. One and one half liquid ozs. per ten 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.

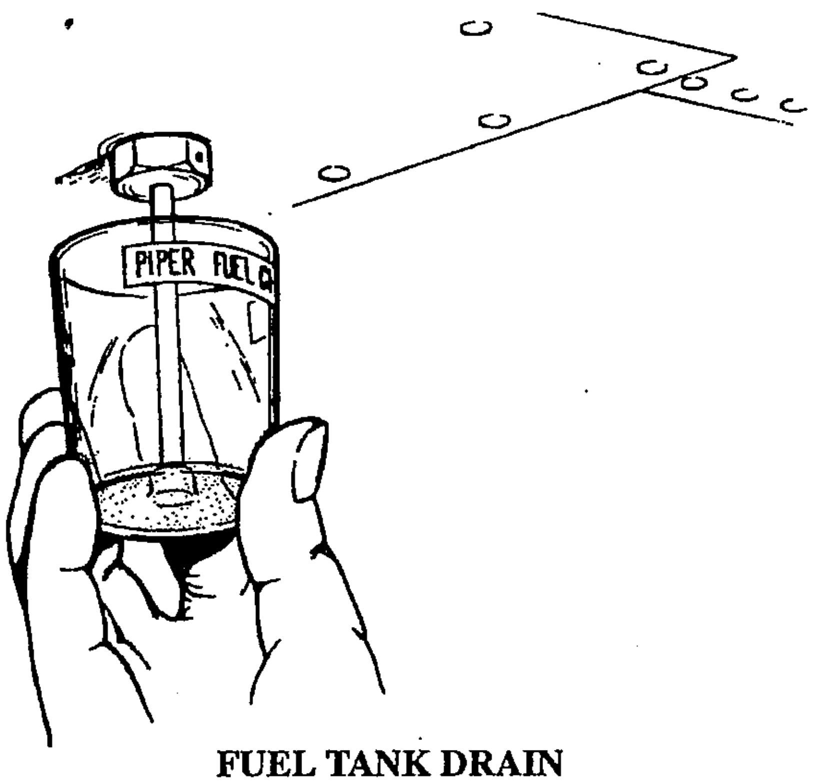
Fuel additive can not be used as a substitute for preflight draining of the fuel system drains.

(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 pressures - 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 aft bulkhead. 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.

SECTION 9

SUPPLEMENTS

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SUPPLEMENTS

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SECTION 9

SUPPLEMENTS

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 ______________________________

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DATE OF APPROVAL JUNE 30, 1997

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 panel which is located in the top center portion of the instrument panel. 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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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 is within the normal operating range.

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 far left side of the instrument panel. The control switch operating modes are "push-for-on" and "push-for-off".

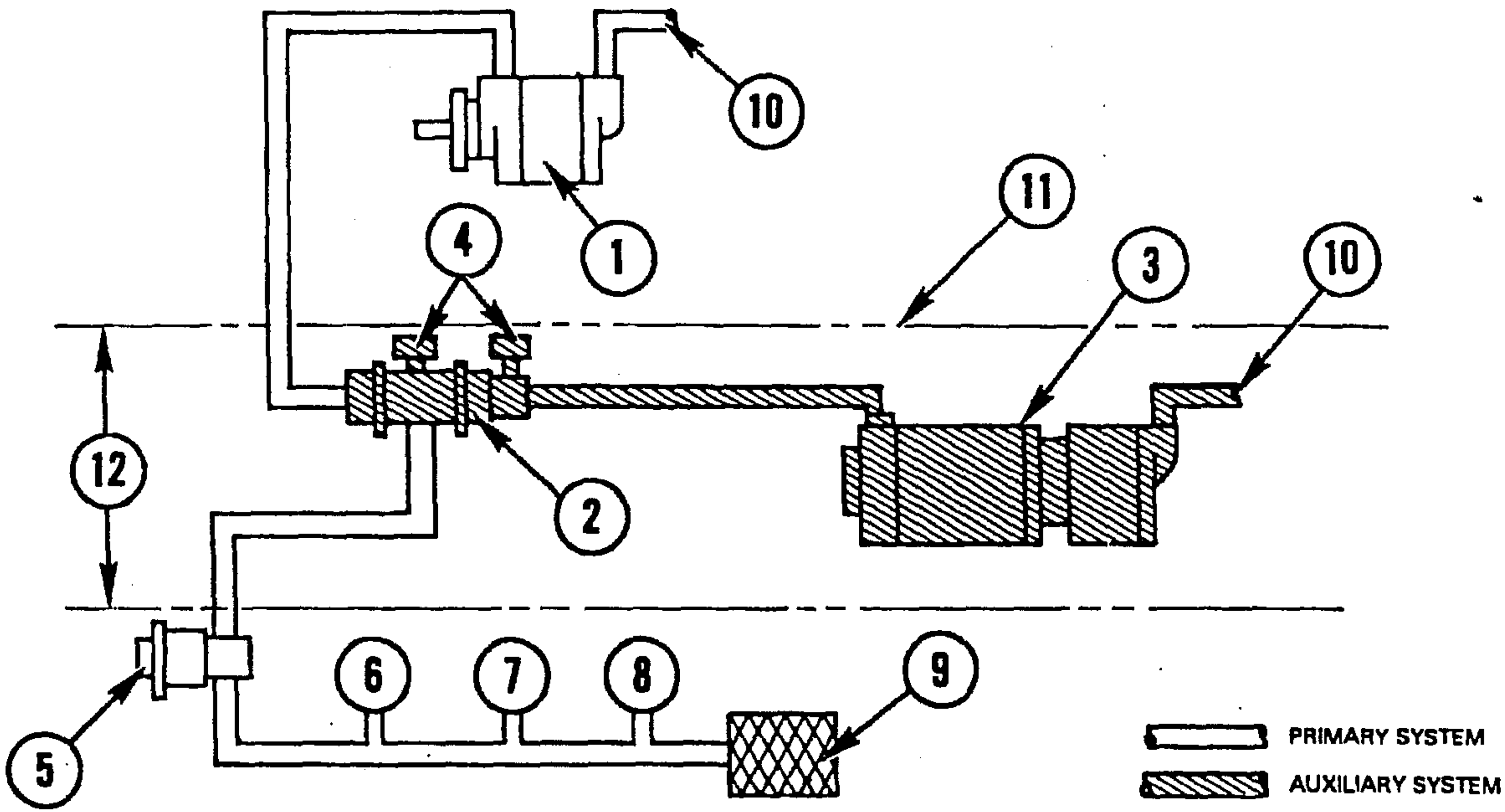
The switch button incorporates two annunciator light sections labeled VAC OFF and AUX ON. The VAC OFF section is controlled by a vacuum switch in the primary pneumatic system and illuminates an amber light when the engine driven pump is inoperative or when the system vacuum falls below the switch activation 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 25237-327 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.



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.

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DATE OF APPROVAL JUNE 30, 1997

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 <u>not</u> 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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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 JUNE 30, 1997

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.

PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 6 FOR BENDIX/KING KLN 89(B) GPS NAVIGATION SYSTEM

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the KLN 89 (B) GPS Navigation System is installed per the Equipment List. The information contained herein supplements or supersedes the 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 Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED: ______________________
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VERO BEACH, FLORIDA

DATE OF APPROVAL: JUNE 30, 1997

SECTION 1 GENERAL

NOTE

This supplement covers both the KLN 89 (VFR) only and the KLN 89B (IFR approved for Enroute, Terminal and non-precision approach phases of flight). There are numerous places throughout this supplement which discuss features and operational characteristics which specifically apply to KLN 89B and not to KLN 89. The parts of this supplement which apply to both the KLN 89 and the KLN 89B will be shown with a generic reference to KLN 89 (B).

The KLN 89(B) 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 card which plugs directly into the front of the unit.

NOTE

SID's, STAR's and instrument approaches, apply only to the KLN 89B.

The data base card 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 cards. Bendix/King makes these data base card updates available to KLN 89(B) GPS users.

Provided the KLN 89(B) GPS navigation system is receiving adequate usable signals, it has been demonstrated capable of and has been shown to meet the accuracy specifications of:

SECTION 1 GENERAL (Cont'd)

VFR/IFR en route oceanic and remote, en route domestic, terminal, and instrument approach (GPS, 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 WGS44 (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 89B to replace one of the other approved means of long-range navigation. A single KLN 89B GPS installation may also be used on short oceanic routes which require only one means of longrange navigation.

NOTE

FAA approval of the KLN 89 (B) does not necessarily constitute approval for use in foreign airspace.

SECTION 2- LIMITATIONS

A. The KLN 89 (B) GPS Pilot's Guide, P/N 006-08786-0000, dated May, 1995 (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: (KLN 89B only.)

1. The system must utilize ORS level 01 or later FAA approved revision.

2. The data on the self test page must be verified prior to use.

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 89B data base. The KLN 89B data base must incorporate the current update cycle.

   (a) The KLN 89B Quick Reference, P/N 006-08787-0000, dated 5/95 (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 89B 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 89 (B) 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 89 (B) 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 89B 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 89 (B) 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 89 (B) does not constitute proficiency in approach operations. Do not attempt approach operations In IMC prior to attaining proficiency in the use of the KLN 89 (B).

A. OPERATION

Normal operating procedures are outlined in the KLN 89 (B) GPS Pilot's Guide, P/N 006-08786-0000, dated May 1995, (or later applicable revision). A KLN 89 (B) Quick Reference, P/N 006-08787-0000 dated 5/95 (or later applicable revision) containing an approach sequence, operating tips and approach related messages is intended for cockpit use by the KLN 89B 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 89 (B) GPS. Presentation on the HSI is also required for autopilot coupling. NAV is green. **GPS** is blue.

NORMAL PROCEDURES

2. Message (MSG) annunciator - Will flash to alert the pilot of a situation that requires attention. Press the MSG button on the KLN 89 (B) GPS to view the message. (Appendix B of the KLN 89 (B) Pilot's Guide contains a list of all of the message page messages and their meanings). **MSG** is amber.
3. Waypoint (**WPT**) annunciator - Prior to reaching a waypoint in the active flight plan, the KLN 89 (B) 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. HSI course control ① knob - Provides analog course input to the KLN 89 (B) 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 89 (B). The HSI course control knob must also be set to provide proper course datum to the autopilot if coupled to the KLN 89 (B) in LEG or OBS.

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 89 (B) displayed message.

NORMAL PROCEDURES

5. GPS approach (**GPS APR ARM/ACTV**) switch/annunciator - (KLN 89B only) 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.

6. RMI NAV presentation switch - May be used to select data for presentation on the RMI; either **NAV 1** data from the number one navigation receiver, **NAV 2** data from the number two navigation receiver or GPS data from the KLN 89 (B) GPS.

C. PILOTS 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 89 (B) 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).

NORMAL PROCEDURES

E. ALTITUDE ALERT AURAL TONES

- 1000 feet prior to reaching the selected altitude - three short tones.
- Upon reaching the selected altitude - two short tones.
- Deviating above or below the selected altitude by more than the warn altitude - four short tones.

F. APPROACH MODE SEQUENCING AND RAIM PREDICTION (KLN 89B only.)

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 outer knob, select the **ACT** (Active Flight Plan Waypoints) pages. Pull the 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 **OTH 3** 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.

NORMAL PROCEDURES

3. At 30 nm from the airport:

   a. Verify automatic annunciation of APR **ARM**.
   b. Note automatic dbar scaling change from ± 5.0 nm to ±1.0 nm over the next 30 seconds.
   c. Update the KLN 89B altimeter baro setting as required.
   d. Internally the KLN 89B will transition from en route to terminal integrity monitoring.

4. Select **NAV 4** 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.

NORMAL PROCEDURES

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 89B will transition from terminal to approach integrity monitoring.
7. Crossing the FAF and APR **ACTV** is <u>not</u> annunciated:
   a <u>Do not descend.</u>
   b. Execute the missed approach.
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 $\boxed{\text{—D►}}$ 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 **OTH 3** page is recommended. A self check occurs automatically within 2 nm 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 **NAV4** or the **FPL 0** pages).
- <u>Some approach waypoints do not appear on the approach plates (including in some instances the FAF)!</u>

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 7
FOR
S-TEC SYSTEM 55 TWO AXIS
AUTOMATIC FLIGHT GUIDANCE SYSTEM
WITH TRIM MONITOR

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the S-TEC System 55 Autopilot is installed per STC SA8396SW-D. 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 the 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: DECEMBER 18, 1998

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PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 8
FOR
GARMIN GNS 430 VHF COMMUNICATION TRANSCEIVER/VOR/ILS RECEIVER/GPS RECEIVER
(Serial numbers 3246126 and up)

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Garmin GNS 430 VHF Communication Transceiver/VOR/ILS Receiver/Global Positioning System is installed per the Equipment List. The information contained herein supplements or supersedes the 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 Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED: Christina L. Marsh
CHRISTINA L. MARSH
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THE NEW PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA

DATE OF APPROVAL: NOVEMBER 22, 1999

SECTION 1 - GENERAL

The GNS 430 System is a fully integrated, panel mounted instrument, which contains a VHF Communications Transceiver, a VOR/ILS receiver, and a Global Positioning System (GPS) Navigation computer. The system consists of a GPS antenna, GPS receiver, VHF VOR/LOC/GS antenna, VOR/ILS receiver, VHF COMM antenna and a VHF Communications transceiver. The primary function of the VHF Communication portion of the equipment is to facilitate communication with Air Traffic Control. The primary function of the VOR/ILS Receiver portion of the equipment is to receive and demodulate VOR, Localizer, and Glide Slope signals. The primary function of the GPS portion of the system is to acquire signals from the GPS system satellites, recover orbital data, make range and Doppler measurements, and process this information in real-time to obtain the user's position, velocity, and time.

Provided the GARMIN GNS 430's GPS receiver is receiving adequate usable signals, it has been demonstrated capable of and has been shown to meet the accuracy specifications for:

> VFR/IFR enroute, terminal, and non-precision instrument approach (GPS, Loran-C, VOR, VOR-DME, TACAN, NDB, NDB-DME, RNAV) operation within the U.S. National Airspace System in accordance with AC 20-138.
>
> North Atlantic Minimum Navigation Performance Specification (MNPS) Airspace in accordance with AC 91-49 and AC 120-33.

Navigation is accomplished using the WGS-84 (NAD-83) coordinate reference datum. Navigation data is based upon use of only the Global Positioning System (GPS) operated by the United States of America.

SECTION 2 - LIMITATIONS

A. The GARMIN GNS 430 Pilot's Guide, p/n 190-00140-00, Rev. A, dated October 1998, or later appropriate revision, must be immediately available to the flight crew whenever navigation is predicated on the use of the system.

B. The GNS 430 must utilize the following or later FAA approved software versions:

Sub-System	Software Version
Main	2.00
GPS	2.00
COMM	2.00
VOR/LOC	2.00
G/S	2.00

The main software version is displayed on the GNS 430 self test page immediately after turn-on for 5 seconds. The remaining system software versions can be verified on the AUX group sub-page 2, "SOFTWARE/DATABASE VER".

C. IFR enroute and terminal navigation predicated upon the GNS 430's GPS Receiver 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.

D. Instrument approach navigation predicated upon the GNS 430's GPS Receiver must be accomplished in accordance with approved instrument approach procedures that are retrieved from the GPS equipment data base. The GPS equipment data base must incorporate the current update cycle.

1. Instrument approaches utilizing the GPS receiver must be conducted in the approach mode and Receiver Autonomous Integrity Monitoring (RAIM) must be available at the Final Approach Fix.

SECTION 2 - LIMITATIONS (continued)

2. Accomplishment of ILS, LOC, LOC-BC, LDA, SDF, MLS or any other type of approach not approved for GPS overlay with the GNS 430's GPS receiver is not authorized.

3. Use of the GNS 430 VOR/ILS receiver to fly approaches not approved for GPS require VOR/ILS navigation data to be present on the external indicator.

4. 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, the aircraft must have the operational equipment capable of using that navigation aid, and the required navigation aid must be operational.

5. VNAV information may be utilized for advisory information only. Use of VNAV information for Instrument Approach Procedures does not guarantee Step-Down Fix altitude protection, or arrival at approach minimums in normal position to land.

E. If not previously defined, the following default settings must be made in the "SETUP 1" menu of the GNS 430 prior to operation (refer to Pilot's Guide for procedure if necessary):

1. dis, spd........ nm kt (sets navigation units to "nautical miles" and "knots")
2. alt, vs...........ft fpm (sets altitude units to "feet" and "feet per minute")
3. map datum..WGS 84 (sets map datum to WGS-84, see not below)
4. posn............deg-min (sets navigation grid units to decimal minutes)

NOTE

In some areas outside the United States, datums other than WGS-84 or NAD-83 may be used. If the GNS 430 is authorized for use by the appropriate Airworthiness authority, the required geodetic datum must be set in the GNS 430 prior to its use for navigation.

SECTION 3 - EMERGENCY PROCEDURES

ABNORMAL PROCEDURES

A. If GARMIN GNS 430 navigation information is not available or invalid, utilize remaining operational navigation equipment as required.

B. If "RAIM POSITION WARNING" message is displayed the system will flag and no longer provide GPS based navigational guidance. The crew should revert to the GNS 430 VOR/ILS receiver or an alternate means of navigation other than the GNS 430's GPS receiver.

C. If "RAIM IS NOT AVAILABLE" message is displayed in the enroute, terminal, or initial approach phase of flight, continue to navigate using the GPS equipment or revert to an alternate means of navigation other than the GNS 430's GPS receiver appropriate to the route and phase of flight. When continuing to use GPS navigation, position must be verified every 15 minutes using the GNS 430's VOR/ILS receiver or another IFR-approved navigation system.

D. If "RAIM IS NOT AVAILABLE" message is displayed while on the final approach segment, GPS based navigation will continue for up to 5 minutes with approach CDI sensitivity (0.3 nautical mile). After 5 minutes the system will flag and no longer provide course guidance with approach sensitivity. Missed approach course guidance may still be available with 1 nautical mile CDI sensitivity by executing the missed approach.

E. In an in-flight emergency, depressing and holding the Comm transfer button for 2 seconds will select the emergency frequency of 121.500 Mhz into the "Active" frequency window.

SECTION 4 - NORMAL PROCEDURES

WARNING

Familiarity with the enroute operation of the GNS 430 does not constitute proficiency in approach operations. Do not attempt approach operations in IMC prior to attaining proficiency in the use of the GNS 430 approach feature.

A. DETAILED OPERATING PROCEDURES

Normal operating procedures are described in the GARMIN GNS 430 Pilot's Guide, p/n 190-00140-00, Rev. A, dated October 1998, or later appropriate revision.

B. PILOT'S DISPLAY

The GNS 430 System data will appear on the Pilot's HSI. The source of data is either GPS or VLOC as annunciated on the display above the CDI key.

C. AUTOPILOT/FLIGHT DIRECTOR OPERATION

Coupling of the GNS 430 System steering information to the autopilot/flight director can be accomplished by engaging the autopilot/flight director in the NAV or APR mode.

When the autopilot/flight director system is using course information supplied by the GNS 430 System and the course pointer is not automatically driven to the desired track, the course pointer on the HSI must be manually set to the desired track (DTK) indicated by the GNS 430. For detailed autopilot/flight director operational instructions, refer to the FAA Approved Flight Manual Supplement for the autopilot/flight director.

SECTION 4 - NORMAL PROCEDURES (continued)

D. AUTOMATIC LOCALIZER COURSE CAPTURE

By default, the GNS 430 automatic localizer course capture feature is enabled. This feature provides a method for system navigation data present on the external indicators to be switched automatically from GPS guidance to localizer / glide slope guidance at the point of course intercept on a localizer at which GPS derived course deviation equals localizer derived course deviation. If an offset from the final approach course is being flown, it is possible that the automatic switch from GPS course guidance to localizer / glide slope course guidance will not occur. It is the pilot's responsibility to ensure correct system navigation data is present on the external indicator before continuing a localizer based approach beyond the final approach fix.

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.

SECTION 7 - DESCRIPTION AND OPERATION

See GNS 430 Pilot's Guide for a complete description of the GNS 430 system.

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PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 9
FOR
GARMIN GNS 430 VHF COMMUNICATION TRANSCEIVER/VOR/ILS RECEIVER/GPS RECEIVER
WITH
TRAFFIC ADVISORY & LIGHTNING STRIKE ADVISORY DATA

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Garmin GNS 430 VHF Communication Transceiver/VOR/ILS Receiver/GPS Receiver with Traffic Advisory & Lightning Strike Advisory Data is installed per the Equipment List. The information contained herein supplements or supersedes the 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 Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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SECTION 1 - GENERAL

The GNS 430 System is a fully integrated, panel mounted instrument, which contains a VHF Communications Transceiver, a VOR/ILS Receiver, and a Global Positioning System (GPS) Navigation computer. The system consists of a GPS Antenna, GPS Receiver, VHF VOR/LOC/GS Antenna, VOR/ILS Receiver, VHF COMM Antenna and a VHF Communications Transceiver. The primary function of the VHF Communication portion of the equipment is to facilitate communication with Air Traffic Control. The primary function of the VOR/ILS Receiver portion of the equipment is to receive and demodulate VOR, Localizer, and Glide Slope signals. The primary function of the GPS portion of the system is to acquire signals from the GPS system satellites, recover orbital data, make range and Doppler measurements, and process this information in real- time to obtain the user's position, velocity, and time.

Provided the GARMIN GNS 430's GPS receiver is receiving adequate usable signals, it has been demonstrated capable of and has been shown to meet the accuracy specifications for:

- VFR/IFR enroute, terminal, and non-precision instrument approach (GPS, Loran-C, VOR, VOR-DME, TACAN, NDB, NDB- DME, RNAV) operation within the U.S. National Airspace System in accordance with AC 20-138.

- One of the approved sensors, for a single or dual GNS 430 installation, for North Atlantic Minimum Navigation Performance Specification (MNPS) Airspace in accordance with AC 91-49 and AC 120- 33.

- The system meets RNP5 airspace (BRNAV) requirements of AC 90-96 and in accordance with AC 20-138, and JAA AMJ 20X2 Leaflet 2 Revision 1, provided it is receiving usable navigation information from the GPS receiver.

NOTE

Navigation is accomplished using the WGS-84 (NAD-83) coordinate reference datum. Navigation data is based upon use of only the Global Positioning System (GPS) operated by the United States of America.

SECTION 2 - LIMITATIONS

A. The GARMIN GNS 430 Pilot's Guide, p/n 190-00140-00, Rev. A, dated October 1998, or later appropriate revision, must be immediately available to the flight crew whenever navigation is predicated on the use of the system.

The Garmin 400 Series Pilot's Guide Addendum, p/n 190-00140-10, Rev. A, dated October 1999, Display Interface for Traffic and Weather Data, must be immediately available to the flight crew if the BF Goodrich WX-500 Stormscope or the BF Goodrich SKYWATCH Traffic Advisory System (TAS) is installed.

B. The GNS 430 must utilize the following or later FAA approved software versions:

Sub-System	Software Version
Main	2.00
GPS	2.00
Comm	1.22
VOR/LOC	1.25
G/S	2.00

The main software version is displayed on the GNS 430 self test page immediately after turn-on for 5 seconds. The remaining system software versions can be verified on the AUX group sub-page 2, "SOFTWARE/DATABASE VER".

SECTION 2 - LIMITATIONS (continued)

C. IFR enroute and terminal navigation predicated upon the GNS 430's GPS Receiver 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.

D. Instrument approach navigation predicated upon the GNS 430's GPS Receiver must be accomplished in accordance with approved instrument approach procedures that are retrieved from the GPS equipment data base. The GPS equipment data base must incorporate the current update cycle.

E. Instrument approaches utilizing the GPS receiver must be conducted in the approach mode and Receiver Autonomous Integrity Monitoring (RAIM) must be available at the Final Approach Fix.

F. Accomplishment of ILS, LOC, LOC-BC, LDA, SDF, MLS or any other type of approach not approved for GPS overlay with the GNS 430's GPS receiver is not authorized.

G. Use of the GNS 430 VOR/ILS receiver to fly approaches not approved for GPS require VOR/ILS navigation data to be present on the external indicator.

H. 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, the aircraft must have the operational equipment capable of using that navigation aid, and the required navigation aid must be operational.

I. VNAV information may be utilized for advisory information only. Use of VNAV information for Instrument Approach Procedures does not guarantee Step-Down Fix altitude protection, or arrival at approach minimums in normal position to land.

SECTION 2 - LIMITATIONS (continued)

J. If not previously defined, the following default settings must be made in the "SETUP 1" menu of the GNS 430 prior to operation (refer to Pilot's Guide for procedure if necessary):

n k
1. dis, spd.........m t (sets navigation units to "nautical miles" and "knots")
2. alt, vs...........ft fpm (sets altitude units to "feet" and "feet per minute")
3. map datum...WGS 84 (sets map datum to WGS-84, see not below)
4. posn.............deg-min (sets navigation grid units to decimal minutes)

NOTE

In some areas outside the United States, datums other than WGS-84 or NAD-83 may be used. If the GNS 430 is authorized for use by the appropriate Airworthiness authority, the required geodetic datum must be set in the GNS 430 prior to its use for navigation.

SECTION 3 - EMERGENCY PROCEDURES

ABNORMAL PROCEDURES

A. If GARMIN GNS 430 navigation information is not available or invalid, utilize remaining operational navigation equipment as required.

B. If "RAIM POSITION WARNING" message is displayed the system will flag and no longer provide GPS based navigational guidance. The crew should revert to the GNS 430 VOR/ILS receiver or an alternate means of navigation other than the GNS 430's GPS receiver.

C. If "RAIM IS NOT AVAILABLE" message is displayed in the enroute, terminal, or initial approach phase of flight, continue to navigate using the GPS equipment or revert to an alternate means of navigation other than the GNS 430's GPS receiver appropriate to the route and phase of flight. When continuing to use GPS navigation, position must be verified every 15 minutes using the GNS 430's VOR/ILS receiver or another IFR-approved navigation system.

D. If "RAIM IS NOT AVAILABLE" message is displayed while on the final approach segment, GPS based navigation will continue for up to 5 minutes with approach CDI sensitivity (0.3 nautical mile). After 5 minutes the system will flag and no longer provide course guidance with approach sensitivity. Missed approach course guidance may still be available with 1 nautical mile CDI sensitivity by executing the missed approach.

E. In an in-flight emergency, depressing and holding the Comm transfer button for 2 seconds will select the emergency frequency of 121.500 Mhz into the "Active" frequency window.

SECTION 4 - NORMAL PROCEDURES

CAUTION

Familiarity with the enroute operation of the GNS 430 does not constitute proficiency in approach operations. Do not attempt approach operations in IMC prior to attaining proficiency in the use of the GNS 430 approach feature.

A. DETAILED OPERATING PROCEDURES

Normal operating procedures are described in the GARMIN GNS 430 Pilot's Guide, p/n 190-00140-00, Rev. A, dated October 1998, or later appropriate revision.

B. PILOT'S DISPLAY

The GNS 430 System data will appear on the Pilot's No. 2 Nav Indicator. The source of data is either GPS or VLOC as annunciated on the display above the CDI key.

C. CROSSFILL OPERATIONS

Crossfill capabilities exist between the GNS 430 and GNS 530 systems. Refer to the Garmin GNS 430 Pilot's Guide for detailed crossfill operating instructions.

D. AUTOMATIC LOCALIZER COURSE CAPTURE

By default, the GNS 430 automatic localizer course capture feature is enabled. This feature provides a method for system navigation data present on the external indicator to be switched automatically from GPS guidance to localizer/glide slope guidance at the point of course intercept on a localizer at which GPS derived course deviation equals localizer derived course deviation. If an offset from the final approach course is being flown, it is possible that the automatic switch from GPS course guidance to localizer/glide slope course guidance will not occur. It is the pilot's responsibility to ensure correct system navigation data is present on the external indicator before continuing a localizer based approach beyond the final approach fix.

SECTION 4 - NORMAL PROCEDURES (continued)

E. DISPLAY OF LIGHTNING STRIKE DATA

Lightning strike data detected by the BF Goodrich WX-500 Stormscope will appear on the moving map and weather pages of the GNS 430. For detailed operating instructions regarding the interface of the GNS 430 with the WX-500, refer to the WX-500 Pilot's Guide and the GNS 430 Pilot's Guide Addendum for the WX-500 Stormscope interface.

CAUTION

During activation and deactivation of the air conditioning system, false lightning strikes/cells may appear on the Stormscope display due to electrical interference caused during operation of the air conditioner condenser door motor. This phenomenon will also occur during air conditioning operation with movement of the throttle between full and partial power due to the automatic retraction and extension of the air conditioner condenser door with throttle movement. False lightning strikes/cells can be cleared via the remote Stormscope clear button on the panel or using the controls on the GNS 430/GNS 530 if so equipped.

F. DISPLAY OF TRAFFIC ADVISORY DATA

Traffic data detected by the BF Goodrich SKYWATCH™ Traffic Advisory System (TAS) will appear on the moving map and traffic display pages of the GNS 430. For detailed operating instructions regarding the interface of the GNS 430 with the SKYWATCH, refer to the FAA approved Flight Manual Supplement for the SKYWATCH, the Pilot's Guide for the SKYWATCH and the GNS 430 Pilot's Guide Addendum for the SKYWATCH Traffic Advisory System interface.

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.

SECTION 7 - DESCRIPTION AND OPERATION

See the GNS 430 Pilot's Guide for a complete description of the GNS 430 system.

PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 10 FOR GARMIN GNS 530 VHF COMMUNICATION TRANSCEIVER/VOR/ILS RECEIVER/GPS RECEIVER WITH TRAFFIC ADVISORY AND LIGHTNING STRIKE ADVISORY DATA

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Garmin GNS 530 VHF Communication Transceiver/VOR/ILS Receiver/Global Positioning System is installed per the Equipment List. The information contained herein supplements or supersedes the 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 Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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SECTION 1 - GENERAL

The GNS 530 System is a fully integrated, panel mounted instrument, which contains a VHF Communications Transceiver, a VOR/ILS Receiver, and a Global Positioning System (GPS) Navigation computer. The system consists of a GPS Antenna, GPS Receiver, VHF VOR/LOC/GS Antenna, VOR/ILS Receiver, VHF COMM Antenna and a VHF Communications Transceiver. The primary function of the VHF Communication portion of the equipment is to facilitate communication with Air Traffic Control. The primary function of the VOR/ILS Receiver portion of the equipment is to receive and demodulate VOR, Localizer, and Glide Slope signals. The primary function of the GPS portion of the system is to acquire signals from the GPS system satellites, recover orbital data, make range and Doppler measurements, and process this information in real- time to obtain the user's position, velocity, and time.

Provided the GARMIN GNS 530's GPS receiver is receiving adequate usable signals, it has been demonstrated capable of and has been shown to meet the accuracy specifications for:

- VFR/IFR enroute, terminal, and non-precision instrument approach (GPS, Loran-C, VOR, VOR-DME, TACAN, NDB, NDB- DME, RNAV) operation within the U.S. National Airspace System in accordance with AC 20-138.

- One of the approved sensors, for a single or dual GNS 530 installation, for North Atlantic Minimum Navigation Performance Specification (MNPS) Airspace in accordance with AC 91-49 and AC 120- 33.

- The system meets RNP5 airspace (BRNAV) requirements of AC 90-96 and in accordance with AC 20-138, and JAA AMJ 20X2 Leaflet 2 Revision 1, provided it is receiving usable navigation information from the GPS receiver.

NOTE

Navigation is accomplished using the WGS-84 (NAD-83) coordinate reference datum. Navigation data is based upon use of only the Global Positioning System (GPS) operated by the United States of America.

SECTION 2 - LIMITATIONS

A. The GARMIN GNS 530 Pilot's Guide, p/n 190-00181-00, Rev. A, dated November 1999, or later appropriate revision, must be immediately available to the flight crew whenever navigation is predicated on the use of the system.

B. The Garmin 500 Series Pilot's Guide Addendum, Display Interface for Traffic and Weather Data, must be immediately available to the flight crew if the B.F. Goodrich WX-500 Stormscope® or the B.F. Goodrich SKYWATCH™ Traffic Advisory System (TAS) is installed.

C. The GNS 530 must utilize the following or later FAA approved software versions:

Sub-System	Software Version
Main	2.00
GPS	2.00
Comm	1.22
VOR/LOC	1.25
G/S	2.00

The main software version is displayed on the GNS 530 self test page immediately after turn-on for 5 seconds. The remaining system software versions can be verified on the AUX group sub-page 2, "SOFTWARE/DATABASE VER".

D. IFR enroute and terminal navigation predicated upon the GNS 530's GPS Receiver 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.

E. Instrument approach navigation predicated upon the GNS 530's GPS Receiver must be accomplished in accordance with approved instrument approach procedures that are retrieved from the GPS equipment data base. The GPS equipment data base must incorporate the current update cycle.

1. Instrument approaches utilizing the GPS receiver must be conducted in the approach mode and Receiver Autonomous Integrity Monitoring (RAIM) must be available at the Final Approach Fix.

SECTION 2 - LIMITATIONS (continued)

2. Accomplishment of ILS, LOC, LOC-BC, LDA, SDF, MLS or any other type of approach not approved for GPS overlay with the GNS 530's GPS receiver is not authorized.
3. Use of the GNS 530 VOR/ILS receiver to fly approaches not approved for GPS require VOR/ILS navigation data to be present on the external indicator.
4. 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, the aircraft must have the operational equipment capable of using that navigation aid, and the required navigation aid must be operational.
5. VNAV information may be utilized for advisory information only. Use of VNAV information for Instrument Approach Procedures does not guarantee Step-Down Fix altitude protection, or arrival at approach minimums in normal position to land.

F. If not previously defined, the following default settings must be made in the "SETUP 1" menu of the GNS 530 prior to operation (refer to Pilot's Guide for procedure if necessary):

n k
1. dis, spd m t (sets navigation units to "nautical miles" and "knots")
2. alt, vs . ft fpm (sets altitude units to "feet" and "feet per minute")
3. map datum.. WGS 84 (sets map datum to WGS-84, see not below)
4. posn ... deg-min (sets navigation grid units to decimal minutes)

NOTE

In some areas outside the United States, datums other than WGS-84 or NAD-83 may be used. If the GNS 530 is authorized for use by the appropriate Airworthiness authority, the required geodetic datum must be set in the GNS 530 prior to its use for navigation.

SECTION 3 - EMERGENCY PROCEDURES

ABNORMAL PROCEDURES

A. If GARMIN GNS 530 navigation information is not available or invalid, utilize remaining operational navigation equipment as required.

B. If "RAIM POSITION WARNING" message is displayed the system will flag and no longer provide GPS based navigational guidance. The crew should revert to the GNS 530 VOR/ILS receiver or an alternate means of navigation other than the GNS 530's GPS receiver.

C. If "RAIM IS NOT AVAILABLE" message is displayed in the enroute, terminal, or initial approach phase of flight, continue to navigate using the GPS equipment or revert to an alternate means of navigation other than the GNS 530's GPS receiver appropriate to the route and phase of flight. When continuing to use GPS navigation, position must be verified every 15 minutes using the GNS 530's VOR/ILS receiver or another IFR-approved navigation system.

D. If "RAIM IS NOT AVAILABLE" message is displayed while on the final approach segment, GPS based navigation will continue for up to 5 minutes with approach CDI sensitivity (0.3 nautical mile). After 5 minutes the system will flag and no longer provide course guidance with approach sensitivity. Missed approach course guidance may still be available with 1 nautical mile CDI sensitivity by executing the missed approach.

E. In an in-flight emergency, depressing and holding the Comm transfer button for 2 seconds will select the emergency frequency of 121.500 Mhz into the "Active" frequency window.

SECTION 4 - NORMAL PROCEDURES

CAUTION

Familiarity with the enroute operation of the GNS 530 does not constitute proficiency in approach operations. Do not attempt approach operations in IMC prior to attaining proficiency in the use of the GNS 530 approach features.

A. DETAILED OPERATING PROCEDURES

Normal operating procedures are described in the GARMIN GNS 530 Pilot's Guide, p/n 190-00181-00, Rev. A, dated November 1999, or later appropriate revision.

B. PILOT'S DISPLAY

The GNS 530 System data will appear on the Pilot's HSI. The source of data is either GPS or VLOC as annunciated on the display above the CDI key.

C. AUTOPILOT/FLIGHT DIRECTOR OPERATION

Coupling of the GNS 530 System steering information to the autopilot/flight director can be accomplished by engaging the autopilot/flight director in the NAV or APR mode.

When the autopilot/flight director system is using course information supplied by the GNS 530 System and the course pointer is not automatically driven to the desired track, the course pointer on the HSI must be manually set to the desired track (DTK) indicated by the GNS 530. For detailed autopilot/flight director operational instructions, refer to the FAA Approved Flight Manual Supplement for the autopilot/flight director.

D. CROSSFILL OPERATIONS

Crossfill capabilities exist between the GNS 530 and GNS 430 systems. Refer to the Garmin GNS 530 Pilot's Guide for detailed crossfill operating instructions.

SECTION 4 - NORMAL PROCEDURES (continued)

E. AUTOMATIC LOCALIZER COURSE CAPTURE

By default, the GNS 530 automatic localizer course capture feature is enabled. This feature provides a method for system navigation data present on the external indicators to be switched automatically from GPS guidance to localizer/glide slope guidance at the point of course intercept on a localizer at which GPS derived course deviation equals localizer derived course deviation. If an offset from the final approach course is being flown, it is possible that the automatic switch from GPS course guidance to localizer/glide slope course guidance will not occur. It is the pilot's responsibility to ensure correct system navigation data is present on the external indicator before continuing a localizer based approach beyond the final approach fix.

F. DISPLAY OF LIGHTNING STRIKE DATA

Lightning strike data detected by the BF Goodrich WX-500 Stormscope will appear on the moving map and weather pages of the GNS 530. For detailed operating instructions regarding the interface of the GNS 530 with the WX-500, refer to the WX-500 Pilot's Guide and the GNS 530 Pilot's Guide Addendum for the WX-500 Stormscope interface.

CAUTION

During activation and deactivation of the air conditioning system, false lightning strikes/cells may appear on the Stormscope display due to electrical interference caused during operation of the air conditioner condenser door motor. This phenomenon will also occur during air conditioning operation with movement of the throttle between full and partial power due to the automatic retraction and extension of the air conditioner condenser door with throttle movement. False lightning strikes/cells can be cleared via the remote Stormscope clear button on the panel or using the controls on the GNS 430/GNS 530 if so equipped.

G. DISPLAY OF TRAFFIC ADVISORY DATA

Traffic data detected by the BF Goodrich SKYWATCH™ Traffic Advisory System (TAS) will appear on the moving map and traffic display pages of the GNS 530. For detailed operating instructions regarding the interface of the GNS 530 with the SKYWATCH, refer to the FAA approved Flight Manual Supplement for the SKYWATCH, the Pilot's Guide for the SKYWATCH and the GNS 530 Pilot's Guide Addendum for the SKYWATCH Traffic Advisory System interface.

SECTION 5 - PERFORMANCE

There is no change to aircraft performance with this equipment installed.

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.

SECTION 7 - DESCRIPTION AND OPERATION

See the GNS 530 Pilot's Guide for a complete description of the GNS 530 system.

PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 11 FOR B.F. GOODRICH SKYWATCH TRAFFIC ADVISORY SYSTEM MODEL SKY497

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the optional BF Goodrich Skywatch Traffic Advisory System, Model SKY497 is installed per the Equipment List. The information contained herein supplements or supersedes the 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 Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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SECTION 1 - GENERAL

The SKYWATCH system is an on-board traffic advisory system which monitors a radius of nominally 6 nautical miles about the aircraft by interrogating any "intruding" aircraft transponder, and determines if a potential conflict exists with other aircraft. This is done by computing the range, altitude, bearing, and closure rate of other transponder equipped aircraft, with respect to the SKYWATCH equipped aircraft.

SKYWATCH requires the following other equipment to be functional and operating:

Encoding Altimeter
Aircraft Compass (Directional Gyro)
Aircraft Suppression Bus
Squat Switch (both fixed and retractable gear aircraft)

The SKYWATCH system provides a single level of threat advisory known as a Traffic Advisory (TA). The TA display indicates the relative position of an intruder when it is approximately 30 seconds from Closest Point of Approach (CPA). In addition, all aircraft detected less than 0.55 nm and +/- 800 feet from own aircraft will cause a TA to be generated. In airport approach/departure areas, these criteria are reduced to approximately 15 to 20 seconds from CPA.

The TA calls attention to a possible collision threat using the WX-1000/SKYWATCH display and the voice message "TRAFFIC, TRAFFIC". The TA is intended to assist the pilot in achieving visual acquisition of the threat aircraft.

SKYWATCH is considered a backup system to the "SEE AND AVOID" concept and the ATC radar environment.

SKYWATCH data may be presented on the Garmin 530 and the Garmin 430. See the POH supplements for operating instructions for these items of equipment. The Standby/Operate feature is controlled by the GNS 530.

SECTION 2 - LIMITATIONS

Information shown on the display is provided to the pilot as an aid to visually acquiring traffic. Pilot's should maneuver their aircraft based only on ATC guidance or positive visual acquisition of the conflicting traffic. Maneuver should be consistent with ATC instructions. No maneuvers should be made based only on a Traffic Advisory. ATC should be contacted for resolution of the Traffic conflict.

If the pilot is advised by ATC to disable transponder altitude reporting, SKYWATCH must be turned OFF.

Operation of the SKYWATCH system requires that the SKYWATCH Pilot's Guide, p/n 009-10801-001, latest revision, be kept on the aircraft and available to the pilot at all times.

SKYWATCH can only detect aircraft which are transponder equipped.

SECTION 3 - EMERGENCY PROCEDURES

No change.

SECTION 4 - NORMAL PROCEDURES

SELF TEST

The SKYWATCH system should be tested prior to flight.

After completion of self test, the "TRAFFIC ADVISORY SYSTEM TEST PASSED" audio annunciation will be heard and the display will revert to the standby screen.

SECTION 4 - NORMAL PROCEDURES (continued)

SELF TEST (continued)

If "TRAFFIC ADVISORY SYSTEM TEST FAILED" is heard or the SKY497 FAILED screen appears, the SKYWATCH system should be turned OFF.

NOTE

The SELF TEST is inhibited when the aircraft is airborne.

STANDBY CHARACTERISTICS

The SKYWATCH system will display SKY497 STANDBY when the aircraft is on the ground and not tracking or processing traffic information. Standby gives the system the ability to track targets while on the ground. Pressing the OPR button activates the system and changes the display from the Standby screen to the Above (ABV) mode and 6 nm range. The ranges available are 6 nm and 2 nm and are selected by pressing the Display Range Button.

To go back into Standby, press the STB button. The system will go to the SKY497 STANDBY screen and will not track targets again until the system is either manually switched out of Standby, while on the ground or automatically switched out of Standby 8 seconds after the aircraft becomes airborne.

The SELF TEST works while in the SKY497 SKYWATCH screen by pressing the TEST Button.

The SKYWATCH system, while in flight or operating on the ground, will display 3 altitude display modes. These are: Above (ABV), Normal (NRM), and Below (BLW). These modes are activated by pressing the Altitude display mode button. Refer to the pilot's guide for the SKYWATCH Traffic System Model SKY497, p/n 009-10801-001, Rev. A or latest FAA approved revision.

SECTION 4 - NORMAL PROCEDURES (continued)

ABNORMAL PROCEDURES

If "TRAFFIC ADVISORY SYSTEM TEST FAILED" is heard or the SKY497 FAILED screen appears, the SKYWATCH system should be turned OFF.

If the barometric altimeter fails in flight and is the altitude source for the transponder, turn SKYWATCH OFF.

RESPOND TO TRAFFIC ADVISORIES

When the SKY497 issues a TA, scan outside for the intruder aircraft. Call ATC for guidance and if you visually acquire the traffic, use normal right of way procedures to maintain separation.

Do not attempt maneuvers based solely on traffic information shown on the SKY497 display. Information on the display is provided to the flight crew as an aid in visually acquiring traffic; it is not a replacement for ATC and SEE and AVOID techniques.

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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PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 12
FOR
BF GOODRICH AEROSPACE
WX-500 STORMSCOPE - SERIES II WEATHER MAPPING SENSOR

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the BF Goodrich Aerospace WX-500 Stormscope is installed per the equipment list. The information contained herein supplements or supersedes the 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 Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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DATE OF APPROVAL: June 12, 2000

SECTION 1 - GENERAL

This supplement provides information necessary for the operation of the aircraft with the BF Goodrich WX-500 Stormscope.

WARNING

Never use your Stormscope system to attempt to penetrate a thunderstorm. The FAA Advisory Circular, Subject: Thunderstorms, and the Airman's Information Manual (AIM) recommend that a pilot "avoid by at least 20 miles any thunderstorm identified as severe or giving an intense radar echo."

CAUTION

There are several atmospheric phenomena other than nearby thunderstorms that can cause isolated discharge points in the strike display mode. Clusters of two or more discharge points in the strike display mode, however, do indicate thunderstorm activity when they reappear after clearing the screen. Avoid the clusters and you'll avoid the thunderstorms. In the cell display mode, even a single discharge point may represent thunderstorm activity and should be avoided.

CAUTION

During activation and deactivation of the air conditioning system, false lightning strikes/cells may appear on the Stormscope display due to electrical interference caused during operation of the air conditioner condenser door motor. This phenomenon will also occur during air conditioning operation with movement of the throttle between full and partial power due to the automatic retraction and extension of the air conditioner condenser door with throttle movement. False lightning strikes/cells can be cleared via the remote Stormscope clear button on the panel or using the controls on the GNS 430/GNS 530 if so equipped.

SECTION 2 - LIMITATIONS

The BF Goodrich Aerospace WX-500 Stormscope Users Guide, p/n 009-11501-001, Rev. A, dated September 10, 1997, or later appropriate revision, must be immediately available to the flight crew whenever weather avoidance is predicated on the use of this system.

SECTION 3 - EMERGENCY PROCEDURES

No change.

SECTION 4 - NORMAL PROCEDURES

Normal operating procedures are described in the BF Goodrich Aerospace WX-500 Stormscope Users Guide, p/n 009-11501-001, Rev. A, dated September 10, 1997, or later appropriate revision.

SECTION 5 - PERFORMANCE

No change.

SECTION 6 - WEIGHT AND BALANCE

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

SECTION 7 - DESCRIPTION AND OPERATION

A. OPERATING PROCEDURES

See the BF Goodrich Aerospace WX-500 Stormscope Users Guide for a complete description of the WX-500 system.

B. PILOT'S DISPLAY (Airplane Dependent)

The BF Goodrich Aerospace WX-500 Stormscope's data will appear on either the Garmin GNS 530 or the Garmin GNS 430.

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PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 13
FOR
GARMIN GTX 327 TRANSPONDER

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Garmin GTX 327 Transponder is installed per the Equipment List. The information contained herein supplements or supersedes the 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 Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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DATE OF APPROVAL: January 9, 2001

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the Garmin GTX 327 Transponder is installed in accordance with FAA approved Piper data.

SECTION 2 - LIMITATIONS

No change.

SECTION 3 - EMERGENCY PROCEDURES

To transmit an emergency signal:

- Mode Selection Key - ALT
- Code Selection - SELECT 7700

To transmit a signal representing loss of all communications:

- Mode Selection Key - ALT
- Code Selection - SELECT 7600

SECTION 4 - NORMAL PROCEDURES

BEFORE TAKEOFF:

- To transmit Mode C (Altitude Reporting) code in flight:

- Mode Selection Key - ALT
- Code Selector Keys - SELECT assigned code.

To transmit Mode A (Aircraft Identification) code in flight:

- Mode Selector Key - ON
- Code Selector Keys - SELECT assigned code.

NOTE

During normal operation with the ON mode selected, the reply indicator "R" flashes, indicating transponder replies to interrogations.

NOTE

Mode A reply codes are transmitted in ALT also; however, Mode C codes only are suppressed when the Function Selector ON key is selected.

SECTION 5 - PERFORMANCE

No change.

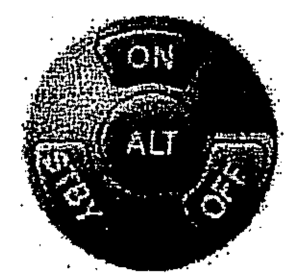
SECTION 6 - WEIGHT AND BALANCE

Factory installed optional equipment is included in the licensed weight and balance data in section 6 of the Airplane Flight Manual.

SECTION 7 - DESCRIPTION AND OPERATION

The GTX 327 transponder is powered on by pressing the **STBY**, **ALT** or **ON** keys, or by a remote avionics master switch (if applicable). After power on, a start-up page will be displayed while the unit performs a self test.

Mode Selection Keys



OFF - Powers off the GTX 327.

STBY - Powers on the transponder in standby mode. At power on the last active identification code will be selected. When in standby mode, the transponder will not reply to any interrogations.

ON - Powers on the transponder in Mode A. At power on the last active identification code will be selected. In this mode, the transponder replies to interrogations, as indicated by the Reply Symbol ®. Replies do not include altitude information.

ALT -Powers on the transponder in Mode A and Mode C. At power on the last active identification code will be selected. In ALT mode, the transponder replies to identification and altitude interrogations, as indicated by the Reply Symbol ®. Replies to altitude interrogations include the standard pressure altitude received from an external altitude source, which is not adjusted for barometric pressure. The ALT mode may be used in aircraft not equipped with the optional altitude encoder; however, the reply signal will not include altitude information.

GTX 327 Configuration Mode

The GTX 327's configuration, which is normally done at time of installation, influences many of the unit's functions described in this manual. If you wish to view or change any of the GTX 327 configuration parameters, you may access the GTX 327 Configuration Mode. Use caution when changing configuration. When in doubt, contact your authorized GARMIN Aviation Service Center. The Configuration Mode should not be used while the aircraft is airborne.

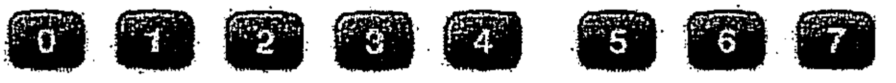
SECTION 7 - DESCRIPTION AND OPERATION (continued)

GTX 327 Configuration Mode (continued)

To use the GTX 327 Configuration Mode:

1. Press and hold the FUNC key while powering on the unit using the **STBY, ON,** or **ALT** key (or using an avionics master switch).
2. Press the **FUNC** key to sequence through the configuration pages.
3. Use the **CRSR** key to highlight selectable fields on each page.
4. When a field is highlighted, enter numeric data using the **0 - 9** keys, and select items from a list using the **8** or **9** keys.
5. Press the **CRSR** key to confirm list selections.

Code Selection



Code selection is done with eight keys (**0 - 7**) that provide 4,096 active identification codes. Pushing one of these keys begins the code selection sequence. The new code will not be activated until the fourth digit is entered. Pressing the **CLR** key will move the cursor back to the previous digit. Pressing the **CLR** key when the cursor is on the first digit of the code, or pressing the **CRSR** key during code entry, will remove the cursor and cancel data entry, restoring the previous code. The numbers 8 and 9 are not used for code entry, only for entering a Count Down time, and in the Configuration Mode.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

Code Selection (continued)

Important Codes:

1200 - The VFR code for any altitude in the US (Refer to ICAO standards elsewhere)

7000 - The VFR code commonly used in Europe (Refer to ICAO standards)

7500 - Hijack code (Aircraft is subject to unlawful interference)

7600 - Loss of communications

7700 - Emergency

7777 - Military interceptor operations (Never squawk this code)

0000 - Military use (Not enterable)

Care should be taken not to select the code 7500 and all codes in the 7600 - 7777 range, which trigger special indicators in automated facilities. Only the code 7500 will be decoded as the hijack code. An aircraft's transponder code (when available) is utilized to enhance the tracking capabilities of the ATC facility, therefore care should be taken when making routine code changes.

Keys for Other GTX 327 Functions

IDENT - Pressing the IDENT key activates the Special Position Identification (SPI) Pulse for 18 seconds, identifying your transponder return from others on the air traffic controller's screen. The word "IDENT" will appear in the upper left corner of the display while the IDENT mode is active.

VFR - Sets the transponder code to the pre-programmed VFR code selected in Configuration Mode (this is set to 1200 at the factory). Pressing the **VFR** key again will restore the previous identification code.

FUNC - Changes the page shown on the right side of the display. Displayed data includes Pressure Altitude, Flight Time, Count Up timer, Count Down timer, and may include Contrast and Display Brightness, depending on configuration (as shown in the screens below):

SECTION 7 - DESCRIPTION AND OPERATION (continued)

Keys for Other GTX 327 Functions (continued)

PRESSURE ALT: Displays the altitude data supplied to the GTX 327 in feet, hundreds of feet (i.e., flight level), or meters, depending on configuration.

FLIGHT TIME: Displays the Flight Time, which is controlled by the **START/STOP** key or by a squat switch as configured during installation. With squat switch control, the timer begins when lift off is sensed and pauses when landing is sensed.

COUNT UP TIMER: Controlled by **START/STOP** and **CLR** keys.

COUNT DOWN TIMER: Controlled by **START/STOP**, **CLR**, and **CRSR** keys. The initial Count Down time is entered with the **0 - 9** keys.

CONTRAST: This page is only displayed if manual contrast mode is selected in Configuration Mode. Contrast is controlled by the **8** and **9** keys.

DISPLAY: This page is only displayed if manual backlighting mode is selected in Configuration Mode. Backlighting is controlled by the **8** and **9** keys.

START/STOP - Starts and stops the Count Up and Count Down timers.

CRSR - Initiates entry of the starting time for the Count Down timer and cancels transponder code entry.

CLR - Resets the Count Up and Count Down timers and cancels the previous keypress during code selection.

8 - Reduces Contrast and Display Brightness when the respective pages are displayed. Also enters the number 8 into the Count Down timer.

9 - Increases Contrast and Display Brightness when the respective pages are displayed. Also enters the number 9 into the Count Down timer.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

Altitude Trend Indicator

When the "PRESSURE ALT" page is displayed, an arrow may be displayed to the right of the altitude, indicating that the altitude is increasing or decreasing. One of two sizes of arrows may be displayed depending on the rate of climb/descent. The sensitivity of these arrows is set using the GTX Configuration Mode.

Timer Operation

To operate the Flight Timer:

1. Press the FUNC key until "FLIGHT TIME" is displayed.
2. If the GTX 327 is configured as having a squat switch installed, the timer will begin counting automatically when the squat switch senses that the aircraft has become airborne.
3. If desired, you may press **START/STOP** to pause or restart the timer.
4. Press **CLR** to reset the timer to zero.
5. If the GTX 327 is configured as having a squat switch installed, the timer will pause automatically when the squat switch senses that the aircraft has touched down.

To operate the Count Up timer:

1. Press the FUNC key until "COUNT UP' is displayed.
2. If necessary, press **CLR** to reset the Count Up timer to zero.
3. Press **START/STOP** to count up.
4. Press **START/STOP** again to pause the timer.
5. Press **CLR** to reset the timer to zero.

To operate the Count Down timer:

1. Press the FUNC key until "COUNT DOWN" is displayed.
2. Press **CRSR** and use the **0 - 9** keys to set the initial time. All digits must be entered (use the 0 key to enter leading zeros).
3. Press **START/STOP** to count down.
4. Press **START/STOP** again to pause the timer.
5. When the Count Down timer expires, the words "COUNT DOWN' are replaced with "EXPIRED", and the time begins counting up and flashing.
6. Press **CLR** to reset the timer to the initial time value.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

Automatic ALT/STBY Mode Switching

If the GTX 327 is configured for automatic standby switching, the mode will automatically change to ALT when a squat switch senses that the aircraft has become airborne. Also, the mode will change to STBY automatically when a squat switch senses that the aircraft has touched down. Additionally, a delay time can be set in the Configuration Mode, causing the GTX 327 to wait a specified length of time after landing before automatically changing to STBY mode.

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PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 14
FOR
S-TEC SYSTEM 55X TWO AXIS
AUTOMATIC FLIGHT GUIDANCE SYSTEM

The FAA approved operational supplement for the S-TEC System 55X Autopilot, installed in accordance with STC SA8396SW-D, is required for operation of this system. S-TEC will be responsible to supply and revise the operational supplement. It is permitted to include the S-TEC supplement in this location of the Pilot's Operating Handbook unless otherwise stated by S-TEC. The information contained in the S-TEC supplement may supersede or supplement the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual with respect to the operation of the S-TEC System 55X Autopilot. For limitations, procedures and performance information not contained in the S-TEC supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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S-TEC CORPORATION
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FAA/DAS APPROVED
PILOT'S OPERATING HANDBOOK AND/OR
AIRPLANE FLIGHT MANUAL SUPPLEMENT
FOR
PIPER MODELS PA-32R-301 AND PA-32R-301T
WITH
S-TEC SYSTEM 55/55X TWO AXIS
AUTOMATIC FLIGHT GUIDANCE SYSTEM
WITH TRIM MONITOR
(28 VOLT SYSTEM)

REG. NO. N3101Q

SER. NO. 3246223

This Supplement must be attached to the applicable FAA Approved Airplane Flight Manual, Pilot's Operating Handbook, or Pilot's Operating Handbook and FAA Approved Airplane Flight Manual for aircraft modified by the installation of S-TEC System 55/55X Autopilot Model ST-536 installed in accordance with STC SA8396SW-D. The information contained herein supplements or supersedes the basic manual. For limitations, procedures and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and/or Airplane Flight Manual.

SECTION I

GENERAL

This manual is to acquaint the pilot with the features and functions of the System 55/55X Two Axis Autopilot and to provide operating instructions for the system when installed in the listed aircraft model(s). The aircraft must be operated within the limitations herein provided when the autopilot is in use.

FAA/DAS APPROVED ____________________
Walter F. Davis

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MINERAL WELLS, TEXAS 76067

FAA/DAS APPROVED
PILOT'S OPERATING HANDBOOK AND/OR
AIRPLANE FLIGHT MANUAL SUPPLEMENT
FOR
PIPER MODELS PA-32R-301 AND PA-32R-301T

LOG OF REVISIONS

REV NO.	PAGES AFFECTED	DESCRIPTION	APPROVED	DATE
1	5	Added a Note to Normal Operating Procedures regarding altitude hold capture.	W.F.D.	10-05-98
2	3, 4, 5	Changed Operating Limitation Item No. 6 and Altitude Loss Information. Changed supplement format.	W.F.D.	2-18-99
3	1, 3, 5, 10	Added System 55X information. Removed Optional Equipment section. Renumbered pages.	W.F.D.	12-05-00
4	2, 3, 9, 10	Correct documentation error in Operating Limitations, Section II.	WFD	3-18-02

SECTION II

OPERATING LIMITATIONS

1. S-TEC System 55 Pilot's Operating Handbook, P/N 8747, dated 10-16-00 or later revision, or S-TEC System 55X Pilot's Operating Handbook, P/N 87109, dated 11-08-00 or later revision, must be carried in the aircraft and be available to the pilot while in flight, as appropriate for your aircraft.
2. Autopilot operation prohibited above 180 KIAS.
3. Go around or missed approach prohibited during autopilot operation.
4. The autopilot must be disengaged from the aircraft controls for take-off and landing.
5. Flap limitations:
    a. For aircraft with <u>mechanical</u> <u>flap</u> system: maximum flap deflection is limited to 25° (two notches) with autopilot engaged.
    b. For aircraft with <u>electric</u> <u>flap</u> system: maximum flap deflection is limited to 10° (first notch) with autopilot engaged.
6. Category I operations only.
7. Autopilot use prohibited below 250' AGL during coupled approach operations.

SECTION III

EMERGENCY OPERATING PROCEDURES

In the event of an autopilot malfunction, or anytime the autopilot is not performing as expected or commanded, do not attempt to identify the system problem.

Immediately regain control of the aircraft by overpowering the autopilot as necessary and then immediately disconnect the autopilot. Do not re-engage the autopilot until the problem has been identified and corrected.

1. The autopilot may be disconnected by:
   a. Depressing the "AP Disconnect" Switch on the left horn of the pilot's control wheel.
   b. Placing the "AP Master Switch" in the "OFF" position.
   c. Momentarily interrupting aircraft electrical power at the battery master switch.
   d. Pulling the autopilot circuit breaker.

2. Trim:
   a. In the event of a trim failure, manually control aircraft and DEPRESS AND HOLD "Trim Interrupt/AP Disconnect Switch" on control wheel.
   b. Place trim master switch in "OFF" position, pull circuit breaker, release interrupt switch.
   c. Retrim aircraft. Leave trim system OFF until corrected.

3. Altitude loss during a malfunction and recovery:
   a. The following altitude losses and bank angles were recorded after a malfunction with a 3 second recovery delay:

Configuration	Bank Angle/Altitude Loss
Climb	55°/-100'
Cruise	60°/-320'
Descent	58°/-350'

b. The following altitude losses and bank angles were recorded after a malfunction with a 1 second recovery delay:

Configuration	Bank Angle/Altitude Loss
Maneuvering	20°/-80'
Approach (Coupled or Uncoupled)	23°/-100'

The above values are the worst case for all the models covered by this document.

SECTION IV

NORMAL OPERATING PROCEDURES

For detailed normal operating procedures, including system description, pre-flight and in flight procedures refer to S-TEC System 55 Pilot's Operating Handbook, P/N 8747, dated 10-16-00 or later revision, or S-TEC System 55X Pilot's Operating Handbook, P/N 87109, dated 11-08-00 or later revision as appropriate for your aircraft.

CAUTION: When S-TEC Flight Director is installed and operating, the Flight Director Autopilot should be disconnected using the control wheel disconnect switch only. Any other means of disconnect (breaker, ON-OFF switch, etc.) may leave steering bars in view, but inoperable.

NOTE: For smoother altitude captures, thus enhancing passenger comfort, engage altitude hold mode at rates of climb or descent of 1,000 FPM or less.

CONTROL WHEEL SWITCHES

The left grip of the pilot's control wheel will normally contain the following autopilot switches:

- Manual Electric Trim
- Trim Interrupt/A/P Disconnect Switch
- Control Wheel Steering (CWS)

If the optional co-pilot switch arrangement is installed, the same three switches with the same functions will be installed in the right grip of the co-pilot's control wheel.

ELECTRIC TRIM SYSTEM

The S-TEC Electric Trim System is designed to accept any single failure, either mechanical or electrical, without uncontrolled operation resulting during operations in the Manual Electric Trim Mode. During autotrim mode the system is designed to limit the effect of any failure causing trim operation. In order to assure proper operation of these safeguards, it is necessary to conduct a simple pre-flight test of the system. Following is a brief description and a pre-flight test procedure for the trim system.

TRIM SYSTEM WITH TRIM MONITOR

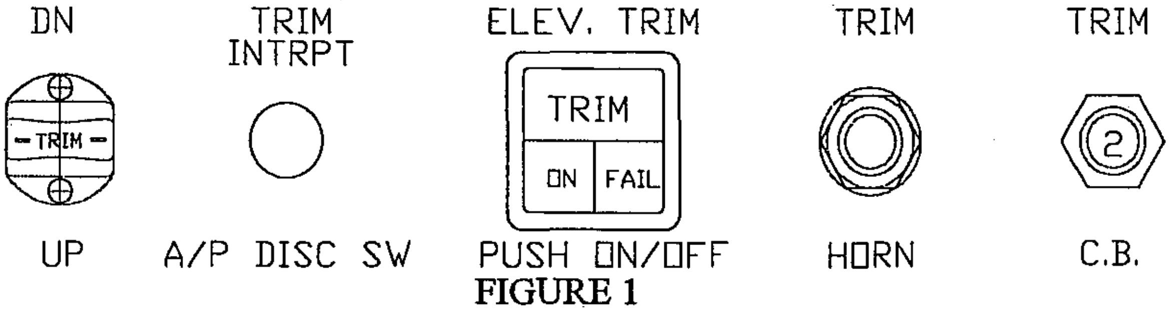

FIGURE 1

SYSTEM DESCRIPTION

The trim monitor system consists of the components pictured in Figure 1 and is designed to alert the pilot of a trim failure or trim in motion.

The system is activated by pushing the trim master switch on. A green On light, a yellow Trim light and a red Fail light will illuminate in the switch and the trim audio horn will activate for one second, as a test. A trim fault will cause the Trim and Fail lights to illuminate along with continuous horn operation. The pilot should press and hold the red Trim Interrupt button and conduct the emergency procedures listed in Section III of this AFMS.

PREFLIGHT TRIM CHECK (With Trim Monitor)

MANUAL ELECTRIC TRIM-Test Prior To Each Flight

1. Check trim circuit breaker – IN.
2. Trim master switch – Push ON - confirm green light ON after completion of test cycle.
3. A/P master switch – ON.
4. Operate trim switch (both knob sections) – NOSE DN. Check that trim moves nose down and yellow trim light in trim master switch flashes while trim is in motion. The trim "in motion" indicator in the autopilot programmer should flash "TRIM" also. Conduct the same test in the NOSE UP direction.
5. With trim operating up or down depress the red control wheel interrupt switch for three seconds minimum. Confirm that trim action stops while switch is pressed. This action should also trigger the trim monitor horn with "Trim" steady and "Fail" flashing in the trim master switch. Recycle the trim master switch to delete the horn.

6. Overpower check – With trim operating electrically, grasp the manual trim wheel and overpower the electric trim to stop trim motion.
7. Operate each half of the trim switch separately – Trim should not operate unless both switch knob segments are moved together.

AUTOTRIM

1. Position elevator control half way aft from full forward.
2. Engage HDG and ALT modes of autopilot.
3. Grasp control and slowly apply forward pressure (nose down). After approximately 3 seconds automatic trim should run NOSE UP. The yellow trim indicator in trim master switch should flash simultaneously with the trim indicator in the A/P programmer.
4. Conduct the same test by slowly applying aft pressure on the elevator control, confirming that auto trim runs NOSE DOWN and trim indicators flash while trim is in motion.
5. Move manual trim switch up or down – Autopilot should disconnect and trim should operate in the commanded direction. (Trim switch will disconnect A/P only when a pitch mode is engaged.)
6. Reengage autopilot HDG and ALT modes – Press trim interrupt/AP disconnect switch – Autopilot should disconnect.
7. Re-trim aircraft for take off – Check all controls for freedom of motion and determine that autopilot and trim have disconnected.

If either the manual electric or autotrim fails any portion of the above check procedure, push the Trim Master Switch "OFF" and do not attempt to use the trim system until the fault is corrected.

With the Trim Master Switch "OFF" the autopilot trim indicators will return to operation. If the electric trim system suffers a power failure in flight the system will automatically revert to the trim indicator lights located in the autopilot annunciator panel. If this occurs push the Trim Master Switch "OFF" and trim manually, using the indicators until the fault can be located and corrected.

GLIDE SLOPE FLIGHT PROCEDURE

Approach the glide slope intercept point (usually the OM) with the flaps set to approach deflection of up to 2 notches as desired (See Limitations Section), at 110 KIAS and with the aircraft stabilized in altitude hold mode. At the glide slope intercept, lower the landing gear and adjust power for the desired descent speed. For best tracking results make power adjustments in small, smooth increments to maintain desired airspeed. At the missed approach point or the decision height, disconnect the autopilot for landing or for the go-around maneuver (See Limitations Section). If a missed approach is required, the autopilot may be reengaged after the aircraft has been reconfigured for and established in a stabilized climb.

NOTE: The landing gear may be lowered at 132 KIAS to slow the aircraft to the flap speed of 110 KIAS. But in any case, the aircraft should be configured and stabilized in altitude hold mode before reaching glide slope intercept, for optimum results.

SECTION V

PERFORMANCE

No change.

SECTION VI

WEIGHT AND BALANCE

No change.

SECTION VII

DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

No change.

SECTION VIII

AIRPLANE HANDLING, SERVICING AND MAINTENANCE

No change.

SECTION IX

SUPPLEMENTS

Refer to contents of this Supplement for operation of System 55/55X Automatic Flight Control System.

SECTION X

OPERATING TIPS

No change.

PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 15 FOR S-TEC ADF-650A SYSTEM

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the S-TEC ADF-650A System is installed per the Equipment List. The information contained herein supplements or supersedes the 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 Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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DATE OF APPROVAL: January 9, 2001

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the S-TEC ADF-650A System is installed in accordance with FAA approved Piper data.

SECTION 2 - LIMITATIONS

No change.

SECTION 3 - EMERGENCY PROCEDURES

No change.

SECTION 4 - NORMAL PROCEDURES

To operate as an Automatic Direction Finder:

- OFF/VOL Control - ON
- Frequency Selector Knobs - SELECT desired frequency.
- ADF SPEAKER/PHONE Selector Switch (on audio control panel) - SELECT as desired.
- OFF/VOL Control - SET to desired volume level.
- ADF Mode Control - Select ADF mode and note relative bearing on display.

ADF Test (Pre-flight or In-flight):

- ADF Mode Control - Select ADF mode and note relative bearing on display.
- Press the TEST button and note the pointer moves to 90° from its prior position. Excessive pointer sluggishness, wavering or reversals indicate a signal that is too weak or a system malfunction.

To Operate BFO:

- OFF/VOL Control - ON
- Frequency Selector Knobs - SELECT desired frequency.
- ADF SPEAKER/PHONE Selector Switch (on audio control panel) - SELECT as desired.
- ADF Mode Control - Select BFO mode.
- OFF/VOL Control - Set to desired volume level.

SECTION 5 - PERFORMANCE

No change.

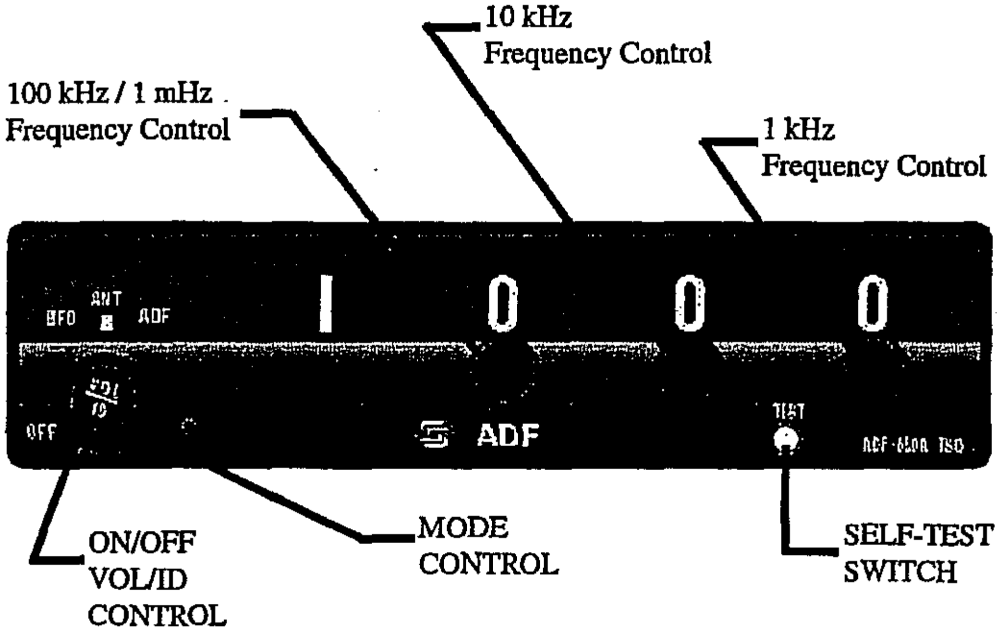
SECTION 6 - WEIGHT AND BALANCE

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

SECTION 7 - DESCRIPTION AND OPERATION

The S-TEC ADF-650A System operates over a frequency range of 200 through 1799 kHz in 1-kHz increments. Three operating modes are included as part of the ADF-650 System.

- BFO
- ANT
- ADF



ADF-650A Receiver, Controls, and Indicators
Figure 1

BFO Mode

The BFO (beat frequency oscillator) and ADF (automatic direction finding) modes are navigation modes that result in pointing operation when in-range station is selected. The ADF mode is used with conventional nondirectional beacons and AM broadcast stations. The BFO mode is used to aurally identify stations that employ keyed cw rather than amplitude modulation techniques.

NOTE

CW signals (Morse Code) are unmodulated and no audio will be heard without use of BFO. This type of signal is not used in the United States air navigation. It is used in some foreign countries and marine beacons.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

ANT (Antenna) Mode

The ANT (antenna) mode cannot be used for navigation; this mode enhances audio reception clarity and is normally used for station identification.

ADF Mode

Automatic Direction Finder (ADF) mode is used for navigation. This mode activates the bearing pointer. The bearing pointer will point in the direction of the station relative to the aircraft heading.

Frequency Selector Controls

Three controls are used to select the system operating frequency. The right hand control selects 1 - kHz increments, the center control 10 - kHz increments, and the left hand control 100 - kHz increments.

Self Test Switch

Pressing and holding the spring loaded self test switch while in the ADF mode will cause the bearing pointer to rotate 90 degrees from its prior position if the ADF-650 system is operating properly. When the test switch is released, the bearing pointer should promptly return to its starting point. At this time, normal operation is restored.

ON/OFF/VOL/ID Control

This control performs three independent functions. In full ccw position, no power is applied to the system; rotating the control cw applies power and continued rotation increases volume. Pulling the knob out enhances the Morse code station identifier when background noise is present; push the knob to hear voice transmissions. A good operating practice is to pull the knob out for station identification purposes and then push it back in after positive identification has been made.

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PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 16
FOR
GARMIN GMA 340 AUDIO PANEL

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Garmin GMA 340 is installed per the 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 Christina L. Marsh

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DATE OF APPROVAL January 9, 2001

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the Garmin GMA 340 audio panel is installed in accordance with FAA approved Piper data.

SECTION 2 - LIMITATIONS

No change.

SECTION 3 - EMERGENCY PROCEDURES

No change.

SECTION 4 - NORMAL PROCEDURES

AUDIO CONTROL SYSTEM OPERATION:

- Select the desired transmitter audio selector button (COM1, COM2, OR COM3) and verify that the buttons LED is illuminated.
- INTERCOM VOL Control (ICS) - Adjust to desired listening level.
- INTERCOM VOX (voice) Sensitivity Control - ROTATE CONTROL knob clockwise to the middle range and then adjust as required for desired voice activation or hot mic intercom.
- If desired, select the speaker function button. Selecting this button allows radio transmissions to be received over the cabin speaker.

NOTE

Audio level is controlled by the selected NAV radio volume control.

MARKER BEACON RECEIVER OPERATION:

- TEST Button - PRESS to verify all marker lights are operational.
- SENS Button - SELECT HI for airway flying for LO for ILS/LOC approaches.

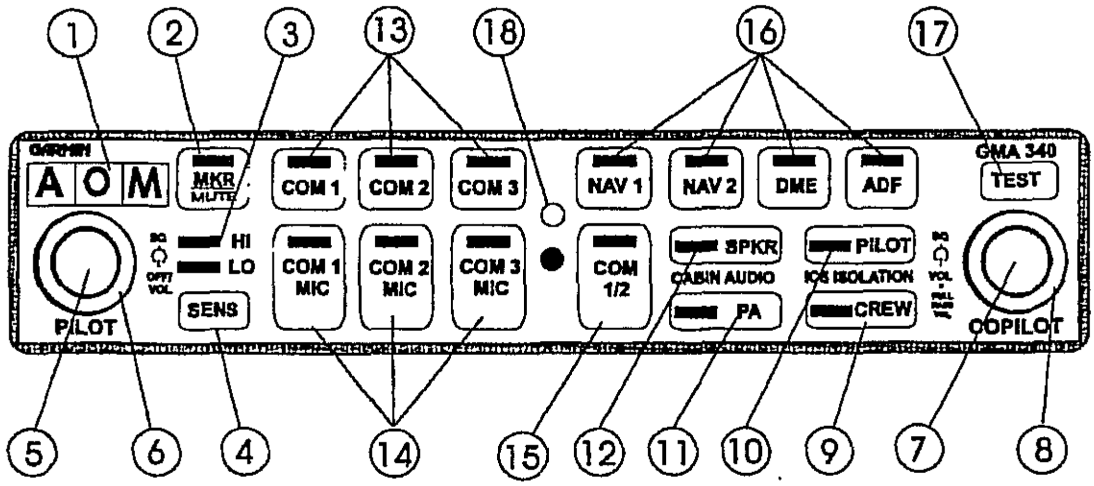
SECTION 5 - PERFORMANCE

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 Airplane Flight Manual.

SECTION 7 - DESCRIPTION AND OPERATION



1. Marker Beacon Lamps
2. Marker Beacon Receiver Audio Select/Mute Button
3. Marker Beacon Receiver Sensitivity Selection Indicator LED
4. Marker Beacon Receiver Sensitivity Selection Button
5. Unit On/Off, Pilot Intercom System (ICS) Volume
6. Pilot ICS Voice Activated (VOX) Intercom Squelch Level
7. Copilot and Passenger ICS Volume Control (Pull out for Passenger Volume)
8. Copilot/Passenger VOX Intercom Squelch Level
9. Crew Isolation Intercom Mode Button
10. Pilot Isolation Intercom Mode Button
11. Passenger Address (PA) Function Button
12. Speaker Function Button
13. Transceiver Audio Selector Buttons (COM1, COM2, COM3)
14. Transmitter (Audio/Mic) Selection Buttons
15. Split COM Button
16. Aircraft Radio Audio Selection Buttons (NAV1, NAV2, DME, ADF)
17. Annunciator Test Button
18. Photocell - Automatic Annunciator Dimming

SECTION 7 - DESCRIPTION AND OPERATION (continued)

ON/OFF, Pilot Intercom System (ICS) Volume Control

The GMA 340 is powered OFF when the left small knob (5) is rotated fully CCW into the detent. To turn the unit ON, rotate the knob clockwise past the click. The knob then functions as the pilot ICS volume control. A fail safe circuit connects the pilot's headset and microphone directly to COM1 in case power is interrupted or the unit is turned OFF.

Transceivers

Selection of either COM1, COM2, or COM3 for both MIC and audio source is accomplished by pressing either COM1, MIC, COM2 MIC, COM3 MIC (14). The activeCOM audio is always heard on the headphones.

Additionally, each audio source can be selected independently by pressing COM1, COM2, or COM3 (13). When selected this way, they remain active as audio sources regardless of which transceiver has been selected for microphone use.

When a microphone is keyed, the active transceiver's MIC button LED blinks approximately one per second to indicate that the radio is transmitting.

NOTE

Audio level is controlled by the selected COM radio volume controls.

Split COM

Pressing the COM 1/2 button (15) activates the split COM function. When this mode is active, COM1 is dedicated solely to the pilot for MIC/Audio while COM2 is dedicated to the copilot for MIC/Audio. The pilot and copilot can simultaneously transmit in this mode over separate radios. Both pilots can still listen to COM3, NAV1, NAV2, DME, ADF, and MRK as selected. The split COM mode is cancelled by pressing the COM 1/2 button a second time.

When in the split COM mode the copilot may make PA announcements while the pilot continues using COM1 independently. When the PA button is pressed after the split com mode is activated the copilot's mic is output over the cabin speaker when keyed. A second press of the PA button returns the copilot to normal split COM operation.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

Aircraft Radios and Navigation

Pressing NAV1, NAV2, DME, ADF (16) or MRK (2) selects each audio source. A second button press deselects the audio.

Speaker Output

Pressing the SPKR button (12) selects the aircraft radios over the cabin speaker. The speaker output is muted when a COM microphone is keyed.

PA Function

The PA mode is activated by pressing the PA button (11). Then, when either the pilot's or copilot's microphone is keyed, the corresponding mic audio is heard over the cabin speaker. If the SKR button is also active, then any selected speaker audio is muted while the microphone is keyed. The SPKR button does not have to be previously active in order to use the PA function.

Intercom System (ICS)

Intercom volume and squelch (VOX) are adjusted using the following front panel knobs:

- **Left Small Knob** - Unit ON/OFF power control and pilot's ICS volume. Full CCW detent position is OFF.
- **Left Large Knob** - Pilot ICS mic VOX squelch level. CW rotation increases the amount of mic audio (VOX level) required to break squelch. Full CCW is the "HOT MIC" position (no squelch).
- **Right Small Knob** - IN position: Copilot ICS volume. OUT position: Passenger ICS volume.
- **Right Large Knob** - Copilot and passenger mic VOX squelch level. CW rotation increases the amount of mic audio (VOX level) required to break squelch. Full CCW is the "HOT MIC" position.
- **PILOT Mode** - This mode isolates the pilot from everyone else and dedicates the aircraft radios to the pilot exclusively. The copilot and passengers share communications between themselves but cannot communicate with the pilot or hear the aircraft radios.
- **CREW Mode** - This mode places the pilot and copilot on a common ICS communication channel with the aircraft radios. The passengers are on their own intercom channel and can communicate with each other, but cannot communicate with the crew or hear the aircraft radios.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

Marker Beacon Receiver

The GMA 340's marker beacon receiver controls are located on the left side of the front panel (1 - 4). The SENS button selects either high or low sensitivity as indicated by the HI or LO LED being lit. Low sensitivity is used on ILS approaches while high sensitivity allows operation over airway markers or to get an earlier indication of nearing the outer marker during an approach.

The marker audio is initially selected by pressing the MKR/Mute button (2). If no beacon signal is received, then a second button press will deselect the marker audio. This operation is similar to selecting any other audio source on the GMA 340. However, if the second button press occurs while a marker beacon signal is received, then the marker audio is muted but not deselected. The buttons LED will remain lit to indicate that the source is still selected. When the current marker signal is no longer received, the audio is automatically un-muted. While in the muted state, pressing the MKR/Mute button deselects the marker audio. The button's LED will extinguish to indicate that the marker audio is no longer selected.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 17
FOR
S-TEC DME-450

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the S-TEC DME-450 is installed per the Equipment List. The information contained herein supplements or supersedes the 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 Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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DATE OF APPROVAL: January 9, 2001

SECTION 1 - GENERAL

The S-TEC DME-450 system is a full feature, solid state, remote mounted system with full 200 channel capability. For long distance operation, it provides a full 100 watts maximum pulse power transmitter output.

The IND-450 indicator (see figure 1) provides selectable read-out of distance to/from the station, ground speed, and time to/from the station. Features also include automatic display dimming and waypoint annunciation.

SECTION 2 - LIMITATIONS

No change.

SECTION 3 - EMERGENCY PROCEDURES

No change.

SECTION 4 - NORMAL PROCEDURES

DME OPERATION

- DME Mode Selector Switch - Set to DME 1 or DME 2
- NAV 1 and NAV 2 VHF Navigation Receivers - ON; SET FREQUENCY to VOR/DME station frequencies, as required.

NOTE

When the VOR frequency is selected, the appropriate DME Frequency is automatically channeled.

- DME audio selector button (on audio selector panel) - SET to desired mode.

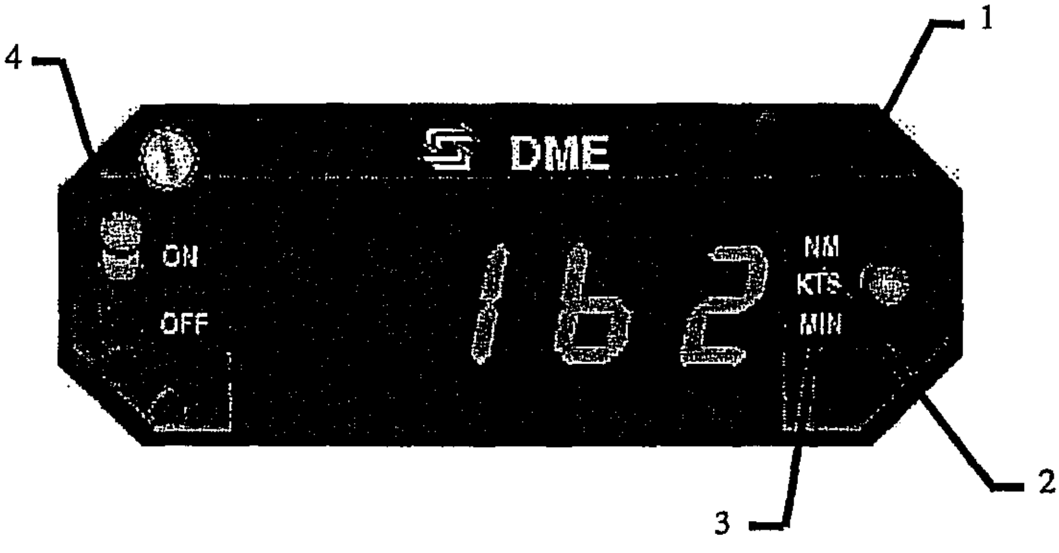
SECTION 5 - PERFORMANCE

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 Pilot's Operating Handbook and Airplane Flight Manual.

SECTION 7 - DESCRIPTION AND OPERATION



IND-450
Figure 1

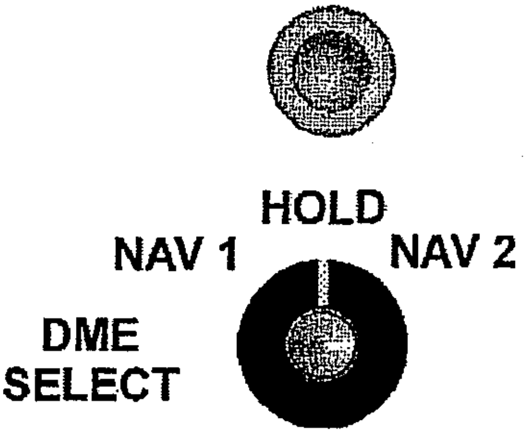
1. DISTANCE DISPLAY (NM) - DME distance to VORTAC/WAYPOINT displayed in .1 nautical mile increments up to 99.9 NM, then in increments of one nautical mile.

2. GROUND SPEED DISPLAY (KTS) - Displays ground speed in knots to or from VORTAC/WAYPOINT up to 999 knots (aircraft must be flying directly to or from the VORTAC/WAYPOINT for true ground speed indication.

3. TIME TO STATION DISPLAY (MIN) - Displays time to station (VORTAC/WAYPOINT) in minutes up to 99 minutes (aircraft must be flying directly to or from the VORTAC/WAYPOINT for true time to the station indication.

7 - DESCRIPTION AND OPERATION (continued)

4. DME ON/OFF SWITCH - Turns DME power on or off.



Mode Selector Switch
Figure 2

5. DME MODE SELECTOR SWITCH (NAV 1, HOLD, NAV 2) - Selects DME operating mode as follows:

NAV 1 - Selects DME operation with NO. 1 VHF navigation set; enables channel selection by NAV 1 frequency selector controls.

HOLD - Selects DME memory circuit; DME remains channeled to station to which it was last channeled when HOLD was selected and will continue to display information relative to this channel. Allows both the NAV 1 and NAV 2 navigation receivers to be set to new operational frequencies without affecting the previously selected DME operation.

NOTE

In the HOLD mode there is no annunciation of the VOR/DME station frequency. However, an annunciator light located above the HOLD position of the selector illuminates to inform the pilot that the DME is in the HOLD mode.

NAV 2 - Selects DME operation with NO. 2 VHF navigation set; enables channel selection by NAV 2 frequency selector controls.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 18
FOR
GARMIN GTX 330 TRANSPONDER

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Garmin GTX 330 Transponder is installed per the Equipment List. The information contained herein supplements or supersedes the 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 Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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DATE OF APPROVAL: December 10, 2003

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the Garmin GTX 330 Transponder is installed in accordance with FAA approved Piper data.

SECTION 2 - LIMITATIONS

A. Display of TIS traffic information is advisory only and does not relieve the pilot responsibility to "see and avoid" other aircraft. Aircraft maneuvers shall not be predicated on the TIS displayed information.

B. Display of TIS traffic information does not constitute a TCAS I or TCAS II collision avoidance system as required by 14 CFR Part 121 or Part 135.

C. Title 14 of the Code of Federal Regulations (14 CFR) states that "When an Air Traffic Control (ATC) clearance has been obtained, no pilot-in-command (PIC) may deviate from that clearance, except in an emergency, unless he obtains an amended clearance." Traffic information provided by the TIS uplink does not relieve the PIC of this responsibility.

D. The 400/500 Series Garmin Display Interfaces (Pilot's Guide Addendum) P/N 190-00140-13 Rev. A or later revision must be accessible to the flight crew during flight.

E. 400/500 Series Main Software 4.00 or later FAA approved software is required to operate the TIS interface and provide TIS functionality.

SECTION 3 - EMERGENCY PROCEDURES

To transmit an emergency signal:

- Mode Selection Key - ALT
- Code Selection - SELECT 7700

To transmit a signal representing loss of all communications:

- Mode Selection Key - ALT
- Code Selection - SELECT 7600

SECTION 4 - NORMAL PROCEDURES

BEFORE TAKEOFF:

- To transmit Mode C (Altitude Reporting) code in flight:

- Mode Selection Key - ALT
- Code Selector Keys - SELECT assigned code.

To transmit Mode A (Aircraft Identification) code in flight:

- Mode Selector Key - ON
- Code Selector Keys - SELECT assigned code.

NOTE

During normal operation with the ON mode selected, the reply indicator "R" flashes, indicating transponder replies to interrogations.

NOTE

Mode A reply codes are transmitted in ALT also; however, Mode C codes only are suppressed when the Function Selector ON key is selected.

1. DETAILED TRANSPONDER OPERATING PROCEDURES

   Normal transponder operating procedures are described in the GARMIN GTX 330 Pilot's Guide, P/N 190-00207-00, Rev. A, or later appropriate revision.

2. DISPLAY OF TRAFFIC INFORMATION SERVICE (TIS) DATA

   TIS surveillance data uplinked by Air Traffic Control (ATC) radar through the GTX 330 Mode S Transponder will appear on the interfaced display device (Garmin 400 or 500 series products). For detailed operating instructions and information regarding the TIS interface, refer to the 400/500 Series Garmin Display Interfaces (Pilot's Guide Addendum) P/N 190-00140-13 Rev. A or later appropriate 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 section 6 of the Airplane Flight Manual.

SECTION 7 - DESCRIPTION AND OPERATION

See the 400/500 Series Garmin Display Interfaces (Pilot's Guide Addendum), P/N 190-00140-13, and GTX 330 Pilot's Guide, P/N 190-00207-00, for a complete description of the GTX 330 system.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 19
FOR
AVIDYNE FLIGHTMAX ENTEGRA
PRIMARY FLIGHT/MULTI-FUNCTION DISPLAYS

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the optional Avidyne FlightMax Entegra Primary Flight and Multi-Function Displays are installed per the Equipment List. 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 Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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DATE OF APPROVAL: March 5, 2004

SECTION 1 - GENERAL

This airplane is equipped with the Avidyne FlightMax Entegra EXP5000 series 700-00006-0XX-( ) Primary Flight Display with 530-00138-000 software and EX5000 series 700-00004-0XX-( ) Multi-Function Display with 530-00137-000 software, herein referred to as the "PFD" and "MFD". The PFD is intended to be the primary display of primary flight and essential engine parameter information to the pilot. The PFD is capable of interfacing with a pair of Garmin GNS 430/530's, and an S-TEC System 55X autopilot.

Figure 1 depicts the Avidyne FlightMax Entegra Series 700-00006-0XX-( ) Primary Flight Display.

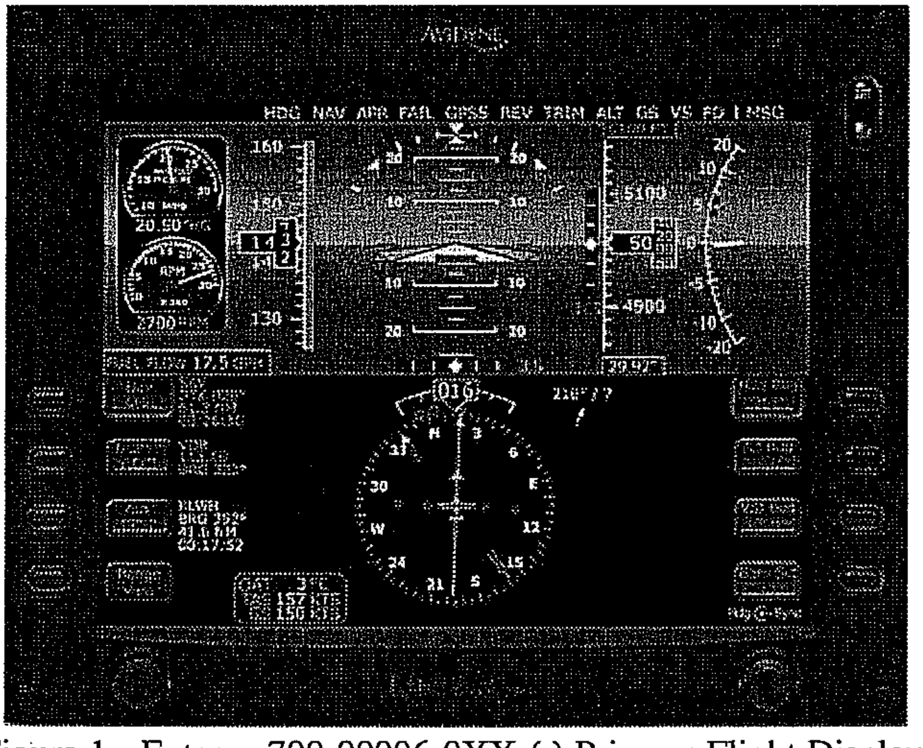

Figure 1 - Entegra 700-00006-0XX-( ) Primary Flight Display

The PFD provides the display of the following aircraft parameters:

- Artificial Horizon
- Airspeed Indication
- Altimeter
- Vertical Speed Indication
- Rate of Turn Indicator
- Skid/Slip Indicator
- Horizontal Situation Indication
- RMI
- Course Deviation Indication
- Outside Air Temperature
- Engine RPM
- Manifold Pressure
- Fuel Flow
- Oil Pressure
- Autopilot Annunciation

SECTION 1 - GENERAL (continued)

The MFD is intended to be a supplemental display of situational and navigation information to the pilot. Its primary function is to provide a moving map display to the pilot for increased situational awareness. The MFD is capable of accepting data from a variety of GPS sensors, the BFG WX-500 Stormscope passive thunderstorm detection unit, Engine Sensor Unit, and either the L3 Skywatch Traffic Advisory System (TAS), Bendix/King TAS, or the Ryan Traffic and Collision Alert Device (TCAD) system. The unit is organized around logical groupings of information presented on "Pages".

Figure 2 depicts the Entegra EX5000 series 700-00004-0XX-( ).

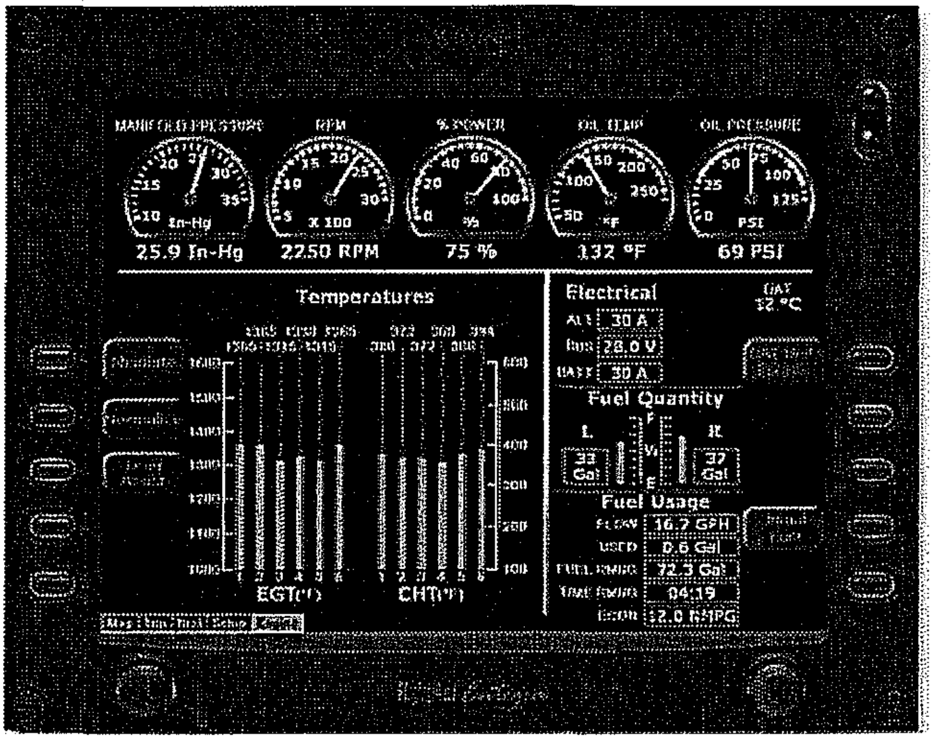

Figure 2 - EX5000 series 700-00004-0XX-( ) Multi-Function Display

The MFD provides the display of the following aircraft parameters:

- Manifold Pressure
- Engine RPM
- Percent Power
- Engine Oil Temperature
- Engine Oil Pressure
- EGT
- Cylinder Head Temperature
- Aircraft Electrical Status
- Outside Air Temperature
- Fuel Quantity
- Fuel Usage Data

SECTION 2 - LIMITATIONS

A. PFD Limitations

1. IFR flight is prohibited when the PFD or any standby instrument is inoperative (altimeter, airspeed indicator, artificial horizon, or whiskey compass).
2. IFR flight is prohibited upon aircraft total loss of essential engine parameter display (manifold pressure, tachometer, fuel flow).
3. The Avidyne FlightMax Entegra series Primary Flight Display Pilot's Guide, p/n 600-00104-000 revision 00 or appropriate later revision, or p/n 600-00143-000 revision 01 (EXP 5000 R6) or appropriate later revision, must be available to the pilot during all flight operations.
4. If a VLOC is displayed on the HSI and GPSS mode is engaged on the autopilot, the autopilot will track the active flight plan in the GPS corresponding to the selected VLOC (i.e. GPS1 for VLOC1 or GPS2 for VLOC2). This configuration is potentially confusing and must be avoided.
5. GPSS mode must not be used on the final approach segment of a VLOC approach (ILS, LOC or non-GPS-overlay VOR). GPSS mode must be deselected (i.e., NAV mode selected) prior to the turn onto the final approach course.

NOTE

The PFD integrates with separately approved sensor and flight control installations. Adherence to limitations in appropriate installation AFM supplements is mandatory.

B. MFD Limitations

1. The Avidyne moving map display provides visual advisory of the airplane's GPS position against a moving map. This information supplements CDI course deviation and information presented on the GPS navigator. The moving map display must not be used as the primary navigation instrument.
2. Use of Map page during IFR flight requires an IFR approved GPS receiver and installation, operated in accordance with its applicable limitations.
3. The Avidyne FlightMax EX-series Pilot's Guide, p/n 600-00105-000 revision 00 or appropriate later revision, must be available to the pilot during all flight operations.

SECTION 2 - LIMITATIONS (continued)

B. MFD Limitations (continued)

4. Aircraft dispatch is prohibited when the MFD is inoperative.
5. Selecting "Lightning Display OFF" for the Lightning overlay of the Map page will prevent current heading values from being sent to the WX500 sensor from the EX5000.

   When "Lightning Display OFF" is selected the EX5000 will stop sending current heading values to the WX500. When this selection is made, the WX500 will still use the last heading value that was present before this selection even though the actual aircraft heading may have changed since that selection was made.

   Consequently, the Stormscope heading information provided to the Garmin 430 by the EX5000 will not be updated, resulting in an inaccurate lightning depiction on the Garmin 430. This issue does not affect the lightning display on the EX5000.

   To avoid this invalid condition, **disable the WX500 on the GNS430**. For instructions on how to accomplish this, refer to the Garmin 400 Series Installation Manual, p/n 190-00140-02, latest revision (reference Section 5.1 Configuration Mode Operations, Section 5.2 Installation Configuration pages, and Section 5.2.2 Main RS232 Configuration page).

CAUTION

Traffic information shown on the Map page display is provided to the pilot as an aid to visually acquiring traffic. Pilot's should maneuver their aircraft based only on ATC guidance or positive visual acquisition of the conflicting traffic. Maneuvers should be consistent with ATC instructions. No maneuvers should be based only on a Traffic Advisory.

Terrain information shown on the Map page display is provided to the pilot as an aid to situational awareness. The Map page terrain color representations should not be used as a basis for terrain avoidance.

NOTE

The MFD integrates with separately approved sensor and flight control installations. Adherence to limitations in appropriate installation AFM supplements is mandatory.

SECTION 2 - LIMITATIONS (continued)

C. CMAX CHART PAGE Limitations

The geographic referenced aircraft symbol must not be used for navigation.

NOTE

The aircraft symbol displayed provides supplemental aircraft situational awareness information. It is not intended as a means for navigation or flight guidance. The airplane symbol is not to be used for conducting instrument approaches or departures. Position accuracy, orientation, and related guidance must be assumed by other means or required navigation.

Operators with the optional CMax Chart Page must have back-up charts available. Do not rely upon CMax charts as your sole source of navigation information.

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SECTION 3 - EMERGENCY PROCEDURES

Failure of Pilot's Electronic Attitude Direction Display Screen (PFD)

Indication: PFD Display goes blank.

Standby Attitude Gyro ....VERIFY ON and flag is pulled on gyro

Maintain attitude control using standby gyro and establish the aircraft in straight and level unaccelerated flight.

If time and conditions permit:

PFD Brightness Control (BRT/DIM) ....Run to full bright
PFD Circuit Breaker ....PULL and RESET

If PFD Screen cannot be reinstated:

On aircraft equipped with the optional second Nav Indicator (OBS):
Mechanical Nav Indicator (OBS)..........................Utilize for primary navigation
Engine Instruments...Refer to Engine page of MFD

NOTE

The Mechanical Nav Indicator (OBS) receives nav information directly from the No. 2 nav/com/GPS. Only VLOC information is available.

Maintain attitude, airspeed and heading control using standby instruments, magnetic compass and other directional indications (such as MFD, MAP/NAV page).

CAUTION

High current loads in the vicinity of the magnetic compass can influence its accuracy. Depending on the flight conditions, the pilot must reduce these loads as much as possible to insure accuracy. Tests have shown that air conditioner and pitot heat contribute to significant heading errors of the magnetic compass. These items should be turned OFF prior to comparing magnetic compass headings.

Land as soon as practical.

SECTION 3 - EMERGENCY PROCEDURES (continued)

Loss of PFD Engine Data

Indication: Indicator needle removed from dial and digital readout replaced with white dashes.

Engine Instruments .... Refer to Engine page of MFD

Land as soon as practical.

Invalid Air Data

Indication: Airspeed, Altimeter, and Vertical Speed data replaced with Red X's.

Maintain aircraft airspeed and altitude by referring to the standby airspeed and altimeter.

If time and conditions permit:

PFD Circuit Breaker .... PULL and RESET

If air data is still invalid:

Refer to standby airspeed indicator and altimeter.

Land as soon as practical.

Invalid Heading Data

Indication: Heading Bug and Heading Data removed and replaced with Red X's.

If time and conditions permit:

PFD Circuit Breaker .... PULL and RESET

Maintain heading control using magnetic compass and other directional indications (such as MFD, MAP/NAV page).

CAUTION

High current loads in the vicinity of the magnetic compass can influence its accuracy. Depending on the flight conditions, the pilot must reduce these loads as much as possible to insure accuracy. Tests have shown that air conditioner and pitot heat contribute to significant heading errors of the magnetic compass. These items should be turned OFF prior to comparing magnetic compass headings.

Land as soon as practical.

SECTION 3 - EMERGENCY PROCEDURES (continued)

Invalid Attitude and Heading Data

Indication: Attitude and Heading Data removed and replaced with Red X's.

Standby Attitude Gyro ....VERIFY ON and flag is pulled on gyro.

Maintain attitude control using standby gyro.

If time and conditions permit:

PFD Circuit Breaker..PULL and RESET

If attitude and heading data is still invalid:

Maintain attitude control by using standby gyro.

Maintain heading control by utilizing magnetic compass and other directional indications (such as MFD, MAP/NAV page).

CAUTION

High current loads in the vicinity of the magnetic compass can influence its accuracy. Depending on the flight conditions, the pilot must reduce these loads as much as possible to insure accuracy. Tests have shown that air conditioner and pitot heat contribute to significant heading errors of the magnetic compass. These items should be turned OFF prior to comparing magnetic compass headings.

Land as soon as practical.

SECTION 3 - EMERGENCY PROCEDURES (continued)

Failure of Attitude, Airspeed and Heading Reference System (ADAHRS)

Indication: Airspeed, Attitude, Heading and Altitude replaced with Red X's.

Standby Attitude Gyro ....VERIFY ON and flag is pulled on gyro

Maintain attitude control using standby gyro.

If time and conditions permit:

PFD Circuit Breaker ....PULL and RESET

If ADAHRS initialization does not occur:

On aircraft equipped with the optional second Nav Indicator (OBS):
Mechanical Nav Indicator (OBS)..........................Utilize for primary navigation
Engine Instruments...Refer to Engine page of MFD

NOTE

The Mechanical Nav Indicator (OBS) receives nav information directly from the No. 2 nav/com/GPS. Only VLOC information is available.

Maintain attitude, airspeed and heading control using standby instruments, magnetic compass and other directional indications (such as MFD, MAP/NAV page).

CAUTION

High current loads in the vicinity of the magnetic compass can influence its accuracy. Depending on the flight conditions, the pilot must reduce these loads as much as possible to insure accuracy. Tests have shown that air conditioner and pitot heat contribute to significant heading errors of the magnetic compass. These items should be turned OFF prior to comparing magnetic compass headings.

Land as soon as practical.

SECTION 3 - EMERGENCY PROCEDURES (continued)

Cross Check Monitor

Indication: Yellow Crosscheck Attitude Annunciator on PFD.

Establish aircraft in straight and level unaccelerated flight.

Aircraft Attitude ....Crosscheck aircraft attitude with standby attitude gyro

Total Loss of Engine Instruments

Indication: Indicator needle removed from dial and digital readout replaced with white dashes.

DAU Circuit Breaker ....PULL and RESET

If engine data is still invalid:

NOTE

The following engine messages will be displayed on the MFD if an exceedance is detected:

- Check Oil Temp
- Check Oil Press
- Check CHT
- Check RPM
- Check Manifold Pressure

If failure occurs during takeoff:

Mixture ....Maintain full rich
Propeller Control ....Full Forward
Manifold Pressure ....As required

Return to airport for landing.

If failure occurs during climb or landing:

Mixture ....Maintain full rich
Propeller Control ....Full Forward
Manifold Pressure ....As required

Land as soon as practical.

If failure occurs after setting cruise power and mixture:

Power ....Maintain power setting

Land as soon as practical.

If failure occurs prior to or during descent:

Manifold Pressure ....Set for descent
Mixture ....Full rich

SECTION 3 - EMERGENCY PROCEDURES (continued)

Alternator Failure

Indication: Alternator Inop annunciator light illuminated and zero current displayed on MFD alternator indication source.

NOTE

Anytime the bus voltage is below 25 Vdc, the Low Bus Voltage annunciator will be illuminated.

Verify Failure .... Check ammeter

If ammeter shows zero:

ALTR switch .... OFF

Reduce electrical load to minimum:

ALTNR FIELD C/B .... CHECK and RESET as required

ALTR Switch .... ON

WARNING

Compass error may exceed 10 degrees with alternator inoperative.

CAUTION

Any power interruption will result in loss of attitude information from the PFD until the unit can be reinstated on the ground.

NOTE

Consider using the autopilot to reduce workload. Using the GPSS mode can assist in maintaining a flight-planned route.

NOTE

LO BUS VOLTAGE annunciator will be illuminated. Anticipate complete electrical failure. Duration of battery power available will be dependent on electrical load and battery condition prior to 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. The flaps will also be inoperative and a flaps up landing will be required.

SECTION 3 - EMERGENCY PROCEDURES (continued)

Alternator Failure (continued)

If power is not restored:

ALTR Switch .... OFF

Reduce electrical loads by switching OFF or pulling circuit breakers for all non-essential equipment to include the following:

- Reduce PFD and MFD brightness as part of overall electrical system management
- Pitot heat (unless required)
- Airconditioner and ventilation fan (if installed)
- Landing light (use sparingly)
- Strobe lights
- Recognition lights (if equipped)
- Cabin/flood lights
- No. 2 nav/com/GPS
- Autopilot
- Electric trim
- DME (unless required for published approach)
- Stormscope (if equipped)
- Skywatch (if equipped)

Land as soon as practical.

SECTION 3 - EMERGENCY PROCEDURES (continued)

Complete Electrical Failure

Standby Attitude Gyro ....SELECT Standby (STBY) power button

CAUTION

The STBY PWR annunciator will rapidly flash for approximately one minute when aircraft power is lost. STBY PWR must be selected, otherwise the gyro will auto shutdown after approximately one minute.

Standby Attitude Gyro ....VERIFY ON and flag is pulled on gyro

Maintain aircraft control with reference to the standby airspeed, altimeter, and attitude gyro indicators.

Battery Switch ....OFF
Ground Clearance Switch (if installed) ....ON

Land as soon as possible.

WARNING

Compass error may exceed 10 degrees with alternator inoperative.

NOTE

Turning ON the ground clearance switch will activate the No. 1 nav/com/GPS radio.

NOTE

If the battery is depleted, the landing gear must be lowered using the emergency extension procedure. The gear position lights will be inoperative. The flaps will also be inoperative and a flaps up landing will be required.

SECTION 3 - EMERGENCY PROCEDURES (continued)

Fire in Flight

Electrical Fire

Fire .... Extinguish
Standby Attitude Gyro .... VERIFY ON and flag is pulled on gyro

Maintain aircraft control with reference to the standby airspeed, altimeter, and attitude gyro indicators.

Battery Master Switch .... OFF
ALTR Switch .... OFF
Ground Clearance Switch (if installed) .... ON

NOTE

Turning ON the ground clearance switch will activate the No. 1 nav/com/GPS radio.

Vents .... OPEN
Cabin Heat .... OFF

Land as soon as practical.

WARNING

Compass error may exceed 10 degrees with alternator inoperative.

NOTE

If the battery is depleted, the landing gear must be lowered using the emergency extension procedure. The gear position lights will be inoperative. The flaps will also be inoperative and a flaps up landing will be required.

SECTION 3 - EMERGENCY PROCEDURES (continued)

Aircraft Engine Power Loss

During an engine failure the pilot may elect to attempt an engine restart. During this time large voltage drops may cause the PFD to lose power and reinitialize. During this initialization process the PFD may not be able to complete a fast alignment during flight and therefore the pilot may have to obtain aircraft attitude and aircraft control using the standby instruments.

- Refer to the Emergency Section of the Pilot's Operating Handbook.
- If the PFD is able to perform fast alignment, when prompted by the PFD:
  - Maintain straight and level flight

    OR

  - If engine does not restart, maintain wings level and appropriate aircraft speed.
- Press the fast erect button.
- If the PFD was not able to perform fast alignment, maintain aircraft control with reference to the standby instruments for aircraft attitude information.

CAUTION

In case of engine failure, minimize the use of the starter and turn off all non-essential electrical equipment to preserve battery capacity.

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 fuel flow indication while the electric 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.

SECTION 3 - EMERGENCY PROCEDURES (continued)

Loss of Heading Accuracy

Indication:

- Difficulty maintaining course while using VOR or GPS.
- Excessive difference between heading and track required maintaining a VOR or GPS course.
- ATC indicates the aircraft is on a wrong heading.
- Excessive deviation between PFD heading and Whiskey Compass. (>10° after compass deviation applied.)

If heading systems differ by more than 10° (after compass deviation applied):

- Use Whiskey Compass for primary heading reference.

CAUTION

High current loads in the vicinity of the Whiskey Compass can influence its accuracy. Depending on the flight conditions, the pilot must reduce these loads as much as possible to insure accuracy. Tests have shown that air conditioner and pitot heat contribute to significant heading errors of the Whiskey Compass. These items should be turned OFF prior to comparing the Whiskey Compass to the PDF heading.

SECTION 4 - NORMAL PROCEDURES

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

Passengers .... BOARD
Door .... CLOSE and LATCH
Seats .... ADJUSTED and LOCKED in position
Seat Belts and Harnesses .... FASTEN/ADJUST
Brakes .... SET
Circuit Breakers .... Check IN
Alternate Air .... OFF
Propeller .... Full INCREASE rpm
Fuel Selector .... Desired tank

SECTION 4 - NORMAL PROCEDURES (continued)

Normal Start - Cold Engine

Throttle .... ½ inch open
Battery Master Switch .... ON
Primary Flight Display (PFD) .... Verify correct aircraft model software
Alternator Switch .... ON
Electric Fuel Pump .... ON
Magneto Switches .... ON
Mixture .... Prime - then idle cut-off
Propeller .... CLEAR
Starter .... ENGAGE
Mixture .... Full RICH
Throttle .... ADJUST
Oil Pressure .... CHECK

Normal Start - Hot Engine

Throttle .... ½ inch open
Battery Master Switch .... ON
Primary Flight Display (PFD) .... Verify correct aircraft model software
Alternator Switch .... ON
Electric Fuel Pump .... ON
Magneto Switches .... ON
Mixture .... Idle cut-off
Propeller .... CLEAR
Starter .... ENGAGE
Mixture .... ADVANCE
Throttle .... ADJUST
Oil Pressure .... CHECK

SECTION 4 - NORMAL PROCEDURES (continued)

Engine Start When Flooded

Throttle .... Open full
Battery Master Switch .... ON
Primary Flight Display (PFD) .... Verify correct aircraft model software
Alternator Switch .... ON
Electric Fuel Pump .... OFF
Magneto Switches .... ON
Mixture .... Idle cut-off
Propeller .... CLEAR
Starter .... ENGAGE
Mixture .... Full rich
Throttle .... RETARD
Oil Pressure .... CHECK

SECTION 4 - NORMAL PROCEDURES (continued)

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 reduced to the level of the ship's battery. This can be tested by turning on 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 external power, the battery master and alternator switches should be OFF.

Battery Master Switch .... OFF
Alternator Switch .... OFF
Magneto Switches .... ON
All Electrical Equipment .... OFF
External Power Plug .... Insert in fuselage
Proceed with normal start checklist
Throttle .... Lowest possible RPM
External Power Plug .... Disconnect from fuselage
Battery Master Switch .... ON
Alternator Switch .... ON - check ammeter
Oil Pressure .... CHECK

SECTION 5 - PERFORMANCE

No change from basic Handbook.

SECTION 6 - WEIGHT AND BALANCE

No change from basic Handbook.

SECTION 7 - DESCRIPTION AND OPERATION

A. PFD Systems Description

NOTE

This supplement provides a general description of the Avidyne FlightMax Entegra Series 700-00006-0XX-( ) PFD, its operation, and aircraft systems interfaces. For a detailed description of PFD operation, refer to the Avidyne FlightMax Entegra Series Primary Flight Display Pilot's Guide, p/n 600-00104-000 revision 00 or later.

The Entegra PFD start-up is automatic once power is applied. The display presents the Initialization Display immediately after power is applied. Power-on default is 75% brightness. Typical alignment times are 3 minutes once power is applied.

Attitude Direction Indicator (ADI)

Air Data

The airspeed tape to the left of the main ADI begins indicating at 20 Knots Indicated Airspeed (IAS) and is color coded in accordance with the model POH airspeeds for V_{SO}, V_{FE}, V_S, V_{NO}, and V_{NE}. An altitude tape is provided to the right of the main ADI and also displays a symbol for the Altitude Preselect (Altitude Bug). The Vertical Speed Indicator (VSI) is displayed to the right of the altitude tape. For vertical speed rates greater than the PFD displayed VSI scale, the indicator needle will peg just outside the scale and a digital readout of actual VSI up to 4000 FPM is then displayed. An additional data block is provided for display of Outside Air Temperature (OAT), True Airspeed (TAS), and Ground Speed (GS). Controls for selecting bug and barometric correction values are along the right side of the PFD. A wind indicator is also provided beneath the altitude tape.

Attitude Data

Attitude is depicted on the main ADI using a combination of an aircraft reference symbol ("flying-delta") against a background of labeled pitch ladders for pitch and a bank angle pointer in the form of an arced scale along the top of the main ADI for bank. A skid/slip indicator is attached to the bottom edge of the bank angle pointer.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

A. PFD Systems Description (continued)

Horizontal Situation Indicator (HSI)

Heading Data

Magnetic heading is represented in a boxed digital form at the top of the compass rose. Heading rate (Rate of Turn Indicator) takes the form of a blue arcing arrow that begins behind the magnetic heading indicator and moves left or right accordingly. Graduations are provided on the rate of turn indicator scale to indicate ½ and full standard rate turns. A heading bug is also provided on the compass rose.

Navigation Data

Navigation data on the PFD takes several forms. A Course Deviation Indicator (CDI) is always provided on the HSI and a bearing pointer can be optionally selected for display on the HSI by the pilot. Controls for selecting the source of navigation data, selecting the display format of the navigation data, and for selecting the type of compass rose and moving map to be displayed are along the left side of the PFD. The active flight plan contained in the GPS Nav/Comm unit selected as the primary navigation source (Nav) can be optionally selected for display on the HSI as well as the desired range of the optionally selectable moving map display. If a localizer or ILS frequency is tuned and captured in the GPS Nav/Comm selected as the Nav source, a Vertical Deviation Indicator (VDI) and Horizontal Deviation Indicator (HDI) are automatically displayed on the ADI.

NOTE

In the event glide slope or localizer signals are lost, the HDI and/or VDI will be displayed as red X's to indicate loss of signal. The red X'd indicator will only be removed if the signal is regained. In this case, the PFD Nav source will set to GPS, or if the GPS Nav/Comm is retuned, to another frequency. Appropriate action must be taken by the pilot if on an approach.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

A. PFD Systems Description (continued)

Autopilot Integration

The Entegra PFD is fully integrated with the S-TEC System 55X Autopilot. Reference bugs for Heading, Altitude, and Vertical Speed are provided on the PFD to control the autopilot and aid pilot situational awareness. These bugs are displayed with solid or hollow symbology depending on the autopilot status. If the autopilot is engaged in that mode, the bug is solid to indicate the autopilot is coupled to that bug. A hollow bug indicates the autopilot is not engaged in that mode.

Autopilot mode annunciations are shown on the S-TEC System 55X computer.

When included as part of the installation, autopilot mode annunciations including autopilot ready and fail indications are provided at the top of the PFD screen.

When included as part of the installation, flight director command bars on the PFD attitude indicator can be enabled by the pilot. When the flight director is enabled and the autopilot is engaged in both lateral and vertical modes, the flight director displays the goals of the autopilot.

A lateral autopilot mode must be engaged on the S-TEC System 55X before a vertical mode can be engaged.

The flight director command bars will only be displayed on the PFD when enabled by the pilot and when both lateral and vertical autopilot modes are engaged.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

A. PFD Systems Description (continued)

Autopilot Integration (continued)

The following autopilot modes are supported by the PFD:

1. HDG (Heading, using the heading bug)
2. NAV (Nav, using the course pointer and course deviation indicator)
3. GPSS (GPS Steering, using GPS course guidance)
4. APR (Approach, using the HDI and VDI, including automatic glide slope capture)
5. REV (Reverse sensing HDI approach)
6. ALT (Altitude Hold and Preselect, using the altitude bug)
7. VS (Vertical Speed, using the vertical speed bug)

NOTE

When HDG mode is engaged, rotation of the heading bug greater than 180° will result in a reversal of turn direction.

CAUTION

If a VLOC is selected in NAV on the PFD and GPSS mode is engaged on the autopilot, the autopilot will track the active flight plan in GPS1 if VLOC1 is selected or GPS2 if VLOC2 is selected and not track VLOC1 or VLOC2 as the selected source in NAV on the PFD. Therefore, the course deviation on the PFD CDI and the course deviation flown by the autopilot can be different. This situation may be confusing and should be avoided.

Engine Instruments

The Entegra PFD provides a display of Engine Tachometer (RPM), Manifold Pressure (MAP), Oil Pressure (OP), and Fuel Flow (FF) in the upper left hand corner of the display. Tach and MAP indications are presented on analog scales with normal operating (green) and warning (red) markings, as appropriate. A digital indication presents fuel flow information in gallons per hour (GPH). A digital indication presents oil pressure information in pounds per square inch (PSI).

SECTION 7 - DESCRIPTION AND OPERATION (continued)

A. PFD Systems Description (continued)

Back-up Instruments

The Entegra PFD system installation includes redundant means of display of certain aircraft flight and systems parameters. Back-up Altimeter, Airspeed and Attitude instruments are provided to facilitate pilot cross-checking of PFD display flight parameters. The aircraft wet compass serves as a back-up heading source.

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SECTION 7 - DESCRIPTION AND OPERATION (continued)

B. MFD Systems Description

NOTE

This supplement provides a general description of the Avidyne EX5000 Series 700-00004-0XX-( ) MFD, its operation and aircraft interface. For a detailed description of the MFD, refer to the Avidyne FlightMax EX5000 Series Pilot's Guide and Reference, p/n 600-00105-000 revision 00 or later.

Navigation

Data associated with the moving map is found on four pages: Map, Nearest, Trip, and Info pages. The MFD contains a Jeppesen NavData database that is available for display on the Map page. In conjunction with GPS-supplied position information, an own-ship symbol is superimposed on the moving map and positioned relative to the NavData information. GPS can also supply the active flight plan for display on the moving map. Terrain data is provided by a USGS terrain database stored within the MFD and updated only on an as needed basis.

The Jeppesen Navigation Database provides data on airports, approaches, VOR's, NDB's, intersections, airspace definitions, and frequencies. North American and international databases are available. Database information can be updated via the USB port on the front face of the bezel.

The navigation data on the moving map display are based on databases that are updated periodically. Database updates are available on 28-day cycle subscriptions. Expired databases are clearly stated to the pilot via messages during system startup and on the System Setup page. The warning can only be removed by updating the data.

NOAA man-made obstruction database information provides data on man-made obstacles over 200 feet AGL. This data is only available for North America and can be updated via the USB port on the front face of the bezel.

The obstacle data on the moving map display are based on databases that are updated periodically. Database updates are available from Avidyne on 56-day cycle subscriptions. Expired databases are clearly stated to the pilot via messages during system startup and on the System Setup page. The warning can only be removed by updating the data.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

B. MFD Systems Description (continued)

Navigation (continued)

Using the Jeppesen NavData data and the GPS-supplied present position, the MFD can provide the pilot with the nearest 25 airports or navaids, depending on pilot selection, within 100 nm. This information is presented on the Nearest page.

More detailed information on a particular airport is also generated from the Jeppesen NavData data and is available for pilot viewing on the Info page.

Flight plan data supplied by the GPS system provide the pilot with a tabular form of the remaining legs in the active GPS flight plan. This information is viewed on the Trip page and includes a CDI for added enroute navigation aiding.

Flight plan data is transmitted to the MFD from an external GPS navigator. Some installations do not support depictions of curved flight paths. In these cases, curved flight path segments will be depicted as straight lines. The GPS navigator and HSI are to be used during approach procedures. Reference the Avidyne FlightMax EX5000 Series Pilot's Guide, p/n 600-00105-000, for more information.

Datalink

Datalink information is received by the MFD based upon installation provisions and a subscription service available through Avidyne (www.myavidyne.com). Data is presented on the Map, Trip, and Nearest pages. Datalink information is provided for strategic planning purposes only. Data aging and transport considerations make it unsuitable for tactical use. Reference the Avidyne FlightMax EX5000 Series Pilot's Guide, p/n 600-00105-000, for more information.

Setup

The various System Setup pages allow the pilot to set user preferences for system operation. In addition to listing the software version identification information and database validity dates, the System Setup page allows access to several pages for preference selection and provides a means to initiate self-tests of the traffic and lightning sensors.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

B. MFD Systems Description (continued)

Setup (continued)

Airport Settings page provides selections for displaying airport type, runway surface type and minimum runway lengths on the moving map. **Declutter Settings** page allows the pilot to select settings for defining the base map detail when changing display range. **System Time** page provides an opportunity to select system time zone and Map page menu timeout options. **DataBlock Edit** page allows the pilot to select the data to be displayed in the datablock windows on the Map page. **Datalink Setup** page allows the pilot to select parameters for the datalink system, including update rate and range of weather data request.

Engine Instruments

The Engine page provides the pilot with engine parameters depicted on simulated gauges and electrical system parameters located in dedicated regions within the MFD display. An Engine Sensor Unit interfaces with engine-mounted sensors and provides data to the MFD for display.

A leaning function assists the pilot in leaning the engine for best power or best fuel economy. To initiate the leaning function, press the Lean Assist bezel key and proceed to lean the engine fuel mixture. Best economy is achieved when the engine is operating at peak EGT of the leanest cylinder (first cylinder to peak), as recommended by the engine manufacturer. Best power is achieved when the engine is leaned to the first cylinder to reach its EGT peak. When leaning is complete, select Absolute or Normalize to complete the leaning process. A digital readout of EGT change from the peak value is provided for reference. If at any point during the lean assist a CHT exceeds 435°F, the lean assist will be exited and the pilot referred to the Piper Pilot's Operating Handbook. Reference the Avidyne FlightMax EX5000 series Pilot's Guide, p/n 600-00105-000, for more information.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 20
FOR
MID-CONTINENT 4300-4XX SERIES
ELECTRIC ATTITUDE INDICATOR

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the optional Mid-Continent 4300-4XX Series Electric Attitude Indicator is installed per the Equipment List. 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 Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED: ALBERT J. MILL
DOA-510620-CE
THE NEW PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA

DATE OF APPROVAL: March 5, 2004

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional Mid-Continent model 4300-XXX Electric Attitude Indicator is installed in accordance with FAA Approved Piper data. For additional information refer to the Mid-Continent Instruments Pilot's Guide, manual number 9015834, revision NR, or later revision.

SECTION 2 - LIMITATIONS

1. The emergency battery must be checked for proper operation prior to flight.
2. Should the RED TEST annunciator illuminate any time during the self test, this is an indication that the battery pack is in need of charging, or possible replacement. Flight in Instrument Meteorological Conditions (IMC) is prohibited.
3. Internal battery should be used for emergency use only.

SECTION 3 - EMERGENCY PROCEDURES

Loss of Aircraft Electrical System

Standby (STBY) Power Button ....SELECT

CAUTION

The STBY PWR annunciator will rapidly flash for approximately one minute when aircraft power is lost. STBY PWR must be selected, otherwise the gyro will auto shutdown after approximately one minute.

Maintain attitude control using standby gyro.

SECTION 4 - NORMAL PROCEDURES

Preflight Check

1. Apply aircraft power and allow the gyro to spin up for approximately 2 minutes.
2. Press and hold the STBY PWR button.
3. Verify that after several seconds the amber LED has started to flash. This indicates that the unit has latched into the Battery Test Mode. At this time the STBY PWR button can be released.
4. Verify that a green annunciator is illuminated under the word TEST.
5. Visually monitor the test lights until the amber LED stops flashing, signaling the end of the test.

NOTE

A green annunciator throughout the test indicates the standby battery is sufficiently charged and should be able to function under normal operation. The presence of a red annunciator at any time during the test is an indication the standby battery is in need of charging, or possibly replacement.

NOTE

The Standby Attitude Indicator will operate for approximately one hour with the internal battery, depending on battery condition at the time of power failure.

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 Airplane Flight Manual.

SECTION 7 - DESCRIPTION AND OPERATION

The Model 4300-4XX Electric Attitude Indicator incorporates a moving display that simulates the earth's horizon and provides the pilot with a real time visual indication of the aircraft pitch and roll attitude relative to the indicator symbolic airplane.

The 4300-4XX Electric Attitude Indicator offers the feature of a self-contained standby power source.

Anytime aircraft power is absent, selecting the STBY PWR button will put the unit into the standby power mode.

A warning circuit monitors the electrical voltage used to power the gyro. When the indicator is turned "OFF", or after the internal battery is discharged, the gyro warning flag comes into view.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 21
FOR
TKS ICE PROTECTION SYSTEM
(NON-FIKI INSTALLATION)

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the optional TKS Ice Protection System (Non-FIKI Installation) is installed per the Equipment List. 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 Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED:
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DATE OF APPROVAL: June 7, 2005

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the TKS Ice Protection System is installed in accordance with FAA approved Piper data.

WARNING

This system is not approved for Flight Into Known Icing (FIKI) conditions.

WARNING

No determination has been made as to the capability of this system to remove or prevent ice accumulation.

CAUTION

If ice accretions are permitted to form with the ice protection system off, the surface fluid anti-ice system may not remove significant accumulations of ice. The system must be turned on immediately upon detecting ice.

NOTE

During examination of this document, the pilot is advised to identify the ice protection controls.

SECTION 2 - LIMITATIONS

There is no change to the basic airplane limitations when the TKS Ice Protection System is installed.

INTENTIONAL FLIGHT INTO KNOWN ICING IS PROHIBITED

Ice Protection Fluid

CAUTION

Under no circumstances are fluids other than those listed below to be used in the TKS system. Some fluids currently used for ground de-icing purposes contain thickening agents which may block the porous panels. If it is known or suspected that such a fluid has been placed in the tank, do not operate the system.

Ice protection fluid must meet one of the following specifications:

a. TKS 80
b. AL-5 (DTD 406B)
c. TKS R328

Fluids conforming to these specifications may be mixed in the aircraft tank in any proportions.

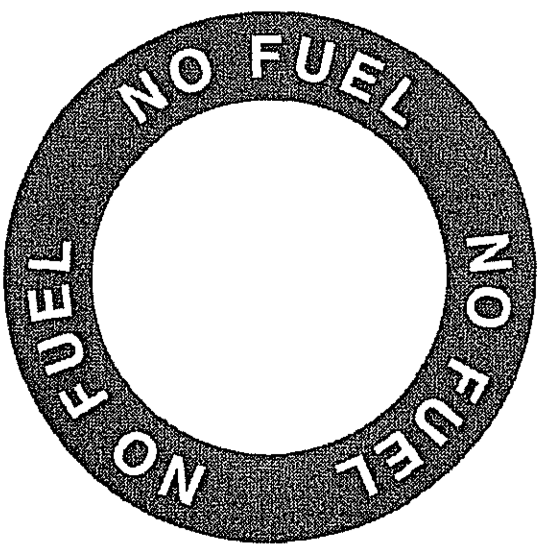
SECTION 2 - LIMITATIONS (continued)

Placards

Placard specifying fluid to be attached adjacent to the de-icing fluid tank filler cap:

T.K.S. ICE PROTECTION TANK
USE ONLY THE FOLLOWING FLUIDS
TKS 80; AL-5(DTD 406B); TKS R328

Fuel caution placard to be attached around the TKS fluid tank filler:



Placard to be fitted adjacent to porous panels:

T.K.S. ICE PROTECTION
CAUTION
POROUS DE-ICING PANELS MAY
BE DAMAGED BY CERTAIN SOLVENTS.
REFER TO SECTION 8 OF
T.K.S. SUPPLEMENT TO
PILOT'S OPERATING HANDBOOK

SECTION 2 - LIMITATIONS (continued)

Placards (continued)

Placard prohibiting flight into known icing conditions fitted on the upper control panel in front of the pilot:

FLIGHT INTO KNOWN ICING CONDITIONS
IS PROHIBITED

SECTION 3 - EMERGENCY PROCEDURES

In Flight

If unexpected icing conditions are encountered, the following procedure is recommended:

Exit the icing condition.

If exiting the icing condition is not possible, then proceed with the following:

a. Normal (NORM) Mode

Pilot workload and loss of aircraft performance due to icing are both minimized if the ice protection equipment is operated continuously during unexpected icing encounters. For this mode of operation, select the NORM position on the airframe/propeller switch when icing conditions are encountered. Select OFF when the icing conditions cease.

b. Maximum (MAX) Mode

Economy of fluid usage may be achieved by using the NORM position of the airframe/propeller switch. To remove ice which has been accreted, select the MAX position on the airframe/propeller switch until accreted ice is cleared, then select OFF or NORM, as required.

CAUTION

If ice accretions are permitted to form with the ice protection system off, the surface fluid anti-ice system may not remove significant accumulations of ice. The system must be turned on immediately upon detecting ice.

CAUTION

Aircraft stall speed and performance will change with ice accumulation on the unprotected surfaces of the aircraft. Simulated ice accumulations have produced stall speed increases of 5 knots for all configurations, a loss of 15 - 20 knots cruise speed, and a loss of 100 feet per minute of climb performance.

Stall warning indications should not be relied upon during or following icing conditions, as operation of the wing mounted sensors is likely to be impaired.

SECTION 3 - EMERGENCY PROCEDURES (continued)

In Flight (continued)

Exit the icing condition (continued).

NOTE

Loss of flow to the airframe and propeller may occur due to air entering the pump in turbulent conditions with low tank contents.

NOTE

In the event of loss of flow to the airframe and propeller with NORM selected, normal flow may be restored by selecting MAX. This procedure will not be effective if the failure is due to the de-icing pump motor or due to failure of the electrical supply to the pump.

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SECTION 3 - EMERGENCY PROCEDURES (continued)

Inadvertent Icing Encounter

CAUTION

Flight into known icing conditions is prohibited.

If icing is inadvertently encountered:

NOTE

Accumulation of fluid mist from the propeller may obstruct vision through the windshield.

NOTE

Loss of flow to the airframe and propeller may occur due to air entering the pump in turbulent conditions with low tank contents.

Pitot Heat....................ON
Windshield Defrost....................ON
Alternate Air....................OPEN

Immediately exit icing conditions.

TKS System....................Select NORM

NOTE

If ice has already been accreted, select the MAX position until accreted ice is clear, then select NORM.

NOTE

Loss of flow to the airframe and propeller may occur due to air entering the pump in turbulent conditions with low tank contents.

NOTE

In the event of loss of flow to the airframe and propeller with NORM selected, normal flow may be restored by selecting MAX. This procedure will not be effective if the failure is due to the de-icing pump motor or due to failure of the electrical supply to the pump.

SECTION 3 - EMERGENCY PROCEDURES (continued)

Descent / Landing

Select system as required.

NOTE

Accumulation of fluid mist from the propeller may obstruct vision through the windshield.

Final Approach

If icing conditions have been encountered or are anticipated:

Maximum Flap Deflection ....Approach setting or less recommended when aircraft has encountered icing conditions

Landing Distance (Approach Flaps) ....Increase full flap landing distance by 20%

Airspeed (Approach Flaps) ....Full flap approach speed +4 KIAS

CAUTION

The amount of the performance and stall degradation due to ice accumulation cannot be accurately predicted. The pilot must use extreme caution during approach and landing, being alert to the first signs of pre-stall buffet and an impending stall.

SECTION 4 - NORMAL PROCEDURES

Preflight Inspection

Battery Switch .... ON
Fluid Quantity Indicator .... Check quantity (See Limitations for weight and balance)
TKS System .... MAX
Airframe Inspection
  Fluid Tank .... Check quantity - Check cap secure
  Porous Panels .... Check condition and security - Check evidence of fluid from all panels and propeller
TKS System .... OFF

In Flight

FLIGHT INTO KNOWN ICING CONDITIONS IS PROHIBITED.

Descent/Landing

Select system as required.

After Landing

TKS System .... OFF

SECTION 5 - PERFORMANCE

No change from the basic airplane, with the exception of a possible 35 FPM decrease in Balked Landing Climb Performance with TKS panels installed.

SECTION 6 - WEIGHT AND BALANCE

The fluid density is 9.2 pounds per U. S. gallon.

There are no changes in the weight and balance limits with the system fitted.

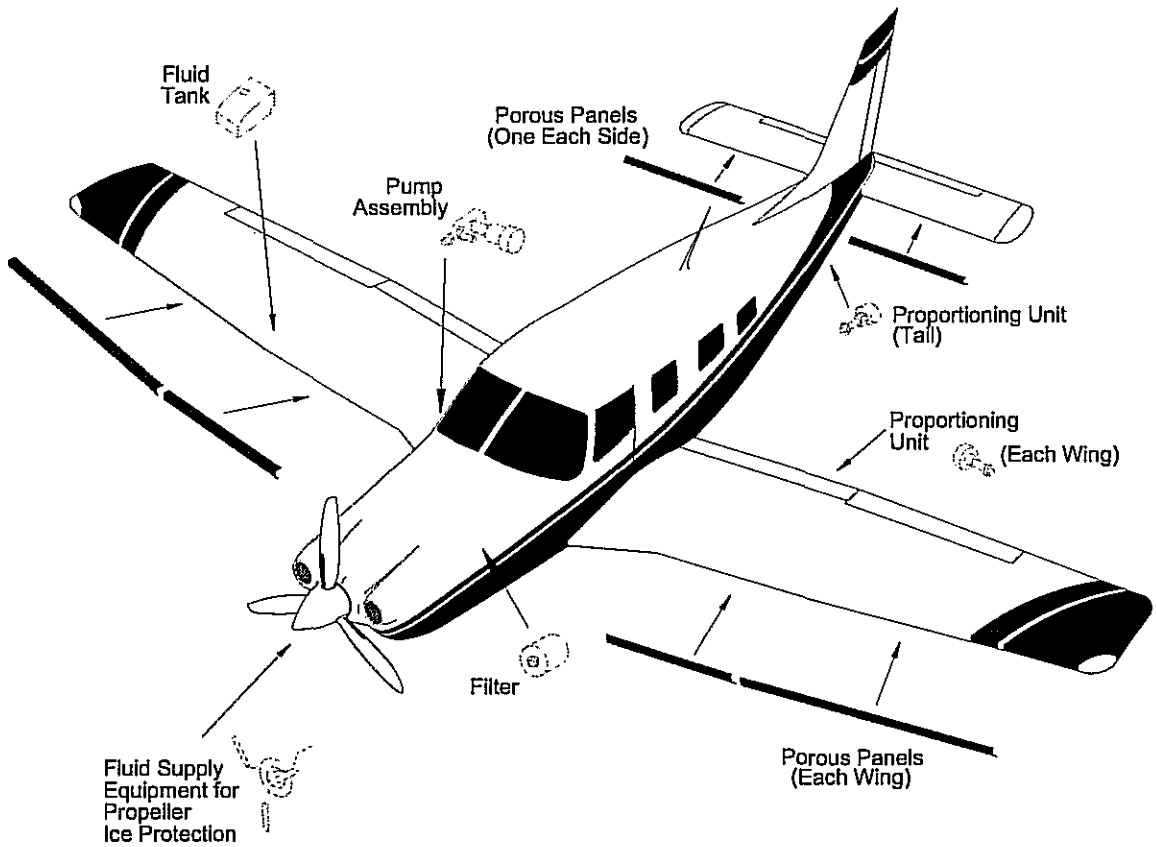
The contents indicator provides an estimate of the quantity of fluid on board. For the purposes of weight and balance, determine the true weight of fluid from the table below.

Gauge Reading	Volume (gal)	Weight (lb)	Arm (in)	Moment (in-lb)
1/4	1.125	10.4	91.4	946
1/2	2.25	20.7	91.4	1892
3/4	3.325	31.1	91.4	2838
F	4.25	39.1	91.4	3574

Ice Protection Fluid Weight and Balance
(aircraft in level attitude on ground)
Table 1

SECTION 7 - DESCRIPTION AND OPERATION

Ice protection with a TKS system is achieved by mounting laser drilled titanium panels to the leading edges of the wings and horizontal stabilizer. The propeller is protected with a fluid slinger ring.

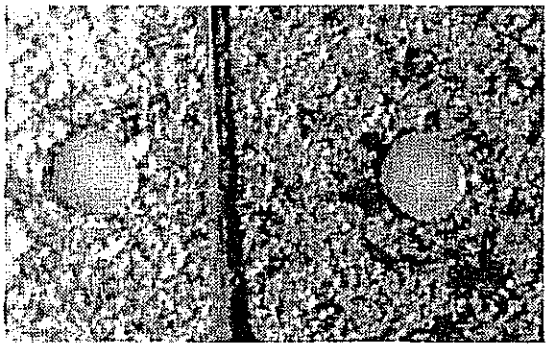


PA-32 General Location of TKS Equipment
Figure 7-1

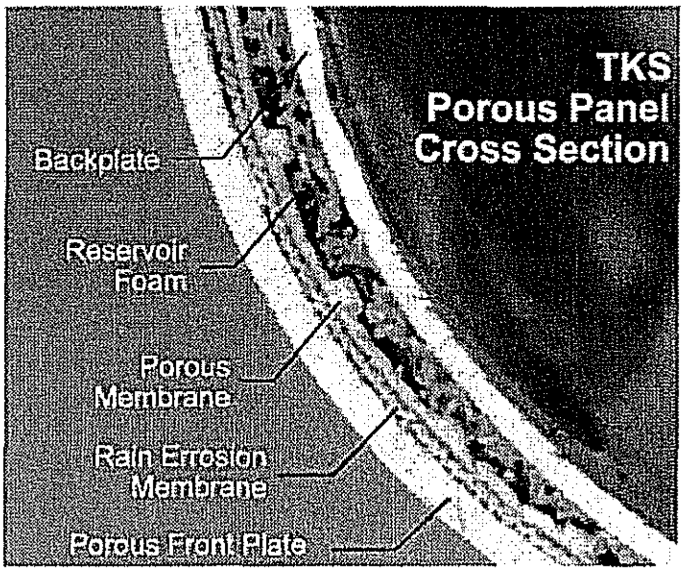
The outer skin of the ice protection panels are manufactured with 0.9 mm thick titanium. Titanium provides excellent strength, durability, light weight, and corrosion resistance. The panel skin is perforated by laser drilling holes, 0.0025 inches in diameter, 800 per square inch. The porous area of the titanium panels is designed for fluid coverage from best rate of climb speed to maximum operational speed.

The back plate of a typical panel is manufactured titanium. It is formed to create a reservoir for the ice protection fluid, allowing fluid supply to the entire porous area. A porous membrane between the outer skin and the reservoir assure even flow and distribution through the entire porous area of the panel.

SECTION 7 - DESCRIPTION AND OPERATION (continued)



Magnified View of Holes Laser Drilled Through Titanium
Figure 7-2



TKS Porous Panel Cross Section
Figure 7-3

SECTION 7 - DESCRIPTION AND OPERATION (continued)

The porous panels are bonded to the leading edges of the protected surfaces with a two-part adhesive. Porous panels cover a majority of the leading edges of the wings. Likewise, the horizontal stabilizer is completely protected with porous panels.

Fluid is supplied to the panels and propeller by a positive displacement, constant volume metering pump. The two-speed pump provides two flow rates to the panels and propeller. The low speed (NORM) supplies fluid for anti-icing during a typical icing condition. Economy of fluid usage may be achieved by using the NORM position of the airframe/propeller switch. The high speed (MAX) doubles the flow rate for removing accumulated ice or providing ice protection for more severe conditions.

NOTE

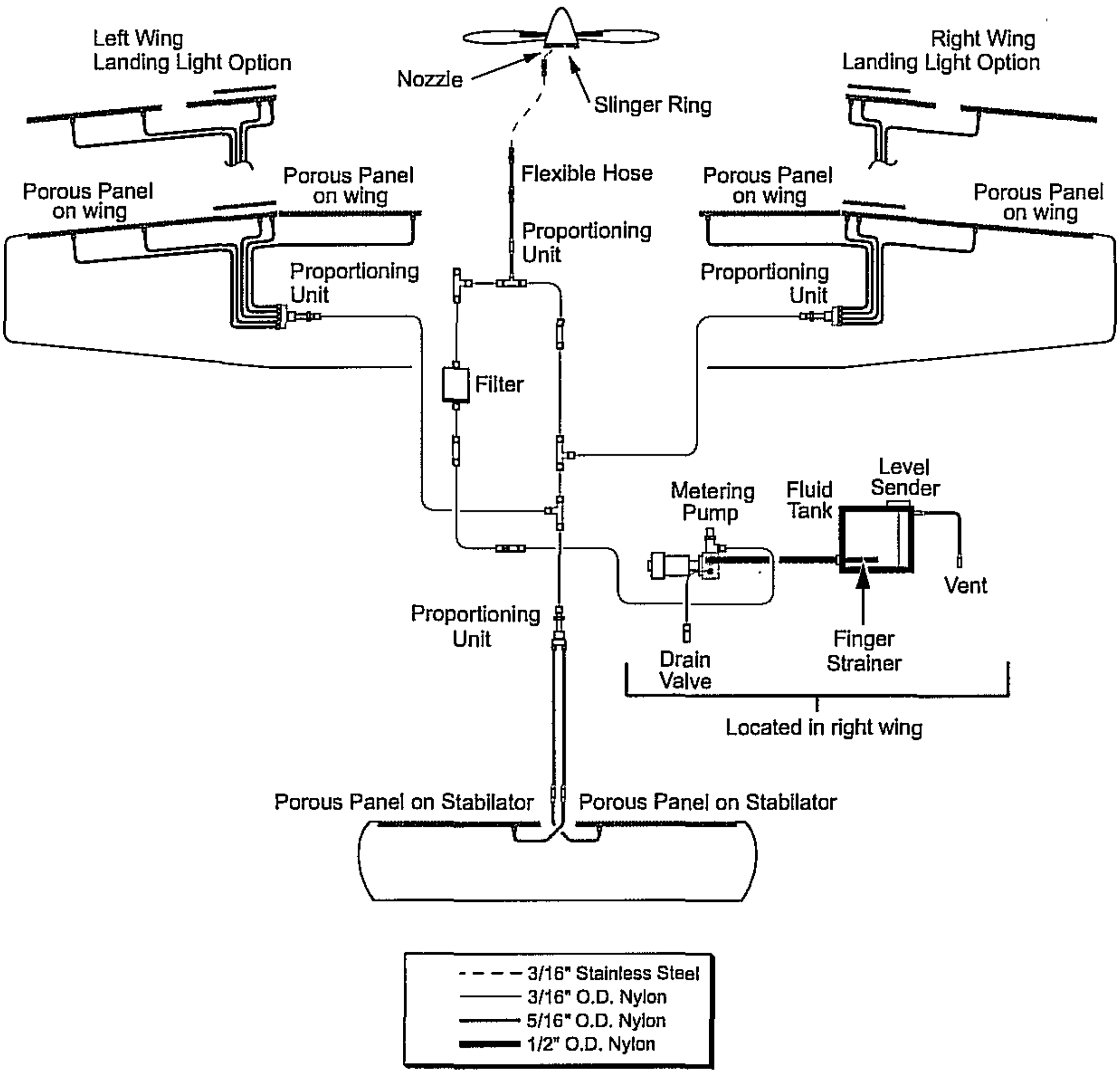
Pilot workload and loss of aircraft performance due to icing are both minimized if the ice protection equipment is operated continuously during unexpected icing encounters.

The fluid passes through a microfilter prior to distribution to the porous panels and propeller. The filter assures all contaminants are removed from the fluid and prevents panel blockage.

A system of nylon tubing carries the fluid to proportioning units typically located in the wings and tail of the aircraft. The proportioning units divide the flow into the volumetric requirements of each panel or device supplied through the unit.

This tank is serviced through a single filler located on the right (starboard) wing, outboard of the fuel filler cap. The tank has a capacity of 4.25 gallons. It is the pilot's responsibility to ensure that an adequate quantity of fluid is carried. A minimum indication of 1/4 tank is required before takeoff if the system is to be considered operational. Fluid quantity is measured by a sensor which transmits an electrical signal to the fluid indicator gauge.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

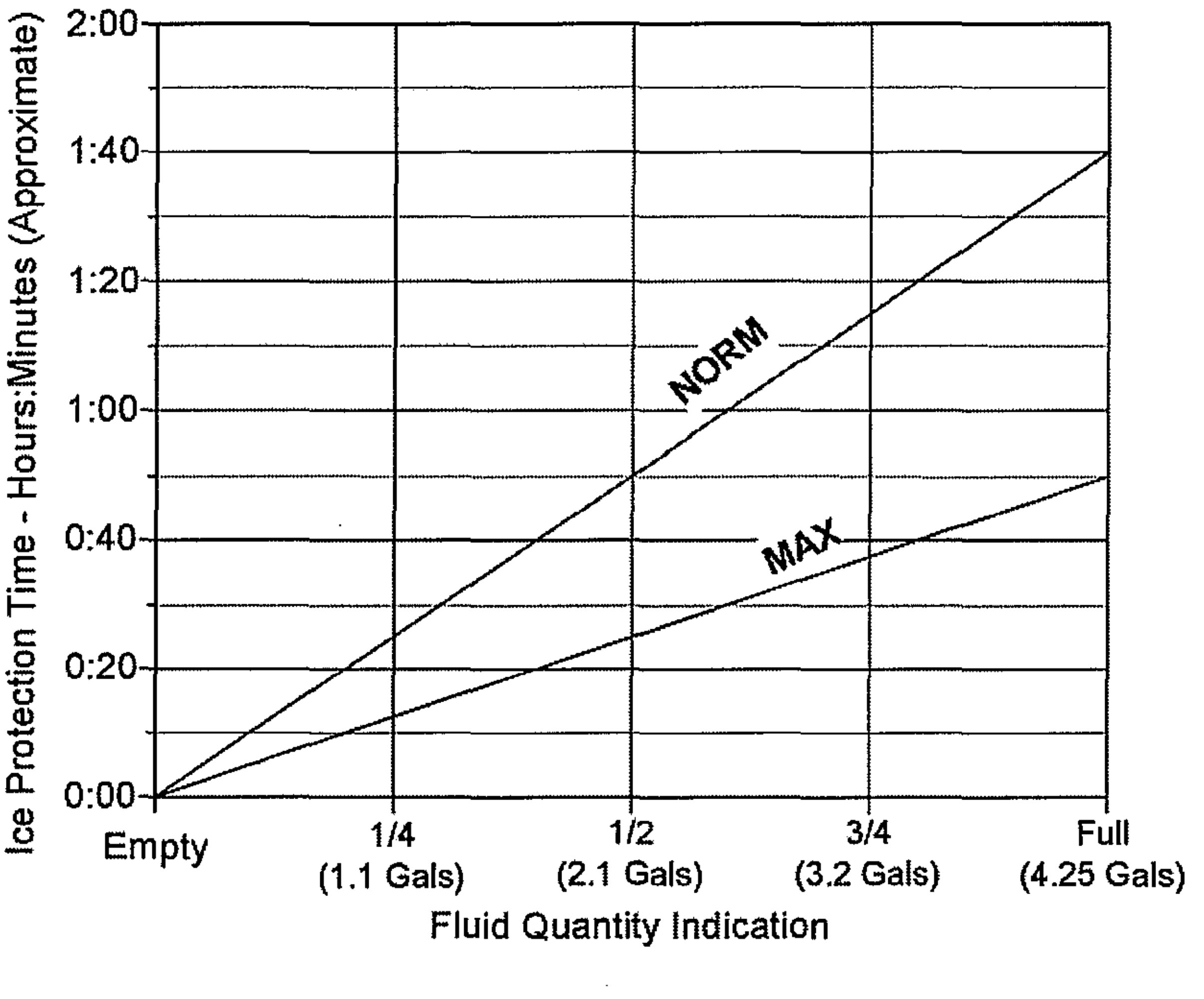


PA-32 TKS System Fluid Schematic
Figure 7-4

Maximum Fluid Endurance:

NORM selected ....approximately 1 hour and 40 minutes
MAX selected ....approximately 50 minutes

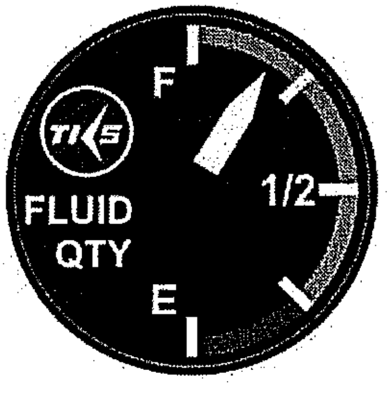
SECTION 7 - DESCRIPTION AND OPERATION (continued)



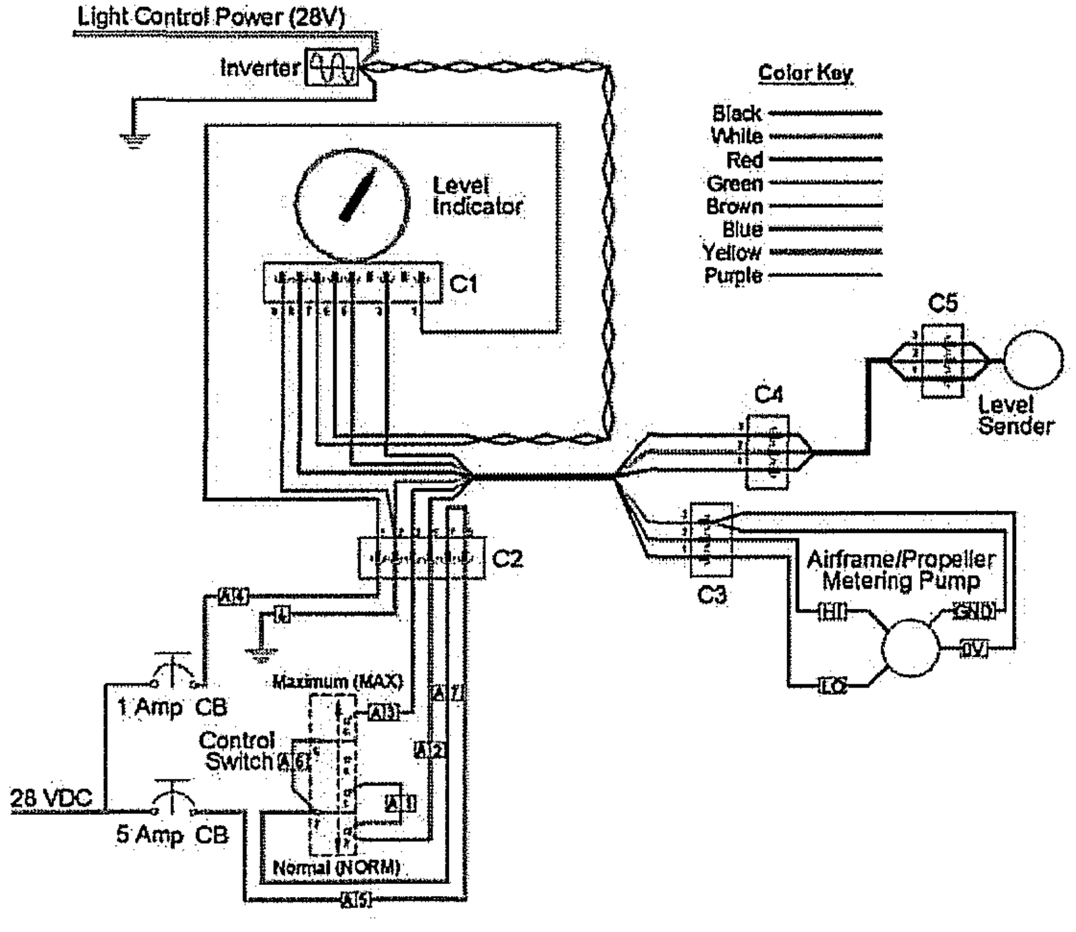
PA-32 TKS System Fluid Endurance (Quantity vs. Time)
Figure 7-5

SECTION 7 - DESCRIPTION AND OPERATION (continued)

The Contents Indicator Gauge is an analog gauge, located on the instrument panel just below the switch panel. This display dims for night operation.



Contents Indicator Gauge
Figure 7-6



System Electrical Schematic
Figure 7-7

SECTION 7 - DESCRIPTION AND OPERATION (continued)

Fluid pressure for airframe/propeller ice protection is provided by a two-speed electrically driven pump. The low speed provides the required flow when NORM is selected, and the high speed provides the required flow when MAX is selected.

The system is operated with a three-position switch, located on the instrument panel. The center position is the OFF position, deactivating the TKS system. The top position (activated by pressing in the top of the switch) activates the MAX or maximum flow rate of the system. Depressing the bottom of the switch activates the NORM or normal flow rate of the system.

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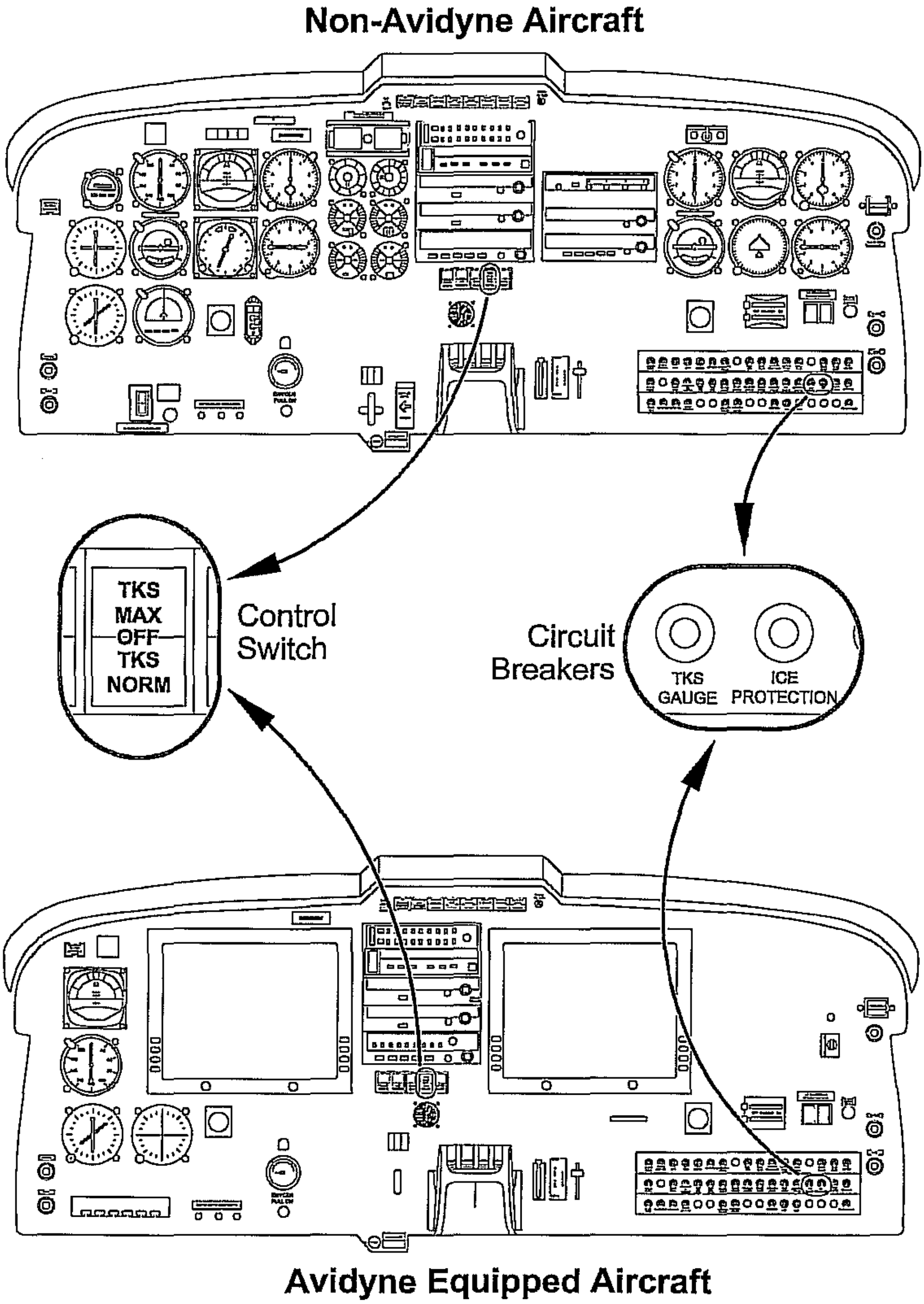
SECTION 7 - DESCRIPTION AND OPERATION (continued)



TKS System Electrical Controls
Figure 7-8

SECTION 7 - DESCRIPTION AND OPERATION (continued)

Inactive TKS System

A common occurrence with all TKS porous ice protection panels is "leaking" when not in use. Specifically, panels will stream very small quantities in flight or drip while parked. This is a normal characteristic of the TKS system because of the porous panel design.

Every panel contains a reservoir for fluid and a porous membrane. The reservoir and membrane work together to provide an even distribution of fluid over the entire porous area of the panel. The membrane is the key element, but it would not work properly unless fluid is supplied and distributed evenly to the membrane. The reservoir provides that supply.

The porosity of the membrane is designed and tuned to create a 3 psi pressure drop when ice protection fluid is forced through it. For general aviation class aircraft, the 3 psi value is far higher than any aerodynamic pressures encountered on the aircraft leading edges. The 3 psi mark assures that a uniform distribution of fluid will pass through the porous panel regardless of airspeed and air flow (angle of attack) angle.

The reservoir also assures that, when properly prepared, a relatively instantaneous supply of fluid is available at the panels for delivery. The combination of the membrane and reservoir are designed to retain the internal fluid volume as long as possible so start up time is kept to a minimum. The panel is able to retain the fluid when the fluid viscosity is maintained at a 32°F value or colder.

As the temperature of the fluid warms beyond 32°F, the viscosity drops. As an example, the viscosity of ice protection fluid at 70°F has roughly 1/3 the viscosity of 32°F fluid. With much thinner fluid, the membrane cannot resist and fluid will start to pass through the membrane.

This characteristic will be seen on the lower edge of the drilled active area of a panel, typically near the inboard end of the panel. The wing dihedral creates a small pressure head in the panel, the highest value being at this point. Fluid will slowly flow downhill in the panel reservoir, then weep from the lowest point.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

Inactive TKS System (continued)

This type of fluid loss from the panel is very low volume, but it can be deceptive to the user. In flight the weeping can look very similar to normal operation on the inboard section of a panel. The thing to remember, however, is the fluid loss is only from the panel reservoir, and it happens in warmer conditions, far away from temperatures associated with icing conditions. It is difficult to quantify exact ranges, but the 60° to 70°F temperature range is typically where this type of weeping occurs.

This is a normal characteristic for a TKS system. It is not a maintenance issue or a concern for normal operation. It does, however, point out the need to observe proper preparation of the system prior to flights where icing conditions may occur. If the panels have drained their fluid, it can take up to 5 to 10 minutes to fill the entire porous panel system. Proper observation of TKS preflight steps assure that the system will be ready and available when the pilot activates the system.

SECTION 8 - HANDLING, SERVICING AND MAINTENANCE

Prolonged Out-of-Service Care

During Flyable Storage

Ensure that the de-icing fluid tank contains at least the minimum takeoff quantity of fluid (refer to Section 7 of this supplement), and that all system components are filled with fluid. If necessary, operate the pump until all air is dispelled from components and pipelines (see Pump Priming). Recheck tank contents.

It is also advisable to run the system at least once a month during flight for at least 15 minutes. Running the system assures that it is operational, flushes any dirt or debris from the porous panels, and exercises the pump. This activity will assure the system is functional and available for use.

Servicing

De-icing Fluid Tank

See Limitations for specified de-icing fluids. The filler cap is located on the right (starboard) wing, inboard of the fuel filler. The tank has a total capacity of 4.25 gallons. To preclude the possibility of contaminated fluid, always clean the top of fluid containers before dispensing, and if required, maintain a clean measuring vessel solely for de-icing fluid. Secure the filler cap immediately after filling.

CAUTION

Always lock the TKS filler cap between fluid fills. Monitor aircraft fueling to assure no fuel is pumped into the TKS fluid tank.

If fuel has been inadvertently pumped into the TKS tank, the tank must be serviced. Do not operate the system with fuel in the tank. The contaminated fluid must be drained completely from the tank, and the tank should be flushed with clean water. At least two complete tanks of water should be drained through the system. After the system has been thoroughly flushed, it must be filled and primed (see Pump Priming).

SECTION 8 - HANDLING, SERVICING AND MAINTENANCE (continued)

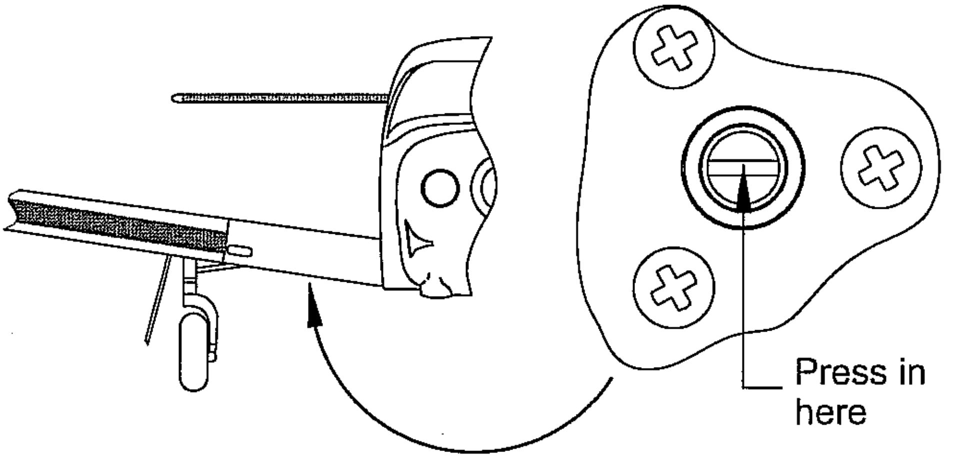
Servicing (continued)

De-icing Fluid Tank (continued)

In the event that the fluid tank must be drained, this may be accomplished using the TKS system drain. The valve is located on the lower, right inboard surface of the wing, ahead of the landing gear area. It is forward of the main spar.

The valve can be locked open by pressing into the valve stem with a screwdriver and turning the stem 1/4 turn. This action will allow the entire contents to be drained without holding the valve open.

After draining, return the valve to the closed position. When the tank has been drained, the pump must be primed. (See Pump Priming.)



System Drain Valve Location
Figure 8-1

SECTION 8 - HANDLING, SERVICING AND MAINTENANCE (continued)

Servicing (continued)

De-icing Fluid Strainer

The de-icing fluid strainer in the fluid tank outlet should not require cleaning unless there is a definite indication of foreign matter in the tank.

If foreign matter is found in the tank, flush the tank with clean water until all evidence of the material is removed.

System Fluid Filter

Replace the system fluid filter every 3 years or 1500 hours of aircraft use, whichever is less, or anytime if required by condition.

Pump Priming

The metering pump is not self-priming and may require priming in the event the TKS tank is run dry or emptied completely. Once prime is established, the pump will maintain the prime unless air re-enters the pump.

If priming is required, locate the system drain valve on the lower, right inboard wing, near the landing gear. The valve is forward of the main spar. Fill the TKS tank completely. The valve is operated by pressing a screwdriver or center-pin cup into the valve, similar to fuel strainers. The pin may be held in momentarily to drain for priming.

For complete pump priming, one quart of fluid must be drained. The fluid may be returned to the tank if kept clean. Assure that the drain valve is closed and not leaking fluid after use.

SECTION 8 - HANDLING, SERVICING AND MAINTENANCE (continued)

Servicing (continued)

Porous Leading Edge Panels

CAUTION

Porous panels contain a plastic membrane which may be damaged by certain solvents, particularly Methyl Ethyl Ketone (MEK), lacquer thinner, and other types of thinners and solvents. Mask panels when painting the aircraft or when using solvents for other purposes in proximity of the porous panels.

Only the following solvents are permitted for use on porous panels, but refer to recommended procedures for cleaning exterior painted surfaces for aircraft:

Water (with soaps or detergents)
De-icing fluids (as specified in Limitations)
Aircraft fuels (gasoline or kerosene)
Isopropyl or ethyl alcohol

The porous panels may be washed with mild soap and water using a brush or lint free cloth.

Cleaning of the porous panels will be greatly facilitated if the system is activated prior to each flight, especially if flight at low altitudes or in insect infested areas is anticipated.

SECTION 8 - HANDLING, SERVICING AND MAINTENANCE (continued)

Component	Overhaul or Replace
Airframe/Propeller Pump	On condition
Motor Brushes, Airframe/Propeller Pump	Every 2,000 aircraft hours
Filter (subject to element replacement detailed in Servicing)	Every three years or 1500 aircraft hours
Fluid Tank	On condition
Pipelines and Couplings	On condition
Proportioning Unit	On condition
Porous Panels	On condition
Propeller and Spinner Mounted Equipment	On condition
Control Switches	On condition

Overhaul or Replacement Guide
Table 8-1

SECTION 8 - HANDLING, SERVICING AND MAINTENANCE (continued)

Servicing (continued)

Porous Leading Edge Panels

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Porous panels contain a plastic membrane which may be damaged by certain solvents, particularly Methyl Ethyl Ketone (MEK), lacquer thinner, and other types of thinners and solvents. Mask panels when painting the aircraft or when using solvents for other purposes in proximity of the porous panels.

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SECTION 8 - HANDLING, SERVICING AND MAINTENANCE (continued)

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Fluid Tank	On condition
Pipelines and Couplings	On condition
Proportioning Unit	On condition
Porous Panels	On condition
Propeller and Spinner Mounted Equipment	On condition
Control Switches	On condition

Overhaul or Replacement Guide
Table 8-1

SECTION 9 - SUPPLEMENTS

Not applicable

SECTION 10 - OPERATING TIPS

Flight in Unexpected Icing Conditions

1. The airframe ice protection system is not intended to remove ice from the aircraft on the ground. Do not attempt to takeoff with frost, ice or snow on flying surfaces.
2. No airplane or combination of de-icing and anti-icing equipment can be designed for the worst possible icing encounter - this condition cannot even be defined. As competent pilots know, there appear to be no predictable limits for the most severe weather conditions. For essentially the same reasons that airplanes, however designed or equipped for IFR flight, cannot be flown safely into conditions such as severe thunderstorms, tornadoes, hurricanes, or other phenomena likely to produce extreme turbulence, airplanes cannot be expected to cope with the worst icing conditions that nature can produce.

   The prudent pilot must remain alert to the possibility that icing conditions may become so severe that his equipment cannot cope with them. At the first indication that such conditions may have been encountered, or may be ahead, the pilot should react by deciding the most expeditious and safe course of action. The decision should be based on weather briefing, recent pilot reports, and ATC observations. Alternatives could be course changes, altitude changes, or even continuance on the same course.
3. The ice protection system is not designed to permit flight in icing conditions for an indefinite period of time. Its purpose is to provide some protection from the effects of ice, should an unexpected or inadvertent encounter with ice occur. At the first observation of airframe ice, the pilot should immediately take action to find a flight condition that will minimize the time in icing and provide a safe exit from the icing conditions. If the possibility of icing exists, the prudent pilot will always plan the flight such that at least one alternative exists (altitude, course, or landing site) that will offer a safe exit from the icing conditions.

SECTION 10 - OPERATING TIPS (continued)

Flight in Unexpected Icing Conditions (continued)

4. Stall warning indications should not be relied upon during or following icing conditions, as operation of the wing mounted sensors is likely to be impaired. Depending upon circumstances, it may be advisable to increase approach and landing speeds, because even with the protected regions totally clear of ice, a performance degradation will occur due to ice on the unprotected regions. The amount of the degradation cannot be accurately predicted. Therefore, the pilot must use extreme caution during approach and landing, being alert to the first signs of pre-stall buffet and an impending stall.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 22
FOR
S-TEC ADF-650D SYSTEM

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the S-TEC ADF-650D System is installed per the Equipment List. The information contained herein supplements or supersedes the 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 Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED:
LINDA J. DICKEN
DOA-510620-CE
THE NEW PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA

DATE OF APPROVAL: July 11, 2005

SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the S-TEC ADF-650D System is installed in accordance with FAA approved Piper data.

SECTION 2 - LIMITATIONS

No change.

SECTION 3 - EMERGENCY PROCEDURES

No change.

SECTION 4 - NORMAL PROCEDURES

To turn on the ADF-650D System:

- Depress the PWR button momentarily and release.

NOTE

If the PWR button is pressed for longer than 3 seconds, the receiver will immediately shut off.

- After successful self test, input desired station frequency and select ANT mode.
- Positively identify selected station or beacon.
- Adjust volume control as required.
- If ADF-650D System is used for navigation, select ADF or BFO mode immediately after the station has been positively identified.

To turn off the ADF-650D System:

- Depress the PWR button for at least 3 seconds.

NOTE

If the PWR button is released within 3 seconds, normal operations will resume.

SECTION 4 - NORMAL PROCEDURES (continued)

To perform the preflight checklist and self test:

- After successful self test, press the mode control until ANT is displayed and input a predetermined frequency to select a station in the immediate area. Adjust the volume control as necessary to provide a comfortable listening level.
- Press the ID button and observe that the station identification code becomes louder (if the station is voice-identified, it is not necessary to press the ID button).
- Press the ID button again to cancel the IDENT function and press the mode control until ADF is displayed.
- Observe the IND-650A Indicator and note that the bearing pointer indicates the relative bearing to the station.
- Push the TEST button while observing the indicator bearing pointer. The bearing pointer will rotate 90° and stop.
- Push the TEST button again (to turn off test function). The bearing pointer returns to the original relative bearing position.
- Switch to BFO mode, if appropriate, and verify a tone is present. Select the appropriate operating mode when all checks have been completed.

SECTION 5 - PERFORMANCE

No change.

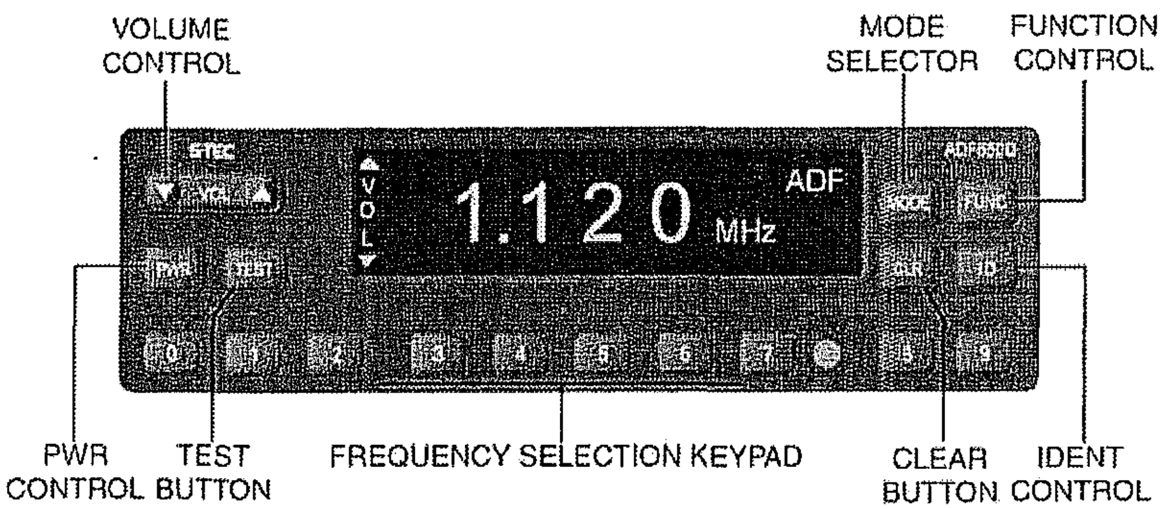
SECTION 6 - WEIGHT AND BALANCE

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

SECTION 7 - DESCRIPTION AND OPERATION

The S-TEC ADF-650D System operates over a frequency range of 200 through 1799 kHz in 1-kHz increments. Three operating modes are included as part of the ADF-650D System.

- BFO
- ADF
- ANT



RCR-650D Receiver Controls

Beat Frequency Oscillator (BFO) Mode

The BFO (beat frequency oscillator) mode is used to aurally identify stations that employ keyed CW (Carrier Wave) rather than amplitude modulation techniques. This mode activates the bearing pointer. The bearing pointer will point in the direction of the station relative to the aircraft heading.

NOTE

CW signals (Morse Code) are unmodulated and no audio will be heard without use of BFO. This type of signal is not used in the United States air navigation. It is used in some foreign countries and marine beacons.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

Automatic Direction Finder (ADF) Mode

The Automatic Direction Finder (ADF) mode uses conventional nondirectional beacons and AM broadcast stations for navigation. This mode activates the bearing pointer. The bearing pointer will point in the direction of the station relative to the aircraft heading.

Antenna (ANT) Mode

The ANT (antenna) mode cannot be used for navigation; this mode enhances audio reception clarity and is normally used for station identification.

Frequency Selection Keypad

The Frequency Selection Keypad is used to select the system operating frequency. The keypad consists of a row of numbered buttons from 0 to 9, located along the bottom of the RCR-650D Receiver. Frequencies in the megahertz and kilohertz range may be selected.

Power (PWR) Control

The power control is used to turn the receiver on and off. Momentarily depressing the PWR button will turn the receiver on and also initiate a self test.

NOTE

If the PWR button is pressed for longer than 3 seconds the receiver will immediately shut off.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

Clear (CLR)

The clear function offers several options for the operator.

- If the entire frequency is entered and the CLR button is pushed, all the numbers will become dashes. An additional push on the CLR button will restore and display the prior frequency entry.
- If an entry is in progress and a number is entered in error, pressing the CLR button will erase the last number entry.
- Pressing the CLR button while in the contrast function reverses the display image and also places the receiver in manual mode.

NOTE

It is not necessary to push CLR to enter a new frequency number. Simply complete the entry and then enter the new numbers and they will replace the old frequency.

Volume (VOL) Control

The audio volume control is used to adjust the settings and levels for all function selector and setup modes and is controlled by pressing the ^ and v buttons on the VOL control.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

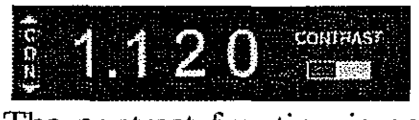
Function (FUNC) Selector

The function selector enables the user to select between contrast and volume display functions (on power-up, the RCR-650D will be in the volume display function). The first time the function selector is pressed, the receiver enters the contrast function. Subsequent presses of the function selector button toggles the unit between contrast and volume. Additionally, pressing the clear button while in the contrast function places the receiver in manual mode. In manual mode, subsequent pushes of the function selector will cycle the receiver through four functions: volume, contrast, display and keypad.

- **Volume**

The volume control function is available on power-up and is accessed immediately by pressing the ^ and v buttons on the VOL control. Upon activation, the kHz and mode annunciations are temporarily replaced by the text "VOLUME" with a horizontal fill bar. The filled portion of the bar indicates the current volume setting.

- **Contrast**



The contrast function is activated by pressing the FUNC selector. Upon activation, the kHz and mode annunciation are temporarily replaced by the text "CONTRAST" with a horizontal fill bar on the right side of the annunciator panel. The filled portion of the bar indicates the current contrast setting. The contrast is adjusted by pressing the appropriate ^ and v indicators on the volume control.

- **Display**

When the display is setup in the manual mode, press the FUNC selector until the display function is selected. The display function is then activated and the kHz and mode annunciations are temporarily replaced by the text "DISPLAY" with a horizontal fill bar on the right side of the annunciator panel. The filled portion of the bar indicates the current display setting. The display is adjusted by pressing the appropriate ^ and v indicators on the volume control.

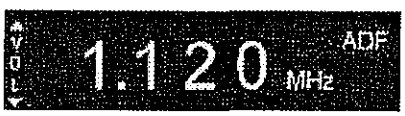
SECTION 7 - DESCRIPTION AND OPERATION (continued)

Function (FUNC) Selector - continued

- **Keypad Light Brightness**

The keypad light brightness setting is used to adjust the brightness of all legends on the display face. When the display is setup in the manual mode, press the FUNC selector until the keypad function is selected. The keypad function is then displayed with the text "KEYPAD" and a horizontal fill bar on the right side of the annunciator panel. The filled portion of the bar indicates the current keypad brightness setting. The brightness is adjusted by pressing the appropriate ^ and v indicators on the volume control.

Mode Selector



The mode selector is used to select one of the three operating states: BFO, ADF, or ANT. Pressing the MODE selector button will step the receiver through the three modes. The current mode will be displayed in the upper right corner of the display. On system power-up, the mode selector will be in the ADF mode.

Ident (ID)

The receiver utilizes an Ident Filter for audio output which aids in receiving weak signals. Pressing the ID button toggles the Ident Filter on and off. When the Ident Filter is active, the text "IDENT" is displayed in the bottom right corner of the display.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

Test Mode

Press the TEST button to start the test mode. The text "TEST" will be displayed in the bottom right corner of the display for approximately 15 seconds. During this time, the IND-650A Indicator pointer will incrementally rotate 90°. Press the TEST button again to cancel the test while in this mode. The pointer will immediately return to its starting point.

PILOT'S OPERATING HANDBOOK
AND
FAA APPROVED AIRPLANE FLIGHT MANUAL

SUPPLEMENT NO. 23
FOR
AVIDYNE FLIGHTMAX ENTEGRA
PRIMARY FLIGHT/MULTI-FUNCTION DISPLAYS
WITH
THE B&C SPECIALTIES BC410 STANDBY ALTERNATOR

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the optional Avidyne FlightMax Entegra Primary Flight and Multi-Function Displays with the B&C Specialties BC410 Standby Alternator is installed per the Equipment List. 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 Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED:
LINDA J. DICKEN
DOA-510620-CE
THE NEW PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA

DATE OF APPROVAL: October 17, 2005

SECTION 1 - GENERAL

This airplane is equipped with the Avidyne FlightMax Entegra EXP5000 series 700-00006-0XX-( ) Primary Flight Display with 530-00138-000 software and EX5000 series 700-00004-0XX-( ) Multi-Function Display with 530-00137-000 software, herein referred to as the "PFD" and "MFD". The PFD is intended to be the primary display of primary flight and essential engine parameter information to the pilot. The PFD is capable of interfacing with a pair of Garmin GNS 430/530's, and an S-TEC System 55X autopilot.

Figure 1 depicts the Avidyne FlightMax Entegra Series 700-00006-0XX-( ) Primary Flight Display.

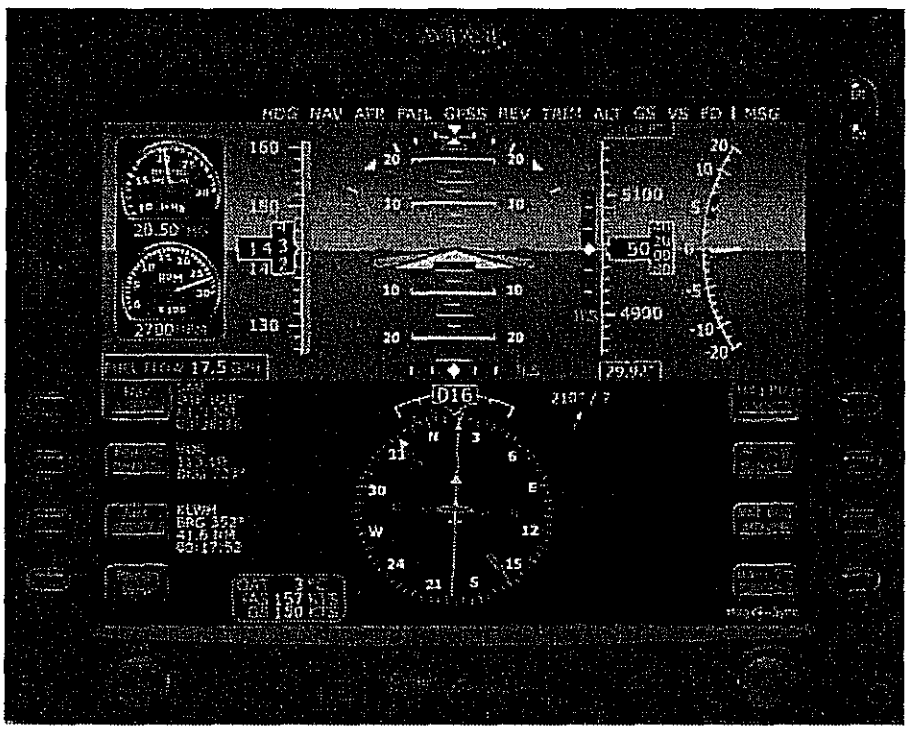


Figure 1 - Entegra 700-00006-0XX-( ) Primary Flight Display

The PFD provides the display of the following aircraft parameters:

- Artificial Horizon
- Airspeed Indication
- Altimeter
- Vertical Speed Indication
- Rate of Turn Indicator
- Skid/Slip Indicator
- Horizontal Situation Indication
- RMI
- Course Deviation Indication
- Outside Air Temperature
- Engine RPM
- Manifold Pressure
- Fuel Flow
- Oil Pressure
- Autopilot Annunciation

SECTION 1 - GENERAL (continued)

The MFD is intended to be a supplemental display of situational and navigation information to the pilot. Its primary function is to provide a moving map display to the pilot for increased situational awareness. The MFD is capable of accepting data from a variety of GPS sensors, the BFG WX-500 Stormscope passive thunderstorm detection unit, Engine Sensor Unit, and either the L3 Skywatch Traffic Advisory System (TAS), Bendix/King TAS, or the Ryan Traffic and Collision Alert Device (TCAD) system. The unit is organized around logical groupings of information presented on "Pages".

Figure 2 depicts the Entegra EX5000 series 700-00004-0XX-( ).

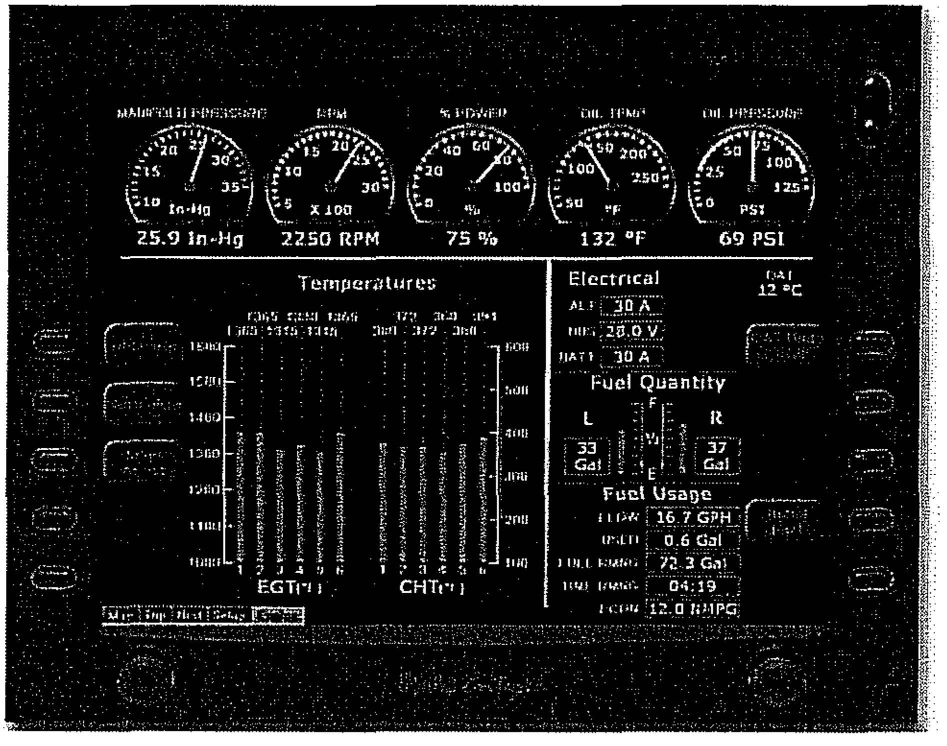


Figure 2 - EX5000 series 700-00004-0XX-( ) Multi-Function Display

The MFD provides the display of the following aircraft parameters:

- Manifold Pressure
- Engine RPM
- Percent Power
- Engine Oil Temperature
- Engine Oil Pressure
- EGT
- Cylinder Head Temperature
- Aircraft Electrical Status
- Outside Air Temperature
- Fuel Quantity
- Fuel Usage Data

SECTION 1 - GENERAL (continued)

A B&C Specialties, BC410 standby alternator, when ON, will automatically activate in the event of a failure in the primary alternator, therefore replacing the primary alternator function, but not supplementing its output. The alternator is gear driven through the engine vacuum pump drive pad.

The standby alternator is rated for 20 amperes of maximum load. The actual load available for use is dependent on engine rpm and current operating conditions.

SECTION 2 - LIMITATIONS

A. PFD Limitations

1. IFR flight is prohibited when the PFD or any standby instrument is inoperative (altimeter, airspeed indicator, artificial horizon, or whiskey compass).
2. IFR flight is prohibited upon aircraft total loss of essential engine parameter display (manifold pressure, tachometer, fuel flow).
3. The Avidyne FlightMax Entegra series Primary Flight Display Pilot's Guide, p/n 600-00104-000 revision 00 or appropriate later revision, or p/n 600-00143-000 revision 01 (EXP 5000 R6) or appropriate later revision, must be available to the pilot during all flight operations.
4. If a VLOC is displayed on the HSI and GPSS mode is engaged on the autopilot, the autopilot will track the active flight plan in the GPS corresponding to the selected VLOC (i.e. GPS1 for VLOC1 or GPS2 for VLOC2). This configuration is potentially confusing and must be avoided.
5. GPSS mode must not be used on the final approach segment of a VLOC approach (ILS, LOC or non-GPS-overlay VOR). GPSS mode must be deselected (i.e., NAV mode selected) prior to the turn onto the final approach course.

NOTE

The PFD integrates with separately approved sensor and flight control installations. Adherence to limitations in appropriate installation AFM supplements is mandatory.

B. MFD Limitations

1. The Avidyne moving map display provides visual advisory of the airplane's GPS position against a moving map. This information supplements CDI course deviation and information presented on the GPS navigator. The moving map display must not be used as the primary navigation instrument.
2. Use of Map page during IFR flight requires an IFR approved GPS receiver and installation, operated in accordance with its applicable limitations.
3. The Avidyne FlightMax EX-series Pilot's Guide, p/n 600-00105-000 revision 00 or appropriate later revision, must be available to the pilot during all flight operations.

SECTION 2 - LIMITATIONS (continued)

B. MFD Limitations (continued)

4. Aircraft dispatch is prohibited when the MFD is inoperative.
5. Selecting "Lightning Display OFF" for the Lightning overlay of the Map page will prevent current heading values from being sent to the WX500 sensor from the EX5000.

   When "Lightning Display OFF" is selected the EX5000 will stop sending current heading values to the WX500. When this selection is made, the WX500 will still use the last heading value that was present before this selection even though the actual aircraft heading may have changed since that selection was made.

   Consequently, the Stormscope heading information provided to the Garmin 430 by the EX5000 will not be updated, resulting in an inaccurate lightning depiction on the Garmin 430. This issue does not affect the lightning display on the EX5000.

   To avoid this invalid condition, **disable the WX500 on the GNS430**. For instructions on how to accomplish this, refer to the Garmin 400 Series Installation Manual, p/n 190-00140-02, latest revision (reference Section 5.1 Configuration Mode Operations, Section 5.2 Installation Configuration pages, and Section 5.2.2 Main RS232 Configuration page).

CAUTION

Traffic information shown on the Map page display is provided to the pilot as an aid to visually acquiring traffic. Pilot's should maneuver their aircraft based only on ATC guidance or positive visual acquisition of the conflicting traffic. Maneuvers should be consistent with ATC instructions. No maneuvers should be based only on a Traffic Advisory.

Terrain information shown on the Map page display is provided to the pilot as an aid to situational awareness. The Map page terrain color representations should not be used as a basis for terrain avoidance.

NOTE

The MFD integrates with separately approved sensor and flight control installations. Adherence to limitations in appropriate installation AFM supplements is mandatory.

SECTION 2 - LIMITATIONS (continued)

C. CMAX CHART PAGE Limitations

The geographic referenced aircraft symbol must not be used for navigation.

NOTE

The aircraft symbol displayed provides supplemental aircraft situational awareness information. It is not intended as a means for navigation or flight guidance. The airplane symbol is not to be used for conducting instrument approaches or departures. Position accuracy, orientation, and related guidance must be assumed by other means or required navigation.

Operators with the optional CMax Chart Page must have back-up charts available. Do not rely upon CMax charts as your sole source of navigation information.

D. STANDBY ALTERNATOR Limitations

The standby alternator system is used in the event of primary alternator failure and not for normal operations.

The standby alternator is limited to 20 amperes continuous output. Transient operations of greater than 20 amperes for no more than 5 consecutive minutes may be conducted.

NOTE

Maintain a minimum of 2500 rpm for full power output.

SECTION 3 - EMERGENCY PROCEDURES

Failure of Pilot's Electronic Attitude Direction Display Screen (PFD)

Indication: PFD Display goes blank.

Standby Attitude Gyro ....VERIFY ON and flag is pulled on gyro

Maintain attitude control using standby gyro and establish the aircraft in straight and level unaccelerated flight.

If time and conditions permit:

PFD Brightness Control (BRT/DIM) ....Run to full bright
PFD Circuit Breaker ....PULL and RESET

If PFD Screen cannot be reinstated:

On aircraft equipped with the optional second Nav Indicator (OBS):
Mechanical Nav Indicator (OBS)..........................Utilize for primary navigation
Engine Instruments...Refer to Engine page of MFD

NOTE

The Mechanical Nav Indicator (OBS) receives nav information directly from the No. 2 nav/com/GPS. Only VLOC information is available.

Maintain attitude, airspeed and heading control using standby instruments, magnetic compass and other directional indications (such as MFD, MAP/NAV page).

CAUTION

High current loads in the vicinity of the magnetic compass can influence its accuracy. Depending on the flight conditions, the pilot must reduce these loads as much as possible to insure accuracy. Tests have shown that air conditioner and pitot heat contribute to significant heading errors of the magnetic compass. These items should be turned OFF prior to comparing magnetic compass headings.

Land as soon as practical.

SECTION 3 - EMERGENCY PROCEDURES (continued)

Loss of PFD Engine Data

Indication: Indicator needle removed from dial and digital readout replaced with white dashes.

Engine Instruments ....Refer to Engine page of MFD

Land as soon as practical.

Invalid Air Data

Indication: Airspeed, Altimeter, and Vertical Speed data replaced with Red X's.

Maintain aircraft airspeed and altitude by referring to the standby airspeed and altimeter.

If time and conditions permit:

PFD Circuit Breaker ....PULL and RESET

If air data is still invalid:

Refer to standby airspeed indicator and altimeter.

Land as soon as practical.

Invalid Heading Data

Indication: Heading Bug and Heading Data removed and replaced with Red X's.

If time and conditions permit:

PFD Circuit Breaker ....PULL and RESET

Maintain heading control using magnetic compass and other directional indications (such as MFD, MAP/NAV page).

CAUTION

High current loads in the vicinity of the magnetic compass can influence its accuracy. Depending on the flight conditions, the pilot must reduce these loads as much as possible to insure accuracy. Tests have shown that air conditioner and pitot heat contribute to significant heading errors of the magnetic compass. These items should be turned OFF prior to comparing magnetic compass headings.

Land as soon as practical.

SECTION 3 - EMERGENCY PROCEDURES (continued)

Invalid Attitude and Heading Data

Indication: Attitude and Heading Data removed and replaced with Red X's.

Standby Attitude Gyro ....VERIFY ON and flag is pulled on gyro.

Maintain attitude control using standby gyro.

If time and conditions permit:

PFD Circuit Breaker ....PULL and RESET

If attitude and heading data is still invalid:

Maintain attitude control by using standby gyro.

Maintain heading control by utilizing magnetic compass and other directional indications (such as MFD, MAP/NAV page).

CAUTION

High current loads in the vicinity of the magnetic compass can influence its accuracy. Depending on the flight conditions, the pilot must reduce these loads as much as possible to insure accuracy. Tests have shown that air conditioner and pitot heat contribute to significant heading errors of the magnetic compass. These items should be turned OFF prior to comparing magnetic compass headings.

Land as soon as practical.

SECTION 3 - EMERGENCY PROCEDURES (continued)

Failure of Attitude, Airspeed and Heading Reference System (ADAHRS)

Indication: Airspeed, Attitude, Heading and Altitude replaced with Red X's.

Standby Attitude Gyro ....VERIFY ON and flag is pulled on gyro

Maintain attitude control using standby gyro.

If time and conditions permit:

PFD Circuit Breaker ....PULL and RESET

If ADAHRS initialization does not occur:

On aircraft equipped with the optional second Nav Indicator (OBS):
Mechanical Nav Indicator (OBS)..........................Utilize for primary navigation
Engine Instruments...Refer to Engine page of MFD

NOTE

The Mechanical Nav Indicator (OBS) receives nav information directly from the No. 2 nav/com/GPS. Only VLOC information is available.

Maintain attitude, airspeed and heading control using standby instruments, magnetic compass and other directional indications (such as MFD, MAP/NAV page).

CAUTION

High current loads in the vicinity of the magnetic compass can influence its accuracy. Depending on the flight conditions, the pilot must reduce these loads as much as possible to insure accuracy. Tests have shown that air conditioner and pitot heat contribute to significant heading errors of the magnetic compass. These items should be turned OFF prior to comparing magnetic compass headings.

Land as soon as practical.

SECTION 3 - EMERGENCY PROCEDURES (continued)

Cross Check Monitor

Indication: Yellow Crosscheck Attitude Annunciator on PFD.

Establish aircraft in straight and level unaccelerated flight.

Aircraft Attitude ....Crosscheck aircraft attitude with standby attitude gyro

Total Loss of Engine Instruments

Indication: Indicator needle removed from dial and digital readout replaced with white dashes.

DAU Circuit Breaker ....PULL and RESET

If engine data is still invalid:

NOTE

The following engine messages will be displayed on the MFD if an exceedance is detected:

- Check Oil Temp
- Check Oil Press
- Check CHT
- Check RPM
- Check Manifold Pressure

If failure occurs during takeoff:

Mixture ....Maintain full rich

Propeller Control ....Full Forward

Manifold Pressure ....As required

Return to airport for landing.

If failure occurs during climb or landing:

Mixture ....Maintain full rich

Propeller Control ....Full Forward

Manifold Pressure ....As required

Land as soon as practical.

If failure occurs after setting cruise power and mixture:

Power ....Maintain power setting

Land as soon as practical.

If failure occurs prior to or during descent:

Manifold Pressure ....Set for descent

Mixture ....Full rich

SECTION 3 - EMERGENCY PROCEDURES (continued)

ALTERNATOR FAILURE

Failure of Primary Alternator

Indication: Alternator Inop annunciator light illuminated and Standby Alternator ON annunciator light illuminated or zero current displayed on MFD alternator indication source.

NOTE

Anytime the bus voltage is below 25 Vdc, the Low Bus Voltage annunciator will be illuminated.

STBY ALTR ....Verify ON/check ammeter indication
Electrical Load ....Reduce until total load is below 20 amps and low bus annunciator is extinguished

NOTE

If the STBY ALTR ON annunciator is flashing then reduce electrical loads until the annunciator no longer flashes.

ALTR ....OFF
ALTR FIELD circuit breaker ....check and reset as required
ALTR..ON

If primary alternator power not restored:

ALTR ....OFF

If primary alternator output cannot be restored, maintain an electrical load of less than 20 amps with which the STBY ALTR ON annunciator no longer flashes and ***land as soon as practical.***

Failure of Standby Alternator

If STBY ALTR ON is not illuminated:
STBY ALTR ....OFF
STBY ALTR FIELD circuit breaker..........................check and reset as required
STBY ALTR SENSE circuit breaker ....check and reset as required
STBY ALTR ....ON

If standby alternator power not restored:

STBY ALTR ....OFF

If the standby alternator has failed or cannot provide adequate power, then electrical power is dependent on available battery storage. Duration of battery power available will be dependent on electrical load and battery condition prior to failure. ***Land as soon as possible.***

SECTION 3 - EMERGENCY PROCEDURES (continued)

Failure of Alternator - General

WARNING

Compass error may exceed 10 degrees with alternator inoperative.

CAUTION

Any power interruption will result in loss of attitude information from the PFD until the unit can be reinstated on the ground.

NOTE

Consider using the autopilot to reduce workload. Using the GPSS mode can assist in maintaining a flight-planned route.

NOTE

LO BUS VOLTAGE annunciator will be illuminated. Anticipate complete electrical failure. Duration of battery power available will be dependent on electrical load and battery condition prior to failure.

NOTE

If both the primary and standby alternator are not functioning and the battery is depleted, the landing gear must be lowered using the emergency extension procedure. The gear position lights will be inoperative. The flaps will also be inoperative and a flaps up landing will be required.

Reduce electrical loads by switching OFF or pulling circuit breakers for all non-essential equipment to include the following:

- Reduce PFD and MFD brightness as part of overall electrical system management
- Pitot heat (unless required)
- Airconditioner and ventilation fan (if installed)
- Landing light (use sparingly)
- Strobe lights
- Recognition lights (if equipped)
- Cabin/flood lights
- No. 2 nav/com/GPS
- Autopilot
- Electric trim
- DME (unless required for published approach)
- Stormscope (if equipped)
- Skywatch (if equipped)

Land as soon as practical.

SECTION 3 - EMERGENCY PROCEDURES (continued)

Electrical Overload (Alternator over 20 amps above known electrical load)

ALTR..ON
BATT MASTR ....OFF

If alternator loads are reduced:

Electrical load ....reduce to minimum

NOTE

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

If alternator loads are not reduced:

ALT ....OFF
STBY ALTR ....verify ON/check ammeter indication
BATT...as required

NOTE

If the STBY ALTR ON annunciator is flashing then reduce electrical loads until the annunciator no longer flashes.

If the standby alternator has failed or cannot provide adequate power, then electrical power is dependent on available battery storage. Duration of battery power available will be dependent on electrical load and battery condition prior to failure.

WARNING

Compass error may exceed 10 degrees with alternator inoperative.

CAUTION

Any power interruption will result in loss of attitude information from the PFD until the unit can be reinstated on the ground.

NOTE

Consider using the autopilot to reduce workload. Using the GPSS mode can assist in maintaining a flight-planned route.

NOTE

LO BUS VOLTAGE annunciator will be illuminated. Anticipate complete electrical failure. Duration of battery power available will be dependent on electrical load and battery condition prior to failure.

SECTION 3 - EMERGENCY PROCEDURES (continued)

Electrical Overload (Alternator over 20 amps above known electrical load) (continued)

If alternator loads are not reduced (continued):

NOTE

If the standby alternator is not functioning and the battery is depleted, the landing gear must be lowered using the emergency extension procedure. The gear position lights will be inoperative. The flaps will also be inoperative and a flaps up landing will be required.

SECTION 3 - EMERGENCY PROCEDURES (continued)

Complete Electrical Failure

Standby Attitude Gyro ....SELECT Standby (STBY) power button

CAUTION

The STBY PWR annunciator will rapidly flash for approximately one minute when aircraft power is lost. STBY PWR must be selected, otherwise the gyro will auto shutdown after approximately one minute.

Standby Attitude Gyro ....VERIFY ON and flag is pulled on gyro

Maintain aircraft control with reference to the standby airspeed, altimeter, and attitude gyro indicators.

Battery Switch ....OFF
Ground Clearance Switch (if installed) ....ON

Land as soon as possible.

WARNING

Compass error may exceed 10 degrees with alternator inoperative.

NOTE

Turning ON the ground clearance switch will activate the No. 1 nav/com/GPS radio.

NOTE

If the battery is depleted, the landing gear must be lowered using the emergency extension procedure. The gear position lights will be inoperative. The flaps will also be inoperative and a flaps up landing will be required.

SECTION 3 - EMERGENCY PROCEDURES (continued)

Fire in Flight

Electrical Fire

Fire...Extinguish
Standby Attitude Gyro ....VERIFY ON and flag is pulled on gyro

Maintain aircraft control with reference to the standby airspeed, altimeter, and attitude gyro indicators.

Battery Master Switch ....OFF
ALTR Switch..OFF
STBY ALTR Switch ....OFF
Ground Clearance Switch (if installed) ....ON

NOTE

Turning ON the ground clearance switch will activate the No. 1 nav/com/GPS radio.

Vents ....OPEN
Cabin Heat..OFF

Land as soon as practical.

WARNING

Compass error may exceed 10 degrees with alternator inoperative.

NOTE

If the battery is depleted, the landing gear must be lowered using the emergency extension procedure. The gear position lights will be inoperative. The flaps will also be inoperative and a flaps up landing will be required.

SECTION 3 - EMERGENCY PROCEDURES (continued)

Aircraft Engine Power Loss

During an engine failure the pilot may elect to attempt an engine restart. During this time large voltage drops may cause the PFD to lose power and reinitialize. During this initialization process the PFD may not be able to complete a fast alignment during flight and therefore the pilot may have to obtain aircraft attitude and aircraft control using the standby instruments.

- Refer to the Emergency Section of the Pilot's Operating Handbook.
- If the PFD is able to perform fast alignment, when prompted by the PFD:
  - Maintain straight and level flight

    OR

  - If engine does not restart, maintain wings level and appropriate aircraft speed.
- Press the fast erect button.
- If the PFD was not able to perform fast alignment, maintain aircraft control with reference to the standby instruments for aircraft attitude information.

CAUTION

In case of engine failure, minimize the use of the starter and turn off all non-essential electrical equipment to preserve battery capacity.

NOTE

If standby alternator is installed, select OFF when primary alternator is OFF.

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 fuel flow indication while the electric 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.

SECTION 3 - EMERGENCY PROCEDURES (continued)

Loss of Heading Accuracy

Indication:

- Difficulty maintaining course while using VOR or GPS.
- Excessive difference between heading and track required maintaining a VOR or GPS course.
- ATC indicates the aircraft is on a wrong heading.
- Excessive deviation between PFD heading and Whiskey Compass. (>10° after compass deviation applied.)

If heading systems differ by more than 10° (after compass deviation applied):

- Use Whiskey Compass for primary heading reference.

CAUTION

High current loads in the vicinity of the Whiskey Compass can influence its accuracy. Depending on the flight conditions, the pilot must reduce these loads as much as possible to insure accuracy. Tests have shown that air conditioner and pitot heat contribute to significant heading errors of the Whiskey Compass. These items should be turned OFF prior to comparing the Whiskey Compass to the PDF heading.

SECTION 4 - NORMAL PROCEDURES

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

Passengers .... BOARD
Door .... CLOSE and LATCH
Seats .... ADJUSTED and LOCKED in position
Seat Belts and Harnesses .... FASTEN/ADJUST
Brakes .... SET
Circuit Breakers .... Check IN
Alternate Air .... OFF
Propeller .... Full INCREASE rpm
Fuel Selector .... Desired tank

SECTION 4 - NORMAL PROCEDURES (continued)

Normal Start - Cold Engine

Throttle ..... ½ inch open
Battery Master Switch ..... ON
Primary Flight Display (PFD) ..... Verify correct aircraft model software
Alternator Switch ..... ON
Standby Alternator Switch ..... ON
Electric Fuel Pump ..... ON
Magneto Switches ..... ON
Mixture ..... Prime - then idle cut-off
Propeller ..... CLEAR
Starter ..... ENGAGE
Mixture ..... Full RICH
Throttle ..... ADJUST
Oil Pressure ..... CHECK

Normal Start - Hot Engine

Throttle ..... ½ inch open
Battery Master Switch ..... ON
Primary Flight Display (PFD) ..... Verify correct aircraft model software
Alternator Switch ..... ON
Standby Alternator Switch ..... ON
Electric Fuel Pump ..... ON
Magneto Switches ..... ON
Mixture ..... Idle cut-off
Propeller ..... CLEAR
Starter ..... ENGAGE
Mixture ..... ADVANCE
Throttle ..... ADJUST
Oil Pressure ..... CHECK

SECTION 4 - NORMAL PROCEDURES (continued)

Engine Start When Flooded

Throttle .... Open full
Battery Master Switch .... ON
Primary Flight Display (PFD) .... Verify correct aircraft model software
Alternator Switch .... ON
Standby Alternator Switch .... ON
Electric Fuel Pump .... OFF
Magneto Switches .... ON
Mixture .... Idle cut-off
Propeller .... CLEAR
Starter .... ENGAGE
Mixture .... Full rich
Throttle .... RETARD
Oil Pressure .... CHECK

SECTION 4 - NORMAL PROCEDURES (continued)

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 reduced to the level of the ship's battery. This can be tested by turning on 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 external power, the battery master and alternator switches should be OFF.

Battery Master Switch....................OFF
Alternator Switch....................OFF
Standby Alternator Switch....................OFF
Magneto Switches....................ON
All Electrical Equipment....................OFF
External Power Plug....................Insert in fuselage
Proceed with normal start checklist
Throttle....................Lowest possible RPM
External Power Plug....................Disconnect from fuselage
Battery Master Switch....................ON
Alternator Switch....................ON - check ammeter
Standby Alternator Switch....................ON
Oil Pressure....................CHECK

SECTION 4 - NORMAL PROCEDURES (continued)

Ground Check

Throttle .... 2300 RPM
ALTR switch .... OFF
STBY ALTR ON annunciator .... verify ON
Increase electrical load to over 20 amps.
STBY ALTR ON annunciator .... verify flashing
Decrease electrical load to less than 20 amps.
STBY ALTR ON annunciator .... verify ON (steady)
Throttle .... retard
ALTR switch .... ON
Verify normal amperage indication.
STBY ALTR ON annunciator .... verify extinguished

Before Takeoff

STBY ALTR switch .... verify ON

Stopping Engine

STBY ALTR switch .... OFF

SECTION 5 - PERFORMANCE

No change from basic Handbook.

SECTION 6 - WEIGHT AND BALANCE

No change from basic Handbook.

SECTION 7 - DESCRIPTION AND OPERATION

A. PFD Systems Description

NOTE

This supplement provides a general description of the Avidyne FlightMax Entegra Series 700-00006-0XX-( ) PFD, its operation, and aircraft systems interfaces. For a detailed description of PFD operation, refer to the Avidyne FlightMax Entegra Series Primary Flight Display Pilot's Guide, p/n 600-00104-000 revision 00 or later.

The Entegra PFD start-up is automatic once power is applied. The display presents the Initialization Display immediately after power is applied. Power-on default is 75% brightness. Typical alignment times are 3 minutes once power is applied.

Attitude Direction Indicator (ADI)

Air Data

The airspeed tape to the left of the main ADI begins indicating at 20 Knots Indicated Airspeed (IAS) and is color coded in accordance with the model POH airspeeds for V_{SO}, V_{FE}, V_S, V_{NO}, and V_{NE}. An altitude tape is provided to the right of the main ADI and also displays a symbol for the Altitude Preselect (Altitude Bug). The Vertical Speed Indicator (VSI) is displayed to the right of the altitude tape. For vertical speed rates greater than the PFD displayed VSI scale, the indicator needle will peg just outside the scale and a digital readout of actual VSI up to 4000 FPM is then displayed. An additional data block is provided for display of Outside Air Temperature (OAT), True Airspeed (TAS), and Ground Speed (GS). Controls for selecting bug and barometric correction values are along the right side of the PFD. A wind indicator is also provided beneath the altitude tape.

Attitude Data

Attitude is depicted on the main ADI using a combination of an aircraft reference symbol ("flying-delta") against a background of labeled pitch ladders for pitch and a bank angle pointer in the form of an arced scale along the top of the main ADI for bank. A skid/slip indicator is attached to the bottom edge of the bank angle pointer.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

A. PFD Systems Description (continued)

Horizontal Situation Indicator (HSI)

Heading Data

Magnetic heading is represented in a boxed digital form at the top of the compass rose. Heading rate (Rate of Turn Indicator) takes the form of a blue arcing arrow that begins behind the magnetic heading indicator and moves left or right accordingly. Graduations are provided on the rate of turn indicator scale to indicate ½ and full standard rate turns. A heading bug is also provided on the compass rose.

Navigation Data

Navigation data on the PFD takes several forms. A Course Deviation Indicator (CDI) is always provided on the HSI and a bearing pointer can be optionally selected for display on the HSI by the pilot. Controls for selecting the source of navigation data, selecting the display format of the navigation data, and for selecting the type of compass rose and moving map to be displayed are along the left side of the PFD. The active flight plan contained in the GPS Nav/Comm unit selected as the primary navigation source (Nav) can be optionally selected for display on the HSI as well as the desired range of the optionally selectable moving map display. If a localizer or ILS frequency is tuned and captured in the GPS Nav/Comm selected as the Nav source, a Vertical Deviation Indicator (VDI) and Horizontal Deviation Indicator (HDI) are automatically displayed on the ADI.

NOTE

In the event glide slope or localizer signals are lost, the HDI and/or VDI will be displayed as red X's to indicate loss of signal. The red X'd indicator will only be removed if the signal is regained. In this case, the PFD Nav source will set to GPS, or if the GPS Nav/Comm is retuned, to another frequency. Appropriate action must be taken by the pilot if on an approach.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

A. PFD Systems Description (continued)

Autopilot Integration

The Entegra PFD is fully integrated with the S-TEC System 55X Autopilot. Reference bugs for Heading, Altitude, and Vertical Speed are provided on the PFD to control the autopilot and aid pilot situational awareness. These bugs are displayed with solid or hollow symbology depending on the autopilot status. If the autopilot is engaged in that mode, the bug is solid to indicate the autopilot is coupled to that bug. A hollow bug indicates the autopilot is not engaged in that mode.

Autopilot mode annunciations are shown on the S-TEC System 55X computer.

When included as part of the installation, autopilot mode annunciations including autopilot ready and fail indications are provided at the top of the PFD screen.

When included as part of the installation, flight director command bars on the PFD attitude indicator can be enabled by the pilot. When the flight director is enabled and the autopilot is engaged in both lateral and vertical modes, the flight director displays the goals of the autopilot.

A lateral autopilot mode must be engaged on the S-TEC System 55X before a vertical mode can be engaged.

The flight director command bars will only be displayed on the PFD when enabled by the pilot and when both lateral and vertical autopilot modes are engaged.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

A. PFD Systems Description (continued)

Autopilot Integration (continued)

The following autopilot modes are supported by the PFD:

1. HDG (Heading, using the heading bug)
2. NAV (Nav, using the course pointer and course deviation indicator)
3. GPSS (GPS Steering, using GPS course guidance)
4. APR (Approach, using the HDI and VDI, including automatic glide slope capture)
5. REV (Reverse sensing HDI approach)
6. ALT (Altitude Hold and Preselect, using the altitude bug)
7. VS (Vertical Speed, using the vertical speed bug)

NOTE

When HDG mode is engaged, rotation of the heading bug greater than 180° will result in a reversal of turn direction.

CAUTION

If a VLOC is selected in NAV on the PFD and GPSS mode is engaged on the autopilot, the autopilot will track the active flight plan in GPS1 if VLOC1 is selected or GPS2 if VLOC2 is selected and not track VLOC1 or VLOC2 as the selected source in NAV on the PFD. Therefore, the course deviation on the PFD CDI and the course deviation flown by the autopilot can be different. This situation may be confusing and should be avoided.

Engine Instruments

The Entegra PFD provides a display of Engine Tachometer (RPM), Manifold Pressure (MAP), Oil Pressure (OP), and Fuel Flow (FF) in the upper left hand corner of the display. Tach and MAP indications are presented on analog scales with normal operating (green) and warning (red) markings, as appropriate. A digital indication presents fuel flow information in gallons per hour (GPH). A digital indication presents oil pressure information in pounds per square inch (PSI).

SECTION 7 - DESCRIPTION AND OPERATION (continued)

A. PFD Systems Description (continued)

Back-up Instruments

The Entegra PFD system installation includes redundant means of display of certain aircraft flight and systems parameters. Back-up Altimeter, Airspeed and Attitude instruments are provided to facilitate pilot cross-checking of PFD display flight parameters. The aircraft wet compass serves as a back-up heading source.

B. MFD Systems Description

NOTE

This supplement provides a general description of the Avidyne EX5000 Series 700-00004-0XX-( ) MFD, its operation and aircraft interface. For a detailed description of the MFD, refer to the Avidyne FlightMax EX5000 Series Pilot's Guide and Reference, p/n 600-00105-000 revision 00 or later.

Navigation

Data associated with the moving map is found on four pages: Map, Nearest, Trip, and Info pages. The MFD contains a Jeppesen NavData database that is available for display on the Map page. In conjunction with GPS-supplied position information, an own-ship symbol is superimposed on the moving map and positioned relative to the NavData information. GPS can also supply the active flight plan for display on the moving map. Terrain data is provided by a USGS terrain database stored within the MFD and updated only on an as needed basis.

The Jeppesen Navigation Database provides data on airports, approaches, VOR's, NDB's, intersections, airspace definitions, and frequencies. North American and international databases are available. Database information can be updated via the USB port on the front face of the bezel.

The navigation data on the moving map display are based on databases that are updated periodically. Database updates are available on 28-day cycle subscriptions. Expired databases are clearly stated to the pilot via messages during system startup and on the System Setup page. The warning can only be removed by updating the data.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

B. MFD Systems Description (continued)

Navigation (continued)

NOAA man-made obstruction database information provides data on man-made obstacles over 200 feet AGL. This data is only available for North America and can be updated via the USB port on the front face of the bezel.

The obstacle data on the moving map display are based on databases that are updated periodically. Database updates are available from Avidyne on 56-day cycle subscriptions. Expired databases are clearly stated to the pilot via messages during system startup and on the System Setup page. The warning can only be removed by updating the data.

Using the Jeppesen NavData data and the GPS-supplied present position, the MFD can provide the pilot with the nearest 25 airports or navaids, depending on pilot selection, within 100 nm. This information is presented on the Nearest page.

More detailed information on a particular airport is also generated from the Jeppesen NavData data and is available for pilot viewing on the Info page.

Flight plan data supplied by the GPS system provide the pilot with a tabular form of the remaining legs in the active GPS flight plan. This information is viewed on the Trip page and includes a CDI for added enroute navigation aiding.

Flight plan data is transmitted to the MFD from an external GPS navigator. Some installations do not support depictions of curved flight paths. In these cases, curved flight path segments will be depicted as straight lines. The GPS navigator and HSI are to be used during approach procedures. Reference the Avidyne FlightMax EX5000 Series Pilot's Guide, p/n 600-00105-000, for more information.

Datalink

Datalink information is received by the MFD based upon installation provisions and a subscription service available through Avidyne (www.myavidyne.com). Data is presented on the Map, Trip, and Nearest pages. Datalink information is provided for strategic planning purposes only. Data aging and transport considerations make it unsuitable for tactical use. Reference the Avidyne FlightMax EX5000 Series Pilot's Guide, p/n 600-00105-000, for more information.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

B. MFD Systems Description (continued)

Setup

The various System Setup pages allow the pilot to set user preferences for system operation. In addition to listing the software version identification information and database validity dates, the System Setup page allows access to several pages for preference selection and provides a means to initiate self-tests of the traffic and lightning sensors.

Airport Settings page provides selections for displaying airport type, runway surface type and minimum runway lengths on the moving map. **Declutter Settings** page allows the pilot to select settings for defining the base map detail when changing display range. **System Time** page provides an opportunity to select system time zone and Map page menu timeout options. **DataBlock Edit** page allows the pilot to select the data to be displayed in the datablock windows on the Map page. **Datalink Setup** page allows the pilot to select parameters for the datalink system, including update rate and range of weather data request.

Engine Instruments

The Engine page provides the pilot with engine parameters depicted on simulated gauges and electrical system parameters located in dedicated regions within the MFD display. An Engine Sensor Unit interfaces with engine-mounted sensors and provides data to the MFD for display.

A leaning function assists the pilot in leaning the engine for best power or best fuel economy. To initiate the leaning function, press the Lean Assist bezel key and proceed to lean the engine fuel mixture. Best economy is achieved when the engine is operating at peak EGT of the leanest cylinder (first cylinder to peak), as recommended by the engine manufacturer. Best power is achieved when the engine is leaned to the first cylinder to reach its EGT peak. When leaning is complete, select Absolute or Normalize to complete the leaning process. A digital readout of EGT change from the peak value is provided for reference. If at any point during the lean assist a CHT exceeds 435°F, the lean assist will be exited and the pilot referred to the Piper Pilot's Operating Handbook. Reference the Avidyne FlightMax EX5000 series Pilot's Guide, p/n 600-00105-000, for more information.

SECTION 7 - DESCRIPTION AND OPERATION (continued)

C. STANDBY ALTERNATOR System Description

The B&C Specialty Products Standby Alternator system automatically delivers electrical power to the aircraft electrical power bus in the event of failure of the primary alternator, provided the STBY ALTR switch is in the ON position. Powering the bus allows the pilot flexibility to choose equipment suitable to the current flight conditions. Equipment that would otherwise deplete the battery reserve may be used within the standby alternator's current limit.

The standby alternator controller monitors the aircraft electrical power bus voltage and activates the standby alternator if the bus voltage falls to less than 26.0 volts. As long as the electrical load is maintained below standby alternator capacity, the bus voltage will not fall below 25.0 volts and the battery will remain charged. Battery energy will then be available for gear extension, flap extension and other approach loads.

The standard aircraft amperage indication represents the standby alternator output when the STBY ALTR ON annunciator is lit.

The standby alternator is capable of outputs greater than maximum continuous load for less than 5 minutes without damage. Extended operation over rated load may cause immediate or premature alternator failure and battery depletion.

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SECTION 10

OPERATING TIPS

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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 described below at the time of licensing by the manufacturer. The New Piper Aircraft, Inc. will not revise this equipment list once 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. 3246223 REGISTRATION NO. N3101Q DATE 07/08/04

Item No.	Item	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lbs.-In.)
	(a) Electrical Equipment			
1	Battery installation, Piper Drawings 104408-5 and 101000-2			
	a.) Battery, Gill P/N G-243, Piper Drawing 101000-2, Piper Code number 450-101	28.00	203.44	5696.21
	b.) Battery hardware installation, Piper Drawing 101000-2	1.42	200.49	284.19
	(b) Cabin Interior			
5	Pilot Adjustable Seat (leather) with headrest, armrest and lumbar support Piper Drawings 78087-12 and 89026-12	25.59	91.2	2333.81
7	Copilot Adjustable Seat (leather) with headrest, armrest and lumbar support Piper Drawings 78087-12 and 89026-13	25.61	91.2	2335.63
9	Center Club Seat (leather)- (left) with Headrest, Piper Drawings 37825-12 and 89036-2	18.58	112.8	2095.82
11	Center Club Seat (leather) -(right) with Headrest, Piper Drawings 37825-12 and 89036-2	18.66	112.8	2104.85
13	Aft Seat (leather)-(left) with Headrest, Piper Drawings 78087-12 and 89046-2	15.68	163.4	2562.11
17	Aft Seat (leather)-(right) with Headrest and center armrest, Piper Drawings 78087-12 and 89046-4	18.16	162.2	2945.55
19	Refreshment console installation, Piper Drawing 37825-11			
	1.) Refreshment console, Piper Drawing 104215	10.10	118.50	1196.90
	2.) Igloo "Legend Six-Packer" cooler – P/N ICI Legend 4, Piper Drawing 104215, Piper Code Number 602-022	1.70	118.50	201.50
	3.) Refreshment console installation hardware, Piper Drawing 37825-11	0.14	128.74	17.63

Item No.	Item	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lbs.-In.)
	(b) Cabin Interior-continued			
21	Fire extinguisher installation, Piper Drawing 100801-3			
	a.) Saber P/N 1211-1301 Halon model RTA600, Piper Drawing 100632-2, Piper Code number 459-887	1.62	103.63	167.41
	b.) Fire extinguisher installation hardware, Piper Drawings 100801-3 and 100632-2	0.60	105.30	63.09
	(h) Standard Avionics Equipment -continued			
31	Pilot's microphone -Piper drawing 79036-023			
	a.) Telex 100T/NH Microphone P/N 62800-001 Piper Code Number 474-657	0.26	73.04	19.06
	b.) Telex Holder P/N 64022-000 and hardware Piper Drawing 79036-023	*0.03*	73.04	*1.98*
33	Pilot's headset-Piper drawing 79036-023			
	a.) Telex 5161A Airman 760 Headset Piper Code Number 692-205	0.20	79.50	16.14
	(i) Miscellaneous			
41	Fuel sampler bottle, Piper Drawing 67728-0	0.07	97.63	6.79
43	Tow Bar assembly, Piper Drawing 69975-2	2.3	193.9	446.0

END OF STANDARD EQUIPMENT

Item No.	Item	Mark if Option Installed	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lbs.-In.)
	(j) Electrical (Optional Equipment)				
81	Tail light installation, Piper Drawing 85505-5 (United Kingdom requirement),				
	a.) Light assembly, Piper Drawing 63886-004	☐	0.139	308.00	42.90
	b.) Light installation, Piper Drawing 85505-5	☐	0.129	267.92	34.47
	Tail light installation weight		0.263	288.51	75.86
	(k) Instruments (Optional Equipment)				
91	Copilot's Advanced Instrumentation, Piper drawing 85569-10, (Marketing Option 454)				
	a.) Truspeed Indicator, United Instruments Part Number 8125-B.794, Cert. Basis - TSO C2b, Piper PS50049-67T, Piper Code number 602-230	☐	0.72	66.73	47.98
	b.) Attitude Gyro, R.C. Allen part number RCA26BK-6, Cert. Basis - TSO C4c, Piper code number 548-365	☐	2.23	64.58	144.01
	c.) Turn and Bank Coordinator, Electric Gyro Corp part number 1394T100-7Z, Cert. Basis - TSO C3b, Piper PS50030-3-5, Piper code number 548-190	☐	1.05	65.66	68.90
	d.) Directional Gyro, Sigma-Tek part number IU262-001-37 Model number 4000B-26, Cert. Basis - TSO C5c, Piper PS 50126-5, Piper code number 548-435	☐	2.45	64.57	157.87
	e.) Altimeter, United Instruments part number UI5934PD-3A.134 Cert. Basis - TSO C10b, Piper PS50008-10-2D, Piper Code number 599-549	☐	0.86	65.83	56.58
	f.) Vertical Speed United Instruments part number UI-7000, Cert. Basis -TSO C8b, Piper Drawing 99010-5, Piper code number 550-556	☐	0.77	66.73	51.05
	g.) Copilot's Advanced Instrumentation hardware, Piper Drawing 85569-10	☐	2.34	61.69	144.26
	Copilot's Advanced Instrumentation system total weight		10.41	64.45	670.69
	(l) Autopilot (Optional Equipment)				
111	Altitude Vertical Speed Selector/Altitude Alerter System Piper Drawing 104583-003, Piper code number 652-158 (Marketing Option 515)				
	a.) S-TEC Altitude Selector/Alerter P/N01279-PX, Piper Code number 652-1586	☐	1.05	67.700	71.09
	b.) S-TEC Altitude Selector/Alerter Cable and hardware STEC Part number 90482-1	☐	0.334	67.753	22.629
	c.) S-TEC Altitude Selector/Alerter Placards STEC-part number 901482-2	☐	0.002	67.880	0.136
	Altitude Vertical Speed Selector/Altitude Alerter System total weight		1.39	67.71296	93.85
113	Copilot's Electric Trim System, Piper Drawing 104583-004 (Marketing Option 580)				
	a.) STEC Optional Co-Pilots Trim system Kit , STEC part number 90485, Piper Code number 651-907	☐	1.027	65.50	67.29
	b.) Copilot's Electric Trim System hardware, Piper Drawing 104583-004	☐	0.106	64.50	6.86
	Copilot's Electric Trim System total weight		1.134	65.41	74.15

Item No.	Item	Mark if Option Installed	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lbs.-In.)
	(l) Autopilot (Optional Equipment)-continued				
115	Copilot's STEC Trim And Mike Switch Assembly Piper Drawing 101117-018	☐	0.25	73.76	18.10
	Remove Standard Copilot's Mike Switch assembly Piper Drawing 101117-008		-0.07	73.76	-5.04
	Delta Between Copilot's Standard and Optional mike switch installation		0.18	73.76	13.05
	(m) Avionics (Optional Equipment)				
133	Garmin Audio Amp/Intercom Installation with summing amp, Piper Drawing 105304-003, Cert. Basis - TSO C35d, C50c				
	a.) Garmin GMA 340 Audio Selector Panel, Piper PS 50040-15-25, Piper Code 601-210				
	1.) Garmin 011-00401-10 GMA Audio Panel Marker /Receiver	☐	1.57	63.86	100.26
	2.) Garmin 011-00403-00 Connector/Rack Kit	☐	0.17	63.86	10.86
	b.) PS Engineering 4622SS Headset (2), Piper Code 694-202	☐	2.13	118.00	251.22
	c.) PS Engineering 4622SS Headset (2), Piper Code 694-202	☐	2.13	154.69	329.34
	d.) Harnesses, Brackets, Summing amp and Hardware, Piper Drawing 105304-003	☐	4.59	84.42	387.07
	Removed Standard Garmin Audio Amp/Intercom Installation, Piper Drawing 105304-002		-9.80	105.71	-1035.64
	Delta System Weight		0.79	54.83	43.10
135	S-TEC DME 451 with /450 Indicator installation Piper Drawing 101246-3, (also include shelf installation item 141) (Marketing Option 575)				
	a.) S-TEC DME Installation Kit PS50040-31-26 Piper Code Number 601-212				
	1.) S-TEC Transceiver TCR-451 P/N 690109	☐	4.80	233.5	1120.8
	2.) S-TEC Transceiver Installation Kit P/N 690224	☐	0.69	233.5	160.4145
	3.) S-TEC Indicator IND-450 P/N 690111-P	☐	0.54	63.88	34.55908
	4.) S-TEC Indicator Installation Kit P/N 690221	☐	0.08	63.88	5.091236
	5.) S-TEC Antenna ANT-451 P/N 690126	☐	0.19	123.74	23.88182
	6.) S-TEC Antenna Installation Kit P/N 690218	☐	0.05	123.74	5.87765
	b.) Harness and hardware Piper Drawing 101246-3	☐	3.55	121.2036	429.72
	S-TEC DME 451 with 450 Indicator Installation Total Weight		9.89	179.95	1780.34

Item No.	Item	Mark if Option Installed	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lbs.-In.)
	(m) Avionics (Optional Equipment)				
137	S-TEC ADF RCR-650D Installation Piper Drawing 101254-003 (Marketing Option 525)				
	a.) S-TEC ADF Kit 901483 (RCR-650D) Piper Code Number 652-168				
	1.) S-TEC Receiver RCR-650D P/N 690108-4	☐	2.48	64.07	159.15
	2.) S-TEC Receiver Installation Kit P/N 690212	☐	0.55	64.07	35.24
	3.) S-TEC Indicator IND-650D P/N 690113-P	☐	0.66	64.07	42.29
	4.) S-TEC Indicator Installation Kit P/N 690217	☐	0.02	64.07	1.28
	5.) S-TEC Antenna ANT-650D P/N 690124	☐	2.28	194.01	442.34
	6.) S-TEC Antenna Installation Kit P/N 690215	☐	0.18	194.01	34.92
	7.) S-TEC Power Adapter P/N 01255	☐	0.52	196.80	102.34
	b.) Harness, bracket and hardware Piper Drawing 101254-003	☐	3.40	113.87	387.70
	S-TEC ADF RCR-650D Installation Total Weight		10.10	119.35	1205.25
139	Situational Awareness Package, Piper Drawings 104386-2, 104278-2 and 104091-005, (also include shelf installation item 141), (Marketing option 340)				
	a.) WX-500 Stormscope system installation, Piper Drawing 104386-2				
	1.) WX-500 System (Stormscope), L3 Communications P/N 830-11500-001, Piper Drawing 72496-270, Piper Code Number 601-225				
	a.) WX-500 Stormscope processor, L3 Communications P/N 805-11500-001, Piper Code Number 601-226	☐	1.70	233.44	396.84
	b.) WX-500 NY163 Stormscope antenna, L3 Communications P/N 805-10930-001, Piper Code Number 683-728	☐	0.81	236.94	190.73
	c.) WX-500 Stormscope antenna cable, L3 Communications P/N 803-10950-004, Piper Code Number 653-688	☐	0.39	232.69	89.59
	d.) WX-500 Stormscope installation, L3 Communications P/N 817-11500-001, Piper Code Number 601-227	☐	1.15	234.61	269.80
	2.) Cable, Harness, Bracket and Hardware, Piper Drawing 104386-2	☐	1.76	158.03	278.45
	WX500 Stormscope system installation total weight		5.80	211.21	1225.42
	b.) TRC-497 Skywatch System Installation, Piper Drawing 104278-2				
	1.) SKY -497 Systems (Skywatch), Piper Drawing 72496-280				
	a.) TRC-497 Transmitter/Receiver Computer (Skywatch), L3 Communications P/N 805-10800-001 with Mounting Tray Assembly P/N 805-10870-001, Piper Code Number 601-223	☐	9.86	215.32	2123.06
	b.) TRC-497 Installation Kit, L3 Communications P/N 817-10800-003, Piper Code Number 601-224	☐	0.51	215.32	109.81
	c.) TRC-497 NY164 Directional Antenna, L3 Communications P/N 805-10890-001, Piper Code Number 683-726	☐	2.31	128.50	296.84
	d.) TRC-497 NY164 Directional Antenna Installation Kit, L3 Communications P/N 817-10009-006, Piper Code Number 683-727	☐	0.76	128.50	97.02
	2.) Cable, Harness, bracket and hardware, Piper Drawing 104278-2	☐	5.85	147.38	862.58
	TRC-497 Skywatch System Installation total weight		19.29	180.91	3489.30
	3. Inverter Installation - MD 26-28, Piper Drawing 104091-5 (Required with TRC-497 Sky watch package)				

Item No.	Item	Mark if Option Installed	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lbs.-In.)
	(m) Avionics (Optional Equipment)-continued				
139	Situational Awareness Package, Piper Drawings 104386-2, 104278-2 and 104091-005, (also include shelf installation item 141), (Marketing option 340)-continued				
	b.) TRC-497 Skywatch System Installation, Piper Drawing 104278-2-continued				
	3. Inverter Installation - MD 26-28, Piper Drawing 104091-5 (Required with TRC-497 Sky watch package)-continued				
	a.) Mid Continent Industries DC-AC Inverter P/N MD26-28, 28VDC/26 VAC, Piper Code Number 602-248	☐	0.48	199.19	95.61
	b.) Harness and hardware Piper Drawing 104091-005	☐	0.372	144.28	53.68
	Inverter Installation - MD 26-28 total weight		0.85	175.21	149.29
	Situational Awareness Package total weight		25.94	187.50	4864.00
141	Shelf installation (Required with DME and and/or Situational Awareness package options), Piper Drawings 101246-003, 104386-2 and 99466-026 (Marketing options 340 and/or 575)				
	a.) Shelf assembly, Piper Drawing 101253-004	☐	1.07	233.03	248.57
143	Removed standard emergency locator transmitter and antenna, Piper Drawing 06327-010 Cert. Basis TSO C91a (Marketing option 260 – International only)				
	a.) Removed Artex ELT model 110-4 kit Piper code number 651-673				
	1.) Removed Artex transmitter model 110-4 unit/bracket Piper Code number 651-673	☐	-4.26	268.02	-1141.77
	2.) Removed antenna Artex P/N 110-324 Piper Code number 651-673	☐	-0.09	240.15	-21.61
	Emergency locator transmitter and antenna package removal weight		-4.35	267.44	-1163.38

Item No.	Item	Mark if Option Installed	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lbs.-In.)
	(n) Avidyne Entegra Avionics (Optional Equipment)				
151	Standard Entegra Avionics Package, Piper Drawings 101844-003, 101844-100, 101844-101, 101844-102, 101844-103, 101844-104, 101844-109, 101844-111, 101847-2, 38453-22 and 101769-002- (Marketing option AVI) Garmin GNS 430 (11-33VDC)/GNS 430 (11-33VDC) System Installation - Dual COM/NAV/GPS Piper Drawings 101844-100 and 101844-101				
	a.) Garmin GNS 430 System Installation - Dual COM/NAV/GPS, Piper Drawing 101844-100, Cert. Basis TSO 37d,C38d, C40c, C36e, C34e, C129a				
	1.) Garmin GNS430 (11-33VDC) #1 with mount, connectors and data card Piper PS50040-40-4, Piper Drawing 101844-100 Piper Code Number 601-229	☐	6.56	62.96	412.76
	2.) Hardware Piper Drawings 101844-100	☐	0.12	67.76	8.11
	3.) NAV receiving AV12-PPR Antenna, Piper Drawing 101844-100, Piper Code Number 451-802	☐	0.40	288.82	115.53
	4.) Nav Antenna Cable assembly and hardware Piper Drawing 101844-100	☐	1.75	161.04	281.65
	5.)VHF Comm #1 Antenna Comant P/N CI-122, Piper Drawing 101844-100, Piper Code Number 683-725	☐	0.60	112.00	67.31
	6.) Comm #1 Antenna Cable assembly and hardware, Piper Drawing 101844-100	☐	0.61	86.91	52.84
	7.) GPS Antenna (Single), Piper Drawing 101844-100	☐			
	a.) Garmin P/N 011-00134-00 GA56 Antenna #1, Piper Drawing 101844-100, Piper Code number 683-721	☐	0.24	101.12	24.47
	b.) Garmin Antenna Cable and hardware, Piper Drawing 101844-100	☐	0.61	86.97	53.14
	b.) Garmin GNS 430 System Installation - Dual COM/NAV/GPS Piper Drawing 101844-101, Cert. Basis TSO 37d,C38d, C40c, C36e, C34e, C129a				
	1.) Garmin GNS430 (11-33VDC) #2 with mount, connectors and data card Piper PS50040-40-4 Piper Code Number 601-229	☐	6.56	62.96	412.76
	2.) Cable assemblies-Nav and Hardware, Piper Drawing 101844-101	☐	0.40	62.93	25.15
	3.) #1 VHF Comm Comant P/N CI-121 Antenna, Piper Drawing 101844-101, PS50040-18-2, Piper Code Number 596-664	☐	0.54	168.00	91.14
	4.) Comm #2 Antenna Cable assembly and hardware, Piper Drawing 101844-101	☐	0.58	167.13	96.59
	5.) GPS Antenna (Single), Piper Drawing 101844-101	☐			
	a.) Garmin P/N 011-00134-00 GA56 Antenna #2, Piper Drawing 101844-101, Piper Code number 683-721	☐	0.24	101.12	24.47
	b.) Garmin Antenna Cable and hardware, Piper Drawing 101844-101	☐	0.59	87.06	51.19
	c.) Garmin GTX-330 Transponder installation with AK-850 and Single GPS, Piper Drawing 101844-109, Cert. Basis-TSO C74C				
	1.) Garmin GTX330 Transponder Unit P/N 011-00455-00, Piper Drawing 101844-109, PS50040-12-15 Piper Code 652-370	☐	4.20	63.88	268.30
	2.) Garmin Transponder Antenna P/N 010-10160-00, Piper Drawing 101844-109, Piper Code Number 683-724	☐	0.21	55.06	11.56
	3.) Backing plate, and hardware, Piper Drawing 101844-109	☐	0.24	58.69	14.03
	4.) Altitude Reporter, Ameri-King Corporation Model AK-350, Piper Drawing 101844-109, Piper Code number 602-290	☐	0.57	54.19	30.83
	5.) Altitude Reporter assembly and hardware, Piper Drawing 101844-109	☐	0.32	55.02	17.72

Item No.	Item	Mark if Option Installed	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lbs.-In.)
	(n) Avidyne Entegra Avionics (Optional Equipment)-continued				
151	Standard Entegra Avionics Package, Piper Drawings 101844-003, 101844-100, 101844-101, 101844-102, 101844-103, 101844-104, 101844-109, 101844-111, 101847-2, 38453-22 and 101769-002- (Marketing option AVI)-continued				
	d.) Garmin GMA –340 Audio Amp Installation Piper Drawing 101844-102 Cert. Basis- TSO C35d, C50c				
	1.) Garmin GMA 340 Audio Selector Panel, Piper Drawing 101844-102, Piper PS 50040-15-25 Piper Code Number 601-210				
	a.) Garmin P/N 011-00401-10 GMA Audio Panel Marker /Receiver	☐	1.57	63.86	100.26
	b.) Garmin P/N 011-00403-00 Connector/Rack Kit	☐	0.17	63.86	10.86
	2.) Harnesses, Brackets and hardware, Piper Drawing 101844-102	☐	0.08	67.71	5.34
	3.) Marker Beacon Antenna Comant P/N CI-102, Piper Drawing 101844-102, Piper PS50040-15-10, Piper Code Number 597-893	☐	0.45	247.43	112.33
	4.) Marker Beacon antenna cable and hardware Piper Drawing 101844-102	☐	0.72	161.28	115.85
	e.) Avidyne Entegra Primary Flight Display EXP 5000 installation, Piper Drawing 101844-103				
	1.) Avidyne Entegra Primary Flight Display EXP 5000, Avidyne part number 700-00006-002, Piper Code number 652-377	☐	12.40	63.85	791.74
	2.) Avidyne Entegra Primary Flight Display EXP 5000 installation hardware, Piper Drawing 101844-103	☐	0.14	64.04	9.27
	f.) Avidyne Entegra Multi Function Display EX-5000 installation, Piper Drawing 101844-104				
	1.) Avidyne Entegra Multi Function Display EX-5000, Avidyne part number 700-00004-006, Piper Code number 652-378	☐	7.60	66.08	502.21
	2.) Avidyne Entegra Multi Function Display EX-5000 installation hardware, Piper Drawing 101844-104	☐	0.05	67.88	3.57
	g.) Avidyne Entegra magnetometer -Outside air temperature installation, Piper Drawing 101844-111				
	1.) Avidyne Entegra magnetometer, Avidyne Part number 700-00011-000, Piper code number 652-375	☐	0.52	94.88	49.34
	2.) Avidyne Entegra magnetometer, installation hardware and harness, Piper Drawing 101844-111	☐	2.02	113.99	230.49
	h.) Avidyne Entegra Data Acquisition Unit installation, Piper Drawing 101844-112				
	1.) Avidyne Entegra Data Acquisition Unit, Avidyne part number 200-00041-000, Piper Code number 652-379	☐	1.60	64.05	102.48
	2.) Avidyne Entegra Data Acquisition Unit installation hardware, Piper Drawing 101844-112	☐	0.03	64.56	2.14
	i.) Avionics -System Installation hardware, Piper drawing 101844-003	☐	19.15	65.77	1259.62
	j.) Entegra structural installation, Piper Drawing 101769-002	☐	1.93	58.03	112.13
	k.) S-TEC System 55X Autopilot installation-Entegra Piper Drawing 101847-002				
	1.) S-TEC P/N 6405-28L Turn Coordinator	☐	1.80	64.95	116.90
	2.) Turn Coordinator hardware 101847-002	☐	0.24	67.64	16.34
	3.) S-TEC P/N 01192-12-68TF Programmer Computer	☐	2.70	65.16	175.93
	4.) S-TEC P/N 55254-1 Mounting Tray	☐	0.35	65.16	22.93

Item No.	Item	Mark if Option Installed	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lbs.-In.)
	(n) Avidyne Entegra Avionics (Optional Equipment)-continued				
151	Standard Entegra Avionics Package, Piper Drawings 101844-003, 101844-100, 101844-101, 101844-102, 101844-103, 101844-104, 101844-109, 101844-111, 101847-2, 38453-22 and 101769-002- (Marketing option AVI)-continued				
	k.) S-TEC System 55X Autopilot installation-Entegra Piper Drawing 101847-002-continued				
	5.) S-TEC Programmer Computer hardware	☐	0.03	64.98	1.94
	6.) S-TEC P/N 0111 Transducer	☐	0.20	67.01	13.40
	7.) S-TEC Transducer installation hardware	☐	0.10	67.05	7.00
	8.) S-TEC P/N 0106-R9 Roll Servo	☐	2.90	117.70	341.33
	9.) S-TEC Roll Servo bracket and hardware	☐	0.66	117.70	77.32
	10.) S-TEC P/N 0108-P1 Pitch Servo	☐	2.90	263.90	765.31
	11.) S-TEC Pitch Servo bracket and hardware	☐	1.38	264.09	363.62
	12.) S-TEC P/N 0106-16-T8 Trim Servo	☐	2.90	193.20	560.28
	13.) S-TEC Trim Servo brackets and hardware	☐	1.31	191.21	250.05
	14.) S-TEC P/N 01240 Trim Monitor	☐	0.30	61.20	18.36
	15.) S-TEC P/N 6542 Sonalert	☐	0.10	61.20	6.12
	16.) S-TEC Trim Monitor and Sonalert hardware	☐	0.063	60.86	3.85
	17.) Aft Autopilot Servo Harness-Entegra, Piper drawing 101750-106	☐	1.56	183.95	286.04
	18.) S-TEC Flap Compensator-potentiometer installation	☐	0.24	114.25	26.90
	19.) S-TEC Switch installation (Control Wheel)	☐	0.062	73.76	4.54
	20.) Autopilot installation hardware, Piper drawing 101847-002	☐	0.33	65.97	21.78
	l. Standby Flight instruments installation, Piper drawings 38453-22 and 85462-007				
	1.) Truspeed Indicator, Piper PS50049-65T United Instruments 8125-B.765, Cert. Basis - TSO C2b	☐	0.72	66.67	47.83
	2.) Altimeter, Piper PS50008-10-2D –United UI5934PD-3A.134 Cert. Basis - TSO C10b	☐	0.86	65.71	56.47
	3.) Standby attitude Indicator with battery pack option, Mid-Continent Part MD4300-411, Piper code 602-319	☐	3.67	63.46	232.88
	4.) Standby flight instruments installation hardware, Piper drawings 38453-22 and 85462-007	☐	0.73	63.67	46.67
	Removed Standard Avionics Package, Piper Drawings 105302-002, 105306-002, 105304-002, 104391-002, 101426-002, 101319-004, 101310-002, 101273-004, 39737-005, 101117-008, 101117-017 and 104583-002		-91.39	99.49	-9092.34
	Removed Standard Vacuum system, Piper drawing 100940-003		-5.53	39.96	-220.95
	Removed Auxiliary Vacuum system, Piper drawing 87778-004		-12.65	43.34	-548.22
	Remove Flight instruments installation, Piper drawings 38453-19 and 85462-004		-4.61	65.68	-302.55
	Removed Engine instruments installation, Piper drawings 100933-003		-4.47	65.75	-294.09
	Delta Avidyne Entegra Standard System Weight		-18.77	81.36	-1527.16

Item No.	Item	Mark if Option Installed	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lbs.-In.)
	(n) Avidyne Entegra Avionics (Optional Equipment)-continued				
153	Copilot's Electric Trim System installation, Piper Drawings 101847-3, 101750-107 and 101117-18- Avidyne Entegra system only – (Marketing Option 580)	☐	1.38	68.65	94.99
155	Garmin GI-106A System installation, Piper Drawing 101844-101 - Avidyne Entegra system only –(Marketing option 225)				
	a.) Garmin GI-106A Indicator, Piper PS 50040-40-2, Piper Code 602-239	☐	1.02	64.66	65.95
	b.) Cables/harnesses and hardware, Piper Drawing 101844-101 and 101750-104	☐	0.54	62.82	33.77
	Garmin GI-106A System installation weight		1.56	64.02	99.72
157	Avidyne Integrated Weather Data Link installation, Piper Drawings 101844-107 and 101750-108 - Avidyne Entegra system only - (Marketing option 250)				
	a.) Avidyne Weather Data link antenna, Comant Model number CI-248-30, Piper Code number 633-735	☐	0.40	168.00	67.20
	b. Avidyne DC-50 Data link Antenna Coupler, Part number 700-00015-000, Piper Code number 652-372	☐	0.63	64.66	40.64
	c.) Cables and hardware, Piper Drawing 101844-107 and 101750-108	☐	0.61	63.06	38.35
	Removed Standard Comm Antenna # 2, Comant Industries Model CI-121, Piper drawing 101844-101, Piper Code number 596-664		-0.54	168.00	-91.14
	Avidyne Integrated Weather Data Link installation delta weight		1.09	50.31	55.05
159	S-TEC DME 451 with /450 Indicator installation Avidyne- Entegra System only, Piper Drawing 101844-105, (also include shelf installation item 163) - (Marketing option 575)				
	a.) S-TEC DME Installation Kit PS50040-31-26, Piper Code Number 601-212				
	1.) S-TEC Transceiver TCR-451 P/N 690109	☐	4.80	233.50	1120.80
	2.) S-TEC Transceiver Installation Kit P/N 690224	☐	0.69	233.50	160.41
	3.) S-TEC Indicator IND-450 P/N 690111-P	☐	0.54	63.88	34.56
	4.) S-TEC Indicator Installation Kit P/N 690221	☐	0.08	63.88	5.09
	5.) S-TEC Antenna ANT-451 P/N 690126	☐	0.19	123.74	23.88
	6.) S-TEC Antenna Installation Kit P/N 690218	☐	0.05	123.74	5.88
	b.) Harness and hardware Piper Drawing 101488-105	☐	3.51	141.37	495.59
	S-TEC DME 451 with 450 Indicator installation weight		9.85	187.36	1846.21

Item No.	Item	Mark if Option Installed	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lbs.-In.)
	(n) Avidyne Entegra Avionics (Optional Equipment)-continued				
161	Situational Awareness Package -Avidyne Entegra, Piper Drawing 101844-106 (also include shelf installation item 163)-(Marketing Option 340)				
	a.) WX500 Stormscope system installation, Piper Drawing 101844-106 (also include shelf installation item 163)				
	1.) WX-500 System (Stormscope), L3 Communications P/N 830-11500-001, Piper Drawing 72496-270, Piper Code Number 601-225				
	a.) WX-500 Stormscope processor, L3 Communications P/N 805-11500-001, Piper Code Number 601-226	☐	1.70	233.44	396.84
	b.) WX-500 NY163 Stormscope antenna, L3 Communications P/N 805-10930-001, Piper Code Number 683-728	☐	0.81	236.94	190.73
	c.) WX-500 Stormscope antenna cable, L3 Communications P/N 803-10950-004, Piper Code Number 653-688	☐	0.39	232.69	89.59
	d.) WX-500 Stormscope installation, L3 Communications P/N 817-11500-001, Piper Code Number 601-227	☐	1.15	234.61	269.80
	2.) Cable, Harness, Bracket and Hardware, Piper Drawing 101844-106	☐	1.77	158.29	279.92
	WX500 Stormscope System installation weight		5.81	211.23	1226.88
	b.) TRC-497 Skywatch system installation, Piper Drawing 101844-106-continued				
	1.) SKY -497 Systems (Skywatch), Piper Drawing 72496-280-continued				
	a.) TRC-497 Transmitter/Receiver Computer (Skywatch) L3 Communications P/N 805-10800-001 with Mounting Tray Assembly P/N 805-10870-001, Piper Code Number 601-223	☐	9.86	215.32	2123.06
	b.) TRC-497 Installation Kit, L3 Communications P/N 817-10800-003, Piper Code Number 601-224	☐	0.51	215.32	109.81
	c.) TRC-497 NY164 Directional Antenna, L3 Communications P/N 805-10890-001, Piper Code Number 683-726	☐	2.31	128.50	296.835
	d.) TRC-497 NY164 Directional Antenna Installation Kit, L3 Communications P/N 817-10009-006, Piper Code Number 683-727	☐	0.76	128.50	97.02
	3.) Cable, Harness, Bracket and Hardware, Piper Drawing 101844-106	☐	5.87	147.64	867.33
	TRC-497 Skywatch System Installation weight		19.31	180.95	3494.05
	Situational Awareness Package total weight		25.12	187.95	4720.94
163	Shelf Installation (Required with DME and/or Situational Awareness Package-Avidyne Entegra System),Piper Drawing 101488-105, -106 and 99466-026				
	a.) Shelf assembly, Piper Drawing 101253-004	☐	1.07	233.03	248.57

Item No.	Item	Mark if Option Installed	Weight (Pounds)	Arm (In.) Aft Datum	Moment (Lbs.-In.)
	(0) Miscellaneous (Optional Equipment)				
181	Air Conditioning Installation HFC 134A - Piper Drawing 85506-4 (Marketing Option 201)				
	a. Condenser Installation, Piper Drawing 99855-4	☐	11.93	223.80	2670.3
	b. Condenser-Heatcraft P/N 979495, Piper Drawing 99387-5, Piper Code number 552-250	☐	4.60	211.77	974.1
	c. Condenser Frame Assembly, Piper Drawing 99549-20	☐	3.34	210.02	701.7
	d. Refrigerant lines installation, Piper Drawing 99291-8	☐	5.31	162.29	862.10
	e. Electrical Installation, Piper Drawing 101294-2	☐	4.09	126.77	518.86
	f. Air conditioning Installation forward of the Firewall Piper Drawing 100920-7	☐	10.46	6.85	71.70
	g. Air conditioning compressor assembly-Compressor Sanden Model SD-507 P/N 5111 -HFC 134A Piper drawing 100821-003 Piper Code number 689-928	☐	14.83	-1.60	-23.73
	h. Bulkhead and Evaporator hardware installation Piper Drawing 78734-10	☐	4.37	203.65	890.12
	i. Evaporator-Heatcraft P/N C-6177 Piper Drawing 99640-008, Piper code number 552-201	☐	3.80	192.44	730.30
	j. Blower assembly-Piper Drawings 99640 and 99642-4	☐	3.91	206.56	806.95
	k. Receiver-Hydrator-Automotive Air International P/N AMA 37781 Piper drawing 99640, Piper Code number 602-275	☐	1.42	199.84	282.77
	j. Cabin Pressure tube installation -Piper Drawing 99978-002	☐	0.14	62.04	8.74
	Fresh Air Blower Installation Piper Drawing 36983-18-Aft		-9.00	209.34	-1884.0
	Remove Cable Installation (Piper Drawing 89402-3)		-2.03	188.03	-381.7
	Delta Weight		57.17	108.80	6219.60
185	Stainless steel fasteners installation, Piper Drawing 101015-5				
	a.) Stainless steel fasteners installation, Piper Drawing 101015-5	☒	0.376	21.99	8.26
	b.) Removed Standard fastener installation, Piper Drawing 100927-22		-0.353	21.76	-7.67
	Delta installation weight		Negligible		

END FACTORY INSTALLED OPTIONS

TOTAL OPTIONAL EQUIPMENT	0.0	0.0	0.0

END OF ORIGINAL EQUIPMENT INSTALLATION