



**Piper**<sup>™</sup>

***MALIBU MIRAGE***  
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* **MIRAGE**

**PA-46-350P**

**SN 4636375 AND UP**

## **INFORMATION MANUAL**



**MANUAL PART NUMBER 767-050**

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**APPLICABILITY**

Application of this handbook is limited to the specific Piper PA-46-350P 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.

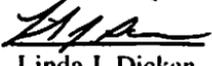
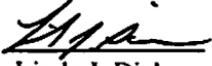
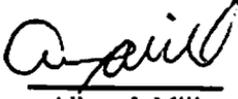
## ORIGINAL PAGES ISSUED

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

Title, ii through viii, 1-1 through 1-12, 2-1 through 2-24, 3-1 through 3-68, 4-1 through 4-50, 5-1 through 5-36, 6-1 through 6-14, 7-1 through 7-68, 8-1 through 8-26, 9-1 through 9-68, and 10-1 through 10-2.

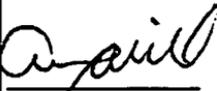
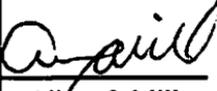
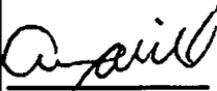
## PILOT'S OPERATING HANDBOOK LOG OF REVISIONS

Current Revisions to the PA-46-350P Mirage Pilot's Operating Handbook,  
REPORT: VB-1950 issued March 30, 2006.

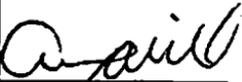
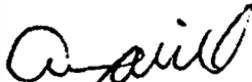
Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 1 (PR060724)	v 2-21	Added Rev. 1 to L of R. Revised para. 2.49.	 Linda J. Dicken July 24, 2006
Rev. 2 (PR060912)	v 2-5 2-16	Added Rev. 2 to L of R. Revised para. 2.15. Revised para. 2.49.	 Linda J. Dicken September 12, 2006
Rev. 3 (PR070625)	v 3-i 3-iii 3-20 3-21 3-53 3-54 4-13 4-33 7-13 7-14 7-26	Added Rev. 3 to L of R. Revised T of C. Revised T of C. Revised para. 3.4n. Revised para. 3.4n. Revised para. 3.28. Revised para. 3.28. Revised para. 4.5d, 4.5e. Revised para. 4.15. Revised para. 7.8a. Revised para. 7.8a. Revised para. 7.8b.	 Linda J. Dicken June 25, 2007
Rev. 4 (PR080304)	i v 9-i 9-69 thru 9-80	Revised POH Title Page Added Rev. 4 to L of R Added Supp. 12 to Section 9 TOC Added Section 9, Supp. 12	 Albert J. Mill March 4, 2008

Rev. 5      ii      Revised POH copyright notice

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

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
(PR090209)	vi	Added Rev. 5 to L of R	 Albert J. Mill Feb. 9, 2009
	2-16	Revised Placard text in Para.	
	2.49		
	2-20	Revised Placard text in Para.	
	2.49		
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	3-5	Revised ANNUN INOP in Para.	
	3.1.		
Rev. 6 (PR090325)	vi	Added Rev. 6 to L of R.	 Albert J. Mill March 25, 2009
	2-16	Revised Placard text in Para.	
	2.49		
	2-22	Revised text in Para. 2.49	
	2-23	Revised text in Para. 2.49	
Rev. 7 (PR090417)	ii	Revised POH copyright notice	 Albert J. Mill April 17, 2009
	vi	Added Rev. 7 to L of R	
	1-4	Revised text in Para. 1.5(c) and 1.5(e).	
	2-3	Revised text in Para. 2.7(i),(j) and (k).	
	4-9	Revised Note in Para. 4.5c.	
	4-30	Revised Note in Para. 4.13a	
	4-49	Revised text and added table to Para. 4.51.	
	8-3	Revised text in Section 8.1	
	8-12	Revised text in Para. 8.19.	
	9-12	Revised propeller designation.	
9-25	Revised propeller designation. Moved text to pg. 9-26.		
9-26	Added text from pg. 9-25.		

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

Revision Number and Code	Revised Pages	Description of Revisions	FAA Approved Signature and Date
Rev. 8 (PR091215)	vi-a vi-b 4-17 4-18  4-18a  4-18b 4-38 4-39 4-39a 4-39b 5-28	Added Pg., Added Rev. 8 to L of R. Added Pg. Revised Para. 4.5i. Revised Para. 4.5i. Added text and Note to Para. 4.5j. Relocated text to pg. 4-18a. Added pg. and relocated text from pg. 4-18, added Notes to para. 4.5j. Added pg. Revised Para's. 4.25 and 4.25b. Added Notes to Para. 4.25b. Added Note to Para. 4.27. Relocated text to pg. 4-39a. Added pg. Relocated text from pg. 4-39. Revised text into a Note Added pg. Added Note.	 Albert J. Mill December 15, 2009
Rev. 9 (PR100527)	i vi-a	Added EASA approval Added Rev. 9 to L of R.	 Albert J. Mill May 27, 2010
Rev. 10 (PR100615)	ii vi-a 7-66  7-67	Revised POH copyright notice. Added Rev. 10 to L of R. Revised Para. 7.41. Relocated text to pg. 7-67. Added text from pg. 7-66.	 Wayne E. Gaulzetti June 15, 2010

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

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

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## SECTION 1

## GENERAL

## 1.1 INTRODUCTION

This Pilot's Operating Handbook is designed for maximum utilization as an operating guide for the pilot. It includes the material required to be furnished to the pilot by the Federal Aviation Regulations and additional information provided by the manufacturer and constitutes the FAA Approved Airplane Flight Manual.

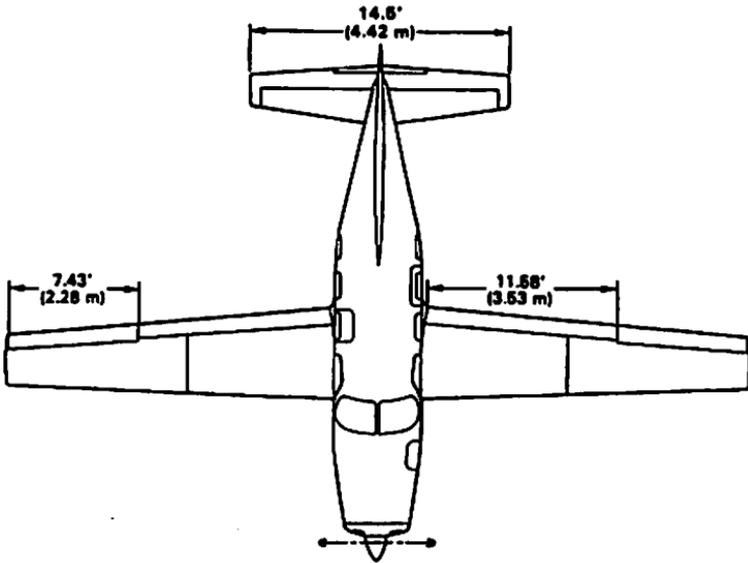
**This handbook is not designed as a substitute for adequate and competent flight instruction, knowledge of current Airworthiness Directives, applicable Federal Aviation Regulations or Advisory Circulars. It is not intended to be a guide for basic flight instruction or a training manual and should not 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.**

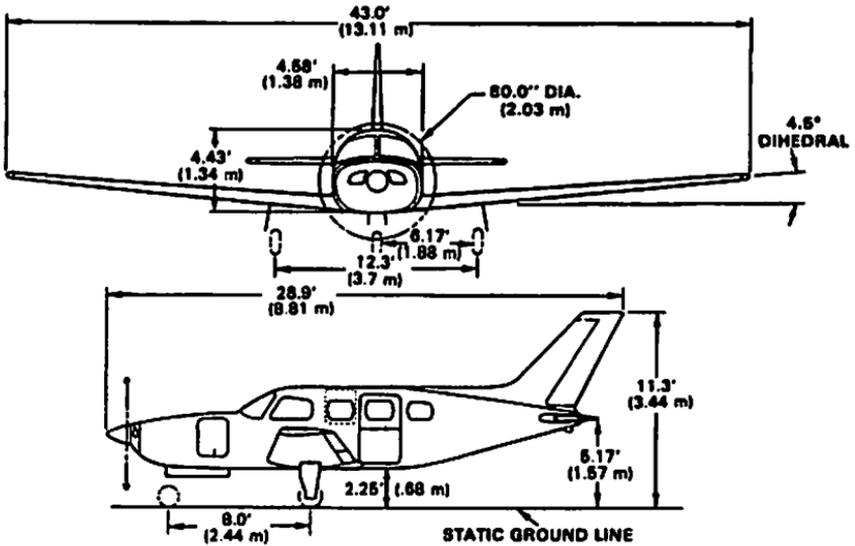
The handbook has been divided into numbered (arabic) sections each provided with a finger-tip tab divider for quick reference. Provisions for expansion of the handbook have been made by the deliberate omission of certain paragraph numbers, figure numbers, item numbers and pages noted as being intentionally 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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**SECTION 1  
GENERAL**

**PA-46-350P, MIRAGE**

**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 Models	7890K N7605K+2
(d) Number of Blades	3
(e) Hub Models	HC-I3YR-1E HC-I3Y1R-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 Blue Aviation Grade
(2) Alternate Fuels	Refer to latest revision of Lycoming Service Instruction 1070, except alcohol is <i>not</i> approved for use in this airplane.

**1.9 OIL**

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

<u>Average Ambient Temperature</u>	<u>MIL-L-22851 Ashless Dispersant 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>A</sub>	Maneuvering Speed is the maximum speed at which application of full available aerodynamic control will not overstress the airplane.
V <sub>FE</sub>	Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a prescribed extended position.

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

<b>V<sub>LE</sub></b>	Maximum Landing Gear Extended Speed is the maximum speed at which an aircraft can be safely flown with the landing gear extended.
<b>V<sub>LO</sub></b>	Maximum Landing Gear Operating Speed is the maximum speed at which the landing gear can be safely extended or retracted.
<b>V<sub>NE/MNE</sub></b>	Never Exceed Speed or Mach Number is the speed limit that may not be exceeded at any time.
<b>V<sub>NO</sub></b>	Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air and then only with caution.
<b>V<sub>S</sub></b>	Stalling Speed or the minimum steady flight speed at which the airplane is controllable.
<b>V<sub>SO</sub></b>	Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration at maximum gross weight.
<b>V<sub>X</sub></b>	Best Angle-of-Climb Speed is the airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.
<b>V<sub>Y</sub></b>	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: (1) The air is a dry perfect gas; (2) The temperature at sea level is 15° Celsius (59° Fahrenheit); (3) The pressure at sea level is 29.92 inches hg. (1013.2 mb); (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.
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**

T.I.T. Gauge	Turbine Inlet Temperature
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**(e) Airplane Performance and Flight Planning Terminology**

Climb Gradient	The demonstrated ratio of the change in height during a portion of a climb, to the horizontal distance traversed in the same time interval.
Demonstrated Crosswind Velocity	The demonstrated crosswind velocity is the velocity of the crosswind component for which adequate control of the airplane during takeoff and landing was actually demonstrated during certification tests.
Accelerate-Stop Distance	The distance required to accelerate an airplane to a specified speed and, assuming failure of an engine at the instant that speed is attained, to bring the airplane to a stop.
Route Segment	A part of a route. Each end of that part is identified by (1) a geographical location or (2) a point at which a definite radio fix can be established.

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

Reference Datum	An imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Station	A location along the airplane fuselage usually given in terms of distance from the reference datum.
Arm	The horizontal distance from the reference datum to the center of gravity (C.G.) of an item.
Moment	The product of the weight of an item multiplied by its arm. (Moment divided by a constant is used to simplify balance calculations by reducing the number of digits.)
Center of Gravity (C.G.)	The point at which an airplane would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the airplane.
C.G. Arm	The arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.
C.G. Limits	The extreme center of gravity locations within which the airplane must be operated at a given weight.
Usable Fuel	Fuel available for flight planning.
Unusable Fuel	Fuel remaining after a runout test has been completed in accordance with governmental regulations.
Standard Empty Weight	Weight of a standard airplane including unusable fuel, full operating fluids and full oil.

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

Basic Empty Weight	Standard empty weight plus optional equipment.
Payload	Weight of occupants, cargo and baggage.
Useful Load	Difference between takeoff weight, or ramp weight if applicable, and basic empty weight.
Maximum Ramp Weight	Maximum weight approved for ground maneuver. (It includes weight of start, taxi and run up fuel.)
Maximum Takeoff Weight	Maximum Weight approved for the start of the takeoff run.
Maximum Landing Weight	Maximum weight approved for the landing touchdown.
Maximum Zero Fuel Weight	Maximum weight exclusive of usable fuel.

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SECTION 2  
LIMITATIONS

## 2.1 GENERAL

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

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

## 2.3 AIRSPEED LIMITATIONS

Speed	KIAS	KCAS
Never Exceed Speed (V <sub>NE</sub> ) - Do not exceed this speed in any operation.	198	200
Maximum Structural Cruising Speed (V <sub>MO</sub> ) - Do not exceed this speed except in smooth air and then only with caution.	168	170
Design Maneuvering Speed (V <sub>A</sub> ) - Do not make full or abrupt control movements above this speed.		
At 4340 LBS. Gross Weight	133	135
At 2450 LBS. Gross Weight	100	102

## CAUTION

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

**2.3 AIRSPEED LIMITATIONS (continued)**

Speed	KIAS	KCAS
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**

Avidyne PFD	KIAS
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	HC-13YR-1E/7890K HC-13Y1R-1N/N7605K+2
(j) Propeller Diameter (inches)	80
(k) Blade Angle Limits 7890K	
Low Pitch Stop Min./Max.	13.5°/13.8°
High Pitch Stop Min./Max. N7605K+2	38.2°/39.2°
Low Pitch Stop Min./Max.	13.8°/14.2°
High Pitch Stop Min./Max.	37.0°/39.0°

**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 Cruise Range)                   | 100° to 245°F     |
| Red Line (Maximum)                                | 245°F             |
| (d) Oil Pressure                                  |                   |
| Green Arc (Normal Cruise Range)                   | 55 PSI to 95 PSI  |
| Yellow Arc (Caution Range) (Idle)                 | 25 PSI to 55 PSI  |
| Yellow Arc (Caution Range)<br>(Start and Warm Up) | 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 500°F    |
| Red Line (Maximum)                                | 500°F             |
| (h) Vacuum Pressure                               |                   |
| Green Arc (Normal Operating Range)                | 4.5 to 5.2 in. Hg |
| Red Line (Minimum)                                | 4.5 In. Hg        |
| Red Line (Maximum)                                | 5.2 In. Hg        |

**2.13 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 AVIDYNE PFD LIMITATIONS**

IFR flight is prohibited when the pilot's PFD or any standby instrument is inoperative (altimeter, airspeed indicator, artificial horizon, or whiskey compass).

The Avidyne FlightMax Entegra series Primary Flight Display Pilot's Guide, p/n 600-00104-002, appropriate revision, must be available to the pilot during all flight operations.

### **2.23 AVIDYNE MFD LIMITATIONS**

The Avidyne moving map displays visual advisory of the airplane's GPS position against a moving map. This information supplements CDI course deviation and information presented on the GPS navigator. The moving map display must not be used as the primary navigation instrument.

Use of MAP page during IFR flight requires an IFR approved GPS receiver and installation, operated in accordance with its applicable limitations.

The Avidyne FlightMax EX5000 Multi-Function Display Pilot's Guide, p/n 600-00121-000, appropriate revision, must be available to the pilot during all flight operations.

Aircraft dispatch is prohibited when the MFD is inoperative.

### **2.25 RADAR LIMITATIONS**

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.

### **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 CMAX CHART PAGE LIMITATIONS**

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

**NOTE**

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

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

**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 and 135 operating requirements.

System	Number Required	Types of Operation and Remarks (DAY, NIGHT, VFR, IFR and ICING Conditions)
1. ELECTRICAL		
Alternators	1	DAY, NIGHT, VFR, IFR
DC Voltmeter	1	DAY, NIGHT, VFR, IFR, ICING
Ammeters	2	DAY, NIGHT, VFR, IFR, ICING
ALT INOP Annunciator	2	DAY, NIGHT, VFR, IFR, ICING
LO BUS VOLT Annunciator	1	DAY, NIGHT, VFR, IFR, ICING
Propeller Heat LED Indicator	1	ICING
Stall Warning	1	DAY, NIGHT, VFR, IFR, ICING
2. EQUIPMENT/ FURNISHINGS		
Safety Restraint Each Occupant	AR	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)
3. FLIGHT CONTROLS		
Flap Position Indicator	1	DAY, NIGHT, VFR, IFR, ICING
Elevator and Rudder Trim Position Indicator	1 ea.	DAY, NIGHT, VFR, IFR, ICING
4. FUEL		
Fuel Quantity Indicating System	2	DAY, NIGHT, VFR, IFR, ICING
BOOST PUMP Annunciator	1	DAY, NIGHT, VFR, IFR, ICING
FUEL PRESS Annunciator	1	DAY, NIGHT, VFR, IFR, ICING
5. ICE PROTECTION		
Pneumatic Deice System (Wing and Empennage Protection)	1	ICING
Wing Ice Detection Light	1	ICING
Electrothermal Propeller Deice Pads	1 per Blade	ICING
Heated Windshield	1	ICING

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

System	Number Required	Types of Operation and Remarks (DAY, NIGHT, VFR, IFR and ICING Conditions)
5. ICE PROTECTION (Continued)		
Heated Stall Warning Transducer	1	ICING
Heated Pitot Head	1	ICING
Alternate Static Source	1	ICING
WSHLD HEAT Annunciator	1	ICING
Vac Pump	2	ICING
SURF DEICE Annunciator	1	ICING
Alternator	2	ICING
6. 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)
7. INSTRUMENTATION - FLIGHT		
Airspeed Indicator	1	DAY, NIGHT, VFR, IFR, ICING
Altimeter	1	DAY, NIGHT, VFR, IFR, ICING
Free Air Temperature Gauge	1	DAY, NIGHT, VFR, IFR, ICING
Gyroscopic Attitude Indicator	1	IFR, ICING
Gyroscopic Heading Indicator	1	IFR, ICING
Slip/Skid Indicator	1	IFR, ICING
8. LANDING GEAR		
Hydraulic Pump	1	DAY, NIGHT, VFR, IFR, ICING
HYD PUMP Annunciator	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 WARN Annunciator	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. LIGHTS - EXTERNAL		
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	NIGHT
10. LIGHTS - COCKPIT		
Instrument Panel Switch Lights	AR	NIGHT
Instrument Lights	AR	NIGHT
Map Lights	2	NIGHT
11. PNEUMATIC/ VACUUM		
Vacuum Pumps	1	IFR
Gyro Suction Indicator	1	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)
12. PRESSURIZED FLIGHT		
Cabin Altimeter	1	DAY, NIGHT, VFR, IFR, ICING
Cabin Differential Pressure Indicator	1	DAY, NIGHT, VFR, IFR ICING
Cabin Vertical Speed Indicator	1	DAY, NIGHT, VFR, IFR ICING
Pressure Control Valve	1	DAY, NIGHT, VFR, IFR ICING
Pressure Relief Safety Valve	1	DAY, NIGHT, VFR, IFR ICING
Pressurization Controller	1	DAY, NIGHT, VFR, IFR ICING
CAB ALT Annunciator	1	DAY, NIGHT, VFR, IFR ICING
Vacuum Pump	1	DAY, NIGHT, VFR, IFR ICING
13. MISCELLANEOUS		
Stall Warning System	1	DAY, NIGHT, VFR, IFR, ICING
STALL WARN FAIL Annunciator	1	DAY, NIGHT, VFR, IFR, ICING
Annunciator 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) Fuel Imbalance  
Maximum fuel imbalance is 10 gallons.

**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 FAR 91 or FAR 135.

**2.39 CABIN PRESSURIZATION LIMITS**

- (a) Pressurized flight operation approved at maximum cabin differential pressure of 5.5 psi.
- (b) Pressurized landing not approved.

**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 low voltage monitor system and annunciator 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 ICING INFORMATION

### 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. 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 nacelles and propeller spinners 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 (MMEL).]

**2.49 PLACARDS**

In clear view of pilot:

**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.**

**PRESSURIZED LANDING NOT APPROVED.**

Above the pilot's PFD:

**V<sub>A</sub> 133 KIAS @  
3440 LBS**

**V<sub>LE</sub> 195 KIAS MAX  
SEE AFM**

2.49 PLACARDS (continued)

Near the yaw damper:

YAW  
DAMPER  TRIM

Above the pilot's PFD:

ELEV. TRIM  
PUSH ON/OFF

Near the standby attitude indicator:

S  
T  
B  
Y      OFF            OFF      G  
Y  
R  
O  
      ON      TEST

At the PFD Coupled/Uncoupled switch on the pilot's instrument panel:

COUPLED  
 P  
F  
D  
UNCOUPLED

Above the stall warning test button, lower pilot's instrument panel:

STALL  
TEST

**2.49 PLACARDS (continued)**

On the parking brake handle:

**PARK  
BRAKE  
PULL**

Around the landing gear handle:

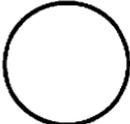
**LANDING  
GEAR**

**▲**  
**UP**  
**126 KIAS**  
**165 KIAS**  
**DN**  
**▼**

Above the emergency gear extension handle:

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

To the right of the cabin pressurization control, lower pilot's instrument panel:

 **CABIN PRESS  
PULL OFF**

## 2.49 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:

TOTAL USABLE FUEL CAPACITY 120 U.S. GALLONS (454 LITERS)

Above the copilot's PFD:

STORMSCOPE NOT TO BE USED FOR  
THUNDERSTORM AREA PENETRATION

Near the TAS switch on the upper copilot's instrument panel:

TAS  
ON  
STBY ○  
TEST

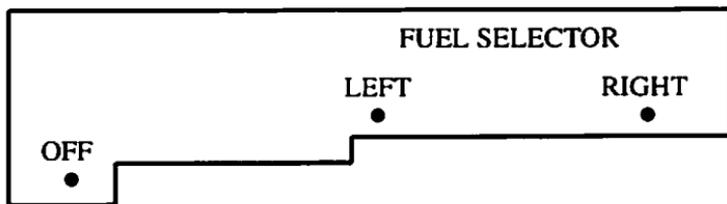
**2.49 PLACARDS (continued)**

Near the magnetic compass:

**STANDBY COMPASS**

**FOR CORRECT READING CHECK:  
WINDSHIELD HT SWITCH OFF  
PROP DE-ICE SWITCH OFF  
COOLING SYSTEM OFF  
COCKPIT AND CABIN HEATING 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**

2.49 PLACARDS (continued)

On the copilot's side panel:

EMERGENCY OXYGEN  
IN DRAWER UNDER SEAT  
(AISLE ACCESS)  
PULL MASK OUT OF DRAWER FULLY  
AT FULL EXTENSION GIVE CORD A TUG  
MAXIMUM DURATION ——— 15 MINS  
SEE POH  
NO SMOKING WHILE IN USE

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

NO SMOKING

Near the defrost control:

DEFROST  
PULL ON



Near the cabin temperature control:

CABIN TEMP  
PULL HOT



**2.49 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 baggage closeout, when coat hooks installed:

**MAXIMUM LOAD EACH COAT HOOK 8 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:



2.49 PLACARDS (continued)

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



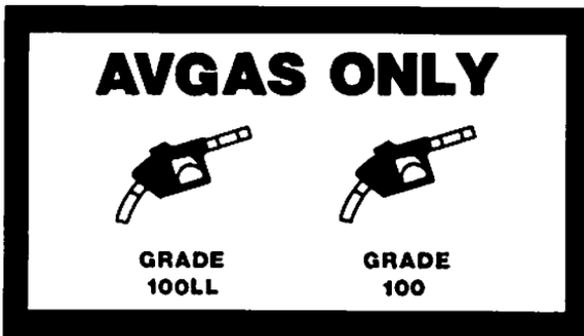
On the main cabin door handle:



On the upper edge of the cabin lower door:



Adjacent to the fuel tank filler caps:



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## 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)**

#### **Warning Systems**

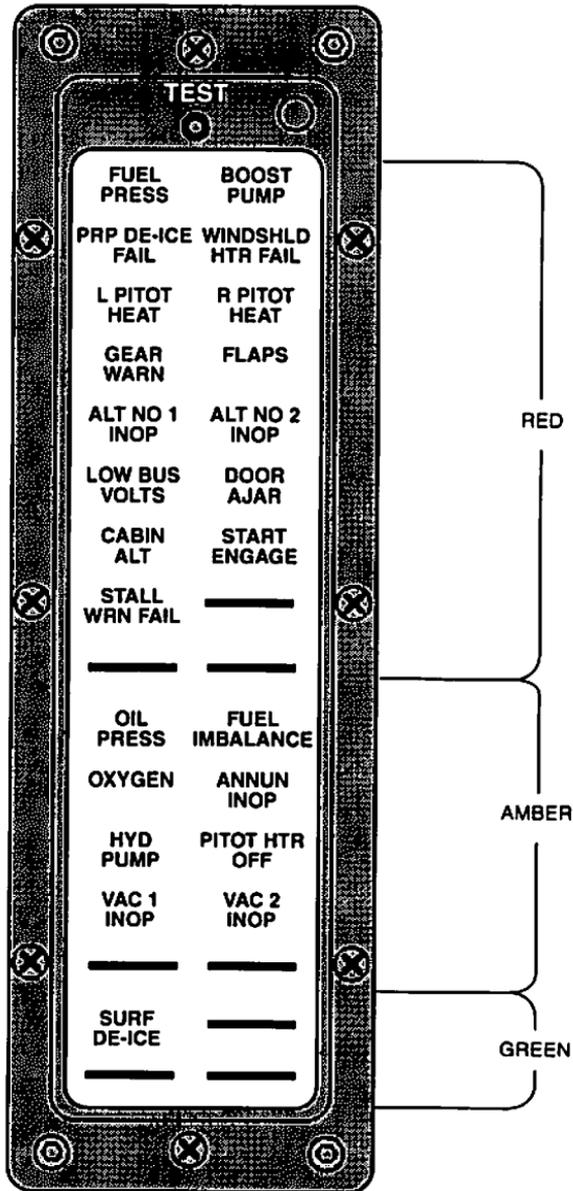
The Mirage is equipped with a comprehensive annunciator panel located on the instrument panel between the Pilot's Primary Flight Display and the Multi-Function Display (see Figure 3-1).

**Red Warning Annunciators** are those annunciators which require immediate corrective action.

**Amber Caution Annunciators** are those annunciators which advise of the possible need for future corrective action.

**Green Advisory Annunciators** are those annunciators which indicate a system is selected and is functioning.

Warning and caution annunciators will remain illuminated as long as the initiating condition exists, while advisory annunciations remain illuminated as long as a particular system is selected.



Annunciator Panel

Figure 3-1

**3.1 GENERAL (continued)**

**Annunciator Descriptions**

**FUEL PRESS** - Indicates fuel pressure is below approximately 10 psig.

**BOOST PUMP** - Illuminates when the fuel boost pump in the tank being used fails to generate sufficient pressure. Also illuminates briefly when switching tanks.

**PRP DEICE FAIL** - Illuminates if a fault develops in the prop heat system or current is under 16.0 amps.

**WINDSHLD HTR FAIL** - Illuminates when the windshield temperature exceeds 170°F or the windshield temperature sensor has failed.

**L PITOT HEAT** - Indicates the left pitot heat has failed.

**R PITOT HEAT** - Indicates the right pitot heat has failed.

**GEAR WARN** - The red GEAR WARN annunciator and gear warning horn will operate simultaneously under the following conditions:

- 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.
- In flight when the flaps are extended more than 10° and the landing gear are not in the DOWN position.
- 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.

**FLAPS** - Indicates a wing flap system failure due to an overcurrent condition in the flap motor/actuator circuit.

**ALT NO 1 INOP** - Illuminates when Alternator No. 1 fails or is selected OFF.

**ALT NO 2 INOP** - Illuminates when Alternator No. 2 fails or is selected OFF.

**LOW BUS VOLTS** - Indicates the main bus voltage is less than 25 Vdc.

**DOOR AJAR** - Indicates the cabin door is not properly closed and latched.

**CABIN ALT** - Indicates the cabin altitude is 10,000 feet or above.

**START ENGAGE** - Indicates the starter contactor is closed and power is being applied to the starter.

**STALL WRN FAIL** - Illuminates if the lift computer and/or the lift transducer fails.

**3.1 GENERAL (continued)**

**Annunciator Descriptions (continued)**

OIL PRESS - Indicates engine oil pressure is below 25 psig.

FUEL IMBALANCE - Illumination indicates a fuel quantity imbalance has reached 10 gallons.

OXYGEN - Illuminates if one or more of the passenger oxygen generators are activated.

ANNUN INOP - Indicates failure of the annunciator system.

HYD PUMP - Illuminates when the landing gear hydraulic pump is operating.

PITOT HTR OFF - Indicates the pitot heat has not been selected ON.

VAC 1 INOP - Illuminates if Vacuum No. 1 is below approximately 2 in.Hg.

VAC 2 INOP - Illuminates if Vacuum No. 2 is below approximately 2 in.Hg.

SURF DE-ICE - Illuminates when the de-ice boots inflate. (When the SURF DE-ICE switch is selected ON, the de-ice boot pressure reaches 10 psig and the pneumatic de-ice system cycles in sequence: tail, lower wing, upper wing.)

### 3.1 GENERAL (continued)

#### Panel Mounted Annunciator Descriptions

STBY ATT IND TEST - Illuminates if the standby attitude indicator system test mode is successfully completed.

STBY ATT IND BATT HTR FAIL - Indicates failure of the standby attitude battery heater.

#### Aural Warnings

Aural warnings are provided to warn:

- When an engine limitation is exceeded (2 chimes per second).
- When approaching a stall (steady tone).
- When the landing gear is not extended during an approach to landing (steady tone).
- Autopilot disconnect (warble tone).
- Terrain caution/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.
- In flight when the flaps are extended more than 10° and the landing gear are not in the DOWN position.
- On the ground when the landing gear selector is in the UP position.



**3.4 EMERGENCY PROCEDURES CHECKLIST**

**3.4a ENGINE FIRE DURING START (3.7)**

Starter (crank engine) .....PUSH  
Mixture .....IDLE CUT-OFF  
Throttle .....OPEN  
Fuel Selector .....OFF  
Emergency (EMERG) Fuel Pump .....CHECK OFF  
Abandon if fire continues

**3.4b TURBOCHARGER FAILURE (3.8)**

**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 CUTOFF  
Throttle.....CRUISE  
Propeller Control .....TAKEOFF  
Mixture.....ADVANCE SLOWLY until engine restarts  
and adjust for smooth engine operation

**Reduce power and land as soon as possible.**

**3.4b TURBOCHARGER FAILURE (3.8) (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 failure results in a partial loss of engine power.

Throttle .....AS REQUIRED  
 Propeller Control .....AS REQUIRED  
 Mixture .....AS REQUIRED  
 Continue Flight.....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.

Propeller.....AS REQUIRED  
 Mixture .....AS REQUIRED  
 Continue Flight.....LAND AS SOON AS POSSIBLE

**3.4c ENGINE POWER LOSS DURING TAKEOFF (3.9)**

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  
 Emergency (EMERG) Fuel Pump.....OFF  
 Fuel Selector .....OFF

**3.4c ENGINE POWER LOSS DURING TAKEOFF (3.9) (continued)**

**If sufficient altitude has been gained to attempt a restart:**

Maintain Safe Airspeed

Emergency (EMERG) Fuel Pump .....Check ON

Fuel Selector .....SWITCH to tank  
containing fuel

Mixture .....FULL RICH

Induction Air .....ALTERNATE

**CAUTION**

If normal engine operation and fuel flow are not reestablished, the emergency (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, switch fuel selector to OFF.

**If power is not regained:**

**Prepare for power off landing.**

**3.4d ENGINE POWER LOSS IN FLIGHT (3.11)**

Trim for 90 KIAS (Power off glide speed)

Emergency (EMERG) Fuel Pump .....ON

Fuel selector .....SWITCH to tank  
containing fuel

Mixture .....RICH

Induction Air .....ALTERNATE

Engine Gauges .....CHECK for indication  
of cause of power loss

**3.4d ENGINE POWER LOSS IN FLIGHT (3.11) (continued)****If power is restored:**

Induction Air .....PRIMARY  
 (Remain in ALTERNATE if  
 induction ice is suspected)

Emergency (EMERG) Fuel Pump (Except in  
 case of engine driven 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 emergency (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, switch fuel selector to OFF.

**If power is not restored:****Prepare for power off landing.****3.4e POWER OFF LANDING (3.13)**

Propeller Control .....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.

**3.4e POWER OFF LANDING (3.13) (continued)**

**When committed to landing:**

Landing Gear Selector .....AS REQUIRED  
Throttle .....CLOSED  
Mixture .....IDLE CUT-OFF  
Flaps.....AS REQUIRED  
Fuel Selector .....OFF  
ALTR Switches.....OFF  
Magneto Switches.....OFF  
Emergency (EMERG) Fuel Pump.....OFF  
Seat Belt and Harness .....TIGHT  
Seats .....adjusted and locked in position

**3.4f FIRE IN FLIGHT (3.15)**

Source Of Fire .....CHECK

**NOTE**

If pressurized, the following procedure will result in an immediate loss of pressurization and the cabin altitude will rise at an uncontrolled rate.

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

Cabin Pressure Dump/Normal Switch .....DUMP  
Cabin Pressurization Control.....PULL to unpressurize

After 5 second delay:

Battery Master Switch .....OFF

Transition to Standby Instruments.

**NOTE**

Activation of the Ground Clearance switch can be used to maintain communications on Comm 1.

ALTR Switches.....OFF

Cabin Heat .....OFF

**3.4f FIRE IN FLIGHT (3.15) (continued)**

**CAUTION**

The cabin pressure dump valve will remain open if the cabin pressure dump/normal switch is positioned to DUMP prior to turning the aircraft electrical system OFF. This provides maximum airflow through the cabin for smoke evacuation. Do not turn the cabin pressure dump/normal switch to NORM. The dump valve will close and cannot be reactivated unless electrical power is turned on.

Emergency descent .....TO A SAFE ALTITUDE  
CONSISTENT WITH TERRAIN

**Land as soon as possible.**

**WARNING**

If emergency oxygen is installed, use ONLY if flames and heat are not present.

**Engine fire:**

- Throttle .....CLOSED
- Mixture .....IDLE CUT-OFF
- Fuel Selector .....OFF
- Magneto Switches.....OFF
- Emergency (EMERG) Fuel Pump .....CHECK OFF
- Vent/Defog Fan .....OFF
- Temperature Control Knob.....PUSH OFF
- Auxiliary Heat Switch .....OFF

Proceed with power off landing procedure (3.4e).

**3.4g LOSS OF OIL PRESSURE (3.17)**

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

**3.4h LOSS OF FUEL FLOW (3.19)**

**CAUTION**

Turn emergency (EMERG) fuel pump OFF if fuel flow and power is 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.

**3.4h LOSS OF FUEL FLOW (3.19) (continued)**

Emergency (EMERG) Fuel Pump .....ON  
Fuel Selector.....CHECK on tank  
containing usable fuel

If power restored:

Emergency (EMERG) Fuel Pump (except in  
case of engine driven pump failure).....OFF  
Mixture .....AS REQUIRED

If power not restored:

Emergency (EMERG) Fuel Pump.....OFF  
Fuel Selector.....OFF  
Proceed with power off landing procedure (3.4e).

**3.4i ENGINE DRIVEN FUEL PUMP FAILURE (FUEL PRESS light  
illuminated - annunciator panel) (3.21)**

Throttle .....RETARD  
Emergency (EMERG) Fuel Pump .....ON  
Throttle .....RESET AS REQUIRED  
Mixture .....RESET AS REQUIRED

**CAUTION**

If normal engine operation and fuel flow are not reestablished the emergency (EMERG) fuel pump 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 fuel selector to OFF.

If power is not restored, proceed with power off landing procedure (3.4e).

**3.4j HIGH OIL TEMPERATURE (3.23)**

Power.....REDUCE  
Mixture.....ENRICH, if practical  
Airspeed .....INCREASE, if practical

If condition is not corrected:

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

**3.4k TURBINE INLET TEMPERATURE (TIT) INDICATION/SENSOR FAILURE (3.24)**

If failure occurs during takeoff, climb, or landing:

Mixture.....Full Rich

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. Less 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.

**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

**3.4I HIGH CYLINDER HEAD TEMPERATURE (3.25)**

**If indicated cylinder head temperature reaches 480°F:**

Power .....REDUCE  
Mixture .....ENRICH, if practical  
Airspeed .....INCREASE, if practical

**If condition is not corrected:**

**Land at nearest airport and investigate problem.**

**3.4m ELECTRICAL FAILURES (3.27)**

**NOTE**

Anytime total tie bus voltage is below 25 Vdc, the  
**LOW BUS VOLTAGE** annunciator will  
illuminate.

**Single alternator Failure (Zero amps or ALTERNATOR #1 or #2 INOP light illuminated - annunciator panel).**

Verify failure .....CHECK AMP INDICATION

Electrical Load (if **LOW BUS VOLTAGE**

annunciator illuminated) .....REDUCE until total load is  
less than 75 amps & **LOW BUS**  
**VOLTAGE** annunciator extinguished

Failed ALTR Switch .....OFF

Failed ALTR Circuit Breaker .....CHECK and RESET as required  
(Located on the pilot's forward circuit breaker panel, row C, position 1 and 2)

Failed ALTR Switch (after OFF at least one second) .....ON

**If power not restored:**

Failed ALTR Switch .....OFF

Amp 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, particularly windshield or propeller heat, may be limited. **Immediate action should be taken to avoid or exit icing conditions.** Under no circumstances may the total electrical load exceed 75 amps. The supplemental electric cabin heater, cabin recirculation blowers, and position, strobe, and landing lights should not be used unless absolutely necessary.

**3.4m ELECTRICAL FAILURES (3.27) (continued)**

**Dual Alternator Failure (Zero amps both ammeters or ALTERNATOR #1 and #2 INOP lights illuminated - annunciator panel).**

**NOTE**

Anytime total tie bus voltage is below 25 Vdc, the LOW BUS VOLTAGE annunciator will illuminate.

Electrical Load .....	REDUCE TO MINIMUM required for safe flight
ALTR NO. 1 and NO. 2 .....	Switches OFF
Circuit Breakers.....	CHECK and RESET as required (Located on the pilot's forward circuit breaker panel, row C, position 1 and 2)
ALTR NO. 1 Switch (after OFF at least one second) .....	ON
ALTR NO. 2 Switch (after OFF at least one second) .....	ON
<b>If only one alternator resets:</b>	
Operating ALTR Switch .....	ON
Failed ALTR Switch .....	OFF
Electrical Load .....	MAINTAIN LESS THAN 75 AMPS
Ammeter .....	MONITOR
<b>If neither alternator resets:</b>	
Both ALTR Switches .....	OFF

**Continue flight with reduced electrical load on battery power only.**

**NOTE**

LOW BUS VOLTAGE annunciator will be illuminated.

**Land as soon as practical.** Anticipate complete electrical failure. Duration of battery power available will be dependent on electrical load and battery condition prior to failure.

**NOTE**

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

3.4m ELECTRICAL FAILURES (3.27) (continued)

**Complete Electrical Failure**

**NOTE**

The emergency standby attitude gyro will activate automatically if the switch is in the ON position.

Standby Attitude Gyro Switch.....VERIFY ON and FLAG  
IS PULLED ON GYRO

Maintain attitude control using standby instruments.

Battery Switch.....OFF  
Ground Clearance Switch.....ON

**NOTE**

Turning ON the Ground Clearance Switch may activate the No. 1 Com/Nav and Audio Panel depending on the nature of the complete electrical failure.

*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 (Section 3.4p).

**3.4m ELECTRICAL FAILURES (3.27) (continued)**

**Supplemental Heater Control Circuit Failure (Heater Continues to Operate With AUX CBN HEAT and VENT/DEFOG switches OFF):**

VENT DEFOG Circuit Breaker.....PULL

**If the heater still operates, land as soon as practical.**

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**3.4n AVIONICS SYSTEMS FAILURES (3.28)****Failure of Pilot's Electronic Attitude Direction Display (PFD)****Indication: PFD Display goes blank.**Standby Attitude Gyro Switch .....VERIFY ON and FLAG  
IS PULLED ON GYRO

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

PFD Brightness Control (BRT/DIM) .....RUN TO FULL BRIGHT

**If PFD screen cannot be reinstated:**

PFD Coupled/Uncoupled Switch.....Coupled

**If time and conditions permit:**Pilot's PFD Circuit Breaker.....PULL  
(Located on the pilot's aft circuit breaker panel, row B, position 2)Pilot's PFD Circuit Breaker.....PULL  
(Located on the copilot's circuit breaker panel, row B, position 1)

Circuit Breakers.....RESET

*If PFD cannot be reinstated:*

On aircraft equipped with the optional second transponder:

Transponder 1 / 2 Switch.....Select Transponder No. 2

Mechanical Nav Indicator (OBS).....Utilize for primary navigation

**NOTE**

The mechanical nav indicator (OBS) receives nav information directly from the No. 1 (pilot's) nav/com/GPS. Only VLOC information is available.

**NOTE**

Failure of the pilot's PFD may cause the loss of Transponder No. 1 Mode C capability.

3.4n AVIONICS SYSTEMS FAILURES (3.28) (continued)

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

*If PFD cannot be reinstated (continued):*

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

**CAUTION**

High current loads in the vicinity of the magnetic compass can influence its accuracy. Depending on the flight conditions, the pilot must reduce these loads as much as possible to insure accuracy. Tests have shown that windshield heat, air conditioner, and pitot heat contribute to significant heading errors of the magnetic compass. These items should be turned OFF prior to cross checking the magnetic compass. Pilot judgment must be used in turning these items OFF (i.e. freezing IMC conditions). MFD MAP and GPS MAP mode may be helpful in maintaining course.

*Land as soon as practical.*

**Yellow Airspeed Mismatch Annunciator on Pilot's and Copilot's PFD's**

**Indicates an airspeed difference of 4 knots.**

Establish aircraft in straight and level unaccelerated flight.

Airspeed ..... Verify correct airspeed  
by cross checking with  
standby airspeed indicator

ADAHRS System ..... Determine system in error

- Pilot's System Error  
ADAHRS 2 ..... Select
- Copilot's System Error  
ADAHRS 1 ..... Select

**Land as soon as practical.**

3.4n AVIONICS SYSTEMS FAILURES (3.28) (continued)

**Yellow Heading Mismatch on Pilot's and Copilot's PFD's  
Indicates a heading difference of 6 degrees or greater.**

Establish aircraft in straight and level unaccelerated flight.

Heading.....Verify correct heading  
by cross checking with  
whiskey compass

- ADAHRS System .....Determine system in error
- Pilot's System Error  
ADAHRS 2.....Select
  - Copilot's System Error  
ADAHRS 1.....Select

**Land as soon as practical.**

**Yellow Altitude Mismatch on Pilot's and Copilot's PFD's  
Indicates an altitude difference of 50 feet or greater.**

**NOTE**

The altitude mismatch annunciator will illuminate when a mismatch of 50 feet is detected from sea level to 5,000 feet. Above 5,000 feet the mismatch value is linearly increased up to 150 feet at 30,000 feet.

Establish aircraft in straight and level unaccelerated flight.

ADAHRS System .....Determine system in error  
by cross checking with  
standby altimeter

- Pilot's System Error  
ADAHRS 2.....Select
- Copilot's System Error  
ADAHRS 1.....Select

**Land as soon as practical.**

**3.4n AVIONICS SYSTEMS FAILURES (3.28) (continued)**

**Yellow Pitch & Roll Miscompare on Pilot's and Copilot's PFD's  
Indicates a pitch or roll difference of 3 degrees.**

Establish aircraft in straight and level unaccelerated flight.

ADAHRS System .....Determine system in error  
by cross checking with  
standby attitude indicator

- Pilot's System Error  
ADAHRS 2.....Select
- Copilot's System Error  
ADAHRS 1.....Select

**Land as soon as practical.**

**3.4n AVIONICS SYSTEMS FAILURES (3.28) (continued)****Invalid Air Data**

**Indication: Airspeed, Altimeter, and Vertical Speed Data Replaced with Red X's.**

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

**If time and conditions permit:**

*If failure is associated with the Pilot's ADAHRS:*

Pilot's PFD Circuit Breaker .....PULL  
(Located on the pilot's aft circuit breaker panel, row B, position 2)

Pilot's PFD Circuit Breaker .....PULL  
(Located on the copilot's circuit breaker panel, row B, position 1)

Circuit Breakers.....RESET

**If air data is still invalid:**

ADAHRS 1 / 2 Select Switch .....Select ADAHRS 2

On aircraft equipped with the optional second transponder:

Transponder 1 / 2 Switch .....Select Transponder No. 2

*If failure is associated with the Copilot's ADAHRS:*

Copilot's PFD Circuit Breaker .....PULL  
(Located on the pilot's aft circuit breaker panel, row B, position 3)

Copilot's PFD Circuit Breaker .....PULL  
(Located on the copilot's circuit breaker panel, row B, position 8)

Circuit Breakers.....RESET

**If air data is still invalid:**

ADAHRS 1 / 2 Select Switch .....Select ADAHRS 1

**NOTE**

Certain failures of the pilot's PFD may cause a loss of Transponder No. 1 Mode C capability. Loss of Transponder No. 2 Mode C capability can be caused by failure of the copilot's PFD. Verify Mode C operation with ATC.

Cross check airspeed and altitude indications with the standby instruments.

**Land as soon as practical.**

3.4n AVIONICS SYSTEMS FAILURES (3.28) (continued)

**Invalid Heading Data**

**Indication: Heading Bug and Heading Data Removed and Replaced with Red X's.**

**If time and conditions permit:**

*If failure is associated with the Pilot's ADAHRS:*

- Pilot's PFD Circuit Breaker.....PULL  
(Located on the pilot's aft circuit breaker panel, row B, position 2)
- Pilot's PFD Circuit Breaker.....PULL  
(Located on the copilot's circuit breaker panel, row B, position 1)
- Circuit Breakers.....RESET

**If heading is still invalid:**

ADAHRS 1 / 2 Select Switch .....Select ADAHRS 2

*If failure is associated with the Copilot's ADAHRS:*

- Copilot's PFD Circuit Breaker .....PULL  
(Located on the pilot's aft circuit breaker panel, row B, position 3)
- Copilot's PFD Circuit Breaker .....PULL  
(Located on the copilot's circuit breaker panel, row B, position 8)
- Circuit Breakers.....RESET

**If heading is still invalid:**

ADAHRS 1 / 2 Select Switch .....Select ADAHRS 1

Monitor magnetic compass.

**NOTE**

For accurate magnetic compass readings select the WINDSHLD HT, PROP HEAT, AIR COND and BLOWER switches OFF.

**Land as soon as practical.**

**3.4n AVIONICS SYSTEMS FAILURES (3.28) (continued)**

**Crosscheck Monitor**

**Indication: Yellow Crosscheck Attitude Annunciator on PFD.**

Establish aircraft in straight and level unaccelerated flight.

Aircraft Attitude .....Crosscheck aircraft attitude  
with off side PFD and  
standby attitude gyro

ADAHRS 1 / 2 Switch .....Select operational ADAHRS

Monitor the standby attitude indicator.

3.4n AVIONICS SYSTEMS FAILURES (3.28) (continued)

**Invalid Attitude and Heading Data**

**Indication: Attitude and Heading Data Removed and Replaced with Red X's.**

Standby Attitude Gyro Switch.....VERIFY ON and FLAG  
IS PULLED ON GYRO

Maintain attitude control using standby gyro.

**If time and conditions permit:**

*If failure is associated with the Pilot's ADAHRS:*

Pilot's PFD Circuit Breaker.....PULL  
(Located on the pilot's aft circuit breaker panel, row B, position 2)

Pilot's PFD Circuit Breaker.....PULL  
(Located on the copilot's circuit breaker panel, row B, position 1)

Circuit Breakers.....RESET

**If attitude and heading data is still invalid:**

ADAHRS 1 / 2 Select Switch .....Select ADAHRS 2

Monitor the standby attitude indicator.

*If failure is associated with the Copilot's ADAHRS:*

Copilot's PFD Circuit Breaker .....PULL  
(Located on the pilot's aft circuit breaker panel, row B, position 3)

Copilot's PFD Circuit Breaker .....PULL  
(Located on the copilot's circuit breaker panel, row B, position 8)

Circuit Breakers.....RESET

**If attitude and heading data is still invalid:**

ADAHRS 1 / 2 Select Switch .....Select ADAHRS 1

Monitor the standby attitude indicator.

**Land as soon as practical.**

**3.4n AVIONICS SYSTEMS FAILURES (3.28) (continued)**

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

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

Standby Attitude Gyro Switch.....VERIFY ON and FLAG IS PULLED ON GYRO

Maintain attitude control using standby instruments.

**If time and conditions permit:**

*If failure is associated with the Pilot's ADAHRS:*

Pilot's PFD Circuit Breaker.....PULL  
(Located on the pilot's aft circuit breaker panel, row B, position 2)

Pilot's PFD Circuit Breaker.....PULL  
(Located on the copilot's circuit breaker panel, row B, position 1)

Circuit Breakers.....RESET

**If ADAHRS initialization does not occur:**

ADAHRS 1 / 2 Select Switch .....Select ADAHRS 2

On aircraft equipped with the optional second transponder:

Transponder 1 / 2 Select Switch.....Select Transponder No. 2

*If failure is associated with the Copilot's ADAHRS:*

Copilot's PFD Circuit Breaker .....PULL  
(Located on the pilot's aft circuit breaker panel, row B, position 3)

Copilot's PFD Circuit Breaker .....PULL  
(Located on the copilot's circuit breaker panel, row B, position 8)

Circuit Breakers.....RESET

**If ADAHRS initialization does not occur:**

ADAHRS 1 / 2 Select Switch .....Select ADAHRS 1

**Land as soon as practical.**

**3.4n AVIONICS SYSTEMS FAILURES (3.28) (continued)**

**Failure of Multi-Function Display (MFD)**

**Indication: Multi-Function Display (MFD) Goes Blank.**

MFD Circuit Breaker.....PULL and RESET  
(Located on the pilot's aft circuit breaker panel, row B, position 4)

**If MFD initialization does not occur:**

**Land as soon as possible.**

**Loss of Standby Attitude Indicator**

**Indication: OFF Warning Flag in View, Tumbled or Erroneous  
Attitude Display.**

Standby Attitude Indicator.....TEST (verify green STBY  
ATT IND TEST annunciator  
illuminated) / ON / ERECT

Establish aircraft in straight and level unaccelerated flight.

Standby Attitude Indicator .....Cage then uncage

**If standby attitude indicator is not recovered:**

Standby Attitude Indicator .....Cage

**Land as soon as practical.**

**3.4n AVIONICS SYSTEMS FAILURES (3.28) (continued)****Failure of Flight and Navigation Displays****Indication: All Displays Blank Out.**Standby Attitude Gyro Switch.....**VERIFY ON and FLAG  
IS PULLED ON GYRO**

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

Avionics Dimming Circuit Breaker.....**PULL**  
(Located on the pilot's aft circuit breaker panel, row B, position 8)**NOTE**

A failure of the display dimmer control can result in the two Garmin displays going blank. This is an indication of a partial failure of the dimmer control. A complete failure of this control would normally reinstate the displays to a full bright condition. However, if the displays should blank out, reinstatement of the displays to a full bright condition can be accomplished by bypassing the dimmer control (pulling the Avionics Dimming Circuit Breaker).

**3.4o PROPELLER OVERSPEED (3.29)**

Throttle .....RETARD  
Oil Pressure .....CHECK  
Propeller Control .....FULL DECREASE rpm,  
then set if any  
control available  
Airspeed .....REDUCE  
Throttle .....AS REQUIRED to remain  
below 2500 rpm

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

**3.4p EMERGENCY LANDING GEAR EXTENSION (3.31)**

If emergency gear extension is required due to electrical power failure, the gear position indicator lights will not illuminate.

**Prior to emergency extension procedure:**

Battery Master Switch .....CHECK ON  
Circuit Breakers .....CHECK  
DAY/NIGHT Dimming 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  
Landing Gear Selector .....DOWN  
Emergency Gear Extend Control .....PULL  
(while fishtailing airplane)

**CAUTION**

The Emergency Gear Extension procedure will require the pilot to pull the emergency gear extend control knob through a region of high resistance (up to 25 lbs.) in order to reach the stop and extend the landing gear.

**3.4q SPIN RECOVERY (3.33)**

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

**3.4r ENGINE ROUGHNESS (3.35)**

Mixture .....	ADJUST FOR MAXIMUM SMOOTHNESS
Induction Air .....	ALTERNATE
Emergency (EMERG) Fuel Pump .....	ON
Fuel Selector .....	SELECT ANOTHER TANK

**3.4s EMERGENCY DESCENT (3.37)****NOTE**

If pressurized, the following procedure will result in an immediate loss of pressurization and the cabin altitude will rise at an uncontrolled rate.

Throttle .....	CLOSED
Propeller Control .....	FULL INCREASE
Mixture .....	AS REQUIRED
Landing Gear .....	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 2450 lbs. 100 KIAS
---	--

**3.4t PRESSURIZATION SYSTEM MALFUNCTION (3.39)**

**Should the differential pressure rise above 5.5 psi maximum or a structural failure appear imminent, proceed as follows:**

**NOTE**

If pressurized, the following procedure will result in an immediate loss of pressurization and the cabin altitude will rise at an uncontrollable rate.

Cabin Pressure Dump/Normal Switch .....DUMP  
Cabin Pressurization Control .....PULL to unpressurize  
Emergency Descent .....TO A SAFE ALTITUDE  
CONSISTENT WITH TERRAIN

**NOTE**

If emergency oxygen is installed, don masks, activate oxygen generators, check flow, and descend.

*Should the aircraft suddenly lose pressurization, proceed as follows:*

Cabin Pressure Dump/Normal Switch .....CHECK NORM  
Cabin Pressurization Control .....CHECK IN  
Emergency Descent .....TO A SAFE ALTITUDE  
CONSISTENT WITH TERRAIN

**NOTE**

If emergency oxygen is installed, don masks, activate oxygen generators, check flow, and descend.

**3.4u CABIN AIR CONTAMINATION/SMOKE EVACUATION (3.4I)  
(Pressurized)**

**NOTE**

If pressurized, the following procedure will result in an immediate loss of pressurization and the cabin altitude will rise at an uncontrollable rate.

- Cabin Pressure Dump/Normal Switch .....DUMP
- Cabin Pressurization Control .....PULL to unpressurize
- Auxiliary Cabin Heat Switch .....OFF
- Vent/Defog Switch .....ON
- AIR COND Switch.....OFF
- Storm Window .....closed
- Emergency Descent .....TO A SAFE ALTITUDE  
CONSISTENT WITH TERRAIN

**Land as soon as practical.**

**NOTE**

If emergency oxygen is installed, don masks, activate oxygen generators, check flow, and descend.

**NOTE**

If fumes/smoke dissipate, land as soon as practical to investigate problem. If fumes/smoke persist, refer to Fire in Flight paragraph 3.4f.

**3.4v VACUUM SYSTEM FAILURE (3.43)**

**Single Vacuum System Failure (Reduced suction pressure and left or right Vacuum Inoperative Annunciators illuminated.)**

Gyro Suction Indication .....CHECK (within normal operating range)  
Operating Pump annunciator light .....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.

**Dual Vacuum System Failure (Suction below 4.0 in. Hg, both Vacuum Inoperative Annunciators illuminated.)**

If both vacuum systems are inoperable, the wing and tail deicer boots will be inoperative, and loss of cabin pressure control is possible. Manually dump cabin pressure before landing. A precautionary landing should be considered depending on operating conditions.

**3.4w INADVERTENT ICING ENCOUNTER (3.45)**

**WARNING**

Flight into known icing conditions is prohibited unless Ice Protection System is installed and fully operational. Refer to Section 9, Supplement 3.

Induction Air .....ALTERNATE  
Pitot Heat .....ON  
Stall Warning Heat .....ON  
Windshield Defrost .....ON  
Propeller Heat .....ON  
Vent/Defog Fan .....ON  
Electric Windshield Heat .....LOW or HIGH,  
as required

**Change heading and/or altitude to exit icing conditions.**

**3.4x HYDRAULIC SYSTEM MALFUNCTION (3.49)**

HYDRAULIC PUMP annunciator light illuminates continuously, or cycles on and off rapidly:

HYDRAULIC PUMP POWER Circuit Breaker .....PULL

*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 pump continues to run after gear is locked down, pull the HYDRAULIC PUMP POWER circuit breaker (located on the pilot's forward circuit breaker panel, row B, position 6). If gear fails to extend, refer to Emergency Landing Gear Extension (3.4p).

**3.4y FLAP SYSTEM MALFUNCTION (3.51)**

FLAPS annunciator light illuminated:

FLAP WARN circuit breaker.....PULL and RESET

VERIFY Normal Flap Operation.

(Located on pilot's forward circuit breaker panel, row C, position 6)

If FLAPS annunciator light remains illuminated:

FLAP MOTOR Circuit Breaker.....PULL

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

**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.

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

**3.4z FUEL TANK SUBMERGED PUMP FAILURE (BOOST PUMP light illuminated - annunciator panel) (3.53)**

Fuel Selector .....CHECK

Boost Pump Circuit Breaker .....CHECK - RESET if necessary  
(Located on pilot's forward circuit breaker panel, row A, positions 2 and 3)

BOOST PUMP Annunciator Light .....EXTINGUISHED

**If annunciator remains lit:**

Emergency (EMERG) Fuel Pump .....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.

**3.4aa STALL WARNING FAILURE (STALL WARN FAIL light illuminated - annunciator panel) (3.55)**

STALL WARN Circuit Breaker .....CHECK - RESET if necessary  
(Located on pilot's forward circuit breaker panel, row B, position 7)

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

**3.4bb ANNUNCIATOR LIGHT PANEL FAILURE (ANNUNCIATOR INOP light illuminated - annunciator panel) (3.57)**

ANNUN Circuit Breaker .....CHECK - RESET if necessary  
(Located on pilot's aft circuit breaker panel, row B, position 7)

ANNUNCIATOR INOP Light .....EXTINGUISHED

**If ANNUN circuit breaker not open:**

Annunciator Test Switch .....PUSH

If annunciator lights illuminate, annunciator panel is functioning properly. ANNUNCIATOR INOP will remain lit.

If ANNUN circuit breaker does not remain closed, or lights fail to illuminate when tested, annunciator lights will be inoperative for remainder of flight. System should be repaired prior to further flight.

**3.4cc EMERGENCY EXIT (3.59)**

Exit (second window from front  
on right side).....LOCATE

**NOTE**

The cabin must be depressurized before attempting  
to open the emergency exit.

Plexiglas Cover.....REMOVE  
Handle .....PULL  
Emergency Exit Window .....PULL IN

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### 3.5 AMPLIFIED EMERGENCY PROCEDURES (GENERAL)

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

### 3.7 ENGINE FIRE DURING START (3.4a)

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

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

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

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

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

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

### 3.8 TURBOCHARGER FAILURE (3.4b)

#### 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.

### 3.8 TURBOCHARGER FAILURE (3.4b) (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. Retard the mixture control to the IDLE CUTOFF 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, propeller 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 propeller and mixture controls as necessary and **land as soon as possible**.

**3.9 ENGINE POWER LOSS DURING TAKEOFF (3.4c)**

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 idle cut-off, turn OFF the emergency (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 emergency (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 emergency (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, switch 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 paragraph 3.4e).

### 3.11 ENGINE POWER LOSS IN FLIGHT (3.4d)

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 paragraph 3.4e). **An airspeed of 90 KIAS (the power off glide speed) should be maintained.**

If altitude permits, turn the emergency (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 emergency (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 emergency (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, 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 used up, and allowing the engine to windmill may restore power. If power loss is due to water, fuel flow indications will be normal.

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

If power is not regained, proceed with the Power Off Landing procedure (refer to paragraph 3.4e).

**3.13 POWER OFF LANDING (3.4e)**

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 your charts for airports in the immediate vicinity; it may be possible to land at one if you have sufficient altitude. At best gliding angle, with no wind, with the engine windmilling and the propeller control in full DECREASE rpm, the aircraft will travel approximately 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, move the mixture to idle cut-off. Set the flaps to the desired flap setting, and move the fuel selector valve to OFF. Turn the alternator switches, magneto switches, and emergency fuel pump switch OFF. The seat belts and shoulder harness should be tightened and checked. The seats should be adjusted and locked in position.

**3.15 FIRE IN FLIGHT (3.4f)**

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.

**WARNING**

If emergency oxygen is installed, use **ONLY** if flames and heat are not present.

Check for the source of the fire first.

**NOTE**

If pressurized, the following procedure will result in an immediate loss of pressurization and the cabin altitude will rise at an uncontrolled rate.

If an electrical fire is indicated (smoke in cockpit), place the cabin pressure dump/normal switch in the **DUMP** position and **PULL** the cabin pressurization control to clear the smoke. After a delay of 5 seconds turn off the battery master and alternator switches and, transition to the standby instruments. The cabin heat should also be turned **OFF**.

**NOTE**

Activation of the Ground Clearance switch can be used to maintain communications on Comm 1.

**CAUTION**

The cabin pressure dump valve will remain open if the cabin pressure dump/normal switch is positioned to **DUMP** prior to turning the aircraft electrical system **OFF**. This provides maximum airflow through the cabin for smoke evacuation. Do not set the cabin pressure dump/normal switch to **NORM**. The dump valve will close and cannot be reactivated unless electrical power is turned **ON**.

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 idle cut-off and place the fuel selector in the **OFF** position. Turn the magneto switches **OFF** and check that the emergency (**EMERG**) fuel pump is **OFF**. In all cases, the heater and defroster should be **OFF**. If the terrain permits, a landing should be made immediately (refer to Power Off Landing procedure paragraph 3.4e).

**3.17 LOSS OF OIL PRESSURE (3.4g)**

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 a pressure gauge malfunction, the engine may stop suddenly. Maintain altitude until such time as a power off landing can be accomplished. Do not change power settings unnecessarily, as this may hasten complete power loss.

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

If engine stoppage occurs, proceed with Power Off Landing procedure (refer to paragraph 3.4e).

**3.19 LOSS OF FUEL FLOW (3.4h)****CAUTION**

Turn emergency (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 fuel selector 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 emergency (EMERG) fuel pump ON and check that the fuel selector is on a tank containing usable fuel.

If power is restored, turn OFF the emergency (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 emergency (EMERG) fuel pump and the fuel selector OFF, and proceed with Power Off Landing procedure (refer to paragraph 3.4e).

**3.21 ENGINE DRIVEN FUEL PUMP FAILURE (FUEL PRESS light illuminated - annunciator panel) (3.4i)**

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

**CAUTION**

If normal engine operation and fuel flow are not reestablished, the emergency (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, switch fuel selector to OFF.

**3.23 HIGH OIL TEMPERATURE (3.4j)**

An abnormally high oil temperature indication may be caused by a low oil level, an obstruction in the oil cooler, damaged or improper baffle seals, a 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 practical** at an appropriate airport and have the cause investigated.

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

**3.24 TURBINE INLET TEMP (TIT) INDICATOR/SENSOR FAILURE  
(3.4k)**

In the event the Turbine Inlet Temperature (TIT) indicator or sensor fails during flight, 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.

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

**3.25 HIGH CYLINDER HEAD TEMPERATURE (3.4l)**

Excessive cylinder head temperature may parallel excessive oil temperature. In any case, reduce power and/or enrich the mixture, and increase airspeed if practical. If the problem persists, **land as soon as practical** at an appropriate airport and have the cause investigated.

**3.27 ELECTRICAL FAILURES (3.4m)**

**SINGLE ALTERNATOR FAILURE (Zero amps or ALTERNATOR #1 or #2 INOP light illuminated - annunciator panel)**

**NOTE**

Anytime total tie bus voltage is below 25 Vdc, the **LOW BUS VOLTAGE** annunciator will illuminate.

Loss of either alternator is indicated by a zero reading on the appropriate ammeter indication and the illumination of the associated annunciator (ALTERNATOR #1 INOP or ALTERNATOR #2 INOP).

If the **LOW BUS VOLTAGE** annunciator is illuminated, first reduce the electrical load to less than 75 amps, which should extinguish the **LOW BUS VOLTAGE** annunciator, 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 (ALTNR NO. 1 or ALTNR 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 ammeter continues to read zero, and the annunciator remains lit, turn the failed alternator's switch OFF. Continue flight and monitor the operating alternator's ammeter to ensure the electrical load does not exceed 75 amps. The annunciator of the failed alternator will remain lit.

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. Under no circumstances may the total electrical load exceed 75 amps. The electric cabin heater, cabin recirculation blowers, and position, strobe, and landing lights should not be used unless absolutely necessary.

**3.27 ELECTRICAL FAILURES (3.4m) (continued)**

DUAL ALTERNATOR FAILURE (Zero amps both ammeter indications or ALTERNATOR #1 and #2 INOP light illuminated - annunciator panel)

**NOTE**

Anytime total tie bus voltage is below 25 Vdc, the LOW BUS VOLTAGE annunciator will illuminate.

In the event that both alternators indicate failure simultaneously, reduce electrical load to minimum required for safe flight by turning OFF switches and pulling circuit breakers for all nonessential electrical equipment. Maintain only that equipment required to provide heading, attitude, and altitude information, plus one navigation radio and one communications radio for emergency use only.

Attempt to reestablish alternator power on each alternator individually by first turning OFF both alternators for at least one second, resetting any tripped alternator (ALTR) control circuit breakers, and then turning each alternator ON, one at a time.

If only one alternator can be restored, reinstate electrical load as desired to a maximum of 75 amps. Land as soon as practical for proper repairs.

If neither alternator can be restored to operation, continue flight with reduced electrical load on battery power only.

**NOTE**

LOW BUS VOLTAGE annunciator will be illuminated.

**Land as soon as safely practical**, as battery power duration is dependent upon the condition of the battery at time of failure.

**NOTE**

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

**3.27 ELECTRICAL FAILURES (3.4m) (continued)**

**COMPLETE ELECTRICAL FAILURE**

**NOTE**

The emergency standby attitude gyro will activate automatically if the switch is in the ON position.

Should a complete electrical failure occur, **verify that the standby attitude gyro switch is ON and the flag is pulled on the gyro.**

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

Turn the battery switch OFF and turn the ground clearance switch ON.

**NOTE**

Turning ON the Ground Clearance Switch may activate the No. 1 Com/Nav and Audio Panel depending on the nature of the complete electrical failure.

**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 (Section 3.4p).

**SUPPLEMENTAL HEATER CONTROL CIRCUIT FAILURE (Heater Continues to Operate With AUX CBN HEAT and VENT/DEFOG Switches OFF)**

Pull the VENT DEFOG circuit breaker. If the heater still continues to operate, **land as soon as practical.**

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**3.28 AVIONICS SYSTEMS FAILURES (3.4n)**

**FAILURE OF PILOT'S ELECTRONIC ATTITUDE DIRECTION DISPLAY (PFD)**

Should the primary flight display (PFD) go blank, verify the standby attitude gyro switch is ON and the flag is pulled on the gyro, maintain attitude control using the standby instruments and establish the aircraft in straight and level unaccelerated flight.

Adjust the PFD brightness control (BRT/DIM) to full bright. If the PFD screen cannot be reinstated, select COUPLED on the PFD COUPLED/UNCOUPLED switch.

If time and conditions permit, and the failure is associated with the pilot's PFD, pull the pilot's PFD circuit breakers (one located on the pilot's aft circuit breaker panel and one located on the copilot's circuit breaker panel). Reset both circuit breakers.

If the PFD screen cannot be reinstated and the aircraft is equipped with the optional second transponder, select the No. 2 Transponder. Use the mechanical nav indicator (OBS) for primary navigation.

**NOTE**

The mechanical nav indicator (OBS) receives nav information directly from the No. 1 (pilot's) nav/com/GPS. Only VLOC information is available.

**NOTE**

Failure of the pilot's PFD may cause the loss of Transponder No. 1 Mode C capability.

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

**CAUTION**

High current loads in the vicinity of the magnetic compass can influence its accuracy. Depending on the flight conditions, the pilot must reduce these loads as much as possible to insure accuracy. Tests have shown that windshield heat, air conditioner, and pitot heat contribute to significant heading errors of the magnetic compass. These items should be turned OFF prior to cross checking the magnetic compass. Pilot judgment must be used in turning these items OFF (i.e. freezing IMC conditions). MFD MAP and GPS MAP mode may be helpful in maintaining course.

*Land as soon as practical.*

**3.28 AVIONICS SYSTEMS FAILURES (3.4n) (continued)****YELLOW AIRSPEED MISCOMPARE ANNUNCIATOR ON PILOT'S AND COPILOT'S PFD'S**

Should an airspeed difference of 4 knots or greater exist between the pilot's PFD (ADAHRS 1) and the copilot's PFD (ADAHRS 2), **establish the aircraft in straight and level unaccelerated flight.**

Reference the airspeed indicated on the standby airspeed indicator to see which ADAHRS system it more closely matches and to verify which ADAHRS system is in error. If it is determined that the pilot's ADAHRS 1 system is in error, change the pilot's system to ADAHRS 2. If it is determined that the copilot's ADAHRS 2 system is in error, change the copilot's system to ADAHRS 1.

**Land as soon as practical.**

**YELLOW HEADING MISCOMPARE ON PILOT'S AND COPILOT'S PFD'S**

Should a heading difference of 6 degrees or greater exist between the pilot's PFD (ADAHRS 1) and the copilot's PFD (ADAHRS 2), **establish the aircraft in straight and level unaccelerated flight.**

Reference the heading indicated on the magnetic compass to see which ADAHRS system it more closely matches and to verify which ADAHRS system is in error. If it is determined that the pilot's ADAHRS 1 system is in error, change the pilot's system to ADAHRS 2. If it is determined that the copilot's ADAHRS 2 system is in error, change the copilot's system to ADAHRS 1.

**Land as soon as practical.**

**3.28 AVIONICS SYSTEMS FAILURES (3.4n) (continued)**

**YELLOW ALTITUDE MISCOMPARE ON PILOT'S AND COPILOT'S PFD'S**

Should an altitude difference of 50 feet or greater exist between the pilot's PFD (ADAHRS 1) and the copilot's PFD (ADAHRS 2), **establish the aircraft in straight and level unaccelerated flight.**

**NOTE**

The altitude miscompare annunciator will illuminate when a miscompare of 50 feet is detected from sea level to 5,000 feet. Above 5,000 feet the miscompare value is linearly increased up to 150 feet at 30,000 feet.

Reference the altitude indicated on the standby altimeter to see which ADAHRS system it more closely matches and to verify which ADAHRS system is in error. If it is determined that the pilot's ADAHRS 1 system is in error, change the pilot's system to ADAHRS 2. If it is determined that the copilot's ADAHRS 2 system is in error, change the copilot's system to ADAHRS 1.

**Land as soon as practical.**

**YELLOW PITCH AND ROLL MISCOMPARE ON PILOT'S AND COPILOT'S PFD'S**

Should a pitch or roll difference of 3 degrees or greater exist between the pilot's PFD (ADAHRS 1) and the copilot's PFD (ADAHRS 2), **establish the aircraft in straight and level unaccelerated flight.**

Reference the pitch and roll indicated on the standby attitude indicator to see which ADAHRS system it more closely matches and to verify which ADAHRS system is in error. If it is determined that the pilot's ADAHRS 1 system is in error, change the pilot's system to ADAHRS 2. If it is determined that the copilot's ADAHRS 2 system is in error, change the copilot's system to ADAHRS 1.

**Land as soon as practical.**

**3.28 AVIONICS SYSTEMS FAILURES (3.4n) (continued)****INVALID AIR DATA**

Should the airspeed, altimeter, and vertical speed data be replaced with red X's, refer to the standby airspeed and altimeter instruments for aircraft airspeed and altimeter data.

If time and conditions permit, and the failure is associated with the pilot's ADAHRS, pull the pilot's PFD circuit breakers (one located on the pilot's aft circuit breaker panel and one located on the copilot's circuit breaker panel). Reset both circuit breakers.

If air data is still invalid, select ADAHRS 2, and if the aircraft is equipped with the optional second transponder, select Transponder No. 2.

If time and conditions permit, and the failure is associated with the copilot's ADAHRS, pull the copilot's PFD circuit breakers (one located on the pilot's aft circuit breaker panel and one located on the copilot's circuit breaker panel). Reset both circuit breakers.

If air data is still invalid, select ADAHRS 1

**NOTE**

Certain failures of the pilot's PFD may cause a loss of Transponder No. 1 Mode C capability. Loss of Transponder No. 2 Mode C capability can be caused by failure of the copilot's PFD. Verify Mode C operation with ATC.

Cross check airspeed and altitude indications with the standby instruments.

**Land as soon as practical.**

### 3.28 AVIONICS SYSTEMS FAILURES (3.4n) (continued)

#### INVALID HEADING DATA

Should the heading bug and heading data be replaced with red X's, refer to the magnetic compass for heading data.

#### NOTE

For accurate magnetic compass readings select the WINDSHLD HT, PROP HEAT, AIR COND AND BLOWER switches OFF.

If time and conditions permit, and the failure is associated with the pilot's ADAHRS, pull the pilot's PFD circuit breakers (one located on the pilot's aft circuit breaker panel and one located on the copilot's circuit breaker panel). Reset both circuit breakers.

If heading data is still invalid, select ADAHRS 2 and continue to monitor the magnetic compass.

If time and conditions permit, and the failure is associated with the copilot's ADAHRS, pull the copilot's PFD circuit breakers (one located on the pilot's aft circuit breaker panel and one located on the copilot's circuit breaker panel). Reset both circuit breakers.

If heading data is still invalid, select ADAHRS 1, and continue to monitor the magnetic compass.

**Land as soon as practical.**

#### CROSSCHECK MONITOR

Should the PFD display a yellow crosscheck attitude annunciator, establish the aircraft in straight and level unaccelerated flight.

Crosscheck the aircraft attitude with the off side PFD and standby attitude gyro. Select the operational ADAHRS and monitor the standby attitude indicator.

**Land as soon as practical.**

**3.28 AVIONICS SYSTEMS FAILURES (3.4n) (continued)****INVALID ATTITUDE AND HEADING DATA**

Should the attitude and heading data be replaced with red X's, **verify the standby attitude gyro switch is ON and the flag is pulled on the gyro and refer to the standby attitude gyro for attitude control.**

If time and conditions permit, and the failure is associated with the pilot's ADAHRS, pull the pilot's PFD circuit breakers (one located on the pilot's aft circuit breaker panel and one located on the copilot's circuit breaker panel). Reset both circuit breakers.

If attitude and heading data is still invalid, select ADAHRS 2.

If time and conditions permit, and the failure is associated with the copilot's ADAHRS, pull the copilot's PFD circuit breakers (one located on the pilot's aft circuit breaker panel and one located on the copilot's circuit breaker panel). Reset both circuit breakers.

If attitude and heading data is still invalid, select ADAHRS 1.

Continue to monitor the standby attitude indicator for attitude control.

**Land as soon as practical.**

**FAILURE OF ATTITUDE, AIRSPEED AND HEADING REFERENCE SYSTEM (ADAHRS)**

Should the airspeed, attitude, heading and altitude data be replaced with red X's, **verify the standby attitude gyro switch is ON and the flag is pulled on the gyro and refer to the standby instruments for attitude control.**

If time and conditions permit, and the failure is associated with the pilot's ADAHRS, pull the pilot's PFD circuit breakers (one located on the pilot's aft circuit breaker panel and one located on the copilot's circuit breaker panel). Reset both circuit breakers.

If ADAHRS initialization does not occur, select ADAHRS 2.

If the aircraft is equipped with the optional second transponder, time and conditions permitting, pull the copilot's PFD circuit breakers (one located on the pilot's aft circuit breaker panel and one located on the copilot's circuit breaker panel). Reset both circuit breakers.

If ADAHRS initialization does not occur, select ADAHRS 1.

Continue to monitor the standby instruments for attitude control.

**Land as soon as practical.**

**3.28 AVIONICS SYSTEMS FAILURES (3.4n) (continued)**

**FAILURE OF MULTI-FUNCTION DISPLAY (MFD)**

Should the Multi-Function Display (MFD) go blank, pull and reset the MFD circuit breaker located on the pilot's aft circuit breaker panel.

**If initialization of the MFD does not occur, land as soon as possible.**

**LOSS OF STANDBY ATTITUDE INDICATOR**

Should the OFF Warning Flag display, or should the indicator be tumbled or show erroneous attitude display, select TEST on the standby attitude indicator test switch (located to the left of the standby attitude indicator) and verify that the green STBY ATT IND TEST annunciator illuminates.

Establish the aircraft in straight and level unaccelerated flight, then pull the "PULL TO CAGE" knob on the standby attitude indicator, then Uncage.

**If the standby attitude indicator does not recover, pull the "PULL TO CAGE" knob to Cage, and land as soon as practical.**

**FAILURE OF FLIGHT AND NAVIGATION DISPLAYS**

Should all displays go blank, **verify the standby attitude gyro switch is ON and the flag is pulled on the gyro, maintain aircraft in straight and unaccelerated flight by referring to the standby airspeed, altimeter, and attitude gyro indicators.**

Pull the Avionics Dimming Circuit Breaker located on the pilot's aft circuit breaker panel.

**NOTE**

A failure of the display dimmer control can result in the two Garmin displays going blank. This is an indication of a partial failure of the dimmer control. A complete failure of this control would normally reinstate the displays to a full bright condition. However, if the displays should blank out, reinstatement of the displays to a full bright condition can be accomplished by bypassing the dimmer control (pulling the Avionics Dimming Circuit Breaker).

**3.29 PROPELLER OVERSPEED (3.4o)**

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

If propeller overspeed should occur, retard the throttle and check the oil pressure. The propeller control should be moved to full DECREASE rpm and then reset if any control is available. Airspeed should be reduced and throttle used to maintain 2500 RPM. **Land as soon as practical** and investigate cause of overspeed.

**3.31 EMERGENCY LANDING GEAR EXTENSION (3.4p)**

Prior to proceeding with an emergency gear extension, check to ensure that the battery master switch (BATT MSTR) is ON and that the circuit breakers have not popped. If it is daytime, the Day/Night dimmer 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, place the landing gear selector in the DOWN position, pull the emergency gear extend control OUT and fishtail the airplane. Verify the landing gear position lights indicate down and locked.

**CAUTION**

The Emergency Gear Extension procedure will require the pilot to pull the emergency gear extend control knob through a region of high resistance (up to 25 lbs.) in order to reach the stop and extend the landing gear.

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

**3.33 SPIN RECOVERY (3.4q)**

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.

**3.35 ENGINE ROUGHNESS (3.4r)**

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 (EMERG) 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 magneto 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.

**3.37 EMERGENCY DESCENT (3.4s)**

**NOTE**

If pressurized, the following procedure will result in the immediate loss of pressurization and the cabin altitude will rise at an uncontrolled rate.

In the event an emergency descent becomes necessary, retard the throttle to idle and move the propeller 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  
2450 lb = 100 KIAS

Use straight line variation between points.

After reaching a safe altitude, advance the throttle and adjust mixture and propeller controls for power as required.

**3.39 PRESSURIZATION SYSTEM MALFUNCTION (3.4t)****NOTE**

If pressurized, the following procedure will result in an immediate loss of pressurization and the cabin altitude will rise at an uncontrollable rate.

Should the differential pressure rise above 5.5 psi maximum or a structural failure appear imminent, an immediate decrease in differential pressure is required. To accomplish this, select DUMP on the cabin pressure dump/normal switch and PULL the cabin pressurization (CABIN PRESS) control. This will cause the cabin altitude to rise at an uncontrolled rate and cabin differential pressure to decrease, subsequently relieving the overpressure condition. If emergency oxygen is not installed, execute an emergency descent to a safe altitude consistent with terrain. If emergency oxygen is installed, don the oxygen masks, activate the oxygen generators and descend to a safe altitude consistent with terrain.

Should the aircraft suddenly lose pressurization, check that the cabin pressure dump/normal switch is in the NORM position and that the cabin pressurization (CABIN PRESS) control is pushed in. If the aircraft does not begin to repressurize and emergency oxygen is not installed, execute an emergency descent to a safe altitude consistent with terrain. If emergency oxygen is installed, don the oxygen masks, activate the oxygen generators and descend to a safe altitude consistent with terrain.

**3.41 CABIN AIR CONTAMINATION/SMOKE EVACUATION (3.4u)****NOTE**

If pressurized, the following procedure will result in an immediate loss of pressurization and the cabin altitude will rise at an uncontrollable rate.

Strong fumes or smoke in the cabin may indicate a malfunction in the pressurization system or 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, set the cabin pressure dump/normal switch to DUMP and PULL the cabin pressurization (CABIN PRESS) control out. Turn OFF the auxiliary cabin heater. Turn ON the vent/defog blower and turn OFF the cabin air recirculation blower. Do not open the storm window. This procedure will provide the maximum flow of outside ram air through the cabin. If emergency oxygen is not installed, execute an emergency descent to a safe altitude consistent with terrain. If emergency oxygen is installed, don the oxygen masks, activate the oxygen generators and descend to a safe altitude consistent with terrain. **Land as soon as practical** and investigate the cause. If the fumes or smoke persist the problem may be a fire (see paragraph 3.4f, Fire In Flight).

### 3.43 VACUUM SYSTEM FAILURE (3.4v)

A failure of either vacuum pump is indicated by the illumination of a vacuum failure annunciator, "VAC 1 INOP".or "VAC 2 INOP".

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 vacuum failure annunciator 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 4.0 inches of mercury and illumination of both annunciators.

If both vacuum systems are inoperable, the wing and tail deicer boots will be inoperative. Also, loss of cabin pressure control is possible; the cabin pressure will have to be dumped manually before landing. A precautionary landing should be considered depending on operating conditions.

### 3.45 INADVERTENT ICING ENCOUNTER (3.4w)

#### WARNING

Flight into known icing conditions is prohibited unless Ice Protection System is installed and fully operational. Refer to Section 9, Supplement 3.

If icing conditions are inadvertently encountered, select ALTERNATE induction air 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. Turn the windshield vent/defog fan ON to keep the windshield as clear as possible. If installed, turn the electric windshield heat ON. **Change aircraft heading and/or altitude to exit icing conditions as soon as possible.**

**3.49 HYDRAULIC SYSTEM MALFUNCTION (3.4x)**

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 HYDRAULIC PUMP amber annunciator light. Pull the HYDRAULIC PUMP POWER circuit breaker 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 (3.4p).

**3.51 FLAP SYSTEM MALFUNCTION (3.4y)**

Illumination of the FLAPS annunciator 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 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 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.

**3.53 FUEL TANK SUBMERGED PUMP FAILURE (BOOST PUMP light illuminated - annunciator panel) (3.4z)**

Illumination of the BOOST PUMP annunciator light 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 PUMPS (L BOOST or R BOOST) circuit breaker located on the pilot's forward breaker panel; reset as necessary. Check that the BOOST PUMP annunciator is extinguished.

If the FUEL PUMPS circuit breaker does not remain closed, or the BOOST PUMP annunciator remains lit, turn ON the emergency (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.

**3.55 STALL WARNING FAILURE (STALL WARN FAIL light illuminated - annunciator panel) (3.4aa)**

Illumination of the STALL WARN FAIL annunciator light means the lift computer has failed. Check, and if necessary, reset the STALL WARN circuit breaker located on the pilot's forward circuit breaker panel. If the breaker does not remain closed, or if the STALL WARN FAIL annunciator light 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.

**3.57 ANNUNCIATOR LIGHT PANEL FAILURE (ANNUNCIATOR INOP light illuminated - annunciator panel) (3.4bb)**

Should the ANNUNCIATOR INOP light illuminate, check the ANNUN circuit breaker located on the pilot's aft circuit breaker panel. Reset, if necessary, and the ANNUNCIATOR INOP light should extinguish.

If the ANNUN circuit breaker is not open, the annunciator fail relay switch is faulty. Push the annunciator test switch; if all lights illuminate, the annunciator panel is functioning properly. The ANNUNCIATOR INOP light will remain lit.

Should the ANNUN circuit breaker fail to remain closed, or the annunciators fail to illuminate when tested, the annunciator lights will be inoperative for the remainder of the flight. Also, the landing gear position lights cannot be tested nor dimmed. The system should be repaired prior to further flight.

**3.59 EMERGENCY EXIT (3.4cc)**

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

**NOTE**

The cabin must be depressurized before attempting to open the 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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**SECTION 4**  
**NORMAL PROCEDURES**

**4.1 GENERAL**

This section provides the normal operating procedures for the PA-46-350P, Mirage 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 short form 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 not intended for use as an inflight reference due to the lengthy explanation. The short form checklists should be used on the ground and in flight. 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.

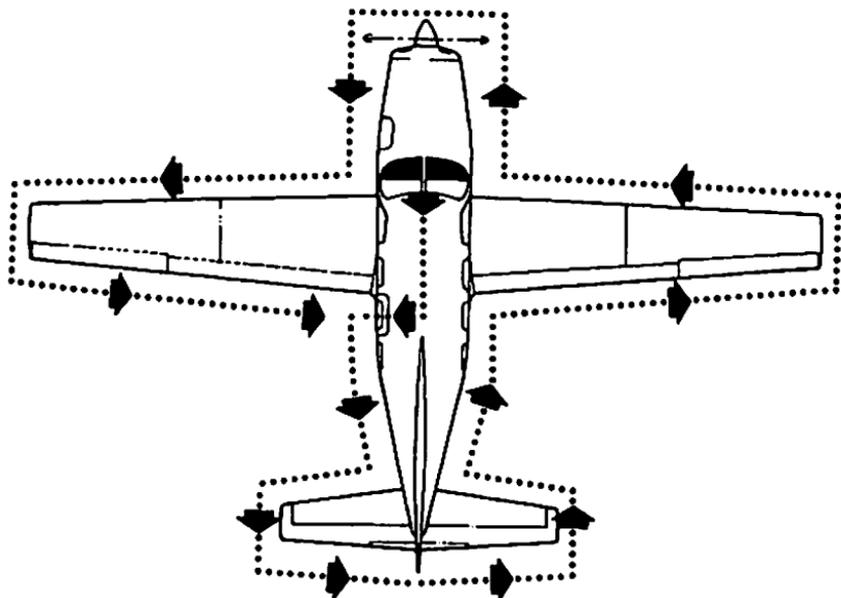
4.3 AIRSPEEDS FOR SAFE OPERATIONS

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 .....110 KIAS
- (b) Best Angle of Climb Speed.....81 KIAS
- (c) Turbulent Air Operating Speed (See Subsection 2.3).....133 KIAS
- (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

## 4.5 NORMAL PROCEDURES CHECKLIST



WALK-AROUND

Figure 4-1

## 4.5a Preflight Checklists (4.9)

## COCKPIT (4.9a)

Oxygen System (if installed) .....	CHECK MASKS and HOSES
Control Wheel .....	RELEASE RESTRAINTS
Parking Brake .....	SET
Gear Handle .....	DOWN
All Switches .....	OFF
Magneto Switches .....	OFF
Radio Master Switch .....	OFF
Mixture .....	IDLE CUT-OFF
Battery Master Switch .....	ON
Landing Gear Indicator Lights .....	THREE GREEN
Annunciator Panel .....	CHECK
Switch Panel .....	CHECK

4.5a Preflight Checklists (4.9) (continued)

COCKPIT (4.9a) (continued)

FUEL PRESS Annunciator .....ON

**CAUTION**

See fuel imbalance limitations, Section 2.35.

Oxygen Light (if installed) .....CHECK

Stall Warning System .....TEST

Flaps .....EXTEND

Interior Lighting .....ON and CHECK

Pitot Heat.....ON

Stall Warning 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 .....OFF

Stall Warning Heat.....OFF

Battery Master Switch .....OFF

Primary Flight Controls .....PROPER OPERATION

Trim .....NEUTRAL

Static System .....DRAIN

Alternate Static System .....CHECK NORMAL POSITION

Emergency Exit .....CHECK

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)

## EMPENNAGE (4.9b)

Antennas .....	CHECK
Surface Condition .....	CLEAR OF ICE, FROST, SNOW
Left Static Ports .....	CLEAR
Storage Compartment Door.....	CLOSE/SECURE
Alternate and Pressurization Static Ports .....	CLEAR
Elevator .....	CHECK
Elevator Trim Tab .....	CHECK
Rudder .....	CHECK
Static Wicks .....	CHECK
Tie Down .....	REMOVE
Right Static Ports .....	CLEAR

## RIGHT WING (4.9c)

Surface Condition.....	CLEAR OF ICE, FROST, SNOW
Flap and Hinges.....	CHECK
Aileron and Hinges .....	CHECK
Static Wicks.....	CHECK
Wing Tip and Lights.....	CHECK
Fuel Tank Vent .....	CLEAR
Fuel Tank .....	CHECK SUPPLY VISUALLY - SECURE CAP
De-ice Boot .....	CHECK
Stall Strips (2 per wing).....	CHECK
Tie Down and Chock .....	REMOVE
Radar Pod and Storage Door .....	CHECK/SECURE
Pitot Head.....	CHECK FOR OBSTRUCTIONS
Main Gear Strut .....	PROPER INFLATION (3.44 +/- 0.25 in.)
Tire .....	CHECK
Brake Block and Disc .....	CHECK

**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
---------------------	---

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

**NOSE SECTION (4.9d)**

General Condition .....CHECK  
Fuel Filter Sump .....DRAIN and CHECK  
for water, sediment  
and proper fuel  
Cowling .....SECURE  
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

## 4.5a Preflight Checklist (4.9) (continued)

## LEFT WING (4.9e)

Surface Condition .....CLEAR of ICE, FROST, SNOW

**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  
Main Gear Strut .....INFLATION (3.44 +/- 0.25 INCH  
Tire .....CHECK  
Brake Block and Disc .....CHECK  
Tie Down and Chock .....REMOVE  
Pitot Head .....CHECK FOR OBSTRUCTIONS  
Fuel Tank .....CHECK SUPPLY VISUALLY  
- SECURE CAP  
Fuel Tank Vent .....CLEAR  
De-ice Boot .....CHECK  
Stall Strips (2 per wing) .....CHECK  
Wing Tip and Light .....CHECK  
Aileron and Hinges .....CHECK  
Flap and Hinges .....CHECK  
Static Wicks .....CHECK

4.5b Before Starting Engine Checklist (4.11)

**BEFORE STARTING ENGINE (4.11)**

Passengers .....BOARD  
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  
Parking Brake .....SET  
Propeller Control.....FULL INCREASE  
Fuel Selector.....DESIRED TANK  
All Electrical Switches .....OFF  
Day/Night Switch .....VERIFY PROPER SETTING  
Circuit Breakers .....CHECK IN  
Alternators.....ON  
Cabin Altitude Selector.....SET  
Altitude Rate Control.....SET  
Cabin Pressurization Control.....SET  
Cabin Pressure Dump/Switch.....NORM  
Induction Air Control .....CHECK then PRIMARY  
Battery Switch.....ON  
Primary Flight Display (PFD).....VERIFY CORRECT AIRCRAFT  
MODEL SOFTWARE  
TAS.....STANDBY  
Annunciator Panel Lights .....TEST AND HOLD  
ADAHRS 1 / 2 Switch.....CENTER POSITION  
Alternate Static System.....CHECK PRIMARY POSITION  
Pitot and Static .....DRAIN  
PFD Coupled/Uncoupled Switch .....VERIFY PROPER SETTING  
Initial Usable Fuel .....CHECK QUANTITY & BALANCE

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**

The STARTER ENGAGE annunciator will illuminate during engine cranking. If the annunciator remains lit 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.

**NOTE**

Starter manufacturer recommends starter cranking periods be limited to 10 seconds with a 2 minute rest period between cranking periods. Maximum of 5 start periods allowed. If start is not achieved on fifth attempt allow starter to cool for 30 minutes before attempting additional starts.

4.5c Engine Start Checklist (4.13) (continued)

**NORMAL START - COLD ENGINE (4.13b)**

Throttle .....1/2 INCH OPEN  
Battery Master Switch .....ON  
Emergency (EMERG) Fuel Pump .....OFF  
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.

Magneto Switches .....ON  
Prop Area .....CLEAR  
Starter.....ENGAGE  
Mixture (when engine fires) .....ADVANCE  
Throttle.....ADJUST  
Oil Pressure .....CHECK  
Alternators .....CHECK AMMETER  
Gyro Suction .....CHECK

**NORMAL START - HOT ENGINE (4.13c)**

Throttle .....1/2 INCH OPEN  
Battery Master Switch.....ON  
Emergency (EMERG) Fuel Pump.....OFF  
Mixture .....IDLE CUT-OFF  
Magneto Switches .....ON  
Prop Area .....CLEAR  
Starter.....ENGAGE  
Mixture (when engine fires) .....ADVANCE  
Throttle.....ADJUST  
Oil Pressure .....CHECK  
Alternators .....CHECK AMMETER  
Gyro Suction .....CHECK

4.5c Engine Start Checklist (4.13) (continued)

**ENGINE START WHEN FLOODED (4.13d)**

Throttle .....OPEN FULL  
Battery Master Switch.....ON  
Emergency (EMERG) Fuel Pump.....OFF  
Mixture .....IDLE CUT-OFF  
Magneto Switches .....ON  
Prop Area .....CLEAR  
Starter.....ENGAGE  
Mixture (when engine fires) .....ADVANCE  
Throttle .....RETARD  
Oil Pressure .....CHECK  
Alternators .....CHECK AMMETER  
Gyro Suction .....CHECK

4.5c Engine Start Checklist (4.13) (continued)

**ENGINE START WITH EXTERNAL POWER SOURCE (4.13e)**

- Battery Master Switch.....OFF
- Alternators.....OFF
- All Electrical Equipment.....OFF
- External Power Plug.....INSERT in receptacle

**NOTE**

For all normal operations using an external power source, the battery master switch should be OFF, but it is possible to use the ship's battery in parallel by turning the battery master switch ON. This will give longer cranking capabilities, but will not increase 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 battery master switch ON momentarily while the starter is engaged. If cranking speed increases, the ship's battery is at a higher level than the external power supply.

- Throttle.....½ INCH OPEN
- Emergency (EMERG) Fuel Pump.....OFF
- Mixture.....IDLE CUT-OFF
- Magneto Switches.....ON
- Prop Area.....CLEAR
- Starter.....ENGAGE
- Mixture (when engine fires).....ADVANCE
- Throttle.....LOWEST POSSIBLE RPM
- External Power Plug.....DISCONNECT from receptacle
- Baggage Door.....CLOSED and SECURE
- Battery Master Switch.....ON
- Voltmeter.....CHECK
- Alternators.....ON
- Ammeters.....CHECK
- Throttle.....ADVANCE to 1000 RPM
- Oil Pressure.....CHECK
- Gyro Suction.....CHECK

## 4.5d Before Taxiing Checklist (4.15)

## BEFORE TAXIING (4.15)

## CAUTION

Do not operate engine above 1200 RPM with cabin doors open.

Throttle.....	1000 to 1200 RPM
Radio Master Switch.....	ON
Autopilot Master Switch.....	SELECT ON / Verify Self Test Completed
Standby Attitude Gyro.....	ON/ERECT
Altimeter/Standby Altimeter.....	SET
Select Aux Page on MFD.....	Verify set to proper GPS
TAWS .....	TEST (if installed)
Pilot/Copilot ADAHRS .....	VERIFY INITIALIZED
Environmental System .....	AS DESIRED
Supplemental Electric Heater .....	AS DESIRED

## 4.5e Taxiing Checklist (4.17)

## TAXIING (4.17)

Taxi Area.....	CLEAR
Parking Brake .....	RELEASED
Propeller Control.....	FULL INCREASE
Throttle .....	APPLY SLOWLY
Brakes.....	CHECK
Steering.....	CHECK
Flight Instruments .....	CHECK

## CAUTION

During taxi, if the low voltage annunciator comes on, increase engine RPM, if possible, to retain adequate battery charging.



## 4.5g Before Takeoff Checklist (4.21)

## BEFORE TAKEOFF (4.21)

## NOTE

Refer to Section 9, Supplement 3 for Mirage Aircraft Flight Into Known Icing (FIKI), prior to any flight operations (takeoff, cruise, landing, etc.).

Battery Master Switch .....	ON
Emergency (EMERG) Fuel Pump .....	ON
Alternators .....	ON - CHECK INDICATIONS
Fuel Selector .....	PROPER TANK
Induction Air .....	PRIMARY
Seat Backs .....	ERECT
Seats .....	ADJUSTED & LOCKED IN POSITION
Armrests .....	STOWED
Belts/Harness .....	FASTENED/ADJUSTED
Pressurization System .....	SET
Mixture .....	FULL RICH
Propeller Control .....	FULL INCREASE
Windshield Heat .....	AS REQUIRED
Pitot Heat .....	AS REQUIRED
Taxi/Rec Lights .....	AS REQUIRED
Landing Light .....	AS REQUIRED
Nav & Strobe Lights .....	ON
Flight Instruments .....	CHECK (Primary and Standby)
Annunciator Lights .....	CONSIDER ANY LIGHTS ILLUMINATED
Engine Instruments .....	CHECK
Radios/Avionics .....	AS REQUIRED
Flaps .....	SET (0° to 20°)
Elevator and Rudder Trim .....	SET
Flight Controls .....	FREE & PROPER TRAVEL

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.)

**NOTE**

During landing gear operation, it is normal for the HYDRAULIC PUMP annunciator light to illuminate until full system pressure is restored.

**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 .....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 .....UP

## 4.5h Takeoff Checklist (4.23) (continued)

## SHORT FIELD TAKEOFF PERFORMANCE (4.23c)

## NOTE

Gear warning will sound when the landing gear is retracted with the flaps extended more than 10°.

Flaps .....	20°
Brakes .....	APPLY
Trim .....	SET
Power .....	SET TO MAXIMUM
Brakes .....	RELEASE
Liftoff .....	69 KIAS
Obstacle Clearance Speed .....	80 KIAS
After liftoff and positive rate of climb:	
Flaps .....	RETRACT as speed builds thru 90 KIAS
Landing Gear .....	UP

## 4.5i Climb Checklist (4.25)

## MAXIMUM CONTINUOUS POWER CLIMB (4.25a)

Mixture .....	FULL RICH
Propeller Speed .....	2500 RPM
Manifold Pressure .....	MAXIMUM
	CONTINUOUS POWER
Cylinder Head Temperature (CHT) .....	500°F MAX
Turbine Inlet Temperature (TIT) .....	1750°F MAX
Oil Temperature .....	245°F MAX
Best Angle of Climb (short duration only) .....	81 KIAS
Best Rate of Climb .....	110 KIAS
Pressurization Controls .....	SET
Emergency (EMERG) Fuel Pump .....	OFF at safe altitude
Landing Light .....	OFF
Taxi/Rec Lights .....	AS REQUIRED
TAS .....	ON

**NOTE:** For maximum engine life it is recommended to transition to Cruise Climb once clear obstacles.

4.5i Climb Checklist (4.25) (continued)

**CRUISE CLIMB (4.25b)**

Manifold Pressure .....	35 IN. HG
Propeller Speed.....	2500 RPM
Mixture.....	32 GPH
Climb Speed .....	125 KIAS
Cylinder Head Temperature (CHT).....	CHECK 500°F MAX 435°F Recommended (See Section 4.25b)
Turbine Inlet Temperature (TIT) .....	CHECK 1750°F MAX 1650°F Recommended or 100°F richer than peak TIT whichever is less. (See Section 4.25b)
Oil Temperature .....	245°F MAX
Pressurization Controls .....	SET
Emergency (EMERG) Fuel Pump .....	OFF at safe altitude
Landing Light .....	OFF
Taxi/Rec Lights.....	AS REQUIRED
TAS.....	ON

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 paragraphs 2.35 and 7.19.

Reference Section 5 power setting table and performance charts.

Cruise Power.....	SET per power table
Mixture (Refer to para. 4.27).....	ADJUST
Cylinder Head Temperature (CHT).....	CHECK 500°F MAX 400°F Recommended (See Section 4.27)

## 4.5j Cruise Checklist (4.27) (continued)

## CRUISE (4.27) (continued)

Turbine Inlet Temperature (TIT) .....	CHECK 1750°F MAX 1650°F Recommended or 100°F richer than peak TIT whichever is less. (See Section 4.27)
Pressurization Controls .....	CHECK

## NOTE

Higher operating temperatures and pressures generally increase the wear rate of critical engine parts. Aircraft engines have operating limitations, termed redlines, that represent the maximum allowable value for a given parameter. The engine is certified to perform safely at these redline conditions. However, continuous operation at redline values may shorten the service life of the engine. For example, engines continuously run at the highest possible cruise setting at maximum Turbine Inlet Temperature may require a top overhaul of cylinders before engine TBO. Operating consistently at the maximum allowable engine parameters does not promote optimum service life.

## NOTE

Do not exceed 1750°F TIT. Recommended TIT is 1650°F or 100°F richer than peak TIT whichever is less.

## NOTE

The maximum permissible cylinder head temperature for all operations is 500°F. No matter what approved power setting is used, cylinder head temperatures should not exceed 435°F in level flight cruise. For optimum service life, cruise cylinder head temperatures should be maintained below 400°F. Adjust cylinder head temperatures by reducing power, adjusting the mixture, or any combination of these methods.

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**4.5k Descent Checklist (4.29)****NORMAL DESCENT (4.29a)**

Windshield Defrost.....AS REQUIRED  
 Windshield Heat .....AS REQUIRED  
 Ice Protection Equipment .....AS REQUIRED  
 Altimeter/Standby Altimeter.....SET  
 Power .....CRUISE  
 Mixture.....CRUISE SETTING  
 Airspeed.....AS REQUIRED  
 Cabin Pressure Controller.....SET (field elevation + 500 feet)  
 Cabin Rate Control.....SET for comfort (approx. 9 o'clock position)  
 Cabin Comfort Controls .....AS REQUIRED

**REDUCED POWER DESCENT (4.29b)**

Windshield Defrost.....AS REQUIRED  
 Windshield Heat .....AS REQUIRED  
 Ice Protection Equipment .....AS REQUIRED  
 Altimeter/Standby Altimeter .....CHECK  
 Throttle.....AT or ABOVE 20 IN. HG.  
 Mixture .....MAINTAIN 1350 TIT  
 Propeller Speed .....CRUISE SETTING  
 Cabin Pressure Controller.....SET (field elevation + 500 feet)  
 Cabin Rate Control.....SET for comfort (approx. 9 o'clock position)  
 Cabin Comfort Controls .....AS REQUIRED

**4.5m Before Landing Checklist (4.31)**

**APPROACH CHECK (4.31a)**

Altimeter/Standby Altimeter.....SET  
Pressurization.....SET  
Seat Backs .....ERECT  
Seats.....ADJUSTED & LOCKED IN POSITION  
Belts/Harness .....FASTEN/ADJUST  
Emergency (EMERG) Fuel Pump .....ON  
Fuel Selector .....PROPER TANK  
Mixture.....RICH  
Propeller Control .....SET  
Gear .....DOWN (below 165 KIAS)

**NOTE**

During landing gear operation it is normal for the HYDRAULIC PUMP annunciator light to illuminate until full system pressure is restored.

Flaps .....SET (10° @ 165 KIAS max.)  
Rudder Trim.....SET TO NEUTRAL  
Air Conditioner.....OFF

**LANDING CHECK (4.31b)**

Landing Gear.....3 GREEN LIGHTS  
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  
TAS.....AS REQUIRED



**4.5p After Landing Checklist (4.37)**

**AFTER LANDING (4.37)**

Induction Air Control .....PRIMARY  
Flaps .....RETRACT  
Air Conditioner .....AS DESIRED  
Radar .....OFF  
Emergency (EMERG) Fuel Pump .....OFF  
Ice Protection Equipment .....OFF  
WX Radar .....OFF  
Transponder .....AS REQUIRED  
Strobe Lights .....OFF  
Landing/Taxi Lights .....AS REQUIRED

**4.5q Stopping Engine Checklist (4.39)**

**STOPPING ENGINE (4.39)**

Radios and Electrical Equipment .....OFF  
External Lights .....OFF  
Air Conditioner .....OFF  
Propeller Control .....FULL INCREASE  
Throttle .....CLOSED until a  
decided decrease in CHT  
Throttle .....1000 RPM for  
approx. 30 seconds  
Mixture .....IDLE CUT-OFF  
Magnetos .....OFF  
Alternators .....OFF  
Battery Master Switch .....OFF  
Standby Attitude Indicator.....OFF

**4.5r Mooring Checklist (4.41)**

**MOORING (4.41)**

Parking Brake .....SET  
Control Wheel.....SECURED with belts  
Flaps.....FULL UP  
Wheel Chocks .....IN PLACE  
Tie Downs.....SECURE

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#### **4.7 AMPLIFIED NORMAL PROCEDURES (GENERAL)**

The following paragraphs are provided to supply detailed information and 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)**

Upon entering the cockpit, if the supplemental oxygen system is installed and will be used in 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 parking brake knob.

Check that the landing gear selector is in the DOWN position. Ensure that all electrical switches and the magneto switches are OFF. Turn OFF the radio master switch. The mixture should be in idle cut-off. Turn the battery master switch ON.

Verify that the three green landing gear indicator lights are illuminated, check the annunciator panel illuminates, and the FUEL PRESS annunciator is ON.

#### **CAUTION**

See fuel imbalance limitations, Section 2.35.

If the supplemental oxygen system is installed and its annunciator is lit, the expended canisters must be replaced if oxygen capability is desired for the flight.

Press the stall warning test switch and note that the stall warning horn sounds.

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, stall warning 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 stall warning heat.

Turn OFF the battery master switch.

Check the primary flight controls for proper operation and set the elevator and rudder trim to neutral. Open the static system drain to remove any moisture that has accumulated in the lines. Verify that the alternate static system valve is in the normal 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 and right side of the aft fuselage and the alternate and pressurization static ports on the underside of the aft fuselage are clear of obstructions. Verify the contents of the tail storage compartment are secured properly, then close and verify that the compartment door is secured. 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.

**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 for any nicks, tears or delamination, and verify that the stall strips are securely attached.

Remove the tiedown and chock.

Check the radar pod 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. Make a visual check of the brake block and disc.

**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.

**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. 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. Make a visual check of the brake block and disc.

Remove the tiedown and chock.

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 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 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 parking brake is set and the area around the airplane is clear of personnel and equipment.

Move the propeller control to full INCREASE and set the fuel selector to the desired tank. 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. Turn the alternator switches ON.

If the flight is to be made unpressurized, the cabin pressurization control should be pulled out to dump bleed air overboard and the cabin pressure dump/normal switch should be in the DUMP position in order to provide maximum cabin airflow. If pressurization is to be used during the flight, set the cabin altitude selector to 500 feet above the field elevation and the cabin altitude rate control to the 9 o'clock position. The cabin pressurization control must be pushed in and the cabin pressure dump/normal switch must be in the NORM position.

Check the induction air control for freedom of movement by moving lever to ALTERNATE and back to PRIMARY.

Turn the battery master switch ON.

Verify that the PFD displays the correct aircraft model in the center of the display.

Select STBY on the TAS switch. Verify that all annunciators on the annunciator panel illuminate by selecting TEST on the annunciator panel. Move the ADAHRS 1 / 2 switch to the center position.

Verify that the alternate static system valve is in the normal (DOWN) position. Drain the pitot and static systems using 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).

Set the PFD Coupled/Uncoupled switch to the proper position for the flight.

Set the fuel totalizer for the current fuel load. Verify the fuel imbalance falls within the maximum allowed per Section 2.35.

**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**

The **STARTER ENGAGE** annunciator will illuminate during engine cranking. If the annunciator remains lit 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.

**NOTE**

Starter manufacturer recommends starter cranking periods be limited to 10 seconds with a 2 minute rest period between cranking periods. Maximum of 5 start periods allowed. If start is not achieved on fifth attempt allow starter to cool for 30 minutes before attempting additional starts.

**4.13 ENGINE START (4.5c) (continued)****4.13b Normal Start - Cold Engine (4.5c)**

Open the throttle lever approximately 1/2 inch. Turn the battery master switch ON, and check that the emergency (EMERG) fuel pump is OFF. Move the mixture control to full RICH for approximately four seconds then to idle cut-off. 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.

Turn both magneto 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 ammeters for output. Check the gyro suction display for a positive indication.

**4.13c Normal Start - Hot Engine (4.5c)**

Open the throttle 1/2 inch. Turn the battery master switch ON and check that the emergency (EMERG) fuel pump is OFF. Verify the mixture control is at idle cut-off. Turn both magneto 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 ammeters for output. Check the gyro suction display for a positive indication.

**4.13d Engine Start When Flooded (4.5c)**

The throttle lever should be full open. Turn the battery master switch ON and check that the emergency (EMERG) fuel pump is OFF. Verify the mixture control is at idle cut-off. Turn both magneto 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 ammeters for output. Check the gyro suction display for a positive indication.

**4.13e Engine Start With External Power Source (4.5c)**

Turn the battery master and alternator switches 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 battery master switch should be OFF, but it is possible to use the ship's battery in parallel by turning the battery master switch ON. This will give longer cranking capabilities, but will not increase 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 battery master switch ON momentarily while the starter is engaged. If cranking speed increases, the ship's battery is at a higher level than the external power supply.

Open the throttle lever approximately 1/2 inch. Check that the emergency (EMERG) fuel pump is OFF. Verify the mixture control is at idle cut-off. Turn both magneto 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.

Disconnect the external power source from the aircraft and secure the baggage door. Turn the battery master and alternator switches ON and check for an indication of output. When the engine is firing evenly, advance the throttle to 1000 rpm and check for a positive indication of oil pressure. Check gyro suction display for a positive 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 radio master switch ON. Select the autopilot master switch ON and verify the autopilot completes a self test. Verify the standby attitude indicator is ON and ERECT. Set the altimeter on the PFD and the standby altimeter. Select the Aux page on the MFD and verify the correct GPS is selected. Conduct a self-test of the Terrain Awareness Warning System (TAWS), if installed. Verify the pilot and copilot ADAHRS have completed a successful alignment.

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 technique 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 low voltage annunciator comes on, increase engine RPM, if possible, to retain adequate battery charging.

Determine that the propeller back blast and taxi areas are clear. Avoid holes and ruts when taxiing over uneven ground.

Release the parking brake by first depressing and holding the toe brake pedals and then pushing in on the parking brake knob. Taxi with the propeller 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)**

**WARNING**

Refer to paragraph 4.53, Icing Information, prior to any flight operations. (Takeoff, cruise, landing, etc.)

**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**

If flight into icing conditions (in visible moisture below +5°C) is anticipated, conduct a preflight check of the icing systems per Supplement 3 - Ice Protection System.

Set the parking brake. The magnetos should be checked at 2000 rpm with the propeller 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 on the MFD shows within normal operating range.

Conduct a preflight check of the ice protection systems for proper operation.

Check the voltmeter and ammeters 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 propeller 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 PFD for proper indication of fuel flow, then retard the throttle.

Check the annunciator panel lights with the TEST button and check operation of the environmental/deice control panel with the TEST button.

**4.21 BEFORE TAKEOFF (4.5g)****NOTE**

Refer to Section 9, Supplement 3 for Mirage Aircraft Flight Into Known Icing (FIKI), prior to any flight operations (takeoff, cruise, landing, etc.).

Ensure that the battery master switch is ON. Turn ON the alternators and check for proper 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.

Check that the cabin pressurization controls are properly set. Check that the emergency (EMERG) fuel pump is ON.

The mixture control should be set to full RICH and propeller control should be set to full INCREASE.

Turn pitot, stall warning, windshield, and propeller heat ON if necessary. The taxi/recognition lights, landing light, navigation and strobe lights should be utilized as required.

Check and set all of the primary and standby flight instruments as required. Consider any annunciator lights that are illuminated and take appropriate action as necessary. Check engine readings to verify normal operating range.

Check that the 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.

**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.)

**NOTE**

During landing gear operation, it is normal for the **HYDRAULIC PUMP** annunciator light to illuminate until full system pressure is restored.

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.

**4.23 TAKEOFF (see charts in Section 5) (4.5h) (continued)****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 will be obtained at 110 KIAS. The best angle of climb may be 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. Set the cabin pressurization controls in accordance with paragraph 4.47. The emergency (EMERG) fuel pump should be OFF when reaching a safe altitude. Turn OFF the landing light and use the recognition lights as required. Turn ON the TAS.

**NOTE: For maximum engine life it is recommended to transition to Cruise Climb once clear obstacles.**

**4.25b Cruise Climb (4.5i)**

For reduced enroute fuel consumption in climb attain a speed of 125 KIAS, with the manifold pressure to 35 in. Hg, use 2500 rpm, and lean the mixture to produce a fuel flow of 32 gph. Set the cabin pressurization controls in accordance with paragraph 4.47. The emergency (EMERG) fuel pump should be OFF when reaching a safe altitude. Turn OFF the landing light and use the recognition lights as required. Turn ON the TAS. Above 24000 feet, reduce MAP to 34" or below. This slightly reduced power setting combined with higher climb speed provides better engine cooling.

**NOTE**

Do not exceed 1750°F TIT. Recommended TIT is 1650°F or 100°F richer than peak TIT whichever is less.

**NOTE**

The maximum permissible cylinder head temperature for all operations is 500°F. No matter what approved power setting is used, cylinder head temperatures should not exceed 435°F in level flight cruise. For optimum service life, cruise cylinder head temperatures should be maintained below 400°. Adjust cylinder head temperatures by reducing power, adjusting the mixture, or any combination of these methods.

**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**

Mixture may be leaned to peak TIT not to exceed 1750°F TIT. Recommended TIT is 1650°F or 100°F richer than peak TIT whichever is less.

**NOTE**

Higher operating temperatures and pressures generally increase the wear rate of critical engine parts. Aircraft engines have operating limitations, termed redlines, that represent the maximum allowable value for a given parameter. The engine is certified to perform safely at these redline conditions. However, continuous operation at redline values may shorten the service life of the engine. For example, engines continuously run at the highest possible cruise setting at maximum Turbine Inlet Temperature may require a top overhaul of cylinders before engine TBO. Operating consistently at the maximum allowable engine parameters does not promote optimum service life.

**4.27 CRUISE (4.5j) (continued)**

**NOTE**

The maximum permissible cylinder head temperature for all operations is 500°F. No matter what approved power setting is used, cylinder head temperatures should not exceed 435°F in level flight cruise. For optimum service life, cruise cylinder head temperatures should be maintained below 400°F. 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 and the pressurization system checked.

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.

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4.27 CRUISE (4.5j) (continued)

The emergency (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 selector should be changed to another tank before fuel is exhausted from the tank in use.

**NOTE**

The BOOST PUMP annunciator will momentarily illuminate when switching fuel tanks.

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 emergency (EMERG) fuel pump 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 annunciator. 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 emergency (EMERG) fuel pump switched to the ON position. If excessive fuel vapor is suspected, usually indicated by fluctuating fuel flow, turn the emergency (EMERG) fuel pump 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. **Even aircraft equipped with a complete deicing option are 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 RPM adjustments. The primary 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 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. while maintaining cabin pressurization. At reduced power maintain at least 1350F 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 up to 165 KIAS and the aircraft operated at speeds up to 195 KIAS with the gear extended. This procedure will significantly increase rate of descent.

Shortly after letdown is initiated, set the Cabin Altitude Controller to 500 feet above the pressure altitude of the landing field. Adjust the rate control high enough to allow the cabin to descend to the landing setting before the aircraft descends to that altitude. For normal let down the rate knob should be at the nine o'clock position. A higher setting should be selected for rapid descents so that the aircraft altitude does not catch up with cabin altitude.

**4.31 BEFORE LANDING (4.5m)**

**4.31a Approach Check (4.5m)**

Set the altimeter and standby altimeter. Verify that the cabin pressurization is set.

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 emergency (EMERG) fuel pump should be ON.

The fuel selector should be on the fullest tank. The mixture should be RICH and propeller control should be set. When 165 KIAS or less is attained, lower the landing gear and set the flaps to 10°.

**NOTE**

During landing gear operation, it is normal for the HYDRAULIC PUMP annunciator light to illuminate until full system pressure is restored.

Set the rudder trim to neutral in preparation for landing. The air conditioner 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. Utilize TAS as required.

### 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 propeller control should be at full INCREASE, and the throttle should be advanced to full power while the pitch attitude is increased to obtain the balked 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 conditioner as desired. Turn OFF the radar and the emergency (EMERG) fuel pump. Turn OFF the ice protection equipment and the weather radar. Select transponder mode as required. Turn OFF the strobe lights and use the landing/taxi lights as required.

#### **4.39 STOPPING ENGINE (4.5q)**

##### **Stopping Engine (4.5q)**

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

The air conditioner should be turned OFF, the propeller control set in the full INCREASE position, and the throttle should be CLOSED 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 turbocharger oil system. Stop the engine by pulling the mixture control back to idle cut-off. After the engine stops, both magneto switches, both alternator switches, the battery master switch, and the standby attitude indicator must be turned OFF.

#### **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 parking 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 Mirage 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 battery and alternator switches OFF.

During preflight, the stall warning system should be checked by turning the battery switch on and pressing the stall warning 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 maneuvering speed to reduce the structural loads caused by gusts and to allow for inadvertent speed build-ups which may occur as a result of the turbulence or of distractions caused by the conditions. (Refer to paragraph 2.3 for maneuvering speeds.)

#### 4.47 CABIN PRESSURIZATION SYSTEM

Cabin pressurization system controls, gauges and switches are located on the lower section of the pilot's instrument panel, lower copilot's instrument panel, and overhead switch panel. (Refer to Section 7, Figures 7-19 and 7-23.)

The cabin pressurization system controls, gauges and switches are as follows:

- (a) Cabin Altitude Controller with Rate of Change Control
- (b) Cabin Pressure Altitude/Differential Pressure/Rate of Climb Gauge
- (c) Cabin Pressure Dump/Normal Switch
- (d) Cabin Pressurization Control

Prior to starting engine, check the operation of the cabin pressurization control. Note that a firm effort is required to move the lever out of either the outside air or the pressurized air position. If little effort is required to move the lever, be suspicious of a broken control cable. If a cable is broken, the air control valve may have failed in either the open or closed position. If failed open, pressurized flight will not be possible, but unpressurized flight will be possible. If failed closed, pressurized flight would be possible but should not be attempted, as it would not be possible to bring in fresh air should contamination occur.

Set *cabin* altitude (outer scale) on the cabin altitude controller to 500 feet above the field pressure altitude before takeoff. (Cabin pressurization will begin as the cabin passes through the altitude selected.) If no further adjustments are made, cabin altitude will remain at the selected altitude until maximum cabin differential (5.5 PSI) is reached, at which time the cabin altitude will begin to climb until at 25,000 feet aircraft pressure altitude the cabin pressure altitude will be approximately 8000 feet.

For flight below an airplane altitude of 12,500 feet, the cabin altitude control should be left at the takeoff setting. For flight above 12,500 feet, at which point maximum differential will be achieved, smoother operation will result by setting the *cabin* altitude (outer scale) on the cabin altitude controller to 500 feet above field elevation for takeoff. Once the cabin has begun to pressurize and the controller has captured isobaric control, reset the *aircraft* altitude (inner scale) on the cabin altitude controller to 500 feet above the cruise altitude and adjust the cabin rate of climb as desired. The normal 9 o'clock position should provide a cabin rate of climb of approximately 500 feet per minute. No additional adjustment should be required prior to descent unless cruise altitude is changed, at which point the *aircraft* altitude (inner scale) should be reset to 500 feet above the new cruise altitude.

**4.47 CABIN PRESSURIZATION SYSTEM (continued)**

To descend for landing be certain that the selected *cabin* altitude (outer scale) is higher than the pressure altitude of the landing field. Shortly after letdown is initiated, set the *cabin* altitude (outer scale) to 500 feet above the pressure altitude of the landing field and adjust the rate of control high enough to allow the cabin to descend to the landing setting before the aircraft descends to that altitude. For normal letdown the rate knob should be at the normal 9 o'clock position. A higher setting should be selected for rapid descents so that the aircraft altitude does not catch up with the cabin altitude.

**WARNING**

Do not land with aircraft pressurized.

To repressurize while in flight, push the pressurization control in and set the cabin pressure dump/normal switch to NORM.

**4.49 SUPPLEMENTAL ELECTRIC HEATER**

**AFTER ENGINE START**

BATT MASTER Switch .....	ON
Alternator Switches .....	OFF
VENT DEFOG Switch .....	ON
Airflow .....	CHECK
Voltmeter .....	LESS than 25 Vdc (increase electrical load as necessary to lower voltage)
LOW BUS VOLTAGE Annunciator .....	ILLUMINATED
Electrical Switches .....	OFF
VENT DEFOG Switch .....	OFF
Alternator Switches .....	ON

**NOTE**

Low voltage monitor system and LOW BUS VOLTAGE annunciator must be checked operational before heater operation. VENT/DEFOG BLOWER must be checked operational before heater ground operation.

**HEATER OPERATION**

VENT DEFOG Switch.....	ON
AUX CBN HEAT Switch .....	ON

**For maximum heat:**

AIR COND Switch .....	OFF
CABIN TEMP Control. ....	FULL OUT
DEFROST Control .....	AS REQUIRED to CLEAR WINDSHIELD; then FULL IN

**NOTE**

This unit should be considered primarily as an auxiliary backup to the standard heating system. There is no external control over the heat produced by the unit.

**4.51 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-13YR-1E/7890K	79.7 dB(A) (amdt. 16)	81.3 dB(A)
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.

### **4.53 ICING INFORMATION**

#### **THE FOLLOWING WEATHER CONDITIONS MAY BE CONDUCTIVE TO SEVERE IN-FLIGHT ICING**

Visible rain at temperatures below 0 degrees Celsius ambient air temperature.

Droplets that splash or splatter on impact at temperature below 0 degrees Celsius 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 degrees Celsius, increased vigilance is warranted at temperatures around freezing with visible moisture present. If the visual cues specified in the Limitations Section of the AFM for identifying severe icing conditions 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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SECTION 5  
PERFORMANCE

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## SECTION 5 PERFORMANCE

### 5.1 GENERAL

All of the required (FAA regulations) and complementary 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 3.

### 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 5-15, 5-17, 5-19 and 5-21) 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 5-21

\*\*reference Figure 5-45

## 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 5-27). 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 5-27). 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 5-27

**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 5-39). 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 5-39). 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                               |                      |
| (8.9 gal. minus 0.5 gal.)                         | 8.4 gal.*            |
| (2) Time to Descend                               |                      |
| (25.1 min. minus 1.4 min.)                        | 23.7 min.*           |
| (3) Distance to Descend                           |                      |
| (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 5-28) 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 Vs. Altitude graph (Figure 5-33).

\*reference Figure 5-39

**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 5-28).

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 5-33 and Page 5-28

**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

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**CONVERSION TABLE**

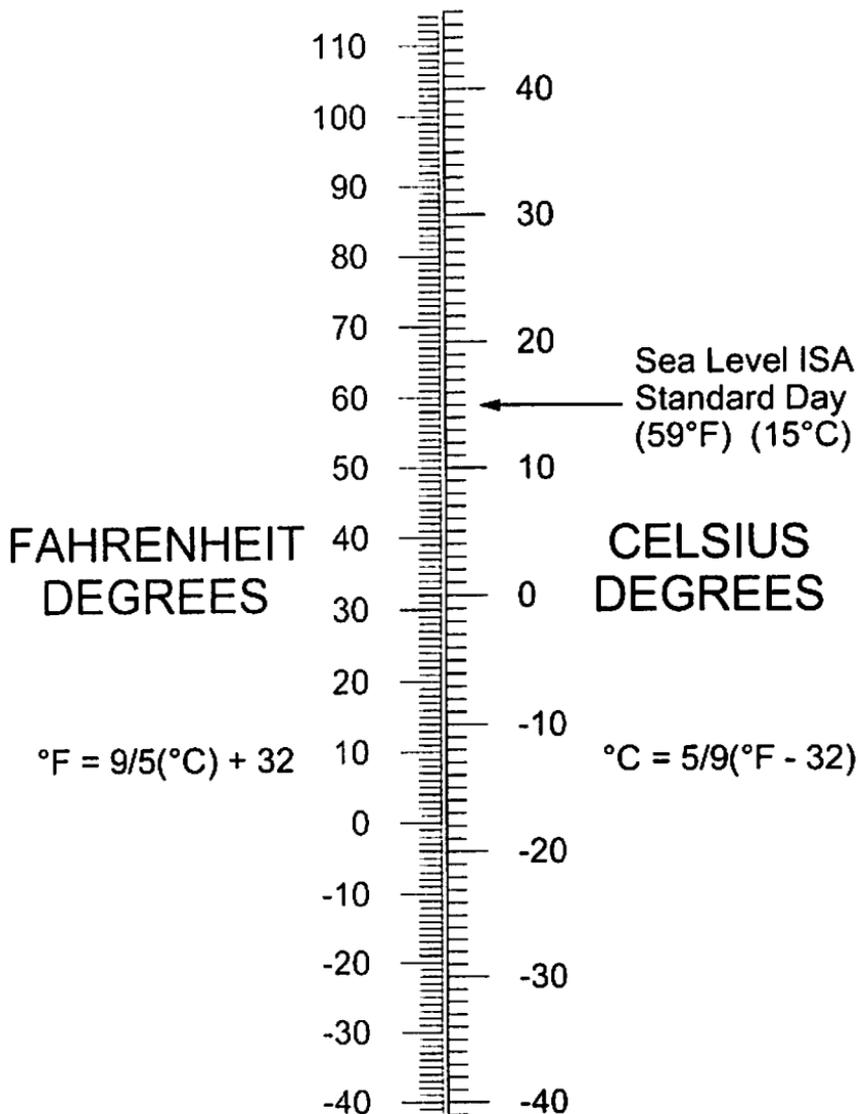
<b>MULTIPLY</b>	<b>BY</b>	<b>TO OBTAIN</b>
Feet	0.3048	Meters
Meters	3.2808	Feet
Gallons	3.7854	Liters
Liters	0.2642	Gallons
Pounds	0.4536	Kilograms
Kilograms	2.2046	Pounds
Inches of Mercury	33.8639	Millibars
Millibars	0.02953	Inches of Mercury

Example: 50 feet =  $50 \times 0.3048$  meters = 15.24 meters

100 liters =  $100 \times 0.2642$  gallons = 26.42 gallons

**CONVERSION TABLE**

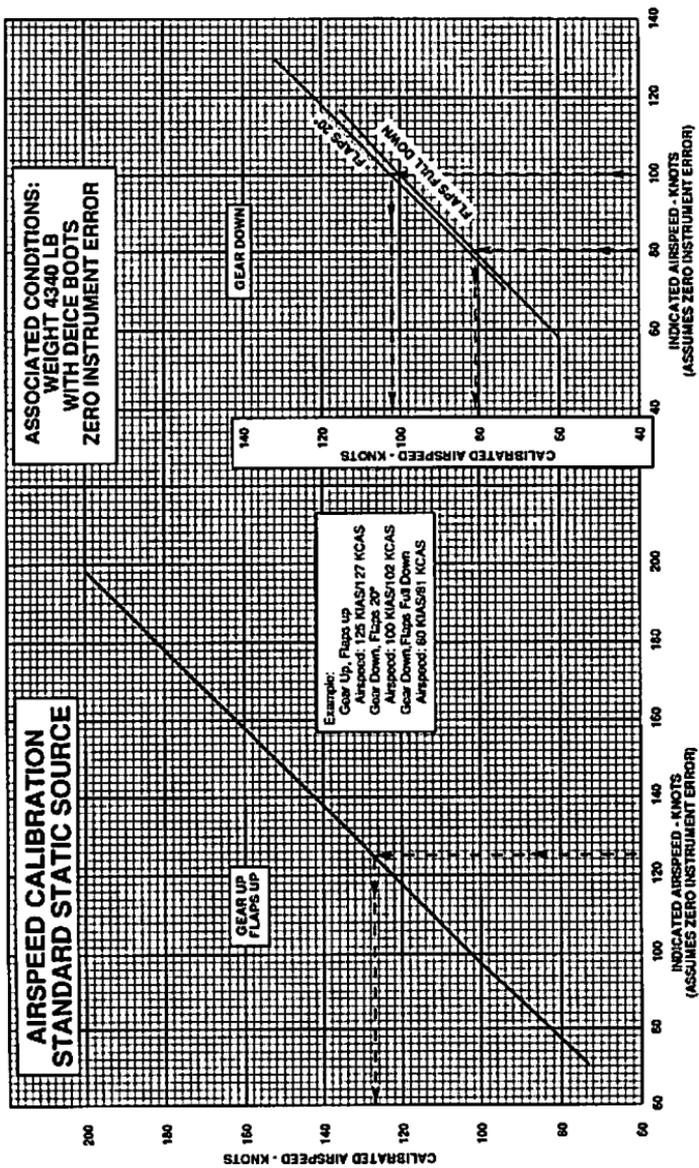
Figure 5-1



TEMPERATURE CONVERSION

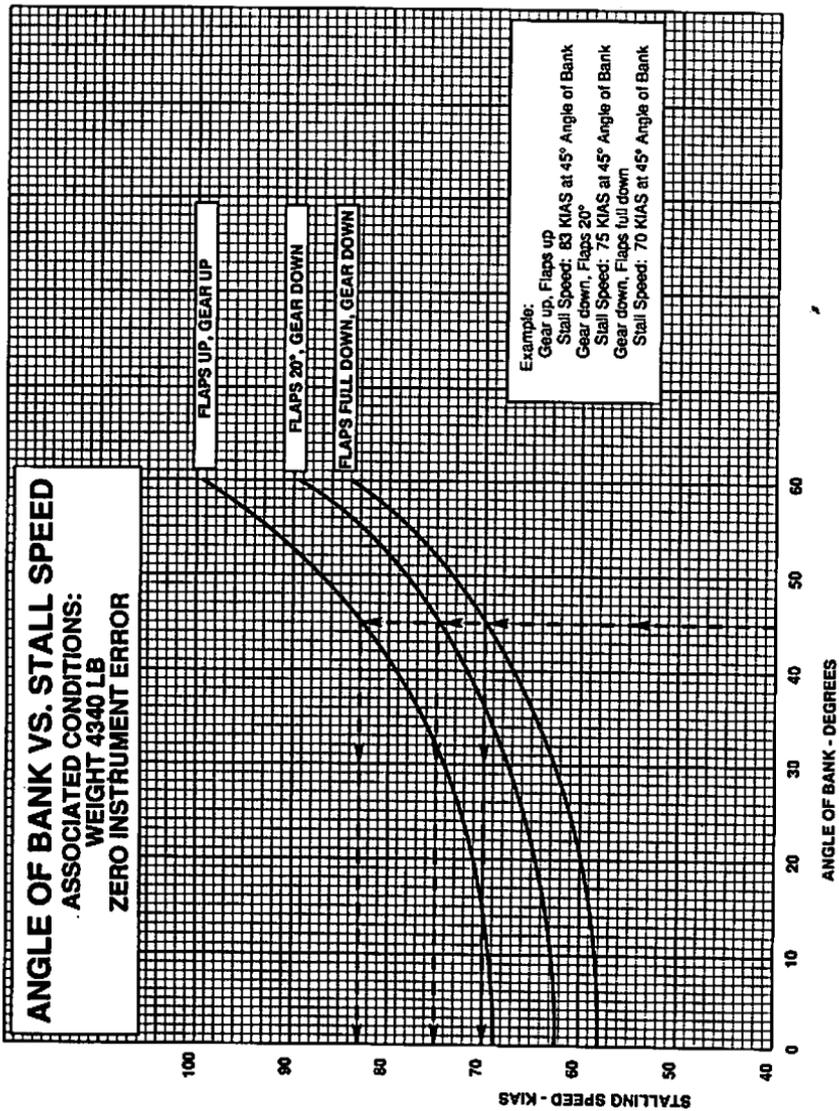
Figure 5-3

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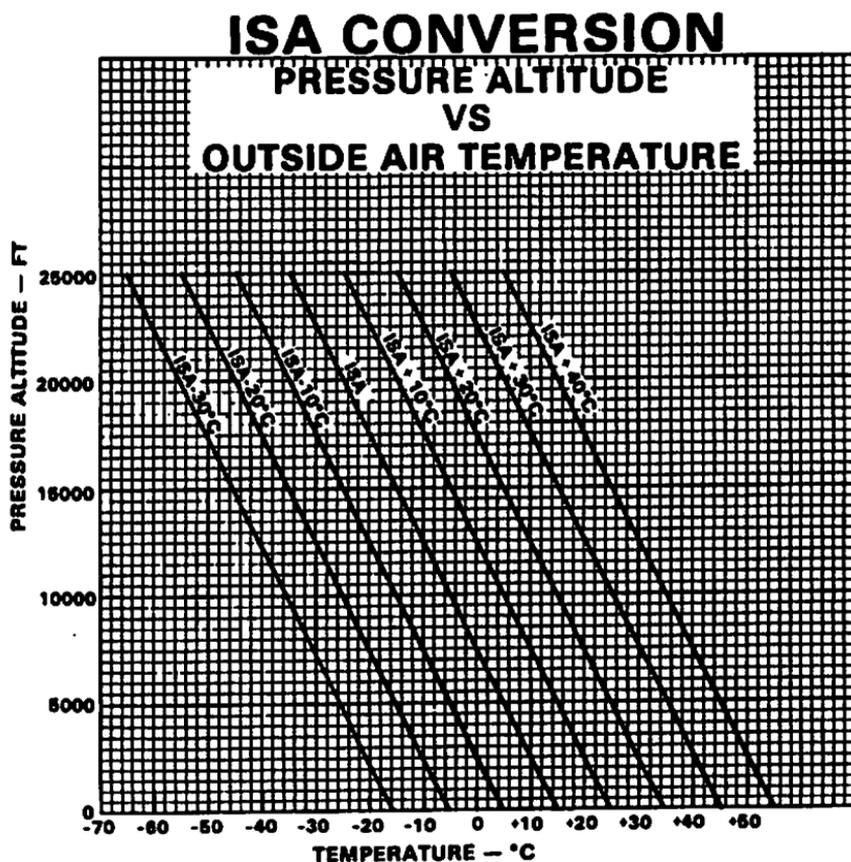
**AIRSPEED CALIBRATION**

Figure 5-5



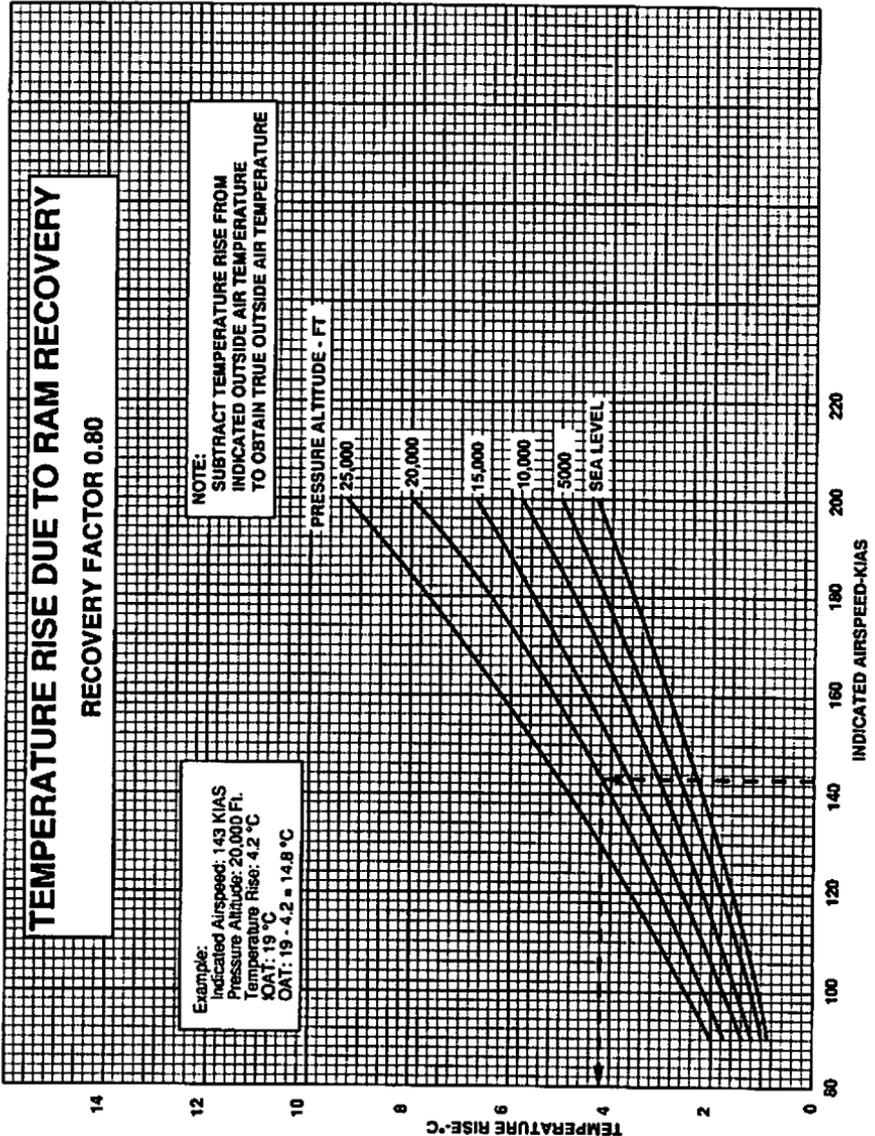
ANGLE OF BANK vs. STALL SPEED

Figure 5-7



PRESSURE ALTITUDE vs. OUTSIDE AIR TEMPERATURE

Figure 5-9



TEMPERATURE RISE DUE TO RAM RECOVERY

Figure 5-11

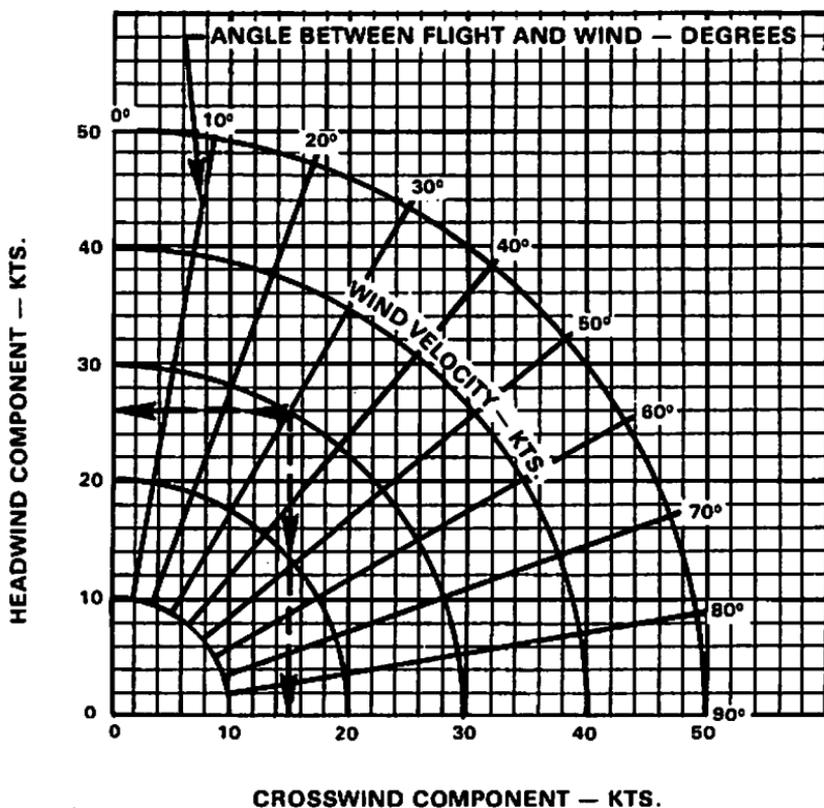
Example:

Wind velocity: 30 knots

Angle between flight path and wind: 30°

Headwind component: 26 knots

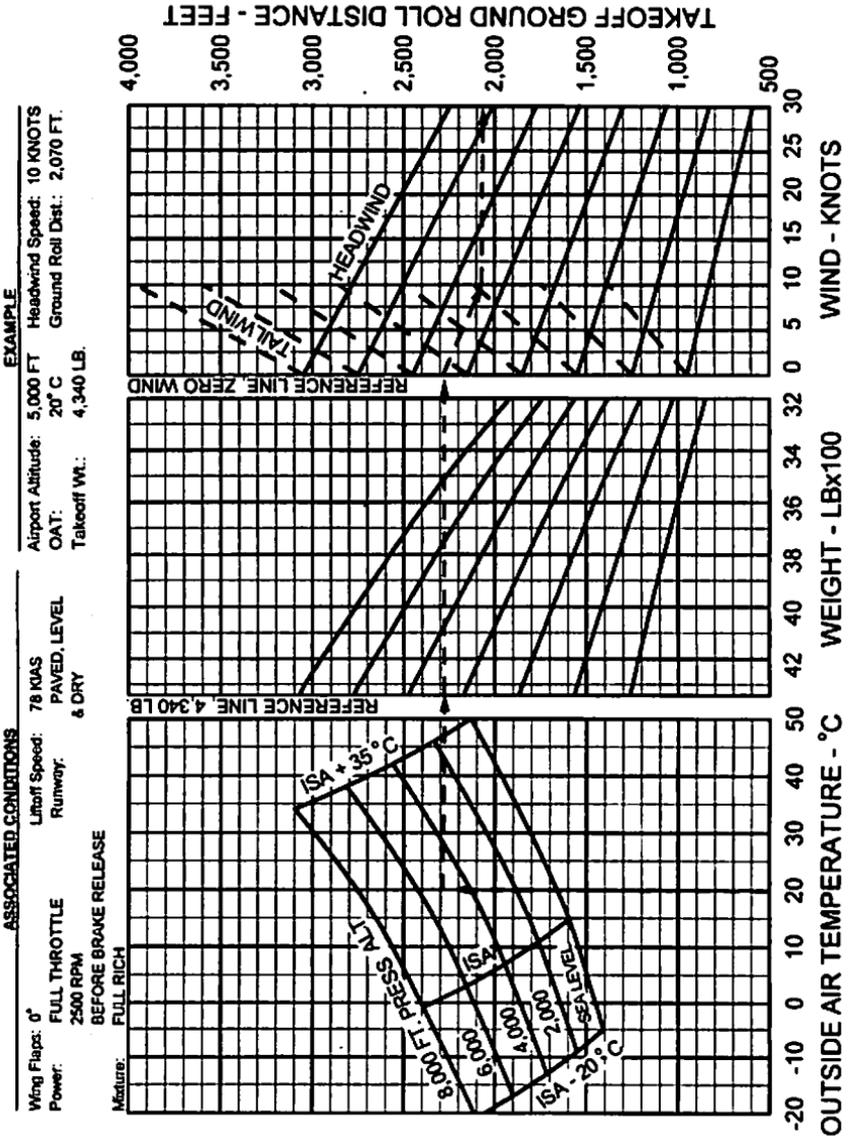
Crosswind components: 15 knots



WIND COMPONENTS

Figure 5-13

**TAKEOFF GROUND ROLL DISTANCE - 0° FLAPS**

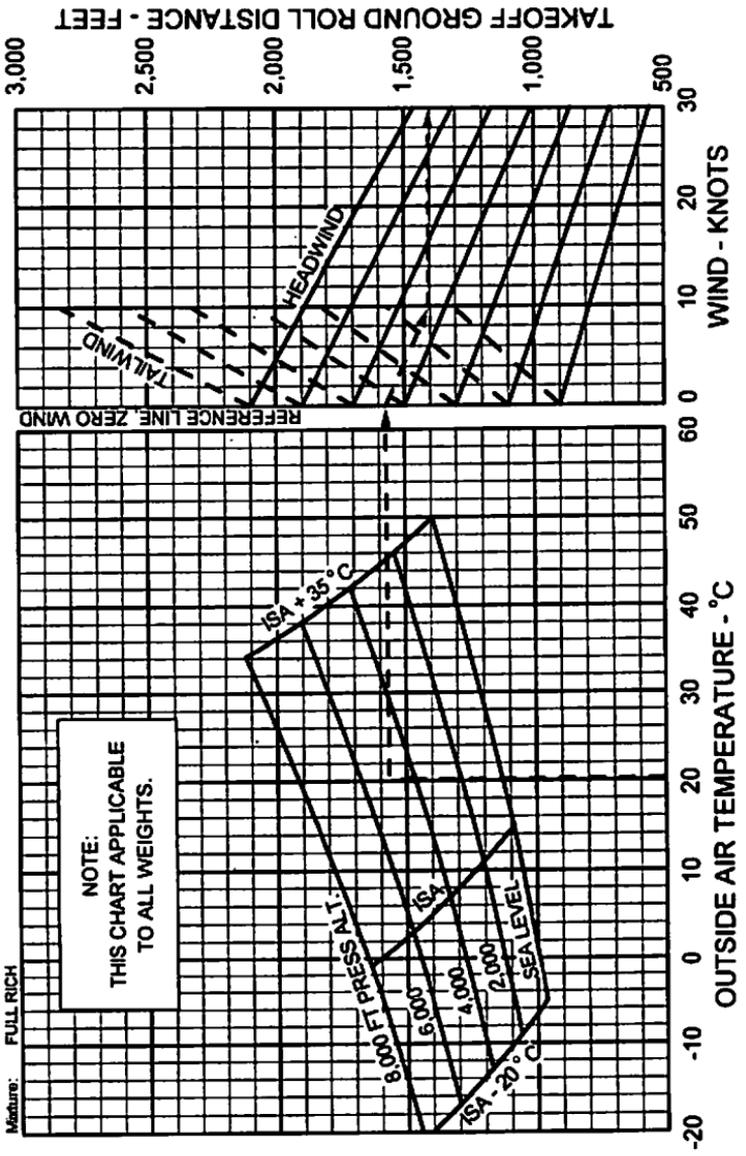


TAKEOFF GROUND ROLL, 0° FLAPS

Figure 5-15

**TAKEOFF GROUND ROLL DISTANCE - 20° FLAPS**

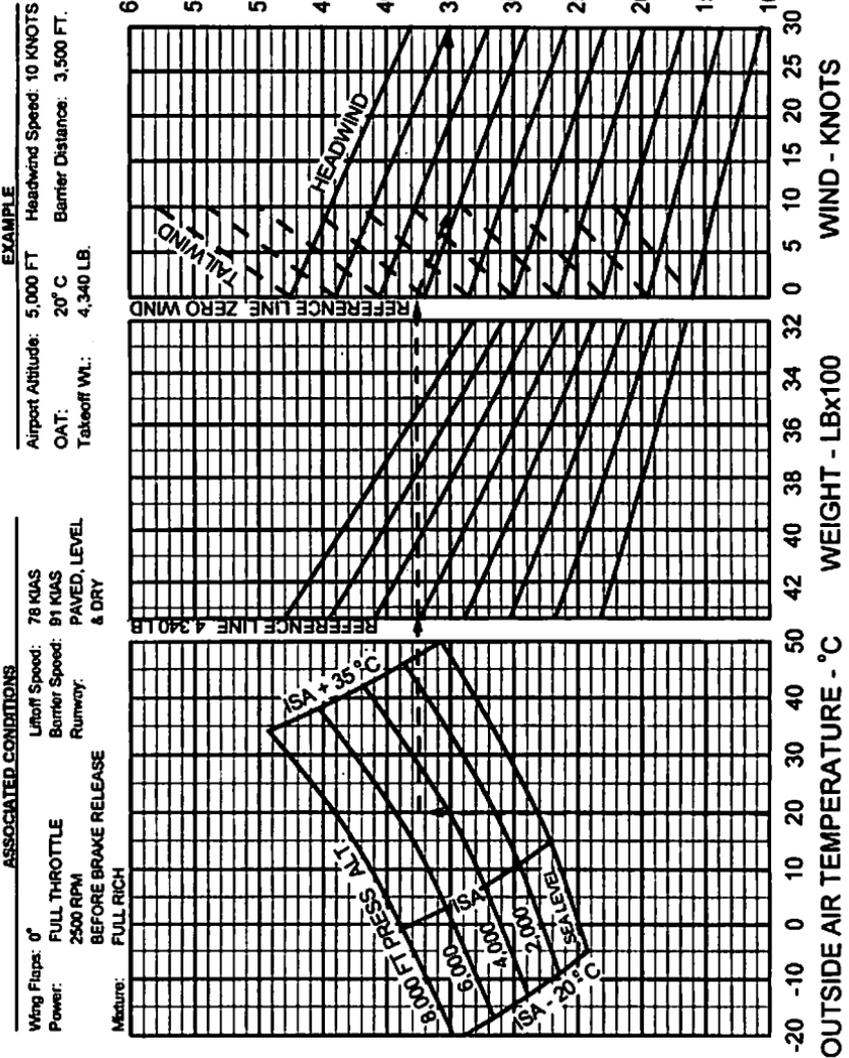
**ASSOCIATED CONDITIONS**  
 Wing Flaps: 20° FULL THROTTLE BEFORE BRAKE RELEASE  
 Power: 2,500 RPM FULL RICH  
 Liftoff Speed: 68 KIAS  
 Runway: PAVED, LEVEL & DRY  
 Airport Altitude: 5,000 FT  
 Headwind Speed: 10 KNOTS  
 OAT: 20° C  
 Takeoff Ground Roll Dist.: 1,406 FT.  
 Takeoff Wt.: ALL



**TAKEOFF GROUND ROLL, 20° FLAPS**

Figure 5-17

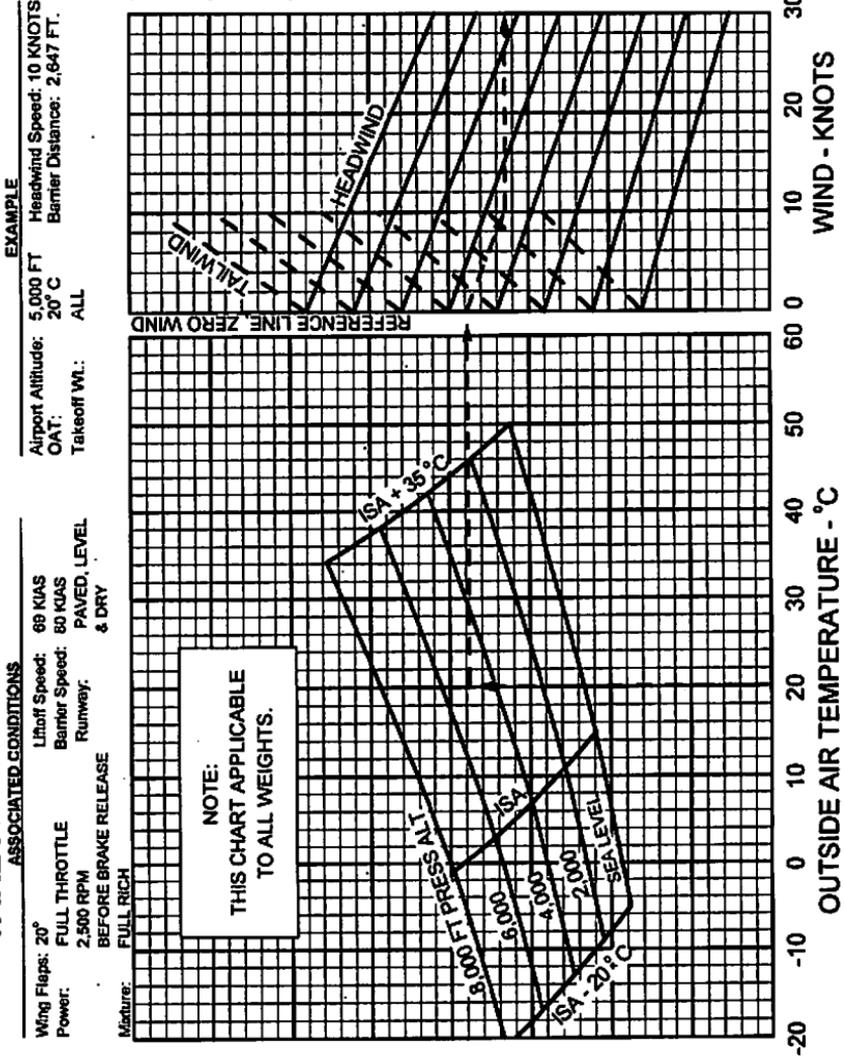
**TAKEOFF DISTANCE OVER 50 FT OBSTACLE - 0° FLAPS**



TAKEOFF DISTANCE OVER 50 FT. OBSTACLE, 0° FLAPS

Figure 5-19

**TAKEOFF DISTANCE OVER 50 FT OBSTACLE - 20° FLAPS**



TAKEOFF DISTANCE OVER 50 FT. OBSTACLE, 20° FLAPS

Figure 5-21

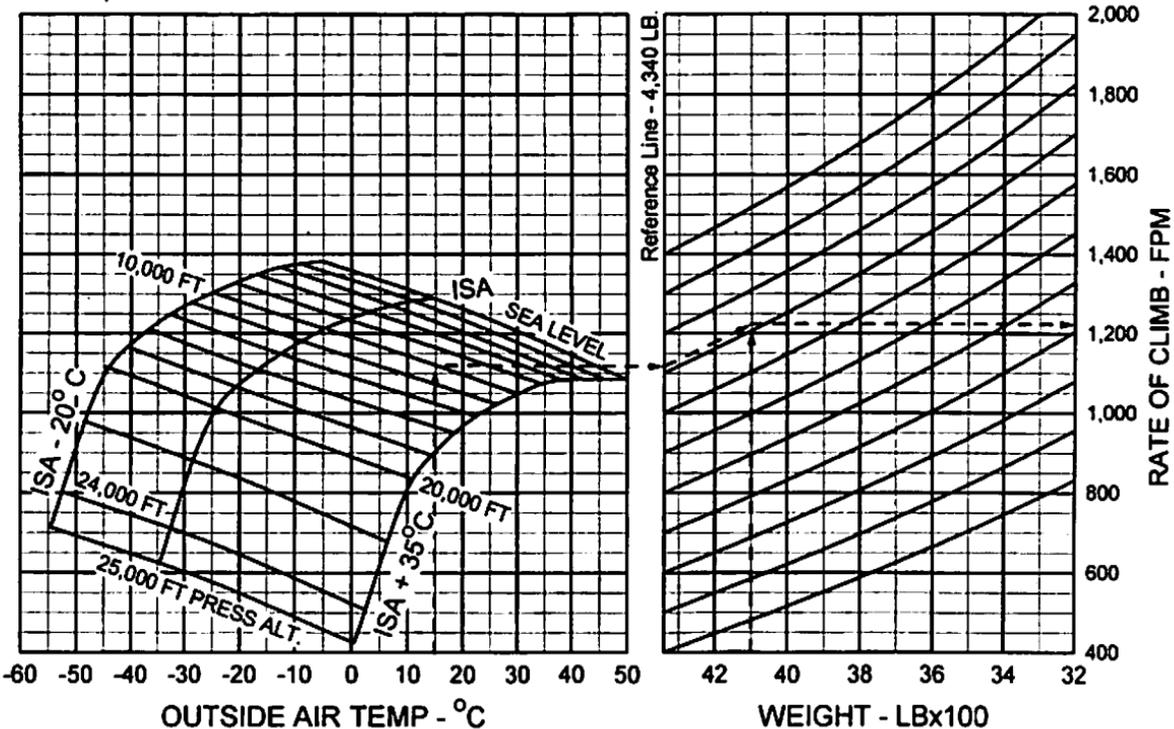
# MAXIMUM CLIMB PERFORMANCE

**ASSOCIATED CONDITIONS**

Gear: UP Power: FULL THROTTLE  
 Flaps: 0° 2,500 RPM  
 Climb Speed: 110 KIAS

**EXAMPLE**

Press. Alt.: 10,000 FT Weight: 4,100 LB  
 OAT: 15° C ROC: 1,223 FPM



RATE OF CLIMB

Figure 5-23

**TIME, FUEL, DISTANCE TO MAX CLIMB**

**ASSOCIATED CONDITIONS**

Gross Weight: 4340 LB  
Landing Gear: UP  
Flaps: UP  
Climb Speed: 110 KIAS

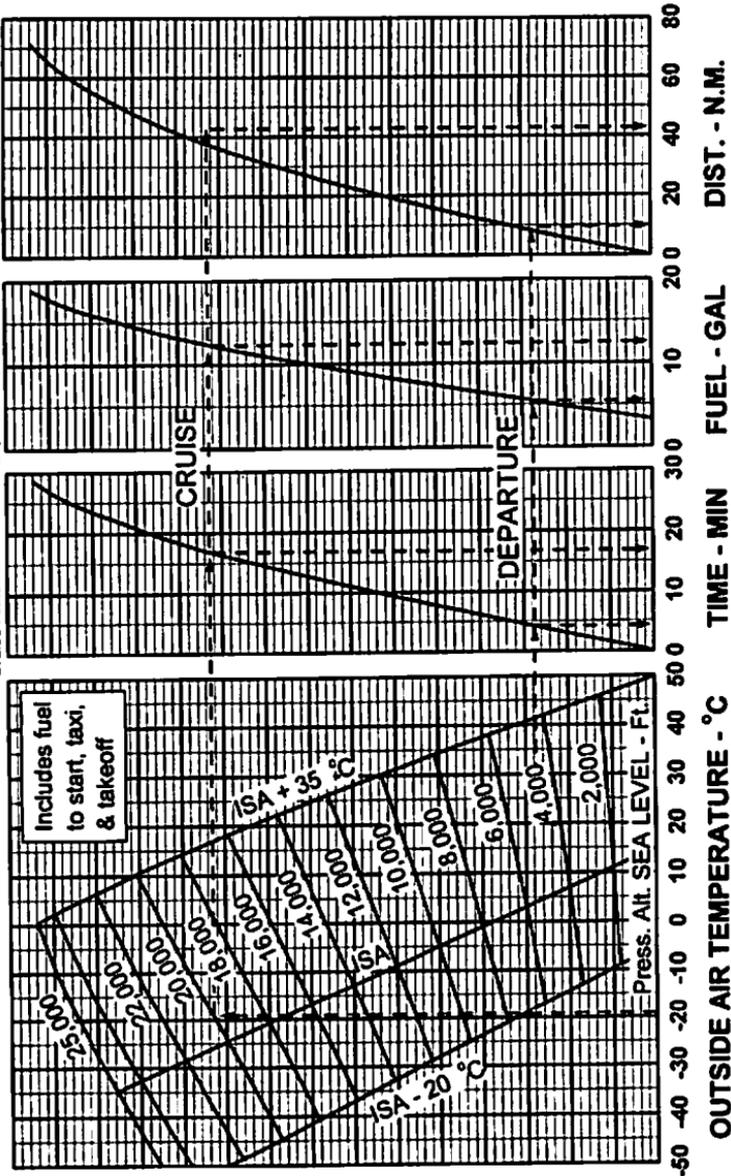
Power: 2,500 RPM  
42 IN. HG. OR  
FULL THROTTLE

Mixture: FULL RICH

**EXAMPLE**

Departure Airport O.A.T.: 20 °C  
Departure Airport Altitude: 5,000 FT.  
Cruise O.A.T.: -19 °C  
Cruise Altitude: 20,000 FT.

Time to Climb: 16.9 - 4.2 = 12.7 MIN  
Fuel to Climb: 12.4 - 5.4 = 7.0 GAL  
Distance to Climb: 37.5 - 8.4 = 29.1 N.M.



**MAXIMUM CONTINUOUS POWER  
TIME, FUEL, AND DISTANCE TO CLIMB (110 KIAS)**

Figure 5-25

**TIME, FUEL, DISTANCE TO CLIMB**

**ASSOCIATED CONDITIONS**

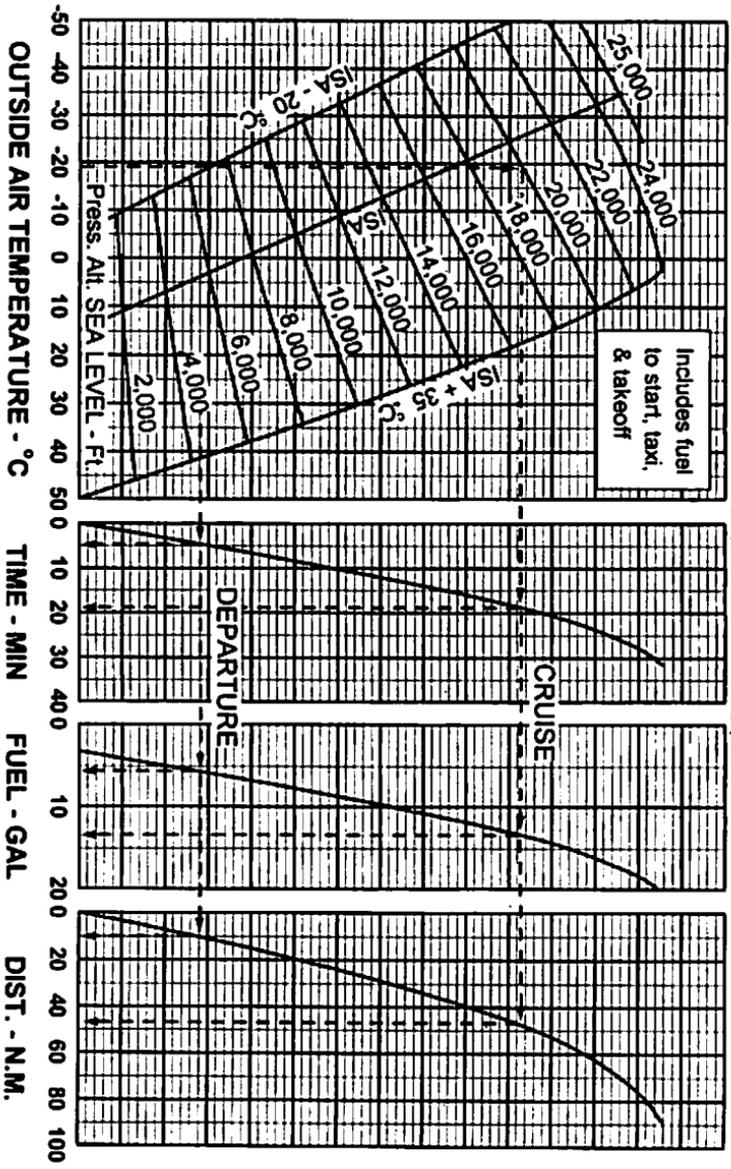
Gross Weight: 4,340 LB    Power: 2,500 RPM  
 Landing Gear: UP    42 IN. HG. OR  
 Flaps: UP    FULL THROTTLE  
 Climb Speed: 125 KIAS    Mixture: FULL RICH

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 5-27



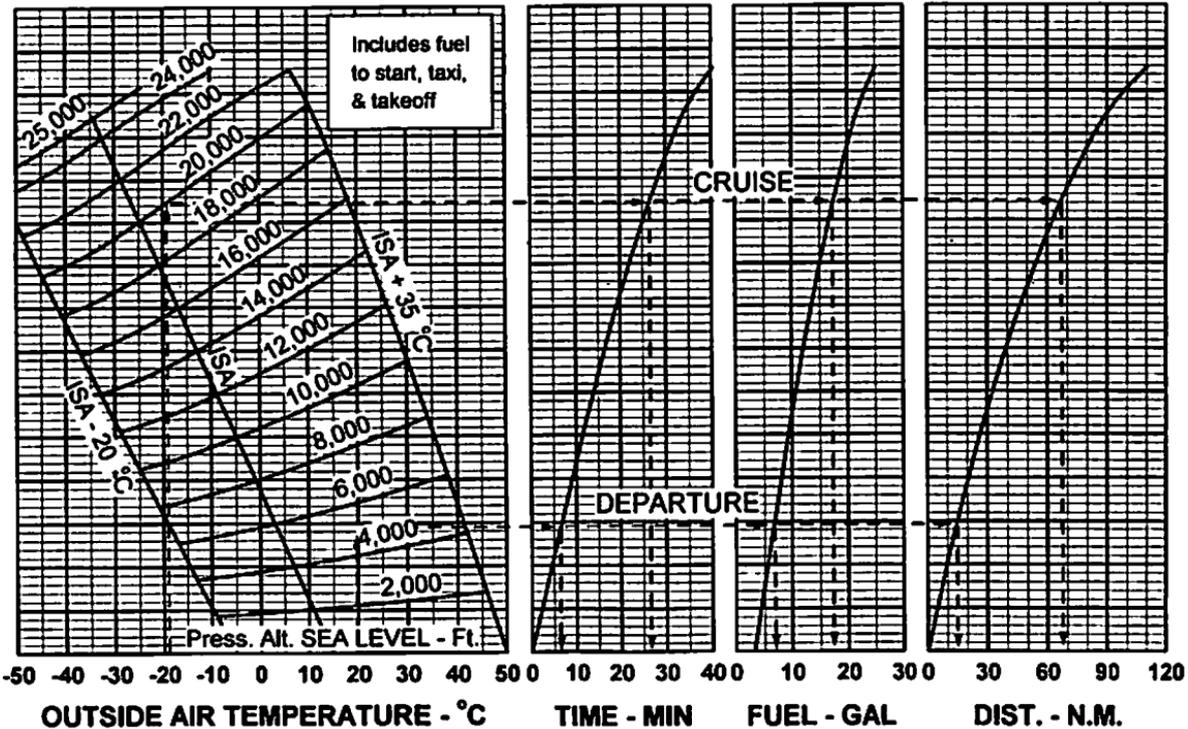
# TIME, FUEL, DISTANCE TO CRUISE CLIMB

**ASSOCIATED CONDITIONS**

Gross Weight: 4,340 LB    Power: 2,500 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.



CRUISE CLIMB  
TIME, FUEL, AND DISTANCE TO CLIMB

Figure 5-29



**POWER SETTING TABLE  
REFERENCE FIG. 5-33**

**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:**

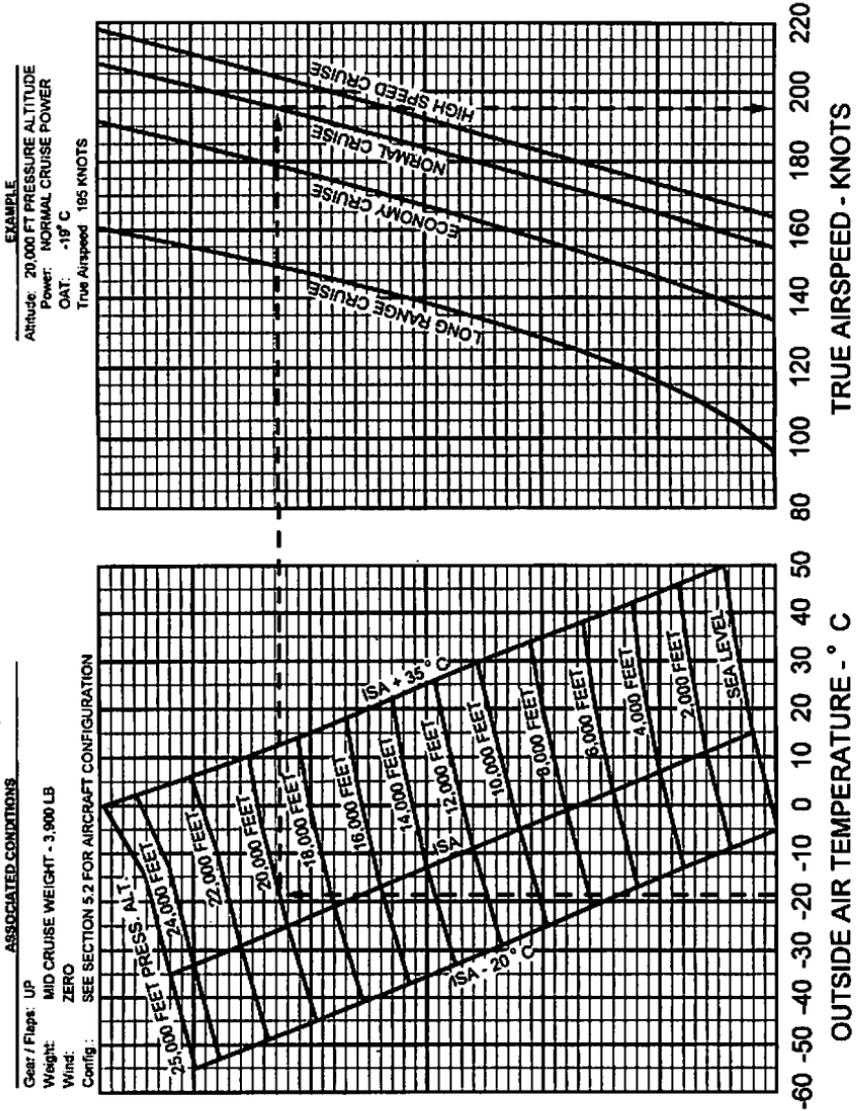
- Cruise altitude: 20,000 ft
- Cruise OAT: -19° C
- Cruise power: Normal cruise
- Cruise weight: 3900 lb
- Cruise fuel flow: 18 gph
- Cruise speed: 195 KTAS

**NOTE**

For maximum engine life follow temperature recommendations in 4.25 and 4.27. If operating at higher fuel flows to reduce engine temperatures, range and associated cruise performance will be reduced.

\*Reference Figure 5-33

**CRUISE SPEED VS. ALTITUDE**



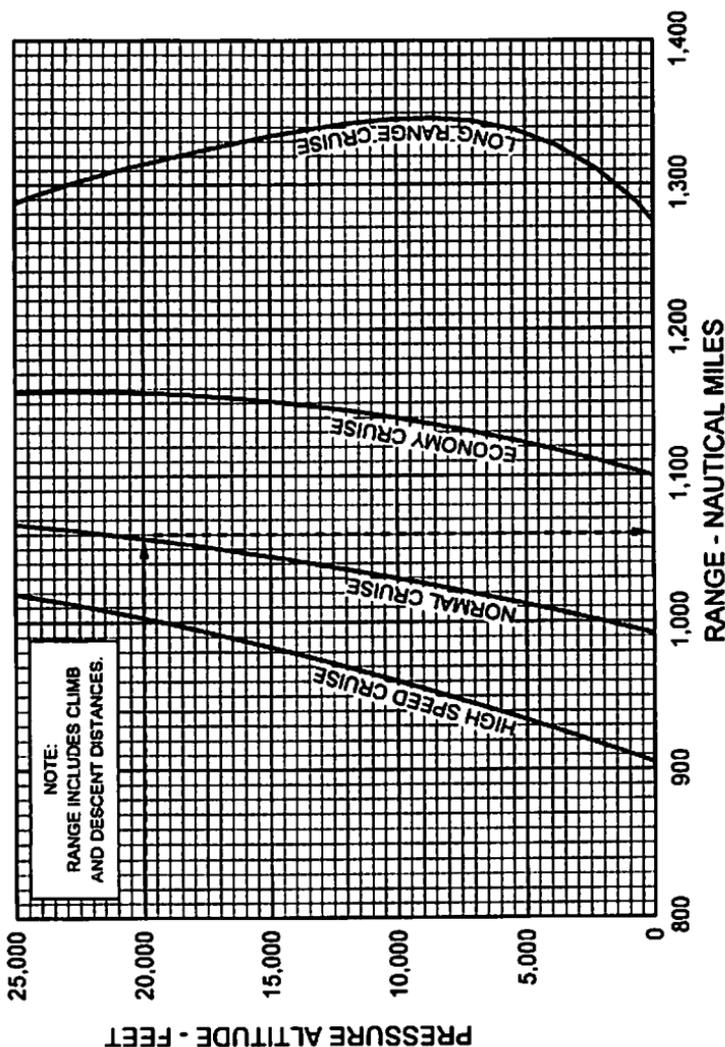
**ISA RANGE**

**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: 1060 NAUTICAL MILES



**ISA RANGE**  
 Figure 5-35

ISA ENDURANCE

ASSOCIATED CONDITIONS:

Gear / Flaps: UP

Reserve: 45 MIN AT LONG RANGE CRUISE POWER

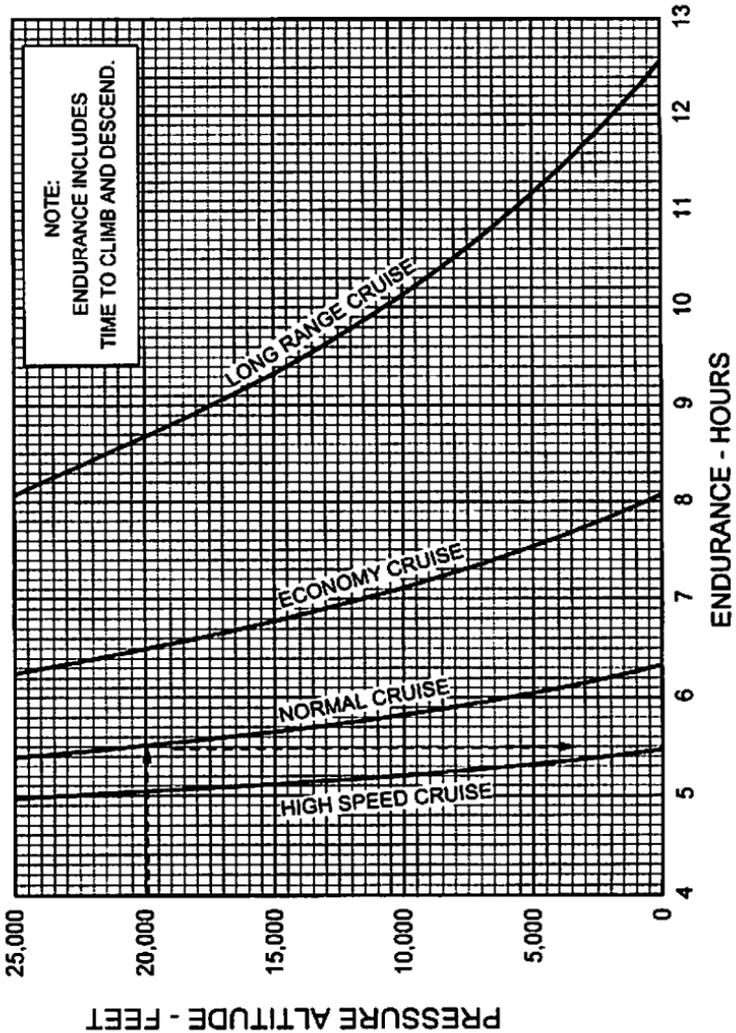
Usable Fuel: 120 GALLONS

EXAMPLE:

Power Setting: NORMAL CRUISE

Cruise: 20,000 FT PRESSURE ALTITUDE

Endurance: 5.5 HOURS



ISA ENDURANCE

Figure 5-37

**TIME, FUEL, DISTANCE TO DESCEND**

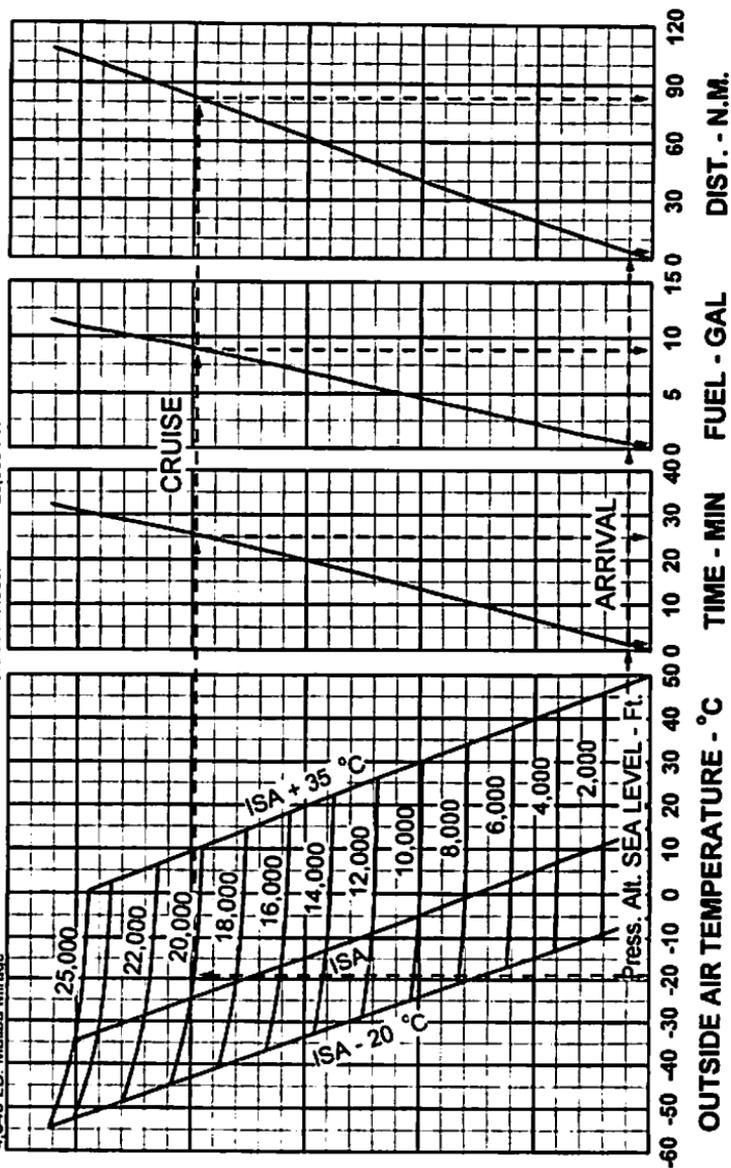
**ASSOCIATED CONDITIONS**

Landing Gear: UP Power: 2,400 RPM  
 Flaps: UP 25 IN. HG.  
 Descend Speed: 165 KIAS 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.: -18 °C Distance to Descend: 82.4 · 3.6 = 78.8 N.M.  
 Cruise Altitude: 20,000 FT.



FUEL, TIME, AND DISTANCE TO DESCEND

Figure 5-39

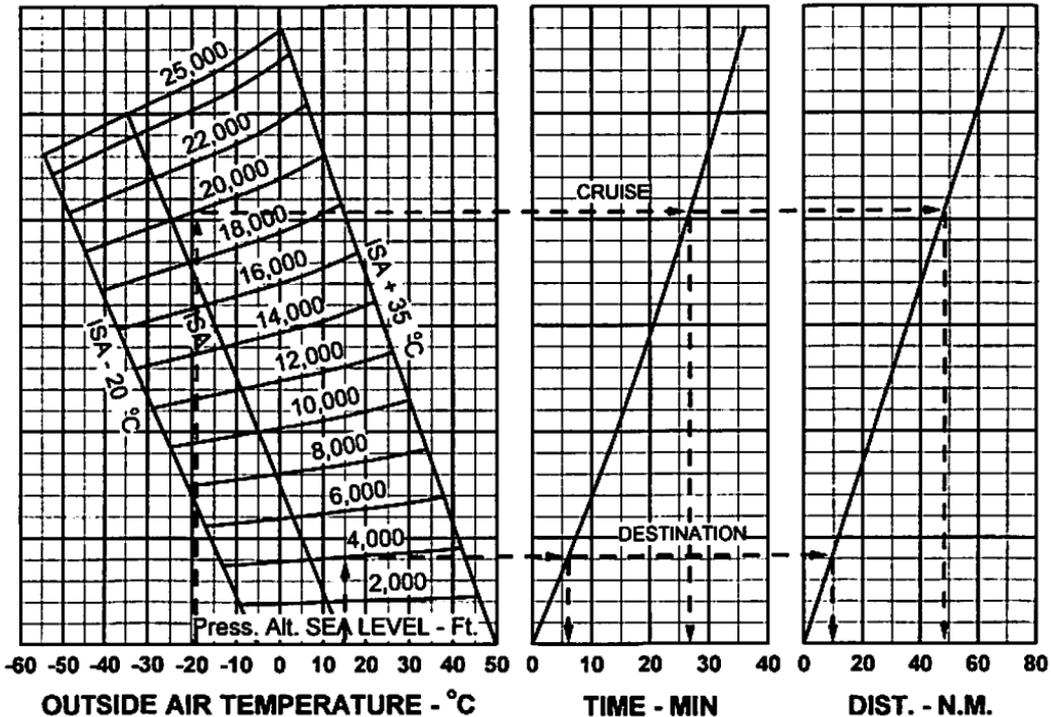
## GLIDE TIME, &amp; DISTANCE

## ASSOCIATED CONDITIONS

Landing Gear: UP Prop Control: FULL AFT  
 Flaps: UP Glide Speed: 90 KIAS  
 ZERO WIND

## EXAMPLE

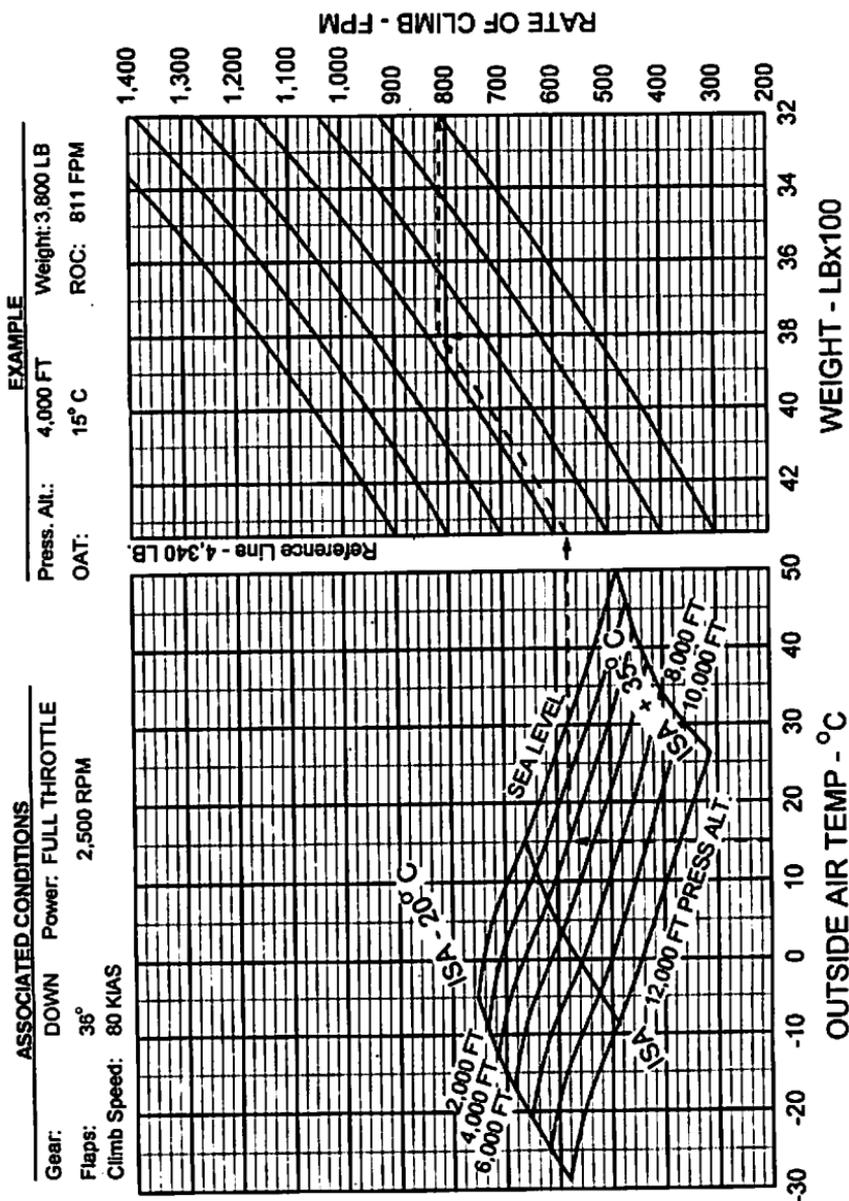
Destination OAT: 15 °C Time to Descend: 26.8 - 6.1 = 20.7 MIN  
 Destination Altitude: 4,000 FT. Distance to Descend: 48.6 - 9.7 = 38.9 N.M.  
 Cruise O.A.T.: -19 °C  
 Cruise Altitude: 20,000 FT.



## GLIDE TIME AND DISTANCE

Figure 5-41

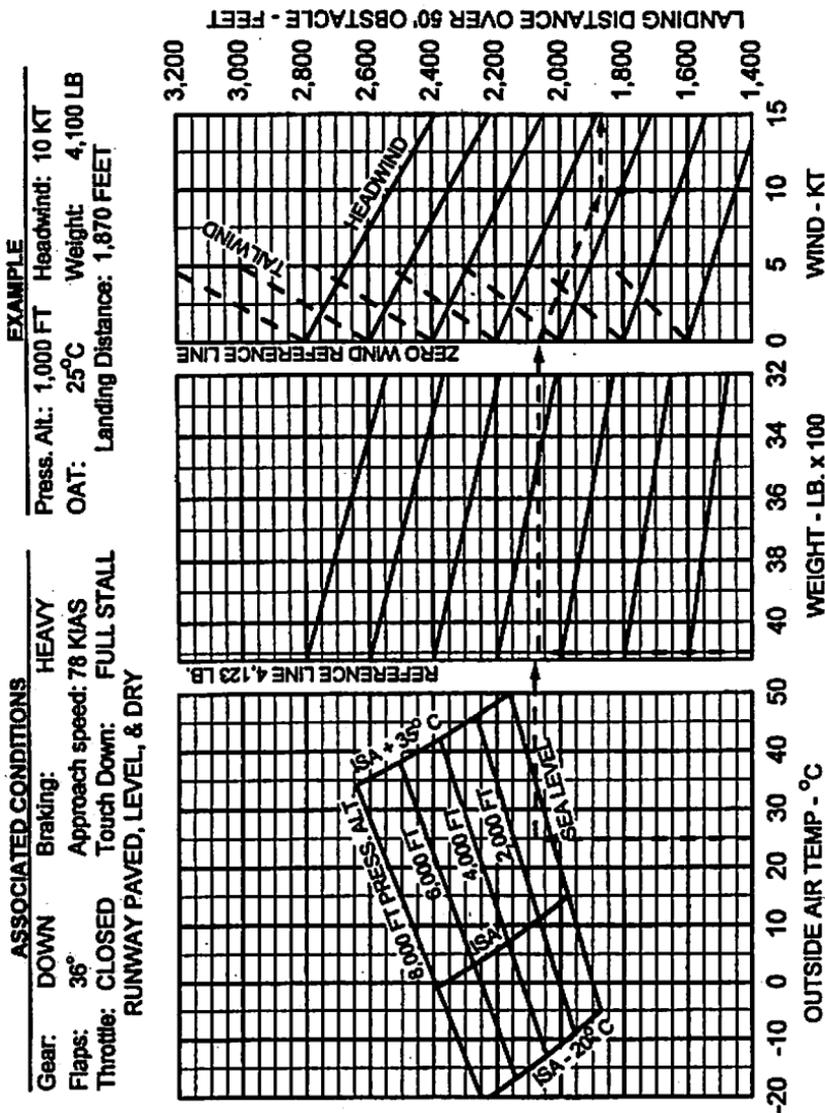
**BALKED LANDING CLIMB PERFORMANCE**



**BALKED LANDING CLIMB**

Figure 5-43

# LANDING PERFORMANCE



LANDING DISTANCE OVER 50 FT. OBSTACLE

Figure 5-45

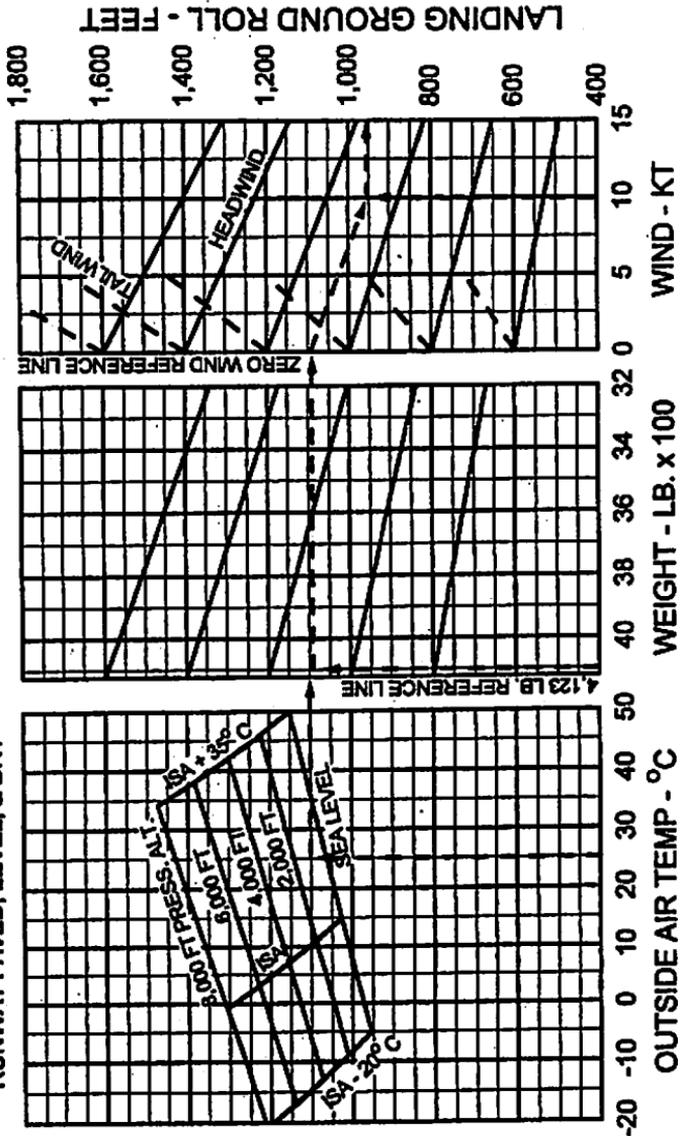
**LANDING GROUND ROLL DISTANCE**

**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 5-47

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**SECTION 7  
DESCRIPTION AND OPERATION  
OF THE AIRPLANE AND ITS SYSTEMS**

**7.1 THE AIRPLANE**

The PA-46-350P Mirage is a single engine, all metal, retractable landing gear, low wing, turbocharged airplane. It has a pressurized cabin with 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 pressurized cabin section, and the tail cone section. The cabin section is sealed to maintain pressurization.

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 and copilot windows, a storm window in the pilot's window, and three passenger windows on each side.

The forward baggage compartment is unpressurized and has a locking door on the left side, forward of the wing.

### **7.3 THE AIRFRAME (continued)**

The wing is in effect 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.

Tiedown rings are installed on the bottom of each wing outboard of the main landing gear. The rings, which pivot about their forward edge, 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.

Various access panels on the fuselage, wings and empennage are removable for service or 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 Mirage 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, a belt-driven air conditioner compressor, an oil filter, and an air/oil separator in the crankcase breather system.

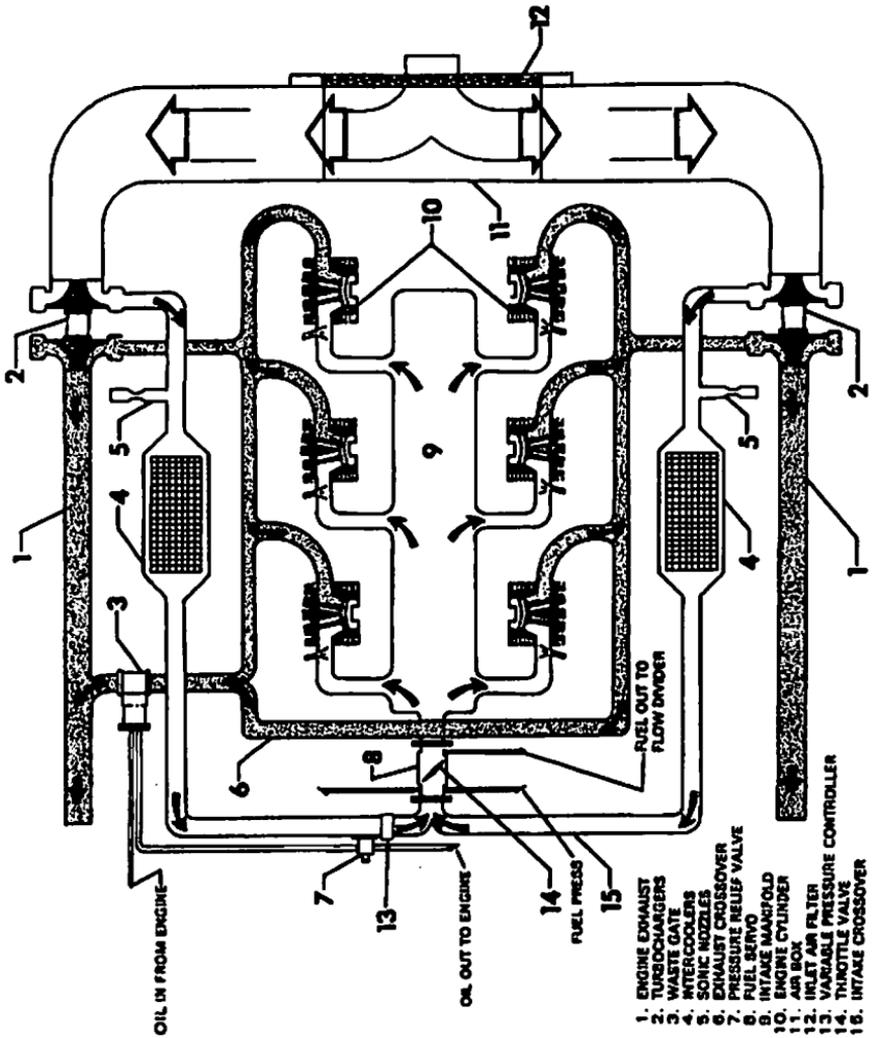
Turbocharging (Figure 7-1) is accomplished by two Garrett - A.I.D. turbo-compressors, one located on each side of the engine. Turbochargers extract energy from engine cylinder exhaust gases and use this energy to compress engine induction air. This allows the engine to maintain rated manifold pressure 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 waste gate valve. The waste gate 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 waste gate 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)



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). Turbocharger compressors supply air for cabin pressurization and power reduction below that recommended could cause a decrease in cabin pressure. Sudden cooling or gradual extreme cooling of engine cylinders will accelerate engine wear. Follow normal descent procedures described in Section 4.

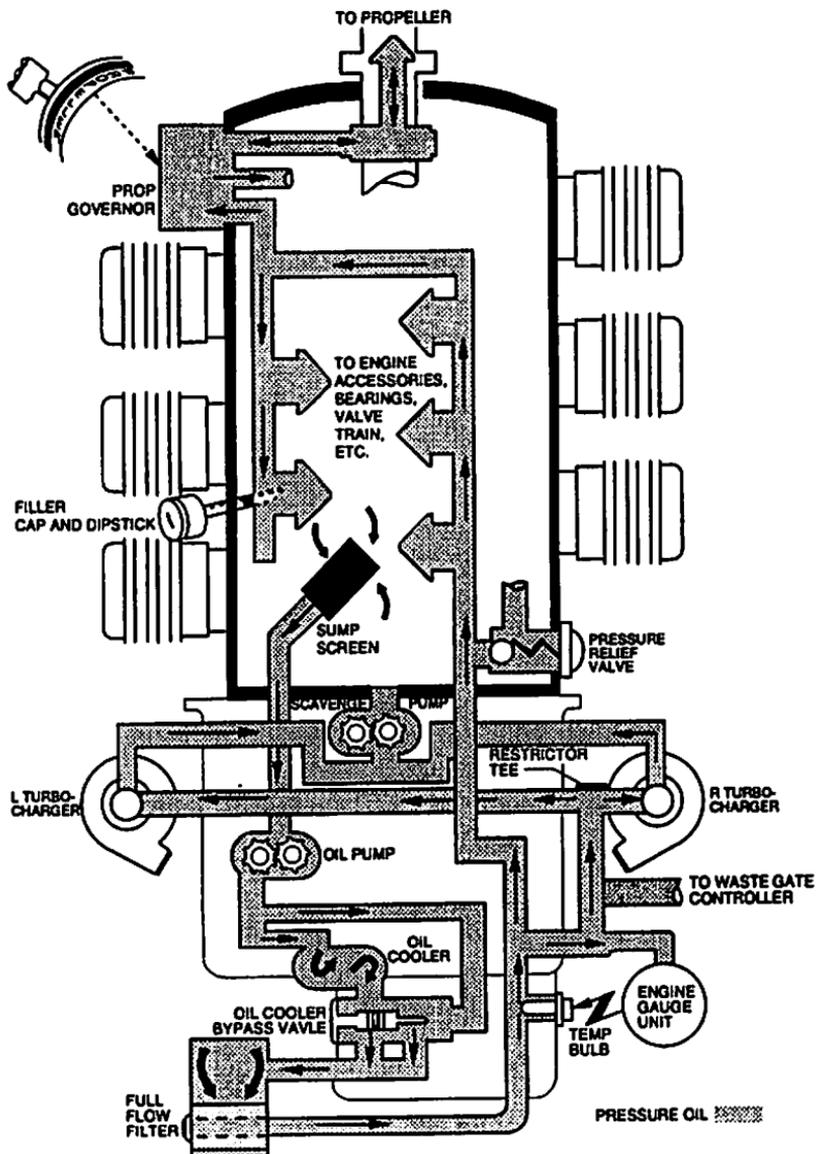
The engine is equipped with a Bendix RSA-10ED1 fuel injection system. An engine-driven fuel pump supplies fuel under pressure to the fuel injection regulator, which measures air flow and meters the correct proportion of fuel to a flow divider. The flow divider then directs the fuel to each of the individual 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 waste gate 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 waste gate 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 propeller control lever in the cockpit.

The propeller 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 by the tachometer, 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)**

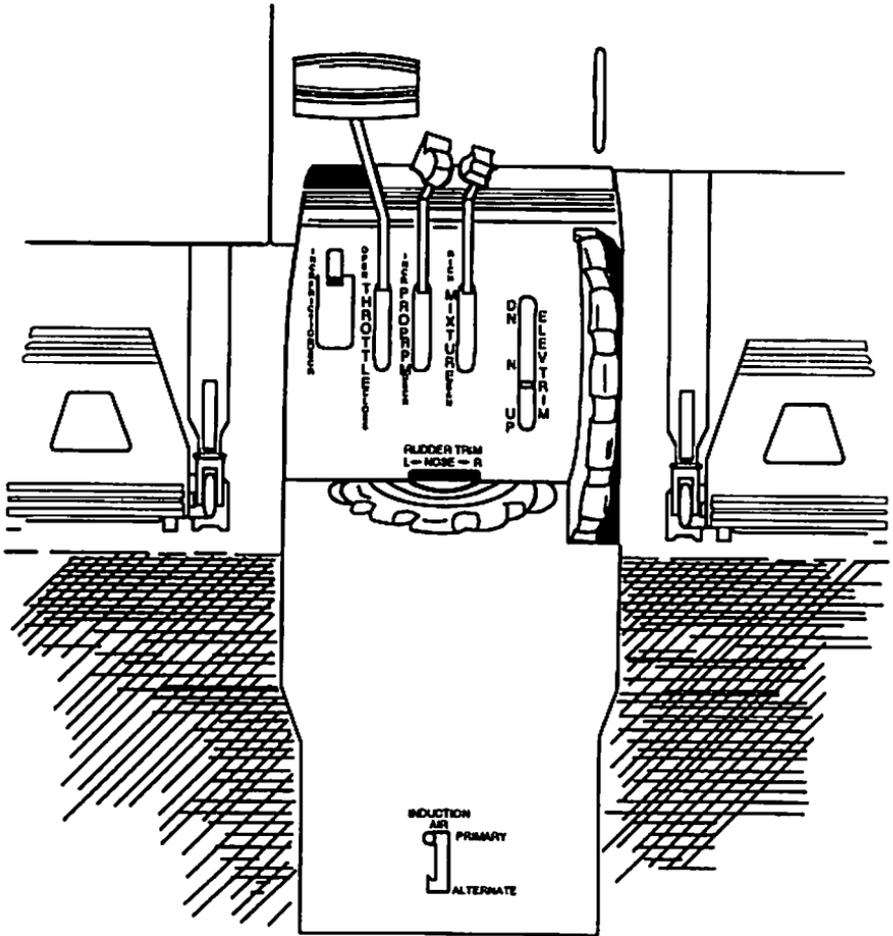
The engine air induction system receives ram air through forward facing ram air louvers located on the lower cowl below the propeller. Air enters these louvers and flows through a removable air filter mounted adjacent to the louvers. The filter removes dust and other foreign matter from the induction 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 provide air to the engine. This alternate air control is located on the center console just below engine control quadrant. When the induction air lever is up, or on primary air, the engine is operating on filtered air drawn through the forward facing ram air louvers. When the lever is down, 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, propeller 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. The throttle lever incorporates a gear-up warning horn switch, which is activated when manifold pressure is reduced to below approximately 14 inches of mercury. 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, propeller and mixture controls.

The propeller 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 in the full aft position.

## 7.8 AVIDYNE FLIGHTMAX ENTEGRA PRIMARY FLIGHT / MULTI-FUNCTION DISPLAYS

Due to the design of the Avidyne FlightMax Entegra Avionics System utilized on the Mirage, the various avionics systems are very integrated.

This section provides a general description of the Avidyne FlightMax Entegra Series 700-00006-0XX (appropriate revision) PFD, its operation, and aircraft systems interfaces. For a detailed description of PFD operation, refer to the Avidyne FlightMax Entegra Series Primary Flight Display Pilot's Guide, p/n 600-00104-002, appropriate revision.

### 7.8a PFD SYSTEMS DESCRIPTION

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

#### Attitude Direction Indicator (ADI)

##### Air Data

The airspeed tape to the left of the PFD begins indicating at 20 Knots Indicated Airspeed (IAS) and is color coded in accordance with the model POH airspeeds for  $V_{SO}$ ,  $V_{FE}$ ,  $V_S$ , and  $V_{NE}$ . An altitude tape is provided to the right of the PFD which also displays a symbol for the Altitude Preselect (Altitude Bug). The Vertical Speed Indicator (VSI) is displayed to the right of the altitude tape. For vertical speed rates greater than the PFD displayed VSI scale, the indicator needle will peg just outside the scale and a digital readout of actual VSI up to 4000 FPM is then displayed. An additional data block is provided for display of Outside Air Temperature (OAT), True Airspeed (TAS), and Ground Speed (GS). Controls for selecting bug and barometric correction values are along the right side of the PFD. A wind indicator is also provided beneath the altitude tape.

##### Attitude Data

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

## 7.8a PFD SYSTEMS DESCRIPTION (continued)

### Horizontal Situation Indicator (HSI) (continued)

#### Heading Data

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

#### Navigation Data

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

#### NOTE

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

**7.8a PFD SYSTEMS DESCRIPTION (continued)****Autopilot Integration**

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

Autopilot mode annunciations are shown along the top of the PFD.

Flight director command bars on the PFD attitude indicator can be enabled by the pilot. When the flight director is enabled and the autopilot is engaged in both lateral and vertical modes, the flight director displays the goals of the autopilot. A lateral autopilot mode must be engaged on the S-TEC System 55X Autopilot before a vertical mode can be engaged.

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

The following autopilot modes are supported by the PFD:

1. HDG (Heading, using the heading bug)
2. NAV (Nav, using the course pointer and course deviation indicator)
3. GPSS (GPS Steering, using GPS course guidance)
4. APR (Approach, using the HDI and VDI, including automatic glide slope capture)
5. REV (Reverse sensing HDI approach)

**NOTE**

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

**CAUTION**

A potentially confusing situation may develop if either VLOC1 or VLOC2 is selected on the PFD while GPSS mode is engaged on the autopilot. If either VLOC is selected (NAV source) on the PFD, the CDI will display course deviation to the radio navigation source dialed into the corresponding VLOC radio, but the autopilot will track the active GPS flight plan. As a result, the course deviation on the PFD CDI may not agree with the course being flown by the autopilot. This confusing situation may be avoided by selecting NAV mode on the autopilot when VLOC1 or VLOC2 is selected as the PFD NAV source.

## **7.8a PFD SYSTEMS DESCRIPTION (continued)**

### **Autopilot Integration (continued)**

#### **Coupled/Uncoupled Switch**

A coupled/uncoupled switch is included as part of the avionics suite. This switch allows the pilot to remove several features from the copilot's PFD. The features which are isolated from the copilot's display include:

- Nav Course Setting
- Heading Bug
- Altitude Bug
- BARO (Altimeter setting)

### **Engine Instruments**

#### **Manifold Pressure -**

Displays current engine manifold pressure in inches of mercury. A numeric display below the torque analog indicator displays the torque value to the nearest tenth of an inch. If the manifold pressure enters the warning (red) area, the analog indicator and the numeric readout will be displayed in the corresponding color.

#### **Fuel Flow -**

Displays the current engine fuel flow as a numeric display, to the nearest 1 pound per hour (or 1 kilogram per hour if metric units are selected).

#### **RPM -**

Displays current engine speed in revolutions per minute. A numeric display below the RPM analog indicator displays RPM value to the nearest 10 RPM's. If the RPM enters the warning (red) area, the analog indicator and the numeric readout will be displayed in the corresponding color.

#### **Oil Pressure -**

As the engines come online, displays the oil pressure for each engine in PSI. This data block supports engine start and is removed when the oil pressure is out of the warning (red) range.

**7.8b MFD SYSTEMS DESCRIPTION****NOTE**

For a detailed description of the MFD, refer to the Avidyne FlightMax EX5000 Series Pilot's Guide and Reference, p/n 600-00121-000, appropriate revision.

**Navigation**

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

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

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

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

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

## **7.8b MFD SYSTEMS DESCRIPTION (continued)**

### **Navigation (continued)**

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

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

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

Flight plan data is transmitted to the MFD from an external GPS navigator. Some installations do not support depictions of curved flight paths. In these cases, curved flight path segments will be depicted as straight lines. The GPS navigator and HSI are to be used during approach procedures. Reference the Avidyne FlightMax EX5000 Series Pilot's Guide, p/n 600-00121-000, appropriate revision, for more information.

### **Datalink**

Datalink information is received by the MFD based upon installation provisions and a subscription service available through Avidyne ([www.myavidyne.com](http://www.myavidyne.com)). Data is presented on the Map, Trip, and Nearest pages. Datalink information is provided for strategic planning purposes only. Data aging and transport considerations make it unsuitable for tactical use. Reference the Avidyne FlightMax EX5000 Series Pilot's Guide, p/n 600-00121-000, appropriate revision, for more information.

### **Setup**

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

**7.8b MFD SYSTEMS DESCRIPTION (continued)****Setup (continued)**

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

**Engine Instruments**

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

## **7.8b MFD SYSTEMS DESCRIPTION (continued)**

### **Traffic Mode**

Traffic Information Service (TIS) provides a graphic display of traffic advisory information overlaid on the MFD Map page. TIS is a ground based service providing relative location of all ATRBS Mode A and Mode C transponder equipped aircraft within a specified service volume. Aircraft without an operating transponder are invisible to TIS.

If an aircraft has a transponder, but does not have altitude reporting, the TIS will depict it without the altitude information tag. If the depicted traffic is reporting altitude and is climbing or descending at a rate of at least 500 feet per minute, a trend arrow is displayed near the traffic symbol indicating that the aircraft is climbing or descending. If the intruder is not reporting altitude, the traffic symbol appears without an altitude tag or trend arrow. Traffic ground track is indicated by a "target track vector", a short line displayed in 45 degree increments.

The symbology displayed is as follows:

- (1) Other Aircraft - An open cyan diamond indicates that an intruder's relative aircraft is greater than +/- 3000 feet, or its distance is beyond 7 nm range. It is not considered a threat.
- (2) Proximity Intruder Traffic - A filled cyan diamond indicates that the intruder aircraft is within +/- 1200 feet, and within 7 nm range, but is still not considered a threat.
- (3) Traffic Alert (TA) - A symbol changed to a filled amber circle indicates that the intruder aircraft is considered to be potentially hazardous. The condition which causes a traffic alert is defined on a course that will intercept a 0.5 nm radius and a relative altitude of +/- 500 feet within 34 seconds.

When a hazardous intruder aircraft is detected an annunciator will be displayed on the MFD with relative bearing, range and relative altitude along with the advisory voice message "TRAFFIC, TRAFFIC" heard through the audio system.

**7.8b MFD SYSTEMS DESCRIPTION (continued)****Terrain Awareness and Warning System (TAWS) Mode**

Rotating the MFD Page knob will allow you to view the TAWS display page. The TERRAIN function is active when the amber TERR N/A annunciator is extinguished and the following systems are operational:

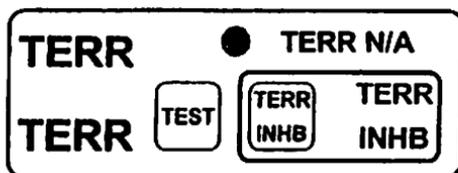
- Multi Hazard Warning Processor
- Encoding Altimeter

**NOTE**

Horizontal position is derived from the Number 1 GNS 430 receiver. Should the Number 1 GNS 430 become inoperative TAWS will not be available.

Perform a system self test on the ground prior to every flight to verify proper operation.

The remote Terrain Awareness Control Unit (see Figure 7-7) incorporates all of the terrain annunciations and control functions into a single panel mounted unit. All annunciation colors are as described in Table 7-1. The two push buttons are black legends on white switches.



**Terrain Awareness Control Unit**

Figure 7-7

7.8b MFD SYSTEMS DESCRIPTION (continued)

Terrain Awareness and Warning System (TAWS) Mode (continued)

<u>INDICATOR/CONTROL</u>	<u>COLOR</u>	<u>FUNCTION</u>
TERR lamp	RED	Terrain Warnings.
TERR lamp	AMBER	Terrain Cautions.
TERR N/A lamp	AMBER	Indicates terrain function INOP.
TEST switch		Provides test function for the terrain function.
TERR INHB lamp/switch	WHITE	Push-on to inhibit all terrain alerting functions.

**TAWS Annunciation Legend**

Table 7-1

Proper operation of the TAWS can be verified when the aircraft is on the ground as follows:

Select the TERR display mode on the MFD.

Ensure the TERR INHB switch is NOT ENGAGED, and momentarily push the TEST switch.

The amber TERR N/A light illuminates.

The red TERR light illuminates.

An aural "EGPWS SYSTEM OK" message is enunciated over the cockpit speaker.

The red TERR light extinguishes.

The amber TERR light illuminates.

A terrain self test pattern appears on the MFD.

The terrain self test pattern disappears after several sweeps of the terrain display.

The amber TERR light extinguishes.

The amber TERR N/A light extinguishes.

**7.8b MFD SYSTEMS DESCRIPTION (continued)****Response to Ground Proximity Warnings**

When an aural "PULL UP" warning occurs, the following procedure should be followed:

1. Level the wings, simultaneously adding maximum power.
2. Smoothly pitch up at a rate of 2 to 3 degrees per second towards an initial target pitch attitude of 15 degrees nose up.
3. Adjust pitch attitude to ensure terrain clearance, while respecting stall warning. If flaps are extended, retract flaps to the up position.
4. Continue climb at best angle of climb speed ( $V_x$ ) until terrain clearance is assured.
  - Only vertical maneuvers are recommended unless operating in VMC or the pilot determines, 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 an EGPWS warning.

When an aural warning other than "PULL UP" occurs, initiate corrective action to remove the cause of the warning. The following aural warnings can occur:

"SINK RATE"

"DON'T SINK"

**NOTE**

During operations at certain locations, warning thresholds may be exceeded due to specific terrain or operating procedures. During day, VFR, these expected warnings may be considered as cautionary and the approach continued.

**7.8b MFD SYSTEMS DESCRIPTION (continued)**

**Advisory Callouts**

“FIVE HUNDRED” - occurs at 500 feet AGL.

**Response to Terrain / Obstacle Awareness Alerts**

**CAUTION ALERT**

When an aural “CAUTION TERRAIN” or a “CAUTION OBSTACLE” alert occurs, take positive corrective action until the alert ceases. Stop descending, or initiate a climb and/or turn as necessary, based on analysis of all available instruments and information.

If the GPWS issues a caution when the terrain display is not selected, a pop up message will appear on the active display page of the MFD. The pilot must acknowledge the pop up message.

**WARNING ALERT**

When an aural “TERRAIN TERRAIN, PULL UP” or an “OBSTACLE OBSTACLE, PULL UP” warning occurs, follow the procedure described for a “PULL UP” warning.

If the GPWS issues a warning when the terrain display is not selected, a pop up message will appear on the active display page of the MFD. The pilot must acknowledge the pop up message.

**7.8b MFD SYSTEMS DESCRIPTION (continued)****Use of Terrain Awareness Display**

The Terrain Awareness Display is selected by rotating the page control knob to the TAWS legend located on the bottom of the MFD. The display is intended to enhance situational awareness with respect to separation from terrain or obstacles.

*The TERR display is not intended to be used for navigation purposes.*

Color and intensity variations are used to show terrain/obstacle heights relative to the airplane - refer to Avidyne FlightMax EX5000 Multi-Function Display Pilot's Guide, p/n 600-00121-000, appropriate revision.

The 500/250-foot GREEN to YELLOW boundary is BELOW the airplane in order to account for altimetry and/or terrain/obstacle height errors. For situational awareness with respect to terrain/obstacle shown on the display, the pilot should assume that the YELLOW or RED terrain or obstacle is at or above the airplane. GREEN terrain is below the airplane. These boundary levels are biased upwards by half of the aircraft's descent rate greater than 1000 feet per minute.

If there is no terrain data in the database for a particular area, that portion of the display is colored a MAGENTA dot pattern. Terrain is not shown (black) if it is below the lowest band and/or is within 400 feet of the runway elevation nearest the aircraft.

Two elevation numbers indicate the highest and lowest terrain currently displayed on the screen. The elevation numbers indicate terrain in hundreds of feet above sea level (e.g., "125" is 12,500 feet MSL) and are color matched to the display. In the event that there is no appreciable difference between the highest and lowest elevations (flat terrain or over water), only the highest numeric value is displayed.

Geometric Altitude, which is displayed on the upper left of the TERR display, is an additional feature incorporated into the GA-EGPWS. Based on GPS Altitude, Geometric Altitude is a computed pseudo-barometric altitude designed to reduce or eliminate errors potentially induced in Corrected Barometric Altitude by temperature extremes, non-standard pressure altitude conditions, and altimeter miss-sets. This ensures an optimal EGPWS Terrain display and alerting capability. Geometric Altitude also allows continuous EGPWS operations in QFE environments without custom inputs or special operational procedures.

**7.8b MFD SYSTEMS DESCRIPTION (continued)**

**Use of Terrain Awareness Display (continued)**

Geometric Altitude requires a GPS Altitude input with its associated Vertical Figure of Merit (VFOM) and RAIM failure indication, standard (uncorrected) altitude, Radio Altitude, Ground Speed, Roll Angle, and aircraft position (latitude and longitude). Additionally, corrected Barometric Altitude, Static Air Temperature (SAT), GPS mode, and the number of satellites tracked are used if available.

The Geometric Altitude is computed by blending a calculated Non-Standard Altitude, Runway Calibrated Altitude (determined during takeoff), GPS Calibrated Altitude, Radio Altitude Calibrated Altitude (determined during approach), and Barometric Altitude (if available). Estimates of the VFOM for each of these are determined and applied in order to determine its weight in the final altitude. The blending algorithm gives the most weight to altitudes with a higher estimated accuracy, reducing the effect of less accurate altitudes. Each component altitude is also checked for reasonableness using a window monitor computed from GPS Altitude and its VFOM. Altitudes that are invalid, not available, or fall outside the reasonableness window are not included in the final Geometric Altitude value.

The Geometric Altitude algorithm is designed to allow continued operation when one or more of the altitude components are not available. If all component altitudes are invalid or unreasonable, the GPS Altitude is used directly. If GPS Altitude fails or is not present, then the EGPWS reverts to using Corrected Barometric Altitude on the Altimeter alone.

The Geometric Altitude function is fully automatic and requires no pilot action other than the proper setting of Corrected Barometric Altitude on the Altimeter.

**System Constraints**

1. If there is no terrain data in the database for a particular area, then Terrain/Obstacle Awareness alerting is not available for that area. The affected display area is colored with a MAGENTA dot pattern.
2. If the Terrain/Obstacle Awareness features have been inhibited (e.g., selected OFF due to excessive navigation system position error), the GA-EGPWS will not give aural alerts. A WARNINGS INHIBITED message will be annunciated on the MFD.
3. The Geometric Altitude is intended only as a reference against which the Barometric Altitude is checked. It is not intended to be the primary altitude reference for the aircraft.

**7.8b MFD SYSTEMS DESCRIPTION (continued)****Radar Mode**

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 Bendix/King RDR Vertical Profile Weather Radar System is an X-band radar designed for weather location and analysis and for ground mapping. All features for the weather radar are presented by selecting the "RADAR" feature of the MFD. Weather patterns can be displayed on both the radar page of the MFD or overlaid on the Map page. The radar generates high level RF pulses and should be operated with caution while on the ground. When operating on the ground, position the nose of the airplane so that the antenna scan sector is free of large metallic objects such as hangars or other aircraft for a distance of at least 100 feet.

The system detects storms along the flight path and gives the pilot a visual indication, in color, of storm intensity. Storm intensity is displayed at five color levels with black representing weak or no returns, and green, yellow, red, and magenta showing progressively stronger returns. In ground mapping mode, levels of increasing reflectivity are displayed as black, cyan, yellow, and magenta.

Located on the radar page of the MFD are soft keys for operating the different radar modes. They are "Radar On" - applies electrical power to the system and turns the radar on in normal operation. "Radar Test" - when this mode is selected the weather depiction will be a special colored test pattern to allow verification of system operation. "Radar Standby" - in this position the radar is powered up but does not radiate any RF energy nor does the antenna scan. "Radar Off" - removes electrical power from the system. "Knob" - switches the left outer knob function from "Bearing" to "Gain" in order to allow adjustment of the gain setting. "Mode" - allows to select between Weather (WX), Weather Alert (WxA), and Ground (GND) modes. "Scan" - allows selection of either "Normal" or "Sector" scan. "VP" - places the radar in "Vertical Profile" operation. "Control" - changes the bottom left button, and top right three buttons to: "Traffic", "View", "Declutter", "Base Map", and "Weather Overlay (WxOvly)".

For additional description of the radar page modes of operation refer to the Avidyne FlightMax EX5000 Multi-Function Display Pilot's Guide, p/n 600-00121-000, appropriate revision.

### **7.8b MFD SYSTEMS DESCRIPTION (continued)**

#### **Engine Page**

All engine instruments are of the vertical tape readout design except for fuel flow which is digital readout only.

The FUEL FLOW indication displays fuel flow in gallons per hour. Readings are accurate at stabilized power settings.

The FUEL QUANTITY indicator is calibrated in gallons of fuel and accurately displays fuel remaining in the left and right tanks.

For additional description of the engine page features refer to the Avidyne FlightMax EX5000 Multi-Function Display Pilot's Guide, p/n 600-00121-000, appropriate revision.

### **7.8c ADAHRS REVERSION**

Failure of an ADAHRS will be apparent when the on-side air data parameters are replaced with red X's and a red (ATTITUDE FAIL) "Refer to Backup Gauges" annunciator is displayed in the top center of the PFD. If either ADAHRS should fail, the ADAHRS reversion switch located on the pilot's upper panel will allow the pilot to select the remaining ADAHRS to provide the air data parameters to both displays. The three position switch is labeled ADAHRS 1 / ADAHRS 2.

## 7.9 STANDBY INSTRUMENTS

The standby instrument group includes an electric attitude indicator, an airspeed indicator, and a barometric altimeter mounted to the left of the pilot's PFD. The standby airspeed and altimeter are plumbed to the left side pitot static system, and are of the traditional mechanical design. The standby electric attitude indicator is powered by an emergency battery mounted in the underwing radar pod, and is controlled by a three position toggle switch placarded STBY GYRO, ON, OFF, and TEST. If a fault occurs which causes one of the ADAHRS to output misleading information to the PFD, the standby instruments act as a useful comparison to indicate which out of the three displays are correct.

### Standby Attitude Indicator

The Standby Attitude Indicator provides backup display of aircraft attitude. It is located at the top of the standby instrument group where it can be viewed easily by the pilot. It is powered from an emergency battery so that it will remain powered for at least 45 minutes after the loss of the aircraft electrical system. The attitude indicator is a DC powered electromechanical unit. A power warning flag is rotated out of sight by a flag motor which allows the flag to reappear if power is interrupted. The standby attitude indicator switch must be selected ON for the standby gyro system to operate.

Depressing the test switch applies a ground for the ON/OFF control circuit. If the self test does not complete within 5 seconds, one or more of the following may be true:

- Batteries are less than 50% charged.
- The TEST/FAIL annunciator is burned out.
- The attitude indicator power supply itself is defective.

The illumination of the amber "STBY ATT IND BATT HTR FAIL" annunciator means the standby attitude indicator battery heater has failed. The standby attitude indicator should be considered to be unreliable and every effort should be made to exit IMC conditions.

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## 7.11 HYDRAULIC SYSTEM

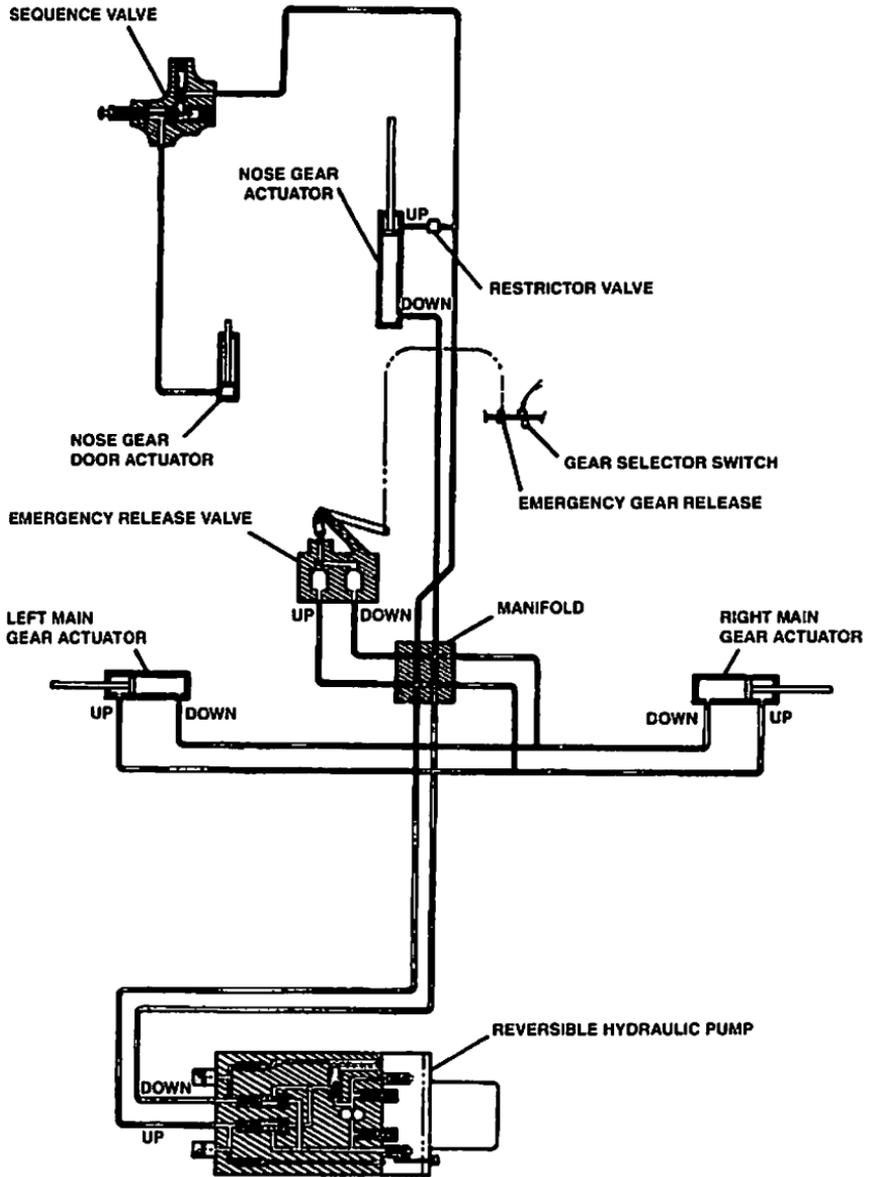
The hydraulic system (refer to Figure 7-9) provides the power to retract and extend the landing gear.

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.

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

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

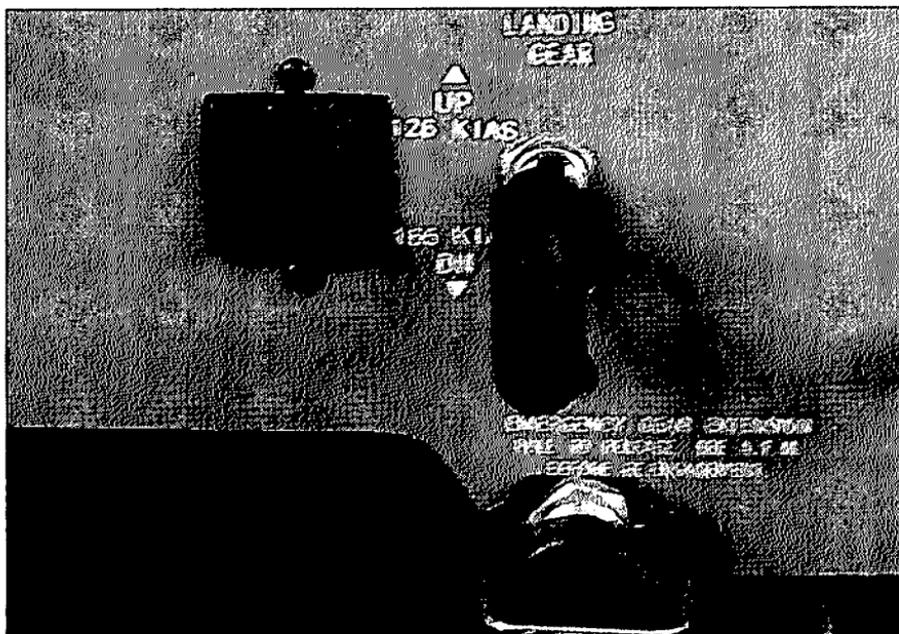
The landing gear selector knob must be pulled outward to release it from a detent in the DOWN position prior to moving it to the UP position. In addition, there is a squat switch on the left main gear which prevents operation of the gear UP electrical circuit when the aircraft weight is on the gear. If the landing gear selector is placed in the UP position with the aircraft weight on the gear, the gear warning horn will sound, and the red GEAR WARN annunciator 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. Approximately 25 pounds of force is required to pull the EMERGENCY GEAR extension control. 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 HYD PUMP 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 HYD PUMP circuit breaker must be reset in order for hydraulic pressure to be generated in the UP side of the system and the gear retracted.

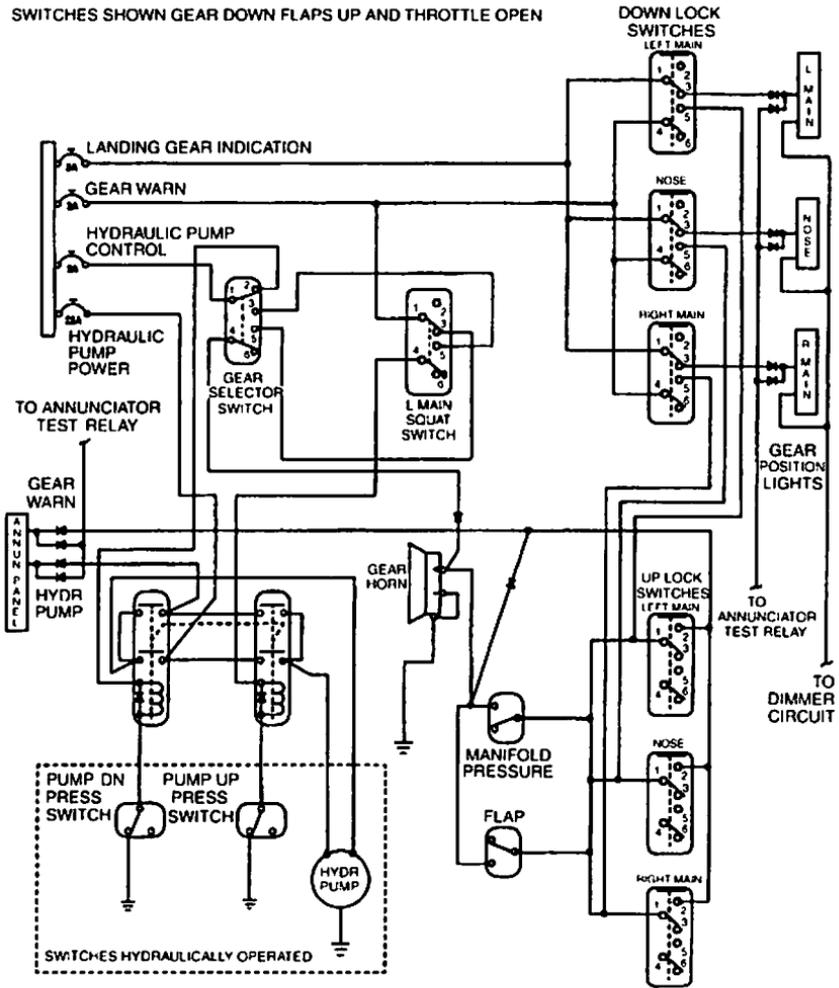


LANDING GEAR SELECTOR

Figure 7-11

7.13 LANDING GEAR (continued)

SWITCHES SHOWN GEAR DOWN FLAPS UP AND THROTTLE OPEN



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.

The annunciator panel contains two lights pertaining to landing gear operation. A red GEAR WARN annunciator is activated whenever all three gears 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 annunciator which indicates that the hydraulic pump motor is being supplied with electrical power. The annunciator is illuminated during normal landing gear operation for approximately the same duration as the GEAR WARN annunciator. If the light remains on or begins cycling intermittently after gear operation, a system malfunction is indicated.

The red GEAR WARN 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 parking 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 parking brake knob. To release the parking brake, first depress and hold the toe brake pedals and then push in on the parking 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 WARN annunciator will illuminate. A FLAPS annunciator light is provided as part of the annunciator panel located in the upper center section of the instrument panel. If the annunciator light illuminates, it is indicative of a system malfunction in which case 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 annunciator 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 restricted vent is suspected, select the opposite tank immediately. Monitor the suspect wing and land as soon as possible.

### NOTE

When opening the fuel tank filler cap, a rush of air will normally be heard and felt. This is caused by the large volume of vapor space in the wing tank, which is under a slight pressure differential. This pressure is the minimum required to open the combination valve in the vent and does not represent a hazard.

**7.19 FUEL SYSTEM (continued)**

**CAUTION**

For proper mid range accuracy, fuel quantity readings should be taken when the aircraft is in coordinated level flight at zero degrees bank angle. (Pitch, roll and yaw.) Failure to observe fuel quantity in this manner will result in erroneous readings due to wing cross section, low dihedral angle and fuel tank geometry.

If readings are taken in configurations other than coordinated level flight at zero degrees bank angle, there may be periods during flight when the accuracy of the fuel quantity gauging system will appear to be incorrect by seeming to present an unchanging quantity in spite of fuel being consumed from the tank.

Fuel quantity is indicated on the multi-function display (MFD). Each tank has two sensor sending units. Gauges are electrical and will operate when the battery switch is ON. 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.

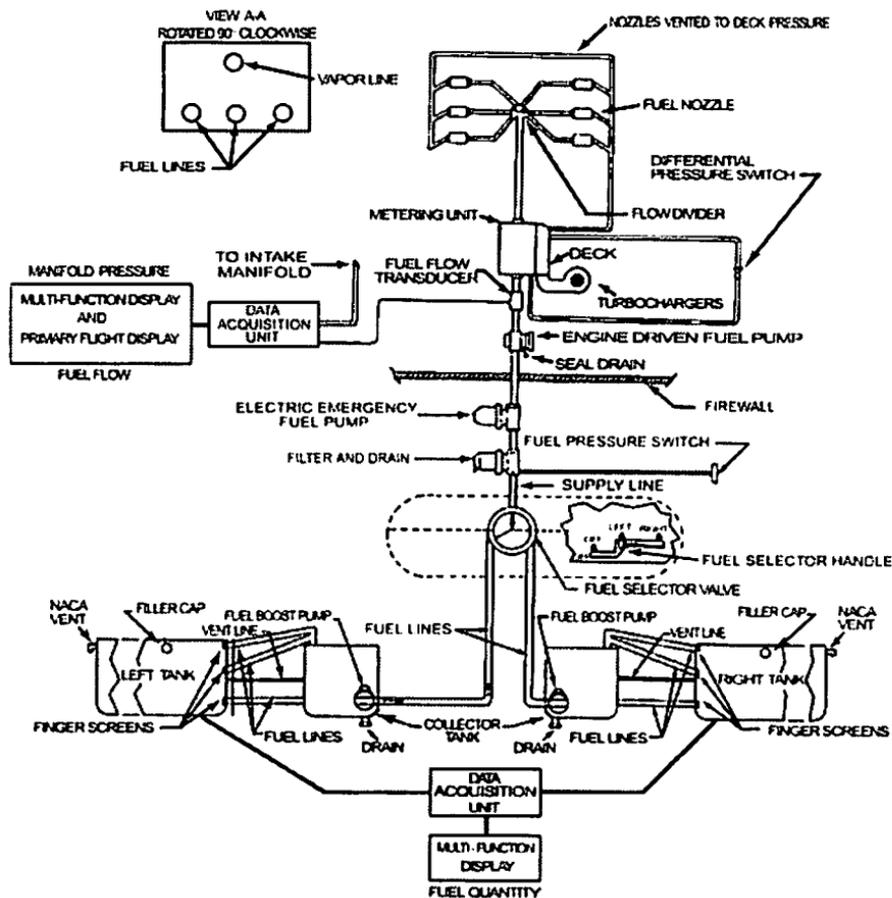
Quantity indication should be monitored at regular intervals during flight. Fuel tank selection should be alternated accordingly to maintain fuel and wing balance. See fuel imbalance limitations (2.35(e)).

**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 battery master 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 BOOST PUMP light on the annunciator panel 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 annunciator remains lit, select the opposite tank. 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 FUEL PRESS light on the annunciator panel will illuminate. Immediately select the emergency fuel pump ON. The FUEL PRESS annunciator will extinguish when adequate fuel pressure is restored. The emergency fuel pump 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 thumbsized 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.

Fuel flows from the filter, forward through the emergency fuel pump and firewall, into the engine compartment, to the engine-driven pump.

### 7.19 FUEL SYSTEM (continued)

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).

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.

### 7.21 ELECTRICAL SYSTEM

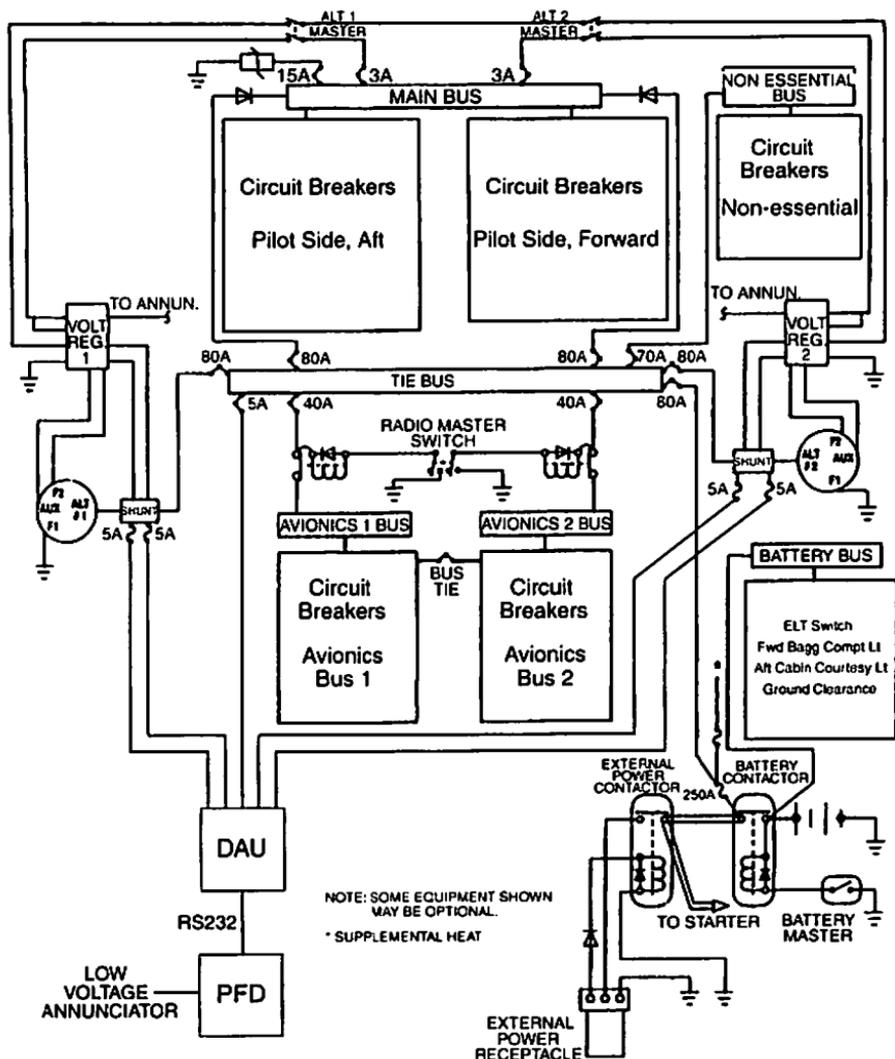
Power for the 28 Vdc, negative ground, dual fed split bus electrical system (Figure 7-17) is supplied by two belt driven, parallel connected, 28 Vdc 75 ampere self exciting alternators mounted on the forward section of the engine. When both alternators are operating and turned ON, a maximum continuous 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 and exterior light switches are located in an overhead switch panel (Figure 7-19).
- (b) Avionics related switches are located below the pilot's PFD (Figure 7-23).
- (c) 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).

A battery bus, located in the battery compartment, provides a continuous source of power for the ELT switch, ground clearance, 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 Battery Master switch is OFF. Fuses located on the battery bus are used to protect these circuits.

7.21 ELECTRICAL SYSTEM (continued)



ELECTRICAL POWER DISTRIBUTION SYSTEM

Figure 7-17

**7.21 ELECTRICAL SYSTEM (continued)**

When the Battery Master switch, located on the main 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 Battery Master 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.

A low bus voltage annunciator light will illuminate when the system voltage drops back below  $25 \pm 0.3\text{Vdc}$ .

**NOTE**

When utilizing just the airplane's battery, or just a 24 volt external power source, the LOW BUS VOLTAGE annunciator will be illuminated. Check the voltmeter for correct voltage.

Each alternator system is provided an independent ON-OFF switch, 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 1 and ALTR 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, or is selected OFF, the appropriate ALTERNATOR INOP annunciator light will illuminate.

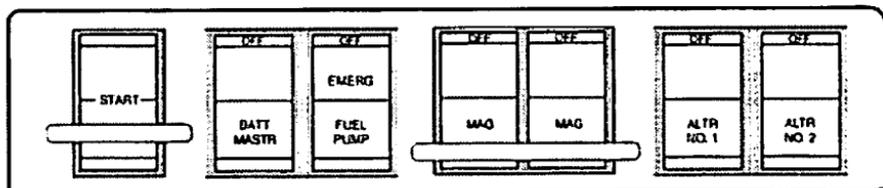
A main bus and a nonessential bus (Figure 7-21), with associated circuit breakers, are located on the pilot's left side panels. Two avionics buses, with associated circuit breakers (Figure 7-21), are located on the copilot's right side panel. The two avionics buses are interconnected through the avionics 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.

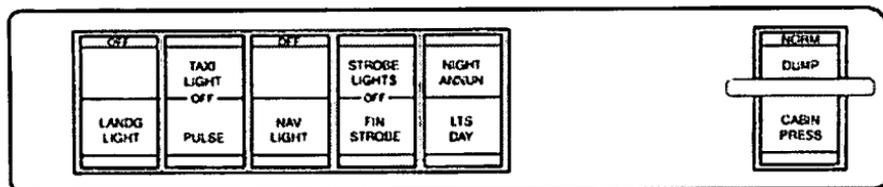
7.21 ELECTRICAL SYSTEM (continued)

Current from the tie bus is fed to each avionics bus through independent solenoid contactors. When the Radio Master switch is selected ON, both solenoid contactors close, permitting current flow to both avionics buses. Avionics bus overload protection is provided by the 40 amp tie bus AVIONICS NO. 1 and AVIONICS NO. 2 circuit breakers (Figure 7-21). Should the need arise, either avionics bus can be isolated by pulling out the avionics bus BUS TIE circuit breaker 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-ESSEN circuit breaker (Figure 7-21).



LEFT

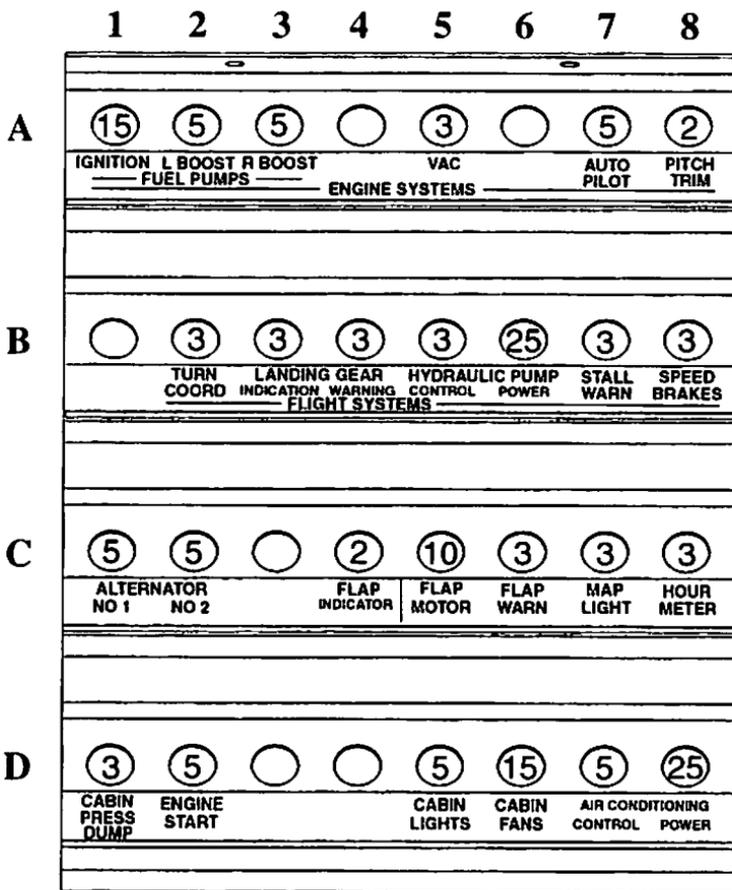


RIGHT

OVERHEAD SWITCH PANEL

Figure 7-19

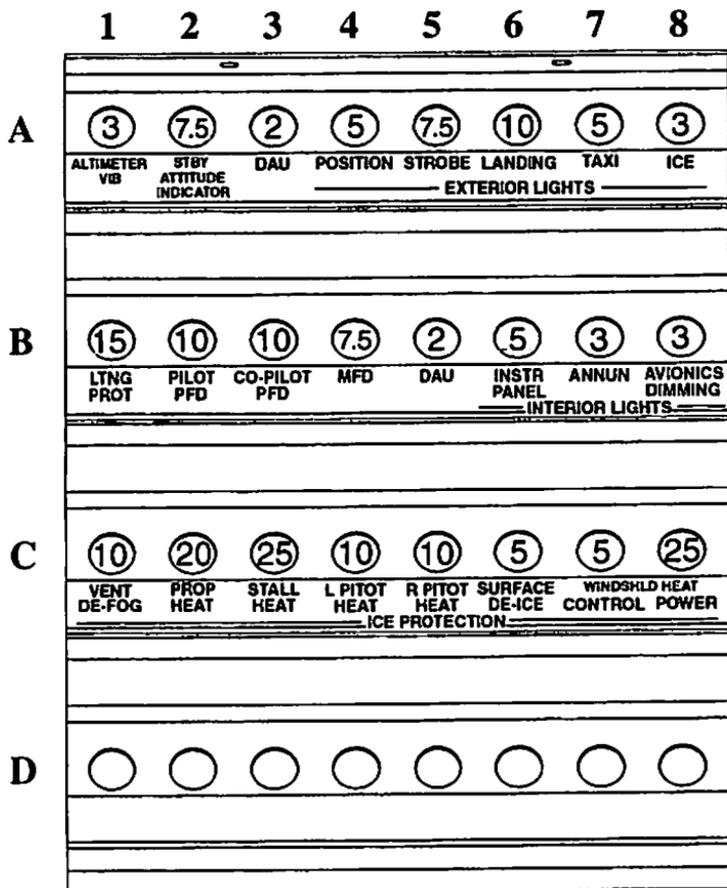
7.21 ELECTRICAL SYSTEM (continued)



**CIRCUIT BREAKER PANELS**  
(Pilot's Side - Forward, Typical)

Figure 7-21

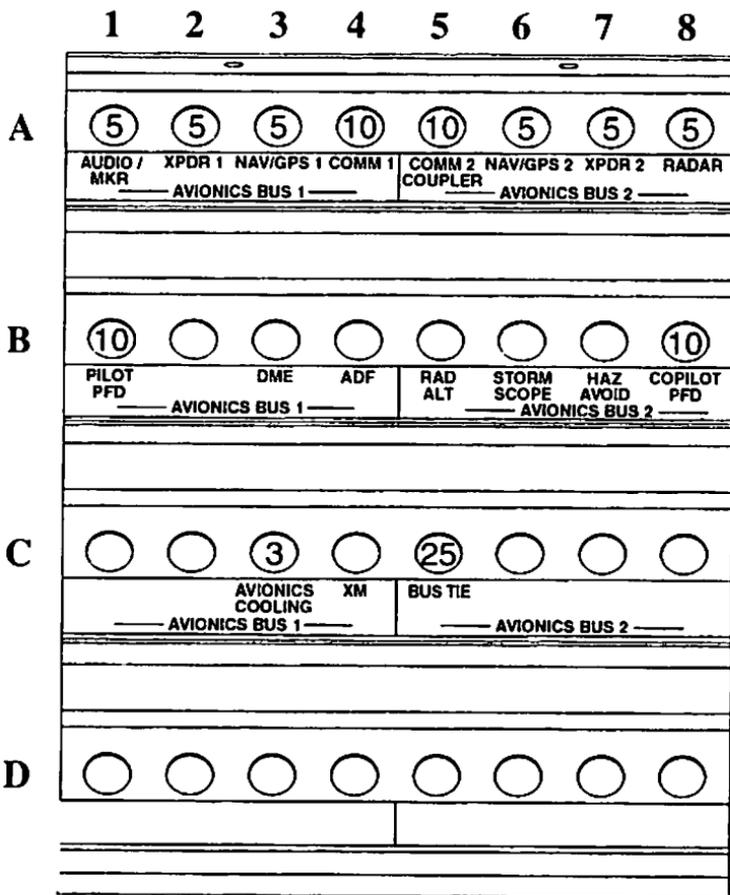
7.21 ELECTRICAL SYSTEM (continued)



**CIRCUIT BREAKER PANELS**  
(Pilot's Side - Aft, Typical)

Figure 7-21 (continued)

7.21 ELECTRICAL SYSTEM (continued)

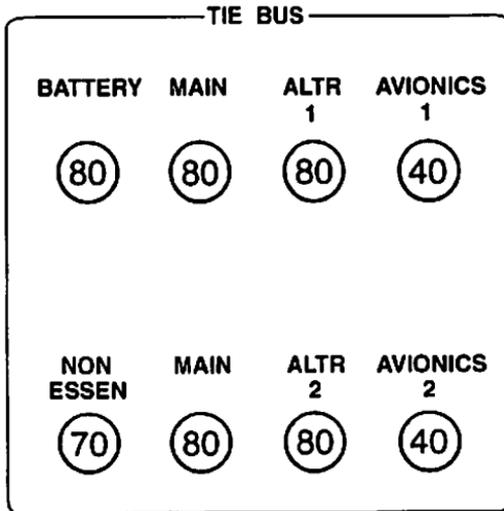


**CIRCUIT BREAKER PANELS**

(Copilot's Side, Typical)

Figure 7-21 (continued)

7.21 ELECTRICAL SYSTEM (continued)



CIRCUIT BREAKER PANELS  
(Tie Bus)

Figure 7-21 (continued)

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### **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.



## **7.25 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 ADAHRS units on the PFD's. Static pressure for the two ADAHRS units and standby altimeter and airspeed indicators is sensed by static source ports on each side of the rear fuselage forward of the elevator. Static pressure for the pressurization system outflow valve is sensed by a separate static port located on the aft bottom of the aircraft in close proximity to the static ports.

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 airspeed, altimeter and vertical speed indicator 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. Corrections for each operating mode are shown in Section 5, Performance.

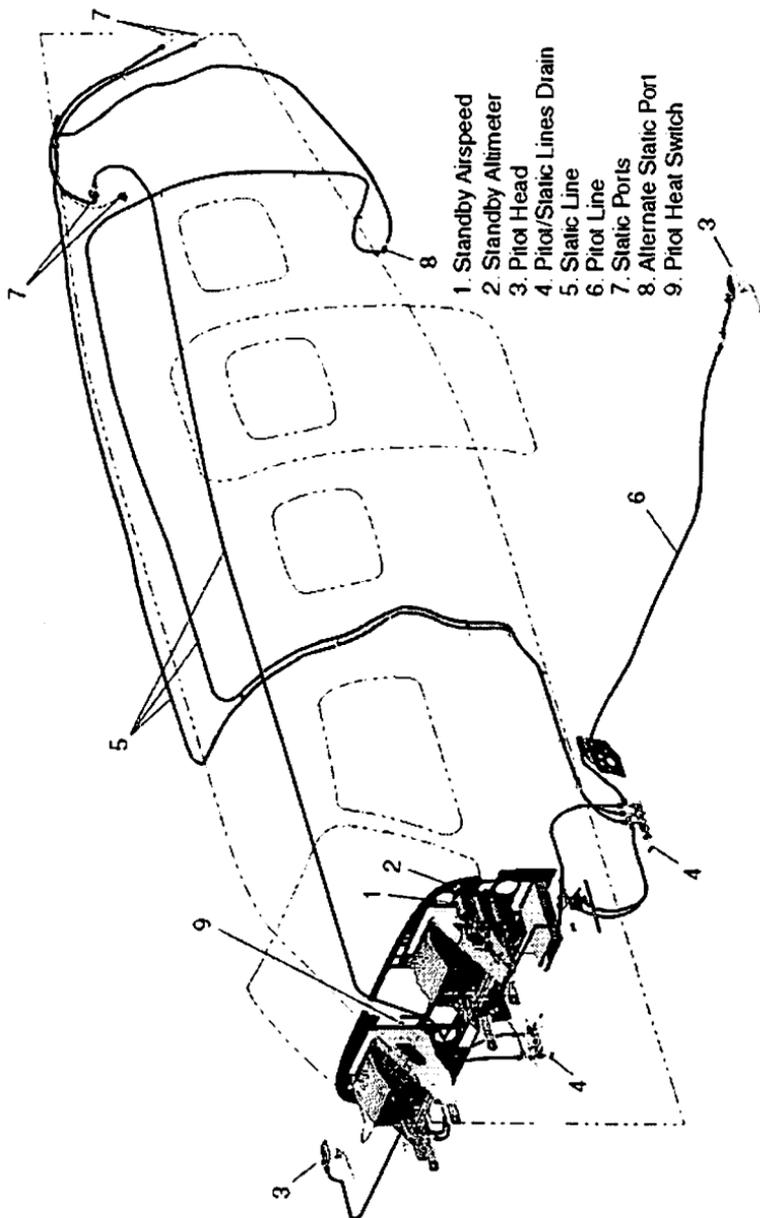
If one or more of the pitot static instruments malfunction, the system should be checked for dirt, leaks or moisture.

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 can be drained through separate drain valves located on both the right and left lower side panel 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 right overhead 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)



PITOT STATIC SYSTEM

Figure 7-25

## 7.27 ENVIRONMENTAL SYSTEM (Refer to Figure 7-27)

The environmental system consists of:

- (a) A compressor bleed air and conditioning system.
- (b) The ventilating air system.
- (c) A supplemental electric cabin heater.
- (d) An air conditioning system.
- (e) The cabin air distribution system.
- (f) The pressurization and control system.

Switches to control and regulate the various systems, except the pressurization system, are located on the switch panel to the right of the MFD.

Compressor bleed air from the engine turbochargers supplies air for heating the cabin during flight and ground operations and for pressurization. The bleed air is first routed through an air-to-air heat exchanger, and then into the cabin through the lower left and right cabin side panel ducts. The heat exchanger utilizes ambient ram air to cool the bleed air, or hot air from an exhaust shroud to heat the bleed air. 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 heat exchanger.

The cabin pressurization system isobaric outflow valve provides the means by which smoke and impurities are vented from the cabin.

Cabin ventilating air during ground or unpressurized low altitude flight operations is provided by the ambient ram air source to the bleed air heat exchanger. 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.

### NOTE

If electric supplemental heat is not used, maximum cabin heat for ground operations and unpressurized low altitude flight will be obtained with the CABIN PRESS control full out.

**7.27 ENVIRONMENTAL SYSTEM (Refer to Figure 7-27) (continued)**

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 pressure 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/DEFOG and AUX CBN HEAT switches must be ON to supply power to the heating element.

Both the heater control circuit and the vent/defog fan circuit utilize the 10 amp VENT DEFOG circuit breaker located on the ICE PROTECTION circuit breaker panel. 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 40.35 amps. Operation is limited to airplanes with both alternators functioning.

Cabin air conditioning is provided by a vapor cycle system. The freon 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.

**7.27 ENVIRONMENTAL SYSTEM (Refer to Figure 7-27) (continued)**

The AIR COND and BLOWER HI & LO switches, located as part of the environmental switch panel, are used to control the air conditioning system.

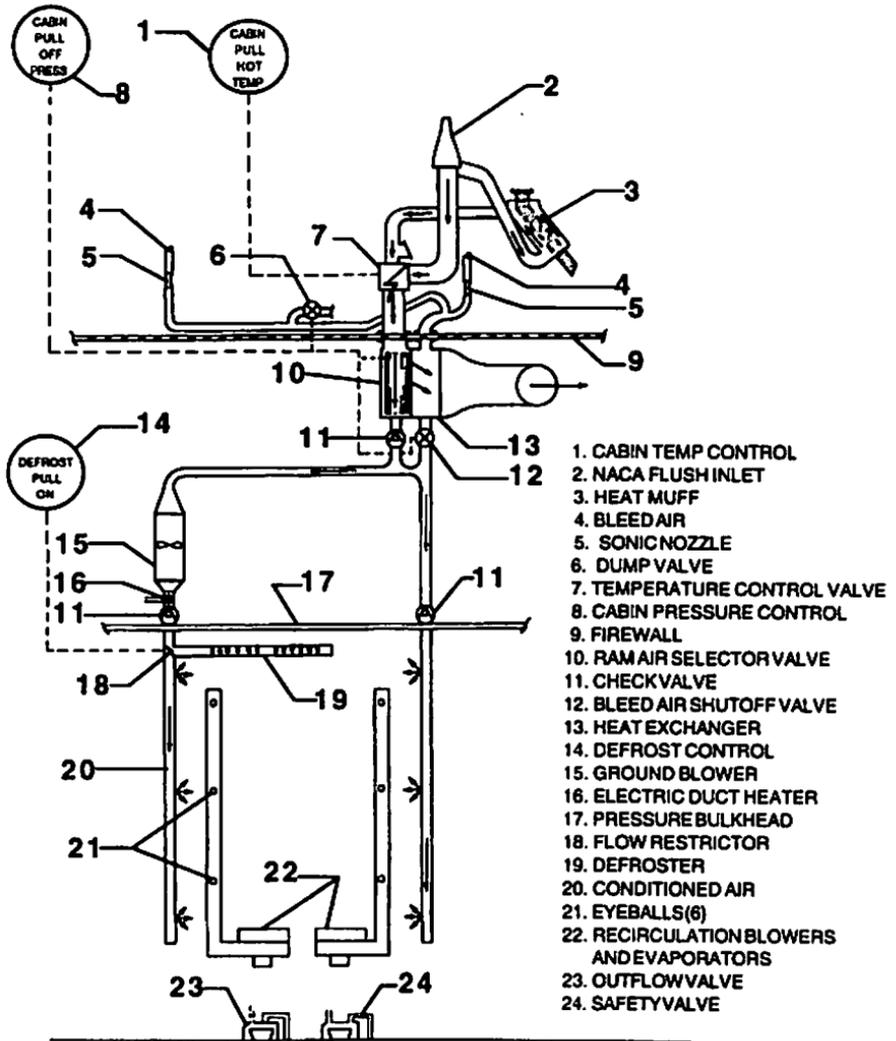
When the AIR COND switch is selected ON, the compressor belt drive is electrically clutched, the condenser blower motor relay is closed, and both recirculation blowers are activated. The recirculation blowers can be operated independently of the air conditioner by selecting the BLOWER HI or LO on. In 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 10 amp CABIN BLOWERS, 5 amp AIR CONDITIONER CONTROL, and 25 amp AIR CONDITIONER POWER circuit breakers in the nonessential bus section of the pilot's forward circuit breaker panel.

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.

The cabin pressurization and control system consists of an isobaric outflow valve, a safety outflow valve, cabin altitude and rate selector, electronically operated vacuum solenoid valve, surge tank, and associated interconnecting plumbing and wiring. Cabin altitude, differential pressure, and rate of change are displayed on a single three inch diameter indicator. Should cabin pressure altitude exceed 10,000 feet, the CABIN ALTITUDE annunciator will illuminate to warn the pilot.

Refer to paragraph 7.29, BLEED AIR, CONDITIONING AND PRESSURIZATION SYSTEM, for a more complete description of the pressurization system and use of related controls and switches.

7.27 ENVIRONMENTAL SYSTEM (Refer to Figure 7-27) (continued)



ENVIRONMENTAL SYSTEM

Figure 7-27

## **7.29 BLEED AIR, CONDITIONING AND PRESSURIZATION SYSTEM**

Air for cabin pressure is obtained from the engine turbocharger induction air system through two sonic venturi tubes. Bleed air is routed through the bleed air heat exchanger for the temperature conditioning to provide the desired cabin comfort level. Ram ambient air is routed across the heat exchanger to cool the bleed air, and hot ambient air from the heat muff is routed across the heat exchanger to heat the bleed air. Mixtures of ram ambient and heated ambient air may also be selected.

Cabin air is controlled by a push-pull knob labeled CABIN PRESS located beneath the control wheel on the pilot's instrument panel. Bleed air for pressurizing the cabin is provided when the control is fully in. Unpressurized ambient air is provided for ventilating the cabin when the control is fully out. This control operates three valves: the bleed air shutoff valve, the bleed air dump valve, and the ram air selector valve. When pushed fully in, the bleed air shutoff valve is open, the bleed air dump valve is closed, and the ram air selector valve is positioned to route ambient air across the bleed air heat exchanger. When the control is pulled completely out, the bleed air shutoff valve is closed, the bleed air dump valve is open, and the ram air selector valve is positioned to route ambient air into the conditioned air ducts through the check valve and into the cabin.

Controls and switches needed to operate the cabin pressurization system are located on the lower section of the pilot's instrument panel and on the lower copilot's instrument panel. In addition to the CABIN PRESS and CABIN TEMP controls, they include the cabin pressure and rate controller located to the left of the standby altimeter, and the CABIN PRESS DUMP/NORM switch located on the right overhead switch panel.

For pressurized flight, set the cabin pressure controller at 500 feet above the airport pressure altitude, CABIN PRESS control knob full in and the CABIN PRESS DUMP/NORM switch to NORM. The rate of cabin ascent and descent change is controlled with the rate knob (left lower corner of the cabin pressure controller), and may be adjusted between approximately 200 and 2000 feet per minute, as desired. Setting the rate knob arrow to the 9 o'clock position provides a cabin rate of change of approximately 500 feet per minute. This position gives a comfortable rate for normal operations.

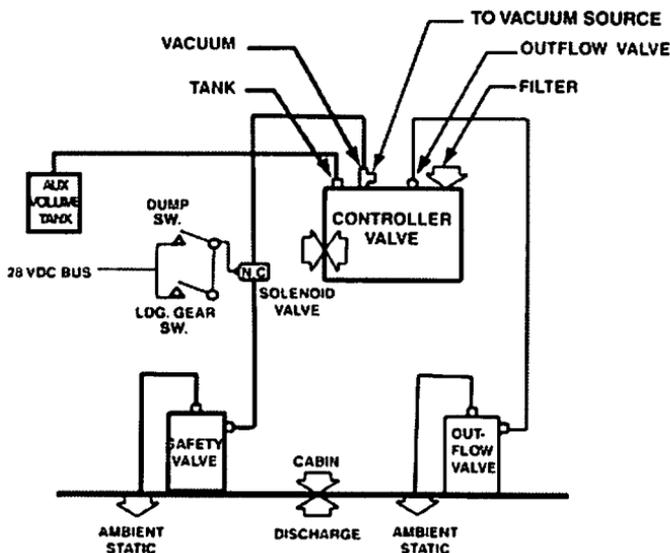
7.29 BLEED AIR, CONDITIONING AND PRESSURIZATION SYSTEM  
(continued)**PRESSURIZATION CONTROL SCHEMATIC**

Figure 7-29

Below the pilot's PFD, a triple indicator simplifies monitoring the system's operation. The triple indicator displays the cabin altitude, cabin rate of change and the differential pressure between the cabin and the outside atmosphere. Maximum cabin differential pressure is 5.5 psi.

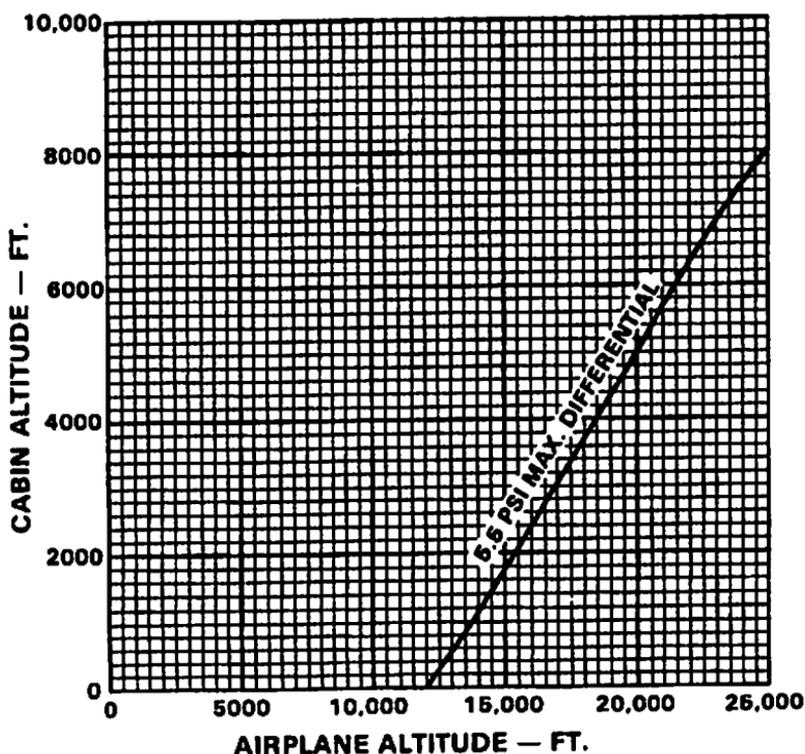
A **CABIN ALTITUDE** warning light on the annunciator display warns the pilot when the cabin altitude is above 10,000 feet. Cabin pressure is automatically regulated to a maximum of 5.5 psi pressure differential. Should the cabin outflow valve malfunction, the cabin safety valve will maintain a maximum of 5.6 cabin differential pressure. The landing gear squat switch, on the left main landing gear, prevents the cabin from being pressurized while the airplane is on the ground.

For complete instructions on the operation of the cabin pressurization system, refer to Section 4, Normal Procedures.

The **CABIN PRESS DUMP/NORM** switch, when set to DUMP, electrically opens a solenoid valve allowing vacuum suction pressure to open the safety valve and rapidly dump cabin pressure to ambient pressure.

7.29 BLEED AIR, CONDITIONING AND PRESSURIZATION SYSTEM  
(continued)

## CABIN ALTITUDE VS. AIRPLANE ALTITUDE



CABIN ALTITUDE vs. AIRPLANE ALTITUDE

Figure 7-31

## 7.29 BLEED AIR, CONDITIONING AND PRESSURIZATION SYSTEM (continued)

For unpressurized flight the CABIN PRESS control should be pulled fully out. Setting the CABIN PRESS/DUMP/NORM switch to DUMP will provide maximum airflow through the cabin. Cabin temperature will continue to be controlled by the CABIN TEMP control.

For complete instructions on pressurization malfunctions, refer to Section 3 - Emergency Procedures.

## 7.31 VACUUM SYSTEM

Vacuum for the system 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, an inlet air filter, and a manifold that connects the cabin pressure controller and vacuum solenoid valve. The latter two components are part of the cabin pressurization system.

The two vacuum regulators are mounted on the forward pressure bulkhead in the forward baggage compartment

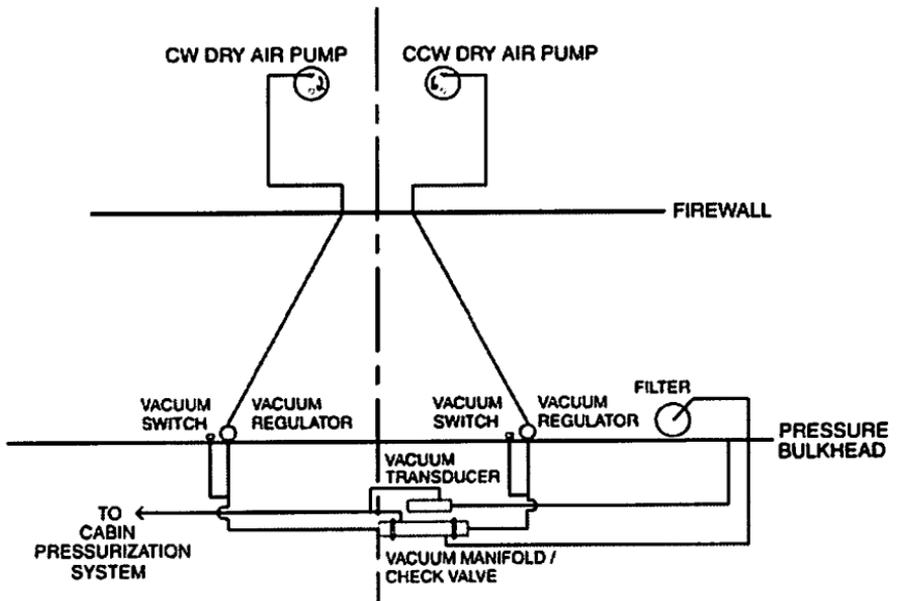
A vacuum indication on the MFD and two vacuum failure annunciators provide information to the pilot regarding the operation of both pumps. When both pumps are operating, neither annunciator is illuminated. The No. 1 vacuum failure annunciator will illuminate should the clockwise rotating pump fail, while the No. 2 vacuum failure annunciator will illuminate should the counterclockwise rotating pump fail.

Any decrease in system vacuum may indicate a dirty filter, dirty screens, sticking vacuum regulator, or a leak in the system.

Upon completion of the flight, all system abnormalities or malfunctions should be checked by a mechanic, and necessary repairs made, prior to further pressurized flight.

Operators of airplanes equipped with wing and tail deicers should refer to Section 9, Supplement 3, for additional information concerning the vacuum system.

7.31 VACUUM SYSTEM (continued)



VACUUM SYSTEM

Figure 7-33

### 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.

Shoulder harnesses shall be worn during takeoff, landing and during an emergency situation.

Standard cabin features include a pilot's storm window, map pockets, cup holders, sun visors, stowage drawers under the aft facing seats 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. A cabin entrance flood light is located above the door.

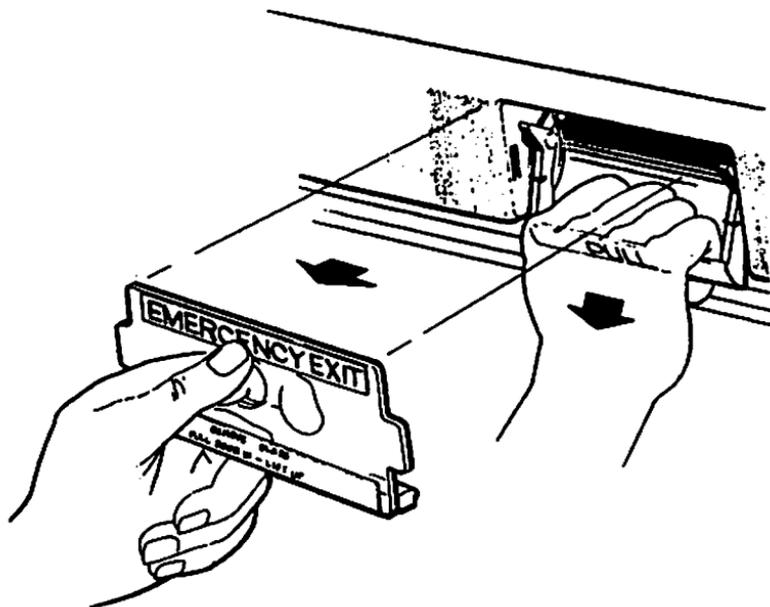
The four passenger seats with folding armrests and headrests are positioned in a club seating arrangement. The center seats face aft. The seat backs recline by pushing a button mounted in the outboard armrest.

An optional 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.

Optional cabinets located behind the pilot seats are available. The right cabinet is designed for Jeppesen manual stowage in the bottom and contains a drawer for general use.

The left cabinet contains a removable ice chest, a tray, space for six canned drinks, and a fold down cup holder in the lower drawer. The upper drawer has space for thermos containers, cups and miscellaneous items.

7.33 CABIN FEATURES (continued)



**EMERGENCY EXIT**

Figure 7-35

Optional passenger oxygen generators and masks are available and, if installed, are located in a drawer under the right aft facing seat.

Crew oxygen is located under the copilot's seat, readily available to either crew member. An annunciator light illuminates when any of the three generators have been activated. The light remains illuminated with the battery switch ON, until the system is serviced.

An optional fire extinguisher is available and, if installed, is located either behind the spar or on top of the right cabinet.

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. The cabin must be unpressurized to open the exit.

### 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 DOOR AJAR annunciator light will illuminate on the annunciator panel.

#### 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.

### **7.41 EMERGENCY LOCATOR TRANSMITTER**

The Emergency Locator Transmitter (ELT) operates on self-contained batteries and is located in the aft fuselage section. It is accessible through a cover on the bottom right side.

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.

The ME-406 ELT (406 MHz), if installed, is equipped with a warning buzzer. This 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 lengthens after a predetermined transmitter "ON" time. The objective is to hear the buzzer from outside the aircraft while the engine is not running.

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.

**7.41 EMERGENCY LOCATOR TRANSMITTER (continued)****ARTEX ELT OPERATION (continued)**

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.

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**SECTION 8****AIRPLANE HANDLING, SERVICING, AND MAINTENANCE****8.1 GENERAL**

This section provides guidelines relating to the handling, servicing, and maintenance of the Mirage. For complete maintenance instructions, refer to the PA-46-350P Maintenance Manual.

**WARNING**

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

**WARNING**

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

**8.1 GENERAL (continued)**

**WARNING**

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

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

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

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

## 8.1 GENERAL (continued)

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

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

Piper Service Bulletins are of special importance and Piper considers compliance mandatory. These are available on the Piper.com website. Depending on the nature of the release, material and labor allowances may apply. This information is provided to all authorized Piper Service Centers.

Service Letters deal with product improvements and servicing techniques pertaining to the airplane. These are available on the Piper.com website. 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.

### **8.3 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-46-350P (see PA-46-350P Maintenance and Inspection Manuals). The PA-46-350P Inspection Manual contains appropriate forms, and all inspection procedures should be complied with by a properly trained, knowledgeable, and qualified mechanic at an authorized 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 programmed Inspection, approved by the Federal Aviation Administration (FAA), is also available to the owner. This involves routine and detailed inspections to allow maximum utilization of the airplane. Maintenance inspection costs are reduced, and the maximum standard of continued airworthiness is maintained. Complete details are available from Piper.

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

### 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 accomplished in accordance with advisory Circular 43.13-2, when performed by an A & P mechanic, may be approved by the local FAA office. Major alterations to the basic airframe or systems not covered by AC 43.13-2 require a Supplemental Type Certificate.

### **8.7 AIRPLANE ALTERATIONS (continued)**

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

- (a) To be displayed in the aircraft at all times:
  - (1) Aircraft Airworthiness Certificate Form FAA-8100-2.
  - (2) Aircraft Registration Certificate Form FAA-8050-3.
  - (3) Aircraft Radio Station License if transmitters are installed.
- (b) To be carried in the aircraft at all times:
  - (1) Pilot's Operating Handbook.
  - (2) Weight and Balance data plus a copy of the latest Repair and Alteration Form FAA-337, if applicable.
  - (3) Aircraft equipment list.

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

### **8.9 GROUND HANDLING**

- (a) Towing

The airplane may be moved on the ground by the use of the nose wheel steering bar that is stowed in the 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.

**8.9 GROUND HANDLING (continued)****(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.
- (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.

**8.9 GROUND HANDLING (continued)**

**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.

**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.

**8.9 GROUND HANDLING (continued)**

- (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.

**8.11 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 conditions. Extra filters are inexpensive, and a spare should be kept on hand for use as a rapid replacement.

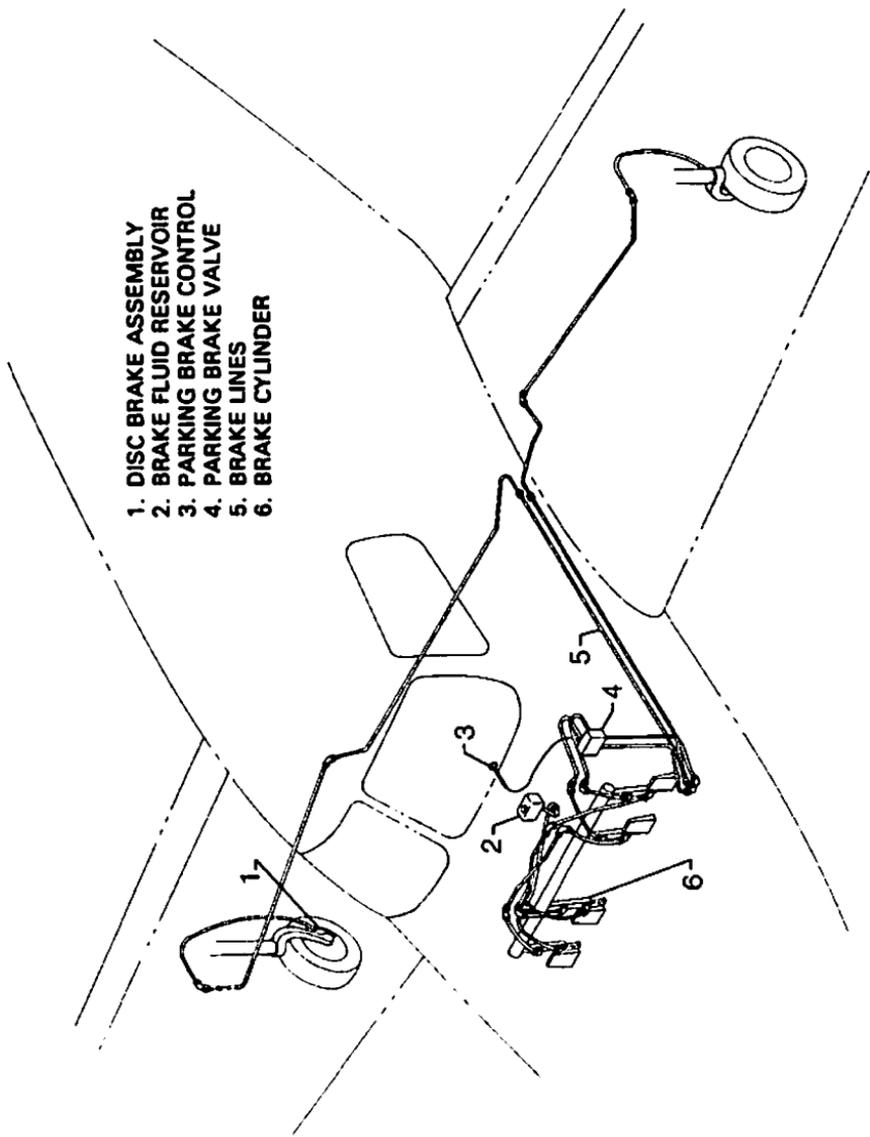
To clean the filter:

- (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 should be restricted to one year or 500 hours, whichever comes first.
- (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.

8.13 BRAKE SERVICE



**BRAKE SYSTEM**

Figure 8-1

### 8.13 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 blocks become excessively worn they should be replaced with new segments.

### 8.15 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.

### 8.17 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.

### **8.17 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 pushing the airplane back and forth with the rudder two degrees to the right to determine that the plane follows a straight line. The turning arc of the nose wheel is  $30^{\circ} \pm 1^{\circ}$  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  $2^{\circ}$  right with the rudder pedals neutralized and the nose wheel centered.

### **8.19 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.

**8.21 OIL REQUIREMENTS**

The oil capacity of the Textron Lycoming T10-540-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	<b>MINERAL OIL NOT APPROVED</b>	15W-50 or 20W-50
Above 80°F		60
Above 60°F		40 or 50
30°F to 90°F		40
0°F to 70°F		30, 40 or 20W-40
Below 10°F		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.

8.23 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
91/98	blue	2.0	*100LL	blue	2.0	none	none	none
100/130	green	3.0	100	green	**3.0	100/130	green	**3.0
115/145	purple	4.6	none	none	none	115/145	purple	4.6

\* -Grade 100LL fuel in some overseas countries is currently colored green and designated as "100L."

\*\* -Commercial fuel grade 100 and grade 100/130 (both of which are colored green) having TEL content of up to 4 ml/U.S. gallon are approved for use in all engines certificated for use with grade 100/130 fuel.

**8.23 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.

**8.23 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.

## 8.23 FUEL SYSTEM (continued)

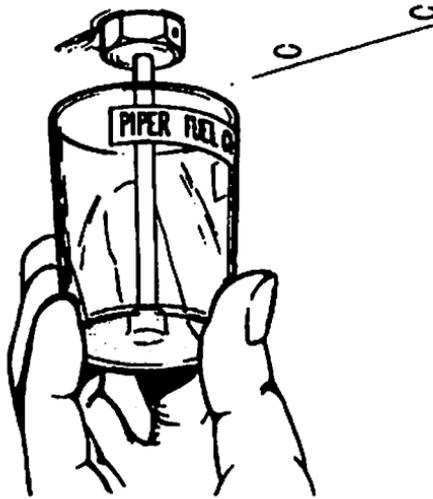
**FUEL TANK DRAIN**

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 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.

### **8.27 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, recharge starting at a 3 amp rate and finishing with a 1.5 amp rate. Quick charges are not recommended.

### **8.29 EMERGENCY OXYGEN SYSTEM (OPTIONAL)**

The optional emergency oxygen system must be serviced if used. The canister generators must be replaced with new units to restore the emergency system to a useable condition.

### **8.31 PRESSURIZATION SYSTEM**

The system should be given an operational check before each flight. Should the operational check show any malfunction of the pressurization system, refer to the Mirage Service Manual.

### 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-46-350P 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, 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-46-350P 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.*

**8.35 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.

**8.35 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 distortion 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 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)**

- (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 Mirage 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**

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)**

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-46-350P Maintenance Manual.

### 8.36 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.)

**8.36 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.

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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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**PILOT'S OPERATING HANDBOOK  
AND  
FAA APPROVED AIRPLANE FLIGHT MANUAL  
SUPPLEMENT NO. 1  
FOR  
EMERGENCY OXYGEN SYSTEM**

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Emergency Oxygen 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



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

DATE OF APPROVAL: March 30, 2006

**SECTION 1 - GENERAL**

This supplement supplies information necessary for the operation of the airplane when the optional Emergency Oxygen System is installed in accordance with FAA Approved Piper Data.

**SECTION 2 - LIMITATIONS**

The following placard is installed on the right cabin side panel, immediately forward of the copilot's air vent, and the right aft facing seat, aft of the air vent.

**EMERGENCY OXYGEN**

**IN DRAWER UNDER SEAT PULL  
MASK OUT OF DRAWER FULLY AT  
FULL EXTENSION GIVE CORD A TUG  
MAXIMUM DURATION = 15 MINS  
SEE POH  
NO SMOKING WHILE IN USE**

**SECTION 3 - EMERGENCY PROCEDURES**

In the event that the emergency oxygen system is needed, proceed as follows:

- Mask compartment(s).....OPEN
- Mask.....REMOVE and extend lanyard to full length; tug to activate generator. Unfold and don mask(s).
- Flow Indicator(s).....green area in bottom of accumulator INFLATES, indicating oxygen flow.
- Cabin Altitude .....REDUCE to a safe altitude consistent with terrain before the 15 minute oxygen supply is fully depleted.

**WARNING**

No smoking while oxygen is in use. Remove oil and grease (including lipstick, chapstick, makeup, etc.) before using oxygen.

**NOTE**

Descent should be started as soon as possible in order to assure that flow rate remains adequate throughout the descent. Refer to SECTION 3 of the basic POH and FAA Approved AFM for emergency descent procedures. This system, once activated, cannot be turned off.

**SECTION 4 - NORMAL PROCEDURES**

Prior to each flight, turn on the master switch and check that the amber OXYGEN annunciator light is not illuminated. If the annunciator is illuminated, one or more of the oxygen generators should be replaced. In addition, check the oxygen masks and hoses for accessibility and condition.

**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 OF THE EMERGENCY  
OXYGEN SYSTEM**

The optional emergency oxygen system consists of three "two-man" chemical oxygen generators, which provide sufficient oxygen flow for six people, during a descent from 25,000 feet to 12,000 feet or below, for a 15 minute time period. Once an oxygen generator is activated, it will continue to produce oxygen until depleted; no shut-off provisions are provided. Each generator has two oxygen masks connected, either of which is capable of activating the generator. The masks are accessible from each crew/passenger seat.

The system consists of two major assemblies, the crew assembly and the passenger assembly.

The crew assembly is located under the copilot's seat and contains one two-man oxygen generator and two masks mounted on a sliding tray. The tray is accessible from the aisle between the pilot's and copilot's seats and is pulled out from under the seat to expose the two masks. Each mask is connected to the generator with a clear plastic tube and lanyard. The tube delivers oxygen to the mask when the lanyard is pulled out, releasing the firing mechanism, which activates a chemical reaction within the oxygen generator. Each generator has two over-pressure relief valves to prevent excessive pressure in the generator, in the event of a malfunction or delivery tube restriction. When activated, the generator delivers oxygen to both attached masks simultaneously.

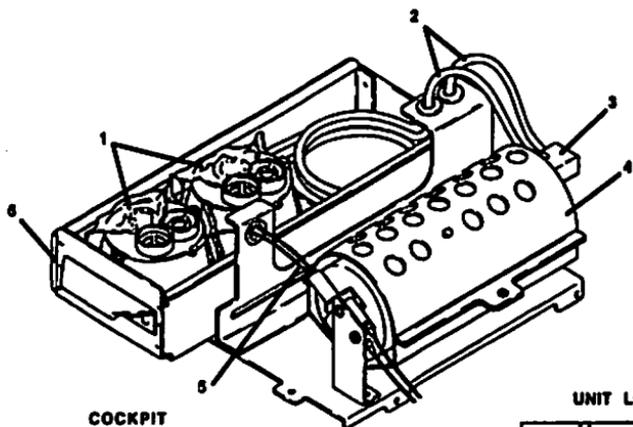
**SECTION 7 - DESCRIPTION AND OPERATION OF THE EMERGENCY  
OXYGEN SYSTEM (continued)**

The passenger assembly is located in the drawer in the right aft facing passenger seat base. The drawer is accessible from the aft side of the base, under the seat bottom and is pulled aft to expose the four masks. The two inboard masks are attached to one generator, while the two outboard masks are attached to the second generator. Either of the four masks will reach any of the four passenger seat locations. Activation of the generators is the same as the crew installation; pulling out the lanyard attached to the mask. Operation of the passenger provisions are identical to that of the crew.

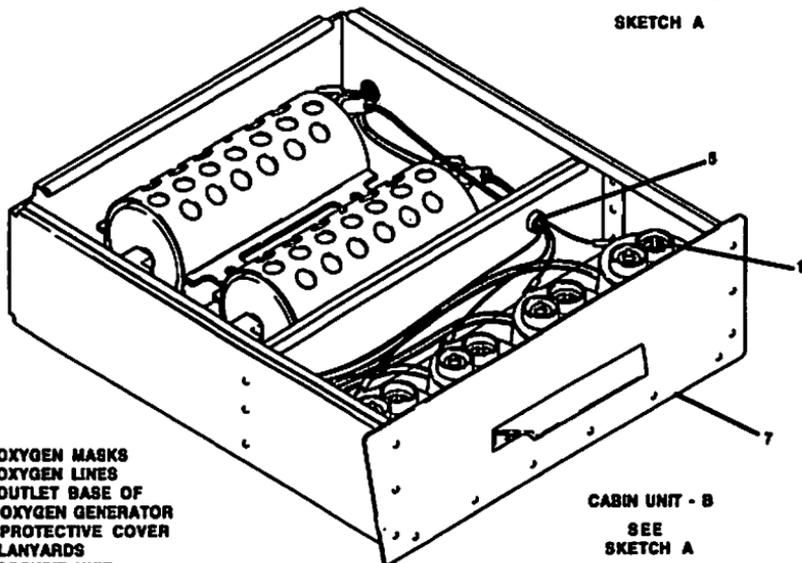
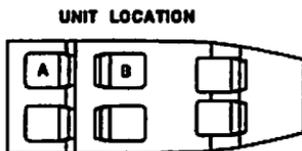
Placards are provided on the side panel outboard of the copilot's seat and the right aft facing seat, stating the location and operation of the oxygen system, and that smoking is prohibited while oxygen is in use.

An amber OXYGEN annunciator is provided to inform the crew whenever either of the three oxygen generators has been activated. The annunciator light is operated by a micro switch adjacent to each generator firing mechanism. The light will continue to be illuminated until the generator is replaced with a full one with an untripped firing mechanism.

SECTION 7 - DESCRIPTION AND OPERATION OF THE EMERGENCY  
OXYGEN SYSTEM (continued)



COCKPIT  
UNIT - A  
SEE SKETCH A



- 1. OXYGEN MASKS
- 2. OXYGEN LINES
- 3. OUTLET BASE OF OXYGEN GENERATOR
- 4. PROTECTIVE COVER
- 5. LANYARDS
- 6. COCKPIT UNIT
- 7. CABIN UNIT

CABIN UNIT - B  
SEE  
SKETCH A

OXYGEN SYSTEM INSTALLATION

Figure 7-1

**PILOT'S OPERATING HANDBOOK  
AND  
FAA APPROVED AIRPLANE FLIGHT MANUAL**

**SUPPLEMENT NO. 2  
FOR  
PROPELLER HEAT, HEATED WINDSHIELD AND  
WING ICE DETECTION LIGHT**

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when any or all of the following equipment is installed: Prop Heat, Heated Windshield, and Wing Ice Detection Light.

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



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DOA-510620-CE  
THE NEW PIPER AIRCRAFT, INC.  
VERO BEACH, FLORIDA

DATE OF APPROVAL: March 30, 2006

## SECTION 1 - GENERAL

This supplement supplies information necessary for the operation of the airplane when the optional propeller heat, heated windshield, and wing ice detection light are installed in accordance with FAA Approved Piper data.

## SECTION 2 - LIMITATIONS

- (a) This aircraft is not approved for flight in icing conditions. (See Supplement 3, Section 2 (a) Limitations.)
- (b) Under no circumstances should the heated windshield be turned on for a period exceeding 20 seconds unless the aircraft is in flight.

## SECTION 3 - EMERGENCY PROCEDURES

No change.

## SECTION 4 - NORMAL PROCEDURES

The equipment should be functionally checked for proper operation prior to flight.

### CAUTION

Do not operate propeller deice in ambient temperatures above 50° F to avoid damage to prop deicers.

A check of the heated propeller can be performed by turning the PROP HEAT switch ON and feeling the deice pads. The pads should become warm to the touch.

### CAUTION

To avoid possible windshield damage during ground operations, or during testing, do not turn the WSHLD HI switch ON for more than 20 seconds.

An operational check of the heated windshield may be done only if the ambient temperature of the windshield is less than 115°F (46°C), and the engine is running. To accomplish the check, turn one alternator OFF. Then, while observing the operating alternator's ammeter, select "WSHLD LO" switch to on by pressing once, then press again to turn off. Press the "WSHLD HI" switch to turn on, then press again to turn off. A load increase of approximately 13 amps when set to LOW, with an approximate 10 amp *additional* increase when set to HIGH, indicates normal operation.

**SECTION 4 - NORMAL PROCEDURES (continued)**

When in visible moisture at temperatures at or below +5°C and icing conditions are anticipated, turn on the windshield heat LO switch. If low windshield heat is inadequate or if icing is encountered at temperatures at or below -15°C, turn on the windshield heat HI switch.

**NOTE**

Depending on ambient temperatures, when switching from HIGH to LOW windshield heat, a WINDSHIELD HEAT FAIL annunciation may occur until the windshield surface temperature cools to the low heat temperature range.

**CAUTION**

The "Windshield Heat Fail" annunciator light will illuminate when a failure in the temperature sensor has occurred. As a result of this failure a possible over temp. of the windshield may result with windshield heat switch HI or LO turned on. In the event of the illumination of this annunciator the windshield heat switches should IMMEDIATELY be placed in the OFF position. Failure to select windshield heat OFF could result in severe damage to the windshield.

Windshield heat may be used to help clear the windshield during descent from high altitude.

**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, HEATED WINDSHIELD, AND WING ICE DETECTION LIGHT**

The presence of one or more items of 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 components are situated in the switch panel. (Figure 7-1).

**SECTION 7 - DESCRIPTION AND OPERATION OF PROPELLER  
HEAT, HEATED WINDSHIELD, AND WING ICE  
DETECTION LIGHT (continued)**

**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) situated in the switch panel. Circuit protection is provided by an ICE circuit breaker located in the EXTERIOR LIGHTS section of the pilot's aft circuit breaker 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 7-1) situated in the switch panel. Power for the propeller heat 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 heat system.

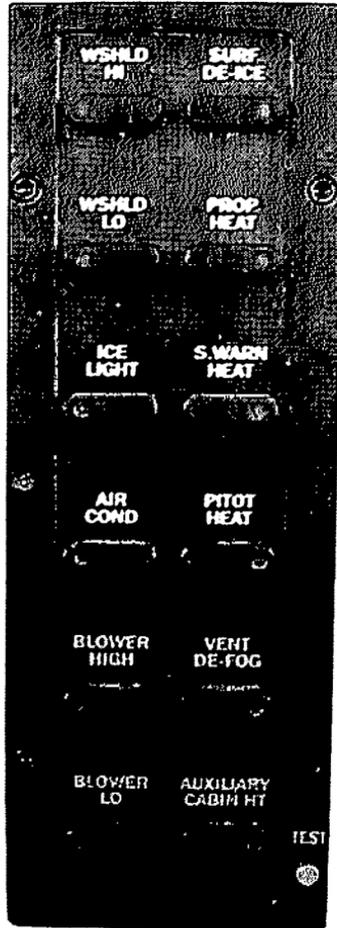
Power from the timer is cycled to brush assemblies which distribute power to slip rings. The current is then supplied from the slip rings directly to the electrothermal propeller heat pads.

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 designations are: HC-13YR-1E/7890K  
HC-13Y1R-1N/N7605K+2.

**SECTION 7 - DESCRIPTION AND OPERATION OF PROPELLER  
HEAT, HEATED WINDSHIELD, AND WING ICE  
DETECTION LIGHT (continued)**



**DEICE SWITCH PANEL**

Figure 7-1

**SECTION 7 - DESCRIPTION AND OPERATION OF PROPELLER  
HEAT, HEATED WINDSHIELD, AND WING ICE  
DETECTION LIGHT (continued)**

**ELECTRIC HEATED WINDSHIELD**

**WARNING**

Flight into known or forecast icing is not approved. If icing is encountered, take avoidance action immediately.

The electrically heated left windshield is controlled by two switches in the switch panel. One switch controls low windshield heat and the other high heat, and are labeled accordingly. To switch from LOW HEAT to HIGH HEAT, you must first de-select the LOW HEAT prior to selecting HIGH WSHLD HEAT. Circuit protection is provided by the windshield CONTROL and POWER breakers in the ICE PROTECTION section of the pilot's aft circuit breaker panel.

**CAUTION**

To avoid possible windshield distortion during ground operations, or during testing, do not turn on the WSHLD HI switch for more than 20 seconds.

A pre-takeoff operational check of the heated windshield may be done only if the ambient temperature of the windshield is less than 115°F (46°C), and the engine is running. To accomplish the check, turn one alternator OFF. Then, while observing the operating alternator's ammeter, select, first LOW WSHLD HEAT, and then to HIGH WSHLD HEAT. A load increase of approximately 13 amps when set to LOW, with an approximate 10 amp *additional* increase when set to HIGH, indicates normal operation.

**PILOT'S OPERATING HANDBOOK  
AND  
FAA APPROVED AIRPLANE FLIGHT MANUAL  
SUPPLEMENT NO. 3  
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



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DOA-510620-CE  
THE NEW PIPER AIRCRAFT, INC.  
VERO BEACH, FLORIDA

DATE OF APPROVAL: March 30, 2006

**SECTION 1 - GENERAL**

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

**SECTION 2 - LIMITATIONS**

- (a) The ice protection system was designed and tested for operation in the meteorological conditions of 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 and/or mixed conditions or for icing conditions more severe than those of FAR 25, Appendix C. Therefore, flight in those conditions may exceed the capabilities of the ice protection system.**
- (b) Equipment required for flight into known or forecast icing:
  - (1) Pneumatic wing and empennage boots and SURF DEICE annunciation.
  - (2) Wing ice detection light.
  - (3) Electrothermal propeller deice pads on the propeller blades.
  - (4) Electrically heated windshield and WSHLD HEAT annunciation.
  - (5) Heated lift detector.
  - (6) Heated pitot head.
  - (7) Dual alternators.
  - (8) Dual vacuum pumps.
  - (9) Alternate static source.
  - (10) All equipment required for night IFR flight.
- (c) If all the equipment listed is not installed and operative, the following placard must be installed in full view of the pilot.

**WARNING**

**THIS AIRCRAFT IS NOT APPROVED FOR FLIGHT  
IN ICING CONDITIONS.**

**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.

**ALTERNATOR FAILURE IN ICING CONDITIONS (ALTERNATOR #1 INOP or ALTERNATOR #2 INOP annunciator light illuminated)**

**NOTE**

Anytime total tie bus voltage is below 25 Vdc, the **LOW BUS VOLTAGE** annunciator will illuminate.

Verify failure.....	CHECK AMMETER
Electrical load (if Low Bus Voltage annunciator illuminated).....	Reduce until load is less than 75 amps & LOW BUS VOLTAGE annunciator extinguished.
Failed ALTR switch.....	OFF
Failed ALTR circuit breaker.....	CHECK and RESET as required
Failed ALTR switch (after OFF at least one second).....	ON
If power not restored:	
Failed ALTR switch.....	OFF
Ammeter.....	Monitor and maintain below 75 amps

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. Under no circumstances may the total electrical load exceed 75 amps. 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)**

**SINGLE VACUUM PUMP FAILURE IN ICING CONDITIONS** (Reduced suction pressure and left or right vacuum inoperative annunciator illuminate)

Gyro Suction Gauge .....Check (within normal operating range)  
Operative Pump vacuum inoperative annunciator .....extinguished

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

**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  
(b) OFF (flashing)  
for approx. 90 seconds

Illumination of the prop heat deice 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.*

**SECTION 3 - EMERGENCY PROCEDURES (continued)****SURFACE DEICE MALFUNCTION**

If SURFACE DE-ICE annunciator light remains illuminated more than 30 seconds, pull the surface deice circuit breaker. Immediate action should be taken to exit icing conditions.

**WINDSHIELD ANTI-ICE HEAT MALFUNCTION**

If WINDSHIELD HEAT FAIL annunciator illuminates, immediately select WSHLD HI or WSHLD LO switch to OFF. Take immediate action to exit icing conditions.

**SECTION 4 - NORMAL PROCEDURES**

The Piper Mirage 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.

**PREFLIGHT****CAUTION**

To avoid possible windshield distortion during ground operations, or during testing, do not position the WSHLD HEAT switch to HIGH for more than 20 seconds.

- (a) A check of the heated propeller should be performed by pressing "prop heat" button on switch 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.

**SECTION 4 - NORMAL PROCEDURES (continued)**

After 30 seconds, the flash rate is reduced, indicating the heater is in the "off" cycle. The green lamp will continue to flash at the slower flash rate as long as the aircraft is on the ground or until the pilot de-selects "prop heat" on the switch panel.

**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.

- (b) A check of the heated pitot head and lift detector should be performed by turning the S. WRN HEAT and PITOT HEAT switches ON and touching the units.
- (c) The surface boots should be checked prior to flight for damage and cleanliness. If necessary, damage should be repaired and boots cleaned prior to flight. An operational check of the boot system should be performed during engine run-up at 2000 RPM as follows:
  - (1) Actuate the momentary SURFACE DE-ICE switch - the boots will inflate through three phases: empennage, lower wing and upper wing with a duration of approximately six seconds per phase. The surface boot system then remains off until the switch is activated again. A green SURFACE DE-ICE annunciator light will remain on for approximately eighteen seconds.
  - (2) Visually check to insure that the boots have fully deflated to indicate proper operation of the vacuum portion of the pneumatic boot pump system.
- (d) An operational check of the heated windshield may be done only if the ambient temperature of the windshield is *less* than 115°F (46°C), and the engine is running. To accomplish the check, turn one alternator OFF. Then, while observing the operating alternator's ammeter, press WSHLD LO to ON, a load increase of approximately 13 amps will be seen on aircraft ammeter. Press WSHLD HI to ON, a load increase of 10 additional amps indicates normal operation. Press WSHLD HI and WSHLD LO switches to the OFF position.
- (e) Check the operation of both alternators by observing that both ammeters indicate an output.
- (f) During engine run-up, check that both vacuum pumps are operating by observing that both the left and right vacuum inop. annunciators are extinguished.

**SECTION 4 - NORMAL PROCEDURES (continued)**

**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. Continuous attention of the pilot is required to monitor the rate of ice build-up in order to effect the boot cycle at the optimum time. Boots should be cycled when ice has built to between 1/4 and 1/2 inch thickness on the leading edge to assure proper ice removal. Repeated boot cycles at less than 1/4 inch can cause a cavity to form under the ice and prevent removal; boot cycles at thicknesses greater than 1/2 inch may also fail to remove ice.

Before entering probable icing conditions use the following procedures:

- (a) INDUCTION AIR .....ALTERNATE
- (b) PITOT HEAT switch .....ON
- (c) S. WRN HEAT switch .....ON
- (d) WSHLD LO switch .....ON (WSHLD HI in actual ice)
- (e) PROP HEAT switch .....ON
- (f) DEFROST knob .....OUT
- (g) VENT/DEFOG BLWR switch .....ON, if additional  
defrost is desired
- (h) SURFACE DEICE switch .....activate after 1/4 to 1/2  
inch accumulation
- (i) Relieve propeller unbalance (if required) by exercising propeller control briefly. Repeat as required.

**NOTE**

For accurate magnetic compass readings, turn the WSHLD LO and HI, PROP HEAT and PITOT HEAT switches OFF momentarily.

**WARNING**

Do not cycle surface boots with less than 1/4 inch of ice accumulation. Operation of boots with less than 1/4 inch of ice accumulation can result in failure to remove ice. Do not hold the momentary SURFACE DEICE 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 deicer boots.

**SECTION 4 - NORMAL PROCEDURES (continued)**

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.

**NOTE**

Anytime total tie bus voltage is below 25 Vdc, the **LOW BUS VOLTAGE** annunciator will illuminate.

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 are not accurate and should not be relied upon.

If ice is remaining on the unprotected surfaces of the airplane at the termination of the flight, the landing can be made using full flaps and carrying a slight amount of power whenever practical. 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. Approach speeds should be increased by 10 to 15 knots. Allow for increased landing distance due to the higher approach speeds.

**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**

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.

## 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

Ice accumulation on the unprotected surfaces can result in significant performance loss. During cruise, loss of airspeed can be as much as 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 91-51, 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

For flight into known icing conditions (FIKI), a complete ice protection system is required on the Mirage.

The complete 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 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 components are located above the right radio stack (Figure 7-1).

A single component or a combination of components may be installed. However, the warning placard specified in Section 2 of this supplement is required when the complete system is not installed. Such a placard is also required if any component is inoperative.

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) located on the deice 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.

**SECTION 7 - DESCRIPTION AND OPERATION OF THE ICE PROTECTION SYSTEM AND EQUIPMENT (cont.)****WING AND EMPENNAGE BOOTS (continued)**

The boot solenoid valves are activated and air pressure is released to the boots, sequentially inflating the surface deicers. A SURFACE DE-ICE indicator light, located on the annunciator panel illuminates when the boots inflate. When the cycle is complete, the deicer solenoid valves permit automatic overboard exhaustion of pressurized air. Suction is then reapplied to the boots.

Circuit protection for the surface deice system is provided by a SURF DEICE 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 switch panel. Circuit protection is provided by an ICE circuit breaker located in the EXTERIOR LIGHTS section of the pilot's aft circuit breaker panel.

**ELECTRIC 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 deice 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.

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.

The propeller designations are: HC-13YR-1E/7890K  
HC-13Y1R-1N/N7605K+2

**SECTION 7 - DESCRIPTION AND OPERATION OF THE ICE  
PROTECTION SYSTEM AND EQUIPMENT (cont.)**

**ELECTRIC PROPELLER DEICE (cont.)**

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.

**ELECTRICALLY HEATED WINDSHIELD**

The electrically heated left windshield is heated by current from the aircraft electrical system. It is controlled by WSHLD HI and WSHLD LO switches located on the switch panel. Circuit protection is provided by the windshield 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 HI 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 will illuminate the WINDSHIELD HEAT FAIL light located in the annunciator panel. In this eventuality the heated windshield should immediately be selected OFF.

**HEATED LIFT DETECTOR**

A heated lift detector is installed on the left wing. It is controlled by a S. WRN HEAT switch located on the 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 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 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 head is installed under the the wing. It is controlled by an ON-OFF type PITOT HEAT switch located on the switch panel and is protected by a PITOT HEAT circuit breaker 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. During normal operation both alternators must be turned ON. The system is designed so that the alternators will share the total load equally. If either ALTR switch is turned OFF the appropriate annunciator light (ALTERNATOR 1 INOP or ALTERNATOR 2 INOP) will illuminate and remain lit.

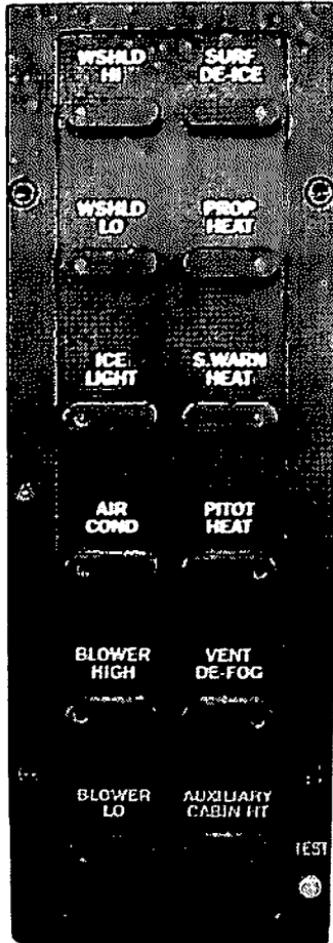
**DUAL VACUUM PUMPS**

Dual engine driven vacuum pumps are installed as standard equipment. 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.

**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 down. To select alternate static source, place the lever in the up position. When the alternate static source is selected the airspeed and altimeter and vertical speed indicator are vented to the alternate static pad 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 sources at different airspeeds. 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.

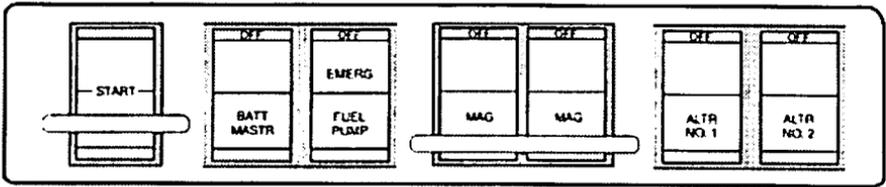
SECTION 7 - DESCRIPTION AND OPERATION OF THE ICE  
PROTECTION SYSTEM AND EQUIPMENT (cont.)



DEICE SWITCH PANEL

Figure 7-1

SECTION 7 - DESCRIPTION AND OPERATION OF THE ICE  
PROTECTION SYSTEM AND EQUIPMENT (cont.)



LEFT

OVERHEAD SWITCH PANEL - PILOT SIDE

Figure 7-2

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**PILOT'S OPERATING HANDBOOK  
AND  
FAA APPROVED AIRPLANE FLIGHT MANUAL**

**SUPPLEMENT NO. 4  
FOR  
GARMIN GNS 430 VHF COMMUNICATION  
TRANSCIVER/VOR/ILS RECEIVER/GPS RECEIVER**

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Garmin GNS 430 VHF Communication Transceiver/VOR/ILS Receiver/Global Positioning System is installed per the Equipment List. The information contained herein supplements or supersedes the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED:



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

DATE OF APPROVAL: March 30, 2006

**SECTION 1 - GENERAL**

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

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

- VFR/IFR enroute, terminal, and non-precision instrument approach (GPS, Loran-C, VOR, VOR-DME, TACAN, NDB, NDB-DME, RNAV) operation within the U.S. National Airspace System in accordance with AC 20-138.
- North Atlantic Minimum Navigation Performance Specification (MNPS) Airspace in accordance with AC 91-49 and AC 120-33.
- The system meets RNP5 airspace (BRNAV) requirements of AC 90-96 and in accordance with AC 20-138, and JAA AMJ 20X2 Leaflet 2 Revision 1, provided it is receiving usable navigation information from the GPS receiver.

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

**SECTION 2 - LIMITATIONS**

- A. The GARMIN GNS 430/430A Pilot’s Guide, p/n 190-00140-00, Rev. G, dated April 2003, or later appropriate revision, must be immediately available to the flight crew whenever navigation is predicated on the use of the system.
- B. The GNS 430 must utilize the following or later FAA approved software versions:

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

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

- C. IFR enroute and terminal navigation predicated upon the GNS 430’s GPS Receiver is prohibited unless the pilot verifies the currency of the data base or verifies each selected waypoint for accuracy by reference to current approved data.
  - D. Instrument approach navigation predicated upon the GNS 430’s GPS Receiver must be accomplished in accordance with approved instrument approach procedures that are retrieved from the GPS equipment data base. The GPS equipment data base must incorporate the current update cycle.
1. Instrument approaches utilizing the GPS receiver must be conducted in the approach mode and Receiver Autonomous Integrity Monitoring (RAIM) must be available at the Final Approach Fix.

**SECTION 2 - LIMITATIONS (continued)**

2. Accomplishment of ILS, LOC, LOC-BC, LDA, SDF, MLS or any other type of approach not approved for GPS overlay with the GNS 430's GPS receiver is not authorized.
  3. Use of the GNS 430 VOR/ILS receiver to fly approaches not approved for GPS require VOR/ILS navigation data to be present on the external indicator.
  4. When an alternate airport is required by the applicable operating rules, it must be served by an approach based on other than GPS or Loran-C navigation, the aircraft must have the operational equipment capable of using that navigation aid, and the required navigation aid must be operational.
  5. VNAV information may be utilized for advisory information only. Use of VNAV information for Instrument Approach Procedures does not guarantee Step-Down Fix altitude protection, or arrival at approach minimums in normal position to land.
- E. If not previously defined, the following default settings must be made in the "SETUP 1" menu of the GNS 430 prior to operation (refer to Pilot's Guide for procedure if necessary):
1. dis, spd . . . .nm kt (sets navigation units to "nautical miles" and "knots")
  2. alt, vs . . . .ft fpm (sets altitude units to "feet" and "feet per minute")
  3. map datum...WGS 84 (sets map datum to WGS-84, see note below)
  4. posn . . . . .deg-min (sets navigation grid units to decimal minutes)

**NOTE**

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

**SECTION 3 - EMERGENCY PROCEDURES****ABNORMAL PROCEDURES**

- A. If GARMIN GNS 430 navigation information is not available or invalid, utilize remaining operational navigation equipment as required.
- B. If "RAIM POSITION WARNING" message is displayed the system will flag and no longer provide GPS based navigational guidance. The crew should revert to the GNS 430 VOR/ILS receiver or an alternate means of navigation other than the GNS 430's GPS receiver.
- C. If "RAIM IS NOT AVAILABLE" message is displayed in the enroute, terminal, or initial approach phase of flight, continue to navigate using the GPS equipment or revert to an alternate means of navigation other than the GNS 430's GPS receiver appropriate to the route and phase of flight. When continuing to use GPS navigation, position must be verified every 15 minutes using the GNS 430's VOR/ILS receiver or another IFR-approved navigation system.
- D. If "RAIM IS NOT AVAILABLE" message is displayed while on the final approach segment, GPS based navigation will continue for up to 5 minutes with approach CDI sensitivity (0.3 nautical mile). After 5 minutes the system will flag and no longer provide course guidance with approach sensitivity. Missed approach course guidance may still be available with 1 nautical mile CDI sensitivity by executing the missed approach.
- E. In an in-flight emergency, depressing and holding the Comm transfer button for 2 seconds will select the emergency frequency of 121.500 Mhz into the "Active" frequency window.

**SECTION 4 - NORMAL PROCEDURES**

**WARNING**

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

**A. DETAILED OPERATING PROCEDURES**

Normal operating procedures are described in the GARMIN GNS 430 Pilot's Guide, p/n 190-00140-00, Rev. G, dated April 2003, or later appropriate revision.

**B. PILOT'S DISPLAY**

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

**C. AUTOPILOT/FLIGHT DIRECTOR OPERATION**

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

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

**SECTION 5 - PERFORMANCE**

No change.

**SECTION 6 - WEIGHT AND BALANCE**

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

**SECTION 7 - DESCRIPTION AND OPERATION**

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

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**PILOT'S OPERATING HANDBOOK  
AND  
FAA APPROVED AIRPLANE FLIGHT MANUAL**

**SUPPLEMENT NO. 5  
FOR  
GARMIN GTX 330 TRANSPONDER**

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Garmin GTX 330 Transponder is installed per the Equipment List. The information contained herein supplements or supersedes the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED:



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

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## **SECTION 1 - GENERAL**

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

## **SECTION 2 - LIMITATIONS**

- A. Display of TIS traffic information is advisory only and does not relieve the pilot responsibility to "see and avoid" other aircraft. Aircraft maneuvers shall not be predicated on the TIS displayed information.
- B. Display of TIS traffic information does not constitute a TCAS I or TCAS II collision avoidance system as required by 14 CFR Part 121 or Part 135.
- C. Title 14 of the Code of Federal Regulations (14 CFR) states that "When an Air Traffic Control (ATC) clearance has been obtained, no pilot-in-command (PIC) may deviate from that clearance, except in an emergency, unless he obtains an amended clearance." Traffic information provided by the TIS up-link does not relieve the PIC of this responsibility.
- D. The 400/500 Series Garmin Display Interfaces (Pilot's Guide Addendum) P/N 190-00140-13 Rev. A or later revision must be accessible to the flight crew during flight.
- E. 400/500 Series Main Software 4.00 or later FAA approved software is required to operate the TIS interface and provide TIS functionality.

## **SECTION 3 - EMERGENCY PROCEDURES**

To transmit an emergency signal:

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

To transmit a signal representing loss of all communications:

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

**SECTION 4 - NORMAL PROCEDURES****BEFORE TAKEOFF:**

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

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

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

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

**NOTE**

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

**NOTE**

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

**1. DETAILED TRANSPONDER OPERATING PROCEDURES**

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

**2. DISPLAY OF TRAFFIC INFORMATION SERVICE (TIS) DATA**

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

**SECTION 5 - PERFORMANCE**

No change.

**SECTION 6 - WEIGHT AND BALANCE**

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

**SECTION 7 - DESCRIPTION AND OPERATION**

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

**PILOT'S OPERATING HANDBOOK  
AND  
FAA APPROVED AIRPLANE FLIGHT MANUAL**

**SUPPLEMENT NO. 6  
FOR  
GARMIN GMA 340 AUDIO PANEL**

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Garmin GMA 340 is installed per the Equipment List. The information contained herein supplements or supersedes the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures, and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED:



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

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**SECTION 1 - GENERAL**

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

**SECTION 2 - LIMITATIONS**

No change.

**SECTION 3 - EMERGENCY PROCEDURES**

No change.

**SECTION 4 - NORMAL PROCEDURES**

**AUDIO CONTROL SYSTEM OPERATION:**

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

**NOTE**

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

**MARKER BEACON RECEIVER OPERATION:**

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

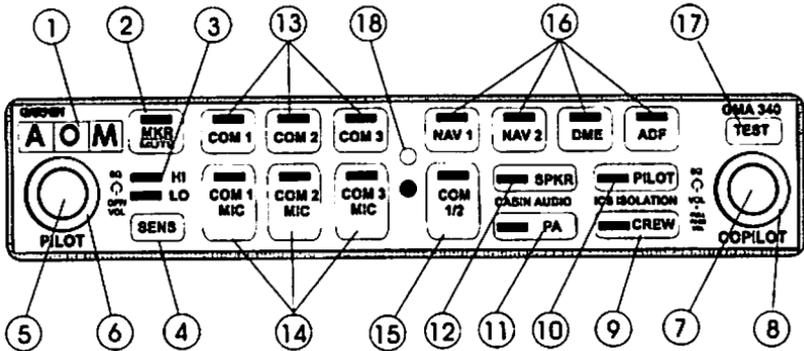
## SECTION 5 - PERFORMANCE

No change.

## SECTION 6 - WEIGHT AND BALANCE

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

## SECTION 7 - DESCRIPTION AND OPERATION



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

**SECTION 7 - DESCRIPTION AND OPERATION (continued)**

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

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

**Transceivers**

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

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

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

**NOTE**

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

**SECTION 7 - DESCRIPTION AND OPERATION (continued)****Split COM**

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

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

**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 (16) or MRK (2) selects each audio source. A second button press deselects the audio.

**Speaker Output**

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

**PA Function**

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

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

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

**PILOT'S OPERATING HANDBOOK  
AND  
FAA APPROVED AIRPLANE FLIGHT MANUAL**

**SUPPLEMENT NO. 7  
FOR  
PRECISE FLIGHT SPEEDBRAKE 2000 SYSTEM**

The FAA approved operational supplement for the Precise Flight SpeedBrake 2000 System, installed in accordance with STC SA00520SE, is required for operation of this system. Precise Flight will be responsible to supply and revise the operational supplement. It is permitted to include the Precise Flight supplement in this location of the Pilot's Operating Handbook unless otherwise stated by Precise Flight. The information contained in the Precise Flight supplement may supersede or supplement the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual with respect to the operation of the Precise Flight SpeedBrake 2000 System. For limitations, procedures and performance information not contained in the Precise Flight supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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**PILOT'S OPERATING HANDBOOK  
AND  
FAA APPROVED AIRPLANE FLIGHT MANUAL**

**SUPPLEMENT NO. 8  
FOR  
S-TEC YAW DAMPER SYSTEM  
(28 Volt System)**

The FAA approved operational supplement for the S-TEC Yaw Damper System, installed in accordance with STC SA09402AC-D, is required for operation of this system. S-TEC will be responsible to supply and revise the operational supplement. It is permitted to include the S-TEC supplement in this location of the Pilot's Operating Handbook unless otherwise stated by S-TEC. The information contained in the S-TEC supplement may supersede or supplement the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual with respect to the operation of the S-TEC Yaw Damper System. For limitations, procedures and performance information not contained in the S-TEC supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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**PILOT'S OPERATING HANDBOOK  
AND  
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**SUPPLEMENT NO. 9  
FOR  
S-TEC SYSTEM 55X TWO AXIS  
AUTOMATIC FLIGHT GUIDANCE SYSTEM  
WITH TRIM MONITOR  
(28 Volt System)**

The FAA approved operational supplement for the S-TEC System 55X Autopilot, installed in accordance with STC SA09402AC-D, is required for operation of this system. S-TEC will be responsible to supply and revise the operational supplement. It is permitted to include the S-TEC supplement in this location of the Pilot's Operating Handbook unless otherwise stated by S-TEC. The information contained in the S-TEC supplement may supersede or supplement the information in the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual with respect to the operation of the S-TEC System 55X Autopilot. For limitations, procedures and performance information not contained in the S-TEC supplement, consult the basic Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

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**PILOT'S OPERATING HANDBOOK  
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FAA APPROVED AIRPLANE FLIGHT MANUAL**

**SUPPLEMENT NO. 10  
FOR  
BENDIX/KING KR-87 DIGITAL ADF  
WITH KI-227 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 KI-227 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:



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

DATE OF APPROVAL: March 30, 2006

## **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 is comprised of a receiver, a built-in electronic timer, a bearing indicator 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 and the bearing indicator 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 Button - SELECT ADF mode and note relative bearing on indicator.

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

1. ADF Button - SELECT ANT mode and note pointer moves to 90° position.
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/ELT 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.

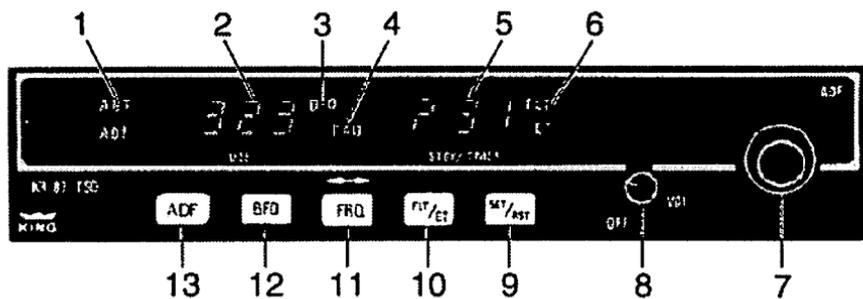
**SECTION 5 - PERFORMANCE**

No change.

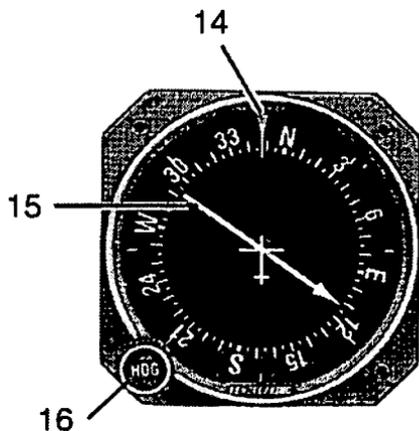
**SECTION 6 - WEIGHT AND BALANCE**

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



KI-227 Indicator

King Digital ADF Operating Controls and Indicators  
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 park in the 90° relative position. 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 FRO 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. Index (Rotatable Card) - Indicates relative, magnetic, or true heading of aircraft, as selected by the HDG control.

**SECTION 7 - DESCRIPTION AND OPERATION (continued)**

**Legend - Figure 1 (continued)**

15. Pointer - Indicates station bearing in degrees of azimuth, relative to the nose of the aircraft. When heading control is adjusted, indicates relative, magnetic, or true bearing of radio signal.
16. Heading Card Control (HDG) - Rotates card to set in relative, magnetic, or true bearing information.

**PILOT'S OPERATING HANDBOOK  
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**SUPPLEMENT NO. 11  
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:



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

DATE OF APPROVAL: March 30, 2006

**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 KDI-572 Panel Display which contains all the operating controls and displays, and a remotely mounted KN-63 Receiver-Transmitter. The KDI-572 Panel Display digitally displays distances in nautical miles, ground speed in knots, and time to station in minutes. All displays are in self-dimming gas discharge numerics.

**SECTION 2 - LIMITATIONS**

No change.

**SECTION 3 - EMERGENCY PROCEDURES**

No change.

**SECTION 4 - NORMAL PROCEDURES**

**DME Operation**

1. DME Mode Selector Switch - SET to N1 or N2.
2. NAV 1 and NAV 2 VHF Navigation Receivers - ON; SET FREQUENCY selector switches to VOR/DME station frequencies, as required.

**NOTE**

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

3. DME SPEAKER/PHONE selector buttons (on audio control panel) - SET to desired mode.

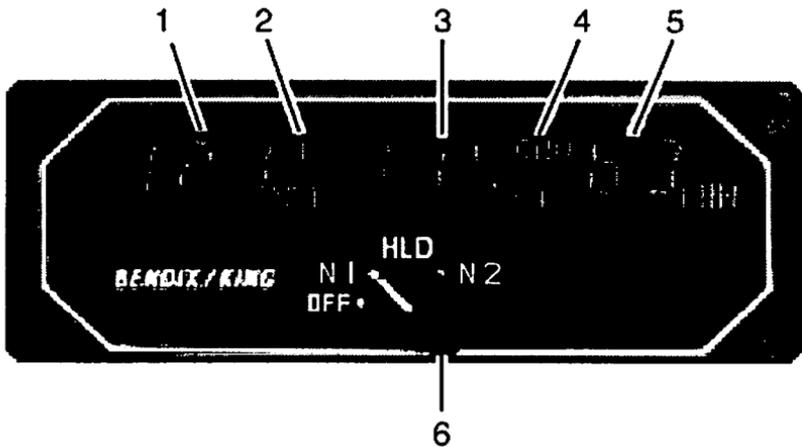
**SECTION 5 - PERFORMANCE**

No change.

**SECTION 6 - WEIGHT AND BALANCE**

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

## SECTION 7 - DESCRIPTION AND OPERATION



Bendix/King KN-63 DME

Figure 1

## Legend - Figure 1

1. DISTANCE DISPLAY (NM) - DME distance to VORTAC/WAYPOINT displayed in .1 nautical mile increments up to 99.9 NM, then in increments of one nautical mile to 389 NM.
2. DME MODE ANNUNCIATOR - Displays the DME operating mode: NAV 1 (1); NAV 2 (2); NAV 1 HOLD (H1); NAV 2 HOLD (H2); of the mode selector switch (6).
3. GROUND SPEED DISPLAY (KT) - Displays ground speed in knots to or from VORTAC/WAYPOINT up to 999 knots (aircraft must be flying directly to or from the VORTAC/WAYPOINT for true ground speed indication).
4. RNAV ANNUNCIATOR (RNV) - Indicates RNV when displayed data is in relation to the RNAV waypoint. If the wrong DME mode is selected during RNAV operation, the RNAV annunciator will flash.
5. TIME-TO-STATION DISPLAY (MIN) - Displays time-to-station (VORTAC/WAYPOINT) in minutes up to 99 minutes (aircraft must be flying directly to or from the Vortac/Waypoint for true time-to-station indication).

**SECTION 7 - DESCRIPTION AND OPERATION (continued)**

**Legend - Figure 1 (continued)**

6. DME MODE SELECTOR SWITCH (OFF, N1, HLD, N2) - Applies power to the DME and selects DME operating mode as follows:
- OFF: Turns DME power off.
- NAV 1  
(N1): Selects DME operation with No. 1 VHF navigation set; enables channel selection by NAV 1 frequency selector controls.
- HOLD  
(HLD): Selects DME memory circuit; DME remains channeled to station to which it was last channeled when HOLD was selected and will continue to display information relative to this channel. Allows both the NAV 1 and NAV 2 navigation receivers to be set to new operational frequencies without affecting the previously selected DME operation.

**NOTE**

In the HOLD mode there is no annunciation of the VOR/DME station frequency. However, an annunciator labeled "H1" or "H2" illuminates on the DME display to flag the pilot that the DME is in the HOLD mode.

NAV 2

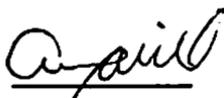
- (N2): Selects DME operation with No. 2 VHF navigation set; enables channel selection by NAV 2 frequency selector switches. Brightness of the labels for this switch is controlled by the RADIO light dimming rheostat.

**PILOT'S OPERATING HANDBOOK  
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**SUPPLEMENT NO. 12  
FOR  
GARMIN GNS 430W VHF COMMUNICATION  
TRANSCIVER/VOR/ILS RECEIVER/GPS RECEIVER**

This supplement must be attached to the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual when the Garmin GNS 430W VHF Communication Transceiver/VOR/ILS Receiver/Global Positioning System is installed per the Equipment List. The information contained herein supplements or supersedes the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this supplement, consult the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.

FAA APPROVED:



ALBERT J. MILL  
DOA-510620-CE  
PIPER AIRCRAFT, INC.  
VERO BEACH, FLORIDA

DATE OF APPROVAL: March 4, 2008

**SECTION 1 - GENERAL**

The GNS430W System is a fully integrated, panel mounted instrument, which contains a VHF Communications Transceiver, a VOR/ILS receiver, and a WAAS-enabled Global Positioning System (GPS) Navigation computer. The system consists of a GPS antenna, GPS/WAAS receiver, VHF VOR/LOC/GS antenna, VOR/ILS receiver, VHF COMM antenna and a VHF Communications transceiver. The primary function of the VHF Communication portion of the equipment is to facilitate communication with Air Traffic Control. The primary function of the VOR/ILS Receiver portion of the equipment is to receive and demodulate VOR, Localizer, and Glide Slope signals. The primary function of the GPS/WAAS portion of the system is to acquire signals from the GPS system satellites, recover orbital data, make range and Doppler measurements, and process this information in real-time to obtain the user's position, velocity, and time.

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

- **GPS/WAAS TSO-C146a Class 3 Operation:** The Garmin GNS430W uses GPS and WAAS (within the coverage of a Space-Based Augmentation System complying with ICAO Annex 10) for enroute, terminal area, non-precision approach operations (including "GPS" and "RNAV" approaches) and approach procedures with vertical guidance (including "LNAV/VNAV" and "LPV").

GPS 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.

**SECTION 1 - GENERAL (continued)****Class II Oceanic, Remote, and other operations**

The Garmin 430W has been found to comply with the requirements for GPS primary means of Class II navigation in oceanic and remote airspace when used in conjunction with Garmin Prediction Program part number 006-A0154-03. Oceanic operations are supported when the GNS430W unit annunciates OCN. This provides an alarm limit of four nautical miles and a mask angle of five degrees. The GNS430W unit also has the ability to predict RAIM availability at any waypoint in the database if WAAS corrections are expected to be absent or disabled. This does not constitute an operational approval for Oceanic or Remote area operations. Additional equipment installations or operational approvals may be required.

- Oceanic navigation requires an additional approved long range oceanic and/or remote area navigation system with independent display, sensors, antenna, and power source.
- Redundant VHF Com and VHF Nav systems may be required for other than US 14 CFR Part 91 operations. Check foreign regulation requirements as applicable.
- Operations approval *may* be granted for the use of the GNS430W unit RAIM prediction function in lieu of the Prediction Program for operators requiring this capability. Refer to your appropriate civil aviation authorities for these authorizations.

**SECTION 2 - LIMITATIONS**

**Pilot's Guide**

The Garmin 400W Series Pilot's Guide, part number and revision listed below (or later revisions), must be immediately available for the flight crew whenever navigation is predicated on the use of the GNS430W unit.

- 400W Series Pilot's Guide & Reference P/N 190-00356-00 Rev. B

This AFM supplement does not grant approval for IFR operations to aircraft limited to VFR operations. Additional aircraft systems may be required for IFR operational approval.

**System Software**

The system must utilize the Main and GPS software versions listed below (or later FAA approved versions for this installation). The software versions are displayed on the self-test page immediately after turn-on, for approximately 5 seconds, or they can be accessed in the AUX pages.

Subsequent software versions may support different functions. Check the 400W Series Pilot's Guide for further information.

**Table 1 - Approved Software Versions**

Software Item	Approved Software Version (or later FAA approved versions)	
	SW version	As displayed on unit
Main SW Version	3.0	3.0
GPS SW Version	3.0	3.0

**Navigation Data Base**

The GNS430W unit database cards listed in the following table (or later FAA approved versions for this installation) must be installed.

- IFR enroute and terminal navigation is prohibited unless the pilot verifies the currency of the database or verifies each selected waypoint for accuracy by reference to current approved data.

**SECTION 2 - LIMITATIONS (continued)****Navigation Data Base (continued)**

- GPS instrument approaches using the GNS430W are prohibited, unless the GNS430W's approach data is verified by the pilot or crew to be current. Instrument approaches must be accomplished in accordance with an approved instrument approach procedure that is loaded from the GNS430W's database.
- Installations with dual 430W units will only crossfill between those units when they contain the same database cycle. Updating of each database must be accomplished on the ground prior to flight.

**Table 2 - Approved Navigation Database Cards**

<b>Part Number</b>	<b>Description</b>
010-10546-00	Data Card, WAAS, IFR, World Wide
010-10546-01	Data Card, WAAS, IFR, Americas
010-10546-02	Data Card, WAAS, IFR, International

**SECTION 2 - LIMITATIONS (continued)**

**Terrain Data Base**

The GNS430W supports Terrain and requires a Terrain database card to be installed in order for the feature to operate. The table below lists compatible database cards for the GNS430W. Each of the database cards contains the following data:

- 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, and is updated as frequently as every 56 days.

**NOTE**

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

**Table 3 - Approved Terrain Database Cards**

<b>Part Number</b>	<b>Description</b>
010-10201-20	Data Card, TAWS / Terrain, 128MB
010-10201-21	Data Card, TAWS / Terrain, 256MB

**Navigation**

No navigation is authorized north of 89° (degrees) north latitude or south of 89° (degrees) south latitude.

**SECTION 2 - LIMITATIONS (continued)****Approaches**

- During GPS approaches, the pilot must verify the GNS430W unit is operating in the approach mode. (LNAV, LNAV+V, L/VNAV, or LPV.)
- When conducting approaches referenced to true North, the heading selection on the AUX pages must be adjusted to TRUE.
- Accomplishment of an ILS, LOC, LOC-BC, LDA, SDF, MLS, VOR approach, or any other type of approach not approved for GPS overlay, is not authorized with GPS navigation guidance.
- Use of the GNS430W VOR/LOC/GS receiver to fly approaches not approved for GPS requires VOR/LOC/GS navigation data to be present on the external indicator (i.e. proper CDI source selection).

**Terrain Display**

Terrain refers to the display of terrain information. Pilots are NOT authorized to deviate from their current ATC clearance to comply with terrain/obstacle alerts. Terrain unit alerts are advisory only and are not equivalent to warnings provided by a Terrain Awareness and Warning System (TAWS). Navigation must not be predicated upon the use of the terrain display.

The terrain display is intended to serve as a situational awareness tool only. By itself, it may not provide either the accuracy or the fidelity on which to base decisions and plan maneuvers to avoid terrain or obstacles.

**VNAV**

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

### **SECTION 3 - EMERGENCY PROCEDURES**

#### **Emergency Procedures**

No change.

#### **Abnormal Procedures**

- If the Garmin GNS430W GPS navigation information is not available, or is invalid, utilize other remaining operational navigation equipment installed in the airplane as appropriate. If the 430W loses GPS position and reverts to Dead Reckoning mode (indicated by the annunciation of “DR” in the lower left of the display), the moving map will continue to be displayed. Aircraft position will be based upon the last valid GPS position and estimated by Dead Reckoning methods. Changes in airspeed or winds aloft can affect the estimated position substantially. Dead Reckoning is only available in Enroute mode; Terminal and Approach modes do not support DR.
- If a “Loss of Integrity” (INTEG) message is displayed during:
  - Enroute/Terminal: continue to navigate using GPS equipment and periodically cross-check the GPS guidance to other approved means of navigation.
  - GPS Approach: GPS approaches are not authorized under INTEG - Execute missed approach or revert to alternate navigation.
- During a GPS LPV precision approach or GPS LNAV/VNAV approach, the 430W will downgrade the approach if the Horizontal or Vertical alarm limits are exceeded. This will cause the vertical guidance to flag as unavailable. The procedure may be continued using the LNAV only minimums.
- During any GPS approach in which precision and non-precision alarm limits are exceeded, the 430W will flag the lateral guidance and generate a system message “ABORT APPROACH loss of navigation”. Immediately upon acknowledging the message the unit will revert to Terminal alarm limits. If the position integrity is within these limits, lateral guidance will be restored and the GPS may be used to execute the missed approach, otherwise alternate means of navigation should be utilized.
- In an in-flight emergency, depressing and holding the Comm transfer button for 2 seconds will select the emergency frequency of 121.500 Mhz into the “Active” frequency window.

**SECTION 4 - NORMAL PROCEDURES**

Refer to the 400W Series unit Pilot's Guide defined in Section 2 - Limitations of this supplement for normal operating procedures. This includes all GPS operations, VHF COM and NAV, and Multi-Function Display information.

Although intuitive and user friendly, the GNS430W requires a reasonable degree of familiarity to prevent operations without becoming too engrossed at the expense of basic instrument flying in IMC and basic see-and-avoid in VMC. Pilot workload will be higher for pilots with limited familiarity in using the unit in an IFR environment, particularly without the autopilot engaged. Garmin provides excellent training tools with the Pilot's Guide and PC based simulator. Pilots should take full advantage of these training tools to enhance system familiarization. Use of an autopilot is strongly encouraged when using the GNS430W in IMC conditions.

**Approaches with Vertical Guidance**

The GNS430W supports three types of GPS approaches with vertical guidance: LPV approaches, LNAV/VNAV (annunciated as L/VNAV) approaches, and LNAV approaches with advisory vertical guidance (annunciated as LNAV+V). For LNAV approaches with advisory vertical guidance, the GNS430W will annunciate LNAV+V indicating vertical guidance is available. LNAV minimums will be controlling in this case.

**NOTE**

If flying an LPV or LNAV/VNAV approach, be prepared to fly the LNAV only approach prior to reaching the final approach fix (FAF). If the GPS integrity is not within vertical approach limits, the system will flag the vertical guidance. This may be annunciated by a downgrade to LNAV message.

For additional information on approaches with vertical guidance, refer to the 400W Series unit Pilot's Guide.

**SECTION 4 - NORMAL PROCEDURES (continued)**

**Autopilot Operation**

The Garmin GNS430W may be coupled to the STEC 55X Autopilot when operating as prescribed in the LIMITATIONS section of this supplement. For lateral guidance, the STEC 55X Autopilot may utilize GPSS or GPS Roll Steering in lieu of the analog deviation information. For autopilot operational instructions, refer to the FAA approved Flight Manual or Flight Manual Supplement for the autopilot.

**Coupling the Autopilot during Approaches**

The Garmin GNS430W supports analog and digital (GPSS) control interfaces to the STEC 55X Autopilot. The STEC 55X may use digital GPS roll steering commands (GPSS) during GPS enroute, terminal, and LNAV approach operations only. When switching between GPS and VLOC, the pilot should be aware that the autopilot will need to be re-engaged in GPSS or NAV/APR, depending on the CDI nav source last selected or the type of approach desired.

Autopilot coupling to GPS vertical guidance requires that the autopilot be engaged in an analog APR mode identical to coupling to an ILS. To capture the vertical guidance, the pilot may engage the autopilot in APR mode at any time when the GPS Glide Slope (VDI) becomes valid (displayed without a FLAG).

Should a missed approach be required per the published missed approach procedure, the autopilot must be engaged in GPSS mode for proper guidance.

**CAUTION**

Do not operate the autopilot in the approach (APR) mode when conducting the published missed approach procedure.

**SECTION 4 - NORMAL PROCEDURES (continued)**

**WFDE Prediction Program**

The Garmin WAAS Fault Detection and Exclusion (WFDE) Prediction Program is required for Remote/Oceanic operations.

The Prediction Program should be used in conjunction with the Garmin 400W/500W Simulator. After entering the intended route of flight in the Simulator flight plan, the pilot selects the FDE Prediction Program under the Options menu of the Simulator program.

For detailed information, refer to the WFDE Prediction Program instructions (190-00643-01). The availability of FDE is only required for Oceanic or Remote operations.

**SECTION 5 - PERFORMANCE**

No change.

**SECTION 6 - WEIGHT AND BALANCE**

No change.

**SECTION 7 - DESCRIPTION AND OPERATION**

See Garmin 400W Series unit Pilot's Guide for a complete description of the GNS430W unit.

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SECTION 10  
OPERATING TIPS

10.1 GENERAL

This section provides operating tips of particular value in the operation of the Mirage.

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) The best speed for takeoff is 80 to 85 KIAS under normal conditions. Trying to pull the airplane off the ground at too low an airspeed decreases the controllability of the airplane in the event of engine failure.
- (c) 10° of flaps may be lowered at airspeeds up to 165 KIAS and full flaps up to 116 KIAS, but to reduce flap operating loads, it is desirable to have the airplane at a slower speed 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 radio switches, light switches and the pitot heat switch are in the off position so as not to create an overloaded condition when the starter is engaged.
- (f) Anti-collision lights should not be operating when flying through cloud, fog or haze, since reflected light can produce spatial disorientation. Strobe lights should not be used in close proximity to the ground, such as during taxiing, takeoff or landing.

**10.3 OPERATING TIPS (continued)**

- (g) 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.
- (h) 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.
- (i) 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.