



***MALIBU MATRIX G1000***  
**Information Manual**

## **WARNING**

**This Information Manual may be used for general information purposes only.**

**This Information Manual is not kept current. It must not be used as a substitute for the official FAA approved Pilot's Operating Handbook required for operation of the airplane.**



*Malibu* **MATRIX**  
**PA-46R-350T**

SN 4692134 AND UP  
with Garmin G1000 System  
and GFC 700 Systems

**INFORMATION**  
**MANUAL**



MANUAL PART NUMBER 767-083

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**APPLICABILITY**

Application of this handbook is limited to the specific Piper PA-46R-350T model airplane designated by serial number and registration number on the face of the title page of this handbook.

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

**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.**

**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 airplane was licensed by the manufacturer and thereafter must be maintained by the owner.

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

### I. Revisions

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

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

### II. Identification of Revised Material

Each handbook page is dated at the bottom of the page showing the date of original issue and the date of the latest revision. Revised text and illustrations are indicated by a black vertical line located along the outside margin of each revised page opposite the revised, added, or deleted information. A vertical line next to the page number indicates that an entire page has been changed or added.

Vertical black lines indicate current revisions only. Correction of typographical or grammatical errors or the physical relocation of information on a page will not be indicated by a symbol.

## ORIGINAL PAGES ISSUED

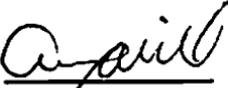
The original pages issued for this handbook prior to revision are given below:

Title, ii through viii, 1-i, 1-ii, 1-1 through 1-14, 2-i, 2-ii, 2-1 through 2-28, 3-i, 3-ii, 3-iii, 3-iv, 3-1 through 3-88, 4-i, 4-ii, 4-iii, 4-iv, 4-1 through 4-52, 5-i, 5-ii, 5-1 through 5-36, 6-i, 6-ii, 6-1 through 6-14, 7-i, 7-ii, 7-1 through 7-82, 8-i, 8-ii, 8-1 through 8-26, 9-i, 9-ii, 9-1 through 9-66, and 10-i, 10-ii, 10-1 through 10-2.

**PA-46R-350T, MALIBU MATRIX**

**PILOT'S OPERATING HANDBOOK LOG OF REVISIONS**

Current Revisions to the PA-46R-350T Malibu Matrix Pilot's Operating Handbook, REPORT: VB-2122 issued October 26, 2009.

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 1 (PR100527)	i ii v	Added EASA approval statement to POH title page. Updated copyright information Added Rev. 1 to L of R.	 Albert J. Mill May 27, 2010

**PILOT'S OPERATING HANDBOOK LOG OF REVISIONS (cont)**

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date

## TABLE OF CONTENTS

<b>SECTION 1</b>	<b>GENERAL</b>
<b>SECTION 2</b>	<b>LIMITATIONS</b>
<b>SECTION 3</b>	<b>EMERGENCY PROCEDURES</b>
<b>SECTION 4</b>	<b>NORMAL PROCEDURES</b>
<b>SECTION 5</b>	<b>PERFORMANCE</b>
<b>SECTION 6</b>	<b>WEIGHT AND BALANCE</b>
<b>SECTION 7</b>	<b>DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS</b>
<b>SECTION 8</b>	<b>AIRPLANE HANDLING, SERVICING AND MAINTENANCE</b>
<b>SECTION 9</b>	<b>SUPPLEMENTS</b>
<b>SECTION 10</b>	<b>OPERATING TIPS</b>

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## TABLE OF CONTENTS

## SECTION 1

## GENERAL

Paragraph No.		Page No.
1.1	Introduction .....	1-1
1.2	Notations .....	1-3
1.3	Engine.....	1-4
1.5	Propeller .....	1-4
1.7	Fuel.....	1-5
1.9	Oil .....	1-5
1.11	Maximum Weights .....	1-6
1.13	Standard Airplane Weights.....	1-6
1.15	Cabin and Entry Dimensions .....	1-6
1.17	Baggage Space and Entry Dimensions .....	1-6
1.19	Specific Loading .....	1-6
1.21	Symbols, Abbreviations and Terminology .....	1-7

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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 the Federal Aviation Regulations and additional information provided by the manufacturer and constitutes the FAA Approved Airplane Flight Manual.

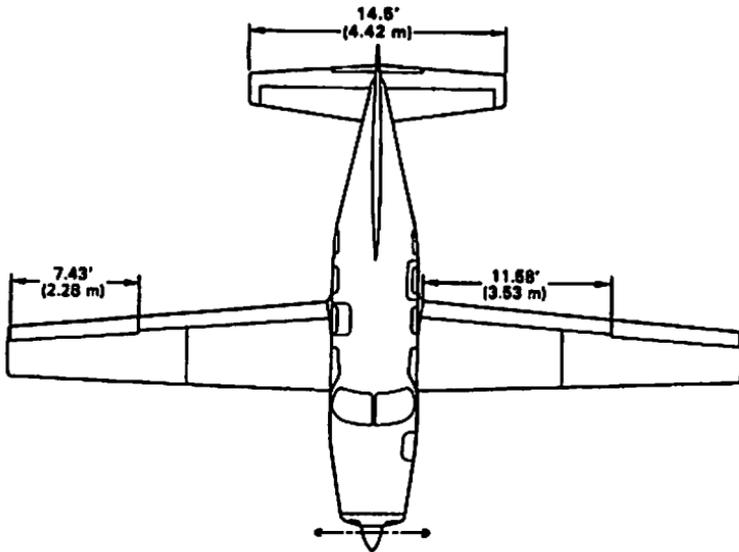
**This handbook is not designed as a substitute for adequate and competent flight instruction, knowledge of current Airworthiness Directives, applicable Federal Aviation Regulations or Advisory Circulars. It is not intended to be a guide for basic flight instruction or a training manual and should not be used for operational purposes unless kept in a current status. The pilot should study the entire handbook to familiarize himself with the limitations, performance, procedures and operational handling characteristics of the airplane before flight.**

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.

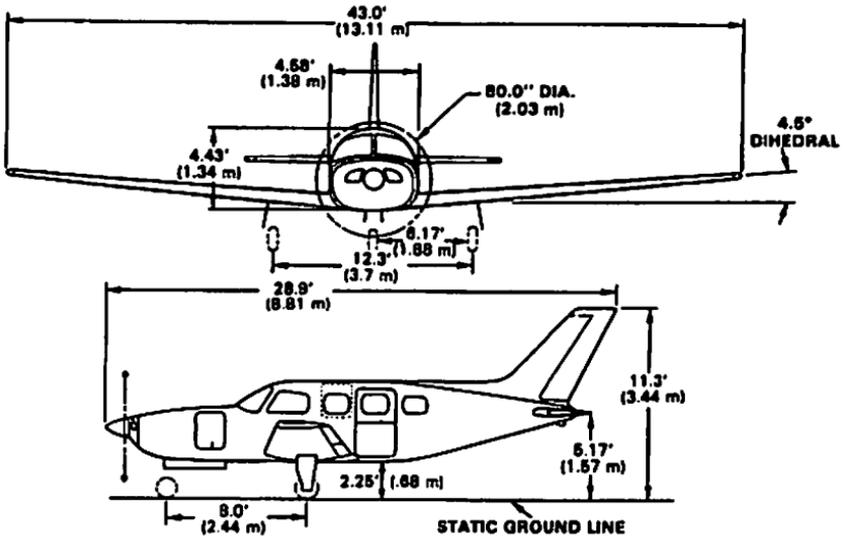
The handbook has been divided into numbered (arabic) sections each provided with a finger-tip tab divider for quick reference. Provisions for expansion of the handbook have been made by the deliberate omission of certain paragraph numbers, figure numbers, item numbers and pages noted as being intentionally left blank.

## NOTE

In countries other than the United States of America, FAA operating rules may not apply. Operators must ensure that the aircraft is operated in accordance with national operating rules.



Wing Area 175.0 sq. ft. (16.3 sq. meters)  
Min. Turning Radius (from pivot point to wing tip) 35.4 ft. (10.8 meters)



THREE VIEW  
Figure 1-1

## **1.2 NOTATIONS**

### **WARNING**

Operating procedures or techniques which may result in personal injury or loss of life if not carefully followed.

### **CAUTION**

Operating procedures or techniques which may result in damage to equipment if not carefully followed.

### **NOTE**

Supplemental information or highlights considered of sufficient significance to require emphasizing.

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**1.3 ENGINE**

(a) Number of Engines	1
(b) Engine Manufacturer	Textron Lycoming
(c) Engine Model Number	TIO-540-AE2A
(d) Rated Horsepower	350
(e) Rated Speed (rpm)	2500
(f) Maximum Manifold Pressure (in. Hg.)	42.0
(g) Bore (inches)	5.125
(h) Stroke (inches)	4.375
(i) Displacement (cubic inches)	541.5
(j) Compression Ratio	7.3:1
(k) Engine Type	Six Cylinder, Direct Drive, Horizontally Opposed, Air Cooled, Turbocharged, Fuel Injected

**1.5 PROPELLER (Standard)**

(a) Number of Propellers	1
(b) Propeller Manufacturer	Hartzell
(c) Blade Model	N7605+2 N7605K+2
(d) Number of Blades	3
(e) Hub Model	HC-13Y1R-1N
(f) Propeller Diameter (inches)	80
(g) Propeller Type	Constant Speed, Hydraulically Actuated

**1.7 FUEL**

## AVGAS ONLY

- |                                       |                                            |
|---------------------------------------|--------------------------------------------|
| (a) Fuel Capacity (U.S. gal.) (total) | 122                                        |
| (b) Usable Fuel (U.S. gal.) (total)   | 120                                        |
| (c) Fuel                              |                                            |
| (1) Minimum Grade                     | 100- Green or 100LL<br>Blue Aviation Grade |

## (2) Alternate Fuels

Refer to latest revision of  
Lycoming Service Instruction 1070,  
except alcohol is *not* approved  
for use in this airplane.

**1.9 OIL**

- |                                                                |                                                                   |
|----------------------------------------------------------------|-------------------------------------------------------------------|
| (a) Oil Capacity (U.S. quarts)                                 | 12                                                                |
| (b) Oil Specification                                          | Refer to latest revision of<br>Lycoming Service Instruction 1014. |
| (c) Oil Viscosity per Average Ambient Temperature for Starting |                                                                   |

<u>Average Ambient Temperature</u>	MIL-L-22851 Ashless Dispersant <u>SAE Grades</u>
All Temperatures	15W-50 or 20W-50
Above 80F	60
Above 60F	40 or 50
30F to 90F	40
0F to 70F	30, 40 or 20W-40
Below 10F	30 or 20W-30

When operating temperatures overlap indicated ranges, use the lighter grade oil. Use ashless dispersant oil only per the latest revision of Textron Lycoming Service Instruction 1014.

**1.11 MAXIMUM WEIGHTS**

(a) Maximum Ramp Weight (lb)	4358
(b) Maximum Takeoff Weight (lb)	4340
(c) Maximum Landing Weight (lb)	4123
(d) Maximum Zero Fuel Weight (lb)	4123
(e) Maximum Weights in Baggage Compartments (lb)	
(1) Forward	100
(2) Aft	100

**1.13 STANDARD AIRPLANE WEIGHTS**

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

**1.15 CABIN AND ENTRY DIMENSIONS (IN.)**

(a) Cabin Width (max.)	49.5
(b) Cabin Length (Instrument panel to rear bulkhead)	148
(c) Cabin Height (max.)	47
(d) Entry Width	24
(e) Entry Height	46

**1.17 BAGGAGE SPACE AND ENTRY DIMENSIONS**

(a) Compartment Volume (cu. ft.)	
(1) Forward	13
(2) Aft	20
(b) Entry Dimensions (in.)	
(1) Forward	19 x 23
(2) Aft	24 x 46

**1.19 SPECIFIC LOADING**

(a) Wing Loading (lbs. per sq. ft.)	24.8
(b) Power Loading (lbs. per hp)	12.4

**1.21 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY**

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

**(a) General Airspeed Terminology and Symbols**

CAS	Calibrated Airspeed means the indicated speed of an aircraft, corrected for position and instrument error. Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level.
KCAS	Calibrated Airspeed expressed in "Knots."
GS	Ground Speed is the speed of an airplane relative to the ground.
IAS	Indicated Airspeed is the speed of an aircraft as shown on the airspeed indicator when corrected for instrument error. IAS values published in this handbook assume zero instrument error.
KIAS	Indicated Airspeed expressed in "Knots."
M	Mach Number is the ratio of true airspeed to the speed of sound.
TAS	True Airspeed is the airspeed of an airplane relative to undisturbed air which is the CAS corrected for altitude, temperature and compressibility.
V <sub>FE</sub>	Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a prescribed extended position.
V <sub>LE</sub>	Maximum Landing Gear Extended Speed is the maximum speed at which an aircraft can be safely flown with the landing gear extended.

1.21 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (continued)

V <sub>LO</sub>	Maximum Landing Gear Operating Speed is the maximum speed at which the landing gear can be safely extended or retracted.
V <sub>NE/MNE</sub>	Never Exceed Speed or Mach Number is the speed limit that may not be exceeded at any time.
V <sub>NO</sub>	Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air and then only with caution.
V <sub>O</sub>	Maximum Operating Maneuvering Speed is the maximum speed at which application of full available aerodynamic control will not overstress the airplane.
	NOTE V <sub>O</sub> is defined in accordance with FAR 23 Amendment 45
V <sub>s</sub>	Stalling Speed or the minimum steady flight speed at which the airplane is controllable.
V <sub>s1</sub>	Speed or the minimum steady flight speed obtained in a specific configuration.
V <sub>s0</sub>	Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration at maximum gross weight.
V <sub>x</sub>	Best Angle-of-Climb Speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.
V <sub>y</sub>	Best Rate-of-Climb Speed is the airspeed which delivers the greatest gain in altitude in the shortest possible time.

**1.21 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (continued)****(b) Meteorological Terminology**

ISA	International Standard Atmosphere in which: <ol style="list-style-type: none"><li>(1) The air is a dry perfect gas;</li><li>(2) The temperature at sea level is 15° Celsius (59° Fahrenheit);</li><li>(3) The pressure at sea level is 29.92 inches hg. (1013.2 mb);</li><li>(4) The temperature gradient from sea level to the altitude at which the temperature is -56.5C (-69.7F) is -0.00198C (-0.003564F) per foot and zero above that altitude.</li></ol>
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.

**1.21 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (continued)**

(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

CHT	Cylinder Head Temperature.
MAP	Manifold Pressure.
T.I.T. Gauge	Turbine Inlet Temperature.

**1.21 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (continued)****(e) Avionics System Abbreviations/Terminology**

<b>1</b>	Refers to pilot's side (AHRS1, ADC1, GPS1)
<b>2</b>	Refers to co-pilot's side (AHRS2, ADC2, GPS2)
<b>ADC</b>	Air Data Computer
<b>AFCS</b>	Automatic Flight Control System
<b>AHRS</b>	Attitude and Heading Reference System
<b>CAS</b>	Crew Alerting System
<b>EIS</b>	Engine Indication System
<b>FDE</b>	Fault Detection and Exclusion
<b>FOB</b>	Fuel On Board
<b>GCU</b>	Garmin MFD/PFD Control Unit
<b>GDL</b>	Garmin Datalink
<b>GDU</b>	Garmin Display Unit
<b>GEA</b>	Garmin Engine/Airframe Processing Unit
<b>GFC</b>	Garmin Flight Control System
<b>GIA</b>	Garmin Integrated Avionics Unit
<b>GMA</b>	Garmin Audio Panel
<b>GMC</b>	Garmin AFCS Mode Controller
<b>GMU</b>	Garmin Magnetometer Unit
<b>GPS</b>	Global Positioning System
<b>GSA</b>	Garmin AFCS Servo Actuator
<b>GSM</b>	Garmin Servo Mount
<b>GTP</b>	Garmin Temperature Probe (OAT)
<b>GTX</b>	Garmin Transponder
<b>GWX</b>	Garmin Weather Radar
<b>MFD</b>	Multi-Function Display
<b>PFD</b>	Primary Flight Display
<b>PFT</b>	Preflight Test
<b>SBAS</b>	Satellite-Based Augmentation System

**1.21 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (continued)**

(e) Avionics System Abbreviations/Terminology (continued)

<b>TAWS</b>	Terrain Awareness and Warning System
<b>WAAS</b>	Wide Area Augmentation System

(f) Airplane Performance and Flight Planning Terminology

<b>Accelerate-Stop Distance</b>	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.
<b>Climb Gradient</b>	The demonstrated ratio of the change in height during a portion of a climb, to the horizontal distance traversed in the same time interval.
<b>Demonstrated Crosswind Velocity</b>	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.
<b>MEA</b>	Minimum Enroute IFR Altitude.
<b>Route Segment</b>	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.

(g) Weight and Balance Terminology

<b>A.O.D.</b>	Aft of Datum.
<b>Arm</b>	The horizontal distance from the reference datum to the center of gravity (C.G.) of an item.

**1.21 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (continued)****(g) Weight and Balance Terminology (continued)**

Center of Gravity (C.G.)	The point at which an airplane would balance if suspended. The C.G.'s 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.
Datum	An imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Basic Empty Weight	Standard empty weight plus optional equipment.
Maximum Landing Weight	Maximum weight approved for touchdown when landing.
Maximum Ramp Weight	Maximum weight approved for ground maneuver. (It includes the weight of fuel for start, taxi and run up.)
Maximum Takeoff Weight	Maximum Weight approved for the start of the takeoff run.
Maximum Zero Fuel Weight	Maximum weight exclusive of usable fuel.
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.)
Payload	Weight of occupants, cargo and baggage.

**1.21 SYMBOLS, ABBREVIATIONS AND TERMINOLOGY (continued)**

**(g) Weight and Balance Terminology (continued)**

<b>Standard Empty Weight</b>	Weight of a standard airplane including unusable fuel, full operating fluids and full oil.
<b>Station</b>	A location along the airplane fuselage usually given in terms of distance from the reference datum.
<b>Unusable Fuel</b>	Fuel remaining after a runout test has been completed in accordance with governmental regulations.
<b>Usable Fuel</b>	Fuel available for flight planning.
<b>Useful Load</b>	Difference between takeoff weight, or ramp weight if applicable, and basic empty weight

## TABLE OF CONTENTS

SECTION 2  
LIMITATIONS

Paragraph No.		Page No.
2.1	General .....	2-1
2.3	Airspeed Limitations .....	2-1
2.5	Airspeed Indicator Markings .....	2-2
2.7	Power Plant Limitations .....	2-3
2.9	Leaning Limitations .....	2-4
2.11	Power Plant Instrument Markings.....	2-4
2.13	Weight Limits .....	2-5
2.15	Center of Gravity Limits .....	2-5
2.17	Maneuver Limits .....	2-5
2.19	Flight Load Factors .....	2-5
2.21	Flight Crew Limits .....	2-6
2.23	Garmin G1000 Avionics Systems Limitations.....	2-6
2.25	Radar Limitations.....	2-9
2.27	Terrain Awareness and Warning System (TAWS).....	2-9
2.29	Traffic Information.....	2-9
2.31	Jeppesen Chartview or Garmin Flight Charts Limitations .....	2-9
2.33	Kinds of Operation Equipment List.....	2-10
2.35	Fuel Limitations .....	2-17
2.37	Operating Altitude Limitations .....	2-17
2.39	Oxygen System Limitations .....	2-18
2.41	Air Conditioning System Limitations .....	2-18
2.43	Electric Auxiliary Cabin Heater Limitations .....	2-18
2.45	Maximum Seating Configuration.....	2-19
2.47	Smoking .....	2-19
2.49	Operation in Severe Icing Conditions .....	2-19

**TABLE OF CONTENTS (Continued)**

**SECTION 2  
LIMITATIONS**

Paragraph No.		Page No.
2.51	Placards .....	2-20

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.	198	200
Maximum Structural Cruising Speed (VNO) - Do not exceed this speed except in smooth air and then only with caution.	168	170
Maximum Operating Maneuvering Speed - (Vo) Do not make full or abrupt control movements- above this speed. Interpolation between weights is acceptable for weights between those shown. Minimum flying weight is 3214 lb.	SEE TABLE	

WEIGHT (lb.)	KIAS	KCAS
4340	133	135
4200	131	133
4000	128	130
3800	125	127
3600	121	123
3400	118	120
3200	114	116

**2.3 AIRSPEED LIMITATIONS (continued)**

<b>Speed</b>	<b>KIAS</b>	<b>KCAS</b>
Maximum Speed for Pneumatic Boot Inflation.	178	180
Maximum Flaps Extended Speed (V <sub>FE</sub> ) - Do not exceed this speed at the given flap setting.		
10°	165	167
20°	130	132
36°	116	115
Maximum Landing Gear Extension Speed (V <sub>LO</sub> ) - Do not exceed this speed when extending the landing gear.	165	167
Maximum Landing Gear Retraction Speed (V <sub>LO</sub> ) - Do not exceed this speed when retracting the landing gear.	126	128
Maximum Landing Gear Extended Speed (V <sub>LE</sub> ) Do not exceed this speed with the landing gear extended.	195	197

**2.5 AIRSPEED INDICATOR MARKINGS**

<b>Garmin PFD</b>	<b>KIAS</b>
Red Radial Line (Never Exceed)	198 KTS
Yellow Arc (Caution Range - Smooth Air Only)	168 KTS to 198 KTS
Green Arc (Normal Operating Range)	69 KTS to 168 KTS
White Arc (Flaps Down)	58 KTS to 116 KTS
Red Line	58 KTS
<b>Standby Airspeed Indicator</b>	
Red Radial Line (Never Exceed)	198 KTS
Yellow Arc (Caution Range - Smooth Air Only)	168 KTS to 198 KTS
Green Arc (Normal Operating Range)	69 KTS to 168 KTS
White Arc (Flaps Down)	58 KTS to 116 KTS

**2.7 POWER PLANT LIMITATIONS**

(a) Number of Engines	1
(b) Engine Manufacturer	Textron Lycoming
(c) Engine Model No.	TIO-540-AE2A
(d) Engine Operating Limits	
(1) Maximum Engine Speed	2500 RPM
(2) Maximum Oil Temperature	245°F
(3) Maximum Cylinder Head Temperature	500°F
(4) Maximum Turbine Inlet Temperature	1750°F
(5) Maximum Manifold Pressure (inches of mercury)	
To 20,600 feet	42
20,600 to 25,000 feet	42 -1.6 per 1000 foot increase
(e) Oil Pressure	
Minimum (red line)	25 PSI
Maximum (red line)	115 PSI
(f) Fuel (AVGAS ONLY) (minimum grade)	100 or 100LL Aviation Grade
(g) Number of Propellers	1
(h) Propeller Manufacturer	Hartzell
(i) Propeller Hub and Blade Models (3 Blade)	HC-I3Y1R-1N/N7605K+2 HC-I3Y1R-1N/N7605+2
(j) Propeller Diameter (inches) 3 Blade	80
(k) Blade Angle Limits	
Low Pitch Stop (3 Blade) Min./Max.	13.8°/14.2°
High Pitch Stop (3 Blade) Min./Max.	37°/39°

**2.9 LEANING LIMITATIONS**

Mixture full RICH at all engine powers above high speed cruise power.

**2.11 POWER PLANT INSTRUMENT MARKINGS**

- (a) Tachometer
  - Green Arc (Normal Operating Range) 600 to 2500 RPM
  - Red Line (Maximum) 2500 RPM
- (b) Manifold Pressure
  - Green Arc (Normal Operating Range) 10 to 42.0 in. Hg
  - Red Line (Takeoff Power) 42.0 in. Hg
- (c) Oil Temperature
  - Green Arc (Normal Operating Range) 100° to 245°F
  - Red Line (Maximum) 245°F
- (d) Oil Pressure
  - Green Arc (Below 1200 RPM) 25 PSI to 95 PSI
  - Green Arc (Normal Operating Range) 55 PSI to 95 PSI
  - Amber Arc (Caution Range) (Above 1200 RPM) 25 PSI to 55 PSI
  - Amber Arc (Caution Range) 95 PSI to 115 PSI
  - Red Line (Minimum) 25 PSI
  - Red Line (Maximum) 115 PSI
- (e) Turbine Inlet Temperature
  - Green Arc (Normal Operating Range) 1200°F to 1750°F
  - Red Line (Maximum) 1750°F
- (f) Cylinder Head Temperature
  - Green Arc (Normal Operating Range) 200°F to 480°F
  - Amber Arc (Caution Range) 480°F to 500°F
  - Red Line (Maximum) 500°F
- (h) Vacuum Pressure
  - Green Arc (Normal Operating Range) 4.0 to 6.0 in. Hg

**2.13 WEIGHT LIMITS**

(a) Maximum Ramp Weight	4358 LB
(b) Maximum Takeoff Weight	4340 LB
(c) Maximum Landing Weight	4123 LB
(d) Maximum Zero Fuel Weight	4123 LB
(e) Maximum Baggage (100 lb each compartment)	200 LB

**NOTE**

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

**2.15 CENTER OF GRAVITY LIMITS**

Weight Pounds	Forward Limit Inches Aft of Datum	Rearward Limit Inches Aft of Datum
4340	144.1	147.1
4123	139.6	147.1
4000	137.0	146.5
2450	130.7	137.6
2400	130.7	137.3

**NOTES**

Straight line variation between points given.

The datum used is 100.0 inches ahead of the forward pressure bulkhead.

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

**2.17 MANEUVER LIMITS**

No acrobatic maneuvers including spins approved.

**2.19 FLIGHT LOAD FACTORS**

(a) Positive Load Factor (Maximum)	
(1) Flaps Up	3.8 G
(2) Flaps Down	2.0 G
(b) Negative Load Factor (Maximum)	No inverted maneuvers approved

## **2.21 FLIGHT CREW LIMITS**

The minimum required flight crew is one pilot in the left seat.

## **2.23 GARMIN G1000 AVIONICS SYSTEMS LIMITATIONS**

1. The Garmin G1000 Cockpit Reference Guide for the Piper PA-46 Matrix, Garmin p/n 190-01107-XX, latest revision, must be immediately available to the flight crew.

### **NOTE**

The Cockpit Reference Guide contains additional Warnings, Cautions and Advisories with which the pilot should become familiar.

2. The Loader Image displayed in the upper right corner of the MFD splash screen must be part number 0720.10 or later approved revision.
3. IFR enroute, oceanic and terminal navigation predicated upon the Garmin G1000 GPS Receiver is prohibited unless the pilot verifies the currency of the navigation database or verifies each selected waypoint for accuracy by reference to current data.
4. Instrument approach navigation predicated upon the Garmin G1000 GPS Receiver must be accomplished in accordance with approved instrument approach procedures that are retrieved from the G1000 Navigation database. The G1000 Navigation database must incorporate the current update cycle or each waypoint must be verified for accuracy with current approach chart data.
5. When GPS WAAS corrections are unavailable or if operating outside of GPS WAAS coverage, instrument approaches utilizing the GPS receiver will be conducted in the approach mode and Fault Detection and Exclusion mode. Loss of Integrity annunciations must not be displayed at the Final Approach Fix. Vertical guidance from GPS will not be available if WAAS corrections are unavailable or if operating outside of WAAS coverage.
6. Operation is prohibited north of 70° N and south of 70° S latitudes. In addition, operation is prohibited in the following two regions: 1) north of 65° N between 75° W and 120° W longitude and 2) south of 55° S between 120° E and 165° E longitude.

**2.23 GARMIN G1000 AVIONICS SYSTEM LIMITATIONS****(Continued)**

7. If the optional GDL 69 datalink is installed, weather information is limited to supplemental use only and may not be used in lieu of an official weather data source.
8. The TAWS / TERRAIN databases have an area of coverage as detailed below:
  - The Terrain Database has an area of coverage from North 75° latitude to South 60° latitude in all longitudes.
  - The Airport Terrain Database has an area of coverage that includes the United States, Canada, Mexico, Latin America, and South America.
  - The Obstacle Database has an area of coverage that includes the United States.

**NOTE**

The area of coverage may be modified, as additional terrain data sources become available.

9. The AFCS preflight test must be successfully completed prior to use of the autopilot, flight director or manual electric trim. This is indicated by a white "PFT" annunciation during test, and upon successful conclusion a tone will be heard with the "PFT" annunciation clearing on the PFD.
10. A pilot with the seat belt fastened must occupy the left pilot's seat during all autopilot operations.
11. The autopilot and yaw damper must be off during takeoff and landing. The autopilot must be disengaged below 200 feet AGL during approach operations and minimum engagement height on takeoff is 400 feet AGL. Cruise engagement minimum altitude is 1000 feet AGL.
12. Autopilot operation with the G1000 in the reversionary (Display Backup) mode is limited to training operations and actual display failure operations.
13. Autopilot minimum approved operating speed - 78 KIAS.  
Autopilot maximum approved operating speed - 183 KIAS
14. Minimum airspeed for autopilot coupled approaches - 90 KIAS

**2.23 GARMIN G1000 AVIONICS SYSTEM LIMITATIONS  
(Continued)**

**Approach Operation Limitations:**

15. The GFC 700 autopilot is approved for Category 1 precision instrument approaches and non-precision approaches only.
16. To avoid giving unwanted audible alerts, TAWS should be inhibited when landing at an airport that is not included in the airport database.
17. All TAWS caution and warning aural alerts must be followed immediately upon receipt. Pilots are authorized to deviate from their current ATC clearance to the extent necessary to comply with terrain/obstacle warnings from the TAWS per FAR 91.223.
18. When operating single pilot - BARO SYNCH must be ON.  
When operating two pilot - BARO SYNCH must be OFF.

**2.25 RADAR LIMITATIONS (Optional)**

Do not operate the radar during refueling operations or within 15 feet of trucks or containers accommodating flammables or explosives. Do not allow personnel within 15 feet of area being scanned by antenna when system is transmitting. Radar images beyond approximately 130nm should not be relied upon.

**2.27 TERRAIN AWARENESS AND WARNING SYSTEM (TAWS)**

Navigation must not be predicated upon the use of the Terrain Awareness Display. The Terrain Awareness Display is intended to serve as a situational awareness tool only, and may not provide the accuracy and/or fidelity on which to solely base terrain or obstacle avoidance maneuvering decisions.

**2.29 TRAFFIC INFORMATION**

The pilot should not maneuver the aircraft based on the traffic display only. The traffic display is intended to assist in visually locating traffic. The traffic display lacks the resolution necessary for use in evasive maneuvering. Maneuvers should be consistent with ATC instructions.

**2.31 JEPPESEN CHARTVIEW OR GARMIN FLIGHT CHARTS 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 of required navigation.

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

**2.33 KINDS OF OPERATION EQUIPMENT LIST**

This airplane may be operated in day or night VFR, day or night IFR and known icing when the appropriate equipment is installed and operable.

The following equipment list identifies the systems and equipment upon which type certification for each kind of operation was predicated and must be installed and operable for the particular kind of operation indicated.

**NOTE**

The following system and equipment list does not include specific flight instruments and communication/navigation equipment required by the FAR Part 91 operating requirements.

System	Number Required	Types of Operation and Remarks (DAY, NIGHT, VFR, IFR and ICING Conditions)
1. GARMIN G1000 SYSTEM EQUIPMENT		
GDU 1040 Primary Flight Display	0 <sup>(1)</sup> 2	DAY, NIGHT, VFR IFR, ICING
GDU 1500 Multi-function Display	1 <sup>(2)</sup>	IFR, ICING
GCU 476 MFD/PFD Control Unit (Keypad)	1	IFR, ICING
GIA 63W Integrated Avionics Unit	2	DAY, NIGHT, VFR, IFR, ICING
GEA 71 Engine Airframe Interface	1	DAY, NIGHT, VFR, IFR, ICING
GRS 77 Attitude and Heading Reference System (AHRS)	1 2	DAY, NIGHT, VFR IFR, ICING
GDC 74A Air Data Computer (ADC)	1 2	DAY, NIGHT, VFR IFR, ICING

<sup>(1)</sup> The MFD must be functional to fly DAY, NIGHT, VFR with an inoperative PFD1.

<sup>(2)</sup> The MFD must be functional for ALL flight operations if PFD1 is inoperative.

## 2.33 KINDS OF OPERATION EQUIPMENT LIST (continued)

System	Number Required	Types of Operation and Remarks (DAY, NIGHT, VFR, IFR and ICING Conditions)
1. GARMIN G1000 SYSTEM EQUIPMENT (Continued)		
GMU 44 Magnetometer	2	DAY, NIGHT, VFR, IFR, ICING
GMA 347 Audio Panel	1	IFR, ICING
2. FLIGHT INSTRUMENTATION		
Standby Attitude Indicator	1	IFR, ICING
Standby Airspeed Indicator	1	IFR, ICING
Standby Altimeter	1	IFR, ICING
Magnetic Compass	1	DAY, NIGHT, VFR, IFR, ICING
Outside Air Temperature (OAT) Indicator	1	DAY, NIGHT, VFR, IFR, ICING
Clock	1	IFR, ICING
3. ELECTRICAL		
Alternators	1	DAY, NIGHT, VFR, IFR
DC Voltmeter	1	DAY, NIGHT, VFR, IFR, ICING
Ammeters	2	DAY, NIGHT, VFR, IFR, ICING
ALTR 1 FAIL ALTR 2 FAIL CAS Messages	2	DAY, NIGHT, VFR, IFR, ICING

**SECTION 2  
LIMITATIONS**

**PA-46R-350T, MALIBU MATRIX**

System	Number Required	Types of Operation and Remarks (DAY, NIGHT, VFR, IFR and ICING Conditions)
3. ELECTRICAL (Continued)  VOLTS Indication	1	DAY, NIGHT, VFR, IFR, ICING
4. EQUIPMENT/ FURNISHINGS  Safety Restraint Each Occupant	AR	DAY, NIGHT, VFR, IFR, ICING
5. FLIGHT CONTROLS  Flap Position Indicator  Elevator Trim Position Indicator  Rudder Trim Position Indicator	1   1  1	DAY, NIGHT, VFR, IFR, ICING   DAY, NIGHT, VFR, IFR, ICING  DAY, NIGHT, VFR, IFR, ICING
6. FUEL  Fuel Quantity Indicating System  BOOST PUMP FAIL CAS Message  FUEL PRESS LOW CAS Message	2  1  1	DAY, NIGHT, VFR, IFR, ICING  DAY, NIGHT, VFR, IFR, ICING  DAY, NIGHT, VFR, IFR, ICING

System	Number Required	Types of Operation and Remarks (DAY, NIGHT, VFR, IFR and ICING Conditions)
7. ICE PROTECTION (Optional Equipment)		
Pneumatic Deice System (Wing and Empennage Protection)	1	ICING
SURF DE-ICE ON CAS Message	1	ICING
SURF DE-ICE FAIL CAS Message	1	ICING
Wing Ice Detection Light	1	ICING
Electrothermal Propeller Deice Boots	1 per Blade	ICING
PROP HEAT Switch Light	1	ICING
PROP HT FAIL CAS Message	1	ICING
Heated Windshield	1	ICING
WNSHLD OVERTEMP CAS Message	1	ICING
S. WARN HEAT Switch Light	1	ICING
Heated Pitot Head	1 (pilot) 2	DAY, NIGHT, VFR IFR, ICING
L PITOT HT FAIL CAS Message	1	DAY, NIGHT, VFR, IFR, ICING

**2.33 KINDS OF OPERATION EQUIPMENT LIST (continued)**

System	Number Required	Types of Operation and Remarks (DAY, NIGHT, VFR, IFR and ICING Conditions)
7. ICE PROTECTION (Optional Equipment) (Continued)		
R PITOT HT FAIL CAS Message	1	IFR, ICING
Alternate Static Source	1	ICING
Vacuum Pump	2	ICING
VACUUM LOW CAS Message	1	ICING
Alternator	2	ICING
8. INSTRUMENTATION - ENGINE		
Tachometer	1	DAY, NIGHT, VFR, IFR, ICING
Oil Pressure Indicator	1	DAY, NIGHT, VFR, IFR, ICING
Oil Temperature Indicator	1	DAY, NIGHT, VFR, IFR, ICING
Manifold Pressure Indicator	1	DAY, NIGHT, VFR, IFR, ICING
Cylinder Head Tem- perature Indicator	1	DAY, NIGHT, VFR, IFR, ICING
Turbine Inlet Tem- perature Indicator	1	DAY, NIGHT, VFR, IFR, ICING

## 2.33 KINDS OF OPERATION EQUIPMENT LIST (continued)

System	Number Required	Types of Operation and Remarks (DAY, NIGHT, VFR, IFR and ICING Conditions)
9. LANDING GEAR		
Hydraulic Pump	1	DAY, NIGHT, VFR, IFR, ICING
HYDR PUMP ON CAS Message	1	DAY, NIGHT, VFR, IFR, ICING
Landing Gear Down Position Indicating Lights	3	DAY, NIGHT, VFR, IFR, ICING
Landing Gear Warning Horn	1	DAY, NIGHT, VFR, IFR, ICING
GEAR WARNING Annunciator (instrument panel red light)	1	DAY, NIGHT, VFR, IFR, ICING
10. LIGHTS - EXTERNAL		
Landing Light	1	NIGHT
Position Lights		
a. Left Wing - Red and White	1 ea.	NIGHT
b. Right Wing - Green and White	1 ea.	NIGHT
Anti-Collision (Strobe) Lights	2	DAY, NIGHT, VFR, IFR, ICING
Taxi / Pulse Lights	2	NIGHT

**2.33 KINDS OF OPERATION EQUIPMENT LIST (continued)**

System	Number Required	Types of Operation and Remarks (DAY, NIGHT, VFR, IFR and ICING Conditions)
11. LIGHTS - COCKPIT		
Instrument Panel Switch Lights	AR	NIGHT
Instrument Lights	AR	NIGHT
Dome Lights	1 (pilot)	NIGHT
12. MISCELLANEOUS		
Stall Warning System	1	DAY, NIGHT, VFR, IFR, ICING
STALL WARN FAIL CAS Message	1	DAY, NIGHT, VFR, IFR, ICING
LTS / GEAR ANNUN TEST System	1	DAY, NIGHT, VFR, IFR, ICING

**2.35 FUEL LIMITATIONS**

- (a) Minimum Aviation Fuel Grade..... 100LL/100
- (b) Total Capacity ..... 122 U.S. GAL.
- (c) Unusable Fuel ..... 2 U.S. GAL.  
The unusable fuel for this airplane has been determined as 1.0  
gallon in each wing in critical flight attitudes.
- (d) Usable Fuel ..... 120 U.S. GAL.  
The usable fuel in this airplane has been determined as 60 gallons in  
each wing.
- (e) Maximum Fuel Imbalance ..... 10 U.S. GAL.

**2.37 OPERATING ALTITUDE LIMITATIONS**

Flight above 25,000 feet pressure altitude is not approved. Flight up to and including 25,000 feet is approved if equipped with avionics in accordance with 14 CFR Part 91.

THIS SPACE INTENTIONALLY LEFT BLANK

**2.39 OXYGEN SYSTEM LIMITATIONS**

- (a) No smoking allowed when oxygen system is in use.
- (b) Six occupants maximum when oxygen is required.
- (c) Oxygen duration (Bottle pressure 1850 PSI):

**AEROX SYSTEM DURATION (Hours)  
(Based on 90% Consumption)**

Altitude (feet)	User(s)					
	1	2	3	4	5	6
10,000	17.83	8.91	5.94	4.46	3.57	2.97
12,500	14.04	7.02	4.68	3.51	2.81	2.34
15,000	11.81	5.90	3.94	2.95	2.36	1.97
17,000	10.98	5.49	3.66	2.74	2.20	1.83
20,000	9.34	4.67	3.11	2.34	1.87	1.56
22,000	8.53	4.26	2.84	2.13	1.71	1.42
24,000	8.28	4.14	2.76	2.07	1.66	1.38
25,000	7.13	3.57	2.38	1.78	1.43	1.19

**NOTE**

Each individual flowmeter/regulator must be adjusted to the proper altitude in order to achieve the indicated duration.

**2.41 AIR CONDITIONING SYSTEM LIMITATIONS**

AIR COND switch in OFF position for takeoffs and landings.

**NOTE**

BLOWER LOW or BLOWER HIGH switch may be selected

**2.43 ELECTRIC AUXILIARY CABIN HEATER LIMITATIONS**

- (a) Both alternators must be functioning.
- (b) The VOLTS indicating system must be functional.
- (c) The Vent/Defog Fan must be operational for heater ground operation.
- (d) Maximum ambient temperature for heater operation is 20°C (68°F).

## 2.45 MAXIMUM SEATING CONFIGURATION

The maximum seating capacity is 6 (six) persons.

## 2.47 SMOKING

Smoking is not permitted in the aircraft.

## 2.49 OPERATION IN SEVERE ICING CONDITIONS

### WARNING

Severe icing may result from environmental conditions outside of those for which the airplane is certified. Flight in freezing rain, freezing drizzle, or mixed icing conditions (supercooled liquid water and ice crystals) may result in ice build-up on protected surfaces exceeding the capability of the ice protection system, or may result in ice forming aft of the protected surfaces. This ice may not be shed using the ice protection systems, and may seriously degrade the performance and controllability of the airplane.

During flight, severe icing conditions that exceed those for which the airplane is certificated shall be determined by the following visual cues. Leave flaps in current position, do not extend or retract. Avoid abrupt and excessive maneuvering that may exacerbate control difficulties. If unusual or uncommanded roll control movement is observed, reduce angle of attack. If one or more of these visual cues exists, immediately request priority handling from Air Traffic Control to facilitate a route or an altitude change to exit the icing conditions.

Unusually extensive ice accumulation on the airframe and windshield in areas not normally observed to collect ice.

Accumulation of ice on the upper surface of the wing, aft of the protected area.

Accumulation of ice on the engine nacelle and propeller spinner farther aft than normally observed.

Since the autopilot, when installed and operating, may mask tactile cues that indicate adverse changes in handling characteristics, use of the autopilot is prohibited when any of the visual cues specified above exist, or when unusual lateral trim requirements or autopilot trim warnings are encountered while the airplane is in icing conditions.

All wing icing inspection lights must be operative prior to flight into known or forecast icing conditions at night. [NOTE: This supersedes any relief provided by the Master Minimum Equipment List (M MEL).]

**2.49 OPERATION IN SEVERE ICING CONDITIONS (Continued)**

See Section 9, Supplements, of this Pilot's Operating Handbook for additional information about the ice protection system.

**2.51 PLACARDS**

**On the pilot's left hand side panel:**

THIS AIRCRAFT 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 ICING FLIGHT WHEN EQUIPPED IN ACCORDANCE WITH THE AIRPLANE FLIGHT MANUAL.

**WARNING**

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

**WARNING**

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

**Near the lights / gear annunciator test button (above the pilot's PFD):**

LTS/GEAR  
ANNUN TEST

**Near the Display Backup buttons (above each PFD):**

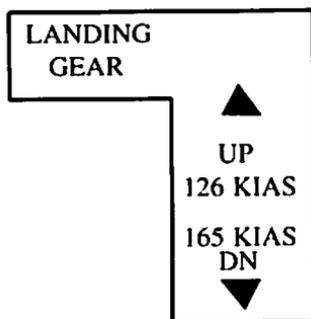
DISPLAY  
BACKUP

**2.51 PLACARDS (continued)****Above the pilot's PFD:**

$V_0$  118 KIAS  
SEE AFM

$V_{1,0}$  165 KIAS DN  
 $V_{1,0}$  126 KIAS UP  
 $V_{1,E}$  195 KIAS MAX

NO ACROBATIC MANEUVERS, INCLUDING SPINS, APPROVED.

**On the parking brake handle:****Around the landing gear handle:****Above the emergency gear extension handle:**

EMERGENCY GEAR EXTENSION  
PULL TO RELEASE. SEE A.F.M.  
BEFORE RE-ENGAGEMENT

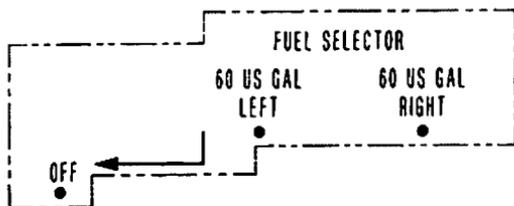
2.51 PLACARDS (continued)

Near the flap selector:

F L A P S		0° ▷
	<u>KIAS</u>	
	165	10° ▷
	130	20° ▷
	116	36° ▷

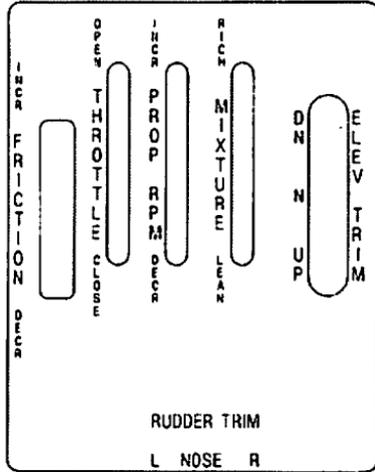
Above the copilot's PFD:

WEATHER DETECTION SYSTEM NOT TO BE USED FOR  
THUNDERSTORM AREA PENETRATION

**2.51 PLACARDS (continued)****Near the magnetic compass:****STANDBY COMPASS****FOR CORRECT READING CHECK:****AVIONICS ON  
PITOT HEAT OFF  
AIR COND OFF  
WINDSHIELD HEAT OFF  
PROP HEAT OFF  
STALL WARN HEAT OFF  
AUXILIARY CABIN HT OFF****Near the fuel selector:****On the pilot's side panel directly below the window:****ALTERNATE STATIC SOURCE  
(LOCATED PILOT'S SIDE BELOW PANEL)  
UP - ALTERNATE  
DOWN - PRIMARY****On the instrument panel, near the oxygen system control:****OXYGEN  
PULL ON**

2.51 PLACARDS (continued)

Near the elevator trim wheel:



In full view of the pilot and below the right center window:

NO SMOKING

2.51 PLACARDS (continued)

Near the defrost control:

DEFROST  
PULL ON



Near the cabin temperature control:

CABIN TEMP  
PULL HOT



Near the induction air control:



**2.51 PLACARDS (continued)**

**On the inside of the forward baggage door:**

**MAXIMUM BAGGAGE THIS COMPARTMENT 100 LBS.**

**On the aft baggage closeout:**

**MAXIMUM BAGGAGE THIS COMPARTMENT 100 LBS.**

**On the aft close out panel, if required:**

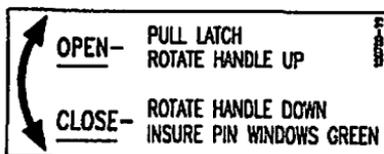
**Rear Passenger / Baggage Areas  
MAXIMUM ALLOWABLE WEIGHT  
MAXIMUM ALLOWABLE COMBINED WEIGHT IN AFT SEATS IS  
\_\_\_\_\_ POUNDS**

**LOAD IN ACCORDANCE WITH  
WEIGHT AND BALANCE DATA**

**Over the emergency exit handle:**

**EMERGENCY EXIT  
REMOVE GLASS  
PULL DOOR IN - LIFT UP**

**On the upper door inner latch:**

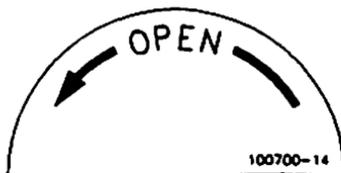


2.51 PLACARDS (continued)

On the lower cabin door stop (if installed), and left and right side of the upper cabin door bottom edge.



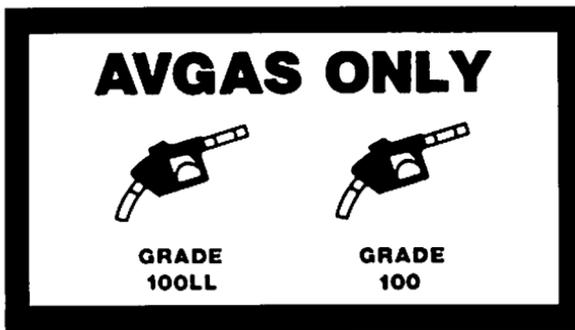
On the main cabin door handle:



On the upper edge of the cabin lower door:



Adjacent to the fuel tank filler caps:



2.51 PLACARDS (continued)

Inside of oxygen filler door on left side of tail cone:

OXYGEN - DANGER  
100700-074

NO SMOKING WHILE CHARGING  
AVOID CONTACT WITH  
OIL, SOAP, GREASY,  
AND FATTY MATERIALS  
USE ONLY AVIATOR  
BREATHING OXYGEN  
FILL TO 1850 PSI  
MAX WORKING PRESSURE  
DO NOT EXCEED 2200 PSI  
100700-075

## TABLE OF CONTENTS

## SECTION 3

## EMERGENCY PROCEDURES

Paragraph No.		Page No.
3.1	General .....	3-1
	Crew Alerting System (CAS) Messages .....	3-2
	PFD Annunciations and Alerts .....	3-7
	Aural Alerts .....	3-10
	Overriding Considerations.....	3-11
	Terminology .....	3-11
3.3	Airspeeds for Emergency Operations .....	3-11
3.5	Emergency Procedures Checklist.....	3-12
3.5a	Engine Fire During Start (3.9) .....	3-12
3.5b	Turbocharger Failure (3.11) .....	3-12
3.5c	Engine Power Loss During Takeoff (3.13) .....	3-13
3.5d	Engine Power Loss In Flight (3.15) .....	3-14
3.5e	Power Off Landing (3.17) .....	3-15
3.5f	Fire In Flight (3.19) .....	3-16
	Electrical Fire.....	3-16
	Engine Fire.....	3-17
3.5g	Loss of Oil Pressure (3.21) .....	3-17
3.5h	Loss of Fuel Flow (3.23) .....	3-18
3.5i	Engine Driven Fuel Pump Failure (3.25).....	3-18
3.5j	High Oil Temperature (3.27) .....	3-19
3.5k	TIT Indicator/Sensor Failure (3.29) .....	3-19
3.5l	High Cylinder Head Temperature (3.31) .....	3-20
3.5m	Electrical Failures (3.33) .....	3-20
	Single Alternator Failure.....	3-20
	Dual Alternator Failure .....	3-21
	Complete Electrical Failure .....	3-24
	Supplemental Heater Control Circuit Failure.....	3-25
3.5n	Avionics Systems Failures (3.35).....	3-26
	Pilot's PFD Failure.....	3-26
	MFD Failure.....	3-27
	Co-pilot's PFD Failure.....	3-27

**TABLE OF CONTENTS (continued)**

**SECTION 3**

**EMERGENCY PROCEDURES**

<b>Paragraph No.</b>		<b>Page No.</b>
	Attitude and Heading Reference System (AHRS) Failure .....	3-28
	Air Data Computer (ADC) Failure .....	3-32
	Erroneous or Loss of Engine and Fuel Displays .....	3-35
	Erroneous or Loss of Warning/Caution CAS Messages...	3-36
	COM1 and COM2 Failure .....	3-37
	Autopilot Malfunction .....	3-37
	Automatic Autopilot Disconnect.....	3-38
	Electric Trim Failure .....	3-38
	Electric Pitch Trim Runaway .....	3-39
	Autopilot Overspeed Recovery .....	3-39
	Loss of Navigation Information.....	3-40
	Autopilot Out-Of-Trim.....	3-40
	Abnormal Flight Director Mode Transitions .....	3-41
	Autopilot Preflight Test Failure .....	3-42
	Dual GPS Failure .....	3-42
3.5o	Propeller Overspeed (3.37) .....	3-44
3.5p	Emergency Landing Gear Extension (3.39) .....	3-45
3.5q	Spin Recovery (3.41) .....	3-45
3.5r	Engine Roughness (3.43) .....	3-46
3.5s	Oxygen System (3.45).....	3-46
3.5t	Emergency Descent (3.47) .....	3-47
3.5u	Cabin Air Contamination/Smoke Evacuation (3.49) .....	3-47
3.5v	Vacuum System Failure (3.51).....	3-48
3.5w	Inadvertent Icing Encounter (3.53) .....	3-48
3.5x	Hydraulic System Malfunction (3.55) .....	3-49
3.5y	Flap System Malfunction (3.57) .....	3-49
3.5z	Fuel Tank Submerged Pump Failure (3.59).....	3-50
3.5aa	Stall Warning Failure (3.61).....	3-50
3.5bb	Emergency Exit (3.63) .....	3-50

## TABLE OF CONTENTS (continued)

## SECTION 3

## EMERGENCY PROCEDURES

Paragraph No.		Page No.
3.7	<b>Amplified Emergency Procedures</b> .....	3-51
3.9	Engine Fire During Start (3.5a) .....	3-51
3.11	Turbocharger Failure (3.5b) .....	3-51
3.13	Engine Power Loss During Takeoff (3.5c).....	3-53
3.15	Engine Power Loss In Flight (3.5d).....	3-54
3.17	Power Off Landing (3.5c) .....	3-55
3.19	Fire In Flight (3.5f) .....	3-56
3.21	Loss of Oil Pressure (3.5g) .....	3-57
3.23	Loss of Fuel Flow (3.5h).....	3-57
3.25	Engine Driven Fuel Pump Failure (Fuel PRESS light illuminated - annunciator panel) (3.5i) .....	3-58
3.27	High Oil Temperature (3.5j).....	3-58
3.29	TIT Indicator/Sensor Failure (3.5k).....	3-59
3.31	High Cylinder Head Temperature (3.5l) .....	3-59
3.33	Electrical Failures (3.5m).....	3-60
	Single Alternator Failure .....	3-60
	Dual Alternator Failure .....	3-61
	Complete Electrical Failure.....	3-64
	Supplemental Heater Control Circuit Failure .....	3-65
3.35	Avionics Systems Failures (3.5n).....	3-65
	Pilot's PFD Failure.....	3-65
	MFD Failure .....	3-66
	Co-pilot's PFD Failure .....	3-67
	Attitude and Heading Reference System (AHRS) Failure .....	3-68
	Air Data Computer (ADC) Failure .....	3-71
	Erroneous or Loss of Engine and Fuel Displays .....	3-74
	Erroneous or Loss of Warning/Caution CAS Messages .....	3-75

**TABLE OF CONTENTS (continued)**

**SECTION 3**

**EMERGENCY PROCEDURES**

<b>Paragraph No.</b>		<b>Page No.</b>
	COM1 and COM2 Failure .....	3-76
	Autopilot Malfunction.....	3-76
	Automatic Autopilot Disconnect.....	3-76
	Electric Trim Failure .....	3-77
	Electric Pitch Trim Runaway .....	3-77
	Autopilot Overspeed Recovery .....	3-77
	Loss of Navigation Information .....	3-78
	Autopilot Out of Trim .....	3-78
	Abnormal Flight Director Mode Transitions .....	3-79
	Autopilot Preflight Test Failure .....	3-80
	Dual GPS Failure .....	3-80
3.37	Propeller Overspeed (3.5o) .....	3-82
3.39	Emergency Landing Gear Extension (3.5p).....	3-82
3.41	Spin Recovery (3.5q) .....	3-82
3.43	Engine Roughness (3.5r).....	3-83
3.45	Oxygen System (3.5s).....	3-83
3.47	Emergency Descent (3.5t).....	3-84
3.49	Cabin Air Contamination/Smoke Evacuation (3.5u) .....	3-84
3.51	Vacuum System Failure (3.5v).....	3-85
3.53	Inadvertent Icing Encounter (3.5w) .....	3-85
3.55	Hydraulic System Malfunction (3.5x) .....	3-86
3.57	Flap System Malfunction (3.5y) .....	3-86
3.59	Fuel Tank Submerged Pump Failure (3.5z) .....	3-87
3.61	Stall Warning Failure (3.5aa) .....	3-87
3.63	Emergency Exit (3.5bb) .....	3-87

## SECTION 3

### EMERGENCY PROCEDURES

#### 3.1 GENERAL

This section provides the recommended procedures for handling various emergency or critical situations. All emergency procedures required by the FAA as well as those necessary for operation of the airplane, as determined by the operating and design features of the airplane, are presented.

Emergency procedures associated with optional systems and equipment which require handbook supplements are presented in Section 9, Supplements.

Pilots must familiarize themselves with the procedures in this section and must be prepared to take the appropriate action should an emergency situation arise. The procedures are offered as a course of action for handling the particular situation or condition described. They are not a substitute for sound judgement and common sense.

#### **KNOW YOUR AIRCRAFT AND BE THOROUGHLY FAMILIAR WITH IMPORTANT EMERGENCY PROCEDURES**

Most basic emergency procedures are a normal part of pilot training. The information presented in this section is not intended to replace this training. This information is intended to provide a source of reference for the procedures which are applicable to this airplane. The pilot should review standard emergency procedures periodically to remain proficient in them.

### **3.1 GENERAL (Continued)**

#### **Crew Alerting System (CAS) Messages**

The Crew Alerting System (CAS) consists of Master Warning and Master Caution Indicators operating in conjunction with CAS text messages. CAS text messages appear in the lower left area of the MFD during normal operations and in the right side area of the PFD's during reversionary mode operation. The Master Warning and Master Caution Indicators are illuminated push-button switches centered above the pilot's PFD. The severity of CAS messages are categorized as Warning, Caution and Advisory as follows:

#### **Red Warning Messages**

All Warning messages consist of a flashing red Master Warning indicator, located above the pilot's PFD, and many have a flashing (inversely red on white) CAS Warning text message located in the lower left corner of the MFD. All Warnings are accompanied by a continuous aural chime, which can be silenced by pressing (acknowledging) the MASTER WARN RESET switch. When acknowledged, the MASTER WARN RESET switch will extinguish, the CAS Warning text message, if applicable, will stop flashing and will revert to normal (red on black) message, and the aural chime will silence. CAS Warning text messages will persist until the initiating condition is removed. If the warning was initiated by a parameter whose indication appears on the MFD, a CAS Warning text message will not be present and that parameter's indication will flash for 5 seconds then remain steady red until the condition is removed. The typical flashing Master Warning indicator and continuous aural chime will accompany these warnings.

### 3.1 GENERAL (Continued)

#### Crew Alerting System (CAS) Messages (continued)

##### Amber Caution Messages

Caution messages consist of an amber Master Caution indicator, located above the pilot's PFD, and many have a (inversely black on amber) CAS Caution text message located in the lower left corner of the MFD. Cautions are accompanied by a single aural chime. Caution messages can be acknowledged by pressing the MASTER CAUTION RESET switch. When acknowledged, the MASTER CAUTION RESET switch will extinguish, the CAS Caution text message, if applicable, will revert to normal (amber on black) message. CAS Caution text messages will persist until the initiating condition is removed. If the Caution was initiated by a parameter whose indication appears on the MFD, a CAS Caution text message will not be present and that parameter's indication will remain steady amber until the condition is removed. The typical Master Caution indicator and single aural chime will accompany these cautions.

##### White Advisory Messages

CAS Advisory text messages appear in the CAS window in white text. Advisory messages do not require acknowledgment and are not accompanied by aural chimes. CAS Advisory Messages persist until the initiating condition is removed.

#### NOTE

The Garmin G1000 Cockpit Reference Guide for the Piper PA-46 Matrix, Garmin p/n 190-01107-XX, latest revision and the Garmin G1000 Pilot's Guide for the Piper PA-46R-350T, Garmin p/n 190-01108-XX, latest revision, contain detailed descriptions of the annunciator system (CAS and Non-CAS) and all warnings, cautions and advisories.

The following tables show the color and significance of the Warning, Caution and Advisory messages which may appear on the Garmin G1000 displays.

**3.1 GENERAL (Continued)**

**Crew Alerting System (CAS) Messages (continued)**

**Warning Messages - Red - Repeating Aural Chime**

<b>Message</b>	<b>Cause</b>
ALTR 1 FAIL	ALTR NO. 1 switch is turned ON and the alternator has failed.
ALTR 2 FAIL	ALTR NO. 2 switch is turned ON and the alternator has failed.
FUEL PRESS LOW	Fuel pressure is below approximately 10 psig.
DOOR AJAR	Cabin door is not properly closed and latched while the engine is running.
L FUEL QTY LOW	Left tank fuel quantity is less than or equal to 5.0 gallons while the engine is running.
R FUEL QTY LOW	Right tank fuel quantity is less than or equal to 5.0 gallons while the engine is running.
SPEEDBRAKES EXTD (Optional Equipment)	Speedbrakes are extended during the takeoff phase of flight.
WNSHLD OVERTEMP (Optional Equipment)	Windshield temperature exceeds 170°F or the windshield temperature sensor has failed.

**3.1 GENERAL (Continued)****Crew Alerting System (CAS) Messages (continued)****Caution Messages - Amber - Single Aural Chime**

<b>Message</b>	<b>Cause</b>
BOOST PUMP FAIL	Fuel boost pump in the tank being used fails to generate sufficient pressure.
FLAP FAIL	Flap system failure due to an overcurrent condition in the flap motor/actuator circuit.
FUEL IMBALANCE	Fuel imbalance is greater than 10 gallons while the engine is running.
HYDR PUMP ON	Hydraulic pump has been running for 1-second (on ground) or 20-seconds (in flight).
L PITOT HT FAIL	Left pitot heat has failed.
R PITOT HT FAIL	Right pitot heat has failed.
PITOT HT OFF	Pitot heat is turned OFF. No aural chime accompanies this action.
PROP HT FAIL (Optional Equipment)	Prop heat fault has developed or the current is less than 16.0 amps.
SPEEDBRAKES EXTD (Optional Equipment)	Speedbrakes are extended in flight while the engine is OFF, being started or during landing.
STALL WARN FAIL	The stall warning lift computer and/or lift transducer has failed.
STARTER ENGAGED	Engine starter is engaged for greater than 30-seconds during engine start or anytime while the engine is running.
SURF DE-ICE FAIL (Optional Equipment)	Surface de-ice system has failed to reach appropriate pressure.

**3.1 GENERAL (Continued)  
Crew Alerting System (CAS) Messages (continued)**

**Advisory Messages - White - No Aural Chime**

<b>Message</b>	<b>Cause</b>
DOOR AJAR	Cabin door is not properly closed and latched while the engine is OFF.
EMERG FUEL OFF	Emergency fuel pump is OFF while the engine is running and fuel pressure has dropped below 10 psi.
EMERG FUEL ON	Emergency fuel pump is ON after completing the takeoff phase of flight.
FUEL IMBALANCE	Fuel imbalance is greater than 10 gallons while the engine is OFF.
L FUEL QTY LOW	Left tank fuel quantity is less than or equal to 5.0 gallons while the engine is OFF.
R FUEL QTY LOW	Right tank fuel quantity is less than or equal to 5.0 gallons while the engine is OFF.
SPEEDBRAKES EXTD (Optional Equipment)	Speedbrakes are extended while the airplane is on the ground or after completing the takeoff phase of flight.
SURF DE-ICE ON (Optional Equipment)	Surface de-ice system is selected ON and power is being applied to the SURF DE-ICE timer.
VACUUM 1 FAIL (Optional Equipment)	Vacuum No. 1 pressure is less than approx. 2.0 in. Hg.
VACUUM 2 FAIL (Optional Equipment)	Vacuum No. 2 pressure is less than approx. 2.0 in. Hg.

**3.1 GENERAL (Continued)****PFD Annunciations and Alerts**

The Garmin G1000 System produces a number of PFD annunciations and alerts outside of the Crew Alerting System (CAS). PFD annunciations and alerts are not accompanied by Master Warning or Master Caution Indications and are displayed in dedicated areas of the PFD or MFD. Various aural alerts (voice, horn or tone) may accompany PFD annunciations and alerts and no pilot action is required to acknowledge PFD annunciations and alerts.

**3.1 GENERAL (Continued)  
PFD Annunciations and Alerts (continued)**

**Comparator Annunciations**

<b>Comparator Window Text</b>	<b>Condition</b>
ALT MISCOMP	Difference in altitude sensors is $\geq 200$ feet.
IAS MISCOMP	If both airspeed sensors detect $< 35$ knots, this is inhibited.  If either airspeed sensor detects $\geq 35$ knots, and the difference in sensors is $> 10$ knots.  If either airspeed sensor detects $\geq 80$ knots, and the difference in sensors is $> 7$ knots.
HDG MISCOMP	Difference in heading sensors is $> 6$ degrees.
PIT MISCOMP	Difference in pitch sensors is $> 5$ degrees.
ROL MISCOMP	Difference in roll sensors is $> 6$ degrees.
ALT NO COMP	No data from one or both altitude sensors.
IAS NO COMP	No data from one or both airspeed sensors.
HDG NO COMP	No data from one or both heading sensors.
PIT NO COMP	No data from one or both pitch sensors.
ROL NO COMP	No data from one or both roll sensors.

### 3.1 GENERAL (Continued)

#### PFD Annunciations and Alerts (continued)

#### Reversionary Sensor Annunciations

<b>Reversionary Sensor Window Text</b>	<b>Condition</b>
BOTH ON ADC1	Both PFD's are displaying data from the number 1 Air Data Computer.
BOTH ON ADC2	Both PFD's are displaying data from the number 2 Air Data Computer.
BOTH ON AHRS1	Both PFD's are displaying data from the number 1 Attitude and Heading Reference System.
BOTH ON AHRS2	Both PFD's are displaying data from the number 2 Attitude and Heading Reference System.
BOTH ON GPS1	Both PFD's are displaying data from the number 1 GPS Receiver.
BOTH ON GPS2	Both PFD's are displaying data from the number 2 GPS Receiver.
USING ADC 1	The PFD displaying this annunciation is displaying data from the number 1 Air Data Computer.
USING ADC 2	The PFD displaying this annunciation is displaying data from the number 2 Air Data Computer.
USING AHRS 1	The PFD displaying this annunciation is displaying data from the number 1 Attitude and Heading Reference System.
USING AHRS 2	The PFD displaying this annunciation is displaying data from the number 2 Attitude and Heading Reference System.

### **3.1 GENERAL (continued)**

#### **Aural Alerts**

Aural alerts are provided to alert the crew and call for their attention:

- Master Cautions (single chime). Master Warnings (repeating chime).
- When in a  $V_{NE}$  overspeed condition ("Airspeed, Airspeed").
- Autopilot disconnect and preflight test complete (warble tone).
- Terrain cautions/warnings.
- Traffic Alerts.
- Stall Warning (steady tone).
- Gear Warning - In flight when the throttle is reduced to the point at which manifold pressure is approximately 14 inches of mercury or below and the landing gear are not in the DOWN position (beeping tone).
- Gear Warning - In flight when the flaps are extended more than 10° and the landing gear are not in the DOWN position (beeping tone).
- Gear Warning - On the ground when the landing gear selector is in the UP position (beeping tone).

Garmin G1000 produced alerts are audible through the headsets and cockpit speaker, while alerts produced by cockpit horns such as those for gear warning and stall warning are audible only from the cockpit horn itself.

3.1 GENERAL (continued)

**Overriding Considerations**

In all emergencies, the overriding consideration must be to:

- **Maintain Airplane Control.**
- Analyze the situation.
- Take proper action.

**NOTE**

Should a circuit breaker trip open after resetting, do not attempt a second re-set.

**Terminology**

Many emergencies require some urgency in landing the aircraft. The degree of urgency varies with the emergency; therefore the terms "land as soon as possible" and "land as soon as practical" are employed. These terms are defined as follows:

**Land as soon as possible** - A landing should be accomplished at the nearest suitable airfield considering the severity of the emergency, weather conditions, field facilities, and ambient lighting.

**Land as soon as practical** - Emergency conditions are less urgent, and although the mission is to be terminated, the emergency is such that an immediate landing at the nearest suitable airfield may not be necessary.

3.3 AIRSPEEDS FOR EMERGENCY OPERATIONS

**STALL SPEEDS**

4340 lbs (Gear UP, Flaps 0°) .....69 KIAS

4340 lbs (Gear DOWN, Flaps 36°).....58 KIAS

OPERATING MANEUVERING SPEED .....118 KIAS at 3411 lbs.  
(See table in Section 2.3)

**BEST GLIDE**

4340 lbs.....90 KIAS

**3.5 EMERGENCY PROCEDURES CHECKLIST****3.5a ENGINE FIRE DURING START (3.9)**

START Switch (crank engine).....PUSH  
 MIXTURE.....IDLE CUT-OFF  
 THROTTLE.....OPEN  
 FUEL SELECTOR.....OFF  
 EMERG FUEL PUMP Switch .....CHECK OFF  
 Abandon if fire continues

**3.5b TURBOCHARGER FAILURE (3.11)****CAUTION**

If a turbocharger failure is the result of loose, disconnected or burned through exhaust system components, a potentially serious fire hazard exists as well as the risk of carbon monoxide migration into the passenger compartment of the aircraft. If a failure within the exhaust system is suspected in flight, immediately reduce power to idle (or as low a power setting as possible) and **LAND AS SOON AS POSSIBLE**. If a suspected exhaust system failure occurs prior to takeoff, **DO NOT FLY THE AIRCRAFT**.

**NOTE**

A turbocharger malfunction may result in an overly rich fuel mixture, which could result in a partial power loss and/or a rough running engine. In worst-case conditions a complete loss of engine power may result.

**COMPLETE LOSS OF ENGINE POWER:**

If a suspected turbocharger or turbocharger control system failure results in a complete loss of engine power, the following procedure is recommended:

MIXTURE.....IDLE CUT-OFF  
 THROTTLE.....cruise setting  
 PROP RPM.....TAKEOFF position  
 MIXTURE.....ADVANCE SLOWLY until engine restarts  
 and adjust for smooth engine operation

*Reduce power and land as soon as possible.*

**3.5b TURBOCHARGER FAILURE (3.11) (continued)**

**PARTIAL LOSS OF ENGINE POWER**

If the turbocharger wastegate fails in the OPEN position, a partial loss of engine power may result. The following procedure is recommended if a suspected turbocharger or turbocharger wastegate control fails.

- THROTTLE .....AS REQUIRED
- PROP RPM .....AS REQUIRED
- MIXTURE .....AS REQUIRED

*Land as soon as possible.*

**ENGINE POWER OVERBOOST**

If the turbocharger wastegate control fails in the CLOSED position, an engine power overboost condition may occur. The following procedure is recommended for an overboost condition:

- THROTTLE .....REDUCE AS NECESSARY  
to keep manifold pressure within limits

**NOTE**

Expect manifold pressure response to throttle movements to be sensitive.

- PROP RPM .....AS REQUIRED
- MIXTURE .....AS REQUIRED

*Land as soon as possible.*

**3.5c ENGINE POWER LOSS DURING TAKEOFF (3.13)**

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:

- LANDING GEAR Selector .....UP
- MIXTURE .....IDLE CUT-OFF
- EMERG FUEL PUMP Switch .....OFF
- FUEL SELECTOR .....OFF



**3.5d ENGINE POWER LOSS IN FLIGHT (3.15) (continued)**

**If power is restored:**

- INDUCTION AIR.....PRIMARY  
(Remain in ALTERNATE if induction ice is suspected)
- EMERG FUEL PUMP Switch (Except in case of engine driven fuel pump failure).....OFF
- MIXTURE.....AS REQUIRED

***Land as soon as practical and investigate cause of power loss.***

**CAUTION**

If normal engine operation and fuel flow are not reestablished, the EMERG FUEL PUMP Switch should be turned OFF. The lack of a fuel flow indication could indicate a leak in the fuel system. If fuel system leak is verified, switch fuel selector to OFF.

**If power is not restored:**

**Prepare for power off landing per Para. 3.5e.**

**3.5e POWER OFF LANDING (3.17)**

PROP RPM.....FULL DECREASE

**Best gliding angle 90 KIAS.**

Locate suitable field.

Establish spiral pattern.

1000 ft. above field at downwind position for normal landing approach. When field can easily be reached slow to 77 KIAS for shortest landing.

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

**3.5e POWER OFF LANDING (3.17) (continued)**

**When committed to landing:**

LANDING GEAR Selector.....AS REQUIRED  
THROTTLE.....CLOSED  
MIXTURE.....IDLE CUT-OFF  
FLAPS .....AS REQUIRED  
FUEL SELECTOR .....OFF  
ALTR No. 1 and ALTR No. 2 Switches.....OFF  
MAG Switches.....OFF  
EMERG FUEL PUMP Switch .....OFF  
Seat Belt and Harness .....TIGHT  
Seats.....adjusted and locked in position

**3.5f FIRE IN FLIGHT (3.19)**

Source Of Fire .....CHECK

**WARNING**

Use oxygen ONLY if flames and heat are not present.

**Electrical Fire (smoke in cabin):**

CABIN TEMP Knob.....PUSH (off)  
ALTR No. 1 and ALTR No. 2 Switches.....OFF  
EMER SWITCH .....ON  
BATT MASTR Switch .....OFF

**CAUTION**

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

Standby (STBY) Gyro Power Button .....SELECT  
Standby Attitude Gyro.....VERIFY ON and FLAG  
IS NOT VISIBLE ON GYRO

**3.5f FIRE IN FLIGHT (3.19) (continued)**

Emergency descent .....ACCOMPLISH PER PARA. 3.5s  
TO A SAFE ALTITUDE  
CONSISTENT WITH TERRAIN

*Land as soon as possible.*

(Perform Emergency Landing Gear Extension procedure and 0° flap landing).

**WARNING**

Use oxygen ONLY if flames and heat are not present.

**Engine fire:**

THROTTLE.....CLOSE  
MIXTURE.....IDLE CUT-OFF  
FUEL SELECTOR .....OFF  
MAG Switches.....OFF  
EMERG FUEL PUMP Switch .....CHECK OFF  
AUXILIARY CABIN HT Switch .....OFF  
VENT/DE-FOG Switch.....OFF  
DEFROST Knob.....PUSH (off)  
CABIN TEMP Knob.....PUSH (off)

Conduct an Emergency Descent per Para. 3.5s and Power Off Landing per Para. 3.5e.

**3.5g LOSS OF OIL PRESSURE (3.21)**

**Indication: Master Warning Indication; Repeating aural chime; Red Oil Pressure indication.**

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

**3.5h LOSS OF FUEL FLOW (3.23)**

**CAUTION**

Turn the EMERG FUEL PUMP switch OFF if fuel flow and power are not immediately restored. The lack of fuel flow indication could indicate a leak in the fuel system. If fuel system leak is verified, switch FUEL SELECTOR to OFF.

EMERG FUEL PUMP Switch.....ON  
FUEL SELECTOR.....CHECK on tank  
containing usable fuel

If power restored:

EMERG FUEL PUMP Switch (except in  
case of engine driven pump failure).....OFF  
MIXTURE.....AS REQUIRED

If power not restored:

EMERG FUEL PUMP Switch.....OFF  
FUEL SELECTOR.....OFF

Proceed with power off landing procedure (Para. 3.5e).

**3.5i ENGINE DRIVEN FUEL PUMP FAILURE (3.25)**

**Indication: Master Warning Indication; Red FUEL PRESS LOW message; Repeating aural chime.**

THROTTLE.....REDUCE  
EMERG FUEL PUMP Switch.....ON  
THROTTLE.....RESET AS REQUIRED  
MIXTURE.....RESET AS REQUIRED

*Land as soon as possible.*

**CAUTION**

If normal engine operation and fuel flow are not reestablished the EMERG FUEL PUMP Switch should be turned OFF. The lack of a fuel flow indication could indicate a leak in the fuel system. If system leak is verified, switch the FUEL SELECTOR to OFF.

**If power is not restored, proceed with power off landing procedure (Para. 3.5e).**

**3.5j HIGH OIL TEMPERATURE (3.27)**

**Indication:** Master Warning Indication; Repeating aural chime; Red oil temperature indication.

THROTTLE .....REDUCE  
 MIXTURE .....ENRICH, if practical  
 Airspeed .....INCREASE, if practical

**If condition is not corrected:**

*Land as soon as possible and investigate the problem. Prepare for power off landing per Para. 3.5e.*

**3.5k TURBINE INLET TEMPERATURE (TIT) INDICATION/SENSOR FAILURE (3.29)**

**Indication:** Red-x on TIT indication or indication does not correlate with related parameters.

If failure occurs during takeoff, initial climb, or landing:

MIXTURE .....Full RICH

During cruise climb conditions:

Power .....Set per Section 4  
 Cruise Climb checklist  
 (35 In. Hg, 2500 rpm, 32 gph)

If failure occurs prior to setting cruise power:

Power.....Set Power per POH Section 5  
 Power Setting Table

MIXTURE.....Lean to Approx. POH Section 5  
 Power Setting Table Fuel Flow  
 +4 GPH. Monitor CHT and Oil Temp.

**CAUTION**

Aircraft POH range and endurance data presented in Section 5 will no longer be applicable. This range/endurance will result due to higher fuel flow/fuel consumption.

If failure occurs after setting cruise power and mixture:

Power.....Note/Maintain Power Setting  
 MIXTURE.....Increase indicated Fuel Flow +1 GPH.  
 Monitor CHT and Oil Temp.

**3.5k TURBINE INLET TEMPERATURE (TIT) INDICATION/SENSOR FAILURE (3.29) (continued)**

**CAUTION**

Aircraft POH range and endurance data presented in Section 5 will no longer be applicable. Less range/endurance will result due to higher fuel flow/fuel consumption.

If failure occurs prior to or during descent:

Power .....Set for 25 in. MAP @ 2400 RPM  
MIXTURE .....Full RICH

**3.5l HIGH CYLINDER HEAD TEMPERATURE (3.31)**

**Indication: Master Warning Indication; Repeating aural chime;  
Red CHT indication.**

If indicated cylinder head temperature reaches 480°F (Caution range):

THROTTLE .....REDUCE  
MIXTURE .....ENRICH, if practical  
Airspeed .....INCREASE, if practical

If condition is not corrected:

*Land as soon as possible and investigate problem.*

**3.5m ELECTRICAL FAILURES (3.33)**

**Single Alternator Failure.**

**Indication: Master Warning Indication; Red ALTR 1 FAIL or ALTR 2  
FAIL message; Repeating aural chime:**

**NOTE**

With a single alternator failure, the VOLTS indication will turn red anytime total tie bus voltage is below 25 VDC.

Verify failure .....CHECK Amperage Indications  
Electrical Load (if VOLTS indication  
in red range) .....REDUCE until total load is  
less than 75 amps & VOLTS  
indication is out of red range  
Failed ALTR No. 1 or 2 Switch .....OFF

**3.5m ELECTRICAL FAILURES (3.33) (continued)**

Failed ALTERNATOR No. 1 or 2 Circuit Breaker .....CHECK and RESET  
as required

(Located on the pilot's forward circuit breaker panel, row A, positions 2 and 3)

Failed ALTR No. 1 or 2 Switch (after OFF at least one second) .....ON

**If power not restored:**

Failed ALTR Switch .....OFF

Amperage Indication.....Monitor and maintain  
BELOW 75 AMPS

While one alternator will supply sufficient current for minimum required avionics and cockpit lighting, use of deicing equipment (if installed), particularly windshield or propeller heat, may be limited. **Immediate action should be taken to avoid or exit icing conditions.** Effort should be taken to keep the electrical load under 75 amps, however under certain circumstances the load may exceed 75 amps when large momentary loads such as landing gear are used in combination with other required equipment. The electric cabin heater, cabin recirculation blowers, and position, strobe, and landing lights should not be used unless absolutely necessary.

**Dual Alternator Failure.**

**Indication: Master Warning Indication; Red ALTR1 FAIL and ALTR2 FAIL messages; Repeating aural chime:**

**NOTE**

With a dual alternator failure, the VOLTS indication will turn red anytime total tie bus voltage is below 24 VDC.

Verify failure .....Check Amperage Indications

ALTR NO. 1 and 2 Switches.....OFF

ALTERNATOR No. 1 and 2 Circuit Breakers.....CHECK and RESET  
as required

(Located on the pilot's forward circuit breaker panel, row A, position 2 and 3)

ALTR NO. 1 Switch (after OFF at least one second) .....ON

ALTR NO. 2 Switch (after OFF at least one second) .....ON

**If only one alternator resets:**

Operating ALTR No. 1 or 2 Switch .....ON

Failed ALTR No. 1 or 2 Switch .....OFF

Electrical Load .....MAINTAIN LESS  
THAN 75 AMPS

Amperage Indication .....MONITOR

*Exit and avoid icing conditions.*

**3.5m ELECTRICAL FAILURES (3.33) (continued)**

**If neither alternator resets:**

ALTR NO. 1 and ALTR NO. 2 Switches .....OFF  
EMER Switch.....Verify OFF  
BATT MASTR Switch.....Verify ON  
Electrical Load.....REDUCE TO MINIMUM  
(per load shed procedures as shown)

**NOTE**

To have 30-minutes of battery power remaining after failure of both alternators, the load shed procedure must be completed within 3-minutes. It is advised to start the load shedding procedure as soon as conditions permit. Items that are not shown, such as standby attitude indicator, are allowed to run continuously and still meet the 30-minute requirement. After a 3-minute load shed procedure, the remainder of the flight (for 30-minute battery life) consists of a 22-minute CRUISE Segment and a 5-minute LANDING Segment.

**Load-shed procedure (for 30-minutes of battery life):**

CRUISE Segment:

**CAUTION**

Turning off the AV BUS MASTR switch removes power from all equipment on Avionics Bus 1 and Avionics Bus 2, some of which may be desired. Care should be exercised when deactivating certain items. Any items that remain ON or are activated beyond the usages shown may reduce the battery life to less than 30-minutes.

AV BUS MASTR Switch... ..OFF  
INVERTER Circuit Breaker.....PULL  
(Located on the pilot's forward circuit breaker panel, row D, position 4.)  
ENVIRONMENTAL/DE-ICE SWITCH PANEL Switches .....All OFF

## 3.5m ELECTRICAL FAILURES (3.33) (continued)

CRUISE Segment: (continued)**If optional Ice Protection System installed and icing conditions present:**

R PITOT HEAT Circuit Breaker.....PULL  
(Located on the pilot's aft circuit breaker panel, row A, position 4.)

PITOT HEAT Switch.....ON

SURF DE-ICE Switch.....2-Cycles Usage

ICE LIGHT Switch.....1-Minute Usage

PITOT HEAT Switch.....VERIFY OFF

EMERG FUEL PUMP Switch.....OFF

LANDG LIGHT.....OFF

TAXI/PULSE Lights.....OFF

NAV Lights.....OFF

STROBE Lights.....OFF

PANEL/AVIONICS/FLOOD Light Dimmers.....LOWEST USABLE  
SETTING

COM 1 Transmit.....1-Minute Usage

**NOTE**

Operation of #1 transponder is allowed and still meets the 30-minute battery life, while activating additional avionics equipment may shorten battery life to less than 30-minutes.

If additional avionics are desired (such as #1 transponder):

All copilot sidepanel circuit breakers.....PULL

AV BUS MASTR Switch.....ON

Desired equipment circuit breakers.....RESET

LANDING Segment:**NOTE**

If the landing is performed at a time that is in excess of 30-minutes after the dual alternator failure, activation of the following equipment may cause a complete electrical system failure. With a complete electrical failure, emergency landing gear extension and landing without flaps will be required. Refer to Emergency Landing Gear Extension (Para. 3.5p).

3.5m ELECTRICAL FAILURES (3.33) (continued)

LANDING Segment: (continued)

<b>If optional Ice Protection System installed and icing conditions present:</b>	
PITOT HEAT Switch .....	ON
SURF DE-ICE Switch .....	2-Cycles Usage
ICE LIGHT Switch .....	1-Minute Usage

PITOT HEAT Switch .....	VERIFY OFF
EMERG FUEL PUMP Switch .....	2-Minutes Usage
LANDG LIGHT .....	2-Minutes Usage
FLAPS .....	AS REQUIRED
(FLAP SYSTEM MALFUNCTION, Section 3.5y)	
LANDING GEAR Selector .....	AS REQUIRED
(EMERGENCY LANDING GEAR EXTENSION, Section 3.5p)	
COM 1 Transmit .....	1-Minute Usage

**Complete Electrical Failure**

**Indication:** PFD's, MFD and all equipment, less standby gyro, will be unpowered.

**NOTE**

After a Complete Electrical Failure, the ADC 1 and AHRS 1 will require approximately 45 seconds to realign.

**CAUTION**

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

Standby (STBY) Gyro Power Button .....	SELECT
Standby Attitude Gyro .....	VERIFY ON and FLAG IS NOT VISIBLE ON GYRO

**3.5m ELECTRICAL FAILURES (3.33) (continued)**

Maintain attitude control using standby instruments.

EMER Switch.....	ON
BATT MASTR Switch .....	OFF
ALTR NO. 1 and ALTR NO. 2 Switches.....	OFF
AV BUS MASTR Switch.....	OFF

**NOTE**

Turning ON the EMER Switch will activate the #1 PFD in reversionary mode with AHRS 1 data, ADC1 data, a subset of engine parameters, #1 COMM/NAV/GPS, audio panel, landing gear down lights, internal lighting for the standby instruments and illumination of the magnetic compass.

*Land as soon as possible.*

**NOTE**

With a complete electrical failure, emergency landing gear extension and landing without flaps will be required. Refer to Emergency Landing Gear Extension (Para. 3.5p).

**Supplemental Heater Control Circuit Failure**

**Indication: Heater Continues to Operate With AUXILIARY CABIN HT and VENT DE-FOG switches OFF.**

VENT DE-FOG Circuit Breaker .....	PULL
-----------------------------------	------

(Located on the pilot's aft circuit breaker panel, row A, position 1)

**If the heater continues to operate, *land as soon as practical.***

### 3.5n AVIONICS SYSTEMS FAILURES (3.35)

#### Pilot's PFD Failure

**Indication:** PFD1 Display goes blank.

DISPLAY BACKUP button above pilot's PFD .....PUSH  
XFR button on autopilot .....SELECT to PFD2  
XPDR2 Softkey .....SELECT  
COM 2 .....ACTIVATE and TUNE as necessary  
NAV 2 .....ACTIVATE and TUNE as necessary  
COM 2/MIC .....SELECT on Audio Panel  
DME 2 (if installed) .....SELECT on MFD and Audio Panel

*Exit and avoid IFR and icing conditions as soon as practical.*

#### NOTE

If the pilot's PFD fails, the MFD and the co-pilot's PFD will remain in normal mode. Pushing the DISPLAY BACKUP button above the pilots PFD allows the MFD to display AHRS and ADC information but lose certain map functions such as radar. The keypad must be used to perform typical PFD functions such as activating the COM and NAV receivers (using COM and NAV buttons) and tuning the COM and NAV frequencies. If Com 1 or Nav 1 was active at the time of PFD failure, the FMS NAV/COM knob on the keypad must be pushed to highlight/activate Com 2 or Nav 2. The following features will become inoperative if there is a complete loss of PFD1 functionality:

- Autopilot (if XFR button is pointing left)
- Com 1 (red x'd but 121.5 MHz remains available)
- Nav 1
- Transponder (#1 Transponder if dual transponders installed)
- #1 GPS
- GDL 69 (Garmin Datalink - XM)
- L PILOT HT FAIL caution CAS message
- VACUUM 1 FAIL advisory CAS message

**3.5n AVIONICS SYSTEMS FAILURES (3.35) (continued)****MFD Failure****NOTE**

PFD 1 and PFD 2 should automatically revert to the reversionary mode display.

**Indication: MFD Display goes blank.**

DISPLAY BACKUP button above pilot's PFD .....PUSH  
 XFR button on autopilot .....SELECT to PFD1  
 XPDR1 Softkey .....SELECT  
 COM 1 .....SELECT on PFD1  
 COM 1/MIC .....SELECT on Audio Panel  
 NAV 1 .....SELECT on PFD1 and Audio Panel

*Exit and avoid IFR and icing conditions as soon as practical.*

**NOTE**

The pilot's PFD and co-pilot's PFD will revert to a reversionary mode display. The following features will become inoperative if there is a complete loss of MFD functionality:

- Autopilot (if XFR button is pointing right)
- Com 2 (red X'd but 121.5 MHz remains available)
- Nav 2
- #2 GPS
- Transponder (#2 Transponder if dual transponders installed)
- GWX (Weather Radar)
- Stormscope
- Traffic
- ADF indication
- DME indication
- R PITOT HT FAIL caution CAS message
- VACUUM 2 FAIL advisory CAS message

**Co-Pilot's PFD Failure****Indication: PFD2 Display goes blank.**

XFR button on autopilot .....SELECT to PFD1  
 XPDR1 Softkey .....SELECT

*Exit and avoid IFR and icing conditions as soon as practical.*

3.5n AVIONICS SYSTEMS FAILURES (3.35) (continued)

**Co-Pilot's PFD Failure (continued)**

**NOTE**

If the co-pilot's PFD fails, the MFD and pilot's PFD will remain in normal display format. The following features will become inoperative if there is a complete loss of PFD2 functionality:

- Autopilot (if XFR button is pointing right)

**Attitude and Heading Reference System (AHRS) Failure**

**AHRS 1 Total Failure**

**On Ground:**

**Indication:** HDG NO COMP, PIT NO COMP, ROL NO COMP white annunciations on PFD; Red x's on failed attitude and heading indications.

System Messages (MSG Softkey).....CONSIDER  
AHRS 1 Circuit Breaker .....RESET  
(Located on the pilot's aft circuit breaker panel, row C, position 6)

If AHRS 1 data still invalid:

AHRS 2 SENSOR Softkey.....SELECT  
*Avoid flight in IFR and icing conditions.*

**In Flight:**

**Indication:** HDG NO COMP, PIT NO COMP, ROL NO COMP white annunciations and BOTH ON AHRS2 amber annunciation on PFD.

System Messages (MSG Softkey).....CONSIDER  
AHRS 1 Circuit Breaker .....RESET  
(Located on the pilot's aft circuit breaker panel, row C, position 6)

If AHRS 1 data still invalid:

AHRS 2 data . . . .CROSSCHECK with STANDBY ATTITUDE GYRO  
*Exit and avoid IFR and icing conditions as soon as practical.*

3.5n AVIONICS SYSTEMS FAILURES (3.35) (continued)

**Attitude and Heading Reference System (AHRS) Failure  
(continued)**

**AHRS 1 Total Failure (continued)**

**In Flight (continued)**

**NOTE**

If AHRS 1 is still invalid, the autopilot will be inoperative.

**NOTE**

For partial AHRS failures, the system will not autorevert to the good AHRS but a red-x and amber text will appear over the affected parameter(s).

**NOTE**

If a MISCOMPARE annunciation is displayed on the PFD, compare AHRS parameters and other related sources of information and select the good AHRS via the SENSOR softkey on the PFD.

**AHRS 2 Total Failure**

**On Ground:**

**Indication:** HDG NO COMP, PIT NO COMP, ROL NO COMP white annunciations on PFD; Red x's on failed attitude and heading indications.

System Messages (MSG Softkey).....CONSIDER

AHRS 2 Circuit Breaker .....RESET

(Located on the co-pilot's circuit breaker panel, row B, position 4)

If AHRS 2 data still invalid:

AHRS 1 SENSOR softkey .....SELECT

*Avoid flight in IFR and icing conditions.*

3.5n AVIONICS SYSTEMS FAILURES (3.28) (continued)

**Attitude and Heading Reference System (AHRS) Failure  
(continued)**

**In Flight:**

**Indication:** HDG NO COMP, PIT NO COMP, ROL NO COMP white annunciations and BOTH ON AHRS1 amber annunciation on PFD.

System Messages (MSG Softkey).....CONSIDER  
AHRS 2 Circuit Breaker .....RESET  
(Located on the co-pilot's circuit breaker panel, row B, position 4)

If AHRS 2 data still invalid:

AHRS 1 data . . . .CROSSCHECK with STANDBY ATTITUDE GYRO  
*Exit and avoid IFR and icing conditions as soon as practical.*

**NOTE**

If AHRS 2 is still invalid, the autopilot will be inoperative.

**NOTE**

For partial AHRS failures, the system will not autorevert to the good AHRS but a red-x and amber text will appear over the affected parameter(s).

**NOTE**

If a MISCOMPARE annunciation is displayed on the PFD, compare AHRS parameters and other related sources of information and select the good AHRS via the SENSOR softkey on the PFD.

**AHRS 1 and AHRS 2 Total Failure**

**On Ground:**

**Indication:** HDG NO COMP, PIT NO COMP, ROL NO COMP white annunciations, and red-x's and amber failure text on all AHRS parameters.

System Messages (MSG Softkey).....CONSIDER  
If all AHRS data is still invalid .....RESET AHRS 1 and 2  
Circuit Breakers

(AHRS 1 - Located on pilot's aft circuit breaker panel, row C, position 6)

**3.5n AVIONICS SYSTEMS FAILURES (3.35) (continued)****Attitude and Heading Reference System (AHRS) Failure  
(continued)****AHRS 1 and AHRS 2 Total Failure (continued)****On Ground (continued)**

(AHRS 2 - Located on co-pilot's circuit breaker panel, row B, position 4)

If one of the AHRS data still invalid:

Operating AHRS SENSOR softkey.....SELECT

***Avoid flight in IFR and icing conditions.***

If both of the AHRS data still invalid:

***Aircraft cannot be flown until maintenance is performed.*****NOTE**

For partial AHRS failures, a red-x and amber text will appear over the affected parameter(s).

**In Flight:****Indication: HDG NO COMP, PIT NO COMP, ROL NO COMP white annunciations, and red-x's and amber failure text on all AHRS parameters.**

Standby Attitude Indicator.....Verify FLAG is NOT VISIBLE

Attitude.....Use standby attitude gyro

Heading.....Use magnetic compass

Course.....Set using digital window

System Messages (MSG Softkey).....CONSIDER

If all AHRS data is still invalid

and time allows .....RESET AHRS 1 and 2 Circuit Breakers

(AHRS 1 - Located on pilot's aft circuit breaker panel, row C, position 6)

(AHRS 2 - Located on co-pilot's circuit breaker panel, row B, position 4)

If one of the AHRS data still invalid:

Operating AHRS data.....CROSSCHECK with STANDBY  
ATTITUDE GYRO***Avoid flight in IFR and icing conditions***

If both of the AHRS data still invalid:

***Land as soon as practical.***

3.5n AVIONICS SYSTEMS FAILURES (3.28) (continued)

**Air Data Computer (ADC) Failure**

**ADC 1 Total Failure**

**On Ground:**

**Indication:** ALT NO COMP, IAS NO COMP white annunciations on PFD: Red-x's and amber failure text on all ADC1 parameters.

System Messages (MSG Softkey).....CONSIDER

ADC 1 Circuit Breaker .....RESET

(Located on the pilot's aft circuit breaker panel, row C, position 5)

If ADC 1 data still invalid:

ADC 2 SENSOR softkey.....SELECT

*Avoid flight in IFR and icing conditions.*

**In Flight:**

**Indication:** ALT NO COMP, IAS NO COMP white annunciations and BOTH ON ADC 2 amber annunciation on PFD.

System Messages (MSG Softkey).....CONSIDER

ADC 1 Circuit Breaker .....RESET

(Located on the pilot's aft circuit breaker panel, row C, position 5)

If ADC 1 data still invalid:

ADC 2 data.....CROSSCHECK with STANDBY  
AIRSPEED & ALTITUDE

*Exit and avoid IFR and icing conditions as soon as practical.*

**NOTE**

For partial ADC failures, the system will not autorevert to the good ADC but a red-x and amber text will appear over the affected parameter(s).

**NOTE**

If a MISCOMPARE annunciation is displayed on the PFD, compare ADC parameters and other related sources of information and select the good ADC via the SENSOR softkey on the PFD.

**3.5n AVIONICS SYSTEMS FAILURES (3.35) (continued)****Air Data Computer (ADC) Failure (continued)****ADC 2 Total Failure****On Ground:**

**Indication:** ALT NO COMP, IAS NO COMP white annunciations on PFD: Red-x's and amber failure text on all ADC2 parameters.

System Messages (MSG Softkey).....CONSIDER

ADC 2 Circuit Breaker .....RESET

(Located on the co-pilot's circuit breaker panel, row B, position 5)

If ADC 2 data still invalid:

ADC 1 SENSOR softkey.....SELECT

*Avoid flight in IFR and icing conditions.*

**In Flight:**

**Indication:** ALT NO COMP, IAS NO COMP white annunciations and BOTH ON ADC 1 amber annunciation on PFD.

System Messages (MSG Softkey).....CONSIDER

ADC 2 Circuit Breaker .....RESET

(Located on the co-pilot's forward circuit breaker panel, row B, position 5)

If ADC 2 data still invalid:

ADC 1 data.....CROSSCHECK with STANDBY

AIRSPEED & ALTITUDE

*Exit and avoid IFR and icing conditions as soon as practical.*

**NOTE**

For partial ADC failures, the system will not autorevert to the good ADC but a red-x and amber text will appear over the affected parameter(s).

**NOTE**

If a MISCOMPARE annunciation is displayed on the PFD, compare ADC parameters and other related sources of information and select the good ADC via the SENSOR softkey on the PFD.

3.5n AVIONICS SYSTEMS FAILURES (3.35) (continued)

**Air Data Computer (ADC) Failure (continued)**

**ADC 1 and ADC 2 Total Failure**

**On Ground:**

**Indication: ALT NO COMP, IAS NO COMP white annunciations and red-x's and amber failure text on all ADC parameters.**

System Messages (MSG Softkey).....CONSIDER  
If all ADC data is still invalid.....RESET ADC 1 and  
2 Circuit Breakers

(ADC 1 - Located on pilot's aft circuit breaker panel, row C, position 5)

(ADC 2 - Located on co-pilot's circuit breaker panel, row B, position 5)

If one of the ADC data still invalid:

Operating ADC SENSOR softkey.....SELECT

*Avoid flight in IFR and icing conditions.*

If both of the ADC data still invalid:

*Aircraft cannot be flown until maintenance is performed.*

**In Flight:**

**Indication: ALT NO COMP, IAS NO COMP white annunciations and red-x's and amber failure text on all ADC parameters.**

System Messages (MSG Softkey).....CONSIDER

Airspeed.....use Standby Airspeed Indicator

Altitude.....use Standby Altimeter

If all ADC data is still invalid

and time allows.....RESET ADC 1 and 2 Circuit Breakers

(ADC 1 - Located on pilot's aft circuit breaker panel, row C, position 5)

(ADC 2 - Located on co-pilot's circuit breaker panel, row B, position 5)

If one of the ADC data still invalid:

Operating ADC data.....CROSSCHECK with STANDBY  
AIRSPEED and ALTITUDE

*Avoid flight in IFR and icing conditions.*

If both of the ADC data still invalid:

*Land as soon as practical.*

**3.5n AVIONICS SYSTEMS FAILURES (3.35) (continued)****Erroneous or Loss of Engine and Fuel Displays**

**Indication:** Red-x over affected engine parameter or fuel display as erroneous indications.

**NOTE**

Erroneous information may be identified by indications which do not agree with other system information. Erroneous indications may be determined by comparing a display with other displays and other system information.

1. Set power based on throttle lever position, engine sound and speed.
2. Monitor other indications to determine the health of the engine.
3. Use known power settings and power setting tables for approximate fuel flow values.
4. Use other system information, such as annunciator messages, fuel totalizer quantity and flow, to safely complete the flight.

### 3.5n AVIONICS SYSTEMS FAILURES (3.35) (continued)

**If ALL engine parameters are invalid and time allows:**

GEA circuit breaker .....RESET  
(Located on the pilot's aft circuit breaker panel, row C, position 1)

**If all engine parameters are still unavailable, *land as soon as practical.***

#### **Erroneous or Loss of Warning/Caution CAS Messages**

**Indication:** Red-x is shown over the CAS message window for complete failure or CAS message present when not expected or CAS message not present when expected.

1. If a red-x is placed over the CAS message window, special attention should be placed on all engine and airframe related parameters. The Master Warning and Master Caution lights will not function, therefore CAS messages indicating a failure of a particular system, such as L PITOT HT FAIL or PROP HT FAIL can go undetected
2. If a CAS message appears that is not expected, treat it as if the condition exists.
3. If an abnormal condition exists but the CAS system has not been activated, use other available information to confirm the condition exists. If it cannot be determined that the condition does not exist, treat the situation as if the condition does exist and take appropriate action.

#### **NOTE**

CAS messages are inhibited for all parameters that have indications displayed on the MFD. The Master Warning and Master Caution lights and associated chimes are still activated whenever any indicated parameter enters the red or amber color bands.

**If a red-x appears over the CAS message window, land as soon as possible.**

**3.5n AVIONICS SYSTEMS FAILURES (3.35) (continued)****COM1 and COM2 Failure**

**Indication:** Inability to communicate/receive on COM1 and COM2.

**NOTE**

If power is lost to the audio panel a fail-safe communications path becomes available between the pilot's headset/microphone and COM1.

AUDIO MKR circuit breaker .....PULL  
(Located on the pilot's aft circuit breakers panel, row C, position 4)

*Exit and avoid IFR and icing conditions as soon as practical.*

**Autopilot Malfunction**

**Indication:** An unexpected roll or pitch deviation from the desired flight path, possible flight director commands deviations from desired aircraft attitudes and possible autopilot disconnect with red AFCS annunciation, amber or red AP annunciation on PFD.

Control Wheel .....GRASP FIRMLY  
Attitude Indicators .....CROSSCHECK  
AP Disconnect/Trim Interrupt Switch .....DEPRESS and HOLD  
Pitch Trim .....RETRIM as necessary  
AUTOPILOT Circuit Breaker .....PULL  
(Located the pilot's forward circuit breaker panel, row D, position 2)  
Autopilot .....DO NOT RE-ENGAGE

**3.5n AVIONICS SYSTEMS FAILURES (3.35) (continued)**

**Automatic Autopilot Disconnect**

**Indication:** Flashing red and white AP on PFD and aural disconnect alert:

A/P DISC Switch.....DEPRESS and RELEASE  
(cancels disconnect tone, and disconnects Autopilot and Yaw Damper)

Pitch Trim.....RETRIM as necessary

**NOTE**

The autopilot disconnect may be accompanied by a red boxed PTCH (pitch), ROLL, YAW or PTRM annunciation on the PFD, indicating the axis which has failed. The autopilot cannot be re-engaged with any of these annunciations present.

**NOTE**

Yaw Damper disengagement is indicated by a 5 second flashing amber "YD".

**Electric Trim Failure**

**Indication:** Red boxed PTRM on PFD

**NOTE**

Loss of the electric pitch trim servo will not cause the autopilot to disconnect. Monitor pitch attitude for unusual behavior. Be alert to possible autopilot out-of-trim conditions (see AUTOPILOT OUT OF TRIM procedure this section) and expect residual control forces upon disconnect. The autopilot will not re-engage after disconnect with failed pitch trim.

Autopilot .....DISCONNECT

**3.5n AVIONICS SYSTEMS FAILURES (3.35) (continued)****Electric Pitch Trim Runaway**

**Indication:** Blue TRIM annunciator light is illuminated continuously and an unexpected pitch deviation from the desired flight path and possible autopilot disconnect with red AFCS annunciation and amber or red AP annunciation.

**NOTE**

If the autopilot was not engaged when a pitch trim runaway occurs, there will be no related annunciation on the PFD.

Control Wheel .....GRASP FIRMLY  
 Attitude Indicators .....CROSSCHECK  
 AP DISC Switch .....DEPRESS and HOLD  
 PITCH TRIM Circuit Breaker .....PULL  
 (Located on the pilot's forward circuit breaker panel, row D, position 1)  
 Pitch Trim .....RETRIM MANUALLY

**Autopilot Overspeed Recovery**

**Indication:** Amber MAXSPD on PFD speedtape

This submode of the autopilot becomes active when the aircraft actual or projected airspeed exceeds  $V_{NE}$ . It remains active until the airspeed is reduced and  $V_{NE}$  exceedance is no longer a factor.

THROTTLE .....REDUCE POWER as required  
 Autopilot Pitch Reference .....RESET to slow the aircraft  
 Autopilot .....DISCONNECT if required

The pilot may elect to hand-fly the aircraft after autopilot disconnect.

**NOTE**

Overspeed recovery mode provides a pitch up command (to a maximum level flight altitude) to decelerate the airplane below  $V_{NE}$ . Overspeed recovery is not active in altitude hold (ALT), glideslope (GS) or glidepath (GP) modes. The speed reference cannot be adjusted while in overspeed recovery mode.

**3.5n AVIONICS SYSTEMS FAILURES (3.35) (continued)**

**Loss Of Navigation Information**

**Indication: Amber VOR, VAPP, GPS, BC, LOC or GS flashing on PFD**

**NOTE**

If a navigation signal is lost while the autopilot is tracking it, the autopilot will roll the aircraft wings level and default to roll mode (ROL).

Autopilot.....SELECT ANOTHER LATERAL MODE  
Nav Source.....SELECT A VALID NAV SOURCE  
Autopilot.....SELECT NAV

If on an instrument approach at the time the navigation signal is lost:

Missed Approach .....EXECUTE  
(A second approach may be attempted using other nav aids.)

**Autopilot Out-Of-Trim**

**Indication: Amber RUD→, ←RUD, ←AIL, AIL→, ↑ELE, or ↓ELE on PFD**

**CAUTION**

Do not attempt to overpower the autopilot in the event of a mis-trim. The autopilot servos will oppose pilot input and will trim opposite the direction of pilot input (pitch axis only). This could lead to a significant out-of-trim condition. Disconnect the autopilot using the A/P DISC / TRIM INTER switch if manual control is desired.

If RUD→ or ←RUD annunciation.....ADJUST rudder trim.

If AIL → or ←AIL annunciation.....Verify SLIP/SKID INDICATOR centered.

(Observe 10 gallon max. fuel imbalance limit)

If ↑ELE or ↓ELE annunciation .....Suspect elevator trim issue  
Control Wheel .....GRASP FIRMLY with both hands

**3.5n AVIONICS SYSTEMS FAILURES (3.35) (continued)**

**Autopilot Out-Of-Trim (continued)**

CAUTION

Be prepared to apply a sustained control force in the direction of the annunciation arrow. For example, an arrow pointing to the right with MI annunciation indicates that sustained right wing down control wheel force will be required upon autopilot disconnect.

AP DISC Switch .....DEPRESS  
 Affected trim system .....RETRIM  
 Autopilot .....RE-ENGAGE if available

If the mistrim indication re-occurs, disconnect the autopilot for the remainder of the flight or until the offending condition is resolved.

**Abnormal Flight Director Mode Transitions**

**Indication: Flashing lateral or vertical mode annunciations on PFD**

NOTE

After 10 seconds, the new mode will be annunciated in green. Upon loss of a selected mode, the system will revert to the default mode for the affected axis, either ROL or PIT.

**Loss of selected vertical mode (FLC, VS, ALT, GS, GP)**

Autopilot Mode Controls .....SELECT ANOTHER VERTICAL MODE

*If on an instrument approach:*

Autopilot .....DISCONNECT (if coupled) and  
 continue manually or execute  
 missed approach

**Loss of selected lateral mode (HDG, NAV, LOC, APP, BC)**

Autopilot Mode Controls .....SELECT ANOTHER LATERAL MODE

*If on an instrument approach:*

Autopilot .....DISCONNECT (if coupled) and  
 continue manually or execute  
 missed approach

**3.5n AVIONICS SYSTEMS FAILURES (3.35) (continued)**

**Autopilot Preflight Test Failure**

**Indication: Red Boxed PFT on PFD**

**AUTOPILOT Circuit Breaker .....PULL & RESET  
(Located on the pilot's forward circuit breaker panel, row D, position 2)**

**NOTE**

When the AUTOPILOT circuit breaker is pulled, the red PFT annunciation will be removed and the autopilot will be unavailable. One attempt at resetting the circuit breaker is allowed.

**3.5n AVIONICS SYSTEMS FAILURES (3.35) (continued)****Dual GPS Failure**

Navigation.....Use alternate source of navigation  
(ILS, LOC, VOR, DME, ADF)

If no alternate navigation sources are available:

Dead Reckoning (DR) Mode - Active when the airplane is greater than 30 NM from the destination airport.

Navigation.....Use the airplane symbol and magenta course line on the MAP display and the amber CDI on the HSI.

**WARNING**

Information normally derived from GPS turns amber. Information will become more inaccurate over time.

**WARNING**

TAWS is Inoperative.

**NOTE**

DR mode uses heading, airspeed and last known GPS position to estimate the airplanes current position.

All maps with an airplane symbol show a ghosted airplane and a "DR" label.

Traffic Information System (TIS) is not dependent on GPS information. The position of displayed traffic relative to the airplane symbol on the map is still accurate.

Loss of Integrity (LOI) mode - Active when the airplane is within 30 NM of the destination airport (as calculated from the previews GPS or DR position).

Navigation .....Fly towards known VMC. Use ATC or other information sources as possible.

3.5n AVIONICS SYSTEMS FAILURES (3.35) (continued)

Dual GPS Failure (continued)

NOTE

All information derived from GPS or DR is removed from the displays.

The airplane symbol is removed from all maps. The map will remain centered at the last known position.

“NO GPS POSITION” is shown in the center of the map.

TAWS and TIS are inoperative.

3.5o PROPELLER OVERSPEED (3.37)

**Indication: Master Warning Indication; Repeating aural chime; Red RPM indication.**

Throttle.....RETARD  
Oil Pressure .....CHECK (green range)  
PROP RPM .....FULL DECREASE rpm,  
then set if any  
control available  
Airspeed .....REDUCE  
Throttle .....AS REQUIRED to remain  
at or below 2500 rpm

***Land as soon as practical and investigate cause of overspeed.***

**3.5p EMERGENCY LANDING GEAR EXTENSION (3.39)****NOTE**

If emergency gear extension is required due to a complete electrical failure, refer to the Complete Electrical Failure checklist in Section 3.5m.

**Prior to emergency extension procedure:**

BATT MASTR Switch .....CHECK ON  
(OFF if operating on the EMER bus)  
Circuit Breakers .....CHECK IN  
DAY/NIGHT Switch (in daytime) .....DAY

**If landing gear does not check down and locked:**

Airspeed .....BELOW 90 KIAS  
HYDRAULIC PUMP-POWER Circuit Breaker (25 amp) .....PULL  
(Located on the pilot's forward circuit breaker panel, row C, position 2)  
LANDING GEAR Selector .....DOWN  
EMERGENCY GEAR EXTENSION Control .....PULL  
(while fishtailing airplane)

**3.5q SPIN RECOVERY (3.41)**

Rudder .....FULL OPPOSITE to  
DIRECTION of ROTATION  
Control Wheel .....FULL FORWARD while  
NEUTRALIZING AILERONS  
THROTTLE .....CLOSED  
Rudder (when rotation stops) .....NEUTRAL  
Control Wheel .....AS REQUIRED to smoothly  
regain level flight attitude

**3.5r ENGINE ROUGHNESS (3.43)**

MIXTURE .....ADJUST FOR MAXIMUM SMOOTHNESS  
INDUCTION AIR.....ALTERNATE  
EMER FUEL PUMP Switch.....ON  
FUEL SELECTOR.....SELECT ANOTHER TANK  
Engine indications.....CHECK  
MAG Switches .....CHECK single MAG Operations

If engine runs smoothly on a single magneto, continue flight on single mag neto and *land as soon as possible*.

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

**3.5s OXYGEN SYSTEM (3.45)**

**NOTE**

The time of useful consciousness at 25,000 feet is approximately 3 minutes.

**NOTE**

The pilot should monitor oxygen quantity to ensure compliance with the applicable supplemental oxygen regulations.

**If hypoxic conditions are present:**

Oxygen Quantity .....CHECK  
*Descend immediately to below 12,500 feet if quantity is low or depleted.*  
Oxygen Flow .....CHECK

If oxygen flow is interrupted as evidenced by the flowmeters or hypoxic indications:

- (1) Install another mask unit.
- (2) Install mask connection in an unused outlet, if available.
- (3) If flow is not restored, immediately descend to below 12,500 feet.

In the event an emergency descent becomes necessary, refer to paragraph 3.5t.

**3.5t EMERGENCY DESCENT (3.47)**

THROTTLE .....CLOSE  
 PROP RPM .....FULL INCREASE  
 MIXTURE .....AS REQUIRED  
 LANDING GEAR Selector .....DOWN  
 (165 KIAS maximum)  
 FLAPS .....UP  
 SMOOTH AIR

Airspeed After Landing Gear Is Fully Extended 180-195 KIAS

**ROUGH AIR**

Airspeed After Landing Gear Is Fully Extended .....4340 lbs. 133 KIAS  
 3400 lbs. 118 KIAS

**3.5u CABIN AIR CONTAMINATION/SMOKE EVACUATION (3.49)**

In the event of smoke or fire, prepare to land the aircraft without delay while completing fire suppression and/or smoke evacuation procedures. If it cannot be visually verified that the fire has been completely extinguished, whether the smoke has cleared or not, land immediately at the nearest suitable airfield or landing site.

**CAUTION**

If fire is suspected, do not use oxygen at lower altitude where oxygen is not required.

Oxygen .....ON/Don mask if necessary  
 Auxiliary Cabin Heat Switch .....OFF  
 Vent/Defog Switch .....ON  
 AIR COND Switch .....OFF

If smoke persists, See Paragraph 3.5f, Fire In Flight.

*Land as soon as possible.*

**3.5v VACUUM SYSTEM FAILURE (3.51) (Optional Equipment)**

**Single Vacuum System Failure**

**Indication:** White VACUUM 1 FAIL or VACUUM 2 FAIL message.

Vacuum Indication.....CHECK (within normal operating range)

Operating Vacuum Pump CAS message .....EXTINGUISHED

**NOTE**

Although either vacuum pump has sufficient capacity to operate the deice boots in a normal manner, immediate action should be taken to exit icing conditions.

**Dual Vacuum System Failure**

**Indication:** White VACUUM 1 FAIL and VACUUM 2 FAIL messages; Amber vacuum indication below 2.0 in. Hg., Single aural chime.

**NOTE**

If both vacuum systems are inoperable, the wing and tail deicer boots will be inoperative. Immediate action should be taken to exit icing conditions. A precautionary landing should be considered depending on operating conditions.

**3.5w INADVERTENT ICING ENCOUNTER (3.53)**

**WARNING**

Flight into known icing conditions is prohibited unless Ice Protection System is installed fully operational. Refer to Section 9, Supplement 1.

**For aircraft not equipped with the optional Ice Protection System:**

INDUCTION AIR .....ALTERNATE  
PITOT HEAT Switch .....ON  
S WARN HEAT Switch.....ON  
Windshield DEFROST Knob .....PULL ON  
PROP HEAT Switch (if installed).....ON  
VENT DE-FOG Switch.....ON

**3.5x HYDRAULIC SYSTEM MALFUNCTION (3.55)**

**Indication: Master Caution Indication; Amber HYDR PUMP ON message; Single aural chime.**

HYDRAULIC PUMP POWER Circuit Breaker .....PULL  
(Located on the pilot's forward circuit breaker panel, row C, position 2)

***Land as soon as practical and investigate the cause.***

Prior to landing, the HYDRAULIC PUMP POWER circuit breaker (located on the pilot's forward circuit breaker panel, row C, position 2) must be reset in order to extend the landing gear. If pump continues to run after gear is locked down, pull the HYDRAULIC PUMP POWER circuit breaker. If gear fails to extend, refer to Emergency Landing Gear Extension (Para. 3.5p).

**3.5y FLAP SYSTEM MALFUNCTION (3.57)**

**Indication: Master Caution Indication; Amber FLAP FAIL message; Single aural chime.**

FLAP WARN circuit breaker .....RESET  
VERIFY Normal Flap Operation.  
(Located on pilot's forward circuit breaker panel, row C, position 8)

If FLAP FAIL message remains illuminated:

FLAP MOTOR Circuit Breaker .....PULL  
(Located on pilot's forward circuit breaker panel, row C, position 7)

**CAUTION**

Higher than normal approach and landing speeds may be required if full symmetrical flap extension is not available. Longer landing distances than shown in Section 5 will result from increased airspeed approaches.

The flaps will remain in the same position as when the malfunction occurred.

***Land as soon as practical and investigate the cause.***

**3.5z FUEL TANK SUBMERGED PUMP FAILURE (3.59)**

**Indication: Master Caution Indication; Amber BOOST PUMP FAIL message; Single aural chime.**

FUEL SELECTOR .....CHECK in detent  
L BOOST Circuit Breaker .....CHECK - RESET if necessary  
R BOOST Circuit Breaker .....CHECK - RESET if necessary  
(Located on pilot's forward circuit breaker panel, row B, positions 2 and 3)  
BOOST PUMP FAIL CAS message .....EXTINGUISHED

**If annunciator remains lit:**

EMERG FUEL PUMP SWITCH .....ON  
Fuel Flow .....CHECK for fluctuation  
Continue flight if no fuel flow fluctuations are observed. If fuel flow fluctuations are observed, descend to an altitude where the fluctuations cease and continue flight. After landing, have the inoperative boost pump repaired prior to further flight.

**3.5aa STALL WARNING FAILURE (3.61)**

**Indication: Master Caution Indication; Amber STALL WARN FAIL message; Single aural chime.**

STALL WARN Circuit Breaker .....CHECK - RESET if necessary  
(Located on pilot's forward circuit breaker panel, row C, position 5)

If circuit breaker does not remain closed, or STALL WARN FAIL CAS message does not extinguish, the stall warning system will be inoperative for remainder of flight. After landing, have system repaired prior to further flight.

**3.5bb EMERGENCY EXIT (3.63)**

EMERGENCY EXIT (second window from front  
on right side) .....LOCATE  
Plexiglas Cover .....REMOVE  
Handle .....PULL  
Emergency Exit Window .....PULL IN

### 3.7 AMPLIFIED EMERGENCY PROCEDURES (GENERAL)

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

#### 3.9 ENGINE FIRE DURING START (3.5a)

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 LEAN (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.

Turn OFF the EMERG FUEL PUMP. The FUEL SELECTOR valve should be OFF and the MIXTURE at LEAN (idle cut-off) if an external fire extinguishing method is to be used.

**If fire continues, abandon the aircraft.**

#### 3.11 TURBOCHARGER FAILURE (3.5b)

##### CAUTION

If a turbocharger failure is the result of loose, disconnected or burned through exhaust system components, a potentially serious fire hazard exists as well as the risk of carbon monoxide migration into the passenger compartment of the aircraft. If a failure within the exhaust system is suspected in flight, immediately reduce power to idle (or as low a power setting as possible) and LAND AS SOON AS POSSIBLE. If a suspected exhaust system failure occurs prior to takeoff, DO NOT FLY THE AIRCRAFT.

##### NOTE

A turbocharger malfunction may result in an overly rich fuel mixture, which could result in a partial power loss and/or a rough running engine. In worst-case conditions a complete loss of engine power may result.

**3.11 TURBOCHARGER FAILURE (3.5b) (continued)**

**COMPLETE LOSS OF ENGINE POWER:**

If a suspected turbocharger or turbocharger control system failure results in a complete loss of engine power, the following procedure is recommended. Move the MIXTURE control to the LEAN (idle cut-off) position. If necessary, reset the THROTTLE to cruise power position and the PROPELLER control to the full forward position. Slowly advance the MIXTURE until the engine restarts and adjust for smooth engine operation. Reduce the power to the minimum required and **land as soon as possible.**

**PARTIAL LOSS OF ENGINE POWER**

If the turbocharger wastegate fails in the OPEN position, a partial loss of engine power may result. The following procedure is recommended if a suspected turbocharger or turbocharger wastegate control failure results in a partial loss of engine power.

Should a partial loss of engine power occur (i.e. wastegate fails open), the THROTTLE, PROP RPM and MIXTURE controls can be set as required for flight. Monitor all engine gauges and **land as soon as possible** to have the cause of the power loss investigated.

**ENGINE POWER OVERBOOST**

If the turbocharger wastegate control fails in the CLOSED position, an engine power overboost condition may occur.

If an overboost condition occurs, REDUCE the THROTTLE as necessary to keep the manifold pressure within limits.

**NOTE**

Expect manifold pressure response to throttle movements to be sensitive.

Set the PROP RPM and MIXTURE controls as necessary and **land as soon as possible.**

**3.13 ENGINE POWER LOSS DURING TAKEOFF (3.5c)**

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 LANDING GEAR selector switch to the UP position and prepare for a gear up landing. If time permits, move MIXTURE control to LEAN (idle cut-off), turn OFF the EMERG FUEL PUMP, and move the FUEL SELECTOR to OFF.

If sufficient altitude has been gained to attempt a restart, maintain a safe airspeed, turn the EMERG FUEL PUMP ON, and switch the FUEL SELECTOR to another tank containing fuel. Ensure the MIXTURE is full RICH and move the INDUCTION AIR lever to the ALTERNATE position.

**CAUTION**

If normal engine operation and fuel flow are not reestablished, the EMERG FUEL PUMP should be turned OFF. The lack of a fuel flow indication could indicate a leak in the fuel system. If fuel system leak is verified, move the FUEL SELECTOR to OFF.

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 Para. 3.5e).

### **3.15 ENGINE POWER LOSS IN FLIGHT (3.5d)**

Complete engine power loss is usually caused by fuel flow interruption and power will be restored shortly after fuel flow is restored. The first step is to prepare for a power off landing (refer to Para. 3.5e). **An airspeed of 90 KIAS (the power off glide speed) should be maintained.**

If altitude permits, turn the EMERG FUEL PUMP ON and switch the FUEL SELECTOR to another tank containing fuel. Reset the MIXTURE control to RICH and move the INDUCTION AIR lever to ALTERNATE. 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.

If power is restored, move the INDUCTION AIR to the PRIMARY position (unless induction ice is suspected). Turn OFF the EMERG FUEL PUMP (except in case of engine driven fuel pump failure) and adjust the MIXTURE control as necessary. **Land as soon as practical and investigate cause of power loss.**

#### **CAUTION**

If normal engine operation and fuel flow are not reestablished, the EMERG FUEL PUMP should be turned OFF. The lack of a fuel flow indication could indicate a leak in the fuel system. If fuel system leak is vented, switch FUEL SELECTOR to OFF.

**If the preceding steps do not restore power, prepare for a power off landing.**

**If previous procedure has not restored power and time permits, secure one magneto at a time, then back to both 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. Water in the fuel could take some time to be consumed, therefore allowing the engine to windmill may restore power. If power loss is due to water, fuel flow indications will appear 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 Para. 3.5e).**

**3.17 POWER OFF LANDING (3.5e)**

If loss of power occurs at altitude, trim the aircraft for best gliding angle, (90 KIAS) and look for a suitable field. If measures taken to restore power are not effective, and if time permits, check the MFD maps and 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 PROP RPM control in full DECR position, the aircraft will travel approximately 2 miles for each thousand feet of altitude. 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, slow to 77 KIAS with flaps down 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.

Touchdowns 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. Close the THROTTLE and move the MIXTURE to LEAN (idle cut-off) position. Set the flaps to the desired flap setting, and move the fuel selector valve to OFF. Turn the ALTR switches, MAG switches, and EMERG FUEL PUMP switch OFF. The seat belts and shoulder harness should be tightened and checked. The seats should be adjusted and locked in position.

**3.19 FIRE IN FLIGHT (3.5f)**

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

Check for the source of the fire first.

**WARNING**

Use oxygen if installed, use **ONLY** if flames and heat are not present.

If an electrical fire is indicated (smoke in cockpit). The cabin heat should be turned **OFF** by pushing the **CABIN TEMP** knob in. Turn both alternators **OFF** via the **ALTR NO. 1** and **ALTR NO. 2** switches. Turn the **EMER** switch **ON**, then the **BATT MASTR** switch **OFF**. Press the **STBY PWR** button on the standby attitude indicator to turn power **ON**.

**CAUTION**

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

An emergency descent should be executed to a safe altitude consistent with terrain and a landing made as soon as possible.

If an engine fire is present, close the **THROTTLE**, move the **MIXTURE** control to **LEAN** (idle cut-off) and place the **FUEL SELECTOR** in the **OFF** position. Turn the **MAG** switches **OFF** and check that the **EMERG FUEL PUMP** is **OFF**. Turn the **AUXILIARY CABIN HT** and **VENT/DE-FOG** switches **OFF**. Push the **DEFROST** knob and **CABIN TEMP** knob to the **OFF** positions. If the terrain permits, a landing should be made immediately (refer to Power Off Landing procedure Para. 3.5e).

### 3.21 LOSS OF OIL PRESSURE (3.5g)

Loss of oil pressure is indicated by a Master Warning indication, a repeating aural chime and a red oil pressure indication.

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 indication. In either case, proceed toward the nearest airport and be prepared for a forced landing. If the problem is not pressure measuring or indicating related, the engine may stop suddenly. Maintain altitude until such time as a power off landing can be accomplished. Do not change power settings unnecessarily, as this may hasten complete power loss.

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

If engine stoppage occurs, proceed with Power Off Landing procedure (refer to Para. 3.5e).

### 3.23 LOSS OF FUEL FLOW (3.5h)

#### CAUTION

Turn the EMERG FUEL PUMP OFF if fuel flow and power is not immediately restored. The lack of a fuel flow indication could indicate a leak in the fuel system. If fuel system leak is verified, switch the FUEL SELECTOR to OFF.

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 the EMERG FUEL PUMP ON and check that the FUEL SELECTOR is on a tank containing usable fuel.

If power is restored, turn OFF the EMERG FUEL PUMP (except in the case of an engine driven fuel pump failure). Adjust the MIXTURE control as necessary.

If power is not restored, turn the EMERG FUEL PUMP and the FUEL SELECTOR OFF, and proceed with Power Off Landing procedure (refer to Para. 3.5e).

**3.25 ENGINE DRIVEN FUEL PUMP FAILURE (3.5i)**

An engine driven fuel pump failure is indicated by a Master Warning indication, a red FUEL PRESS LOW CAS message and a repeating aural chime. Reduce the THROTTLE and turn the EMERG FUEL PUMP ON. The THROTTLE and MIXTURE should then be reset as required. A landing should be made as soon as possible and the cause of the failure investigated.

**CAUTION**

If normal engine operation and fuel flow are not reestablished, the EMERG FUEL PUMP switch should be turned OFF. The lack of a fuel flow indication could indicate a leak in the fuel system. If fuel system leak is verified, switch the FUEL SELECTOR to OFF.

If power can not be restored, proceed with power off landing procedure per Para. 3.5e.

**3.27 HIGH OIL TEMPERATURE (3.5j)**

An abnormally high oil temperature is indicated by a Master Warning indication, a repeating aural chime and a red oil temperature indication. This 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 faulty display, or other causes. Reduce power and/or enrich the MIXTURE, and increase airspeed if practical. If condition is not corrected, **land as soon as possible** at the nearest 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 display for an accompanying loss of oil pressure.

### 3.29 TURBINE INLET TEMP (TIT) INDICATOR/SENSOR FAILURE (3.5k)

A turbine inlet temperature exceedance is indicated by a Master Warning indication, a repeating aural chime and a red Turbine Inlet Temperature (TIT) indication.

A TIT indicator or sensor failure is indicated by a red-x on the TIT indicator or a TIT indication that does not correlate with related parameters. Continued flight is possible using conservative mixture/TIT settings.

If TIT failure occurs during takeoff, climb, descent, or landing, maintain a full rich MIXTURE to assure adequate fuel flow for engine cooling. During cruise climb operations, a fuel flow of 32 gph may be used. If TIT failure occurs prior to setting cruise power, set power per the POH Section 5 power setting table and then lean to the approximate POH power setting table fuel flow +4 GPH. This fuel flow will maintain adequate engine cooling and a TIT value below TIT limits. Monitor CHT and Oil Temperature for normal operation.

#### CAUTION

Aircraft POH range and endurance data presented in Section 5 will no longer be applicable. Less range/endurance will result due to higher fuel flow/fuel consumption.

If TIT failure occurs after setting cruise power and MIXTURE per the POH Section 5 power setting table, maintain the power setting and increase indicated fuel flow by + 1 GPH. This fuel flow will maintain adequate engine cooling and TIT value below TIT limits. Monitor CHT and Oil Temperature for normal operation.

#### CAUTION

Aircraft POH range and endurance data presented in Section 5 will no longer be applicable. Less range/endurance will result due to higher fuel flow/fuel consumption.

If TIT failure occurs prior to or during descent, set power to 25 in. MAP at 2400 rpm and increase the MIXTURE to full RICH.

The TIT indicating system should be repaired as soon as practical.

### 3.31 HIGH CYLINDER HEAD TEMPERATURE (3.5I)

A cylinder head temperature (CHT) exceedance is indicated by a Master Warning indication, a repeating aural chime and a red CHT indication.

**3.31 HIGH CYLINDER HEAD TEMPERATURE (3.5I)(continued)**

Excessive cylinder head temperature may accompany excessive oil temperature. If indicated cylinder head temperature reaches the 480°F caution range, reduce power and/or enrich the MIXTURE, and increase airspeed if practical. If the problem persists, land as soon as possible at an appropriate airport and have the cause investigated.

**3.33 ELECTRICAL FAILURES (3.5m)**

**SINGLE ALTERNATOR FAILURE**

A single alternator is indicated by a Master Warning indication, a red ALTR 1 FAIL or ALTR 2 FAIL CAS message and a repeating aural chime.

**NOTE**

With a single alternator failure, the VOLTS indication will turn red anytime total tie bus voltage is below 25 VDC.

Loss of either alternator is indicated by a zero reading on the appropriate alternator's amperage indication.

If the VOLTS indication is in the red range, first reduce the electrical load to less than 75 amps, which should allow the VOLTS indication to come out of the red range, and prevent overloading the operating alternator.

Next, turn the failed alternator (ALTR NO. 1 or ALTR NO. 2) switch OFF for at least one second. Check the inoperative alternator (ALTERNATOR NO. 1 or ALTERNATOR NO. 2) circuit breaker and reset as required.

If the trouble was caused by a momentary overvoltage condition, the alternator control unit can now be reset by turning the failed alternator switch ON.

If the affected alternator's amperage indication continues to read zero, and the ALTR NO. 1 or ALTR NO. 2 CAS message remains illuminated, turn the failed alternator's switch OFF. Continue flight and monitor the operating alternator's amperage indication to ensure the electrical load does not exceed 75 amps. The CAS message of the failed alternator will remain illuminated.

While one alternator will supply sufficient current for minimum required avionics and cockpit lighting, use of deicing equipment (if installed), particularly windshield or propeller heat, may be limited. Immediate action should be taken to avoid or exit icing conditions. Effort should be taken to keep the electrical load under 75 amps, however under certain circumstances the load may exceed 75 amps when large momentary loads such as landing gear are used in combination with other required equipment. The electric cabin heater, cabin recirculation blowers, and position, strobe, and landing lights should not be used unless absolutely necessary.

**3.33 ELECTRICAL FAILURES (3.5m) (continued)****DUAL ALTERNATOR FAILURE**

A dual alternator failure is indicated by a Master Warning indication, red ALTR 1 FAIL and ALTR 2 FAIL CAS messages and a repeating aural chime.note

**NOTE**

With a dual alternator failure, the VOLTS indication will turn red anytime total tie bus voltage is below 24 VDC.

In the event that both alternators indicate failure simultaneously, attempt to restore power on each alternator individually by turning OFF the ALTR NO.1 and ALTR NO. 2 switches for at least one second, resetting any tripped ALTERNATOR NO. 1 or ALTERNATOR NO. 2 circuit breakers located on the pilot's forward circuit breaker panel, row A, positions 2 and 3, then turning ON the ALTR NO. 1 and ALTR NO. 2 switches one at a time.

If only one alternator can be restored, reinstate electrical load as desired to a maximum of 75 amps. *Exit and avoid icing conditions.*

If neither alternator can be restored, turn ALTR NO. 1 and ALTR NO. 2 switches OFF. The remainder of the flight should occur with a reduced electrical load via the load shedding procedures shown below while using the battery power only.

**NOTE**

To have 30-minutes of battery power remaining after failure of both alternators, the load shed procedure must be completed within 3-minutes. It is advised to start the load shedding procedure as soon as conditions permit. Items that are not shown, such as standby attitude indicator, are allowed to run continuously and still meet the 30-minute requirement. After a 3-minute load shed procedure, the remainder of the flight (for 30-minute battery life) consists of a 22-minute CRUISE Segment and a 5-minute LANDING Segment.

**3.33 ELECTRICAL FAILURES (3.5m) (continued)**

**DUAL ALTERNATOR FAILURE (continued)**

**CRUISE Segment:**

**CAUTION**

Turning off the AV BUS MASTR switch removes power from all equipment on Avionics Bus 1 and Avionics Bus 2, some of which may be desired. Care should be exercised when deactivating certain items. Any items that remain ON or are activated beyond the usages shown may reduce the battery life to less than 30-minutes.

Turn OFF the AV BUS MASTR switch. The MFD and PFD2 displays will go blank and the pilot's PFD will automatically display in reversionary mode. The use of the pilot's PFD and standby gauges should be used for primary aircraft control. Pull the INVERTER circuit breaker, located on the pilot's forward circuit breaker panel, row D, position 4. This will immediately de-energize any accessory plugged into the 110V inverter in the cabin. Turn OFF all switches located on the Environmental/De-Ice Switch Panel. Pull the R PITOT HEAT circuit breaker, located on the pilot's aft circuit breaker panel, row A, position 4. If icing conditions are present, and the optional Ice Protection System is installed, activate the PITOT HEAT, the SURF DE-ICE for 2-cycles and the ICE LIGHT for 1-minute during the 22-minute CRUISE Segment. Turn the EMERG FUEL PUMP Switch OFF. Turn OFF the external lights (LANDG LIGHT, TAXI/PULSE, NAV and STROBE lights) and reduce the internal light dimmers (PANEL, AVIONICS and FLOOD) to their lowest usable settings. 30-minute battery life from time of dual alternator failure is predicated on the PANEL, AVIONICS and FLOOD dimmers being used at 50% of their total brightness settings. Limit COM 1 transmissions to 1-minute.

**NOTE**

Operation of #1 transponder is allowed and still meets the 30-minute battery life, while activating additional avionics equipment may shorten battery life to less than 30-minutes.

**3.33 ELECTRICAL FAILURES (3.5m) (continued)****DUAL ALTERNATOR FAILURE (continued)****LANDING Segment:****NOTE**

If the landing is performed at a time that is in excess of 30-minutes after the dual alternator failure, activation of the following equipment may cause a complete electrical system failure. Be prepared to execute the appropriate emergency procedure.

If icing conditions are present, and the optional Ice Protection System is installed, activate the PITOT HEAT for up to 5-minutes, the SURF DE-ICE for 2-cycles and the ICE LIGHT for 1-minute during the 5-minute LANDING Segment. Turn the EMERG FUEL PUMP and LANDG LIGHT switches ON for a maximum of 2-minutes. When required, one full extension of the FLAPS and LANDING GEAR are acceptable. Limit COM 1 transmissions to 1-minute.

**3.33 ELECTRICAL FAILURES (3.5m) (continued)**

**COMPLETE ELECTRICAL FAILURE**

A complete electrical failure is indicated by the PFD's MFD and all equipment (less the standby attitude indicator) being unpowered.

**NOTE**

After a Complete Electrical Failure, the ADC 1 and AHRS 1 will require approximately 45 seconds to realign.

**CAUTION**

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

Should a complete electrical failure occur, press the STBY PWR button on the standby attitude indicator and **verify that the flag is not visible on the gyro.**

**Maintain attitude control by using the standby instruments.**

Turn the EMER switch ON, then turn the BATT MASTR switch OFF, ALTR NO. 1 and ALTR NO. 2 switches OFF and the AV BUS MASTR switch OFF.

**NOTE**

Turning ON the EMER Switch will activate the # 1 PFD in reversionary mode with AHRS 1 data, ADC 1 data, a subset of engine parameters, #1 Com/Nav/GPS, audio panel, landing gear down lights, internal lighting for the standby instruments and illumination of the magnetic compass.

**Land as soon as possible.**

**NOTE**

With a complete electrical failure, emergency landing gear extension and landing without flaps will be required. Refer to Emergency Landing Gear Extension (Para. 3.5p).

If additional avionics are desired (such as the #1 transponder), pull all co-pilot sidepanel circuit breakers and turn OFF the AV BUS MASTR switch. Reset additional avionics circuit breakers only as needed.

**3.33 ELECTRICAL FAILURES (3.5m) (continued)****SUPPLEMENTAL HEATER CONTROL CIRCUIT FAILURE**

If the heater continues to operate with the AUXILIARY CABIN HT and VENT DE-FOG switches OFF, Pull the VENT DE-FOG circuit breaker. If the heater continues to operate, *land as soon as practical.*

**3.35 AVIONICS SYSTEMS FAILURES (3.5n)****Pilot's PFD Failure**

A pilot's PFD failure is indicated by PFD1 going blank.

The MFD and co-pilot's PFD will remain in normal display format. The suggested course of action is to press the red DISPLAY BACKUP button adjacent to the pilot's PFD, thereby allowing the MFD to go into the reversionary display mode. When this is done, the MFD will display AHRS and ADC information but lose certain map functions such as radar and Stormscope. The keypad must be used to perform typical PFD functions such as activating and tuning NAV and COM frequencies. If Com 1 or Nav 1 was active at the time of PFD failure, the FMS NAV/COM knob on the keypad must be pushed to highlight/activate Com 2 or Nav 2. Select COM 2/MIC on the audio panel. If DME is installed and needed, select DME 2 on the MFD via the DME softkey and select DME on the audio panel.

If the transfer button (XFR) on the autopilot was pointing towards PFD1 during the failure of the pilot's PFD, the autopilot will automatically disconnect. If further use of the autopilot is desired, press the XFR button on the autopilot towards PFD2 and reactivate the autopilot. If continued use of the transponder is desired, select the XPDR2 softkey on the MFD.

*Exit and avoid IFR and icing conditions as soon as practical.*

Items that become inoperative if there is a complete loss of PFD1 functionality are:

- Autopilot (if XFR button is pointing left)
- Com 1 (red X'd but 121.5 MHz remains available)
- Nav 1
- #1 Transponder (if dual transponders installed)
- #1 GPS
- GDL 69 (Garmin Datalink - XM)
- L PITOT HT FAIL caution CAS message
- VACUUM 1 FAIL advisory CAS message

**3.35 AVIONICS SYSTEMS FAILURES (3.5n) (continued)**

**MFD Failure**

An MFD failure is indicated by the MFD going blank.

The pilot's PFD and co-pilot's PFD will automatically revert to the reversionary mode display. Although automatic display reversion should take place on both PFD's, the red DISPLAY BACKUP button adjacent to the pilot's PFD should be pressed. This will ensure that regardless of the MFD failure causes, the pilot's PFD will go into reversionary mode display. If the transfer button (XFR) on the autopilot was pointing towards PFD2 during the failure of the MFD, the autopilot will automatically disconnect. If further use of the autopilot is desired, press the XFR button on the autopilot towards PFD1 and reactivate the autopilot. If continued use of the transponder is desired, select the XPDR1 softkey on PFD1. If COM 2 or NAV 2 was active at the time of MFD failure, COM 1 and NAV 1 should be selected on PFD 1 and COM1/MIC and NAV 1 selected on the audio panel.

*Exit and avoid IFR and icing conditions as soon as practical.*

Items that become inoperative if there is a complete loss of MFD functionality are:

- Autopilot (if XFR button is pointing right)
- Com2 (red x'd but 121.5 MHz remains available)
- Nav2
- #2 GPS
- #2 Transponder (if dual transponders installed)
- GWX (Weather Radar)
- Stormscope
- Traffic
- ADF indication
- DME indication
- R PITOT HT FAIL caution CAS message
- VACUUM 2 FAIL advisory CAS message

**3.35 AVIONICS SYSTEMS FAILURES (3.5n) (continued)****Co-pilot's PFD Failure**

A co-pilot's PFD failure is indicated by PFD2 going blank.

The MFD and pilot's PFD will remain in normal display format. If the transfer button (XFR) on the autopilot were pointing towards PFD2 during the failure of the co-pilot's PFD, the autopilot will automatically disconnect. If continued use of the autopilot is desired and PFD1 is functioning, press the XFR button on the autopilot towards PFD1. If the XFR button were already pointing towards PFD1, then no action is needed. If continued use of the transponder is desired, verify that the XPDR1 softkey on the pilot's PFD is selected.

*Exit and avoid IFR and icing conditions as soon as practical.*

Items that become inoperative if there is a complete loss of PFD2 functionality are:

- Autopilot (if XFR button is pointing right)

### 3.35 AVIONICS SYSTEMS FAILURES (3.5n) (continued)

#### Attitude and Heading Reference System (AHRS) Failure

The severity of a complete AHRS failure and the actions required after this failure are slightly different depending on whether the airplane is on the ground or in flight.

#### AHRS 1 Total Failure

##### On Ground:

A total failure of AHRS 1 is indicated by the white PFD annunciations HDG NO COMP, PIT NO COMP and ROL NO COMP and red-x's and amber failure text on the failed attitude and heading indications. Automatic reversion to AHRS 2 information is inhibited while on the ground. The autopilot will be inoperative during all failed AHRS operations.

Consider all System Messages that are present under the "MSG" softkey on the PFD. An attempt to reinitialize the AHRS should be made by resetting the AHRS 1 circuit breaker located on the pilot's aft circuit breaker panel, row C, position 6. If the AHRS 1 data remains invalid, then display AHRS 2 information on the pilot's PFD by pressing the SENSOR softkey on the PFD and selecting AHRS 2. AHRS redundancy is now lost and the aircraft should not be flown in IFR and icing conditions.

##### In Flight:

A total failure of AHRS 1 is indicated by the white PFD annunciations HDG NO COMP, PIT NO COMP and ROL NO COMP as well as an amber PFD annunciation BOTH ON AHRS2. AHRS 2 data should automatically replace the bad AHRS 1 data while in flight. The autopilot will be inoperative during all failed AHRS operations.

Consider all System Messages that are present under the "MSG" softkey on the PFD. An attempt to reinitialize the AHRS should be made by resetting the AHRS 1 circuit breaker located on the pilot's aft circuit breaker panel, row C, position 6. If the AHRS 1 data remains invalid (by reselecting AHRS 1 via the SENSOR softkey on the PFD), then reselect AHRS 2 information on the pilot's PFD and crosscheck this data with that of the standby attitude indicator. AHRS redundancy is now lost so it is imperative to *exit and avoid IFR and icing conditions*.

For partial AHRS failures, the system will not automatically revert to the good AHRS but a red-x will appear over the affected parameter(s).

**3.35 AVIONICS SYSTEMS FAILURES (3.5n) (continued)****AHRS 1 Total Failure (continued)****In Flight: (continued)**

If an AHRS parameter is valid but different enough from that of the opposing AHRS, a MISCOMPARE annunciation is displayed. Compare AHRS parameters and other related sources of information and select the good AHRS via the SENSOR softkey on the PFD.

**AHRS 2 Total Failure****On Ground:**

A total failure of AHRS 2 is indicated by the white PFD annunciations HDG NO COMP, PIT NO COMP and ROL NO COMP and red-x's and amber failure text on the failed attitude and heading indications. Automatic reversion to AHRS 1 information is inhibited while on the ground. The autopilot will be inoperative during all failed AHRS operations.

Consider all System Messages that are present under the "MSG" softkey on the PFD. An attempt to reinitialize the AHRS should be made by resetting the AHRS 2 circuit breaker located on the co-pilot's circuit breaker panel, row B, position 4. If the AHRS 2 data remains invalid, then verify the display AHRS 1 information on the pilot's PFD by pressing the SENSOR softkey on the PFD and selecting AHRS 1. AHRS redundancy is now lost and the aircraft should not be flown in IFR and icing conditions.

**In Flight:**

A total failure of AHRS 2 is indicated by the white PFD annunciations HDG NO COMP, PIT NO COMP and ROL NO COMP as well as an amber PFD annunciation BOTH ON AHRS1. AHRS 1 data should automatically replace the bad AHRS 2 data while in flight. The autopilot will be inoperative during all failed ARHS operations.

Consider all System Messages that are present under the "MSG" softkey on the PFD. An attempt to reinitialize the AHRS should be made by resetting the AHRS 2 circuit breaker located on the co-pilot's circuit breaker panel, row B, position 4. If the AHRS 2 data remains invalid (by reselecting AHRS 2 via the SENSOR softkey on the PFD), then verify reselection of AHRS 1 information on the pilot's PFD and crosscheck this data with that of the standby attitude indicator. AHRS redundancy is now lost so it is imperative to *exit and avoid IFR and icing conditions*.

### 3.35 AVIONICS SYSTEMS FAILURES (3.5n) (continued)

#### AHRS 2 Total Failure (continued)

##### In Flight: (continued)

For partial AHRS failures, the system will not automatically revert to the good AHRS but a red-x and amber failure text will appear over the affected parameter(s).

If an AHRS parameter is valid but different enough from that of the opposing ADC, a MISCOMPARE annunciation is displayed. Compare AHRS parameters and other related sources of information and select the good AHRS via the SENSOR softkey on the PFD.

#### AHRS 1 and 2 Total Failure

##### On Ground:

A total failure of AHRS 1 and AHRS 2 is indicated by the white PFD annunciations HDG NO COMP, PIT NO COMP and ROL NO COMP and red-x's and amber failure text on all attitude and heading indications.

Consider all System Messages that are present under the "MSG" softkey on the PFD. An attempt to reinitialize the AHRS should be made by resetting the AHRS 1 circuit breaker located on the pilot's aft circuit breaker panel, row C, position 6 and the AHRS 2 circuit breaker located on the co-pilot's circuit breaker panel, row B, position 4. If one of the AHRS data remains invalid, then select the operating AHRS via the SENSOR softkey on the pilot's PFD and crosscheck this data with that of the standby attitude indicator. AHRS redundancy is now lost so it is imperative to avoid IFR and icing conditions. If both of the AHRS data remains invalid, the aircraft cannot be flown until maintenance is performed.

##### In Flight:

A total failure of AHRS 1 and AHRS 2 is indicated by the white PFD annunciations HDG NO COMP, PIT NO COMP and ROL NO COMP and red-x's and amber failure text on all attitude and heading indications.

When these indications are present, verify the standby attitude indicator flag is not visible and transition/use the standby attitude indicator for attitude information. Utilize the magnetic compass for heading information and set course using the digital window on the PFD. If time allows, consider all System Messages that are present under the "MSG" softkey on the PFD. An

**3.35 AVIONICS SYSTEMS FAILURES (3.5n) (continued)****AHRS 1 and 2 Total Failure (continued)****In Flight: (continued)**

attempt to reinitialize the AHRS should be made by resetting the AHRS 1 circuit breaker located on the pilot's aft circuit breaker panel, row C, position 6 and the AHRS 2 circuit breaker located on the co-pilot's circuit breaker panel, row B, position 4. If one of the AHRS data remains invalid, crosscheck the operating AHRS data with that of the standby attitude indicator. AHRS redundancy is now lost so it is imperative to exit and avoid IFR and icing conditions. If both of the AHRS data remains invalid, land as soon as practical. The autopilot will be inoperative during all failed AHRS operations.

**ADC 1 Total Failure****On Ground:**

A total failure of ADC 1 is indicated by the white annunciations ALT NO COMP, IAS NO COMP on the PFD, and red-x's and amber failure text on all ADC1 parameters.

Consider all System Messages that are present under the "MSG" softkey on the PFD. An attempt to reinitialize the ADC 1 should be made by resetting the ADC 1 circuit breaker located on the pilot's aft circuit breaker panel, row C, position 5. If ADC 1 data remains invalid, then select the operating ADC 2 via the SENSOR softkey on the pilot's PFD and crosscheck this data with that of the standby airspeed and altitude indicators. An amber annunciation BOTH ON ADC 2 will now appear on the PFD. ADC redundancy is now lost so it is imperative to avoid IFR and icing conditions.

**In Flight:**

A total failure of ADC 1 is indicated by the white annunciations ALT NO COMP, IAS NO COMP, and amber annunciation BOTH ON ADC 2 on the PFD.

Consider all System Messages that are present under the "MSG" softkey on the PFD. During total failures of ADC 1, the system will autorevert to ADC 2. The pilot should then crosscheck the ADC 2 data with that of the standby airspeed and altitude indicators. An attempt to reinitialize the ADC 1 should be made by resetting the ADC 1 circuit breaker located on the pilot's aft circuit breaker panel, row C, position 5. If ADC 1 data becomes valid, which is confirmed via the absence of the ALT NO COMP and IAS NO COMP annunciations, then the pilot must reselect ADC 1 on the pilot PFD.

**3.35 AVIONICS SYSTEMS FAILURES (3.5n) (continued)**

**ADC 1 Total Failure (continued)**

**In Flight:(continued)**

If ADC 1 does not become valid, ADC redundancy is now lost so it is imperative to exit and avoid IFR and icing conditions.

For partial ADC failures, the system will not autorevert to the good ADC but a red-x and amber text will appear over the affected parameter(s). If an ALT NO COMP or IAS NO COMP annunciation is displayed on the PFD, compare ADC parameters with other related sources of information and select the good ADC via the SENSOR softkey on the PFD.

**ADC 2 Total Failure**

**On Ground:**

A total failure of ADC 2 is indicated by the white annunciations ALT NO COMP, IAS NO COMP on the PFD, and red-x's and amber failure text on all ADC2 parameters.

Consider all System Messages that are present under the "MSG" softkey on the PFD. An attempt to reinitialize the ADC 2 should be made by resetting the ADC 2 circuit breaker located on the copilot's aft circuit breaker panel, row B, position 5. If ADC 2 data remains invalid, then select the operating ADC 1 via the SENSOR softkey on the pilot's PFD and crosscheck this data with that of the standby airspeed and altitude indicators. An amber annunciation BOTH ON ADC 1 will now appear on the PFD. ADC redundancy is now lost so it is imperative to avoid IFR and icing conditions.

**In Flight:**

A total failure of ADC 2 is indicated by the white annunciations ALT NO COMP, IAS NO COMP, and amber annunciation BOTH ON ADC 1 on the PFD.

Consider all System Messages that are present under the "MSG" softkey on the PFD. During total failures of ADC 2, the system will autorevert to ADC 1. The pilot should then crosscheck the ADC 1 data with that of the standby airspeed and altitude indicators. An attempt to reinitialize the ADC 2 should be made by resetting the ADC 2 circuit breaker located on the copilot's aft circuit breaker panel, row B, position 5. If ADC 2 data becomes valid, which is confirmed via the absence of the ALT NO COMP and IAS NO COMP annunciations, then the pilot must reselect ADC 2 on the copilot PFD.

**3.35 AVIONICS SYSTEMS FAILURES (3.5n) (continued)****ADC 2 Total Failure** (continued)**In Flight:** (continued)

If ADC 2 does not become valid, ADC redundancy is now lost so it is imperative to exit and avoid IFR and icing conditions.

For partial ADC failures, the system will not autorevert to the good ADC but a red-x and amber text will appear over the affected parameter(s). If an ALT NO COMP or IAS NO COMP annunciation is displayed on the PFD, compare ADC parameters with other related sources of information and select the good ADC via the SENSOR softkey on the PFD.

**ADC 1 and ADC 2 Total Failure****On Ground:**

A total failure of ADC 1 and ADC 2 is indicated by the white annunciations ALT NO COMP, IAS NO COMP, and red-x's and amber failure text on all ADC parameters.

Consider all System Messages that are present under the "MSG" softkey on the PFD. An attempt to reinitialize the ADCs should be made by resetting the ADC 1 circuit breaker located on the pilot's aft circuit breaker panel, row C, position 5 and the ADC 2 circuit breaker located on the copilot's circuit breaker panel, row B, position 5. If one of the ADC data remains invalid, then select the operating ADC via the SENSOR softkey on the pilot's PFD and crosscheck this data with that of the standby airspeed and altitude indicators. ADC redundancy is now lost so it is imperative to avoid IFR and icing conditions. If both of the ADC data remains invalid, the aircraft cannot be flown until maintenance is performed.

**In Flight:**

A total failure of ADC 1 and ADC 2 is indicated by the white annunciations ALT NO COMP, IAS NO COMP, and red-x's and amber failure text on all ADC parameters.

When these indications are present, transition/use the standby airspeed and altitude indicators. If time allows, consider all System Messages that are present under the "MSG" softkey on the PFD. An attempt to reinitialize the ADCs should be made by resetting the ADC 1 circuit breaker located on the pilot's aft circuit breaker panel, row C, position 5, and the ADC 2 circuit

**3.35 AVIONICS SYSTEMS FAILURES (3.5n) (continued)****ADC 1 and ADC 2 Total Failure** (continued)**In Flight:** (continued)

breaker located on the copilot's circuit breaker panel, row B, position 5. If one of the ADC data remains invalid, crosscheck this data with that of the standby airspeed and altitude indicators. ADC redundancy is now lost so it is imperative to exit and avoid IFR and icing conditions. If both of the ADC data remains invalid, then land as soon as practical. The autopilot will revert to PIT and ROL modes, during all dual failure ADC operations as long as valid AHRS data is available.

**Erroneous or Loss of Engine and Fuel Displays**

Erroneous engine and fuel displays are identified by indications that do not agree with other system information. Erroneous indications may be determined by comparing one display with other displays to determine which is bad. Loss of engine and fuel displays is indicated by red-x's on the affected engine parameter or fuel display.

If the engine indications required for setting power are erroneous or missing, set power based on THROTTLE lever position, engine sound and speed. Monitor all related indications to determine the health of the engine. Use known power settings and power-setting tables to achieve approximate fuel flow values. Use additional system information, such as system messages, CAS messages, PFD annunciators, fuel totalizer and flow, to safely complete the flight.

If ALL engine parameters are invalid and time allows, reset the GEA circuit breaker located on the pilot's aft circuit breaker panel, row C, position 1. If all engine parameters are still unavailable, *land as soon as practical*.

**3.35 AVIONICS SYSTEMS FAILURES (3.5n) (continued)****Erroneous or Loss of Warning/Caution CAS Messages**

A failure of the entire CAS message system is indicated by a red-x on the CAS Message window. Additionally, an unexpected CAS message could be present when it is not expected or a CAS message is expected but is not present.

1. If a red-x is placed over the CAS message window, special attention should be placed on all engine and airframe related parameters. The Master Warning and Master Caution lights will not function, therefore CAS messages indicating a failure of a particular system, such as L PITOT HT FAIL or PROP HT FAIL can go undetected.
2. If a CAS message appears that is not expected, treat it as if the condition exists.
3. If an abnormal condition exists but the CAS system has not been activated, use other available information to confirm the condition exists. If the abnormal condition cannot be confirmed, then treat the situation as if the condition does exist and take appropriate actions.

**NOTE**

CAS messages are inhibited for all parameters that have indications displayed on the MFD.

If a red-x appears over the CAS message window, *land as soon as possible.*

### **3.35 AVIONICS SYSTEMS FAILURES (3.5n) (continued)**

#### **COM1 and COM2 Failure**

If power is lost to the audio panel or the unit is turned OFF COM1 and COM2 will become inoperative. To verify power is removed from the audio panel, the AUDIO MKR circuit, located on the pilot's aft circuit breaker panel, row C, position 4, should be pulled. When this occurs a fail safe communications path becomes available between the pilot's headset/microphone and COM1. The cockpit speaker will be inoperative as will other functions of the audio panel. Whenever the fail-safe communication path is being used, the pilot should exit and avoid IFR and icing conditions.

#### **Autopilot Malfunction**

Autopilot malfunctions are indicated by an unexpected roll or pitch deviation from the desired flight path and/or flight director command deviations from the desired aircraft attitudes. Detected autopilot malfunctions disconnect the autopilot are accompanied by an amber or red flashing AP annunciation on the PFD followed by a red AFCS annunciation.

If the failure is not detected by the system, the desire is to control the airplane flight path and airspeed and disconnect the autopilot. To do that, grasp the control wheel firmly while crosschecking the attitude indicators vs. the natural horizon (if available) for the correct indication. Press and hold the AP Disconnect/Trim Interrupt switch on the control yoke. Retrim any residual forces that may have built up during the failure period and pull the AUTOPILOT circuit breaker located on the pilot's forward circuit breaker panel, row D, position 2. Do not reengage the autopilot for the remainder of the flight.

#### **Automatic Autopilot Disconnect**

An automatic autopilot disconnect is indicated by a flashing red/white AP annunciation on the PFD and the audible disconnect tone. If the yaw damper also disconnects, it will be indicated by flashing amber YD annunciation on the PFD. These disconnects are consider abnormal since they were not initiated by the pilot, such as when the pilot presses the AP/DISC switch on the control yoke. Upon hearing the disconnect tone, press the AP/DISC switch to silence the tone and stop the AP and YD annunciations from flashing. Retrim the aircraft if necessary.

**3.35 AVIONICS SYSTEMS FAILURES (3.5n) (continued)****Electric Trim Failure**

The autopilot disconnect may be accompanied by a red boxed PTCH (pitch), ROLL, YAW or PTRM annunciation on the PFD, indicating the axis which has failed. The autopilot cannot be re-engaged with any of these annunciations present.

An electric pitch trim failure is indicated by a red boxed PTRM annunciation on the PFD. The pitch trim servo will remain in the position where the failure occurred. The autopilot will not disconnect after a pitch trim failure, but once disconnected, it cannot be reengaged.

The pitch servo will now provide autopilot pitch control of the airplane without the aid of the pitch trim to relieve any residual forces. Therefore, out-of-trim forces may be present during subsequent autopilot operations and during autopilot disconnect. See the Autopilot Out-Of-Trim procedure in this section for details. Grasp the controls firmly, disconnect the autopilot and manually trim away any residual control forces.

**Electric Pitch Trim Runaway**

A pitch trim runaway, that is undetected by the system, is indicated by an unexpected pitch deviation from the desired flight path with a possible autopilot disconnect, red boxed AFCS annunciation and amber or red AP annunciation on the PFD. If the autopilot was not engaged when the pitch trim runaway occurred, there will be no related annunciations on the PFD. Anytime the pitch trim is activated, the blue TRIM annunciator illuminates.

Once a deviation from the flight path is noticed, firmly grasp the control wheel, crosscheck the attitude indicators to determine the accurate indication and control the airplane to that indication or outside visual references if available. Disconnect the autopilot via the AP/DISC switch and pull the PITCH TRIM circuit breaker located on the pilot's forward circuit breaker panel, row D, position 1. Manually trim away any residual control forces.

**Autopilot Overspeed Recovery**

An autopilot overspeed recovery is indicated by an amber flashing MAXSPD annunciation located at the top of the airspeed tape and the airplane pitching up (maximum pitch up is level flight attitude) to keep airspeed from exceeding VNE. The MAXSPD annunciation disappears when a  $V_{NE}$  exceedance is no longer an issue.

### **3.35 AVIONICS SYSTEMS FAILURES (3.5n) (continued)**

#### **Autopilot Overspeed Recovery (continued)**

When MAXSPD is present, reduce power and/or change the pitch reference to slow the aircraft. If desired, the autopilot may be disconnected and the aircraft hand-flown.

The maximum pitch up command that can be generated by the overspeed protection mode is level flight. Although the MAXSPD annunciation is present at the requisite airspeed, the overspeed recovery mode does not pitch up the aircraft while flying in ALT, GS or GP hold modes. Airspeed control is based on pilot inputs alone.

#### **Loss of Navigation Information**

A loss of navigation information is indicated by an amber flashing VOR, VAPP, GPS, BC, LOC or GS annunciation on the PFD. If the navigation signal was lost while it was being tracked by the autopilot, the system will default to ROL mode and roll the aircraft to wings level attitude. If ROL mode is not desired, another valid lateral mode will have to be selected.

If the navigation signal lost was part of an instrument approach, a missed approach procedure should be executed and a second approach may be attempted using other navigation aids.

#### **Autopilot Out-of-Trim**

An out-of-trim condition is indicated by an amber annunciation(s) of RUD→, ←RUD, AIL →, ←AIL annunciation, ELE↑ ELE↓ on the PFD. These annunciations are present when the corresponding autopilot servo is holding a force against a constraint of some type.

#### **CAUTION**

Do not attempt to overpower the autopilot in the event of a mistrim annunciation. The autopilot servos will oppose pilot input and will trim opposite the direction of pilot input (pitch axis only). This could lead to a significant out-of-trim condition. Disconnect the autopilot using the A/P DISC/TRIM INTER switch if manual control is desired.

**3.35 AVIONICS SYSTEMS FAILURES (3.5n) (continued)****Autopilot Out-of-Trim (continued)**

If a RUD→ or a ←RUD annunciation is present, light momentary pressure on the rudder (in the direction of the arrow) or a slight adjustment of the rudder trim (in the direction of the arrow) will alleviate the issue. After rudder trim adjustments, verify that the slip/skid indicator is centered.

If an AIL→ or ←AIL annunciation is present, verify that the slip/skid indicator is centered and check fuel quantity for proper balance.

If a sustained ELE → or ←ELE annunciation is present, suspect that a problem with the electric elevator pitch trim has occurred. During normal operations, the electric elevator pitch trim removes the forces from the pitch servo. When either of these annunciations are present grasp the control wheel firmly and disconnect the autopilot via the AP/DISC switch. Manually retrim the aircraft as required and re-engage the autopilot if desired and available. If the ELE mistrim occurs again, disconnect the autopilot for the remainder of the flight or until the offending condition is resolved.

**Abnormal Flight Director Mode Transitions**

Abnormal flight director mode transitions are indicated by flashing lateral or vertical mode annunciations on the PFD. The mode will flash for 10-seconds, then be replaced by the appropriate green ROL or PIT mode or both.

If the abnormal mode transition is a vertical mode such as FLC, VS, ALT, GS or GP, select another vertical mode that does not exhibit this issue. If the abnormal mode transition occurs while on an instrument approach, disconnect the autopilot and fly the approach manually or execute a missed approach. The subsequent approach can be attempted using a different vertical mode.

If the abnormal mode transition is a lateral mode such as HDG, NAV, LOC, APP or BC, select another lateral mode that does not exhibit this issue. If the abnormal mode transition occurs while on an instrument approach, disconnect the autopilot and fly the approach manually or execute a missed approach. The subsequent approach can be attempted using a different vertical mode.

**3.35 AVIONICS SYSTEMS FAILURES (3.5n) (continued)**

**Autopilot Preflight Test Failure**

An autopilot preflight test failure is indicated by a red boxed PFT annunciation on the PFD. The autopilot preflight test normally begins after the AV BUS MASTR switch is turned ON and a white PFT annunciation appears on the PFD during the test. At the completion of a successful preflight test, the white PFT annunciation disappears and an autopilot disconnect tone is heard.

If the preflight test fails, the red boxed PFT annunciation will appear and the disconnect tone will not be heard. Pull the AUTOPILOT circuit breaker located on the pilot's forward circuit breaker panel, row D, position 2. While the AUTOPILOT circuit breaker is pulled, the red boxed PFT annunciation will be removed from the display and the autopilot will not be available for use. One attempt at resetting the AUTOPILOT circuit breaker is allowed.

**Dual GPS Failure**

Navigation .....Use alternate source of navigation  
(ILS, LOC, VOR, DME, ADF)

If no alternate navigation sources are available:

Dead Reckoning (DR) Mode - Active when the airplane is greater than 30 NM from the destination airport.

Navigation .....Use the airplane symbol and magenta course line on the MAP display and the amber CDI on the HSI.

**WARNING**

Information normally derived from GPS turns amber. Information will become more inaccurate over time.

**WARNING**

TAWS is Inoperative.

**Dual GPS Failure (Continued)**

**NOTE**

DR mode uses heading, airspeed and last known GPS position to estimate the airplanes current position.

All maps with an airplane symbol show a ghosted airplane and a "DR" label.

Traffic Information System (TIS) is not dependent on GPS information. The position of displayed traffic relative to the airplane symbol on the map is still accurate.

Loss of Integrity (LOI) mode - Active when the airplane is within 30 NM of the destination airport (as calculated from the previews GPS or DR position).

Navigation.....Fly towards known VMC. Use ATC or other information sources as possible.

**NOTE**

All information derived from GPS or DR is removed from the displays.

The airplane symbol is removed from all maps. The map will remain centered at the last known position.

"NO GPS POSITION" is shown in the center of the map.

TAWS and TIS are inoperative.

### **3.37 PROPELLER OVERSPEED (3.5o)**

A propeller overspeed is indicated by a Master Warning Indication, a repeating aural chime and a red RPM indication.

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 PROP RPM control should be moved to full DECREASE rpm and then reset if any control is available. Airspeed should be reduced and throttle used to maintain at or below 2500 RPM. **Land as soon as practical** and investigate cause of overspeed.

### **3.39 EMERGENCY LANDING GEAR EXTENSION (3.5p)**

If complete electrical power loss is experienced, the landing gear must be extended using the procedures in Section 3.5p. The gear position indicator lights will not illuminate unless the Complete Electrical Failure in Section 3.5m is followed.

Prior to proceeding with an emergency gear extension, check to ensure that the BATT MASTR switch is ON and that the circuit breakers have not popped. If it is daytime, the DAY/NIGHT switch should be in the DAY position.

If the landing gear does not check down and locked, reduce the airspeed to below 90 KIAS, pull out the HYDRAULIC PUMP POWER circuit breaker, located on the pilot's forward circuit breaker panel, row C, position 2, place the LANDING GEAR selector in the DOWN position, PULL out the EMERGENCY GEAR EXTENSION control and fishtail the airplane. Verify the landing gear position lights indicate down and locked.

### **3.41 SPIN RECOVERY (3.5q)**

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. CLOSE the THROTTLE. When the rotation stops, neutralize the rudder and relax forward pressure on the control wheel as required to smoothly regain a level flight attitude.

**3.43 ENGINE ROUGHNESS (3.5r)**

Engine roughness may be caused by dirt in the injector nozzles, induction filter icing, ignition problems, or other causes. First adjust the MIXTURE for maximum smoothness. The engine will run rough if the mixture is too rich or too lean. Move the INDUCTION AIR to ALTERNATE and turn the EMERGENCY FUEL PUMP ON. Switch the FUEL SELECTOR to another tank to determine if fuel contamination is the problem. Check the engine displays for abnormal readings. If any readings are abnormal proceed accordingly. The MAG switches should then be turned OFF individually and then turned back ON. If operation is satisfactory on only one magneto, proceed on the good magneto at reduced power to a landing at the first available airport. If roughness persists, prepare for a precautionary landing at pilot's discretion.

**3.45 OXYGEN SYSTEM (3.5s)****NOTE**

The time of useful consciousness at 25,000 feet is approximately 3 to 5 minutes.

**NOTE**

The pilot should monitor oxygen quantity to ensure compliance with the applicable supplemental oxygen regulations.

Should hypoxic symptoms or indications be evident, check oxygen quantity. **Descend immediately to below 12,500 feet if quantity is low or depleted.** If there is an interruption of oxygen flow as evidenced by the flow indicators, immediately install another mask unit or install the mask connection in an unused outlet, if available.

**If oxygen flow is not restored, immediately descend to below 12,500 feet. Refer to Emergency Descent checklist., paragraph 3.5t.**

**3.47 EMERGENCY DESCENT (3.5t)**

In the event an emergency descent becomes necessary, retard the THROTTLE to idle and move the PROP RPM control to the full INCREASE position. The MIXTURE should be reset as required to ensure the engine will continue operating. Lower the landing gear and immediately initiate a descent. If in smooth air, descend at 180 to 195 KIAS maximum. If extremely rough air is encountered, the airspeed should be limited according to the following airspeed versus Gross Weight Table:

4340 lb = 133 KIAS

3400 lb = 118 KIAS

Use straight line variation between points or the AIRSPEED LIMITATIONS table in Para. 2.3.

After reaching a safe altitude, advance the THROTTLE and adjust MIXTURE and PROP RPM controls for power as required.

**3.49 CABIN AIR CONTAMINATION/SMOKE EVACUATION (3.5u)**

**CAUTION**

If fire is suspected, do not use oxygen at lower altitude where oxygen is not required.

Strong fumes or smoke in the cabin may indicate a fire. In any event, the primary concern is to establish maximum airflow through the cabin in order to vent the fumes or smoke. To accomplish this, turn OFF the auxiliary cabin heater, turn ON the vent/defog blower and turn OFF the cabin air recirculation blower. Turn OFF the air conditioner. This procedure will provide the maximum flow of outside ram air through the cabin. If necessary turn on and don oxygen masks. If the fumes or smoke persist, the problem may be a fire (see paragraph 3.5f, Fire In Flight).

**3.51 VACUUM SYSTEM FAILURE (Optional Equipment) (3.5v)**

A failure of a vacuum pump is indicated by the illumination of the white VACUUM 1 FAIL or VACUUM 2 FAIL CAS messages.

In the event one vacuum pump fails, check that the vacuum display still indicates within the normal operating range, and that the operating pump's fail CAS message is extinguished.

Although either vacuum pump independently has sufficient capacity to operate the deice boots in a normal manner, intentional or continued operation in icing conditions is not recommended. **Immediate action should be taken to avoid or exit icing conditions.**

Failure of both vacuum pumps is indicated by the vacuum display reading less than 2.0 inches of mercury and illumination of both failure CAS messages along with the single aural chime.

If both vacuum systems are inoperable, the wing and tail deicer boots will be inoperative. A precautionary landing should be considered depending on operating conditions.

**3.53 INADVERTENT ICING ENCOUNTER (3.5w)****WARNING**

Flight into known icing conditions is prohibited unless Ice Protection System is installed and fully operational. Refer to Section 9, Supplement 1.

**For aircraft not equipped with the optional Ice Protection System:**

If icing conditions are inadvertently encountered, select the INDUCTION AIR to ALTERNATE and adjust manifold pressure as required. Turn the pitot and stall warning heat ON. Pull ON the windshield defrost and turn the propeller heat ON if installed. Turn the windshield vent/defog fan ON to keep the windshield as clear as possible. **Change aircraft heading and/or altitude to exit icing conditions as soon as possible.**

### 3.55 HYDRAULIC SYSTEM MALFUNCTION (3.5x)

A hydraulic system malfunction, which causes the hydraulic pump to either run continuously (more than 15-20 seconds), or cycle on and off rapidly (more than 6-8 times), may be detected by the illumination of the HYDR PUMP ON amber CAS message and a single aural chime. Pull the HYDRAULIC PUMP POWER circuit breaker located on the pilot's forward circuit breaker panel, row C, position 2, to stop operation. The pump is not designed for continuous duty and will fail if left running. **Land as soon as practical** and investigate the cause. Prior to landing, the HYDRAULIC PUMP POWER circuit breaker must be reset in order to extend the landing gear. If the pump continues to run after the gear is locked down, again pull the HYDRAULIC PUMP POWER circuit breaker. If the gear fails to extend, refer to Emergency Landing Gear Extension (3.5p).

### 3.57 FLAP SYSTEM MALFUNCTION (3.5y)

A Flap system malfunction is indicated by an amber FLAP FAIL CAS message and single aural chime. The failure would normally be the result of an overcurrent condition in the flap motor/actuator circuit. If an overcurrent fault occurs the flap protection circuit will sense the malfunction and automatically remove power from the flap motor/actuator and flap operation will stop. Pulling and resetting the FLAP WARN circuit breaker located on the pilot's forward circuit breaker panel, row C, position 8, will restore flap power to normal operation.

After resetting, normal operation of the flaps should be verified.

#### CAUTION

Higher than normal approach and landing speeds may be required if full symmetrical flap extension is not available. Longer landing distances than shown in Section 5 will result from increased airspeed approaches.

If normal flap operation is not regained, or the FLAPS annunciator remains illuminated, pull the FLAP MOTOR circuit breaker located on the pilot's forward circuit breaker panel, row C, position 7, and **land as soon as practical** to ascertain the cause of the problem. The flaps will remain in the same position as when the malfunction occurred.

**3.59 FUEL TANK SUBMERGED PUMP FAILURE (BOOST PUMP light illuminated - annunciator panel) (3.5z)**

An amber BOOST PUMP FAIL CAS message and single aural chime indicates the selected fuel tank's submerged fuel boost pump has failed. Immediately check that the FUEL SELECTOR is in the proper position and check the appropriate fuel pump circuit breakers L BOOST or R BOOST located on the pilot's forward circuit breaker panel row B, positions 2 and 3; Reset as necessary. Check that the BOOST PUMP FAIL CAS message has extinguished.

If the L BOOST or R BOOST circuit breakers do not remain closed, or the BOOST PUMP FAIL message remains lit, turn ON the EMERG FUEL PUMP and check for fluctuations in the fuel flow indication. Continue flight if no fuel flow fluctuations are observed. If fuel flow fluctuations are observed, descend to an altitude where the fluctuations cease and continue flight. After landing, have the inoperative boost pump repaired prior to further flight.

**3.61 STALL WARNING FAILURE (3.5aa)**

An amber STALL WARN FAIL CAS message and single aural chime indicate that the stall warning lift computer has failed. Check, and if necessary, reset the STALL WARN circuit breaker located on the pilot's forward circuit breaker panel row C, position 5. If the breaker does not remain closed, or if the STALL WARN FAIL message does not extinguish, the stall warning system will be inoperative for the remainder of the flight. After landing, have the system repaired before further flight.

**3.63 EMERGENCY EXIT (3.5bb)**

The second window aft of the windshield on the right side of the fuselage is an emergency exit.

To use the emergency exit, remove the plexiglas cover over the handle, pull the handle, and pull in on the exit window.

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**TABLE OF CONTENTS**  
**SECTION 4**  
**NORMAL PROCEDURES**

Paragraph No.		Page No.
4.1	GENERAL .....	4-1
4.3	AIRSPEEDS FOR SAFE OPERATION .....	4-2
4.5	NORMAL PROCEDURES CHECKLIST.....	4-3
4.5a	Preflight Checklists (4.9) .....	4-3
4.5b	Before Starting Engine Checklist (4.11).....	4-8
4.5c	Engine Start Checklist (4.13).....	4-9
	ENGINE START - GENERAL (4.13a).....	4-9
	NORMAL START - COLD ENGINE (4.13b) .....	4-10
	NORMAL START - HOT ENGINE (4.13c) .....	4-10
	ENGINE START WHEN FLOODED (4.13d) .....	4-11
	ENGINE START WITH EXTERNAL POWER SOURCE (4.13e) .....	4-11
4.5d	Before Taxiing Checklist (4.15).....	4-13
4.5e	Taxiing Checklist (4.17).....	4-14
4.5f	Ground Check Checklist (4.19) .....	4-15
4.5g	Before Takeoff Checklist (4.21).....	4-16
4.5h	Takeoff Checklist (4.23).....	4-17
	NORMAL TECHNIQUE (4.23a).....	4-17
	0° FLAP TAKEOFF PERFORMANCE (4.23b) .....	4-17
	SHORT FIELD TAKEOFF PERFORMANCE (4.23c).....	4-18
4.5i	Climb Checklist (4.25).....	4-18
	MAXIMUM CONTINUOUS POWER CLIMB (4.25a).....	4-18
	CRUISE CLIMB (4.25b) .....	4-19

**TABLE OF CONTENTS (continued)**

**SECTION 4**

**NORMAL PROCEDURES**

<b>Paragraph No.</b>		<b>Page No.</b>
4.5j	Cruise Checklist (4.27) .....	4-19
4.5k	Descent Checklist (4.29) .....	4-20
	NORMAL DESCENT (4.29a) .....	4-20
	REDUCED POWER DESCENT (4.29b) .....	4-20
	POH Section 5 PERFORMANCE DESCENT (4.29c) .....	4-20
4.5m	Before Landing Checklist (4.31) .....	4-21
	APPROACH CHECK (4.31a) .....	4-21
	LANDING CHECK (4.31b) .....	4-21
4.5n	Landing (4.33) .....	4-22
	NORMAL TECHNIQUE (4.33a) .....	4-22
	SHORT FIELD TECHNIQUE (4.33b) .....	4-22
4.5o	Go-around Checklist (4.35) .....	4-22
4.5p	After Landing Checklist (4.37) .....	4-23
4.5q	Stopping Engine Checklist (4.39) .....	4-23
4.5r	Mooring Checklist (4.41) .....	4-24
4.7	AMPLIFIED NORMAL PROCEDURES .....	4-25
4.9	PREFLIGHT CHECK (4.5a) .....	4-25
4.9a	Cockpit (4.5a) .....	4-25
4.9b	Empennage (4.5a) .....	4-26
4.9c	Right Wing (4.5a) .....	4-27
4.9d	Nose Section (4.5a) .....	4-28
4.9e	Left Wing (4.5a) .....	4-29
4.11	BEFORE STARTING ENGINE (4.5b) .....	4-30

## TABLE OF CONTENTS (continued)

## SECTION 4

## NORMAL PROCEDURES

Paragraph No.		Page No.
4.13	ENGINE START (4.5c) .....	4-31
4.13a	Engine Start - General (4.5c) .....	4-31
4.13b	Normal Start - Cold Engine (4.5c).....	4-31
4.13c	Normal Start - Hot Engine (4.5c).....	4-32
4.13d	Engine Start When Flooded (4.5c).....	4-32
4.13e	Engine Start With External Power Source (4.5c) .....	4-33
4.15	BEFORE TAXIING (4.5d) .....	4-34
4.17	TAXIING (4.5e) .....	4-35
4.19	GROUND CHECK (4.5f) .....	4-36
4.21	BEFORE TAKEOFF (4.5g) .....	4-37
4.23	TAKEOFF (4.5h).....	4-37
4.23a	Normal Technique (4.5h) .....	4-38
4.23b	0° Flaps Takeoff Performance (4.5h).....	4-38
4.23c	Short Field Takeoff Performance (4.5h) .....	4-38
4.25	CLIMB (4.5i) .....	4-39
4.25a	Maximum Continuous Power Climb (4.5i) .....	4-39
4.25b	Cruise Climb (4.5i) .....	4-39
4.27	CRUISE (4.5j).....	4-40
4.29	DESCENT (4.5k) .....	4-42
4.31	BEFORE LANDING (4.5m) .....	4-43
4.31a	Approach Check (4.5m).....	4-43
4.31b	Landing Check (4.5m) .....	4-43
4.33	LANDING (4.5n).....	4-43
4.33a	Normal Technique (4.5n) .....	4-44
4.33b	Short Field Technique (4.5n).....	4-44

**TABLE OF CONTENTS (continued)**

**SECTION 4**

**NORMAL PROCEDURES**

<b>Paragraph No.</b>		<b>Page No.</b>
4.35	GO-AROUND (4.5o) .....	4-44
4.37	AFTER LANDING (4.5p) .....	4-44
4.39	STOPPING ENGINE (4.5q) .....	4-45
4.41	MOORING (4.5r) .....	4-45
4.43	STALLS .....	4-46
4.45	TURBULENT AIR OPERATION .....	4-46
4.47	SUPPLEMENTAL ELECTRIC HEATER .....	4-47
4.49	NOISE LEVEL .....	4-48
4.51	ICING INFORMATION .....	4-50

**SECTION 4  
NORMAL PROCEDURES****4.1 GENERAL**

This section provides the normal operating procedures for the PA-46R-350T, Matrix airplane. All of the normal operating procedures required by the FAA are presented as well as those procedures which have been determined as necessary for the operation of the airplane, as determined by the operating and designed features of the airplane, are presented.

Normal operating procedures associated with optional systems and equipment which require handbook supplements are presented in Section 9, Supplements.

These procedures are provided to supply information on procedures which are not the same for all airplanes and as a source of reference and review. Pilots should familiarize themselves with these procedures to become proficient in the normal operation of the airplane.

This section also contains Icing Information. A series of guide lines are presented to help recognize, operate in, and exit from an inadvertent encounter with severe icing.

This section is divided into two parts. The first part is a Normal Procedures Checklist supplying an action - reaction sequence for normal procedures with little emphasis on the operation of the systems. Numbers in parentheses after each checklist section indicate the paragraph where the corresponding amplified procedure can be found.

The second part of this section contains the amplified normal procedures which provide detailed information and explanations of the procedures and how to perform them. This portion of the section is intended for use as a reference due to the lengthy explanation, whereas the short form checklists should be used on the ground and in flight due to its brevity and efficiency. Numbers in parentheses after each paragraph title indicate where the corresponding checklist can be found.

**4.1 GENERAL (continued)**

**CAUTION**

Pilots who fly at high altitude must be aware of the physiological problems associated with prolonged flight at such altitudes. Dehydration and the onset of hypoxia may occur in the passengers and crew.

Passenger comfort may be increased by an occasional intake of fluids. Prolonged high altitude flights require warm clothing and monitoring of the cabin temperature and the physical state of the crew and passengers.

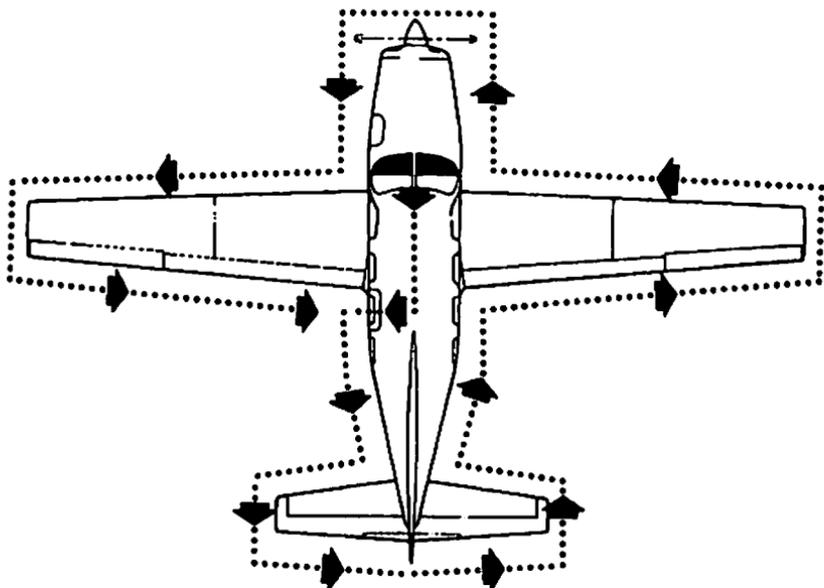
**4.3 AIRSPEEDS FOR SAFE OPERATIONS**

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

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

- (a) Best Rate of Climb Speed (Vy) .....110 KIAS
- (b) Best Angle of Climb Speed (Vx).....81 KIAS
- (c) Maximum Operating Maneuvering Speed  $V_o$ .....118 KIAS  
(at 3400 LBS)  
See Airspeed Limitations, Section 2.3
- (d) Landing Final Approach Speed (Full Flaps).....77 KIAS
- (e) Maximum Demonstrated Crosswind Velocity .....17 KTS
- (f) Maximum Flaps Extended Speed
  - 10° .....165 KIAS
  - 20° .....130 KIAS
  - Full Flaps (36°).....116 KIAS
- (g) Airspeeds for Autopilot Operation .....75 - 183 KIAS
- (h) Minimum Airspeed for Autopilot Coupled Approach .....90 KIAS

## 4.5 NORMAL PROCEDURES CHECKLIST



WALK-AROUND

Figure 4-1

## 4.5a Preflight Checklists (4.9)

## COCKPIT (4.9a)

Oxygen System.....	CHECK MASKS and HOSES
Control Wheel.....	RELEASE RESTRAINTS
PARK BRAKE.....	PULL ON
LANDING GEAR Selector.....	DOWN
All Switches.....	OFF
MAG Switches.....	OFF
AV BUS MASTR Switch.....	OFF
MIXTURE.....	IDLE CUT-OFF
BATT MASTR Switch.....	ON
Landing Gear Indicator Lights.....	THREE GREEN
LTS/GEAR ANNUN TEST Switch.....	PRESS
CAS Messages.....	CHECK and RESPOND
Environmental/De-ice Switch Panel.....	Switches OFF then TEST
Fuel Gauges.....	CHECK Quantity and Balance

**4.5a Preflight Checklists (4.9) (continued)**

**COCKPIT (4.9a) (continued)**

**CAUTION**

See fuel imbalance limitations, Section 2.35.

Oxygen Supply Indicator .....CHECK QUANTITY  
Oxygen System .....TURN ON/  
CHECK FLOWMETER ON ALL MASKS  
Interior Lighting .....ON and CHECK  
FLAPS .....EXTEND  
PITOT HEAT Switch .....ON  
S. WARN HEAT Switch .....ON  
Exterior Light Switches .....ON

**CAUTION**

Care should be taken when an operational check of the heated pitot head and heated lift detector is being performed. The units become very hot. Ground operation should be limited to three minutes to avoid damaging the heating elements.

Pitot Heads .....CHECK WARM  
Stall Warning Vane .....CHECK WARM  
Exterior Lights .....CHECK OPERATION  
Exterior Light Switches .....OFF  
PITOT HEAT Switch .....OFF  
S. WARN HEAT Switch .....OFF  
BATT MASTR Switch .....OFF  
Primary Flight Controls .....PROPER OPERATION  
Elevator and Rudder Trims .....NEUTRAL  
Pitot and Static Drains .....PUSH to drain  
Alternate Static System .....CHECK PRIMARY POSITION  
Emergency Exit .....CHECK SECURE  
Windows .....CHECK CLEAN  
Required Papers .....CHECK ON BOARD  
Baggage .....STOW PROPERLY - SECURE  
Empty Seats .....SEAT BELTS SNUGLY FASTENED



**4.5a Preflight Checklist (4.9) (continued)**

**RIGHT WING (4.9c) (continued)**

**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

**NOSE SECTION (4.9d)**

General Condition .....**CHECK**  
Cowling .....**SECURE**  
Fuel Filter Sump.....**DRAIN and CHECK**  
for water, sediment  
and proper fuel  
Windshield.....**CLEAN**  
Propeller and Spinner.....**CHECK**  
Air Inlets.....**CLEAR**  
Landing Light.....**CHECK**  
Chock .....**REMOVE**  
Nose Gear Strut.....**PROPER INFLATION**  
(1.65 ± 0.25 in.)  
Nose Wheel Tire.....**CHECK**  
Engine Baffle Seal.....**CHECK**  
Oil... ..**CHECK QUANTITY**  
Oil Filler/Dipstick Cap.....**PROPERLY SEATED**  
and **SECURE**  
Cowl Oil Door.....**CLOSED**  
Tow Bar .....**STOW properly- SECURE**  
Baggage Door .....**CLOSE and SECURE**



**4.5b Before Starting Engine Checklist (4.11)**

**BEFORE STARTING ENGINE (4.11)**

Passengers.....BOARD/BRIEF ON  
Oxygen System Operation  
Door.....CLOSE and LATCH

**WARNING**

Do not initiate any flight if all four door pin indicators are not green and/or the DOOR AJAR annunciator is illuminated.

Door Pins .....ALL INDICATORS GREEN  
Seats.....ADJUSTED and LOCKED IN POSITION  
Seat Belts and Harnesses .....FASTEN/ADJUST  
PARK BRAKE .....SET  
PROP RPM .....FULL INCREASE  
All Electrical Switches .....OFF  
DAY/NIGHT Switch .....VERIFY PROPER SETTING  
Circuit Breakers .....CHECK IN  
INDUCTION AIR Control.....CHECK then PRIMARY  
Alternate Static System.....CHECK PRIMARY POSITION  
Pitot and Static Drains .....VERIFY PUSH TO DRAIN  
EMER Switch .....ON  
Verify operation of the pilot's PFD,  
No. 1 Nav/Com, Audio Panel, and  
illumination of the Landing Gear  
Down Indicators, Standby Instruments  
and Magnetic Compass.  
EMER Switch.....OFF

Proceed with appropriate Engine Start Checklist.

**4.5c Engine Start Checklist (4.13)****ENGINE START - GENERAL (4.13a)****CAUTION**

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

**CAUTION**

If engine does not start within 10 seconds, prime and repeat starting procedure. Starter manufacturer recommends starter cranking periods be limited to 10 seconds with a 20 second rest period between cranking periods. Maximum of 6 start periods allowed. If start is not achieved on sixth attempt allow starter to cool for 30 minutes before attempting additional starts.

**CAUTION**

The STARTER ENGAGE (CAS) message will illuminate after 30 seconds of continuous engine cranking. If the CAS message illuminates after the engine is running, stop the engine and determine the cause.

**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.

4.5c Engine Start Checklist (4.13) (continued)

**NORMAL START - COLD ENGINE (4.13b)**

THROTTLE ..... 1/2 INCH OPEN  
BATT MASTR Switch ..... ON  
CAS Messages ..... CONSIDER ANY ILLUMINATED  
PFD Annunciations ..... CONSIDER ANY ILLUMINATED  
ALTR NO. 1 and ALTR NO. 2 Switches ..... ON  
EMERG FUEL PUMP Switch ..... OFF  
FUEL SELECTOR ..... DESIRED TANK  
MIXTURE ..... RICH - then IDLE CUT-OFF

**NOTE**

The amount of prime depends on engine temperature. Familiarity and practice will enable the operator to estimate the amount of prime required.

MAG Switches ..... ON  
Prop Area ..... CLEAR  
START Switch ..... ENGAGE  
MIXTURE (when engine fires) ..... ADVANCE  
THROTTLE ..... ADJUST  
Oil Pressure ..... CHECK  
Alternator AMPS Indications ..... CHECK NORMAL  
VACUUM Indication (if installed) ..... CHECK NORMAL

**NORMAL START - HOT ENGINE (4.13c)**

THROTTLE ..... 1/2 INCH OPEN  
BATT MASTR Switch ..... ON  
CAS Messages ..... CONSIDER ANY ILLUMINATED  
PFD Annunciations ..... CONSIDER ANY ILLUMINATED  
ALTR NO. 1 and ALTR NO. 2 Switches ..... ON  
EMERG FUEL PUMP Switch ..... OFF  
FUEL SELECTOR ..... DESIRED TANK  
MIXTURE ..... IDLE CUT-OFF  
MAG Switches ..... ON  
Prop Area ..... CLEAR  
START Switch ..... ENGAGE  
MIXTURE (when engine fires) ..... ADVANCE

4.5c Engine Start Checklist (4.13) (continued)

**NORMAL START - HOT ENGINE (4.13c) (continued)**

THROTTLE .....ADJUST  
 Oil Pressure.....CHECK NORMAL  
 Alternator AMPS Indications .....CHECK NORMAL  
 VACUUM Indication (if installed) .....CHECK NORMAL

**ENGINE START WHEN FLOODED (4.13d)**

THROTTLE.....OPEN FULL  
 BATT MASTR Switch.....ON  
 CAS Messages .....CONSIDER ANY ILLUMINATED  
 PFD Annunciations .....CONSIDER ANY ILLUMINATED  
 ALTR NO. 1 and ALTR NO. 2 Switches .....ON  
 EMERG FUEL PUMP Switch.....OFF  
 FUEL SELECTOR.....DESIRED TANK  
 MIXTURE.....IDLE CUT-OFF  
 MAG Switches .....ON  
 Prop Area .....CLEAR  
 START Switch.....ENGAGE  
 MIXTURE (when engine fires).....ADVANCE  
 THROTTLE.....RETARD  
 Oil Pressure.....CHECK NORMAL  
 Alternator AMPS Indications .....CHECK NORMAL  
 VACUUM Indication (if installed) .....CHECK NORMAL

**ENGINE START WITH EXTERNAL POWER SOURCE (4.13e)**

BATT MASTR Switch .....Verify OFF  
 ALTR NO. 1 and ALTR NO. 2 Switches.....Verify OFF  
 All Electrical Equipment.....OFF  
 External Power Plug.....INSERT in receptacle

**NOTE**

For all normal operations using an external power source, the BATT MASTR switch should be OFF, but it is possible to use the ship's battery in parallel by turning the BATT MASTR switch ON. This will give longer cranking capabilities, but will not increase amperage.

**4.5c Engine Start Checklist (4.13) (continued)**

**ENGINE START WITH EXTERNAL POWER SOURCE (4.13e)  
(continued)**

**CAUTION**

Care should be exercised because if the ship's battery has been depleted, the external power supply can be reduced to the level of the ship's battery. This can be tested by turning the BATT MASTR 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.

**THROTTLE.....½ INCH OPEN**  
**CAS Messages .....CONSIDER ANY ILLUMINATED**  
**PFD Annunciations .....CONSIDER ANY ILLUMINATED**  
**EMERG FUEL PUMP Switch.....OFF**  
**FUEL SELECTOR.....DESIRED TANK**  
**MIXTURE.....RICH - then IDLE CUT-OFF**

**NOTE**

The amount of prime depends on engine temperature. Familiarity and practice will enable the operator to estimate the amount of prime required.

**MAG Switches .....ON**  
**Prop Area .....CLEAR**  
**START Switch .....ENGAGE**  
**MIXTURE (when engine fires) .....ADVANCE**  
**THROTTLE .....LOWEST POSSIBLE RPM**  
**BATT MASTR Switch .....ON**  
**External Power Plug .....DISCONNECT from receptacle**  
**Baggage Door .....CLOSED and SECURE**  
**(DOOR AJAR warning CAS message extinguished)**  
**THROTTLE .....ADVANCE to 1000 RPM**  
**ALTR NO. 1 and ALTR NO. 2 Switches .....ON**  
**Alternator AMPS Indications .....CHECK NORMAL**  
**VOLTS Indication .....CHECK NORMAL**  
**Oil Pressure .....CHECK NORMAL**  
**VACUUM Indications (if installed) .....CHECK NORMAL**



**4.5d Before Taxiing Checklist (4.15) (continued)**

**BEFORE TAXIING (4.15) (continued)**

Altimeter/Standby Altimeter.....SET  
STALL TEST Switch.....PRESS TO TEST  
TAWS and TRAFFIC (if installed).....TEST  
COM/NAV Radios and Avionics .....CHECK/SET  
FLAPS .....RETRACT

**4.5e Taxiing Checklist (4.17)**

**TAXIING (4.17)**

Taxi Area.....CLEAR  
PARK BRAKE .....RELEASED  
PROP RPM .....FULL INCREASE  
THROTTLE.....APPLY SLOWLY  
Brakes.....CHECK  
Steering.....CHECK  
Flight Instruments .....CHECK

**CAUTION**

During taxi, if the VOLTS indication decreases into the red range, increase engine RPM, if possible, to retain adequate battery charging.

## 4.5f Ground Check Checklist (4.19)

## GROUND CHECK (4.19)

## CAUTION

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

PARK BRAKE.....	Pull to SET
PROP RPM .....	FULL INCREASE
THROTTLE.....	2000 RPM
MAG Switches .....	CHECK
	max. drop 175 RPM
	- max. diff. 50 RPM
VACUUM INDICATION (if installed).....	CHECK
	(within normal operating range)

## NOTE

Refer to paragraph 4.53, Icing Information, prior to any flight operations. (Takeoff, cruise, landing, etc.) If flight into icing conditions (in visible moisture below +5°C) is anticipated, conduct a preflight check of the ice protection systems (if installed) per Section 9, Supplement 1 - Ice Protection System.

Ice Protection Equipment (if installed).....	CHECK AS REQUIRED
VOLTS Indication .....	CHECK NORMAL
ALTR AMPS 1 and ALTR AMPS 2.....	CHECK NORMAL
Oil Temperature .....	CHECK NORMAL
Oil Pressure .....	CHECK NORMAL
PROP RPM.....	EXERCISE - then
	FULL INCREASE
Fuel Flow .....	CHECK NORMAL
THROTTLE .....	RETARD to Idle
	(check smooth engine operation)
THROTTLE .....	1000 to 1200 RPM
LTS/GEAR ANNUN TEST Switch .....	PRESS
Environmental/De-Ice Switch Panel .....	PRESS-TO-TEST

4.5g Before Takeoff Checklist (4.21)

BEFORE TAKEOFF (4.21)

NOTE

Refer to Section 9, Supplement 1 for Matrix Aircraft Flight Into Known Icing (FIKI), (if installed), prior to any flight operations (takeoff, cruise, landing, etc.).

BATT MASTR Switch .....Verify ON  
EMERG FUEL PUMP Switch .....ON  
MAG Switches .....ON  
ALTR NO. 1 and ALTR NO. 2 Switches .....ON - CHECK  
AMPERAGE INDICATIONS  
FUEL SELECTOR .....PROPER TANK  
INDUCTION AIR Control .....PRIMARY  
Seat Backs .....ERECT  
Seats.....ADJUSTED& LOCKED IN POSITION  
Armrests .....STOWED  
Belts/Harness .....FASTENED/ADJUSTED  
MIXTURE .....FULL RICH  
PROP RPM .....FULL INCREASE  
Flight Instruments.....CHECK (Primary and Standby)  
CAS Messages.....CONSIDER ANY MESSAGES ILLUMINATED  
Engine Instruments .....CHECK NORMAL  
COM/NAV Radios and Avionics.....AS REQUIRED  
FLAPS .....SET (0° to 20°)  
Elevator and Rudder Trim .....SET  
Flight Controls.....FREE & PROPER TRAVEL  
Ice Protection Equipment (if installed) .....AS REQUIRED  
TAXI and LANDG LIGHT Switches .....AS REQUIRED  
NAV LIGHT Switch.....AS REQUIRED  
STROBE LIGHT Switch .....ON

**4.5h Takeoff Checklist (4.23)****NOTE**

Demonstrated crosswind component is 17 knots.

**NOTE**

Takeoffs are normally made with full throttle. However, under some off-standard conditions, the manifold pressure indication can exceed its indicated limit at full throttle. Limit manifold pressure to 42 in. Hg maximum. (See Section 7.)

**NORMAL TECHNIQUE (4.23a)**

FLAPS .....0° to 10°  
 Brakes .....APPLY  
 Trim.....SET  
 Power .....SET TO MAXIMUM  
 Brakes .....RELEASE  
 Liftoff .....80-85 KIAS  
 Climb Speed .....90-95 KIAS  
 After liftoff and positive rate of climb:  
 LANDING GEAR Selector .....UP  
 FLAPS.....RETRACT

**0° FLAP TAKEOFF PERFORMANCE (4.23b)**

FLAPS .....0°  
 Brakes .....APPLY  
 Trim.....SET  
 Power .....SET TO MAXIMUM  
 Brakes .....RELEASE  
 Liftoff.....78 KIAS  
 Obstacle Clearance Speed .....91 KIAS  
 After liftoff and positive rate of climb:  
 LANDING GEAR Selector .....UP



**4.5i Climb Checklist (4.25) (continued)**

**CRUISE CLIMB (4.25b)**

- Manifold Pressure .....35 IN. HG
- PROP RPM .....2500 RPM
- MIXTURE .....32 GPH
- Climb Speed .....125 KIAS
- EMERG FUEL PUMP Switch .....OFF at safe altitude
- LANDG LIGHT Switch .....OFF
- TAXI/PULSE Lights .....AS REQUIRED
- Oxygen System .....AS REQUIRED
  1. Adjust oxygen mask.
  2. Turn on system.
  3. Adjust flowmeter/regulators for planned cruise altitude.
  4. Monitor flowmeters and quantity.

**NOTE**

Do not use oxygen system below 200 psi to prevent contamination and/or moisture from entering depleted cylinder-regulator assembly. If cylinder has been depleted, it must be removed and refurbished in accordance with the manufacturer's recommended procedures.

**4.5j Cruise Checklist (4.27)**

**CRUISE (4.27)**

**WARNING**

Operation above 25,000 feet is not approved.

**CAUTION**

To maintain lateral balance, alternate between right and left fuel tanks. See operating pages 4-13 and 4-19.

Reference Section 5 power setting table and performance charts.

- Cruise Power .....SET per power table
- MIXTURE (Refer to para. 4.27) .....ADJUST

**4.5k Descent Checklist (4.29)**

**NORMAL DESCENT (4.29a)**

Windshield DEFROST .....AS REQUIRED  
Windshield Heat (if installed) .....AS REQUIRED  
Ice Protection Equipment (if installed) .....AS REQUIRED  
Altimeter/Standby Altimeter.....SET  
Power.....CRUISE SETTING  
MIXTURE .....CRUISE SETTING  
Airspeed.....AS REQUIRED  
Cabin Comfort Controls .....AS REQUIRED

**NOTE**

Aircraft POH Time, Fuel and Distance to Descend data presented in Section 5 will no longer be applicable if the NORMAL DESCENT procedure is used.

**REDUCED POWER DESCENT (4.29b)**

Windshield Defrost .....AS REQUIRED  
Windshield Heat (if installed) .....AS REQUIRED  
Ice Protection Equipment (if installed) .....AS REQUIRED  
Altimeter/Standby Altimeter .....CHECK  
THROTTLE .....AT or ABOVE 20 IN. HG.  
MIXTURE .....MAINTAIN 1350°F TIT MINIMUM  
PROP RPM .....CRUISE SETTING  
Cabin Comfort Controls .....AS REQUIRED

**NOTE**

Aircraft POH Time, Fuel and Distance to Descend data presented in Section 5 will no longer be applicable if the REDUCED POWER DESCENT procedure is used.

**POH Section 5 PERFORMANCE DESCENT (4.29c)**

Windshield DEFROST .....AS REQUIRED  
Windshield Heat (if installed) .....AS REQUIRED  
Ice Protection Equipment (if installed) .....AS REQUIRED  
Altimeter/Standby Altimeter.....Set

**4.5k Descent Checklist (4.29) (continued)****POH Section 5 PERFORMANCE DESCENT (4.29c) (continued)**

THROTTLE.....25 IN. HG.  
 PROP RPM.....2400 RPM  
 MIXTURE.....MAINTAIN 1350°F TIT  
 Airspeed.....165 KIAS  
 Cabin Comfort Controls.....AS REQUIRED

**4.5m Before Landing Checklist (4.31)****APPROACH CHECK (4.31a)**

LANDG LIGHT Switch.....AS REQUIRED  
 Altimeter/Standby Altimeter.....SET  
 Seat Backs.....ERECT  
 Seats.....ADJUSTED & LOCKED IN POSITION  
 Belts/Harness.....FASTEN/ADJUST  
 EMERG FUEL PUMP Switch.....ON  
 FUEL SELECTOR.....PROPER TANK  
 MIXTURE.....RICH  
 PROP RPM.....SET  
 LANDING GEAR Selector.....DOWN (below 165 KIAS)  
 FLAPS.....SET (10° @ 165 KIAS max.)  
 Rudder Trim.....SET TO NEUTRAL  
 AIR COND Switch.....OFF

**LANDING CHECK (4.31b)**

Landing Gear Lights.....3 GREEN  
 Brakes.....CHECK

**WARNING**

After pumping several times, if one or both toe brakes are inoperative, DO NOT attempt landing on a short field.

FLAPS.....SET (36° @ 116 KIAS)  
 Autopilot.....DISENGAGE  
 Yaw Damper (prior to landing).....OFF

**4.5n Landing (4.33)**

**NOTE**

In crosswind conditions, the nosewheel may not be aligned with the runway as the wheel touches down because of opposite rudder input. To prevent swerving in the direction the nosewheel is offset, the rudder must be promptly centered just as the nosewheel touches down.

**NORMAL TECHNIQUE (4.33a)**

FLAPS .....ANY SETTING  
(normal is 36°)  
Airspeed.....80 - 85 KIAS (flaps down)  
95 KIAS (flaps up)  
THROTTLE.....AS REQUIRED  
After touchdown:  
Brakes .....AS REQUIRED

**SHORT FIELD TECHNIQUE (4.33b)**

FLAPS .....FULL DOWN  
Airspeed.....78 KIAS  
THROTTLE.....AS REQUIRED  
Over obstacle:  
THROTTLE.....REDUCE TO IDLE  
After touchdown:  
Brakes .....MAXIMUM

**4.5o Go-around Checklist (4.35)**

**GO-AROUND (4.35)**

MIXTURE .....FULL RICH  
PROP RPM .....FULL INCREASE  
THROTTLE .....FULL POWER  
Control Wheel .....back pressure to  
ROTATE to CLIMB ATTITUDE  
Airspeed .....80 KIAS  
LANDING GEAR Selector.....UP  
FLAPS .....RETRACT SLOWLY  
Trim .....AS REQUIRED

**4.5p After Landing Checklist (4.37)****AFTER LANDING (4.37)**

INDUCTION AIR Control .....	PRIMARY
FLAPS .....	RETRACT
AIR COND .....	AS DESIRED
EMERG FUEL PUMP Switch.....	OFF
Ice Protection Equipment (if installed) .....	OFF
WX Radar (if installed) .....	STBY
Transponder .....	AS REQUIRED
STROBE LIGHTS .....	AS REQUIRED
LANDG/TAXI Lights .....	AS REQUIRED

**4.5q Stopping Engine Checklist (4.39)****STOPPING ENGINE (4.39)**

AV BUS MASTR Switch .....	OFF
External Lights .....	OFF
AIR COND Switch .....	OFF
PROP RPM .....	FULL INCREASE
THROTTLE .....	CLOSE until a decided decrease in CHT
THROTTLE.....	1000 RPM for approx. 30 seconds
MIXTURE .....	IDLE CUT-OFF
MAG Switches .....	OFF
ALTR NO. 1 and ALTR NO. 2 Switches.....	OFF
BATT MASTR Switch .....	OFF
Standby Attitude Indicator.....	OFF

**NOTE**

No pilot action is required to turn OFF the standby attitude indicator. Verify that after the amber light stops flashing the OFF flag appears on the instrument.

**4.5r Mooring Checklist (4.41)**

**MOORING (4.41)**

**PARK BRAKE .....SET**  
**Control Wheel.....SECURED with belts**  
**FLAPS .....FULL UP**  
**Wheel Chocks .....IN PLACE**  
**Tie Downs.....SECURE**

#### 4.7 AMPLIFIED NORMAL PROCEDURES (GENERAL)

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

#### 4.9 PREFLIGHT CHECK (4.5a)

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.

##### 4.9a Cockpit (4.5a)

If oxygen use is anticipated for the flight, check all masks and hoses for integrity.

Release the seat belts securing the control wheel.

Set the parking brake by first depressing and holding the toe brake pedals and then pull the PARK BRAKE knob.

Check that the LANDING GEAR selector is in the DOWN position. Ensure that all electrical switches and the MAG switches are OFF. Turn OFF the AV BUS MASTER switch. The MIXTURE should be in the LEAN (idle cut-off) position. Turn the BATT MASTR switch ON.

Verify that the three green landing gear indicator lights are illuminated. Press the LTS/GEAR ANNUN TEST switch and verify illumination of the red GEAR WARNING light and switches above the pilot's PFD illuminate. Check the CAS message window for any abnormal messages. Check the environmental/de-ice switch panel to ensure all switches are OFF, then TEST. Check fuel gauges for fuel quantity and correct fuel balance.

#### CAUTION

See fuel imbalance limitations, Section 2.35.

Check operation of the interior lighting, then turn OFF interior lighting.

Extend the flaps for the walk-around inspection.

**4.9 PREFLIGHT CHECK (4.5a) (continued)**

**4.9a Cockpit (4.5a) (continued)**

**CAUTION**

Care should be taken when an operational check of the heated pitot head and heated lift detector is being performed. The units become very hot. Ground operation should be limited to three minutes to avoid damaging the heating elements.

Turn ON the PITOT HEAT, S. WARN HEAT, and the exterior light switches. Verify that the pitot heads and stall warning vane become warm, and check operation of the exterior lights.

Turn OFF the exterior light switches, PITOT HEAT, and S. WARN HEAT.

Turn OFF the BATT MASTR switch.

Check the primary flight controls for proper operation and set the elevator and rudder trims to neutral. Push the pitot-static system drains to remove any moisture that has accumulated in the lines. Verify that the alternate static system valve is in the primary (down) position. Check that the emergency exit is in place and securely latched. Check the windows for cleanliness. Verify that the required papers are on board and that all baggage is stowed and secured properly. All seat belts on seats not occupied should be fastened and pulled secure.

**4.9b Empennage (4.5a)**

Begin the walk-around at the left side of the aft fuselage. Check the condition of any antennas located on the fuselage. All surfaces of the empennage must be clear of ice, frost, snow or other extraneous substances. Fairings and access covers should be attached properly. Ensure that the primary static system ports on the left side of the aft fuselage and the alternate static port on the underside of the aft fuselage are clear of obstructions. Check oxygen gauge pressure on oxygen cylinder then close and verify that the oxygen access door is secure. Check the condition of the deice boot, if installed, for any nicks, tears, or delamination. The elevator and rudder should be operational and free from damage or interference of any type. Check the condition of the elevator trim tab and ensure that all hinges and push rods are sound and operational. Elevator and rudder static wicks should be firmly attached and in good condition. If the tail has been tied down, remove the tiedown rope. Ensure that the primary static parts on the right side of the aft fuselage are clear of obstructions.

**4.9 PREFLIGHT CHECK (4.5a) (continued)****4.9c Right Wing (4.5a)**

Check that the wing surface and control surfaces are clear of ice, frost, snow or other extraneous substances. Check the flap, aileron and hinges for damage and operational interference. Static wicks should be firmly attached and in good condition. Check the wing tip and lights for damage.

Open the fuel cap and visually check the fuel color. The quantity should match the fuel quantity that is displayed on the MFD. Replace cap securely. The fuel tank vent should be clear of obstructions.

Check the condition of the deice boot, if installed, for any nicks, tears or delamination, and verify that the stall strips are securely attached.

Remove the tiedown and chock.

Check the radar pod, if installed, for any damage, that all attachment points are secure, and the storage door is closed and latched. If installed, remove the cover from the pitot head and verify that the pitot head is clear of obstructions.

Next, complete a check of the landing gear. Check the gear strut for proper inflation. There should be 3.44 +/- 0.25 inches of strut exposure under a normal static load. Check for hydraulic leaks. Check the tire for cuts, wear, and proper inflation. Perform a visual check of the brake block and disc.

**CAUTION**

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

Drain the fuel tank sump through the quick drain located on the lower surface of the wing just inboard of the gear well, making sure that enough fuel has been drained to ensure that all water and sediment is removed. The fuel system should be drained daily prior to the first flight and after each refueling.

**4.9 PREFLIGHT CHECK (4.5a) (continued)**

**4.9d Nose Section (4.5a)**

Check the general condition of the nose section; look for oil or fluid leakage and that the cowling is secure. Drain the fuel filter sump located on the lower fuselage aft of the cowling making sure that all water and sediment is removed. 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. The landing light should be clean and intact.

Remove the chock and check the nose gear strut for proper inflation. There should be 1.65 +/- 0.25 inches of strut exposure under a normal static load. Check the tire for cuts, wear, and proper inflation. Check the engine baffle seals. Check the oil level; maximum endurance flights should begin with 12 quarts of oil. Make sure that the oil filler/dipstick cap has been properly seated and secured, and that the cowl oil door is closed. Ensure that the tow bar is secured in the nose baggage area.

Close and secure the nose baggage door.

**4.9 PREFLIGHT CHECK (4.5a) (continued)****4.9e Left Wing (4.5a)**

Check that the wing surface and control surfaces are clear of ice, frost, snow or other extraneous substances.

**CAUTION**

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

Drain the fuel tank sump through the quick drain located on the lower surface of the wing just inboard of the gear well, making sure that enough fuel has been drained to ensure that all water and sediment is removed. The fuel system should be drained daily prior to the first flight and after each refueling.

Complete a check of the landing gear. Check the gear strut for proper inflation. There should be 3.44 +/- 0.25 inches of strut exposure under a normal static load. Check for hydraulic leaks. Check the tire for cuts, wear, and proper inflation. Perform a visual check of the brake block and disc.

Remove the tiedown and chock.

Check the OAT probes for security and ensure holes in cover are unobstructed.

If installed, remove the cover from the pitot head and verify that the pitot head is clear of obstructions.

Open the fuel cap and visually check the fuel color. The quantity should match the fuel quantity that is displayed on the MFD. Replace cap securely. The fuel tank vent should be clear of obstructions.

Check the condition of the deice boot, if installed, for any nicks, tears or delamination, and verify that the stall strips are securely attached. Check the wing tip and lights for damage. Check the flap, aileron and hinges for damage and operational interference. Static wicks should be firmly attached and in good condition.

**4.11 BEFORE STARTING ENGINE (4.5b)**

When all passengers are on board, the pilot should brief the passengers on the operation of the oxygen system (briefing should include oxygen mask donning, flowmeter adjustment, and connection to the oxygen bottle regulator). The pilot should check that the cabin door is properly closed and latched and visually check that all four door pin indicators are green.

**WARNING**

Do not initiate any flight if all four door pin indicators are not green and/or the "DOOR AJAR" annunciator is illuminated.

Seats should be adjusted and locked in position. Seat belts on empty seats should be snugly fastened. All passengers should fasten their seat belts and shoulder harnesses. A pull test of the inertia reel locking restraint feature should be performed.

Verify the PARK BRAKE is set and the area around the airplane is clear of personnel and equipment.

Move the PROP RPM control to full INCREASE. Turn OFF all electrical switches. Verify the DAY/NIGHT selector switch is properly set and check circuit breaker panels to verify circuit breakers are in.

Check the INDUCTION AIR control for freedom of movement by moving lever to ALTERNATE and back to PRIMARY. Verify that the alternate static system valve is in the down (PRIMARY) position. Verify that the pitot and static systems drain valves located on both the right and left cockpit lower side panels next to the crew seats (two valves on the pilot's side and four on the copilot's side) have been drained.

Turn EMER switch ON and verify operation of the pilot's PFD, No. 1 NAV/COM, Audio Panel, and illumination of the Landing Gear Down Indicators, Standby Instruments and Magnetic Compass. Once the above EMER switch items have been verified, turn the EMER switch OFF.

Proceed with the appropriate Engine Start Checklist.

**4.13 ENGINE START (4.5c)****4.13a Engine Start - General (4.5c)****CAUTION**

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

**CAUTION**

If engine does not start within 10 seconds, prime and repeat starting procedure. Starter manufacturer recommends starter cranking periods be limited to 10 seconds with a 20 second rest period between cranking periods. Maximum of 6 start periods allowed. If start is not achieved on sixth attempt allow starter to cool for 30 minutes before attempting additional starts.

**CAUTION**

The STARTER ENGAGED CAS message will illuminate after 30 seconds of continuous engine cranking. If the CAS message illuminates after the engine is running, stop the engine and determine the cause.

**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.

**4.13b Normal Start - Cold Engine (4.5c)**

Open the THROTTLE lever approximately 1/2 inch. Turn the BATT MASTR switch ON. After PFD 1 initialization is complete, consider any CAS messages and PFD annunciations that are illuminated. Turn the ALTR NO. 1 and ALTR NO. 2 switches ON. Check that the EMERG FUEL PUMP is OFF. Move the FUEL SELECTOR to the desired tank. Move the MIXTURE control to full RICH for approximately four seconds then to LEAN (idle cut-off) position. The engine is now primed.

**4.13 ENGINE START (4.5c) (continued)**

**4.13b Normal Start - Cold Engine (4.5c) (continued)**

**NOTE**

The amount of prime depends on engine temperature. Familiarity and practice will enable the operator to estimate the amount of prime required.

Turn both MAG switches ON. Verify the area around the propeller is clear and engage the starter. When the engine fires advance the MIXTURE control to full RICH. Move the THROTTLE to the desired setting and check the oil pressure for a positive indication. Confirm that the alternators are on by checking the amperage indications for output. Check the VACUUM display, if installed, for an acceptable (green) indication.

**4.13c Normal Start - Hot Engine (4.5c)**

Open the THROTTLE 1/2 inch. Turn the BATT MASTR switch ON. After PFD 1 initialization is complete, consider any CAS messages and PFD annunciations that are illuminated. Turn the ALTR NO. 1 and ALTR NO. 2 switches ON. Check that the EMERG FUEL PUMP switch is OFF. Move the FUEL SELECTOR to the desired tank. Verify the MIXTURE control is at the LEAN (idle cut-off) position. Turn both MAG switches ON. Verify the area around the propeller is clear and engage the starter. When the engine fires, slowly advance the MIXTURE control. Move the THROTTLE to the desired setting and check for a positive indication of oil pressure. Confirm that the alternators are on by checking the amperage indications for output. Check the VACUUM display, if installed, for an acceptable (green) indication.

**4.13d Engine Start When Flooded (4.5c)**

The THROTTLE lever should be full open. Turn the BATT MASTR switch ON. After PFD 1 initialization is complete, consider any CAS messages and PFD annunciations that are illuminated. Turn the ALTR NO. 1 and ALTR NO. 2 switches ON. Check that the EMERG FUEL PUMP switch is OFF. Verify the MIXTURE control is at the LEAN (idle cut-off) position. Turn both MAG switches ON. Verify the area around the propeller is clear and engage the starter. When the engine fires, advance the MIXTURE control, retard the THROTTLE, and check for a positive indication of oil pressure. Confirm that the alternators are on by checking the amperage indications for output. Check the VACUUM display, if installed, for an acceptable (green) indication.

**4.13e Engine Start With External Power Source (4.5c)**

Verify the BATT MASTR and ALTR NO. 1 and ALTR NO. 2 switches are OFF, and turn all electrical equipment OFF.

Plug the auxiliary power unit into the socket located inside the forward baggage door. If using an external battery, connect the RED lead of the jumper cable to the POSITIVE (+) terminal of an external 24-volt battery and the BLACK lead to the NEGATIVE (-) terminal. Insert the plug of the jumper cable into the socket located inside the forward baggage door. Note that, after the plug is inserted, the airplane's electrical system is ON.

**NOTE**

For all normal operations using an external power source, the BATT MASTR switch should be OFF, but it is possible to use the ship's battery in parallel by turning the BATT MASTR switch ON. This will give longer cranking capabilities, but will not increase amperage.

**CAUTION**

Care should be exercised because if the ship's battery has been depleted, the external power supply can be reduced to the level of the ship's battery. This can be tested by turning the BATT MASTR 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.

Open the THROTTLE lever approximately 1/2 inch. After PFD 1 initialization is complete, consider any CAS messages and PFD annunciations that are illuminated. Check that the EMERG FUEL PUMP switch is OFF. Move the FUEL SELECTOR to the desired tank. Move the MIXTURE control to full RICH for approximately four seconds then to LEAN (idle cut-off) position. The engine is now primed.

**NOTE**

The amount of prime depends on engine temperature. Familiarity and practice will enable the operator to estimate the amount of prime required.

#### **4.13e Engine Start With External Power Source (4.5c) (continued)**

Turn both MAG switches ON. Verify the area around the propeller is clear and engage the starter. When the engine fires, slowly advance the MIXTURE control. Move the THROTTLE to the lowest possible RPM to reduce sparking.

Turn the BATT MASTR switch ON, then disconnect the external power source from the aircraft and secure the baggage door. Verify DOOR AJAR warning CAS message has extinguished. When the engine is firing evenly, advance the THROTTLE to 1000 RPM. Turn the ALTR NO. 1 and ALTR NO. 2 switches ON and check for an indication of output. Check for the proper VOLTS indication and a positive indication of oil pressure. Check VACUUM display, if installed, for an acceptable indication.

#### **4.15 BEFORE TAXIING (4.5d)**

##### **CAUTION**

Do not operate engine above 1200 RPM with cabin doors open.

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

Turn the AV BUS MASTR switch ON. The MFD will power-up with a splash screen that lists all databases and expiration dates. The pilot should verify database currency. The MFD - Weight Planning page will appear to allow the appropriate weights to be entered and summarized. The weight of fuel on board may be entered manually or by pressing the FOB SYNC Softkey. Consider any CAS messages that are illuminated.

Verify that the autopilot automatically completes its preflight self-test (PFT) and the disconnect tone is heard. The navigation and strobe lights and the taxi/rec lights should be utilized as required. The cabin climate controls can be set as desired. Verify the standby attitude indicator is ON and ERECT and the flag is not visible. Perform the standby attitude gyro preflight test per paragraph 4.5d. Set the altimeter on the PFD and the standby altimeter. Press the STALL TEST switch and verify the stall warning tone is heard. Conduct a self-test of the Terrain Awareness Warning System (TAWS) and Traffic Alerting System (TAS), if installed. Set the Com and Nav radios to the desired frequencies and load a flight plan if desired. Retract the flaps. Set environmental system as desired. Set the supplemental electric heater as desired (refer to paragraph 4.49).

**4.17 TAXIING (4.5e)****CAUTION**

Non-pilot personnel should not attempt to taxi the airplane until they have been instructed in taxiing procedures and techniques by a qualified person authorized by the owner.

**CAUTION**

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

**CAUTION**

During taxi, if the VOLTS indication increases into the red range, increase engine RPM, if possible, to retain adequate battery charging.

**Determine that the propeller blast and taxi areas are clear. Avoid holes and ruts when taxiing over uneven ground.**

**Release the PARK BRAKE by first depressing and holding the toe brake pedals and then pushing in on the parking brake knob. Taxi with the PROP RPM control set to full INCREASE. Power should be applied slowly to start the taxi roll. Taxi a few feet forward and apply the brakes to determine their effectiveness. While taxiing, make slight turns to ascertain the effectiveness of the steering and to check the flight instruments.**

### **4.19 GROUND CHECK (4.5f)**

#### **CAUTION**

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

#### **NOTE**

Refer to paragraph 4.53, Icing Information, prior to any flight operations. (Takeoff, cruise, landing, etc.). If flight into icing conditions (in visible moisture below +5°C) is anticipated, conduct a preflight check of the icing systems, if installed, per Supplement 1 - Ice Protection System.

Set the parking brake. The magnetos should be checked at 2000 rpm with the PROP RPM control set at full INCREASE. 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.

While at 2000 rpm, check that vacuum reading, if installed, on the MFD shows within normal operating range.

Conduct a preflight check of the ice protection systems for proper operation.

Check the VOLTS and AMPS indications for proper voltage and alternator outputs. Check oil temperature and oil pressure for normal readings. The temperature may be low for some time if the engine is being run for the first time of the day.

The PROP RPM control should be moved through its complete range to check for proper operation and then placed in full INCREASE rpm for takeoff. 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 reading on the MFD for proper indication of fuel flow, then retard the THROTTLE to idle to check smooth engine operation. Advance the THROTTLE to 1000 to 1200 rpm.

Check the cockpit annunciator lights with the LTS/GEAR ANNUN TEST button and check operation of the lights within environmental/de-ice control panel with the TEST button.

**4.21 BEFORE TAKEOFF (4.5g)****NOTE**

Refer to Section 9, Supplement 1 for Matrix Aircraft Flight Into Known Icing (FIKI), if installed, prior to any flight operations (takeoff, cruise, landing, etc.).

Ensure that the BATT MASTR switch, EMERG FUEL PUMP switch, and both MAG switches are in the ON position. Verify both ALTR NO. 1 and ALTR NO. 2 switches are on and check for proper amperage indications. Check the FUEL SELECTOR to make sure it is set to the proper tank. Verify that the INDUCTION AIR control is in the PRIMARY position.

Seats should be adjusted and locked in position. All seat backs should be erect, all seat belts and harnesses should be fastened and adjusted, and armrests stowed.

The MIXTURE control should be set to full RICH and PROP RPM control should be set to full INCREASE.

Check and set all of the primary and standby flight instruments as required. Consider any CAS messages that are illuminated and take appropriate action to resolve any issues. Check engine readings to verify normal operating range.

Check that the nav and com radios and avionics are set and functioning as required.

Set the flaps 0° to 20°, as required, and set the elevator and rudder trim, as required. Ensure proper flight control movement and response.

Turn the ice protection equipment on as necessary, if installed. Turn on the TAXI, LANDG LIGHT and NAV LIGHT as required. Turn on the STROBE LIGHTS.

**4.23 TAKEOFF (see charts in Section 5) (4.5h)****NOTE**

Demonstrated crosswind component is 17 knots.

**NOTE**

Takeoffs are normally made with full throttle. However, under some off standard conditions, the manifold pressure indication can exceed its indicated limit at full throttle. Limit manifold pressure to 42 in. Hg maximum. (See Section 7.)

**4.23 TAKEOFF (see charts in Section 5) (4.5h) (continued)**

Takeoffs are normally made with flaps 0° to 10°. For short field takeoffs or takeoffs affected by soft runway conditions or obstacles, total distance can be reduced appreciably by lowering the flaps to 20°.

**4.23a Normal Technique (4.5h)**

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 in the 0° to 10° position and the pitch trim set slightly aft of neutral. Align the airplane with the runway, apply full power, and accelerate to 80-85 KIAS.

Apply back pressure to the control wheel to lift off at 80-85 KIAS, then control pitch attitude as required to attain the desired climb speed of 90-95 KIAS. Retract the landing gear when a straight-ahead landing on the runway is no longer possible. Retract the flaps.

**4.23b 0° Flaps Takeoff Performance (4.5h)**

Set the flaps to 0° and set the trim for takeoff. Set maximum power before brake release and accelerate the airplane to 78 KIAS for liftoff. After liftoff, adjust the airplane attitude as required to achieve the obstacle clearance speed of 91 KIAS passing through 50 feet of altitude. Once immediate obstacles are cleared, retract the landing gear and establish the desired enroute climb configuration and speed.

**4.23c Short Field Takeoff Performance (4.5h)**

**NOTE**

Gear warning will sound when the landing gear is retracted with the flaps extended more than 10°.

For departure from short runways or runways with adjacent obstructions, a short field takeoff technique with flaps set at 20° should be used. Set trim for takeoff. Maximum power is established before brake release and the airplane is accelerated to 69 KIAS for liftoff. After liftoff, control the airplane attitude to accelerate to 80 KIAS passing through the 50-foot obstacle height. Once clear of the obstacle, retract the landing gear and accelerate through 90 KIAS while retracting the flaps. Then establish the desired enroute climb configuration and speed.

**4.25 CLIMB (4.5i)****4.25a Maximum Continuous Power Climb (4.5i)**

The best rate of climb at gross weight and maximum continuous power is obtained at 110 KIAS. The best angle of climb is obtained at 81 KIAS. The recommended procedure for climb is to use maximum continuous power with the MIXTURE full RICH. Under some off standard conditions, the manifold pressure indication will exceed its indicated limits at full throttle. Adjust power to remain within limits. The EMERG FUEL PUMP switch should be OFF when reaching a safe altitude. Turn OFF the landing light and use the recognition lights as required.

**4.25b Cruise Climb (4.5i)**

For reduced enroute fuel consumption in climb attain a speed of 125 KIAS, with the manifold pressure set to 35 in. Hg, PROP RPM set to 2500 rpm, and lean the MIXTURE to produce a fuel flow of 32 gph. The EMERG FUEL PUMP switch should be OFF when reaching a safe altitude. Turn OFF the landing light and use the recognition lights as required.

If oxygen is required, adjust the oxygen mask, turn on the oxygen system and monitor flowmeters and quantity.

**NOTE**

Do not use oxygen system below 200 psi to prevent contamination and/or moisture from entering depleted cylinder-regulator assembly. If cylinder has been depleted, it must be removed and refurbished in accordance with the manufacturer's recommended procedures.

**4.27 CRUISE (4.5j)**

**WARNING**

Operation above 25,000 feet is not approved.

**CAUTION**

To maintain lateral balance, alternate between right and left fuel tanks. See paragraphs 2.35 and 7.19.

**NOTE**

Reference Section 5 power setting table and performance charts.

The cruising speed is determined by many factors, including power setting, altitude, temperature, loading, and equipment installed on 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. The higher RPM setting for the desired power should be used when operating above 20,000 feet. Proper leaning during cruise is essential for smooth engine operation and optimum fuel economy. This is especially important during power reductions, such as level off, to prevent rough engine operation. For cruise, MIXTURE should be leaned to peak TIT. Always use the TIT indication for leaning.

**NOTE**

Do not exceed 1750°F TIT.

The maximum permissible cylinder head temperature for all operations is 500°F. To obtain maximum service life of engine components, cylinder head temperature should not exceed 435°F during cruise operation. Adjust cylinder head temperatures by reducing power, adjusting the MIXTURE, or any combination of these methods.

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

During flight, keep account of time and fuel used in connection with power settings to determine how the fuel flow and fuel quantity systems are operating.

#### 4.27 CRUISE (4.5j) (continued)

The EMERG FUEL PUMP should always 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 FUEL SELECTOR should be changed to another tank before fuel is exhausted from the tank in use.

During cruise, use the following procedure to maintain lateral balance, and stay within the fuel imbalance limitations of 2.35:

- (a) When starting with a symmetrical fuel load, use the left tank first until 10 gallons are burned, then alternate tanks at approximately one hour intervals.
- (b) When starting with an unsymmetrical fuel load, care must be taken not to allow the fuel imbalance to exceed 10 gallons.

The EMERG FUEL PUMP switch should normally be OFF so that any malfunction of the engine driven fuel pump is immediately apparent. Loss of fuel pressure to the fuel injector is indicated by the illumination of the FUEL PRESS LOW CAS message. 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 EMERG FUEL PUMP switched to the ON position. If excessive fuel vapor is suspected, usually indicated by fluctuating fuel flow, turn the EMERG FUEL PUMP switch ON until the fuel flow indications are smooth.

The pilot should monitor weather conditions while flying, and be alert for meteorological conditions which might lead to icing. **This aircraft is not approved for flight in heavy icing, heavy snow, or freezing rain.** (See Section 9.) Immediate steps shall be taken to exit any area where such icing conditions are inadvertently encountered. Saturated air accelerating through the induction system filter can form ice although ambient temperatures are above freezing. If induction system icing is suspected, place the INDUCTION AIR control in the ALTERNATE position. Alternate air should also be selected before entering clouds. Manifold pressure may decrease significantly when alternate air is selected depending on altitude, power setting, and other factors. This loss of manifold pressure can exceed 8 inches of Hg. when selecting alternate air at cruise power settings during icing conditions. If ice is forming on the filter, manifold pressure could continue to deteriorate after selecting alternate air. When manifold pressure stabilizes, attempt to regain cruise power with THROTTLE and or PROP RPM adjustments. The primary air filter may retain ice after leaving icing conditions, making the selection of PRIMARY induction air impractical until ice melts or sublimates.

**4.27 CRUISE (4.5j) (continued)**

There are no mechanical uplocks in the landing gear system. In the event of a hydraulic system malfunction, check valves should prevent the gear from extending. However, some hydraulic system malfunctions may cause the gear to free-fall to the gear down position. The true airspeed with gear down is approximately 70% 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.

**4.29 DESCENT (4.5k)**

Use windshield DEFROST and heat, and other ice protection equipment, if installed, as required. Set the altimeter and standby altimeter.

The recommended procedure for descent is to leave the engine controls at the cruise settings and increase the airspeed to give the desired rate of descent. Monitor the manifold pressure and adjust to maintain the cruise setting. Leave the MIXTURE leaned to the cruise setting. This will prevent rapid engine cooling which may damage the engine. Should additional rate of descent be required, power can be reduced to 20 in. Hg. At reduced power maintain at least 1350°F TIT in order to keep engine temperatures from cooling too rapidly. If descending with the gear retracted does not provide the desired rate of descent the gear may be extended at speeds less than 165 KIAS and the aircraft operated at speeds less than 195 KIAS with the gear extended. This procedure will significantly increase rate of descent.

To achieve the Time, Fuel, and Distance performance defined in Section 5, reduce the power to 25 in. Hg. and 2500 RPM and control pitch attitude to maintain 165 KIAS. Set the mixture to maintain 1350°F TIT.

**4.31 BEFORE LANDING (4.5m)****4.31a Approach Check (4.5m)**

Turn the LANDG LIGHT switch ON as required. Set the altimeter and standby altimeter.

Seats should be adjusted and locked in position. All seat backs should be erect, all seat belts and harnesses should be fastened and adjusted, and armrests stowed.

The EMERG FUEL PUMP should be ON.

The FUEL SELECTOR should be on the fullest tank. The MIXTURE should be RICH and PROP RPM control should be set. When 165 KIAS or less is attained, lower the landing gear and set the flaps to 10°.

Set the rudder trim to neutral in preparation for landing. The AIR COND should be OFF to ensure maximum rate of climb in the event of a go-around.

**4.31b Landing Check (4.5m)**

Verify that all three landing gear indicator lights are green. Pump the toe brakes to ensure that the system is capable of uniform braking during the landing rollout.

**WARNING**

After pumping several times, if one or both toe brakes are inoperative, DO NOT attempt landing on a short field.

When 116 KIAS or less is attained, lower the flaps to 36°.  
Disengage the autopilot and turn OFF the yaw damper prior to landing.

**4.33 LANDING (4.5n)****NOTE**

In crosswind conditions, the nosewheel may not be aligned with the runway as the wheel touches down because of opposite rudder input. To prevent swerving in the direction the nosewheel is offset, the rudder must be promptly centered just as the nosewheel touches down.

**4.33a Normal Technique (4.5n)**

Landings may be made with any flap setting, although normally, full flaps are used. The aircraft should be flown down the final approach course at 80 - 85 KIAS with full flaps extended (95 KIAS with flaps retracted), and power as required to maintain the desired approach angle. When descending through 50 feet, reduce power to idle. Make normal landing, and brake as required during ground roll.

**4.33b Short Field Technique (4.5n)**

For landings on short runways, or runways with adjacent obstructions, a short field landing technique with full flaps should be used in accordance with the Landing Ground Roll Distance or the Landing Distance Over 50 FT Obstacle charts in Section 5. The airplane should be flown down the final approach at 78 KIAS with flaps fully extended, with power set to produce a normal 3° descent (approximately 400 ft/min) angle. As the obstacle is cleared, reduce the power to idle and adjust airplane attitude to maintain 78 KIAS to the flare point. After touchdown, apply maximum braking.

**4.35 GO-AROUND (4.5o)**

**Go-Around (4.5o)**

To initiate a go-around from a landing approach, the MIXTURE should be set to full RICH, the PROP RPM control should be at full INCREASE, and the THROTTLE should be advanced to full power while the pitch attitude is increased to obtain the bailed landing climb speed of 80 KIAS. Retract the landing gear and slowly retract the flaps when a positive climb is established. Allow the airplane to accelerate to the best angle of climb speed (81 KIAS) for obstacle clearance or to the best rate of climb speed (110 KIAS) if obstacles are not a factor. Reset the longitudinal trim as required.

**4.37 AFTER LANDING (4.5p)**

**After Landing (4.5p)**

When clear of the active runway, move the INDUCTION AIR control to PRIMARY, retract the FLAPS, and use the AIR COND as desired. Turn OFF the EMERG FUEL PUMP, and ice protection equipment, if installed. The weather radar should automatically default to STBY mode upon landing. Select transponder mode as required. Use the STROBE LIGHTS, LANDG and TAXI LIGHTS as required.

**4.39 STOPPING ENGINE (4.5q)****Stopping Engine (4.5q)**

Prior to shutdown, turn OFF the AV BUS MASTR switch and all electrical equipment and external lights.

The AIR COND switch should be turned OFF, the PROP RPM control set in the full INCREASE position, and the THROTTLE should be in the CLOSE position until there is a decided decrease in CHT. Increase throttle to 1000 rpm. Maintain 1000 rpm for approximately 30 seconds to ensure adequate scavenging of the turbocharger oil system. Stop the engine by pulling the MIXTURE control back to the LEAN (idle cut-off) position. After the engine stops, both MAG switches, both ALTR NO. 1 and ALTR NO. 2 switches, the BATT MASTR switch, and the standby attitude indicator must be turned OFF.

**NOTE**

No pilot action is required to turn OFF the standby attitude indicator. Verify that after the amber light stops flashing the OFF flag appears on the instrument.

**4.41 MOORING (4.5r)****Mooring (4.5r)**

If necessary, the airplane should be moved on the ground with the aid of the nose wheel tow bar.

The PARK BRAKE should be set and the aileron and elevator controls should be secured by looping the safety belt through the control wheel and pulling it snug. The flaps should be fully retracted. Wheel chocks should be positioned in place.

Tiedowns can be secured to the wing tiedown rings 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.

#### **4.43 STALLS**

The stall characteristics of the Matrix 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 pitching may also precede the stall.

The gross weight stalling speed with power off, landing gear extended, and full flaps is 58 KIAS. With the landing gear retracted and flaps up, this speed is increased to 69 KIAS. Loss of altitude during stalls can be as great as 700 feet, depending on configuration and power.

#### **NOTE**

The stall warning system is inoperative with the BATT MASTR, ALTR NO. 1 and ALTR NO. 2 switches OFF.

During preflight, the stall warning system should be checked by turning the BATT MASTR switch on and pressing the STALL TEST switch to determine if the horn is actuated.

#### **4.45 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 operating maneuvering speed ( $V_o$ ) 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. (Refer to paragraph 2.3 for operating maneuvering speeds appropriate to the weight of the aircraft.)

**4.47 SUPPLEMENTAL ELECTRIC HEATER****AFTER ENGINE START**

BATT MASTR Switch .....	ON
ALTR NO. 1 and ALTR NO. 2 Switches .....	OFF
VENT DE-FOG Switch .....	ON
Airflow .....	CHECK
VOLTS Indication .....	LESS than 24 Vdc (increase electrical load as necessary to lower voltage)
VOLTS CAS MESSAGE .....	ILLUMINATED
Electrical Switches (used to increase load) .....	OFF
VENT DE-FOG Switch .....	OFF
ALTR NO. 1 and ALTR NO. 2 Switches .....	ON

**NOTE**

The VOLTS indicating system must be checked operational before heater operation. The VENT/DE-FOG BLOWER must be checked operational before heater ground operation.

**HEATER OPERATION**

VENT DE-FOG Switch .....	ON
AUXILIARY CABIN HT Switch .....	ON

**For maximum heat:**

AIR COND Switch .....	OFF
CABIN TEMP Control. ....	PULL (on)
DEFROST Control .....	AS REQUIRED to CLEAR WINDSHIELD; then PUSH IN

**NOTE**

This auxiliary cabin heat should be considered as a backup to the standard heating system. There is no external control over the heat produced by the unit.

**4.49 NOISE LEVEL**

The corrected noise levels of this aircraft are as follows:

Propeller Designation	14 CFR Part 36 Appendix G	ICAO Annex 16 Volume 1, Chapter 10
HC-13Y1R-1N/N7605+2 HC-13Y1R-1N/N7605K+2	81.0 dB(A) (amdt. 28)	81.0 dB(A) (3 <sup>rd</sup> , amdt.7)

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 14 CFR Part 36 - Noise Standards: Aircraft Type and Airworthiness Certification. This aircraft model is in compliance with all 14 CFR Part 36 noise standards applicable to this type.

**4.51 ICING INFORMATION****THE FOLLOWING WEATHER CONDITIONS MAY BE CONDUCTIVE TO SEVERE IN-FLIGHT ICING**

Visible rain at temperatures below 0° C ambient air temperature.

Droplets that splash or splatter on impact at temperatures below 0° C ambient air temperature.

**PROCEDURES FOR EXITING THE SEVERE ICING ENVIRONMENT**

These procedures are applicable to all flight phases from takeoff to landing. Monitor the ambient air temperature. While severe icing may form at temperatures as cold as -18° C, increased vigilance is warranted at temperatures around freezing with visible moisture present. If the visual cues specified in the Ice Protection System supplement of this POH for identifying severe icing conditions, including Supercooled Large Droplets (SLD) are observed, accomplish the following:

- Immediately request priority handling from Air Traffic Control to facilitate a route or an altitude change to exit the severe icing conditions in order to avoid extended exposure to flight conditions more severe than those for which the airplane has been certificated.
- Avoid abrupt and excessive maneuvering that may exacerbate control difficulties.
- Do not engage the autopilot.
- If the autopilot is engaged, hold the control wheel firmly and disengage the autopilot.
- If an unusual roll response or uncommanded roll control movement is observed, reduce the angle-of-attack.
- Do not extend flaps when holding in icing conditions. Operation with flaps extended can result in a reduced wing angle-of-attack, with the possibility of ice forming on the upper surface further aft on the wing than normal, possibly aft of the protected area.
- If the flaps are extended, do not retract them until the airframe is clear of ice.
- Report these weather conditions to Air Traffic Control.

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TABLE OF CONTENTS  
SECTION 5  
PERFORMANCE

Paragraph No.		Page No.
5.1	General .....	5-1
5.2	Aircraft Configuration.....	5-1
5.3	Introduction - Performance and Flight Planning .....	5-1
5.5	Flight Planning Example.....	5-3
5.7	Performance Graphs.....	5-9
	List of Figures .....	5-9

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**SECTION 5**  
**PERFORMANCE**

**5.1 GENERAL**

All of the required (FAA regulations) and supplementary performance information is provided by this section.

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

**5.2 AIRCRAFT CONFIGURATION**

Performance depicted in Section 5 is applicable to aircraft equipped with ice protection system and weather radar pod.

For the effect of ice protection system on performance, refer to Section 9, Supplement 1.

**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 and quantity checks are recommended.

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

**5.3 INTRODUCTION - PERFORMANCE AND FLIGHT PLANNING  
(continued)**

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.

**5.5 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 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	3156.5 lb
(2) Occupants (See Section 6.9)	800.0 lb
(3) Baggage and Cargo	80.0 lb
(4) Fuel (6 lb/gal. x 53.58 gal.)	321.5 lb
(5) Ramp Weight	4358.0 lb
(6) Start, Taxi & Run-up Fuel	-18.0 lb
(7) Takeoff Weight	4340.0 lb
(8) Landing Weight	
(a)(7) minus (g)(1),	
(4340.0 lb minus 258.5 lb)	4081.5 lb

The takeoff weight is at or below the maximum allowable weight of 4340 lbs and the weight and balance calculations have determined the C.G. position within the approved limits. The landing weight is at or below the maximum landing weight of 4123 lb.

**5.5 FLIGHT PLANNING EXAMPLE (continued)**

**(b) Takeoff and Landing**

Now that the aircraft loading has been determined, 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 Ground Roll and Takeoff Distance (Figures 5-13, 5-15, 5-17 and 5-19) to determine the length of runway necessary for the takeoff and/or obstacle clearance.

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	5000 ft	1000 ft
(2) Temperature	20°C	25°C
(3) Wind Component (Headwind)	10 KTS	10 KTS
(4) Runway Length Available	3400 ft	5000 ft
(5) Takeoff and Landing Distance Required	2647 ft*	1870 ft**

\*reference Figure 5-19

\*\*reference Figure 5-43

**5.5 FLIGHT PLANNING EXAMPLE (continued)****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 is to determine the necessary climb segment components.

The desired cruise pressure altitude and corresponding cruise outside air temperature values are the first variables to be considered in determining the climb components from the Fuel, Time, and Distance to Climb graph (Figure 5-25). After the fuel, time, and distance for the cruise pressure altitude and outside air temperature values have been established, apply the existing conditions at the departure field to graph (Figure 5-25). Now, subtract the values obtained from the graph for the field of departure conditions from those for the cruise pressure altitude.

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

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

(1) Cruise Pressure Altitude	20000 ft
(2) Cruise OAT	-19° C
(3) Fuel to Climb (13.5 gal. minus 5.7 gal.)	7.8 gal.*
(4) Time to Climb (18.8 min. minus 4.7 min.)	14.1 min.*
(5) Distance to Climb (47.6 nautical miles minus 10.1 nautical miles)	37.5 nautical miles*

\*reference Figure 5-25

**5.5 FLIGHT PLANNING EXAMPLE (continued)**

**(d) Descent**

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

Utilizing the cruise pressure altitude and OAT, determine the basic fuel, time, and distance for descent (Figure 5-37). These figures must be adjusted for the field pressure altitude and temperature at the destination airport. To find the necessary adjustment values, use the existing pressure altitude and temperature conditions at the destination airport as variables to find the fuel, time, and distance values from the graph (Figure 5-37). Now, subtract the values obtained from the field conditions from the values obtained from the cruise conditions to find the true fuel, time and distance values needed for the descent segment of the flight plan.

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

- |                                                                              |                      |
|------------------------------------------------------------------------------|----------------------|
| (1) Fuel to Descend<br>(8.9 gal. minus 0.5 gal.)                             | 8.4 gal.*            |
| (2) Time to Descend<br>(25.1 min. minus 1.4 min.)                            | 23.7 min.*           |
| (3) Distance to Descend<br>(82.4 nautical miles minus 3.6<br>nautical miles) | 78.8 nautical miles* |

**(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 Textron Lycoming Manual and the Cruise Performance Table (refer to page 5-27) when selecting the cruise power setting. The established pressure altitude and temperature values and the selected cruise power should now be used to determine the true airspeed from the Cruise Speed versus. Altitude graph (Figure 5-31).

\*reference Figure 5-37

5.5 FLIGHT PLANNING EXAMPLE (continued)

Calculate the cruise fuel consumption for the cruise power setting from the information provided by the Textron Lycoming Manual and the Cruise Performance Table (refer to page 5-27).

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              | 375 nautical miles   |
| (2) Cruise Distance             |                      |
| (e)(1) minus (c)(5) minus       |                      |
| (d)(3), (375 nautical miles     |                      |
| minus 37.5 nautical miles       |                      |
| minus 78.8 nautical miles)      | 258.7 nautical miles |
| (3) Cruise Power                |                      |
| (lean to peak T.I.T.)           | Normal cruise power  |
| (4) Cruise Speed                | 195 KTS TAS*         |
| (5) Cruise Fuel Consumption     | 18 gph*              |
| (6) Cruise Time                 |                      |
| (e)(2) divided by (e)(4),       |                      |
| (258.7 nautical miles           |                      |
| divided by 195 KTS)             | 1.33 hrs             |
|                                 | 79.6 min.            |
| (7) Cruise Fuel                 |                      |
| (e)(5) multiplied by (e)(6)     |                      |
| (18 gph multiplied by 1.33 hrs) | 23.88 gal.           |

\*reference Figure 5-31 and Page 5-27

**5.5 FLIGHT PLANNING EXAMPLE (continued)**

**(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 flight time required for the flight planning example is shown below:

**(1) Total Flight Time**

(c)(4) plus (d)(2) plus (e)(6),  
(0.235 hrs plus 0.395 hrs plus 1.33 hrs)  
(14.1 min. plus 23.7 min. plus 79.6 min.) 1.96 hrs/117.4 min.

**(g) Total Fuel Required**

Determine the total fuel required by adding the fuel for start, taxi, and runup (3.0 gal., calculated by allowing 5 minutes of fuel flow at takeoff power), 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**

Fuel for Start, Taxi, and Runup plus	
(c)(3) plus (d)(1) plus (e)(7), (3 gal.	
plus 7.8 gal. plus 8.4 gal. plus 23.88 gal.)	43.08 gal
(43.1 gal. multiplied by 6 lb/gal.)	258.5 lb

## 5.7 PERFORMANCE GRAPHS

## LIST OF FIGURES

Figure No.		Page No.
5-1	Conversion Table .....	5-11
5-3	Temperature Conversion .....	5-12
5-5	Airspeed Calibration .....	5-14
5-7	Angle of Bank vs. Stall Speed .....	5-15
5-9	Pressure Altitude vs Outside Air Temperature .....	5-16
5-11	Wind Components .....	5-17
5-13	Takeoff Ground Roll, 0° Flaps .....	5-18
5-15	Takeoff Ground Roll, 20° Flaps .....	5-19
5-17	Takeoff Distance Over 50 Ft. Obstacle, 0° Flaps .....	5-20
5-19	Takeoff Distance Over 50 Ft. Obstacle, 20° Flaps .....	5-21
5-21	Rate of Climb .....	5-22
5-23	Maximum Continuous Power Time, Fuel, and Distance to Climb (110 KIAS) .....	5-23
5-25	Maximum Continuous Power Time, Fuel, and Distance to Climb (125 KIAS) .....	5-24
5-27	Cruise Climb Time, Fuel, and Distance to Climb.....	5-25
5-29	Maximum Manifold Pressure vs. Pressure Altitude .....	5-26
	Power Setting Table.....	5-27
5-31	Cruise Speed vs. Altitude .....	5-28
5-33	Range.....	5-29
5-35	Endurance .....	5-30
5-37	Fuel, Time, and Distance to Descend .....	5-31
5-39	Glide Time and Distance.....	5-32
5-41	Balked Landing Climb .....	5-33
5-43	Landing Distance Over 50 Ft. Obstacle .....	5-34
5-45	Landing Ground Roll .....	5-35

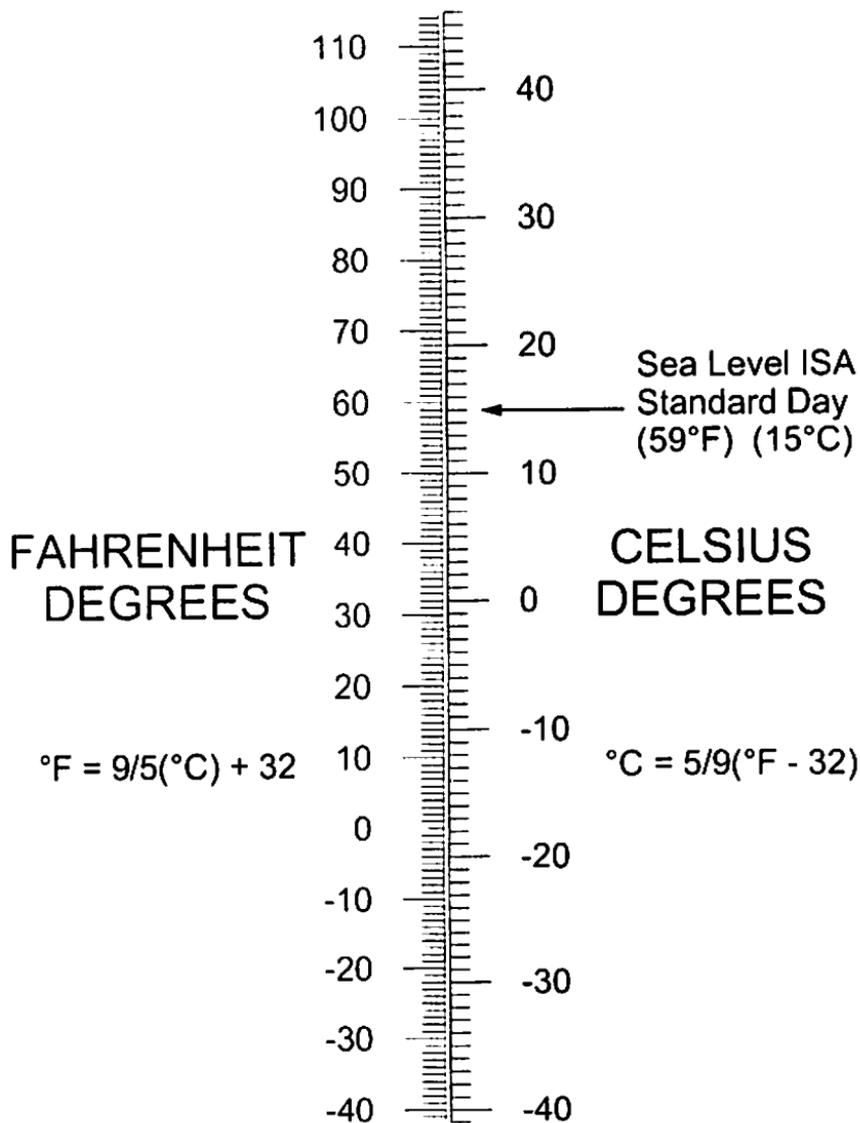
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## CONVERSION TABLE

MULTIPLY	BY	TO OBTAIN
Feet	0.3048	Meters
Meters	3.2808	Feet
Gallons	3.7854	Liters
Liters	0.2642	Gallons
Pounds	0.4536	Kilograms
Kilograms	2.2046	Pounds
Inches of Mercury	33.8639	Millibars
Millibars	0.02953	Inches of Mercury

Example: 50 feet = 50 x 0.3048 meters = 15.24 meters  
 100 liters = 100 x 0.2642 gallons = 26.42 gallons

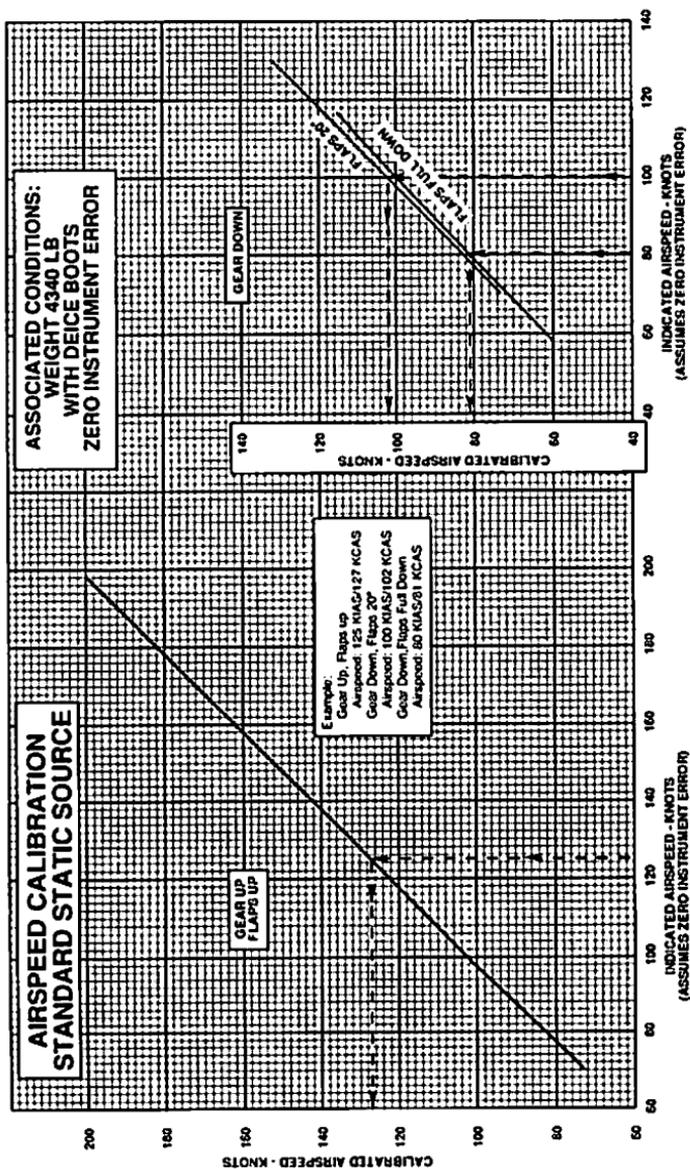
**CONVERSION TABLE**  
Figure 5-1



TEMPERATURE CONVERSION

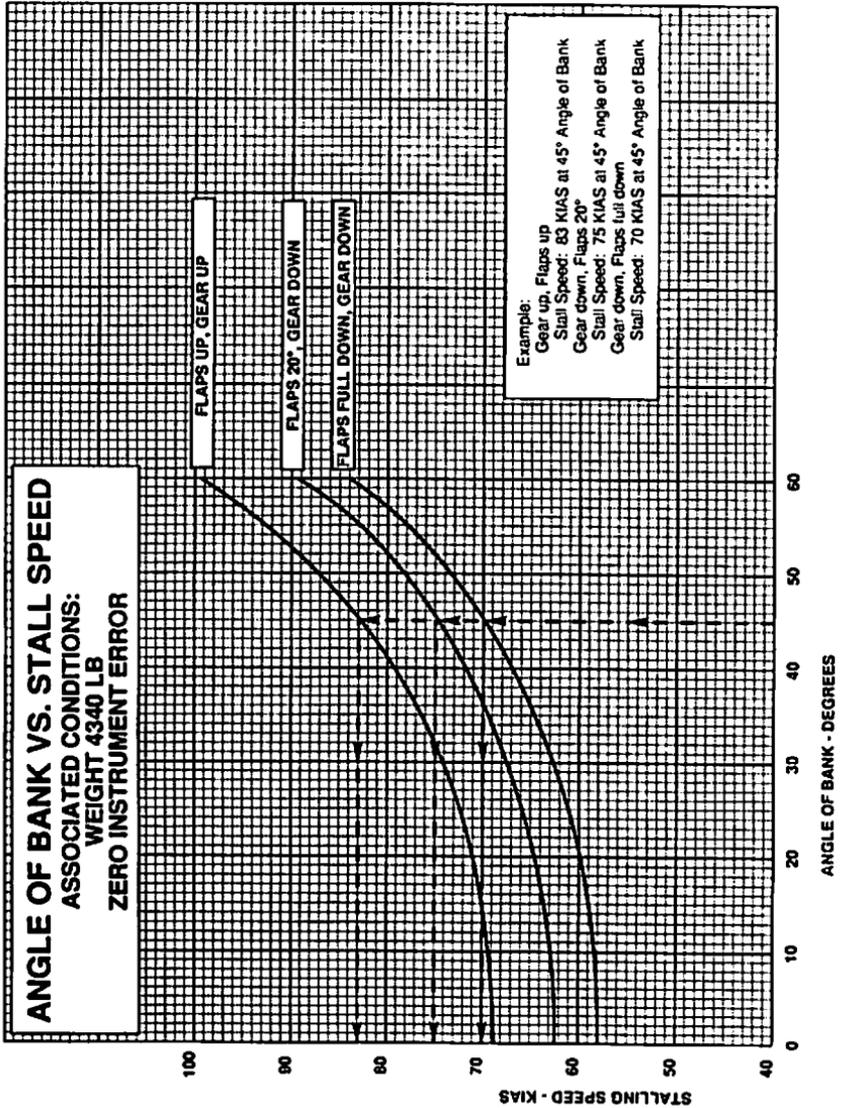
Figure 5-3

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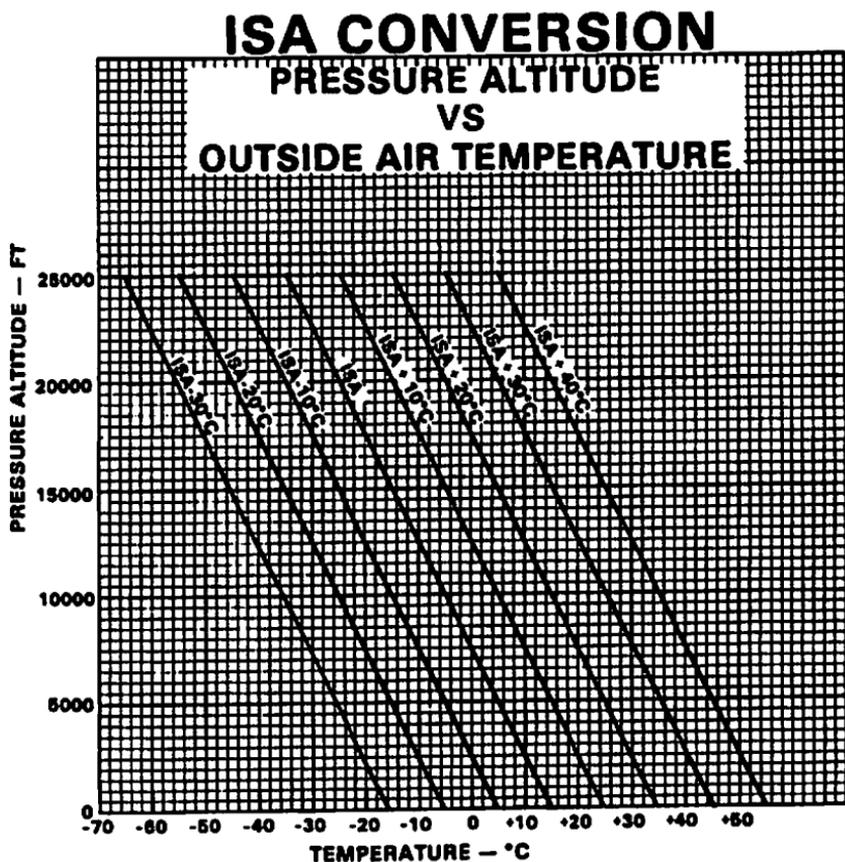
AIRSPEED CALIBRATION

Figure 5-5



ANGLE OF BANK vs. STALL SPEED

Figure 5-7



PRESSURE ALTITUDE vs. OUTSIDE AIR TEMPERATURE

Figure 5-9

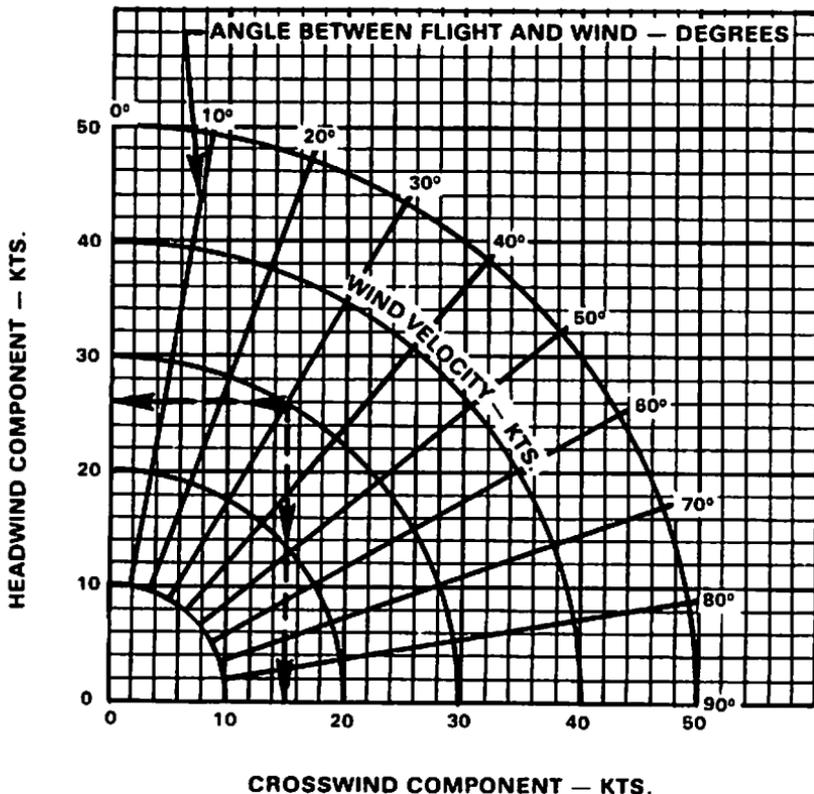
Example:

Wind velocity: 30 knots

Angle between flight path and wind: 30°

Headwind component: 26 knots

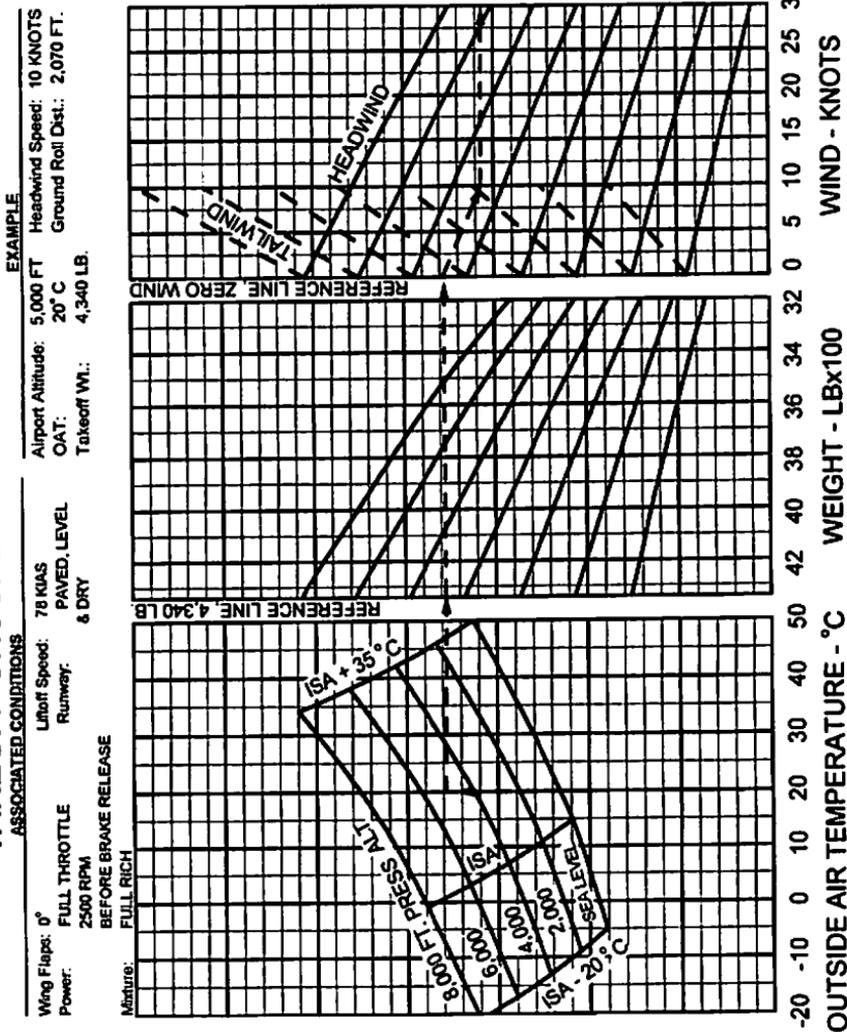
Crosswind components: 15 knots



WIND COMPONENTS

Figure 5-11

# TAKEOFF GROUND ROLL DISTANCE - 0° FLAPS

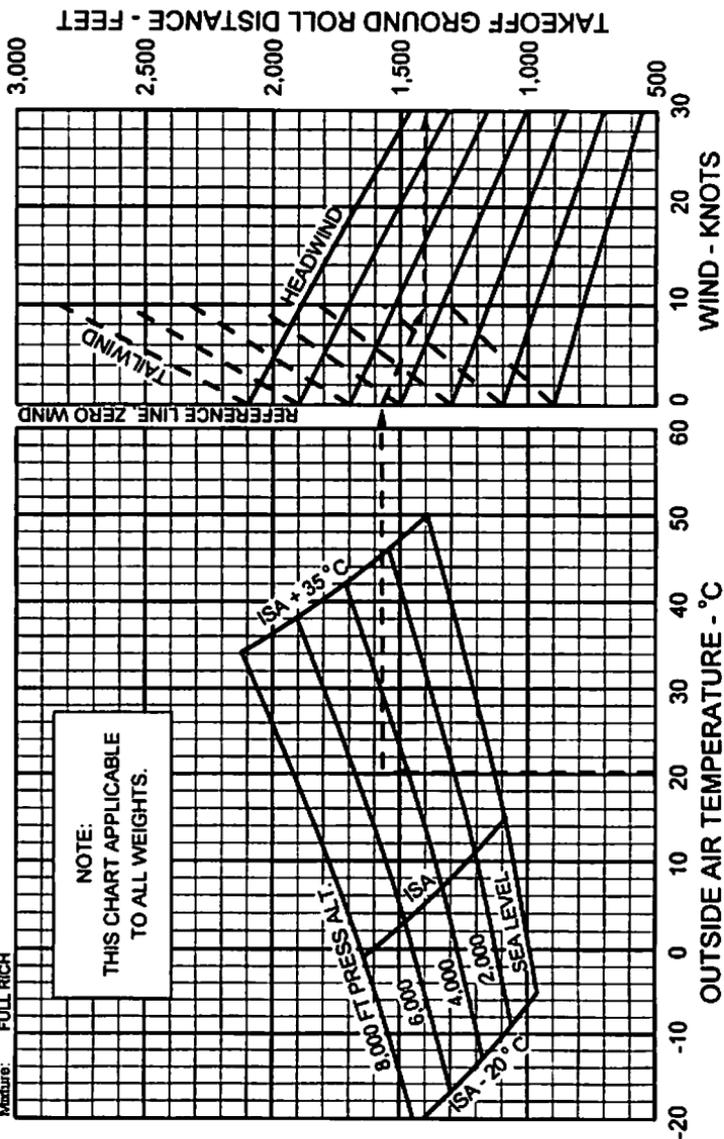


TAKEOFF GROUND ROLL, 0° FLAPS

Figure 5-13

**TAKEOFF GROUND ROLL DISTANCE - 20° FLAPS**

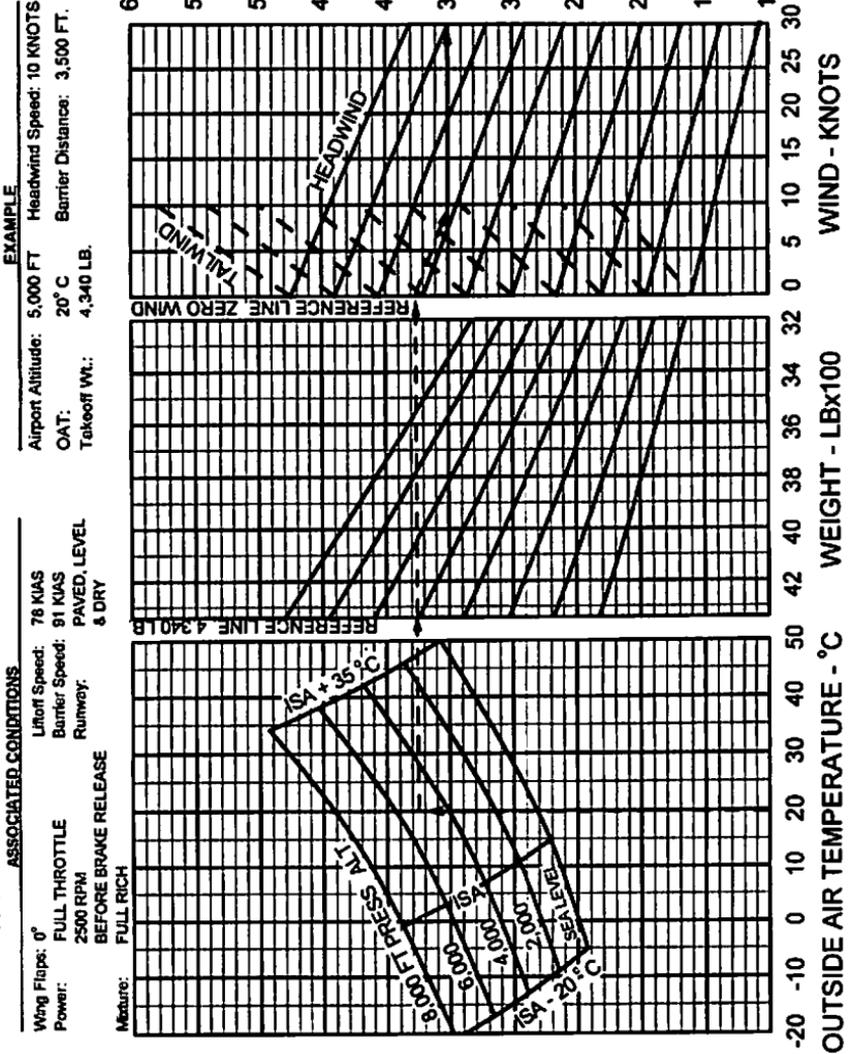
<b>ASSOCIATED CONDITIONS</b>		<b>EXAMPLE</b>	
Wing Flaps: 20°	Liftoff Speed: 69 KIAS	Airport Altitude: 5,000 FT	Headwind Speed: 10 KNOTS
Power: FULL THROTTLE	Runway: PAVED, LEVEL & DRY	OAT: 20° C	Takeoff Ground Roll Dist.: 1,406 FT.
	BEFORE BRAKE RELEASE	Takeoff Wt.: ALL	
Mixture: FULL RICH			



**TAKEOFF GROUND ROLL, 20° FLAPS**

Figure 5-15

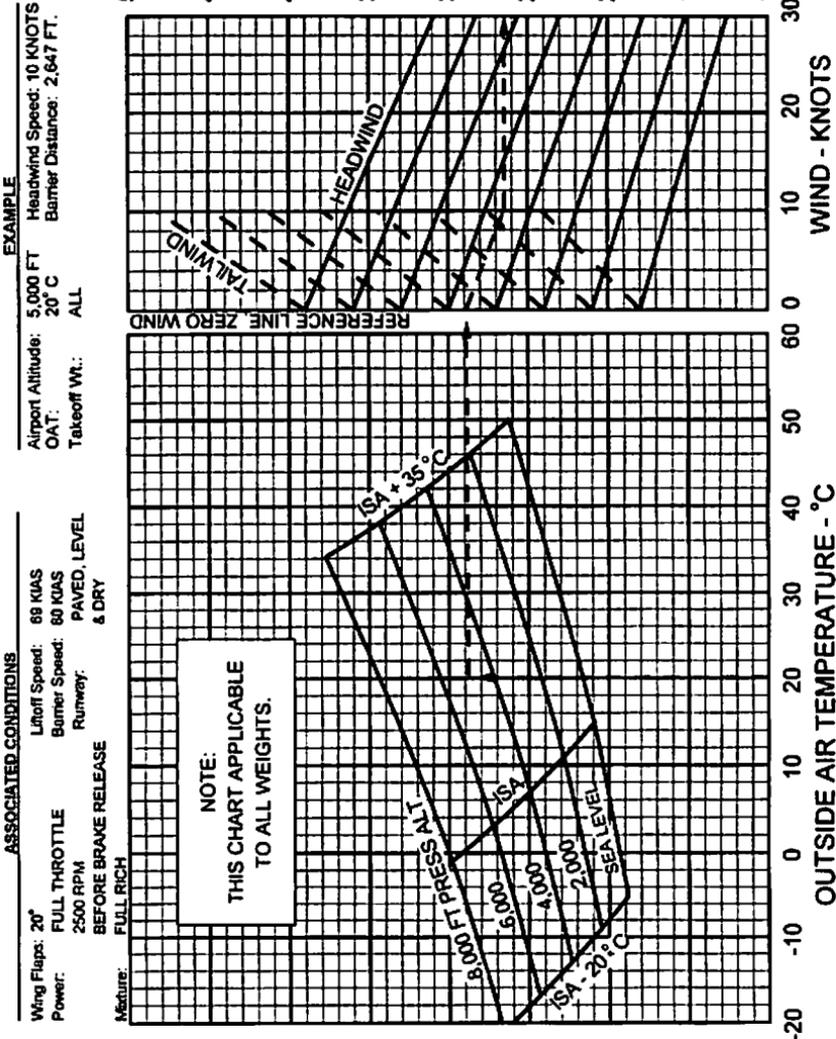
**TAKEOFF DISTANCE OVER 50 FT OBSTACLE - 0° FLAPS**



TAKEOFF DISTANCE OVER 50 FT. OBSTACLE, 0° FLAPS

Figure 5-17

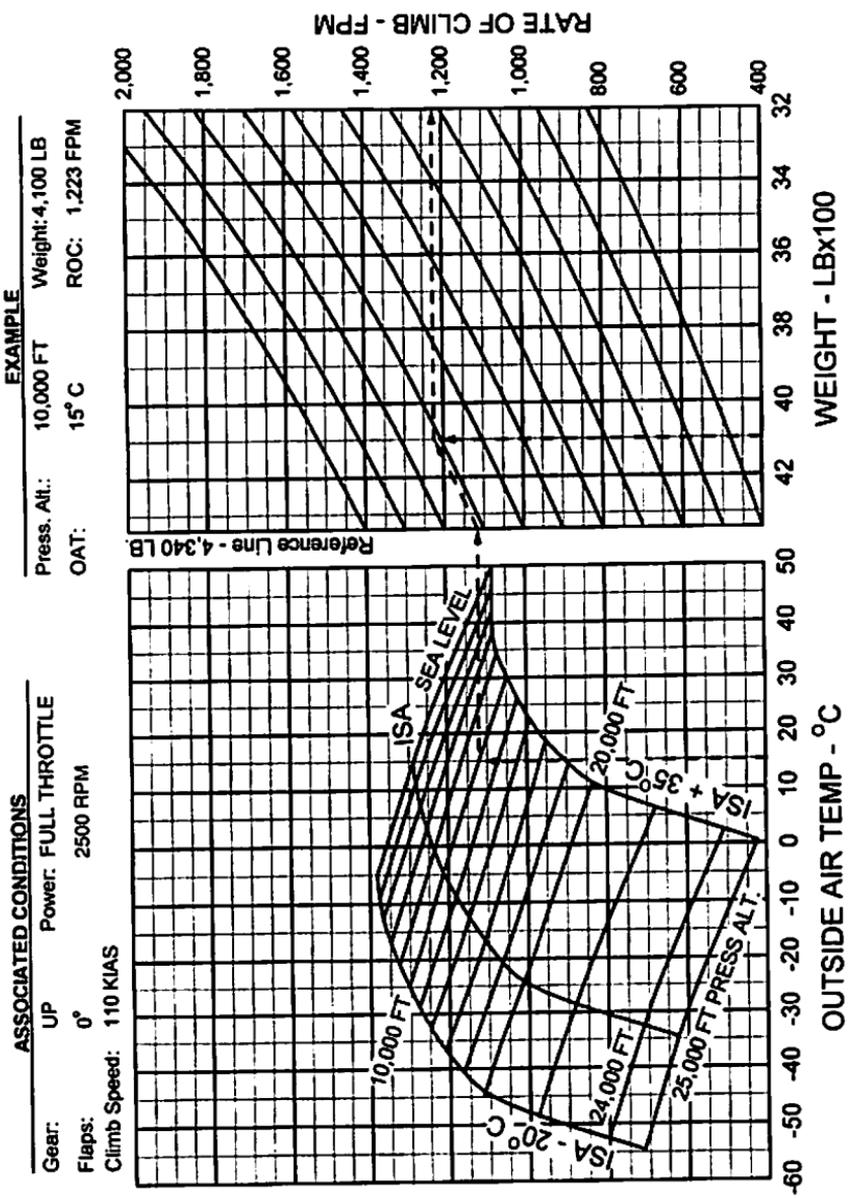
**TAKEOFF DISTANCE OVER 50 FT OBSTACLE - 20° FLAPS**



TAKEOFF DISTANCE OVER 50 FT. OBSTACLE, 20° FLAPS

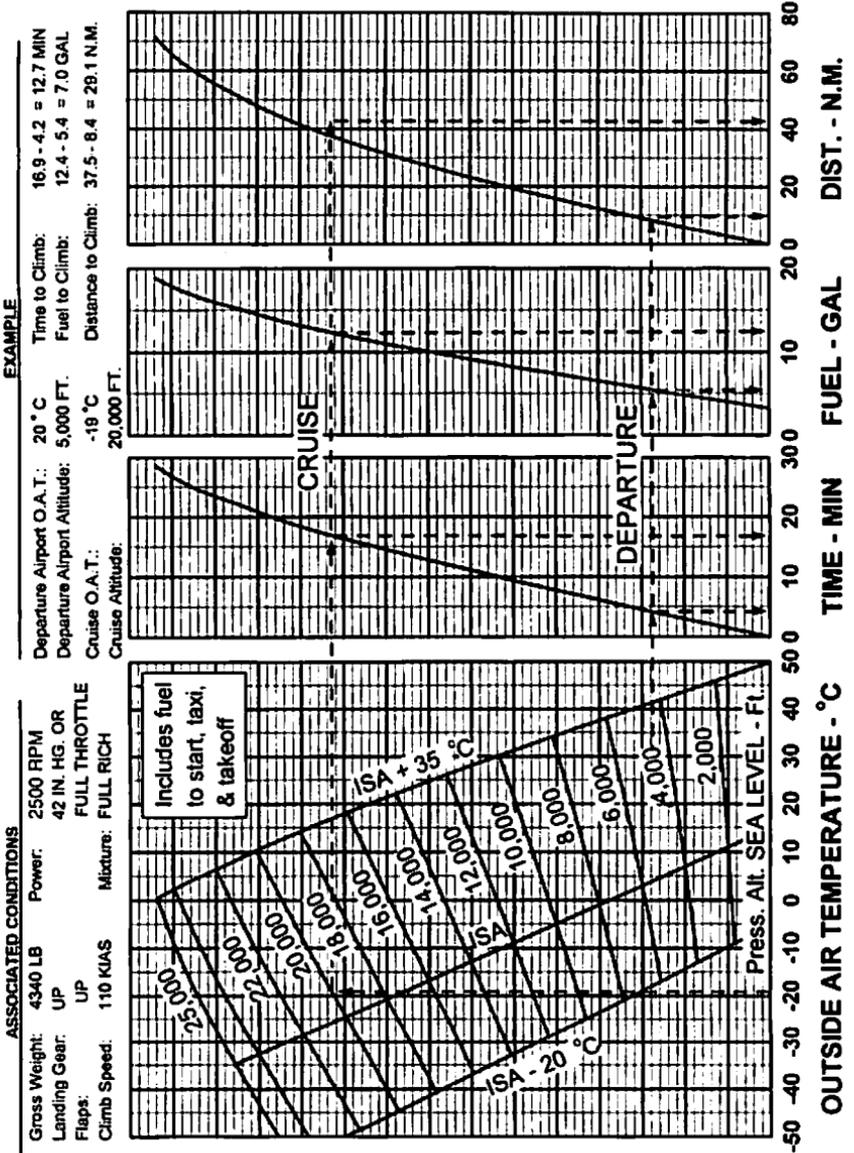
Figure 5-19

**MAXIMUM CLIMB PERFORMANCE**



**RATE OF CLIMB**  
Figure 5-21

**TIME, FUEL, DISTANCE TO MAX CLIMB**



**MAXIMUM CONTINUOUS POWER  
TIME, FUEL, AND DISTANCE TO CLIMB (110 KIAS)**

Figure 5-23

**TIME, FUEL, DISTANCE TO CLIMB**

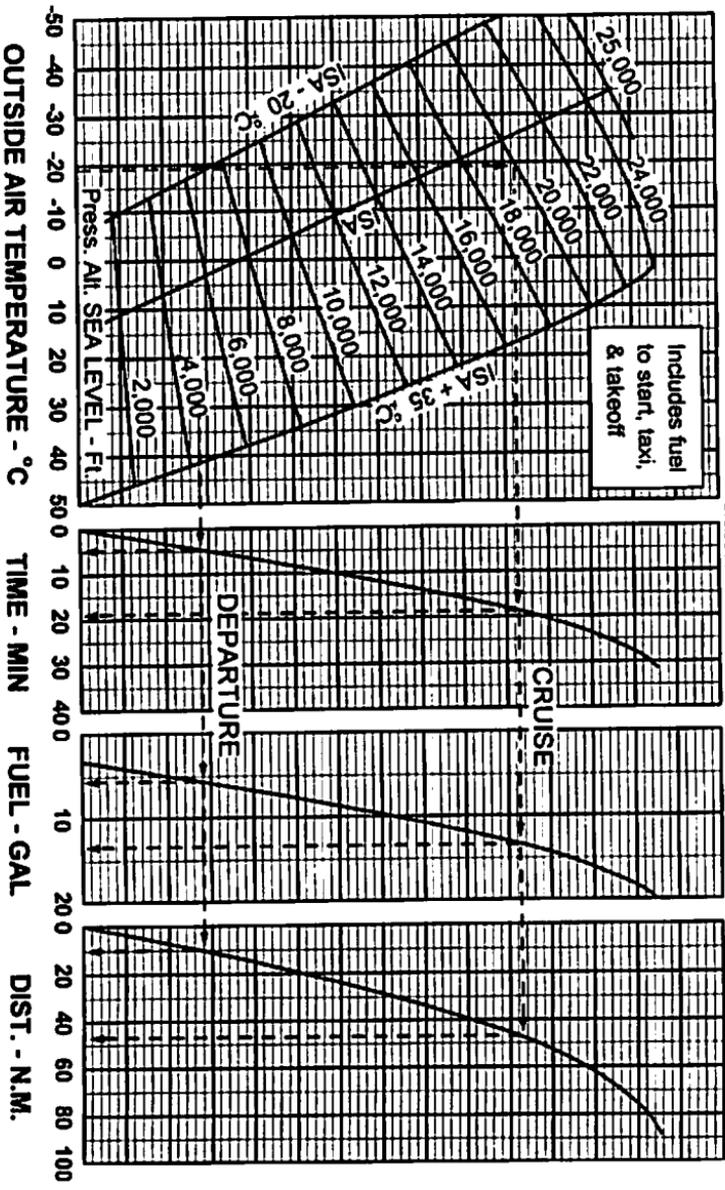
ASSOCIATED CONDITIONS

Gross Weight: 4,340 LB Power: 2500 RPM  
 Landing Gear: UP 42 IN. HG. OR FULL THROTTLE  
 Flaps: UP Mixture: FULL RICH  
 Climb Speed: 125 KIAS

Includes fuel to start, taxi, & takeoff

Departure Airport O.A.T.: 20 °C Time to Climb: 18.8 - 4.7 = 14.1 MIN  
 Departure Airport Altitude: 5,000 FT. Fuel to Climb: 13.5 - 5.7 = 7.8 GAL  
 Cruise O.A.T.: -19 °C Distance to Climb: 47.6 - 10.1 = 37.5 N.M.  
 Cruise Altitude: 20,000 FT.

MAXIMUM CONTINUOUS POWER  
 TIME, FUEL, AND DISTANCE TO CLIMB (125 KIAS)  
 Figure 5-25



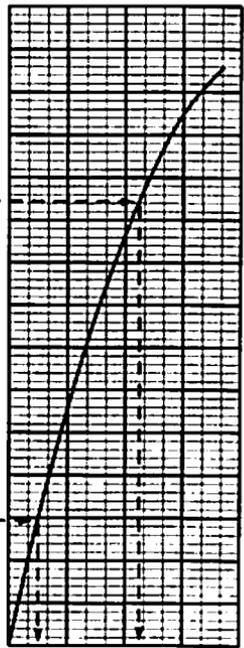
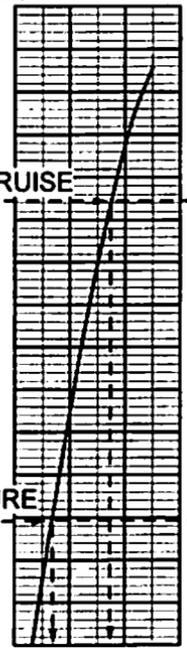
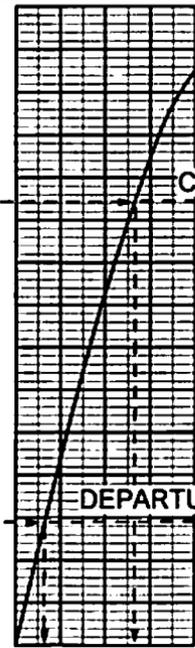
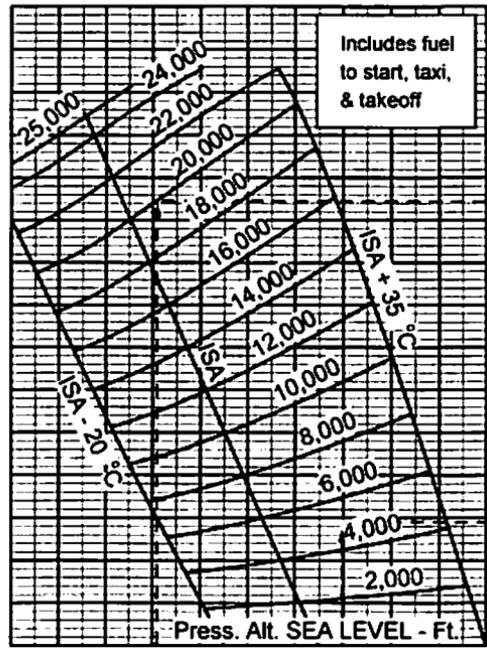
# TIME, FUEL, DISTANCE TO CRUISE CLIMB

## ASSOCIATED CONDITIONS

Gross Weight:	4,340 LB	Power:	2500 RPM
Landing Gear:	UP		35 IN. HG.
Flaps:	UP	Fuel Flow:	32 GPH
Climb Speed:	125 KIAS		

## EXAMPLE

Departure Airport O.A.T.:	20 °C	Time to Climb:	26.7 - 6.4 = 20.3 MIN
Departure airport Altitude:	5,000 FT.	Fuel to Climb:	17.4 - 6.9 = 10.5 GAL
Cruise O.A.T.:	-19 °C	Distance to Climb:	67.8 - 15.4 = 52.4 N.M.
Cruise Altitude:	20,000 FT.		

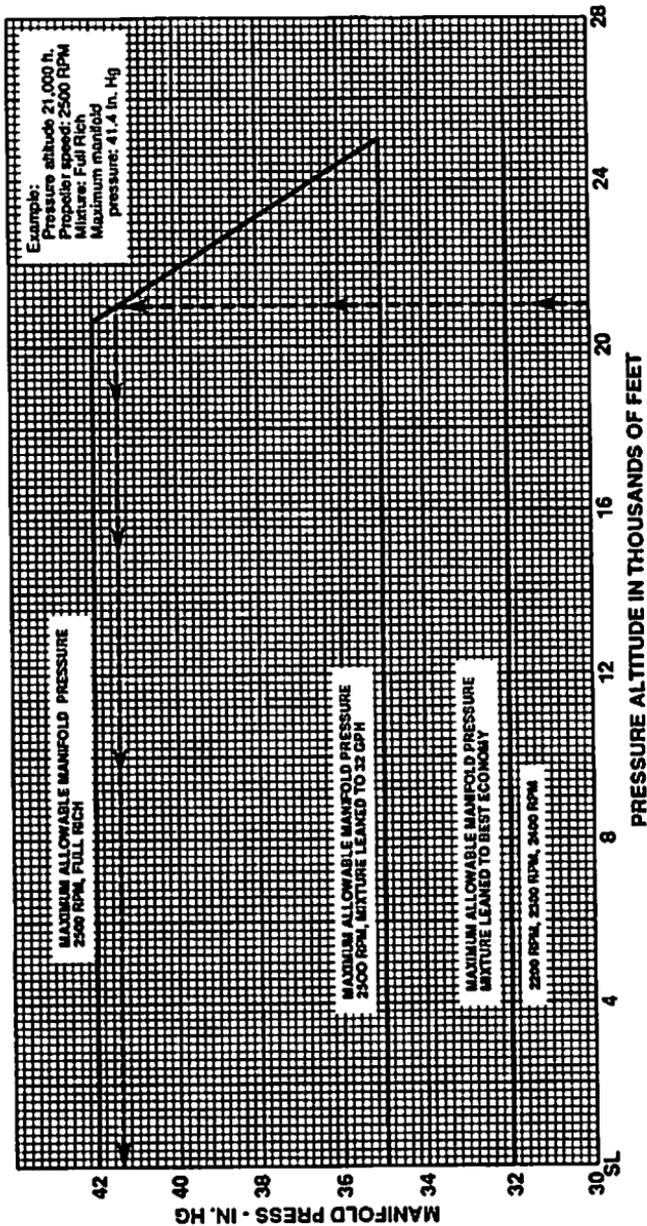


OUTSIDE AIR TEMPERATURE - °C      TIME - MIN      FUEL - GAL      DIST. - N.M.

CRUISE CLIMB  
TIME, FUEL, AND DISTANCE TO CLIMB

Figure 5-27

MAXIMUM MANIFOLD PRESSURE  
VS  
PRESSURE ALTITUDE



MAXIMUM MANIFOLD PRESSURE  
vs. PRESSURE ALTITUDE

Figure 5-29

POWER SETTING TABLE  
REFERENCE FIG. 5-31

## ASSOCIATED CONDITIONS

	RPM	Man. Press.	Approx. Fuel Flow @ 20,000 ft	TIT
High Speed Cruise	2500	32" Hg	20 GPH	Lean to Peak
Normal Cruise	2500 2400	29" Hg 30" Hg	18 GPH	Lean to Peak
Economy Cruise	2400 2200	25" Hg 26" Hg	15 GPH	Lean to Peak
Long Range Cruise	2200	20" Hg	11 GPH	Lean to Peak

The higher rpm settings should be used at altitudes above 20,000 ft.

The cruise speeds are shown at mid-cruise weight, 3900 pounds. The speed differential for weight is 0.7 knots per 100 pounds, faster at lighter weights and slower at heavier weights.

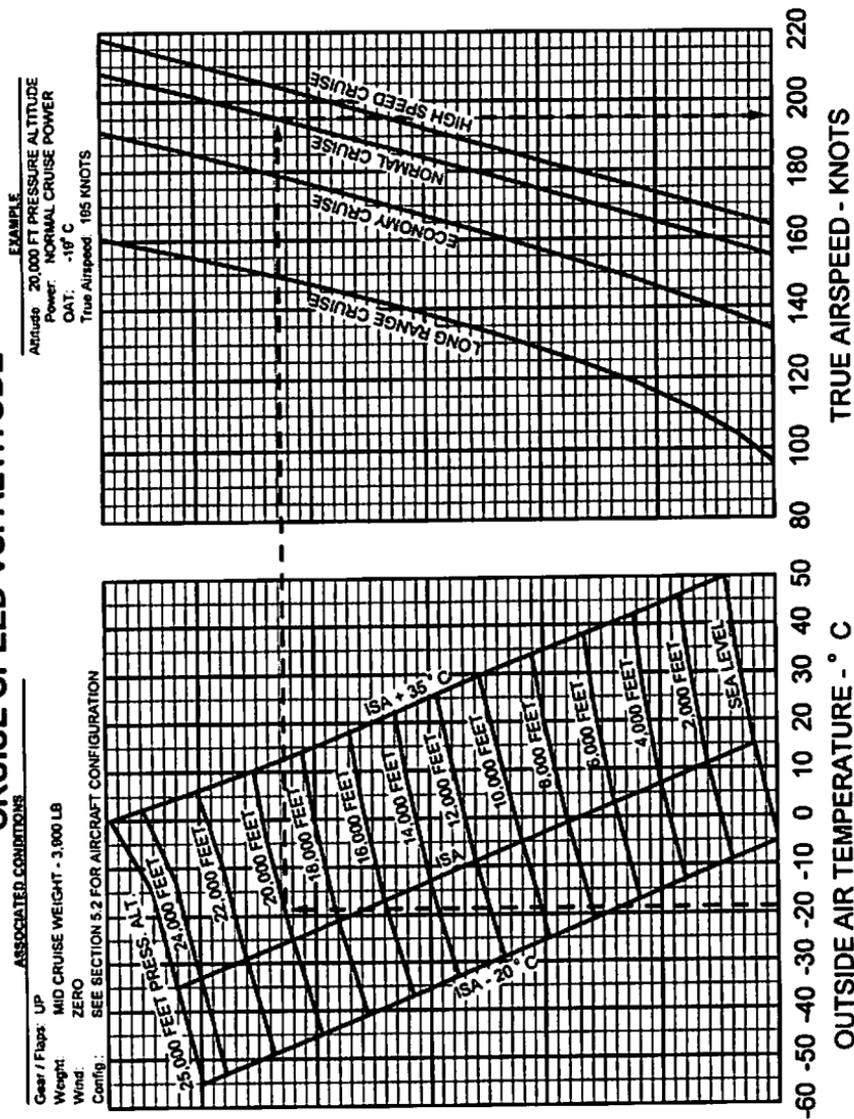
The leaning procedure is to establish peak TIT.

## \*Example:

Cruise altitude: 20,000 ft  
 Cruise OAT: -19° C  
 Cruise power: Normal cruise  
 Cruise weight: 3900 lb  
 Cruise fuel flow: 18 gph  
 Cruise speed: 195 KTAS

\*Reference Figure 5-31

CRUISE SPEED VS. ALTITUDE



CRUISE SPEED vs. ALTITUDE

Figure 5-31

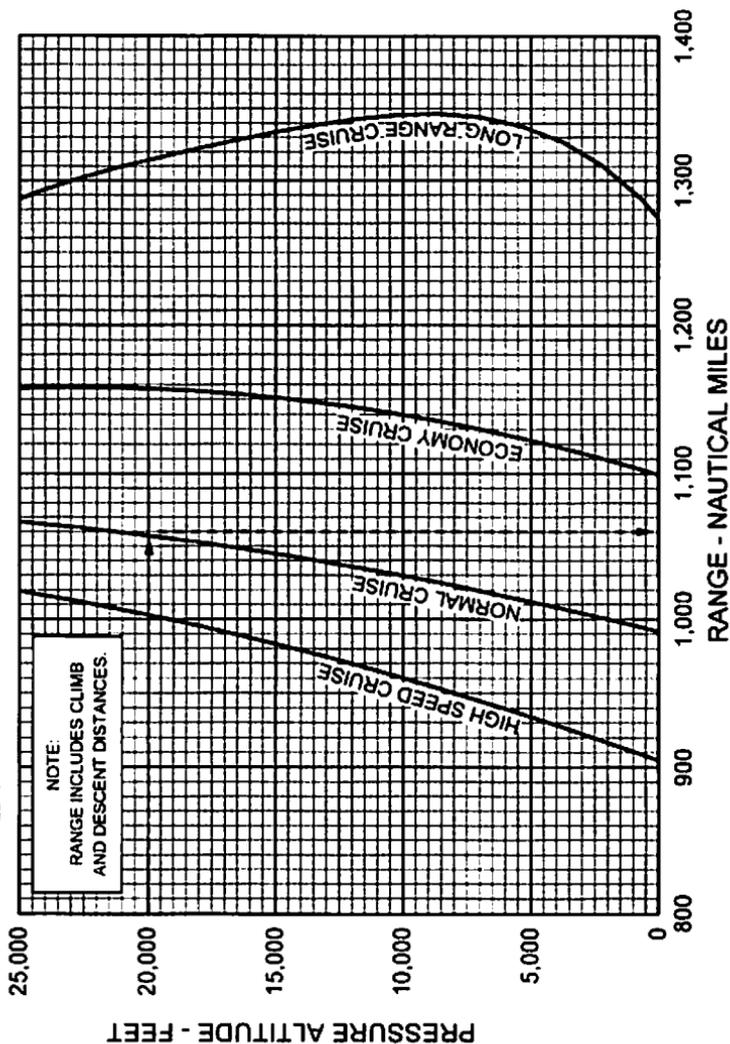
ISA RANGE

ASSOCIATED CONDITIONS:

Gear / Flaps UP  
 Weight MID CRUISE WEIGHT - 3900 LB  
 Reserve 45 MIN AT LONG RANGE CRUISE POWER  
 Usable Fuel 120 GALLONS  
 Wind ZERO

EXAMPLE:

Power Setting NORMAL CRUISE  
 Cruise 20,000 FT PRESSURE ALTITUDE  
 Range 1080 NAUTICAL MILES



ISA RANGE  
Figure 5-33

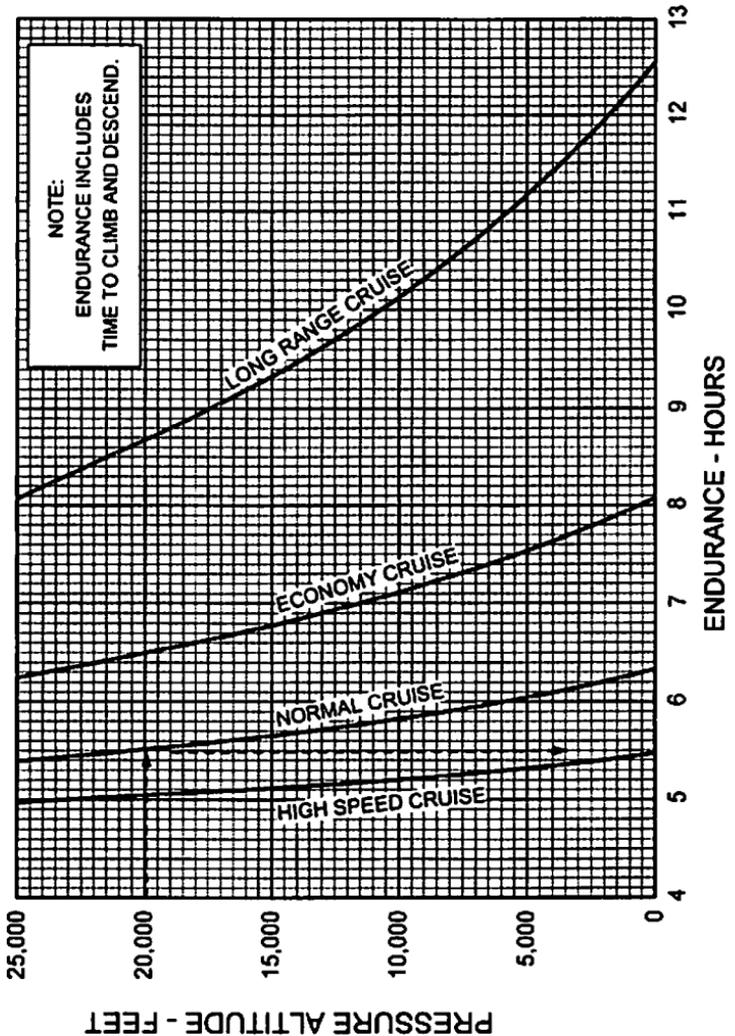
**ISA ENDURANCE**

**ASSOCIATED CONDITIONS:**

Gear / Flaps: UP  
 Reserve: 45 MIN AT LONG RANGE CRUISE POWER  
 Usable Fuel: 120 GALLONS

**EXAMPLE:**

Power Setting: NORMAL CRUISE  
 Cruise: 20,000 FT PRESSURE ALTITUDE  
 Endurance: 5.5 HOURS



**ISA ENDURANCE**

Figure 5-35

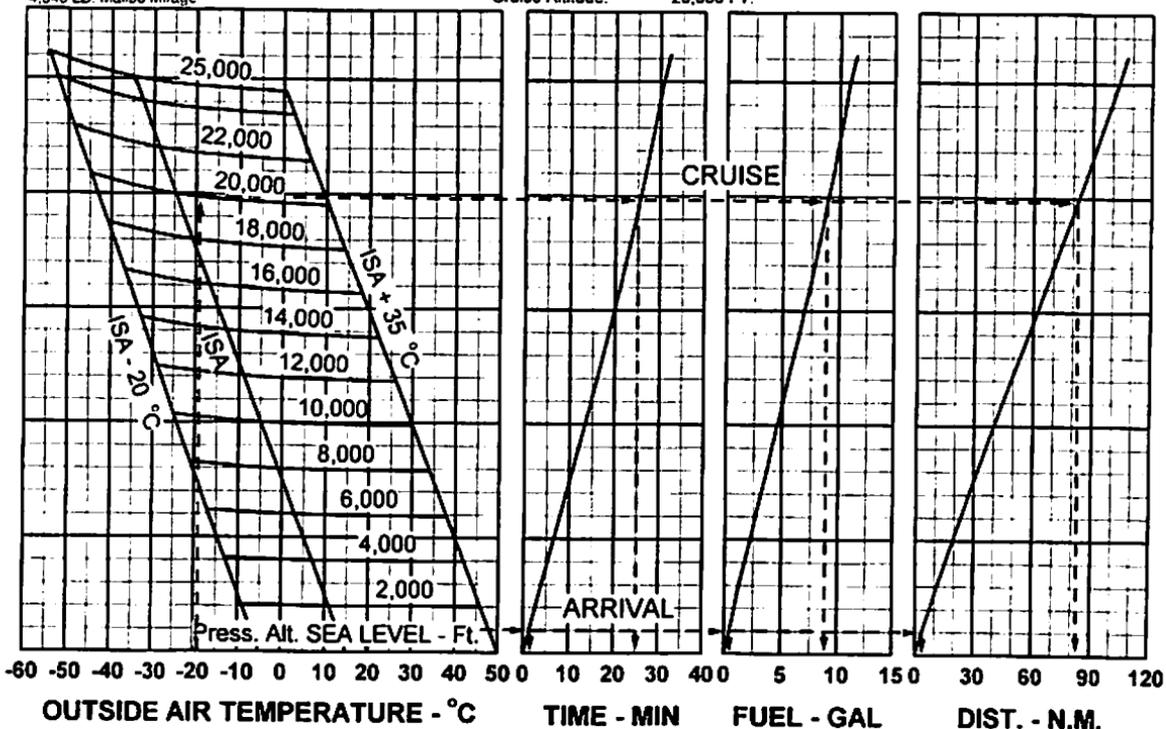
# TIME, FUEL, DISTANCE TO DESCEND

## ASSOCIATED CONDITIONS

Landing Gear: UP Power: 2400 RPM  
 Flaps: UP 25 IN. HG.  
 Descend Speed: 165 KIAS Mixture: 1350°F TIT  
 ZERO WIND  
 4,340 LB. Malibu Mirage

## EXAMPLE

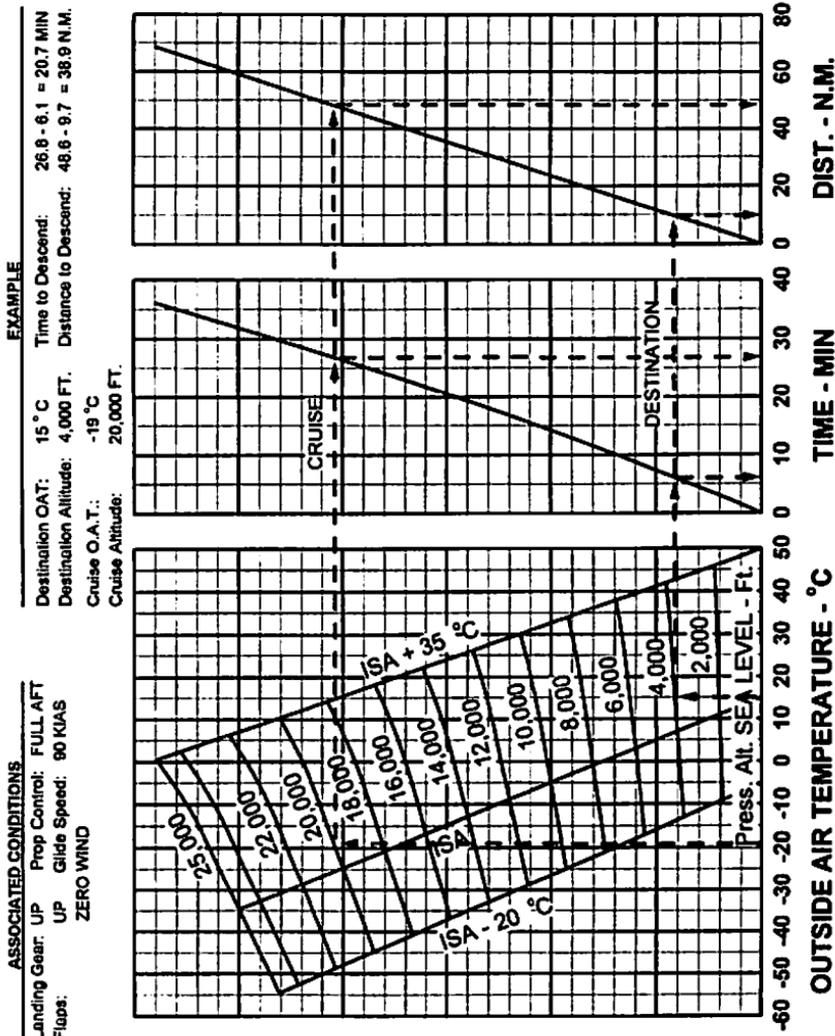
Arrival Airport O.A.T.: 25 °C Time to Descend: 25.1 - 1.4 = 23.7 MIN  
 Arrival Airport Altitude: 1,000 FT. Fuel to Descend: 8.9 - 0.5 = 8.4 GAL  
 Cruise O.A.T.: -19 °C Distance to Descend: 82.4 - 3.6 = 78.8 N.M.  
 Cruise Altitude: 20,000 FT.



FUEL, TIME, AND DISTANCE TO DESCEND

Figure 5-37

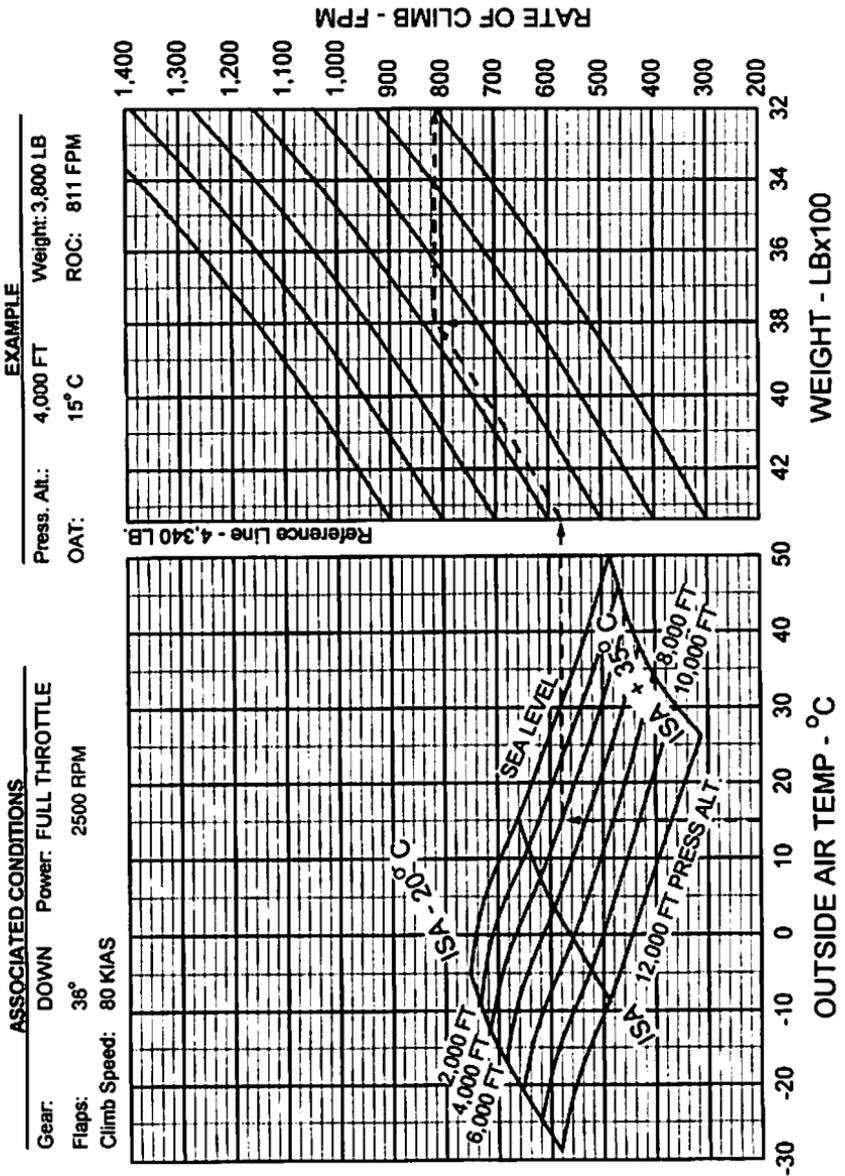
# GLIDE TIME, & DISTANCE



GLIDE TIME AND DISTANCE

Figure 5-39

**BALKED LANDING CLIMB PERFORMANCE**

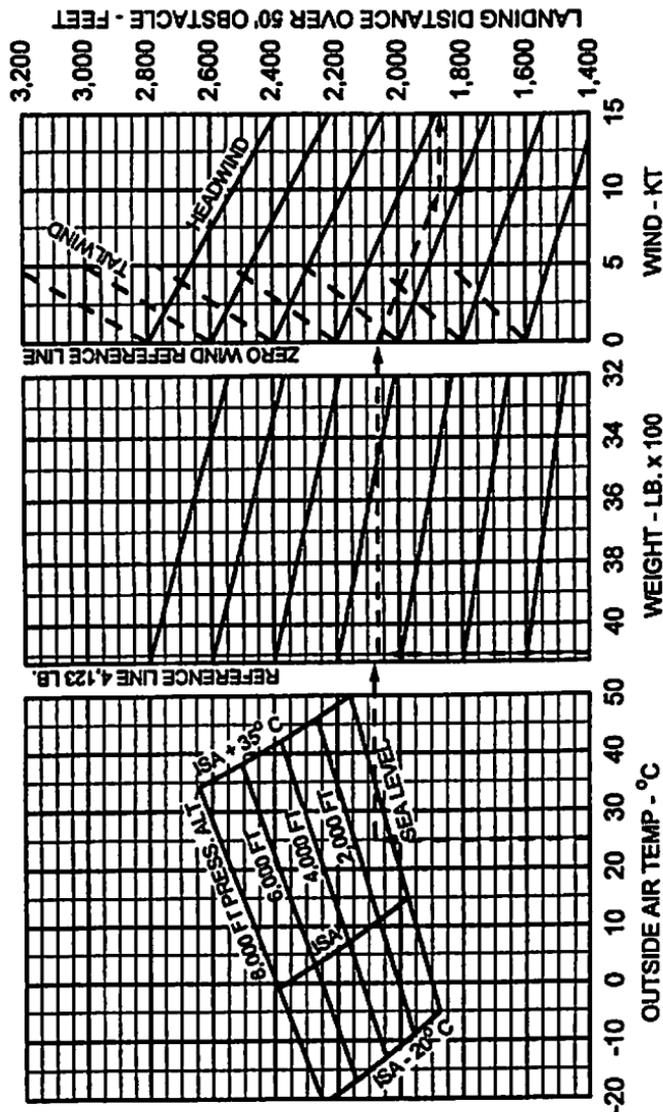


**BALKED LANDING CLIMB**

Figure 5-41

# LANDING PERFORMANCE

<b>ASSOCIATED CONDITIONS</b>		<b>EXAMPLE</b>	
Gear: DOWN	Braking: HEAVY	Press. Alt.: 1,000 FT	Headwind: 10 KT
Flaps: 36°	Approach speed: 78 KIAS	OAT: 25°C	Weight: 4,100 LB
Throttle: CLOSED	Touch Down: FULL STALL	Landing Distance: 1,870 FEET	
RUNWAY PAVED, LEVEL, & DRY			



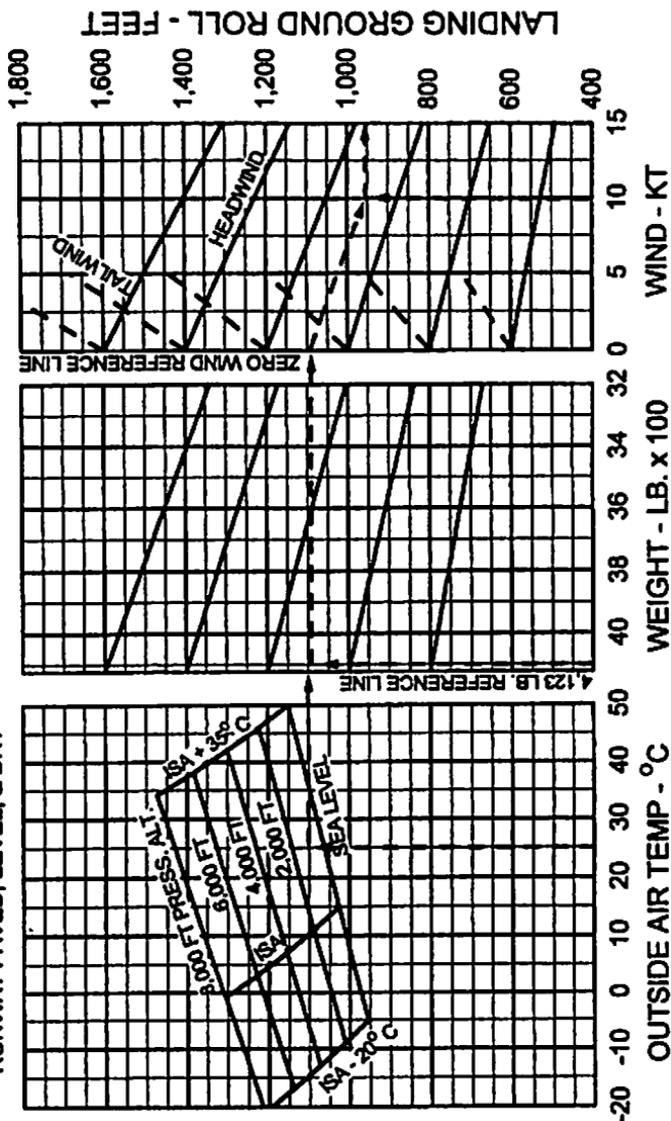
LANDING DISTANCE OVER 50 FT. OBSTACLE

Figure 5-43

# LANDING GROUND ROLL DISTANCE

**ASSOCIATED CONDITIONS**  
 Gear: DOWN Throttle: CLOSED  
 Flaps: 36° Braking: HEAVY  
 FULL STALL TOUCH DOWN  
 RUNWAY PAVED, LEVEL, & DRY

**EXAMPLE**  
 Press. Alt.: 1,000 FT Headwind: 10 KT  
 OAT: 25°C Weight: 4,100 LB  
 Landing Ground Roll: 955 FEET



LANDING GROUND ROLL

Figure 5-45

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TABLE OF CONTENTS  
SECTION 6  
WEIGHT AND BALANCE

Paragraph No.		Page No.
6.1	General .....	6-1
6.3	Airplane Weighing Procedure .....	6-2
6.5	Weight and Balance Data and Record .....	6-5
6.7	General Loading Recommendations .....	6-9
6.9	Weight and Balance Determination for Flight .....	6-10
	Equipment List (Form 240-0127).....	Supplied with aircraft paperwork

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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 takeoff is attempted.

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, 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.

### **6.1 GENERAL (continued)**

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 (2 gallons total, 1 gallon each wing).**

**6.3 AIRPLANE WEIGHING PROCEDURE (continued)****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 ensure that no air exists in the fuel supply lines.

- (4) Fill with oil to full capacity.
- (5) Place pilot and copilot seats in fifth (5th) 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 the airplane on scales, insert a 3.4-inch spacer on each of the main gear struts and a 3.0-inch spacer on the nose gear strut.
- (2) Level airplane (refer to Figure 6-3) deflating (or inflating as required) 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.

**6.3 AIRPLANE WEIGHING PROCEDURE (continued)**

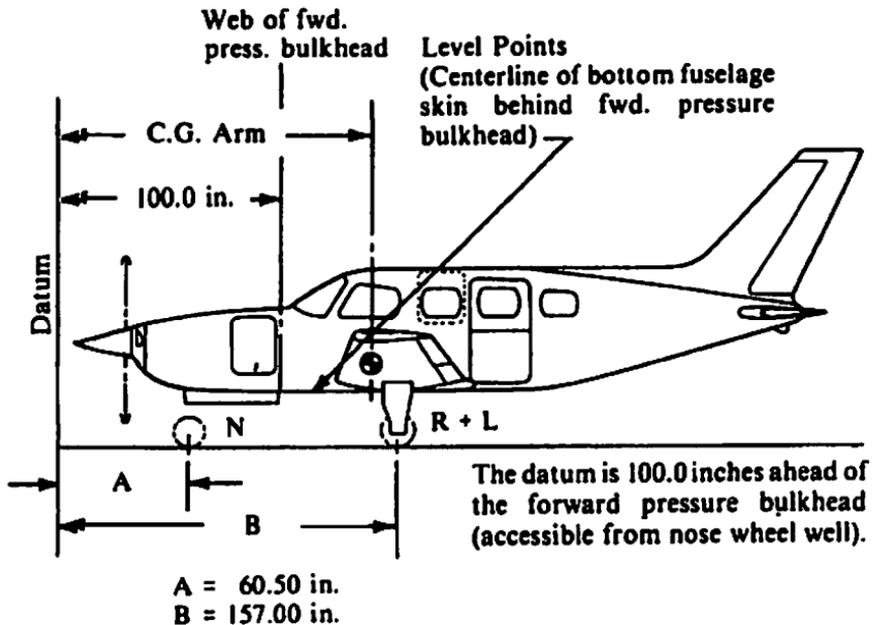
Scale Position and Symbol	Scale Reading	Tare	Net Weight
Nose Wheel (N)			
Right Main Wheel (R)			
Left Main Wheel (L)			
Basic Empty Weight, as Weighed (T)			

**WEIGHING FORM**

Figure 6-1

(d) Basic Empty Weight Center of Gravity

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



**LEVELING DIAGRAM**

Figure 6-3

**6.3 AIRPLANE WEIGHING PROCEDURE (continued)**

- (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:

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

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

**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.

**6.5 WEIGHT AND BALANCE DATA AND RECORD (continued)**

**MODEL PA-46R-350T MATRIX**

Airplane Serial Number \_\_\_\_\_

Registration Number \_\_\_\_\_

Date \_\_\_\_\_

**AIRPLANE BASIC EMPTY WEIGHT**

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

\*The standard empty weight includes full oil capacity and 2.0 gallons of unusable fuel.

**AIRPLANE USEFUL LOAD - NORMAL CATEGORY OPERATION**

$(\text{Ramp Weight}) - (\text{Basic Empty Weight}) = \text{Useful Load}$

$(4358 \text{ lbs}) - (\quad \text{ lbs}) = \quad \text{ lbs.}$

**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-46-350P		Serial Number	Registration Number			Page Number		
Date	Item No.	Description of Article or Modification	Added (+) Removed (-)	Weight Change			Running Basic Empty Weight	
				Wt. (Lb.)	Arm (In.)	Moment /100	Wt. (Lb.)	Moment /100
		As licensed						

**WEIGHT AND BALANCE RECORD**  
Figure 6-7

ISSUED: OCTOBER 26, 2009

REPORT: VB-2122

6-7

PA-46-350P		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

Figure 6-7 (continued)

**6.7 GENERAL LOADING RECOMMENDATIONS**

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.

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 first. Investigation is required to determine the amount of forward baggage and fuel.
- (b) 2 Occupants - Pilot and Passenger in Front  
Load rear baggage compartment first. Fuel load may be limited by forward envelope.
- (c) 3 Occupants - 2 in front, 1 in rear  
Fuel and baggage in nose may be limited by forward envelope.
- (d) 4 Occupants - 2 in front, 2 in rear  
Investigation is required to determine optimum fuel and baggage load.
- (e) 5 Occupants - 2 in front, 1 in middle, 2 in rear  
Investigation is required to determine optimum fuel and baggage load.  
(Note: Placard if installed.)
- (f) 6 Occupants - 2 in front, 2 in middle, 2 in rear  
With six occupants, aft passengers weight, fuel and baggage may be limited by envelope. Investigation is required to determine optimum fuel and baggage load. (Note: Placard if installed.)

**NOTE**

With takeoff loadings falling near the aft limit, it is important to check anticipated landing loadings since fuel burn could result in a final loading outside of the approved envelope.

**NOTE**

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 envelope while in flight.

Always load the fuel equally between the right and left tanks.

**6.9 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT**

- (a) Add the weight of all items to be loaded, except fuel, to the basic empty weight to determine zero fuel 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 zero fuel weight 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.
- (f) Add the weight of the fuel to be loaded to the total weight calculated for item (a) to determine ramp weight.
- (g) Use the loading graph (Figure 6-13) to determine the moment of the fuel to be loaded and add to the total moment determined for item (c).
- (h) Subtract the weight and moment of the fuel allowance for engine start, taxi, and runup.
- (i) Divide the total moment by the total weight to determine takeoff C.G.
- (j) Locate the takeoff weight center of gravity 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.
- (k) Subtract the Estimated Fuel Burnoff from the Takeoff Weight to determine the Landing Weight C.G.
- (l) Locate the landing weight center of gravity 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.

**6.9 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT  
(continued)**

	Weight (Lb)	Arm Aft of Datum (Inches)	Moment (In.-Lb)
Basic Empty Weight	3156.5	135.33	427169
Pilot and Front Passenger	320	135.50	43360
Passengers (Center Seats)	340	177.00	60180
Passengers (Rear Seats)	140	218.75	30625
Baggage (Forward) (100 Lb Limit)	0	88.60	0
Baggage (Aft) (100 Lb Limit)	80	248.23	19858
Zero Fuel Weight (4123 Lb Max.)	4036.5	143.98	581193
Fuel (120 Gal./720 Lb Max. Usable)	321.5	150.31	48328
Ramp Weight (4358 Lb Max.)	4358	144.45	629520
Fuel Allowance for Engine Start, Taxi, & Runup (3 Gal./18 Lb Max.)	-18	150.31	-2706
Takeoff Weight (4340 Lb Max.)	4340	144.43	626815

The center of gravity (C.G.) for the takeoff weight of this sample loading problem is at 144.43 inches aft of the datum line. Locate this point (144.43) on the C.G. range and weight graph (Figure 6-15). Since this point falls within the weight - C.G. envelope, this loading meets the weight and balance requirements.

Takeoff Weight	4340	144.43	626815
Minus Estimated Fuel Burn-off (climb & cruise) @ 6.0 Lb/Gal.	-258.50	150.31	-38855
Landing Weight	4081.50	144.05	587960

Locate the center of gravity of the landing weight on the C.G. range and weight graph (Figure 6-15). Since this point falls within the weight - C.G. envelope, the loading is acceptable for landing.

**IT IS THE SOLE RESPONSIBILITY OF THE PILOT IN COMMAND TO ENSURE THAT THE AIRPLANE IS LOADED PROPERLY AT ALL TIMES.**

**SAMPLE LOADING PROBLEM  
(NORMAL CATEGORY)**

Figure 6-9

**6.9 WEIGHT AND BALANCE DETERMINATION FOR FLIGHT  
(continued)**

	Weight (Lb)	Arm Aft of Datum (Inches)	Moment (In.-Lb)
Basic Empty Weight			
Pilot and Front Passenger		135.50	
Passengers (Center Seats)		177.00	
Passengers (Rear Seats)		218.75	
Baggage (Forward) (100 Lb Limit)		88.60	
Baggage (Aft) (100 Lb Limit)		248.23	
Zero Fuel Weight (4123 Lb Max.)			
Fuel (120 Gal./720 Lb Max. Usable)		150.31	
Ramp Weight (4358 Lb Max.)			
Fuel Allowance for Engine Start, Taxi, & Runup (3 Gal./18 Lb Max.)	-18	150.31	-2706
Takeoff Weight (4340 Lb Max.)			

Locate the center of gravity (C.G.) of the takeoff weight on the C.G. range and weight graph (Figure 6-15). If this point falls within the weight - C.G. envelope, the loading is acceptable for takeoff.

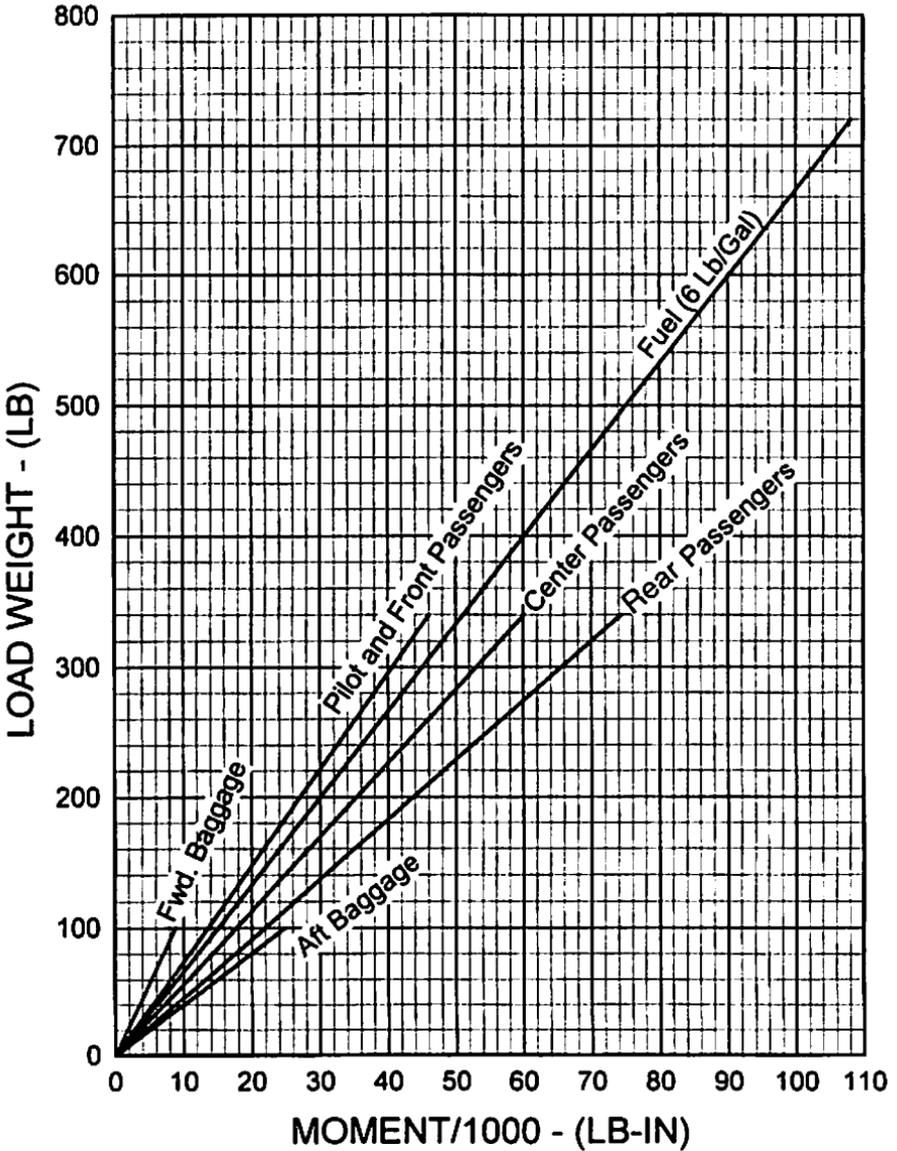
Takeoff Weight			
Minus Estimated Fuel Burn-off (climb & cruise) @ 6.0 Lb/Gal.		150.31	
Landing Weight			

Locate the center of gravity of the landing weight on the C.G. range and weight graph (Figure 6-15). If this point falls within the weight - C.G. envelope, the loading is acceptable for landing.

**IT IS THE SOLE RESPONSIBILITY OF THE PILOT IN COMMAND TO ENSURE THAT THE AIRPLANE IS LOADED PROPERLY AT ALL TIMES.**

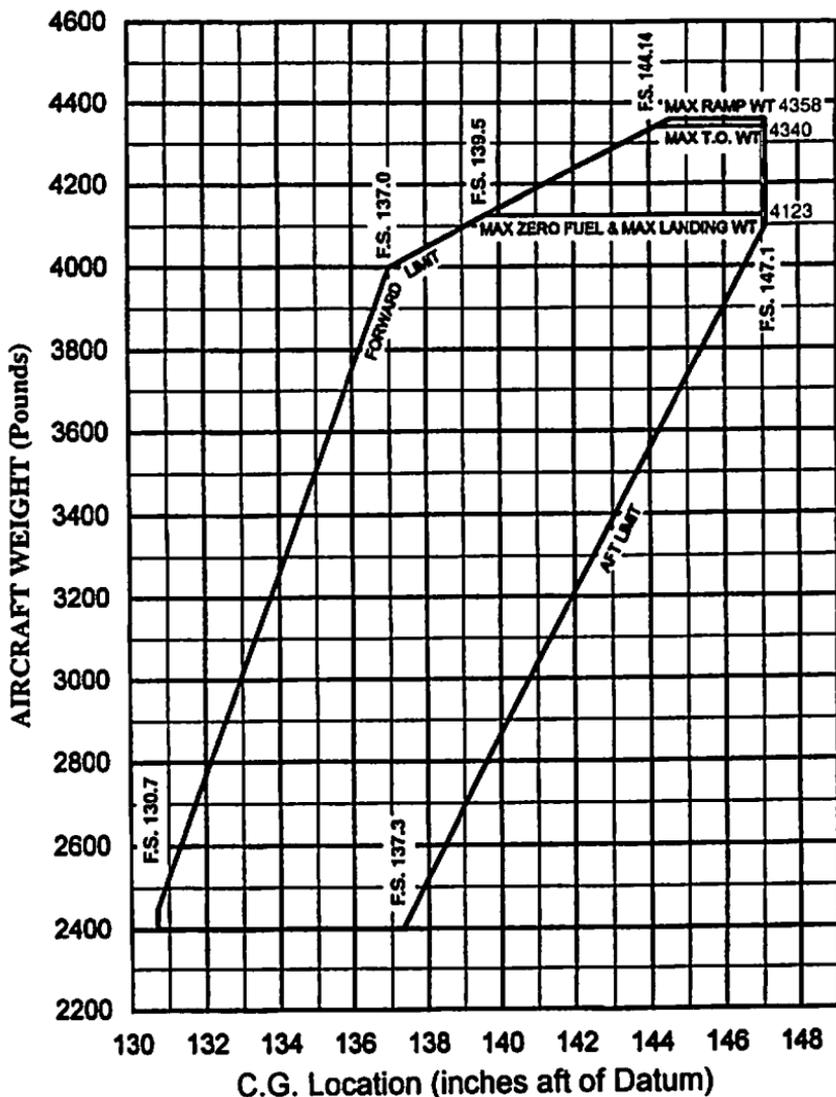
**WEIGHT AND BALANCE LOADING FORM  
(NORMAL CATEGORY)**

Figure 6-11



LOADING GRAPH

Figure 6-13



C.G. RANGE AND WEIGHT GRAPH

Figure 6-15

**TABLE OF CONTENTS**  
**SECTION 7**  
**DESCRIPTION AND OPERATION**  
**OF THE AIRPLANE AND ITS SYSTEMS**

Paragraph No.		Page No.
7.1	The Airplane.....	7-1
7.3	The Airframe.....	7-1
7.5	Engine and Propeller.....	7-2
7.6	Air Induction System.....	7-7
7.7	Engine Controls.....	7-8
7.8	Garmin G1000 Avionics System.....	7-11
7.9	Standby Instruments.....	7-43
7.11	Hydraulic System.....	7-45
7.13	Landing Gear.....	7-47
7.15	Brake System.....	7-51
7.17	Flight Control System.....	7-52
7.19	Fuel System.....	7-53
7.21	Electrical System.....	7-57
7.23	Instrument Panel.....	7-66
7.25	Pitot Static System.....	7-68
7.27	Environmental System.....	7-70
7.29	Oxygen System.....	7-73
7.31	Vacuum System.....	7-75
7.33	Cabin Features.....	7-77
7.35	Baggage Area.....	7-79
7.37	Finish.....	7-79

**TABLE OF CONTENTS (continued)  
SECTION 7  
DESCRIPTION AND OPERATION  
OF THE AIRPLANE AND ITS SYSTEMS**

<b>Paragraph No.</b>		<b>Page No.</b>
7.39	Stall Warning .....	7-79
7.41	Emergency Locator Transmitter.....	7-80
7.43	External Power .....	7-81

## **SECTION 7 DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS**

### **7.1 THE AIRPLANE**

The PA-46R-350T Matrix is a single engine, all metal, retractable landing gear, low wing, turbocharged airplane. It has seating for six occupants and two separate luggage compartments.

### **7.3 THE AIRFRAME**

The primary airframe is of aluminum alloy construction, with a steel combination engine mount - nose gear support structure. The nose cowl is also made of aluminum. The rear section of the dorsal fairing is fiberglass.

The fuselage is an all metal, semi-monocoque structure with flush riveted skin. The skin has internally bonded doublers and is butt jointed at all seams not in the airflow direction. There are three basic fuselage sections: the forward baggage section, the cabin section, and the tail cone section

The seating arrangement includes two crew seats and four passenger seats. The forward passenger seats face aft, and all passenger seats have adjustable backs with built-in headrests. An inside baggage area is provided aft of the rear passenger seats.

Cabin access is through the main cabin door, located on the left side, aft of the wing. The main door is a horizontally split door with retractable steps in the lower half. The upper half is held open by a gas spring. A plug type, inward releasing, emergency egress door is located on the right side adjacent to the aft facing seat.

Windows include a two-piece windshield, pilot, copilot and six passenger side windows.

The forward baggage compartment has a locking door on the left side, forward of the wing.

### **7.3 THE AIRFRAME (continued)**

The wing is a three section structure. The center section built-up main spar extends through the lower fuselage and outboard of each main landing gear. This section has a forward spar and a rear spar which are pin jointed at the fuselage sides. The main landing gear retracts inward into recesses located aft of the main spar. The outboard section of each wing, to within approximately 18 inches of the tip, is a sealed integral fuel cell. Portions of the wing structure are adhesively bonded, and skins are butt jointed and flush riveted for a smooth airfoil surface.

The all-metal flaps are electrically actuated through a mechanical linkage. The flaps extend aft and down on three tracks and have four preselect positions.

The all-metal ailerons are mass balanced and operated by a cable system mounted on the aft wing spar.

Retractable tiedown rings are installed on the bottom of each wing outboard of the main landing gear. The rings are spring loaded to retract into the lower wing surface when not in use. When retracted, a small ring protuberance extends below the wing surface. Applying a slight forward pulling force to the protrusion will extend the ring.

The empennage is of conventional fin and rudder, stabilizer and elevator design with aerodynamic and mass balanced control surfaces. Surfaces are of all-metal construction and the single-piece elevator assembly carries a center-mounted trim tab. This tab operates to combine anti-servo and trim functions.

Access panels on the fuselage, wings and empennage are removable for service and inspection purposes.

Electrical bonding is provided to ensure good electrical continuity between components. Lightning strike protection is provided in accordance with presently accepted practices. Anti-static wicks are provided on trailing edges of ailerons, elevator and rudder to discharge static electricity that might cause avionics interference.

### **7.5 ENGINE AND PROPELLER**

#### **ENGINE**

The Matrix is powered by a Textron Lycoming TIO-540-AE2A engine. It is a direct drive, horizontally opposed, overhead valve, fuel injected, air cooled, turbocharged-intercooled engine with variable absolute pressure controller. Maximum rated power is 350 HP at 2500 RPM and 42.0 in. Hg. manifold pressure. Accessories include a starter, two magnetos, a propeller governor, two belt-driven alternators, two gear-driven vacuum

## 7.5 ENGINE AND PROPELLER (continued)

pumps and a belt-driven air conditioner compressor.

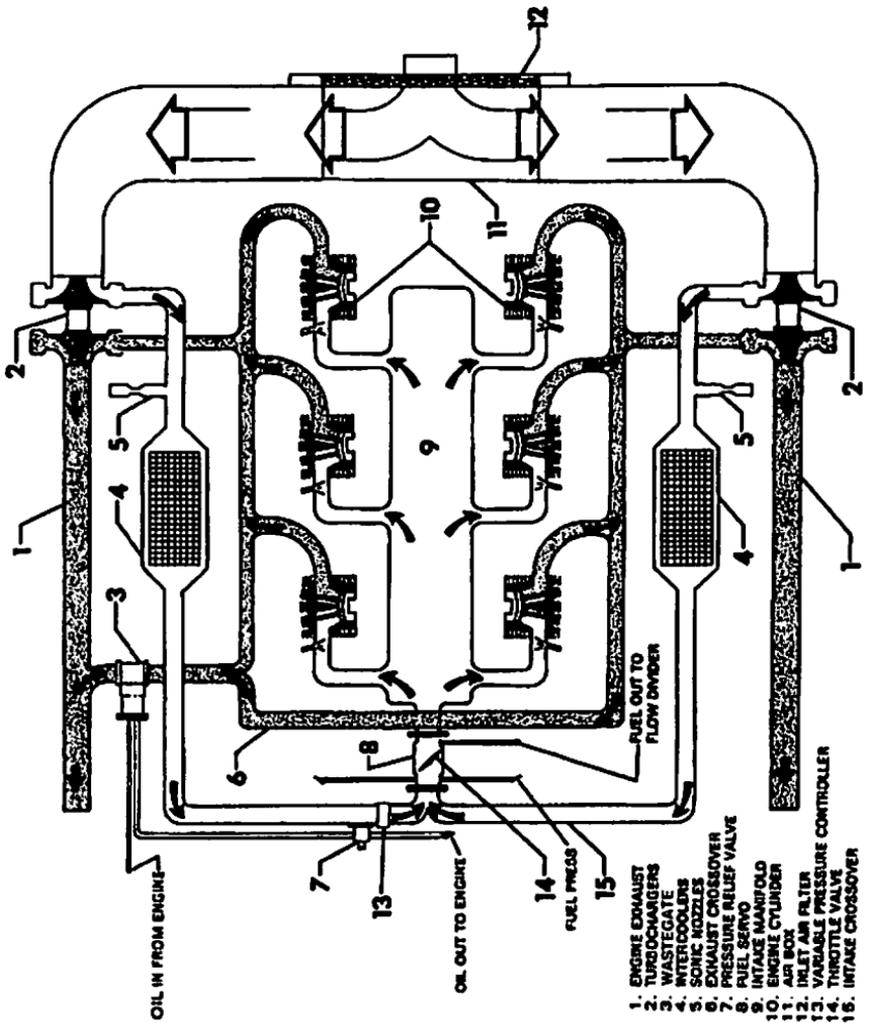
Turbocharging (Figure 7-1) is accomplished by two Garrett - A.I.D. turbo-compressors, one located on each side of the engine. Turbochargers extract energy from engine cylinder exhaust gases and use this energy to compress engine induction air. This allows the engine to maintain rated manifold pressure at altitude. When engine induction air is compressed by the turbocharger, the air temperature is increased. The elevated air temperature is reduced by air intercoolers located on each side of the engine. This aids in engine cooling and improves engine power and efficiency.

Each turbocharger extracts exhaust energy from its respective bank of cylinders to pressurize the induction air. Air flows through the induction inlet louvers into the induction air box, where it is filtered and divided for distribution to the left and right turbo compressors. At the compressor, air pressure and temperature are increased. Pressure increases air density making a greater mass of air available to the engine cylinders on each intake stroke. Air then flows through an intercooler where air temperature is reduced, further increasing the density of air available to each cylinder. Downstream the intercoolers, air flow joins at the "Y" junction of intake tubes at the lower back of the engine, then passes through the fuel injector, into the intake manifold, where it is divided to individual intake pipes flowing to each cylinder. Metered fuel is injected into the cylinder head, upstream of the intake valve. After the fuel burns in the cylinder, exhaust gases flow into the exhaust manifold and then to turbocharger turbines where exhaust energy is extracted to drive the compressor.

Turbo compressed air is throttled across the throttle butterfly valve as set by the throttle lever. A control system monitors pressure and uses engine oil pressure to automatically position the wastegate valve. The wastegate bleeds excess exhaust gas from the exhaust manifold crossover pipe and out the left exhaust stack, bypassing the turbocharger. Thus the controller automatically maintains manifold pressure.

The engine is well protected against overboost damage from excessive manifold pressure. The wastegate controller senses manifold pressure and will continually adjust turbocharger output, maintaining the manifold pressure set by the throttle. The controller automatically protects the engine from overboost damage by limiting manifold pressure to 42.0 in. Hg. In the event of a controller malfunction, there is a pressure relief valve on the induction manifold which will relieve manifold pressure and prevent an overboost.

7.5 ENGINE AND PROPELLER (continued)



- 1. ENGINE EXHAUST
- 2. TURBOCHARGERS
- 3. WASTEGATE
- 4. INTERCOOLERS
- 5. SONIC NOZZLES
- 6. EXHAUST CROSSOVER
- 7. FUEL PRESSURE RELIEF VALVE
- 8. INTAKE MANIFOLD
- 9. ENGINE CYLINDER
- 10. AIR BOX
- 11. INLET AIR FILTER
- 12. VARIABLE PRESSURE CONTROLLER
- 13. THROTTLE VALVE
- 14. INTAKE CROSSOVER

TURBO-INDUCTION SYSTEM

Figure 7-1

## 7.5 ENGINE AND PROPELLER (continued)

When descending from altitude, care should be exercised to maintain engine power and temperatures (oil, CHT). Sudden cooling or gradual extreme cooling of engine cylinders will accelerate engine wear. Follow normal descent procedures described in Section 4.

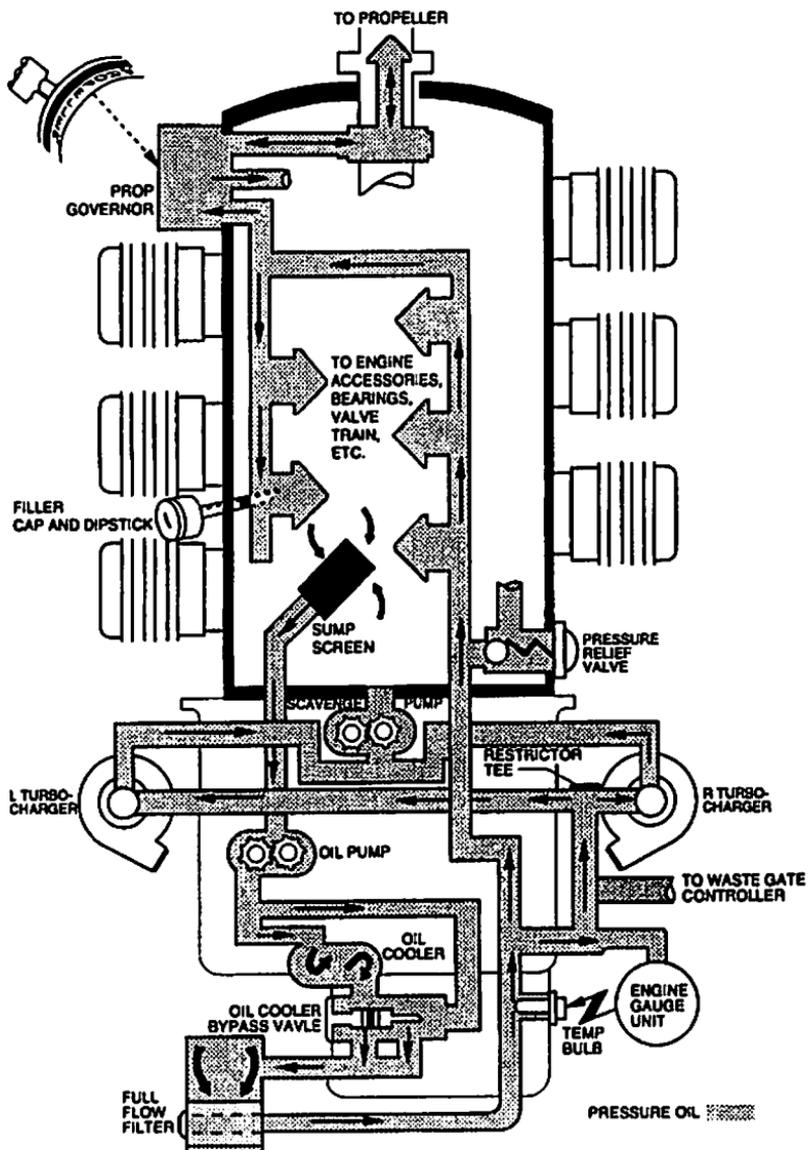
The engine is equipped with a Bendix RSA-10ED1 fuel injection system. An engine-driven fuel pump supplies fuel under pressure to the fuel injection regulator, which measures air flow and meters the correct proportion of fuel to a flow divider. The flow divider then directs the fuel to each of the individual cylinder injector nozzles. A fuel vent system provides a common reference vent pressure to the fuel pressure switch, engine-driven fuel pump and injection nozzles. The vent source is taken downstream of the turbochargers to ensure proper vent pressure during turbocharger operation.

The engine employs a full pressure, 12 quart wet sump lubrication system (Figure 7-3). Maximum endurance flights should begin with 12 quarts of oil. The sump is filled through a combination dipstick oil filler cap. Lubricating oil is drawn through the oil sump inlet screen by the engine oil pump and directly to the oil cooler and a thermostatic bypass valve. When engine oil is cold, the thermostatic bypass valve will open allowing oil to flow directly to the full flow oil filter bypassing the cooler. As the oil warms up, the bypass valve will close thereby forcing more oil to circulate through the cooler prior to entering the oil filter. From the oil filter, the oil passes through an oil pressure relief valve which regulates system oil pressure. The regulated oil is then routed to the wastegate actuator, turbochargers, and through the main oil galleries to the various engine bearings, piston oil cooling nozzles, valve mechanisms, and moving parts. Gravity returns the oil to the sump.

The turbochargers are also lubricated by the regulated oil from the engine system. Oil circulated through the turbochargers is returned to the sump by a scavenge pump attached to the hydraulic pump accessory pad. Oil from the oil pump is also supplied directly to the wastegate control system.

Oil temperature and pressure information is available from separate gauges located as part of the engine gauge stack. Engine crankcase gases are discharged to an air/oil separator behind the left rear cylinder, and then vented out the left exhaust stack.

7.5 ENGINE AND PROPELLER (continued)



ENGINE OIL SYSTEM SCHEMATIC

Figure 7-3

## 7.5 ENGINE AND PROPELLER (continued)

### PROPELLER

The propeller is a Hartzell composite, three blade, constant speed unit with an 80-inch diameter. Constant propeller rotational speed (RPM) is maintained by a balance of air load and engine rotational forces. The Hartzell propeller governor, mounted on the left front of the engine, pressurizes and regulates the flow of engine oil to a piston in the propeller dome. The piston is linked by a sliding rod and fork arrangement to propeller blades. Governor oil pressure against the piston works to increase propeller blade pitch, thus decreasing propeller and engine RPM. Centrifugal twisting moments on the propeller blades work to decrease propeller blade pitch and increase RPM. Simple control of the interaction of these and other forces to maintain a constant RPM is provided by the PROP RPM control lever in the cockpit.

The PROP RPM control lever, linked by cable to the propeller governor, determines a wide range of in-flight RPM. Governor range is more limited during ground operation. Pushing the lever forward selects increased or higher RPM. Pulling the lever aft selects decreased or lower RPM. When in flight the RPM should not fluctuate significantly from that set, regardless of throttle setting.

The propeller may be operated within the full range of RPM indicated on the MFD, up to the red radial line. In cruise, always use the power setting charts provided. Avoid exceeding maximum RPM and excessive engine stress by moving propeller and throttle levers in smooth deliberate motions. On cold days during run-up, exercise the propeller several times to flow warm oil into the propeller hub. This assures propeller governing for takeoff.

## 7.6 AIR INDUCTION SYSTEM

### CAUTION

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

## **7.6 AIR INDUCTION SYSTEM (continued)**

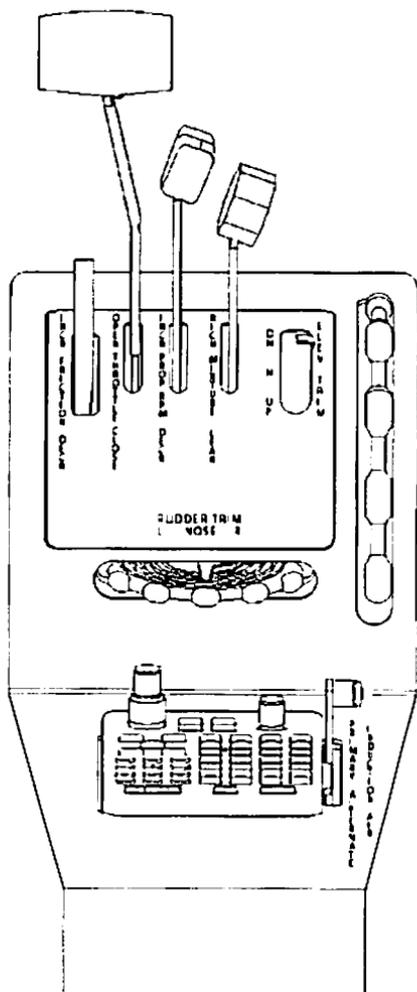
The engine air induction system receives ram air through forward facing ram air louvers located on the lower cowl below the propeller. Air enters these louvers and flows through a removable air filter mounted adjacent to the louvers. The filter removes dust and other foreign matter from the induction air. However, in the event the ram air louvers or the filter should become obstructed by ice or other causes, the pilot must manually select alternate air to the ALTERNATE position to provide air to the engine. This ALTERNATE AIR control is located on the center console just aft of the engine control quadrant and to the right of the keypad. When the INDUCTION AIR lever is forward, or on PRIMARY air, the engine is operating on filtered air drawn through the forward facing ram air louvers. When the lever is aft, or on ALTERNATE air, the engine is operating on unfiltered air, drawn through the aft facing louvers immediately aft of the ram air louvers. Since the alternate air bypasses the air filter, alternate air should never be used during ground operations, except for checking its operation.

Application of alternate air will result in a loss of manifold pressure when operating with a combination of high altitude and low RPM where the turbocharger wastegate is closed. Loss of manifold pressure of up to 8 inches Hg can result at maximum continuous power, with a possible greater reduction resulting at cruise power settings. Some of this manifold pressure loss may be recovered with THROTTLE and / or RPM adjustment.

## **7.7 ENGINE CONTROLS**

The engine is controlled by THROTTLE, PROP RPM and MIXTURE control levers, located on the control quadrant on the lower central instrument panel (Figure 7-5). The controls utilize teflon-lined control cables to reduce friction and binding. The THROTTLE lever is used to control engine power by simultaneously moving the butterfly valve in the fuel-air control unit and the variable absolute pressure controller, thus adjusting manifold pressure. A pressure switch activates the gear-up warning horn when manifold pressure is reduced to approximately 14 inches of mercury and below. 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 safety feature to warn the pilot of an inadvertent gear-up landing. All throttle operations should be made with a smooth, deliberate movement to prevent unnecessary engine wear or damage and to allow time for the turbocharger speed to stabilize.

7.7 ENGINE CONTROLS (continued)



**CONTROL PEDESTAL**  
Figure 7-5

**7.7 ENGINE CONTROLS (continued)**

The friction adjustment lever, located on the far left of the control quadrant, may be adjusted to increase or decrease the friction holding the THROTTLE, PROP RPM and MIXTURE controls.

The PROP RPM control lever is used to adjust engine speed (RPM) at the propeller governor. Propeller speed controls power availability, which is increased by increasing RPM when the lever is moved forward. The lever is moved aft to reduce RPM. Propeller operations should be smooth and deliberate to avoid unnecessary wear.

The MIXTURE control lever is used to adjust the fuel-to-air ratio at the fuel-air control unit. Full forward is rich mixture. Normal engine shutdown is accomplished by placing the MIXTURE control in the full aft position.

## 7.8 GARMIN G1000 AVIONICS SYSTEM

### NOTE

Refer to the Garmin G1000 Cockpit Reference Guide for the Piper PA-46 Matrix, Garmin p/n 190-01107-XX, latest revision, for complete descriptions of the G1000 system and operating procedures.

The Garmin G1000 Integrated Avionics System consists of dual Primary Flight Displays (PFD), a Multi-Function Display (MFD), an Audio Panel, dual Attitude and Heading Reference Systems (AHRS), dual Air Data Computers (ADC), and the sensors and computers to process flight and engine information for display to the pilot. The system contains dual GPS WAAS receivers, dual VOR/ILS receivers, dual VHF communications transceivers, a transponder, and an integrated crew alerting system (CAS) to alert the pilot via status messages, caution messages and warning messages. The G1000 system also provides system messages which alert the pilot to abnormalities associated with the G1000 system. The G1000 system also has optional equipment which includes integrated weather radar, terrain proximity system, Traffic Information Service (TIS), (FliteCharts), dual transponders, Class B TAWS, Traffic Advisory System (TAS), Stormscope, Jeppesen ChartView, and the Garmin Datalink (GDL) for XM weather and music.

### Primary Flight Display

The Primary Flight Display (PFD) typically displays airspeed, attitude, altitude, and heading information in a traditional format. Slip information is shown as a trapezoid under the bank pointer. One width of the trapezoid is equal to a one ball width slip. Rate of turn information is shown on the scale above the rotating compass card; a standard rate turn is accomplished when the turn rate trend vector stops at the second tick mark (standard rate tick mark). OAT information is presented in the lower left corner of the PFD. The measured value of OAT is adjusted for probe recovery factor and ram air effects to indicate static air temperature.

The primary function of the PFD is to provide attitude and heading data from the Attitude and Heading Reference System, air data from the Air Data Computer, and navigation and alerting information. The PFD may also be used for flight planning and increased situational awareness via the synthetic vision and Pathways.

**Primary Flight Display (continued)**

The following controls are available on the PFD (clockwise from top right):

- Communications frequency volume and squelch knob
- Communications frequency set knobs
- Communications frequency transfer button
- Altimeter setting knob (BARO)
- Course knob
- Map range knob and cursor control
- FMS control buttons and knob
- PFD softkey buttons, including master warning/caution acknowledgement
- Altitude reference set knob
- Heading bug control
- Navigation frequency transfer button
- Navigation frequency set knobs
- Navigation frequency volume and Identifier knob

The primary function of the VHF Communication portion of the G1000 is to enable external radio communication. The primary function of the VOR/ILS Receiver portion of the equipment is to receive VOR, Localizer, and Glide Slope signals. The primary function of the GPS portion of the system is to acquire signals from the GPS and WAAS satellites and process this information in real-time to obtain the user's position, velocity, and time. This GPS WAAS is certified under TSO C146a and therefore is qualified as a primary navigation system. The PFD also displays all autopilot annunciations, including mode annunciations at the top, center of the display and system and preflight test status annunciations near the top of the altitude tape.

**Primary Flight Display (continued)****Attitude and Heading Reference System (AHRS)**

The AHRS uses GPS, rate sensors, air data, and magnetic variation to provide pitch and roll attitude, sideslip and heading to the display system. The AHRS incorporates internal monitors to determine validity of its parameters. If a parameter is suspect but still within tolerance of the internal monitors, the appropriate MISCOMPARE annunciation will be posted and the pilot, considering similar parameters for comparison, must determine the suspect parameter. If the parameter is determined invalid by the internal monitors, a red-x is displayed over the invalid parameter and a NO COMPARE annunciation is posted. If the entire AHRS becomes invalid while in flight, the G1000 system will automatically select the other AHRS, as indicated by a BOTH ON AHRS1 or BOTH ON AHRS2 annunciation, depending on which AHRS is functioning, and post the appropriate NO COMPARE annunciations. In this situation, the autopilot will become inoperative. If the AHRS becomes valid again, the pilot must manually re-select that AHRS if desired. Selection of which AHRS should be used is made via the SENSOR softkey on the PFD. If both AHRS become invalid, a red-x and amber ATTITUDE FAIL will be displayed on the attitude indicator and a red-x and amber HDG will be displayed on the heading display. The course pointer on the HSI will indicate straight up and the course may be set using the digital window. The AHRS will align while the aircraft is in motion, but will align quicker if the wings are kept level during the alignment process.

### **Primary Flight Display (continued)**

#### **Air Data Computer (ADC)**

The ADC provides airspeed, altitude, vertical speed, and air temperature to the display system. In addition to the primary displays, this information is used by the FMS and Traffic systems.

The ADC incorporates internal monitors to determine validity of its parameters. If a parameter is suspect but still within tolerance of the internal monitors, the appropriate MISCOMPARE annunciation will be posted and the pilot, considering similar parameters for comparison, must determine the suspect parameter. If the parameter is determined invalid by the internal monitors, a red-x is displayed over the invalid parameter and a NO COMPARE annunciation is posted. If the entire ADC becomes invalid while in flight, the GI000 system will automatically select the other ADC, as indicated by a BOTH ON ADC1 or BOTH ON ADC2 annunciation, depending on which ADC is functioning, and post the appropriate NO COMPARE annunciations. If the ADC becomes valid again, the pilot must manually re-select that ADC if desired via the SENSOR softkey on the PFD. If both ADC's become invalid, a red-x and amber AIRSPEED FAIL, ALTITUDE FAIL and VERTICAL SPEED FAIL will be displayed on the appropriate display. In the dual ADC failure case and if AHRS data are still valid, the autopilot will default to PIT/ROL modes.

#### **Reversionary Mode - PFD**

The PFDs will automatically be displayed in a composite format (Reversionary mode) for emergency use if the MFD display fails. The DISPLAY BACKUP button above the associated PFD should also be pressed. In the composite mode, the PFD will display the engine parameters typically reserved for the MFD, including the full crew alerting system and autopilot annunciations, and only limited map functions are available via the inset map.

#### **Autopilot Integration**

The GFC 700 Automatic Flight Control System (AFCS) is a 2-axis autopilot with integrated yaw damper and flight director system, controlled through a dedicated autopilot controller mounted below the MFD, which provides the pilot with the following features:

- One autopilot controller (GMC) which contains the following mode control buttons: AP (autopilot engage/disengage); FD (Flight Director On/Off); HDG (Heading mode On/Off); NAV (Nav mode On/Off); APR (Approach mode On/Off); ALT (Altitude Hold mode On/Off); VS (Vertical Speed mode On/Off); FLC (Flight Level Change mode On/Off); NOSE UP and NOSE DN (vertical mode reference change).

**Autopilot Integration (continued)**

- Servos with autopilot processing logic in the pitch, roll and pitch trim control systems
- Servo mounts and brackets
- Flight Director processing logic in the GIAs
- Control wheel-mounted elevator electric pitch trim switch (split switch)
- Control wheel-mounted trim interrupt and autopilot disconnect switches
- Control wheel-mounted CWS (Control Wheel Steering) switch
- Remote-mounted go-around switch on the throttle
- PFD/MFD mounted altitude preselect knobs
- Yaw Damper system with "YD" switch on the mode controller

The GFC 700 autopilot contains an electric pitch trim system which is used by the autopilot for automatic pitch trim during autopilot operation and manual electric pitch trim when the autopilot is not engaged. The manual electric pitch trim system is operated by a split switch on the pilot's and copilot's control wheels. A blue TRIM annunciation above the pilot's PFD illuminates anytime the pitch trim system is activated by the automatic or manual electric methods. The GFC 700 autopilot and manual electric trim will not operate if the system has not satisfactorily completed a preflight test as indicated by a PFT annunciation or if a red AFCS annunciation is present.

Upon initial system power-up and verification of required sensor inputs, the autopilot/flight director system undergoes preflight test. At the end of the test, a two-tone aural sounds and the PFT and AFCS annunciations are removed. Successful completion of the preflight test is required for the electric pitch trim and autopilot to engage.

Annunciation of the flight director and autopilot modes is shown in the autopilot status field of the PFD. In general, green indicates active modes and white indicates armed modes. When a mode is directly selected by the pilot, no flashing of the mode will occur. When automatic mode changes occur, they will be annunciated with a flashing annunciation of the new mode for ten seconds in green. If a mode becomes unavailable for any reason, the mode will flash for ten seconds in yellow and be replaced by the default ROL mode in green. The flight director bars have a hollow appearance for flight director only operations and solid appearance for autopilot operations.

**Autopilot Integration (continued)**

Autopilot operation below 78 KIAS and above 183 KIAS in any mode is not authorized. Autopilot coupled approaches below 90 KIAS are not authorized. Small airspeed perturbations around 90 KIAS, due to atmospheric disturbances are acceptable.

The autopilot features an overspeed recovery submode which becomes active when the aircraft actual or projected airspeed exceeds  $V_{NE}$ . Presence of this submode is indicated by an amber MAXSPD above the airspeed tape on the PFD. It becomes active at approximately 183 KIAS and it remains active until the airspeed is reduced below approximately 183 KIAS and  $V_{NE}$  exceedance is no longer a factor. The overspeed recovery mode provides a pitch up command to a maximum level flight attitude to lessen the descent rate and to decelerate the airplane below  $V_{NE}$ . Overspeed recovery is not active in altitude hold (ALT), glideslope (GS), or glidepath (GP) modes. The airspeed reference (FLC), which is adjustable through a speed range of 75 to 183 KIAS, cannot be adjusted while in overspeed recovery mode.

Normal autopilot disconnects are annunciated with a yellow flashing AP on the PFD accompanied by a two second autopilot disconnect tone. Normal disconnects are those initiated by the pilot with the A/P DISC switch on the control yoke, the manual pitch trim switch, or the GA button. Abnormal disconnects will be accompanied by a red flashing AP on the PFD accompanied by a continuous autopilot disconnect tone. Abnormal disconnects are those detected by the system, such as total AHRS failure and stall warning horn activation. The disconnect tone may be silenced by pressing the A/P DISC switch or the manual pitch trim switch.

**NOTE**

Specific fault annunciations and associated emergency procedures are discussed in the Emergency Procedures, Section 3.

The following conditions will cause the autopilot and yaw damper to disengage:

- Electrical power failure, including pulling the AUTOPILOT and/or GMC circuit breakers
- Internal autopilot system failure
- Total AHRS malfunction
- Depressing the red A/P DISC switch on the pilot's control wheel

**Autopilot Integration (continued)**

- Actuating either half or both halves of the manual electric pitch trim split switch
- Pushing the AP button on the autopilot mode controller when the autopilot is engaged
- Pushing the GA button on the throttle handle
- Stall warning horn activation
- Depressing the CWS (Control Wheel Steering) will disconnect the servos from the flight controls as long as the switch is depressed, and re-engage upon release. Upon release the system will synchronize to the existing airspeed/pitch, or roll angle depending upon the mode selected. Review the Cockpit Reference Guide for additional information.
- Activating the EMER switch (with Battery and Alternators OFF).

Power to the pitch, roll and yaw servos is supplied through the AUTOPILOT circuit breaker. The pitch trim servo is powered through the PITCH TRIM circuit breaker and the Garmin Mode Controller (GMC) is powered through the GMC circuit breaker. The AV BUS MASTR switch can also function as an emergency autopilot disconnect switch should the red disconnect switch on the control yoke fail.

The autopilot mode controller contains a button labeled "SPD", which allows the airplane to hold a constant Mach number. This button is deactivated for the Matrix and should the pilot depress the button a system message, "SPD KEY DISABLED – The SPD key is disabled for this model aircraft", will be displayed.

**Multi-Function Display**

The Multi-Function Display (MFD) is the primary display for engine parameters, map information (including dedicated map pages for navigation, traffic, weather radar, stormscope, weather datalink and TAWS), waypoint information, nearest functions, charts, flight plan information, approach procedures, and the Crew Alerting System (CAS).

**Crew Alerting System (CAS) Messages**

The Crew Alerting System (CAS) consists of Master Warning and Master Caution Indicators operating in conjunction with CAS text messages. CAS text messages appear in the lower left area of the MFD during normal operations and in the right side area of the PFD's during reversionary mode operation. The CAS

**Multi-Function Display (continued)**

**Crew Alerting System (CAS) Messages (continued)**

message window is capable of displaying 14 CAS messages in normal operating mode and 13 CAS messages in reversionary mode. Should the total CAS message count exceed these values, the oldest message will be removed from the window until the total message count is reduced to 14 in normal mode or 13 in reversionary mode. The Master Warning and Master Caution Indicators are illuminated push-button switches centered above the pilot's PFD. The severity of CAS messages are categorized as Warning, Caution and Advisory as follows:

*Red Warning Messages*

All Warning messages consist of a flashing red Master Warning indicator, located above the pilot's PFD, and many have a flashing (inversely red on white) CAS Warning text message located in the lower left corner of the MFD. All Warnings are accompanied by a continuous aural chime, which can be silenced by pressing (acknowledging) the MASTER WARN RESET switch. When acknowledged, the MASTER WARN RESET switch will extinguish, the CAS Warning text message, if applicable, will stop flashing and will revert to normal (red on black) message, and the aural chime will silence. CAS Warning text messages will persist until the initiating condition is removed. If the warning was initiated by an engine parameter a CAS Warning text message will not be present, but that parameter's indication will flash for 5-seconds then return to steady red until the condition is removed.

*Amber Caution Messages*

Caution messages consist of an amber Master Caution indicator, located above the pilot's PFD, and many have a (inversely black on amber) CAS Caution text message located in the lower left corner of the MFD. Cautions are accompanied by a single aural chime. Caution messages can be acknowledged by pressing the MASTER CAUTION RESET switch. When acknowledged, the MASTER CAUTION RESET switch will extinguish and the CAS Caution text message, if applicable, will revert to a normal (amber on black) message. CAS Caution text messages will persist until the initiating condition is removed. If the Caution was initiated by an engine parameter, a CAS Caution text message will not be present, but that parameter's indication will remain steady amber until the condition is removed.

**Multi-Function Display (continued)****Crew Alerting System (CAS) Messages (continued)***White Advisory Messages*

CAS Advisory text messages appear in the CAS window in white text. Advisory messages do not require acknowledgment and are not accompanied by aural chimes. CAS Advisory Messages persist until the initiating condition is removed.

**NOTE**

The Garmin G1000 Cockpit Reference Guide for the Piper PA-46 Matrix, Garmin p/n 190-01107-XX, latest revision and the Garmin G1000 Pilot's Guide for the Piper PA-46R-350T, Garmin p/n 190-01108-XX, latest revision, contain detailed descriptions of the annunciator system (CAS and Non-CAS) and all warnings, cautions and advisories.

**Reversionary Mode - MFD**

Should the PFD in front of the pilot become inoperative, the MFD can be selected into reversionary mode by pressing the DISPLAY BACKUP button above the pilot's PFD. The MFD will then show typical PFD information, including the pilot selectable data fields, autopilot annunciations, transponder information and G1000 system messages. Information retained from the MFD will also be available, including CAS messages, engine parameters, flight planning information with DTK and DIS fields, and an inset map with all features except radar.

**Navigation**

Provided the Garmin G1000 navigation receivers are receiving adequate and usable GPS and/or VHF navigation signals, it has been demonstrated capable of and meets the accuracy specifications for the following types of flight operations:

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

**Multi-Function Display (continued)**

**Navigation (continued)**

- The system is approved for use for RNAV Enroute and Terminal operations in accordance with AC 90-100.
- The systems meets RNP5 airspace (BRNAV) requirements of AC 90-96 and in accordance with AC 20-138A, JAA AMJ 20X2 Leaflet 2 Revision 1 for oceanic and remote airspace operations, provided it is receiving usable navigation information from the GPS receiver. (A separate prediction software application may be required for oceanic and remote operations in the absence of WAAS corrections.)

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

**Traffic Information Service (TIS)**

**NOTE**

If the G1000 system is configured to use the optional Traffic Advisory System (TAS), TIS will not be available for use.

Traffic Information Service (TIS) provides a graphic display of traffic advisory information to the pilot. The G1000 system performs an automatic test of the TIS system upon power-up. If the TIS power-up test is passed, it will enter STANDBY mode while on the ground. If the TIS power-up test is failed, a failure annunciation will be indicated in the center of the Traffic Map page. The traffic mode of operation is indicated in the upper-left corner of the Traffic Map page. The TIS will automatically switch to OPERATING mode once the aircraft is airborne and provide a voice or tone audio output and a graphic display of traffic.

TIS uses the Mode S transponder for the traffic data link and is available only when the aircraft is within the service volume of a TIS-capable, ground based, terminal radar site. Updates are available to the pilot in 5-second intervals. Aircraft without a transponder are invisible to TIS and aircraft without altitude reporting capability are shown without altitude separation data or climb/descent indication.

**Multi-Function Display (continued)****Traffic Information Service (TIS) (continued)***Traffic Map Page*

The Traffic Map page, located in the Map Group on the MFD, is selectable from 2 nm to 12 nm. The G1000 system can display up to eight traffic targets within a 7.5 nm radius, from 3000 feet below to 3500 feet above the requesting aircraft. The altitude difference between the requesting aircraft and other aircraft is displayed above/below the traffic symbol in hundreds of feet. If the traffic target is above the requesting aircraft, the altitude separation text appears above the traffic symbol; if below, the altitude separation text appears below the traffic symbol. An altitude trend up/down arrow is displayed to the right of the traffic target symbol when the relative climb or descent speeds are greater than 500 ft/min in either direction. TIS also provides a vector line showing the direction in which the traffic is moving, to the nearest 45°.

Traffic is overlaid on the following pages:

- \* Navigation Map Page
- \* Traffic Map Page
- \* Trip Planning Page
- \* Nearest Pages
- \* Active Flight Plan Page
- \* PFD Inset Map

*TIS Alerts*

Traffic is displayed according to TCAS symbology using four different symbols:

1. Non-Threat Traffic – An open white diamond with black center that indicates traffic is beyond a 5 nm range and greater than  $\pm 1200$  feet from the requesting aircraft.
2. Traffic Advisory (TA) – A solid yellow circle that indicates that traffic has met the criteria for a traffic advisory and is considered to be potentially hazardous. A yellow TRAFFIC annunciation is displayed at the top left of the altitude indicator on the PFD and an alert is heard in the cockpit, advising “Traffic”.

**Multi-Function Display (continued)**

**Traffic Information Service (TIS) (continued)**

*TIS Alerts (continued)*

3. Traffic Advisory Off Scale - On the Traffic Map page a half TA symbol indicating a traffic advisory (TA), which is detected but is outside the range of the map will be displayed at the edge of the scale on the azimuth of the detected traffic. On the map page the off-scale traffic advisory is provided in a text box located on the lower left corner of the map.

Traffic information for which TIS is unable to determine the bearing (non-bearing traffic) is displayed in the center of the Traffic Map Page or in a banner at the lower left corner of map pages other than the Traffic Map Page on which traffic can be displayed.

TIS customization options are available to the pilot by depressing the MENU key while on the Navigation Map Page, and then selecting "Map Setup" then "Traffic" Group. TIS traffic may also be displayed on the Navigation Map page by selecting the MAP softkey and then selecting the TRAFFIC softkey.

Additional details on the Traffic Information Service (TIS) are contained in the latest appropriate revisions of the Garmin Cockpit Reference Guide for the Piper PA-46 Matrix P/N: 190-01107-XX and/or the Garmin G1000 Pilot's Guide for the Piper PA-46 Matrix P/N: 190-01108-XX.

**Multi-Function Display (continued)****Traffic Advisory System (TAS) – Optional****NOTE**

If the G1000 system is configured to use the optional Traffic Advisory System (TAS), TIS will not be available for use.

The KTA-810 Traffic Advisory System (TAS) is used to assist in the detection and avoidance of other aircraft. TAS uses an onboard processor and antennas to detect and track other aircraft by interrogating their transponders. TAS analyzes the transponder replies to determine range, bearing and relative altitude, if the other aircraft is equipped with an altitude reporting transponder. Aircraft without a transponder are invisible to TAS and aircraft without altitude reporting capabilities are displayed with only range and bearing information.

After a normal power-up of the TAS, the unit will automatically enter its normal operating mode as indicated by the word OPERATING in the upper-left corner of the Traffic Map page and the NORMAL softkey will be highlighted. If the self-test does not pass, the word FAIL will be indicated in the upper left corner of the Traffic Map page and the STANDBY softkey will be highlighted. During ground operations, traffic targets will be depicted but aural alerts will be suppressed. Once airborne, TAS will remain in its normal operating mode and will depict traffic targets and provide aural alerts. If the pilot selects the STANDBY softkey at any time, the TAS will be forced out of its normal operating mode and will switch to STANDBY mode as indicated by the word STANDBY in the upper-left corner of the Traffic Map page and highlighting of the STANDBY softkey. In STANDBY mode, traffic targets are not depicted and aural traffic alerts are suppressed. The NORMAL softkey must be reselected to return to OPERATING mode.

The pilot may perform a TAS test by setting the range on the Traffic Map page to 2/6 nm (for optimum display) and then selecting the TEST softkey. If the TAS test is passed, it will display traffic symbols and the voice alert "TAS System Test Passed" will be heard. If the TAS test is failed, it will revert to STANDBY mode and a voice alert "TAS System Test Failed" will be heard. Use of the TAS self-test function in flight will inhibit normal TAS operation for up to 8 seconds. For this reason, the pilot should use caution when initiating the test in flight.

**Multi-Function Display (continued)**

**Traffic Advisory System (TAS) – Optional (continued)**

*Traffic Map Page*

The Traffic Map page, located in the Map Group on the MFD, range is selectable from 2 nm to 40 nm. The TAS can track up to 45 aircraft and display up to 30 of them. TAS can track aircraft with relative altitudes from 10,000 feet below to 10,000 feet above the requesting aircraft. The altitude difference between the requesting aircraft and other (intruder) aircraft is displayed above/below the traffic symbol in hundreds of feet. If the traffic target is above the requesting aircraft, the altitude separation text appears above the traffic symbol; if below, the altitude separation text appears below the traffic symbol. An altitude trend up/down arrow is displayed to the right of the traffic target symbol when the relative climb or descent speeds are greater than 500 ft/min in either direction.

Traffic is overlaid on the following pages:

- \* Navigation Map Page
- \* Traffic Map Page
- \* Trip Planning Page
- \* Nearest Pages
- \* Active Flight Plan Page
- \* PFD Inset Map

*TAS Alerts:*

Traffic is displayed according to TCAS symbology using four different symbols.

1. Non-Threat Traffic – An open white diamond with black center that indicates traffic is beyond a 5 nm range and greater than  $\pm 1200$  feet from the requesting aircraft.
2. Proximity Advisory – A solid white diamond that indicates traffic is within a 5 nm range and within  $\pm 1200$  feet of the requesting aircraft. They are not considered traffic advisories (TA), which alert the crew to intruding aircraft.
3. Traffic Advisory (TA) – A solid yellow circle that indicates that traffic has met the criteria for a traffic advisory and is considered to be potentially hazardous. An aural alert is heard in the cockpit, advising: “Traffic, Traffic”

**Multi-Function Display (continued)****Traffic Advisory System (TAS) – Optional (continued)***TAS Alerts (continued)*

4. Traffic Advisory Off Scale – On the Traffic Map page a half TA symbol indicating a traffic advisory (TA), which is detected but is outside the range of the map will be displayed at the edge of the scale on the azimuth of the detected traffic. On the map page the off-scale traffic advisory is provided in a text box located on the lower left corner of the map.

Traffic information for which TAS is unable to determine the bearing (non-bearing traffic) is displayed in the center of the Traffic Map Page or in a banner at the lower left corner of maps other than the Traffic Map Page on which traffic can be displayed.

TAS customization options are available to the pilot by depressing the MENU key while on the Navigation Map Page, and then selecting “Map Setup” then “Traffic” Group. TAS traffic may also be displayed on the Navigation Map by selecting the MAP softkey and then selecting TRAFFIC softkey.

Additional details on the Traffic Advisory System (TAS) are contained in the latest appropriate revisions of the Garmin Cockpit Reference Guide for the Piper PA-46 Matrix P/N: 190-01107-0XX and/or the Garmin G1000 Pilot’s Guide for the Piper PA-46 Matrix P/N: 190-01108-XX.

**Terrain Proximity****NOTE**

If the G1000 system is configured to use the optional Terrain Awareness and Warning System (TAWS), Terrain Proximity will not be available for use.

G1000 Terrain Proximity is a terrain awareness system that increases situational awareness and aids in preventing controlled flight into terrain (CFIT). It is similar to the Terrain Awareness and Warning System (TAWS) but does not comply with TSO-C151b certification standards. Terrain Proximity does not provide warning annunciations or voice alerts but it does provide color indications on map displays when terrain and obstacles are within a certain altitude threshold from the aircraft. Although the terrain and obstacle color map displays are the same, TAWS uses a more extensive database and more sophisticated algorithms to assess aircraft distance from terrain and obstacles. The terrain and obstacles

## **Multi-Function Display (continued)**

### **Terrain Proximity (continued)**

database may not contain all obstructions, so the information provided should be used as an aid to situational awareness and should never be used to navigate or maneuver around terrain.

GPS altitude, which is derived from satellite position and therefore may differ from baro-corrected altitude read from the altimeter, is converted to mean sea level (MSL)-based altitude (GPS-MSL altitude) and is used in conjunction with GPS position to calculate and predict the aircraft's flight path in relation to the surrounding terrain and obstacles, whose altitudes are also referenced to MSL.

#### *System Status:*

Terrain Proximity requires the following components to operate properly:

- \* valid 3-D GPS position
- \* valid terrain/obstacle database

If Terrain Proximity does not have a valid 3-D GPS position a yellow "No GPS Position" text will be displayed at the center of the Terrain Proximity Page and on the PFD inset map if terrain is selected. If there is not a valid terrain/obstacle database, the system will not display the yellow and red colors associated with the offending obstacles and terrain.

#### *Operation of Terrain Proximity:*

Terrain is displayed on the following pages:

- \* Navigation Map Page
- \* Terrain Proximity Page
- \* Trip Planning Page
- \* Flight Plan Page
- \* PFD Inset Map

To display terrain data on maps other than the Terrain Proximity page, select the MAP softkey (select INSET softkey for the PFD inset map) on the Navigation Map Page and then select the TERRAIN softkey. When Terrain Proximity is selected on maps other than the Terrain Proximity Page, an icon to indicate the feature is enabled for display and a legend for Terrain Proximity colors are shown.

**Multi-Function Display (continued)****Terrain Proximity (continued)**

Terrain customization options are available by pressing the MENU key while on the Navigation Map Page, and then selecting "Map Setup" then "Map" group. Options selected on the Navigation Map page will be used on other map pages (less the Terrain Proximity Page itself) that display terrain information. Additional information about obstacles can be displayed by panning over the display on the map. The panning feature is enabled by depressing the RANGE knob on the keypad then pushing the knob in the desired direction until it is over the obstacle of interest. There is no inhibit function associated with Terrain Proximity, as there are no aural or visual alerts to inhibit.

*Terrain Proximity Page:*

The Terrain Proximity Page is specialized to show terrain and obstacle data in relation to the aircraft's current altitude, without clutter from the basemap. Aviation data (airports, VORs, and other NAVAIDs) can be displayed for reference.

Aircraft orientation on this map is always heading up unless there is no valid heading. Two views are available relative to the position of the aircraft: the 360° default display and the radar-like ARC (120°) display. Map range is adjustable with the RANGE Knob from 1 to 200 nm, as indicated by the map range rings (or arcs).

*Operation of Terrain Proximity:*

The Terrain Proximity Page is located in the Map Page Group on the MFD. On all pages that display terrain data, obstacles and terrain are depicted with the following colors:

- \* Red - above or within 100 feet below the aircraft altitude.
- \* Yellow - between 100 feet and 1000 feet below the aircraft altitude.
- \* Black - more than 1000 feet below the aircraft altitude.

*Terrain Proximity Alerts:*

Terrain Proximity does not provide warning annunciations or voice alerts associated with obstacles or terrain.

**Multi-Function Display (continued)**

**Terrain Awareness and Warning System (TAWS) – Optional**

**NOTE**

If the G1000 system is configured to use the optional Terrain Awareness and Warning System (TAWS), Terrain Proximity will not be available for use.

The Terrain Awareness and Warning System (TAWS) is an optional feature used to increase situational awareness and aid in reducing controlled flight into terrain (CFIT). TAWS provides visual and aural cautions and warning alerts when terrain and obstacles are within a given altitude threshold from the aircraft. The displayed alerts and warnings are advisory in nature only. TAWS satisfies TSO-C151b Class B certification requirements whereas the more limited Terrain Proximity does not.

TAWS uses terrain and obstacle information supplied by government sources. Terrain information is based on terrain elevation information in a database that may contain inaccuracies. Individual obstructions may be shown if available in the database. The data undergoes verification by Garmin to confirm accuracy of the content, per TSO-C151b standards, however, the displayed information should never be understood as being all-inclusive and data may be inaccurate.

GPS altitude, which is derived from satellite position and therefore may differ from baro-corrected altitude read from the altimeter, is converted to mean sea level (MSL)-based altitude (GPS-MSL altitude) and is used in conjunction with GPS position to calculate and predict the aircraft's flight path in relation to the surrounding terrain and obstacles, whose altitudes are also referenced to MSL.

*System Status:*

During G1000 power-up, TAWS conducts a self-test of its aural and visual annunciations. The system test can also be manually initiated by selecting the TAWS Page then depress the MENU key, then select the "Test TAWS" option. An aural alert "TAWS System Test OK" or "TAWS System Failure" is issued at test completion, regardless of whether the test was initiated automatically or manually. TAWS System Testing is disabled when ground speed exceeds 30 knots.

TAWS requires the following to operate properly:

- \* A valid terrain/obstacle/airport terrain database
- \* A valid 3-D GPS position solution

**Multi-Function Display (continued)****Terrain Awareness and Warning System (TAWS) – Optional (continued)***System Status (continued)*

If a valid 3-D GPS position solution and vertical accuracy requirements are not attained or the aircraft is out of the database coverage area, a TAWS N/A annunciation will appear on the TAWS Page and the aural annunciation "TAWS Not Available" is heard. When the GPS signal is re-established and the aircraft is within the database coverage area, the aural message "TAWS Available" is heard.

*Operation of TAWS:*

Terrain is displayed on the following pages:

- \* Navigation Map Page
- \* TAWS Page
- \* Trip Planning Page
- \* Flight Plan Page
- \* PFD Inset Map

To display terrain data on maps other than the TAWS Page, select the MAP softkey (select INSET softkey for the PFD inset map) on the Navigation Map Page and then select the TERRAIN softkey. When TAWS is selected on maps other than the TAWS Page, an icon to indicate the feature is enabled for display and a legend for TAWS terrain colors is shown.

Terrain customization options are available by depressing the MENU key while on the Navigation Map Page, and then selecting "Map Setup" then "Map" group. Options selected on the Navigation Map page will be used on other map pages (less the TAWS Page itself) that display terrain information. Additional information about obstacles can be displayed by panning over the display on the map. The panning feature is enabled by depressing the RANGE knob on the keypad then pushing the knob in the desired direction until it is over the obstacle of interest.

## Multi-Function Display (continued)

### Terrain Awareness and Warning System (TAWS) – Optional (continued)

#### *Operation of TAWS (continued)*

To inhibit the aural and visual Premature Descent Alert (PDA) and Forward Looking Terrain Awareness (FLTA) alerts (RTC, ITI, ROC and IOI), press the INHIBIT softkey on the TAWS Page or depress the MENU key then select "Inhibit TAWS" or "Enable TAWS" depending on the current state. In either case, inhibiting and enabling TAWS alerts depends on the status of the INHIBIT softkey, as the INHIBIT softkey performs both functions. Use caution when inhibiting TAWS as the system should be enabled when appropriate. Once TAWS is inhibited a TAWS INHB alert annunciation is displayed on the MFD and PFD.

#### NOTE

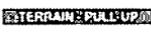
If TAWS alerts are inhibited when the Final Approach Fix is the active waypoint during a GPS WAAS approach, a LOW ALT annunciation may appear on the PFD next to the altimeter if the current aircraft altitude is at least 164 feet below the prescribed altitude at the Final Approach Fix.

#### *TAWS Page:*

The TAWS Page is located in the Map Page Group on the MFD.

The TAWS Page is specialized to show terrain, obstacle, and potential impact point data in relation to the aircraft's current altitude, without clutter from the basemap. Aviation data (airports, VORs, and other NAVAIDs) can be displayed for reference. If an obstacle and the projected flight path of the aircraft intersect, the display automatically zooms in to the closest potential point of impact on the TAWS Page.

Aircraft orientation on this map is always heading up unless there is no valid heading. Two views are available relative to the position of the aircraft; the 360° default display and the radar-like ARC (120°) display. Map range is adjustable with the RANGE Knob from 1 to 200 nm, as indicated by the map range rings or arcs.

Alert Type	PFD/MFD Alert Annunciation	MFD Pop-Up Alert	Aural Message	Response Technique
Excessive Descent Rate Warning (EDR)			"Pull Up"	WARNING
Reduced Required Terrain Clearance Warning (RTC)			"Terrain, Terrain; Pull Up, Pull Up"	WARNING
Imminent Terrain Impact Warning (ITI)			"Terrain Ahead, Pull Up; Terrain Ahead, Pull Up"	WARNING
Reduced Required Obstacle Clearance Warning (ROC)			"Obstacle, Obstacle; Pull Up, Pull Up"	WARNING
Imminent Obstacle Impact Warning (IOI)			"Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up"	WARNING
Reduced Required Terrain Clearance Caution (RTC)		CAUTION - TERRAIN	"Caution, Terrain; Caution, Terrain"	CAUTION
Imminent Terrain Impact Caution (ITI)		TERRAIN AHEAD	"Terrain Ahead; Terrain Ahead"	CAUTION
Reduced Required Obstacle Clearance Caution (ROC)		CAUTION - OBSTACLE	"Caution, Obstacle; Caution, Obstacle"	CAUTION
Imminent Obstacle Impact Caution (IOI)		OBSTACLE AHEAD	"Obstacle Ahead; Obstacle Ahead"	CAUTION
Premature Descent Alert Caution (PDA)		TOO LOW - TERRAIN	"Too Low, Terrain"	CAUTION
Altitude Callout "500"	None	None	"Five-Hundred"	N/A
Excessive Descent Rate Caution (EDR)		SINK RATE	"Sink Rate"	CAUTION
Negative Climb Rate Caution (NCR)		DON'T SINK	"Don't Sink"	CAUTION

\* See associated Response Techniques checklists on pages 7-29 and 7-30.

TAWS Alert Types  
Table 1

**Multi-Function Display (continued)**

**Terrain Awareness and Warning System (TAWS) – Optional (continued)**

*TAWS Page (continued)*

On all pages that display terrain data, the obstacles and terrain are depicted with the following colors:

- \* Red - above or within 100 feet below the aircraft altitude.
- \* Yellow - between 100 feet and 1000 feet below the aircraft altitude.
- \* Black - more than 1000 feet below the aircraft altitude.

*TAWS Alerts:*

Alerts are issued when flight conditions meet parameters that are set within TAWS software algorithms. TAWS alerts typically employ a CAUTION or a WARNING alert severity level, or both. When an alert is issued, visual annunciations are displayed on the PFD and MFD and aural alerts are simultaneously issued. The TAWS Alert Annunciation is shown at the upper left of the Altimeter tape on the PFD and below the Terrain Legend on the MFD. If the TAWS Page is not displayed at the time, a pop-up alert appears on the MFD. To acknowledge the pop-up alert:

- Press the CLR Key (returns to the currently viewed page), or
- Press the ENT Key (accesses the TAWS Page)

TAWS alerts types are shown in Table 1 on page 7-31.

**Response Technique - WARNING:**

1. Level the wings while simultaneously adding maximum power.
2. Smoothly pitch up at a rate of 2° to 3° per second towards an initial target pitch attitude of 15°.
3. Adjust pitch attitude to ensure terrain clearance, while respecting stall warning. If the flaps are extended, retract flaps to the up position.
4. Continue climb at best angle of climb speed ( $V_X$ ) until terrain or obstacle clearance is assured.
  - \* Only vertical maneuvers are recommended unless operating in VMC or the pilot determines, after using all available information and instruments, that a turn, in addition to the vertical escape maneuver, is the safest course of action.
  - \* Pilots are authorized to deviate from their current air traffic control (ATC) clearance to the extent necessary to comply with a TAWS warning.

**Multi-Function Display (continued)****Terrain Awareness and Warning System (TAWS) – Optional (continued)***TAWS Alerts (continued)***Response Technique - CAUTION:**

1. Take positive corrective action until the alert ceases.
2. Based on analysis of all available instruments and information:
  - \* Stop descending or,
  - \* Initiate a climb and/or,
  - \* Turn as necessary.

**Weather Radar - Optional**

The Weather Radar installation consists of a Receiver/Transmitter unit in a teardrop shaped pod mounted beneath the right wing just outboard of the wing jack point.

The Garmin GWX 68 Airborne Color Weather Radar is a four-color digital pulsed radar with 6.5 kilowatts of output power. It combines excellent range and adjustable scanning profiles with a high-definition target display. The pulse width is four microseconds ( $\mu\text{s}$ ) on all ranges except the 2.5 nm range. At close range, the GWX 68 uses a one  $\mu\text{s}$  pulse width to reduce the targets from smearing together.

The Piper PA-46 Matrix uses a 10-inch phased array antenna that is fully stabilized to accommodate  $30^\circ$  of pitch and roll.

To focus radar scanning on specific areas, Sector Scanning offers pilot-adjustable horizontal scan angles of  $20^\circ$ ,  $40^\circ$ ,  $60^\circ$ , or  $90^\circ$ . A vertical scanning function helps to analyze storm tops, gradients, and cell buildup activity at various altitudes.

Radar features include:

- \* Extended Sensitivity Time Constant (STC) logic that automatically correlates distance of the return echo with intensity, so cells do not suddenly appear to get larger as they get closer.
- \* WATCH® (Weather Attenuated Color Highlight) helps identify possible shadowing effects of short-range cell activity, identifying areas where radar return signals are weakened or attenuated by intense precipitation (or large areas of lesser precipitation) and may not fully reflect the weather behind a storm.
- \* Weather Alert that looks ahead for intense cell activity in the 80-320 nm range, even if these ranges are not being monitored.

**Multi-Function Display (continued)**

**Weather Radar (continued)**

*Operation of Radar:*

**NOTE**

Radar images beyond approximately 130 nm should not be relied upon.

Weather Mode:

To activate the radar's Weather mode while on the ground, proceed to the Map Page Group on the MFD, rotate the small FMS knob to the Weather Radar Page, select the MODE softkey, and then select the STANDBY mode softkey. After the system goes through a 60-second warm-up period (countdown is displayed on the screen) the radar will enter STANDBY mode. To begin radar transmitting, select the WEATHER mode softkey. A pop-up menu will appear alerting the pilot that the radar is being activated on the ground and safety precautions should be exercised.

To activate the radar while in flight, proceed to the Map Page Group on the MFD, rotate the small FMS knob to the Weather Radar Page, select the MODE softkey, and then select the WEATHER mode softkey. After the system goes through a 60-second warm-up period (countdown is displayed on the screen) the radar will begin transmitting.

When the weather radar system is in either the Weather or Ground Map mode, the system automatically switches to Standby mode upon landing.

Ground Map Mode:

To activate the radar's Ground Map mode, proceed to the Map Page Group on the MFD, rotate the small FMS knob to the Weather Radar Page, select the MODE softkey, and then select the GROUND softkey. Select the BACK softkey, then activate the cursor by pressing the small FMS knob, rotate the large FMS knob to place the cursor in the TILT field, then turn the small FMS knob to adjust the antenna tilt angle to display ground returns at the desired distance.

When the weather radar system is in either the Weather or Ground Map mode, the system automatically switches to Standby mode upon landing.

**Multi-Function Display (continued)****Weather Radar (continued)***Weather Radar Page:*Weather Display:

When evaluating various target returns on the weather radar display, the colors denote precipitation intensity and rates shown in the following table.

<b>Weather Mode Color</b>	<b>Intensity</b>	<b>Approximate Precipitation Rate (Inches/hour)</b>
<b>Black</b>	< 23 dBZ	< .01
<b>Green</b>	23 dBZ to < 32 dBZ	.01 to 0.1
<b>Yellow</b>	32 dBZ to < 41 dBZ	0.1 to 0.5
<b>Red</b>	41 dBZ to < 50 dBZ	0.5 to 2
<b>Magenta</b>	50 dBZ and greater	> 2

**Precipitation Intensity and Rates**

Table 2

Updrafts and downdrafts in thunderstorms carry water through the cloud, therefore the more severe the drafts, the greater the number and size of the precipitation droplets. With this in mind, the following interpretations can be made from what is displayed on the weather radar.

Avoid these areas by an extra wide margin.

- \* In areas where the displayed target intensity is red or magenta (indicating large amounts of precipitation), the turbulence is considered severe.
- \* Areas that show steep color gradients (intense color changes) over thin bands or short distances suggest irregular rainfall rate and strong turbulence.
- \* Areas that show red or magenta are associated with hail or turbulence, as well as heavy precipitation. Vertical scanning and antenna tilt management may be necessary to identify areas of maximum intensity.

Proper use of the weather radar is critical for detecting various types of weather phenomena (thunderstorms, squall lines, tornadoes, hail, etc.).

**Multi-Function Display (continued)**

**Weather Radar (continued)**

*Weather Radar Page (continued)*

Additional details on the weather radar are contained in the latest appropriate revisions of the Garmin Cockpit Reference Guide for the Piper PA-46 Matrix P/N: 190-01107-XX and/or the Garmin G1000 Pilot's Guide for the Piper PA-46 Matrix P/N: 190-01108-XX.

**Ground Map Display:**

When evaluating various intensities of ground target returns, the colors shown in the table below should be used.

Ground Map Mode Color	Intensity
Black	0 dB
Light Blue	> 0 dB to < 9 dB
Yellow	9 dB to < 18 dB
Magenta	18 dB to < 27 dB
Blue	27 dB and greater

**Ground Target Return Intensities**

Table 3

A secondary use of the weather radar system is for the presentation of terrain. This can be a useful tool for verifying aircraft position. A picture of the ground is represented much like a topographical map that can be used as a supplement to the Navigation Map on the MFD.

Ground Map mode uses a different gain range than Weather mode. Different colors are also used to represent the intensity levels. The displayed intensity of ground target returns is defined in the table shown above. The type and orientation of the target in relation to the aircraft affects the intensity displayed. Use of the GAIN and TILT controls helps improve contrast so that specific ground targets can be recognized more easily.

**Multi-Function Display (continued)****Weather Radar (continued)***Weather Radar Page (continued)*

Proper use of the weather radar is critical for detecting various types/features of terrain. Additional details on the weather radar are contained in the latest appropriate revisions of the Garmin Cockpit Reference Guide for the Piper PA-46 Matrix P/N: 190-01107-XX and/or the Garmin G1000 Pilot's Guide for the Piper PA-46 Matrix P/N: 190-01108-XX

**Garmin Datalink (GDL) – Optional**

XM Satellite Weather and XM Satellite Radio® entertainment services is provided through the optional GDL 69A, a remote-mounted data-link satellite receiver. XM Satellite Radio and XM Satellite Weather services, available by subscription, each have coded IDs unique to the installed GDL 69A. These coded ID's must be provided to XM Satellite Radio to activate service. These IDs are located on the label on the back of the Data Link Receiver and on the XM Information Page on the MFD and in the XM Satellite Radio Activation Instructions included with the unit (available at [www.garmin.com](http://www.garmin.com), P/N 190-00355-04). Once activated, XM Satellite Radio uses the coded IDs to send an activation signal that allows the G1000 to display weather data and/or entertainment programming provided through the GDL 69A.

**NOTE**

Pulling the XM circuit breaker will disable the Garmin Datalink (GDL), which include XM weather and XM radio.

*XM Satellite Weather:*

Received graphical weather information and associated text is displayed on the Multi Function Display (MFD) and the Primary Flight Display (PFD) Inset Map. XM satellite weather operates in the S-band frequency range and provides continuous reception capabilities at any altitude throughout North America.

The primary map for viewing XM Weather data is the Weather Data Link Page in the Map Page Group. This is the only G1000 map display capable of showing information for all available XM weather products.

**Multi-Function Display (continued)**

**Garmin Datalink (GDL) – Optional (continued)**

*XM Satellite Weather (continued)*

Selecting the products for display on the Weather Data Link Page is made by pressing the softkey associated with that product. The label for the product is shown in capital letters in the Weather Products column in the table below. When a weather product is selected for display, the corresponding softkey label changes to gray to indicate the product is enabled. Unavailable weather products have subdued softkey labels (softkeys are disabled from selection).

**NOTE**

Echo Tops and Cloud Tops are not selectable at the same time due to their color similarities.

The following pages can display various portions of XM Weather data:

- \* Navigation Map
- \* Weather Datalink Page (able to display all XM Weather data)
- \* Weather Information Page
- \* AUX - Trip Planning Page
- \* Nearest Pages
- \* Flight Plan Pages
- \* PFD Inset Map

When a weather product is active on the Weather Data Link Page or the Navigation Map Page, the age of the data is displayed on the screen. The age of the product is based on the time difference between when the data was assembled on the ground and the current GPS time. Weather products are refreshed at specific intervals.

If for any reason, a weather product is not refreshed within the 30, 60, or 90-minute Expiration Time intervals, the data is considered expired and is removed from the display. This ensures that the displayed data is consistent with what is currently being broadcast by XM Satellite Radio services. If more than half of the expiration time has elapsed, the color of the product age displayed changes to yellow.

**Multi-Function Display (continued)****Garmin Datalink (GDL) – Optional (continued)***XM Satellite Weather (continued)*

<b>Weather Product</b>	<b>Symbol</b>	<b>Expiration Time (minutes)</b>	<b>Refresh Rate (minutes)</b>
NEXRAD		30	5
Cloud Top (CLD TOP)		60	15
Echo Top (ECHO TOP)		30	7.5
XM Lightning (LTNG)		30	5
Cell Movement (CELL MOV)		30	1.25
SIGMETs/AIRMETs (SIG/AIR)		60	12
METARs		90	12
City Forecast (CITY)		90	12
Surface Analysis (SFC)		60	12
Freezing Levels (FRZ LVL)		60	12
Winds Aloft (WIND)		60	12
County Warnings (COUNTY)		60	5
Cyclone Warnings (CYCLONE)		60	12
Radar Coverage	No product image	30	5
TFRs	No product image	60	12
TAFs	No product image	60	12

**Weather Product Symbols, Expiration Times and Refresh Rates**  
Table 4

**Multi-Function Display (continued)**

**Garmin Datalink (GDL) – Optional (continued)**

*XM Satellite Weather (continued)*

The table on page 7-39 shows the weather product symbols, the expiration time and the refresh rate. The refresh rate represents the interval at which XM Satellite Radio broadcasts new signals that may or may not contain new weather data. It does not represent the rate at which weather data is updated or new content is received by the Data Link Receiver. Weather data are refreshed at intervals defined and controlled by XM Satellite Radio and their data vendors.

Additional details on the weather products are contained in the latest appropriate revisions of the Garmin Cockpit Reference Guide for the Piper PA-46 Matrix P/N: 190-01107-XX and/or the Garmin G1000 Pilot's Guide for the Piper PA-46 Matrix P/N: 190-01108-XX.

Customizing the Weather Data Link Page is possible by selecting Weather Data Link Page from the Map Group, press the MENU key, select Weather Setup option from the Page Menu and press the ENT key. Turn the large FMS knob to scroll to a weather product of interest then rotate the small FMS knob to scroll through the options for each product (ON/OFF, range settings, etc.). Press the ENT key to select the option then press the FMS knob or the CLR key to return to the Weather Data Link Page with the changed settings.

Customizing Weather Data Link options is also available on the Navigation Map page. Proceed to the Navigation Map page, depress the MENU key, highlight the Map Setup option and press the ENT key, turn the small FMS knob to highlight the Weather group, turn the large FMS knob to highlight and move between the product selections. When an item is highlighted, turn the small FMS knob to select the option and press the ENT key. Press the FMS knob or the CLR key to return to the Navigation Map Page with the changed settings.

**Multi-Function Display (continued)****Garmin Datalink (GDL) – Optional (continued)***XM Radio Entertainment:*

The optional XM Radio entertainment feature of the GDL 69A Data Link Receiver is available for the pilot's and passengers' enjoyment. XM Satellite Radio offers a variety of radio programming over long distances without having to constantly search for new stations. The GDL 69A can receive the S-band, XM Satellite Radio® entertainment services at any altitude throughout the Continental U.S. Based on signals from satellites, coverage far exceeds land-based transmissions.

Entertainment audio is not available on the GDL 69 Data Link Receiver as it is on the GDL 69A Data Link Receiver.

XM Radio is never muted for the cabin passengers unless a stereo input to the stereo input jack is installed. XM Radio is automatically muted for the front seat crew members during the following conditions:

- Aircraft radio reception
- Push-to-talk switch activation
- Stall warning activation
- Gear warning activation
- Marker beacon audio activity
- Master caution and master warning chimes
- Audible system messages

The XM Radio Page provides information and control of the audio entertainment features of the XM Satellite Radio. To get to the XM Radio Page, proceed to the AUX Page Group on the MFD, turn the small FMS knob to the AUX-XM Information Page and select the RADIO softkey.

Additional details on the XM Radio features are contained in the latest appropriate revisions of the Garmin Cockpit Reference Guide for the Piper PA-46 Matrix P/N: 190-01107-XX and/or the Garmin G1000 Pilot's Guide for the Piper PA-46 Matrix P/N: 190-01108-XX.

### **Keypad**

Control for the MFD, and if desired, the PFD, is performed by the MFD/PFD control unit (keypad) located aft of the throttle quadrant. Alpha-numeric keys are provided for easy entry of flight plan information, waypoint information, and frequency information. A range knob is provided to select ranges on the MFD or PFD, if desired. For a description of all the keys and features of the keypad, refer to the Garmin G1000 Cockpit Reference Guide for Piper PA-46 Matrix, Garmin p/n 190-01107-XX, latest revision or the Garmin G1000 Pilot's Guide for the Piper PA-46 Matrix, Garmin p/n 190-01108-XX, latest revision.

### **Audio Panel**

The audio panel contains traditional transmitter and receiver selectors, as well as an integral intercom and marker beacon system. The marker beacon lights appear on the PFD and the marker beacon audio can be heard on the cockpit speaker. In addition, a clearance recorder records the last 2½ minutes of received audio. Lights above the audio panel selection buttons indicate which selections are active. If a failure of Com 1 and Com 2 occurs, a fail-safe communications path is available between the pilot's headset/microphone and Com 1. The fail-safe communications path is activated by pulling the AUDIO MKR circuit breaker located on the pilot's aft circuit breaker panel, row C, position 4.

### **GTX 33 Mode S Transponder**

The G1000 Avionics Suite includes a GTX 33 Mode S Elementary Surveillance Operations transponder which connects to the PFD for control and display. The transponder provides Mode A (squawk code), Mode C (Altitude Encoding) and Mode S (Data Communications) functions.

The transponder is an automated transceiver operating on radar frequencies, receiving ground radar and traffic alert and collision avoidance system (TCAS) interrogations at 1030 MHz, then transmitting a coded response at 1090 MHz. The unit includes an altitude monitor and traffic information service (TIS). Altitude and traffic alerts are announced by a voice audio output. The PFD displays the code, reply indication, and operating mode. The MFD displays TIS graphical information, which may also appear in the PFD inset map. A traffic alert causes the PFD inset maps to automatically appear.

## 7.9 STANDBY INSTRUMENTS

The standby instrument group, located to the left of the PFD, includes an airspeed indicator, an electric attitude indicator, and a barometric altimeter. The standby airspeed and altimeter are plumbed to the pitot static system, and are of the traditional mechanical design. The standby electric attitude indicator is powered by a self-contained standby power source and includes a test feature.

### Mid-Continent 4300-4XX Series Standby Attitude Indicator

The standby attitude indicator provides backup display of aircraft attitude. It is located in the middle of the standby instrument group where it can be viewed easily by the pilot. It is powered by a self-contained standby power source so that it will remain powered for a minimum of 30 minutes after loss of the aircraft electrical system. In the event of a loss or interruption of the aircraft electrical power, the amber standby power light will start flashing, warning that the indicator has lost its main DC power source. Selecting the STBY PWR button located on the face of the instrument will power the indicator by means of the self-contained power source.

The self-contained emergency battery must be checked for proper operation prior to flight. 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 if the standby attitude indicator or the battery pack are inoperable.

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**7.11 HYDRAULIC SYSTEM**

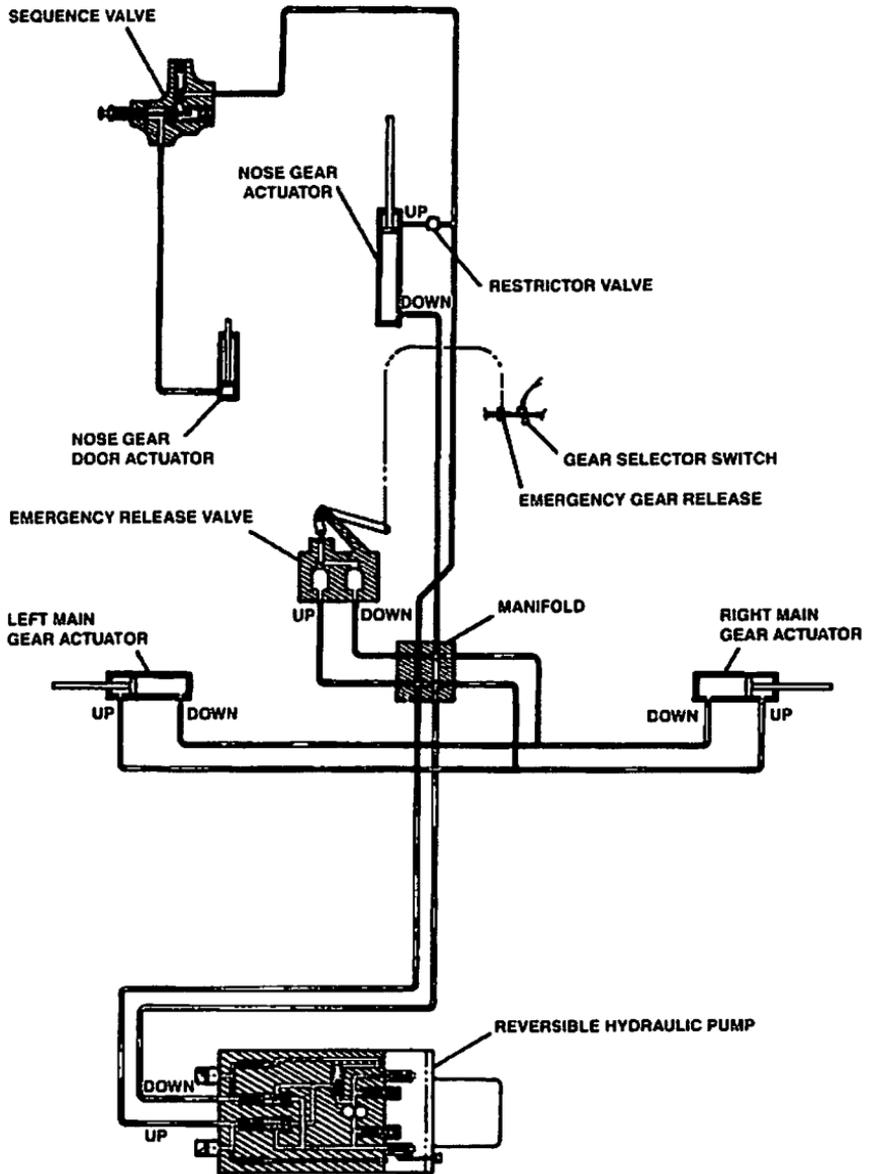
The hydraulic system (refer to Figure 7-9) provides the power to retract and extend the landing gear.

The electric motor driven hydraulic pump assembly is located aft of the rear baggage compartment and is accessible through the baggage compartment aft closeout panel. The pump assembly has an integral reservoir with filler plug, sight gauge and vent. The pump assembly incorporates pressure switches, bypass relief valves, and thermal relief valves in both the UP and DOWN sides. A shuttle valve is also incorporated to allow for unequal volumes of hydraulic fluid displaced during UP and DOWN gear actuation. Normal system operating pressure is controlled by the pressure switches. Maximum system operating pressure is limited by the bypass relief valves, and maximum system holding or trapped pressure is limited by the thermal relief valves.

The motor which drives the hydraulic pump is reversible and runs in one direction to supply gear UP pressure and in the opposite direction to supply gear DOWN pressure. The direction in which the pump runs is controlled electrically by the position of the gear selector switch on the instrument panel. An amber HYDR PUMP ON CAS message illuminates whenever the hydraulic pump operates for more than 1-second (on ground) or 20-seconds (in flight).

Other major components of the hydraulic system are the three gear actuators and the emergency gear extension valve. Operation of these components is covered in the landing gear section.

7.11 HYDRAULIC SYSTEM (continued)



HYDRAULIC SYSTEM

Figure 7-9

### 7.13 LANDING GEAR

The aircraft is equipped with hydraulically operated, fully retractable, tricycle landing gear.

Locking-type actuators are used for main and nose gears. The actuator assembly provides mechanical gear-down locking at the fully extended position and is hydraulically unlocked. The actuator also acts as the gear brace in the extended position.

The main gear retracts inboard into the wing root area. A mechanically linked door covers the strut assembly.

Hydraulic pressure for gear operation is furnished by an electrically driven hydraulic pump (refer to Figures 7-9 and 7-13). Gear operation is initiated by a two position selector with a wheel shaped knob located to the left of the engine control quadrant (Figure 7-11). Three green lights, which are individually activated as each gear mechanically locks into the DOWN position are located above the LANDING GEAR selector.

#### NOTE

The DAY/NIGHT 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.

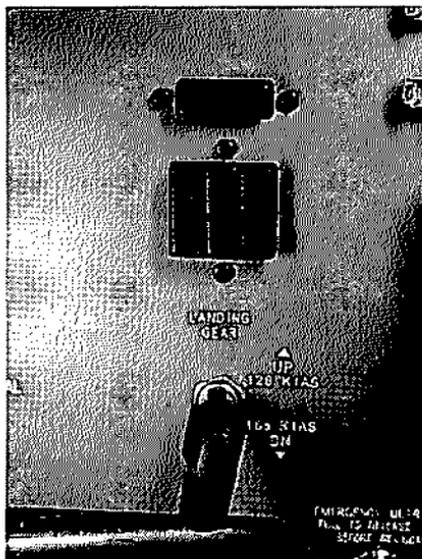
The LANDING GEAR selector knob must be pulled outward to release it from a detent in the DOWN position prior to moving it to the UP position. In addition, there is a squat switch on the left main gear which prevents operation of the gear UP electrical circuit when the aircraft weight is on the gear. If the landing gear selector is placed in the UP position with the aircraft weight on the gear, the gear warning horn will sound, the red GEAR WARNING annunciator and the amber HYDR PUMP ON CAS message will illuminate.

The landing gear is held in the UP position by hydraulic pressure which is trapped in the system UP lines by a check valve in the pump assembly. When normal pump operation is stopped by the pressure switch, a check valve in the pump assembly closes to trap fluid pressure in the UP side of the system. Emergency gear extension is accomplished by a manually actuated valve which relieves the pressure in the UP side and bypasses fluid to the DOWN side of the system. The additional fluid required for DOWN operation comes directly from the reservoir.

**7.13 LANDING GEAR (continued)**

The landing gear is held in the DOWN position by spring loaded mechanical locking mechanisms built into each of the three actuating cylinders. The individual gear safe light switches are also mechanically operated when each mechanism is in the LOCKED position. With the hydraulic pump and system operating normally, hydraulic pressure is also trapped in the DOWN side of the system. This DOWN pressure is not required to mechanically lock the cylinders and is not available if the hydraulic pump is inoperative.

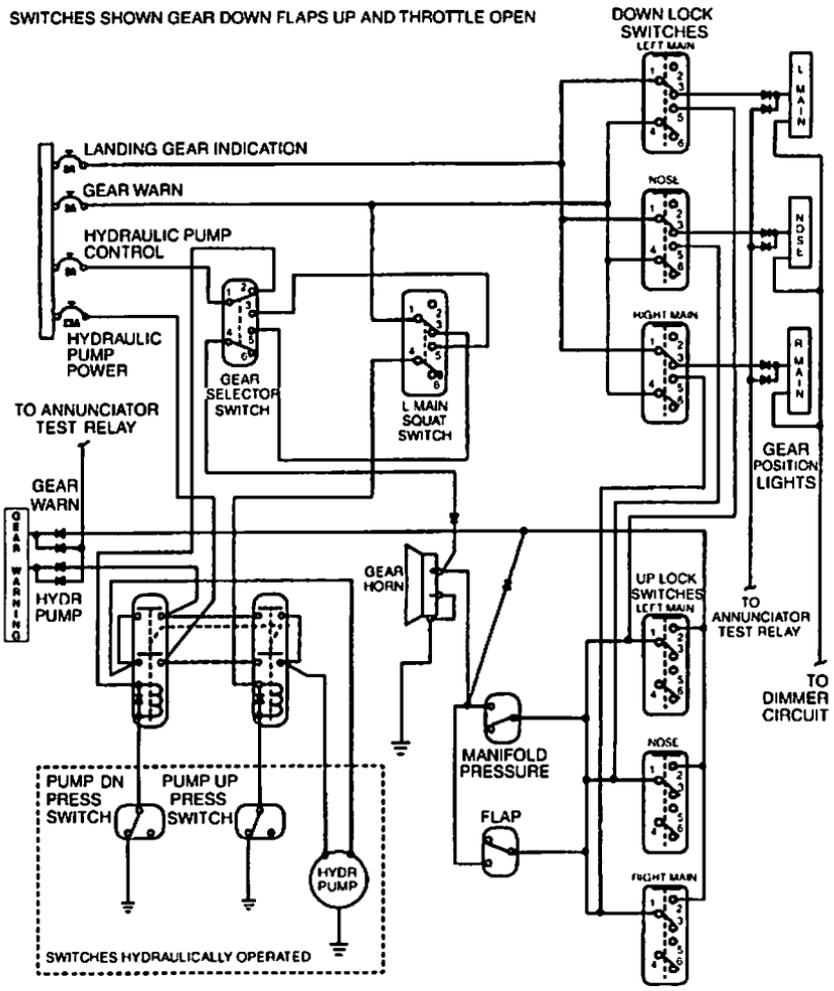
The emergency gear extension system allows the landing gear to free fall, with spring assist on the nose gear, into the extended position where the mechanical locks engage. If a gear system malfunction has been indicated and the emergency gear extension system used, it is recommended that the EMERGENCY GEAR EXTENSION control and the HYDRAULIC PUMP POWER circuit breaker 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 HYDRAULIC PUMP POWER circuit breaker must be reset in order for hydraulic pressure to be generated in the UP side of the system and the gear retracted.



**LANDING GEAR SELECTOR**

Figure 7-11

7.13 LANDING GEAR (continued)



LANDING GEAR ELECTRICAL DIAGRAM  
Figure 7-13

**7.13 LANDING GEAR (continued)**

**CAUTION**

When flying in extreme cold where the aircraft has been cold soaked for hours, the gear may not indicate down and locked for 10 to 15 seconds while aircraft temperatures are stabilizing.

A red GEAR WARNING annunciator, located on the instrument panel above the three green gear-down lights, is activated whenever all three landing gear are not fully down and locked, or not fully up with the gear doors closed. This annunciator comes on during normal gear operation to indicate that the gear is in transit. If it does not go out within approximately 10 seconds during normal gear operation or illuminates steadily during flight with the landing gear selector in the UP position, a system malfunction is indicated. There is also an amber HYD PUMP ON CAS message and single aural chime which indicates that the hydraulic pump motor has been operating for more than 20-seconds. A system malfunction is present. The CAS message is not illuminated during normal landing gear operation.

The red GEAR WARNING annunciator and gear warning horn will operate simultaneously under the following conditions:

- (a) In flight when the throttle is reduced to the point at which manifold pressure is approximately 14 inches of mercury or below and the landing gear are not in the DOWN position.
- (b) In flight when the flaps are extended more than 10° and the landing gear are not in the DOWN position.
- (c) On the ground when the landing gear selector is in the UP position. The landing gear squat switch activates to prevent operation of the retract side of the hydraulic pump on the ground.

**7.15 BRAKE SYSTEM**

The brake system is designed to meet all normal braking needs. Two single-disc, double puck brake assemblies, one on each main gear, are actuated by toe brake pedals mounted on both the pilot's and copilot's rudder pedals. A brake system reservoir, independent of the hydraulic system reservoir, is located behind the aft access panel in the forward baggage compartment. Brake fluid should be maintained at the level marked on the reservoir. For further information see BRAKE SERVICE in Section 8 of this handbook.

The PARK BRAKE knob is located just below the left control column. To set the parking brake, first depress and hold the toe brake pedals and then pull the PARK BRAKE knob. To release the parking brake, first depress and hold the toe brake pedals and then push in on the PARK BRAKE knob.

### **7.17 FLIGHT CONTROL SYSTEM**

The primary flight controls are conventional and are operated by dual control wheels and rudder pedals. The control wheel operates the ailerons and elevator. The rudder pedals actuate the rudder and nose wheel steering. The toe brakes, which are an integral part of the pedals, operate the wheel brakes. The ailerons and rudder are interconnected through a spring system, which is activated only when controls are out of harmony. In normal coordinated flight, the system is inactive. All flight control systems are operated by closed circuit cable systems.

Secondary control is by elevator and rudder trim. The controls are located on the pedestal (Figure 7-5). Aileron trim is provided by a fixed, ground-adjustable tab. The elevator trim control wheel is located on the right side of the pedestal. The wheel is rotated forward for nose-down trim and aft for nose-up trim. The rudder trim wheel is located on the aft face of the pedestal. The wheel is rotated to the right (counterclockwise) for nose right and left (clockwise) for nose left. Trim indications for the individual systems are located on the pedestal.

The wing flaps are electrically controlled by a selector lever mounted on the instrument panel immediately to the right of the control pedestal. The flap position indicator is located to the left of the selector lever. The flaps may be set to four positions; up (0°), 10°, 20°, and full down (36°). Each position is detented on the flap selector panel. The flaps will automatically move to the selected position, which can be confirmed by referring to the position indicator. The flaps may be extended to 10 at airspeeds below 165 KIAS, 20° below 130 KIAS, and 36° flap extension is limited to airspeeds below 116 KIAS. When extending the flap with the landing gear retracted, prior to the flap reaching the 20° position, the landing gear warning horn will sound, and the GEAR WARNING annunciator will illuminate. An amber FLAP FAIL CAS message illuminates if an over current condition occurs in the flap motor/actuator system. If this occurs, the flap protection circuit automatically removes power from the electric flap motor. Resetting of the FLAP WARN circuit breaker will restore normal operating power to the flap motor. If, after resetting, and operation of the flaps, the CAS message illuminates again then a system malfunction is indicated and the flap motor circuit breaker should be pulled.

## 7.19 FUEL SYSTEM

Fuel is stored in two main integral wing tanks (see Figure 7-15), located outboard of the mid-wing splice. Fuel quantity held by each wing tank is 60 usable gallons with one gallon of unusable fuel, for a total of 122 gallons. The minimum fuel grade is 100 or 100LL aviation grade. Each tank gravity feeds fuel through finger screens into three lines leading to collector/sump tanks located at the root of each wing, just aft of the main spar. During preflight the collector/sump tank and one of the three lines can be inspected in each main wheel well. Collector/sump tanks vent back to the main tanks by a fourth line located forward of the main spar. The main tanks vent to the atmosphere by non-icing vents installed in the most outboard forward access panels of each wing tank. Reverse fuel flow from collector tanks to main tanks is prevented by 2 flapper check valves installed in each collector tank. Collector tank sumps are the lowest points in the fuel system, and each has a drain valve for draining collector and main tanks.

### WARNING

Avoid prolonged uncoordinated flight to prevent uncovering of fuel tank outlets and subsequent fuel starvation.

Each tank separately vents air in and fumes out to equalize pressure with ambient conditions. This is accomplished through combination valves in non-icing fuel tank vents located at the most outboard, forward tank access panels.

### CAUTION

Do not insert objects into the wing vent as damage to the combination valve could result in fuel leakage.

### CAUTION

A plugged vent could result in fuel starvation. If a restrictal vent is suspected, select the opposite tank immediately. Monitor the suspect wing and fuel as soon as possible.

**7.19 FUEL SYSTEM (continued)**

**CAUTION**

The most accurate fuel quantity readings are obtained during coordinated flight.

Fuel quantity is indicated on the multi-function display (MFD). Each tank has two sensor sending units. Fuel tanks can be visually confirmed full if fuel level is up to the filler neck.

**NOTE**

Removal of the fuel filler cap from a wing tank that is sitting low or from an overfilled tank caused by thermal expansion could result in fuel spillage.

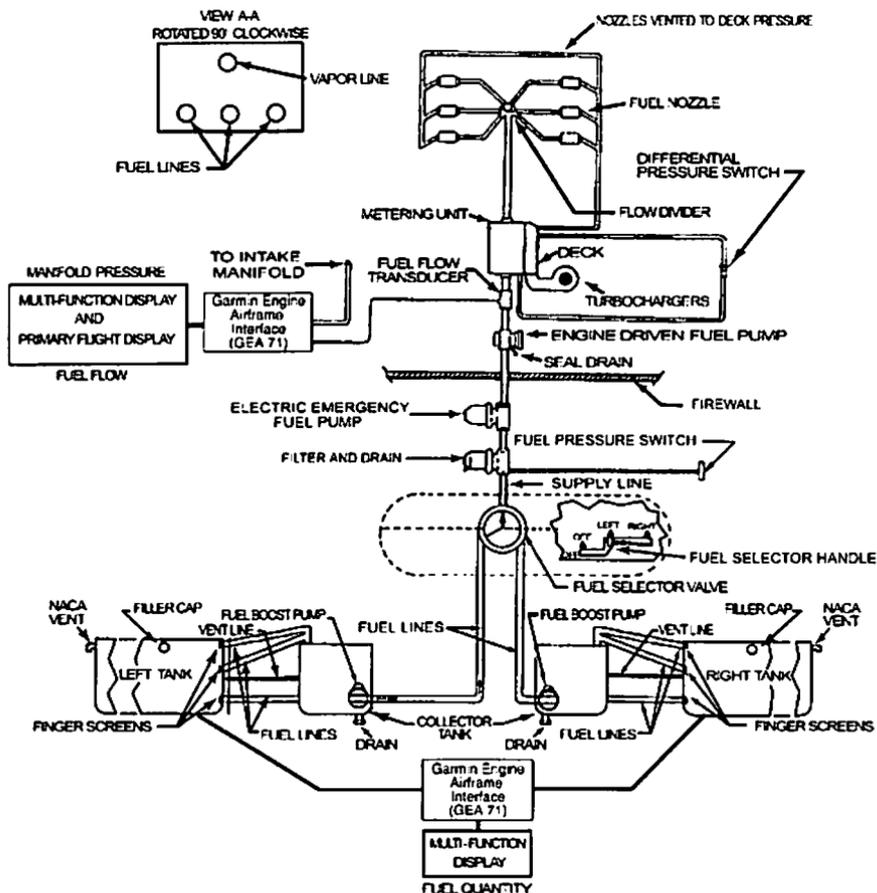
Quantity indication should be monitored at regular intervals during flight. Fuel tank selection should be alternated accordingly to maintain fuel and wing balance. See fuel imbalance limitations (2.35(e)).

**NOTE**

Airplane should be fueled symmetrically in a wings level condition. At times, this will require alternate filling of left and right tanks until the full condition is reached.

Each collector/sump tank has a submerged, electrically operated, centrifugal fuel boost pump to suppress fuel vaporization in the fuel lines between the fuel tanks and the engine fuel pump. When the BATT MASTR switch is ON, the appropriate boost pump is turned ON when the FUEL SELECTOR is set to the LEFT or RIGHT position. Thus, the boost pump of the selected fuel tank operates continuously during engine start, and normal engine operations on the ground or in flight. Neither pump will operate if the fuel selector is set to OFF, or positioned between the LEFT and RIGHT detents.

7.19 FUEL SYSTEM (continued)



FUEL SYSTEM SCHEMATIC  
Figure 7-15

**7.19 FUEL SYSTEM (continued)**

Should the fuel boost pump in the fuel tank being used fail to produce sufficient pressure, the amber BOOST PUMP FAIL CAS message will illuminate. In this event, confirm that the FUEL SELECTOR is properly seated in the detent for the selected tank. If the selector is properly seated, and the CAS message remains illuminated, select the opposite tank. Check the L BOOST and R BOOST circuit breakers and reset as necessary. Since there may be difficulty in obtaining the fuel from the tank with the malfunctioning boost pump, a precautionary landing at the nearest suitable airport should be considered to identify and correct the problem.

Should the engine driven fuel pump fail to produce sufficient pressure to sustain engine performance, the red FUEL PRESS LOW CAS message will illuminate. Immediately select the EMERG FUEL PUMP switch ON. The FUEL PRESS LOW CAS message will extinguish when adequate fuel pressure is restored. The EMERG FUEL PUMP switch should also be turned ON during takeoff and landing.

Fuel leaving the left or right collector/sump tank flows to a selector valve which is located on the right fuselage side behind the copilot's seat in a non-pressurized compartment. All fuel lines passing through the pressurized cabin are metal tubes surrounded by plastic cushion and encased by a second metal tube. This second tube is sealed from the cabin environment to preclude fuel from entering the cabin area or pressurized cabin air from entering fuel lines in the event of a leak.

The selector valve is cable controlled by a thumb sized handle located to the right of the parking brake handle. The detented selections are OFF, LEFT, RIGHT. LEFT or RIGHT positions direct fuel flow to the engine from the tank selected. To select OFF the FUEL SELECTOR must be moved to the left tank position, moved down against spring pressure, then moved to the far left, or OFF position.

Fuel flows from the fuel selector forward to the fuel filter located below the baggage floor on the right side. The filter drain is a nylon tube located on the right side of the aircraft, forward of the wing. To drain fuel simply push in the nylon tube. If contaminants clog the filter, an internal relief valve will allow fuel to bypass the filter. This will allow unfiltered fuel to reach the engine and could contaminate the fuel distribution system in the engine.

**NOTE**

Regular servicing of the filter and examination of fuel samples for contamination is required.

### 7.19 FUEL SYSTEM (continued)

Fuel flows from the filter, forward through the emergency fuel pump and firewall, into the engine compartment, to the engine-driven pump, through the fuel flow transducer, metering unit, flow divider and through each of six fuel nozzles into each cylinder.

When beginning flight operations with an equal amount of fuel in each tank, start, taxi, takeoff, and climb on the left tank. When beginning operations with unequal amounts of fuel in each tank, care must be taken not to exceed the fuel imbalance limitations specified in paragraph 2.35(e). An amber FUEL IMBALANCE CAS message illuminates whenever the imbalance exceeds 10 gallons.

After established in the cruise configuration, the mixture should be leaned. See Section 4 for proper leaning procedure. To maintain lateral balance, it is suggested that alternate tanks be selected in 20 gallon (approximately 60 minute) increments, thus requiring minimal aileron force to keep the wings level. In any case, the fuel imbalance limitations in Section 2 must not be exceeded. The pilot must monitor the fuel quantity indications and switch tanks as required. Fuel cannot be used from both tanks at the same time. The fuel quantity indication turns amber and a master caution sounds whenever the fuel quantity in either tank is less than or equal to 10 gallons. The fuel quantity indication turns red, a master warning sounds and a red L FUEL QTY LOW and R FUEL QTY LOW CAS message illuminates whenever the fuel quantity in the respective tank is less than or equal to 5 gallons.

### 7.21 ELECTRICAL SYSTEM

Power for the 28 Vdc, negative ground, dual fed split bus electrical system (Figure 7-17) is supplied by two belt driven, parallel connected, 28 Vdc 75 ampere alternators mounted on the forward section of the engine. When both alternators are operating and turned ON, a maximum continuous output of 150 amps is available. A 24 Vdc, 16 ampere hour lead acid battery, located beneath the left floor panel of the forward baggage compartment, provides power for engine starting. The battery also serves as a source of emergency electrical power in the event both alternators fail.

Electrical switches are located in one of three switch panels:

- (a) All powerplant, exterior light switches, and avionics related switches are located in an overhead switch panel (Figure 7-19).
- (b) A switch panel located between the MFD and the copilot's PFD contains all de-ice/anti-ice and environmental control related switches (Figure 7-23).



**7.21 ELECTRICAL SYSTEM (continued)**

A battery bus, located in the battery compartment, provides a continuous source of power for the ELT switch, EMER switch, forward baggage compartment light, and aft cabin courtesy light. Because the battery bus is connected directly to the battery, power is available for these functions even when the BATT MASTR switch is OFF. Fuses located on the battery bus are used to protect these circuits.

When the BATT MASTR switch, located on the overhead switch panel, is turned ON, the battery solenoid contactor closes, enabling current to flow from the battery to both the starter solenoid contactor and the tie bus located on the lower right section of the pilot's instrument panel (Figure 7-23). Should the airplane's battery be depleted, a receptacle located inside the forward baggage compartment door permits using an external 24 Vdc power supply for engine start. With the BATT MASTR switch OFF, connecting an appropriate external power source completes a circuit that closes the external power solenoid contactor, permitting current to flow from the external source direct to the starter contactor and the tie bus. Whether using the airplane's battery, or external power, tie bus overcurrent protection is provided by the 80 amp tie bus BATTERY circuit breaker and a 250 amp in line current limiter fuse.

**NOTE**

When utilizing just the airplane's battery, or just a 24 volt external power source, the VOLTS indication will be in the red range. Check the voltage indication for correct voltage readings.

Each alternator system is provided an independent ON-OFF switch (ALTR NO. 1 and ALTR NO. 2), located on the main switch panel, and a solid state voltage regulator that automatically regulates alternator field current. When selected ON, the positive output of each alternator is fed through individual shunts to the tie bus. Overcurrent protection is provided by the 80 amp tie bus ALTR NO. 1 and ALTR NO. 2 circuit breakers. Should an overvoltage condition occur in either alternator, its voltage regulator will shut off the field winding voltage of that alternator; thus overvoltage relays are not required. Output from either alternator can be shut off manually by turning that alternator's switch OFF. When either alternator fails, the appropriate ALTERNATOR FAIL CAS message will illuminate. With both alternators functioning as a single alternator failure the VOLTS indication will turn red when the tie bus voltage drops below 25 VDC. With neither alternator functioning the VOLTS indication will turn red when the tie bus voltage drops below 24 VDC.

## 7.21 ELECTRICAL SYSTEM (continued)

A main bus and a nonessential bus (Figure 7-21), with associated circuit breakers, are located on the pilot's left side panels. Two avionics buses, with associated circuit breakers (Figure 7-21), are located on the copilot's right side panel. The two avionics buses are interconnected through the avionics bus 25 amp BUS TIE circuit breaker.

Current is fed from the tie bus to the main bus by two conductors. In line diodes prevent reverse current flow to the tie bus. Two tie bus 80 amp MAIN BUS circuit breakers (Figure 7-21) protect the main bus from an overload.

Current from the tie bus is fed to each avionics bus through independent solenoid contactors. When the AV BUS MASTR switch is selected ON, both solenoid contactors de-energize, permitting current flow to both avionics buses. Avionics bus overload protection is provided by the 40 amp tie bus #1 AVIONICS BUS and #2 AVIONICS BUS circuit breakers (Figure 7-21). Should the need arise, either avionics bus can be isolated by pulling out the AVIONICS BUS TIE circuit breaker located on the co-pilot's circuit breaker panel row B, position 1 and the appropriate tie bus avionics circuit breaker.

The nonessential bus is also fed from the tie bus. Overload Protection is provided by the tie bus 70 amp NON ESS BUS circuit breaker (Figure 7-21).

The emergency bus is intended to provide emergency power to systems required to land the aircraft in the event of a Complete Electrical Failure. Its use is not intended for a non-complete loss of electrical power, such as loss of both alternators. The emergency bus is activated by pressing the EMER switch on the overhead switch panel.

### NOTE

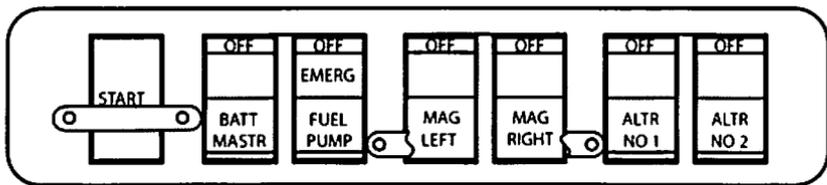
In the event of a total electrical failure and to operate exclusively on the emergency bus, the EMER switch should be turned ON and the BATT MASTR switch must be OFF.

### NOTE

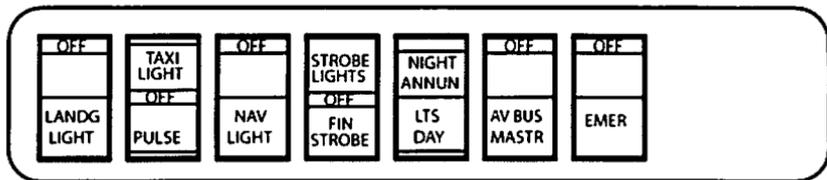
The displayed voltage "VOLTS" will be that of the emergency bus when the EMER switch is turned ON and the BATT MASTR, ALTR NO. 1 and ALTR NO. 2 are turned OFF, otherwise the displayed voltage will be that of the TIE BUS.

7.21 ELECTRICAL SYSTEM (continued)

The EMER bus is tied directly to the battery via a relay. The EMER bus provides power to the #1 PFD (in reversionary display mode), #1 Com/Nav/GPS, #1 AHRS, #1 ADC, the audio panel, the emergency bus voltage indication, a subset of engine parameters, landing gear down lights and internal lighting for the standby instruments, including the magnetic compass. The following parameters on PFD1 will display invalid while operating exclusively on the EMER bus: Manifold Pressure, Oil Pressure, Vacuum (if installed), Nav2/Com2, DME, XPDR1 and XPDR2 (if installed). The flaps will not function and the indication will correspond to the value present when the complete electrical failure occurred. The landing gear must be extended using the Emergency Landing Gear Extension procedure in Section 3.5p.



LEFT

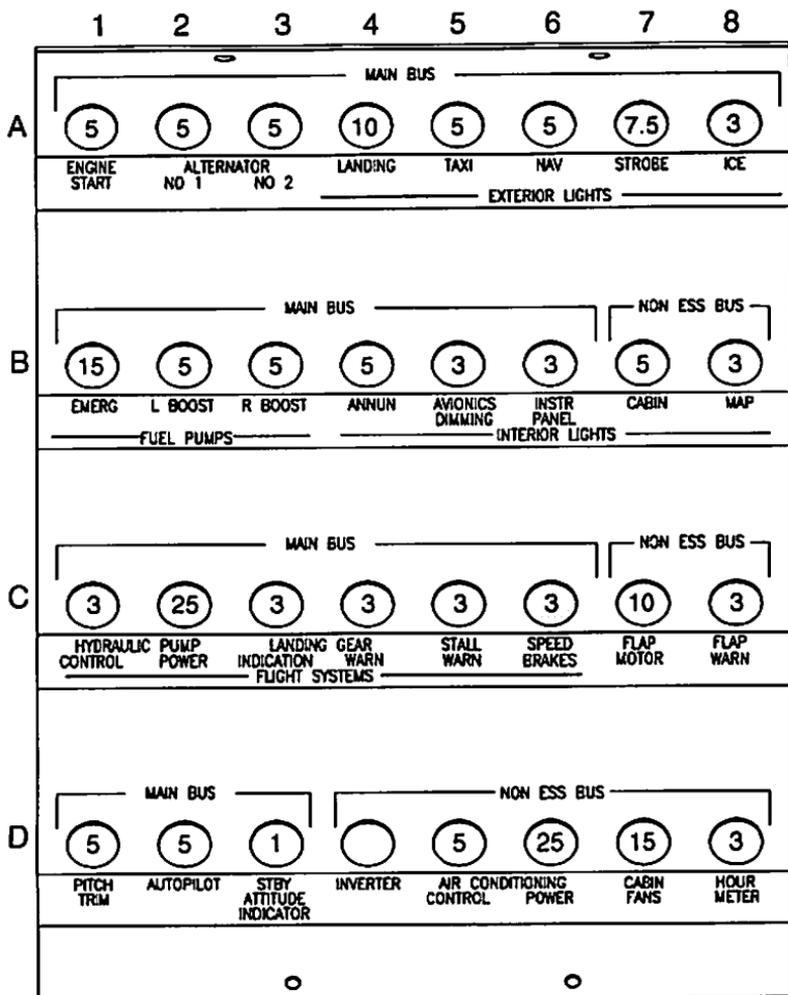


RIGHT

OVERHEAD SWITCH PANEL

Figure 7-19

7.21 ELECTRICAL SYSTEM (continued)

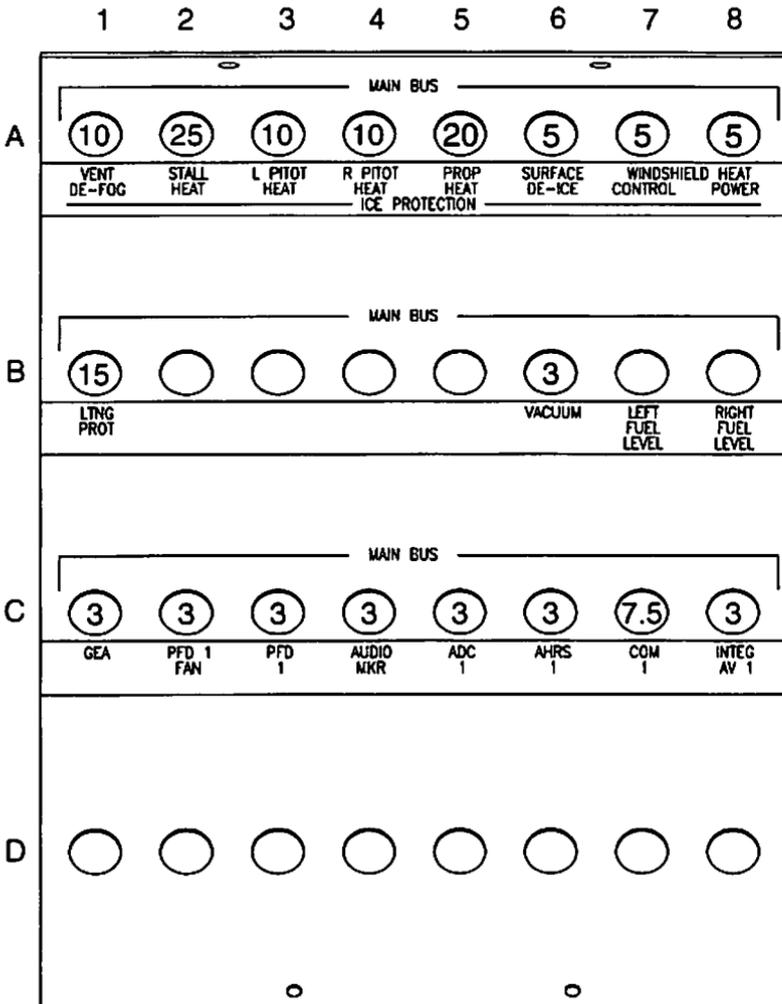


○ Shaded circuit breakers denote optional equipment

**CIRCUIT BREAKER PANELS**  
**(Pilot's Side - Forward, Typical)**

Figure 7-21

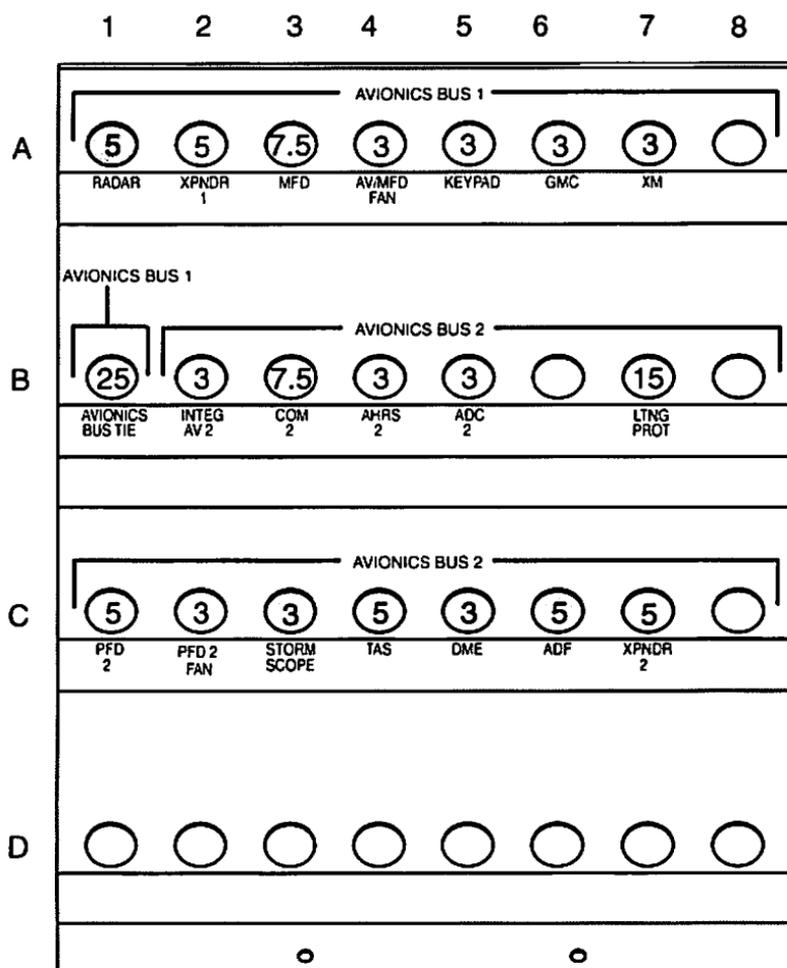
7.21 ELECTRICAL SYSTEM (continued)



○ Shaded circuit breakers denote optional equipment

**CIRCUIT BREAKER PANELS**  
(Pilot's Side - Aft, Typical)  
Figure 7-21 (continued)

7.21 ELECTRICAL SYSTEM (continued)

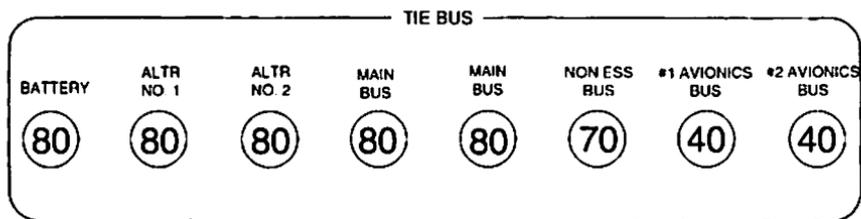


○ Shaded circuit breakers denote optional equipment

**CIRCUIT BREAKER PANELS**

(Copilot's Side, Typical)

Figure 7-21 (continued)



**CIRCUIT BREAKER PANELS  
(Tie Bus)**

Figure 7-21 (continued)

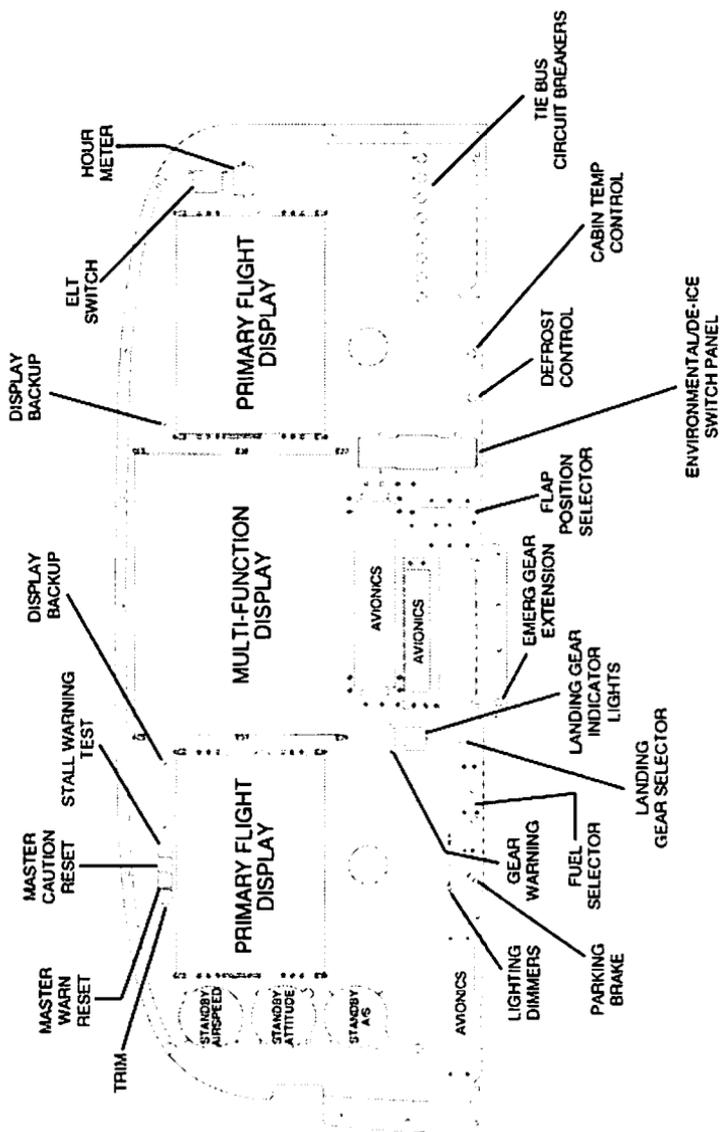
### **7.23 INSTRUMENT PANEL**

The instrument panel is designed to accommodate the flight instruments and the required power plant instruments.

All the high current tie bus input and feeder circuit breakers are located on the lower right section of the instrument panel.

See Figure 7-23.

7.23 INSTRUMENT PANEL (continued)



INSTRUMENT PANEL (Typical)

Figure 7-23

## **7.25 PITOT STATIC SYSTEM**

Pitot pressure for the airspeed indicators is sensed by heated pitot heads installed on the bottom of the left and right wings and is carried through lines within the wing and fuselage to the two Air Data Computers (ADC). Static pressure for the pilot's ADC and standby altimeter and airspeed indicators is sensed by static source ports on each side of the rear fuselage forward of the elevator. Co-located static ports are used for the co-pilot's ADC. Static pressure for the alternate static system is sensed by a separate static port located on the bottom of the aircraft just aft of the entry door.

An alternate static source control valve is located below the instrument panel to the left of the pilot. For normal operation, the lever remains down. To select alternate static source, place the lever in the up position. When the alternate static source is selected, the pilot's ADC and standby altimeter and airspeed are vented to alternate static ports on the bottom aft fuselage. During alternate static source operation, these instruments may give slightly different readings. The pilot can determine the effects of the alternate static source on instrument readings by switching from standard to alternate sources at different airspeeds.

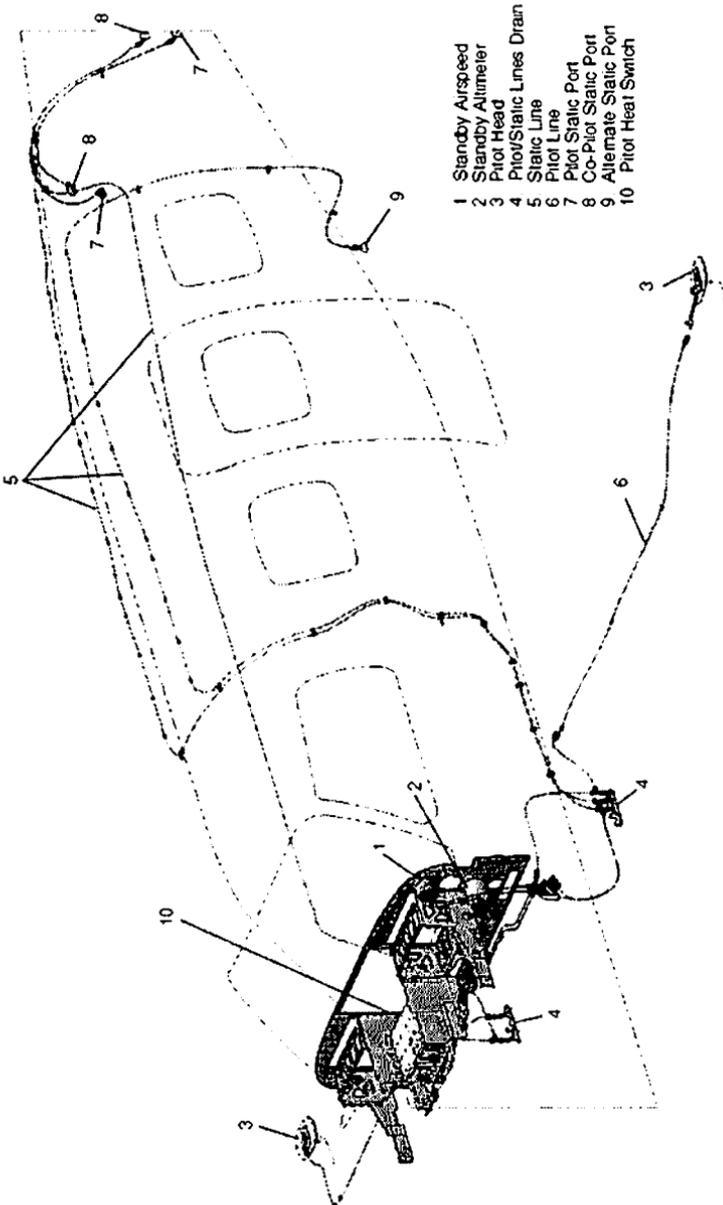
If one or more of the pitot static instruments malfunction, the system should be checked for dirt, leaks or moisture.

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.

Both the pitot and static systems can be drained through separate drain valves located on both the right and left lower side panels next to the crew seats. Three drain valves exist on the pilot side. The forward two drain valves are the pilot static drains and the aft drain valve is the pilot pitot drain. Two drain valves exist on the copilot side. The forward drain valve is the copilot pitot drain, the aft drain valve is the copilot static drain.

The heated pitot heads, which alleviate problems with icing and heavy rain, are standard equipment. The switch for pitot heat is located on the environmental/de-ice switch panel. Static source ports have been demonstrated to be non-icing; however, in the event that icing does occur, selecting the alternate static source will alleviate the problem.

7.25 PITOT STATIC SYSTEM (continued)



- 1 Standby Airspeed
- 2 Standby Altimeter
- 3 Pitot Head
- 4 Pitot/Static Lines Drain
- 5 Static Line
- 6 Pitot Line
- 7 Pitot Static Port
- 8 Co-Pilot Static Port
- 9 Alternate Static Port
- 10 Pitot Heat Switch

PITOT STATIC SYSTEM

Figure 7-25

**7.27 ENVIRONMENTAL SYSTEM (Refer to Figure 7-27)**

The environmental system consists of:

- (a) The ventilating air system.
- (b) A supplemental electric cabin heater.
- (c) An air conditioning system.
- (d) The cabin air distribution system.

Switches to control and regulate the various systems are located on the environmental switch panel to the right of the MFD.

Cabin ventilation is provided by ambient ram air and cabin heat is provided by ambient ram air routed through an exhaust shroud heat exchanger. Desired cabin comfort is maintained by using the cabin temp push-pull knob to manually adjust a flapper-type control valve located forward of the firewall. The position of this valve will allow ambient air, or hot air, or a mixture of both to enter the cabin air distribution system. Air is then routed into the cabin through the lower left and right side panel ducts.

An electric vane-axial ventilation/defog blower, located in the left cabin air inlet duct below the forward baggage compartment floor, is used to produce an air flow to the windshield defogger, and to supplement the inflow of ventilating air during ground operations. The blower is activated by selecting the VENT/DEFOG switch ON. Incoming ventilating air can be heated by mixing it with hot air from the exhaust shroud.

The supplemental electric heater consists of a resistance type heat element, a dual hermetically sealed bimetallic type overtemperature protection, a power relay, and a 35 amp in line current limiter fuse. Its function is to provide additional heat for maintaining desired cabin comfort during ground or flight operations under temperature conditions when fully heated bleed air or ventilating air is inadequate. When an external power source is used, the supplemental heater can also be used to preheat the cabin prior to engine start. See Section 2 for limitations on use of the supplemental heater.

The supplemental heater heat element is installed forward of the bulkhead in the left bleed air duct immediately downstream of the ventilation/defog blower. Because the ventilation/defog blower must be operating whenever supplemental heat is used, both the VENT DE-FOG and AUXILIARY CABIN HT switches must be ON to supply power to the heating element.

SECTION 3 - EMERGENCY PROCEDURES (continued)

ICE PROTECTION SYSTEM ANNUNCIATIONS (continued)

SINGLE ALTERNATOR FAILURE

**Indication: Master Warning Indication; Red ALTR 1 FAIL or ALTR 2 FAIL; Repeating aural chime.**

**NOTE**

With a single alternator failure, the VOLTS indication will turn red anytime total tie bus voltage is below 25 VDC.

Verify failure .....CHECK Amperage Indications

Electrical load (if VOLTS CAS message

illuminated).....REDUCE until load is less than 75 amps & VOLTS indication is out of red range

Failed ALTR switch.....OFF

Failed ALTR circuit breaker .....CHECK and RESET as required.

(Located on the pilot's forward circuit breaker panel, row A, positions 2 and 3)

Failed ALTR switch (after OFF at

least one second).....ON

**If power not restored:**

Failed ALTR switch.....OFF

Amperage Indication .....Monitor and maintain below 75 amps.

**NOTE**

While one alternator will supply sufficient current for minimum required avionics and cockpit lighting, use of deicing equipment, particularly windshield or propeller heat, may be limited. *Immediate action should be taken to avoid or exit icing conditions.* Effort should be taken to keep the electrical load under 74 amps, however under certain circumstances the load may exceed 75 amps when large momentary loads such as landing gear are used in combination with other required equipment. The electric cabin heater, cabin recirculation blowers, and position, strobe, and landing lights should not be used unless absolutely necessary.

**SECTION 3 - EMERGENCY PROCEDURES (continued)****ICE PROTECTION SYSTEM ANNUNCIATIONS (continued)****CAUTION Messages - Amber - Single Aural Chime**

Message	Cause
L PITOT HT FAIL	Left pitot heat has failed.
R PITOT HT FAIL	Right pitot heat has failed.
PITOT HT OFF	Pitot heat has not been selected ON (no chime accompanies this CAS message).
PROP HT FAIL	A fault has developed in the prop heat system or current is under 16.0 amps.
STALL WARN FAIL	The stall warning lift computer and/or lift transducer has failed.
SURF DE-ICE FAIL	Surface de-ice system has failed.

**ADVISORY Messages - White - No Aural Chime**

Message	Cause
SURF DE-ICE ON	Surface de-ice system is selected ON and power is being applied to the SURF DE-ICE timer.
VACUUM 1 FAIL	Vacuum 1 is below approximately 2.0 in.-Hg.
VACUUM 2 FAIL	Vacuum 2 is below approximately 2.0 in.-Hg.

**SECTION 3 - EMERGENCY PROCEDURES**

**WARNING**

The malfunction of any required deice equipment requires immediate action to exit icing conditions. Depending on the severity of the icing encounter, failure to take immediate positive action can lead to performance losses severe enough to make level flight impossible. Therefore, upon verification of a system malfunction or failure, climb or descend out of icing conditions if this provides the shortest route. If exit must be made in level flight, consider the use of maximum power and exit by the most direct route. The effect of the additional fuel burned at higher power settings on aircraft range must be considered and an alternate airport chosen if necessary.

**ICE PROTECTION SYSTEM ANNUNCIATIONS**

**WARNING Messages - Red - Repeating Aural Chime**

Message	Cause
ALTR 1 FAIL	ALTR NO. 1 switch is turned ON and the alternator has failed.
ALTR 2 FAIL	ALTR NO. 2 switch is turned ON and the alternator has failed.
WNSHLD OVERTEMP	Windshield temperature exceeds 170° F or the windshield temperature sensor has failed.

**SECTION 2 - LIMITATIONS (continued)****CAUTION**

Accumulation of ice on any surface of the airplane leads to an increase in total drag and a resulting reduction in airspeed. Aircraft airspeed, airspeed indicator markings, adverse handling characteristics, and frequent pitch trim activation (blue TRIM annunciator light or trim wheel movement) should be monitored closely to maintain proper low airspeed awareness.

**STALL WARNING SYSTEM**

Since stall buffet and stall speeds increase with with intercycle and residual ice accumulated on the boots and unprotected surfaces, the stall warning system may not be accurate and should not be relied upon.

**OAT PROBES**

At the worst case condition (highest derived Mach number) presented in the performance charts of this POH and with a fully iced over OAT probe, which assumes the measured total temperature equals static temperature, the maximum indicated temperature error calculated is 4°C less than actual.

**PLACARDS**

On the pilot's left side panel:

THIS AIRCRAFT 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 ICING FLIGHT WHEN EQUIPPED IN ACCORDANCE  
WITH THE AIRPLANE FLIGHT MANUAL.

**WARNING**

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

**WARNING**

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

100700-073

**SECTION 2 - LIMITATIONS (continued)**

**AUTOPILOT**

Autopilot operation during icing conditions may mask cues that indicate adverse changes in aircraft handling characteristics. Autopilot operation is prohibited if any of the following conditions in icing flight are experienced:

- Severe icing conditions (reference SECTION 1 - GENERAL).
- Elevator bridging is encountered.
- Frequent pitch trim activation during straight and level flight as indicated by trim wheel movement and illumination of the TRIM annunciator light.
- Conditions developed which cause pitch, roll or yaw servo to provide a sustained force as indicated by ELE, AIL or RUD alert annunciations in the AFCS system status field on the PFD and/or pilot qualitative evaluations.

**NOTE**

The autopilot must be disconnected periodically to evaluate the above mentioned conditions.

**CAUTION**

During flight in icing conditions, ice will form on the unprotected leading edge of the elevator, and possibly form a bridge of ice, or ice cap, between the stabilizer and the elevator. This condition may be detected and verified by visual observation, by increased elevator pitch control forces, or frequent autopilot mistrim or trim animation (TRIM) annunciations during straight and level flight. If ice bridging is detected or suspected, disconnect the autopilot and pilot the aircraft (elevator pitch control) to dislodge the ice bridge. Elapsed time between conducting elevator checks will vary, depending upon the amount and type of ice accretion. Usually 8 to 10 minutes between elevator pairing cycles is considered sufficient.

**SECTION 2 - LIMITATIONS (continued)**

**ENVIRONMENTAL CONDITIONS (continued)**

**MINIMUM OUTSIDE AIR TEMPERATURE FOR BOOT OPERATION**

Operation of the pneumatic deice system at temperatures below -40° may result in damage to the deicer boots.

**WINDSHIELD HEAT CHECKS**

Ambient temperature of the windshield must be less than 115°F (46° C).

The engine must be running.

WSHLD HIGH operations limited to 20 seconds during ground operations and system tests.

**MAGNETIC COMPASS**

Accuracy of the magnetic compass may be unreliable with the combination of air conditioner, pitot heat, stall warning heat, auxiliary cabin heat, windshield heat and propeller heat turned on.

**SECTION 2 - LIMITATIONS (continued)**

**ENVIRONMENTAL CONDITIONS (continued)**

*With frost, ice, snow or slush adhering to the following areas: (continued)*

8. Top of fuselage
9. Static ports
10. Windshield
11. Upper surface of engine cowling forward of windshield

A visual and tactile (hand on surface) check of the wing leading edge and wing upper surface must be performed to ensure the wing is free from frost, ice, snow, or slush when the outside air temperature is less than 10°C (50°F) or if it cannot be determined, wing fuel temperature is above 0°C (32°F) and

1. there is visible moisture present (rain, drizzle, sleet, snow, fog, etc.); or
2. water is present on the wing upper surface; or
3. the difference between the dew point and the outside temperature is 3°C (5°F) or less; or
4. the atmospheric conditions have been conducive to frost formation.

**MINIMUM SPEED IN ICING CONDITIONS**

Minimum speed during flight in icing conditions with the flaps up is 130 KIAS.

**FLAP SETTINGS FOR OPERATIONS IN ICING CONDITIONS**

Flaps must be up when holding in icing condition, maximum flap extension with ANY ice accumulation on the airframe is limited to 20°.

**MINIMUM APPROACH SPEED WITH FAILED SURFACE DE-ICE SYSTEM**

A minimum approach speed of 105 KIAS should be used with the flaps in the 0° (fully retracted) position.

**MINIMUM APPROACH SPEED WITH OPERATIONAL SURF DE-ICE SYSTEM**

A minimum approach speed of 95 KIAS should be used with the flaps in the 20° position.

**SECTION 2 - LIMITATIONS****REQUIRED EQUIPMENT**

The Piper Matrix airplane is approved for flight into light to moderate icing conditions as defined by 14 CFR Part 25, Appendix C, only if the following required ice protection systems and equipment are installed and functioning properly.

- (1) Pneumatic wing and empennage boots and SURF DE-ICE ON and SURF DE-ICE FAIL CAS messages.
- (2) Wing ice detection light.
- (3) Electrothermal propeller deice pads on the propeller blades and PROP HT FAIL CAS message.
- (4) Electrically heated windshield and WINDSHLD OVERTEMP CAS message.
- (5) Heated stall warning lift detector.
- (6) Heated pitot heads and L/R PITOT HT FAIL CAS messages.
- (7) Dual alternators.
- (8) Dual vacuum pumps and VACUUM LOW CAS message.
- (9) Alternate static source.
- (10) All equipment required for night IFR flight.

**ENVIRONMENTAL CONDITIONS**

Inadvertent operation in freezing rain, freezing drizzle, or conditions defined as severe may be detected by heavy ice accumulation on the airframe and windshield, ice accumulation in areas not normally observed to collect ice, or when ice forms on the upper surface of the wing, aft of the surface de-ice boot. If these conditions are encountered, the pilot should take immediate action to exit these conditions by changing altitude or course.

Takeoff is prohibited with the following forms of contamination:

*With frost, ice, snow or slush adhering to the following areas:*

1. Wing leading edge
2. Wing upper surface
3. Horizontal stabilizer
4. Control surfaces
5. Windshield
6. Propeller blades
7. Engine inlets

**SECTION 1 - GENERAL (continued)**

**ICING DEFINITIONS**

**Residual Ice** - Ice that remains attached to the de-ice boot at the conclusion of that boot inflation cycle.

**Intercycle Ice** - The quantity of ice that accumulates on the wing horizontal stabilizer and vertical tail de-ice boots between de-ice boot cycles.

**Failure Ice** - The quantity of ice accumulated on the wing horizontal stabilizer and vertical tail de-ice boots if the pneumatic surface de-ice system fails.

**Light Icing** - The rate of accumulation may create a problem if flight is prolonged in this environment. Occasional use of de-icing/anti-icing equipment removes/prevents accumulation.

**Moderate Icing** - The rate of accumulation is such that even short encounters become potentially hazardous and use of de-icing/anti-icing equipment or flight diversion is necessary.

**Severe Icing** - The rate of accumulation is such that de-icing/anti-icing equipment fails to reduce or control the hazard. Immediate flight diversion is necessary.

**Rime Ice** - A rough, milky, opaque ice formed by the instantaneous freezing of small, supercooled water droplets.

**Mixed Ice** - Simultaneous appearance of rime and clear ice or an ice formation that has the characteristics of both rime and clear ice.

**Clear Ice** - A glossy, clear, or translucent ice formed by the relatively slow freezing of large supercooled water droplets. The terms "clear" and "glaze" have been used for essentially the same type of ice accretion, although some reserve "clear" for thinner accretions which lack horns and conform to the airfoil.

**SECTION 1 - GENERAL (continued)****VISUAL CUES FOR SUPERCOOLED LARGE DROPLETS (SLD) CONDITIONS**

Should supercooled large droplets (SLD) be present, most aircraft with unpowered controls and pneumatic boots should request a route or altitude change to exit the conditions.

The cues listed as follows are indicative of SLD conditions:

- Ice may become visible on the upper or lower surface of the wing, aft of the active part of the deicing boots. Pilots should look for irregular or jagged lines of ice or for pieces of ice shedding off the airplane. During night operations, adequate illumination should be used to observe all areas.
- The aft limit of ice accumulation on a propeller spinner that is not heated will reveal ice extending beyond normal limits.
- Unheated portions of side windows may begin to accumulate granular dispersed ice crystals or a translucent or opaque coating over the entire window. This icing may be accompanied by other ice patterns on the windows, such as ridges. These patterns may occur from within a few seconds to half a minute after exposure to SLD conditions.
- Ice coverage may become unusually extensive, with visible ice fingers or feathers on parts of the airframe that normally would not be covered by ice.
- The aircraft's performance may degrade. Pilots should remain vigilant when icing conditions are present, and any alteration of the aircraft's performance should be monitored closely as a sign of icing on the airplane.

## SECTION 1 - GENERAL

This supplement provides information necessary for the operation of the Piper Matrix aircraft for flight into known icing conditions.

Icing conditions can exist when:

- The outside air temperature (OAT) is 10°C or colder, and visible moisture in any form such as clouds, fog or mist, rain, snow, sleet and ice crystals are present.
- During ground operations when operating on contaminated ramps, taxiways or runways where surface snow, ice, standing water or slush are present.
- There are visible signs of ice accretion on the aircraft.

The Matrix ice protection system was designed and tested for operation in light to moderate meteorological conditions defined in FAR 25, Appendix C, for continuous maximum and intermittent maximum icing conditions. The ice protection system was not designed or tested for flight in freezing rain, freezing drizzle or supercooled liquid water and ice crystals, or conditions defined as severe. Flight in these conditions is prohibited and must be avoided.

The ice protection system was not designed to remove ice, snow or frost accumulations from a parked airplane. Ice, snow or frost must be completely removed during preflight to ensure a safe takeoff and subsequent flight. Procedures for ice, snow or frost removal, such as a heated hangar and/or approved deicing fluids, must be used to ensure that **ALL** ice, snow, or frost is **COMPLETELY** removed from the wings, tail, control surfaces, windshield, propeller, engine intakes, fuel vents and pitot-static ports, prior to flight.

Some icing conditions not defined in FAR Part 25, Appendix C have the potential of producing hazardous ice accumulations, which may exceed the capabilities of the airplane's ice protection equipment. See section titled Visual Cues for Supercooled Large Droplet (SLD) Conditions in this supplement.

Flight into icing conditions which are outside the FAR defined conditions is prohibited, and pilots are advised to be prepared to divert the flight promptly, by changing course or altitude, if hazardous ice accumulations occur.

**PILOT'S OPERATING HANDBOOK  
AND  
FAA APPROVED AIRPLANE FLIGHT MANUAL**

**SUPPLEMENT NO. 1  
FOR  
ICE PROTECTION SYSTEM  
(APPROVED FOR FLIGHT INTO KNOWN ICING CONDITIONS)**

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when Ice Protection System 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



**WAYNE E. GAULZETTI  
ODA-510620-CE  
PIPER AIRCRAFT, INC.  
VERO BEACH, FLORIDA**

DATE OF APPROVAL: October 26, 2009

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**SECTION 9  
SUPPLEMENTS**

**9.1 GENERAL**

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

All of the supplements provided in 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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TABLE OF CONTENTS

SECTION 9

SUPPLEMENTS

Paragraph/Supplement No.		Page No.
9.1	General .....	9-1
1	Ice Protection System.....(28 pages)	9-3
2	Garmin GMA 347 Audio Panel .....(8 pages)	9-31
3	Bendix/King KR-87 Digital ADF with Garmin PFD Indicator.....(10 pages)	9-39
4	Bendix/King KN-63 DME .....	(4 pages) 9-49
5	Precise Flight SpeedBrake 2000 System .....	(8 pages) 9-53
6	Propeller Heat.....(6 pages)	9-61

**8.37 CLEANING AND MAINTENANCE OF RELIEF TUBE SYSTEM  
(continued)**

**(b) Exterior**

Exterior bottom painted surfaces of the aircraft must be cleaned from the firewall to the tip of the tail including the bottom of the tail surfaces, at termination of each flight when the relief tube system has been used. Cleaning should occur in accordance with paragraph 8.35(c) with the following exception: After completion of washing, a solution of baking soda (10%) and water should be applied to the entire area and allowed to remain for a few minutes. The area then must be thoroughly rinsed with clean water. The area should be thoroughly dried and observed for paint chips and corrosion, with touch up as necessary.

**8.39 CLEANING GARMIN PFD AND MFD DISPLAYS**

The Garmin Primary Flight Display (PFD) and Multi-Function Display (MFD) use a lens coated with a special anti-reflective coating that is very sensitive to skin oils, waxes and abrasive cleaners.

**CAUTION**

Cleaners containing ammonia will harm the anti-reflective coating. It is very important to clean the display lenses using a clean, lint-free cloth and an eyeglass lens cleaner that is specified as safe for anti-reflective coatings.

**8.37 CLEANING AND MAINTENANCE OF RELIEF TUBE SYSTEM**

When the aircraft is equipped with a relief tube system, the corrosive effects of urine or other liquids poured through the system are extreme and require much attention to the cleanliness of this system both inside and outside of the aircraft. From the interior standpoint, the funnel tube assembly, rubber hose and surrounding sheet metal should be cleaned at termination of flight when the system has been used. Likewise, attention to the exterior of the aircraft is equally as important and must be cleaned as described below.

*The corrosive affects of urine on painted and unpainted surfaces cannot be overemphasized. Corrosion may appear in surrounding areas if allowed to go uncleaned for one day!*

**(a) Interior**

After each use of the relief tube, the area surrounding the relief tube should be examined for spillage and cleaned according to the cleaning procedures listed in paragraphs 8.35(e) and (f) above. Clean area inside the box and access door, funnel and tube using mild soap and water. After cleaning, assure that no soapy residue remains by flushing with clean water. Dry system thoroughly.

**CAUTION**

Should spillage extending into the fuselage be evident, maintenance actions must occur which include removing panels to access the floor structure to neutralize urine spillage in the aircraft structure.

Prepare to flush the relief tube assembly by placing a container underneath the relief tube outlet. Flush tube by pouring a solution of baking soda (10%) and water through the tube, flushing out the entire system. Flush again with at least 1/2 gallon of clear water. (Shop air, at low pressure, may be blown through the relief tube system to dry the system.)

**8.35 CLEANING (continued)**

Petroleum products are injurious to rubber and their use as cleaning agents should be avoided. Limited use of Mineral Spirits or non-leaded (NOT LOW LEAD) gasoline is not harmful in cleaning the deicers, if the cloth is dampened (not dripping) with solvent, and a dry cloth is used to wipe the deicer before the solvent has time to soak into the rubber.

With the deicer boots properly cleaned, a coating of Agemaster No. 1 should be applied. This treatment helps protect the neoprene deice boots from ozone attack, aging and weathering.

Icex may be applied to all of the boots if icing conditions are anticipated. Any boots treated with Agemaster should be allowed to dry before application of Icex. For specific instructions refer to the PA-46R-350T Maintenance Manual.

**8.35 CLEANING (continued)**

- (2) For simple stains (e.g. coffee, cola) clean headliner with a sponge and a common household suds detergent (e.g. Tide). Dirty grease stains should be first spot cleaned with a lighter fluid containing Naphtha to remove the solvent soluble matter. Any stain residue should then be shampooed with a household upholstery cleaner (e.g. Carbona upholstery and rug shampoo).

With proper care, your Matrix headliner will provide years of excellent appearance and durability.

**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 nonflammable dry cleaning fluid. Floor carpets may be cleaned like any household carpet.

**(g) Cleaning Oxygen Equipment**

- (1) Clean the mask assemblies with a suitable oil-free disinfectant.
- (2) Wipe dirt and foreign particles from the unit with a clean, dry, lint-free cloth.

**(h) Cleaning Surface Deicing Equipment (if installed)**

The deicers should be cleaned when the aircraft is washed using a mild soap and water solution.

In cold weather, wash the boots with the airplane inside a warm hangar if possible. If the cleaning is to be done outdoors, heat the soap and water solution before taking it out to the airplane. If difficulty is encountered with the water freezing on boots, direct a blast of warm air along the region being cleaned using a portable ground heater.

**8.35 CLEANING (continued)**

**(d) Cleaning Windshield and Windows**

**CAUTION**

Use only mild soap and water when cleaning the heated windshield. Use of ANY other cleaning agent or material may cause discoloration or damage to windshield coatings.

- (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 Plexiglas Polish and cleaner, conforming to Federal Specification P-P-560 or 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 minor scratch or mar in plastic can be removed by rubbing out the scratch with jeweler's rouge. Smooth both sides and apply wax. Deep scratches may lead to failure when pressurized.**
- (6) If a deep scratch or crack is found in any of the windshields or windows, do not pressurize cabin until serviced at authorized repair station.**

**(e) Cleaning Headliner, Side Panels and Seats**

- (1) For normal soiling and smudges, simply use the dry cleaning pad provided. This pad contains an exclusive grit- free powder with unusual power to absorb dirt.**

Squeeze and twist the pad so the powder sifts through the meshes and adheres to the cloth. Then rub the soiled part in any direction, as hard as necessary to clean.

Even though the pad eventually becomes soiled, this soil will not transfer back to the headliner.

**8.35 CLEANING (continued)****(b) Cleaning Landing Gear**

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

**CAUTION**

Do not brush the micro switches.

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

**(c) Cleaning Exterior Surfaces**

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

**CAUTION**

Do not direct any stream of water or cleaning solutions at the openings in the pitot head, static ports, alternate static ports or fuselage belly drains.

- (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.

### 8.33 LUBRICATION

For lubricating instructions, a chart showing lubrication points and types of lubricants to be used, and lubrication methods, refer to the PA-46R-350T Maintenance Manual.

### 8.35 CLEANING

#### (a) Cleaning Engine Compartment

- (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 alternators, vacuum pumps, starter, magnetos 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) Lubricate the controls, bearing surfaces, etc., in accordance with the Lubrication Chart in the PA-46R-350T Maintenance Manual.
- (5) Assure that all engine exhaust deposits and stains are removed frequently from bottom of aircraft around exhaust outlets. *Accumulation of exhaust deposits left even over short periods of time will cause corrosion.*

### 8.27 TIRE INFLATION

For maximum service, keep tires inflated to the proper pressure: 50 psi for the nose tire and 55 psi for the main tires. 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.

### 8.29 BATTERY SERVICE

Access to the 24-volt battery is gained by opening the forward baggage door and removing the left floor of the forward baggage compartment. 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.

Inspect overflow sump for presence of battery fluid. Fluid in the sump is not a normal condition and indicates either a battery or charging system problem. If fluid is present, the electrical system must be serviced to eliminate cause and the neutralizer media in the sump jar replaced.

If the battery is not up to charge, remove it from the aircraft, then recharge starting at a 3 amp rate and finishing with a 1.5 amp rate. Quick charges are not recommended.

### 8.31 OXYGEN SYSTEM

#### CAUTION

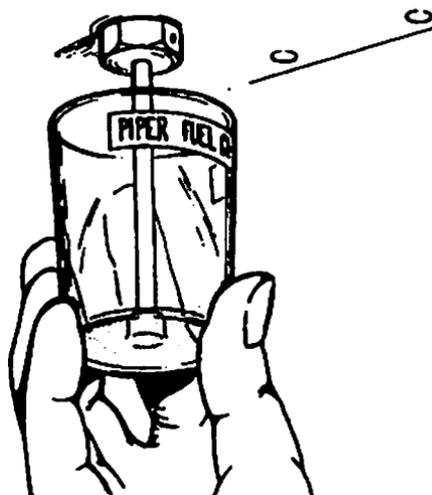
Positively NO SMOKING while oxygen is being used by anyone in the aircraft.

#### CAUTION

To preclude the possibility of fire by spontaneous combustion, oil, grease, paint, hydraulic fluid, and other flammable material should be kept away from oxygen equipment.

The oxygen system should be serviced per the PA-46R-350T Maintenance Manual, Chapter 35.

8.25 FUEL SYSTEM (continued)



**FUEL TANK DRAIN**

Figure 8-3

(e) Emptying Fuel System

Drain the bulk of fuel at sump tanks. Set fuel selector on left or right tank. Push in sump drain valves and twist turn to lock open. Remaining fuel may be drained through the filter drain. Close sump drain valves before refueling.

**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.

**8.25 FUEL SYSTEM (continued)**

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 60 U.S. gallons. When using less than the standard 120 gallon capacity, fuel should be distributed equally between each side.

**NOTE**

Aircraft should be refueled in a wing level condition. At times this will require alternate filling of left and right tanks until the full condition is reached.

**(d) Draining Fuel Strainer, Sumps and Lines**

The fuel tank sumps and filter should be drained before the first flight of the day and after refueling. Set fuel selector on left or right tank before draining. The fuel collector/sump tanks, located at the root of each wing, are the lowest points in the system. Each tank drain is accessible through a hole in the bottom wing skin adjacent to the wheel well. The fuel filter drain is located on the right hand side of the fuselage several feet forward of the wing. Sumps and filter should be drained until sufficient fuel has flowed to ensure the removal of any contaminants. When draining sumps, use the end on sampler cup to push in valve, catching fuel in the cup. (Refer to Figure 8-3.) To drain filter, hold sampler cup under nylon tube and push in tube. Always inspect fuel for contaminants, water and fuel grade (color). Assure that valves have sealed after draining.

**NOTE**

Sump drains will lock open if valve is pushed in and turned. Continue turning to release lock.

### **8.25 FUEL SYSTEM (continued)**

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-1-27686, 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 ounces per ten gallons of fuel would fall within this range. A blender supplied by the additive manufacturer should be used. Except for the information contained in this section, the manufacturer's mixing or blending instructions should be carefully followed.

#### **CAUTIONS**

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

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

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

#### **(c) Filling Fuel Tanks**

#### **WARNINGS**

Do not operate any avionics or electrical equipment on the airplane during refueling. Do not allow open flame or smoking in the vicinity of the airplane while refueling.

During all refueling operations, fire fighting equipment must be available. Two ground wires from different points on the airplane to separate approved grounding stakes shall be used.

**8.25 FUEL SYSTEM****(a) Servicing Fuel System**

At every 100 hour inspection or after an extended downtime, the fuel filter strainer must be cleaned. The fuel filter strainer is located below the floor on the lower right side of the forward baggage compartment.

**(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 (Textron Lycoming Specified Fuels).

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

FUEL GRADE COMPARISON CHART

Previous Commercial Fuel Grades (ASTM-D910)			Current Commercial Fuel Grades (ASTM-D910-75)			Current Military Fuel Grades (MIL-G-5572E) Amendment No. 3		
Grade	Color	Max. TEL ml/U.S. Gal.	Grade	Color	Max. TEL ml/U.S. Gal.	Grade	Color	Max. TEL ml/U.S. Gal.
80/87	red	0.5	80	red	0.5	80/87	red	0.5
91/96	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 \*100LL.\*

\*\* -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.

**8.23 OIL REQUIREMENTS**

The oil capacity of the Textron Lycoming TIO-540-AE2A engine is 12 quarts with an inflight minimum quantity of approximately 2.75 quarts. Maximum endurance flights should begin with 12 quarts of oil. For all shorter flights, it is recommended that oil be added if the quantity falls to 10 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 following grades are required for temperatures:

Average Ambient Temperature	MIL-L-6082B SAE Grade	MIL-L-22851 Ashless Dispersant SAE Grades
All Temperatures Above 80°F Above 60°F 30°F to 90°F 0°F to 70°F Below 10°F	<b>MINERAL OIL NOT APPROVED</b>	15W-50 or 20W-50 60 40 or 50 40 30, 40 or 20W-40 30 or 20W-30

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

**NOTE**

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

**8.19 LANDING GEAR SERVICE (continued)**

In jacking the aircraft for landing gear or other service, two hydraulic jacks and a tail stand should be used. At least 400 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 rods from the rudder pedals to the transverse bellcrank in the nose wheel tunnel are factory adjusted and should be readjusted only in accordance with the applicable rigging specification. Nose wheel alignment is accomplished by adjusting the rod end(s) on the steering bungee assembly in such a way that the nose wheel is in line with the fore and aft axis of the plane when the rudder pedals are centered. Alignment of the nose wheel can be checked by applying 2° of right rudder and verifying that the plane follows a straight line along the ground. The turning arc of the nose wheel is 30° +/- 1° in either direction and is limited by stops at the trunnion forging or the forward steering contact arm mounted on the engine mount.

**NOTE**

The rudder is set to 2° right with the rudder pedals neutralized and the nose wheel centered.

**8.21 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. Significant damage must be repaired by a qualified mechanic prior to flight. Nicks or scratches cause 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.

### **8.15 BRAKE SERVICE (continued)**

The brake system is filled with MIL-H-5606 (petroleum base) hydraulic fluid. The fluid level should be checked periodically or at every 100 hour inspection and replenished when necessary. The brake fluid reservoir is located behind the aft access panel in the forward baggage 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 pads become excessively worn they should be replaced with new segments.

### **8.17 HYDRAULIC SYSTEM SERVICE**

The hydraulic system reservoir is an integral part of the electric hydraulic pump assembly. It is located aft of the aft cabin baggage compartment and is accessible through the baggage compartment aft closeout panel. Fill the reservoir with MIL-H-5606 hydraulic fluid. The fluid level should be checked periodically or every 100 hour inspection and replenished when necessary. With the landing gear down and the system up to pressure, fill to the FULL line on the sight gauge.

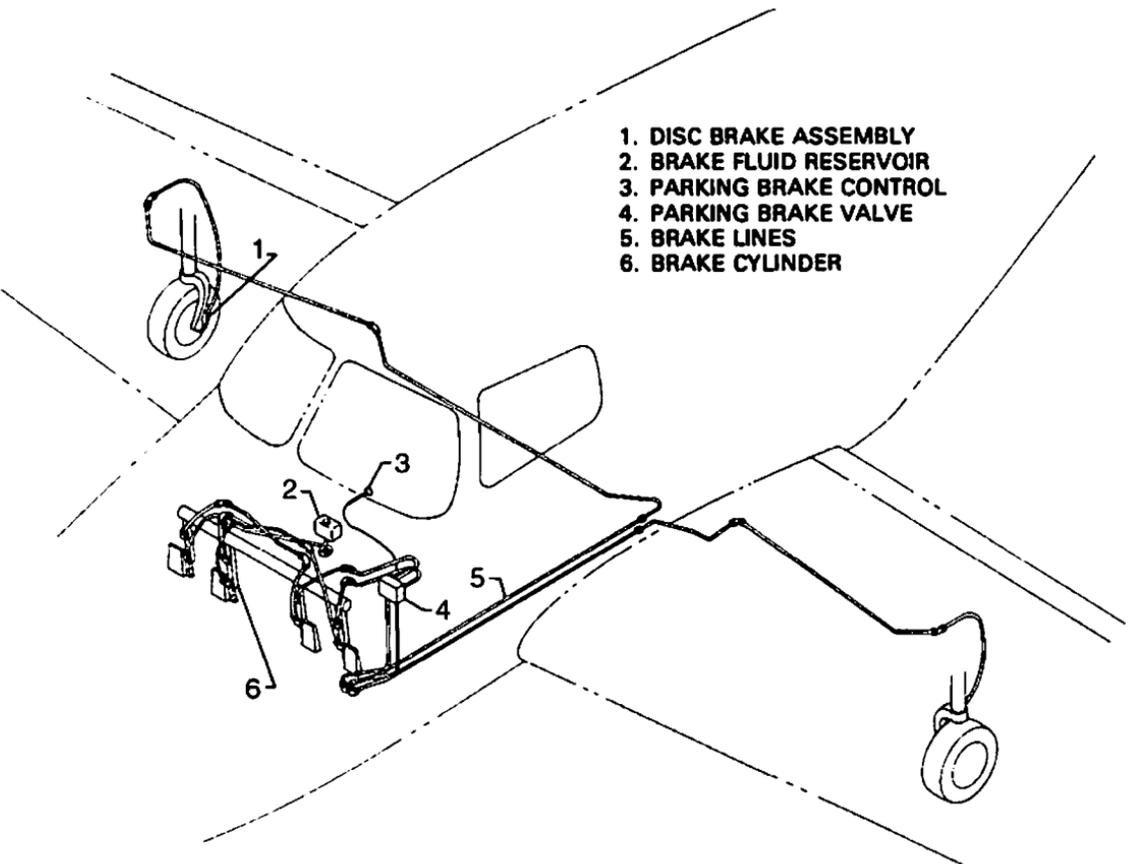
### **8.19 LANDING GEAR SERVICE**

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 McCauley or 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 8.25.)

Wheels are removed by taking off the hub cap, cotter pin, axle nut, and bolts holding the brake segment in place. Mark tire and wheel for reinstallation; then dismount by deflating the tire, removing the 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 3.44 +/- 0.25 inches of oleo piston tube is exposed, and the nose gear should show 1.65 +/- 0.25 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.

8.15 BRAKE SERVICE



BRAKE SYSTEM  
Figure 8-1

**8.13 ENGINE INDUCTION AIR FILTER (Continued)**

- (3) After cleaning check all components for dirt and damage. Wipe the filter and inlet clean. Do not oil the filter.

**(c) Installation of Induction Air Filter**

Replace filter, inlet and screws. Reinstall induction air panel assembly.

## 8.11 GROUND HANDLING (continued)

### CAUTION

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

### NOTE

Additional preparations for high winds include using tiedown ropes from the nose landing gear 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 door should be locked when the airplane is unattended.

## 8.13 ENGINE INDUCTION AIR FILTER

### (a) Removing Induction Air Filter

- (1) Remove louvered induction air panel assembly at nose of aircraft by removing screws.
- (2) Remove screws around perimeter of filter on induction air inlet to withdraw inlet and filter.

### (b) Cleaning Induction Air Filter

The induction air filter must be cleaned at least once every 50 hours, and more often, even daily, when operating in dusty or high industrial pollution 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 filter gently to remove dirt particles. Do not use compressed air or cleaning solvents.
- (2) Inspect filter. If paper element is torn or ruptured or gasket is damaged, the filter should be replaced. The usable life of the filter is restricted to 500 hours, or on condition, whichever comes first.

**8.11 GROUND HANDLING (continued)**

- (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) The parking brake knob is located just below the left control column. To set the parking brake, first depress and hold the toe brakes and then pull out on the parking brake knob. To release the parking brake, first depress the brake pedals and then push in on the parking brake knob.

**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 elevator 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 elevator by looping the seat belt through the control wheel and pulling it snug.
- (4) Block the wheels.
- (5) Secure tiedown ropes to wing and tail tiedown rings 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.

**8.11 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 forward baggage compartment or by power equipment that will not damage or excessively strain the nose gear steering assembly.

**CAUTION**

When towing with power equipment, do not turn the nose gear beyond its steering limit 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****CAUTION**

Do not operate engine above 1200 rpm with cabin doors open.

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.

### **8.9 AIRPLANE FILE**

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 FAA Form -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.

**8.3 AIRPLANE INSPECTION PERIODS (continued)**

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 must be documented on a Form 337 and performed via field approval or Supplemental Type Certificate.

### **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-46R-350T (see PA-46R-350T Maintenance and Inspection Manuals). The PA-46R-350T Inspection Manual contains appropriate forms, and all inspection procedures should be complied with by a properly trained, knowledgeable, and qualified mechanic at an Approved Piper 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 progressive Inspection, 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.

**8.1 GENERAL (continued)**

Every owner should stay in close contact with an Approved 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 posted on Piper's website; [www.piper.com](http://www.piper.com). Depending on the nature of the release, material and labor allowances may apply. This information is provided to all Approved Piper Service Centers.

Service Letters deal with product improvements and servicing techniques pertaining to the airplane. They are sent to Piper Service Centers and, are also posted on Piper's website; [www.piper.com](http://www.piper.com). 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.

Maintenance manuals, parts catalogs, and revisions to both, are available from Piper Service Centers.

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

**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.

**SECTION 8**

**AIRPLANE HANDLING, SERVICING, AND MAINTENANCE**

**8.1 GENERAL**

This section provides guidelines relating to the handling, servicing, and maintenance of the Matrix. For complete maintenance instructions, refer to the PA-46R-350T 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.

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## TABLE OF CONTENTS

## SECTION 8

## AIRPLANE HANDLING, SERVICING, AND MAINTENANCE

Paragraph No.		Page No.
8.1	General .....	8-1
8.3	Airplane Inspection Periods .....	8-4
8.5	Preventive Maintenance .....	8-5
8.7	Airplane Alterations .....	8-5
8.9	Airplane File.....	8-6
8.11	Ground Handling.....	8-7
8.13	Engine Induction Air Filter .....	8-9
8.15	Brake Service .....	8-12
8.17	Hydraulic System Service .....	8-12
8.19	Landing Gear Service.....	8-12
8.21	Propeller Service .....	8-13
8.23	Oil Requirements .....	8-14
8.25	Fuel System.....	8-15
8.27	Tire Inflation.....	8-19
8.29	Battery Service .....	8-19
8.31	Oxygen System .....	8-19
8.33	Lubrication .....	8-20
8.35	Cleaning .....	8-20
8.37	Cleaning and Maintenance of Relief Tube System.....	8-25
8.39	Cleaning Garmin PFD and MFD Displays.....	8-26

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**7.41 EMERGENCY LOCATOR TRANSMITTER (continued)****ARTEX ELT OPERATION (continued)**

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.

**7.43 EXTERNAL POWER**

The external power receptacle allows the airplane engine to be started from an external power source without the necessity of gaining access to the airplane battery. The cable from the external power source can be attached to a receptacle, located on the aft side of the forward baggage compartment. Instructions on a placard located on the cover of the receptacle should be followed when starting with external power. For instructions on the use of starting with external power, refer to Starting Engines in Section 4.

### **7.41 EMERGENCY LOCATOR TRANSMITTER**

The 406 MHz Emergency Locator Transmitter (ELT) meets the requirements of TSO-C126a. It operates on self-contained batteries and is located in the aft fuselage section. It is accessible through a cover on the bottom right side of the fuselage.

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, 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 a test must be made at any other time, the test should be coordinated with the nearest FAA tower or flight service station.

### **ARTEX 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 copilots 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.

A warning buzzer, which receives power from the ELT itself, is mounted in the tailcone. Whenever the ELT is activated the buzzer "beeps" periodically. The time between pulses lengthen after a predetermined transmitter "ON" time. The objective is to hear the buzzer from outside the aircraft while the engine is not running.

**7.35 BAGGAGE AREA**

The airplane has two separate baggage areas each with a 100-pound capacity. A 13-cubic-foot forward baggage compartment, located just aft of the firewall, is accessible through a 19 x 23 inch door on the left side of the fuselage. An aft baggage compartment, which is accessible from inside the cabin, is located behind the back seats.

A forward baggage door annunciation system senses the baggage door latch position. If the baggage door is not closed and latched, the white DOOR AJAR message will illuminate when the engine is not running or a red CAS message when the engine is running..

**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 Section 6, Weight and Balance).

**7.37 FINISH**

All exterior surfaces are primed and finished with polyurethane. To keep the finish attractive looking, polyurethane touch-up paint is available from Piper Factory Authorized Service Centers.

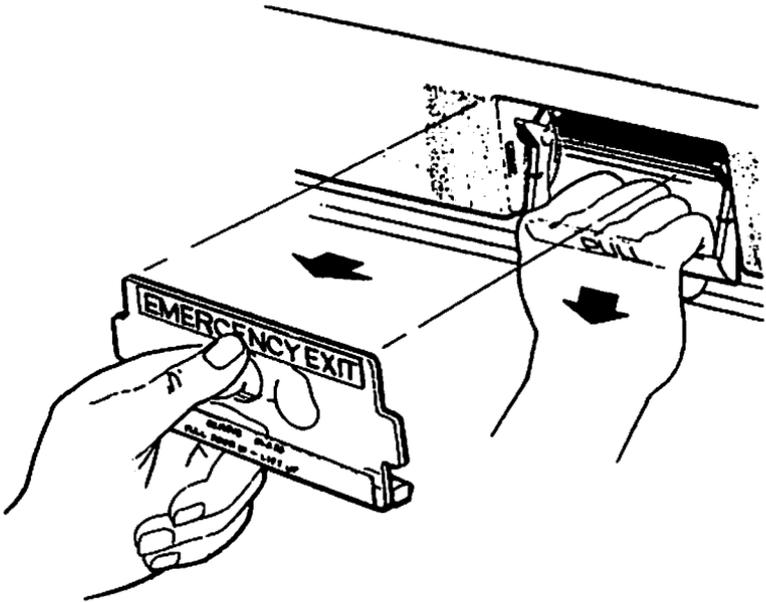
**7.39 STALL WARNING**

An approaching stall is indicated by a stall warning horn sounding a continuous tone, as opposed to the landing gear horn's beeping tone. Mild airframe buffeting may also precede a stall.

The stall warning is activated by a lift transducer installed in the leading edge of the left wing. An onboard computer will distinguish between power on, power off, and flap position conditions during normal stalls, causing the horn to sound five to ten knots above the stall speed.

A graph showing stall speeds at various angles of bank is contained in Section 5.

7.33 CABIN FEATURES (continued)



**EMERGENCY EXIT**

Figure 7-35

An optional fire extinguisher is available and, if installed, is located on the cabin floor behind the wing spar on the right side of the cabin.

The emergency exit is located on the right side of the fuselage, adjacent to the aft facing seat. Instructions for opening the emergency exit are placarded on the cover over the handle. To open, remove the cover and pull the handle. The window releases inward.

### **7.33 CABIN FEATURES**

The front seats are adjustable fore and aft and vertically. Pivoting armrests are provided on the inboard side of each seat.

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.

The shoulder harness is routed over the shoulder adjacent to the windows and attached to the lap belt buckle.

Seat belts and shoulder harnesses shall be worn during movement on the surface, takeoff, landing and during an emergency situation.

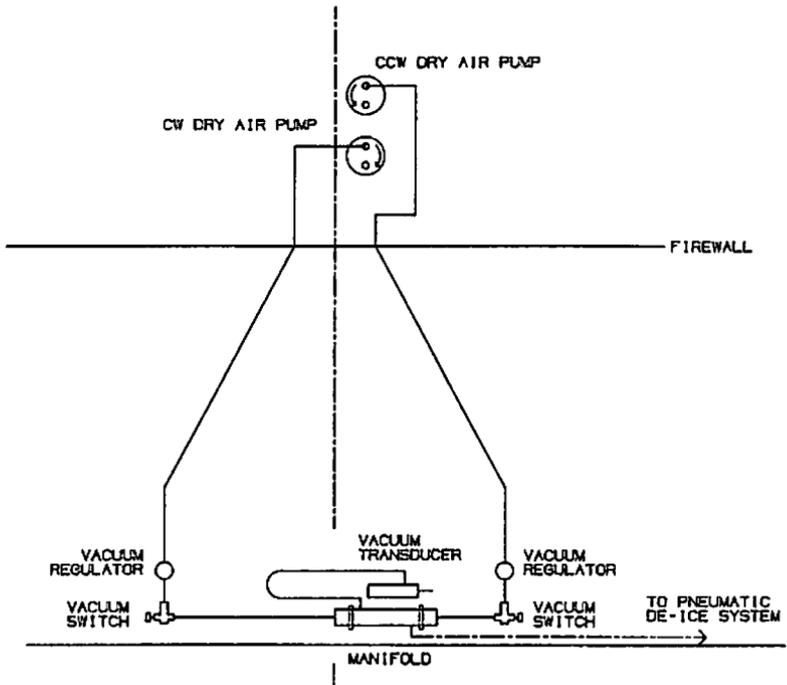
Standard cabin features include map pockets, cup holders, sun visors, and a baggage restraint net behind the rear seats.

Two combination instrument panel flood/map lights are provided forward, and four passenger reading lights are provided aft. Two cabin entrance flood lights are located above the door as well as a single light in the aft door jamb. Two additional lights are located in the aft baggage area. Each of these five lights and a light timer is activated whenever the lower cabin entrance door is opened. The lights remain on for 10-minutes then automatically shut off. A black push-button switch labeled BAGGAGE, located in the cabin just aft of the lower door, can be pressed to activate the lights for another 10-minute cycle. To preserve battery power the lower cabin door should not be left open for extended periods of time.

The four passenger seats with folding armrests and headrests are positioned in a club seating arrangement. The center seats face aft. The seat backs recline by pushing a button mounted in the outboard armrest.

A conference table located between the right passenger seats is available. The table is extended by pulling in on the upper edge of the leaf and then upward. The leaf is then rotated down into position and unfolded. Reverse this procedure for stowage.

7.31 VACUUM SYSTEM (continued)



VACUUM SYSTEM

Figure 7-33

### 7.31 VACUUM SYSTEM

The vacuum system is only installed when the optional Ice Protection System is installed. Vacuum is provided by two continuously operating engine driven dry air vacuum pumps; one rotating clockwise and one rotating counterclockwise. Either pump can independently support the system. Also included are two regulators, a low vacuum switch, and an inlet air filter.

The two vacuum regulators are mounted on the forward pressure bulkhead in the forward baggage compartment

A vacuum indication on the MFD and independent advisory VACUUM 1 FAIL and VACUUM 2 FAIL CAS messages provide information to the pilot regarding the operation of both pumps. When both pumps are operating, neither CAS message is illuminated. The VACUUM 1 FAIL message will illuminate should the counterclockwise rotating (upper) pump fail, while the VACUUM 2 FAIL message will illuminate should the clockwise rotating (lower) pump fail.

Any decrease in system vacuum may indicate a dirty filter, dirty screens, sticking vacuum regulator, or a leak in the system. If both vacuum pumps fail or anytime the vacuum decreases below 2.0 in. Hg the vacuum indication turns amber and a single aural chime sounds.

Upon completion of the flight, all system abnormalities or malfunctions should be checked by a mechanic, and necessary repairs made.

Operators of airplanes equipped with wing and tail deicers should refer to Section 9, Supplement 1, for additional information concerning the vacuum system.

**7.29 OXYGEN SYSTEM (continued)**

Each mask assembly oxygen line incorporates a flowmeter/regulator. The black ball in the flowmeter serves as a visual indication that oxygen is flowing and of the amount of oxygen being delivered. The flowmeter/regulator should be set by holding it vertically and turning the black knob to adjust the flow until the black indicator ball reaches the planned cruising altitude on the standard mask scale. Do not use the smaller scale for oxygen conserving equipment. The occupant can then don the mask and breathe normally for a sufficient supply of oxygen. If the actual cruising altitude changes or if the flowmeter ball drops below the actual cruising altitude, the regulator must be adjusted to ensure adequate flow of oxygen. If the flowmeter ball cannot be adjusted to the proper altitude, descend immediately to a safe altitude.

When not in use, masks may be stowed in the removable pouches between the front and center seats. Always remove fittings from the oxygen receptacles and stow masks when they are not in use. If the control knob is pulled on and the fitting is in the receptacle, oxygen will flow through the mask continuously. Masks may be damaged if they are not properly stowed.

To stop the flow of oxygen through the system, the control knob should be pushed to the OFF position. Verify that the cylinder valve has closed completely and the flow of oxygen has stopped, by observing the indicator ball on a flowmeter. To bleed down low pressure lines, it is recommended that the mask assembly be left connected to the outlet for at least three minutes after the control knob is turned off.

To preclude the possibility of fire by spontaneous combustion, oil, grease, paint, hydraulic fluid, and other flammable material should be kept away from oxygen equipment.

## 7.29 OXYGEN SYSTEM

### CAUTION

Positively **NO SMOKING** while oxygen is being used by anyone in the aircraft.

The fixed oxygen system provides supplementary oxygen for the crew and passengers during high altitude flights (above 10,000 feet). The major components of the oxygen system are a 50 cubic foot oxygen cylinder, an oxygen supply gauge on the MFD, an ON-OFF flow control knob, a pressure regulator, six plug-in receptacles and six oxygen masks with individual flowmeter/regulators.

The oxygen supply gauge on the MFD has both an amber CAUTION and a red WARNING range to alert the pilot to the following conditions:

#### Yellow Range

- At or below 500 psi supply pressure, the MFD gauge label, pointer, and digital indication will turn yellow at any altitude.
- When at or below 500 psi supply pressure and above 12,500 ft altitude, MASTER CAUTION indication and a single chime will occur to remind the pilot he is low on oxygen.

#### Red Range

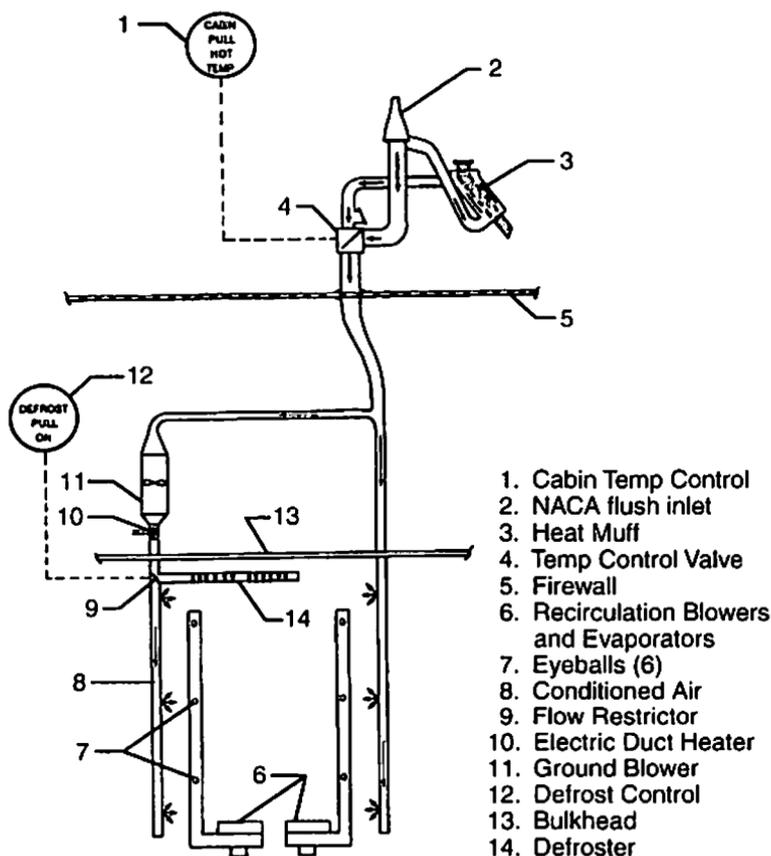
- At or above 2200 psi, the MFD gauge label, pointer, and digital indication will turn red, accompanied by a MASTER WARN indication and continuous chime to alert the pilot his oxygen bottle has been overcharged.

The oxygen cylinder is mounted on the aft equipment shelf behind the aft closeout panel. When fully charged, the cylinder contains oxygen at a pressure of 1850 psi at 70°F. The oxygen flow control knob, labeled Oxygen/Pull-On is mounted in the instrument panel. The pressure regulator is mounted directly on the oxygen cylinder. Once the oxygen flow control knob is on, each of the oxygen plug-in receptacles operates as an automatic on-off valve. The oxygen cylinder can be recharged through the O<sub>2</sub> fill port on the left side of the fuselage.

If high altitude flight is anticipated, it should be determined that the oxygen supply is adequate for the proposed flight and that the passengers are briefed. When oxygen is required, the control knob should be pulled to the ON position, allowing oxygen to flow from the cylinder through the system. Connecting the constant flow mask fitting to a receptacle and turning it 90 degrees clockwise, automatically releases oxygen to the mask through the on-off valve feature of the receptacle.

7.27 ENVIRONMENTAL SYSTEM (Refer to Figure 7-27) (continued)

The freon portion of the system incorporates a receiver dryer, a sight gauge, suction and discharge service valves, and 265 psi high pressure and 40 psi low pressure switches, should the compressor discharge pressure increases above 265 psi, or decrease below 40 psi, the applicable pressure switch will open, disengaging the freon compressor clutch.



ENVIRONMENTAL SYSTEM

Figure 7-27

**7.27 ENVIRONMENTAL SYSTEM (Refer to Figure 7-27) (continued)**

Both the heater control circuit and the vent/defog fan circuit utilize the 10 amp VENT DE-FOG circuit breaker located on the circuit breaker panel row A, position 1. Heater element power is supplied from the battery master solenoid through the 35 amp heater fuse and the heater power relay. The 35 amp heater fuse is not accessible to the pilot. The electrical load imposed by the heater and the vent/defog fan is approximately 40 amps. Operation is limited to airplanes with both alternators functioning.

Cabin air conditioning is provided by a vapor cycle system. The compressor is belt driven by the engine. Condenser cooling airflow is provided by a continuous duty motor driven fan. Cabin air is recirculated across the evaporators to provide cool air at each seat outlet.

The condenser and its cooling air fan are located in the tailcone immediately aft of the rear pressure bulkhead. Cooling air from outside the tailcone is drawn into the cooling air duct through a flush opening in the skin, routed across the condenser coil, and discharged overboard through the tailcone exit opening.

Two recirculation blowers and evaporator assemblies are located aft of each rear seat below the rear baggage compartment floor. The recirculation blowers draw air into each evaporator coil through grills in the floor structure behind the rear seats and discharges it into the upper left and right cabin side panel ducts. Adjustable eyeball outlets are located at each seat in the airplane.

The AIR COND and BLOWER HI & LO switches, located as part of the environmental switch panel, are used to control the air conditioning system.

When the AIR COND switch is selected ON, the compressor belt drive is electrically clutched, the condenser blower motor relay is closed, and both recirculation blowers are activated. The recirculation blowers can be operated independently of the air conditioner by selecting the BLOWER HI or LO on. In either situation, the BLOWER switches are used only to select a HI or LO recirculation blower motor speed. When selecting between BLOWER HI and BLOWER LO the switch currently "on" should be deselected to "off" before selecting the other "on". Overcurrent protection is provided by the 15 amp CABIN FANS, 5 amp AIR CONDITIONER CONTROL, and 25 amp AIR CONDITIONER POWER circuit breakers in the nonessential bus section of the circuit breaker panel.

**SECTION 3 - EMERGENCY PROCEDURES (continued)**

**ICE PROTECTION SYSTEM ANNUNCIATIONS (continued)**

**SINGLE VACUUM SYSTEM FAILURE**

**Indication:** White VACUUM 1 FAIL or VACUUM 2 FAIL message.

Vacuum Indication.....CHECK (within normal operating range)

Operating Vacuum Pump CAS message .....EXTINGUISHED

**NOTE**

Although either vacuum pump has sufficient capacity to operate the deice boots, immediate action should be taken to exit icing conditions.

**DUAL VACUUM SYSTEM FAILURE**

**Indication:** White VACUUM 1 FAIL and VACUUM 2 FAIL messages; Amber vacuum indication below 2.0 in. Hg., single aural chime.

**NOTE**

If both vacuum systems are inoperable, the wing and tail deicer boots will be inoperative. Immediate action should be taken to exit icing conditions. A precautionary landing should be considered depending on operating conditions.

**PROPELLER HEAT SYSTEM MALFUNCTION**

**Indication:** Master Caution Indication; Amber PROP HT FAIL message; Single aural chime.

**NOTE**

Excessive vibration may be an indication that the propeller heat is not functioning properly.

PROP RPM Control .....EXERCISE

PROP HEAT Switch.....check for proper LED indications:

Steady for 90 sec. - System ON

Flashing 90 sec. - System OFF

PROP HT FAIL CAS Message .....CHECK

**SECTION 3 - EMERGENCY PROCEDURES (continued)**  
**ICE PROTECTION SYSTEM ANNUNCIATIONS (continued)**  
**PROPELLER HEAT SYSTEM MALFUNCTION (continued)**

**NOTE**

Illumination of the PROP HT FAIL CAS message is an indication that the propeller blades may not be deicing properly.

PROP HEAT Switch .....OFF (if failure is indicated)

**WARNING**

It is imperative that the PROP HEAT switch be turned OFF if vibration persists. This can be a symptom of uneven blade deicing which can lead to propeller unbalance and engine failure.

*Immediate action should be taken to exit icing conditions.*

**LEFT PITOT HEAT FAILURE**

**Indication: Master Caution Indication; Amber L PITOT HT FAIL message; Single aural chime.**

**NOTE**

Failure of the L Pitot Heat could cause erroneous indications of pilot's airspeed and standby airspeed. Airspeeds on each PFD should be compared for accuracy.

L PITOT HEAT Circuit Breaker .....RESET  
(Located on the pilot's aft circuit breaker panel, row A, position 3.)

If IAS MISCOMPARE  
annunciation illuminated.....SELECT GOOD ADC

**RIGHT PITOT HEAT FAILURE**

**Indication: Master Caution Indication; Amber R PITOT HT FAIL message; Single aural chime.**

**NOTE**

Failure of the R Pitot Heat could cause erroneous indications of copilot's airspeed. Airspeeds on each PFD should be compared for accuracy.

**SECTION 3 - EMERGENCY PROCEDURES (continued)**

**ICE PROTECTION SYSTEM ANNUNCIATORS (continued)**

**RIGHT PITOT HEAT FAILURE (continued)**

R PITOT HEAT Circuit Breaker .....RESET  
(Located on the pilot's aft circuit breaker panel, row A, position 4.)

If IAS MISCOMPARE  
annunciation illuminated.....SELECT GOOD ADC

**BOTH LEFT AND RIGHT PITOT HEAT FAILURE**

**Indication: Amber L PITOT HT FAIL and R PITOT HT FAIL CAS  
messages; Single aural chime.**

**NOTE**

Failure of both left and right pitot heaters could cause erroneous pilot, copilot and/or standby airspeed indications. Exit and avoid icing conditions and monitor pilot and copilot airspeeds. In the event of complete loss of airspeed, maintain safe airspeed by use of throttle, engine settings and airframe sensory cues.

L PITOT HEAT Circuit Breaker .....RESET  
(Located on the pilot's aft circuit breaker panel, row A, position 3.)

R PITOT HEAT Circuit Breaker .....RESET  
(Located on the pilot's aft circuit breaker panel, row A, position 4.)

**If either circuit breaker opens again, do not reset.**

**SURFACE DEICE MALFUNCTION**

**Indication: White SURF DE-ICE ON message does not illuminate or  
remains ON for greater than 30 seconds followed by an  
Amber SURF DE-ICE FAIL message; Single aural chime.**

SURF DE-ICE Circuit Breaker .....CHECK IN  
(Located on the pilot's aft circuit breaker panel, row A, position 6)

SURF DE-ICE Switch .....PRESS (to recycle de-ice system)

If SURF DE-ICE FAIL message remains illuminated:

SURFACE DE-ICE Circuit Breaker .....PULL  
(Located on the pilot's aft circuit breaker panel, row A, position 6)

*Immediate action should be taken to exit icing conditions.*

**SECTION 3 - EMERGENCY PROCEDURES (continued)**

**ICE PROTECTION SYSTEM ANNUNCIATORS (continued)**

**WINDSHIELD ANTI-ICE HEAT MALFUNCTION**

**Indication: Master Warning Indication; Red WNDSHLD OVERTEMP message; Repeating aural chime.**

WSHLD HIGH/WSHLD LOW Switches .....Select OFF

*Immediate action should be taken to exit icing conditions.*

**Stall Warning Fail**

**Indication: Master Caution Indication; Amber STALL WARN FAIL message; Single aural chime.**

STALL WARN Circuit Breaker.....RESET

(Located on the pilot's forward circuit breaker panel, row C, position 5.)

**Avoid low airspeeds and monitor approach speeds closely.**

**SECTION 4 - NORMAL PROCEDURES**

The Piper Matrix is approved for flight into known icing conditions when equipped with the complete Piper Ice Protection System. Operating in icing conditions of Continuous Maximum and Intermittent Maximum as defined in FAR 25, Appendix C has been substantiated; however, there is no correlation between these conditions and forecasts of reported "Light, Moderate and Severe" conditions. **Flight into severe icing is not approved.**

Icing conditions can exist in any clouds when the temperature is below freezing; therefore it is necessary to closely monitor outside air temperature when flying in clouds or precipitation. Clouds which are dark and have sharply defined edges usually have high water content and should be avoided whenever possible. **Freezing rain must always be avoided.**

Pneumatic boots must be cleaned regularly for proper operation in icing. The exterior surfaces of the aircraft should be checked prior to flight. **Do not attempt flight with frost, ice or snow adhering to the exterior surfaces of the aircraft or landing gear.**

Prior to dispatch into forecast icing conditions all ice protection equipment should be functionally checked for proper operation.

**SECTION 4 - NORMAL PROCEDURES (continued)**

**PREFLIGHT**

**CAUTION**

Care should be taken when an operational check of the heated pitot head and heated stall warning HT detector is being performed. The units become very hot.

- PITOT HEAT Switch .....ON
- S. WARN HEAT Switch .....ON
- Pitot Probes & Stall Warning Vane .....Verify WARM
- PITOT HEAT Switch.....OFF
- S. WARN HEAT Switch.....OFF
- Surface De-Ice Boots.....Verify clean and no damage

**ENGINE RUNUP**

**CAUTION**

An operational check of the windshield heat system may be done only if the ambient temperature of the windshield is LESS than 115°F (46°C) and the engine is running. WSHLD HIGH should not be used for more than 20 seconds during ground operations/tests.

- WSHLD LOW Switch .....ON  
Verify approx. 13 amp increase
- WSHLD HIGH Switch .....ON  
Verify additional approx. 10 amp increase
- WSHLD LOW & WSHLD HIGH Switches.....OFF
- PITOT HEAT Switch .....ON  
Verify increased amps,  
amber PITOT HEAT OFF message extinguished,  
absence of L PITOT HT FAIL or R PITOT HT FAIL. messages
- PITOT HEAT Switch.....OFF

**SECTION 4 - NORMAL PROCEDURES (continued)**

**ENGINE RUNUP(continued)**

**CAUTION**

To avoid possible windshield distortion during ground operations, or during testing, do not turn ON the WSHIELD HIGH switch for more than 20 seconds.

- PROP HEAT Switch .....ON  
    Verify LED flashes rapidly for 30 seconds - System is ON  
    Verify LED flashes slowly - System is OFF
- PROP HEAT Switch.....OFF
- S. WARN HEAT Switch .....ON  
    Verify increased amps
- S. WARN HEAT Switch.....OFF
- PROP RPM Control .....2000 RPM
- Alternator Amps.....CHECK Ammeters for appropriate output
- Vacuum Suction.....CHECK for appropriate indication (green),  
    Verify absence of VACUUM LOW, VACUUM HIGH,  
    VACUUM 1 FAIL or VACUUM 2 FAIL messages
- SURF DE-ICE Switch .....ON  
    Verify (visually) proper boot inflation and deflation,  
    SURF DE-ICE ON message for three boot phases  
    (approx. 18 seconds total),  
    absence of SURF DE-ICE FAIL and VACUUM LOW messages
- Boot Inflation Cycle .....Verify COMPLETE  
    SURF DE-ICE ON message extinguished

**IN FLIGHT**

Icing conditions of any kind should be avoided whenever possible, since any minor malfunction which may occur is potentially more serious in icing conditions.

**SECTION 4 - NORMAL PROCEDURES (continued)**

**IN FLIGHT (continued)**

Before entering probable icing conditions use the following procedures:

- INDUCTION AIR Lever.....ALTERNATE
- PITOT HEAT Switch .....ON
- S. WARN HEAT Switch .....ON
- WSHLD LOW Switch .....ON (WSHLD HIGH in actual ice)
- PROP HEAT Switch .....ON
- DEFROST Knob .....PULL ON (out)
- VENT/DE-FOG Switch .....ON, if additional defrost is desired

At first sign of ice formation anywhere on the aircraft:

- SURF DE-ICE Switch .....ACTIVATE, continue to ACTIVATE as needed to minimize ice accretion.

If propeller imbalance is suspected:

- PROP RPM .....EXERCISE

**NOTE**

For accurate magnetic compass readings, turn the WSHLD LOW and HIGH, PROP HEAT, AIR COND, S. WARN HEAT, AUX CABIN HEAT and PITOT HEAT switches OFF momentarily.

**WARNING**

Do not hold the momentary SURF DE-ICE switch on.

**WARNING**

Elevator movement should be periodically checked prior to the first surface boot inflation in order to prevent an ice cap from forming between the elevator and stabilizer.

**CAUTION**

Operation of the pneumatic deice system is not recommended in temperatures below -40°C. Such operation may result in damage to the deice boots.

Both alternator ammeters should be monitored whenever the deice equipment is in use. An excessive indication shows an excessive electrical load, which may cause a battery discharging condition that could eventually lead to battery depletion. Nonessential electrical equipment should be turned off to correct or prevent this condition.

**SECTION 4 - NORMAL PROCEDURES (continued)**

**NOTE**

With both alternators functioning the VOLTS indication will turn red anytime total tie bus voltage is below 25 VDC.

When ice has accumulated on the unprotected surfaces of the airplane, aerodynamic buffet commences 5 to 19 knots before the stall. A substantial margin of airspeed should be maintained above the normal stall speed, since the stall speed will increase in prolonged icing encounters. For the same reason, stall warning devices may not be accurate and should not be relied upon.

**CAUTION**

If cruise airspeed drops below 130 knots in icing conditions, increase power to maintain 130 knots. If maximum continuous power is required to maintain 130 knots, immediate action should be taken to exit icing conditions.

**CAUTION**

Accumulation of ice on any surface of the airplane leads to an increase in total drag and a resulting reduction in airspeed. Aircraft airspeed, airspeed indicator markings, adverse handling characteristics, and frequent pitch trim activation (blue TRIM annunciator light or trim wheel movement) should be monitored closely to maintain proper low air-speed awareness.

**SECTION 4 - NORMAL PROCEDURES (continued)**

**NOTE**

An icing encounter can render the aircraft radar unreliable due to beam reflection off of the ice layer on the radome. Also, there may be a degradation of communication and navigation equipment due to ice accumulation on antennas.

If ice is remaining on the unprotected surfaces of the airplane at the termination of the flight, the approach and landing should be made using 20° of flaps and carrying the required amount of power to keep airspeed at 95 KIAS. If ice removal from the protected surfaces cannot be accomplished (ie. due to a failure of the surface deice system) prior to the approach, the flaps must be left in the full up position and approach speeds should not be reduced below 105 KIAS. Allow for increased landing distance due to the higher approach speeds. See Section 2 of this supplement for additional limitations.

**SECTION 5 - PERFORMANCE**

Climb speed should be increased to 130 knots when icing conditions are encountered during climb.

Cruise speeds are reduced approximately 5 knots when the surface boots are installed.

**CAUTION**

Intercycle and residual ice on the boots and ice accumulation on the unprotected surfaces can result in significant performance loss. During cruise, loss of airspeed can be 30 knots or more.

**NOTE**

When icing conditions are encountered, loss of cruise airspeed and increased fuel flow resulting from higher than normal power settings to maintain altitude will reduce the aircraft range significantly. The use of an alternate airport should be considered if fuel quantity appears marginal.

**CAUTION**

If cruise airspeed drops below 130 knots in icing conditions increase power to maintain 130 knots. If maximum continuous power is required to maintain 130 knots immediate action should be taken to exit icing conditions.

**NOTE**

For additional general information on inflight icing refer to FAA Advisory Circular AC91-51A, Effect of Icing on Aircraft Control and Airplane Deice and Anti-ice Systems.

**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 OF THE ICE PROTECTION SYSTEM AND EQUIPMENT**

The ice protection system consists of the following components: Pneumatic wing and empennage boots, wing ice detection light, electrothermal propeller deice pads, electrically heated windshield, heated stall warning lift detector, heated pitot head, two operating alternators, two operating vacuum pumps and the alternate static source. Alternator controls are located on the left overhead switch panel. Controls for the ice protection systems are located on the environmental/de-ice switch panel.

The aircraft is designed to allow operation in the meteorological conditions of the FAR 25 envelopes for continuous maximum and intermittent maximum icing. **The airplane is not designed to operate for an indefinite period of time in every icing condition encountered in nature.** Activation of the ice protection system prior to entering icing conditions and attempting to minimize the length of the icing encounter will contribute significantly to the ice flying capabilities of the airplane.

**WING AND EMPENNAGE BOOTS**

Pneumatic deice boots are installed on the leading edges of the wing, the vertical stabilizer and the horizontal stabilizer. During normal operation, when the surface deice system is turned off, the engine driven vacuum pumps applies a constant suction to the boots to provide smooth, streamlined leading edges. The boots are inflated by a momentary ON type SURF DE-ICE switch (Figure 7-1 of this supplement), located on the environmental/de-ice switch panel. Actuation of the SURF DE-ICE switch activates two pressure regulator valves (one for each vacuum pump) which energizes three (tail, lower wing & upper wing) deice flow valves for approximately six seconds each.

The boot solenoid valves are activated and air pressure is released to the boots, sequentially inflating the surface deicers. A SURF DE-ICE CAS message is present when the boots inflate properly. If the boots do not inflate properly a SURF DE-ICE FAIL CAS message is displayed. When the cycle is complete, the deicer solenoid valves permit automatic overboard exhaustion of pressurized air. Suction is then reapplied to the boots.

**SECTION 7 - DESCRIPTION AND OPERATION OF THE ICE  
PROTECTION SYSTEM AND EQUIPMENT (cont.)**

**WING AND EMPENNAGE BOOTS (continued)**

Circuit protection for the surface deice system is provided by a SURFACE DE-ICE circuit breaker located on the pilot's aft circuit breaker panel.

**WING ICE DETECTION LIGHT**

Wing icing conditions may be detected during night flight by use of an ice detection light installed on the left side of the forward fuselage. The light is controlled by an ICE LIGHT switch (Figure 7-1) located on the environmental/de-ice switch panel. Circuit protection is provided by an ICE circuit breaker located in the EXTERIOR LIGHTS section of the pilot's forward circuit breaker panel.

**ELECTROTHERMAL PROPELLER DEICE**

Electrothermal propeller deice pads are bonded to a portion of the leading edges of the propeller blades. The system is controlled by an ON-OFF type PROP HEAT switch (Figure 7-1) located on the environmental/de-ice switch panel. Power for the propeller deicers is supplied by the aircraft electrical system through a PROP HEAT circuit breaker on the pilot's aft circuit breaker panel. When the PROP HEAT switch is actuated, power is applied to a timer which monitors the current through the propeller deice system.

Power from the timer is cycled to brush assemblies which distribute power to slip rings. The current is then supplied from the slip rings directly to the electrothermal propeller deice pads.

During ground operations the Hartzell propeller is deiced in a cycle which applies power to the deice pads for approximately 30 seconds and then shuts off power to the deice pads. The PROP HEAT switch green LED should flash rapidly for the 30 seconds indicating that the system is energized, then flash slowly (until turned OFF by the pilot) indicating that the system is de-energized.

During flight operations the Hartzell propeller is deiced in a cycle which applies power to the deice pads for approximately 90 seconds and then shuts off for approximately 90 seconds. Once begun, cycling will proceed in the above sequence and will continue until the system is turned off. The PROP HEAT switch green LED should indicate green during the portion of the cycle when power is being applied and flashes during the off cycle.

**SECTION 7 - DESCRIPTION AND OPERATION OF THE ICE PROTECTION SYSTEM AND EQUIPMENT (cont.)****ELECTRICALLY HEATED WINDSHIELD**

The electrically heated left windshield is heated by current from the aircraft electrical system. It is controlled by WSHLD HIGH and WSHLD LOW switches located on the environmental/de-ice switch panel. Circuit protection is provided by the WINDSHIELD HEAT CONTROL and POWER circuit breakers in the ICE PROTECTION section of pilot's aft circuit breaker panel.

**CAUTION**

To avoid possible windshield distortion during ground operations or during testing, do not turn the WSHLD HIGH switch to ON for more than 20 seconds.

Windshield heat is an anti-ice device, which must be activated prior to entering suspected icing. Sudden penetration into icing conditions, with the heat OFF, will greatly reduce its effectiveness to prevent or eliminate windshield ice. Windshield heat can also be used to prevent windshield fog.

An overtemperature sensor is included as an integral part of the heated windshield. A system failure causing an overtemperature condition of 170° F will produce a WNDSHLD OVERTEMP CAS message. In this eventuality the heated windshield should immediately be selected OFF.

**HEATED STALL WARNING LIFT DETECTOR**

A heated stall warning lift detector is installed on the left wing leading edge. It is controlled by a S. WARN HEAT switch located on the environmental/de-ice switch panel and is protected by a STALL HEAT circuit breaker located in the ICE PROTECTION section of the pilot's aft circuit breaker panel. The stall warning lift detector has an in-line resistor activated by the main gear squat switch which limits the ground electrical load to approximately 33 percent of the inflight load. This allows the lift detector to be ground checked and activated prior to flight without damaging the unit.

**CAUTION**

Care should be taken when an operational check of the heated stall warning lift detector is being performed on the ground. The unit becomes very hot.

**SECTION 7 - DESCRIPTION AND OPERATION OF THE ICE  
PROTECTION SYSTEM AND EQUIPMENT (cont.)**

**HEATED PITOT HEAD**

A heated AN-type pitot head is installed under each wing. It is controlled by an ON-OFF type PITOT HEAT switch located on the environmental/de-ice switch panel and is protected by a L PITOT HEAT and R PITOT HEAT circuit breakers located in the ICE PROTECTION section of the pilot's aft circuit breaker panel.

**CAUTION**

Care should be taken when an operational check of the heated pitot head is being performed on the ground. The unit becomes very hot.

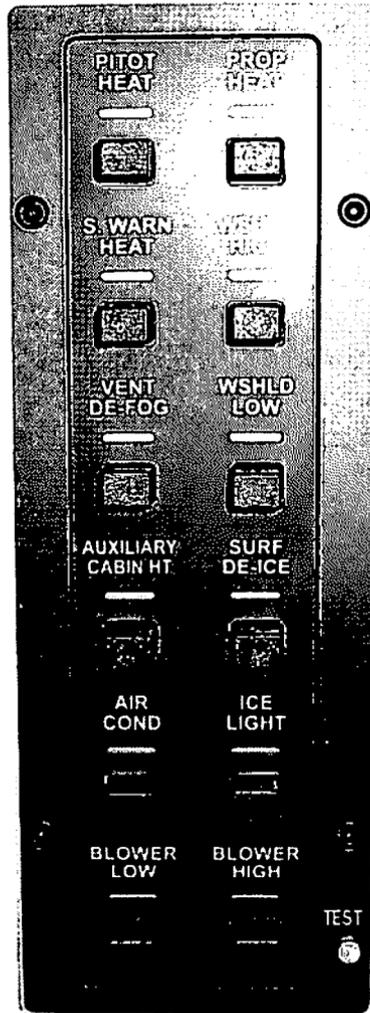
**DUAL ALTERNATORS**

Dual 28 volt, 75 amp alternators are installed as standard equipment. Both alternators must be operational for flight in icing conditions. They are controlled by ON-OFF type switches labeled ALTR NO. 1 and ALTR NO. 2 located in the overhead switch panel (Figure 7-2). Circuit protection is provided by similarly labeled circuit breakers located on the TIE BUS circuit breaker panel located on the instrument panel. During normal operation both alternators must be turned ON. The system is designed so that the alternators will share the total electrical load equally. If an alternator fails, the appropriate ALTR 1 FAIL or ALTR 2 FAIL Warning CAS message will appear.

**DUAL VACUUM PUMPS**

Dual engine-driven vacuum pumps are installed as optional equipment as part of the ice protection system. Both pumps operate continuously when the engine is running. While either pump independently is capable of operating the surface deice system, intentional or continued operations in icing conditions with only one operating vacuum pump is not recommended.

SECTION 7 - DESCRIPTION AND OPERATION OF THE ICE  
PROTECTION SYSTEM AND EQUIPMENT (cont.)



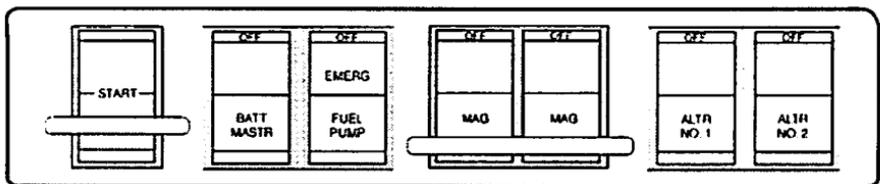
ENVIRONMENTAL/DE-ICE SWITCH PANEL

Figure 7-1

**SECTION 7 - DESCRIPTION AND OPERATION OF THE ICE PROTECTION SYSTEM AND EQUIPMENT (cont.)**

**ALTERNATE STATIC SOURCE**

An alternate static source control valve is located below the instrument panel to the left of the pilot. For normal operation, the lever remains in the down position. To select alternate static source, place the lever in the up position. When the alternate static source is selected, the airspeed and altimeter information on ADC 1 (normally the airspeed and altimeter indications on the pilot's PFD), and the standby airspeed and standby altimeter indicators, are vented to the alternate static pad on the bottom aft fuselage. During alternate static source operation, these instruments may give slightly different readings compared to those of the primary static source. The primary 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



LEFT

**OVERHEAD SWITCH PANEL - PILOT SIDE**

Figure 7-2

**PILOT'S OPERATING HANDBOOK  
AND  
FAA APPROVED AIRPLANE FLIGHT MANUAL**

**SUPPLEMENT NO. 2  
FOR  
GARMIN GMA 347 AUDIO PANEL**

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Garmin GMA 347 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:



WAYNE E. GAULZETTI  
ODA-510620-CE  
PIPER AIRCRAFT, INC.  
VERO BEACH, FLORIDA

DATE OF APPROVAL: October 26, 2009

**SECTION 1 - GENERAL**

This supplement supplies information necessary for the operation of the airplane when the Garmin GMA 347 audio panel is installed in accordance with FAA approved Piper data.

**SECTION 2 - LIMITATIONS**

No change.

**SECTION 3 - EMERGENCY PROCEDURES**

**COM1 and COM2 Failure**

**Indication: Inability to communicate/receive on COM1 and COM2.**

**NOTE**

If power is lost to the audio panel a fail-safe communications path becomes available between the pilot's headset/microphone and COM1.

AUDIO MKR circuit breaker .....PULL  
(Located on the pilot's aft circuit breakers panel, row C, position 4)

*Exit and avoid IFR and icing conditions as soon as practical.*

**SECTION 4 - NORMAL PROCEDURES**

**LAMP TEST:**

- The annunciator lights can be tested by turning the unit OFF then back ON and verifying that all annunciator lights illuminate for approximately ½ to 2 seconds.
- Brightness of the text on each button can be tested by adjusting the AVION-ICS dimmer switch on the instrument panel.

**SECTION 1 - GENERAL**

**SECTION 4 - NORMAL PROCEDURES**

**AUDIO CONTROL SYSTEM OPERATION:**

- Select the desired transmitter audio selector button (COM1 or COM2; COM3 provides no function in this installation) and verify that the buttons LED is illuminated.
- Intercom Volume Control (ICS) - Rotate PILOT and COPILOT inner VOL knobs to desired listening level.
- INTERCOM VOX (voice) Sensitivity Control - Rotate PILOT and COPILOT outer squelch (SQ) knobs clockwise to the middle range and then adjust as required for desired voice activation or hot mic intercom.
- If desired, select the speaker (SPKR) function button. Selecting this button allows radio transmissions to be received over the cabin speaker.
- If PA functionality is desired, press and hold the SPKR button for 2-seconds. The SPKR key annunciator flashes when the PA mode is active and the microphone audio can be heard over the speaker. Press the SPKR button again to deselect the PA function.

**NOTE**

Audio level of the NAV and COM receivers is controlled by the selected NAV and COM radio volume controls on the PFD.

**MARKER BEACON RECEIVER OPERATION:**

- SENS Button - Select HI for airway flying or LO (HI annunciator light is extinguished) for ILS/LOC approaches.

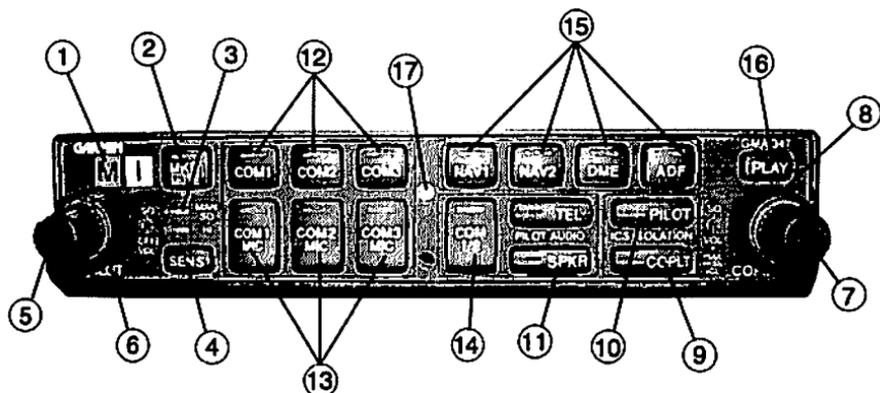
**SECTION 5 - PERFORMANCE**

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 Indicator 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. Speaker, Passenger Address (PA) Function Button
12. Transceiver Audio Selector Buttons (COM1, COM2, COM3)
13. Transmitter (Audio/Mic) Selection Buttons
14. Split COM Button
15. Aircraft Radio Audio Selection Buttons (NAV1, NAV2, DME, ADF)
16. Recording Playback Button (PLAY)
17. Photocell - Automatic Annunciator Dimming

**SECTION 7 - DESCRIPTION AND OPERATION (continued)****ON/OFF, Pilot Intercom System (ICS) Volume Control**

The GMA 347 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 detent. 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**

Transmitting (microphone) and receiving audio sources are activated by pressing either COM1 MIC or COM2 MIC buttons (13). COM3 MIC provides no function in this installation. The active COM audio is always heard on the headphones.

Additionally, each receiving audio source can be selected independently by pressing COM1 or COM2 buttons (12). COM3 provides no function for this installation. 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 once per second to indicate that the radio is transmitting.

**NOTE**

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

**Split COM**

Pressing the COM 1/2 button (14) 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 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 SPKR button is pressed for 2-seconds after the split com mode is activated the copilot's mic is output over the cabin speaker when keyed. A second press of the SPKR button returns the copilot to normal split COM operation.

**SECTION 7 - DESCRIPTION AND OPERATION (continued)**

**Split COM**

**NOTE**

It is possible that radio interference may occur in the split COM mode when the frequencies of the two communications radios are close together (normally less than one MHz). The extent of the interference is a function of the specific frequencies selected, transmitted power, antenna spacing, etc. No guarantee is made to the performance of the split COM feature on small aircraft.

**Aircraft Radios and Navigation**

Pressing NAV1, NAV2, DME, ADF (15) or MRK (2) selects each audio source. A second button press deselects the audio.

**Speaker Output**

Pressing the SPKR button (11) 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 SPKR button (11) for 2-seconds. The SPKR button annunciator flashes when PA is active. Then, when either the pilot's or copilot's microphone is keyed, the corresponding mic audio is heard over the cabin speaker. To deactivate the PA function, press the SPKR button a second time.

**Playback Feature**

Recording and playback of 2.5 minutes of pilot or co-pilot COM audio is available by pressing the PLAY button (16). The COM button selected determines which COM audio gets recorded for playback. During the Split COM mode, COM1 or COM2 audio can be selected for voice recording and playback.

**SECTION 7 - DESCRIPTION AND OPERATION (continued)****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.

**Marker Beacon Receiver**

The GMA 347'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 lack of HI 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 347. 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.

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**PILOT'S OPERATING HANDBOOK  
AND  
FAA APPROVED AIRPLANE FLIGHT MANUAL**

**SUPPLEMENT NO. 3  
FOR  
BENDIX/KING KR-87 DIGITAL ADF  
WITH GARMIN PFD INDICATOR**

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Bendix/King KR-87 Digital ADF with the Garmin Primary Flight Display (PFD) Indicator 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:



**WAYNE E. GAULZETTI  
ODA-510620-CE  
PIPER AIRCRAFT, INC.  
VERO BEACH, FLORIDA**

DATE OF APPROVAL: October 26, 2009

## **SECTION 1 - GENERAL**

The Bendix/King Digital ADF is a panel mounted, digitally tuned, automatic direction finder. It is designed to provide continuous 1 kHz digital tuning in the frequency range of 200 kHz to 1799 kHz and eliminates the need for mechanical band switching. The system comprises a receiver, a built-in electronic timer, a bearing indicator on the Garmin PFD and a KA-44B combined loop and sense antenna.

The Bendix/King Digital ADF can be used for position plotting and homing procedures, and for aural reception of amplitude modulated (AM) signals.

The "flip-flop" frequency display allows switching between pre-selected "STANDBY" and "ACTIVE" frequencies by pressing the frequency transfer button. Both preselected frequencies are stored in a non-volatile memory circuit (no battery power required) and displayed in self-dimming gas discharge numerics. The active frequency is continuously displayed in the left window, while the right window will display either the standby frequency or the selected readout from the built-in timer.

The built-in electronic timer has two separate and independent timing functions: (1) An automatic flight timer that starts whenever the unit is turned on. This timer functions up to 59 hours and 59 minutes. (2) An elapsed timer which will count up or down for up to 59 minutes and 59 seconds. When a preset time interval has been programmed and the countdown reaches :00, the display will flash for 15 seconds. Since both the flight timer and elapsed timer operate independently, it is possible to monitor either one without disrupting the other. The push-button controls are internally lighted.

## **SECTION 2 - LIMITATIONS**

No change.

## **SECTION 3 - EMERGENCY PROCEDURES**

No change.

## SECTION 4 - NORMAL PROCEDURES

### To Operate as an Automatic Direction Finder:

1. OFF/VOL Control - ON.
2. Frequency Selector Knobs - SELECT desired frequency in the standby frequency display.
3. FRQ Button - PRESS to move the desired frequency from the standby to the active position.
4. ADF SPEAKER/PHONE - Selector Switch (on audio control panel) - SELECT as desired.
5. OFF/VOL Control - SET to desired volume level.
6. ADF Bearing - Display ADF bearing on either PFD by selecting the PFD softkey, then pressing the BRG1 or BRG2 softkey until "ADF" is displayed in the appropriate Bearing 1 or Bearing 2 Information Window and the bearing pointer is displayed on the HSI.

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

1. ADF Button - SELECT ANT mode and note pointer moves towards the 90° position and then disappears.
2. ADF Button - SELECT ADF mode and note the pointer moves without hesitation to the station bearing. Excessive pointer sluggishness, wavering or reversals indicate a signal that is too weak or a system malfunction.

**SECTION 4 - NORMAL PROCEDURES (continued)**

**NOTE**

The Standby Frequency which is in memory while Flight Time or Elapsed Time modes are being displayed may be called back by pressing the FRQ button, then transferred to active use by pressing the FRQ button again.

**To Operate Elapsed Time Timer-Count Down Mode:**

1. OFF/VOL Control - ON.
2. FLT/ET Mode Button - PRESS (once or twice) until ET is annunciated.
3. SET/RST Button - PRESS until the ET annunciation begins to flash.
4. FREQUENCY SELECTOR KNOBS - SET desired time in the elapsed time display. The small knob is pulled out to tune the 1's. The small knob is pushed in to tune the 10's. The outer knob tunes minutes up to 59 minutes.

**NOTE**

Selector knobs remain in the time set mode for 15 seconds after the last entry or until the SET/RST, FLT/ET, or FRQ button is pressed.

5. SET/RST Button - PRESS to start countdown. When the timer reaches 0, it will start to count up as display flashes for 15 seconds.

**NOTE**

While FLT or ET are displayed, the active frequency on the left side of the window may be changed, by using the frequency selector knobs, without any effect on the stored standby frequency or the other modes.

**SECTION 4 - NORMAL PROCEDURES (continued)****ADF Operation NOTES:***Erroneous ADF Bearing Due to Radio Frequency Phenomena:*

In the U.S., the FCC, which assigns AM radio frequencies, occasionally will assign the same frequency to more than one station in an area. Certain conditions, such as Night Effect, may cause signals from such stations to overlap. This should be taken into consideration when using AM broadcast station for navigation.

Sunspots and atmospheric phenomena may occasionally distort reception so that signals from two stations on the same frequency will overlap. For this reason, it is always wise to make positive identification of the station being tuned, by switching the function selector to ANT and listening for station call letters.

*Electrical Storms:*

In the vicinity of electrical storms, an ADF indicator pointer tends to swing from the station tuned toward the center of the storm.

*Night Effect:*

This is a disturbance particularly strong just after sunset and just after dawn. An ADF indicator pointer may swing erratically at these times. If possible, tune to the most powerful station at the lowest frequency. If this is not possible, take the average of pointer oscillations to determine relative station bearing.

*Mountain Effect:*

Radio waves reflecting from the surface of mountains may cause the pointer to fluctuate or show an erroneous bearing. This should be taken into account when taking bearings over mountainous terrain.

*Coastal Refraction:*

Radio waves may be refracted when passing from land to sea or when moving parallel to the coastline. This also should be taken into account.

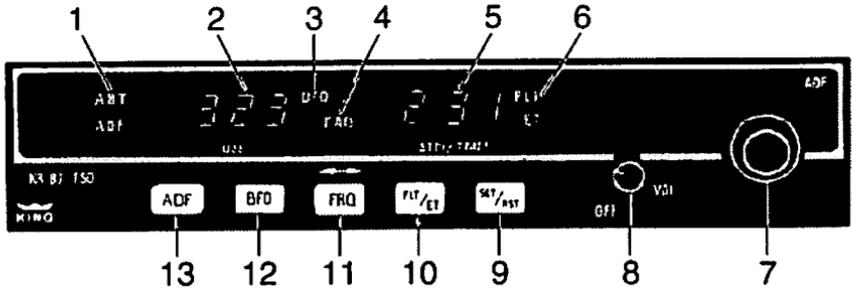
**SECTION 5 - PERFORMANCE**

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



KR-87 Digital ADF



14

ADF Displays on Garmin PFD

King Digital ADF Operating Controls and PFD Indicator  
Figure 1

**SECTION 7 - DESCRIPTION AND OPERATION (continued)**

**Legend - Figure 1**

1. Mode Annunciation - Antenna (ANT) is selected by the "out" position of the ADF button. This mode improves the aural reception and is usually used for station identification. The bearing pointer is deactivated and will move towards the 90° relative position and then disappear. Automatic Direction Finder (ADF) mode is selected by the depressed position of the ADF button. This mode activates the bearing pointer. The bearing pointer will point in the direction of the station relative to the aircraft heading.
2. Active Frequency Display - The frequency to which the ADF is tuned is displayed here. The active ADF frequency can be changed directly when either of the timer functions are selected.
3. Beat Frequency Oscillator (BFO) - The BFO mode, activated and annunciated when the "BFO" button is depressed, permits the carrier wave and associated morse code identifier broadcast on the carrier wave to be heard.

**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.

4. Standby Frequency Annunciation (FRQ) - When FRQ is displayed, the STANDBY frequency is displayed in the right hand display. The STANDBY frequency is selected using the frequency select knobs. The selected STANDBY frequency is put into the ACTIVE frequency window by pressing the frequency transfer button.
5. Standby Frequency Display - Either the standby frequency, the flight timer, or the elapsed time is displayed in this position. The flight timer and elapsed timer are displayed replacing the standby frequency which goes into "blind" memory to be called back at any time by depressing the FRQ button. Flight time or elapsed time are displayed and annunciated alternatively by depressing the FLT/ET button.

**SECTION 7 - DESCRIPTION AND OPERATION (continued)****Legend - Figure 1 (continued)**

6. Timer Mode Annunciation - Either the elapsed time (ET) or flight time (FLT) mode is annunciated here.
7. Frequency Selector Knobs - Selects the standby frequency when FRQ is displayed and directly selects the active frequency whenever either of the timer functions is selected. The frequency selector knobs may be rotated either clockwise or counterclockwise. The small knob is pulled out to tune the 1's. The small knob is pushed in to tune the 10's. The outer knob tunes the 100's with rollover into the 1000's. These knobs are also used to set the desired time when the elapsed timer is used in the countdown mode.
8. Off/Volume Control (OFF/VOL) - Controls primary power and audio output level. Clockwise rotation from OFF position applies primary power to receiver; further clockwise rotation increases audio level. Audio muting causes the audio output to be muted unless the receiver is locked on a valid station.
9. Set/Reset Button (SET/RST) - The set/reset button, when pressed, resets the elapsed timer whether it is being displayed or not.
10. Flight Time/Elapsed Time Mode Selector Button (FLT/ET) - The Flight Timer/Elapsed Time mode selector button, when pressed, alternatively selects either Flight Timer mode or Elapsed Timer mode.
11. Frequency Transfer Button (FRQ) - The FRQ transfer button, when pressed, exchanges the active and standby frequencies. The new frequency becomes active and the former active frequency goes into standby.
12. BFO Button - The BFO button selects the BFO mode when in the depressed position (see Note under item 3).
13. ADF Button - The ADF button selects either the ANT mode or the ADF mode. The ANT mode is selected with the ADF button in the out position. The ADF mode is selected with the ADF button in the depressed position.
14. Bearing Pointer (on PFD) - The cyan arrow indicates magnetic bearing to the station in degrees.

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**PILOT'S OPERATING HANDBOOK  
AND  
FAA APPROVED AIRPLANE FLIGHT MANUAL**

**SUPPLEMENT NO. 4  
FOR  
BENDIX/KING KN-63 DME**

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Bendix/King KN-63 DME 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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**SECTION 1 - GENERAL**

The Bendix/King KN-63 DME supplies continuous slant range distance information from a fixed ground station to an aircraft in flight.

The equipment consists of a Garmin Primary Flight Display (PFD) which contains all the operating controls and displays, and a remotely mounted KN-63 Receiver-Transmitter. The Garmin PFD displays the Nav radio (1 and 2) which is receiving the DME signal, the Nav frequency and the distance to the DME station in nautical miles.

**SECTION 2 - LIMITATIONS**

No change.

**SECTION 3 - EMERGENCY PROCEDURES**

No change.

**SECTION 4 - NORMAL PROCEDURES**

**DME Operation**

1. NAV 1 and NAV 2 VHF Navigation Receivers - ON; TUNE FREQUENCY to VOR/DME or VORTAC station frequencies, as required.

**NOTE**

When the VORTAC or VOR/DME frequency is selected, the appropriate DME frequency is automatically channeled.

2. DME IDENTIFICATION - select DME button on audio panel (audio ID will always come through the headset and will come through the cockpit speaker if SPKR is selected on the audio panel).
3. Select PFD softkey, then DME softkey to display DME Information window.
4. Select DME softkey on PFD to display DME TUNING Window.
5. Select NAV1, NAV2 or HOLD mode from DME TUNING window.

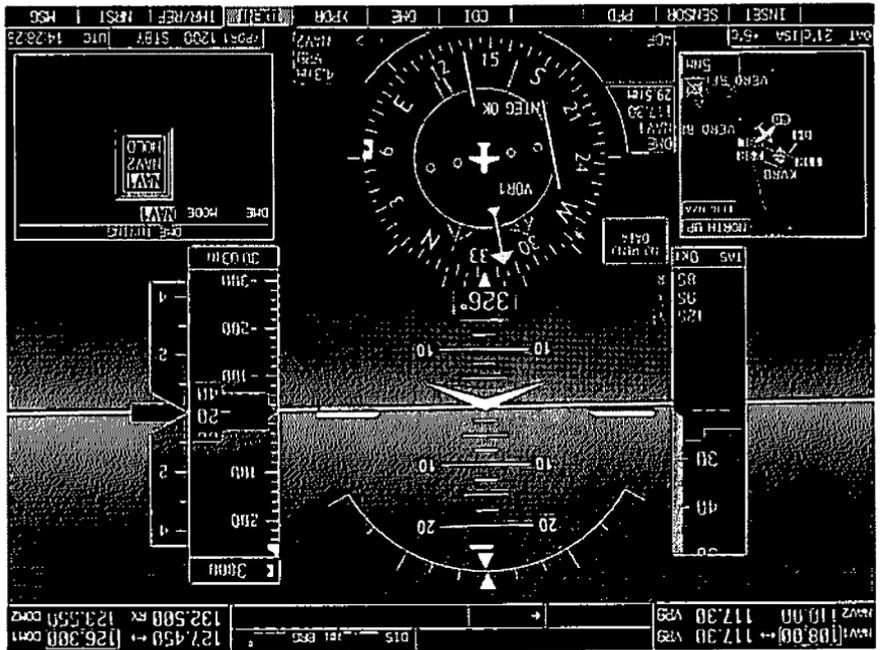
**SECTION 5 - PERFORMANCE**

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



DME Display on Garmin PFD  
Figure 1

Legend - Figure 1

1. DME Information Window
2. DME MODE ANNUNCIATOR  
Displays the DME operating mode; NAV 1; NAV 2; or HOLD as selected in the DME TUNING window.
3. FREQUENCY  
Displays the frequency of the VOR/DME or VORTAC selected on the associated navigation radio.
4. DISTANCE DISPLAY (NM)  
DME distance to VOR/DME or VORTAC displayed in .1 nautical mile increments up to 99.9 NM, then in increments of one nautical mile to up to 389 NM.



SECTION 7 - DESCRIPTION AND OPERATION (continued)

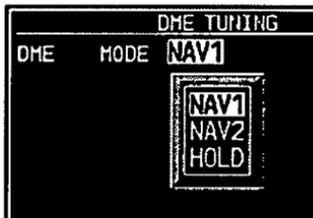
Legend - Figure 1 (continued)

5. DME TUNING Window (NAV1, NAV2, HOLD)

Allows access to the 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.

5



NAV 2 Selects DME operation with No. 2 VHF navigation set; enables channel selection by NAV 2 frequency selector switches. Brightness of the labels for this switch is controlled by the RADIO light dimming rheostat.

HOLD Selects DME memory circuit; DME remains channeled to station which 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 NAV 1 / Nav 2 radio which is being used, but the frequency tuned via that radio remains on the display. Additionally, an annunciator labeled HOLD illuminates on the DME display to flag the pilot that the DME is in the HOLD mode.

**PILOT'S OPERATING HANDBOOK  
AND  
FAA APPROVED AIRPLANE FLIGHT MANUAL  
  
SUPPLEMENT NO. 5  
FOR  
PRECISE FLIGHT SPEEDBRAKE 2000 SYSTEM**

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the SpeedBrake System 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:



WAYNE E. GAULZETTI  
ODA-510620-CE  
PIPER AIRCRAFT, INC.  
VERO BEACH, FLORIDA

DATE OF APPROVAL: October 26, 2009

**SECTION 1 - GENERAL**

This supplement supplies information necessary for the operation of the airplane when the optional Precise Flight SpeedBrakes are installed in accordance with FAA Approved Precise Flight data.

**SECTION 2 - LIMITATIONS**

- (a) Airspeed Limitations are the same as the basic airplane.
- (b) The SpeedBrakes are not approved for deployment in icing conditions.
- (c) The SpeedBrake Circuit Breaker to be indicated by placard or equivalent.
- (d) Placards:  
On each wing, at each SpeedBrake location, in full view.

**ELECTRICALLY ACTUATED  
DO NOT MANUALLY OPERATE**

**SECTION 3 - EMERGENCY PROCEDURES**

- (a) SpeedBrake OFF for a forced landing after engine failure.
- (b) SpeedBrake OFF for any spin recovery.
- (c) SpeedBrake OFF for ditching.
- (d) SpeedBrake OFF if the elevator is disabled.
- (e) SpeedBrake OFF for aircraft electrical failure.
- (f) PULL SpeedBrake Circuit Breaker for SpeedBrake Switch or Electrical failure.

**NOTE**

If use of the circuit breaker is required for SpeedBrake retraction, leave the circuit breaker in the pulled position, and have maintenance personnel inspect system per Precise Flight SpeedBrake 2000 Maintenance Manual.

**SECTION 3 - EMERGENCY PROCEDURES (continued)****PRECISE FLIGHT SPEED BRAKE SYSTEM ANNUNCIATIONS****WARNING Messages - Red - Repeating Aural Chime**

<b>Message</b>	<b>Cause</b>
SPEEDBRAKES EXTD	Speedbrakes are extended during the takeoff phase of flight.

**CAUTION Messages - Amber - Single Aural Chime**

<b>Message</b>	<b>Cause</b>
SPEEDBRAKES EXTD	Speedbrakes are extended in flight while the engine is OFF, being started or during landing.

**ADVISORY Messages - White - No Aural Chime**

<b>Message</b>	<b>Cause</b>
SPEEDBRAKES EXTD	Speedbrakes are extended while the airplane is on the ground or after completing the takeoff phase of flight.

#### **SECTION 4 - NORMAL PROCEDURES**

The SpeedBrake system should be functionally checked for proper operation prior to flight. The independent electrical clutches need to be synchronized by SpeedBrake activation before flight and/or after SpeedBrake Circuit Breaker Pull.

- (a) **BEFORE TAKE-OFF** Place the Switch in the **AFT/ON** position to deploy speedbrakes. Observe that the **SPEEDBRAKES EXTD** advisory CAS message is activated and both speedbrakes are extended.
- (b) Place the Switch in the **FORWARD/OFF** position to retract speedbrakes prior to take-off. Observe that the **SPEEDBRAKES EXTD** advisory CAS message is off and both speedbrakes are retracted.
- (c) During aircraft Take-Off the speedbrake switch should be **OFF** and the speedbrakes retracted..

#### **EXPEDITED DESCENTS**

- (a) Select 2400 RPM and approximately 25 inches Manifold Pressure.
- (b) SpeedBrake switch **ON** to deploy SpeedBrake and maintain 165 KIAS.
- (c) SpeedBrake switch **OFF** to retract SpeedBrake

#### **FINAL APPROACH**

- (a) Fly a high base leg and final approach. Extend wing flaps as desired and place the SpeedBrake switch **ON** to deploy the SpeedBrakes. (The SpeedBrake switch may be operated intermittently - as required - to modulate the glide path). Maintain an 85 KIAS approach speed by establishing a moderately steep, nose-down attitude.

**SECTION 4 - NORMAL PROCEDURES (continued)**

**LANDING**

- (a) Rotate the aircraft more rapidly than usual to perform a tailow touch-down.

**CAUTION**

If the landing rate of sink is excessive, place the SpeedBrake switch "off" to retract the SpeedBrakes and add power as required to reduce the rate of descent.

**BALKED LANDING**

- (a) Advance throttle, SpeedBrake switch OFF, retract wing flaps.

**SECTION 5 - PERFORMANCE**

- (a) Inadvertent takeoff with SpeedBrakes Deployed expect an extended take off roll, and reduction in rate of climb until SpeedBrakes are retracted
- (b) Cruise flight with SpeedBrakes deployed expect cruise speed and range to be reduced approximately the same amount as flight with landing gear extended.
- (c) In the unlikely event of one SpeedBrake Cartridge deploying while the other remains retracted, a maximum of 10% of corrective aileron travel and 5 lbs. of rudder pressure are required for coordinated flight from stall through Vne.

TIME, FUEL, DISTANCE TO DESCEND WITH SPEED BRAKES

ASSOCIATED CONDITIONS

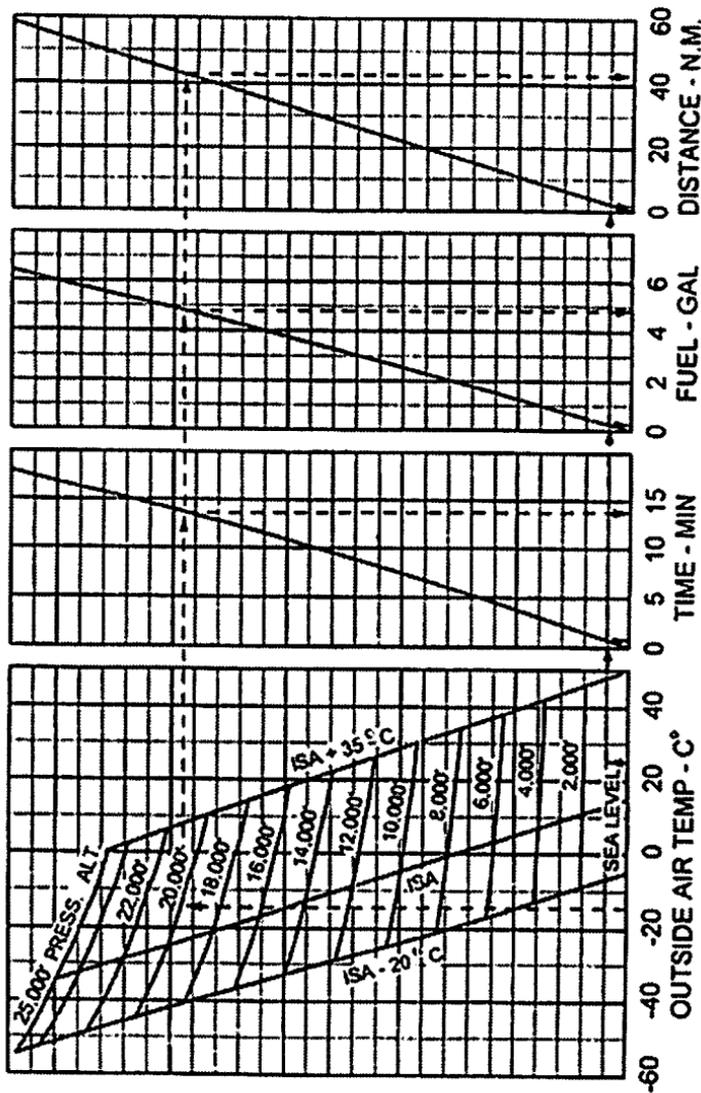
Landing Gear: UP  
 Flaps: 0 DEG.  
 Speed Brakes: DEPLOYED  
 Descent Speed: 185 KIAS  
 ZERO WIND

Max. PEAK TIT  
 Power: 2400 RHPA  
 25" HG MAP

EXAMPLE

Destination Airport O.A.T.: 24° C  
 Destination Airport Altitude: 1000 FT.  
 Cruise O.A.T.: -15° C  
 : 16000 FT.

Time To Descend: 13.5 - 1 = 12.5 MIN  
 Fuel To Descend: 4.8 - 0.2 = 4.6 GAL  
 Distance To Descend: 43.0 - 2.5 = 40.5 N.M.



TIME, FUEL, DISTANCE TO DESCEND WITH SPEEDBRAKES DEPLOYED

**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.

**SECTION 7 - DESCRIPTION AND OPERATION OF THE PRECISE FLIGHT SPEEDBRAKE 2000 SYSTEM**

Precise Flight SpeedBrake 2000 System is installed to provide expedited descents at low cruise power, glide path control on final approach, airspeed reduction and an aid to the prevention of excessive engine cooling in descent. The SpeedBrakes can be extended at aircraft speeds up to Vne.

**WARNING**

If icing is encountered with the SpeedBrakes extended, retract the SpeedBrakes immediately.

The Series 2000 SpeedBrake Option consists of wing mounted electric SpeedBrake Cartridges. Each SpeedBrake Cartridge is interconnected electronically by a central logic-switching unit and the yoke mounted SpeedBrake actuator switch. The SpeedBrake Cartridges receive electrical power from the aircraft electrical buss through a disconnect type circuit breaker.

The Crew Alerting System (CAS) provides speedbrake WARNING, CAUTIONS, and Advisory annunciations notifying the pilot of speedbrake status and abnormal conditions (see this supplements section 3 for details). The SPEEDBRAKES EXTND Advisory CAS message will appear after the speedbrake switch is toggled ON and both brakes are in the up position. If the speedbrake switch is toggled ON and both brakes do not extend, the SPEEDBRAKES EXTND Advisory CAS message will fail to appear indicating a failure of the speedbrakes. A second attempt to deploy the speedbrakes may be attempted, but if unsuccessful, the speed brake switch should be left off.

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**PILOT'S OPERATING HANDBOOK  
AND  
FAA APPROVED AIRPLANE FLIGHT MANUAL**

**SUPPLEMENT NO. 6  
FOR  
PROPELLER HEAT**

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the following equipment is installed per the appropriate Piper Drawing:

Prop Heat - Dwg. No. 101124-002.

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:



**WAYNE E. GAULZETTI  
ODA-510620-CE  
PIPER AIRCRAFT, INC.  
VERO BEACH, FLORIDA**

DATE OF APPROVAL: October 26, 2009

**SECTION 1 - GENERAL**

This supplement supplies information necessary for the operation of the airplane when the propeller heat option is installed in accordance with FAA Approved Piper data.

**SECTION 2 - LIMITATIONS**

This aircraft is not approved for flight in icing conditions.

**PLACARDS**

In full view of the pilot if all required equipment is not installed and operative:

**WARNING**  
**THIS AIRCRAFT IS NOT APPROVED FOR  
FLIGHT IN ICING CONDITIONS**

**SECTION 3 - EMERGENCY PROCEDURES**

**PROPELLER HEAT SYSTEM MALFUNCTION**

Excessive vibration may be an indication that the propeller heat is not functioning properly.

- Propeller control .....exercise  
Propeller heat annunciator .....check for proper indications:  
    (a) ON for approx. 90 seconds  
        (switch LED steady)  
    (b) OFF for approx. 90 seconds  
        (switch LED flashing)

Illumination of the prop heat deice fail (PRP DE-ICE FAIL) annunciator is an indication that the propeller blades may not be deicing properly.

PROP HEAT switch .....OFF if failure is indicated

**NOTE**

A flashing PROP HEAT selector switch LED is an indication that the 90 second off cycle is activated.

**WARNING**

It is imperative that the PROP HEAT switch be turned OFF if vibration persists. This can be a symptom of uneven blade deicing which can lead to propeller unbalance and engine failure.

*Immediate action should be taken to exit icing conditions and avoid further icing conditions.*

**SECTION 4 - NORMAL PROCEDURES**

A check of the heated propeller should be performed by pressing PROP HEAT button on environmental control panel. The green lamp in the PROP HEAT button will start to flash rapidly for 30 seconds, indicating the heater is in the "on" cycle.

**IN FLIGHT**

If inadvertent icing is encountered:

- |                                                                                                            |                                      |
|------------------------------------------------------------------------------------------------------------|--------------------------------------|
| (a) INDUCTION AIR                                                                                          | ALTERNATE                            |
| (b) PITOT HEAT switch                                                                                      | ON                                   |
| (c) S. WRN HEAT switch                                                                                     | ON                                   |
| (d) PROP HEAT switch                                                                                       | ON                                   |
| (e) DEFROST knob                                                                                           | OUT                                  |
| (f) VENT/DEFOG BLWR switch                                                                                 | ON, if additional defrost is desired |
| (g) Relieve propeller unbalance (if required) by exercising propeller control briefly. Repeat as required. |                                      |

Exit icing conditions immediately.

**NOTE**

For accurate magnetic compass readings, turn the PROP HEAT, AIR COND, S. WARN HEAT, AUX CABIN HEAT, and PITOT heat switches off momentarily.

**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.

**SECTION 7 - DESCRIPTION AND OPERATION OF PROPELLER HEAT**

The presence of propeller deicing equipment does not imply the capability to fly into forecast or known icing. The equipment is provided to enlarge the options available to the pilot as he takes appropriate action to avoid icing that is inadvertently encountered.

Controls for the propeller heat are located in the environmental control panel. (Figure 9-1).

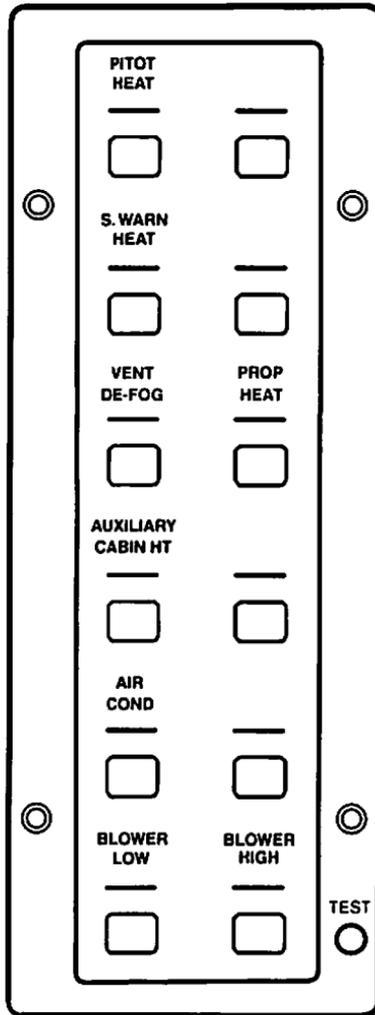


Figure 9-1  
Environmental Control Panel

## PROPELLER HEAT

Electrothermal propeller heat pads are bonded to a portion of the leading edges of the propeller blades. The system is controlled by an ON-OFF type PROP HEAT switch (Figure 9-1), situated in the environmental control panel. Power for the propeller heat is supplied by the aircraft electrical system through a PROP HEAT circuit breaker on the main circuit breaker panel. When the PROP HEAT switch is actuated, power is applied to a timer which monitors the current through the propeller heat system.

Power from the timer is cycled to brush assemblies which distribute power to slip rings. The current is then supplied from the slip rings directly to the electrothermal propeller heat pads.

The Hartzell propeller is heated in a cycle which applies power to the heat pads for approximately 90 seconds and then shuts off for approximately 90 seconds. Once begun, cycling will proceed in the above sequence and will continue until the system is turned off. The steady illumination of the PROP HEAT switch green LED indicates the portion of the cycle when power is being applied to the heat pads. A flashing annunciator indicates the 90 second cycle in which power has been removed from the heat pads.

A ground test of the prop heat can be accomplished by depressing the prop heat switch to "on" prior to takeoff. During this ground test when heat is being applied to the propeller the green LED in the prop heat switch will flash rapidly for approximately 30 seconds, indicating the heater is in the "on" cycle. After approximately 30 seconds, the flash rate is reduced, indicating the prop heat is in the "off" cycle. The green LED will continue to flash at the slower rate as long as the aircraft is on the ground "on" until the pilot de-selects the prop heat switch.

The propeller designation is: HC-I3Y1R-1N/N7605K+2

The heat provided by the deice pads reduces the adhesion between the ice and the propeller so that centrifugal force and the blast of the airstream cause the ice to be thrown off the propeller blades in small pieces.

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**TABLE OF CONTENTS**  
**SECTION 10**  
**OPERATING TIPS**

<b>Paragraph No.</b>		<b>Page No.</b>
10.1	General .....	10-1
10.3	Operating Tips .....	10-1

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SECTION 10  
OPERATING TIPS

**10.1 GENERAL**

This section provides operating tips of particular value in the operation of the Matrix.

**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) On takeoff, do not retract the gear prematurely. The airplane may settle and make contact with the ground because of lack of flying speed, atmospheric conditions, or rolling terrain.
- (c) To reduce flap operating loads, it is desirable to have the airplane at a speed slower than the maximum allowable before extending the flaps.
- (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 AV BUS MASTR, 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 spatial disorientation. The pilot may consider not using the Strobe lights in close proximity to other aircraft, such as during taxiing, operations.
- (g) In extreme turbulence, reduce power setting to obtain design operating maneuvering speed. (See Section 2 Limitations for correct speeds).

**10.3 OPERATING TIPS (continued)**

- (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 feet 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 the tank being used is not full.
- (j) In order to prevent propeller strikes while taxiing on rough terrain or crossing over rises, the airplane should be taxied slowly with minimum power and rises should be crossed at an acute angle. Tires and struts should be properly inflated.
- (k) Pilots who fly above 10,000 feet should be aware of the need for special physiological training. Appropriate training is available for a small fee at approximately twenty-three Air Force Bases throughout the United States. The training is free at the NASA Center in Houston and at the FAA Aeronautical Center in Oklahoma.

Forms to be completed (Physiological Training Application and Agreement) for application for the training course may be obtained by writing to the following address:

Chief of Physiological Training, AAC-143  
FAA Aeronautical Center  
P.O. Box 25082  
Oklahoma City, Oklahoma 73125

It is recommended that all pilots who plan to fly above 10,000 feet take this training before flying this high and then take refresher training every two or three years.